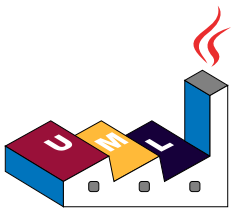
PlantUML 을사용해서 UML 그리기



PlantUML 언어참조가이드

(Version 1.2025.0)

PlantUML 은다이어그램을빠르게작성하기위한오픈소스프로젝트입니다.

- 시퀀스다이어그램
- 유즈케이스다이어그램
- 클래스다이어그램
- 객체다이어그램
- 액티비티다이어그램
- 컴포넌트다이어그램
- 배치다이어그램
- 상태다이어그램
- 타이밍다이어그램

다음의 UML 이외의다이어그램도지원함:

- JSON Data
- YAML Data
- Network diagram (nwdiag)
- Wireframe graphical interface
- Archimate diagram
- Specification and Description Language (SDL)
- Ditaa diagram
- Gantt diagram
- MindMap diagram
- Work Breakdown Structure diagram
- Mathematic with AsciiMath or JLaTeXMath notation
- Entity Relationship diagram

간단하고직관적인언어를사용해다이어그램을정의할수있습니다.

1 시퀀스다이어그램

PlantUML 로시퀀스다이어그램을만드는건굉장히직관적입니다. 이런사용용의성의많은부분은사용자친화적인문법덕분으로, 직관적이고기억하기쉽도록설계되었습니다.

- **Intuitive Syntax:**

First and foremost, users appreciate the straightforward and intuitive syntax that PlantUML employs. This well-thought-out design means that even those new to diagram creation find it easy to grasp the basics quickly and without hassle.

- **Text-to-Graphic Correlation:**

Another distinguishing feature is the close resemblance between the textual representation and the graphical output. This harmonious correlation ensures that the textual drafts translate quite accurately into graphical diagrams, providing a cohesive and predictable design experience without unpleasant surprises in the final output.

- **Efficient Crafting Process:**

The strong correlation between the text and the graphical result not only simplifies the crafting process but also significantly speeds it up. Users benefit from a more streamlined process with fewer requirements for time-consuming revisions and adjustments.

- **Visualization While Drafting:**

The ability to envisage the final graphical outcome while drafting the text is a feature that many find invaluable. It naturally fosters a smooth transition from initial draft to final presentation, enhancing productivity and reducing the likelihood of errors.

- **Easy Edits and Revisions:**

Importantly, editing existing diagrams is a hassle-free process. Since the diagrams are generated from text, users find that making adjustments is considerably easier and more precise than altering an image using graphical tools. It boils down to simply modifying the text, a process far more straightforward and less prone to errors than making changes through a graphical interface with a mouse.

PlantUML facilitates a straightforward and user-friendly approach to creating and editing sequence diagrams, meeting the needs of both novices and seasoned designers alike. It skillfully leverages the simplicity of textual inputs to craft visually descriptive and accurate diagrams, thereby establishing itself as a must-have tool in the diagram creation toolkit.

You can learn more about some of the common commands in PlantUML to enhance your diagram creation experience.

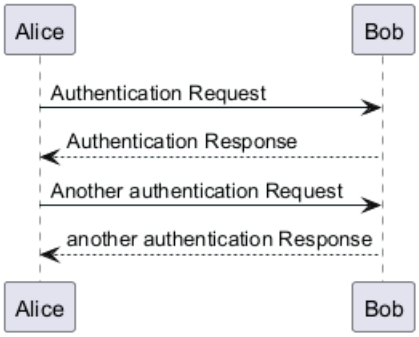
1.1 기본예제

시퀀스 -> 는두참여자들사이의메시지를그리기위해사용된다. 참여자들은명시적으로선언하지않아도된다.

점선화살표를만들기위해서는 --> 를사용한다.

또한 <-과 <--를사용할수있다. 출력되는그림은변경되지않지만, 가독성을향상시키는데사용할수있다.
이는시퀀스다이어그램에만적용되며, 다른다이어그램에는다른규칙이적용된다.

```
@startuml
Alice -> Bob: Authentication Request
Bob --> Alice: Authentication Response

Alice -> Bob: Another authentication Request
Alice <-- Bob: another authentication Response
@enduml
```



1.2 참여자 (participant) 선언

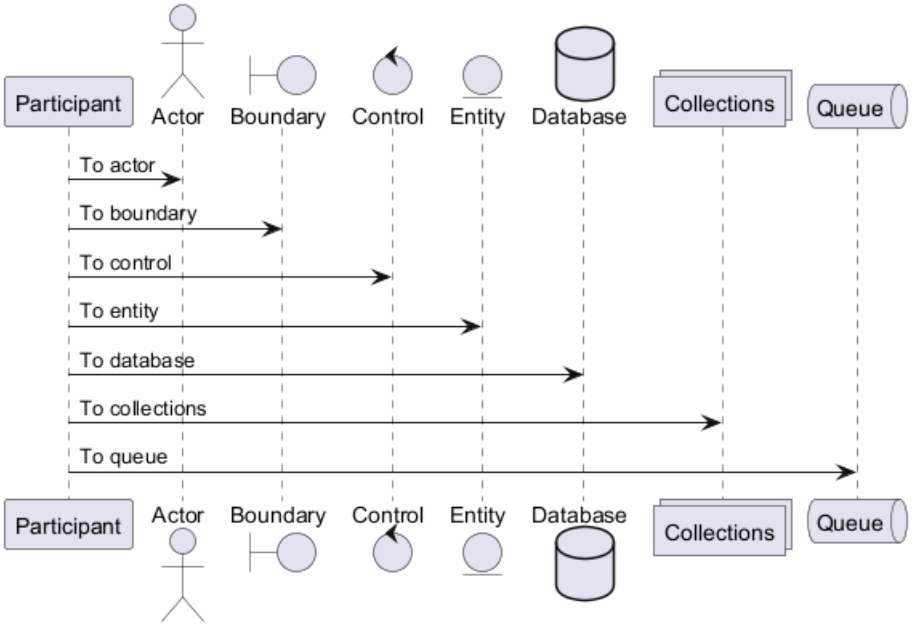
참여자를선언하기위해 participant 키워드를사용하면, 해당참여자에더많은제어를할수있습니다.

선언의순서는 (기본으로) 표시되는순서가됩니다.

또한, 참여자선언에다음과같은키워드를사용하면, 참여자를나타내는 모양을바꿀수있습니다.

- actor
- boundary
- control
- entity
- database
- collections
- queue

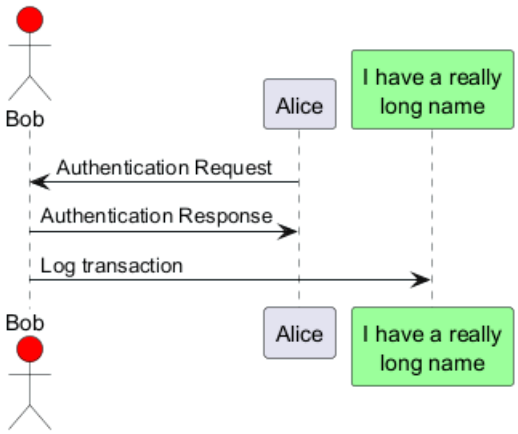
```
@startuml
participant Participant as Foo
actor       Actor       as Foo1
boundary    Boundary    as Foo2
control     Control     as Foo3
entity      Entity      as Foo4
database    Database    as Foo5
collections Collections as Foo6
queue       Queue       as Foo7
Foo -> Foo1 : To actor
Foo -> Foo2 : To boundary
Foo -> Foo3 : To control
Foo -> Foo4 : To entity
Foo -> Foo5 : To database
Foo -> Foo6 : To collections
Foo -> Foo7: To queue
@enduml
```



as 키워드를이용하여참여자의이름을변경할수있다.

또한, 참여자 (actor, participant) 의배경색을변경할수도있다.

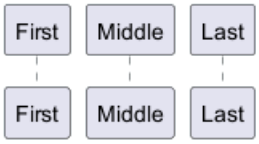
```
@startuml
actor Bob #red
' The only difference between actor
'and participant is the drawing
participant Alice
participant "I have a really\nlong name" as L #99FF99
/' You can also declare:
   participant L as "I have a really\nlong name"  #99FF99
  '/

Alice->Bob: Authentication Request
Bob->Alice: Authentication Response
Bob->L: Log transaction
@enduml
```



order 키워드를이용하여, 참여자의출력순서를지정할수있다.

```
@startuml
participant Last order 30
participant Middle order 20
participant First order 10
```

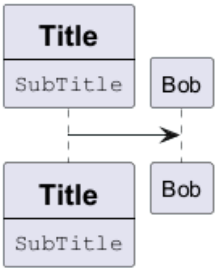
```
@enduml
```



1.3 여러줄에서참여자선언하기

참여자를여러줄에서선언할수있습니다.

```
@startuml
participant Participant [
    =Title
    ----
    ""SubTitle""
]

participant Bob

Participant -> Bob
@enduml
```

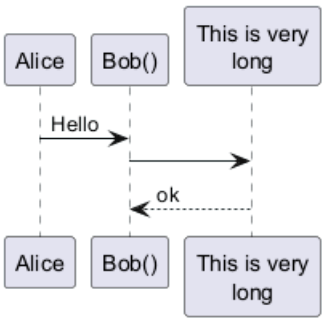


[Ref. QA-15232]

1.4 참여자에서특수문자사용하기

따옴표를사용하여참여자를정의할수있다. 그리고"as" 키워드를사용하여참여자를별칭으로사용할수도있다.

```
@startuml
Alice -> "Bob()" : Hello
"Bob()" -> "This is very\nlong" as Long
' You can also declare:
' "Bob()" -> Long as "This is very\nlong"
Long --> "Bob()" : ok
@enduml
```

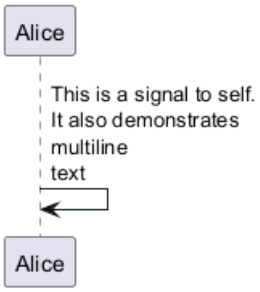


1.5 자신에게메시지보내기

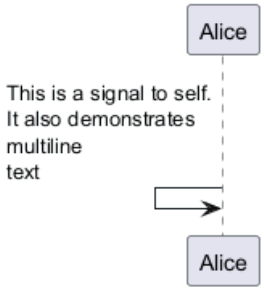
참여자는자기자신에게메시지를보낼수있다.

\n 을이용해서여러줄로쓰는것도가능하다

```
@startuml
Alice -> Alice: This is a signal to self.\nIt also demonstrates\nmultiline \ntext
@enduml
```




```
@startuml
Alice <- Alice: This is a signal to self.\nIt also demonstrates\nmultiline \ntext
@enduml
```



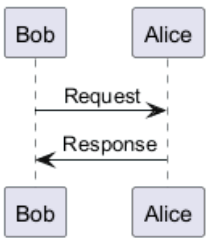
[Ref. QA-1361]

1.6 텍스트정렬

화살표의텍스트정렬은 `skinparam sequenceMessageAlign` 을사용하여 `left`, `right`, `center` 를설정할수있습니다.

`direction` 또는 `reverseDirection` 을사용하여화살표방향에따라텍스트정렬을할수있습니다. skinparam 페이지에서상세한예제를볼수있습니다.

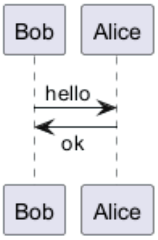
```
@startuml
skinparam sequenceMessageAlign right
Bob -> Alice : Request
Alice -> Bob : Response
@enduml
```



1.6.1 응답메세지텍스트를화살표아래에배치하기

`skinparam responseMessageBelowArrow true` 명령을이용하여응답메세지텍스트를화살표하단에배치할수있습니다.

```
@startuml
skinparam responseMessageBelowArrow true
Bob -> Alice : hello
Bob <- Alice : ok
@enduml
```

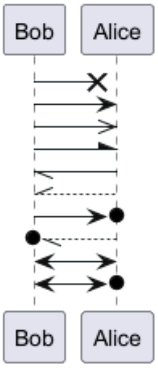


1.7 화살표스타일변경

다음방법으로화살표스타일을바꿀수있다:

- 끝부분에 x 를추가하여메시지가전달되지않았음을표시할수있다.
- < 나 > 대신에 \ 나 / 를사용해서
- 아래쪽이나위쪽화살표만표시한다.
- {$>$} 를두번사용하여화살표모양을얇게표시할수있다. (예. >>)
- - 대신 -- 를사용해서점선화살표를표시한다.
- 화살표다음에"o" 추가도가능하다.
- 양쪽끝에화살표추가도가능하다.

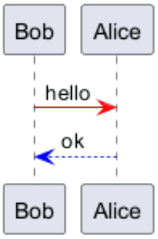
```
@startuml
Bob ->x Alice
Bob -> Alice
Bob ->> Alice
Bob -\ Alice
Bob \\- Alice
Bob //-- Alice

Bob ->o Alice
Bob o\\-- Alice

Bob <-> Alice
Bob <->o Alice
@enduml
```



1.8 화살표색상변경

다음의표기법을이용해서각각화살표의색상을바꿀수있다.

```
@startuml
Bob -[#red]> Alice : hello
Alice -[#0000FF]->Bob : ok
@enduml
```



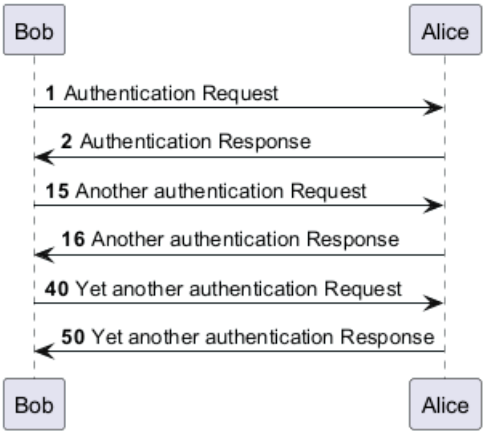
1.9 메시지순서에번호매기기

autonumber 키워드는메시지에자동으로증가하는번호를매길때에사용합니다.

```
@startuml
autonumber
Bob -> Alice : Authentication Request
Bob <- Alice : Authentication Response
@enduml
```

autonumber < 시작번호 > 의형태로표시하면특정번호로시작할수있으며, autonumber < 시작번호 > < 증가값 > 으로표시할경우증가값을조정하는것도가능하다.

```
@startuml
autonumber
Bob -> Alice : Authentication Request
Bob <- Alice : Authentication Response

autonumber 15
Bob -> Alice : Another authentication Request
Bob <- Alice : Another authentication Response

autonumber 40 10
Bob -> Alice : Yet another authentication Request
Bob <- Alice : Yet another authentication Response

@enduml
```

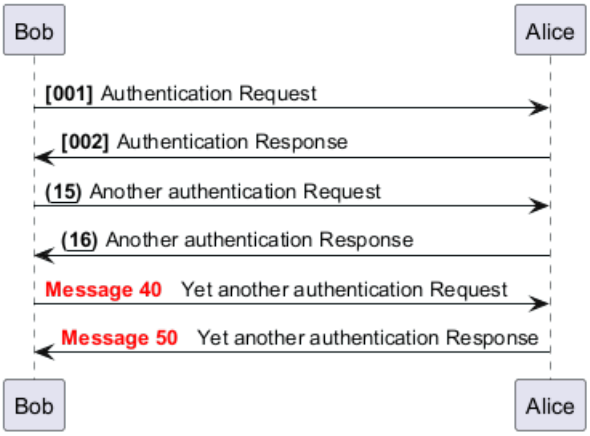


쌍따옴표를이용하여표시형식을바꿀수도있다.

표시형식은자바클래스 `DecimalFormat` 을사용한다. (0 은숫자를의미하며, # 은숫자로표시하되, 빈자리이면 0 으로채우라는뜻이다).

몇가지 html 태그를사용할수있다.

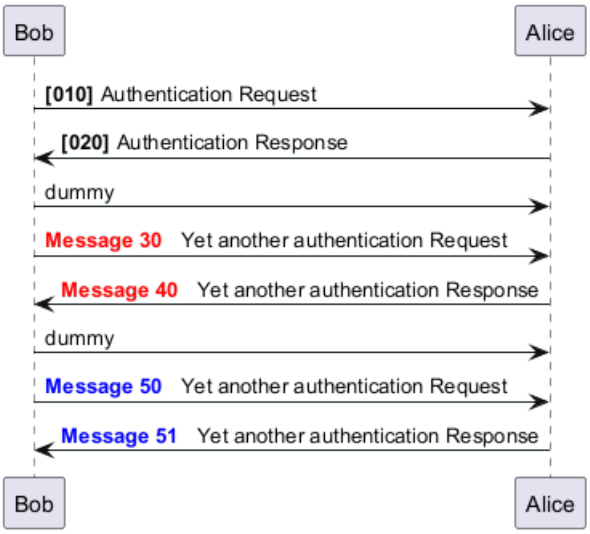
```
@startuml
autonumber "<b>[000]"
Bob -> Alice : Authentication Request
Bob <- Alice : Authentication Response

autonumber 15 "<b>(<u>##</u>)"
Bob -> Alice : Another authentication Request
Bob <- Alice : Another authentication Response

autonumber 40 10 "<font color=red><b>Message 0  "
Bob -> Alice : Yet another authentication Request
Bob <- Alice : Yet another authentication Response

@enduml
```



또한, `autonumber stop` 키워드를이용하여번호매김을일시정지할수있으며, `autonumber resume < 증가값 > < 표시형식 >` 키워드를이용하여계속해서번호를매길수있다.

```
@startuml
autonumber 10 10 "<b>[000]"
Bob -> Alice : Authentication Request
Bob <- Alice : Authentication Response

autonumber stop
Bob -> Alice : dummy
```

```
autonumber resume "<font color=red><b>Message 0  "
Bob -> Alice : Yet another authentication Request
Bob <- Alice : Yet another authentication Response

autonumber stop
Bob -> Alice : dummy

autonumber resume 1 "<font color=blue><b>Message 0  "
Bob -> Alice : Yet another authentication Request
Bob <- Alice : Yet another authentication Response
@enduml
```

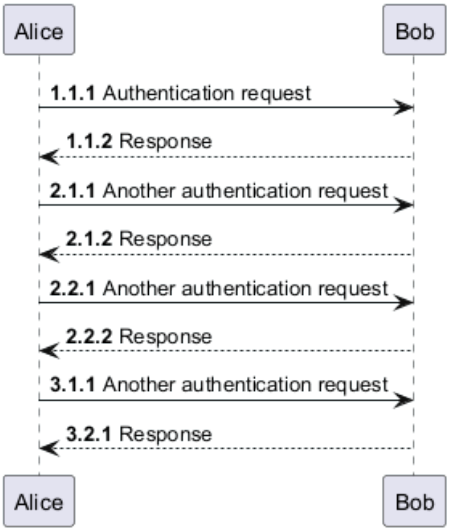


., ;, ,, : 같은필드구분자또는필드구분자의조합으로 2 자리또는 3 자리의번호의시작번호를사용할수 있습니다. 예제: 1.1.1 또는 1.1:1.

자동으로마지막자릿수가증가합니다.

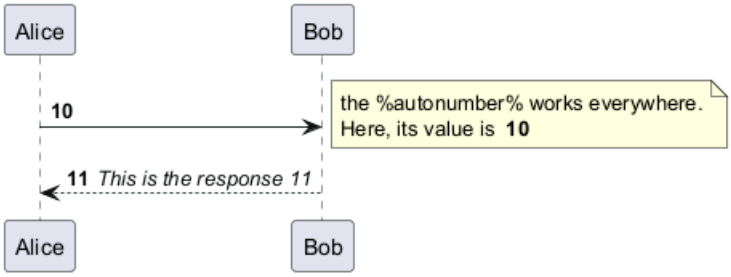
첫째자리를증가하려면, autonumber inc A 를사용하십시오. 둘째자리를증가하려면, autonumber inc B 를사용하십시오.

```
@startuml
autonumber 1.1.1
Alice -> Bob: Authentication request
Bob --> Alice: Response

autonumber inc A
'Now we have 2.1.1
Alice -> Bob: Another authentication request
Bob --> Alice: Response

autonumber inc B
'Now we have 2.2.1
Alice -> Bob: Another authentication request
Bob --> Alice: Response

autonumber inc A
'Now we have 3.1.1
Alice -> Bob: Another authentication request
autonumber inc B
'Now we have 3.2.1
Bob --> Alice: Response
@enduml
```



%autonumber% 변수를사용하여 autonumber 를사용할수있습니다.:

```
@startuml
autonumber 10
Alice -> Bob
note right
  the <U+0025>autonumber<U+0025> works everywhere.
  Here, its value is ** %autonumber% **
end note
Bob --> Alice: //This is the response %autonumber%//
@enduml
```



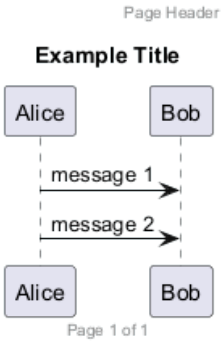
[Ref. QA-7119]

1.10 페이지제목, 머리말과꼬리말

title 키워드를이용하여페이지에제목을추가할수있다.

또한, header 와 footer 를이용하여, 각각머리말과꼬리말을표시할수도있다.

```
@startuml

header Page Header
footer Page %page% of %lastpage%

title Example Title

Alice -> Bob : message 1
Alice -> Bob : message 2

@enduml
```



1.11 다이어그램분리

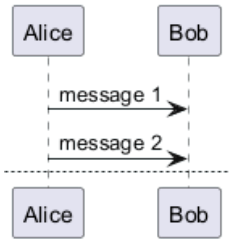
newpage 키워드를이용하여, 다이어그램을여러개의이미지로분리할수있다.

newpage 키워드뒤에바로새로생성되는페이지의제목을넣을수있다.

여러페이지에걸쳐있는긴다이어그램을출력할때유용하다.

(주: 예제에서첫번째페이지만표시되었지만, 실제로잘동작하는기능이다.)

```
@startuml

Alice -> Bob : message 1
Alice -> Bob : message 2

newpage

Alice -> Bob : message 3
Alice -> Bob : message 4

newpage A title for the\nlast page

Alice -> Bob : message 5
Alice -> Bob : message 6
@enduml
```



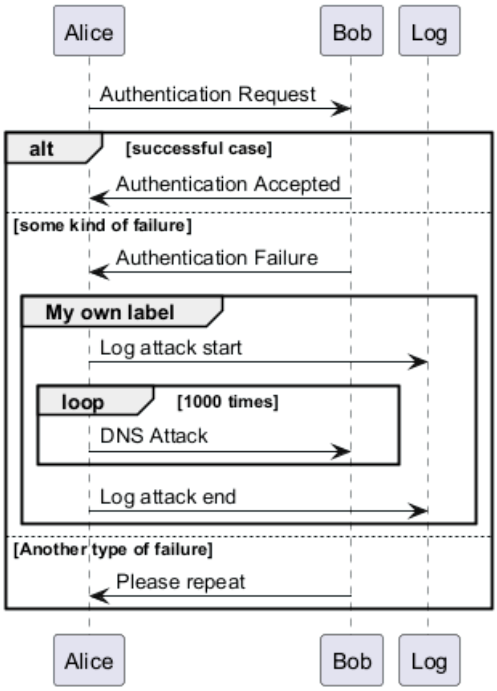
1.12 메세지그룹화

다음과같은키워드들을사용하여메세지를그룹화할수있다:

- alt/else
- opt
- loop
- par
- break
- critical
- group, 화면에보여질텍스트

헤더에표시될텍스트를추가할수있다. (group 에대해서는, 다음 '보조그룹레이블' 을참조하십시오.).
end 키워드는그룹을닫는데사용한다.
또한, 그룹을중첩해서만들수도있다.

```
@startuml
Alice -> Bob: Authentication Request

alt successful case

    Bob -> Alice: Authentication Accepted

else some kind of failure

    Bob -> Alice: Authentication Failure
    group My own label
    Alice -> Log : Log attack start
        loop 1000 times
            Alice -> Bob: DNS Attack
        end
    Alice -> Log : Log attack end
    end

else Another type of failure

   Bob -> Alice: Please repeat

end
@enduml
```

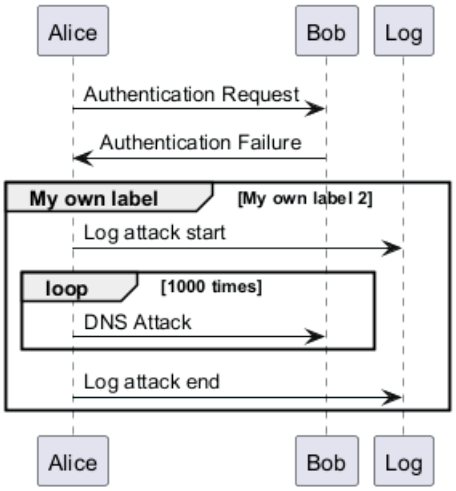


1.13 보조그룹레이블

group 을위해, [하고] 사이에, 머릿글에표시되도록보조문자열이나레이블을추가할수있습니다.

```
@startuml
Alice -> Bob: Authentication Request
Bob -> Alice: Authentication Failure
```

```
group My own label [My own label 2]
    Alice -> Log : Log attack start
    loop 1000 times
        Alice -> Bob: DNS Attack
    end
    Alice -> Log : Log attack end
end
@enduml
```



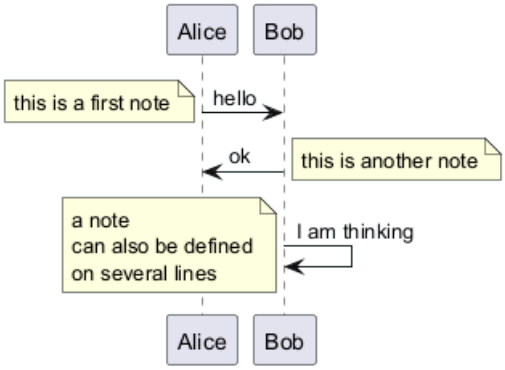
[Ref. QA-2503]

1.14 메시지에노트추가하기

메시지다음에 `note left` 나 `note right` 키워드를이용하여, 메시지에노트를추가할수있다.

또한, 한번에여러줄의노트를추가하는경우에는 `end note` 를이용하여, 노트의끝을표시해주어야한다.

```
@startuml
Alice->Bob : hello
note left: this is a first note

Bob->Alice : ok
note right: this is another note

Bob->Bob : I am thinking
note left
a note
can also be defined
on several lines
end note
@enduml
```



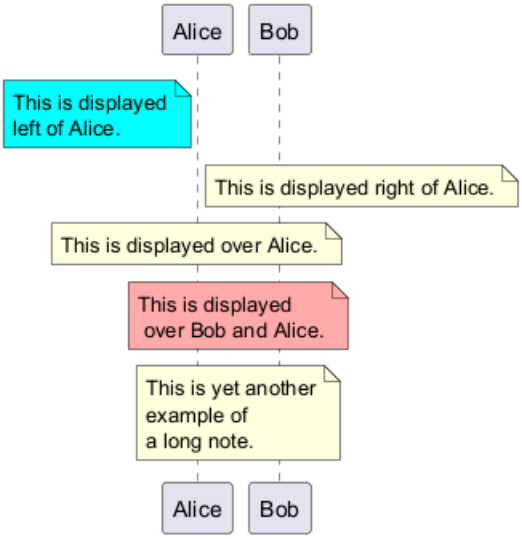
1.15 다른형태의노트들

`note left of` , `note right of`, `note over` 키워드를이용하여참여자의상대적인위치에노트를추가할수도있다.

노트의배경색을변경함으로써, 노트를강조하는것도가능하다.

한번에여러줄의노트를추가하는경우에는, `end note` 를이용하여노트의끝을표시해주어야한다.

```
@startuml
participant Alice
participant Bob
note left of Alice #aqua
This is displayed
left of Alice.
end note

note right of Alice: This is displayed right of Alice.

note over Alice: This is displayed over Alice.

note over Alice, Bob #FFAAAA: This is displayed\n over Bob and Alice.

note over Bob, Alice
This is yet another
example of
a long note.
end note
@enduml
```



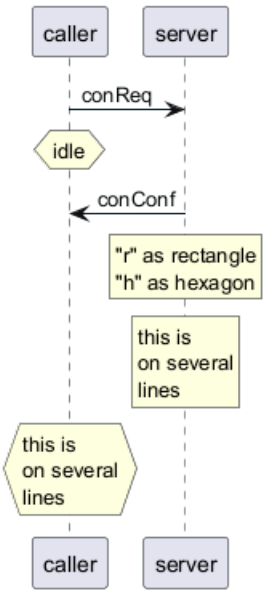
1.16 노트모양바꾸기

`hnote` 와 `rnote` 키워드를이용하여, 노트의모양을바꿀수있습니다:

- `hnote` 는육각형노트;
- `rnote` 는사각형노트.

```
@startuml
caller -> server : conReq
hnote over caller : idle
caller <- server : conConf
rnote over server
 "r" as rectangle
```

```
 "h" as hexagon
endrnote
rnote over server
 this is
 on several
 lines
endrnote
hnote over caller
 this is
 on several
 lines
endhnote
@enduml
```



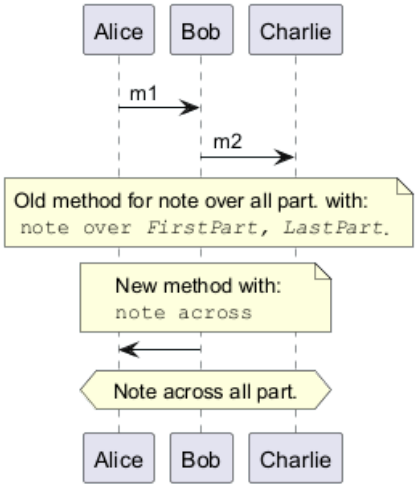
[Ref. QA-1765]

1.17 Note over all participants [across]

다음의문법을이용해서모든참여자에걸치도록노트를작성할수있다:

- `note across: note_description`

```
@startuml
Alice->Bob:m1
Bob->Charlie:m2
note over Alice, Charlie: Old method for note over all part. with:\n ""note over //FirstPart, LastPa
note across: New method with:\n""note across""
Bob->Alice
hnote across:Note across all part.
@enduml
```



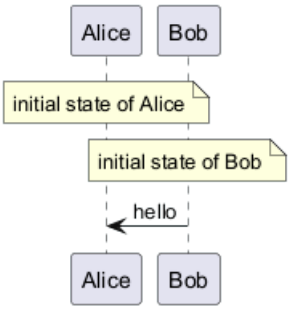
[Ref. QA-9738]

1.18 Several notes aligned at the same level [/]

/ 을사용하여여러개의 note 를같은레벨로정렬하여작성할수있다:

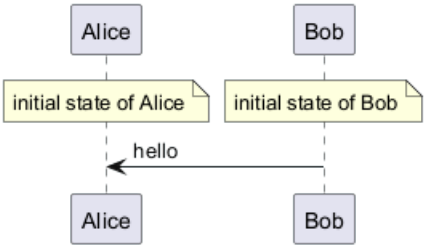
- without / *(by default, the notes are not aligned)*

```
@startuml
note over Alice : initial state of Alice
note over Bob : initial state of Bob
Bob -> Alice : hello
@enduml
```



- with / *(the notes are aligned)*

```
@startuml
note over Alice : initial state of Alice
/ note over Bob : initial state of Bob
Bob -> Alice : hello
@enduml
```

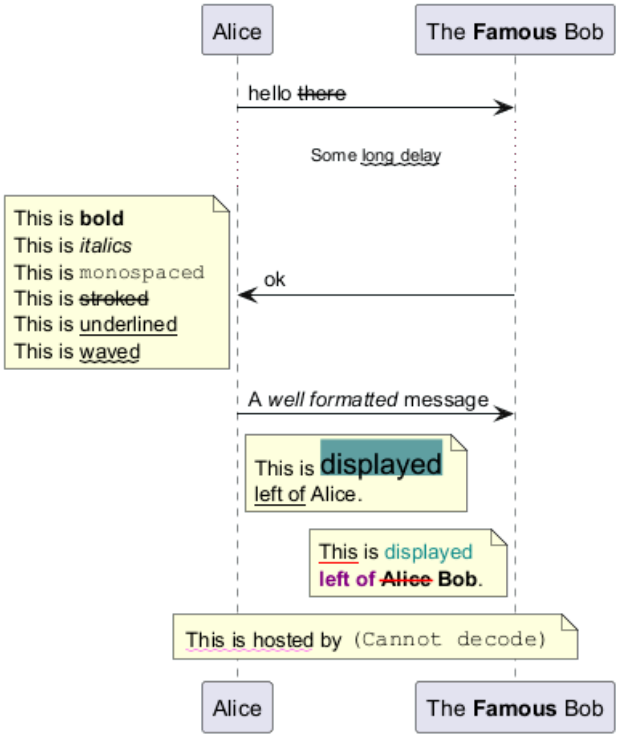


[Ref. QA-354]

1.19 Creole 과 HTML

creole 문법을사용할수도있다:

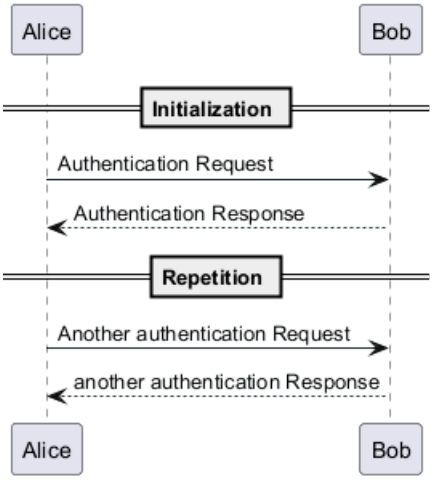
```
@startuml
participant Alice
participant "The **Famous** Bob" as Bob

Alice -> Bob : hello --there--
... Some ~~long delay~~ ...
Bob -> Alice : ok
note left
  This is **bold**
  This is //italics//
  This is ""monospaced""
  This is --stroked--
  This is __underlined__
  This is ~~waved~~
end note

Alice -> Bob : A //well formatted// message
note right of Alice
 This is <back:cadetblue><size:18>displayed</size></back>
 __left of__ Alice.
end note
note left of Bob
 <u:red>This</u> is <color #118888>displayed</color>
 **<color purple>left of</color> <s:red>Alice</strike> Bob**.
end note
note over Alice, Bob
 <w:#FF33FF>This is hosted</w> by <img sourceforge.jpg>
end note
@enduml
```



1.20 구분자또는분리자

== 구분자를이용하여, 다이어그램을논리적인단계로구분하여나눌수있다.

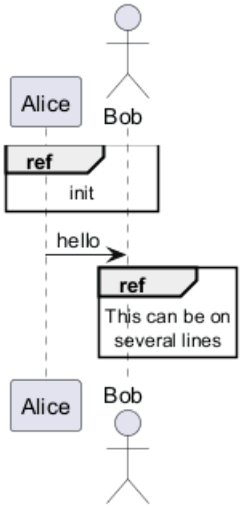
```
@startuml

== Initialization ==

Alice -> Bob: Authentication Request
Bob --> Alice: Authentication Response

== Repetition ==

Alice -> Bob: Another authentication Request
Alice <-- Bob: another authentication Response

@enduml
```



1.21 참조

`ref over` 키워드를이용하여, 다이어그램에참조를표시할수있다.

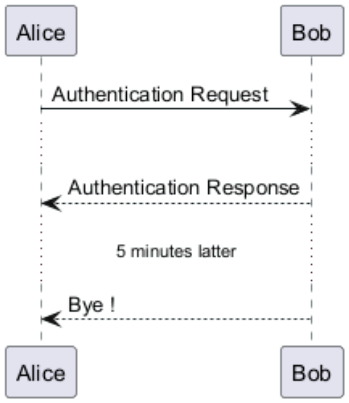
```
@startuml
participant Alice
actor Bob

ref over Alice, Bob : init

Alice -> Bob : hello

ref over Bob
  This can be on
  several lines
end ref
@enduml
```



1.22 지연

... 을이용하여, 다이어그램에지연상태를나타낼수있으며, 그위에메시지를추가할수도있다.

```
@startuml

Alice -> Bob: Authentication Request
...
Bob --> Alice: Authentication Response
...5 minutes latter...
Bob --> Alice: Bye !

@enduml
```

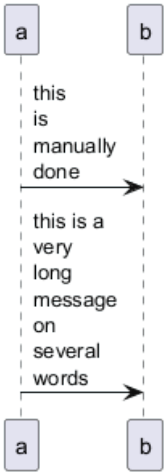


1.23 문장줄바꿈

긴메시지를줄바꿈하려면, 문장안에 \n 을추가한다.

다른방법은 maxMessageSize 설정을사용한다:

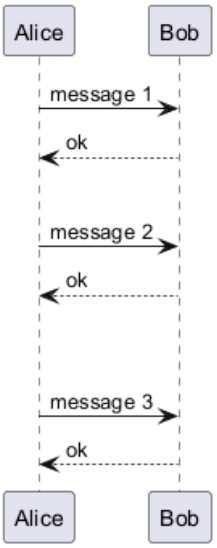
```
@startuml
skinparam maxMessageSize 50
participant a
participant b
a -> b :this\nis\nmanually\ndone
a -> b :this is a very long message on several words
@enduml
```



1.24 공백

||| 을이용하여다이어그램에공백을나타낼수있으며, 공백에얼마만큼의픽셀을사용할것인지숫자로명시할수도있다.

```
@startuml

Alice -> Bob: message 1
Bob --> Alice: ok
|||
Alice -> Bob: message 2
Bob --> Alice: ok
||45||
Alice -> Bob: message 3
Bob --> Alice: ok

@enduml
```



1.25 생명선활성화및비활성화

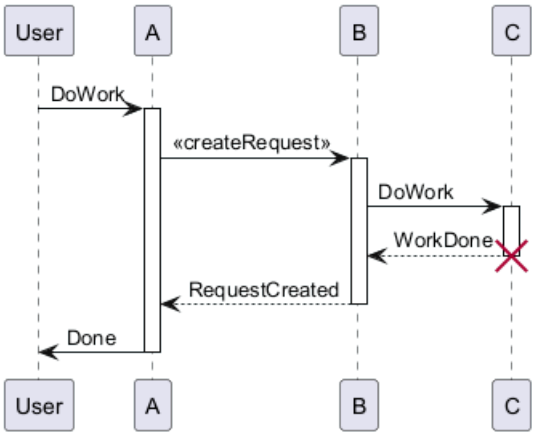
activate 와 deactivate 는참여자의활성화여부를표현하는데사용한다.

참여자가활성화되면, 참여자의생명선이나타난다.

activate 와 deactivate 는바로이전의메시지에적용된다.

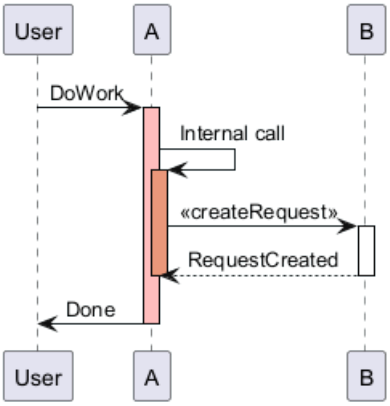
destroy 는참여자의생명선이끝났음을표현한다.

```
@startuml
participant User

User -> A: DoWork
activate A

A -> B: << createRequest >>
activate B

B -> C: DoWork
activate C
C --> B: WorkDone
destroy C

B --> A: RequestCreated
deactivate B

A -> User: Done
deactivate A

@enduml
```



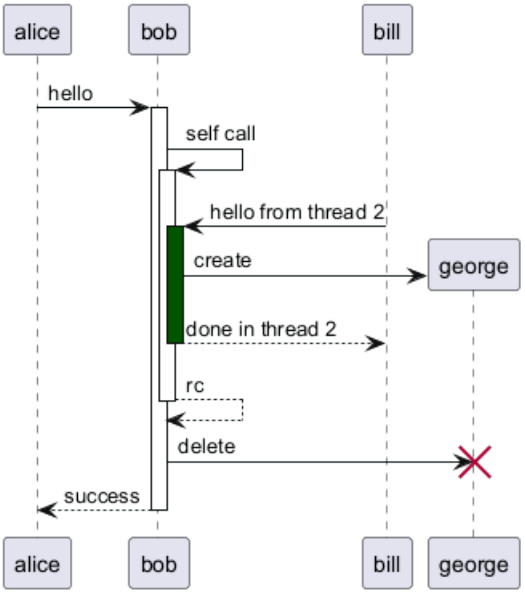
생명선은중첩해서사용할수있으며, 생명선에색을넣을수도있다.

```
@startuml
participant User

User -> A: DoWork
activate A #FFBBBB

A -> A: Internal call
activate A #DarkSalmon

A -> B: << createRequest >>
activate B

B --> A: RequestCreated
deactivate B
deactivate A
A -> User: Done
deactivate A

@enduml
```



return 키워드를사용하여자동활성화도가능합니다.

```
@startuml
autoactivate on
alice -> bob : hello
bob -> bob : self call
bill -> bob #005500 : hello from thread 2
bob -> george ** : create
return done in thread 2
return rc
bob -> george !! : delete
return success

@enduml
```



1.26 리턴

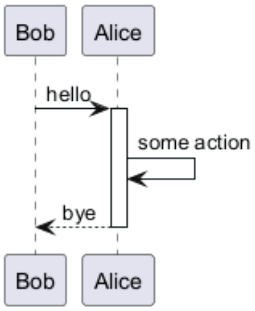
return 명령은추가텍스트레이블과함께리턴메시지를생성합니다.

리턴되는지점은가장최근에생명선을활성화시킨지점의출발점이된다.

문법은간단히 return label 이며, label 은기존의메시지와마찬가지로임의의문자열을쓸수있다.

```
@startuml
Bob -> Alice : hello
activate Alice
Alice -> Alice : some action
```

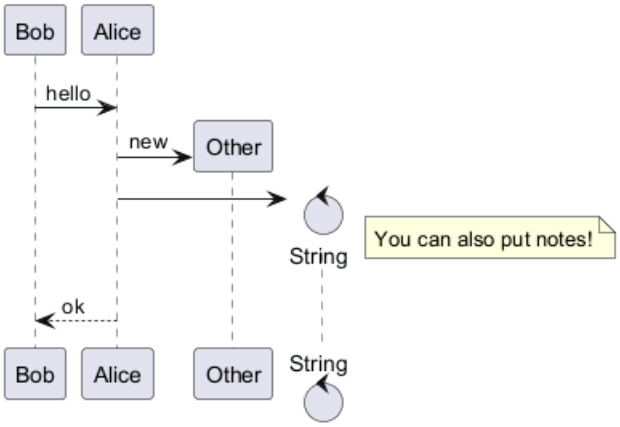
```
return bye
@enduml
```



1.27 참여자생성

해당메시지가실제로새객체를 생성한다는걸강조하기위해, 참여자가첫번째메시지를수신하기전에 `create` 키워드를사용할수있다.

```
@startuml
Bob -> Alice : hello

create Other
Alice -> Other : new

create control String
Alice -> String
note right : You can also put notes!

Alice --> Bob : ok

@enduml
```



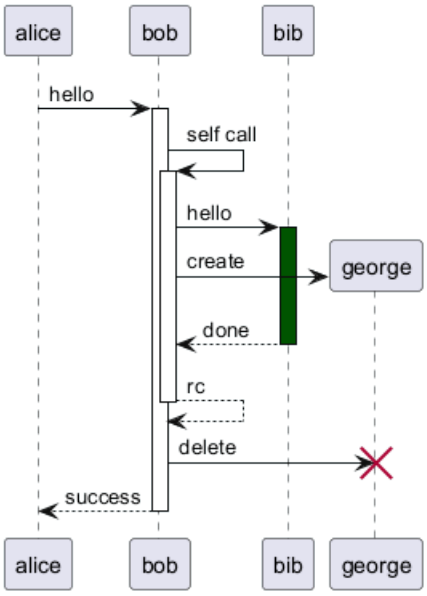
1.28 활성화, 비활성화, 생성을위한단축키

참여대상을지정한직후다음문법을사용할수있습니다:

- `++` 대상활성화 (추가로색을따를수있습니다.)
- `--` 원본비활성화
- `**` 대상인스턴스생성
- `!!` 대상인스턴스파괴

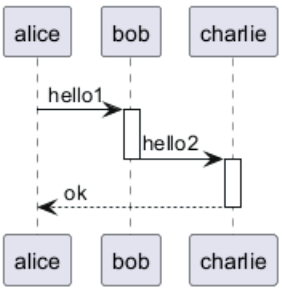
```
@startuml
alice -> bob ++ : hello
```

```
bob -> bob ++ : self call
bob -> bib ++  #005500 : hello
bob -> george ** : create
return done
return rc
bob -> george !! : delete
return success
@enduml
```

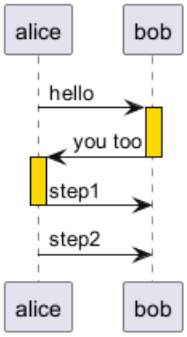


같은줄에서대상의활성화와비활성화를혼용할수있습니다.

```
@startuml
alice   ->  bob     ++   : hello1
bob     ->  charlie --++ : hello2
charlie --> alice   --   : ok
@enduml
```




```
@startuml
@startuml
alice -> bob   --++ #gold: hello
bob   -> alice --++ #gold: you too
alice -> bob   --: step1
alice -> bob   : step2
@enduml
@enduml
```



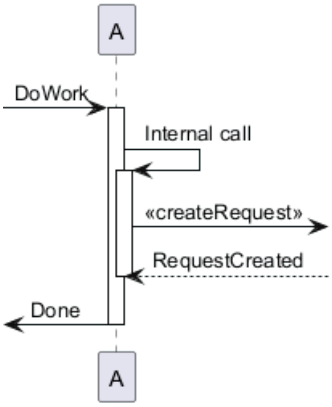
[Ref. QA-4834, QA-9573 and QA-13234]

1.29 Incoming and outgoing messages

You can use incoming or outgoing arrows if you want to focus on a part of the diagram.

Use square brackets to denote the left "[" or the right "]" side of the diagram.

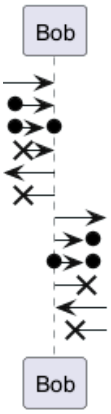
```
@startuml
[-> A: DoWork

activate A

A -> A: Internal call
activate A

A ->] : << createRequest >>

A<--] : RequestCreated
deactivate A
[<- A: Done
deactivate A
@enduml
```



You can also have the following syntax:

```
@startuml
[-> Bob
[o-> Bob
[o->o Bob
[x-> Bob

[<- Bob
[x<- Bob

Bob ->]
```

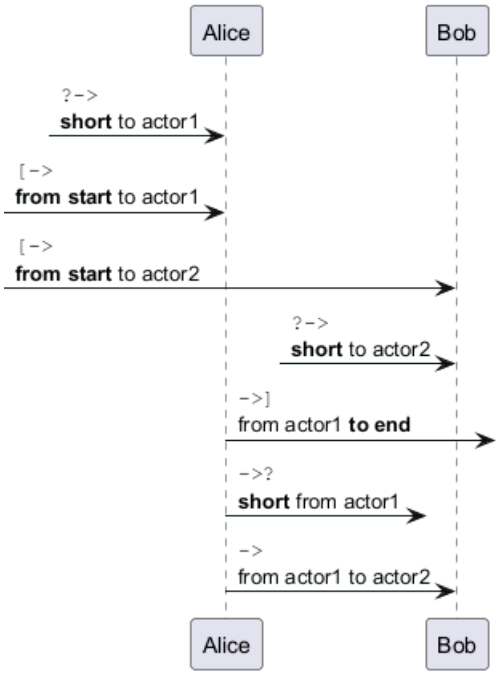
```
Bob ->o]
Bob o->o]
Bob ->x]

Bob <-]
Bob x<-]
@enduml
```



1.30 Short arrows for incoming and outgoing messages

You can have **short** arrows with using ?.

```
@startuml
?-> Alice    : ""?->""\n**short** to actor1
[-> Alice    : ""[->""\n**from start** to actor1
[-> Bob      : ""[->""\n**from start** to actor2
?-> Bob      : ""?->""\n**short** to actor2
Alice ->]    : ""->]""\nfrom actor1 **to end**
Alice ->?    : ""->?""\n**short** from actor1
Alice -> Bob : ""->"" \nfrom actor1 to actor2
@enduml
```

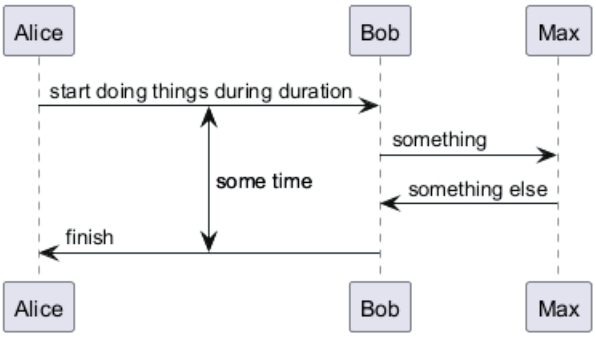


[Ref. QA-310]

1.31 Anchors and Duration

With `teoz` it is possible to add anchors to the diagram and use the anchors to specify duration time.

```
@startuml
!pragma teoz true

{start} Alice -> Bob : start doing things during duration
Bob -> Max : something
Max -> Bob : something else
{end} Bob -> Alice : finish

{start} <-> {end} : some time

@enduml
```



You can use the `-P` command-line option to specify the pragma:

```
java -jar plantuml.jar -Pteoz=true
```

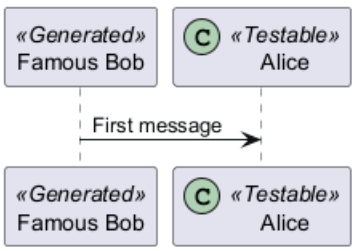
[Ref. issue-582]

1.32 Stereotypes and Spots

It is possible to add stereotypes to participants using `<<` and `>>`.

In the stereotype, you can add a spotted character in a colored circle using the syntax `(X,color)`.

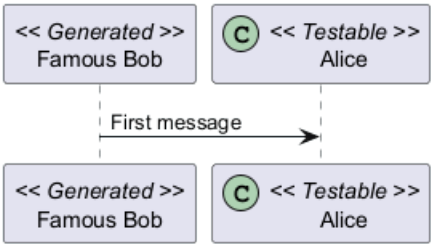
```
@startuml

participant "Famous Bob" as Bob << Generated >>
participant Alice << (C,#ADD1B2) Testable >>

Bob->Alice: First message

@enduml
```



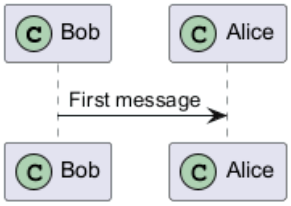
By default, the *guillemet* character is used to display the stereotype. You can change this behavious using the skinparam `guillemet`:

```
@startuml

skinparam guillemet false
```

```
participant "Famous Bob" as Bob << Generated >>
participant Alice << (C,#ADD1B2) Testable >>

Bob->Alice: First message

@enduml
```




```
@startuml

participant Bob << (C,#ADD1B2) >>
participant Alice << (C,#ADD1B2) >>

Bob->Alice: First message

@enduml
```

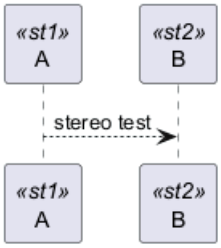


1.33 Position of the stereotypes

It is possible to define stereotypes position (`top` or `bottom`) with the command `skinparam stereotypePosition`.

1.33.1 Top postion *(by default)*

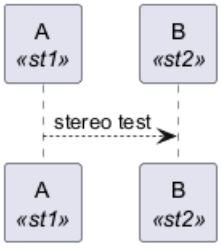
```
@startuml
skinparam stereotypePosition top

participant A<<st1>>
participant B<<st2>>
A --> B : stereo test
@enduml
```



1.33.2 Bottom postion

```
@startuml
skinparam stereotypePosition bottom
```

```
participant A<<st1>>
participant B<<st2>>
A --> B : stereo test
@enduml
```

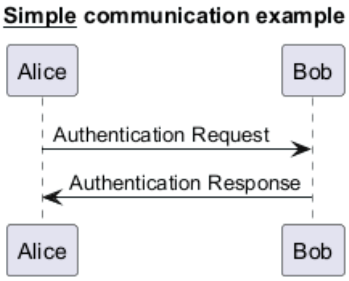


[Ref. QA-18650]

1.34 More information on titles

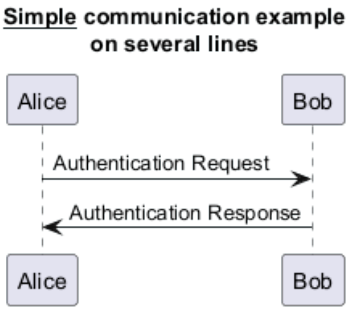
You can use creole formatting in the title.

```
@startuml

title __Simple__ **communication** example

Alice -> Bob: Authentication Request
Bob -> Alice: Authentication Response

@enduml
```



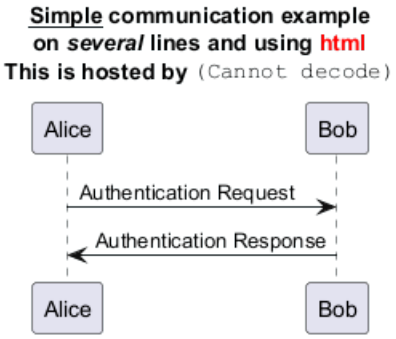
You can add newline using \n in the title description.

```
@startuml

title __Simple__ communication example\non several lines

Alice -> Bob: Authentication Request
Bob -> Alice: Authentication Response

@enduml
```



You can also define title on several lines using `title` and `end title` keywords.

```
@startuml

title
 <u>Simple</u> communication example
 on <i>several</i> lines and using <font color=red>html</font>
 This is hosted by <img:sourceforge.jpg>
end title

Alice -> Bob: Authentication Request
Bob -> Alice: Authentication Response

@enduml
```

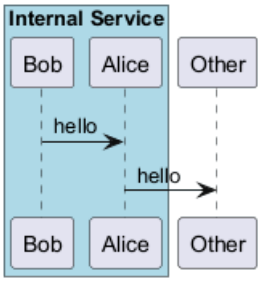


1.35 Participants encompass

It is possible to draw a box around some participants, using `box` and `end box` commands.

You can add an optional title or a optional background color, after the `box` keyword.

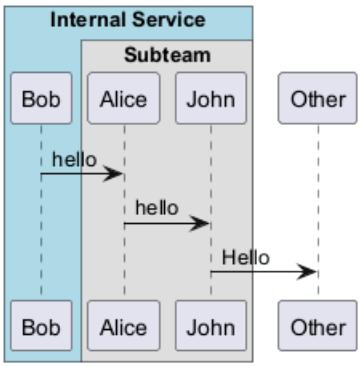
```
@startuml

box "Internal Service" #LightBlue
participant Bob
participant Alice
end box
participant Other

Bob -> Alice : hello
Alice -> Other : hello

@enduml
```



It is also possible to nest boxes - to draw a box within a box - when using the teoz rendering engine, for example:

```
@startuml
```

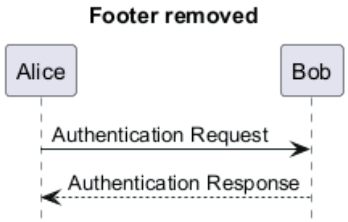
```
!pragma teoz true
box "Internal Service" #LightBlue
participant Bob
box "Subteam"
participant Alice
participant John
end box

end box
participant Other

Bob -> Alice : hello
Alice -> John : hello
John -> Other: Hello

@enduml
```



1.36 Removing Footer

You can use the `hide footbox` keywords to remove the footer of the diagram.

```
@startuml

hide footbox
title Footer removed

Alice -> Bob: Authentication Request
Bob --> Alice: Authentication Response

@enduml
```



1.37 Skinparam

You can use the skinparam command to change colors and fonts for the drawing.

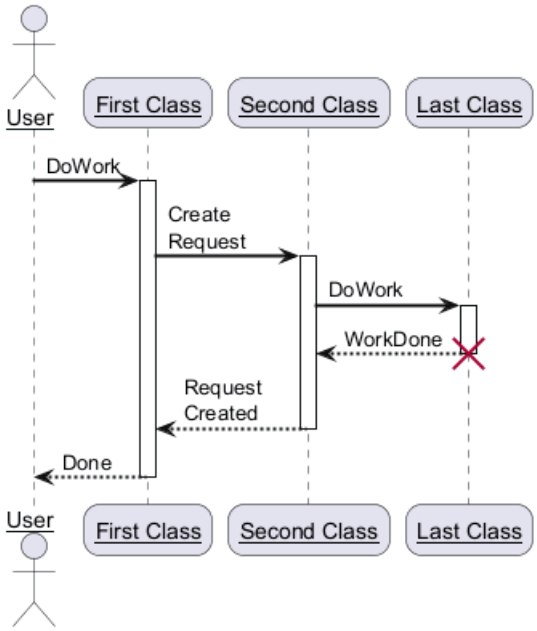
You can use this command:

- In the diagram definition, like any other commands,
- In an included file,

- In a configuration file, provided in the command line or the ANT task.

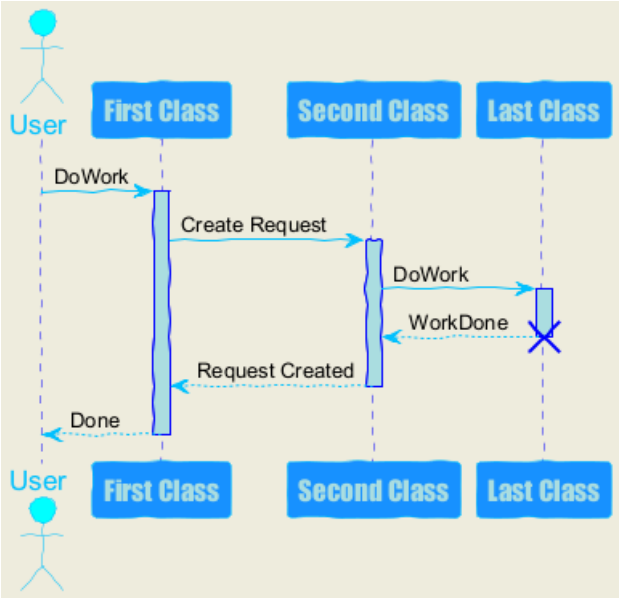
You can also change other rendering parameter, as seen in the following examples:

```
@startuml
skinparam sequenceArrowThickness 2
skinparam roundcorner 20
skinparam maxmessagesize 60
skinparam sequenceParticipant underline

actor User
participant "First Class" as A
participant "Second Class" as B
participant "Last Class" as C

User -> A: DoWork
activate A

A -> B: Create Request
activate B

B -> C: DoWork
activate C
C --> B: WorkDone
destroy C

B --> A: Request Created
deactivate B

A --> User: Done
deactivate A

@enduml
```




```
@startuml
skinparam backgroundColor #EEEBDC
skinparam handwritten true

skinparam sequence {
```

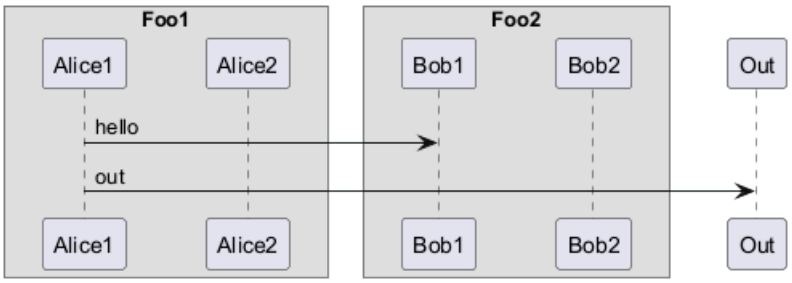
```
ArrowColor DeepSkyBlue
ActorBorderColor DeepSkyBlue
LifeLineBorderColor blue
LifeLineBackgroundColor #A9DCDF

ParticipantBorderColor DeepSkyBlue
ParticipantBackgroundColor DodgerBlue
ParticipantFontName Impact
ParticipantFontSize 17
ParticipantFontColor #A9DCDF

ActorBackgroundColor aqua
ActorFontColor DeepSkyBlue
ActorFontSize 17
ActorFontName Aapex
}

actor User
participant "First Class" as A
participant "Second Class" as B
participant "Last Class" as C

User -> A: DoWork
activate A

A -> B: Create Request
activate B

B -> C: DoWork
activate C
C --> B: WorkDone
destroy C

B --> A: Request Created
deactivate B

A --> User: Done
deactivate A

@enduml
```



1.38 Changing padding

It is possible to tune some padding settings.

```
@startuml
skinparam ParticipantPadding 20
skinparam BoxPadding 10

box "Foo1"
participant Alice1
participant Alice2
end box
box "Foo2"
participant Bob1
participant Bob2
end box
Alice1 -> Bob1 : hello
Alice1 -> Out : out
@enduml
```

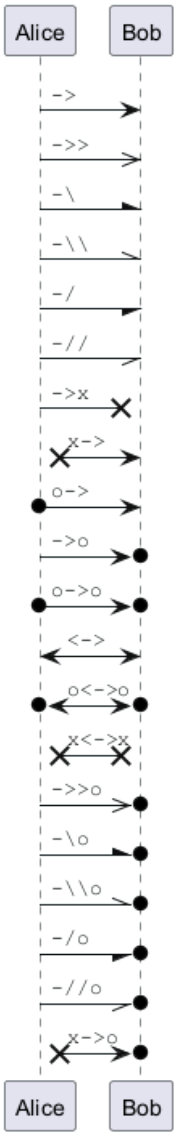


1.39 Appendix: Examples of all arrow type

1.39.1 Normal arrow

```
@startuml
participant Alice as a
participant Bob   as b
a ->     b : ""->   ""
a ->>    b : ""->>  ""
a -\     b : ""-\   ""
```

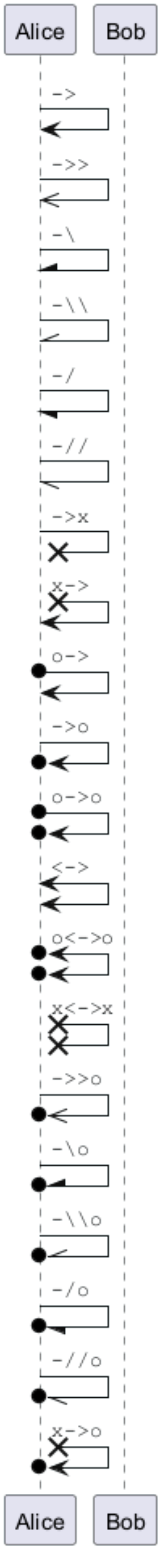
```
a -\\    b : ""-\\\\""
a -/     b : ""-/   ""
a -//    b : ""-//  ""
a ->x    b : ""->x  ""
a x->    b : ""x->  ""
a o->    b : ""o->  ""
a ->o    b : ""->o  ""
a o->o   b : ""o->o ""
a <->    b : ""<->  ""
a o<->o  b : ""o<->o""
a x<->x  b : ""x<->x""
a ->>o   b : ""->>o ""
a -\o    b : ""-\o  ""
a -\\o   b : ""-\\\\o""
a -/o    b : ""-/o  ""
a -//o   b : ""-//o ""
a x->o   b : ""x->o ""
@enduml
```



1.39.2 Itself arrow

```
@startuml
```

```
participant Alice as a
participant Bob   as b
a ->     a : ""->   ""
a ->>    a : ""->>  ""
a -\     a : ""-\   ""
a -\\    a : ""-\\\\""
a -/     a : ""-/   ""
a -//    a : ""-//  ""
a ->x    a : ""->x  ""
a x->    a : ""x->  ""
a o->    a : ""o->  ""
a ->o    a : ""->o  ""
a o->o   a : ""o->o ""
a <->    a : ""<->  ""
a o<->o  a : ""o<->o""
a x<->x  a : ""x<->x""
a ->>o   a : ""->>o ""
a -\o    a : ""-\o  ""
a -\\o   a : ""-\\\\o""
a -/o    a : ""-/o  ""
a -//o   a : ""-//o ""
a x->o   a : ""x->o ""
@enduml
```

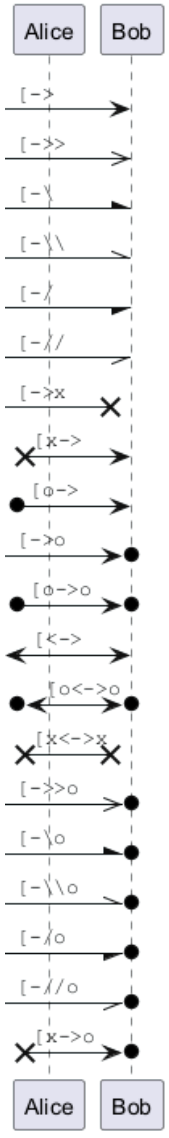


1.39.3 Incoming and outgoing messages (with '[', ']')

1.39.4 Incoming messages (with '[')

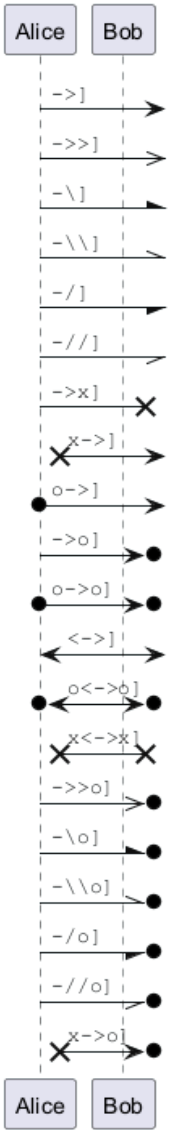
```
@startuml
participant Alice as a
participant Bob   as b
[->      b : ""[->   ""
[->>     b : ""[->>  ""
```

```
[-\      b : ""[-\   ""
[-\\     b : ""[-\\\\""
[-/      b : ""[-/   ""
[-//     b : ""[-//  ""
[->x     b : ""[->x  ""
[x->     b : ""[x->  ""
[o->     b : ""[o->  ""
[->o     b : ""[->o  ""
[o->o    b : ""[o->o ""
[<->     b : ""[<->  ""
[o<->o   b : ""[o<->o""
[x<->x   b : ""[x<->x""
[->>o    b : ""[->>o ""
[-\o     b : ""[-\o  ""
[-\\o    b : ""[-\\\\o""
[-/o     b : ""[-/o  ""
[-//o    b : ""[-//o ""
[x->o    b : ""[x->o ""
@enduml
```



1.39.5 Outgoing messages (with ']')

```
@startuml
participant Alice as a
participant Bob   as b
a ->]       : ""->]   ""
a ->>]      : ""->>]  ""
a -\]       : ""-\]   ""
a -\\]      : ""-\\\\]""
a -/]       : ""-/]   ""
a -//]      : ""-//]  ""
a ->x]      : ""->x]  ""
a x->]      : ""x->]  ""
a o->]      : ""o->]  ""
a ->o]      : ""->o]  ""
a o->o]     : ""o->o] ""
a <->]      : ""<->]  ""
a o<->o]    : ""o<->o]""
a x<->x]    : ""x<->x]""
a ->>o]     : ""->>o] ""
a -\o]      : ""-\o]  ""
a -\\o]     : ""-\\\\o]""
a -/o]      : ""-/o]  ""
a -//o]     : ""-//o] ""
a x->o]     : ""x->o] ""
@enduml
```

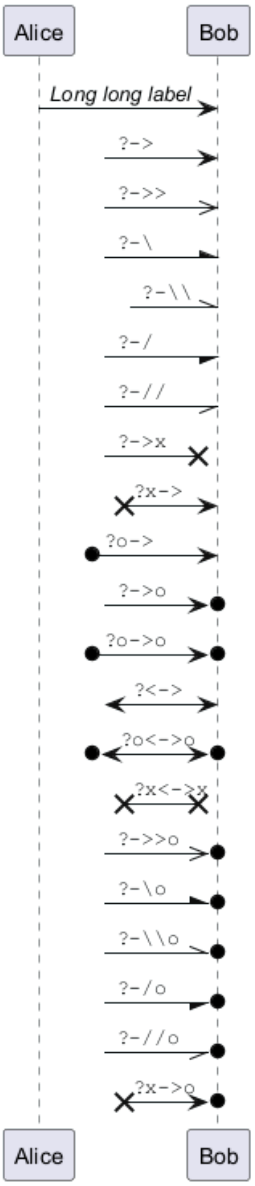


1.39.6 Short incoming and outgoing messages (with '?')

1.39.7 Short incoming (with '?')

```
@startuml
participant Alice as a
participant Bob   as b
a ->     b : //Long long label//
?->      b : ""?->   ""
?->>     b : ""?->>  ""
?-\      b : ""?-\   ""
?-\\     b : ""?-\\\\""
?-/      b : ""?-/   ""
?-//     b : ""?-//  ""
?->x     b : ""?->x  ""
?x->     b : ""?x->  ""
?o->     b : ""?o->  ""
?->o     b : ""?->o  ""
?o->o    b : ""?o->o ""
?<->     b : ""?<->  ""
?o<->o   b : ""?o<->o""
?x<->x   b : ""?x<->x""
```

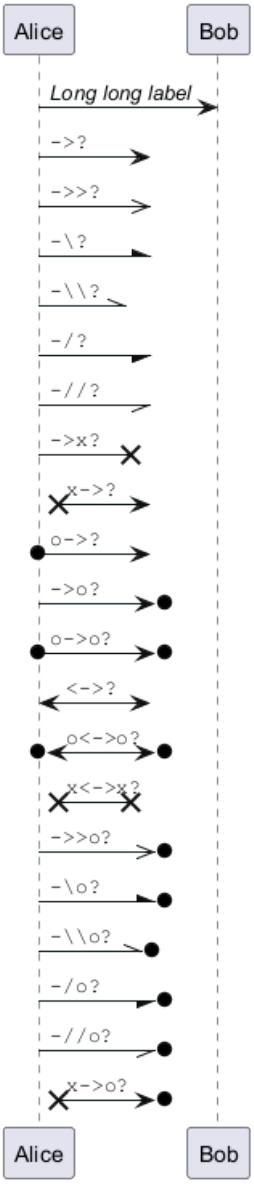
```
?->>o    b : ""?->>o ""
?-\o     b : ""?-\o  ""
?-\\o    b : ""?-\\\\o ""
?-/o     b : ""?-/o  ""
?-//o    b : ""?-//o ""
?x->o    b : ""?x->o ""
@enduml
```



1.39.8 Short outgoing (with '?')

```
@startuml
participant Alice as a
participant Bob   as b
a ->     b : //Long long label//
a ->?      : ""->?   ""
a ->>?     : ""->>?  ""
a -\?      : ""-\?   ""
a -\\?     : ""-\\\\?""
a -/?      : ""-/?   ""
a -//?     : ""-//?  ""
a ->x?     : ""->x?  ""
```

```
a x->?     : ""x->?  ""
a o->?     : ""o->?  ""
a ->o?     : ""->o?  ""
a o->o?    : ""o->o? ""
a <->?     : ""<->?  ""
a o<->o?   : ""o<->o?""
a x<->x?   : ""x<->x?""
a ->>o?    : ""->>o? ""
a -\o?     : ""-\o?  ""
a -\\o?    : ""-\\\\o?""
a -/o?     : ""-/o?  ""
a -//o?    : ""-//o? ""
a x->o?    : ""x->o? ""
@enduml
```

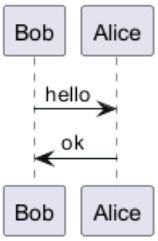


1.40 Specific SkinParameter

1.40.1 By default

```
@startuml
Bob -> Alice : hello
```

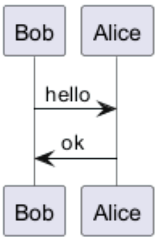
```
Alice -> Bob : ok
@enduml
```



1.40.2 LifelineStrategy

- nosolid *(by default)*

```
@startuml
skinparam lifelineStrategy nosolid
Bob -> Alice : hello
Alice -> Bob : ok
@enduml
```

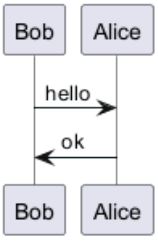


[Ref. QA-9016]

- solid

In order to have solid life line in sequence diagrams, you can use: `skinparam lifelineStrategy solid`

```
@startuml
skinparam lifelineStrategy solid
Bob -> Alice : hello
Alice -> Bob : ok
@enduml
```



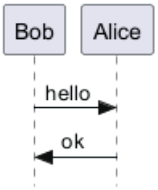
[Ref. QA-2794]

1.40.3 style strictuml

To be conform to strict UML (*for arrow style: emits triangle rather than sharp arrowheads*), you can use:

- `skinparam style strictuml`

```
@startuml
skinparam style strictuml
Bob -> Alice : hello
Alice -> Bob : ok
@enduml
```

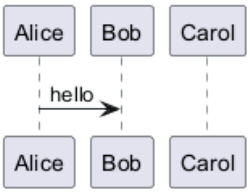


[Ref. QA-1047]

1.41 Hide unlinked participant

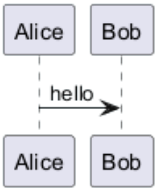
By default, all participants are displayed.

```
@startuml
participant Alice
participant Bob
participant Carol

Alice -> Bob : hello
@enduml
```



But you can `hide unlinked` participant.

```
@startuml
hide unlinked
participant Alice
participant Bob
participant Carol

Alice -> Bob : hello
@enduml
```

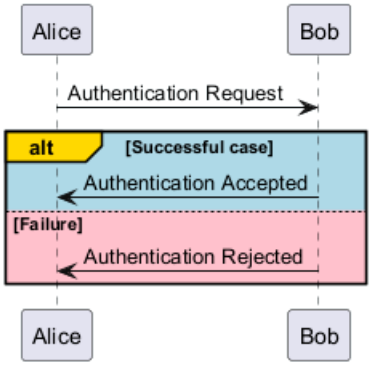


[Ref. QA-4247]

1.42 Color a group message

It is possible to color a group messages:

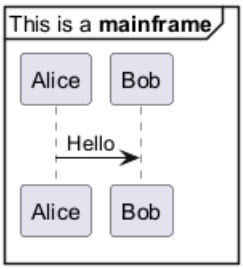
```
@startuml
Alice -> Bob: Authentication Request
alt#Gold #LightBlue Successful case
    Bob -> Alice: Authentication Accepted
else #Pink Failure
    Bob -> Alice: Authentication Rejected
end
@enduml
```



[Ref. QA-4750 and QA-6410]

1.43 Mainframe

```
@startuml
mainframe This is a **mainframe**
Alice->Bob : Hello
@enduml
```



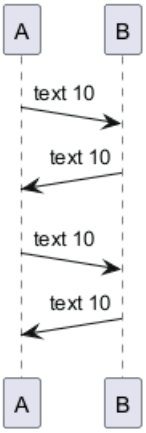
[Ref. QA-4019 and Issue#148]

1.44 Slanted or odd arrows

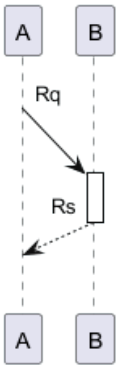
You can use the `(nn)` option (before or after arrow) to make the arrows slanted, where *nn* is the number of shift pixels.

[Available only after v1.2022.6beta+]

```
@startuml
A ->(10) B: text 10
B ->(10) A: text 10

A ->(10) B: text 10
A (10)<- B: text 10
@enduml
```

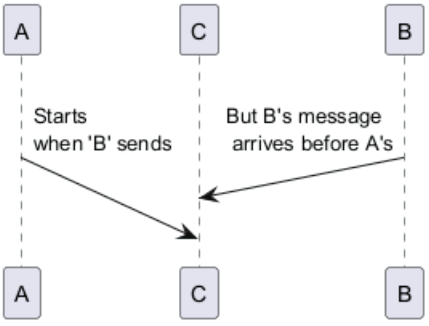



```
@startuml
A ->(40) B++: Rq
B -->(20) A--: Rs
@enduml
```



[Ref. QA-14145]

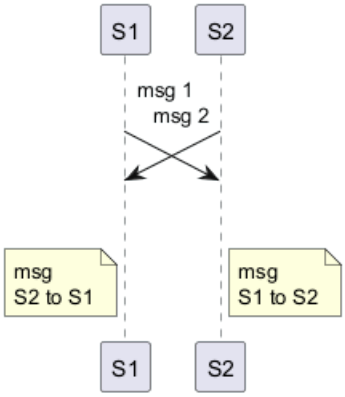
```
@startuml
!pragma teoz true
A ->(50) C: Starts\nwhen 'B' sends
& B ->(25) C: \nBut B's message\n arrives before A's
@enduml
```



[Ref. QA-6684]

```
@startuml
!pragma teoz true

S1 ->(30) S2: msg 1\n
& S2 ->(30) S1: msg 2

note left S1: msg\nS2 to S1
& note right S2: msg\nS1 to S2
```

```
@enduml
```

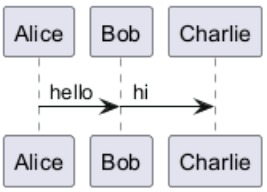


[Ref. QA-1072]

1.45 Parallel messages *(with teoz)*

You can use the `&` teoz command to display parallel messages:

```
@startuml
!pragma teoz true
Alice -> Bob : hello
& Bob -> Charlie : hi
@enduml
```



(See also Teoz architecture)

2 Use Case Diagram

A use case diagram is a visual representation used in software engineering to depict the interactions between **system actors** and the **system itself**. It captures the dynamic behavior of a system by illustrating its **use cases** and the roles that interact with them. These diagrams are essential in specifying the system's **functional requirements** and understanding how users will interact with the system. By providing a high-level view, use case diagrams help stakeholders understand the system's functionality and its potential value.

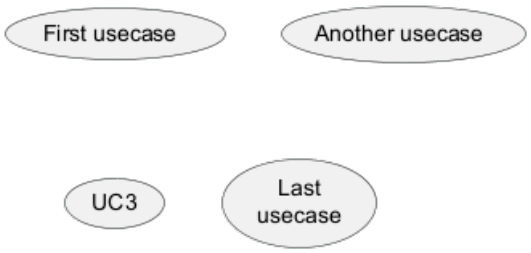
PlantUML offers a unique approach to creating use case diagrams through its text-based language. One of the primary advantages of using PlantUML is its **simplicity and efficiency**. Instead of manually drawing shapes and connections, users can define their diagrams using intuitive and concise textual descriptions. This not only speeds up the diagram creation process but also ensures **consistency and accuracy**. The ability to integrate with various documentation platforms and its wide range of supported output formats make PlantUML a versatile tool for both developers and non-developers. Lastly, being **open-source**, PlantUML boasts a strong community that continually contributes to its improvement and offers a wealth of resources for users at all levels.

2.1 유즈케이스

유즈케이스는 (두개의괄호는원으로보이기때문에) 괄호로싸서표현합니다.

아니면 `usecase` 키워를이용하여정의할수있습니다. 그리고 `as` 키워드를이용하여별칭을정의할수있습니다. 별칭은관계를정의할때사용됩니다.

```
@startuml

(First usecase)
(Another usecase) as (UC2)
usecase UC3
usecase (Last\nusecase) as UC4

@enduml
```



2.2 Actors

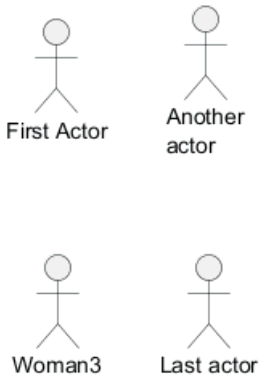
액터를정의하는이름은콜론사이에있습니다.

Actor 키워드를사용하여액터를정의할수도있습니다.

별칭은 as 키워드로할당될수있으며, 나중에관계를정의할때액터이름대신사용될수있습니다.

다음예에서액터정의는선택사항임을알수있습니다.

```
@startuml

:First Actor:
:Another\nactor: as Man2
actor Woman3
actor :Last actor: as Person1

@enduml
```



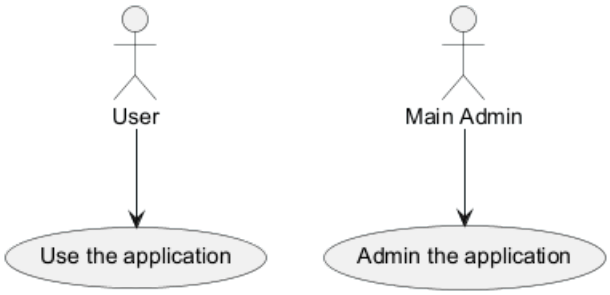
2.3 Change Actor style

You can change the actor style from stick man *(by default)* to:

- an awesome man with the `skinparam actorStyle awesome` command;
- a hollow man with the `skinparam actorStyle hollow` command.

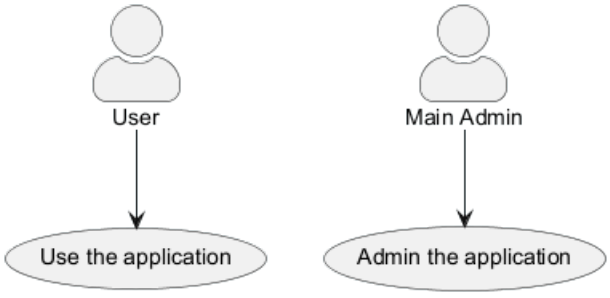
2.3.1 Stick man *(by default)*

```
@startuml
:User: --> (Use)
"Main Admin" as Admin
"Use the application" as (Use)
Admin --> (Admin the application)
@enduml
```



2.3.2 Awesome man

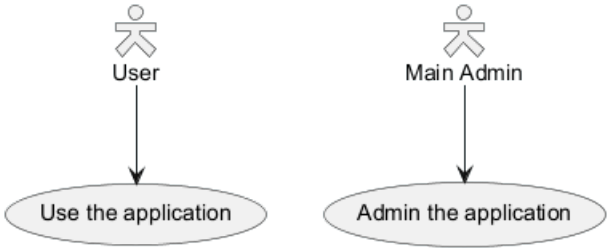
```
@startuml
skinparam actorStyle awesome
:User: --> (Use)
"Main Admin" as Admin
"Use the application" as (Use)
Admin --> (Admin the application)
@enduml
```



[Ref. QA-10493]

2.3.3 Hollow man

```
@startuml
skinparam actorStyle Hollow
:User: --> (Use)
"Main Admin" as Admin
"Use the application" as (Use)
Admin --> (Admin the application)
@enduml
```



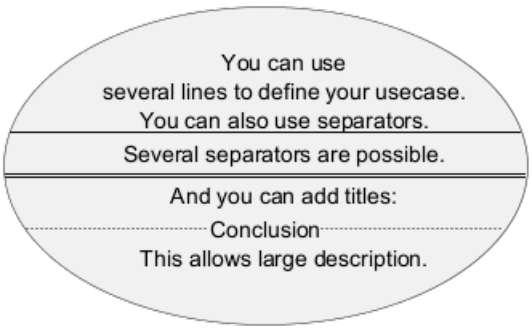
[Ref. PR#396]

2.4 유즈케이스종류

If you want to have description on several lines, you can use quotes.

You can also use the following separators: `--` `..` `==` `__`. And you can put titles within the separators.

```
@startuml

usecase UC1 as "You can use
several lines to define your usecase.
You can also use separators.
--
Several separators are possible.
==
And you can add titles:
..Conclusion..
This allows large description."

@enduml
```

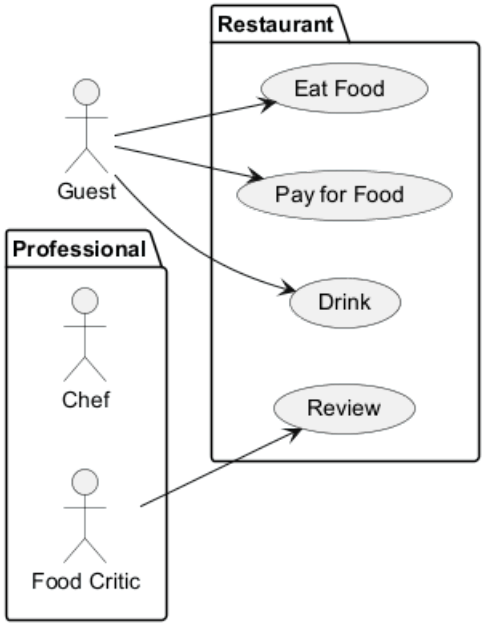


2.5 Use package

You can use packages to group actors or use cases.

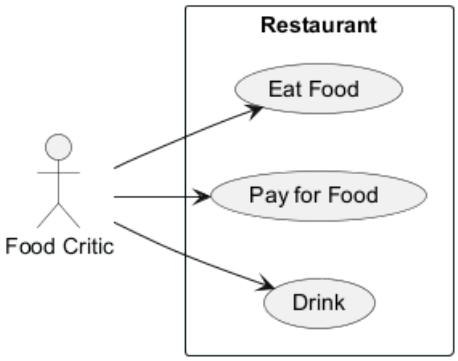
```
@startuml
left to right direction
actor Guest as g
```

```
package Professional {
  actor Chef as c
  actor "Food Critic" as fc
}
package Restaurant {
  usecase "Eat Food" as UC1
  usecase "Pay for Food" as UC2
  usecase "Drink" as UC3
  usecase "Review" as UC4
}
fc --> UC4
g --> UC1
g --> UC2
g --> UC3
@enduml
```



You can use `rectangle` to change the display of the package.

```
@startuml
left to right direction
actor "Food Critic" as fc
rectangle Restaurant {
  usecase "Eat Food" as UC1
  usecase "Pay for Food" as UC2
  usecase "Drink" as UC3
}
fc --> UC1
fc --> UC2
fc --> UC3
@enduml
```



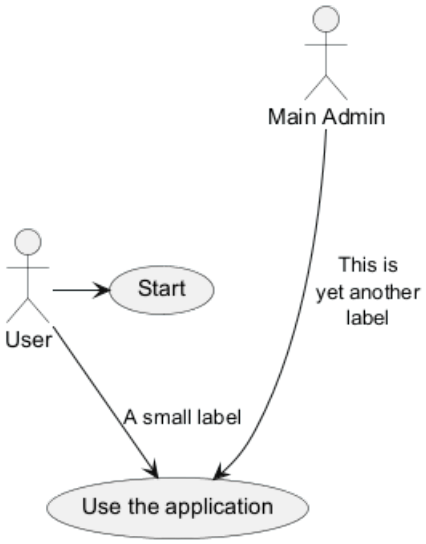
2.6 기본예제

To link actors and use cases, the arrow `-->` is used.

The more dashes `-` in the arrow, the longer the arrow. You can add a label on the arrow, by adding a `:` character in the arrow definition.

In this example, you see that *User* has not been defined before, and is used as an actor.

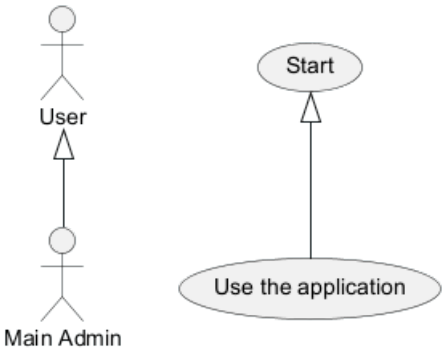
```
@startuml

User -> (Start)
User --> (Use the application) : A small label

:Main Admin: ---> (Use the application) : This is\nyet another\nlabel

@enduml
```



2.7 Extension

If one actor/use case extends another one, you can use the symbol `<|--`.

```
@startuml
:Main Admin: as Admin
(Use the application) as (Use)

User <|-- Admin
(Start) <|-- (Use)

@enduml
```

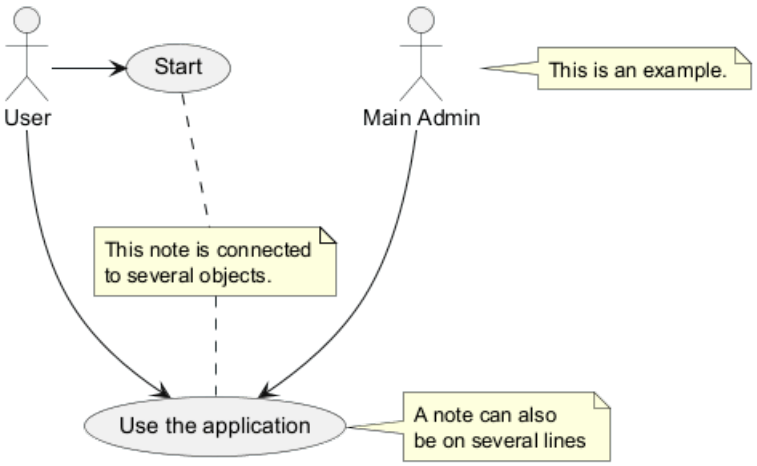


2.8 Using notes

You can use the `note left of` , `note right of` , `note top of` , `note bottom of` keywords to define notes related to a single object.

A note can be also define alone with the `note` keywords, then linked to other objects using the `..` symbol.

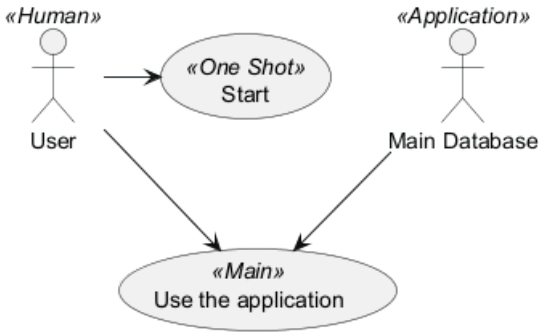
```
@startuml
:Main Admin: as Admin
(Use the application) as (Use)

User -> (Start)
User --> (Use)

Admin ---> (Use)

note right of Admin : This is an example.

note right of (Use)
  A note can also
  be on several lines
end note

note "This note is connected\nto several objects." as N2
(Start) .. N2
N2 .. (Use)
@enduml
```



2.9 Stereotypes

You can add stereotypes while defining actors and use cases using << and >>.

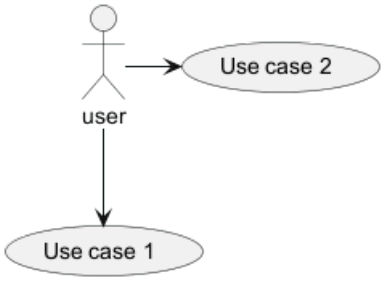
```
@startuml
User << Human >>
:Main Database: as MySql << Application >>
(Start) << One Shot >>
(Use the application) as (Use) << Main >>

User -> (Start)
User --> (Use)

MySql --> (Use)

@enduml
```



2.10 화살표방향변경

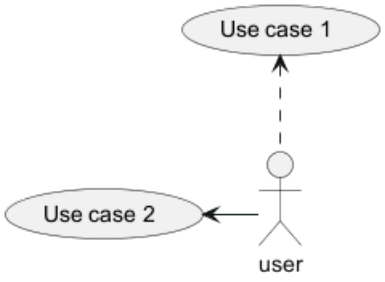
기본적으로, 클래스간의링크는대쉬 2 개 -- 로표시하고수직방향이다. 다음처럼대쉬 1 개 (혹은점) 을넣어서수평방향링크를사용할수있다:

```
@startuml
:user: --> (Use case 1)
:user: -> (Use case 2)
@enduml
```



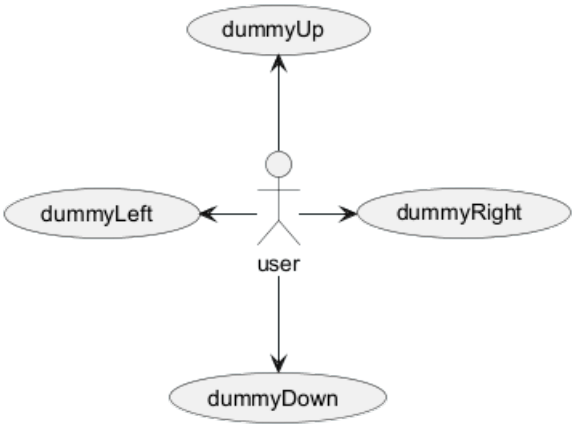
You can also change directions by reversing the link:

```
@startuml
(Use case 1) <.. :user:
(Use case 2) <- :user:
@enduml
```



It is also possible to change arrow direction by adding `left`, `right`, `up` or `down` keywords inside the arrow:

```
@startuml
:user: -left-> (dummyLeft)
:user: -right-> (dummyRight)
:user: -up-> (dummyUp)
:user: -down-> (dummyDown)
@enduml
```



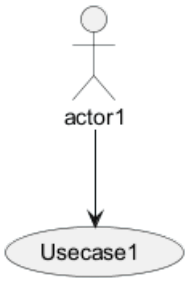
You can shorten the arrow by using only the first character of the direction (for example, `-d-` instead of `-down-`) or the two first characters (`-do-`).

Please note that you should not abuse this functionality : *Graphviz* gives usually good results without tweaking.

2.11 Splitting diagrams

The `newpage` keywords to split your diagram into several pages or images.

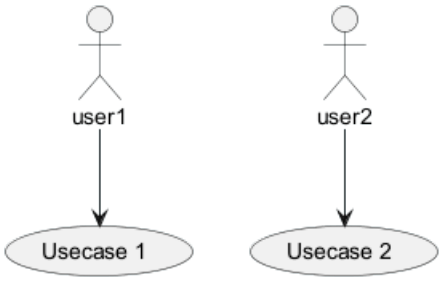
```
@startuml
:actor1: --> (Usecase1)
newpage
:actor2: --> (Usecase2)
@enduml
```



2.12 Left to right direction

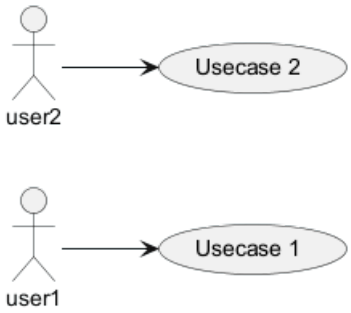
The general default behavior when building diagram is **top to bottom**.

```
@startuml
'default
top to bottom direction
user1 --> (Usecase 1)
user2 --> (Usecase 2)

@enduml
```



You may change to **left to right** using the `left to right direction` command. The result is often better with this direction.

```
@startuml

left to right direction
user1 --> (Usecase 1)
user2 --> (Usecase 2)

@enduml
```



See also 'Change diagram orientation' on Deployment diagram page.

2.13 Skinparam

You can use the skinparam command to change colors and fonts for the drawing.

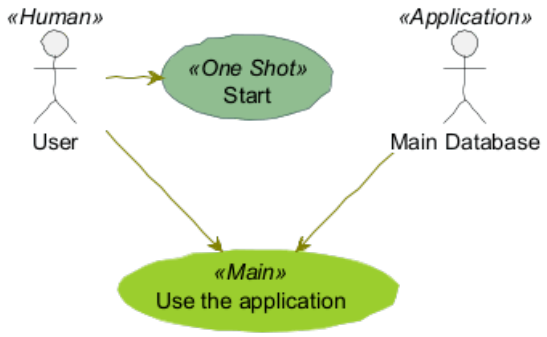
You can use this command :

- In the diagram definition, like any other commands,
- In an included file,
- In a configuration file, provided in the command line or the ANT task.

You can define specific color and fonts for stereotyped actors and usecases.

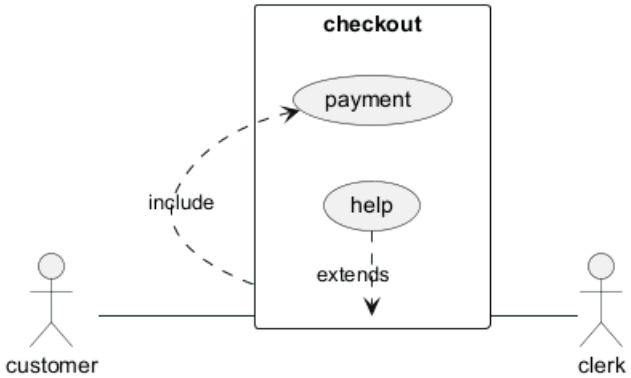
```
@startuml
skinparam handwritten true

skinparam usecase {
BackgroundColor DarkSeaGreen
BorderColor DarkSlateGray

BackgroundColor<< Main >> YellowGreen
BorderColor<< Main >> YellowGreen

ArrowColor Olive
ActorBorderColor black
ActorFontName Courier

ActorBackgroundColor<< Human >> Gold
```

```
}

User << Human >>
:Main Database: as MySql << Application >>
(Start) << One Shot >>
(Use the application) as (Use) << Main >>

User -> (Start)
User --> (Use)

MySql --> (Use)

@enduml
```



2.14 Complete example

```
@startuml
left to right direction
skinparam packageStyle rectangle
actor customer
actor clerk
rectangle checkout {
  customer -- (checkout)
  (checkout) .> (payment) : include
  (help) .> (checkout) : extends
  (checkout) -- clerk
}
@enduml
```

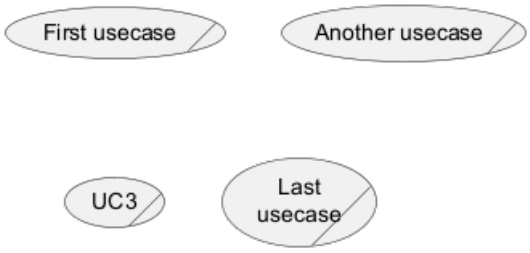


2.15 Business Use Case

You can add / to make Business Use Case.

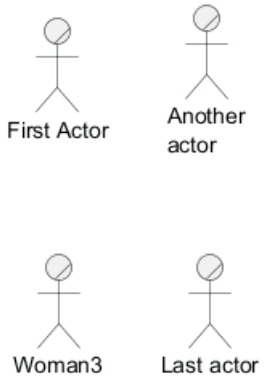
2.15.1 Business Usecase

```
@startuml

(First usecase)/
(Another usecase)/ as (UC2)
usecase/ UC3
usecase/ (Last\nusecase) as UC4

@enduml
```



2.15.2 Business Actor

```
@startuml

:First Actor:/
:Another\nactor:/ as Man2
actor/ Woman3
actor/ :Last actor: as Person1

@enduml
```



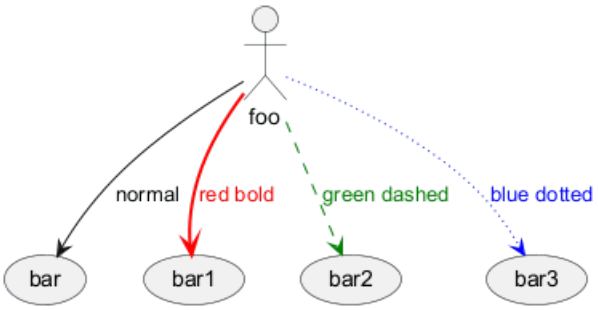
[Ref. QA-12179]

2.16 Change arrow color and style (inline style)

You can change the color or style of individual arrows using the inline following notation:

- `#color;line.[bold|dashed|dotted];text:color`

```
@startuml
actor foo
foo --> (bar) : normal
foo --> (bar1) #line:red;line.bold;text:red  : red bold
foo --> (bar2) #green;line.dashed;text:green : green dashed
foo --> (bar3) #blue;line.dotted;text:blue   : blue dotted
@enduml
```



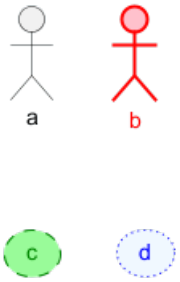
[Ref. QA-3770 and QA-3816] [See similar feature on deployment-diagram or class diagram]

2.17 Change element color and style (inline style)

You can change the color or style of individual element using the following notation:

- `#[color|back:color];line:color;line.[bold|dashed|dotted];text:color`

```
@startuml
actor a
actor b #pink;line:red;line.bold;text:red
usecase c #palegreen;line:green;line.dashed;text:green
usecase d #aliceblue;line:blue;line.dotted;text:blue
@enduml
```



[Ref. QA-5340 and adapted from QA-6852]

2.18 Display JSON Data on Usecase diagram

2.18.1 Simple example

```
@startuml
allowmixing

actor     Actor
usecase   Usecase

json JSON {
   "fruit":"Apple",
   "size":"Large",
   "color": ["Red", "Green"]
}
@enduml
```

JSON	
fruit	Apple
size	Large
color	Red
	Green

[Ref. QA-15481]

For another example, see on JSON page.

3 Class Diagram

Class diagrams are designed using a syntax that mirrors those traditionally employed in programming languages. This resemblance fosters a familiar environment for developers, thereby facilitating an easier and more intuitive diagram creation process.

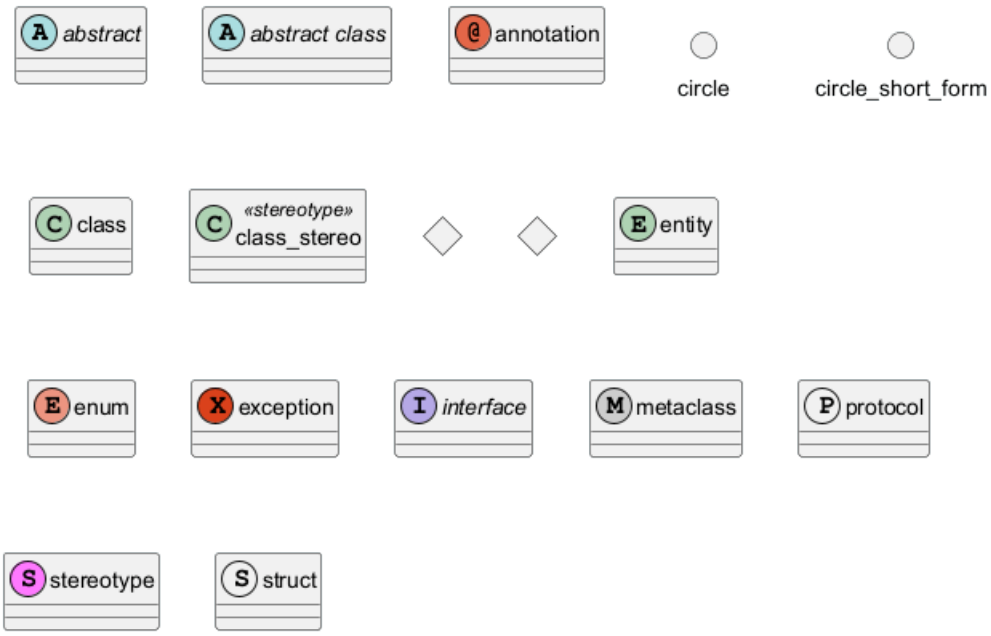
This design approach is not only succinct but also enables the creation of representations that are both concise and expressive. Moreover, it allows for the portrayal of relationships between classes through a syntax that echoes that of sequence diagrams, paving the way for a fluid and insightful depiction of class interactions.

Beyond structural and relational representations, the class diagram syntax supports further enrichments such as the inclusion of notes and the application of colors, empowering users to create diagrams that are both informative and visually appealing.

You can learn more about some of the common commands in PlantUML to enhance your diagram creation experience.

3.1 Declaring element

```
@startuml
abstract        abstract
abstract class  "abstract class"
annotation      annotation
circle          circle
()              circle_short_form
class           class
class           class_stereo  <<stereotype>>
diamond         diamond
<>              diamond_short_form
entity          entity
enum            enum
exception       exception
interface       interface
metaclass       metaclass
protocol        protocol
stereotype      stereotype
struct          struct
@enduml
```



[Ref. for `protocol` and `struct`: GH-1028, for `exception`: QA-16258]

3.2 클래스관계

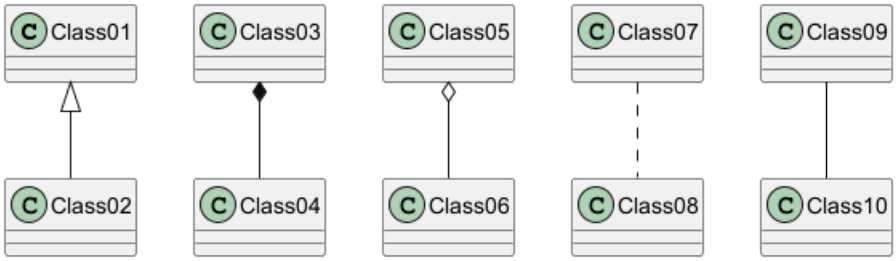
클래스관계는다음과같은부호를사용합니다.

유형	기호	목적
확장	<|--	계층구조에서클래스의특수화
구현	<|..	클래스에의한인터페이스의실현
컴포지션	*--	부분이전체없이는존재할수없음
집합	o--	부분이전체와독립적으로존재할수있음
의존성	-->	객체가다른객체를사용함
약한의존성	..>	더약한형태의의존성

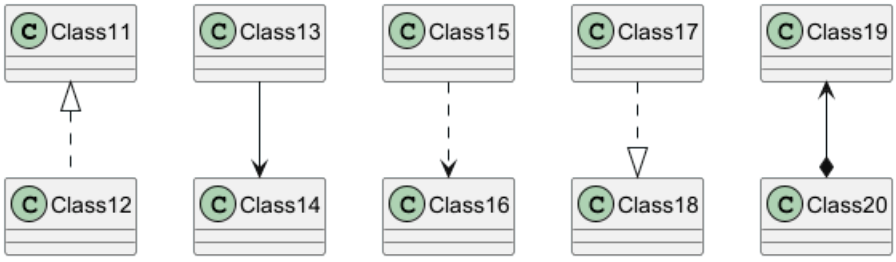
-- 는 .. 점선으로대체가능합니다.

이러한규칙들로다음과같은다이어그램을그리는것이가능합니다.

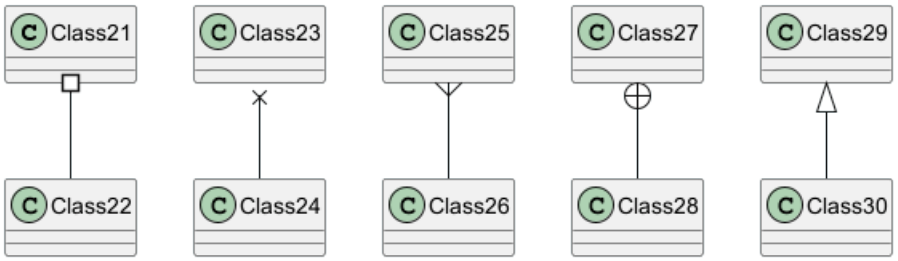
```
@startuml
Class01 <|-- Class02
Class03 *-- Class04
Class05 o-- Class06
Class07 .. Class08
Class09 -- Class10
@enduml
```




```
@startuml
Class11 <|.. Class12
Class13 --> Class14
Class15 ..> Class16
Class17 ..|> Class18
Class19 <--* Class20
@enduml
```




```
@startuml
Class21 #-- Class22
Class23 x-- Class24
Class25 }-- Class26
Class27 +-- Class28
Class29 ^-- Class30
@enduml
```

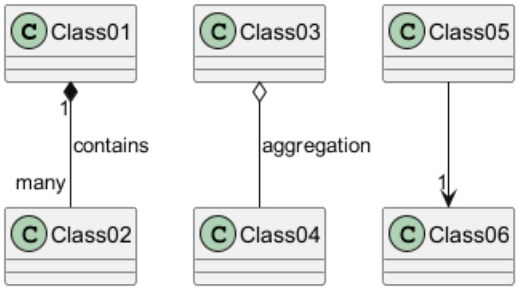


3.3 관계를나타내기위한레이블

관계에서레이블을추가하기위해서는뒤에 : 를붙이고레이블을작성하면됩니다.

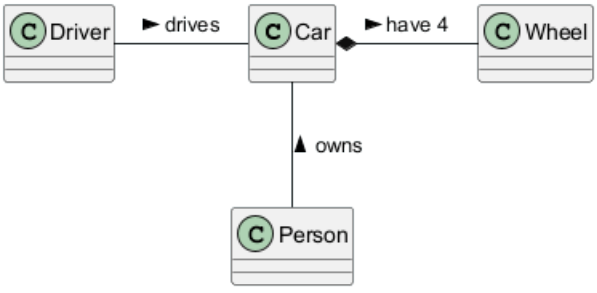
관계차수를나타내기위해서는 "" 를이용하여관계의양쪽끝에작성하면됩니다.

```
@startuml

Class01 "1" *-- "many" Class02 : contains

Class03 o-- Class04 : aggregation

Class05 --> "1" Class06

@enduml
```



< 또는 > 을사용하여객체가다른객체에대한흐름관계를더자세히설명할수있습니다.

```
@startuml
class Car

Driver - Car : drives >
Car *- Wheel : have 4 >
Car -- Person : < owns

@enduml
```

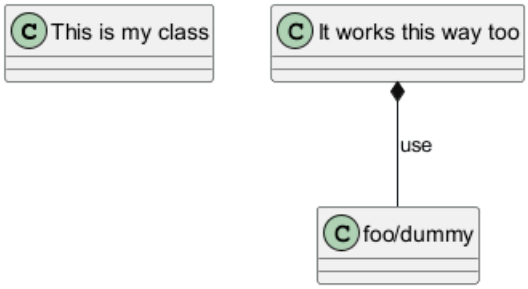


3.4 Using non-letters in element names and relation labels

If you want to use non-letters in the class (or enum...) display name, you can either :

- Use the `as` keyword in the class definition to assign an alias
- Put quotes `""` around the class name

```
@startuml
class "This is my class" as class1
class class2 as "It works this way too"

class2 *-- "foo/dummy" : use
@enduml
```

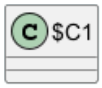


If an alias is assigned to an element, the rest of the file must refer to the element by the alias instead of the name.

3.4.1 Starting names with $

Note that names starting with `$` cannot be hidden or removed later, because `hide` and `remove` command will consider the name a `$tag` instead of a component name. To later remove such elements they must have an alias or must be tagged.

```
@startuml
class $C1
class $C2 $C2
class "$C2" as dollarC2
remove $C1
remove $C2
remove dollarC2
@enduml
```



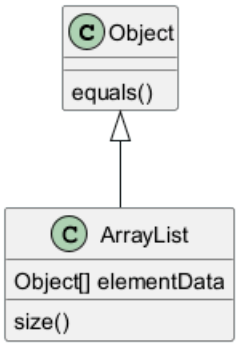
Also note that names starting with `$` are valid, but to assign an alias to such element the name must be put between quotes `""`.

3.5 Adding methods

To declare fields and methods, you can use the symbol `:` followed by the field's or method's name.

The system checks for parenthesis to choose between methods and fields.

```
@startuml
Object <|-- ArrayList

Object : equals()
ArrayList : Object[] elementData
ArrayList : size()

@enduml
```



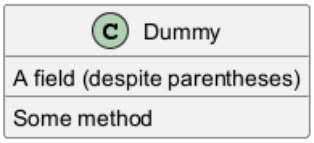
It is also possible to group between brackets {} all fields and methods.

Note that the syntax is highly flexible about type/name order.

```
@startuml
class Dummy {
  String data
  void methods()
}

class Flight {
   flightNumber : Integer
   departureTime : Date
}
@enduml
```

You can use {field} and {method} modifiers to override default behaviour of the parser about fields and methods.

```
@startuml
class Dummy {
  {field} A field (despite parentheses)
  {method} Some method
}

@enduml
```

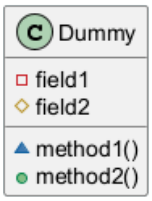


3.6 메소드, 필드가시화 (Visibility) 정의

메소드나필드들을정의할때, 특수문자를사용하여관련된아이템을가시화할수있습니다. 명령어는다음과 같습니다:

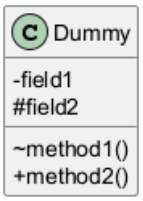
Character	Icon for field	Icon for method	Visibility
-	□	■	private
#	◇	◆	protected
~	△	▲	package private
+	○	●	public

```
@startuml

class Dummy {
 -field1
 #field2
 ~method1()
 +method2()
}

@enduml
```



`skinparam classAttributeIconSize 0` 를사용하여, 아이콘표시를끌수있습니다. 명령어는다음과같습니다:

```
@startuml
skinparam classAttributeIconSize 0
class Dummy {
 -field1
 #field2
 ~method1()
 +method2()
}

@enduml
```



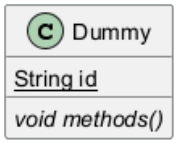
[Ref. [QA-4755](https://forum.plantuml.net/4755/provide-display-visibility-attributes-private-protected)]

3.7 Abstract and Static

You can define static or abstract methods or fields using the `{static}` or `{abstract}` modifier.

These modifiers can be used at the start or at the end of the line. You can also use `{classifier}` instead of `{static}`.

```
@startuml
class Dummy {
  {static} String id
  {abstract} void methods()
}
@enduml
```

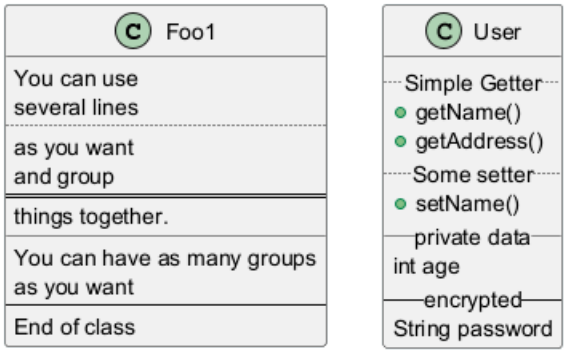


3.8 Advanced class body

By default, methods and fields are automatically regrouped by PlantUML. You can use separators to define your own way of ordering fields and methods. The following separators are possible : `--` `..` `==` `__`.

You can also use titles within the separators:

```
@startuml
class Foo1 {
  You can use
  several lines
  ..
  as you want
  and group
  ==
  things together.
  --
  You can have as many groups
  as you want
  --
  End of class
}

class User {
  .. Simple Getter ..
  + getName()
  + getAddress()
  .. Some setter ..
  + setName()
  __ private data __
  int age
  -- encrypted --
  String password
}

@enduml
```



3.9 Notes and stereotypes

Stereotypes are defined with the `class` keyword, `<<` and `>>`.

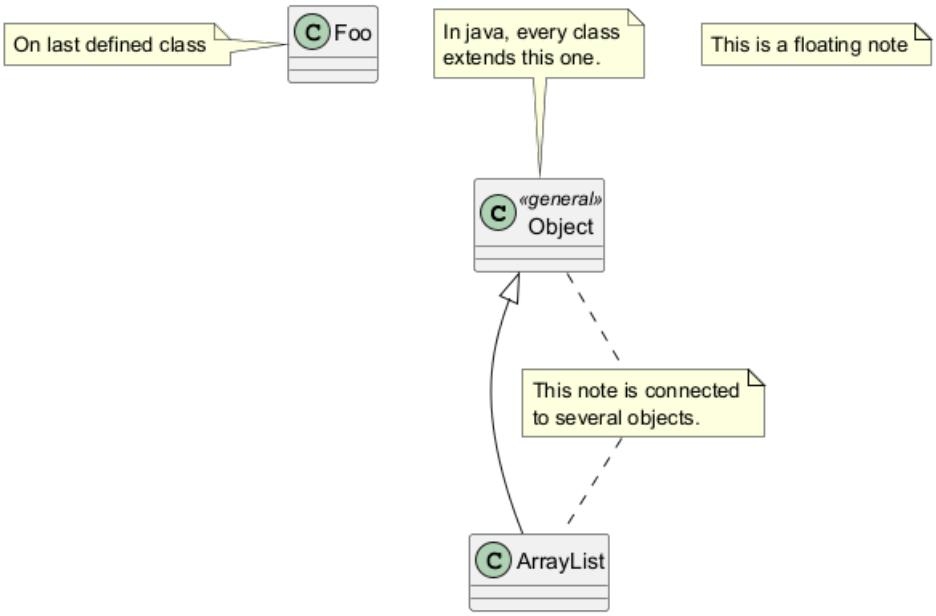
You can also define notes using `note left of` , <code>note right of</code> , `note top of` , `note bottom of` keywords.

You can also define a note on the last defined class using `note left`, `note right`, `note top`, `note bottom`.

A note can be also define alone with the `note` keywords, then linked to other objects using the `..` symbol.

```
@startuml
```

```
class Object << general >>
Object <|--- ArrayList

note top of Object : In java, every class\nextends this one.

note "This is a floating note" as N1
note "This note is connected\nto several objects." as N2
Object .. N2
N2 .. ArrayList

class Foo
note left: On last defined class

@enduml
```



3.10 More on notes

It is also possible to use few HTML tags (See Creole expression) like :

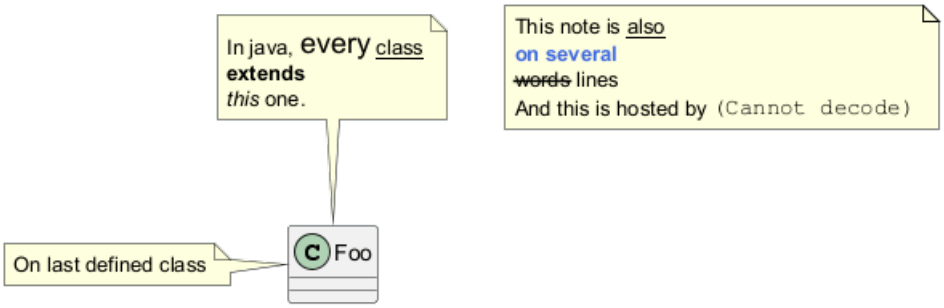
- `<b>`
- `<u>`
- `<i>`
- `<s>`, `<del>`, `<strike>`
- `<font color="#AAAAAA">` or `<font color="colorName">`
- `<color:#AAAAAA>` or `<color:colorName>`
- `<size:nn>` to change font size
- `<img src="file">` or `<img:file>`: the file must be accessible by the filesystem

You can also have a note on several lines.

You can also define a note on the last defined class using `note left`, `note right`, `note top`, `note bottom`.

```
@startuml

class Foo
note left: On last defined class
```

```
note top of Foo
  In java, <size:18>every</size> <u>class</u>
  <b>extends</b>
  <i>this</i> one.
end note

note as N1
  This note is <u>also</u>
  <b><color:royalBlue>on several</color>
  <s>words</s> lines
  And this is hosted by <img:sourceforge.jpg>
end note

@enduml
```



3.11 Note on field (field, attribute, member) or method

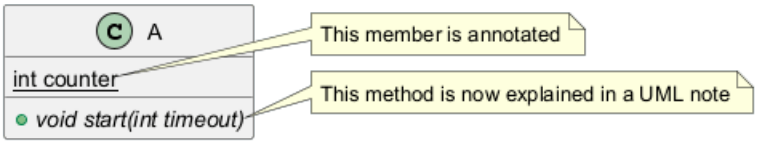
It is possible to add a note on field (field, attribute, member) or on method.

3.11.1 Constraint

- This cannot be used with `top` or `bottom` *(only `left` and `right` are implemented)*
- This cannot be used with namespaceSeparator `::`

3.11.2 Note on field or method

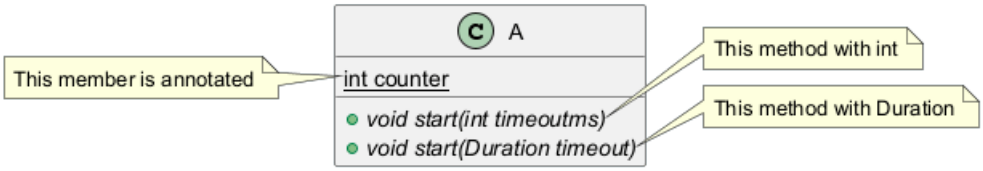
```
@startuml
class A {
{static} int counter
+void {abstract} start(int timeout)
}
note right of A::counter
  This member is annotated
end note
note right of A::start
  This method is now explained in a UML note
end note
@enduml
```



3.11.3 Note on method with the same name

```
@startuml
```

```
class A {
{static} int counter
+void {abstract} start(int timeoutms)
+void {abstract} start(Duration timeout)
}
note left of A::counter
  This member is annotated
end note
note right of A::"start(int timeoutms)"
  This method with int
end note
note right of A::"start(Duration timeout)"
  This method with Duration
end note
@enduml
```



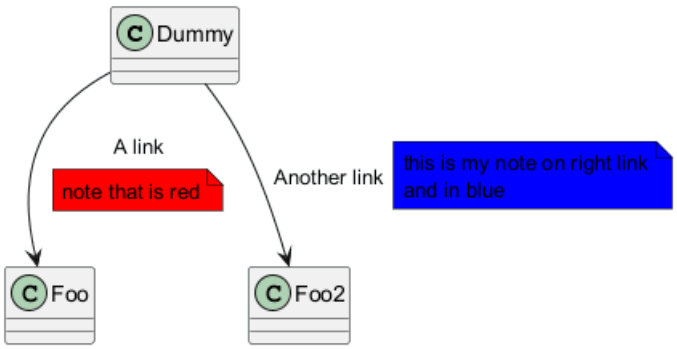
[Ref. QA-3474 and QA-5835]

3.12 Note on links

It is possible to add a note on a link, just after the link definition, using `note on link`.

You can also use `note left on link`, `note right on link`, `note top on link`, `note bottom on link` if you want to change the relative position of the note with the label.

```
@startuml

class Dummy
Dummy --> Foo : A link
note on link #red: note that is red

Dummy --> Foo2 : Another link
note right on link #blue
this is my note on right link
and in blue
end note

@enduml
```



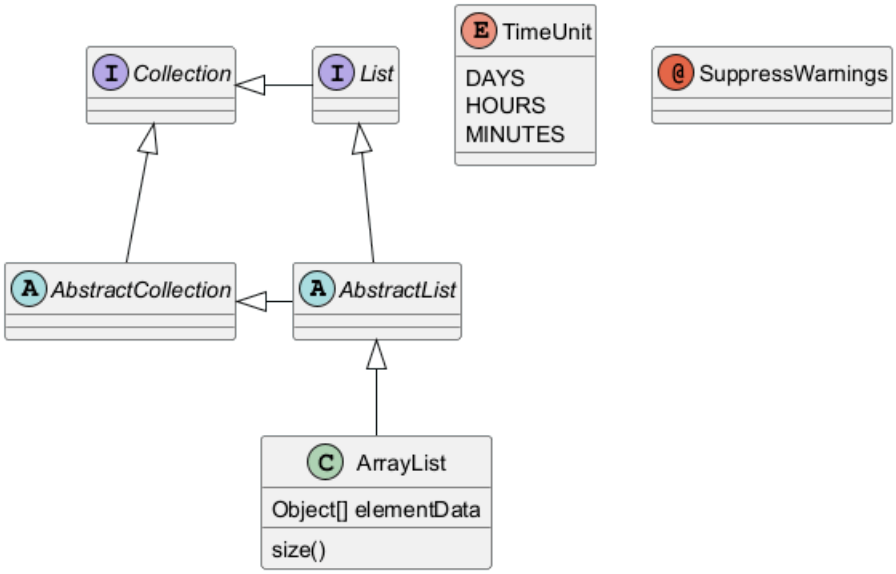
3.13 Abstract class and interface

You can declare a class as abstract using `"abstract"` or `"abstract class"` keywords.

The class will be printed in *italic*.</p>

You can use the `interface`, `annotation` and `enum` keywords too.</p>

```
@startuml

abstract class AbstractList
abstract AbstractCollection
interface List
interface Collection

List <|-- AbstractList
Collection <|-- AbstractCollection

Collection <|- List
AbstractCollection <|- AbstractList
AbstractList <|-- ArrayList

class ArrayList {
  Object[] elementData
  size()
}

enum TimeUnit {
  DAYS
  HOURS
  MINUTES
}

annotation SuppressWarnings

@enduml
```



[Ref. ’Annotation with members’ [Issue#458](https://github.com/plantuml/plantuml/issues/458)]

3.14 Hide attributes, methods...

You can parameterize the display of classes using the `hide/show` command.

The basic command is: `hide empty members`. This command will hide attributes or methods if they are empty.

Instead of `empty members`, you can use:

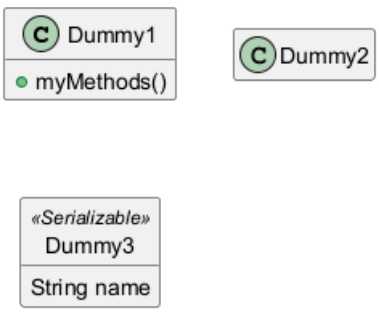
- `empty fields` or `empty attributes` for empty fields,
- `empty methods` for empty methods,
- `fields` or `attributes` which will hide fields, even if they are described,
- `methods` which will hide methods, even if they are described,
- `members` which will hide fields and methods, even if they are described,
- `circle` for the circled character in front of class name,
- `stereotype` for the stereotype.

You can also provide, just after the `hide` or `show` keyword:

- `class` for all classes,
- `interface` for all interfaces,
- `enum` for all enums,
- `<<foo1>>` for classes which are stereotyped with *foo1*,
- an existing class name.

You can use several `show/hide` commands to define rules and exceptions.

```
@startuml

class Dummy1 {
  +myMethods()
}

class Dummy2 {
  +hiddenMethod()
}

class Dummy3 <<Serializable>> {
String name
}

hide members
hide <<Serializable>> circle
show Dummy1 methods
show <<Serializable>> fields

@enduml
```



You can also mix with visibility:

```
@startuml
hide private members
hide protected members
hide package members

class Foo {
  - private
  # protected
  ~ package
}
@enduml
```

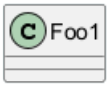
[Ref. QA-2913]

3.15 Hide classes

You can also use the `show/hide` commands to hide classes.

This may be useful if you define a large !included file, and if you want to hide some classes after file inclusion.

```
@startuml

class Foo1
class Foo2

Foo2 *-- Foo1

hide Foo2

@enduml
```



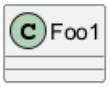
3.16 Remove classes

You can also use the `remove` commands to remove classes.

This may be useful if you define a large !included file, and if you want to remove some classes after file inclusion.

```
@startuml

class Foo1
class Foo2

Foo2 *-- Foo1
```

```
remove Foo2

@enduml
```

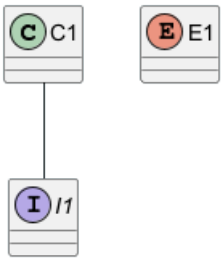


3.17 Hide, Remove or Restore tagged element or wildcard

You can put `$tags` (using `$`) on elements, then remove, hide or restore components either individually or by tags.

By default, all components are displayed:

```
@startuml
class C1 $tag13
enum E1
interface I1 $tag13
C1 -- I1
@enduml
```



But you can:

- `hide $tag13` components:

```
@startuml
class C1 $tag13
enum E1
interface I1 $tag13
C1 -- I1

hide $tag13
@enduml
```

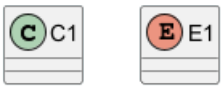
- or `remove $tag13` components:

```
@startuml
class C1 $tag13
enum E1
interface I1 $tag13
C1 -- I1

remove $tag13
```

```
@enduml
```

- or `remove $tag13 and restore $tag1` components:

```
@startuml
class C1 $tag13 $tag1
enum E1
interface I1 $tag13
C1 -- I1

remove $tag13
restore $tag1
@enduml
```



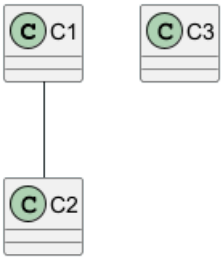
- or `remove * and restore $tag1` components:

```
@startuml
class C1 $tag13 $tag1
enum E1
interface I1 $tag13
C1 -- I1

remove *
restore $tag1
@enduml
```

3.18 Hide or Remove unlinked class

By default, all classes are displayed:

```
@startuml
class C1
class C2
class C3
C1 -- C2
@enduml
```



But you can:

- `hide @unlinked` classes:

```
@startuml
```

```
class C1
class C2
class C3
C1 -- C2

hide @unlinked
@enduml
```

- or `remove @unlinked` classes:

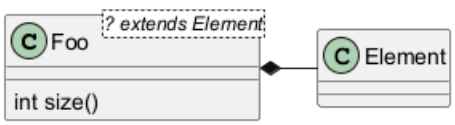
```
@startuml
class C1
class C2
class C3
C1 -- C2

remove @unlinked
@enduml
```

[Adapted from QA-11052]

3.19 Use generics

You can also use bracket < and > to define generics usage in a class.

```
@startuml

class Foo<? extends Element> {
  int size()
}
Foo *- Element

@enduml
```



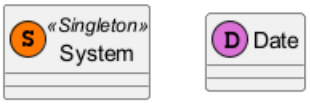
It is possible to disable this drawing using `skinparam genericDisplay old` command.

3.20 Specific Spot

Usually, a spotted character (C, I, E or A) is used for classes, interface, enum and abstract classes.

But you can define your own spot for a class when you define the stereotype, adding a single character and a color, like in this example:

```
@startuml

class System << (S,#FF7700) Singleton >>
class Date << (D,orchid) >>
@enduml
```

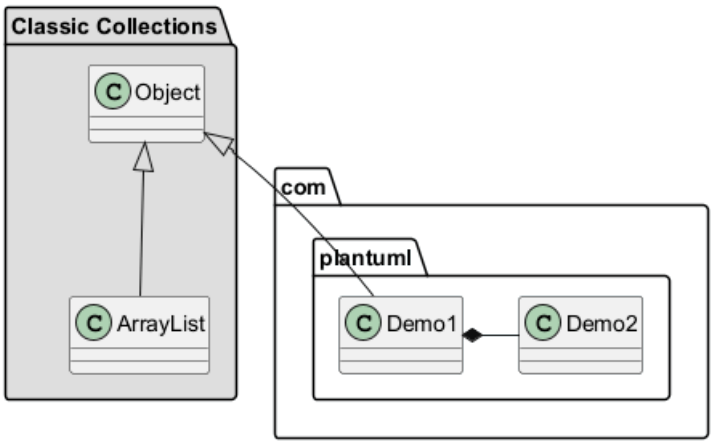


3.21 Packages

You can define a package using the `package` keyword, and optionally declare a background color for your package (Using a html color code or name).

Note that package definitions can be nested.

```
@startuml

package "Classic Collections" #DDDDDD {
  Object <|-- ArrayList
}

package com.plantuml {
  Object <|-- Demo1
  Demo1 *- Demo2
}

@enduml
```



3.22 Packages style

There are different styles available for packages.

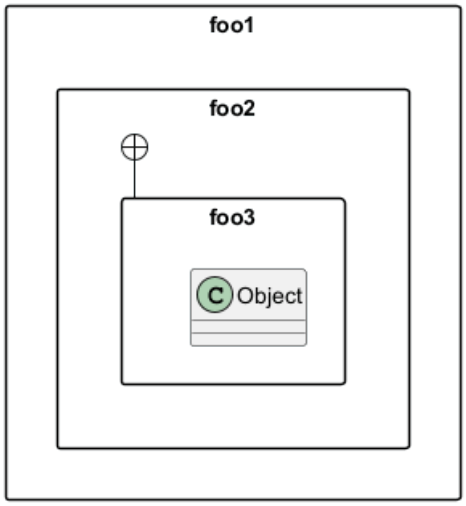
You can specify them either by setting a default style with the command : `skinparam packageStyle`, or by using a stereotype on the package:

```
@startuml
scale 750 width
package foo1 <<Node>> {
```

```
  class Class1
}

package foo2 <<Rectangle>> {
  class Class2
}

package foo3 <<Folder>> {
  class Class3
}

package foo4 <<Frame>> {
  class Class4
}

package foo5 <<Cloud>> {
  class Class5
}

package foo6 <<Database>> {
  class Class6
}

@enduml
```

You can also define links between packages, like in the following example:

```
@startuml

skinparam packageStyle rectangle

package foo1.foo2 {
}

package foo1.foo2.foo3 {
  class Object
}

foo1.foo2 +-- foo1.foo2.foo3

@enduml
```



3.23 Namespaces

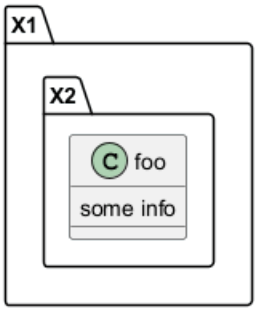
Starting with version 1.2023.2 (which is online as a beta), PlantUML handles differently namespaces and packages.

There won't be any difference between namespaces and packages anymore: both keywords are now synonymous.

3.24 Automatic namespace creation

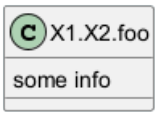
You can define another separator (other than the dot) using the command : `set namespaceSeparator ???`.

```
@startuml

set namespaceSeparator ::
class X1::X2::foo {
  some info
}

@enduml
```



You can disable automatic package creation using the command `set namespaceSeparator none`.

```
@startuml

set namespaceSeparator none
class X1.X2.foo {
  some info
}

@enduml
```

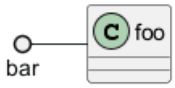


3.25 Lollipop interface

You can also define lollipops interface on classes, using the following syntax:

- `bar ()- foo`
- `bar ()-- foo`
- `foo -() bar`

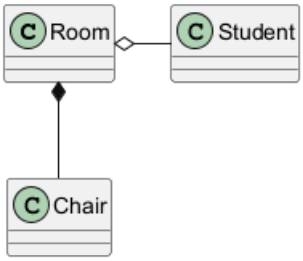
```
@startuml
class foo
bar ()- foo
@enduml
```



3.26 Changing arrows orientation

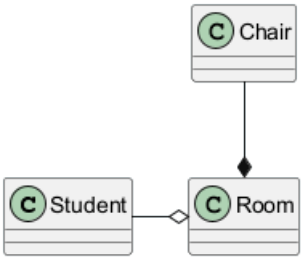
By default, links between classes have two dashes `--` and are vertically oriented. It is possible to use horizontal link by putting a single dash (or dot) like this:

```
@startuml
Room o- Student
Room *-- Chair
@enduml
```



You can also change directions by reversing the link:

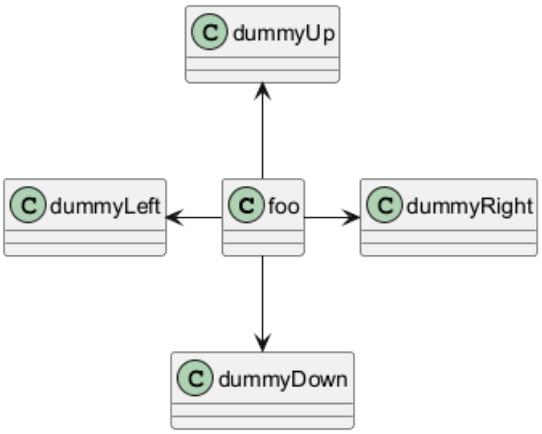
```
@startuml
Student -o Room
Chair --* Room
@enduml
```



It is also possible to change arrow direction by adding `left`, `right`, `up` or `down` keywords inside the arrow:

```
@startuml
foo -left-> dummyLeft
```

```
foo -right-> dummyRight
foo -up-> dummyUp
foo -down-> dummyDown
@enduml
```

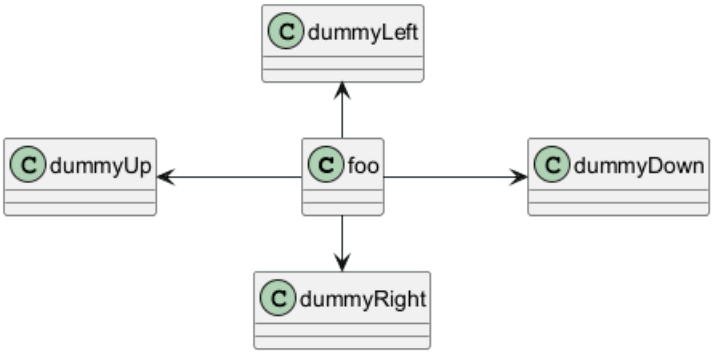


You can shorten the arrow by using only the first character of the direction (for example, `-d-` instead of `-down-`) or the two first characters (`-do-`).

Please note that you should not abuse this functionality : *Graphviz* gives usually good results without tweaking.

And with the `left to right direction` parameter:

```
@startuml
left to right direction
foo -left-> dummyLeft
foo -right-> dummyRight
foo -up-> dummyUp
foo -down-> dummyDown
@enduml
```

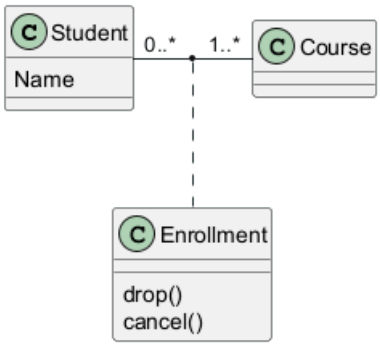


3.27 Association classes

You can define *association class* after that a relation has been defined between two classes, like in this example:

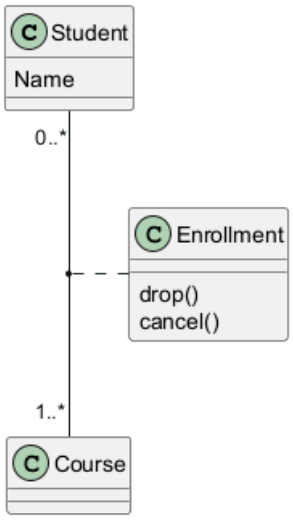
```
@startuml
class Student {
  Name
}
Student "0..*" - "1..*" Course
(Student, Course) .. Enrollment

class Enrollment {
```

```
  drop()
  cancel()
}
@enduml
```



You can define it in another direction:

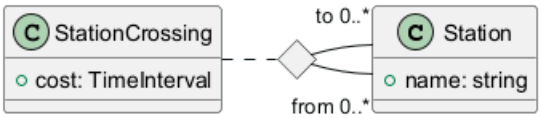
```
@startuml
class Student {
  Name
}
Student "0..*" -- "1..*" Course
(Student, Course) . Enrollment

class Enrollment {
  drop()
  cancel()
}
@enduml
```



3.28 Association on same class

```
@startuml
class Station {
    +name: string
}

class StationCrossing {
    +cost: TimeInterval
}
```

```
<> diamond

StationCrossing . diamond
diamond - "from 0..*" Station
diamond - "to 0..* " Station
@enduml
```



[Ref. Incubation: Associations]

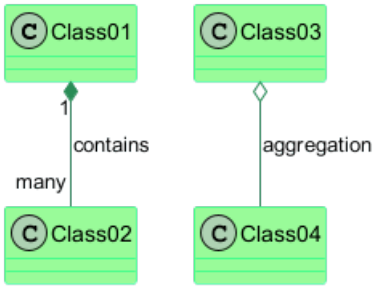
3.29 Skinparam

You can use the skinparam command to change colors and fonts for the drawing.

You can use this command :

- In the diagram definition, like any other commands,
- In an included file,
- In a configuration file, provided in the command line or the ANT task.

```
@startuml

skinparam class {
BackgroundColor PaleGreen
ArrowColor SeaGreen
BorderColor SpringGreen
}
skinparam stereotypeCBackgroundColor YellowGreen

Class01 "1" *-- "many" Class02 : contains

Class03 o-- Class04 : aggregation

@enduml
```

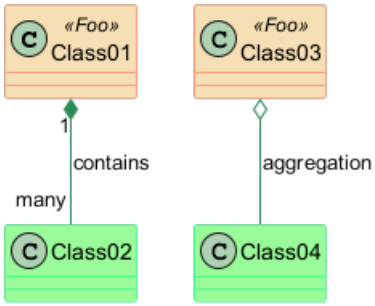


3.30 Skinned Stereotypes

You can define specific color and fonts for stereotyped classes.

```
@startuml

skinparam class {
BackgroundColor PaleGreen
ArrowColor SeaGreen
BorderColor SpringGreen
BackgroundColor<<Foo>> Wheat
```

```
BorderColor<<Foo>> Tomato
}
skinparam stereotypeCBackgroundColor YellowGreen
skinparam stereotypeCBackgroundColor<< Foo >> DimGray

class Class01 <<Foo>>
class Class03 <<Foo>>
Class01 "1" *-- "many" Class02 : contains

Class03 o-- Class04 : aggregation

@enduml
```



Important: unlike class stereotypes, there must be no space between the skin parameter and the following stereotype.

Any of the spaces shown as `_` below will cause **all** skinparams to be ignored, see discord discussion and issue #1932:

- `BackgroundColor_<<Foo>> Wheat`
- `skinparam stereotypeCBackgroundColor_<<Foo>> DimGray`

3.31 Color gradient

You can declare individual colors for classes, notes etc using the # notation.

You can use standard color names or RGB codes in various notations, see Colors.

You can also use color gradient for background colors, with the following syntax: two colors names separated either by:

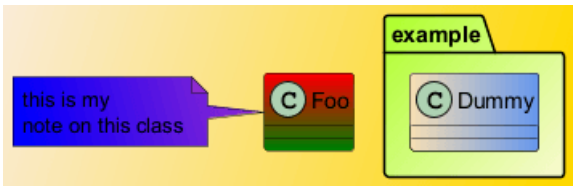
- `|`,
- `/`,
- `\`, or
- `-`

depending on the direction of the gradient.

For example:

```
@startuml

skinparam backgroundcolor AntiqueWhite/Gold
skinparam classBackgroundColor Wheat|CornflowerBlue

class Foo #red-green
note left of Foo #blue\9932CC
  this is my
  note on this class
end note
```

```
package example #GreenYellow/LightGoldenRodYellow {
  class Dummy
}

@enduml
```



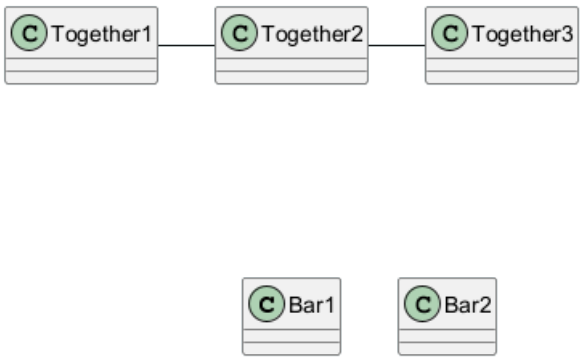
3.32 Help on layout

Sometimes, the default layout is not perfect...

You can use `together` keyword to group some classes together : the layout engine will try to group them (as if they were in the same package).

You can also use `hidden` links to force the layout.

```
@startuml

class Bar1
class Bar2
together {
  class Together1
  class Together2
  class Together3
}
Together1 - Together2
Together2 - Together3
Together2 -[hidden]--> Bar1
Bar1 -[hidden]> Bar2


@enduml
```



3.33 대용량파일분할하기

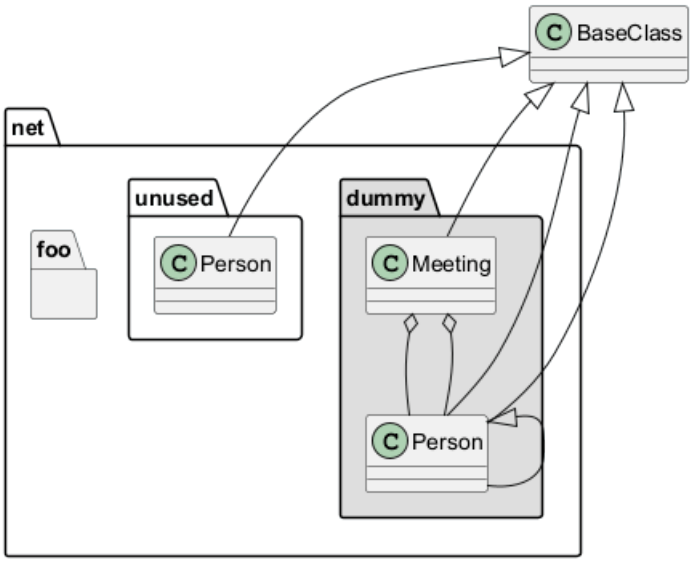
Sometimes, you will get some very large image files.

You can use the `page (hpages)x(vpages)` command to split the generated image into several files :

`hpages` is a number that indicated the number of horizontal pages, and `vpages` is a number that indicated the number of vertical pages.

You can also use some specific skinparam settings to put borders on splitted pages (see example).

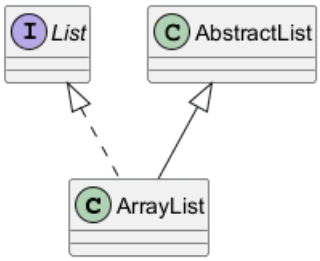
```
@startuml
' Split into 4 pages
page 2x2
skinparam pageMargin 10
skinparam pageExternalColor gray
skinparam pageBorderColor black

class BaseClass

namespace net.dummy #DDDDDD {
    .BaseClass <|-- Person
    Meeting o-- Person

    .BaseClass <|- Meeting

}

namespace net.foo {
  net.dummy.Person  <|- Person
  .BaseClass <|-- Person

  net.dummy.Meeting o-- Person
}

BaseClass <|-- net.unused.Person
@enduml
```



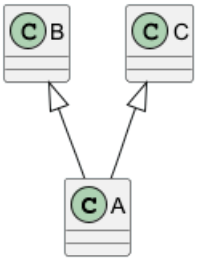
3.34 Extends and implements

It is also possible to use `extends` and `implements` keywords.

```
@startuml
class ArrayList implements List
class ArrayList extends AbstractList
@enduml
```




```
@startuml
class A extends B, C {
}
@enduml
```



[Ref. QA-2239]

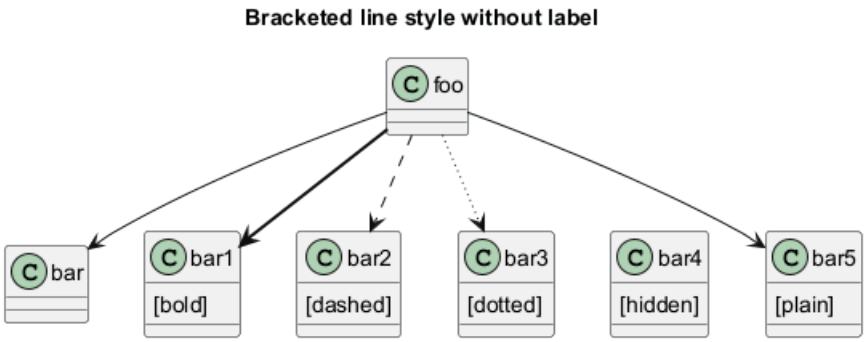
3.35 Bracketed relations (linking or arrow) style

3.35.1 Line style

It's also possible to have explicitly `bold`, `dashed`, `dotted`, `hidden` or `plain` relation, links or arrows:

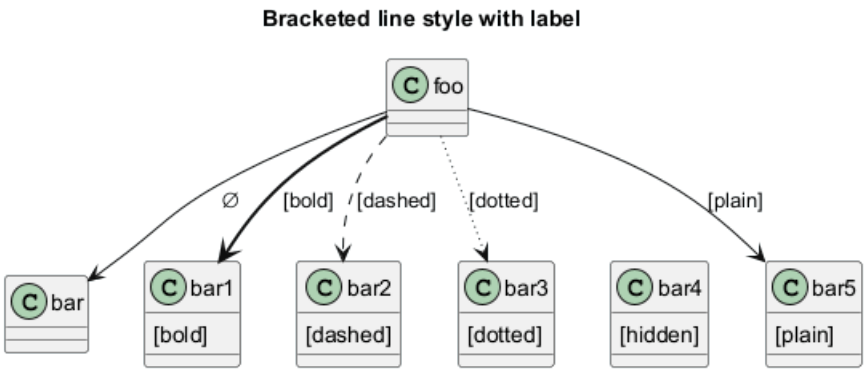
- without label

```
@startuml
title Bracketed line style without label
class foo
class bar
bar1 : [bold]
bar2 : [dashed]
bar3 : [dotted]
bar4 : [hidden]
bar5 : [plain]

foo --> bar
foo -[bold]-> bar1
foo -[dashed]-> bar2
foo -[dotted]-> bar3
foo -[hidden]-> bar4
foo -[plain]-> bar5
@enduml
```



- with label

```
@startuml
title Bracketed line style with label
class foo
class bar
bar1 : [bold]
bar2 : [dashed]
bar3 : [dotted]
bar4 : [hidden]
bar5 : [plain]

foo --> bar          :
foo -[bold]-> bar1   : [bold]
foo -[dashed]-> bar2 : [dashed]
foo -[dotted]-> bar3 : [dotted]
foo -[hidden]-> bar4 : [hidden]
foo -[plain]-> bar5  : [plain]

@enduml
```

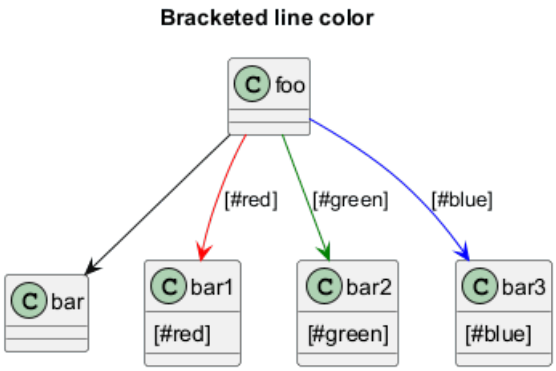


[Adapted from QA-4181]

3.35.2 Line color

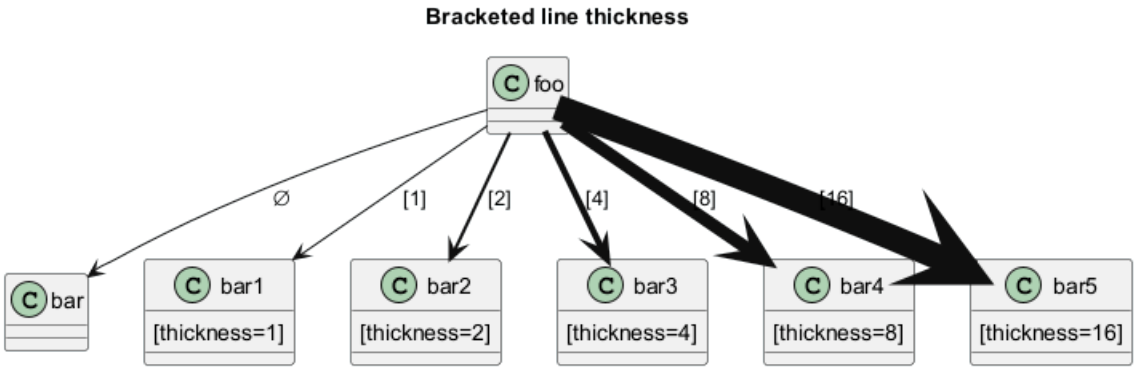
```
@startuml
title Bracketed line color
class foo
class bar
bar1 : [#red]
bar2 : [#green]
bar3 : [#blue]

foo --> bar
foo -[#red]-> bar1     : [#red]
```

```
foo -[#green]-> bar2   : [#green]
foo -[#blue]-> bar3    : [#blue]
'foo -[#blue;#yellow;#green]-> bar4
@enduml
```



3.35.3 Line thickness

```
@startuml
title Bracketed line thickness
class foo
class bar
bar1 : [thickness=1]
bar2 : [thickness=2]
bar3 : [thickness=4]
bar4 : [thickness=8]
bar5 : [thickness=16]

foo --> bar                 :
foo -[thickness=1]-> bar1   : [1]
foo -[thickness=2]-> bar2   : [2]
foo -[thickness=4]-> bar3   : [4]
foo -[thickness=8]-> bar4   : [8]
foo -[thickness=16]-> bar5  : [16]

@enduml
```

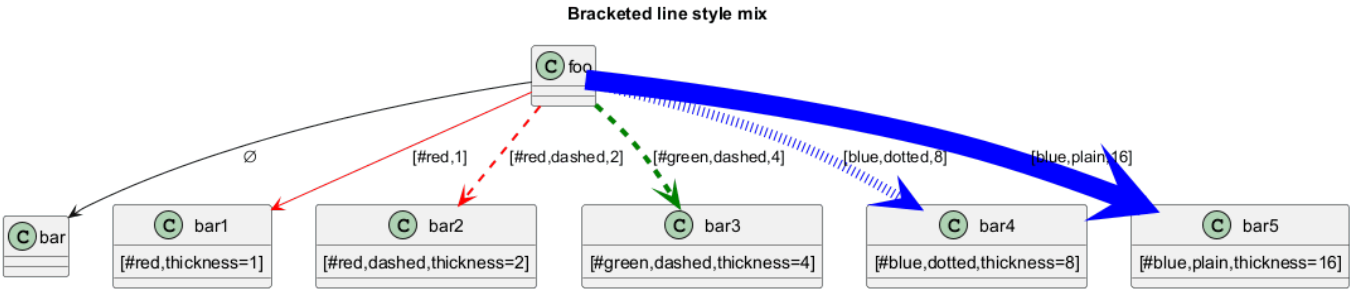


[Ref. QA-4949]

3.35.4 Mix

```
@startuml
title Bracketed line style mix
class foo
class bar
```

```
bar1 : [#red,thickness=1]
bar2 : [#red,dashed,thickness=2]
bar3 : [#green,dashed,thickness=4]
bar4 : [#blue,dotted,thickness=8]
bar5 : [#blue,plain,thickness=16]

foo --> bar                              :
foo -[#red,thickness=1]-> bar1           : [#red,1]
foo -[#red,dashed,thickness=2]-> bar2    : [#red,dashed,2]
foo -[#green,dashed,thickness=4]-> bar3  : [#green,dashed,4]
foo -[#blue,dotted,thickness=8]-> bar4   : [blue,dotted,8]
foo -[#blue,plain,thickness=16]-> bar5   : [blue,plain,16]
@enduml
```

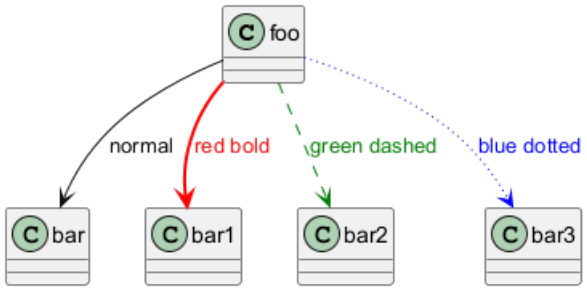


3.36 Change relation (linking or arrow) color and style (inline style)

You can change the color or style of individual relation or arrows using the inline following notation:

- `#color;line.[bold|dashed|dotted];text:color`

```
@startuml
class foo
foo --> bar : normal
foo --> bar1 #line:red;line.bold;text:red  : red bold
foo --> bar2 #green;line.dashed;text:green : green dashed
foo --> bar3 #blue;line.dotted;text:blue   : blue dotted
@enduml
```



[See similar feature on deployment]

3.37 Change class color and style (inline style)

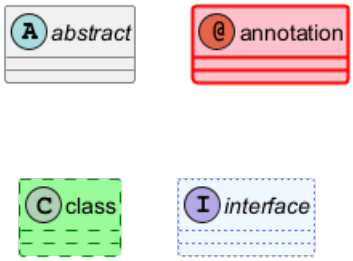
You can change the color or style of individual class using the two following notations:

- `#color ##[style]color`

With background color first (`#color`), then line style and line color (`##[style]color`)

```
@startuml
abstract   abstract
```

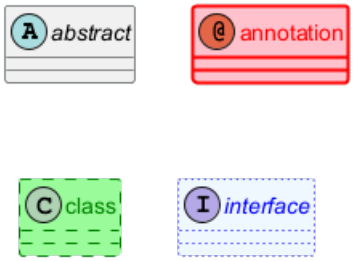
```
annotation annotation #pink ##[bold]red
class      class      #palegreen ##[dashed]green
interface  interface  #aliceblue ##[dotted]blue
@enduml
```



[Ref. QA-1487]

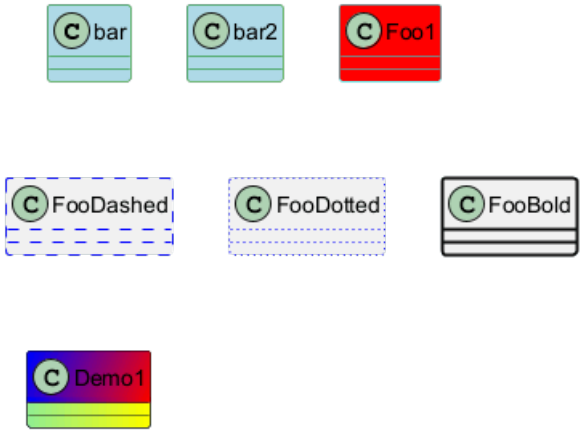
- `#[color|back:color];header:color;line:color;line.[bold|dashed|dotted];text:color`

```
@startuml
abstract   abstract
annotation annotation #pink;line:red;line.bold;text:red
class      class      #palegreen;line:green;line.dashed;text:green
interface  interface  #aliceblue;line:blue;line.dotted;text:blue
@enduml
```



First original example:

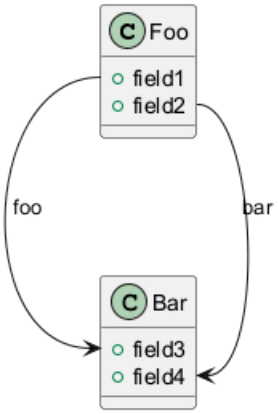
```
@startuml
class bar #line:green;back:lightblue
class bar2 #lightblue;line:green

class Foo1 #back:red;line:00FFFF
class FooDashed #line.dashed:blue
class FooDotted #line.dotted:blue
class FooBold #line.bold
class Demo1 #back:lightgreen|yellow;header:blue/red
@enduml
```



[Ref. QA-3770]

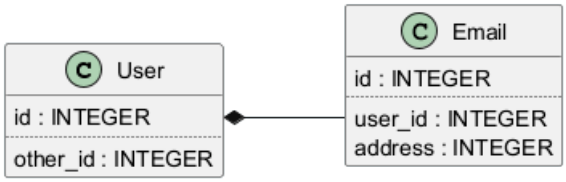
3.38 Arrows from/to class members

```
@startuml
class Foo {
+ field1
+ field2
}

class Bar {
+ field3
+ field4
}

Foo::field1 --> Bar::field3 : foo
Foo::field2 --> Bar::field4 : bar
@enduml
```



[Ref. QA-3636]

```
@startuml
left to right direction

class User {
  id : INTEGER
  ..
  other_id : INTEGER
}

class Email {
  id : INTEGER
  ..
  user_id : INTEGER
  address : INTEGER
}

User::id *-- Email::user_id
@enduml
```



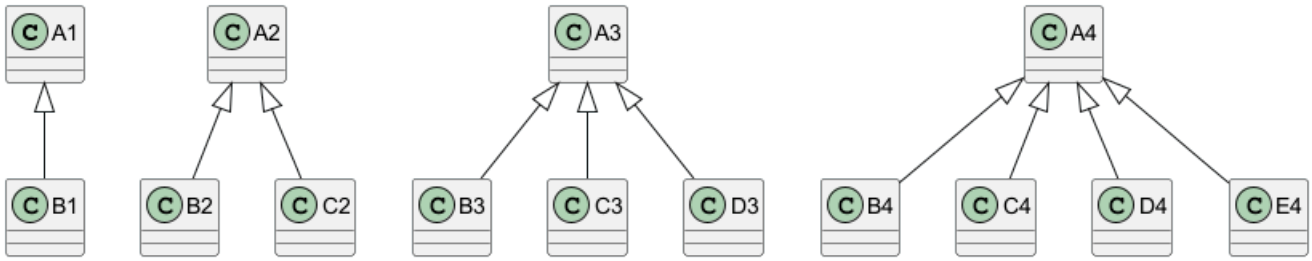
[Ref. QA-5261]

3.39 Grouping inheritance arrow heads

You can merge all arrow heads using the `skinparam groupInheritance`, with a threshold as parameter.

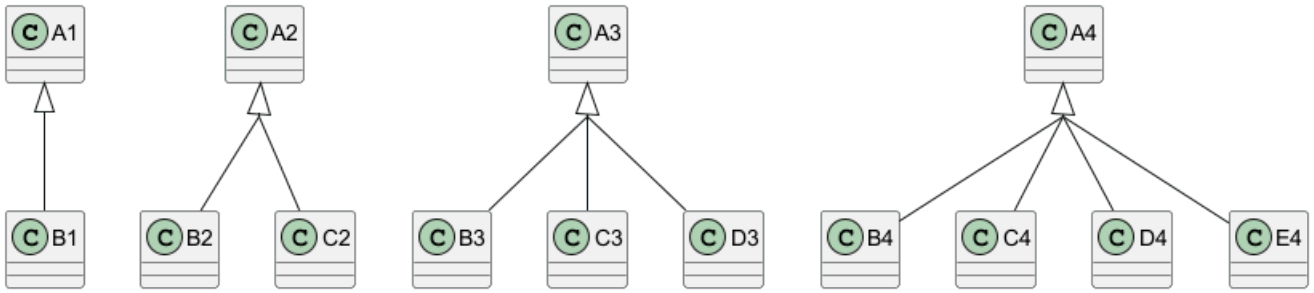
3.39.1 GroupInheritance 1 (no grouping)

```
@startuml
skinparam groupInheritance 1

A1 <|-- B1

A2 <|-- B2
A2 <|-- C2

A3 <|-- B3
A3 <|-- C3
A3 <|-- D3

A4 <|-- B4
A4 <|-- C4
A4 <|-- D4
A4 <|-- E4
@enduml
```



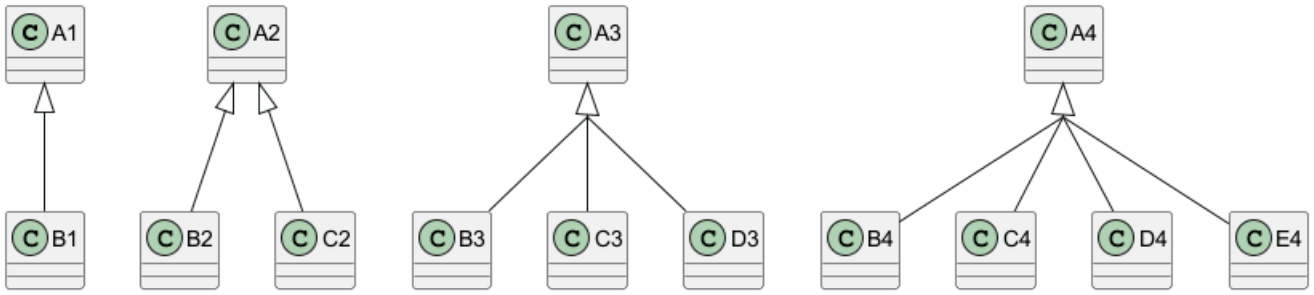
3.39.2 GroupInheritance 2 (grouping from 2)

```
@startuml
skinparam groupInheritance 2

A1 <|-- B1

A2 <|-- B2
A2 <|-- C2

A3 <|-- B3
A3 <|-- C3
A3 <|-- D3

A4 <|-- B4
A4 <|-- C4
A4 <|-- D4
A4 <|-- E4
@enduml
```



3.39.3 GroupInheritance 3 (grouping only from 3)

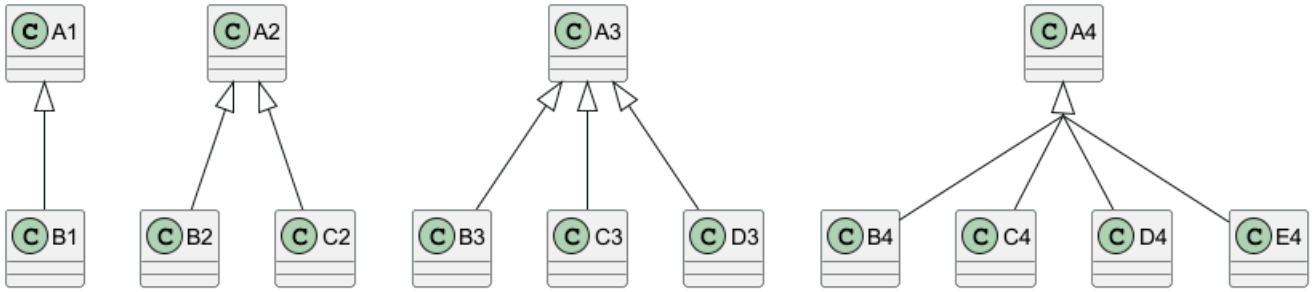
```
@startuml
skinparam groupInheritance 3

A1 <|-- B1

A2 <|-- B2
A2 <|-- C2

A3 <|-- B3
A3 <|-- C3
A3 <|-- D3

A4 <|-- B4
A4 <|-- C4
A4 <|-- D4
A4 <|-- E4
@enduml
```



3.39.4 GroupInheritance 4 (grouping only from 4)

```
@startuml
skinparam groupInheritance 4

A1 <|-- B1

A2 <|-- B2
A2 <|-- C2

A3 <|-- B3
A3 <|-- C3
A3 <|-- D3

A4 <|-- B4
A4 <|-- C4
A4 <|-- D4
```

```
A4 <|-- E4
@enduml
```

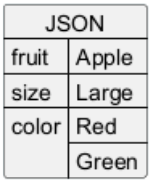


[Ref. QA-3193, and Defect QA-13532]

3.40 Display JSON Data on Class or Object diagram

3.40.1 Simple example

```
@startuml
class Class
object Object
json JSON {
   "fruit":"Apple",
   "size":"Large",
   "color": ["Red", "Green"]
}
@enduml
```



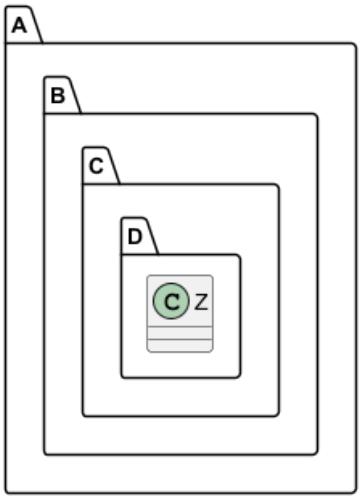
[Ref. QA-15481]

For another example, see on JSON page.

3.41 Packages and Namespaces Enhancement

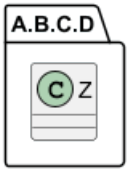
[From V1.2023.2+, and V1.2023.5]

```
@startuml
class A.B.C.D.Z {
}
@enduml
```

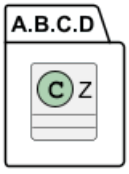



```
@startuml
set separator none
class A.B.C.D.Z {
}
@enduml
```


```
@startuml
!pragma useIntermediatePackages false
class A.B.C.D.Z {
}
@enduml
```




```
@startuml
set separator none
package A.B.C.D {
  class Z {
  }
}
@enduml
```



[Ref. GH-1352]

3.42 Qualified associations

3.42.1 Minimal example

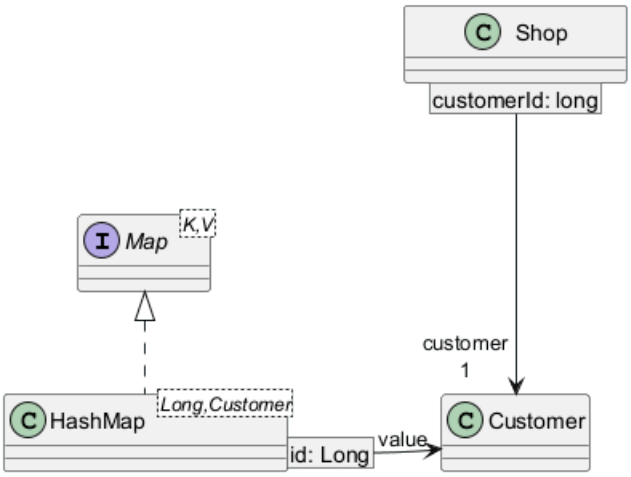
```
@startuml
```

```
class class1
class class2

class1 [Qualifier] - class2
@enduml
```

[Ref. QA-16397, GH-1467]

3.42.2 Another example

```
@startuml
    interface Map<K,V>
    class HashMap<Long,Customer>

    Map <|.. HashMap
    Shop [customerId: long] ---> "customer\n1" Customer
    HashMap [id: Long] -r-> "value" Customer
@enduml
```



3.43 Change diagram orientation

You can change (whole) diagram orientation with:

- `top to bottom direction` *(by default)*
- `left to right direction`

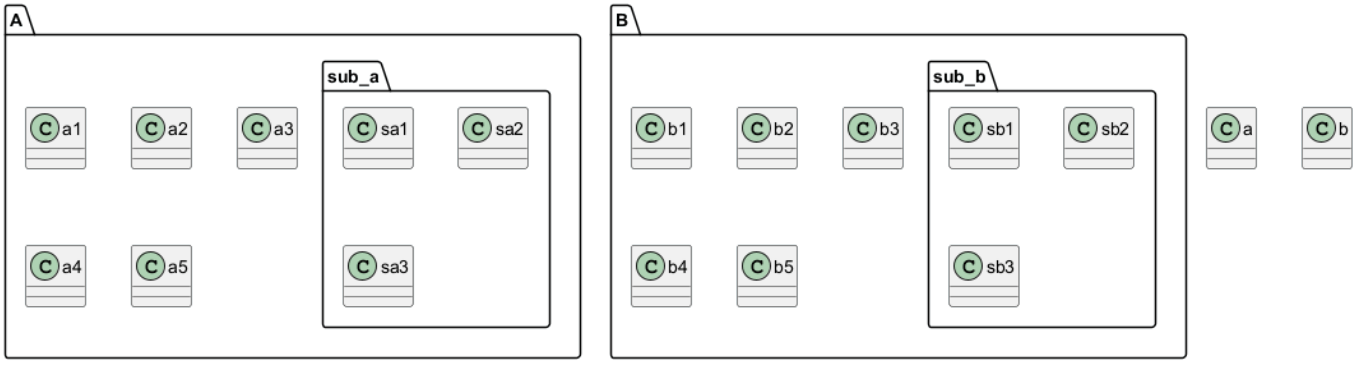
3.43.1 Top to bottom *(by default)*

3.43.2 With Graphviz *(layout engine by default)*

The main rule is: **Nested element first, then simple element.**

```
@startuml
class a
class b
package A {
  class a1
  class a2
  class a3
  class a4
  class a5
```

```
  package sub_a {
   class sa1
   class sa2
   class sa3
  }
}

package B {
  class b1
  class b2
  class b3
  class b4
  class b5
  package sub_b {
   class sb1
   class sb2
   class sb3
  }
}
@enduml
```

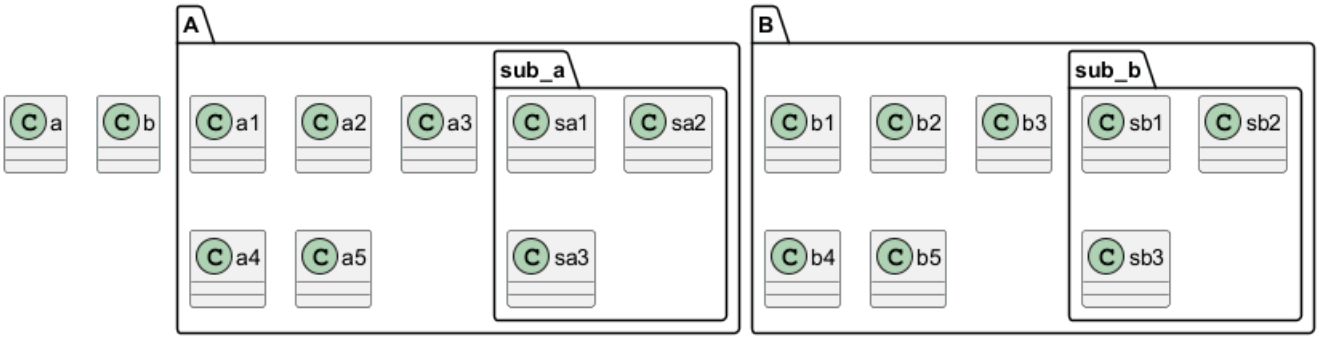


3.43.3 With Smetana *(internal layout engine)*

The main rule is the opposite: **Simple element first, then nested element.**

```
@startuml
!pragma layout smetana
class a
class b
package A {
  class a1
  class a2
  class a3
  class a4
  class a5
  package sub_a {
   class sa1
   class sa2
   class sa3
  }
}

package B {
  class b1
  class b2
  class b3
```

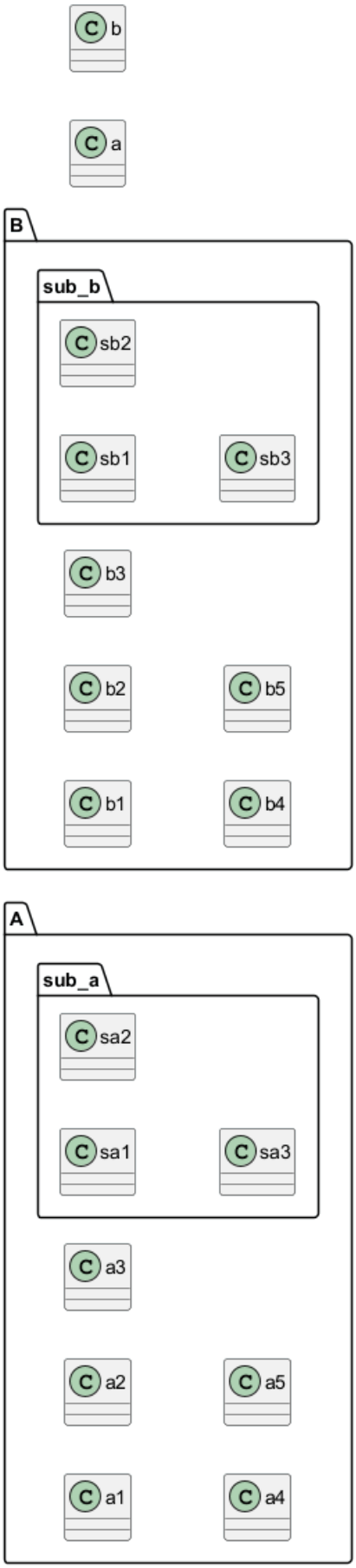
```
  class b4
  class b5
  package sub_b {
   class sb1
   class sb2
   class sb3
  }
}
@enduml
```



3.43.4 Left to right

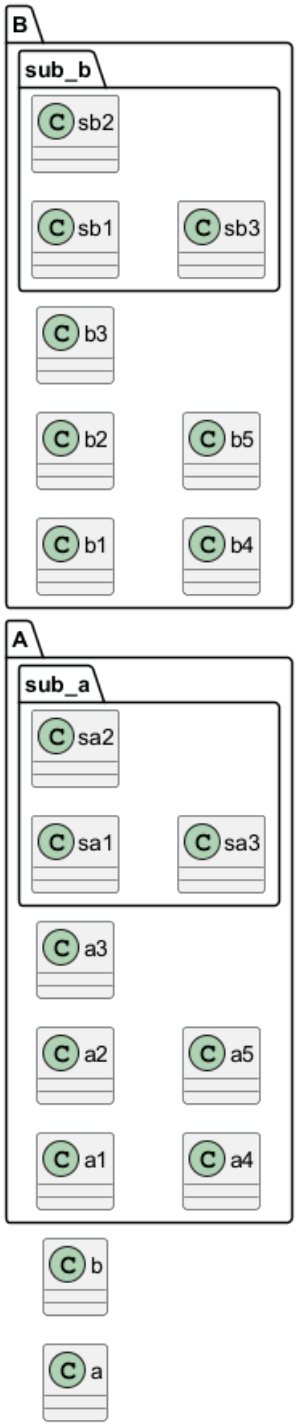
3.43.5 With Graphviz *(layout engine by default)*

```
@startuml
left to right direction
class a
class b
package A {
  class a1
  class a2
  class a3
  class a4
  class a5
  package sub_a {
   class sa1
   class sa2
   class sa3
  }
}

package B {
  class b1
  class b2
  class b3
  class b4
  class b5
  package sub_b {
   class sb1
   class sb2
   class sb3
  }
}
@enduml
```


b
a
B
sub_b
sb2
sb1
sb3
b3
b2
b5
b1
b4
A
sub_a
sa2
sa1
sa3
a3
a2
a5
a1
a4

3.43.6 With Smetana *(internal layout engine)*

```
@startuml
!pragma layout smetana
left to right direction
class a
class b
package A {
  class a1
  class a2
  class a3
  class a4
  class a5
  package sub_a {
   class sa1
   class sa2
   class sa3
  }
}

package B {
  class b1
  class b2
  class b3
  class b4
  class b5
  package sub_b {
   class sb1
   class sb2
   class sb3
  }
}
@enduml
```


B
sub_b
sb2
sb1
sb3
b3
b2
b5
b1
b4
A
sub_a
sa2
sa1
sa3
a3
a2
a5
a1
a4
b
a

4 Object Diagram

An **object diagram** is a graphical representation that showcases objects and their relationships at a specific moment in time. It provides a snapshot of the system's structure, capturing the static view of the instances present and their associations.

PlantUML offers a simple and intuitive way to create object diagrams using plain text. Its user-friendly syntax allows for quick diagram creation without the need for complex GUI tools. Moreover, the PlantUML forum provides a platform for users to discuss, share, and seek assistance, fostering a collaborative community. By choosing PlantUML, users benefit from both the efficiency of markdown-based diagramming and the support of an active community.

4.1 Definition of objects

You define instances of objects using the `object` keyword.

```
@startuml
object firstObject
object "My Second Object" as o2
@enduml
```

4.2 Relations between objects

Relations between objects are defined using the following symbols :

Type	Symbol	Purpose
Extension	`<|--`	Specialization of a class in a hierarchy
Implementation	`<|..`	Realization of an interface by a class
Composition	`*--`	The part cannot exist without the whole
Aggregation	`o--`	The part can exist independently of the whole
Dependency	`-->`	The object uses another object
Dependency	`..>`	A weaker form of dependency

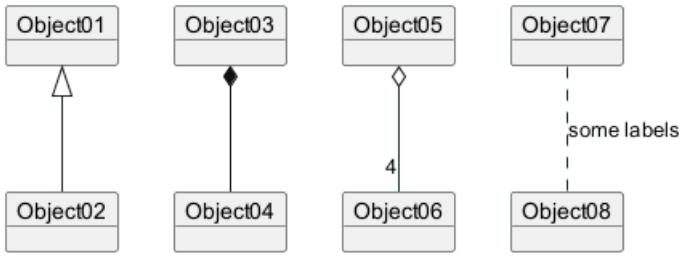
It is possible to replace `--` by `..` to have a dotted line.

Knowing those rules, it is possible to draw the following drawings.

It is possible a add a label on the relation, using `:` followed by the text of the label.

For cardinality, you can use double-quotes `""` on each side of the relation.

```
@startuml
object Object01
object Object02
object Object03
object Object04
object Object05
object Object06
object Object07
object Object08

Object01 <|-- Object02
Object03 *-- Object04
Object05 o-- "4" Object06
Object07 .. Object08 : some labels
@enduml
```



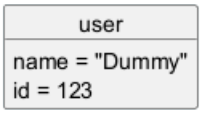
4.3 Associations objects

```
@startuml
object o1
object o2
diamond dia
object o3

o1  --> dia
o2  --> dia
dia --> o3
@enduml
```

4.4 Adding fields

To declare fields, you can use the symbol : followed by the field's name.

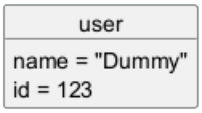
```
@startuml

object user

user : name = "Dummy"
user : id = 123

@enduml
```



It is also possible to group all fields between brackets `{}`.

```
@startuml

object user {
  name = "Dummy"
  id = 123
}
```

```
@enduml
```



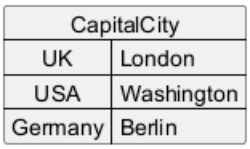
4.5 Common features with class diagrams

- Hide attributes, methods...
- Defines notes
- Use packages
- Skin the output

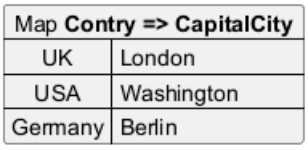
4.6 Map table or associative array

You can define a map table or associative array, with `map` keyword and `=>` separator.

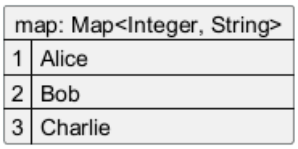
```
@startuml
map CapitalCity {
 UK => London
 USA => Washington
 Germany => Berlin
}
@enduml
```




```
@startuml
map "Map **Contry => CapitalCity**" as CC {
 UK => London
 USA => Washington
 Germany => Berlin
}
@enduml
```



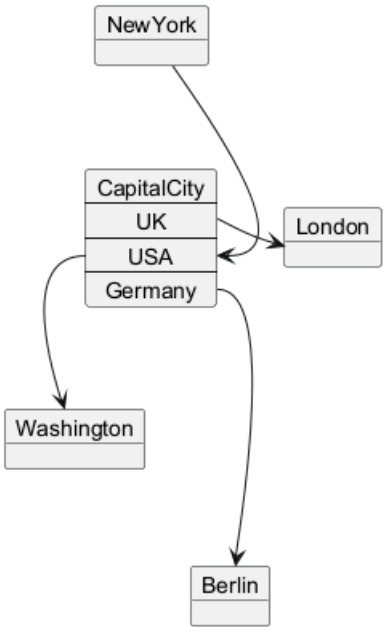

```
@startuml
map "map: Map<Integer, String>" as users {
 1 => Alice
 2 => Bob
 3 => Charlie
}
@enduml
```



And add link with object.

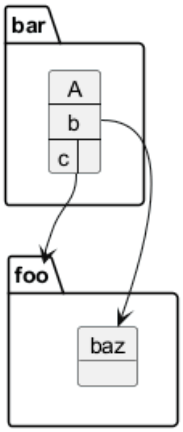
```
@startuml
object London

map CapitalCity {
 UK *-> London
 USA => Washington
 Germany => Berlin
}
@enduml
```


```
@startuml
object London
object Washington
object Berlin
object NewYork

map CapitalCity {
 UK *-> London
 USA *--> Washington
 Germany *---> Berlin
}

NewYork --> CapitalCity::USA
@enduml
```



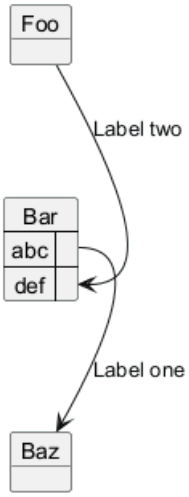
[Ref. #307]

```
@startuml
package foo {
    object baz
}

package bar {
    map A {
        b *-> foo.baz
        c =>
    }
}

A::c --> foo
@enduml
```



[Ref. QA-12934]

```
@startuml
object Foo
map Bar {
  abc=>
  def=>
}
object Baz

Bar::abc --> Baz : Label one
Foo --> Bar::def : Label two
@enduml
```

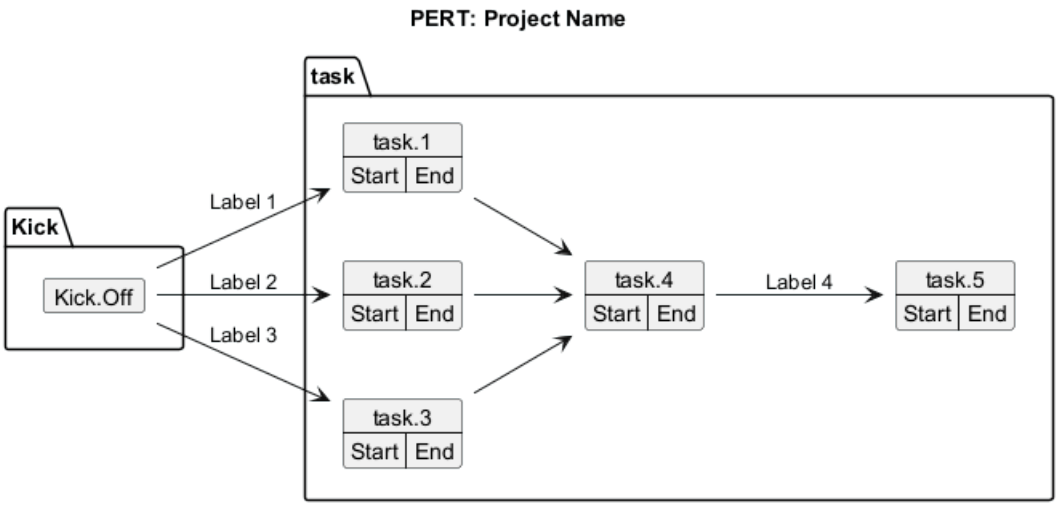


[Ref. #307]

4.7 Program (or project) evaluation and review technique (PERT) with map

You can use `map table` in order to make Program (or project) evaluation and review technique (PERT) diagram.

```
@startuml PERT
left to right direction
' Horizontal lines: -->, <--, <-->
' Vertical lines: ->, <-, <->
title PERT: Project Name

map Kick.Off {
}
map task.1 {
    Start => End
}
map task.2 {
    Start => End
}
map task.3 {
    Start => End
}
map task.4 {
    Start => End
}
map task.5 {
    Start => End
}
Kick.Off --> task.1 : Label 1
Kick.Off --> task.2 : Label 2
Kick.Off --> task.3 : Label 3
task.1 --> task.4
task.2 --> task.4
task.3 --> task.4
task.4 --> task.5 : Label 4
@enduml
```

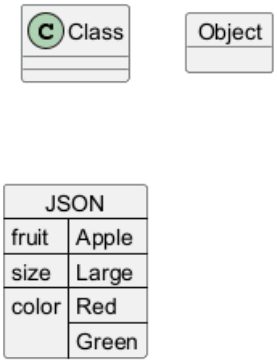


[Ref. QA-12337]

4.8 Display JSON Data on Class or Object diagram

4.8.1 Simple example

```
@startuml
class Class
object Object
json JSON {
   "fruit":"Apple",
   "size":"Large",
   "color": ["Red", "Green"]
}
@enduml
```



[Ref. QA-15481]

For another example, see on JSON page.

5 Activity Diagram (legacy)

This is the old **Activity Diagram (legacy)** syntax, to see the new current version see: **Activity Diagram (new)**.

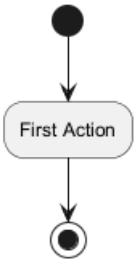
5.1 Simple Action

You can use `(*)` for the starting point and ending point of the activity diagram.

In some occasion, you may want to use `(*top)` to force the starting point to be at the top of the diagram.

Use `-->` for arrows.

```
@startuml

(*) --> "First Action"
"First Action" --> (*)

@enduml
```

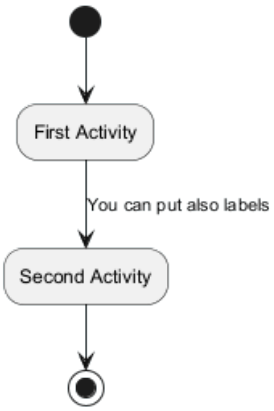


5.2 화살표라벨

기본적으로화살표는마지막으로사용한액티비티에서시작한다.

화살표에라벨을붙이려면화살표정의바로다음에대괄호를사용한다.

```
@startuml

(*) --> "First Activity"
-->[You can put also labels] "Second Activity"
--> (*)

@enduml
```



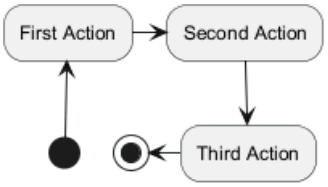
5.3 Changing arrow direction

You can use `->` for horizontal arrows. It is possible to force arrow's direction using the following syntax:

- `-down->` (default arrow)

- `-right->` or `->`
- `-left->`
- `-up->`

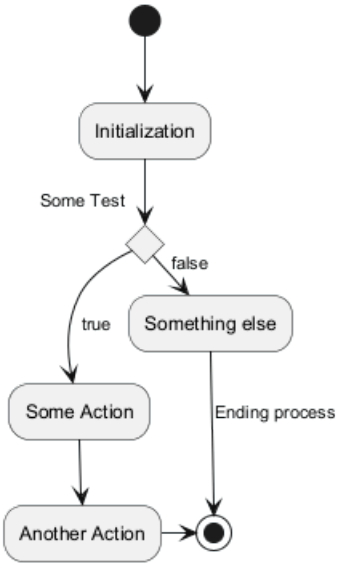
```
@startuml

(*) -up-> "First Action"
-right-> "Second Action"
--> "Third Action"
-left-> (*)

@enduml
```



5.4 Branches

You can use `if/then/else` keywords to define branches.

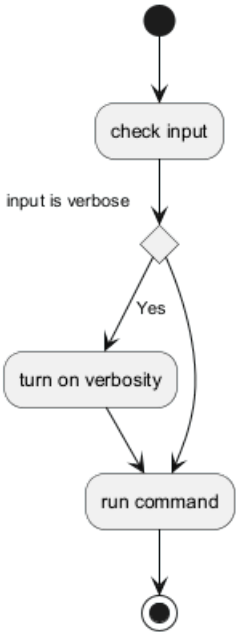
```
@startuml
(*) --> "Initialization"

if "Some Test" then
  -->[true] "Some Action"
  --> "Another Action"
  -right-> (*)
else
  ->[false] "Something else"
  -->[Ending process] (*)
endif

@enduml
```



Unfortunately, you will have to sometimes repeat the same activity in the diagram text:

```
@startuml
```

```
(*)  --> "check input"
If "input is verbose" then
--> [Yes] "turn on verbosity"
--> "run command"
else
--> "run command"
Endif
-->(*)
@enduml
```



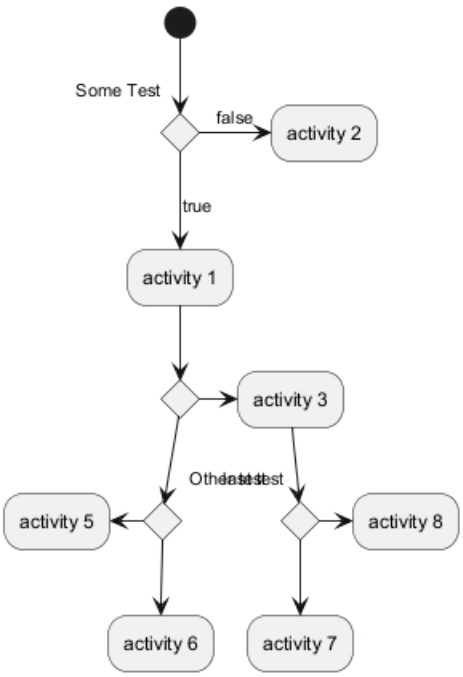
5.5 브랜치에덧붙임

기본적으로브랜치는마지막에정의한액티비티와연결된다. 하지만이룰을오버라이드하여다른연결관계를 `if` 키워드로정의할수있다.

브랜치내브랜치정도가능하다.

```
@startuml

(*) --> if "Some Test" then

  -->[true] "activity 1"

  if "" then
    -> "activity 3" as a3
  else
    if "Other test" then
      -left-> "activity 5"
    else
      --> "activity 6"
    endif
  endif

else

  ->[false] "activity 2"

endif
```

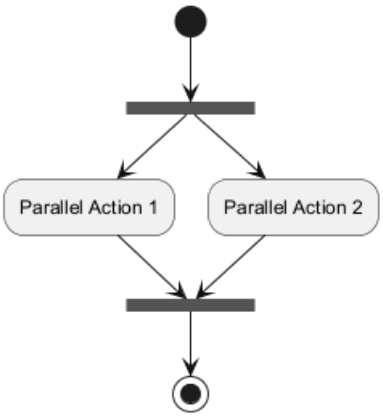
```
a3 --> if "last test" then
  --> "activity 7"
else
  -> "activity 8"
endif

@enduml
```



5.6 Synchronization

You can use `=== code ===` to display synchronization bars.

```
@startuml

(*) --> ===B1===
--> "Parallel Action 1"
--> ===B2===

===B1=== --> "Parallel Action 2"
--> ===B2===

--> (*)

@enduml
```

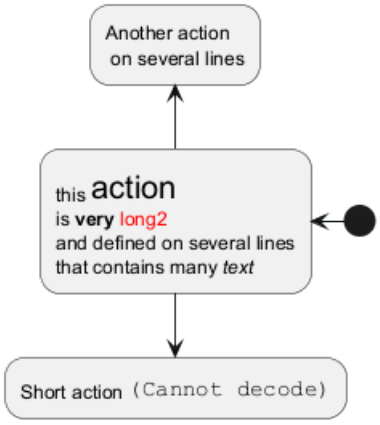


5.7 Long action description

When you declare activities, you can span on several lines the description text. You can also add `\n` in the description.

You can also give a short code to the activity with the `as` keyword. This code can be used latter in the diagram description.

```
@startuml
(*) -left-> "this <size:20>action</size>
is <b>very</b> <color:red>long2</color>
and defined on several lines
that contains many <i>text</i>" as A1

-up-> "Another action\n on several lines"

A1 --> "Short action <img:sourceforge.jpg>"
@enduml
```



5.8 Notes

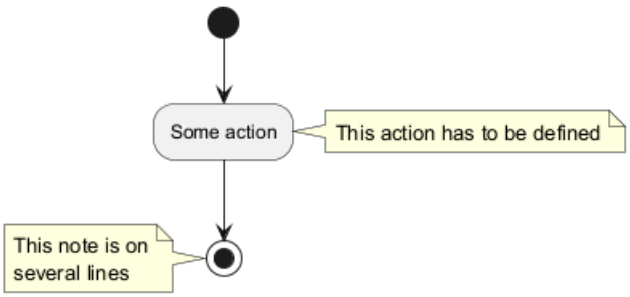
You can add notes on a activity using the commands `note left`, `note right`, `note top` or `note bottom`, just after the description of the activity you want to note.

If you want to put a note on the starting point, define the note at the very beginning of the diagram description.

You can also have a note on several lines, using the `endnote` keywords.

```
@startuml

(*) --> "Some action"
note right: This action has to be defined
```

```
"Some action" --> (*)
note left
 This note is on
 several lines
end note

@enduml
```



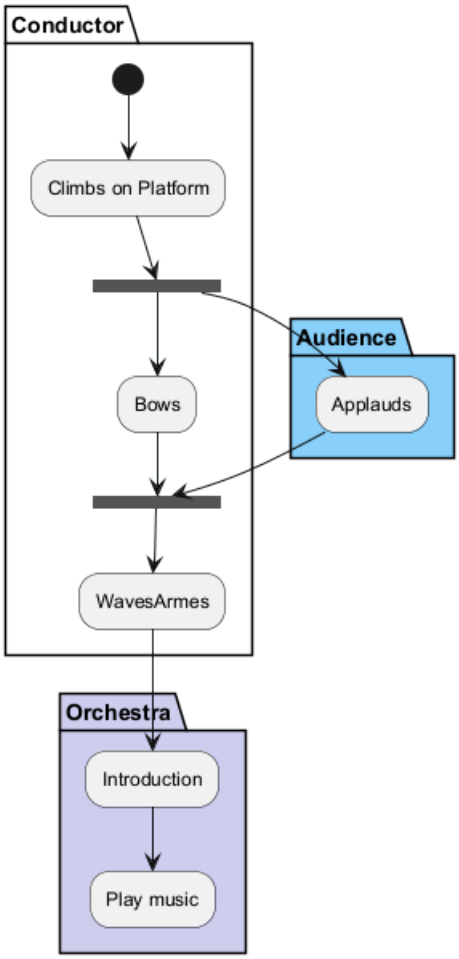
5.9 Partition

You can define a partition using the `partition` keyword, and optionally declare a background color for your partition (Using a html color code or name)

When you declare activities, they are automatically put in the last used partition.

You can close the partition definition using a closing bracket `}`.

```
@startuml

partition Conductor {
  (*) --> "Climbs on Platform"
  --> === S1 ===
  --> Bows
}

partition Audience #LightSkyBlue {
  === S1 === --> Applauds
}

partition Conductor {
  Bows --> === S2 ===
  --> WavesArmes
  Applauds --> === S2 ===
}

partition Orchestra #CCCCEE {
  WavesArmes --> Introduction
  --> "Play music"
}

@enduml
```



5.10 Skinparam

You can use the skinparam command to change colors and fonts for the drawing.

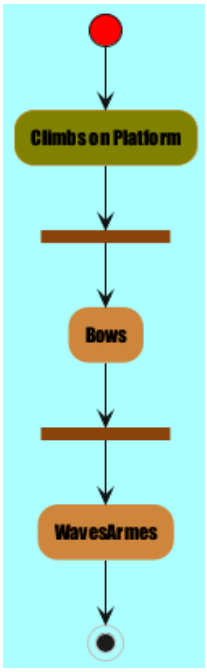
You can use this command :

- In the diagram definition, like any other commands,
- In an included file,
- In a configuration file, provided in the command line or the ANT task.

You can define specific color and fonts for stereotyped activities.

```
@startuml

skinparam backgroundColor #AAFFFF
skinparam activity {
  StartColor red
  BarColor SaddleBrown
  EndColor Silver
  BackgroundColor Peru
  BackgroundColor<< Begin >> Olive
  BorderColor Peru
  FontName Impact
}

(*) --> "Climbs on Platform" << Begin >>
--> === S1 ===
--> Bows
```

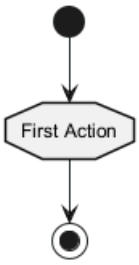
```
--> === S2 ===
--> WavesArmes
--> (*)

@enduml
```



5.11 Octagon

You can change the shape of activities to octagon using the `skinparam activityShape octagon` command.

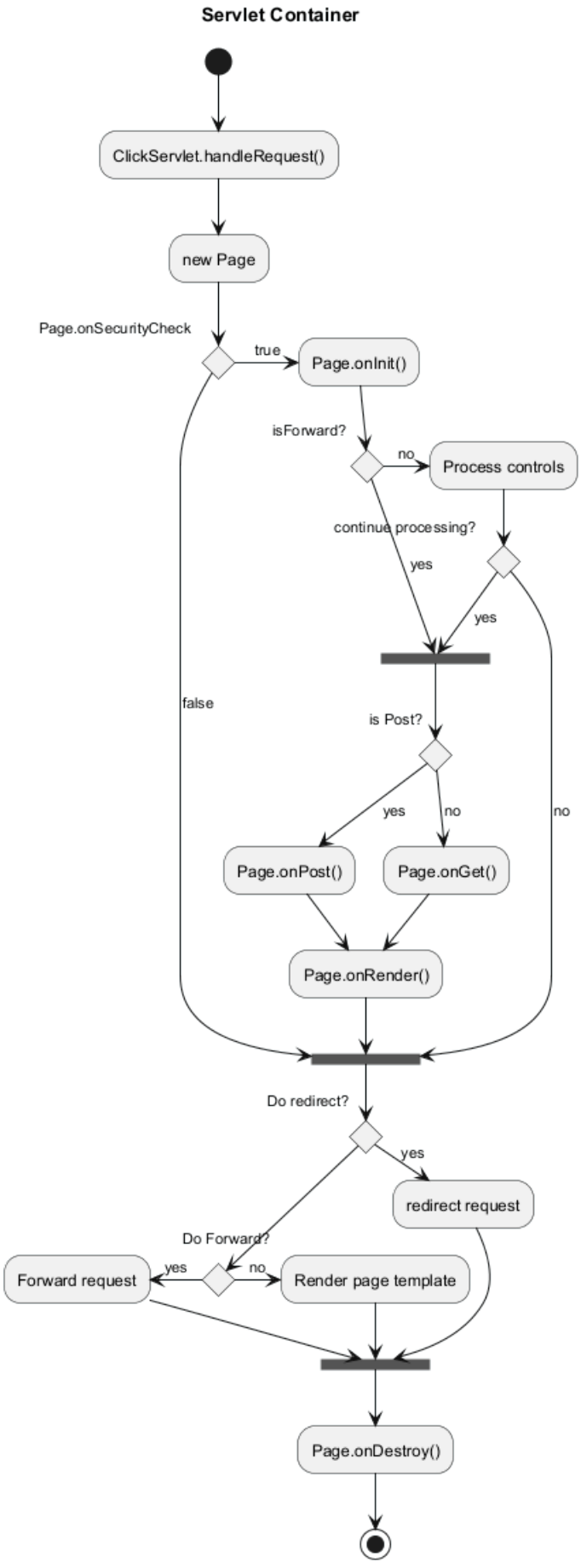
```
@startuml
'Default is skinparam activityShape roundBox
skinparam activityShape octagon

(*) --> "First Action"
"First Action" --> (*)

@enduml
```



5.12 Complete example

```
@startuml
title Servlet Container

(*) --> "ClickServlet.handleRequest()"
--> "new Page"

if "Page.onSecurityCheck" then
```

```
  ->[true] "Page.onInit()"

  if "isForward?" then
   ->[no] "Process controls"

   if "continue processing?" then
     -->[yes] ===RENDERING===
   else
     -->[no] ===REDIRECT_CHECK===
   endif

  else
   -->[yes] ===RENDERING===
  endif

  if "is Post?" then
    -->[yes] "Page.onPost()"
    --> "Page.onRender()" as render
    --> ===REDIRECT_CHECK===
  else
    -->[no] "Page.onGet()"
    --> render
  endif

else
  -->[false] ===REDIRECT_CHECK===
endif

if "Do redirect?" then
 ->[yes] "redirect request"
 --> ==BEFORE_DESTROY===
else
 if "Do Forward?" then
  -left->[yes] "Forward request"
  --> ==BEFORE_DESTROY===
 else
  -right->[no] "Render page template"
  --> ==BEFORE_DESTROY===
 endif
endif

--> "Page.onDestroy()"
-->(*)

@enduml
```


Servlet Container
ClickServlet.handleRequest()
new Page
Page.onSecurityCheck
true
Page.onInit()
isForward?
no
Process controls
continue processing?
yes
yes
false
is Post?
yes
no
no
Page.onPost()
Page.onGet()
Page.onRender()
Do redirect?
yes
redirect request
Do Forward?
Forward request
yes
no
Render page template
Page.onDestroy()

6 Activity Diagram (beta)

기존의 activity diagram 문법은몇몇제약과단점이있다.(예를들면, 유지보수가어렵다.)

그래서완전새로운문법과구현이 베타버전으로고안되었고, 우리는더나은포맷과문법으로정의할수있었다.

이새로운구현의또다른장점은 (시퀀스다이어그램과같이) Graphviz 를설치할필요없이수행된다는것이다.

새로운구문이이전구문을대체할것이다. 그러나 호환성을보장하기위해이전구문이여전히인식될것이다.

새로운구문으로이전을권장한다.

Make the shift today and experience a more streamlined and efficient diagramming process with the new activity diagram syntax.

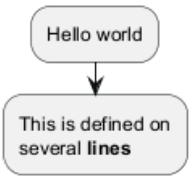
6.1 Simple action

Activities label starts with `:` and ends with `;`.

Text formatting can be done using creole wiki syntax.

They are implicitly linked in their definition order.

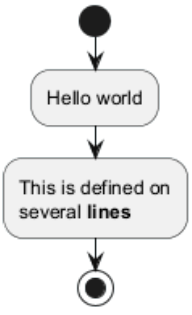
```
@startuml
:Hello world;
:This is defined on
several **lines**;
@enduml
```



6.2 Start/Stop/End

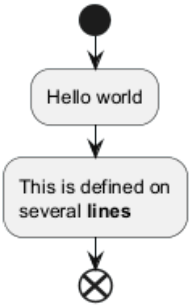
You can use `start` and `stop` keywords to denote the beginning and the end of a diagram.

```
@startuml
start
:Hello world;
:This is defined on
several **lines**;
stop
@enduml
```



You can also use the `end` keyword.

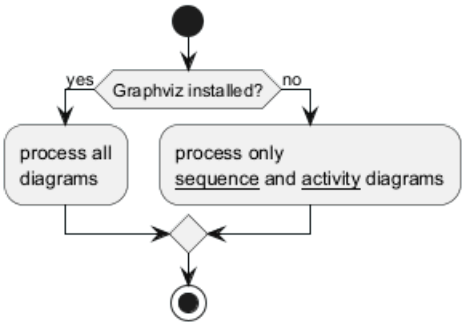
```
@startuml
start
:Hello world;
:This is defined on
several **lines**;
end
@enduml
```



6.3 Conditional

You can use `if`, `then` and `else` keywords to put tests if your diagram. Labels can be provided using parentheses.

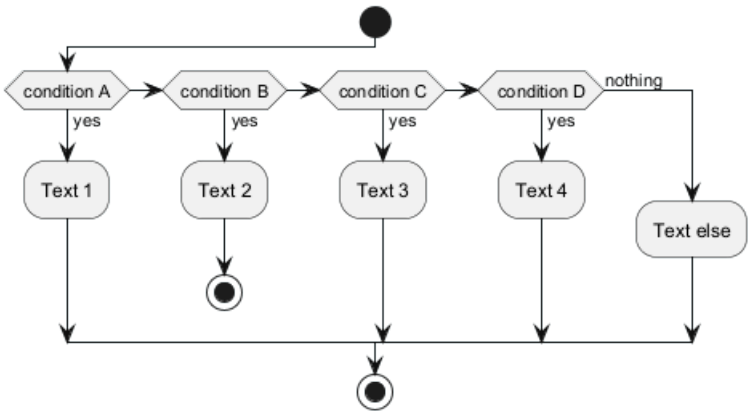
```
@startuml

start

if (Graphviz installed?) then (yes)
  :process all\ndiagrams;
else (no)
  :process only
  __sequence__ and __activity__ diagrams;
endif

stop

@enduml
```



You can use the `elseif` keyword to have several tests :

```
@startuml
start
if (condition A) then (yes)
  :Text 1;
elseif (condition B) then (yes)
  :Text 2;
  stop
elseif (condition C) then (yes)
```

```
  :Text 3;
elseif (condition D) then (yes)
  :Text 4;
else (nothing)
  :Text else;
endif
stop
@enduml
```



*[Refs. [QA-3931](https:*forum.plantuml.net/3931/please-provide-elseif-structure-vertically-activity-diagrams), [issue-582](https:*github.com/plantuml/plantuml/issues/582)]*

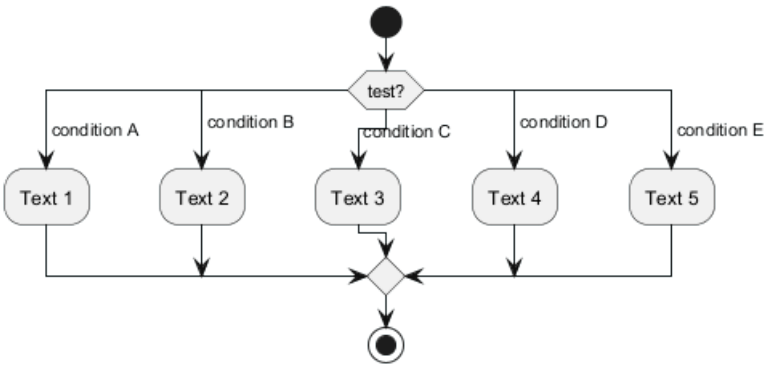
*[Refs. [QA-3931](https:*forum.plantuml.net/3931/please-provide-elseif-structure-vertically-activity-diagrams), [GH-582](https:*github.com/plantuml/plantuml/issues/582)]*

6.4 Switch and case [switch, case, endswitch]

You can use `switch`, `case` and `endswitch` keywords to put switch in your diagram.

Labels can be provided using parentheses.

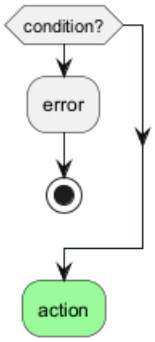
```
@startuml
start
switch (test?)
case ( condition A )
  :Text 1;
case ( condition B )
  :Text 2;
case ( condition C )
  :Text 3;
case ( condition D )
  :Text 4;
case ( condition E )
  :Text 5;
endswitch
stop
@enduml
```



6.5 Conditional with stop on an action [kill, detach]

You can stop action on a if loop.

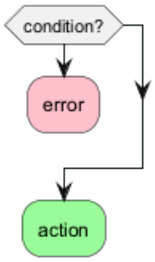
```
@startuml
if (condition?) then
  :error;
  stop
endif
#palegreen:action;
@enduml
```



But if you want to stop at the precise action, you can use the `kill` or `detach` keyword:

- `kill`

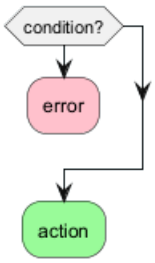
```
@startuml
if (condition?) then
  #pink:error;
  kill
endif
#palegreen:action;
@enduml
```



[Ref. QA-265]

- `detach`

```
@startuml
if (condition?) then
  #pink:error;
  detach
endif
#palegreen:action;
@enduml
```

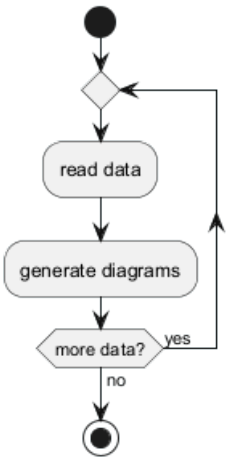


6.6 Repeat loop

6.6.1 Simple repeat loop

You can use `repeat` and `repeat while` keywords to have repeat loops.

```
@startuml

start

repeat
  :read data;
  :generate diagrams;
repeat while (more data?) is (yes) not (no)

stop

@enduml
```

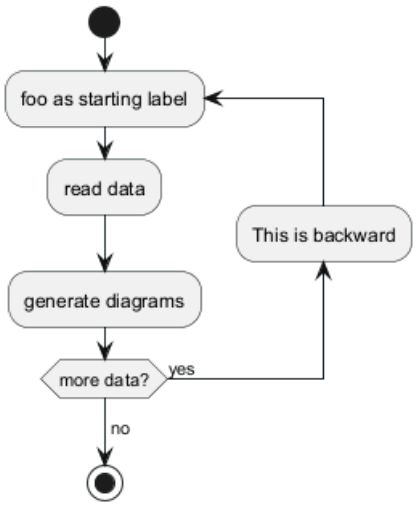


6.6.2 Repeat loop with repeat action and backward action

It is also possible to use a full action as `repeat` target and insert an action in the return path using the `backward` keyword.

```
@startuml

start
```

```
repeat :foo as starting label;
  :read data;
  :generate diagrams;
backward:This is backward;
repeat while (more data?) is (yes)
->no;

stop

@enduml
```

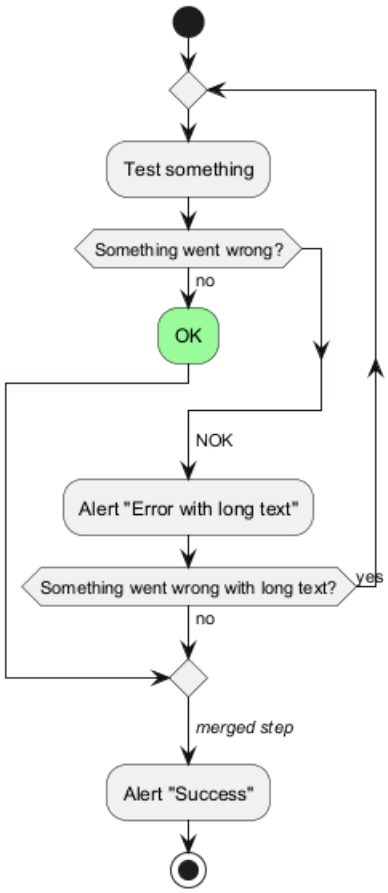


[Ref. QA-5826]

6.7 Break on a repeat loop [break]

You can use the `break` keyword after an action on a loop.

```
@startuml
start
repeat
  :Test something;
    if (Something went wrong?) then (no)
      #palegreen:OK;
      break
    endif
    ->NOK;
    :Alert "Error with long text";
repeat while (Something went wrong with long text?) is (yes) not (no)
->//merged step//;
:Alert "Success";
stop
@enduml
```



[Ref. QA-6105]

6.8 Goto and Label Processing [label, goto]

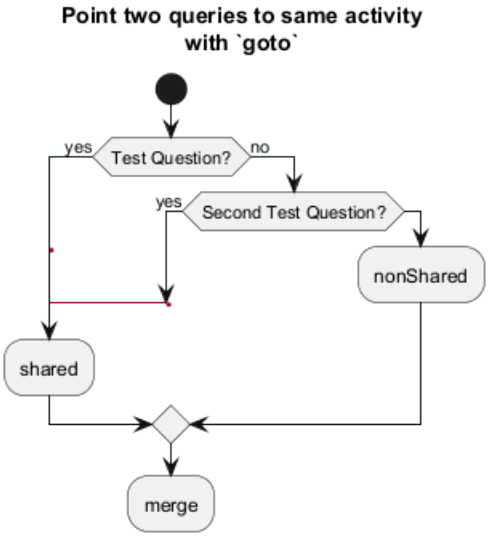
It is currently only experimental

You can use `label` and `goto` keywords to denote goto processing, with:

- `label <label_name>`
- `goto <label_name>`

```
@startuml
title Point two queries to same activity\nwith `goto`
start
if (Test Question?) then (yes)
'space label only for alignment
label sp_lab0
label sp_lab1
'real label
label lab
:shared;
else (no)
if (Second Test Question?) then (yes)
label sp_lab2
goto sp_lab1
else
:nonShared;
endif
endif
:merge;
```

```
@enduml
```



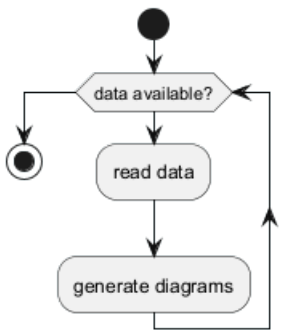
[Ref. QA-15026, QA-12526 and initially QA-1626]

6.9 While loop

6.9.1 Simple while loop

You can use `while` and `endwhile` keywords to have while loop.

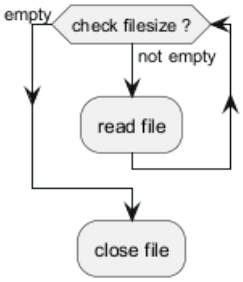
```
@startuml

start

while (data available?)
  :read data;
  :generate diagrams;
endwhile

stop

@enduml
```



It is possible to provide a label after the `endwhile` keyword, or using the `is` keyword.

```
@startuml
while (check filesize ?) is (not empty)
  :read file;
endwhile (empty)
:close file;
```

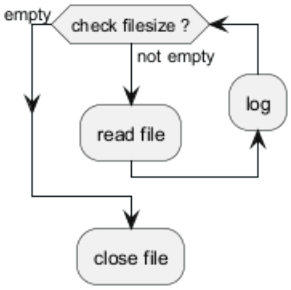
```
@enduml
```



6.9.2 While loop with backward action

It is also possible to insert an action in the return path using the `backward` keyword.

```
@startuml
while (check filesize ?) is (not empty)
  :read file;
  backward:log;
endwhile (empty)
:close file;
@enduml
```

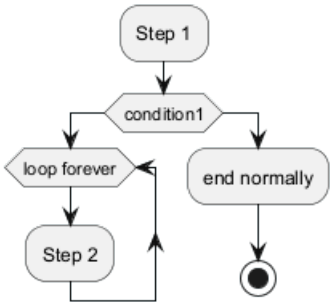


[Ref. QA-11144]

6.9.3 Infinite while loop

If you are using `detach` to form an infinite while loop, then you will want to also hide the partial arrow that results using `-[hidden]->`

```
@startuml
:Step 1;
if (condition1) then
  while (loop forever)
   :Step 2;
  endwhile
  -[hidden]->
  detach
else
  :end normally;
  stop
endif
@enduml
```

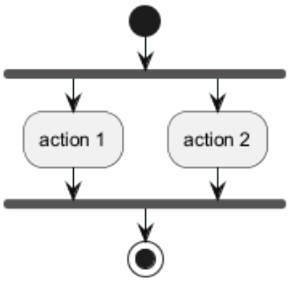


6.10 Parallel processing [fork, fork again, end fork, end merge]

You can use `fork`, `fork again` and `end fork` or `end merge` keywords to denote parallel processing.

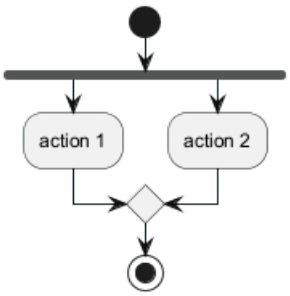
6.10.1 Simple `fork`

```
@startuml
start
fork
  :action 1;
fork again
  :action 2;
end fork
stop
@enduml
```



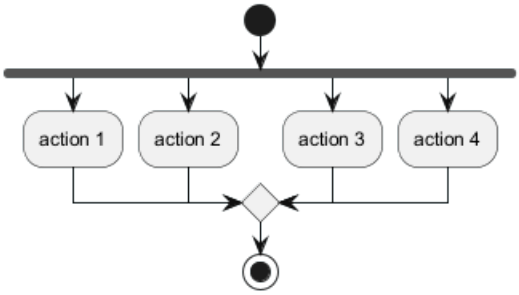
6.10.2 `fork` with end merge

```
@startuml
start
fork
  :action 1;
fork again
  :action 2;
end merge
stop
@enduml
```

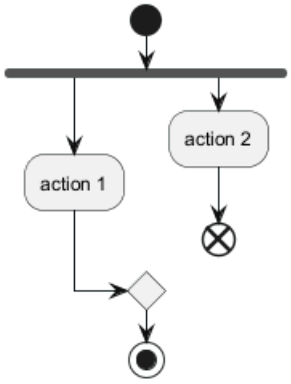


[Ref. QA-5320]

```
@startuml
start
fork
  :action 1;
fork again
  :action 2;
fork again
  :action 3;
fork again
  :action 4;
end merge
stop
@enduml
```




```
@startuml
start
fork
  :action 1;
fork again
  :action 2;
  end
end merge
stop
@enduml
```

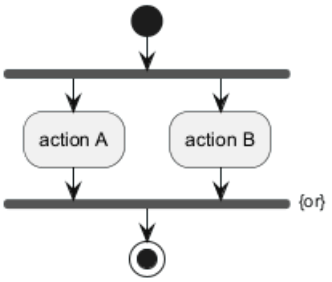


[Ref. QA-13731]

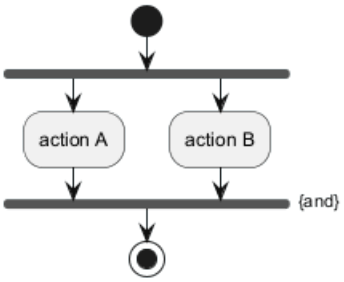
6.10.3 Label on `end fork` (or UML joinspec):

```
@startuml
start
fork
  :action A;
fork again
```

```
  :action B;
end fork {or}
stop
@enduml
```



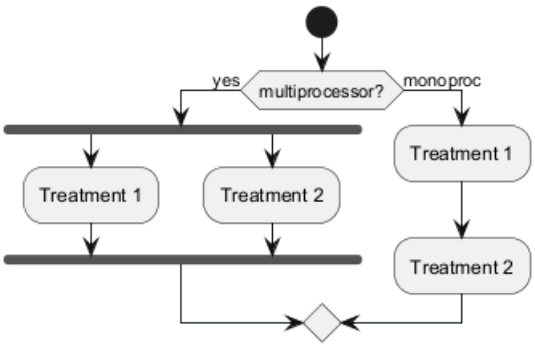

```
@startuml
start
fork
  :action A;
fork again
  :action B;
end fork {and}
stop
@enduml
```



[Ref. QA-5346]

6.10.4 Other example

```
@startuml

start

if (multiprocessor?) then (yes)
  fork
    :Treatment 1;
  fork again
    :Treatment 2;
  end fork
else (monoproc)
  :Treatment 1;
  :Treatment 2;
endif

@enduml
```

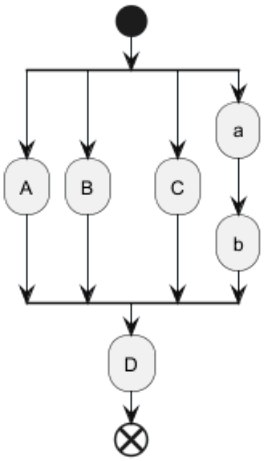


6.11 Split processing

6.11.1 Split

You can use `split`, `split again` and `end split` keywords to denote split processing.

```
@startuml
start
split
   :A;
split again
   :B;
split again
   :C;
split again
   :a;
   :b;
end split
:D;
end
@enduml
```

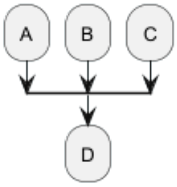


6.11.2 Input split (multi-start)

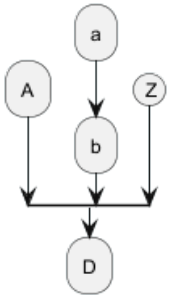
You can use `hidden` arrows to make an input split (multi-start):

```
@startuml
split
   -[hidden]->
   :A;
split again
   -[hidden]->
```

```
   :B;
split again
   -[hidden]->
   :C;
end split
:D;
@enduml
```




```
@startuml
split
   -[hidden]->
   :A;
split again
   -[hidden]->
   :a;
   :b;
split again
   -[hidden]->
   (Z)
end split
:D;
@enduml
```



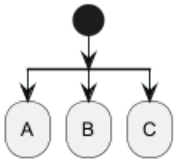
[Ref. QA-8662]

6.11.3 Output split (multi-end)

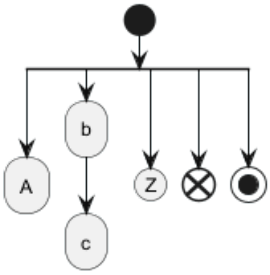
You can use `kill` or `detach` to make an output split (multi-end):

```
@startuml
start
split
   :A;
   kill
split again
   :B;
   detach
split again
   :C;
   kill
```

```
end split
@enduml
```




```
@startuml
start
split
   :A;
   kill
split again
   :b;
   :c;
   detach
split again
   (Z)
   detach
split again
   end
split again
   stop
end split
@enduml
```

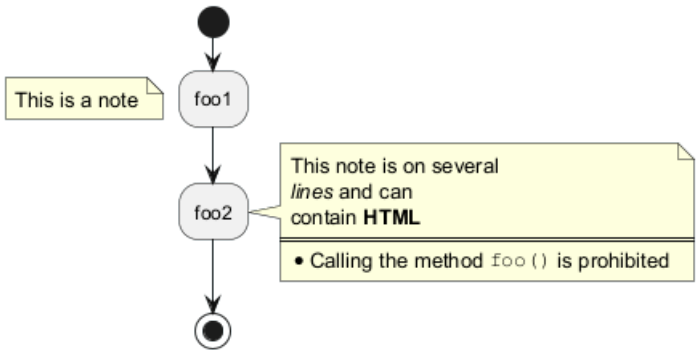


6.12 Notes

Text formatting can be done using creole wiki syntax.

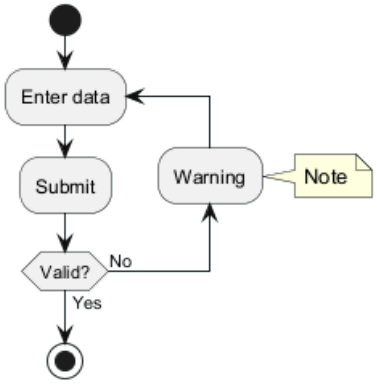
A note can be floating, using `floating` keyword.

```
@startuml

start
:foo1;
floating note left: This is a note
:foo2;
note right
  This note is on several
  //lines// and can
  contain <b>HTML</b>
  ====
  * Calling the method ""foo()"" is prohibited
end note
stop

@enduml
```



You can add note on backward activity:

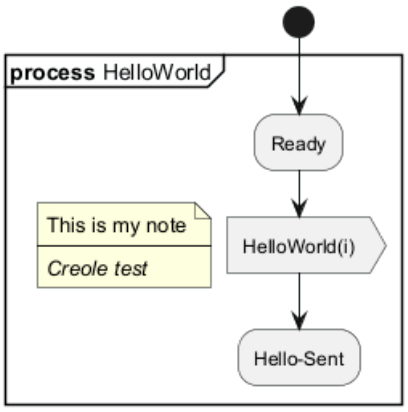
```
@startuml
start
repeat :Enter data;
:Submit;
backward :Warning;
note right: Note
repeat while (Valid?) is (No) not (Yes)
stop
@enduml
```



[Ref. QA-11788]

You can add note on partition activity:

```
@startuml
start
partition "**process** HelloWorld" {
    note
        This is my note
        ----
        //Creole test//
    end note
    :Ready;
    :HelloWorld(i)>
    :Hello-Sent;
}
@enduml
```

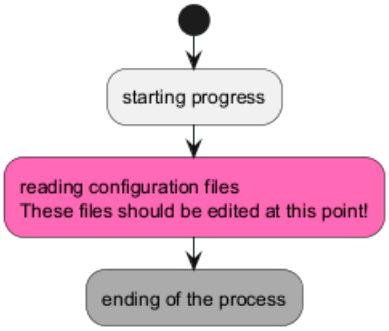


[Ref. QA-2398]

6.13 Colors

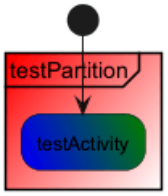
You can specify a color for some activities.

```
@startuml

start
:starting progress;
#HotPink:reading configuration files
These files should be edited at this point!;
#AAAAAA:ending of the process;

@enduml
```



You can also use gradient color.

```
@startuml
start
partition #red/white testPartition {
        #blue\green:testActivity;
}
@enduml
```

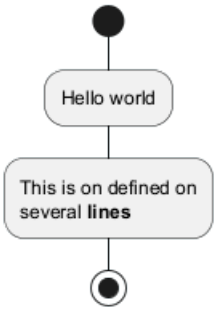


[Ref. QA-4906]

6.14 Lines without arrows

You can use `skinparam ArrowHeadColor none` in order to connect activities using lines only, without arrows.

```
@startuml
skinparam ArrowHeadColor none
start
:Hello world;
:This is on defined on
several **lines**;
stop
@enduml
```




```
@startuml
skinparam ArrowHeadColor none
start
repeat :Enter data;
:Submit;
backward :Warning;
repeat while (Valid?) is (No) not (Yes)
stop
@enduml
```

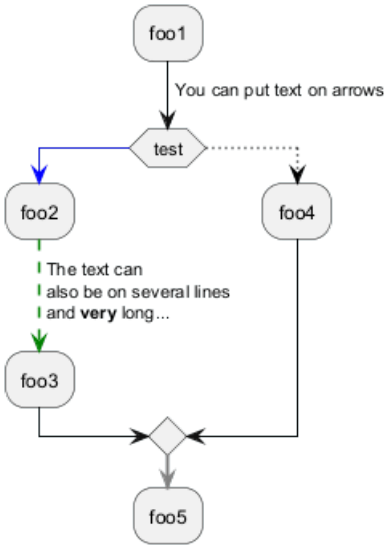
6.15 Arrows

Using the `->` notation, you can add texts to arrow, and change their color.

It's also possible to have dotted, dashed, bold or hidden arrows.

```
@startuml
:foo1;
-> You can put text on arrows;
if (test) then
  -[#blue]->
  :foo2;
  -[#green,dashed]-> The text can
```

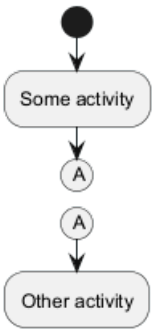
```
  also be on several lines
  and **very** long...;
  :foo3;
else
  -[#black,dotted]->
  :foo4;
endif
-[#gray,bold]->
:foo5;
@enduml
```



6.16 Connector

You can use parentheses to denote connector.

```
@startuml
start
:Some activity;
(A)
detach
(A)
:Other activity;
@enduml
```

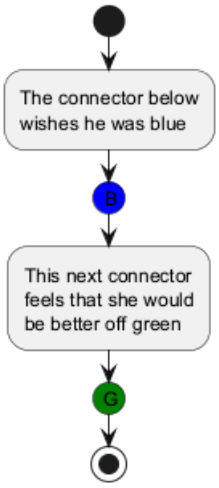


6.17 Color on connector

You can add color on connector.

```
@startuml
```

```
start
:The connector below
wishes he was blue;
#blue:(B)
:This next connector
feels that she would
be better off green;
#green:(G)
stop
@enduml
```



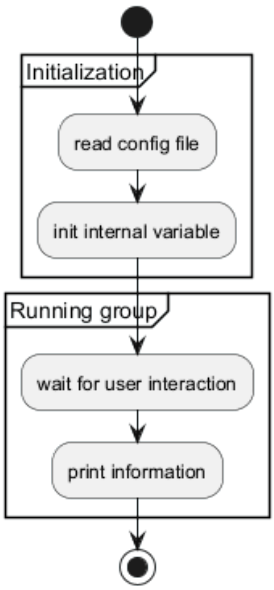
[Ref. QA-10077]

6.18 Grouping or partition

6.18.1 Group

You can group activity together by defining group:

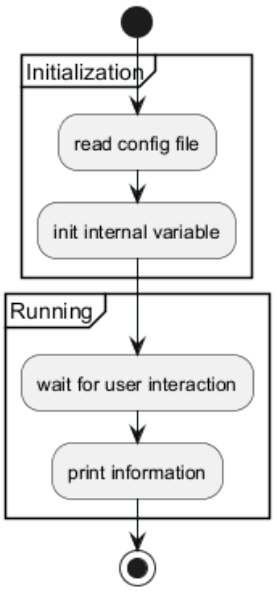
```
@startuml
start
group Initialization
    :read config file;
    :init internal variable;
end group
group Running group
    :wait for user interaction;
    :print information;
end group

stop
@enduml
```



6.18.2 Partition

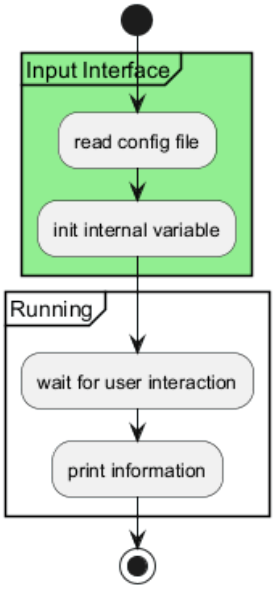
You can group activity together by defining partition:

```
@startuml
start
partition Initialization {
    :read config file;
    :init internal variable;
}
partition Running {
    :wait for user interaction;
    :print information;
}

stop
@enduml
```



It's also possible to change partition color:

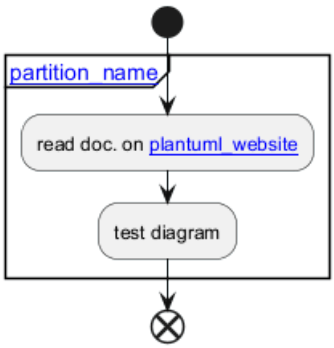
```
@startuml
start
partition #lightGreen "Input Interface" {
    :read config file;
    :init internal variable;
}
partition Running {
    :wait for user interaction;
    :print information;
}
stop
@enduml
```



[Ref. QA-2793]

It's also possible to add link to partition:

```
@startuml
start
partition "[[http://plantuml.com partition_name]]" {
    :read doc. on [[http://plantuml.com plantuml_website]];
    :test diagram;
}
end
@enduml
```



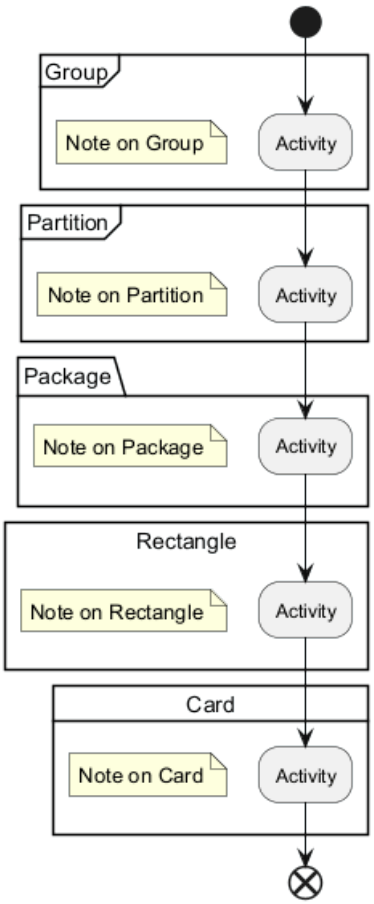
[Ref. QA-542]

6.18.3 Group, Partition, Package, Rectangle or Card

You can group activity together by defining:

- group;
- partition;
- package;
- rectangle;
- card.

```
@startuml
start
group Group
  :Activity;
end group
floating note: Note on Group

partition Partition {
  :Activity;
}
floating note: Note on Partition

package Package {
  :Activity;
}
floating note: Note on Package

rectangle Rectangle {
  :Activity;
}
floating note: Note on Rectangle

card Card {
  :Activity;
}
floating note: Note on Card
end
@enduml
```

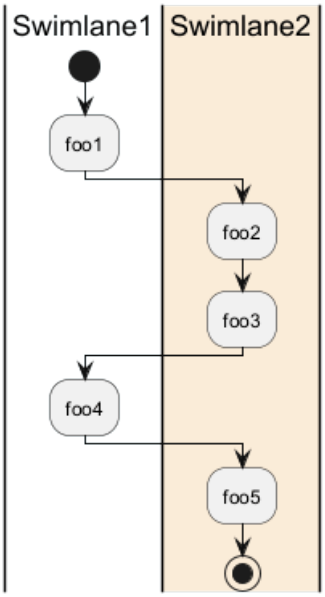


6.19 Swimlanes

Using pipe |, you can define swimlanes.

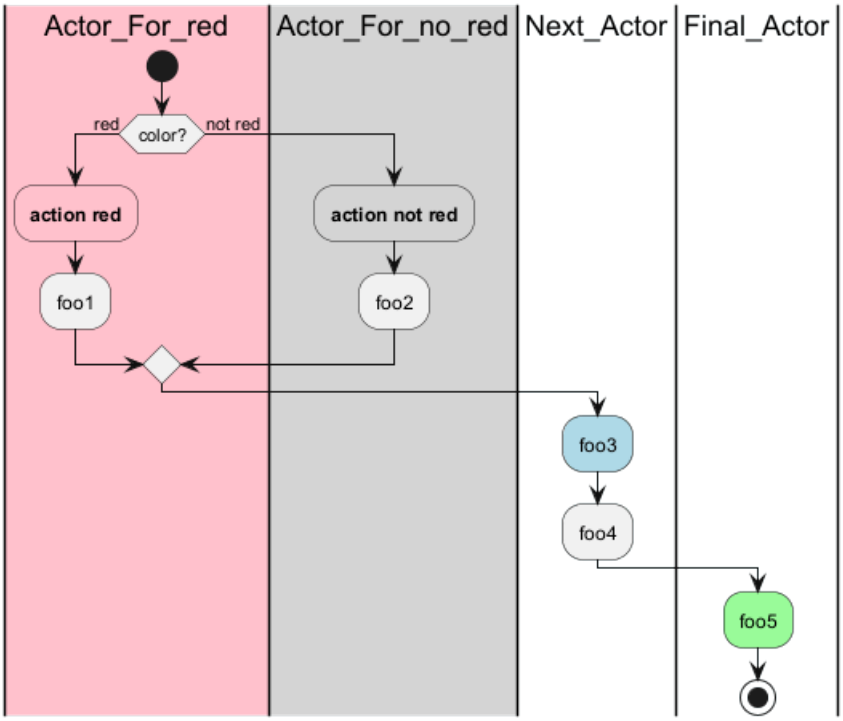
It's also possible to change swimlanes color.

```
@startuml
|Swimlane1|
start
:foo1;
|#AntiqueWhite|Swimlane2|
:foo2;
:foo3;
|Swimlane1|
:foo4;
|Swimlane2|
:foo5;
stop
@enduml
```



You can add `if` conditional or `repeat` or `while` loop within swimlanes.

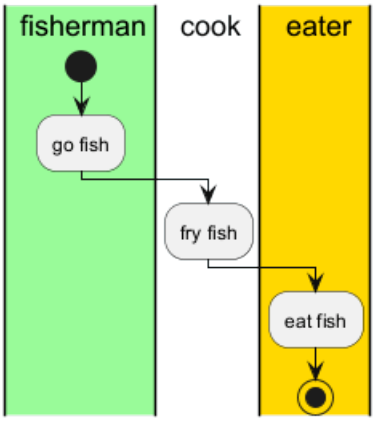
```
@startuml
|#pink|Actor_For_red|
start
if (color?) is (red) then
#pink:**action red**;
:foo1;
else (not red)
|#lightgray|Actor_For_no_red|
#lightgray:**action not red**;
:foo2;
endif
|Next_Actor|
#lightblue:foo3;
:foo4;
|Final_Actor|
#palegreen:foo5;
stop
@enduml
```



You can also use `alias` with swimlanes, with this syntax:

- `|[#<color>|]<swimlane_alias>| <swimlane_title>`

```
@startuml
|#palegreen|f| fisherman
|c| cook
|#gold|e| eater
|f|
start
:go fish;
|c|
:fry fish;
|e|
:eat fish;
stop
@enduml
```



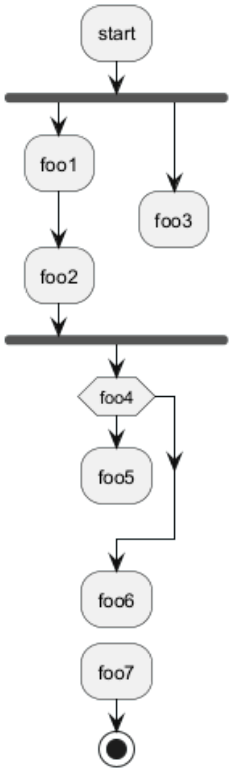
[Ref. QA-2681]

6.20 Detach or kill [detach, kill]

It's possible to remove an arrow using the `detach` or `kill` keyword:

- `detach`

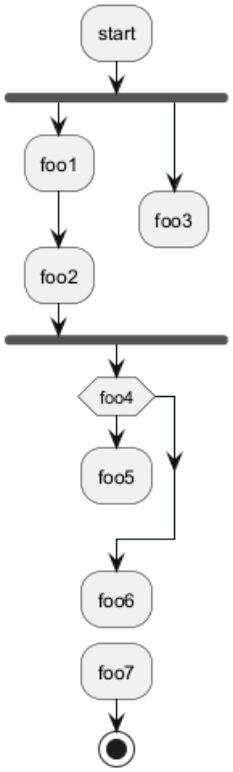
```
@startuml
 :start;
 fork
   :foo1;
   :foo2;
 fork again
   :foo3;
   detach
 endfork
 if (foo4) then
   :foo5;
   detach
 endif
 :foo6;
 detach
 :foo7;
 stop
@enduml
```



- `kill`

```
@startuml
 :start;
 fork
   :foo1;
   :foo2;
 fork again
   :foo3;
   kill
```

```
 endfork
 if (foo4) then
   :foo5;
   kill
 endif
 :foo6;
 kill
 :foo7;
 stop
@enduml
```



6.21 SDL (Specification and Description Language)

6.21.1 Table of SDL Shape Name

Name	Old syntax	Stereotype syntax
Input	<	<<input>>
Output	>	<<output>>
Procedure	|	<<procedure>>
Load	\	<<load>>
Save	/	<<save>>
Continuous	}	<<continuous>>
Task	]	<<task>>

[Ref. QA-11518, GH-1270]

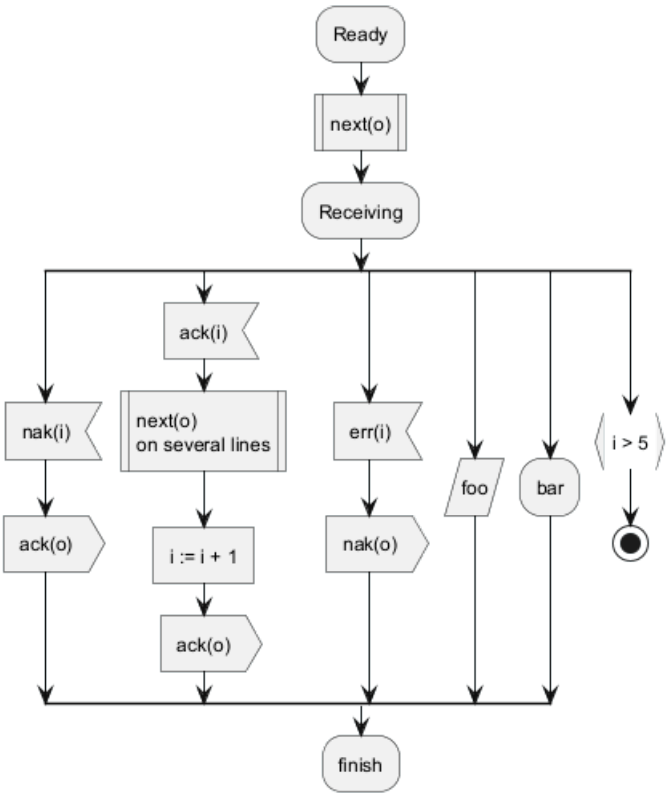
6.21.2 SDL using final separator (Deprecated form)

By changing the final ; separator, you can set different rendering for the activity:

- |
- <
- >

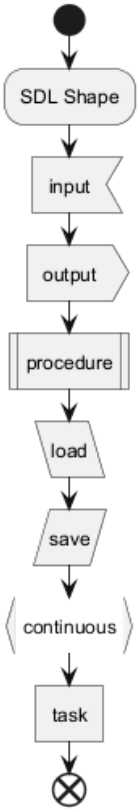
- /
- \\
-]
- }

```
@startuml
:Ready;
:next(o)|
:Receiving;
split
 :nak(i)<
 :ack(o)>
split again
 :ack(i)<
 :next(o)
 on several lines|
 :i := i + 1]
 :ack(o)>
split again
 :err(i)<
 :nak(o)>
split again
 :foo/
split again
 :bar\\
split again
 :i > 5}
stop
end split
:finish;
@enduml
```



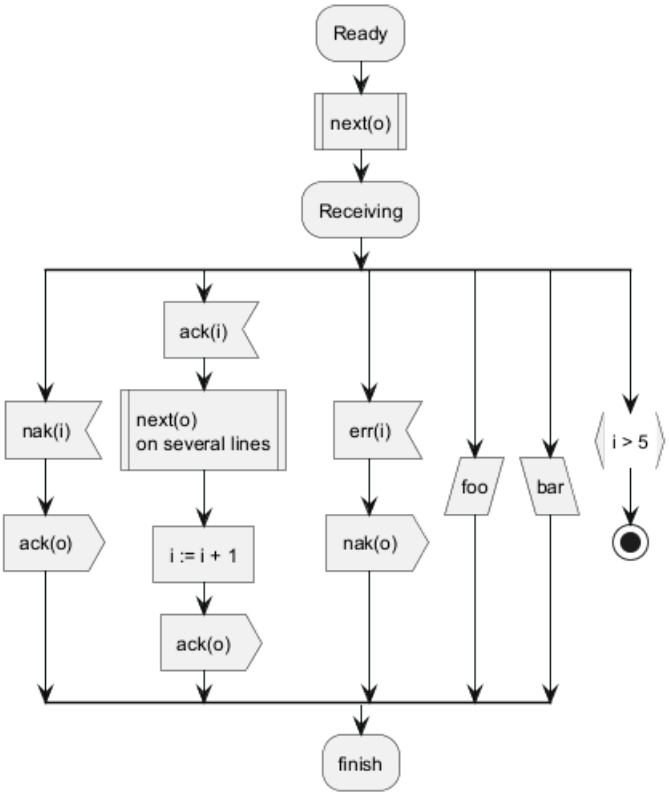
6.21.3 SDL using Normal separator and Stereotype (Current offiial form)

```
@startuml
start
:SDL Shape;
:input; <<input>>
:output; <<output>>
:procedure; <<procedure>>
:load; <<load>>
:save; <<save>>
:continuous; <<continuous>>
:task; <<task>>
end
@enduml
```




```
@startuml
:Ready;
:next(o); <<procedure>>
:Receiving;
split
 :nak(i); <<input>>
 :ack(o); <<output>>
split again
 :ack(i); <<input>>
 :next(o)
 on several lines; <<procedure>>
 :i := i + 1; <<task>>
 :ack(o); <<output>>
split again
 :err(i); <<input>>
 :nak(o); <<output>>
split again
 :foo; <<save>>
```

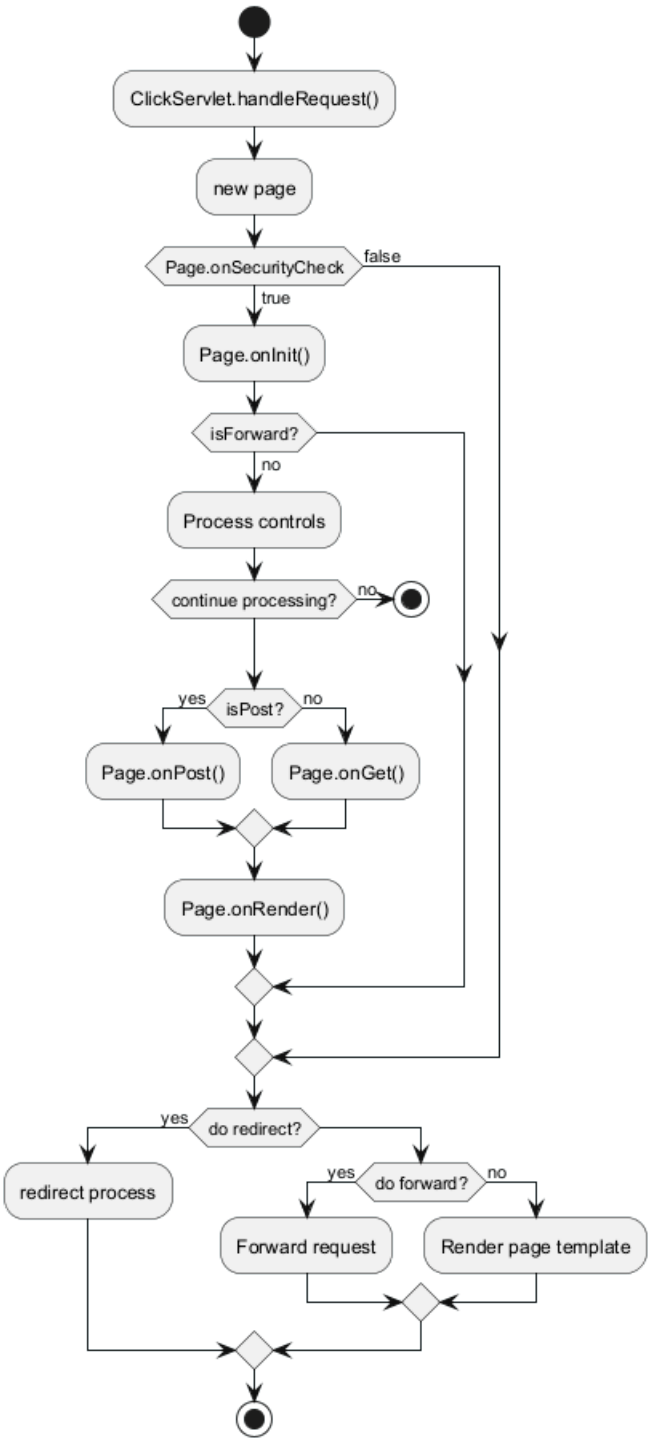
```
split again
 :bar; <<load>>
split again
 :i > 5; <<continuous>>
stop
end split
:finish;
@enduml
```



6.22 Complete example

```
@startuml

start
:ClickServlet.handleRequest();
:new page;
if (Page.onSecurityCheck) then (true)
  :Page.onInit();
  if (isForward?) then (no)
    :Process controls;
    if (continue processing?) then (no)
      stop
    endif

    if (isPost?) then (yes)
      :Page.onPost();
    else (no)
      :Page.onGet();
    endif
    :Page.onRender();
  endif
else (false)
```

```
endif

if (do redirect?) then (yes)
  :redirect process;
else
  if (do forward?) then (yes)
    :Forward request;
  else (no)
    :Render page template;
  endif
endif

stop

@enduml
```

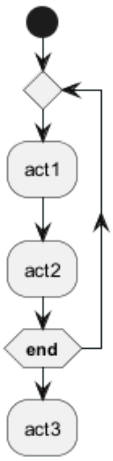


6.23 Condition Style

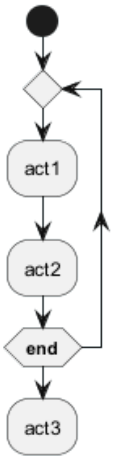
6.23.1 Inside style (by default)

```
@startuml
skinparam conditionStyle inside
start
repeat
  :act1;
  :act2;
repeatwhile (<b>end)
:act3;
```

```
@enduml
```

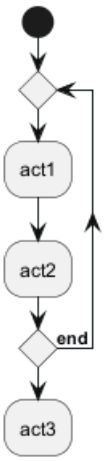



```
@startuml
start
repeat
  :act1;
  :act2;
repeatwhile (<b>end)
:act3;
@enduml
```



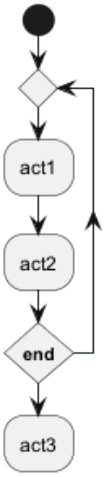
6.23.2 Diamond style

```
@startuml
skinparam conditionStyle diamond
start
repeat
  :act1;
  :act2;
repeatwhile (<b>end)
:act3;
@enduml
```

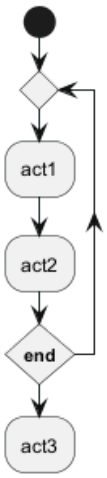


6.23.3 InsideDiamond (or *Foo1*) style

```
@startuml
skinparam conditionStyle InsideDiamond
start
repeat
  :act1;
  :act2;
repeatwhile (<b>end)
:act3;
@enduml
```




```
@startuml
skinparam conditionStyle foo1
start
repeat
  :act1;
  :act2;
repeatwhile (<b>end)
:act3;
@enduml
```



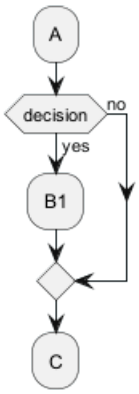
[Ref. QA-1290 and #400]

6.24 Condition End Style

6.24.1 Diamond style (by default)

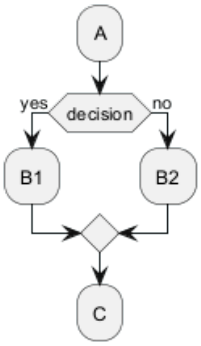
- With one branch

```
@startuml
skinparam ConditionEndStyle diamond
:A;
if (decision) then (yes)
    :B1;
else (no)
endif
:C;
@enduml
```



- With two branches (`B1`, `B2`)

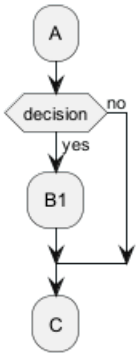
```
@startuml
skinparam ConditionEndStyle diamond
:A;
if (decision) then (yes)
    :B1;
else (no)
    :B2;
endif
:C;
@enduml
@enduml
```



6.24.2 Horizontal line (hline) style

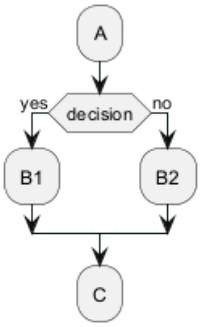
- With one branch

```
@startuml
skinparam ConditionEndStyle hline
:A;
if (decision) then (yes)
    :B1;
else (no)
endif
:C;
@enduml
```



- With two branches (`B1`, `B2`)

```
@startuml
skinparam ConditionEndStyle hline
:A;
if (decision) then (yes)
    :B1;
else (no)
    :B2;
endif
:C;
@enduml
@enduml
```

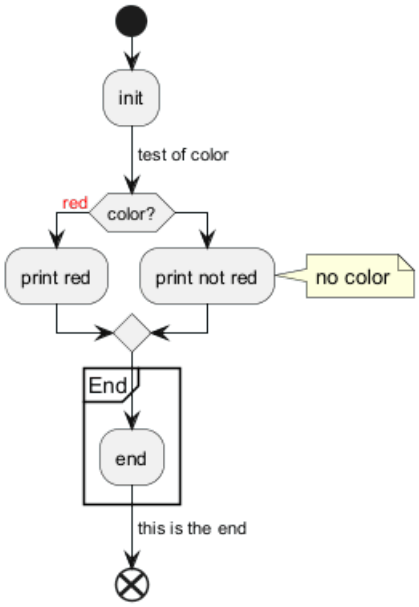


[Ref. QA-4015]

6.25 Using (global) style

6.25.1 Without style *(by default)*

```
@startuml
start
:init;
-> test of color;
if (color?) is (<color:red>red) then
:print red;
else
:print not red;
note right: no color
endif
partition End {
:end;
}
-> this is the end;
end
@enduml
```

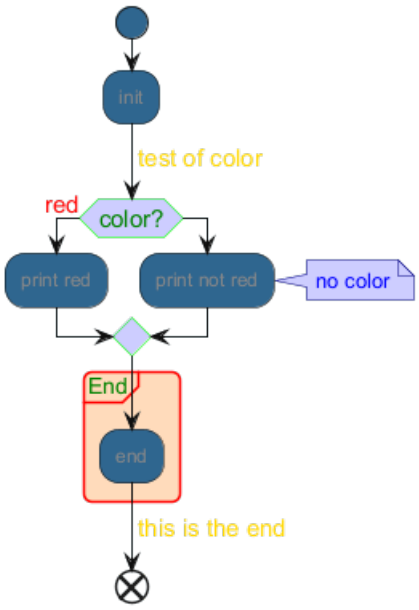


6.25.2 With style

You can use style to change rendering of elements.

```
@startuml
```

```
<style>
activityDiagram {
  BackgroundColor #33668E
  BorderColor #33668E
  FontColor #888
  FontName arial

  diamond {
    BackgroundColor #ccf
    LineColor #00FF00
    FontColor green
    FontName arial
    FontSize 15
  }
  arrow {
    FontColor gold
    FontName arial
    FontSize 15
  }
  partition {
    LineColor red
    FontColor green
    RoundCorner 10
    BackgroundColor PeachPuff
  }
  note {
    FontColor Blue
    LineColor Navy
    BackgroundColor #ccf
  }
}
document {
   BackgroundColor transparent
}
</style>
start
:init;
-> test of color;
if (color?) is (<color:red>red) then
:print red;
else
:print not red;
note right: no color
endif
partition End {
:end;
}
-> this is the end;
end
@enduml
```


init
test of color
red
color?
print red
print not red
no color
End
end
this is the end

7 Component Diagram

Component Diagram: A component diagram is a type of structural diagram used in UML (Unified Modeling Language) to visualize the organization and relationships of system components. These diagrams help in breaking down complex systems into manageable components, showcasing their interdependencies, and ensuring efficient system design and architecture.

Advantages of PlantUML:

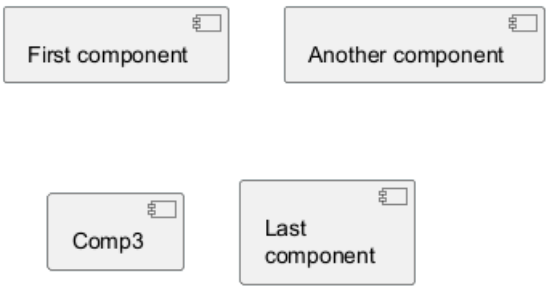
- **Simplicity**: With PlantUML, you can create component diagrams using simple and intuitive text-based descriptions, eliminating the need for complex drawing tools.
- **Integration**: PlantUML seamlessly integrates with various tools and platforms, making it a versatile choice for developers and architects.
- **Collaboration**: The PlantUML forum offers a platform for users to discuss, share, and seek assistance on their diagrams, fostering a collaborative community.

7.1 컴포넌트

컴포넌트는반드시대괄호 [] 로둘러싸여야한다.

컨퍼넌트를정의할때 `component` 키워드도사용할수있다. `as` 키워드를이용해서별명을정의할수도있다. 이별명은뒤에서관계를정의할때사용된다.

```
@startuml

[First component]
[Another component] as Comp2
component Comp3
component [Last\ncomponent] as Comp4

@enduml
```



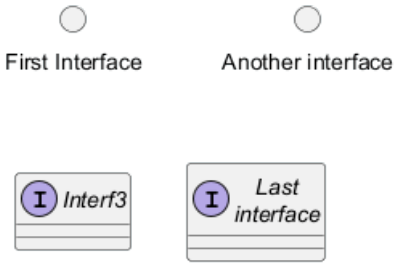
7.2 인터페이스

인터페이스는 () 기호로정의될수있다 (이기호가원처럼보이기때문이다).

`interface` 키워드도인터페이스를정의하는데사용할수있다. `as` 키워드를이용해서별명을정의할수도있다. 이별명은뒤에서관계를정의할때사용된다.

인터페이스를정의하는일은선택 (optional) 이라는것을뒤에서확인할것이다.

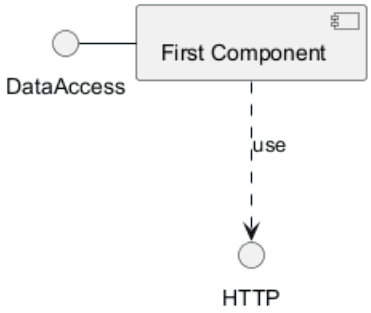
```
@startuml

() "First Interface"
() "Another interface" as Interf2
interface Interf3
interface "Last\ninterface" as Interf4

@enduml
```



7.3 기본예제

요소들간의연결은점선 (..), 실선 (--), 그리고화살표 (-->) 기호들의조합으로생성된다.

```
@startuml

DataAccess - [First Component]
[First Component] ..> HTTP : use

@enduml
```

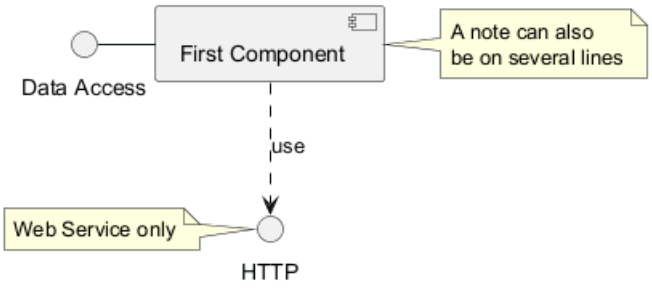


7.4 메모사용하기

각오브젝트에관련된메모를정의하기위해 `note left of` , `note right of` , `note top of` , `note bottom of` 키워드들을사용할수있다.

메모는또한 `note` 키워드를통해단독으로정의될수도있고, 다른오브젝트들에 `..` 기호로연결된다.

```
@startuml

interface "Data Access" as DA

DA - [First Component]
[First Component] ..> HTTP : use

note left of HTTP : Web Service only

note right of [First Component]
  A note can also
  be on several lines
end note

@enduml
```

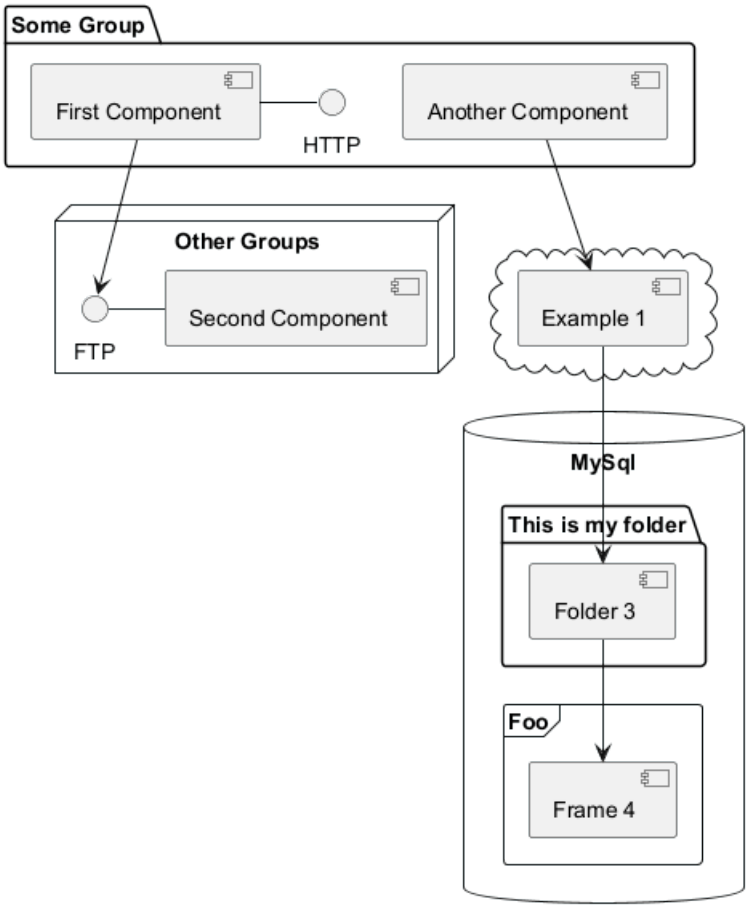


7.5 컴포넌트를그룹으로나누기

컴포넌트들과인터페이스들을그룹으로나누기위해여러가지키워드를사용할수있다:

- package
- node
- folder
- frame
- cloud
- database

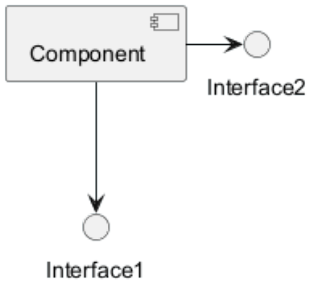
```
@startuml

package "Some Group" {
  HTTP - [First Component]
  [Another Component]
}

node "Other Groups" {
  FTP - [Second Component]
  [First Component] --> FTP
}

cloud {
  [Example 1]
}


database "MySql" {
  folder "This is my folder" {
    [Folder 3]
  }
  frame "Foo" {
    [Frame 4]
  }
}


[Another Component] --> [Example 1]
[Example 1] --> [Folder 3]
[Folder 3] --> [Frame 4]

@enduml
```



7.6 화살표방향바꾸기

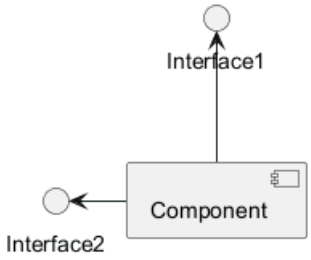
기본적으로클래스들간의연결은두개의대시를 -- 갖고방향은수직방향이다. 다음처럼한개의대시 (혹은 점) 를넣어수평방향연결을사용할수있다:

```
@startuml
[Component] --> Interface1
[Component] -> Interface2
@enduml
```



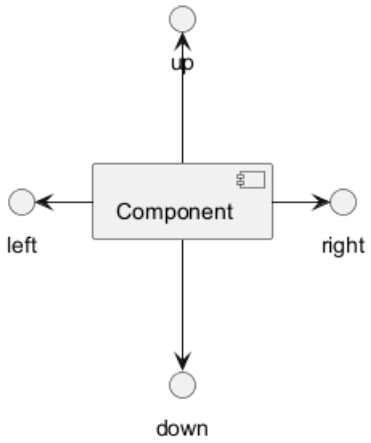
연결을반전시켜방향을바꿀수도있다:

```
@startuml
Interface1 <-- [Component]
Interface2 <- [Component]
@enduml
```



화살표안에 `left`, `right`, `up`, `down` 키워드를추가하여방향을바꾸는것도가능하다:

```
@startuml
[Component] -left-> left
[Component] -right-> right
[Component] -up-> up
[Component] -down-> down
@enduml
```



방향을의미하는단어의첫번째글자만사용해서화살표를짧게할수있다. (예를들면, `-down-` 대신 `-d-`) 또는두글자를사용해도된다. (`-do-`).

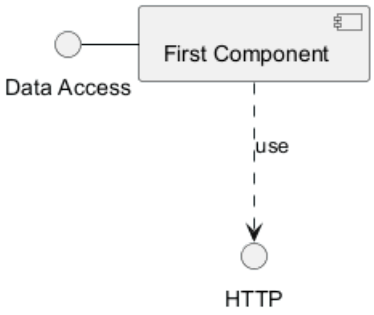
이기능을남용하지말아야한다는것을명심하자: 그래야별다른수정없이도 *GraphViz* 가좋은결과를보여준다.

See also 'Change diagram orientation' on [Deployment diagram](deployment-diagram) page.

7.7 Use UML2 notation

By default *(from v1.2020.13-14)*, UML2 notation is used.

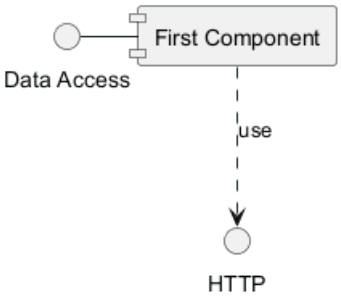
```
@startuml

interface "Data Access" as DA

DA - [First Component]
[First Component] ..> HTTP : use

@enduml
```



7.8 Use UML1 notation

The `skinparam componentStyle uml1` command is used to switch to UML1 notation.

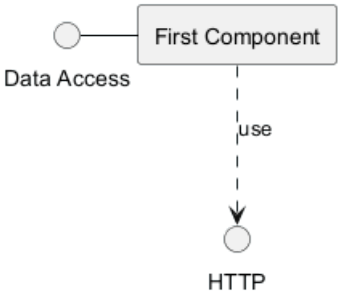
```
@startuml
skinparam componentStyle uml1

interface "Data Access" as DA

DA - [First Component]
[First Component] ..> HTTP : use

@enduml
```



7.9 Use rectangle notation (remove UML notation)

The `skinparam componentStyle rectangle` command is used to switch to rectangle notation *(without any UML notation)*.

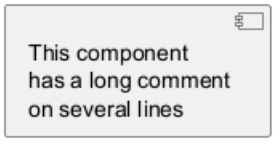
```
@startuml
skinparam componentStyle rectangle

interface "Data Access" as DA

DA - [First Component]
[First Component] ..> HTTP : use

@enduml
```



7.10 Long description

It is possible to put description on several lines using square brackets.

```
@startuml
component comp1 [
This component
has a long comment
on several lines
]
@enduml
```



7.11 Individual colors

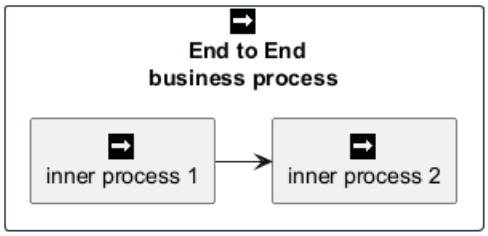
You can specify a color after component definition.

```
@startuml
component  [Web Server] #Yellow
@enduml
```

7.12 Using Sprite in Stereotype

You can use sprites within stereotype components.

```
@startuml
sprite $businessProcess [16x16/16] {
FFFFFFFFFFFFFFFF
FFFFFFFFFFFFFFFF
FFFFFFFFFFFFFFFF
FFFFFFFFFFFFFFFF
FFFFFFFFFF0FFFFF
FFFFFFFFFF00FFFF
FF00000000000FFF
FF0000000000000F
FF00000000000FFF
FFFFFFFFFF00FFFF
FFFFFFFFFF0FFFFF
FFFFFFFFFFFFFFFF
FFFFFFFFFFFFFFFF
FFFFFFFFFFFFFFFF
FFFFFFFFFFFFFFFF
FFFFFFFFFFFFFFFF
}


rectangle " End to End\nbusiness process" <<$businessProcess>> {
 rectangle "inner process 1" <<$businessProcess>> as src
 rectangle "inner process 2" <<$businessProcess>> as tgt
 src -> tgt
}
@enduml
```



7.13 Skinparam

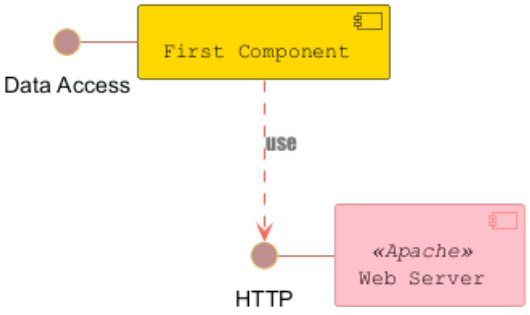
You can use the skinparam command to change colors and fonts for the drawing.

You can use this command :

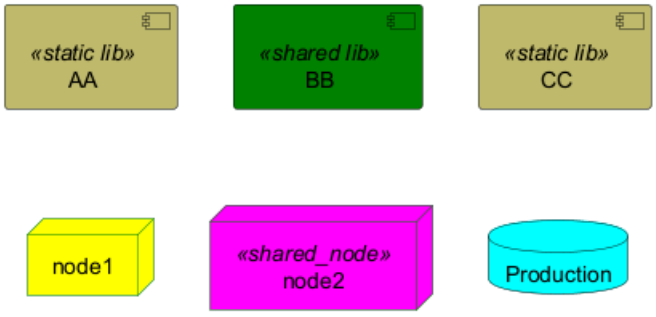
- In the diagram definition, like any other commands;
- In an included file;
- In a configuration file, provided in the command line or the Ant task.

You can define specific color and fonts for stereotyped components and interfaces.

```
@startuml

skinparam interface {
  backgroundColor RosyBrown
  borderColor orange
}

skinparam component {
  FontSize 13
  BackgroundColor<<Apache>> Pink
  BorderColor<<Apache>> #FF6655
  FontName Courier
  BorderColor black
  BackgroundColor gold
  ArrowFontName Impact
  ArrowColor #FF6655
  ArrowFontColor #777777
}

() "Data Access" as DA
Component "Web Server" as WS << Apache >>

DA - [First Component]
[First Component] ..> () HTTP : use
HTTP - WS

@enduml
```



```
@startuml

skinparam component {
  backgroundColor<<static lib>> DarkKhaki
  backgroundColor<<shared lib>> Green
}

skinparam node {
  borderColor Green
  backgroundColor Yellow
  backgroundColor<<shared_node>> Magenta
}
skinparam databaseBackgroundColor Aqua

[AA] <<static lib>>
[BB] <<shared lib>>
[CC] <<static lib>>

node node1
node node2 <<shared_node>>
database Production

@enduml
```

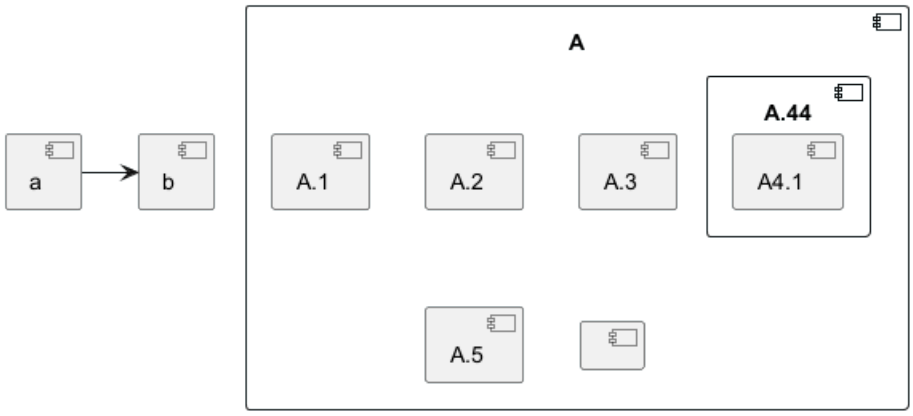


7.14 Specific SkinParameter

7.14.1 componentStyle

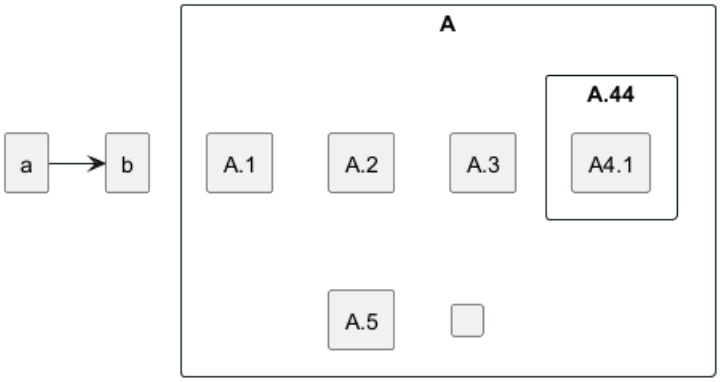
- By default (or with `skinparam componentStyle uml2`), you have an icon for component

```
@startuml
skinparam BackgroundColor transparent
skinparam componentStyle uml2
component A {
   component "A.1" {
}
   component A.44 {
      [A4.1]
}
   component "A.2"
   [A.3]
   component A.5 [
A.5]
   component A.6 [
]
}
[a]->[b]
@enduml
```



- If you want to suppress it, and to have only the rectangle, you can use `skinparam componentStyle rectangle`

```
@startuml
skinparam BackgroundColor transparent
skinparam componentStyle rectangle
component A {
   component "A.1" {
}
   component A.44 {
      [A4.1]
}
   component "A.2"
   [A.3]
   component A.5 [
A.5]
   component A.6 [
]
}
[a]->[b]
@enduml
```



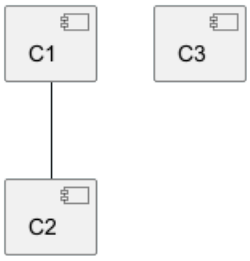
[Ref. 10798]

7.15 Hide or Remove unlinked component

By default, all components are displayed:

```
@startuml
component C1
component C2
component C3
C1 -- C2
```

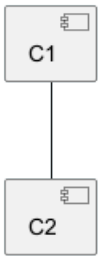
```
@enduml
```



But you can:

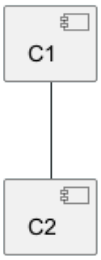
- `hide @unlinked` components:

```
@startuml
component C1
component C2
component C3
C1 -- C2

hide @unlinked
@enduml
```



- or `remove @unlinked` components:

```
@startuml
component C1
component C2
component C3
C1 -- C2

remove @unlinked
@enduml
```



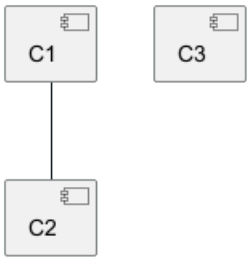
[Ref. QA-11052]

7.16 Hide, Remove or Restore tagged component or wildcard

You can put `$tags` (using `$`) on components, then remove, hide or restore components either individually or by tags.

By default, all components are displayed:

```
@startuml
component C1 $tag13
component C2
component C3 $tag13
C1 -- C2
@enduml
```



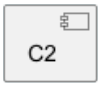
But you can:

- `hide $tag13` components:

```
@startuml
component C1 $tag13
component C2
component C3 $tag13
C1 -- C2

hide $tag13
@enduml
```

- or `remove $tag13` components:

```
@startuml
component C1 $tag13
component C2
component C3 $tag13
C1 -- C2

remove $tag13
@enduml
```



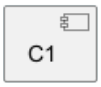
- or `remove $tag13 and restore $tag1` components:

```
@startuml
component C1 $tag13 $tag1
component C2
component C3 $tag13
C1 -- C2

remove $tag13
```

```
restore $tag1
@enduml
```

- or `remove * and restore $tag1` components:

```
@startuml
component C1 $tag13 $tag1
component C2
component C3 $tag13
C1 -- C2

remove *
restore $tag1
@enduml
```

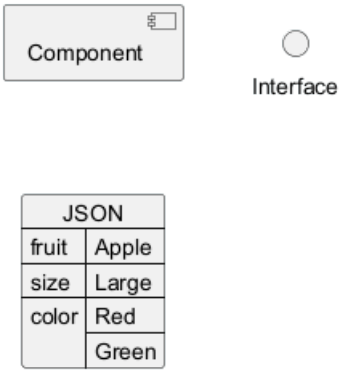


[Ref. QA-7337 and QA-11052]

7.17 Display JSON Data on Component diagram

7.17.1 Simple example

```
@startuml
allowmixing

component Component
()        Interface

json JSON {
   "fruit":"Apple",
   "size":"Large",
   "color": ["Red", "Green"]
}
@enduml
```



[Ref. QA-15481]

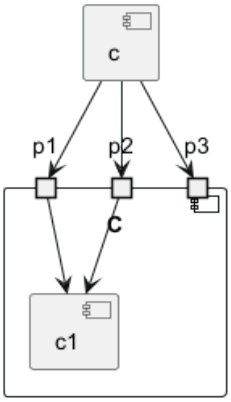
For another example, see on JSON page.

7.18 Port [port, portIn, portOut]

You can add **port** with `port`, `portin`and `portout` keywords.

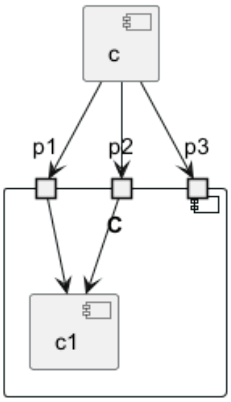
7.18.1 Port

```
@startuml
[c]
component C {
  port p1
  port p2
  port p3
  component c1
}

c --> p1
c --> p2
c --> p3
p1 --> c1
p2 --> c1
@enduml
```



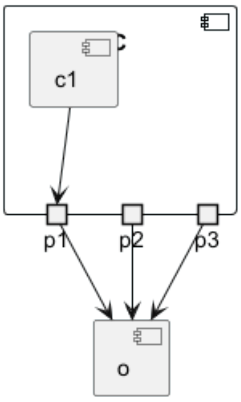
7.18.2 PortIn

```
@startuml
[c]
component C {
  portin p1
  portin p2
  portin p3
  component c1
}

c --> p1
c --> p2
c --> p3
p1 --> c1
p2 --> c1
@enduml
```



7.18.3 PortOut

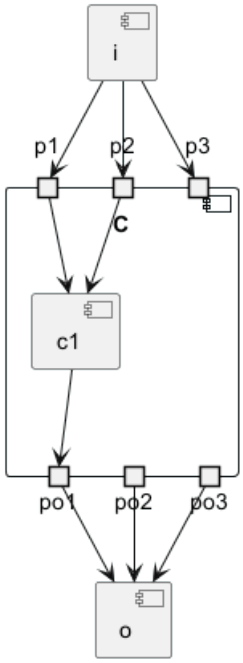
```
@startuml
component C {
  portout p1
  portout p2
  portout p3
  component c1
}
[o]
p1 --> o
p2 --> o
p3 --> o
c1 --> p1
@enduml
```



7.18.4 Mixing PortIn & PortOut

```
@startuml
[i]
component C {
  portin p1
  portin p2
  portin p3
  portout po1
  portout po2
  portout po3
  component c1
}
[o]

i --> p1
```

```
i --> p2
i --> p3
p1 --> c1
p2 --> c1
po1 --> o
po2 --> o
po3 --> o
c1 --> po1
@enduml
```



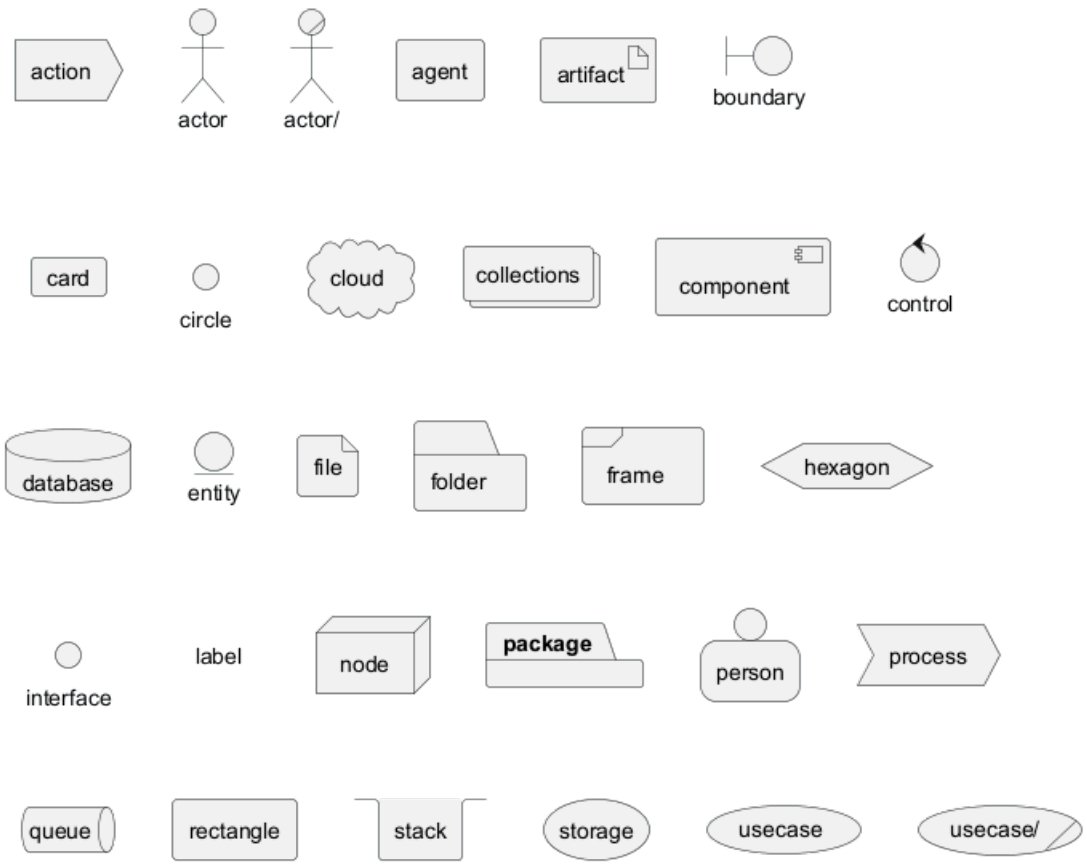
8 Deployment Diagram

A **Deployment Diagram** is a type of diagram that visualizes the architecture of systems, showcasing how software components are deployed onto hardware. It provides a clear picture of the distribution of components across various nodes, such as servers, workstations, and devices.

With PlantUML, creating deployment diagrams becomes a breeze. The platform offers a simple and intuitive way to design these diagrams using plain text, ensuring rapid iterations and easy version control. Moreover, the PlantUML forum provides a vibrant community where users can seek help, share ideas, and collaborate on diagramming challenges. One of the key advantages of PlantUML is its ability to integrate seamlessly with various tools and platforms, making it a preferred choice for professionals and enthusiasts alike.

8.1 Declaring element

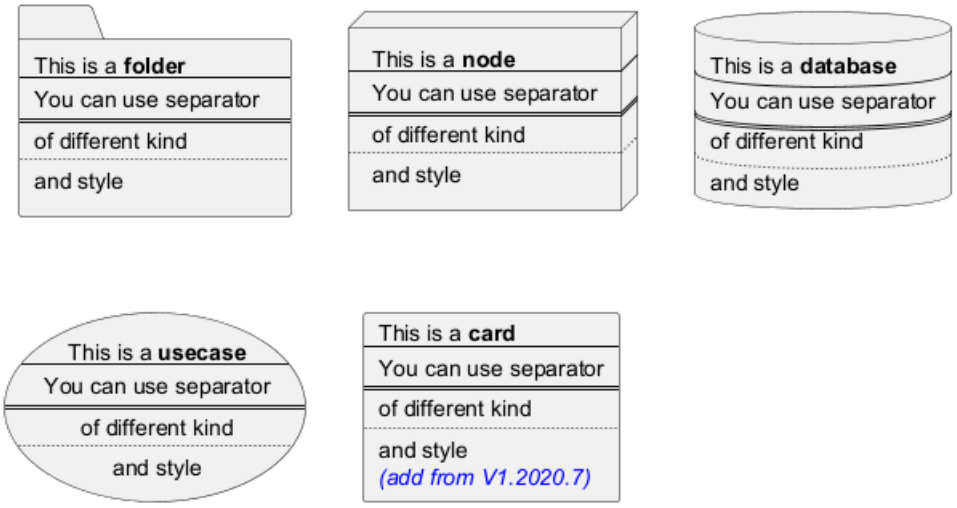
```
@startuml
action action
actor actor
actor/ "actor/"
agent agent
artifact artifact
boundary boundary
card card
circle circle
cloud cloud
collections collections
component component
control control
database database
entity entity
file file
folder folder
frame frame
hexagon hexagon
interface interface
label label
node node
package package
person person
process process
queue queue
rectangle rectangle
stack stack
storage storage
usecase usecase
usecase/ "usecase/"
@enduml
```



You can optionaly put text using bracket `[]` for a long description.

```
@startuml
folder folder [
This is a <b>folder
----
You can use separator
====
of different kind
....
and style
]

node node [
This is a <b>node
----
You can use separator
====
of different kind
....
and style
]

database database [
This is a <b>database
----
You can use separator
====
of different kind
....
and style
```

```
]

usecase usecase [
This is a <b>usecase
----
You can use separator
====
of different kind
....
and style
]

card card [
This is a <b>card
----
You can use separator
====
of different kind
....
and style
<i><color:blue>(add from V1.2020.7)</color></i>
]
@enduml
```



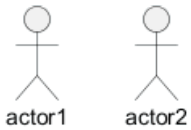
8.2 Declaring element (using short form)

We can declare element using some short forms.

Long form Keyword	Short form Keyword	Long form example	Short form example	Ref.
actor	: *a* :	actor actor1	:actor2:	Actors
component	[*c*]	component component1	[component2]	Components
interface	() *i*	interface interface1	() "interface2"	Interfaces
usecase	(*u*)	usecase usecase1	(usecase2)	Usecases

8.2.1 Actor

```
@startuml

actor actor1
:actor2:

@enduml
```



NB: *There is an old syntax for actor with guillemet which is now deprecated and will be removed some days. Please do not use in your diagram.*

8.2.2 Component

```
@startuml

component component1
[component2]

@enduml
```

8.2.3 Interface

```
@startuml

interface interface1
() "interface2"

label "//interface example//"
@enduml
```

interface example

8.2.4 Usecase

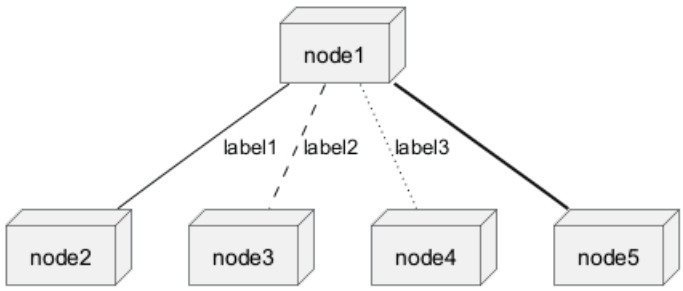
```
@startuml

usecase usecase1
(usecase2)

@enduml
```

8.3 Linking or arrow

You can create simple links between elements with or without labels:

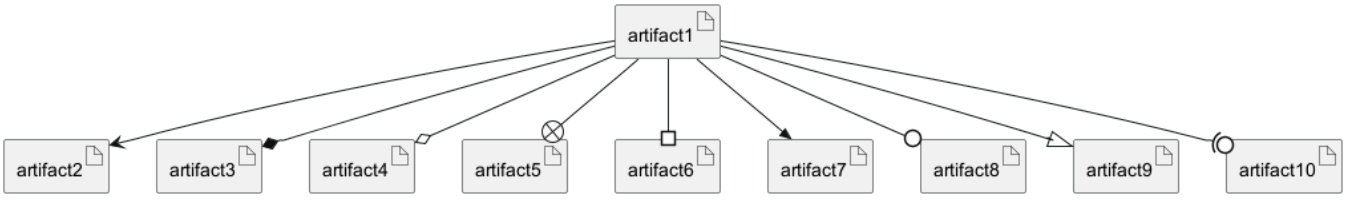
```
@startuml

node node1
node node2
node node3
node node4
```

```
node node5
node1 -- node2 : label1
node1 .. node3 : label2
node1 ~~ node4 : label3
node1 == node5

@enduml
```



It is possible to use several types of links:

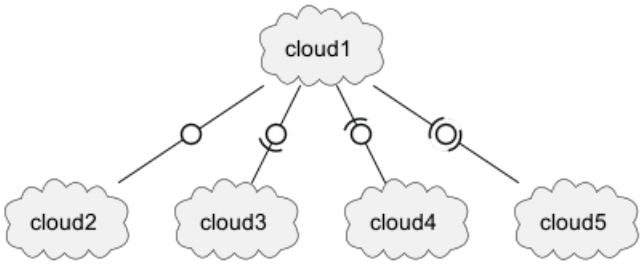
```
@startuml

artifact artifact1
artifact artifact2
artifact artifact3
artifact artifact4
artifact artifact5
artifact artifact6
artifact artifact7
artifact artifact8
artifact artifact9
artifact artifact10
artifact1 --> artifact2
artifact1 --* artifact3
artifact1 --o artifact4
artifact1 --+ artifact5
artifact1 --# artifact6
artifact1 -->> artifact7
artifact1 --0 artifact8
artifact1 --^ artifact9
artifact1 --(0 artifact10

@enduml
```



You can also have the following types:

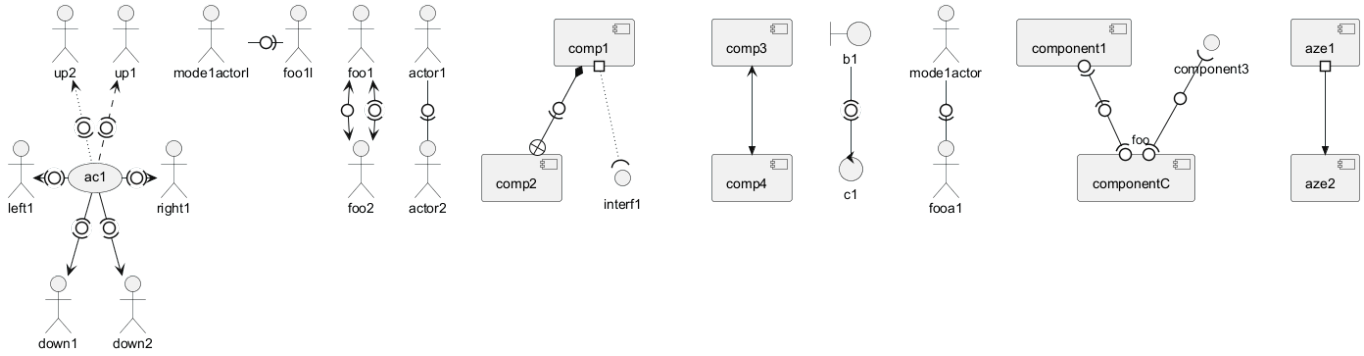
```
@startuml

cloud cloud1
cloud cloud2
cloud cloud3
cloud cloud4
```

```
cloud cloud5
cloud1 -0- cloud2
cloud1 -0)- cloud3
cloud1 -(0- cloud4
cloud1 -(0)- cloud5

@enduml
```



or another example:

```
@startuml
actor foo1
actor foo2
foo1 <-0-> foo2
foo1 <-(0)-> foo2

(ac1) -le(0)-> left1
ac1 -ri(0)-> right1
ac1 .up(0).> up1
ac1 ~up(0)~> up2
ac1 -do(0)-> down1
ac1 -do(0)-> down2

actor1 -0)- actor2

component comp1
component comp2
comp1 *-0)-+ comp2
[comp3] <-->> [comp4]

boundary b1
control c1
b1 -(0)- c1

component comp1
interface interf1
comp1 #~~( interf1

:mode1actor: -0)- fooa1
:mode1actorl: -ri0)- foo1l

[component1] 0)-(0-(0 [componentC]
() component3 )-0-(0 "foo" [componentC]

[aze1] #-->> [aze2]
@enduml
```



[Ref. QA-547 and QA-1736]

See all type on **Appendix**.

8.4 Bracketed arrow style

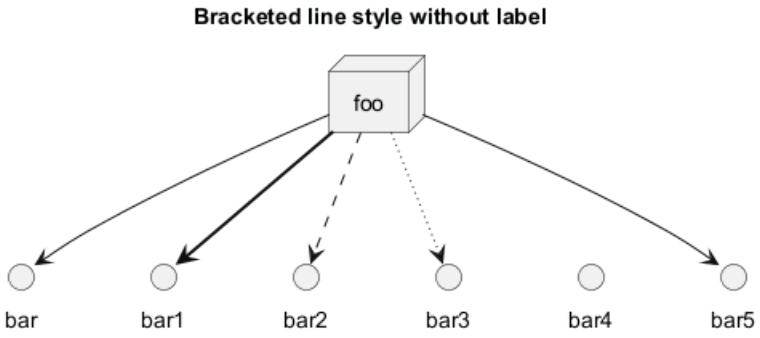
*Similar as Bracketed **class** relations (linking or arrow) style*

8.4.1 Line style

It's also possible to have explicitly `bold`, `dashed`, `dotted`, `hidden` or `plain` arrows:

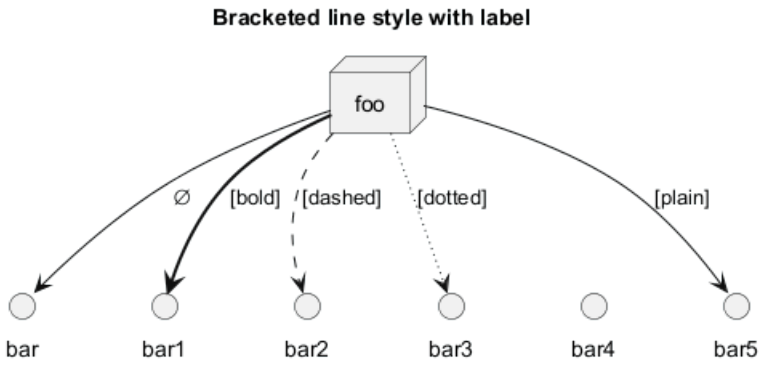
- without label

```
@startuml
node foo
title Bracketed line style without label
foo --> bar
foo -[bold]-> bar1
foo -[dashed]-> bar2
foo -[dotted]-> bar3
foo -[hidden]-> bar4
foo -[plain]-> bar5
@enduml
```



- with label

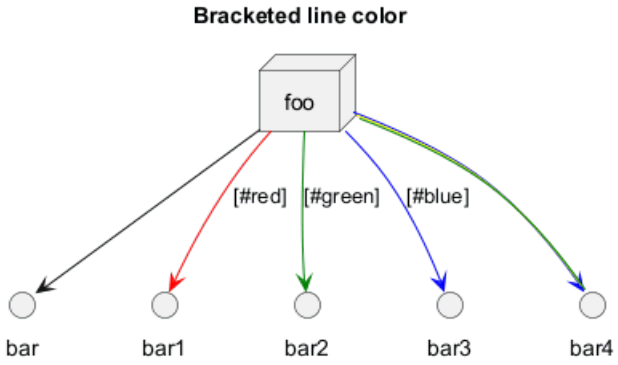
```
@startuml
title Bracketed line style with label
node foo
foo --> bar          :
foo -[bold]-> bar1   : [bold]
foo -[dashed]-> bar2 : [dashed]
foo -[dotted]-> bar3 : [dotted]
foo -[hidden]-> bar4 : [hidden]
foo -[plain]-> bar5  : [plain]
@enduml
```



[Adapted from QA-4181]

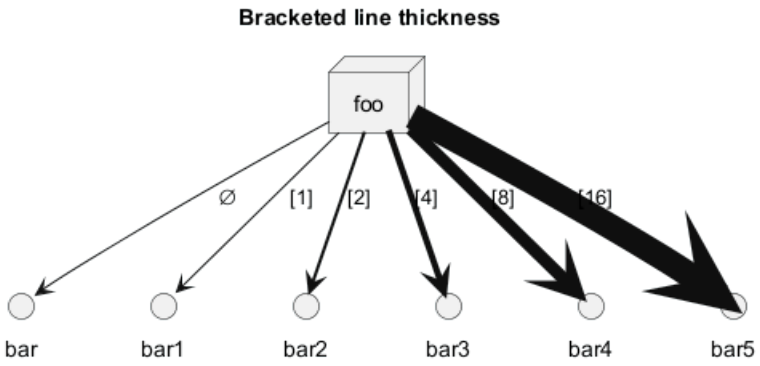
8.4.2 Line color

```
@startuml
title Bracketed line color
node  foo
foo --> bar
foo -[#red]-> bar1     : [#red]
foo -[#green]-> bar2   : [#green]
foo -[#blue]-> bar3    : [#blue]
foo -[#blue;#yellow;#green]-> bar4
@enduml
```



8.4.3 Line thickness

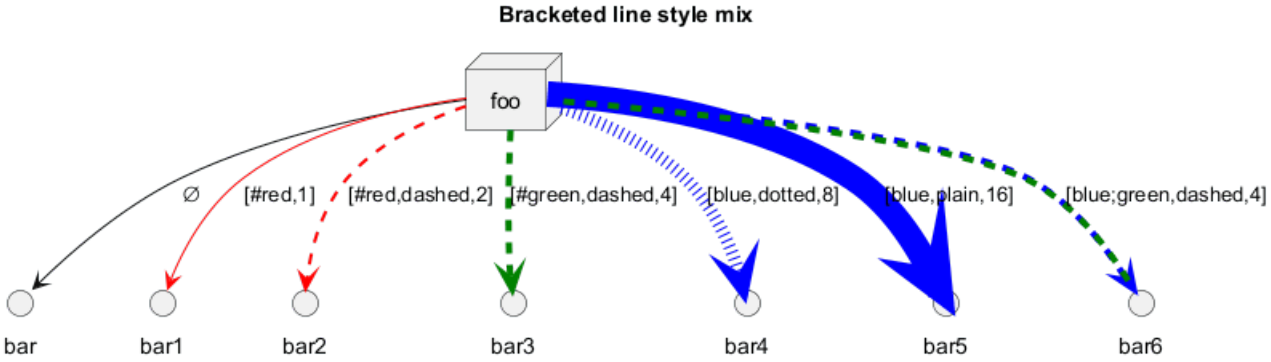
```
@startuml
title Bracketed line thickness
node foo
foo --> bar                 :
foo -[thickness=1]-> bar1   : [1]
foo -[thickness=2]-> bar2   : [2]
foo -[thickness=4]-> bar3   : [4]
foo -[thickness=8]-> bar4   : [8]
foo -[thickness=16]-> bar5  : [16]
@enduml
```



[Adapted from QA-4949]

8.4.4 Mix

```
@startuml
title Bracketed line style mix
node foo
foo --> bar                              :
foo -[#red,thickness=1]-> bar1           : [#red,1]
foo -[#red,dashed,thickness=2]-> bar2    : [#red,dashed,2]
foo -[#green,dashed,thickness=4]-> bar3 : [#green,dashed,4]
foo -[#blue,dotted,thickness=8]-> bar4   : [blue,dotted,8]
foo -[#blue,plain,thickness=16]-> bar5   : [blue,plain,16]
foo -[#blue;#green,dashed,thickness=4]-> bar6  : [blue;green,dashed,4]
@enduml
```

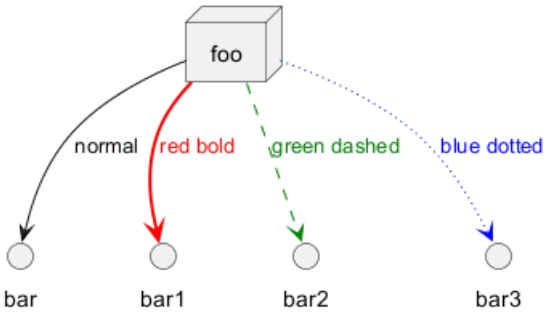


8.5 Change arrow color and style (inline style)

You can change the color or style of individual arrows using the inline following notation:

- `#color;line.[bold|dashed|dotted];text:color`

```
@startuml
node foo
foo --> bar : normal
foo --> bar1 #line:red;line.bold;text:red  : red bold
foo --> bar2 #green;line.dashed;text:green : green dashed
foo --> bar3 #blue;line.dotted;text:blue   : blue dotted
@enduml
```



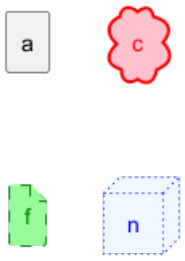
[Ref. QA-3770 and QA-3816] [See similar feature on class diagram]

8.6 Change element color and style (inline style)

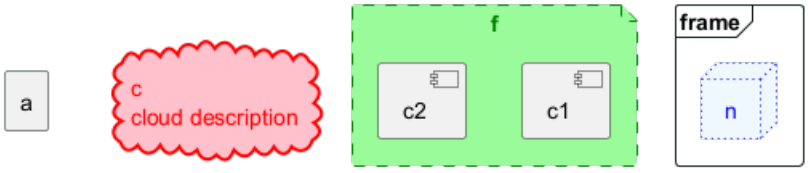
You can change the color or style of individual element using the following notation:

- `#[color|back:color];line:color;line.[bold|dashed|dotted];text:color`

```
@startuml
agent a
cloud c #pink;line:red;line.bold;text:red
file  f #palegreen;line:green;line.dashed;text:green
node  n #aliceblue;line:blue;line.dotted;text:blue
@enduml
```




```
@startuml
agent a
cloud c #pink;line:red;line.bold;text:red [
c
cloud description
]
file  f #palegreen;line:green;line.dashed;text:green {
[c1]
[c2]
}
frame frame {
node  n #aliceblue;line:blue;line.dotted;text:blue
}
@enduml
```



[Ref. QA-6852]

8.7 Nestable elements

Here are the nestable elements:

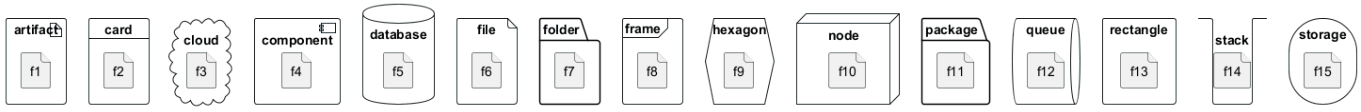
```
@startuml
action action {
}
artifact artifact {
}
card card {
}
cloud cloud {
}
component component {
}
database database {
}
file file {
}
folder folder {
}
frame frame {
}
hexagon hexagon {
}
node node {
}
package package {
}
process process {
}
queue queue {
}
rectangle rectangle {
}
stack stack {
}
storage storage {
}
@enduml
```

8.8 Packages and nested elements

8.8.1 Example with one level

```
@startuml
artifact    artifactVeryLOOOOOOOOOOOOOOOOOOg    as "artifact" {
file f1
}
card        cardVeryLOOOOOOOOOOOOOOOOOOg        as "card" {
file f2
}
cloud       cloudVeryLOOOOOOOOOOOOOOOOOOg       as "cloud" {
file f3
}
component   componentVeryLOOOOOOOOOOOOOOOOOOg   as "component" {
file f4
```

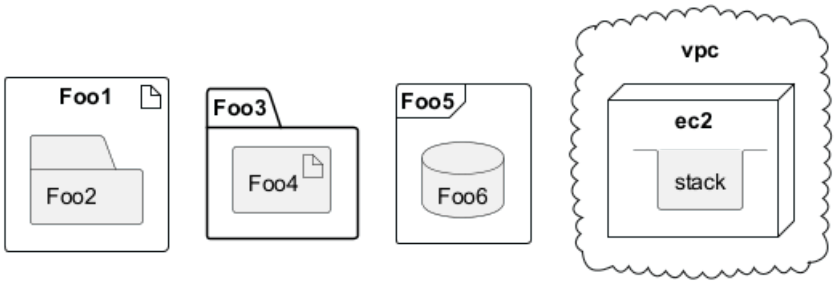
```
}
database    databaseVeryLOOOOOOOOOOOOOOOOOOOg    as "database" {
file f5
}
file        fileVeryLOOOOOOOOOOOOOOOOOOg        as "file" {
file f6
}
folder      folderVeryLOOOOOOOOOOOOOOOOOOg      as "folder" {
file f7
}
frame       frameVeryLOOOOOOOOOOOOOOOOOOg       as "frame" {
file f8
}
hexagon     hexagonVeryLOOOOOOOOOOOOOOOOOOg     as "hexagon" {
file f9
}
node        nodeVeryLOOOOOOOOOOOOOOOOOOg        as "node" {
file f10
}
package     packageVeryLOOOOOOOOOOOOOOOOOOg     as "package" {
file f11
}
queue       queueVeryLOOOOOOOOOOOOOOOOOOg       as "queue" {
file f12
}
rectangle   rectangleVeryLOOOOOOOOOOOOOOOOOOg   as "rectangle" {
file f13
}
stack       stackVeryLOOOOOOOOOOOOOOOOOOg       as "stack" {
file f14
}
storage     storageVeryLOOOOOOOOOOOOOOOOOOg     as "storage" {
file f15
}
@enduml
```



8.8.2 Other example

```
@startuml
artifact Foo1 {
  folder Foo2
}

folder Foo3 {
  artifact Foo4
}

frame Foo5 {
  database Foo6
}

cloud vpc {
  node ec2 {
```

```
    stack stack
  }
}

@enduml
```




```
@startuml
node Foo1 {
 cloud Foo2
}

cloud Foo3 {
  frame Foo4
}

database Foo5  {
  storage Foo6
}

storage Foo7 {
  storage Foo8
}
@enduml
```

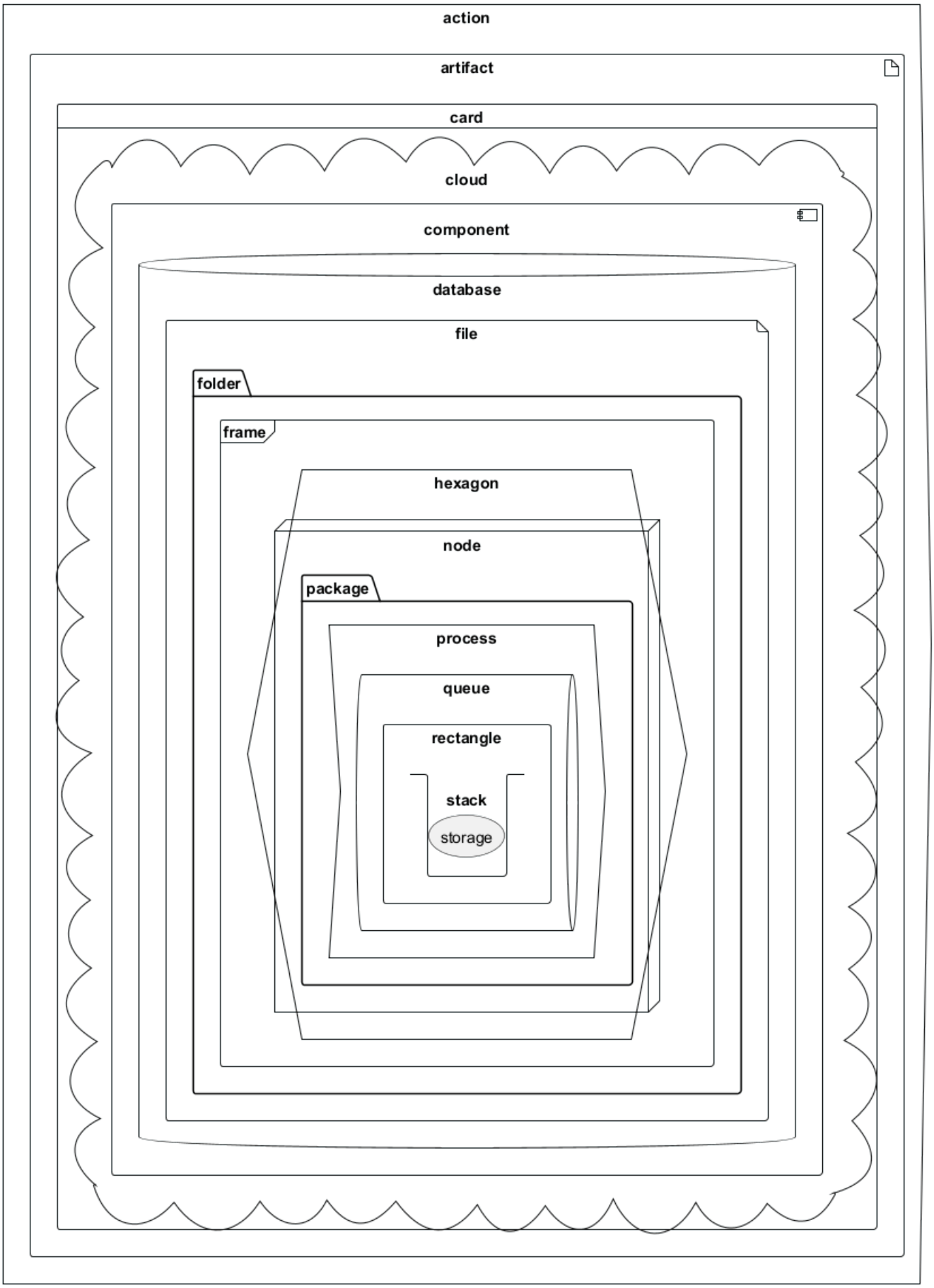
8.8.3 Full nesting

Here is all the nested elements:

- by alphabetical order:

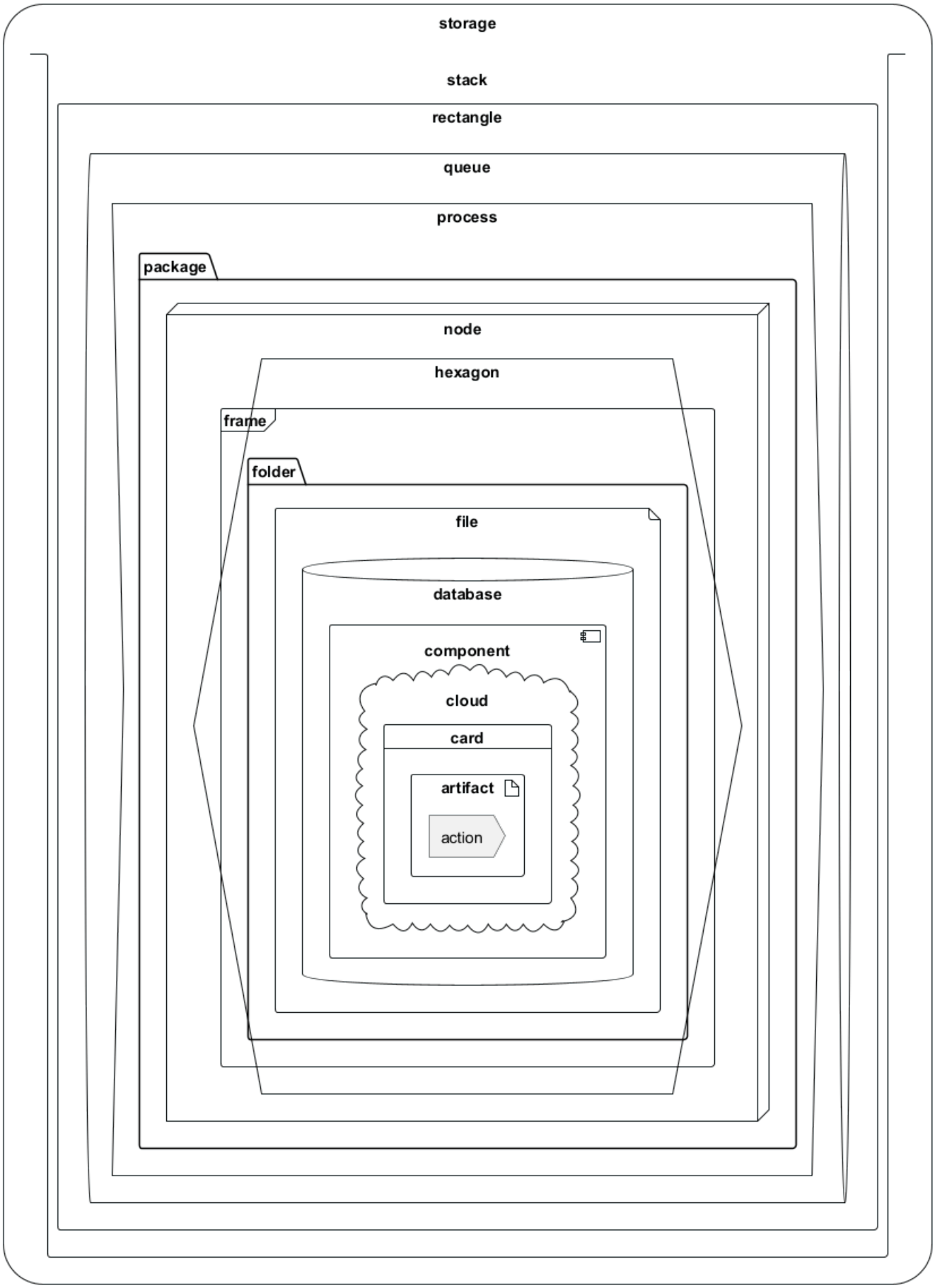
```
@startuml
action action {
artifact artifact {
card card {
cloud cloud {
component component {
database database {
file file {
folder folder {
frame frame {
hexagon hexagon {
node node {
package package {
```

```
process process {
queue queue {
rectangle rectangle {
stack stack {
storage storage {
}
}
}
}
}
}
}
}
}
}
}
}
}
}
}
}
@enduml
```


action
artifact
card
cloud
component
database
file
folder
frame
hexagon
node
package
process
queue
rectangle
stack
storage

- or reverse alphabetical order

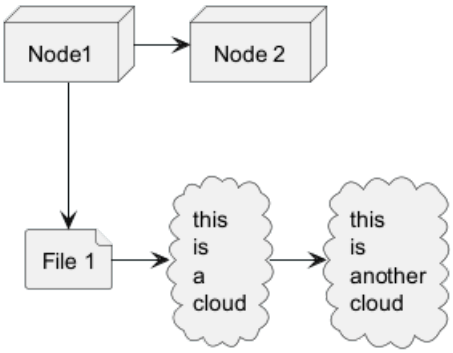
```
@startuml
storage storage {
stack stack {
rectangle rectangle {
queue queue {
process process {
package package {
node node {
hexagon hexagon {
frame frame {
folder folder {
file file {
database database {
component component {
cloud cloud {
card card {
artifact artifact {
action action {
}
}
}
}
}
}
}
}
}
}
}
}
}
}
}
}
@enduml
```


storage
stack
rectangle
queue
process
package
node
hexagon
frame
folder
file
database
component
cloud
card
artifact
action

8.9 Alias

8.9.1 Simple alias with as

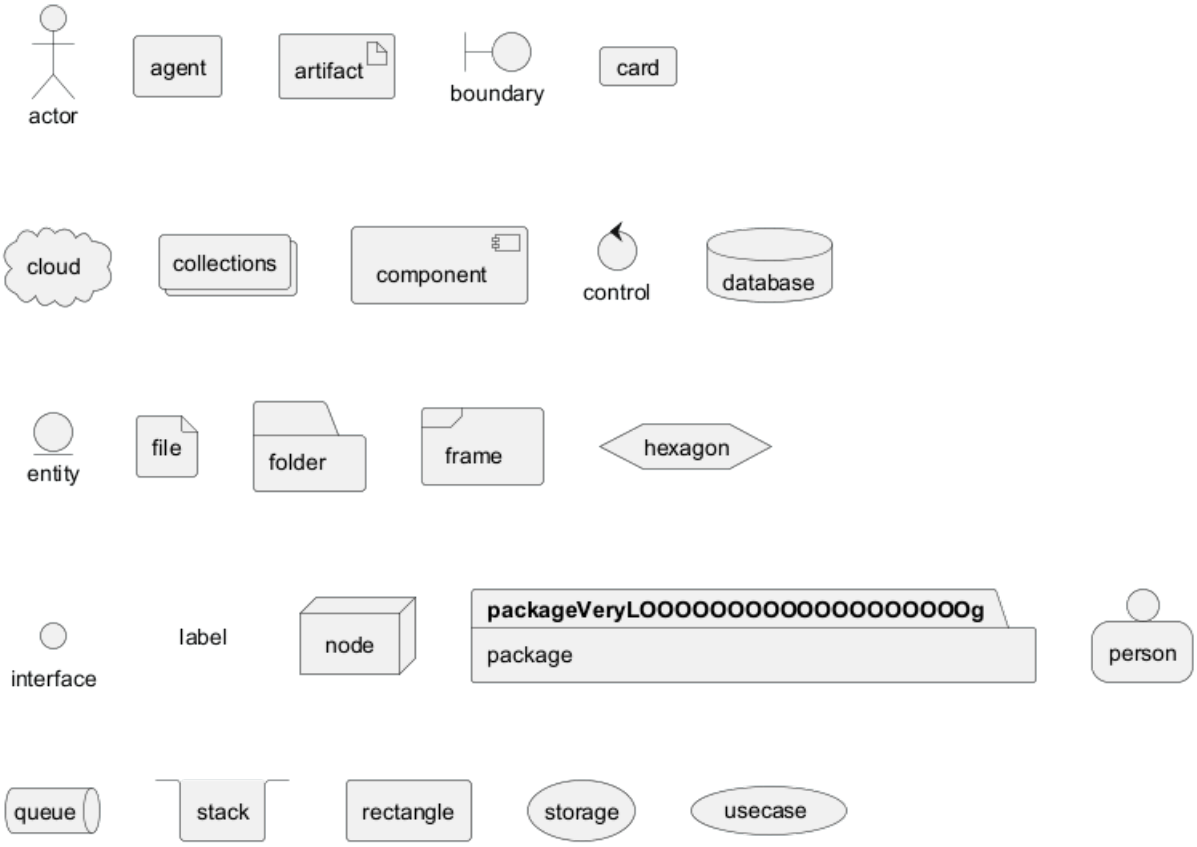
```
@startuml
node Node1 as n1
node "Node 2" as n2
file f1 as "File 1"
cloud c1 as "this
is
a
cloud"
cloud c2 [this
is
another
cloud]

n1 -> n2
n1 --> f1
f1 -> c1
c1 -> c2
@enduml
```



8.9.2 Examples of long alias

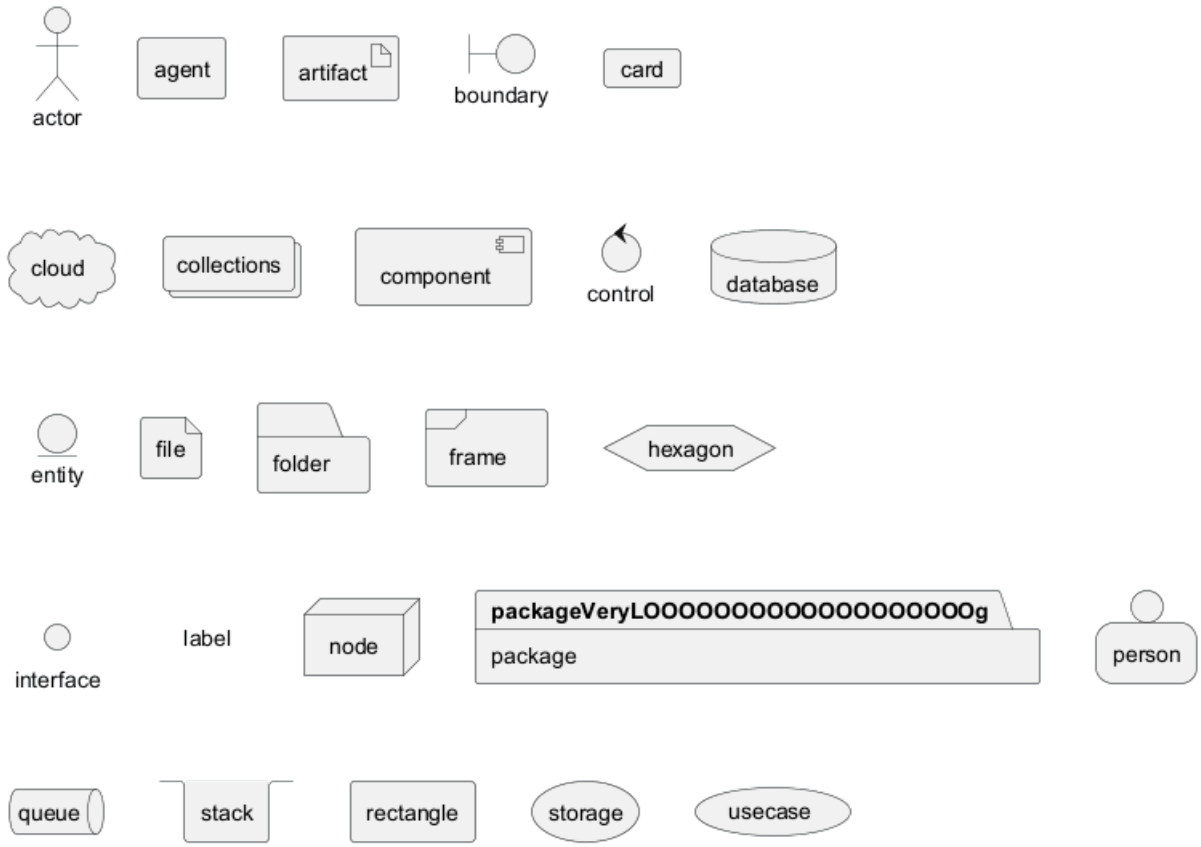
```
@startuml
actor        "actor"       as actorVeryLOOOOOOOOOOOOOOOOOOg
agent        "agent"       as agentVeryLOOOOOOOOOOOOOOOOOOg
artifact     "artifact"    as artifactVeryLOOOOOOOOOOOOOOOOOOg
boundary     "boundary"    as boundaryVeryLOOOOOOOOOOOOOOOOOOg
card         "card"        as cardVeryLOOOOOOOOOOOOOOOOOOg
cloud        "cloud"       as cloudVeryLOOOOOOOOOOOOOOOOOOg
collections  "collections" as collectionsVeryLOOOOOOOOOOOOOOOOOOg
component    "component"   as componentVeryLOOOOOOOOOOOOOOOOOOg
control      "control"     as controlVeryLOOOOOOOOOOOOOOOOOOg
database     "database"    as databaseVeryLOOOOOOOOOOOOOOOOOOg
entity       "entity"      as entityVeryLOOOOOOOOOOOOOOOOOOg
file         "file"        as fileVeryLOOOOOOOOOOOOOOOOOOg
folder       "folder"      as folderVeryLOOOOOOOOOOOOOOOOOOg
frame        "frame"       as frameVeryLOOOOOOOOOOOOOOOOOOg
hexagon      "hexagon"     as hexagonVeryLOOOOOOOOOOOOOOOOOOg
interface    "interface"   as interfaceVeryLOOOOOOOOOOOOOOOOOOg
label        "label"       as labelVeryLOOOOOOOOOOOOOOOOOOg
node         "node"        as nodeVeryLOOOOOOOOOOOOOOOOOOg
package      "package"     as packageVeryLOOOOOOOOOOOOOOOOOOg
person       "person"      as personVeryLOOOOOOOOOOOOOOOOOOg
queue        "queue"       as queueVeryLOOOOOOOOOOOOOOOOOOg
```

```
stack        "stack"       as stackVeryLOOOOOOOOOOOOOOOOOOg
rectangle    "rectangle"   as rectangleVeryLOOOOOOOOOOOOOOOOOOg
storage      "storage"     as storageVeryLOOOOOOOOOOOOOOOOOOg
usecase      "usecase"     as usecaseVeryLOOOOOOOOOOOOOOOOOOg
@enduml
```




```
@startuml
actor       actorVeryLOOOOOOOOOOOOOOOOOOg       as "actor"
agent       agentVeryLOOOOOOOOOOOOOOOOOOg       as "agent"
artifact    artifactVeryLOOOOOOOOOOOOOOOOOOg    as "artifact"
boundary    boundaryVeryLOOOOOOOOOOOOOOOOOOg    as "boundary"
card        cardVeryLOOOOOOOOOOOOOOOOOOg        as "card"
cloud       cloudVeryLOOOOOOOOOOOOOOOOOOg       as "cloud"
collections collectionsVeryLOOOOOOOOOOOOOOOOOOg as "collections"
component   componentVeryLOOOOOOOOOOOOOOOOOOg   as "component"
control     controlVeryLOOOOOOOOOOOOOOOOOOg     as "control"
database    databaseVeryLOOOOOOOOOOOOOOOOOOg    as "database"
entity      entityVeryLOOOOOOOOOOOOOOOOOOg      as "entity"
file        fileVeryLOOOOOOOOOOOOOOOOOOg        as "file"
folder      folderVeryLOOOOOOOOOOOOOOOOOOg      as "folder"
frame       frameVeryLOOOOOOOOOOOOOOOOOOg       as "frame"
hexagon     hexagonVeryLOOOOOOOOOOOOOOOOOOg     as "hexagon"
interface   interfaceVeryLOOOOOOOOOOOOOOOOOOg   as "interface"
label       labelVeryLOOOOOOOOOOOOOOOOOOg       as "label"
node        nodeVeryLOOOOOOOOOOOOOOOOOOg        as "node"
package     packageVeryLOOOOOOOOOOOOOOOOOOg     as "package"
person      personVeryLOOOOOOOOOOOOOOOOOOg      as "person"
queue       queueVeryLOOOOOOOOOOOOOOOOOOg       as "queue"
stack       stackVeryLOOOOOOOOOOOOOOOOOOg       as "stack"
rectangle   rectangleVeryLOOOOOOOOOOOOOOOOOOg   as "rectangle"
storage     storageVeryLOOOOOOOOOOOOOOOOOOg     as "storage"
```

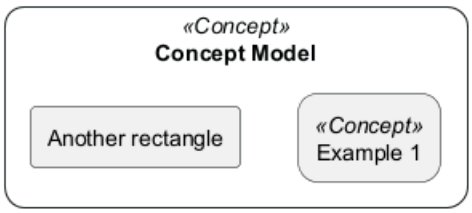
```
usecase     usecaseVeryLOOOOOOOOOOOOOOOOOOg     as "usecase"
@enduml
```



[Ref. QA-12082]

8.10 Round corner

```
@startuml
skinparam rectangle {
    roundCorner<<Concept>> 25
}

rectangle "Concept Model" <<Concept>> {
rectangle "Example 1" <<Concept>> as ex1
rectangle "Another rectangle"
}
@enduml
```

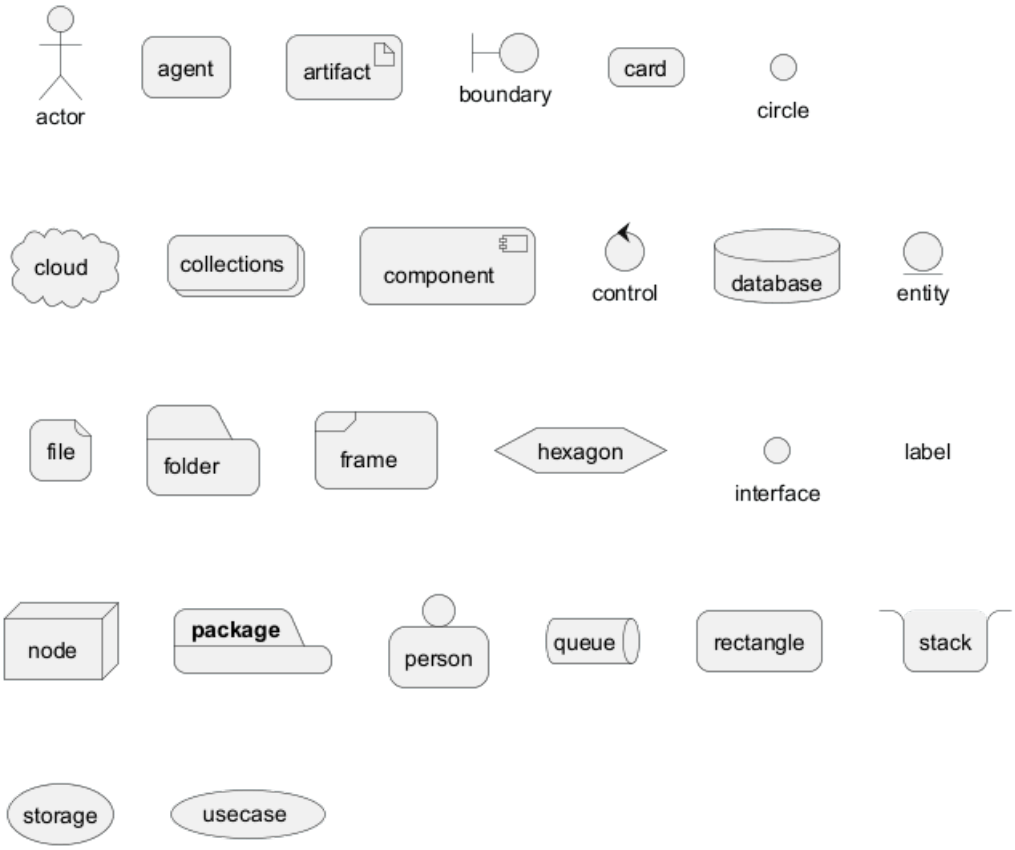


8.11 Specific SkinParameter

8.11.1 roundCorner

```
@startuml
skinparam roundCorner 15
actor actor
```

```
agent agent
artifact artifact
boundary boundary
card card
circle circle
cloud cloud
collections collections
component component
control control
database database
entity entity
file file
folder folder
frame frame
hexagon hexagon
interface interface
label label
node node
package package
person person
queue queue
rectangle rectangle
stack stack
storage storage
usecase usecase
@enduml
```

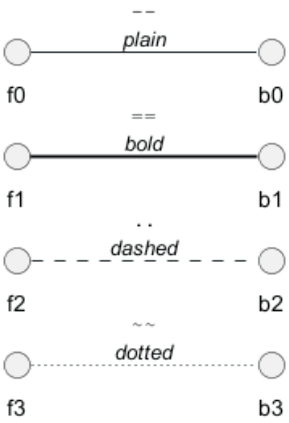


[Ref. QA-5299, QA-6915, QA-11943]

8.12 Appendix: All type of arrow line

```
@startuml
```

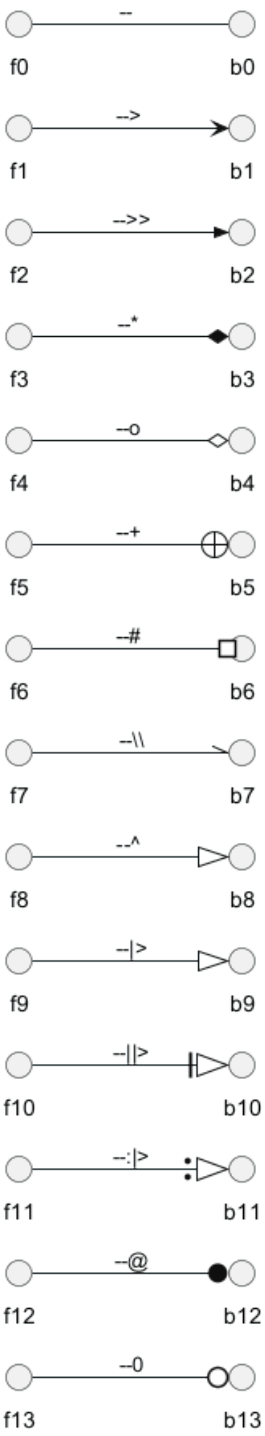
```
left to right direction
skinparam nodesep 5

f3  ~~  b3  : ""~~""\n//dotted//
f2  ..  b2  : ""..""\n//dashed//
f1  ==  b1  : ""==""\n//bold//
f0  --  b0  : ""--""\n//plain//
@enduml
```



8.13 Appendix: All type of arrow head or ’0’ arrow

8.13.1 Type of arrow head

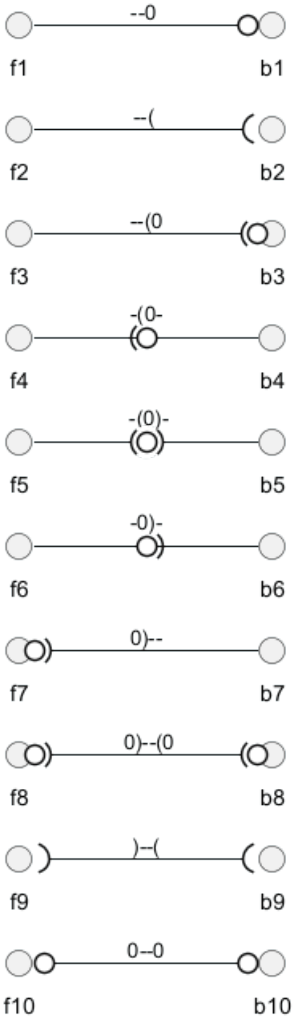
```
@startuml
left to right direction
skinparam nodesep 5

f13 --0   b13 : ""--0""
f12 --@   b12 : ""--@""
f11 --:|> b11 : ""--:|>""
f10 --||> b10 : ""--||>""
f9  --|>  b9  : ""--|>""
f8  --^   b8  : ""--^ ""
f7  --\\  b7  : ""--\\\\""
f6  --#   b6  : ""--# ""
f5  --+   b5  : ""--+ ""
f4  --o   b4  : ""--o ""
f3  --*   b3  : ""--* ""
f2  -->>  b2  : ""-->>""
f1  -->   b1  : ""--> ""
f0  --    b0  : ""--  ""
@enduml
```



8.13.2 Type of '0' arrow or circle arrow

```
@startuml
left to right direction
skinparam nodesep 5

f10 0--0 b10 : "" 0--0 ""
f9 )--(  b9  : "" )--( ""
f8 0)--(0 b8 : "" 0)--(0""
f7 0)--  b7  : "" 0)-- ""
f6 -0)-  b6  : "" -0)- ""
f5 -(0)- b5  : "" -(0)-""
```

```
f4 -(0-  b4  : "" -(0- ""
f3 --(0  b3  : "" --(0 ""
f2 --(   b2  : "" --(  ""
f1 --0   b1  : "" --0  ""
@enduml
```



8.14 Appendix: Test of inline style on all element

8.14.1 Simple element

```
@startuml
action action           #aliceblue;line:blue;line.dotted;text:blue
actor actor             #aliceblue;line:blue;line.dotted;text:blue
actor/ "actor/"         #aliceblue;line:blue;line.dotted;text:blue
agent agent             #aliceblue;line:blue;line.dotted;text:blue
artifact artifact       #aliceblue;line:blue;line.dotted;text:blue
boundary boundary       #aliceblue;line:blue;line.dotted;text:blue
card card               #aliceblue;line:blue;line.dotted;text:blue
circle circle           #aliceblue;line:blue;line.dotted;text:blue
cloud cloud             #aliceblue;line:blue;line.dotted;text:blue
collections collections #aliceblue;line:blue;line.dotted;text:blue
component component     #aliceblue;line:blue;line.dotted;text:blue
control control         #aliceblue;line:blue;line.dotted;text:blue
database database       #aliceblue;line:blue;line.dotted;text:blue
entity entity           #aliceblue;line:blue;line.dotted;text:blue
file file               #aliceblue;line:blue;line.dotted;text:blue
```

```
folder folder           #aliceblue;line:blue;line.dotted;text:blue
frame frame             #aliceblue;line:blue;line.dotted;text:blue
hexagon hexagon         #aliceblue;line:blue;line.dotted;text:blue
interface interface     #aliceblue;line:blue;line.dotted;text:blue
label label             #aliceblue;line:blue;line.dotted;text:blue
node node               #aliceblue;line:blue;line.dotted;text:blue
package package         #aliceblue;line:blue;line.dotted;text:blue
person person           #aliceblue;line:blue;line.dotted;text:blue
process process         #aliceblue;line:blue;line.dotted;text:blue
queue queue             #aliceblue;line:blue;line.dotted;text:blue
rectangle rectangle     #aliceblue;line:blue;line.dotted;text:blue
stack stack             #aliceblue;line:blue;line.dotted;text:blue
storage storage         #aliceblue;line:blue;line.dotted;text:blue
usecase usecase         #aliceblue;line:blue;line.dotted;text:blue
usecase/ "usecase/"     #aliceblue;line:blue;line.dotted;text:blue
@enduml
```

8.14.2 Nested element

8.14.3 Without sub-element

```
@startuml
action action #aliceblue;line:blue;line.dotted;text:blue {
}
artifact artifact #aliceblue;line:blue;line.dotted;text:blue {
}
card card #aliceblue;line:blue;line.dotted;text:blue {
}
cloud cloud #aliceblue;line:blue;line.dotted;text:blue {
}
component component #aliceblue;line:blue;line.dotted;text:blue {
```

```
}
database database #aliceblue;line:blue;line.dotted;text:blue {
}
file file #aliceblue;line:blue;line.dotted;text:blue {
}
folder folder #aliceblue;line:blue;line.dotted;text:blue {
}
frame frame #aliceblue;line:blue;line.dotted;text:blue {
}
hexagon hexagon #aliceblue;line:blue;line.dotted;text:blue {
}
node node #aliceblue;line:blue;line.dotted;text:blue {
}
package package #aliceblue;line:blue;line.dotted;text:blue {
}
process process #aliceblue;line:blue;line.dotted;text:blue {
}
queue queue #aliceblue;line:blue;line.dotted;text:blue {
}
rectangle rectangle #aliceblue;line:blue;line.dotted;text:blue {
}
stack stack #aliceblue;line:blue;line.dotted;text:blue {
}
storage storage #aliceblue;line:blue;line.dotted;text:blue {
}
@enduml
```

8.14.4 With sub-element

```
@startuml
action      actionVeryLOOOOOOOOOOOOOOOOOOg      as "action" #aliceblue;line:blue;line.dotted;text:bl
file f1
}
artifact    artifactVeryLOOOOOOOOOOOOOOOOOOg    as "artifact" #aliceblue;line:blue;line.dotted;text
file f1
}
card        cardVeryLOOOOOOOOOOOOOOOOOOg        as "card" #aliceblue;line:blue;line.dotted;text:blue
file f2
}
cloud       cloudVeryLOOOOOOOOOOOOOOOOOOg       as "cloud" #aliceblue;line:blue;line.dotted;text:blu
file f3
}
component   componentVeryLOOOOOOOOOOOOOOOOOOg   as "component" #aliceblue;line:blue;line.dotted;text
file f4
}
database    databaseVeryLOOOOOOOOOOOOOOOOOOg    as "database" #aliceblue;line:blue;line.dotted;text
file f5
}
file        fileVeryLOOOOOOOOOOOOOOOOOOg        as "file" #aliceblue;line:blue;line.dotted;text:blue
file f6
}
folder      folderVeryLOOOOOOOOOOOOOOOOOOg      as "folder" #aliceblue;line:blue;line.dotted;text:bl
file f7
}
frame       frameVeryLOOOOOOOOOOOOOOOOOOg       as "frame" #aliceblue;line:blue;line.dotted;text:blu
```

```
file f8
}
hexagon      hexagonVeryLOOOOOOOOOOOOOOOOOOg     as "hexagon" #aliceblue;line:blue;line.dotted;text:
file f9
}
node         nodeVeryLOOOOOOOOOOOOOOOOOOg        as "node" #aliceblue;line:blue;line.dotted;text:blu
file f10
}
package      packageVeryLOOOOOOOOOOOOOOOOOOg     as "package" #aliceblue;line:blue;line.dotted;text:
file f11
}
process      processVeryLOOOOOOOOOOOOOOOOOOg     as "process" #aliceblue;line:blue;line.dotted;text:
file f11
}
queue        queueVeryLOOOOOOOOOOOOOOOOOOg       as "queue" #aliceblue;line:blue;line.dotted;text:blu
file f12
}
rectangle    rectangleVeryLOOOOOOOOOOOOOOOOOOg   as "rectangle" #aliceblue;line:blue;line.dotted;tex
file f13
}
stack        stackVeryLOOOOOOOOOOOOOOOOOOg       as "stack" #aliceblue;line:blue;line.dotted;text:blu
file f14
}
storage      storageVeryLOOOOOOOOOOOOOOOOOOg     as "storage" #aliceblue;line:blue;line.dotted;text:
file f15
}
@enduml
```

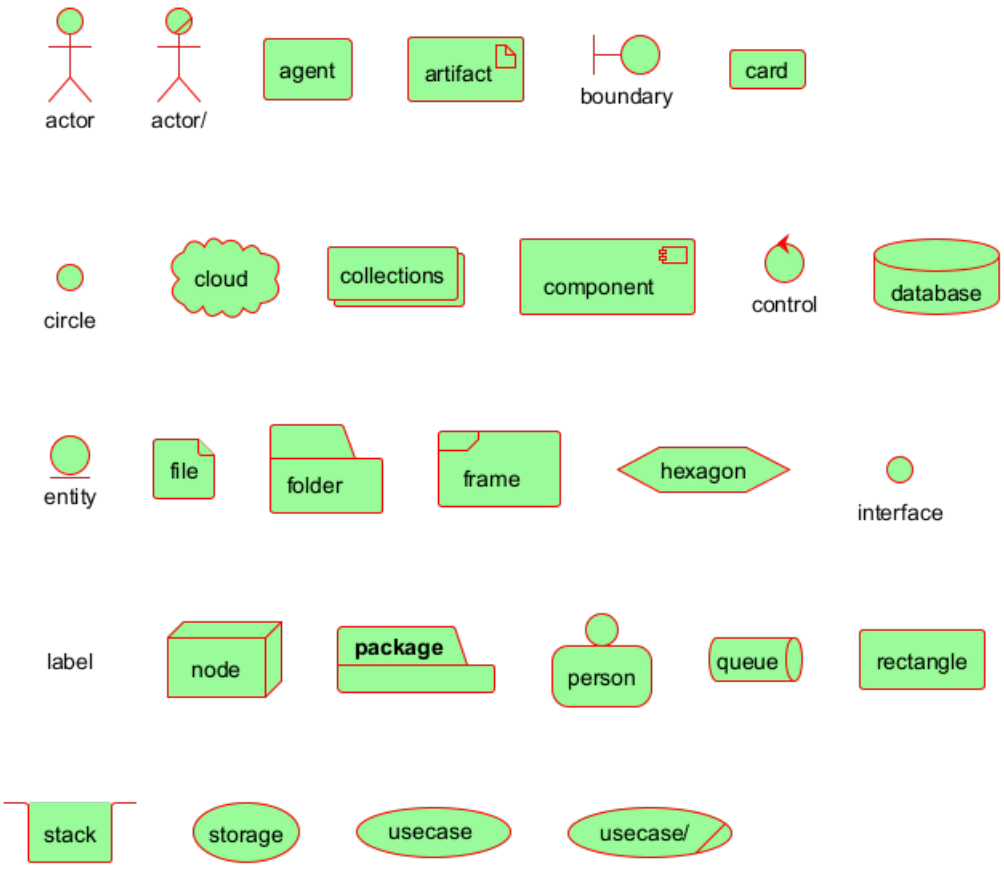
8.15 Appendix: Test of style on all element

8.15.1 Simple element

8.15.2 Global style (on componentDiagram)

```
@startuml
<style>
componentDiagram {
  BackGroundColor palegreen
  LineThickness 1
  LineColor red
}
document {
  BackGroundColor white
}
</style>
actor actor
actor/ "actor/"
agent agent
artifact artifact
boundary boundary
card card
circle circle
cloud cloud
collections collections
component component
```

```
control control
database database
entity entity
file file
folder folder
frame frame
hexagon hexagon
interface interface
label label
node node
package package
person person
queue queue
rectangle rectangle
stack stack
storage storage
usecase usecase
usecase/ "usecase/"
@enduml
```



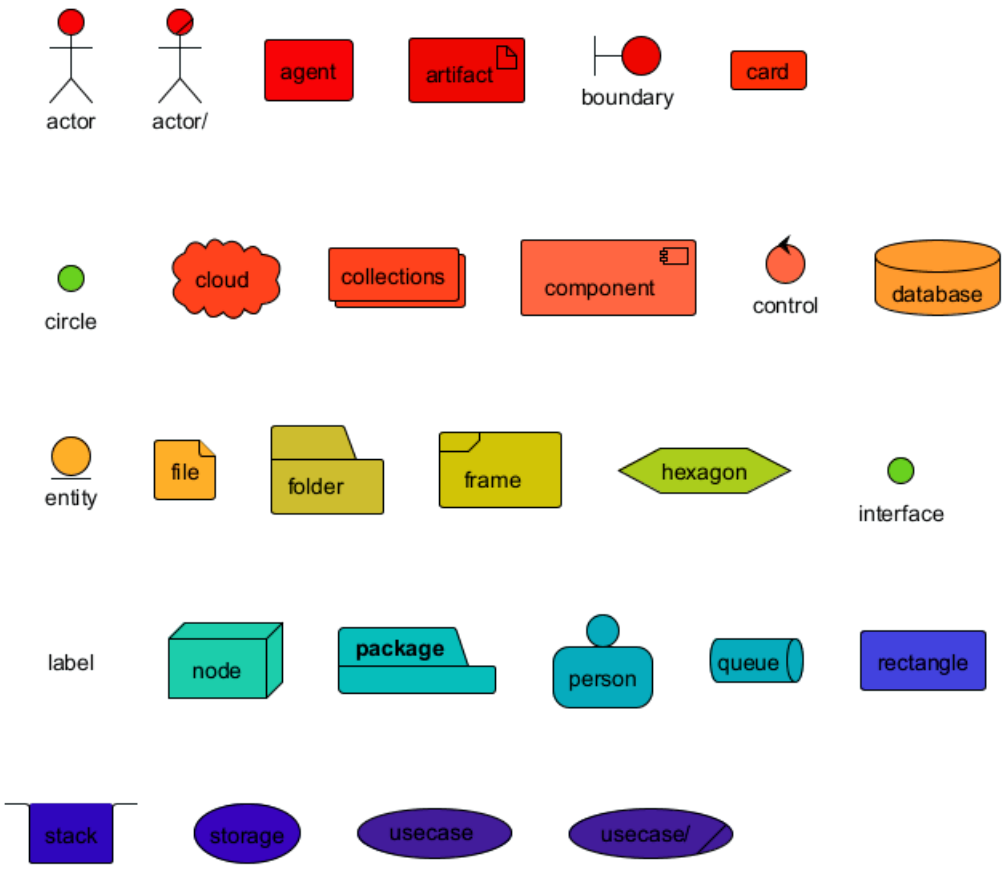
8.15.3 Style for each element

```
@startuml
<style>
actor {
  BackGroundColor #f80c12
  LineThickness 1
  LineColor black
}
agent {
  BackGroundColor #f80c12
```

```
  LineThickness 1
  LineColor black
}
artifact {
  BackGroundColor #ee1100
  LineThickness 1
  LineColor black
}
boundary {
  BackGroundColor #ee1100
  LineThickness 1
  LineColor black
}
card {
  BackGroundColor #ff3311
  LineThickness 1
  LineColor black
}
circle {
  BackGroundColor #ff3311
  LineThickness 1
  LineColor black
}
cloud {
  BackGroundColor #ff4422
  LineThickness 1
  LineColor black
}
collections {
  BackGroundColor #ff4422
  LineThickness 1
  LineColor black
}
component {
  BackGroundColor #ff6644
  LineThickness 1
  LineColor black
}
control {
  BackGroundColor #ff6644
  LineThickness 1
  LineColor black
}
database {
  BackGroundColor #ff9933
  LineThickness 1
  LineColor black
}
entity {
  BackGroundColor #feae2d
  LineThickness 1
  LineColor black
}
file {
  BackGroundColor #feae2d
  LineThickness 1
  LineColor black
}
```

```
folder {
  BackGroundColor #ccbb33
  LineThickness 1
  LineColor black
}
frame {
  BackGroundColor #d0c310
  LineThickness 1
  LineColor black
}
hexagon {
  BackGroundColor #aacc22
  LineThickness 1
  LineColor black
}
interface {
  BackGroundColor #69d025
  LineThickness 1
  LineColor black
}
label {
  BackGroundColor black
  LineThickness 1
  LineColor black
}
node {
  BackGroundColor #22ccaa
  LineThickness 1
  LineColor black
}
package {
  BackGroundColor #12bdb9
  LineThickness 1
  LineColor black
}
person {
  BackGroundColor #11aabb
  LineThickness 1
  LineColor black
}
queue {
  BackGroundColor #11aabb
  LineThickness 1
  LineColor black
}
rectangle {
  BackGroundColor #4444dd
  LineThickness 1
  LineColor black
}
stack {
  BackGroundColor #3311bb
  LineThickness 1
  LineColor black
}
storage {
  BackGroundColor #3b0cbd
  LineThickness 1
```

```
  LineColor black
}
usecase {
  BackGroundColor #442299
  LineThickness 1
  LineColor black
}
</style>
actor actor
actor/ "actor/"
agent agent
artifact artifact
boundary boundary
card card
circle circle
cloud cloud
collections collections
component component
control control
database database
entity entity
file file
folder folder
frame frame
hexagon hexagon
interface interface
label label
node node
package package
person person
queue queue
rectangle rectangle
stack stack
storage storage
usecase usecase
usecase/ "usecase/"
@enduml
```



[Ref. QA-13261]

8.15.4 Nested element (without level)

8.15.5 Global style (on componentDiagram)

```
@startuml
<style>
componentDiagram {
  BackGroundColor palegreen
  LineThickness 2
  LineColor red
}
</style>
artifact artifact {
}
card card {
}
cloud cloud {
}
component component {
}
database database {
}
file file {
}
folder folder {
}
frame frame {
}
hexagon hexagon {
```

```
}
node node {
}
package package {
}
queue queue {
}
rectangle rectangle {
}
stack stack {
}
storage storage {
}
@enduml
```

8.15.6 Style for each nested element

```
@startuml
<style>
artifact {
  BackGroundColor #ee1100
  LineThickness 1
  LineColor black
}
card {
  BackGroundColor #ff3311
  LineThickness 1
  LineColor black
}
cloud {
  BackGroundColor #ff4422
  LineThickness 1
  LineColor black
}
component {
  BackGroundColor #ff6644
  LineThickness 1
  LineColor black
}
database {
  BackGroundColor #ff9933
  LineThickness 1
  LineColor black
}
file {
  BackGroundColor #feae2d
  LineThickness 1
  LineColor black
}
folder {
  BackGroundColor #ccbb33
  LineThickness 1
  LineColor black
}
frame {
```

```
  BackGroundColor #d0c310
  LineThickness 1
  LineColor black
}
hexagon {
  BackGroundColor #aacc22
  LineThickness 1
  LineColor black
}
node {
  BackGroundColor #22ccaa
  LineThickness 1
  LineColor black
}
package {
  BackGroundColor #12bdb9
  LineThickness 1
  LineColor black
}
queue {
  BackGroundColor #11aabb
  LineThickness 1
  LineColor black
}
rectangle {
  BackGroundColor #4444dd
  LineThickness 1
  LineColor black
}
stack {
  BackGroundColor #3311bb
  LineThickness 1
  LineColor black
}
storage {
  BackGroundColor #3b0cbd
  LineThickness 1
  LineColor black
}

</style>
artifact artifact {
}
card card {
}
cloud cloud {
}
component component {
}
database database {
}
file file {
}
folder folder {
}
frame frame {
}
hexagon hexagon {
```

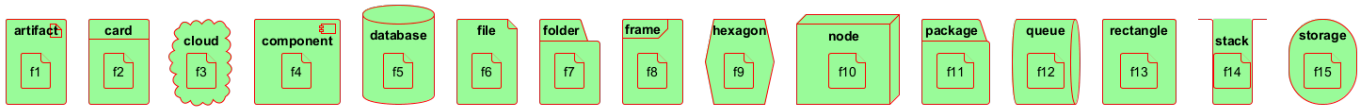
```
}
node node {
}
package package {
}
queue queue {
}
rectangle rectangle {
}
stack stack {
}
storage storage {
}
@enduml
```

8.15.7 Nested element (with one level)

8.15.8 Global style (on componentDiagram)

```
@startuml
<style>
componentDiagram {
  BackGroundColor palegreen
  LineThickness 1
  LineColor red
}
document {
  BackGroundColor white
}
</style>
artifact e1 as "artifact" {
file f1
}
card e2 as "card" {
file f2
}
cloud e3 as "cloud" {
file f3
}
component e4 as "component" {
file f4
}
database e5 as "database" {
file f5
}
file e6 as "file" {
file f6
}
folder e7 as "folder" {
file f7
}
frame e8 as "frame" {
file f8
}
hexagon e9 as "hexagon" {
file f9
```

```
}
node e10 as "node" {
file f10
}
package e11 as "package" {
file f11
}
queue e12 as "queue" {
file f12
}
rectangle e13 as "rectangle" {
file f13
}
stack e14 as "stack" {
file f14
}
storage e15 as "storage" {
file f15
}
@enduml
```

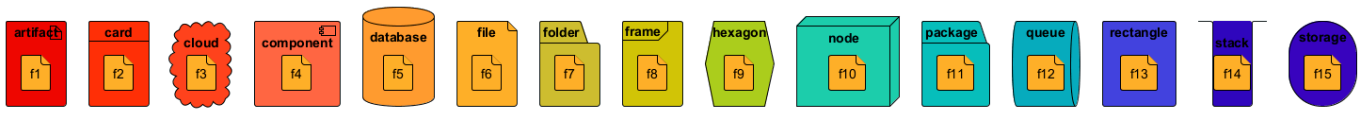


8.15.9 Style for each nested element

```
@startuml
<style>
artifact {
  BackGroundColor #ee1100
  LineThickness 1
  LineColor black
}
card {
  BackGroundColor #ff3311
  LineThickness 1
  LineColor black
}
cloud {
  BackGroundColor #ff4422
  LineThickness 1
  LineColor black
}
component {
  BackGroundColor #ff6644
  LineThickness 1
  LineColor black
}
database {
  BackGroundColor #ff9933
  LineThickness 1
  LineColor black
}
file {
  BackGroundColor #feae2d
  LineThickness 1
```

```
  LineColor black
}
folder {
  BackGroundColor #ccbb33
  LineThickness 1
  LineColor black
}
frame {
  BackGroundColor #d0c310
  LineThickness 1
  LineColor black
}
hexagon {
  BackGroundColor #aacc22
  LineThickness 1
  LineColor black
}
node {
  BackGroundColor #22ccaa
  LineThickness 1
  LineColor black
}
package {
  BackGroundColor #12bdb9
  LineThickness 1
  LineColor black
}
queue {
  BackGroundColor #11aabb
  LineThickness 1
  LineColor black
}
rectangle {
  BackGroundColor #4444dd
  LineThickness 1
  LineColor black
}
stack {
  BackGroundColor #3311bb
  LineThickness 1
  LineColor black
}
storage {
  BackGroundColor #3b0cbd
  LineThickness 1
  LineColor black
}
</style>
artifact e1 as "artifact" {
file f1
}
card e2 as "card" {
file f2
}
cloud e3 as "cloud" {
file f3
}
component e4 as "component" {
```

```
file f4
}
database e5 as "database" {
file f5
}
file e6 as "file" {
file f6
}
folder e7 as "folder" {
file f7
}
frame e8 as "frame" {
file f8
}
hexagon e9 as "hexagon" {
file f9
}
node e10 as "node" {
file f10
}
package e11 as "package" {
file f11
}
queue e12 as "queue" {
file f12
}
rectangle e13 as "rectangle" {
file f13
}
stack e14 as "stack" {
file f14
}
storage e15 as "storage" {
file f15
}
@enduml
```

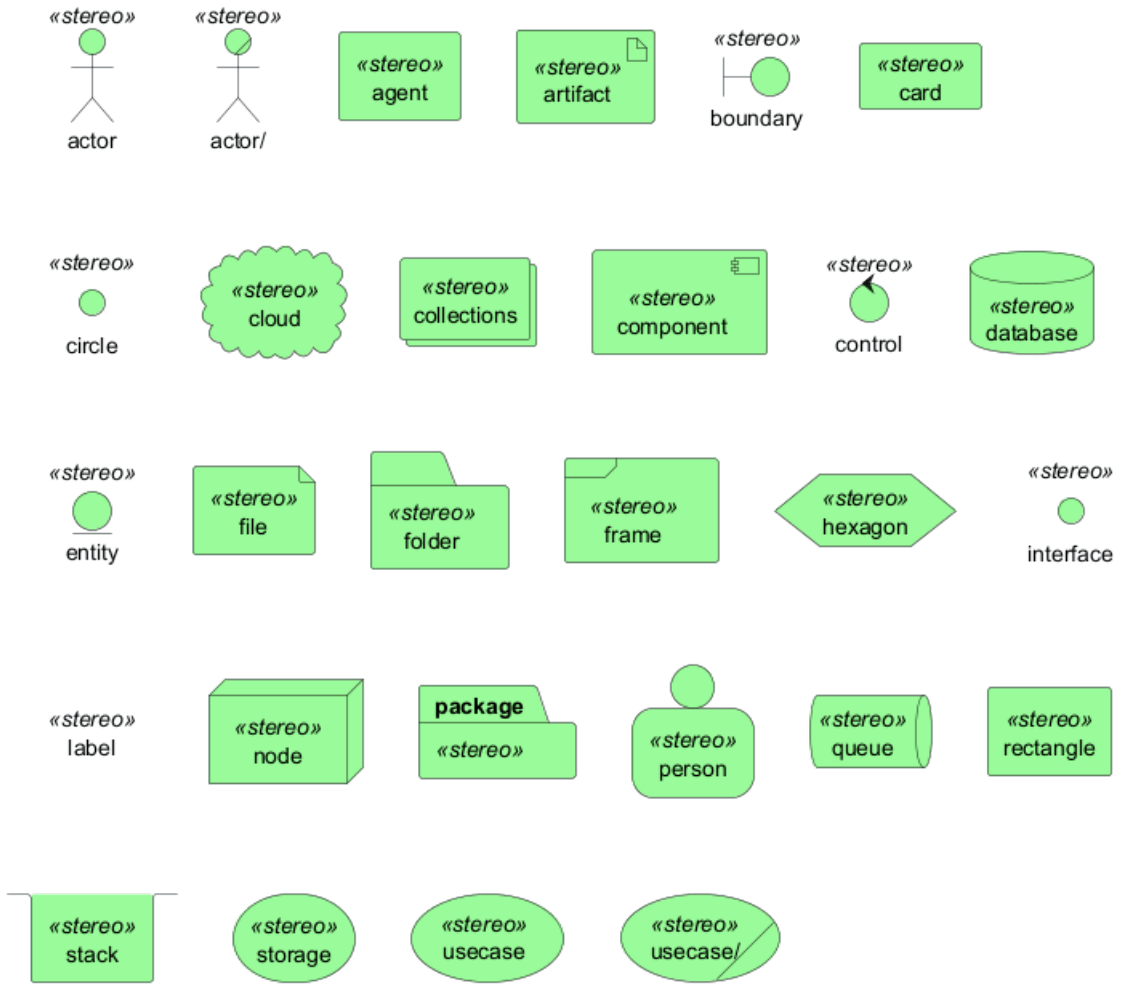


8.16 Appendix: Test of stereotype with style on all element

8.16.1 Simple element

```
@startuml
<style>
.stereo {
  BackgroundColor palegreen
}
</style>
actor actor << stereo >>
actor/ "actor/" << stereo >>
agent agent << stereo >>
artifact artifact << stereo >>
boundary boundary << stereo >>
card card << stereo >>
circle circle << stereo >>
```

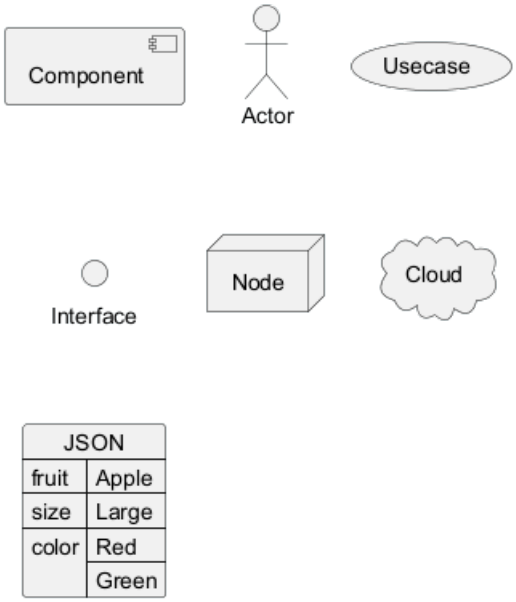
```
cloud cloud << stereo >>
collections collections << stereo >>
component component << stereo >>
control control << stereo >>
database database << stereo >>
entity entity << stereo >>
file file << stereo >>
folder folder << stereo >>
frame frame << stereo >>
hexagon hexagon << stereo >>
interface interface << stereo >>
label label << stereo >>
node node << stereo >>
package package << stereo >>
person person << stereo >>
queue queue << stereo >>
rectangle rectangle << stereo >>
stack stack << stereo >>
storage storage << stereo >>
usecase usecase << stereo >>
usecase/ "usecase/" << stereo >>
@enduml
```



8.17 Display JSON Data on Deployment diagram

8.17.1 Simple example

```
@startuml
allowmixing

component Component
actor     Actor
usecase   Usecase
()        Interface
node      Node
cloud     Cloud

json JSON {
   "fruit":"Apple",
   "size":"Large",
   "color": ["Red", "Green"]
}
@enduml
```



[Ref. QA-15481]

For another example, see on JSON page.

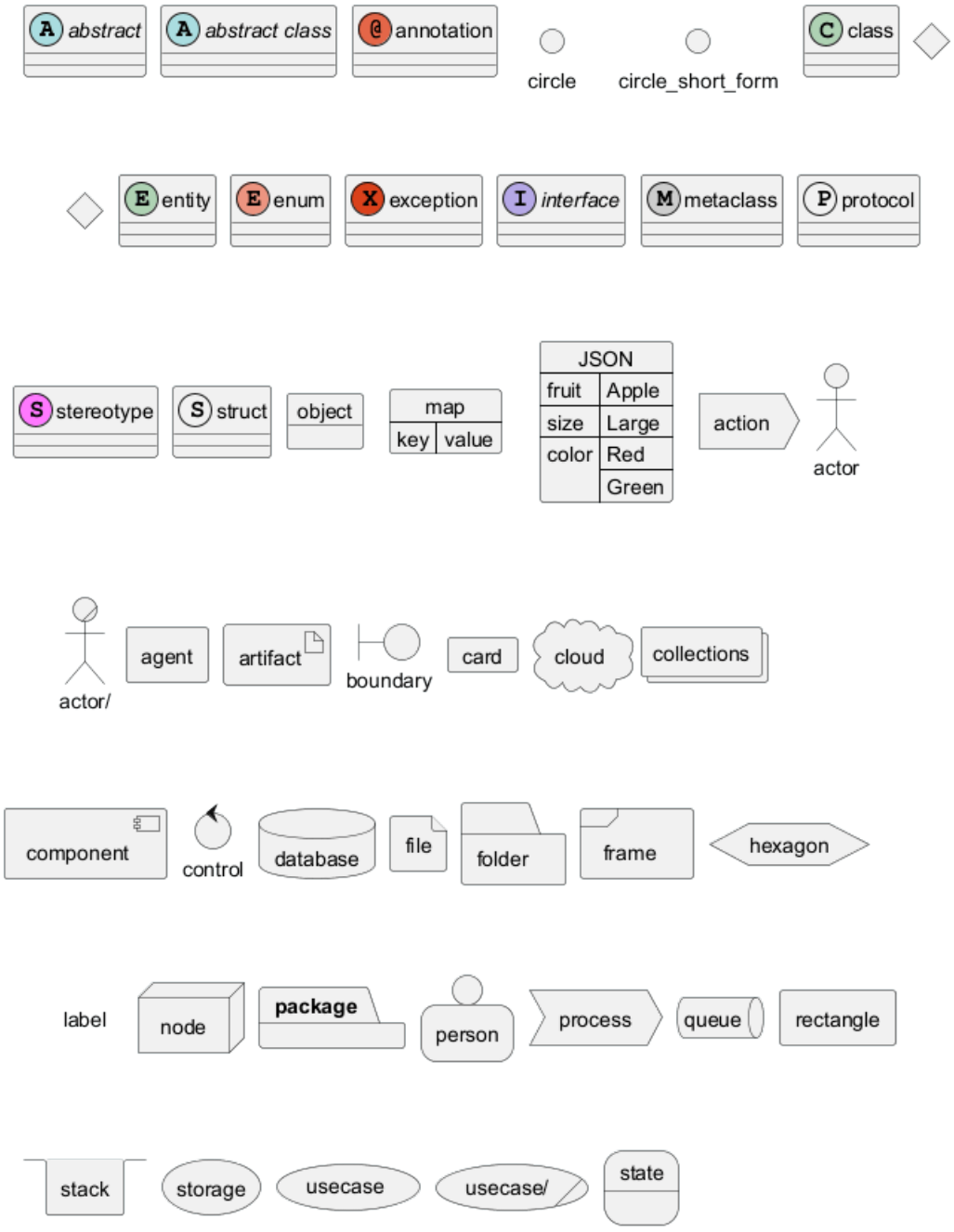
8.18 Mixing Deployment (Usecase, Component, Deployment) element within a Class or Object diagram

In order to add a Deployment element or a State element within a Class or Object diagram, you can use the `allowmixing` or `allow_mixing` directive.

8.18.1 Mixing all elements

```
@startuml

allowmixing

skinparam nodesep 10
abstract        abstract
abstract class  "abstract class"
annotation      annotation
```

```
circle          circle
()              circle_short_form
class           class
diamond         diamond
<>              diamond_short_form
entity          entity
enum            enum
exception       exception
interface       interface
metaclass       metaclass
protocol        protocol
stereotype      stereotype
struct          struct
object          object
map map {
 key => value
}
json JSON {
   "fruit":"Apple",
   "size":"Large",
   "color": ["Red", "Green"]
}
action action
actor actor
actor/ "actor/"
agent agent
artifact artifact
boundary boundary
card card
circle circle
cloud cloud
collections collections
component component
control control
database database
entity entity
file file
folder folder
frame frame
hexagon hexagon
interface interface
label label
node node
package package
person person
process process
queue queue
rectangle rectangle
stack stack
storage storage
usecase usecase
usecase/ "usecase/"
state state
@enduml
```



[Ref. QA-2335 and QA-5329]

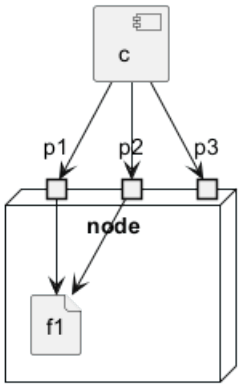
8.19 Port [port, portIn, portOut]

You can added **port** with `port`, `portin`and `portout` keywords.

8.19.1 Port

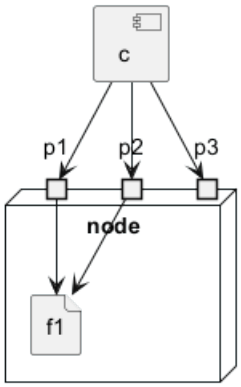
```
@startuml
[c]
node node {
  port p1
  port p2
  port p3
  file f1
}
```

```
c --> p1
c --> p2
c --> p3
p1 --> f1
p2 --> f1
@enduml
```



8.19.2 PortIn

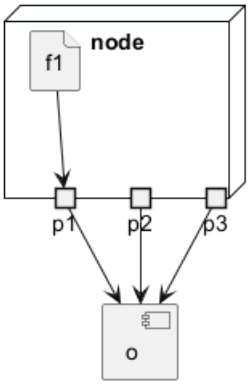
```
@startuml
[c]
node node {
  portin p1
  portin p2
  portin p3
  file f1
}

c --> p1
c --> p2
c --> p3
p1 --> f1
p2 --> f1
@enduml
```



8.19.3 PortOut

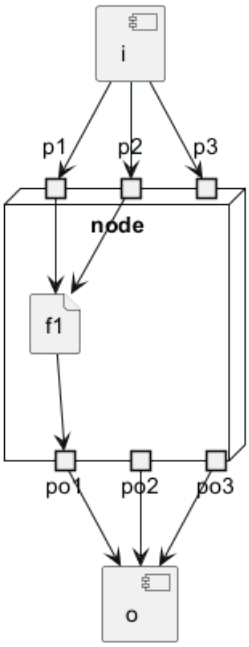
```
@startuml
node node {
  portout p1
  portout p2
```

```
  portout p3
  file f1
}
[o]
p1 --> o
p2 --> o
p3 --> o
f1 --> p1
@enduml
```



8.19.4 Mixing PortIn & PortOut

```
@startuml
[i]
node node {
  portin p1
  portin p2
  portin p3
  portout po1
  portout po2
  portout po3
  file f1
}
[o]

i --> p1
i --> p2
i --> p3
p1 --> f1
p2 --> f1
po1 --> o
po2 --> o
po3 --> o
f1 --> po1
@enduml
```



8.20 Change diagram orientation

You can change (whole) diagram orientation with:

- `top to bottom direction` *(by default)*
- `left to right direction`

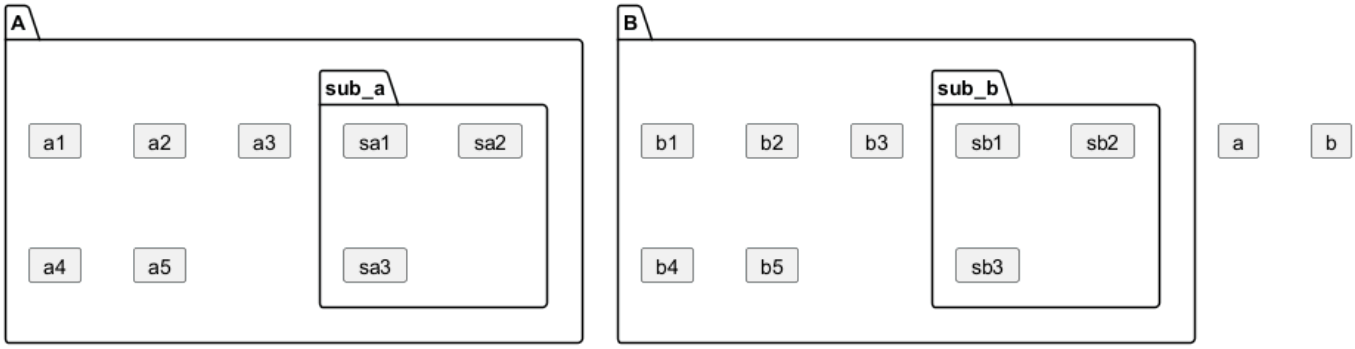
8.20.1 Top to bottom *(by default)*

8.20.2 With Graphviz *(layout engine by default)*

The main rule is: **Nested element first, then simple element.**

```
@startuml
card a
card b
package A {
  card a1
  card a2
  card a3
  card a4
  card a5
  package sub_a {
   card sa1
   card sa2
   card sa3
  }
}

package B {
  card b1
  card b2
  card b3
  card b4
  card b5
  package sub_b {
   card sb1
   card sb2
```

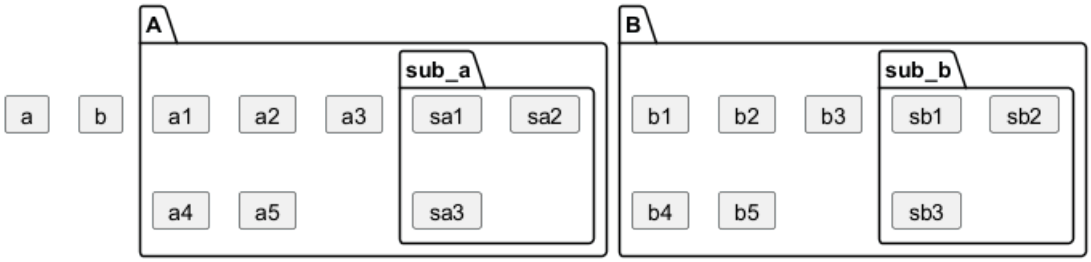
```
   card sb3
  }
}
@enduml
```



8.20.3 With Smetana *(internal layout engine)*

The main rule is the opposite: **Simple element first, then nested element.**

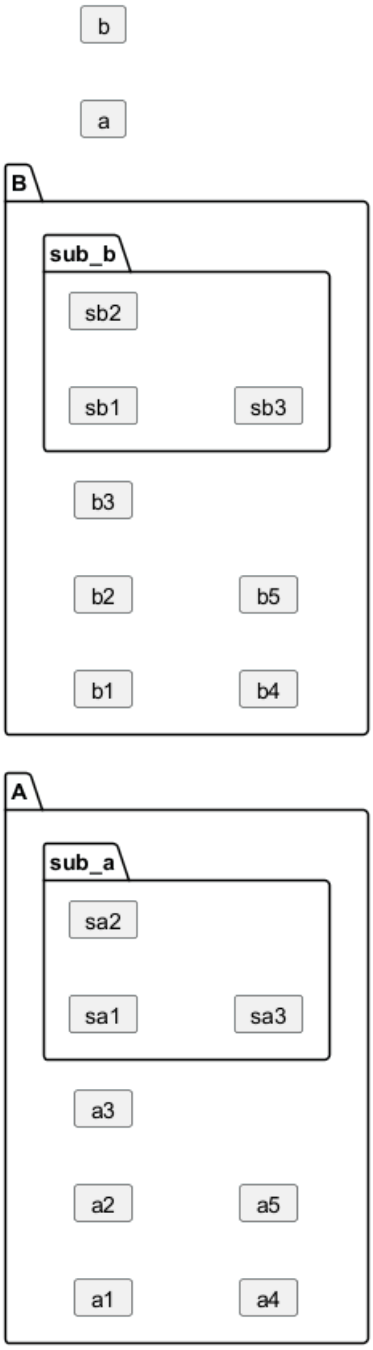
```
@startuml
!pragma layout smetana
card a
card b
package A {
  card a1
  card a2
  card a3
  card a4
  card a5
  package sub_a {
   card sa1
   card sa2
   card sa3
  }
}

package B {
  card b1
  card b2
  card b3
  card b4
  card b5
  package sub_b {
   card sb1
   card sb2
   card sb3
  }
}
@enduml
```



8.20.4 Left to right

8.20.5 With Graphviz *(layout engine by default)*

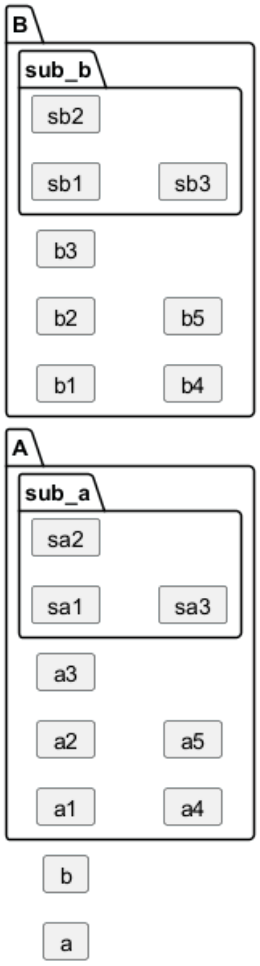
```
@startuml
left to right direction
card a
card b
package A {
  card a1
  card a2
  card a3
  card a4
  card a5
  package sub_a {
   card sa1
   card sa2
   card sa3
  }
}

package B {
  card b1
  card b2
  card b3
  card b4
  card b5
  package sub_b {
   card sb1
   card sb2
   card sb3
  }
}
@enduml
```



8.20.6 With Smetana *(internal layout engine)*

```
@startuml
!pragma layout smetana
left to right direction
card a
card b
package A {
  card a1
  card a2
  card a3
  card a4
  card a5
  package sub_a {
   card sa1
```

```
   card sa2
   card sa3
  }
}

package B {
  card b1
  card b2
  card b3
  card b4
  card b5
  package sub_b {
   card sb1
   card sb2
   card sb3
  }
}
@enduml
```



9 상태다이어그램

Using [**PlantUML**](https://plantuml.com/) to create state diagrams offers several advantages:

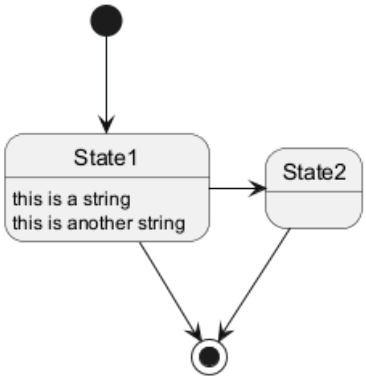
- **Text-Based Language**: Quickly define and visualize the states and transitions without the hassle of manual drawing.
- **Efficiency and Consistency**: Ensure streamlined diagram creation and easy version control.
- **Versatility**: Integrate with various documentation platforms and support multiple output formats.
- **Open-Source & Community Support**: Backed by a [**strong community**](https://forum.plantuml.net/) that continuously contributes to its enhancements and offers invaluable resources.

9.1 간단한상태

`[*]` 을사용해서시작점과종료점을그린다.

`-->` 를사용해서화살표를그린다.

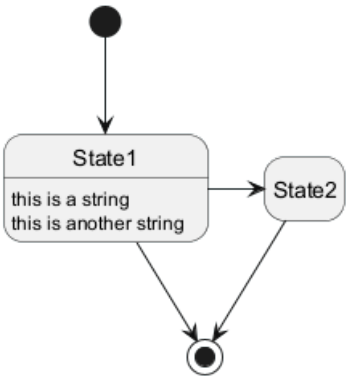
```
@startuml

[*] --> State1
State1 --> [*]
State1 : this is a string
State1 : this is another string

State1 -> State2
State2 --> [*]

@enduml
```



9.2 Change state rendering

You can use `hide empty description` to render state as simple box.

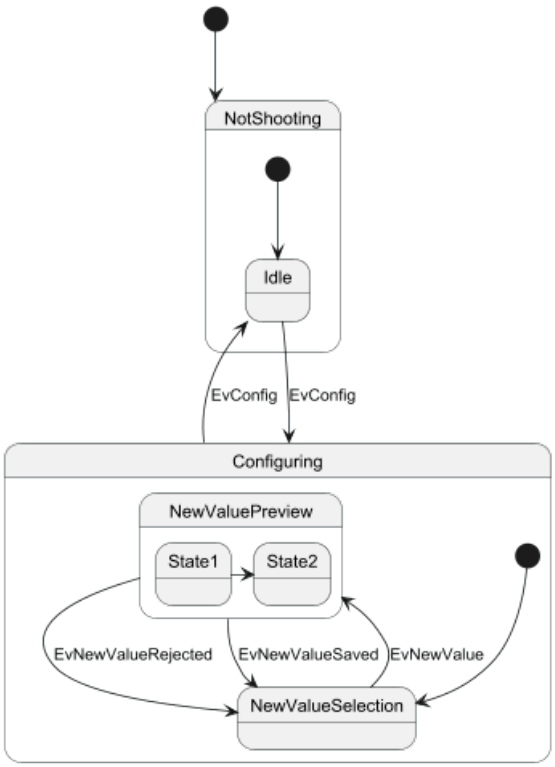
```
@startuml
hide empty description
[*] --> State1
State1 --> [*]
State1 : this is a string
State1 : this is another string

State1 -> State2
State2 --> [*]
@enduml
```



9.3 상태수정

물론상태는수정될수있다. `state` 키워드와브라켓을정의해야한다.

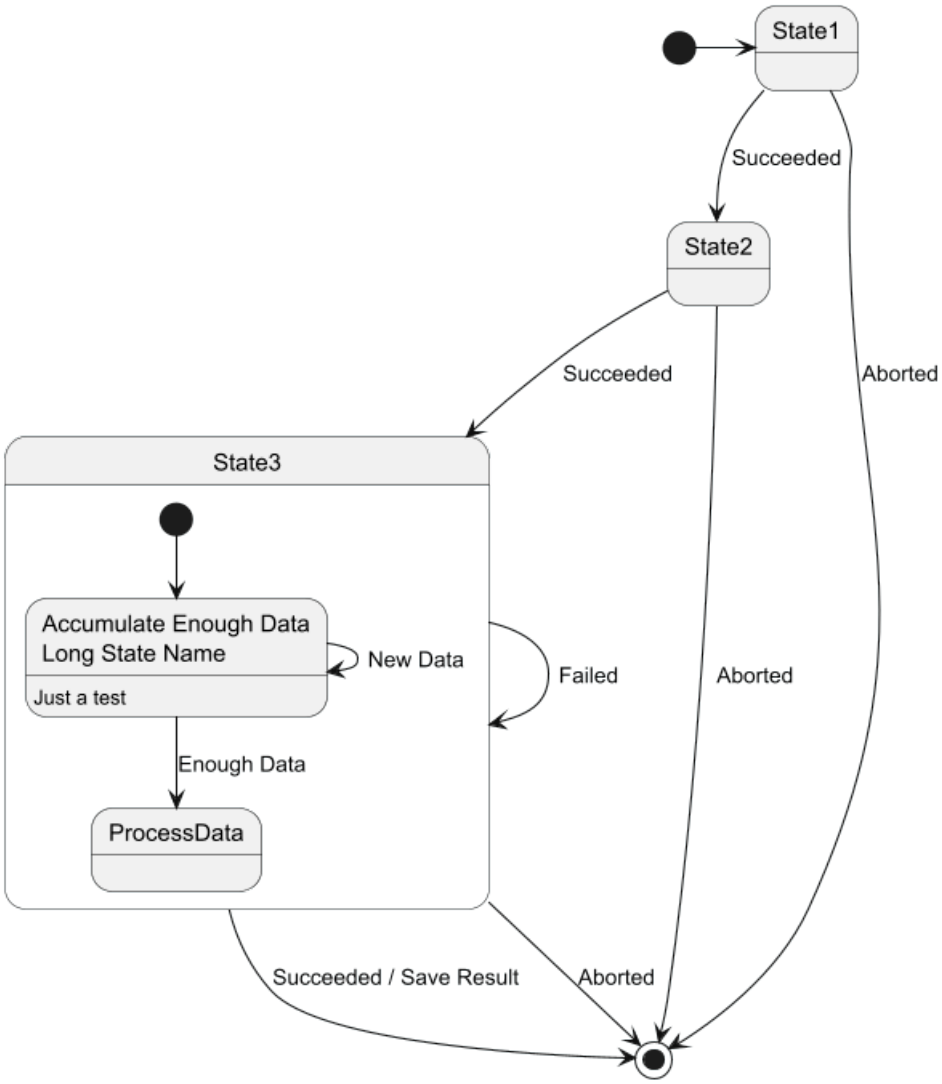
```
@startuml
scale 350 width
[*] --> NotShooting

state NotShooting {
  [*] --> Idle
  Idle --> Configuring : EvConfig
  Configuring --> Idle : EvConfig
}

state Configuring {
  [*] --> NewValueSelection
  NewValueSelection --> NewValuePreview : EvNewValue
  NewValuePreview --> NewValueSelection : EvNewValueRejected
  NewValuePreview --> NewValueSelection : EvNewValueSaved

  state NewValuePreview {
     State1 -> State2
  }

}
@enduml
```



9.4 긴이름

state 키워드를사용하면상태들을길게기술할수있다.

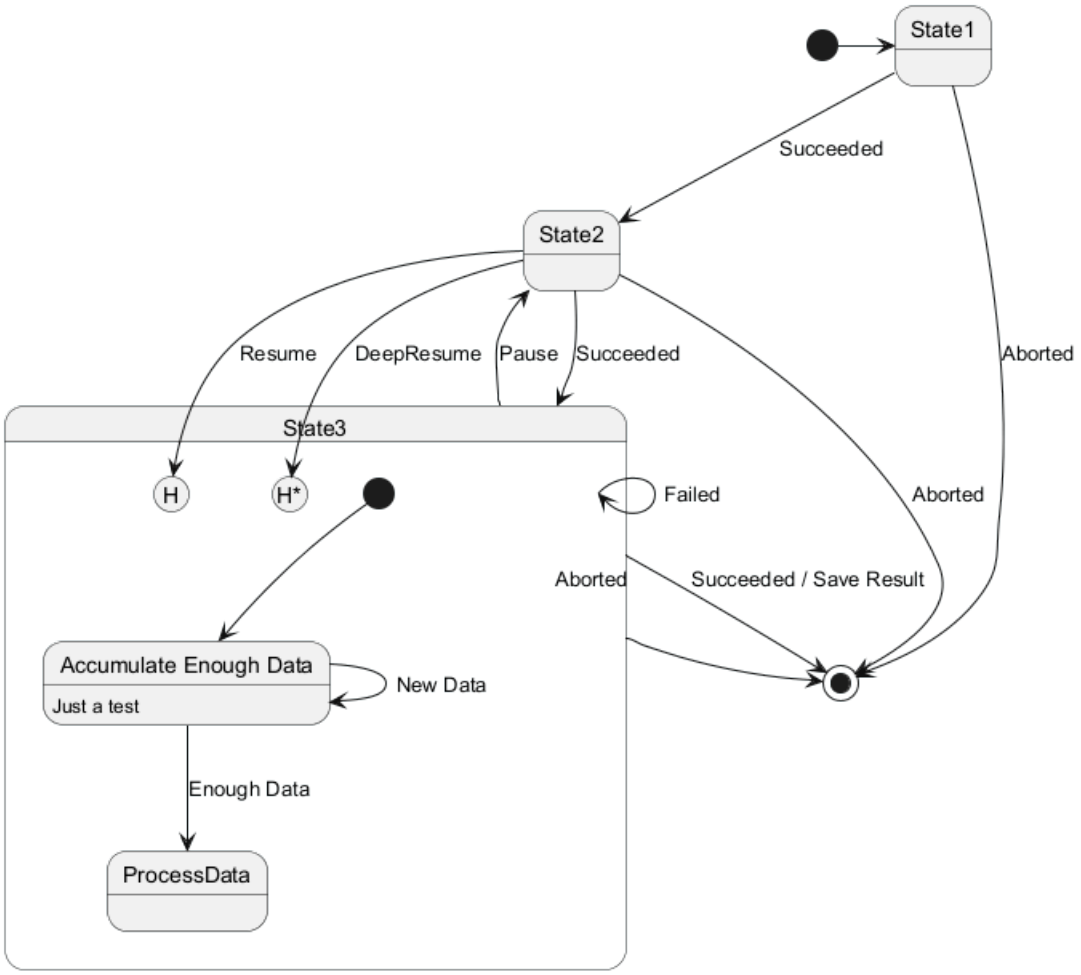
```
@startuml
scale 600 width

[*] -> State1
State1 --> State2 : Succeeded
State1 --> [*] : Aborted
State2 --> State3 : Succeeded
State2 --> [*] : Aborted
state State3 {
  state "Accumulate Enough Data\nLong State Name" as long1
  long1 : Just a test
  [*] --> long1
  long1 --> long1 : New Data
  long1 --> ProcessData : Enough Data
}
State3 --> State3 : Failed
State3 --> [*] : Succeeded / Save Result
State3 --> [*] : Aborted

@enduml
```



9.5 History [[H], [H*]]

You can use `[H]` for the history and `[H*]` for the deep history of a substate.

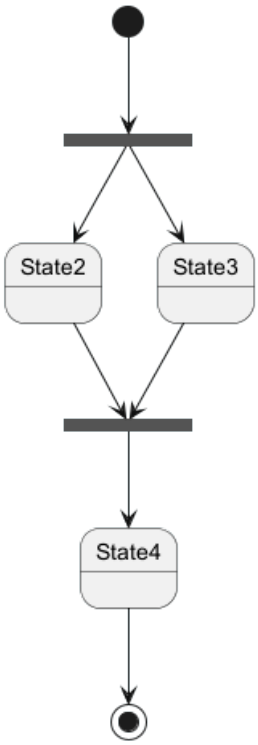
```
@startuml
[*] -> State1
State1 --> State2 : Succeeded
State1 --> [*] : Aborted
State2 --> State3 : Succeeded
State2 --> [*] : Aborted
state State3 {
  state "Accumulate Enough Data" as long1
  long1 : Just a test
  [*] --> long1
  long1 --> long1 : New Data
  long1 --> ProcessData : Enough Data
  State2 --> [H]: Resume
}
State3 --> State2 : Pause
State2 --> State3[H*]: DeepResume
State3 --> State3 : Failed
State3 --> [*] : Succeeded / Save Result
State3 --> [*] : Aborted
@enduml
```



9.6 Fork [fork, join]

You can also fork and join using the `<<fork>>` and `<<join>>` stereotypes.

```
@startuml

state fork_state <<fork>>
[*] --> fork_state
fork_state --> State2
fork_state --> State3

state join_state <<join>>
State2 --> join_state
State3 --> join_state
join_state --> State4
State4 --> [*]

@enduml
```

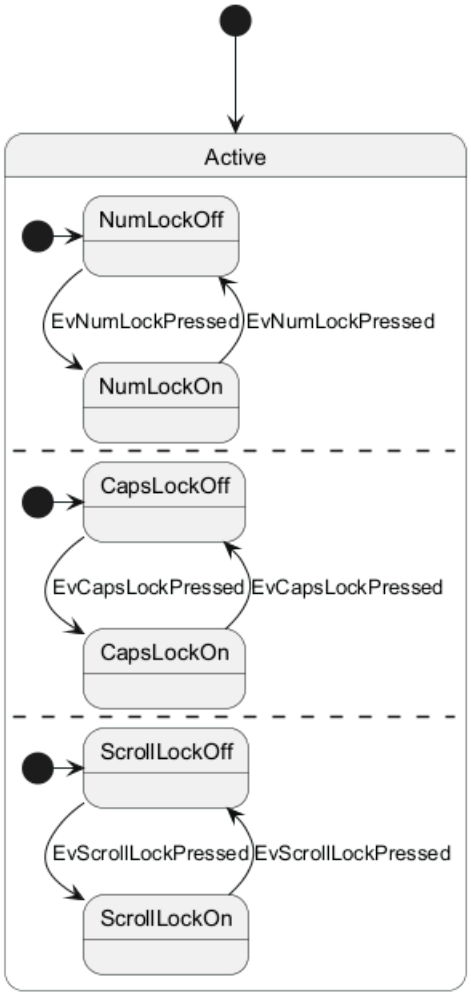


9.7 Concurrent state [–, ||]

You can define concurrent state into a composite state using either `--` or `||` symbol as separator.

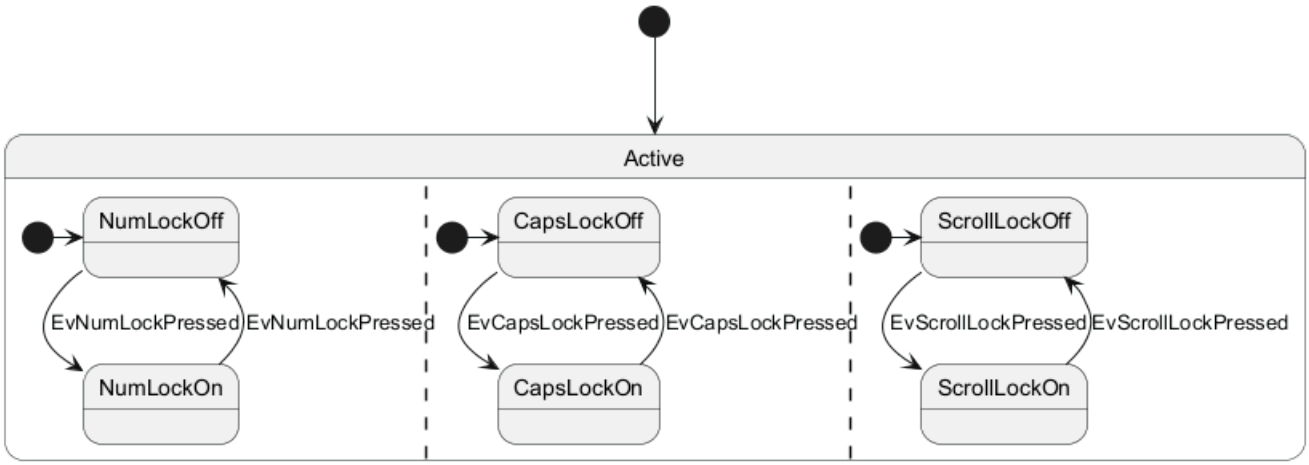
9.7.1 Horizontal separator --

```
@startuml
[*] --> Active

state Active {
  [*] -> NumLockOff
  NumLockOff --> NumLockOn : EvNumLockPressed
  NumLockOn --> NumLockOff : EvNumLockPressed
  --
  [*] -> CapsLockOff
  CapsLockOff --> CapsLockOn : EvCapsLockPressed
  CapsLockOn --> CapsLockOff : EvCapsLockPressed
  --
  [*] -> ScrollLockOff
  ScrollLockOff --> ScrollLockOn : EvScrollLockPressed
  ScrollLockOn --> ScrollLockOff : EvScrollLockPressed
}

@enduml
```



9.7.2 Vertical separator ||

```
@startuml
[*] --> Active

state Active {
  [*] -> NumLockOff
  NumLockOff --> NumLockOn : EvNumLockPressed
  NumLockOn --> NumLockOff : EvNumLockPressed
  ||
  [*] -> CapsLockOff
  CapsLockOff --> CapsLockOn : EvCapsLockPressed
  CapsLockOn --> CapsLockOff : EvCapsLockPressed
  ||
  [*] -> ScrollLockOff
  ScrollLockOff --> ScrollLockOn : EvScrollLockPressed
  ScrollLockOn --> ScrollLockOff : EvScrollLockPressed
}

@enduml
```

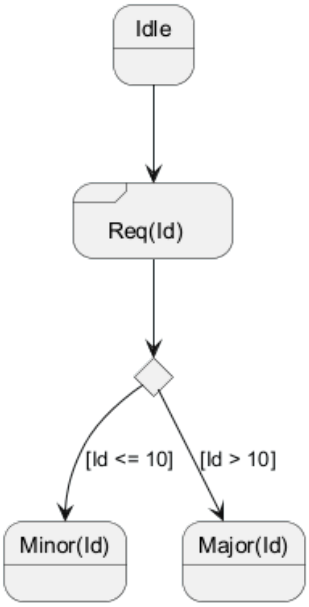


[Ref. QA-3086]

9.8 Conditional [choice]

The stereotype `<<choice>>` can be used to use conditional state.

```
@startuml
state "Req(Id)" as ReqId <<sdlreceive>>
state "Minor(Id)" as MinorId
state "Major(Id)" as MajorId

state c <<choice>>

Idle --> ReqId
ReqId --> c
c --> MinorId : [Id <= 10]
c --> MajorId : [Id > 10]
@enduml
```

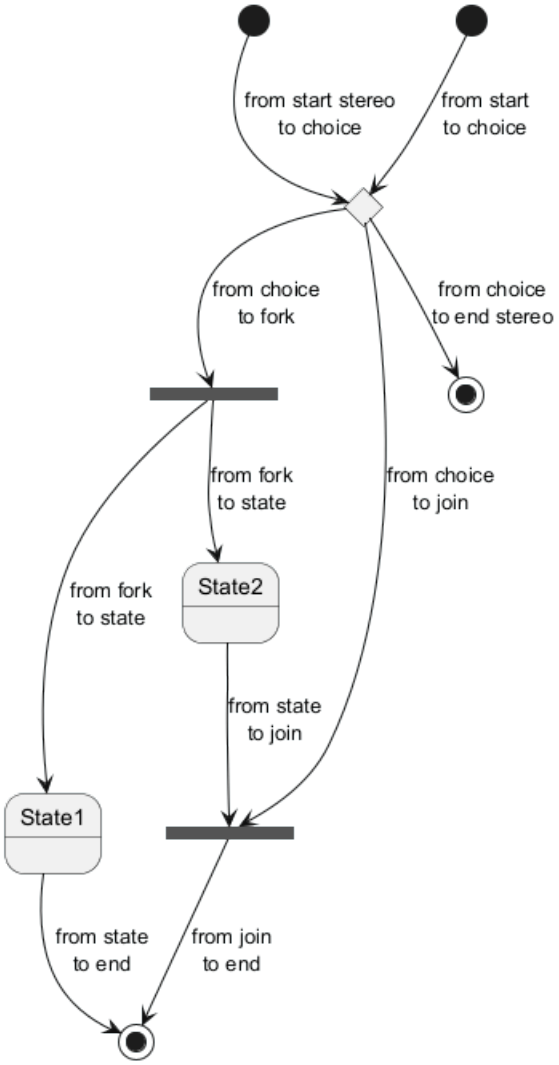


9.9 Stereotypes full example [start, choice, fork, join, end, history, history*]

9.9.1 Start, choice, fork, join, end

```
@startuml
```

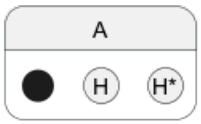
```
state start1  <<start>>
state choice1 <<choice>>
state fork1   <<fork>>
state join2   <<join>>
state end3    <<end>>

[*]     --> choice1 : from start\nto choice
start1  --> choice1 : from start stereo\nto choice

choice1 --> fork1   : from choice\nto fork
choice1 --> join2   : from choice\nto join
choice1 --> end3    : from choice\nto end stereo

fork1   ---> State1 : from fork\nto state
fork1   --> State2  : from fork\nto state

State2  --> join2   : from state\nto join
State1  --> [*]     : from state\nto end

join2   --> [*]     : from join\nto end
@enduml
```



[Ref. QA-404, QA-1159 and GH-887]

9.9.2 History, history*

```
@startuml
state A {
   state s1 as "Start 1" <<start>>
   state s2 as "H 2" <<history>>
   state s3 as "H 3" <<history*>>
}
@enduml
```



[Ref. QA-16824]

9.9.3 Minimal example with all stereotypes

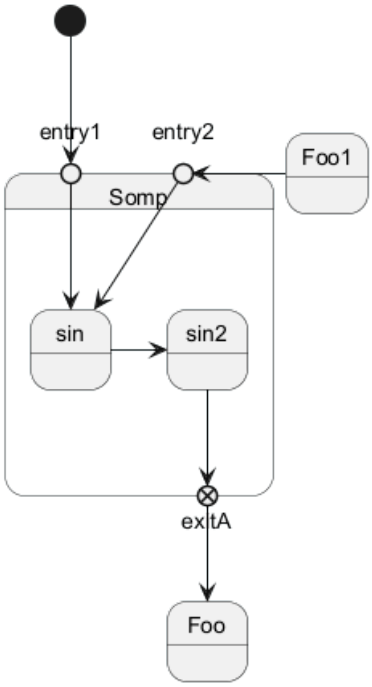
```
@startuml
state start1  <<start>>
state choice1 <<choice>>
state fork1   <<fork>>
state join2   <<join>>
state end3    <<end>>
state sdlreceive <<sdlreceive>>
state history <<history>>
state history2 <<history*>>
@enduml
```

[Ref. QA-19174]

9.10 Point [entryPoint, exitPoint]

You can add **point** with `<<entryPoint>>` and `<<exitPoint>>` stereotypes:

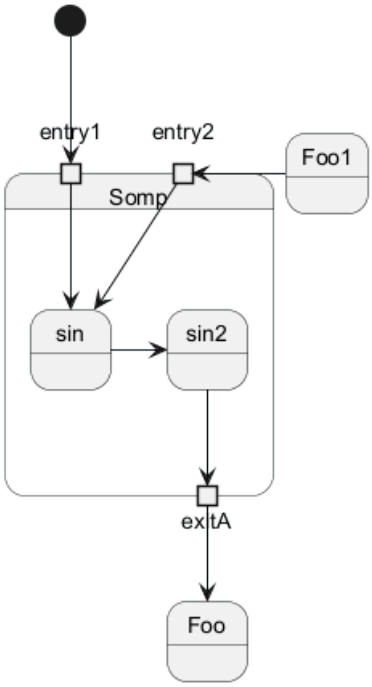
```
@startuml
state Somp {
  state entry1 <<entryPoint>>
  state entry2 <<entryPoint>>
  state sin
  entry1 --> sin
  entry2 -> sin
  sin -> sin2
  sin2 --> exitA <<exitPoint>>
}

[*] --> entry1
exitA --> Foo
Foo1 -> entry2
@enduml
```



9.11 Pin [inputPin, outputPin]

You can add **pin** with `<<inputPin>>` and `<<outputPin>>` stereotypes:

```
@startuml
state Somp {
  state entry1 <<inputPin>>
  state entry2 <<inputPin>>
  state sin
  entry1 --> sin
  entry2 -> sin
  sin -> sin2
  sin2 --> exitA <<outputPin>>
}

[*] --> entry1
exitA --> Foo
Foo1 -> entry2
@enduml
```

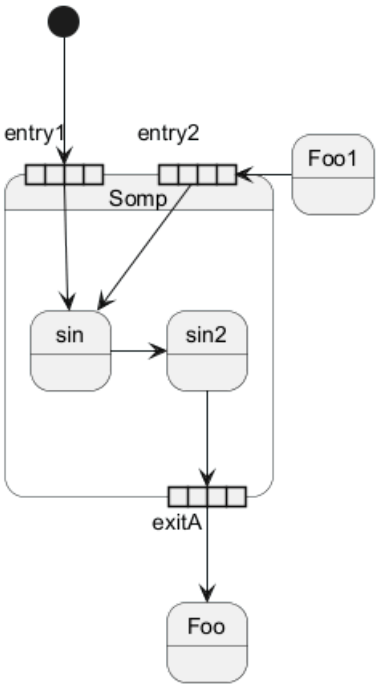


[Ref. QA-4309]

9.12 Expansion [expansionInput, expansionOutput]

You can add **expansion** with `<<expansionInput>>` and `<<expansionOutput>>` stereotypes:

```
@startuml
state Somp {
  state entry1 <<expansionInput>>
  state entry2 <<expansionInput>>
  state sin
  entry1 --> sin
  entry2 -> sin
  sin -> sin2
  sin2 --> exitA <<expansionOutput>>
}

[*] --> entry1
exitA --> Foo
Foo1 -> entry2
@enduml
```



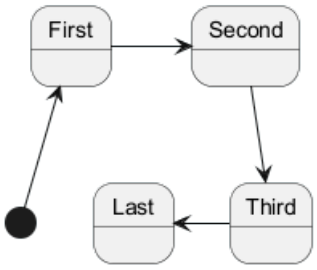
[Ref. QA-4309]

9.13 Arrow direction

You can use `->` for horizontal arrows. It is possible to force arrow's direction using the following syntax:

- `-down->` or `-->`
- `-right->` or `->` *(default arrow)*
- `-left->`
- `-up->`

```
@startuml

[*] -up-> First
First -right-> Second
Second --> Third
Third -left-> Last

@enduml
```



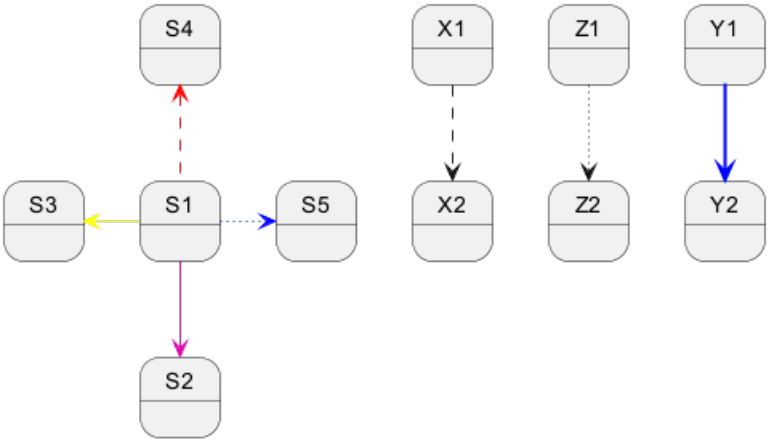
You can shorten the arrow definition by using only the first character of the direction (for example, `-d-` instead of `-down-`) or the two first characters (`-do-`).

Please note that you should not abuse this functionality : *Graphviz* gives usually good results without tweaking.

9.14 Change line color and style

You can change line color and/or line style.

```
@startuml
State S1
State S2
S1 -[#DD00AA]-> S2
S1 -left[#yellow]-> S3
S1 -up[#red,dashed]-> S4
S1 -right[dotted,#blue]-> S5

X1 -[dashed]-> X2
Z1 -[dotted]-> Z2
Y1 -[#blue,bold]-> Y2
@enduml
```



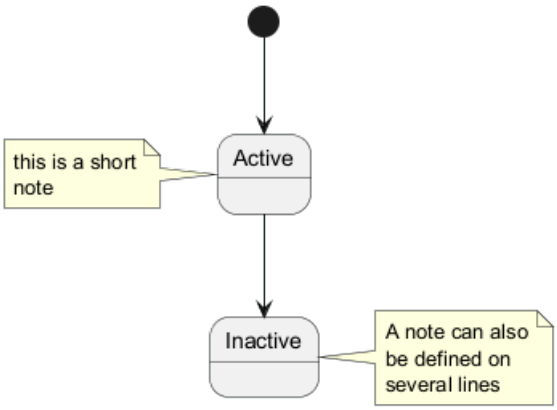
[Ref. Incubation: Change line color in state diagrams]

9.15 Note

You can also define notes using `note left of`, `note right of`, `note top of`, `note bottom of` keywords.

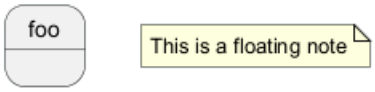
You can also define notes on several lines.

```
@startuml

[*] --> Active
Active --> Inactive

note left of Active : this is a short\nnote

note right of Inactive
  A note can also
  be defined on
  several lines
end note

@enduml
```



You can also have floating notes.

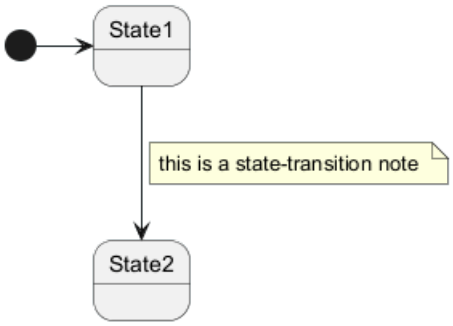
```
@startuml

state foo
note "This is a floating note" as N1

@enduml
```



9.16 Note on link

You can put notes on state-transition or link, with `note on link` keyword.

```
@startuml
[*] -> State1
State1 --> State2
note on link
  this is a state-transition note
end note
@enduml
```

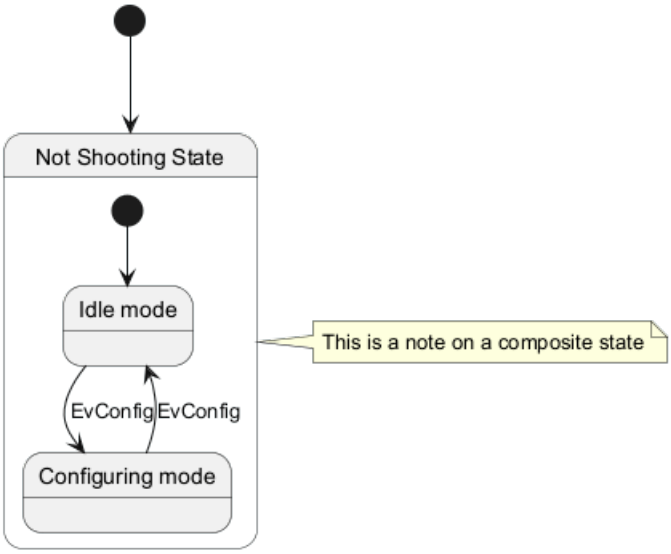


9.17 More in notes

You can put notes on composite states.

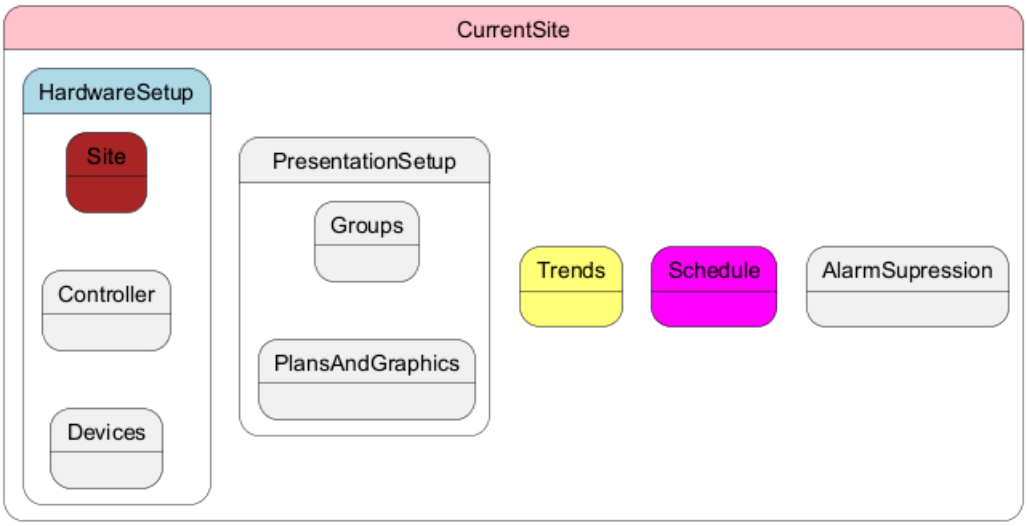
```
@startuml

[*] --> NotShooting

state "Not Shooting State" as NotShooting {
  state "Idle mode" as Idle
  state "Configuring mode" as Configuring
```

```
  [*] --> Idle
  Idle --> Configuring : EvConfig
  Configuring --> Idle : EvConfig
}

note right of NotShooting : This is a note on a composite state

@enduml
```



9.18 Inline color

```
@startuml
state CurrentSite #pink {
    state HardwareSetup #lightblue {
       state Site #brown
        Site -[hidden]-> Controller
        Controller -[hidden]-> Devices
    }
    state PresentationSetup{
        Groups -[hidden]-> PlansAndGraphics
    }
    state Trends #FFFF77
    state Schedule #magenta
    state AlarmSupression
}
@enduml
```



[Ref. QA-1812]

9.19 Skinparam

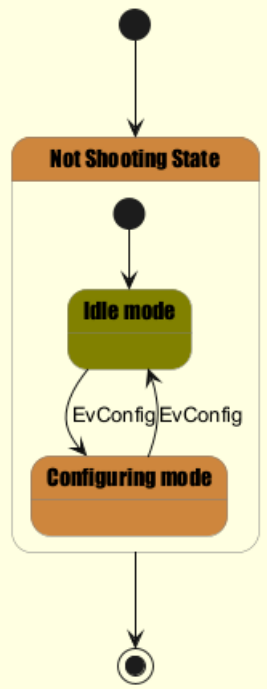
You can use the skinparam command to change colors and fonts for the drawing.

You can use this command :

- In the diagram definition, like any other commands,
- In an included file,
- In a configuration file, provided in the command line or the Ant task.

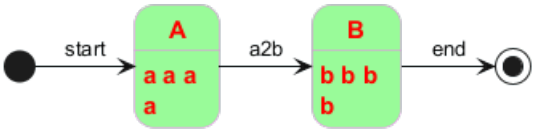
You can define specific color and fonts for stereotyped states.

```
@startuml
skinparam backgroundColor LightYellow
skinparam state {
  StartColor MediumBlue
  EndColor Red
  BackgroundColor Peru
  BackgroundColor<<Warning>> Olive
  BorderColor Gray
  FontName Impact
}

[*] --> NotShooting

state "Not Shooting State" as NotShooting {
  state "Idle mode" as Idle <<Warning>>
  state "Configuring mode" as Configuring
  [*] --> Idle
  Idle --> Configuring : EvConfig
  Configuring --> Idle : EvConfig
}

NotShooting --> [*]
@enduml
```



9.19.1 Test of all specific skinparam to State Diagrams

```
@startuml
skinparam State {
  AttributeFontColor blue
  AttributeFontName serif
  AttributeFontSize  9
  AttributeFontStyle italic
  BackgroundColor palegreen
  BorderColor violet
  EndColor gold
  FontColor red
  FontName Sanserif
  FontSize 15
  FontStyle bold
  StartColor silver
}

state A : a a a\na
state B : b b b\nb

[*] -> A  : start
A -> B : a2b
B -> [*] : end
@enduml
```

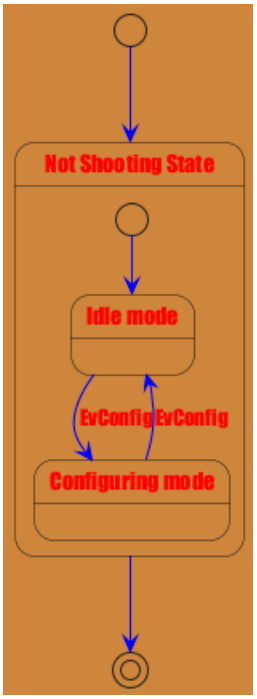


9.20 Changing style

You can change style.

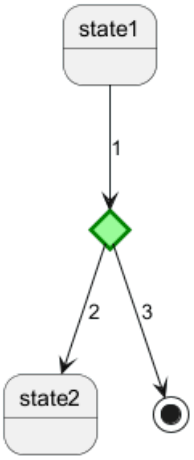
```
@startuml
```

```
<style>
stateDiagram {
  BackgroundColor Peru
  'LineColor Gray
  FontName Impact
  FontColor Red
  arrow {
    FontSize 13
    LineColor Blue
  }
}
</style>


[*] --> NotShooting

state "Not Shooting State" as NotShooting {
  state "Idle mode" as Idle <<Warning>>
  state "Configuring mode" as Configuring
  [*] --> Idle
  Idle --> Configuring : EvConfig
  Configuring --> Idle : EvConfig
}

NotShooting --> [*]
@enduml
```




```
@startuml
<style>
  diamond {
    BackgroundColor #palegreen
    LineColor #green
    LineThickness 2.5
}
</style>
state state1
```

```
state state2
state choice1 <<choice>>
state end3    <<end>>

state1  --> choice1 : 1
choice1 --> state2  : 2
choice1 --> end3    : 3
@enduml
```



[Ref. GH-880]

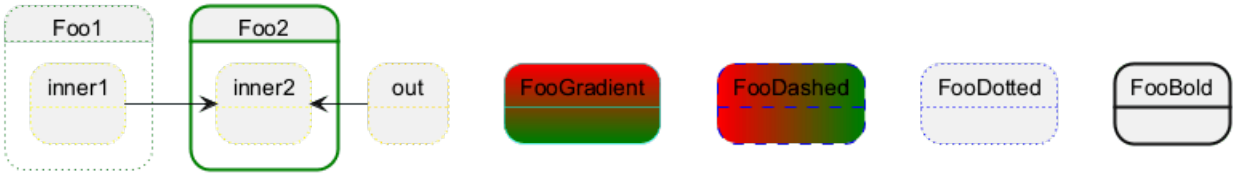
9.21 Change state color and style (inline style)

You can change the color or style of individual state using the following notation:

- `#color ##[style]color`

With background color first (`#color`), then line style and line color (`##[style]color`).

```
@startuml
state FooGradient #red-green ##00FFFF
state FooDashed #red|green ##[dashed]blue {
}
state FooDotted ##[dotted]blue {
}
state FooBold ##[bold] {
}
state Foo1 ##[dotted]green {
state inner1 ##[dotted]yellow
}

state out ##[dotted]gold

state Foo2 ##[bold]green {
state inner2 ##[dotted]yellow
}
inner1 -> inner2
out -> inner2
@enduml
```

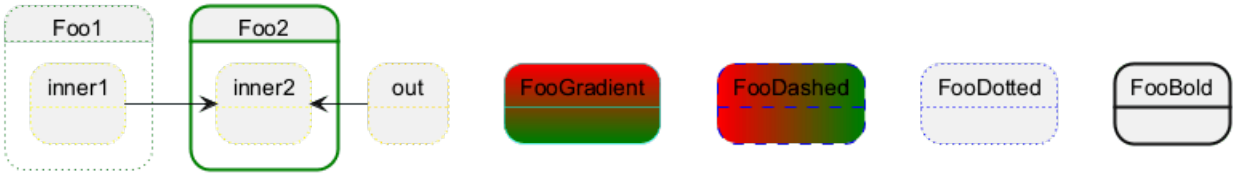


[Ref. QA-1487]

- `#color;line:color;line.[bold|dashed|dotted];text:color`

TODO: FIXME `text:color` seems not to be taken into account **TODO:** FIXME

```
@startuml
@startuml
state FooGradient #red-green;line:00FFFF
state FooDashed #red|green;line.dashed;line:blue {
}
state FooDotted #line.dotted;line:blue {
}
state FooBold #line.bold {
}
state Foo1 #line.dotted;line:green {
state inner1 #line.dotted;line:yellow
}

state out #line.dotted;line:gold

state Foo2 #line.bold;line:green {
state inner2 #line.dotted;line:yellow
}
inner1 -> inner2
out -> inner2
@enduml
@enduml
```




```
@startuml
state s1 : s1 description
state s2 #pink;line:red;line.bold;text:red : s2 description
state s3 #palegreen;line:green;line.dashed;text:green : s3 description
state s4 #aliceblue;line:blue;line.dotted;text:blue   : s4 description
@enduml
```

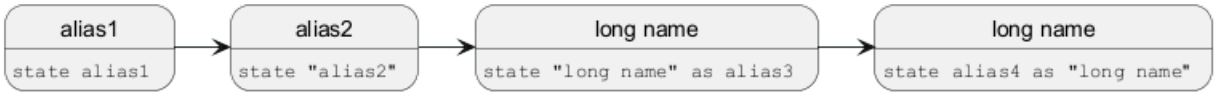
[Adapted from QA-3770]

9.22 Alias

With State you can use `alias`, like:

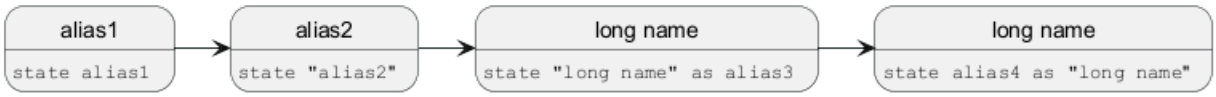
```
@startuml
state alias1
```

```
state "alias2"
state "long name" as alias3
state alias4 as "long name"

alias1 : ""state alias1""
alias2 : ""state "alias2""""
alias3 : ""state "long name" as alias3""
alias4 : ""state alias4 as "long name""""

alias1 -> alias2
alias2 -> alias3
alias3 -> alias4
@enduml
```



or:

```
@startuml
state alias1 : ""state alias1""
state "alias2" : ""state "alias2""""
state "long name" as alias3 : ""state "long name" as alias3""
state alias4 as "long name" : ""state alias4 as "long name""""

alias1 -> alias2
alias2 -> alias3
alias3 -> alias4
@enduml
```

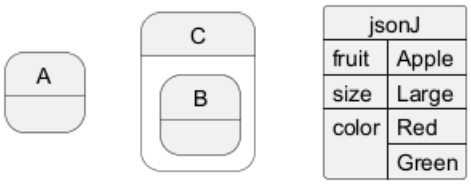


[Ref. QA-1748, QA-14560]

9.23 Display JSON Data on State diagram

9.23.1 Simple example

```
@startuml
state "A" as stateA
state "C" as stateC {
 state B
}

json jsonJ {
   "fruit":"Apple",
   "size":"Large",
   "color": ["Red", "Green"]
}
@enduml
```



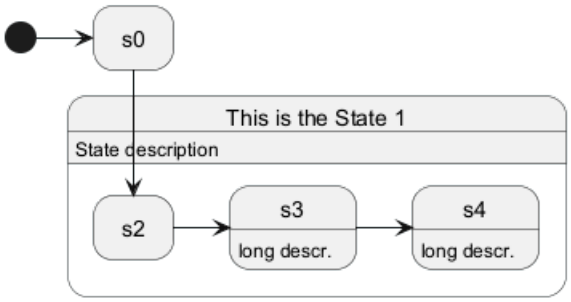
[Ref. QA-17275]

For another example, see on JSON page.

9.24 State description

You can add description to a state or to a composite state.

```
@startuml
hide empty description

state s0

state "This is the State 1" as s1 {
  s1: State description
  state s2
  state s3: long descr.
  state s4
  s4: long descr.
}

[*] -> s0
s0 --> s2

s2 -> s3
s3 -> s4
@enduml
```

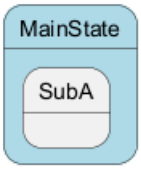


[Ref. QA-16719]

9.25 Style for Nested State Body

```
@startuml
<style>
.foo {
  state,stateBody {
    BackGroundColor lightblue;
  }
}
</style>

state MainState <<foo>> {
  state SubA
```

```
}
@enduml
```



[Ref. QA-16774]

10 Timing Diagram

A Timing Diagram in UML is a specific type of **interaction diagram** that visualizes the **timing constraints** of a system. It focuses on the **chronological order of events**, showcasing how different objects interact with each other over time. **Timing diagrams** are especially useful in **real-time systems** and **embedded systems** to understand the behavior of objects throughout a given period.

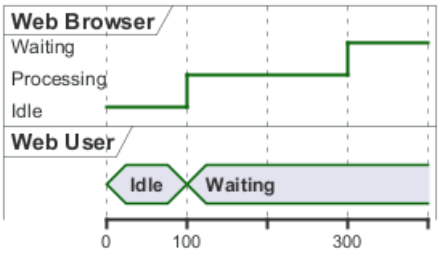
10.1 Declaring element or participant

You declare participant using the following keywords, depending on how you want them to be drawn.

Keyword	Description
`analog`	An `analog` signal is continuous, and the values are linearly interpolated between the given setpoints
`binary`	A `binary` signal restricted to only 2 states
`clock`	A `clocked` signal that repeatedly transitions from high to low, with a `period`, and an optional `pulse` and
`concise`	A simplified `concise` signal designed to show the movement of data (great for messages)
`robust`	A `robust` complex line signal designed to show the transition from one state to another (can have many s

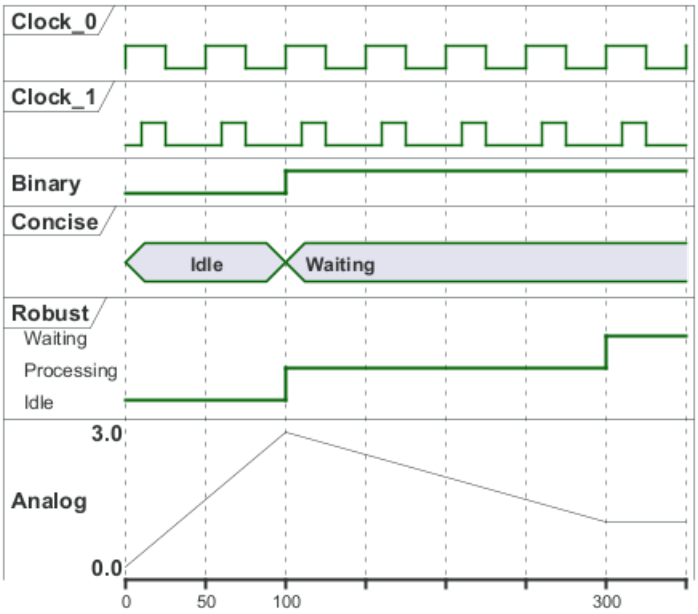
You define state change using the `@` notation, and the `is` verb.

```
@startuml
robust "Web Browser" as WB
concise "Web User" as WU

@0
WU is Idle
WB is Idle

@100
WU is Waiting
WB is Processing

@300
WB is Waiting
@enduml
```




```
@startuml
clock   "Clock_0"   as C0 with period 50
clock   "Clock_1"   as C1 with period 50 pulse 15 offset 10
binary  "Binary"  as B
concise "Concise" as C
robust  "Robust"  as R
analog  "Analog"  as A


@0
C is Idle
R is Idle
A is 0

@100
```

```
B is high
C is Waiting
R is Processing
A is 3

@300
R is Waiting
A is 1
@enduml
```



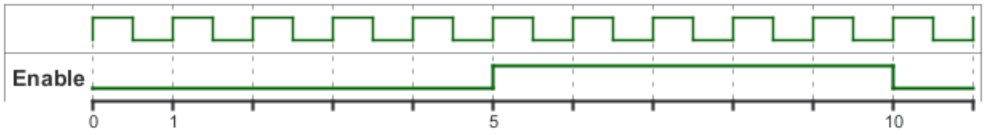
[Ref. QA-14631, QA-14647 and QA-11288]

10.2 Binary and Clock

It's also possible to have binary and clock signal, using the following keywords:

- `binary`
- `clock`

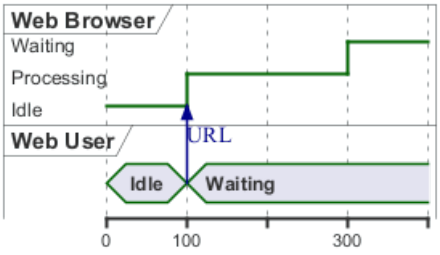
```
@startuml
clock clk with period 1
binary "Enable" as EN

@0
EN is low

@5
EN is high

@10
EN is low
@enduml
```



10.3 Adding message

You can add message using the following syntax.

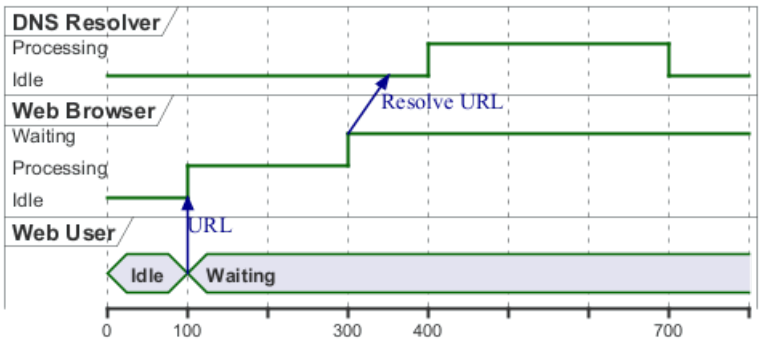
```
@startuml
robust "Web Browser" as WB
concise "Web User" as WU

@0
WU is Idle
WB is Idle

@100
WU -> WB : URL
WU is Waiting
WB is Processing

@300
WB is Waiting
@enduml
```



10.4 Relative time

It is possible to use relative time with `@`.

```
@startuml
robust "DNS Resolver" as DNS
robust "Web Browser" as WB
concise "Web User" as WU

@0
WU is Idle
WB is Idle
DNS is Idle

@+100
WU -> WB : URL
WU is Waiting
WB is Processing

@+200
WB is Waiting
WB -> DNS@+50 : Resolve URL

@+100
DNS is Processing

@+300
DNS is Idle
@enduml
```

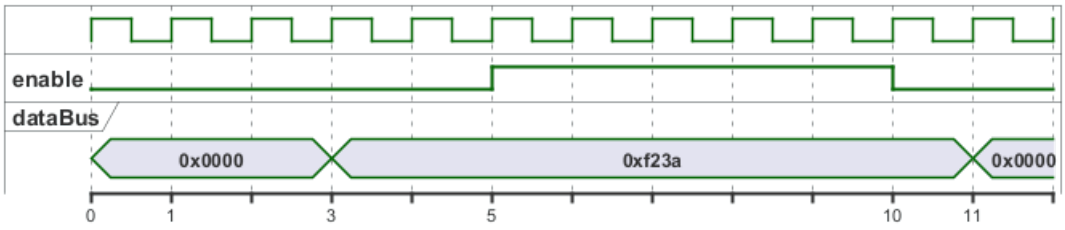


10.5 Anchor Points

Instead of using absolute or relative time on an absolute time you can define a time as an anchor point by using the `as` keyword and starting the name with a `:`.

```
@XX as :<anchor point name>
```

```
@startuml
clock clk with period 1
binary "enable" as EN
concise "dataBus" as db

@0 as :start
@5 as :en_high
@10 as :en_low
@:en_high-2 as :en_highMinus2

@:start
EN is low
db is "0x0000"

@:en_high
EN is high

@:en_low
EN is low

@:en_highMinus2
db is "0xf23a"

@:en_high+6
db is "0x0000"
@enduml
```

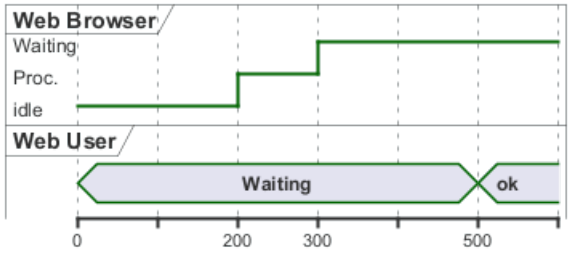


10.6 Participant oriented

Rather than declare the diagram in chronological order, you can define it by participant.

```
@startuml
```

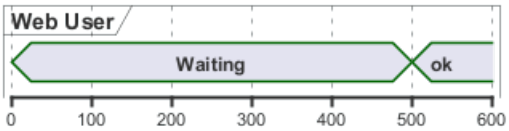
```
robust "Web Browser" as WB
concise "Web User" as WU

@WB
0 is idle
+200 is Proc.
+100 is Waiting

@WU
0 is Waiting
+500 is ok
@enduml
```



10.7 Setting scale

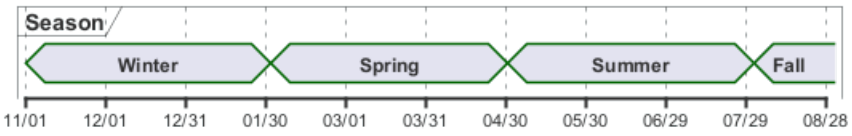
You can also set a specific scale.

```
@startuml
concise "Web User" as WU
scale 100 as 50 pixels

@WU
0 is Waiting
+500 is ok
@enduml
```



When using absolute Times/Dates, 1 ”tick” is equivalent to 1 second.

```
@startuml
concise "Season" as S
'30 days is scaled to 50 pixels
scale 2592000 as 50 pixels

@2000/11/01
S is "Winter"

@2001/02/01
S is "Spring"

@2001/05/01
S is "Summer"

@2001/08/01
S is "Fall"
@enduml
```



10.8 Initial state

You can also define an inital state.

```
@startuml
robust "Web Browser" as WB
concise "Web User" as WU

WB is Initializing
WU is Absent

@WB
0 is idle
+200 is Processing
+100 is Waiting

@WU
0 is Waiting
+500 is ok
@enduml
```

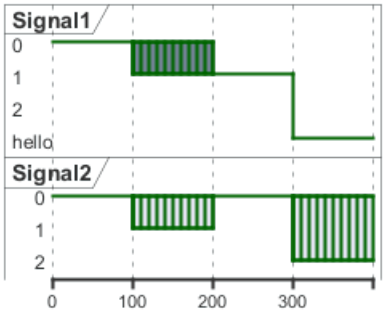
10.9 Intricated state

A signal could be in some undefined state.

10.9.1 Intricated or undefined robust state

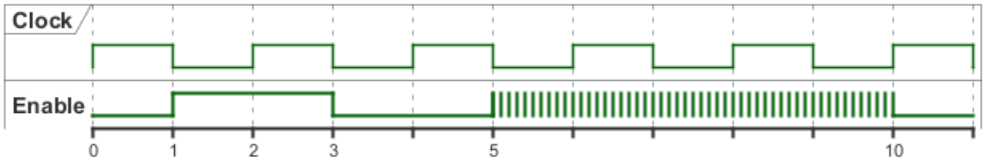
```
@startuml
robust "Signal1" as S1
robust "Signal2" as S2
S1 has 0,1,2,hello
S2 has 0,1,2
@0
S1 is 0
S2 is 0
@100
S1 is {0,1} #SlateGrey
S2 is {0,1}
@200
S1 is 1
S2 is 0
@300
S1 is hello
```

```
S2 is {0,2}
@enduml
```



10.9.2 Intricated or undefined binary state

```
@startuml
clock "Clock" as C with period 2
binary "Enable" as EN

@0
EN is low
@1
EN is high
@3
EN is low
@5
EN is {low,high}
@10
EN is low
@enduml
```



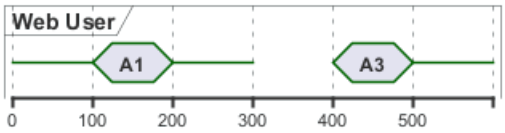
[Ref. QA-11936 and QA-15933]

10.10 Hidden state

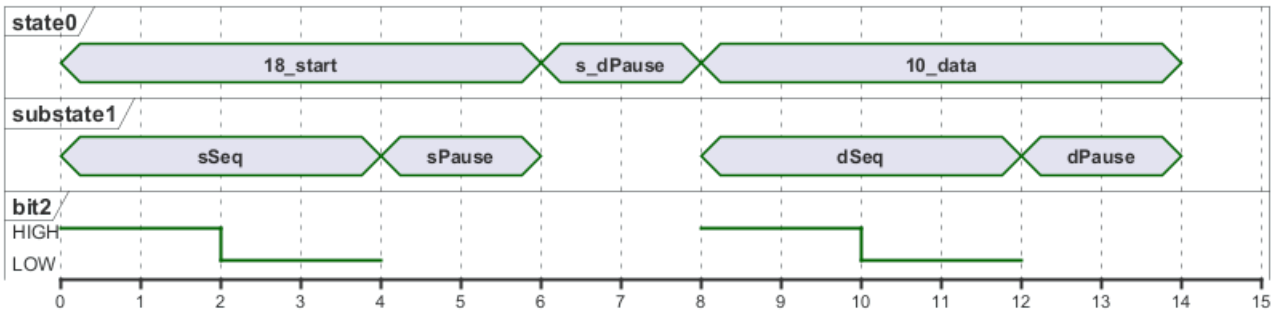
It is also possible to hide some state.

```
@startuml
concise "Web User" as WU

@0
WU is {-}

@100
WU is A1

@200
WU is {-}

@300
WU is {hidden}
```

```
@400
WU is A3

@500
WU is {-}
@enduml
```




```
@startuml
scale 1 as 50 pixels

concise state0
concise substate1
robust bit2

bit2 has HIGH,LOW

@state0
0 is 18_start
6 is s_dPause
8 is 10_data
14 is {hidden}

@substate1
0 is sSeq
4 is sPause
6 is {hidden}
8 is dSeq
12 is dPause
14 is {hidden}

@bit2
0 is HIGH
2 is LOW
4 is {hidden}
8 is HIGH
10 is LOW
12 is {hidden}
@enduml
```



[Ref. QA-12222]

10.11 Hide time axis

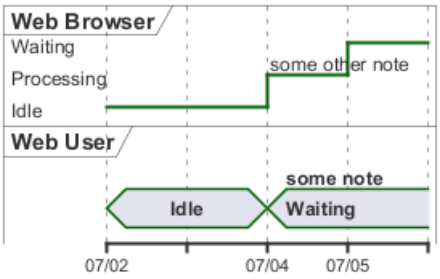
It is possible to hide time axis.

```
@startuml
hide time-axis
concise "Web User" as WU

WU is Absent

@WU
0 is Waiting
+500 is ok
@enduml
```

10.12 Using Time and Date

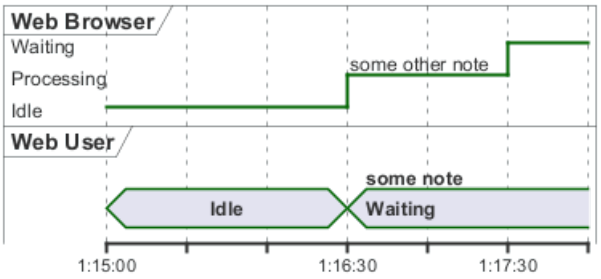
It is possible to use time or date.

```
@startuml
robust "Web Browser" as WB
concise "Web User" as WU

@2019/07/02
WU is Idle
WB is Idle

@2019/07/04
WU is Waiting : some note
WB is Processing : some other note

@2019/07/05
WB is Waiting
@enduml
```




```
@startuml
robust "Web Browser" as WB
concise "Web User" as WU

@1:15:00
WU is Idle
WB is Idle

@1:16:30
WU is Waiting : some note
WB is Processing : some other note
```

```
@1:17:30
WB is Waiting
@enduml
```

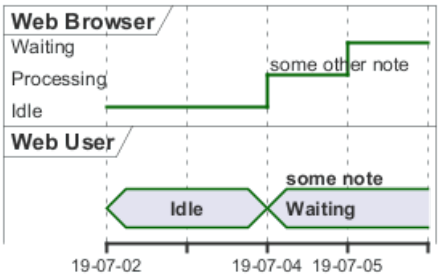


[Ref. QA-7019]

10.13 Change Date Format

It is also possible to change date format.

```
@startuml
robust "Web Browser" as WB
concise "Web User" as WU

use date format "YY-MM-dd"

@2019/07/02
WU is Idle
WB is Idle

@2019/07/04
WU is Waiting : some note
WB is Processing : some other note

@2019/07/05
WB is Waiting
@enduml
```



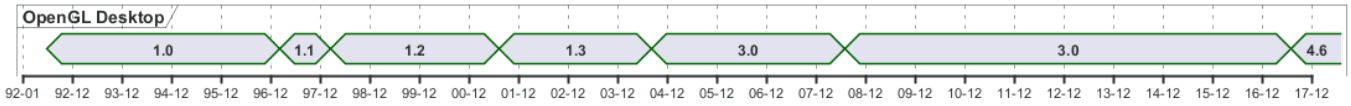
10.14 Manage time axis labels

You can manage the time-axis labels.

10.14.1 Label on each tick *(by default)*

```
@startuml
scale 31536000 as 40 pixels
use date format "yy-MM"

concise "OpenGL Desktop" as OD
```

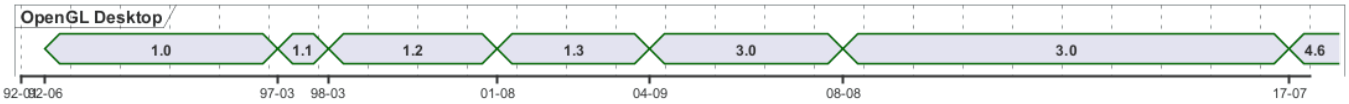
```
@1992/01/01
OD is {hidden}

@1992/06/30
OD is 1.0

@1997/03/04
OD is 1.1

@1998/03/16
OD is 1.2

@2001/08/14
OD is 1.3

@2004/09/07
OD is 3.0

@2008/08/01
OD is 3.0

@2017/07/31
OD is 4.6

@enduml
```



10.14.2 Manual label *(only when the state changes)*

```
@startuml
scale 31536000 as 40 pixels

manual time-axis
use date format "yy-MM"

concise "OpenGL Desktop" as OD

@1992/01/01
OD is {hidden}

@1992/06/30
OD is 1.0

@1997/03/04
OD is 1.1

@1998/03/16
OD is 1.2

@2001/08/14
OD is 1.3

@2004/09/07
```

```
OD is 3.0

@2008/08/01
OD is 3.0

@2017/07/31
OD is 4.6

@enduml
```

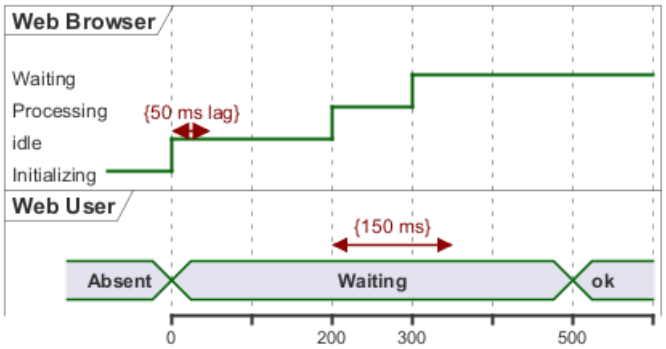


[Ref. GH-1020]

10.15 Adding constraint

It is possible to display time constraints on the diagrams.

```
@startuml
robust "Web Browser" as WB
concise "Web User" as WU

WB is Initializing
WU is Absent

@WB
0 is idle
+200 is Processing
+100 is Waiting
WB@0 <-> @50 : {50 ms lag}

@WU
0 is Waiting
+500 is ok
@200 <-> @+150 : {150 ms}
@enduml
```

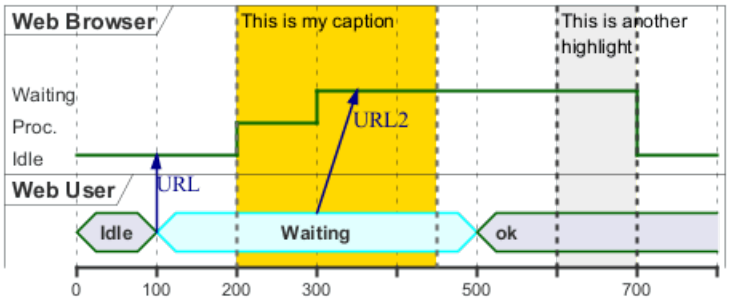


10.16 Highlighted period

You can higlight a part of diagram.

```
@startuml
robust "Web Browser" as WB
concise "Web User" as WU
```

```
@0
WU is Idle
WB is Idle

@100
WU -> WB : URL
WU is Waiting #LightCyan;line:Aqua

@200
WB is Proc.

@300
WU -> WB@350 : URL2
WB is Waiting

@+200
WU is ok

@+200
WB is Idle

highlight 200 to 450 #Gold;line:DimGrey : This is my caption
highlight 600 to 700 : This is another\nhighlight
@enduml
```



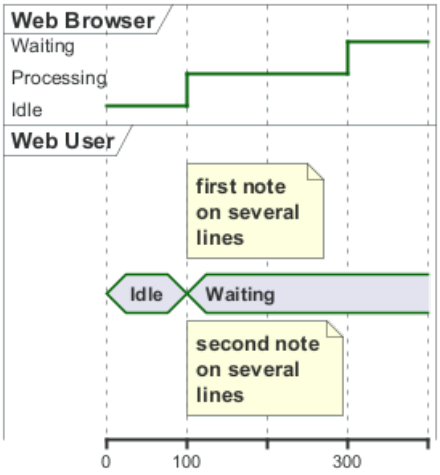
[Ref. QA-10868]

10.17 Using notes

You can use the `note top of` and `note bottom of` keywords to define notes related to a single object or participant *(available only for* `concise` *or* `binary` *object).*

```
@startuml
robust "Web Browser" as WB
concise "Web User" as WU

@0
WU is Idle
WB is Idle

@100
WU is Waiting
WB is Processing
note top of WU : first note\non several\nlines
note bottom of WU : second note\non several\nlines

@300
WB is Waiting
```

```
@enduml
```



[Ref. QA-6877, GH-1465]

10.18 Adding texts

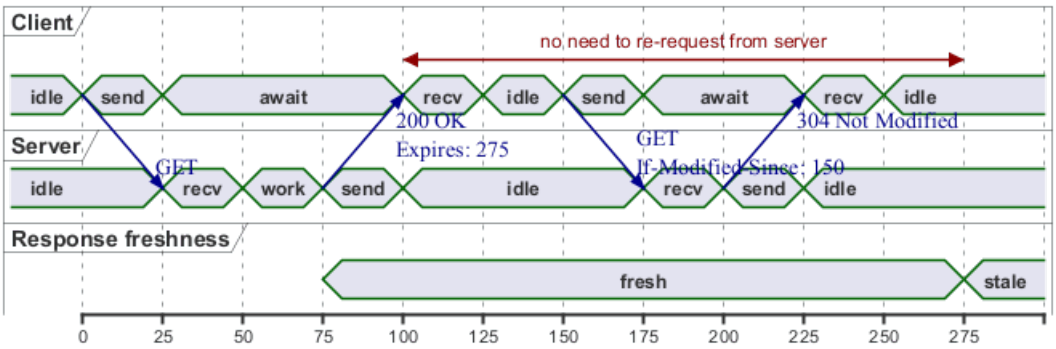
You can optionally add a title, a header, a footer, a legend and a caption:

```
@startuml
Title This is my title
header: some header
footer: some footer
legend
Some legend
end legend
caption some caption

robust "Web Browser" as WB
concise "Web User" as WU

@0
WU is Idle
WB is Idle

@100
WU is Waiting
WB is Processing

@300
WB is Waiting
@enduml
```

10.19 Complete example

Thanks to Adam Rosien for this example.

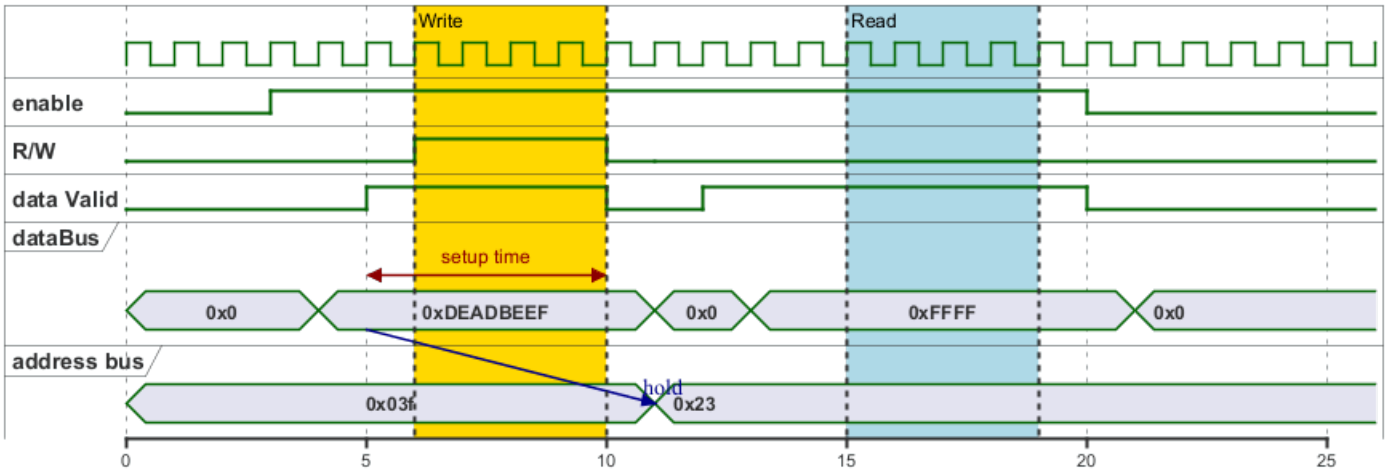
```
@startuml
concise "Client" as Client
concise "Server" as Server
concise "Response freshness" as Cache

Server is idle
Client is idle

@Client
0 is send
Client -> Server@+25 : GET
+25 is await
+75 is recv
+25 is idle
+25 is send
Client -> Server@+25 : GET\nIf-Modified-Since: 150
+25 is await
+50 is recv
+25 is idle
@100 <-> @275 : no need to re-request from server

@Server
25 is recv
+25 is work
+25 is send
Server -> Client@+25 : 200 OK\nExpires: 275
+25 is idle
+75 is recv
+25 is send
Server -> Client@+25 : 304 Not Modified
+25 is idle

@Cache
75 is fresh
+200 is stale
@enduml
```



10.20 Digital Example

```
@startuml
scale 5 as 150 pixels

clock clk with period 1
binary "enable" as en
binary "R/W" as rw
binary "data Valid" as dv
concise "dataBus" as db
concise "address bus" as addr

@6 as :write_beg
@10 as :write_end

@15 as :read_beg
@19 as :read_end


@0
en is low
db is "0x0"
addr is "0x03f"
rw is low
dv is 0

@:write_beg-3
 en is high
@:write_beg-2
 db is "0xDEADBEEF"
@:write_beg-1
dv is 1
@:write_beg
rw is high


@:write_end
rw is low
dv is low
@:write_end+1
rw is low
db is "0x0"
addr is "0x23"

@12
dv is high
```

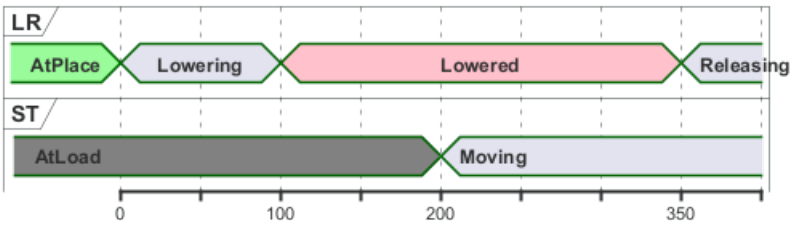
```
@13
db is "0xFFFF"

@20
en is low
dv is low
@21
db is "0x0"

highlight :write_beg to :write_end #Gold:Write
highlight :read_beg to :read_end #lightBlue:Read

db@:write_beg-1 <-> @:write_end : setup time
db@:write_beg-1 -> addr@:write_end+1 : hold
@enduml
```



10.21 Adding color

You can add color.

```
@startuml
concise "LR" as LR
concise "ST" as ST

LR is AtPlace #palegreen
ST is AtLoad #gray

@LR
0 is Lowering
100 is Lowered #pink
350 is Releasing

@ST
200 is Moving
@enduml
```

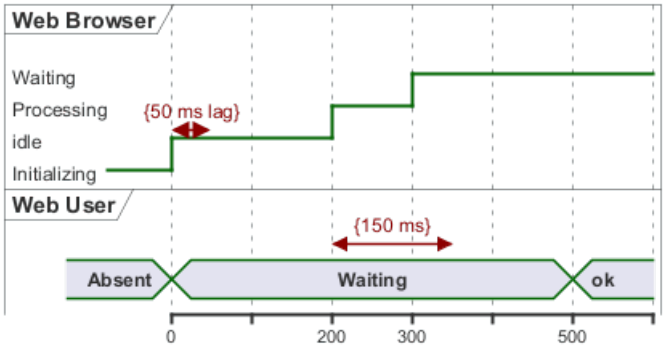


[Ref. QA-5776]

10.22 Using (global) style

10.22.1 Without style *(by default)*

```
@startuml
robust "Web Browser" as WB
concise "Web User" as WU

WB is Initializing
WU is Absent

@WB
0 is idle
+200 is Processing
+100 is Waiting
WB@0 <-> @50 : {50 ms lag}

@WU
0 is Waiting
+500 is ok
@200 <-> @+150 : {150 ms}
@enduml
```

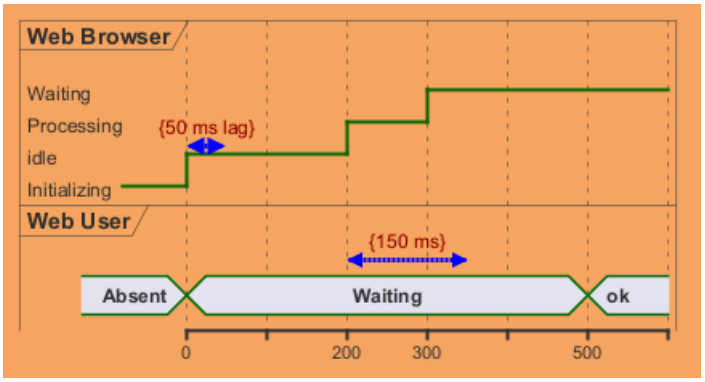


10.22.2 With style

You can use style to change rendering of elements.

```
@startuml
<style>
timingDiagram {
  document {
    BackGroundColor SandyBrown
  }
 constraintArrow {
  LineStyle 2-1
  LineThickness 3
  LineColor Blue
```

```
 }
}
</style>
robust "Web Browser" as WB
concise "Web User" as WU

WB is Initializing
WU is Absent

@WB
0 is idle
+200 is Processing
+100 is Waiting
WB@0 <-> @50 : {50 ms lag}

@WU
0 is Waiting
+500 is ok
@200 <-> @+150 : {150 ms}
@enduml
```



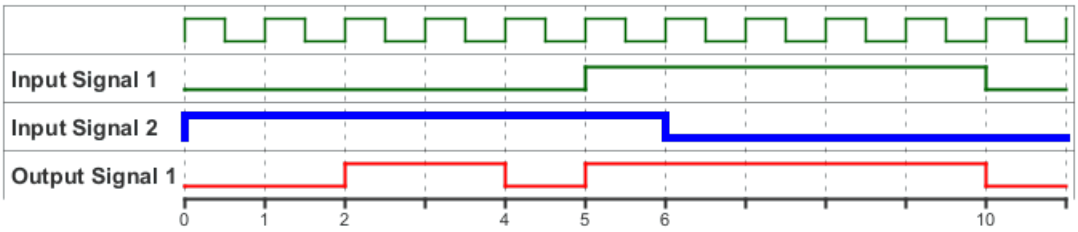
[Ref. QA-14340]

10.23 Applying Colors to specific lines

You can use the `<style>` tags and sterotyping to give a name to line attributes.

```
@startuml
<style>
timingDiagram {
  .red {
    LineColor red
  }
  .blue {
    LineColor blue
    LineThickness 5
  }
}
</style>

clock clk with period 1
binary "Input Signal 1"  as IS1
binary "Input Signal 2"  as IS2 <<blue>>
binary "Output Signal 1" as OS1 <<red>>

@0
IS1 is low
```

```
IS2 is high
OS1 is low
@2
OS1 is high
@4
OS1 is low
@5
IS1 is high
OS1 is high
@6
IS2 is low
@10
IS1 is low
OS1 is low
@enduml
```



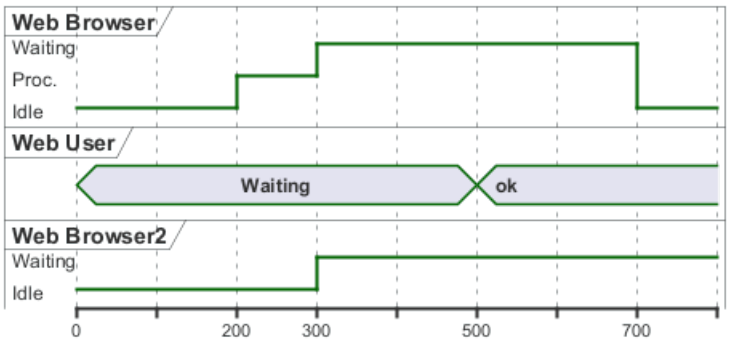
[Ref. QA-15870]

10.24 Compact mode

You can use `compact` command to compact the timing layout.

10.24.1 By default

```
@startuml
robust "Web Browser" as WB
concise "Web User" as WU
robust "Web Browser2" as WB2

@0
WU is Waiting
WB is Idle
WB2 is Idle

@200
WB is Proc.

@300
WB is Waiting
WB2 is Waiting

@500
WU is ok

@700
WB is Idle
@enduml
```



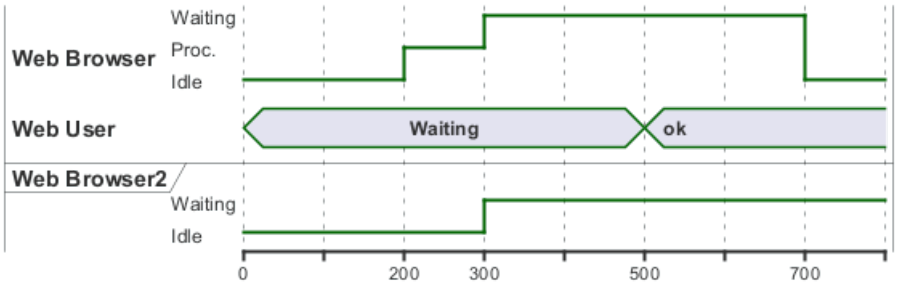
10.24.2 Global mode with `mode compact`

```
@startuml
mode compact
robust "Web Browser" as WB
concise "Web User" as WU
robust "Web Browser2" as WB2

@0
WU is Waiting
WB is Idle
WB2 is Idle

@200
WB is Proc.

@300
WB is Waiting
WB2 is Waiting

@500
WU is ok

@700
WB is Idle
@enduml
```

10.24.3 Local mode with only `compact` on element

```
@startuml
compact robust "Web Browser" as WB
compact concise "Web User" as WU
robust "Web Browser2" as WB2

@0
WU is Waiting
WB is Idle
```

```
WB2 is Idle

@200
WB is Proc.

@300
WB is Waiting
WB2 is Waiting

@500
WU is ok

@700
WB is Idle
@enduml
```



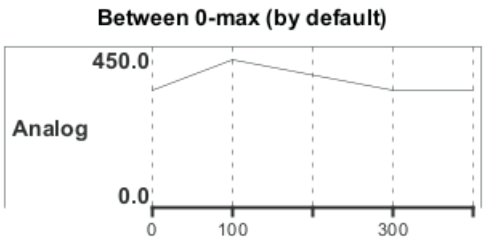
[Ref. QA-11130]

10.25 Scaling analog signal

You can scale analog signal.

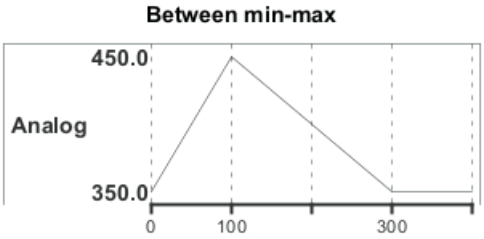
10.25.1 Without scaling: 0-max *(by default)*

```
@startuml
title Between 0-max (by default)
analog "Analog" as A

@0
A is 350

@100
A is 450

@300
A is 350
@enduml
```



10.25.2 With scaling: min-max

```
@startuml
title Between min-max
analog "Analog" between 350 and 450 as A

@0
A is 350

@100
A is 450

@300
A is 350
@enduml
```

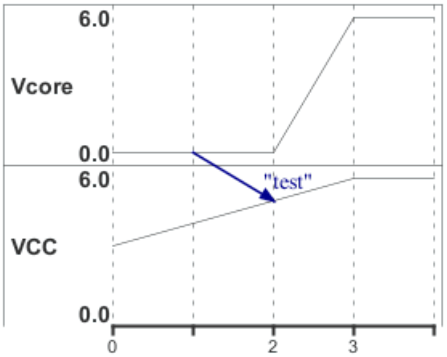


[Ref. QA-17161]

10.26 Customise analog signal

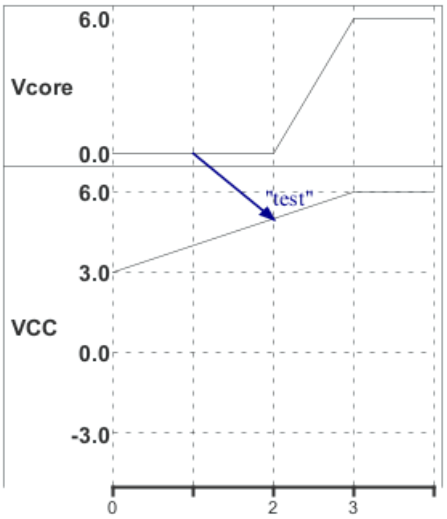
10.26.1 Without any customisation *(by default)*

```
@startuml
analog "Vcore" as VDD
analog "VCC" as VCC

@0
VDD is 0
VCC is 3
@2
VDD is 0
@3
VDD is 6
VCC is 6
VDD@1 -> VCC@2 : "test"
@enduml
```



10.26.2 With customisation (on scale, ticks and height)

```
@startuml
analog "Vcore" as VDD
analog "VCC" between -4.5 and 6.5 as VCC
VCC ticks num on multiple 3
VCC is 200 pixels height

@0
VDD is 0
VCC is 3
@2
VDD is 0
@3
VDD is 6
VCC is 6
VDD@1 -> VCC@2 : "test"
@enduml
```

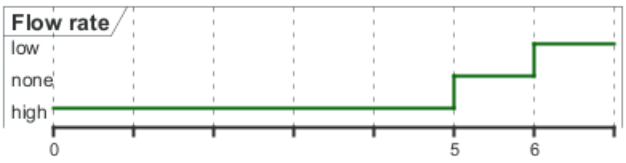


[Ref. QA-11288]

10.27 Order state of robust signal

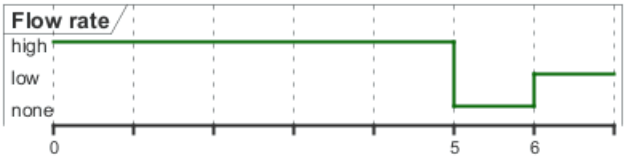
10.27.1 Without order *(by default)*

```
@startuml
robust "Flow rate" as rate

@0
rate is high

@5
rate is none

@6
rate is low
@enduml
```



10.27.2 With order

```
@startuml
robust "Flow rate" as rate
rate has high,low,none

@0
rate is high

@5
rate is none

@6
rate is low
@enduml
```



10.27.3 With order and label

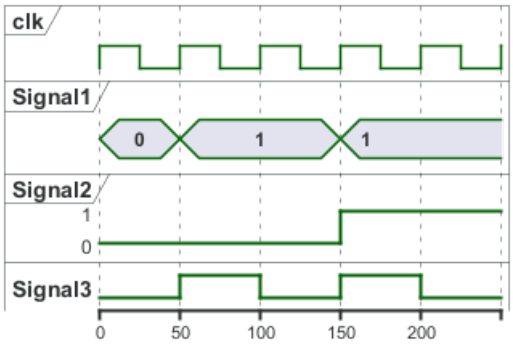
```
@startuml
robust "Flow rate" as rate
rate has "35 gpm" as high
rate has "15 gpm" as low
rate has "0 gpm" as none

@0
rate is high

@5
rate is none

@6
rate is low
@enduml
```

[Ref. QA-6651]

10.28 Defining a timing diagram

10.28.1 By Clock *(@clk)*

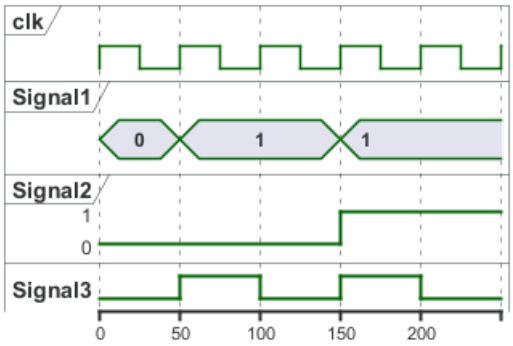
```
@startuml
clock "clk" as clk with period 50
concise "Signal1" as S1
robust "Signal2" as S2
binary "Signal3" as S3

@clk*0
S1 is 0
S2 is 0

@clk*1
S1 is 1
S3 is high

@clk*2
S3 is down

@clk*3
S1 is 1
S2 is 1
S3 is 1

@clk*4
S3 is down
@enduml
```



10.28.2 By Signal *(@S)*

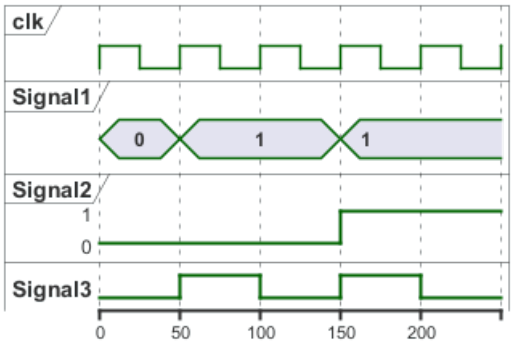
```
@startuml
clock "clk" as clk with period 50
concise "Signal1" as S1
robust "Signal2" as S2
binary "Signal3" as S3

@S1
0 is 0
50 is 1
150 is 1

@S2
0 is 0
150 is 1
```

```
@S3
50  is 1
100 is low
150 is high
200 is 0
@enduml
```



10.28.3 By Time *(@time)*

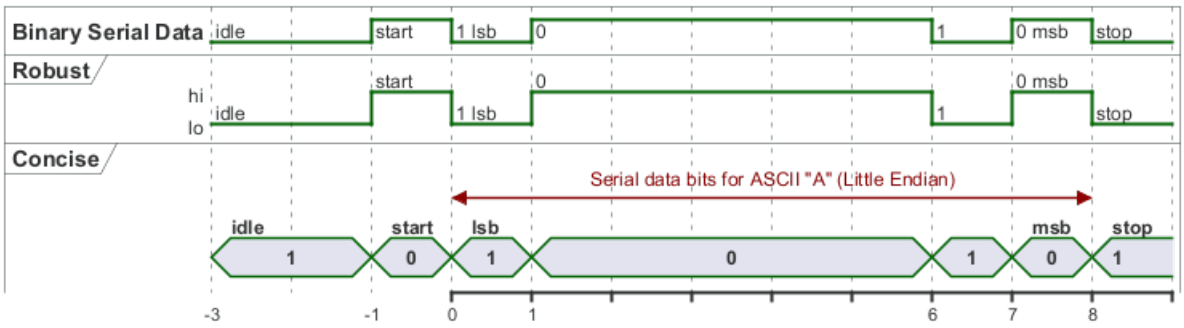
```
@startuml
clock "clk" as clk with period 50
concise "Signal1" as S1
robust "Signal2" as S2
binary "Signal3" as S3

@0
S1 is 0
S2 is 0

@50
S1 is 1
S3 is 1

@100
S3 is low

@150
S1 is 1
S2 is 1
S3 is high

@200
S3 is 0
@enduml
```



[Ref. QA-9053]

10.29 Annotate signal with comment

```
@startuml
binary "Binary Serial Data" as D
robust "Robust" as R
concise "Concise" as C

@-3
D is low: idle
R is lo: idle
C is 1: idle
@-1
D is high: start
R is hi: start
C is 0: start

@0
D is low: 1 lsb
R is lo: 1 lsb
C is 1: lsb

@1
D is high: 0
R is hi: 0
C is 0

@6
D is low: 1
R is lo: 1
C is 1

@7
D is high: 0 msb
R is hi: 0 msb
C is 0: msb

@8
D is low: stop
R is lo: stop
C is 1: stop

@0 <-> @8 : Serial data bits for ASCII "A" (Little Endian)
@enduml
```



[Ref. QA-15762, and QH-888]

11 Display JSON Data

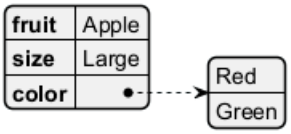
JSON format is widely used in software.

You can use PlantUML to visualize your data.

To activate this feature, the diagram must:

- begin with `@startjson` keyword
- end with `@endjson` keyword.

```
@startjson
{
   "fruit":"Apple",
   "size":"Large",
   "color": ["Red", "Green"]
}
@endjson
```



If you are looking for how to manipulate and manage JSON data on PlantUML: see rather Preprocessing JSON.

11.1 Complex example

You can use complex JSON structure.

```
@startjson
[
{
"category": "트럭",
"features": [
{
"name": "연식",
"example": "2010-05",
"type": "string"
}
],
"subcategory": [
{
"category": "트레일러",
"subcategory": [
{
"category": "컨테이너 트레일러",
"subcategory": [
{
"category": "콤바인샤시"
},
{
"category": "구즈넥(라인)샤시"
},
{
"category": "콤비라인샤시"
}
],
"features": [
```

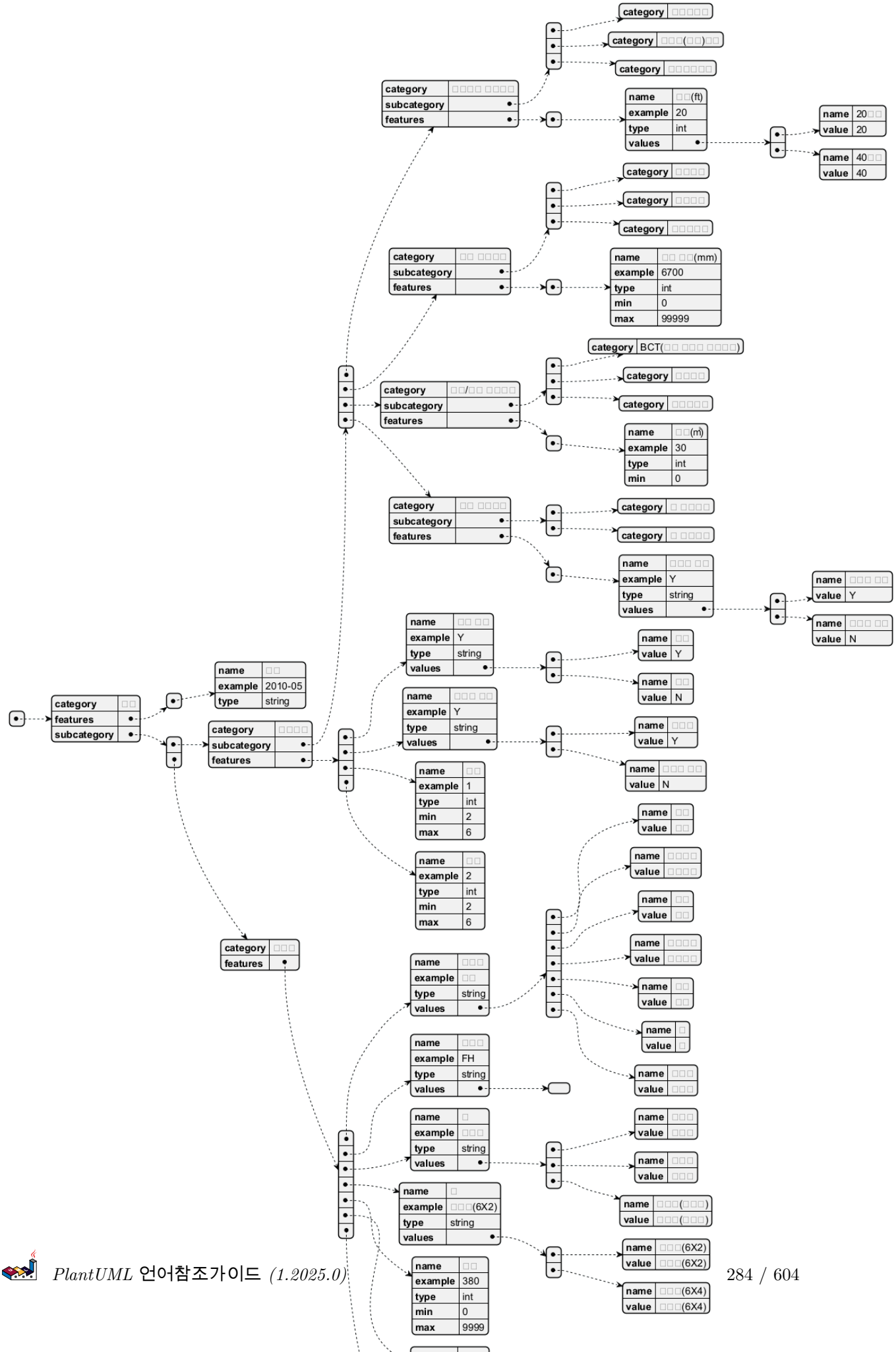
```
{
"name": "피트(ft)",
"example": "20",
"type": "int",
"values": [
{
"name": "20피트",
"value": "20"
},
{
"name": "40피트",
"value": "40"
}
]
}
]
},
{
"category": "평판 트레일러",
"subcategory": [
{
"category": "평판샤시"
},
{
"category": "로우베드"
},
{
"category": "삐딱이샤시"
}
],
"features": [
{
"name": "평판 길이(mm)",
"example": "6700",
"type": "int",
"min": 0,
"max": 99999
}
]
},
{
"category": "탱크/덤프 트레일러",
"subcategory": [
{
"category": "BCT(벌크 시멘트 트레일러)"
},
{
"category": "탱크로리"
},
{
"category": "덤프츄레라"
}
],
"features": [
{
"name": "루베(㎥)",
"example": "30",
"type": "int",
```

```
"min": 0
}
]
},
{
"category": "밴형 트레일러",
"subcategory": [
{
"category": "윙 트레일러"
},
{
"category": "탑 트레일러"
}
],
"features": [
{
"name": "냉동기 여부",
"example": "Y",
"type": "string",
"values": [
{
"name": "냉동기 있음",
"value": "Y"
},
{
"name": "냉동기 없음",
"value": "N"
}
]
}
]
}
],
"features": [
{
"name": "복륜 여부",
"example": "Y",
"type": "string",
"values": [
{
"name": "복륜",
"value": "Y"
},
{
"name": "단륜",
"value": "N"
}
]
},
{
"name": "리프팅 여부",
"example": "Y",
"type": "string",
"values": [
{
"name": "리프팅",
"value": "Y"
},
```

```
{
"name": "리프팅 없음",
"value": "N"
}
]
},
{
"name": "앞축",
"example": "1",
"type": "int",
"min": 2,
"max": 6
},
{
"name": "후축",
"example": "2",
"type": "int",
"min": 2,
"max": 6
}
]
},
{
"category": "트랙터",
"features": [
{
"name": "제조사",
"example": "현대",
"type": "string",
"values": [
{
"name": "현대",
"value": "현대"
},
{
"name": "타타대우",
"value": "타타대우"
},
{
"name": "볼보",
"value": "볼보"
},
{
"name": "스카니아",
"value": "스카니아"
},
{
"name": "벤츠",
"value": "벤츠"
},
{
"name": "만",
"value": "만"
},
{
"name": "이베코",
"value": "이베코"
}
```

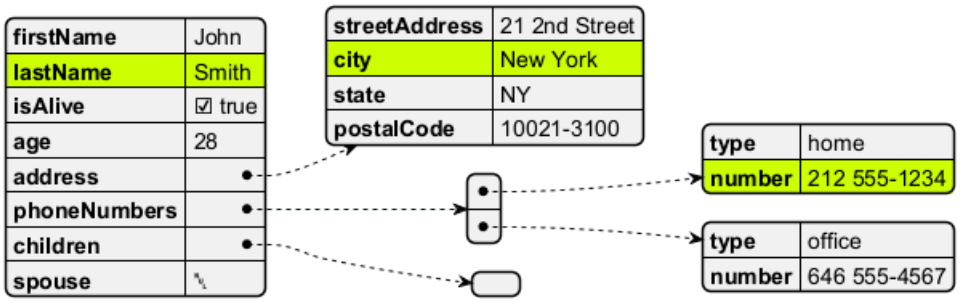
```
]
},
{
"name": "모델명",
"example": "FH",
"type": "string",
"values": []
},
{
"name": "캡",
"example": "표준탑",
"type": "string",
"values": [
{
"name": "표준탑",
"value": "표준탑"
},
{
"name": "중간탑",
"value": "중간탑"
},
{
"name": "하이탑(글로벌)",
"value": "하이탑(글로벌)"
}
]
},
{
"name": "측",
"example": "원데후(6X2)",
"type": "string",
"values": [
{
"name": "원데후(6X2)",
"value": "원데후(6X2)"
},
{
"name": "투데후(6X4)",
"value": "투데후(6X4)"
}
]
},
{
"name": "마력",
"example": "380",
"type": "int",
"min": 0,
"max": 9999
},
{
"name": "변속기",
"example": "자동",
"type": "string",
"values": [
{
"name": "자동",
"value": "자동"
},
```

```
{
"name": "수동",
"value": "수동"
}
]
},
{
"name": "주행거리",
"example": "100000",
"type": "int",
"min": 0,
"max": 999999
}
]
}
]
}
]
@endjson
```


category □□
features
subcategory
name □□
example 2010-05
type string
category □□□□
subcategory
features
category □□□□□
category □□□(□□)□□
category □□□□□□
category □□□□ □□□□
subcategory
features
name □□(ft)
example 20
type int
values
name 20□□
value 20
name 40□□
value 40
category □□□□
category □□□□
category □□□□□
category □□ □□□□
subcategory
features
name □□ □□(mm)
example 6700
type int
min 0
max 99999
category BCT(□□ □□□ □□□□)
category □□□□
category □□□□□
category □□/□□ □□□□
subcategory
features
name □□(㎡)
example 30
type int
min 0
category □□ □□□□
subcategory
features
category □ □□□□
category □ □□□□
name □□□ □□
example Y
type string
values
name □□□ □□
value Y
name □□□ □□
value N
name □□ □□
example Y
type string
values
name □□
value Y
name □□
value N
name □□□
value Y
name □□□ □□
value N
name □□
example 1
type int
min 2
max 6
name □□
example 2
type int
min 2
max 6
category □□□
features
name □□□
example □□
type string
values
name □□
value □□
name □□□□
value □□□□
name □□
value □□
name □□□□
value □□□□
name □□
value □□
name □
value □
name □□□
example FH
type string
values
name □□□
value □□□
name □
example □□□
type string
values
name □□□□
value □□□□
name □□□
value □□□
name □
example □□□(6X2)
type string
values
name □□□(□□□)
value □□□(□□□)
name □□□(6X2)
value □□□(6X2)
name □□
example 380
type int
min 0
max 9999
name □□□(6X4)
value □□□(6X4)

11.2 Highlight parts

```
@startjson
#highlight "lastName"
#highlight "address" / "city"
#highlight "phoneNumbers" / "0" / "number"
{
  "firstName": "John",
  "lastName": "Smith",
  "isAlive": true,
  "age": 28,
  "address": {
    "streetAddress": "21 2nd Street",
    "city": "New York",
    "state": "NY",
    "postalCode": "10021-3100"
  },
  "phoneNumbers": [
    {
      "type": "home",
      "number": "212 555-1234"
    },
    {
      "type": "office",
      "number": "646 555-4567"
    }
  ],
  "children": [],
  "spouse": null
}
@endjson
```

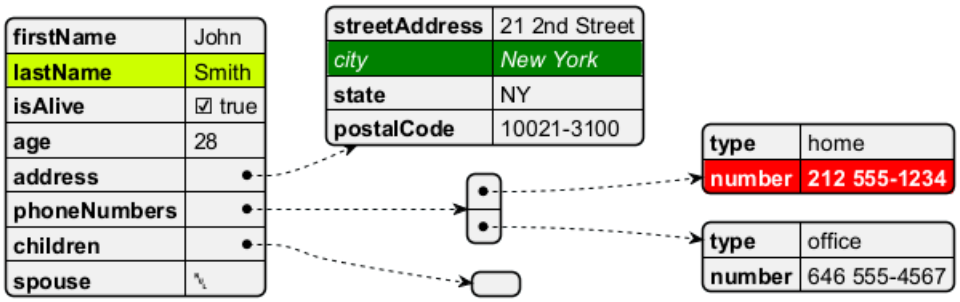


11.3 Using different styles for highlight

It is possible to have different styles for different highlights.

```
@startjson
<style>
  .h1 {
    BackGroundColor green
    FontColor white
    FontStyle italic
  }
  .h2 {
    BackGroundColor red
    FontColor white
    FontStyle bold
  }
</style>
```

```
#highlight "lastName"
#highlight "address" / "city" <<h1>>
#highlight "phoneNumbers" / "0" / "number" <<h2>>
{
  "firstName": "John",
  "lastName": "Smith",
  "isAlive": true,
  "age": 28,
  "address": {
    "streetAddress": "21 2nd Street",
    "city": "New York",
    "state": "NY",
    "postalCode": "10021-3100"
  },
  "phoneNumbers": [
    {
      "type": "home",
      "number": "212 555-1234"
    },
    {
      "type": "office",
      "number": "646 555-4567"
    }
  ],
  "children": [],
  "spouse": null
}
@endjson
```



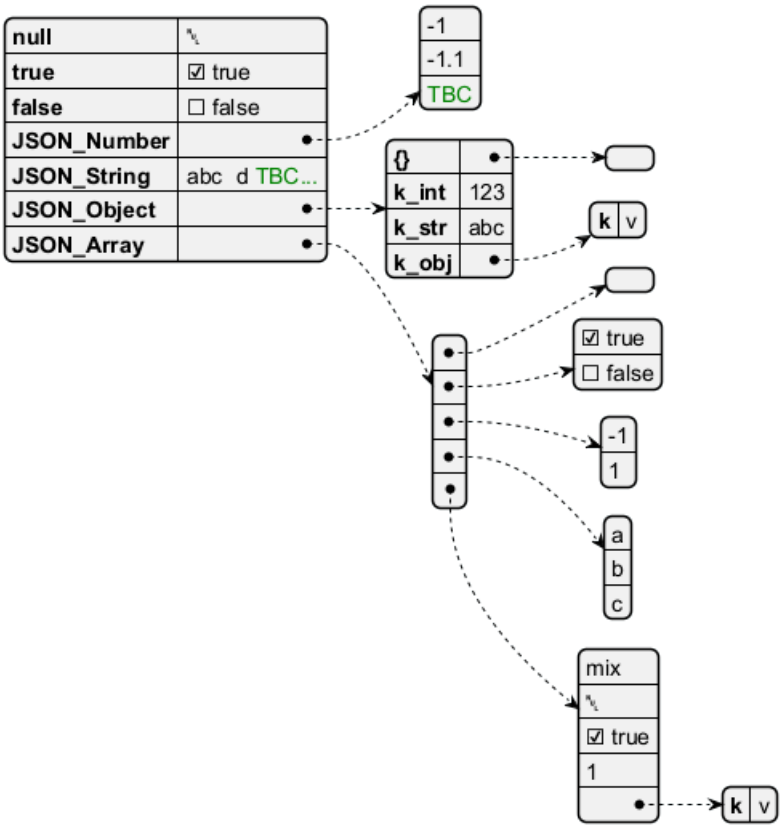
[Ref. QA-15756, GH-1393]

11.4 JSON basic element

11.4.1 Synthesis of all JSON basic element

```
@startjson
{
"null": null,
"true": true,
"false": false,
"JSON_Number": [-1, -1.1, "<color:green>TBC"],
"JSON_String": "a\nb\rc\td <color:green>TBC...",
"JSON_Object": {
  "{}": {},
  "k_int": 123,
  "k_str": "abc",
  "k_obj": {"k": "v"}
},
"JSON_Array" : [
```

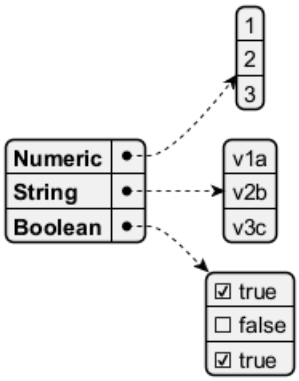
```
  [],
  [true, false],
  [-1, 1],
  ["a", "b", "c"],
  ["mix", null, true, 1, {"k": "v"}]
]
}
@endjson
```



11.5 JSON array or table

11.5.1 Array type

```
@startjson
{
"Numeric": [1, 2, 3],
"String ": ["v1a", "v2b", "v3c"],
"Boolean": [true, false, true]
}
@endjson
```



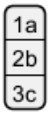
11.5.2 Minimal array or table

11.5.3 Number array

```
@startjson
[1, 2, 3]
@endjson
```

11.5.4 String array

```
@startjson
["1a", "2b", "3c"]
@endjson
```

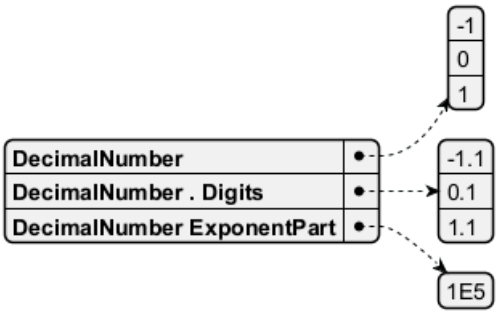


11.5.5 Boolean array

```
@startjson
[true, false, true]
@endjson
```

11.6 JSON numbers

```
@startjson
{
"DecimalNumber": [-1, 0, 1],
"DecimalNumber . Digits": [-1.1, 0.1, 1.1],
"DecimalNumber ExponentPart": [1E5]
}
@endjson
```



11.7 JSON strings

11.7.1 JSON Unicode

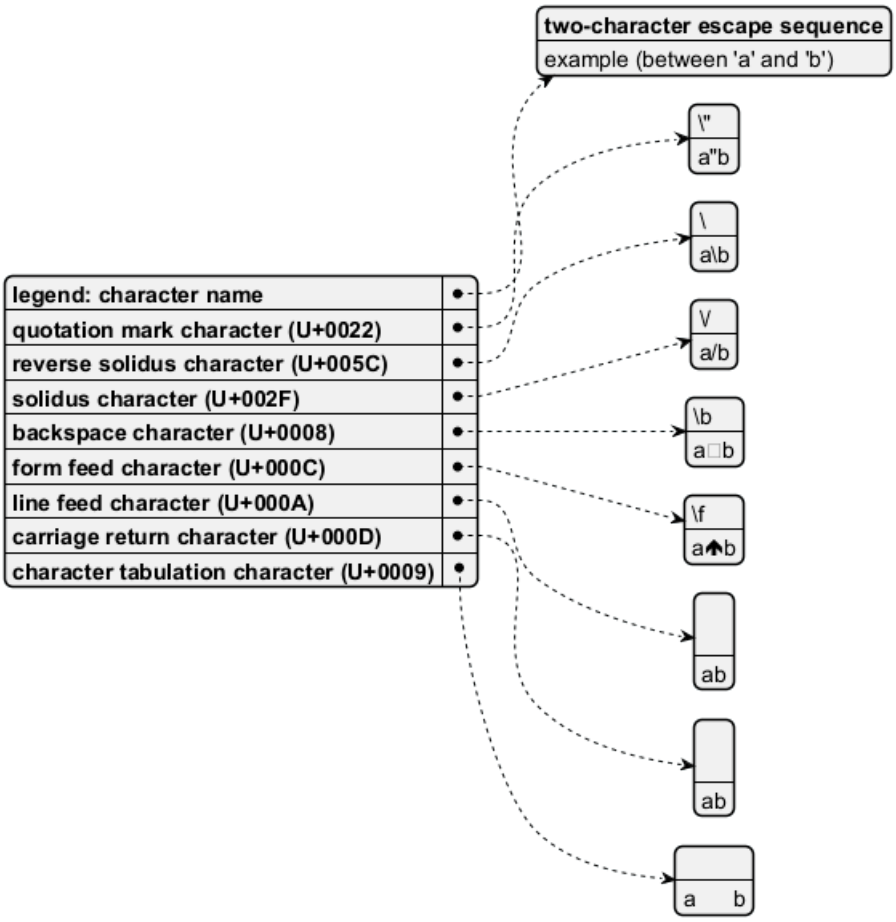
On JSON you can use Unicode directly or by using escaped form like `\uXXXX`.

```
@startjson
{
  "<color:blue><b>code": "<color:blue><b>value",
  "a\\u005Cb":            "a\u005Cb",
  "\\uD83D\\uDE10":       "\uD83D\uDE10",
  " ":                  " "
}
@endjson
```

code	value
a\u005Cb	a\b
\uD83D\uDE10	😐
😐	😐

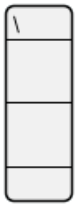
11.7.2 JSON two-character escape sequence

```
@startjson
{
 "**legend**: character name":                ["**two-character escape sequence**", "example (between
 "quotation mark character (U+0022)":         ["\\\"", "a\"b"],
 "reverse solidus character (U+005C)":        ["\\\\", "a\\b"],
 "solidus character (U+002F)":                ["\\\/", "a\/b"],
 "backspace character (U+0008)":              ["\\b", "a\bb"],
 "form feed character (U+000C)":              ["\\f", "a\fb"],
 "line feed character (U+000A)":              ["\\n", "a\nb"],
 "carriage return character (U+000D)":        ["\\r", "a\rb"],
 "character tabulation character (U+0009)":   ["\\t", "a\tb"]
}
@endjson
```



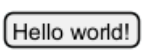
TODO: FIXME FIXME or not , on the same item as `\n` management in PlantUML *See Report Bug on QA-13066* **TODO:** FIXME

```
@startjson
[
"\\\\",
"\\n",
"\\r",
"\\t"
]
@endjson
```



11.8 Minimal JSON examples

```
@startjson
"Hello world!"
@endjson
```



```
@startjson
42
@endjson
```


```
@startjson
true
@endjson
```

(Examples come from STD 90 - Examples)

11.9 Empty table or list

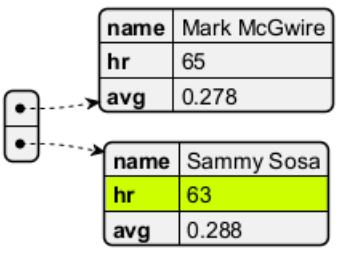
```
@startjson
{
  "empty_tab": [],
  "empty_list": {}
}
@endjson
```

[Ref. QA-14397]

11.10 Using (global) style

11.10.1 Without style *(by default)*

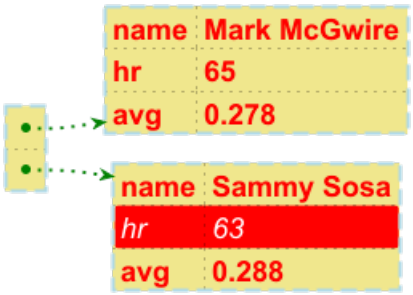
```
@startjson
#highlight "1" / "hr"
[
  {
    "name": "Mark McGwire",
    "hr":   65,
    "avg":  0.278
  },
  {
    "name": "Sammy Sosa",
    "hr":   63,
    "avg":  0.288
  }
]
@endjson
```



11.10.2 With style

You can use style to change rendering of elements.

```
@startjson
<style>
jsonDiagram {
  node {
    BackGroundColor Khaki
    LineColor lightblue
    FontName Helvetica
    FontColor red
    FontSize 18
    FontStyle bold
    RoundCorner 0
    LineThickness 2
    LineStyle 10-5
    separator {
      LineThickness 0.5
      LineColor black
      LineStyle 1-5
    }
  }
  arrow {
    BackGroundColor lightblue
    LineColor green
    LineThickness 2
    LineStyle 2-5
  }
  highlight {
    BackGroundColor red
    FontColor white
    FontStyle italic
  }
}
</style>
#highlight "1" / "hr"
[
  {
    "name": "Mark McGwire",
    "hr":   65,
    "avg":  0.278
  },
  {
    "name": "Sammy Sosa",
    "hr":   63,
    "avg":  0.288
  }
]
@endjson
```

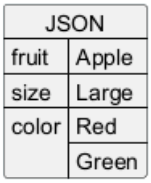


[Adapted from QA-13123 and QA-13288]

11.11 Display JSON Data on Class or Object diagram

11.11.1 Simple example

```
@startuml
class Class
object Object
json JSON {
   "fruit":"Apple",
   "size":"Large",
   "color": ["Red", "Green"]
}
@enduml
```

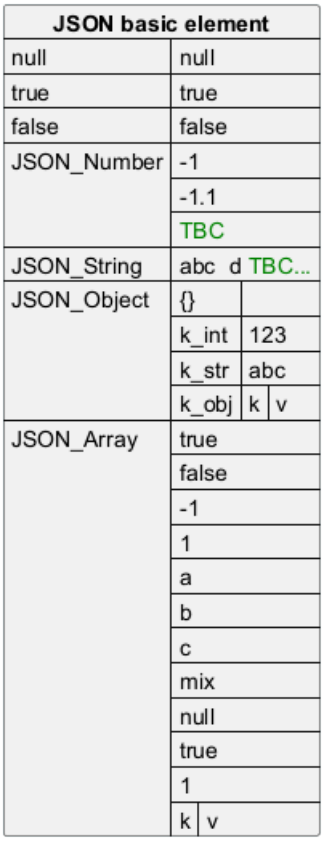


[Ref. QA-15481]

11.11.2 Complex example: with all JSON basic element

```
@startuml
json "<b>JSON basic element" as J {
"null": null,
"true": true,
"false": false,
"JSON_Number": [-1, -1.1, "<color:green>TBC"],
"JSON_String": "a\nb\rc\td <color:green>TBC...",
"JSON_Object": {
  "{}": {},
  "k_int": 123,
  "k_str": "abc",
  "k_obj": {"k": "v"}
},
"JSON_Array" : [
  [],
  [true, false],
  [-1, 1],
```

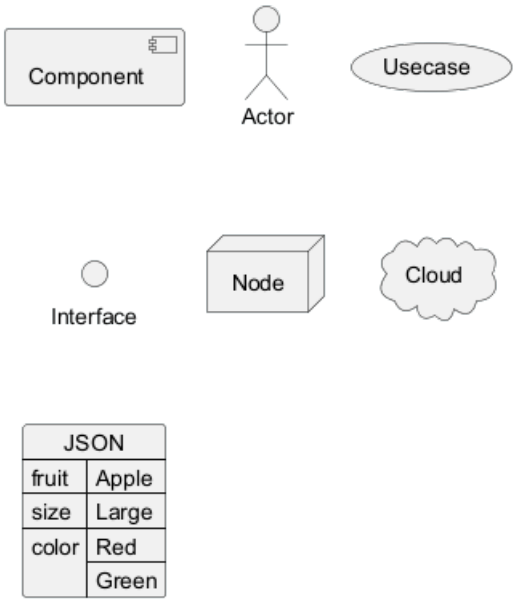
```
  ["a", "b", "c"],
  ["mix", null, true, 1, {"k": "v"}]
]
}
@enduml
```



11.12 Display JSON Data on Deployment (Usecase, Component, Deployment) diagram

11.12.1 Simple example

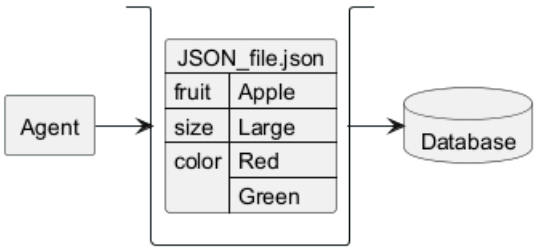
```
@startuml
allowmixing

component Component
actor     Actor
usecase   Usecase
()        Interface
node      Node
cloud     Cloud

json JSON {
   "fruit":"Apple",
   "size":"Large",
   "color": ["Red", "Green"]
}
@enduml
```



[Ref. QA-15481]

Complex example: with arrow

```
@startuml
allowmixing

agent Agent
stack {
  json "JSON_file.json" as J {
    "fruit":"Apple",
    "size":"Large",
    "color": ["Red", "Green"]
  }
}
database Database

Agent -> J
J -> Database
@enduml
```

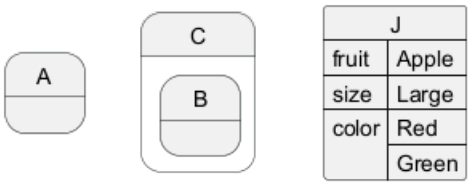


11.13 Display JSON Data on State diagram

11.13.1 Simple example

```
@startuml
state "A" as stateA
state "C" as stateC {
 state B
}
```

```
json J {
   "fruit":"Apple",
   "size":"Large",
   "color": ["Red", "Green"]
}
@enduml
```

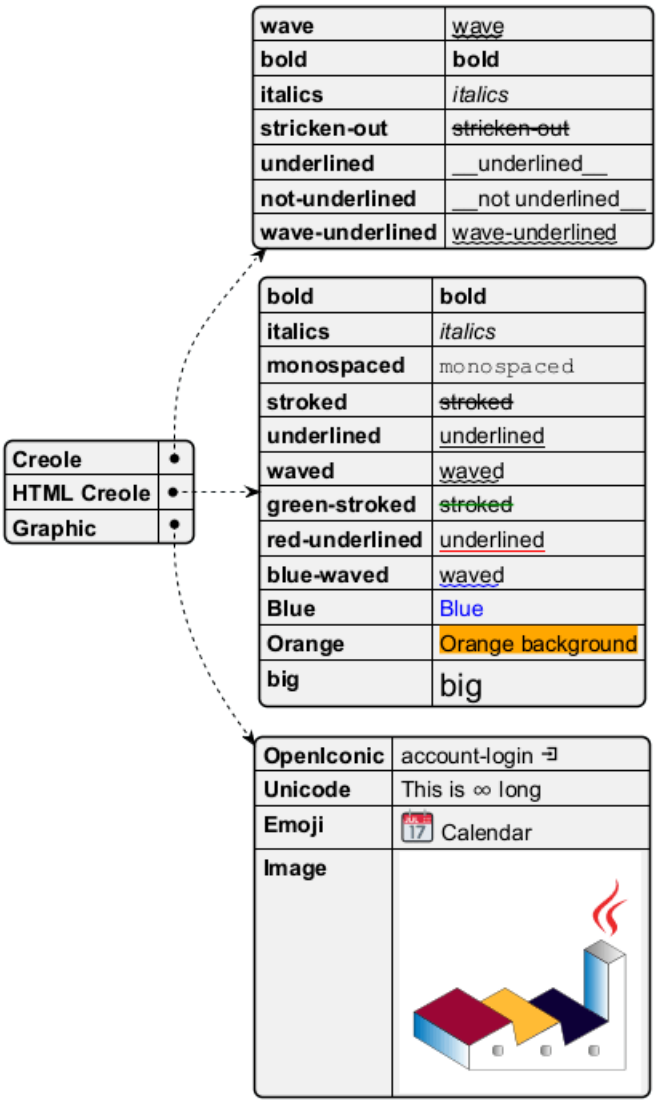


[Ref. QA-17275]

11.14 Creole on JSON

You can use Creole or HTML Creole on JSON diagram:

```
@startjson
{
"Creole":
  {
  "wave": "~~wave~~",
  "bold": "**bold**",
  "italics": "//italics//",
  "stricken-out": "--stricken-out--",
  "underlined": "__underlined__",
  "not-underlined": "~__not underlined__",
  "wave-underlined": "~~wave-underlined~~"
  },
"HTML Creole":
  {
  "bold": "<b>bold",
  "italics": "<i>italics",
  "monospaced": "<font:monospaced>monospaced",
  "stroked": "<s>stroked",
  "underlined": "<u>underlined",
  "waved": "<w>waved",
  "green-stroked": "<s:green>stroked",
  "red-underlined": "<u:red>underlined",
  "blue-waved": "<w:#0000FF>waved",
  "Blue": "<color:blue>Blue",
  "Orange": "<back:orange>Orange background",
  "big": "<size:20>big"
  },
"Graphic":
  {
  "OpenIconic": "account-login <&account-login>",
  "Unicode": "This is <U+221E> long",
  "Emoji": "<:calendar:> Calendar",
  "Image": "<img:https://plantuml.com/logo3.png>"
  }
}
@endjson
```


wave
wave
bold
bold
italics
italics
stricken-out
stricken-out
underlined
__underlined__
not-underlined
__not underlined__
wave-underlined
wave-underlined
Creole
HTML Creole
Graphic
bold
bold
italics
italics
monospaced
monospaced
stroked
stroked
underlined
underlined
waved
waved
green-stroked
stroked
red-underlined
underlined
blue-waved
waved
Blue
Blue
Orange
Orange background
big
big
OpenIconic
account-login
Unicode
This is ∞ long
Emoji
Calendar
Image

12 Display YAML Data

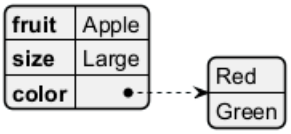
YAML format is widely used in software.

You can use PlantUML to visualize your data.

To activate this feature, the diagram must:

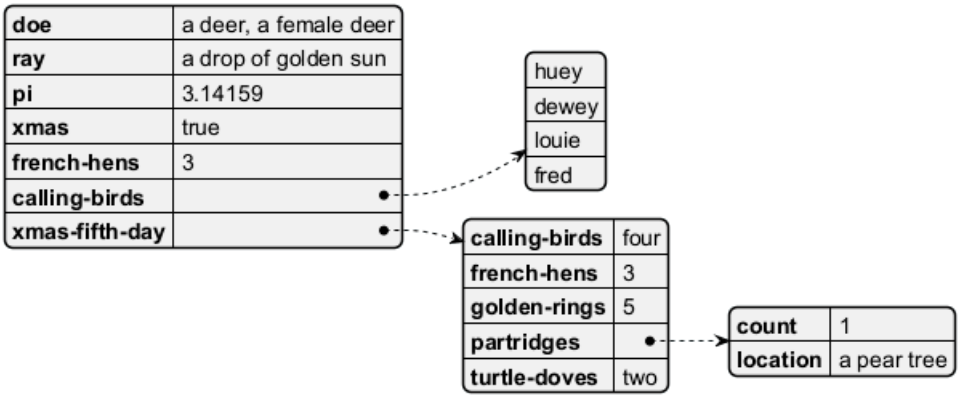
- begin with `@startyaml` keyword
- end with `@endyaml` keyword.

```
@startyaml
fruit: Apple
size: Large
color:
  - Red
  - Green
@endyaml
```



12.1 Complex example

```
@startyaml
doe: "a deer, a female deer"
ray: "a drop of golden sun"
pi: 3.14159
xmas: true
french-hens: 3
calling-birds:
- huey
- dewey
- louie
- fred
xmas-fifth-day:
calling-birds: four
french-hens: 3
golden-rings: 5
partridges:
count: 1
location: "a pear tree"
turtle-doves: two
@endyaml
```



12.2 Specific key (with symbols or unicode)

```
@startyaml
@fruit: Apple
$size: Large
&color: Red
 : Heart
%: Per mille
@endyaml
```

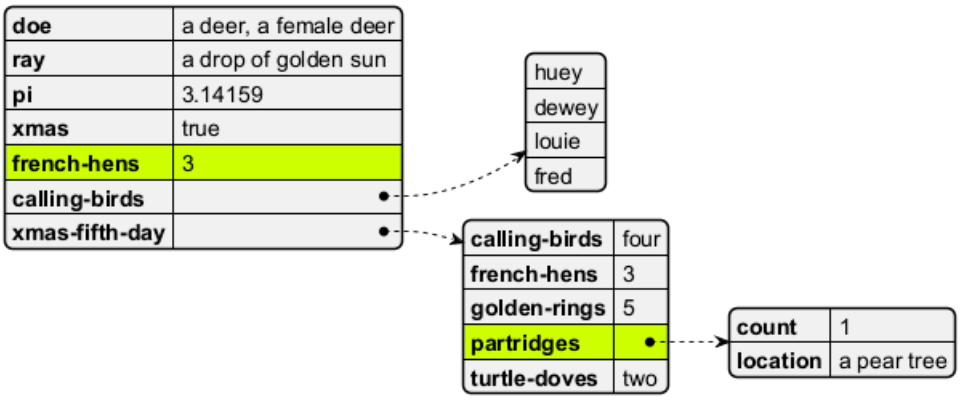
@fruit	Apple
$size	Large
&color	Red
♥	Heart
‰	Per mille

[Ref. QA-13376]

12.3 Highlight parts

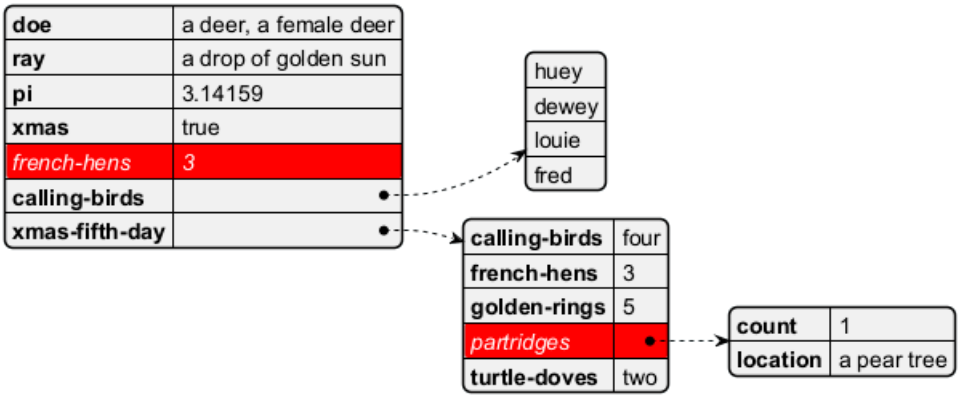
12.3.1 Normal style

```
@startyaml
#highlight "french-hens"
#highlight "xmas-fifth-day" / "partridges"

doe: "a deer, a female deer"
ray: "a drop of golden sun"
pi: 3.14159
xmas: true
french-hens: 3
calling-birds:
- huey
- dewey
- louie
- fred
xmas-fifth-day:
calling-birds: four
french-hens: 3
golden-rings: 5
partridges:
count: 1
location: "a pear tree"
turtle-doves: two
@endyaml
```



12.3.2 Customised style

```
@startyaml
<style>
yamlDiagram {
    highlight {
      BackGroundColor red
      FontColor white
      FontStyle italic
    }
}
</style>
#highlight "french-hens"
#highlight "xmas-fifth-day" / "partridges"

doe: "a deer, a female deer"
ray: "a drop of golden sun"
pi: 3.14159
xmas: true
french-hens: 3
calling-birds:
- huey
- dewey
- louie
- fred
xmas-fifth-day:
calling-birds: four
french-hens: 3
golden-rings: 5
partridges:
count: 1
location: "a pear tree"
turtle-doves: two
@endyaml
```



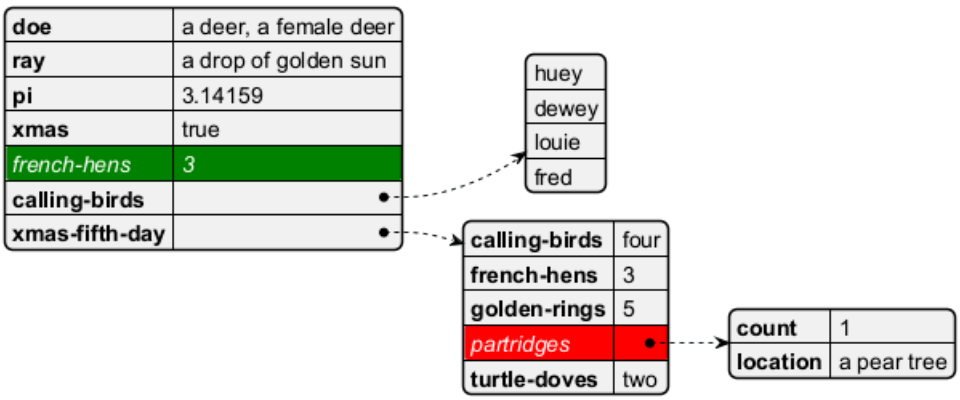
[Ref. QA-13288]

12.4 Using different styles for highlight

It is possible to have different styles for different highlights.

```
@startyaml
<style>
    .h1 {
      BackGroundColor green
      FontColor white
```

```
      FontStyle italic
    }
    .h2 {
      BackGroundColor red
      FontColor white
      FontStyle italic
    }
</style>
#highlight "french-hens" <<h1>>
#highlight "xmas-fifth-day" / "partridges" <<h2>>

doe: "a deer, a female deer"
ray: "a drop of golden sun"
pi: 3.14159
xmas: true
french-hens: 3
calling-birds:
- huey
- dewey
- louie
- fred
xmas-fifth-day:
calling-birds: four
french-hens: 3
golden-rings: 5
partridges:
count: 1
location: "a pear tree"
turtle-doves: two
@endyaml
```



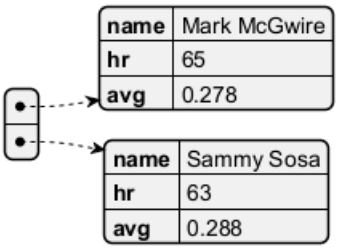
[Ref. QA-15756, GH-1393]

12.5 Using (global) style

12.5.1 Without style *(by default)*

```
@startyaml
  -
    name: Mark McGwire
    hr:   65
    avg:  0.278
  -
    name: Sammy Sosa
    hr:   63
```

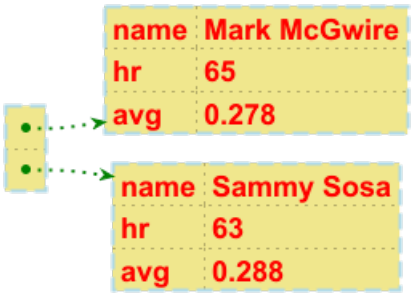
```
    avg:  0.288
@endyaml
```



12.5.2 With style

You can use style to change rendering of elements.

```
@startyaml
<style>
yamlDiagram {
  node {
    BackGroundColor lightblue
    LineColor lightblue
    FontName Helvetica
    FontColor red
    FontSize 18
    FontStyle bold
    BackGroundColor Khaki
    RoundCorner 0
    LineThickness 2
    LineStyle 10-5
    separator {
      LineThickness 0.5
      LineColor black
      LineStyle 1-5
    }
  }
  arrow {
    BackGroundColor lightblue
    LineColor green
    LineThickness 2
    LineStyle 2-5
  }
}
</style>
  -
    name: Mark McGwire
    hr:   65
    avg:  0.278
  -
    name: Sammy Sosa
    hr:   63
    avg:  0.288
@endyaml
```

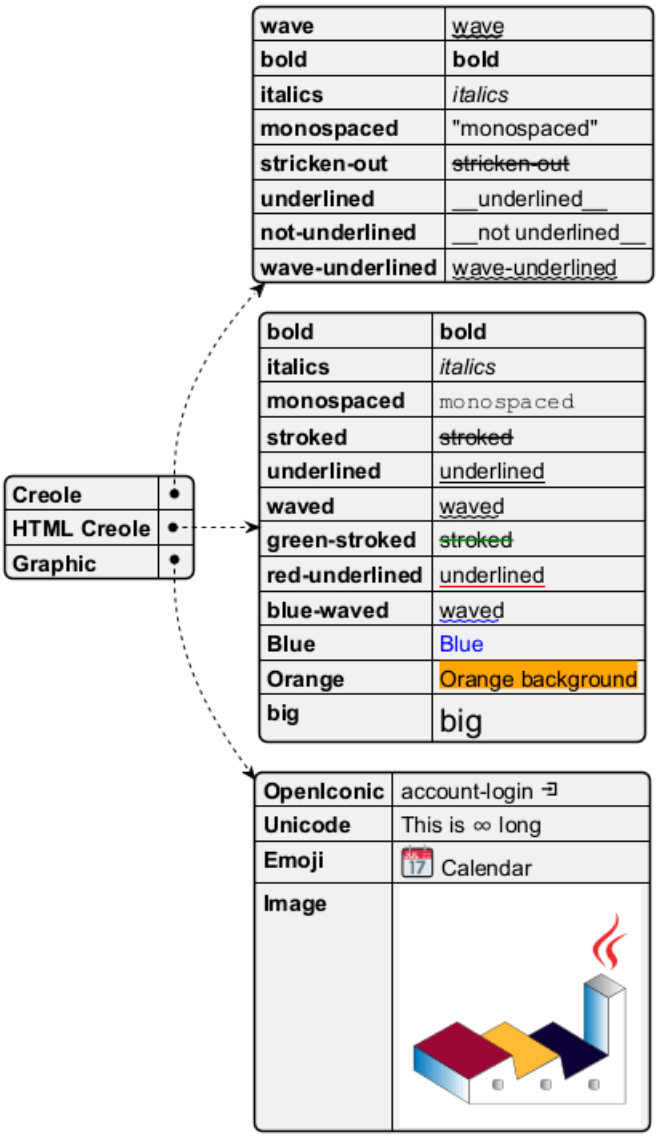


[Ref. QA-13123]

12.6 Creole on YAML

You can use Creole or HTML Creole on YAML diagram:

```
@startyaml
Creole:
  wave: ~~wave~~
  bold: **bold**
  italics: //italics//
  monospaced: ""monospaced""
  stricken-out: --stricken-out--
  underlined: __underlined__
  not-underlined: ~__not underlined__
  wave-underlined: ~~wave-underlined~~
HTML Creole:
  bold: <b>bold
  italics: <i>italics
  monospaced: <font:monospaced>monospaced
  stroked: <s>stroked
  underlined: <u>underlined
  waved: <w>waved
  green-stroked: <s:green>stroked
  red-underlined: <u:red>underlined
  blue-waved: <w:#0000FF>waved
  Blue: <color:blue>Blue
  Orange: <back:orange>Orange background
  big: <size:20>big
Graphic:
  OpenIconic: account-login <&account-login>
  Unicode: This is <U+221E> long
  Emoji: <:calendar:> Calendar
  Image: <img:https://plantuml.com/logo3.png>
@endyaml
```


wave
wave
bold
bold
italics
italics
monospaced
"monospaced"
stricken-out
stricken-out
underlined
__underlined__
not-underlined
__not underlined__
wave-underlined
wave-underlined
Creole
HTML Creole
Graphic
bold
bold
italics
italics
monospaced
monospaced
stroked
stroked
underlined
underlined
waved
waved
green-stroked
stroked
red-underlined
underlined
blue-waved
waved
Blue
Blue
Orange
Orange background
big
big
OpenIconic
account-login
Unicode
This is ∞ long
Emoji
Calendar
Image

13 Network Diagram with nwdiag

A network diagram is a visual representation of a computer or telecommunications network. It illustrates the **arrangement and interconnections** of network components, including servers, routers, switches, hubs, and devices. Network diagrams are invaluable tools for network engineers and administrators to **understand, set up, and troubleshoot networks**. They are also essential for **visualizing the structure and flow of data** in a network, ensuring optimal performance and security.

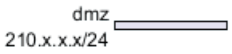
nwdiag, developed by Takeshi Komiya, provides a streamlined platform to swiftly sketch **network diagrams**. We extend our gratitude to Takeshi for this **innovative tool**!

Given its intuitive syntax, nwdiag has been seamlessly integrated into **PlantUML**. The examples showcased here are inspired by the ones documented by Takeshi.

13.1 Simple diagram

13.1.1 Define a network

```
@startuml
nwdiag {
  network dmz {
      address = "210.x.x.x/24"
  }
}
@enduml
```



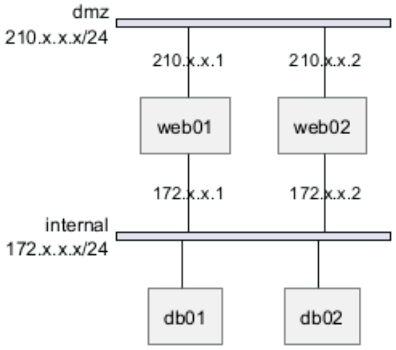
13.1.2 Define some elements or servers on a network

```
@startuml
nwdiag {
  network dmz {
      address = "210.x.x.x/24"

      web01 [address = "210.x.x.1"];
      web02 [address = "210.x.x.2"];
  }
}
@enduml
```

13.1.3 Full example

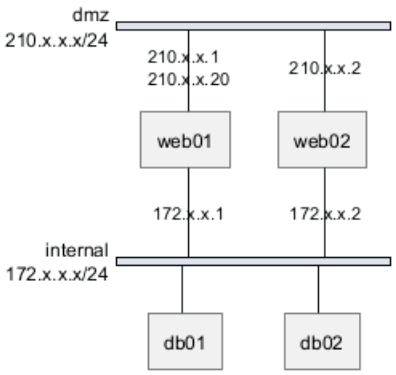
```
@startuml
nwdiag {
  network dmz {
      address = "210.x.x.x/24"

      web01 [address = "210.x.x.1"];
      web02 [address = "210.x.x.2"];
  }
```

```
  network internal {
      address = "172.x.x.x/24";

      web01 [address = "172.x.x.1"];
      web02 [address = "172.x.x.2"];
      db01;
      db02;
  }
}
@enduml
```



13.2 Define multiple addresses

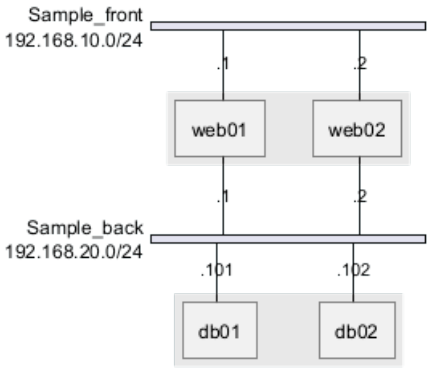
```
@startuml
nwdiag {
  network dmz {
      address = "210.x.x.x/24"

      // set multiple addresses (using comma)
      web01 [address = "210.x.x.1, 210.x.x.20"];
      web02 [address = "210.x.x.2"];
  }
  network internal {
      address = "172.x.x.x/24";

      web01 [address = "172.x.x.1"];
      web02 [address = "172.x.x.2"];
      db01;
      db02;
  }
}
@enduml
```



13.3 Grouping nodes

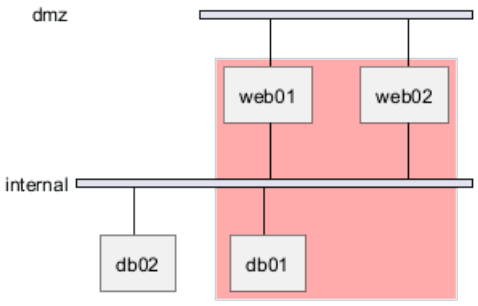
13.3.1 Define group inside network definitions

```
@startuml
nwdiag {
  network Sample_front {
    address = "192.168.10.0/24";

    // define group
    group web {
      web01 [address = ".1"];
      web02 [address = ".2"];
    }
  }
  network Sample_back {
    address = "192.168.20.0/24";
    web01 [address = ".1"];
    web02 [address = ".2"];
    db01 [address = ".101"];
    db02 [address = ".102"];

    // define network using defined nodes
    group db {
      db01;
      db02;
    }
  }
}
@enduml
```



13.3.2 Define group outside of network definitions

```
@startuml
nwdiag {
  // define group outside of network definitions
  group {
    color = "#FFAAAA";

    web01;
    web02;
    db01;
  }

  network dmz {
    web01;
    web02;
  }
  network internal {
    web01;
    web02;
    db01;
    db02;
  }
}
@enduml
```

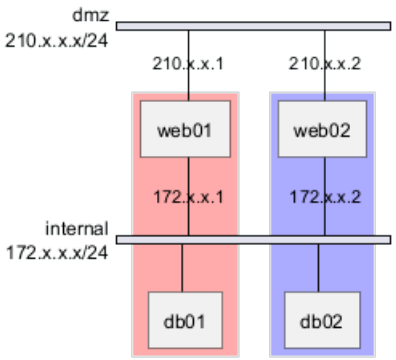


13.3.3 Define several groups on same network

13.3.4 Example with 2 group

```
@startuml
nwdiag {
```

```
  group {
    color = "#FFaaaa";
    web01;
    db01;
  }
  group {
    color = "#aaaaFF";
    web02;
    db02;
  }
  network dmz {
      address = "210.x.x.x/24"

      web01 [address = "210.x.x.1"];
      web02 [address = "210.x.x.2"];
  }
  network internal {
      address = "172.x.x.x/24";

      web01 [address = "172.x.x.1"];
      web02 [address = "172.x.x.2"];
      db01 ;
      db02 ;
  }
}
@enduml
```

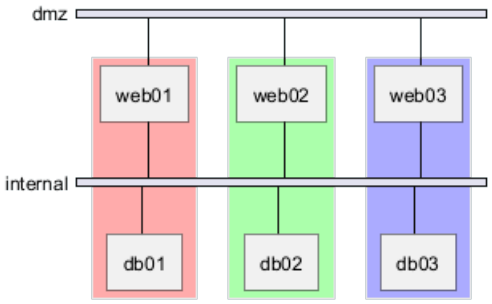


[Ref. QA-12663]

13.3.5 Example with 3 groups

```
@startuml
nwdiag {
  group {
    color = "#FFaaaa";
    web01;
    db01;
  }
  group {
    color = "#aaFFaa";
    web02;
    db02;
  }
  group {
    color = "#aaaaFF";
```

```
    web03;
    db03;
  }

  network dmz {
      web01;
      web02;
      web03;
  }
  network internal {
      web01;
      db01 ;
      web02;
      db02 ;
      web03;
      db03;
  }
}
@enduml
```



[Ref. QA-13138]

13.4 Extended Syntax (for network or group)

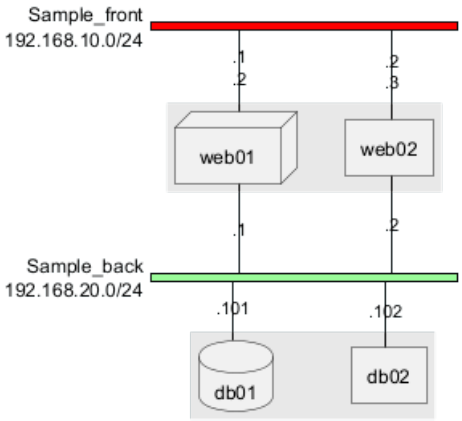
13.4.1 Network

For network or network's component, you can add or change:

- addresses *(separated by comma ,)*;
- color;
- description;
- shape.

```
@startuml
nwdiag {
  network Sample_front {
    address = "192.168.10.0/24"
    color = "red"

    // define group
    group web {
      web01 [address = ".1, .2", shape = "node"]
      web02 [address = ".2, .3"]
    }
  }
  network Sample_back {
    address = "192.168.20.0/24"
```

```
    color = "palegreen"
    web01 [address = ".1"]
    web02 [address = ".2"]
    db01 [address = ".101", shape = database ]
    db02 [address = ".102"]

    // define network using defined nodes
    group db {
      db01;
      db02;
    }
  }
}
@enduml
```



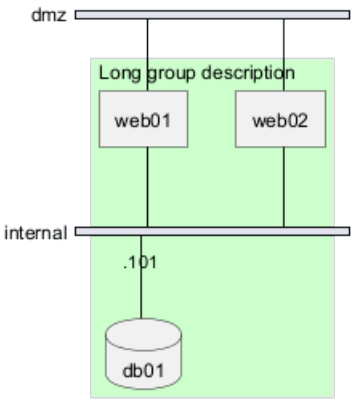
13.4.2 Group

For a group, you can add or change:

- color;
- description.

```
@startuml
nwdiag {
  group {
    color = "#CCFFCC";
    description = "Long group description";

    web01;
    web02;
    db01;
  }

  network dmz {
    web01;
    web02;
  }
  network internal {
    web01;
    web02;
    db01 [address = ".101", shape = database];
  }
}
```

```
@enduml
```



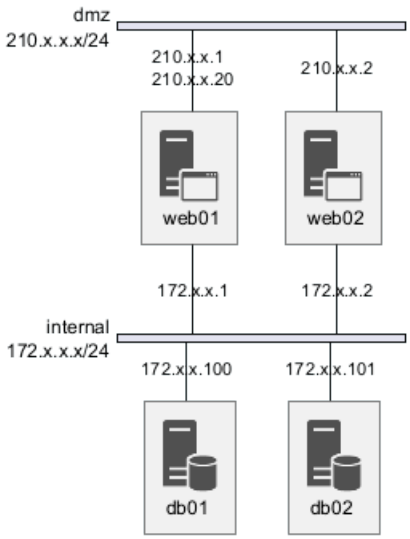
[Ref. QA-12056]

13.5 Using Sprites

You can use all sprites (icons) from the Standard Library or any other library.

Use the notation `<$sprite>` to use a sprite, `\n` to make a new line, or any other Creole syntax.

```
@startuml
!include <office/Servers/application_server>
!include <office/Servers/database_server>

nwdiag {
  network dmz {
      address = "210.x.x.x/24"

      // set multiple addresses (using comma)
      web01 [address = "210.x.x.1, 210.x.x.20",  description = "<$application_server>\n web01"]
      web02 [address = "210.x.x.2",  description = "<$application_server>\n web02"];
  }
  network internal {
      address = "172.x.x.x/24";

      web01 [address = "172.x.x.1"];
      web02 [address = "172.x.x.2"];
      db01 [address = "172.x.x.100",  description = "<$database_server>\n db01"];
      db02 [address = "172.x.x.101",  description = "<$database_server>\n db02"];
  }
}
@enduml
```



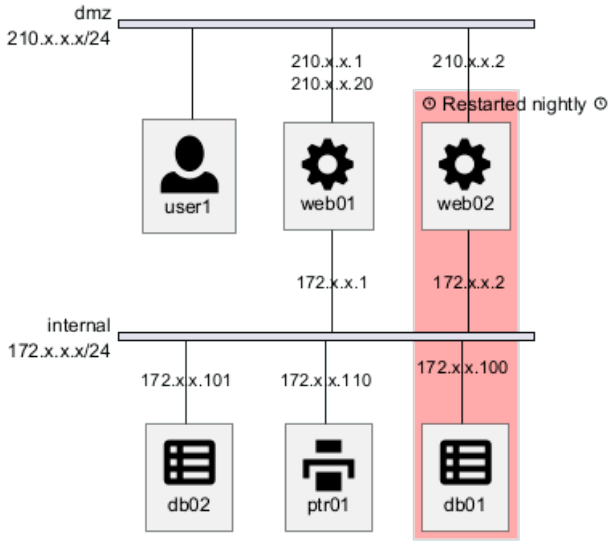
[Ref. QA-11862]

13.6 Using OpenIconic

You can also use the icons from OpenIconic in network or node descriptions.

Use the notation `<&icon>` to make an icon, `<&icon*n>` to multiply the size by a factor `n`, and `\n` to make a newline:

```
@startuml

nwdiag {
  group nightly {
    color = "#FFAAAA";
    description = "<&clock> Restarted nightly <&clock>";
    web02;
    db01;
  }
  network dmz {
      address = "210.x.x.x/24"

      user [description = "<&person*4.5>\n user1"];
      // set multiple addresses (using comma)
      web01 [address = "210.x.x.1, 210.x.x.20",  description = "<&cog*4>\nweb01"]
      web02 [address = "210.x.x.2",  description = "<&cog*4>\nweb02"];

  }
  network internal {
      address = "172.x.x.x/24";

      web01 [address = "172.x.x.1"];
      web02 [address = "172.x.x.2"];
      db01 [address = "172.x.x.100",  description = "<&spreadsheet*4>\n db01"];
      db02 [address = "172.x.x.101",  description = "<&spreadsheet*4>\n db02"];
      ptr  [address = "172.x.x.110",  description = "<&print*4>\n ptr01"];
  }
}
@enduml
```

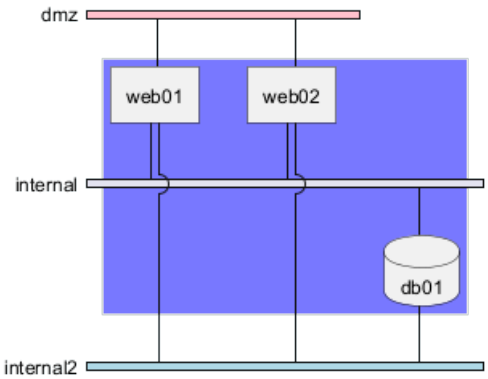


13.7 Same nodes on more than two networks

You can use same nodes on different networks (more than two networks); *nwdiag* use in this case *'jump line'* over networks.

```
@startuml
nwdiag {
  // define group at outside network definitions
  group {
    color = "#7777FF";

    web01;
    web02;
    db01;
  }

  network dmz {
    color = "pink"

    web01;
    web02;
  }

  network internal {
    web01;
    web02;
    db01 [shape = database ];
  }

  network internal2 {
    color = "LightBlue";

    web01;
    web02;
    db01;
  }

}
```

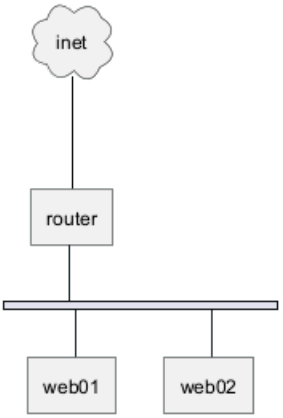
```
@enduml
```



13.8 Peer networks

Peer networks are simple connections between two nodes, for which we don't use a horizontal "busbar" network

```
@startuml
nwdiag {
  inet [shape = cloud];
  inet -- router;

  network {
    router;
    web01;
    web02;
  }
}
@enduml
```

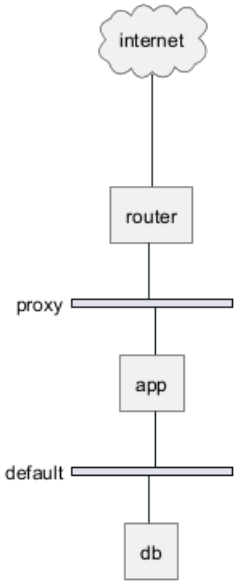


13.9 Peer networks and group

13.9.1 Without group

```
@startuml
nwdiag {
    internet [ shape = cloud];
```

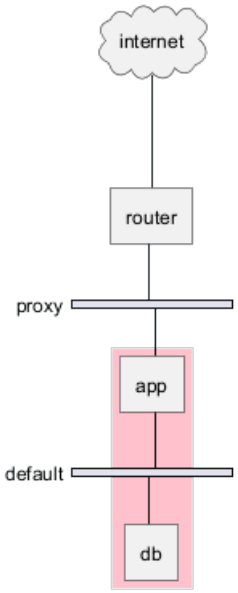
```
    internet -- router;

    network proxy {
        router;
        app;
    }
    network default {
     app;
        db;
    }
}
@enduml
```



13.9.2 Group on first

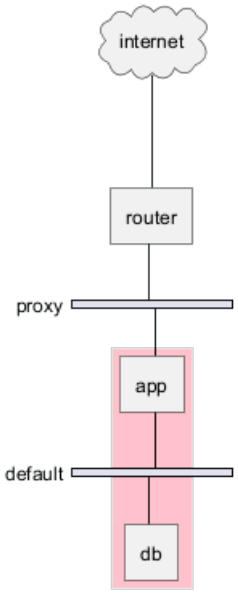
```
@startuml
nwdiag {
    internet [ shape = cloud];
    internet -- router;

    group {
      color = "pink";
      app;
      db;
    }

    network proxy {
        router;
        app;
    }

    network default {
     app;
        db;
    }
}
```

```
@enduml
```



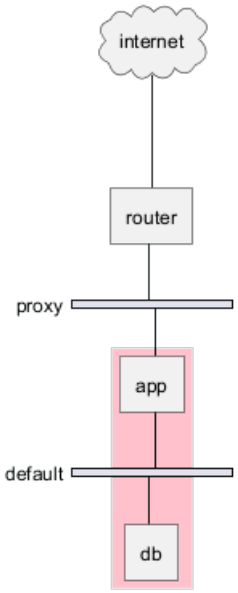
13.9.3 Group on second

```
@startuml
nwdiag {
    internet [ shape = cloud];
    internet -- router;

    network proxy {
        router;
        app;
    }

    group {
      color = "pink";
      app;
      db;
    }

    network default {
     app;
        db;
    }
}
@enduml
```



13.9.4 Group on third

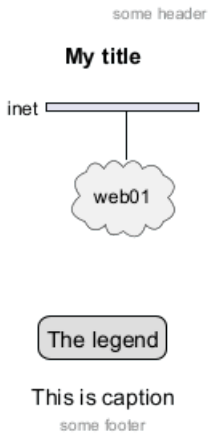
```
@startuml
nwdiag {
    internet [ shape = cloud];
    internet -- router;

    network proxy {
        router;
        app;
    }
    network default {
     app;
        db;
    }
    group {
      color = "pink";
      app;
      db;
    }
}
@enduml
```



[Ref. Issue#408 and QA-12655]

13.10 Add title, caption, header, footer or legend on network diagram

```
@startuml

header some header

footer some footer

title My title

nwdiag {
  network inet {
      web01 [shape = cloud]
  }
}

legend
The legend
end legend

caption This is caption
@enduml
```

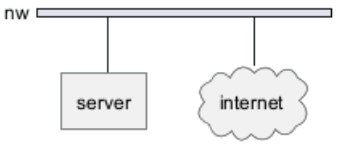


[Ref. QA-11303 and Common commands]

13.11 With or without shadow

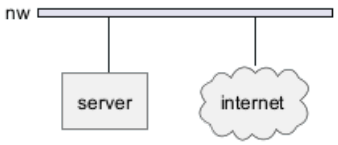
13.11.1 With shadow (by default)

```
@startuml
nwdiag {
  network nw {
    server;
    internet;
  }
  internet [shape = cloud];
}
@enduml
```



13.11.2 Without shadow

```
@startuml
<style>
root {
 shadowing 0
}
</style>
nwdiag {
  network nw {
    server;
    internet;
  }
  internet [shape = cloud];
}
@enduml
```



[Ref. QA-14516]

13.12 Change width of the networks

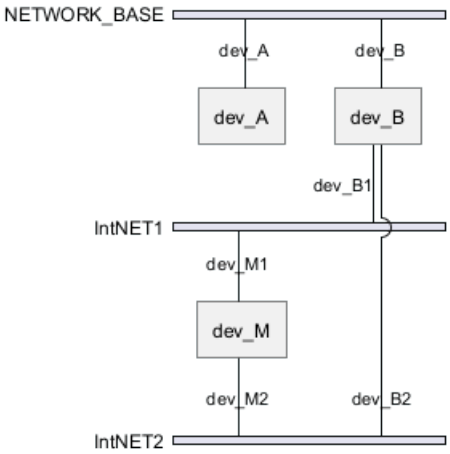
You can change the width of the networks, especially in order to have the same full width for only some or all networks.

Here are some examples, with all the possibilities.

13.12.1 First example

- without

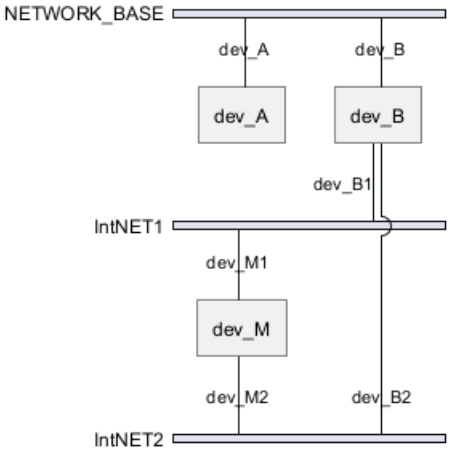
```
@startuml
nwdiag {
  network NETWORK_BASE {
   dev_A [address = "dev_A" ]
   dev_B [address = "dev_B" ]
  }
  network IntNET1 {
   dev_B [address = "dev_B1" ]
   dev_M [address = "dev_M1" ]
  }
  network IntNET2 {
   dev_B [address = "dev_B2" ]
   dev_M [address = "dev_M2" ]
 }
}
@enduml
```



- only the first

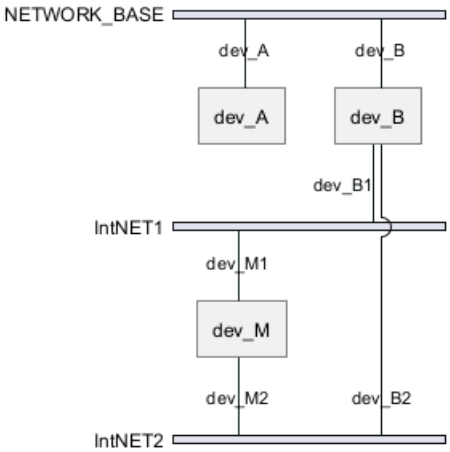
```
@startuml
nwdiag {
  network NETWORK_BASE {
   width = full
```

```
   dev_A [address = "dev_A" ]
   dev_B [address = "dev_B" ]
  }
  network IntNET1 {
   dev_B [address = "dev_B1" ]
   dev_M [address = "dev_M1" ]
  }
  network IntNET2 {
   dev_B [address = "dev_B2" ]
   dev_M [address = "dev_M2" ]
 }
}
@enduml
```



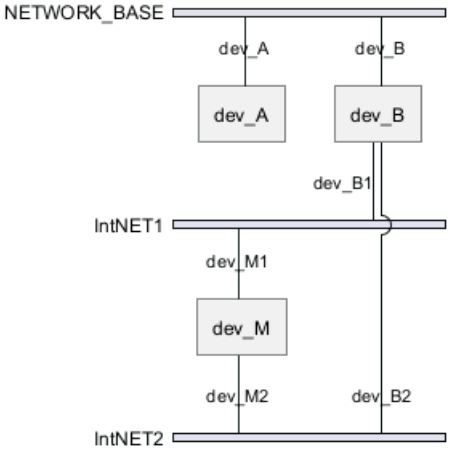
- the first and the second

```
@startuml
nwdiag {
  network NETWORK_BASE {
   width = full
   dev_A [address = "dev_A" ]
   dev_B [address = "dev_B" ]
  }
  network IntNET1 {
   width = full
   dev_B [address = "dev_B1" ]
   dev_M [address = "dev_M1" ]
  }
  network IntNET2 {
   dev_B [address = "dev_B2" ]
   dev_M [address = "dev_M2" ]
 }
}
@enduml
```



- all the network (with same full width)

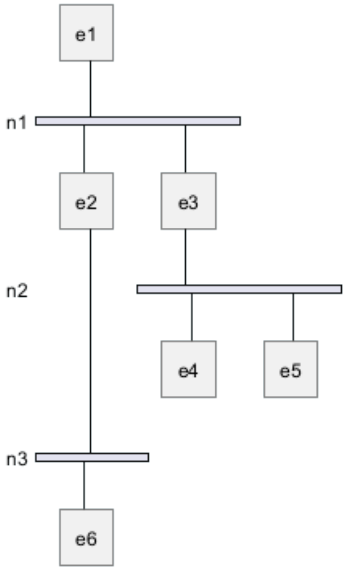
```
@startuml
nwdiag {
  network NETWORK_BASE {
   width = full
   dev_A [address = "dev_A" ]
   dev_B [address = "dev_B" ]
  }
  network IntNET1 {
   width = full
   dev_B [address = "dev_B1" ]
   dev_M [address = "dev_M1" ]
  }
  network IntNET2 {
   width = full
   dev_B [address = "dev_B2" ]
   dev_M [address = "dev_M2" ]
 }
}
@enduml
```



13.12.2 Second example

- without

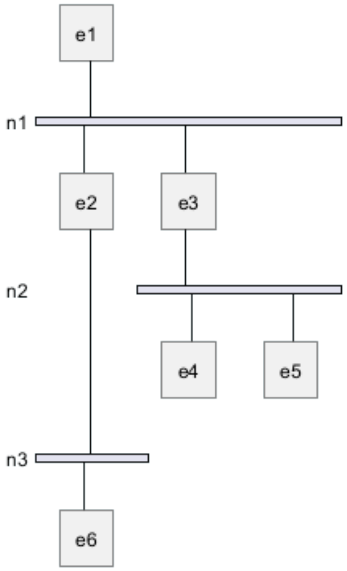
```
@startuml
nwdiag {
  e1
  network n1 {
    e1
    e2
    e3
  }

  network n2 {
    e3
    e4
    e5
  }

  network n3 {
    e2
    e6
  }
}
@enduml
```



- only the first

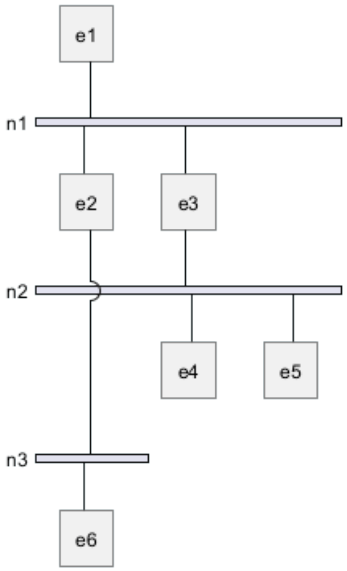
```
@startuml
nwdiag {
  e1
  network n1 {
    width = full
    e1
    e2
    e3
  }

  network n2 {
    e3
    e4
```

```
    e5
  }

  network n3 {
    e2
    e6
  }
}
@enduml
```



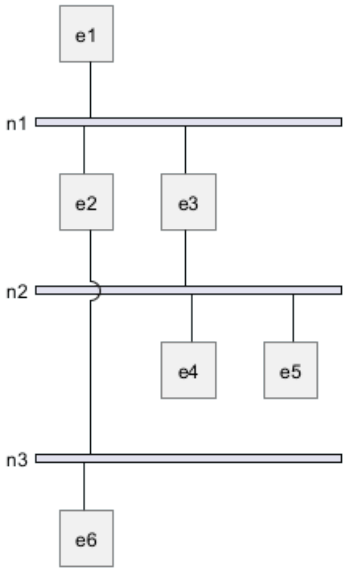
- the first and the second

```
@startuml
nwdiag {
  e1
  network n1 {
    width = full
    e1
    e2
    e3
  }

  network n2 {
    width = full
    e3
    e4
    e5
  }

  network n3 {
    e2
    e6
  }
}
@enduml
```



- all the network (with same full width)

```
@startuml
nwdiag {
  e1
  network n1 {
    width = full
    e1
    e2
    e3
  }

  network n2 {
    width = full
    e3
    e4
    e5
  }

  network n3 {
    width = full
    e2
    e6
  }
}
@enduml
```

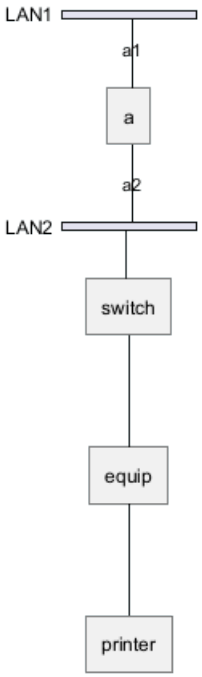


13.13 Other internal networks

You can define other internal networks (TCP/IP, USB, SERIAL,...).

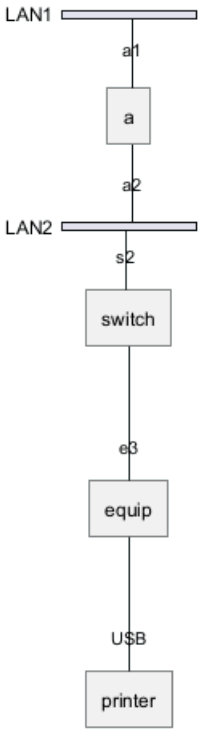
- Without address or type

```
@startuml
nwdiag {
  network LAN1 {
     a [address = "a1"];
  }
  network LAN2 {
     a [address = "a2"];
     switch;
  }
  switch -- equip;
  equip -- printer;
}
@enduml
```



- With address or type

```
@startuml
nwdiag {
  network LAN1 {
     a [address = "a1"];
  }
  network LAN2 {
     a [address = "a2"];
     switch [address = "s2"];
  }
  switch -- equip;
  equip [address = "e3"];
  equip -- printer;
  printer [address = "USB"];
}
@enduml
```

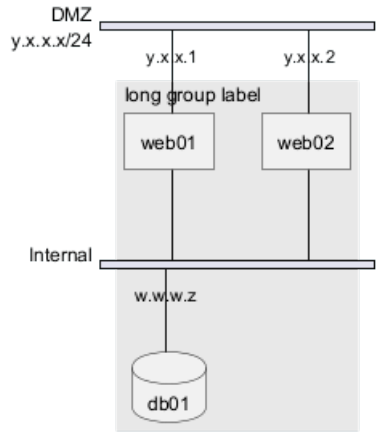


[Ref. QA-12824]

13.14 Using (global) style

13.14.1 Without style *(by default)*

```
@startuml
nwdiag {
  network DMZ {
      address = "y.x.x.x/24"
      web01 [address = "y.x.x.1"];
      web02 [address = "y.x.x.2"];
  }

   network Internal {
    web01;
    web02;
    db01 [address = "w.w.w.z", shape = database];
  }

    group {
    description = "long group label";
    web01;
    web02;
    db01;
  }
}
@enduml
```

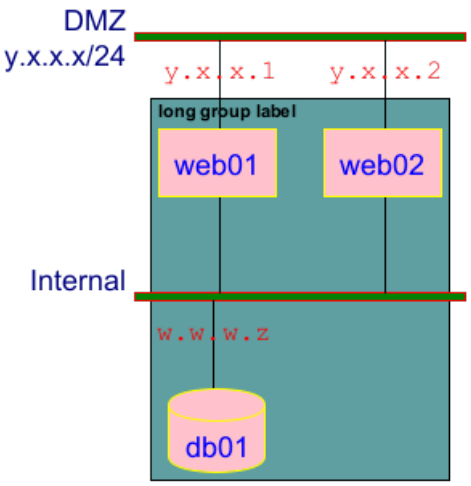


13.14.2 With style

You can use style to change rendering of elements.

```
@startuml
<style>
nwdiagDiagram {
  network {
    BackGroundColor green
    LineColor red
    LineThickness 1.0
    FontSize 18
    FontColor navy
  }
  server {
    BackGroundColor pink
    LineColor yellow
    LineThickness 1.0
    ' FontXXX only for description or label
    FontSize 18
    FontColor #blue
  }
  arrow {
    ' FontXXX only for address
    FontSize 17
    FontColor #red
    FontName Monospaced
    LineColor black
  }
  group {
    BackGroundColor cadetblue
    LineColor black
    LineThickness 2.0
    FontSize 11
    FontStyle bold
    Margin 5
    Padding 5
  }
}
</style>
nwdiag {
```

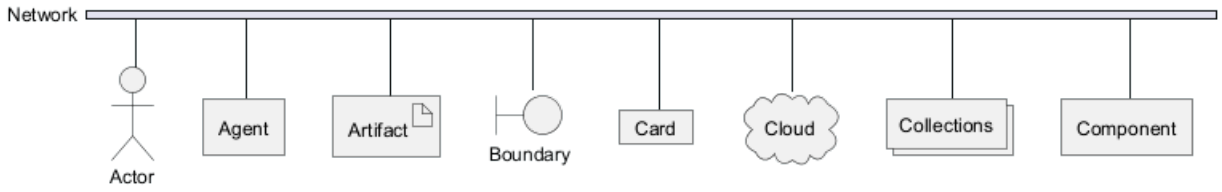
```
  network DMZ {
      address = "y.x.x.x/24"
      web01 [address = "y.x.x.1"];
      web02 [address = "y.x.x.2"];
  }

   network Internal {
    web01;
    web02;
    db01 [address = "w.w.w.z", shape = database];
  }

    group {
    description = "long group label";
    web01;
    web02;
    db01;
  }
}
@enduml
```



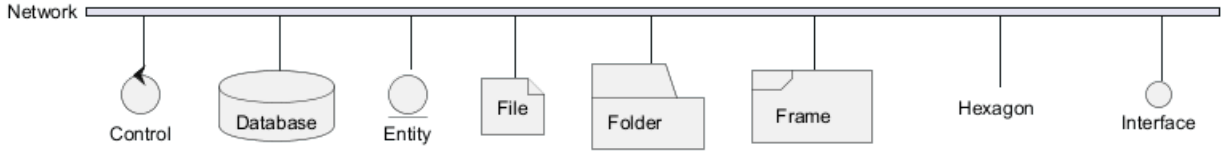
[Ref. QA-14479]

13.15 Appendix: Test of all shapes on Network diagram (nwdiag)

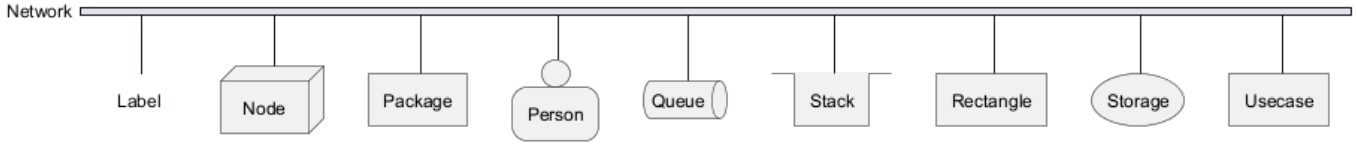
```
@startuml
nwdiag {
  network Network {
    Actor       [shape = actor]
    Agent       [shape = agent]
    Artifact    [shape = artifact]
    Boundary    [shape = boundary]
    Card        [shape = card]
    Cloud       [shape = cloud]
    Collections [shape = collections]
    Component   [shape = component]
  }
}
@enduml
```




```
@startuml
nwdiag {
  network Network {
    Control     [shape = control]
    Database    [shape = database]
    Entity      [shape = entity]
    File        [shape = file]
    Folder      [shape = folder]
    Frame       [shape = frame]
    Hexagon     [shape = hexagon]
    Interface   [shape = interface]
  }
}
@enduml
```

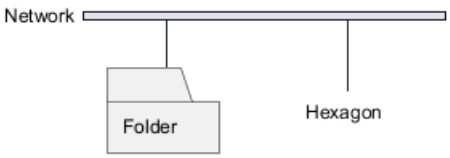



```
@startuml
nwdiag {
  network Network {
    Label       [shape = label]
    Node        [shape = node]
    Package     [shape = package]
    Person      [shape = person]
    Queue       [shape = queue]
    Stack       [shape = stack]
    Rectangle   [shape = rectangle]
    Storage     [shape = storage]
    Usecase     [shape = usecase]
  }
}
@enduml
```

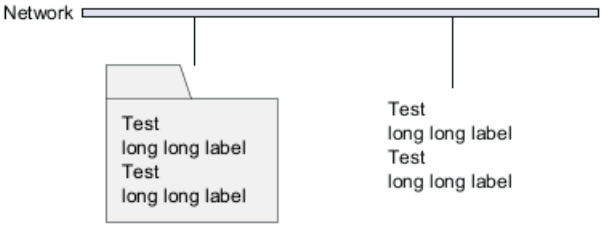


TODO: FIXME ol olli level 0 Overlap of label for folder olli olli level 0 Hexagon shape is missing olli ol

```
@startuml
nwdiag {
network Network {
Folder [shape = folder]
Hexagon [shape = hexagon]
}
}
@enduml
```




```
@startuml
nwdiag {
network Network {
Folder [shape = folder, description = "Test, long long label\nTest, long long label"]
Hexagon [shape = hexagon, description = "Test, long long label\nTest, long long label"]
}
}
@enduml
```



TODO: FIXME

14 Salt (wireframe)

Salt 그래픽인터페이스디자인을위한서브프로젝트이다.

`@startsalt` 키워드를사용하거나, `@startuml` 아래에 salt 키워드를사용할수있다.

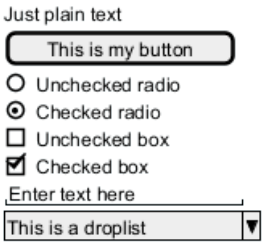
Developers, designers, and user experience professionals employ them to visualize **interface elements**, **navigational systems**, and to facilitate collaboration. They vary in **fidelity**, from low-detail sketches to high-detail representations, crucial for **prototyping** and **iterative design**. This collaborative process integrates different expertise, from **business analysis** to **user research**, ensuring that the end design aligns with both **business** and **user requirements**.

14.1 기본위젯

윈도우는반드시브라킷 ({, }) 으로감싸야한다. 그리고아래의형식으로사용한다.:

- 버튼 (Button) 은 `[` 와 `]`.
- 라디오버튼 (Radio button) 은 `(` 와 `)`.
- 체크박스 (Checkbox) 는 `[` 와 `]`.
- 인풋박스 (User text area) 는 `"`.

```
@startsalt
{
  Just plain text
  [This is my button]
  ()  Unchecked radio
  (X) Checked radio
  []  Unchecked box
  [X] Checked box
  "Enter text here   "
  ^This is a droplist^
}
@endsalt
```

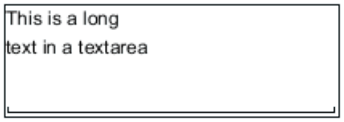


이툴은단순한샘플윈도우에대한토론을위해사용된다.

14.2 Text area

Here is an attempt to create a text area:

```
@startsalt
{+
   This is a long
   text in a textarea
   .
   "                          "
}
@endsalt
```



Note:

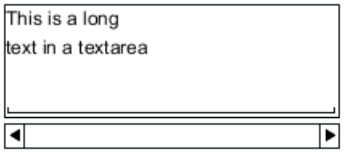
- the dot (`.`) to fill up vertical space;
- the last line of space (`"  "`) to make the area wider.

[Ref. QA-14765]

Then you can add scroll bar:

```
@startsalt
{SI
   This is a long
   text in a textarea
   .
   "                          "
}
@endsalt
```

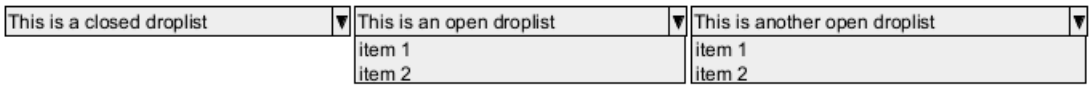

```
@startsalt
{S-
   This is a long
   text in a textarea
   .
   "                          "
}
@endsalt
```



14.3 Open, close droplist

You can open a droplist, by adding values enclosed by `^`, as:

```
@startsalt
{
  ^This is a closed droplist^ |
  ^This is an open droplist^^ item 1^^ item 2^ |
  ^This is another open droplist^ item 1^ item 2^
}
@endsalt
```



[Ref. QA-4184]

14.4 그리드사용하기

테이블은 {를사용할때자동생성된다. 그리고컬럼을구분하기위해선 | 를사용해야한다.

예시:

```
@startsalt
{
  Login    | "MyName   "
  Password | "****     "
  [Cancel] | [  OK   ]
}
@endsalt
```

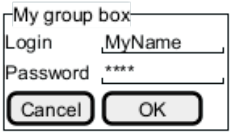
Just after the opening bracket, you can use a character to define if you want to draw lines or columns of the grid :

Symbol	Result
#	To display all vertical and horizontal lines
!	To display all vertical lines
-	To display all horizontal lines
+	To display external lines

```
@startsalt
{+
  Login    | "MyName   "
  Password | "****     "
  [Cancel] | [  OK   ]
}
@endsalt
```

14.5 Group box [^]

```
@startsalt
{^"My group box"
  Login    | "MyName   "
  Password | "****     "
  [Cancel] | [  OK   ]
}
@endsalt
```



[Ref. QA-5840]

14.6 Using separator [.., ==, ~~, --]

You can use several horizontal lines as separator.

```
@startsalt
{
```

```
  Text1
  ..
  "Some field"
  ==
  Note on usage
  ~~
  Another text
  --
  [Ok]
}
@endsalt
```

14.7 Tree widget [T]

To have a Tree, you have to start with `{T` and to use `+` to denote hierarchy.

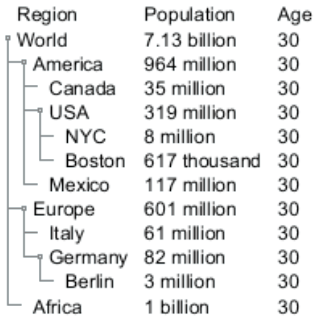
```
@startsalt
{
{T
 + World
 ++ America
 +++ Canada
 +++ USA
 ++++ New York
 ++++ Boston
 +++ Mexico
 ++ Europe
 +++ Italy
 +++ Germany
 ++++ Berlin
 ++ Africa
}
}
@endsalt
```

14.8 Tree table [T]

You can combine trees with tables.

```
@startsalt
{
{T
```

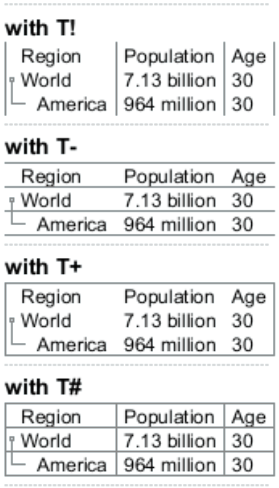
```
+Region         | Population    | Age
+ World         | 7.13 billion  | 30
++ America      | 964 million   | 30
+++ Canada      | 35 million    | 30
+++ USA         | 319 million   | 30
++++ NYC        | 8 million     | 30
++++ Boston     | 617 thousand  | 30
+++ Mexico      | 117 million   | 30
++ Europe       | 601 million   | 30
+++ Italy       | 61 million    | 30
+++ Germany     | 82 million    | 30
++++ Berlin     | 3 million     | 30
++ Africa       | 1 billion     | 30
}
}
@endsalt
```



And add lines.

```
@startsalt
{
..
== with T!
{T!
+Region         | Population    | Age
+ World         | 7.13 billion  | 30
++ America      | 964 million   | 30
}
..
== with T-
{T-
+Region         | Population    | Age
+ World         | 7.13 billion  | 30
++ America      | 964 million   | 30
}
..
== with T+
{T+
+Region         | Population    | Age
+ World         | 7.13 billion  | 30
++ America      | 964 million   | 30
}
..
== with T#
{T#
+Region         | Population    | Age
+ World         | 7.13 billion  | 30
++ America      | 964 million   | 30
```

```
}
..
}
@endsalt
```

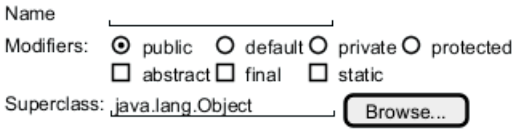


[Ref. QA-1265]

14.9 Enclosing brackets [{, }]

You can define subelements by opening a new opening bracket.

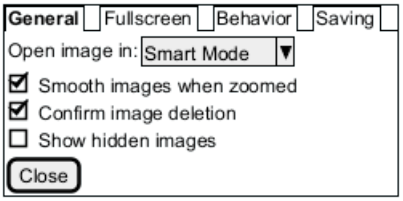
```
@startsalt
{
Name          | "                  "
Modifiers:    | { (X) public | () default | () private | () protected
                  [] abstract | [] final   | [] static }
Superclass:   | { "java.lang.Object " | [Browse...] }
}
@endsalt
```



14.10 Adding tabs [/]

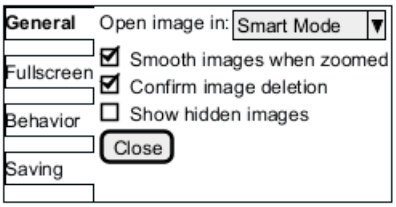
You can add tabs using {/ notation. Note that you can use HTML code to have bold text.

```
@startsalt
{+
{/ <b>General | Fullscreen | Behavior | Saving }
{
{ Open image in: | ^Smart Mode^ }
[X] Smooth images when zoomed
[X] Confirm image deletion
[ ] Show hidden images
}
[Close]
}
@endsalt
```



Tab could also be vertically oriented:

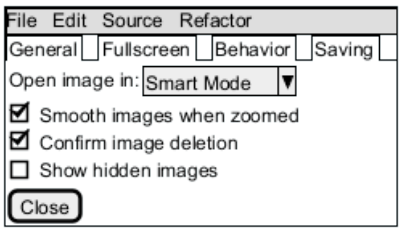
```
@startsalt
{+
{/ <b>General
Fullscreen
Behavior
Saving } |
{
{ Open image in: | ^Smart Mode^ }
[X] Smooth images when zoomed
[X] Confirm image deletion
[ ] Show hidden images
[Close]
}
}
@endsalt
```



14.11 Using menu [*]

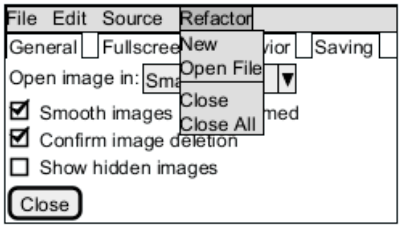
You can add a menu by using `{*` notation.

```
@startsalt
{+
{* File | Edit | Source | Refactor }
{/ General | Fullscreen | Behavior | Saving }
{
{ Open image in: | ^Smart Mode^ }
[X] Smooth images when zoomed
[X] Confirm image deletion
[ ] Show hidden images
}
[Close]
}
@endsalt
```



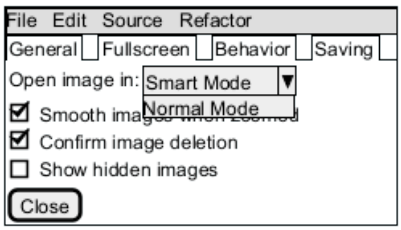
It is also possible to open a menu:

```
@startsalt
{+
{* File | Edit | Source | Refactor
 Refactor | New | Open File | - | Close | Close All }
{/ General | Fullscreen | Behavior | Saving }
{
{ Open image in: | ^Smart Mode^ }
[X] Smooth images when zoomed
[X] Confirm image deletion
[ ] Show hidden images
}
[Close]
}
@endsalt
```



Like it is possible to open a droplist:

```
@startsalt
{+
{* File | Edit | Source | Refactor }
{/ General | Fullscreen | Behavior | Saving }
{
{ Open image in: | ^Smart Mode^^Normal Mode^ }
[X] Smooth images when zoomed
[X] Confirm image deletion
[ ] Show hidden images
}
[Close]
}
@endsalt
```



[Ref. QA-4184]

14.12 Advanced table

You can use two special notations for table :

- `*` to indicate that a cell with span with left
- `.` to denotate an empty cell

```
@startsalt
{#
. | Column 2 | Column 3
Row header 1 | value 1 | value 2
```

```
Row header 2 | A long cell | *
}
@endsalt
```

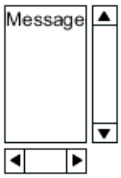
	Column 2	Column 3
Row header 1	value 1	value 2
Row header 2	A long cell	

14.13 Scroll Bars [S, SI, S-]

You can use {S notation for scroll bar like in following examples:

- {S: for horizontal and vertical scrollbars

```
@startsalt
{S
Message
.
.
.
.
}
@endsalt
```



- {SI : for vertical scrollbar only

```
@startsalt
{SI
Message
.
.
.
.
}
@endsalt
```

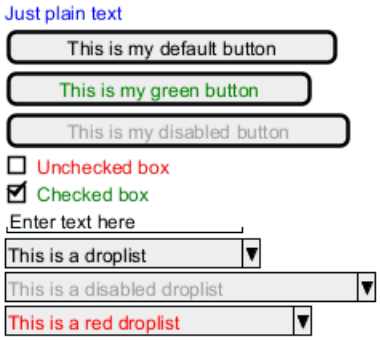
- {S- : for horizontal scrollbar only

```
@startsalt
{S-
Message
.
.
.
.
}
@endsalt
```

14.14 Colors

It is possible to change text color of widget.

```
@startsalt
{
  <color:Blue>Just plain text
  [This is my default button]
  [<color:green>This is my green button]
  [<color:#9a9a9a>This is my disabled button]
  []  <color:red>Unchecked box
  [X] <color:green>Checked box
  "Enter text here   "
  ^This is a droplist^
  ^<color:#9a9a9a>This is a disabled droplist^
  ^<color:red>This is a red droplist^
}
@endsalt
```



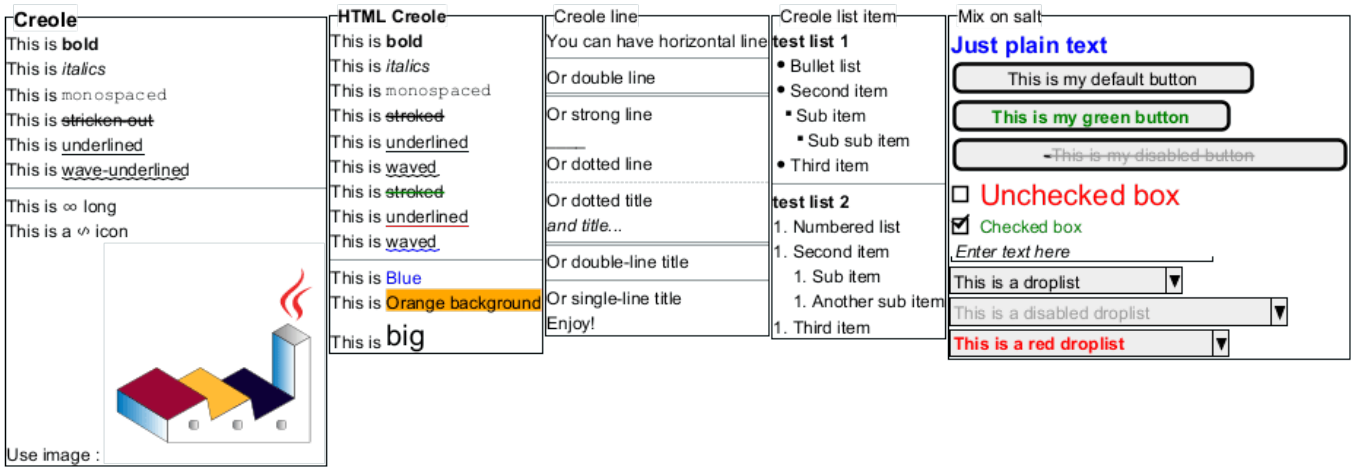
[Ref. QA-12177]

14.15 Creole on Salt

You can use Creole or HTML Creole on salt:

```
@startsalt
{{^==Creole
  This is **bold**
  This is //italics//
  This is ""monospaced""
  This is --stricken-out--
  This is __underlined__
  This is ~~wave-underlined~~
  --test Unicode and icons--
  This is <U+221E> long
  This is a <&code> icon
  Use image : <img:https://plantuml.com/logo3.png>
}|
{^<b>HTML Creole
 This is <b>bold</b>
  This is <i>italics</i>
  This is <font:monospaced>monospaced</font>
```

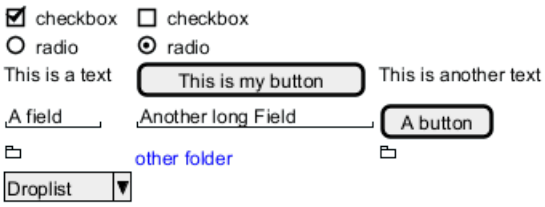
```
  This is <s>stroked</s>
  This is <u>underlined</u>
  This is <w>waved</w>
  This is <s:green>stroked</s>
  This is <u:red>underlined</u>
  This is <w:#0000FF>waved</w>
  -- other examples --
  This is <color:blue>Blue</color>
  This is <back:orange>Orange background</back>
  This is <size:20>big</size>
}|
{^Creole line
You can have horizontal line
----
Or double line
====
Or strong line
____
Or dotted line
..My title..
Or dotted title
//and title... //
==Title==
Or double-line title
--Another title--
Or single-line title
Enjoy!
}|
{^Creole list item
**test list 1**
* Bullet list
* Second item
** Sub item
*** Sub sub item
* Third item
----
**test list 2**
# Numbered list
# Second item
## Sub item
## Another sub item
# Third item
}|
{^Mix on salt
  ==<color:Blue>Just plain text
  [This is my default button]
  [<b><color:green>This is my green button]
  [ ---<color:#9a9a9a>This is my disabled button-- ]
  []  <size:20><color:red>Unchecked box
  [X] <color:green>Checked box
  "//Enter text here//   "
  ^This is a droplist^
  ^<color:#9a9a9a>This is a disabled droplist^
  ^<b><color:red>This is a red droplist^
}}
@endsalt
```



14.16 Pseudo sprite [«, »]

Using << and >> you can define a pseudo-sprite or sprite-like drawing and reusing it latter.

```
@startsalt
 {
 [X] checkbox|[] checkbox
 () radio | (X) radio
 This is a text|[This is my button]|This is another text
 "A field"|"Another long Field"|[A button]
 <<folder
 ............
 .XXXXX......
 .X...X......
 .XXXXXXXXX.
 .X........X.
 .X........X.
 .X........X.
 .X........X.
 .XXXXXXXXX.
 ............
 >>|<color:blue>other folder|<<folder>>
^Droplist^
}
@endsalt
```



[Ref. QA-5849]

14.17 OpenIconic

OpenIconic is a very nice open source icon set. Those icons have been integrated into the creole parser, so you can use them out-of-the-box. You can use the following syntax: <&ICON_NAME>.

```
@startsalt
{
  Login<&person> | "MyName    "
  Password<&key> | "****      "
```

```
  [Cancel <&circle-x>] | [OK <&account-login>]
}
@endsalt
```

The complete list is available on OpenIconic Website, or you can use the following special diagram:

```
@startuml
listopeniconic
@enduml
```

14.18 Add title, header, footer, caption or legend

```
@startsalt
title My title
header some header
footer some footer
caption This is caption
legend
The legend
end legend

{+
  Login    | "MyName   "
  Password | "****     "
  [Cancel] | [  OK   ]
}

@endsalt
```

(See also: Common commands)

14.19 Zoom, DPI

14.19.1 Whitout zoom (by default)

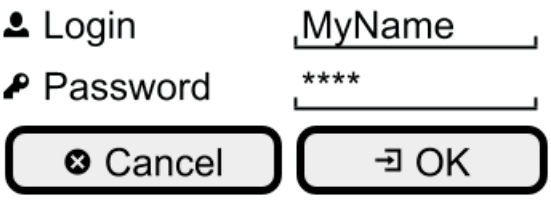
```
@startsalt
{
  <&person> Login  | "MyName   "
  <&key> Password  | "****     "
  [<&circle-x> Cancel ] | [ <&account-login> OK   ]
}
@endsalt
```

14.19.2 Scale

You can use the `scale` command to zoom the generated image.

You can use either a number or a fraction to define the scale factor. You can also specify either width or height (in pixel). And you can also give both width and height: the image is scaled to fit inside the specified dimension.

```
@startsalt
scale 2
{
  <&person> Login  | "MyName   "
  <&key> Password  | "****     "
  [<&circle-x> Cancel ] | [ <&account-login> OK   ]
}
@endsalt
```



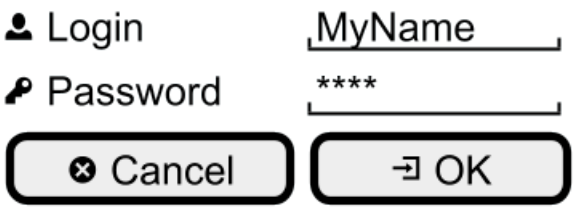
(See also: Zoom on Common commands)

14.19.3 DPI

You can also use the `skinparam dpi`command to zoom the generated image.

```
@startsalt
```

```
skinparam dpi 200
{
  <&person> Login  | "MyName   "
  <&key> Password  | "****     "
  [<&circle-x> Cancel ] | [ <&account-login> OK   ]
}
@endsalt
```

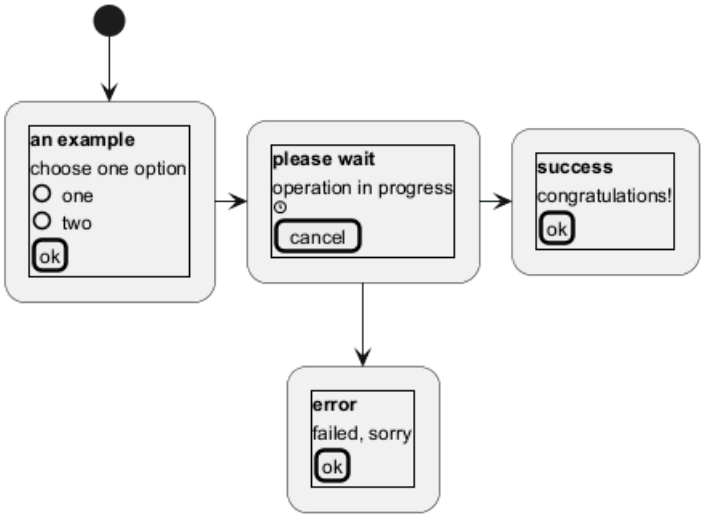


14.20 Include Salt ”on activity diagram”

You can read the following explanation.

```
@startuml
(*) --> "
{{
salt
{+
<b>an example
choose one option
()one
()two
[ok]
}
}}
" as choose

choose -right-> "
{{
salt
{+
<b>please wait
operation in progress
<&clock>
[cancel]
}
}}
" as wait
wait -right-> "
{{
salt
{+
<b>success
congratulations!
[ok]
}
}}
" as success

wait -down-> "
{{
salt
```

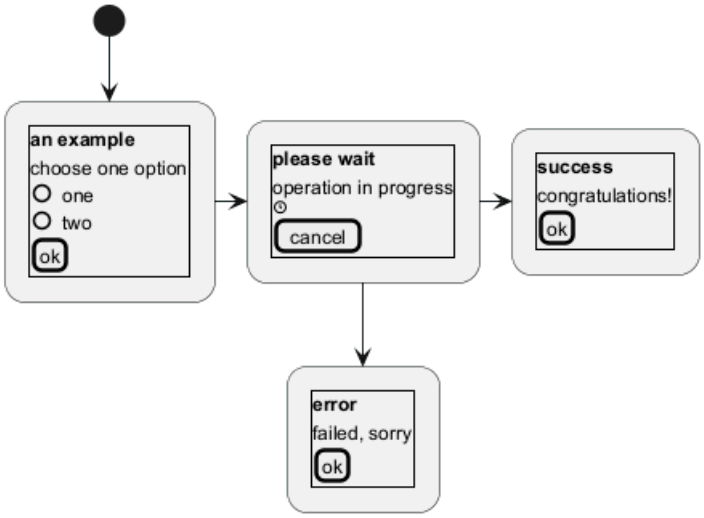
```
{+
<b>error
failed, sorry
[ok]
}
}}
"
@enduml
```



It can also be combined with define macro.

```
@startuml
!unquoted procedure SALT($x)
"{{
salt
%invoke_procedure("_"+$x)
}}" as $x
!endprocedure

!procedure _choose()
{+
<b>an example
choose one option
()one
()two
[ok]
}
!endprocedure

!procedure _wait()
{+
<b>please wait
operation in progress
<&clock>
[cancel]
}
!endprocedure

!procedure _success()
{+
<b>success
congratulations!
```

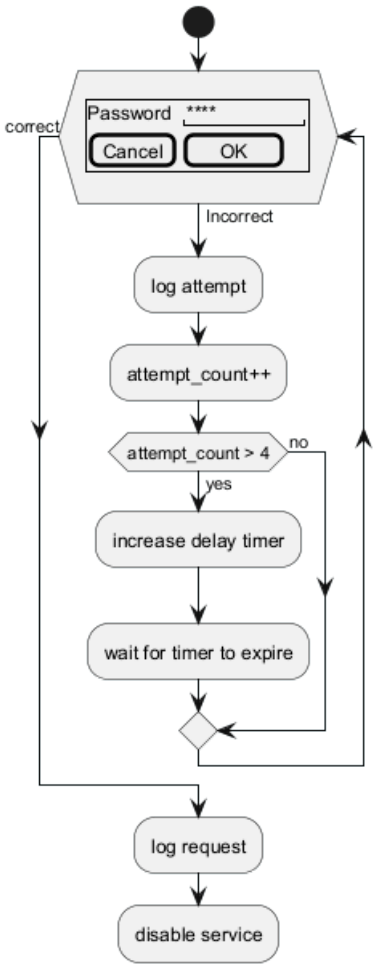
```
[ok]
}
!endprocedure

!procedure _error()
{+
<b>error
failed, sorry
[ok]
}
!endprocedure

(*) --> SALT(choose)
-right-> SALT(wait)
wait -right-> SALT(success)
wait -down-> SALT(error)
@enduml
```



14.21 Include salt "on while condition of activity diagram"

You can include `salt` on while condition of activity diagram.

```
@startuml
start
while (\n{{\nsalt\n{+\nPassword | "****     "\n[Cancel] | [  OK   ]}\n}}\n) is (Incorrect)
  :log attempt;
  :attempt_count++;
  if (attempt_count > 4) then (yes)
    :increase delay timer;
    :wait for timer to expire;
  else (no)
  endif
endwhile (correct)
:log request;
:disable service;
@enduml
```

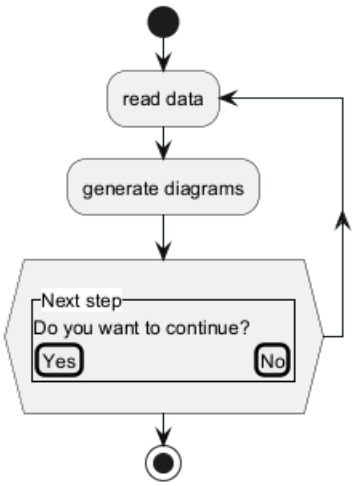


[Ref. QA-8547]

14.22 Include salt "on repeat while condition of activity diagram"

You can include `salt` on 'repeat while' condition of activity diagram.

```
@startuml
start
repeat :read data;
  :generate diagrams;
repeat while (\n{{\nsalt\n{^"Next step"\n  Do you want to continue? \n[Yes]|[No]\n}\n}}\n)
stop
@enduml
```



[Ref. QA-14287]

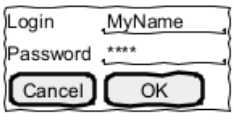
14.23 Skinparam

You can use **[only]** some skinparam command to change the skin of the drawing.

Some example:

```
@startsalt
skinparam Backgroundcolor palegreen
{+
  Login    | "MyName   "
  Password | "****     "
  [Cancel] | [  OK   ]
}
@endsalt
```


```
@startsalt
skinparam handwritten true
{+
  Login    | "MyName   "
  Password | "****     "
  [Cancel] | [  OK   ]
}
@endsalt
```



TODO: FIXME FYI, some other skinparam does not work with salt, as:

```
@startsalt
skinparam defaultFontName monospaced
{+
  Login    | "MyName   "
  Password | "****     "
  [Cancel] | [  OK   ]
}
@endsalt
```

14.24 Style

You can use [**only**] some style command to change the skin of the drawing.

Some example:

```
@startsalt
<style>
saltDiagram {
  BackgroundColor palegreen
}
</style>
{+
  Login    | "MyName   "
  Password | "****     "
  [Cancel] | [  OK   ]
}
@endsalt
```

TODO: FIXME FYI, some other style does not work with salt, as:

```
@startsalt
<style>
saltDiagram {
  Fontname Monospaced
  FontSize 10
  FontStyle italic
  LineThickness 0.5
  LineColor red
}
</style>
{+
  Login    | "MyName   "
  Password | "****     "
  [Cancel] | [  OK   ]
}
@endsalt
```

[Ref. QA-13460]

15 ArchiMate Diagram

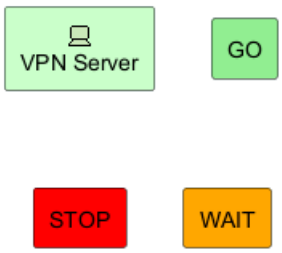
ArchiMate is an open and independent **enterprise architecture modeling language** that supports the description, analysis, and visualization of architecture within and across business domains. An **ArchiMate Diagram** provides a structured representation of the various components of an enterprise, their **interrelationships**, and their integration with **IT infrastructure**.

While both ArchiMate and UML are modeling languages, they serve different purposes. UML is primarily used for software design and system modeling, focusing on the structural and behavioral aspects of systems. In contrast, **ArchiMate** is tailored for **enterprise architecture**, offering a holistic view of the organizational, informational, and technical layers of an enterprise.

15.1 Archimate keyword

You can use the `archimate` keyword to define an element. Stereotype can optionally specify an additional icon. Some colors (`Business`, `Application`, `Motivation`, `Strategy`, `Technology`, `Physical`, `Implementation`) are also available.

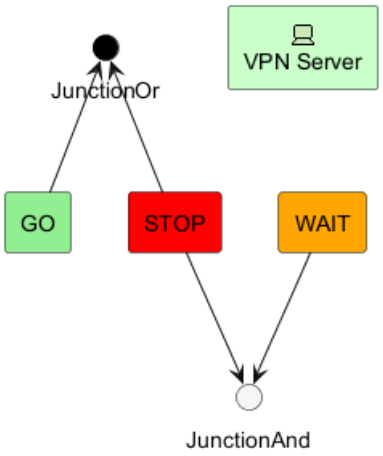
```
@startuml
archimate #Technology "VPN Server" as vpnServerA <<technology-device>>

rectangle GO #lightgreen
rectangle STOP #red
rectangle WAIT #orange
@enduml
```



15.2 Defining Junctions

Using the `circle` keyword and the preprocessor, you can also create junctions.

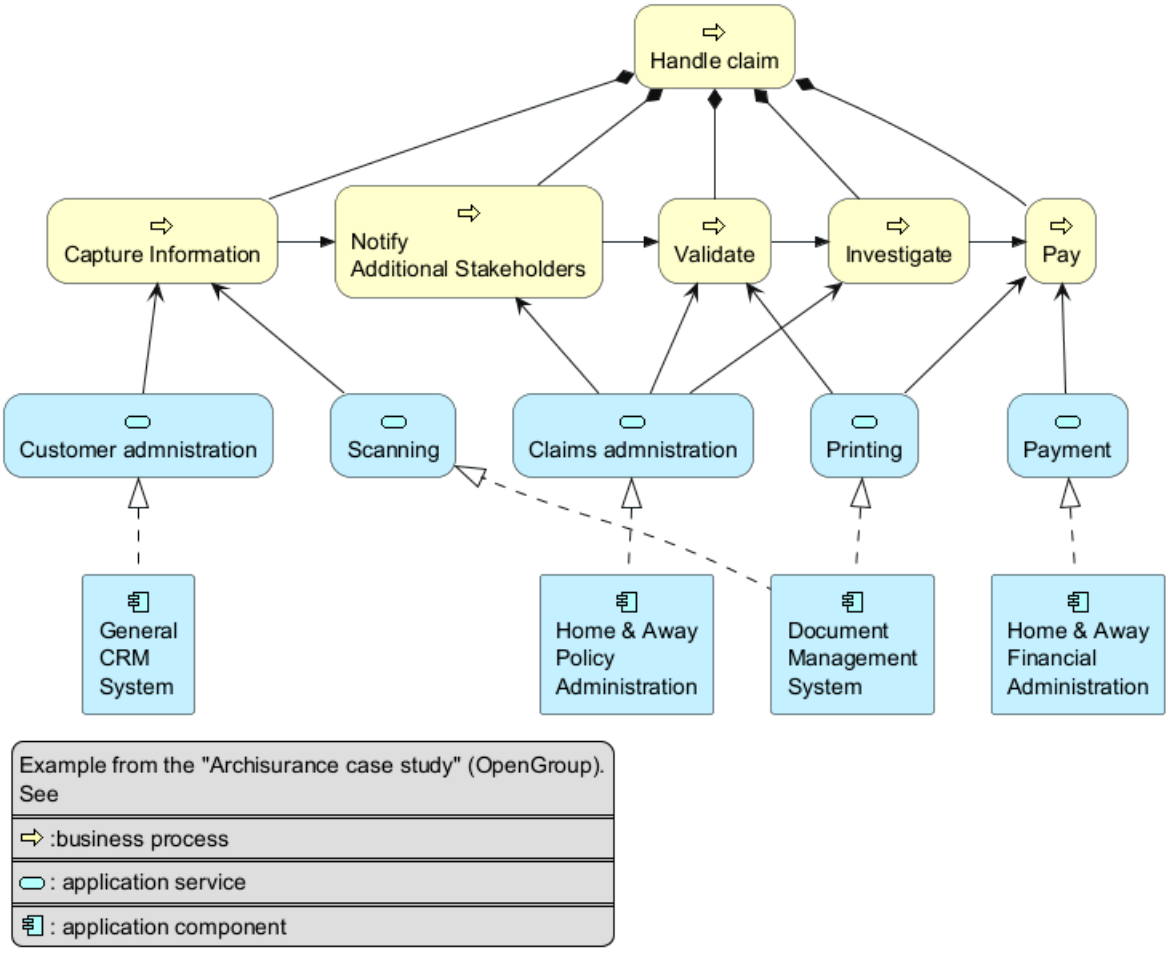
```
@startuml
!define Junction_Or circle #black
!define Junction_And circle #whitesmoke

Junction_And JunctionAnd
Junction_Or JunctionOr

archimate #Technology "VPN Server" as vpnServerA <<technology-device>>

rectangle GO #lightgreen
rectangle STOP #red
rectangle WAIT #orange
GO -up-> JunctionOr
STOP -up-> JunctionOr
STOP -down-> JunctionAnd
WAIT -down-> JunctionAnd
@enduml
```



15.3 Example 1

```
@startuml
skinparam rectangle<<behavior>> {
roundCorner 25
}
sprite $bProcess jar:archimate/business-process
sprite $aService jar:archimate/application-service
sprite $aComponent jar:archimate/application-component

rectangle "Handle claim"  as HC <<$bProcess>><<behavior>> #Business
rectangle "Capture Information"  as CI <<$bProcess>><<behavior>> #Business
rectangle "Notify\nAdditional Stakeholders" as NAS <<$bProcess>><<behavior>> #Business
rectangle "Validate" as V <<$bProcess>><<behavior>> #Business
rectangle "Investigate" as I <<$bProcess>><<behavior>> #Business
rectangle "Pay" as P <<$bProcess>><<behavior>> #Business

HC *-down- CI
HC *-down- NAS
HC *-down- V
HC *-down- I
HC *-down- P

CI -right->> NAS
NAS -right->> V
V -right->> I
I -right->> P

rectangle "Scanning" as scanning <<$aService>><<behavior>> #Application
rectangle "Customer admnistration" as customerAdministration <<$aService>><<behavior>> #Application
rectangle "Claims admnistration" as claimsAdministration <<$aService>><<behavior>> #Application
rectangle Printing <<$aService>><<behavior>> #Application
rectangle Payment <<$aService>><<behavior>> #Application

scanning -up-> CI
customerAdministration  -up-> CI
claimsAdministration -up-> NAS
claimsAdministration -up-> V
claimsAdministration -up-> I
Payment -up-> P

Printing -up-> V
Printing -up-> P
```

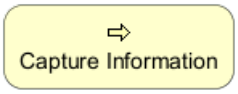
```
rectangle "Document\nManagement\nSystem" as DMS <<$aComponent>> #Application
rectangle "General\nCRM\nSystem" as CRM <<$aComponent>>  #Application
rectangle "Home & Away\nPolicy\nAdministration" as HAPA <<$aComponent>> #Application
rectangle "Home & Away\nFinancial\nAdministration" as HFPA <<$aComponent>>  #Application

DMS .up.|> scanning
DMS .up.|> Printing
CRM .up.|> customerAdministration
HAPA .up.|> claimsAdministration
HFPA .up.|> Payment

legend left
Example from the "Archisurance case study" (OpenGroup).
See
====
<$bProcess> :business process
====
<$aService> : application service
====
<$aComponent> : application component
endlegend
@enduml
```



15.4 Example 2

```
@startuml
```

```
skinparam roundcorner 25
rectangle "Capture Information"  as CI <<$archimate/business-process>> #Business
@enduml
```



15.5 List possible sprites

You can list all possible sprites for Archimate using the following diagram:

```
@startuml
listsprite
@enduml
```

15.6 ArchiMate Macros

15.6.1 Archimate Macros and Library

A list of Archimate macros are defined Archimate-PlantUML here which simplifies the creation of ArchiMate diagrams, and Archimate is natively on the Standard Library of PlantUML.

15.6.2 Archimate elements

Using the macros, creation of ArchiMate elements are done using the following format: `Category_ElementName(nameOfThe "description")`

For example:

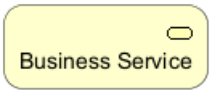
- To define a *Stakeholder* element, which is part of Motivation category, the syntax will be `Motivation_Stakeholder(S "Stakeholder Description")`:

```
@startuml
!include <archimate/Archimate>
```

```
Motivation_Stakeholder(StakeholderElement, "Stakeholder Description")
@enduml
```

- To define a *Business Service* element, `Business_Service(BService, "Business Service")`:

```
@startuml
!include <archimate/Archimate>
Business_Service(BService, "Business Service")
@enduml
```



15.6.3 Archimate relationships

The ArchiMate relationships are defined with the following pattern: `Rel_RelationType(fromElement, toElement, "description")` and to define the direction/orientation of the two elements: `Rel_RelationType_Direction toElement, "description")`

The `RelationTypes` supported are:

- Access
- Aggregation
- Assignment
- Association
- Composition
- Flow
- Influence
- Realization
- Serving
- Specialization
- Triggering

The `Directions` supported are:

- Up
- Down
- Left
- Right

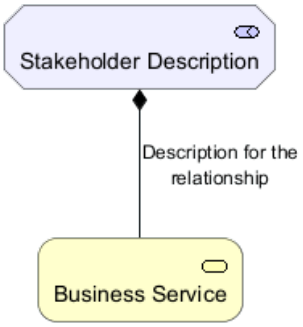
For example:

- To denote a composition relationship between the *Stakeholder* and *Business Service* defined above, the syntax will be

```
Rel_Composition(StakeholderElement, BService, "Description for the relationship")
```

```
@startuml
!include <archimate/Archimate>
Motivation_Stakeholder(StakeholderElement, "Stakeholder Description")
Business_Service(BService, "Business Service")
Rel_Composition(StakeholderElement, BService, "Description for the relationship")
```

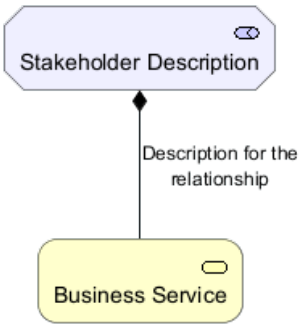
```
@enduml
```



- Unordered List ItemTo orient the two elements in top - down position, the syntax will be

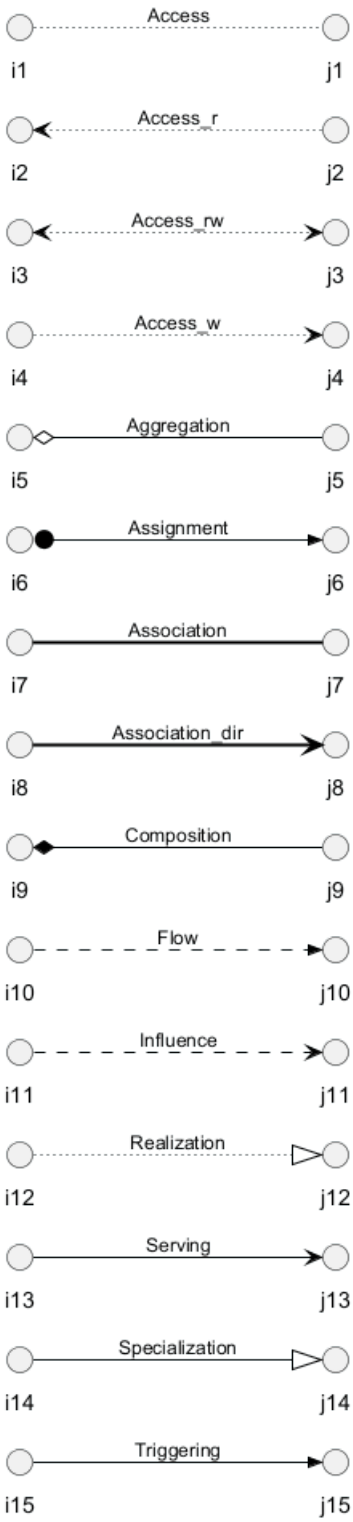
```
Rel_Composition_Down(StakeholderElement, BService, "Description for the relationship")
```

```
@startuml
!include <archimate/Archimate>
Motivation_Stakeholder(StakeholderElement, "Stakeholder Description")
Business_Service(BService, "Business Service")
Rel_Composition_Down(StakeholderElement, BService, "Description for the relationship")
@enduml
```



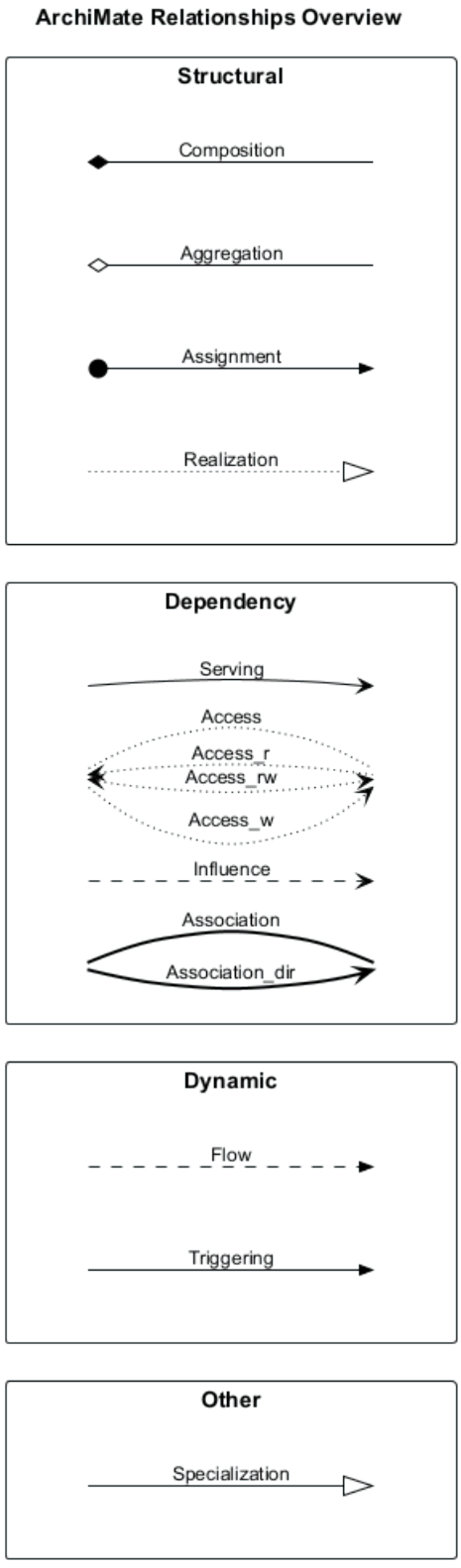
15.6.4 Appendice: Examples of all Archimate RelationTypes

```
@startuml
left to right direction
skinparam nodesep 4
!include <archimate/Archimate>
Rel_Triggering(i15, j15, Triggering)
Rel_Specialization(i14, j14, Specialization)
Rel_Serving(i13, j13, Serving)
Rel_Realization(i12, j12, Realization)
Rel_Influence(i11, j11, Influence)
Rel_Flow(i10, j10, Flow)
Rel_Composition(i9, j9, Composition)
Rel_Association_dir(i8, j8, Association_dir)
Rel_Association(i7, j7, Association)
Rel_Assignment(i6, j6, Assignment)
Rel_Aggregation(i5, j5, Aggregation)
Rel_Access_w(i4, j4, Access_w)
Rel_Access_rw(i3, j3, Access_rw)
Rel_Access_r(i2, j2, Access_r)
Rel_Access(i1, j1, Access)
@enduml
```




```
@startuml
title ArchiMate Relationships Overview
skinparam nodesep 5
<style>
interface {
    shadowing 0
    backgroundcolor transparent
    linecolor transparent
    FontColor transparent
```

```
}
</style>
!include <archimate/Archimate>
left to right direction

rectangle Other {
() i14
() j14
}


rectangle Dynamic {
() i10
() j10
() i15
() j15
}

rectangle Dependency {
() i13
() j13
() i4
() j4
() i11
() j11
() i7
() j7
}

rectangle Structural {
() i9
() j9
() i5
() j5
() i6
() j6
() i12
() j12
}

Rel_Triggering(i15, j15, Triggering)
Rel_Specialization(i14, j14, Specialization)
Rel_Serving(i13, j13, Serving)
Rel_Realization(i12, j12, Realization)
Rel_Influence(i11, j11, Influence)
Rel_Flow(i10, j10, Flow)
Rel_Composition(i9, j9, Composition)
Rel_Association_dir(i7, j7, \nAssociation_dir)
Rel_Association(i7, j7, Association)
Rel_Assignment(i6, j6, Assignment)
Rel_Aggregation(i5, j5, Aggregation)
Rel_Access_w(i4, j4, Access_w)
Rel_Access_rw(i4, j4, Access_rw)
Rel_Access_r(i4, j4, Access_r)
Rel_Access(i4, j4, Access)
@enduml
```



[Adapted from Archimate PR#25]

16 Gantt Chart

A Gantt Chart, is a powerful tool used for **project management**. It visually represents a **project schedule**, allowing managers and team members to see the start and end dates of the entire project at a glance. The diagram displays tasks or activities along a horizontal time axis, showing the **duration** of each task, their **sequence**, and how they overlap or run concurrently.

In a Gantt Chart, each task is represented by a bar, the length and position of which reflects the **start date**, **duration**, and **end date** of the task. This format makes it easy to understand **dependencies** between tasks, where one task must be completed before another can start. Additionally, Gantt Diagrams can include **milestones**, which are significant events or goals in the project timeline, marked as a distinct symbol.

In the context of creating Gantt Charts, **PlantUML** offers several advantages. It provides a **text-based approach** to diagram creation, making it easy to track changes using **version control systems**. This approach is particularly beneficial for teams who are already accustomed to text-based coding environments. PlantUML's syntax for Gantt Charts is **straightforward**, enabling quick modifications and updates to the project timeline. Additionally, the **integration of PlantUML with other tools** and its ability to generate diagrams dynamically from text makes it a versatile choice for teams looking to automate and streamline their project management documentation. The use of PlantUML for Gantt Charts thus combines the **clarity and efficiency** of visual project planning with the **flexibility and control** of a text-based system.

16.1 Declaring tasks

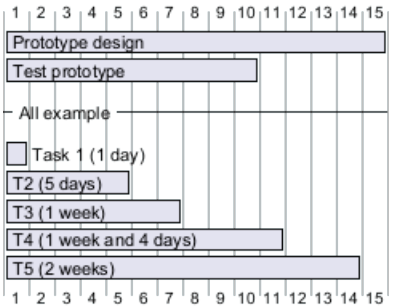
The Gantt is described in *natural* language, using very simple sentences (subject-verb-complement).

Tasks defined using square bracket.

16.1.1 Workload

The workload for each task is specified using the `requires` verb, indicating the amount of work needed in terms of days.

```
@startgantt
[Prototype design] requires 15 days
[Test prototype] requires 10 days
-- All example --
[Task 1 (1 day)] requires 1 day
[T2 (5 days)] requires 5 days
[T3 (1 week)] requires 1 week
[T4 (1 week and 4 days)] requires 1 week and 4 days
[T5 (2 weeks)] requires 2 weeks
@endgantt
```

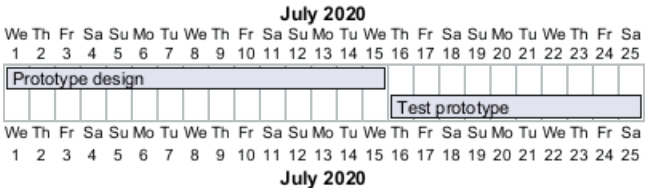


A week is typically understood as a span of seven days. However, in contexts where certain days are designated as 'closed' (like weekends), a week can be redefined in terms of 'non-closed' days. For example, if Saturday and Sunday are marked as closed, then a week in this context will equate to a five-day workload, corresponding to the remaining weekdays.

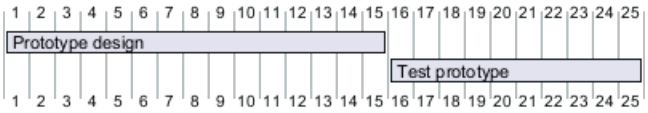
16.1.2 Start

Their beginning are defined using the `start` verb:

```
@startgantt
[Prototype design] requires 15 days
[Test prototype] requires 10 days

Project starts 2020-07-01
[Prototype design] starts 2020-07-01
[Test prototype] starts 2020-07-16
@endgantt
```




```
@startgantt
[Prototype design] requires 15 days
[Test prototype] requires  10 days

[Prototype design] starts D+0
[Test prototype] starts D+15
@endgantt
```

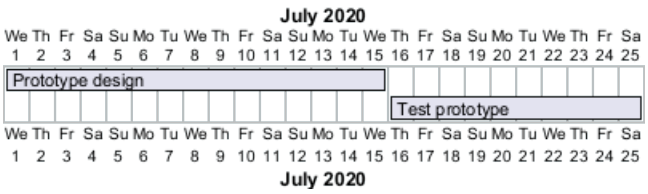


[Ref. for `D+nn` form: QA-14494]

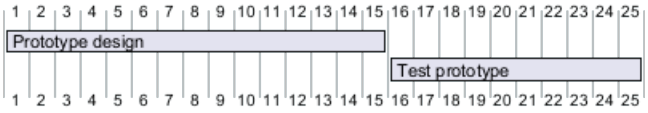
16.1.3 End

Their ending are defined using the `end` verb:

```
@startgantt
[Prototype design] requires 15 days
[Test prototype] requires 10 days

Project starts 2020-07-01
[Prototype design] ends 2020-07-15
[Test prototype] ends 2020-07-25
@endgantt
```



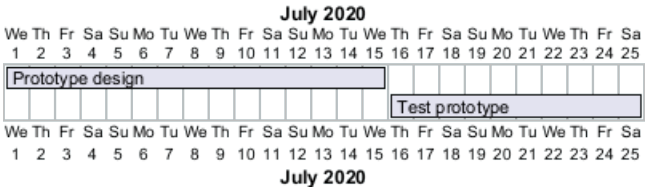

```
@startgantt
[Prototype design] requires 15 days
[Test prototype] requires 10 days

[Prototype design] ends D+14
[Test prototype] ends D+24
@endgantt
```



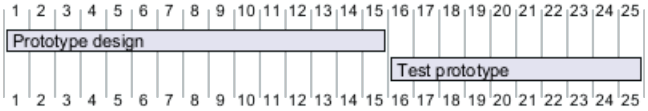
16.1.4 Start/End

It is possible to define both absolutely, by specifying dates:

```
@startgantt
Project starts 2020-07-01
[Prototype design] starts 2020-07-01
[Test prototype] starts 2020-07-16
[Prototype design] ends 2020-07-15
[Test prototype] ends 2020-07-25

@endgantt
```



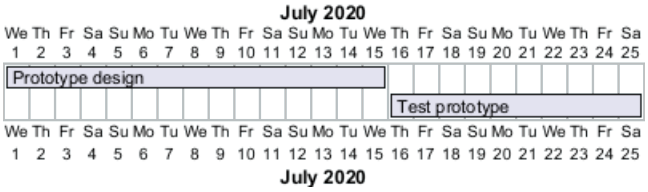

```
@startgantt
[Prototype design] starts D+0
[Test prototype] starts D+15
[Prototype design] ends D+14
[Test prototype] ends D+24
@endgantt
```



16.2 One-line declaration (with the and conjunction)

It is possible to combine declaration on one line with the `and` conjunction.

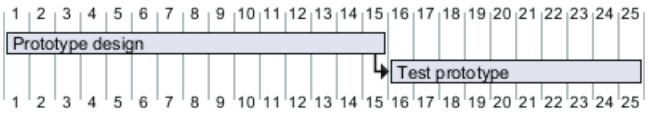
```
@startgantt
Project starts 2020-07-01
[Prototype design] starts 2020-07-01 and ends 2020-07-15
[Test prototype] starts 2020-07-16 and requires 10 days
@endgantt
```



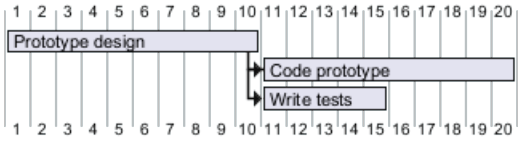
16.3 Adding constraints

It is possible to add constraints between tasks.

```
@startgantt
[Prototype design] requires 15 days
[Test prototype] requires 10 days
[Test prototype] starts at [Prototype design]'s end
@endgantt
```



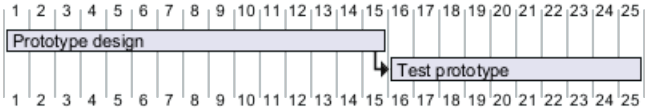

```
@startgantt
[Prototype design] requires 10 days
[Code prototype] requires 10 days
[Write tests] requires 5 days
[Code prototype] starts at [Prototype design]'s end
[Write tests] starts at [Code prototype]'s start
@endgantt
```



16.4 Short names or alias

It is possible to define short name for tasks with the `as` keyword.

```
@startgantt
[Prototype design] as [D] requires 15 days
[Test prototype] as [T] requires 10 days
[T] starts at [D]'s end
@endgantt
```

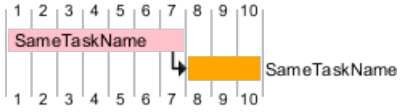


16.5 Tasks with same name

[Starting with V1.2024.6,] it is possible to have multiple tasks with same name.

```
@startgantt
Project starts 2020-11-08
[Task 7 days] as [T7] starts at 2020-11-09
[T7] ends at 2020-11-15
[Task 7 days] as [T7bis] starts at 2020-11-09
[T7bis] ends at 2020-11-15
@endgantt
```


```
@startgantt
[SameTaskName] as [T1] lasts 7 days and is colored in pink
[SameTaskName] as [T2] lasts 3 days and is colored in orange
[T1] -> [T2]
@endgantt
```

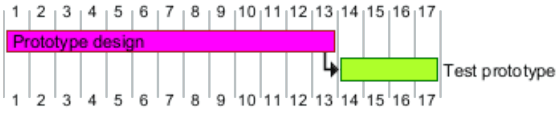


[Ref. QA-12176 and GH-1809]

16.6 Customize colors

It is also possible to customize colors with `is colored in`.

```
@startgantt
[Prototype design] requires 13 days
[Test prototype] requires 4 days
[Test prototype] starts at [Prototype design]'s end
[Prototype design] is colored in Fuchsia/FireBrick
[Test prototype] is colored in GreenYellow/Green
@endgantt
```



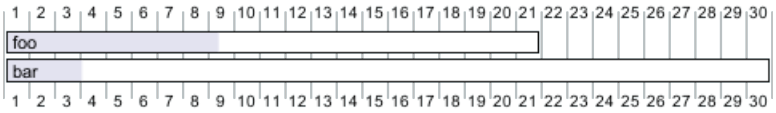
16.7 Completion status

16.7.1 Adding completion depending percentage

You can set the completion status of a task, by the command:

- `is xx% completed`
- `is xx% complete`

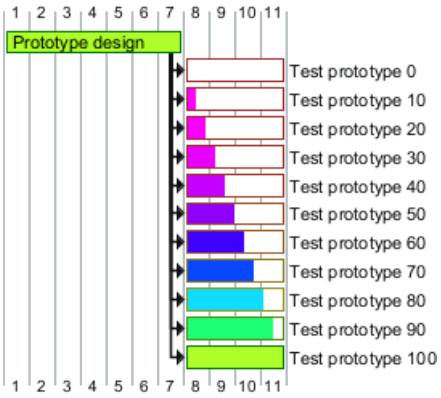
```
@startgantt
[foo] requires 21 days
[foo] is 40% completed
[bar] requires 30 days and is 10% complete
@endgantt
```



16.7.2 Change colour of completion (by style)

```
@startgantt

<style>
ganttDiagram {
  task {
    BackGroundColor GreenYellow
    LineColor Green
    unstarted {
      BackGroundColor Fuchsia
      LineColor FireBrick
    }
  }
}
</style>

[Prototype design] requires 7 days
[Test prototype 0] requires 4 days
[Test prototype 10] requires 4 days
[Test prototype 20] requires 4 days
[Test prototype 30] requires 4 days
[Test prototype 40] requires 4 days
[Test prototype 50] requires 4 days
[Test prototype 60] requires 4 days
```

```
[Test prototype 70] requires 4 days
[Test prototype 80] requires 4 days
[Test prototype 90] requires 4 days
[Test prototype 100] requires 4 days

[Test prototype 0] starts at [Prototype design]'s end
[Test prototype 10] starts at [Prototype design]'s end
[Test prototype 20] starts at [Prototype design]'s end
[Test prototype 30] starts at [Prototype design]'s end
[Test prototype 40] starts at [Prototype design]'s end
[Test prototype 50] starts at [Prototype design]'s end
[Test prototype 60] starts at [Prototype design]'s end
[Test prototype 70] starts at [Prototype design]'s end
[Test prototype 80] starts at [Prototype design]'s end
[Test prototype 90] starts at [Prototype design]'s end
[Test prototype 100] starts at [Prototype design]'s end

[Test prototype 0] is 0% complete
[Test prototype 10] is 10% complete
[Test prototype 20] is 20% complete
[Test prototype 30] is 30% complete
[Test prototype 40] is 40% complete
[Test prototype 50] is 50% complete
[Test prototype 60] is 60% complete
[Test prototype 70] is 70% complete
[Test prototype 80] is 80% complete
[Test prototype 90] is 90% complete
[Test prototype 100] is 100% complete

@endgantt
```

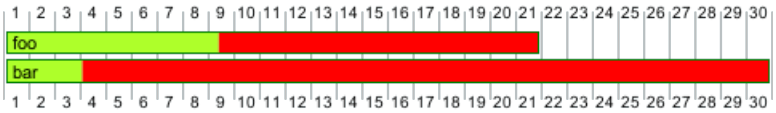


[Ref. QA-8297]

16.7.3 Change colour of undone part of Task (by style)

```
@startgantt
<style>
ganttDiagram {
  task {
    BackGroundColor GreenYellow
    LineColor Green
  }
  undone {
    BackGroundColor red
  }
}
```

```
</style>

[foo] lasts 21 days
[foo] is 40% completed
[bar] lasts 30 days and is 10% complete
@endgantt
```



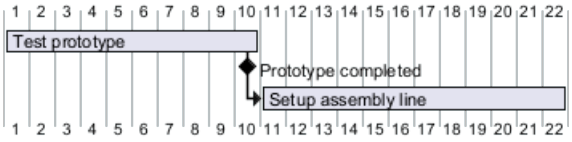
[Ref. QA-15299]

16.8 Milestone

You can define Milestones using the `happen` verb.

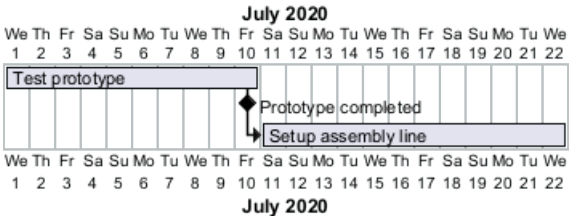
16.8.1 Relative milestone (use of constraints)

```
@startgantt
[Test prototype] requires 10 days
[Prototype completed] happens at [Test prototype]'s end
[Setup assembly line] requires 12 days
[Setup assembly line] starts at [Test prototype]'s end
@endgantt
```



16.8.2 Absolute milestone (use of fixed date)

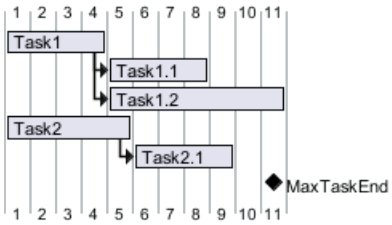
```
@startgantt
Project starts 2020-07-01
[Test prototype] requires 10 days
[Prototype completed] happens 2020-07-10
[Setup assembly line] requires 12 days
[Setup assembly line] starts at [Test prototype]'s end
@endgantt
```



16.8.3 Milestone of maximum end of tasks

```
@startgantt
[Task1] requires 4 days
then [Task1.1] requires 4 days
[Task1.2] starts at [Task1]'s end and requires 7 days

[Task2] requires 5 days
then [Task2.1] requires 4 days

[MaxTaskEnd] happens at [Task1.1]'s end
```

```
[MaxTaskEnd] happens at [Task1.2]'s end
[MaxTaskEnd] happens at [Task2.1]'s end

@endgantt
```



[Ref. QA-10764]

16.9 Hyperlinks

You can add hyperlinks to tasks.

```
@startgantt
[task1] requires 10 days
[task1] links to [[http://plantuml.com]]
@endgantt
```

16.10 Calendar

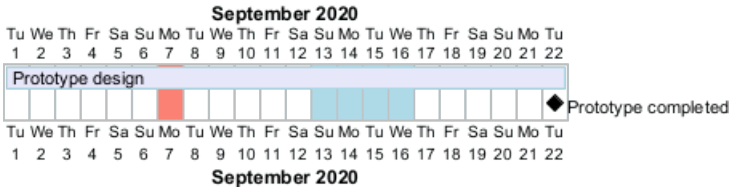
You can specify a starting date for the whole project. By default, the first task starts at this date.

```
@startgantt
Project starts the 20th of september 2017
[Prototype design] as [TASK1] requires 13 days
[TASK1] is colored in Lavender/LightBlue
@endgantt
```

16.11 Coloring days

It is possible to add colors to some days.

```
@startgantt
Project starts the 2020/09/01

2020/09/07 is colored in salmon
2020/09/13 to 2020/09/16 are colored in lightblue

[Prototype design] as [TASK1] requires 22 days
[TASK1] is colored in Lavender/LightBlue
[Prototype completed] happens at [TASK1]'s end
@endgantt
```



16.12 Changing scale

You can change scale for very long project, with one of those parameters:

- printscale
- ganttscale
- projectscale

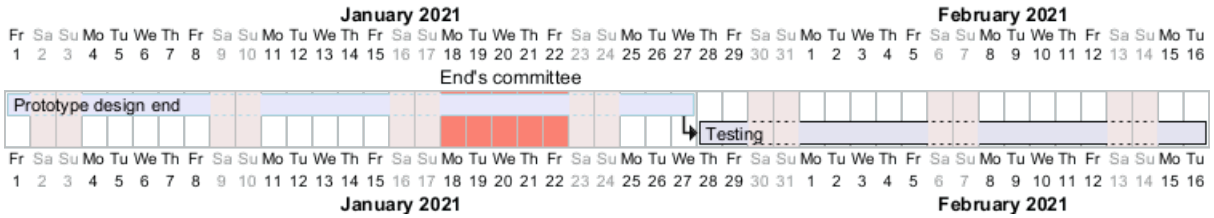
and one of the values:

- daily *(by default)*
- weekly
- monthly
- quarterly
- yearly

(See QA-11272, QA-9041 and QA-10948)

16.12.1 Daily *(by default)*

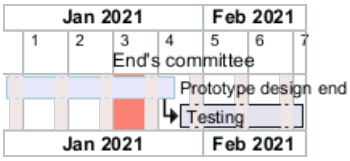
```
@startgantt
saturday are closed
sunday are closed

Project starts the 1st of january 2021
[Prototype design end] as [TASK1] requires 19 days
[TASK1] is colored in Lavender/LightBlue
[Testing] requires 14 days
[TASK1]->[Testing]

2021-01-18 to 2021-01-22 are named [End's committee]
2021-01-18 to 2021-01-22 are colored in salmon
@endgantt
```



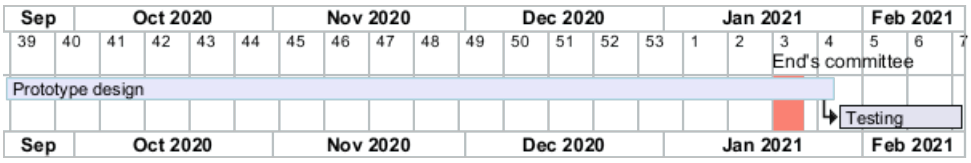
16.12.2 Weekly

```
@startgantt
printscale weekly
saturday are closed
sunday are closed

Project starts the 1st of january 2021
[Prototype design end] as [TASK1] requires 19 days
[TASK1] is colored in Lavender/LightBlue
```

```
[Testing] requires 14 days
[TASK1]->[Testing]

2021-01-18 to 2021-01-22 are named [End's committee]
2021-01-18 to 2021-01-22 are colored in salmon
@endgantt
```

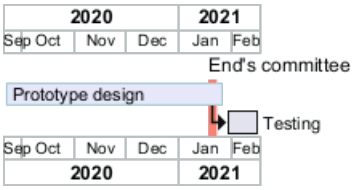



```
@startgantt
printscale weekly
Project starts the 20th of september 2020
[Prototype design] as [TASK1] requires 130 days
[TASK1] is colored in Lavender/LightBlue
[Testing] requires  20 days
[TASK1]->[Testing]

2021-01-18 to 2021-01-22 are named [End's committee]
2021-01-18 to 2021-01-22 are colored in salmon
@endgantt
```



16.12.3 Monthly

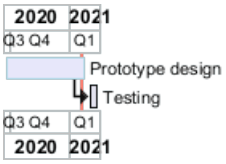
```
@startgantt
projectscale monthly
Project starts the 20th of september 2020
[Prototype design] as [TASK1] requires 130 days
[TASK1] is colored in Lavender/LightBlue
[Testing] requires 20 days
[TASK1]->[Testing]

2021-01-18 to 2021-01-22 are named [End's committee]
2021-01-18 to 2021-01-22 are colored in salmon
@endgantt
```



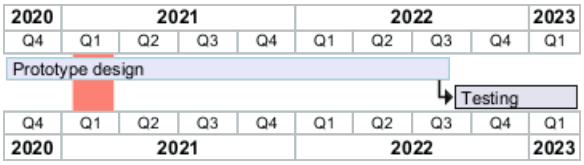
16.12.4 Quarterly

```
@startgantt
projectscale quarterly
Project starts the 20th of september 2020
[Prototype design] as [TASK1] requires 130 days
[TASK1] is colored in Lavender/LightBlue
[Testing] requires 20 days
[TASK1]->[Testing]
```

```
2021-01-18 to 2021-01-22 are named [End's committee]
2021-01-18 to 2021-01-22 are colored in salmon
@endgantt
```

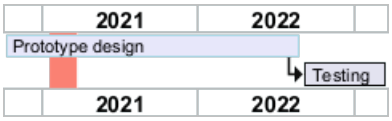



```
@startgantt
projectscale quarterly
Project starts the 1st of october 2020
[Prototype design] as [TASK1] requires 700 days
[TASK1] is colored in Lavender/LightBlue
[Testing] requires 200 days
[TASK1]->[Testing]

2021-01-18 to 2021-03-22 are colored in salmon
@endgantt
```



16.12.5 Yearly

```
@startgantt
projectscale yearly
Project starts the 1st of october 2020
[Prototype design] as [TASK1] requires 700 days
[TASK1] is colored in Lavender/LightBlue
[Testing] requires 200 days
[TASK1]->[Testing]

2021-01-18 to 2021-03-22 are colored in salmon
@endgantt
```

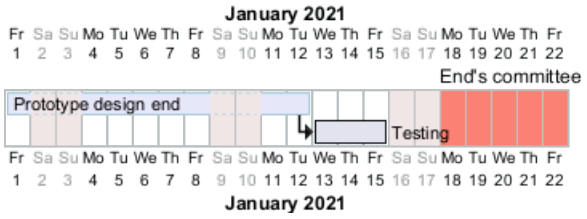


16.12.6 Date range with between

16.12.7 Without date range

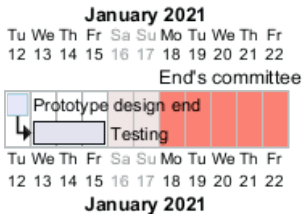
```
@startgantt
saturday are closed
sunday are closed

Project starts the 1st of january 2021
[Prototype design end] as [TASK1] requires 8 days
[TASK1] is colored in Lavender/LightBlue
[Testing] requires 3 days
[TASK1]->[Testing]

2021-01-18 to 2021-01-22 are named [End's committee]
```

```
2021-01-18 to 2021-01-22 are colored in salmon
@endgantt
```



16.12.8 With date range

```
@startgantt
Print between 2021-01-12 and 2021-01-22
Saturday are closed
sunday are closed

Project starts the 1st of january 2021
[Prototype design end] as [TASK1] requires 8 days
[TASK1] is colored in Lavender/LightBlue
[Testing] requires 3 days
[TASK1]->[Testing]

2021-01-18 to 2021-01-22 are named [End's committee]
2021-01-18 to 2021-01-22 are colored in salmon
@endgantt
```



16.13 Zoom (example for all scale)

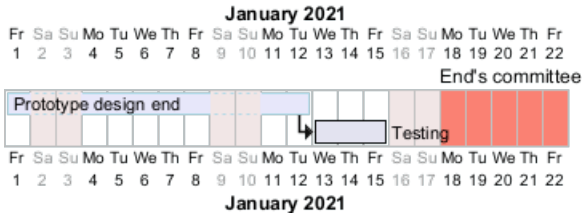
You can change zoom, with the parameter:

- `zoom <integer>`

16.13.1 Zoom on daily (default) scale

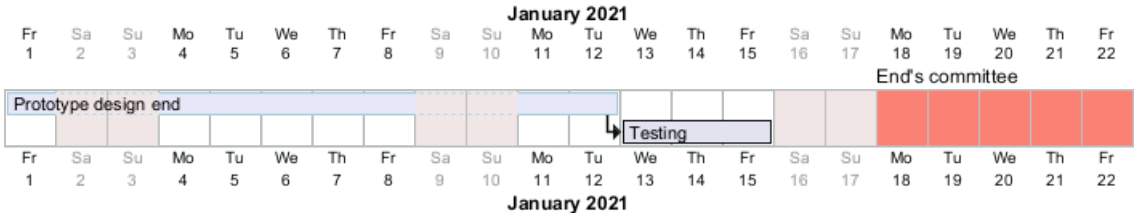
- Without zoom

```
@startgantt
printscale daily
saturday are closed
sunday are closed

Project starts the 1st of january 2021
[Prototype design end] as [TASK1] requires 8 days
[TASK1] is colored in Lavender/LightBlue
[Testing] requires  3 days
[TASK1]->[Testing]

2021-01-18 to 2021-01-22 are named [End's committee]
2021-01-18 to 2021-01-22 are colored in salmon
@endgantt
```



- With zoom

```
@startgantt
printscale daily zoom 2
saturday are closed
sunday are closed

Project starts the 1st of january 2021
[Prototype design end] as [TASK1] requires 8 days
[TASK1] is colored in Lavender/LightBlue
[Testing] requires 3 days
[TASK1]->[Testing]

2021-01-18 to 2021-01-22 are named [End's committee]
2021-01-18 to 2021-01-22 are colored in salmon
@endgantt
```

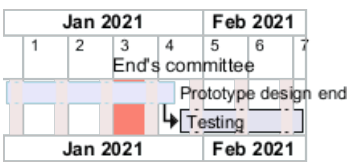


[Ref. QA-13725]

16.13.2 Zoom on weekly scale

- Without zoom

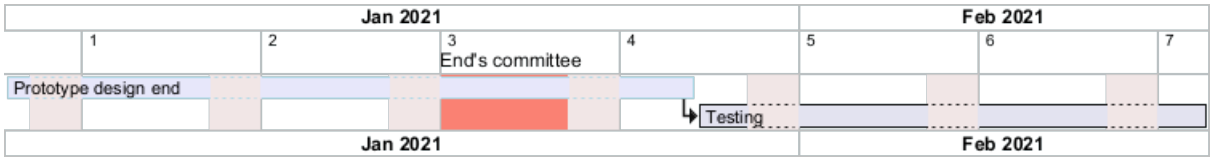
```
@startgantt
printscale weekly
saturday are closed
sunday are closed

Project starts the 1st of january 2021
[Prototype design end] as [TASK1] requires 19 days
[TASK1] is colored in Lavender/LightBlue
[Testing] requires 14 days
[TASK1]->[Testing]

2021-01-18 to 2021-01-22 are named [End's committee]
2021-01-18 to 2021-01-22 are colored in salmon
@endgantt
```



- With zoom

```
@startgantt
```

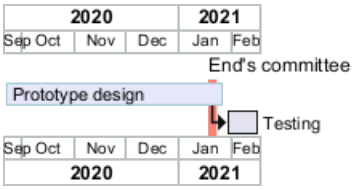
```
printscale weekly zoom 4
saturday are closed
sunday are closed

Project starts the 1st of january 2021
[Prototype design end] as [TASK1] requires 19 days
[TASK1] is colored in Lavender/LightBlue
[Testing] requires 14 days
[TASK1]->[Testing]

2021-01-18 to 2021-01-22 are named [End's committee]
2021-01-18 to 2021-01-22 are colored in salmon
@endgantt
```



16.13.3 Zoom on monthly scale

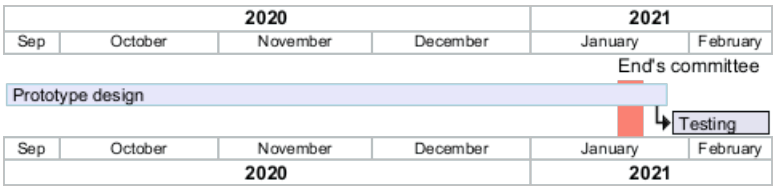
- Without zoom

```
@startgantt
projectscale monthly
Project starts the 20th of september 2020
[Prototype design] as [TASK1] requires 130 days
[TASK1] is colored in Lavender/LightBlue
[Testing] requires 20 days
[TASK1]->[Testing]

2021-01-18 to 2021-01-22 are named [End's committee]
2021-01-18 to 2021-01-22 are colored in salmon
@endgantt
```



- With zoom

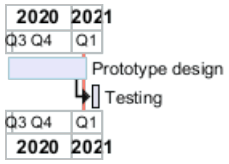
```
@startgantt
projectscale monthly zoom 3
Project starts the 20th of september 2020
[Prototype design] as [TASK1] requires 130 days
[TASK1] is colored in Lavender/LightBlue
[Testing] requires 20 days
[TASK1]->[Testing]

2021-01-18 to 2021-01-22 are named [End's committee]
2021-01-18 to 2021-01-22 are colored in salmon
@endgantt
```



16.13.4 Zoom on quarterly scale

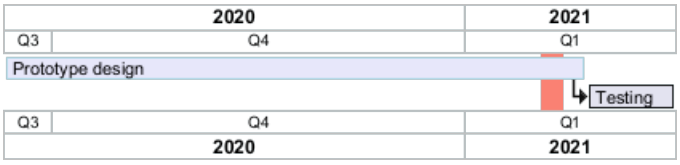
- Without zoom

```
@startgantt
projectscale quarterly
Project starts the 20th of september 2020
[Prototype design] as [TASK1] requires 130 days
[TASK1] is colored in Lavender/LightBlue
[Testing] requires 20 days
[TASK1]->[Testing]

2021-01-18 to 2021-01-22 are named [End's committee]
2021-01-18 to 2021-01-22 are colored in salmon
@endgantt
```



- With zoom

```
@startgantt
projectscale quarterly zoom 7
Project starts the 20th of september 2020
[Prototype design] as [TASK1] requires 130 days
[TASK1] is colored in Lavender/LightBlue
[Testing] requires 20 days
[TASK1]->[Testing]

2021-01-18 to 2021-01-22 are named [End's committee]
2021-01-18 to 2021-01-22 are colored in salmon
@endgantt
```

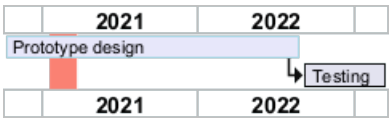


16.13.5 Zoom on yearly scale

- Without zoom

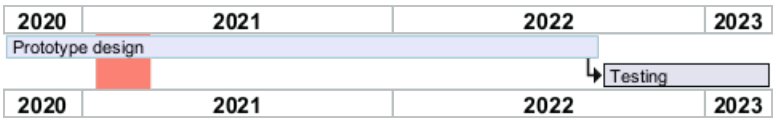
```
@startgantt
projectscale yearly
Project starts the 1st of october 2020
[Prototype design] as [TASK1] requires 700 days
[TASK1] is colored in Lavender/LightBlue
[Testing] requires 200 days
[TASK1]->[Testing]

2021-01-18 to 2021-03-22 are colored in salmon
```

```
@endgantt
```



- With zoom

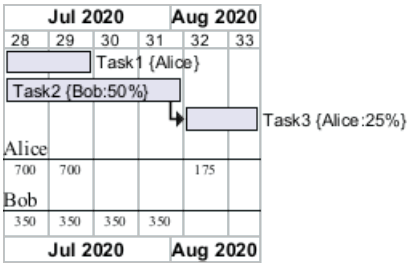
```
@startgantt
projectscale yearly zoom 2
Project starts the 1st of october 2020
[Prototype design] as [TASK1] requires 700 days
[TASK1] is colored in Lavender/LightBlue
[Testing] requires 200 days
[TASK1]->[Testing]

2021-01-18 to 2021-03-22 are colored in salmon
@endgantt
```



16.14 Weekscale with Weeknumbers or Calendar Date

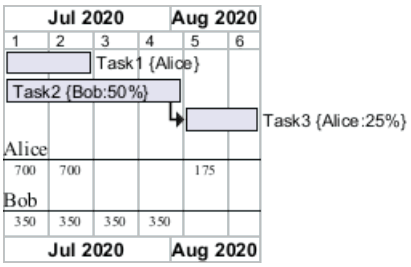
16.14.1 With Weeknumbers *(by default)*

```
@startgantt
printscale weekly
Project starts the 6th of July 2020
[Task1] on {Alice} requires 2 weeks
[Task2] on {Bob:50%} requires 2 weeks
then [Task3] on {Alice:25%} requires 3 days
@endgantt
```



16.14.2 With Weeknumbers *(starting from 1)*

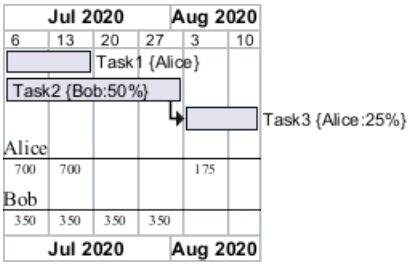
```
@startgantt
printscale weekly with week numbering from 1
Project starts the 6th of July 2020
[Task1] on {Alice} requires 2 weeks
[Task2] on {Bob:50%} requires 2 weeks
then [Task3] on {Alice:25%} requires 3 days
@endgantt
```



[Ref. GH-525]

16.14.3 With Calendar Date

```
@startgantt
printscale weekly with calendar date
Project starts the 6th of July 2020
[Task1] on {Alice} requires 2 weeks
[Task2] on {Bob:50%} requires 2 weeks
then [Task3] on {Alice:25%} requires 3 days
@endgantt
```

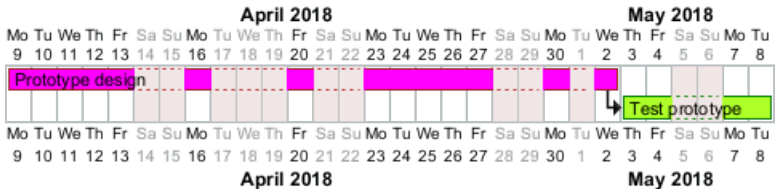


[Ref. QA-11630]

16.15 Close day

It is possible to close some day.

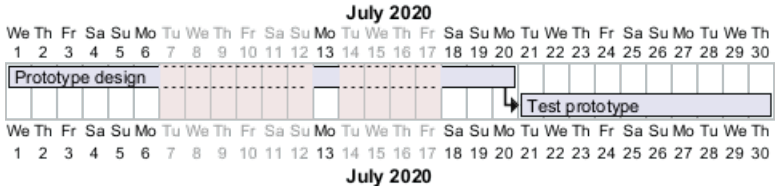
```
@startgantt
project starts the 2018/04/09
saturday are closed
sunday are closed
2018/05/01 is closed
2018/04/17 to 2018/04/19 is closed
[Prototype design] requires 14 days
[Test prototype] requires 4 days
[Test prototype] starts at [Prototype design]'s end
[Prototype design] is colored in Fuchsia/FireBrick
[Test prototype] is colored in GreenYellow/Green
@endgantt
```



Then it is possible to open some closed day.

```
@startgantt
2020-07-07 to 2020-07-17 is closed
2020-07-13 is open
```

```
Project starts the 2020-07-01
[Prototype design] requires 10 days
Then [Test prototype] requires 10 days
@endgantt
```



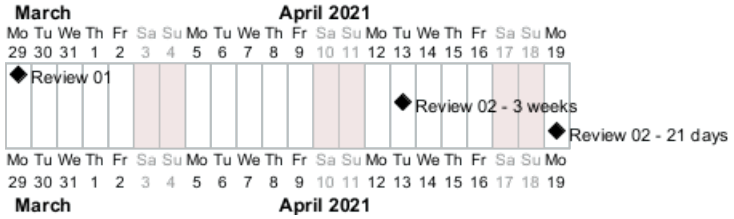
16.16 Definition of a week depending of closed days

A **week** is a synonym for how many non-closed days are in a week, as:

```
@startgantt
Project starts 2021-03-29
[Review 01] happens at 2021-03-29
[Review 02 - 3 weeks] happens on 3 weeks after [Review 01]'s end
[Review 02 - 21 days] happens on 21 days after [Review 01]'s end
@endgantt
```

So if you specify *Saturday* and *Sunday* as closed, a **week** will be equivalent to 5 days, as:

```
@startgantt
Project starts 2021-03-29
saturday are closed
sunday are closed
[Review 01] happens at 2021-03-29
[Review 02 - 3 weeks] happens on 3 weeks after [Review 01]'s end
[Review 02 - 21 days] happens on 21 days after [Review 01]'s end
@endgantt
```



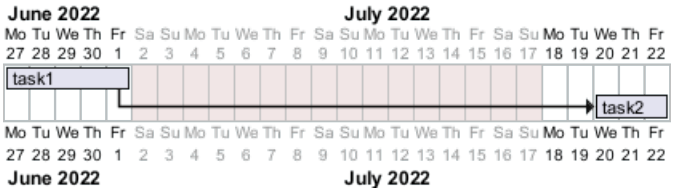
[Ref. QA-13434]

16.17 Working days

It is possible to manage working days.

```
@startgantt

saturday are closed
sunday are closed
2022-07-04 to 2022-07-15 is closed
```

```
Project starts 2022-06-27
[task1] starts at 2022-06-27 and requires 1 week
[task2] starts 2 working days after [task1]'s end and requires 3 days

@endgantt
```

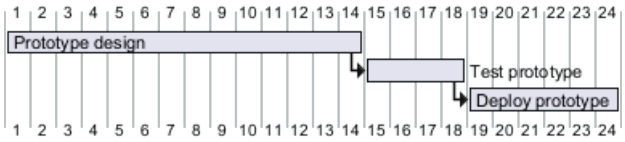


[Ref. QA-16188]

16.18 Simplified task succession

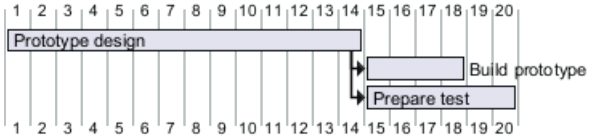
It's possible to use the `then` keyword to denote consecutive tasks.

```
@startgantt
[Prototype design] requires 14 days
then [Test prototype] requires 4 days
then [Deploy prototype] requires 6 days
@endgantt
```



You can also use arrow `->`

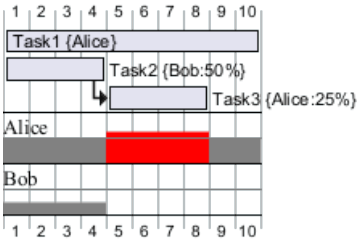
```
@startgantt
[Prototype design] requires 14 days
[Build prototype] requires 4 days
[Prepare test] requires 6 days
[Prototype design] -> [Build prototype]
[Prototype design] -> [Prepare test]
@endgantt
```



16.19 Working with resources

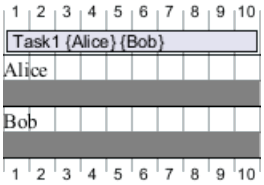
You can affect tasks on resources using the `on` keyword and brackets for resource name.

```
@startgantt
[Task1] on {Alice} requires 10 days
[Task2] on {Bob:50%} requires 2 days
then [Task3] on {Alice:25%} requires 1 days
@endgantt
```



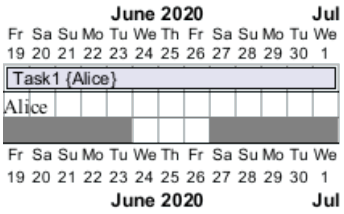
Multiple resources can be assigned to a task:

```
@startgantt
[Task1] on {Alice} {Bob} requires 20 days
@endgantt
```



Resources can be marked as off on specific days:

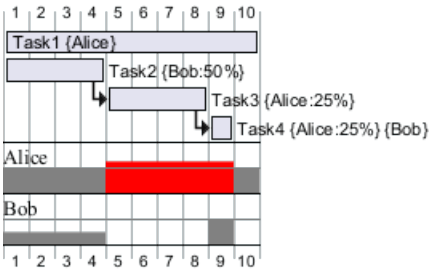
```
@startgantt
project starts on 2020-06-19
[Task1] on {Alice} requires 10 days
{Alice} is off on 2020-06-24 to 2020-06-26
@endgantt
```



16.20 Hide resources

16.20.1 Without any hiding (by default)

```
@startgantt
[Task1] on {Alice} requires 10 days
[Task2] on {Bob:50%} requires 2 days
then [Task3] on {Alice:25%} requires 1 days
then [Task4] on {Alice:25%} {Bob} requires 1 days
@endgantt
```

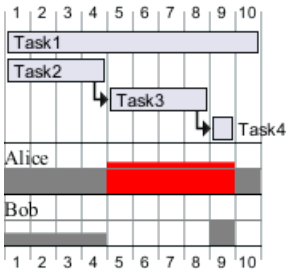


16.20.2 Hide resources names

You can hide resources names and percentage, on tasks, using the `hide resources names` keywords.

```
@startgantt
```

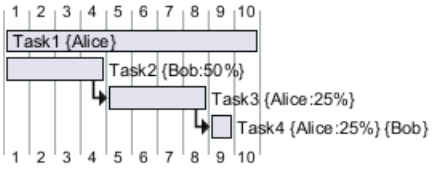
```
hide resources names
[Task1] on {Alice} requires 10 days
[Task2] on {Bob:50%} requires 2 days
then [Task3] on {Alice:25%} requires 1 days
then [Task4] on {Alice:25%} {Bob} requires 1 days
@endgantt
```



16.20.3 Hide resources footbox

You can also hide resources names on bottom of the diagram using the `hide resources footbox` keywords.

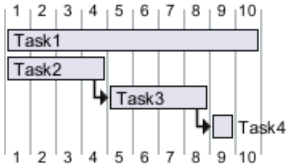
```
@startgantt
hide resources footbox
[Task1] on {Alice} requires 10 days
[Task2] on {Bob:50%} requires 2 days
then [Task3] on {Alice:25%} requires 1 days
then [Task4] on {Alice:25%} {Bob} requires 1 days
@endgantt
```



16.20.4 Hide the both (resources names and resources footbox)

You can also hide the both.

```
@startgantt
hide resources names
hide resources footbox
[Task1] on {Alice} requires  10 days
[Task2] on {Bob:50%} requires 2 days
then [Task3] on {Alice:25%} requires 1 days
then [Task4] on {Alice:25%} {Bob} requires 1 days
@endgantt
```

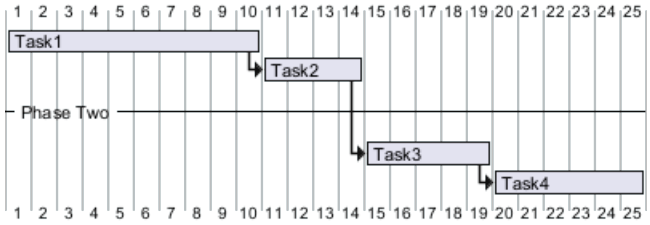


16.21 Horizontal Separator

You can use `--` to separate sets of tasks.

```
@startgantt
[Task1] requires 10 days
```

```
then [Task2] requires 4 days
-- Phase Two --
then [Task3] requires 5 days
then [Task4] requires 6 days
@endgantt
```



16.22 Vertical Separator

You can add Vertical Separators with the syntax: `Separator just [at]`.

```
@startgantt
[task1] requires 1 week
[task2] starts 20 days after [task1]'s end and requires 3 days

Separator just at [task1]'s end
Separator just 2 days after [task1]'s end

Separator just at [task2]'s start
Separator just 2 days before [task2]'s start
@endgantt
```

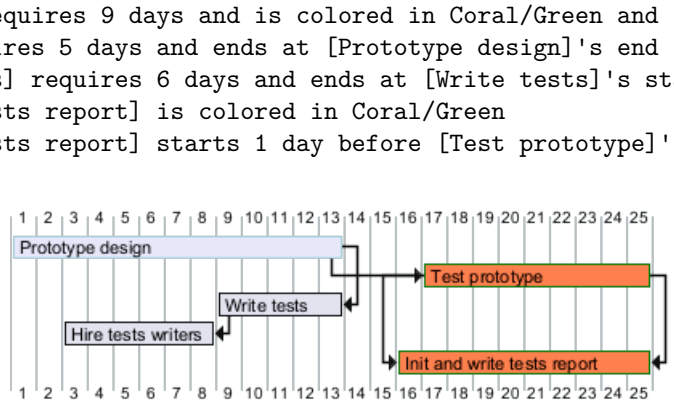
[Ref. QA-16247]

16.23 Complex example

It also possible to use the `and` conjunction.

You can also add delays in constraints.

```
@startgantt
[Prototype design] requires 13 days and is colored in Lavender/LightBlue
[Test prototype] requires 9 days and is colored in Coral/Green and starts 3 days after [Prototype des
[Write tests] requires 5 days and ends at [Prototype design]'s end
[Hire tests writers] requires 6 days and ends at [Write tests]'s start
[Init and write tests report] is colored in Coral/Green
[Init and write tests report] starts 1 day before [Test prototype]'s start and ends at [Test prototyp
@endgantt
```

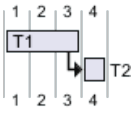


16.24 Comments

As is mentioned on Common Commands page: blockquote Everything that starts with `simple quote '` is a comment.

You can also put comments on several lines using `/'` to start and `'/` to end. blockquote *(i.e.: the first character (except space character) of a comment line must be a* `simple quote` *')*

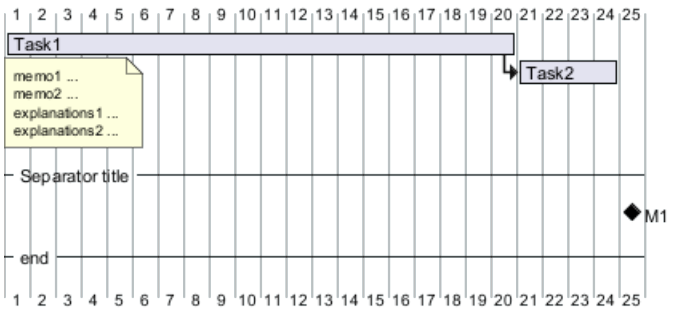
```
@startgantt
' This is a comment

[T1] requires 3 days

/' this comment
is on several lines '/

[T2] starts at [T1]'s end and requires 1 day
@endgantt
```



16.25 Using style

16.25.1 Without style (by default)

```
@startgantt
[Task1] requires 20 days
note bottom
  memo1 ...
  memo2 ...
  explanations1 ...
  explanations2 ...
end note
[Task2] requires 4 days
[Task1] -> [Task2]
-- Separator title --
[M1] happens on 5 days after [Task1]'s end
-- end --
@endgantt
```

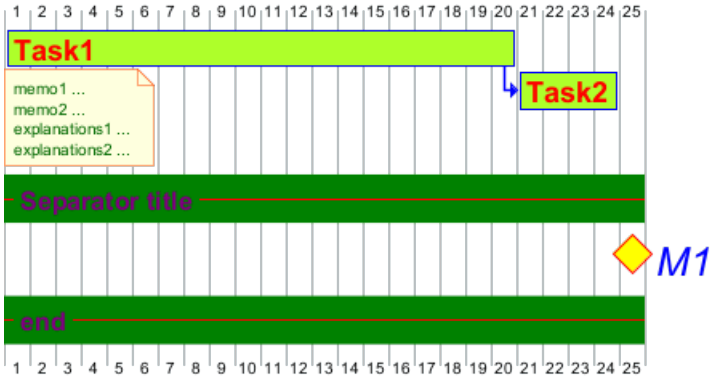


16.25.2 With style

You can use style to change rendering of elements.

```
@startgantt
<style>
ganttDiagram {
task {
FontName Helvetica
FontColor red
FontSize 18
FontStyle bold
BackGroundColor GreenYellow
```

```
LineColor blue
}
milestone {
FontColor blue
FontSize 25
FontStyle italic
BackGroundColor yellow
LineColor red
}
note {
FontColor DarkGreen
FontSize 10
LineColor OrangeRed
}
arrow {
FontName Helvetica
FontColor red
FontSize 18
FontStyle bold
BackGroundColor GreenYellow
LineColor blue
}
separator {
LineColor red
BackGroundColor green
FontSize 16
FontStyle bold
FontColor purple
}
}
</style>
[Task1] requires 20 days
note bottom
  memo1 ...
  memo2 ...
  explanations1 ...
  explanations2 ...
end note
[Task2] requires 4 days
[Task1] -> [Task2]
-- Separator title --
[M1] happens on 5 days after [Task1]'s end
-- end --
@endgantt
```

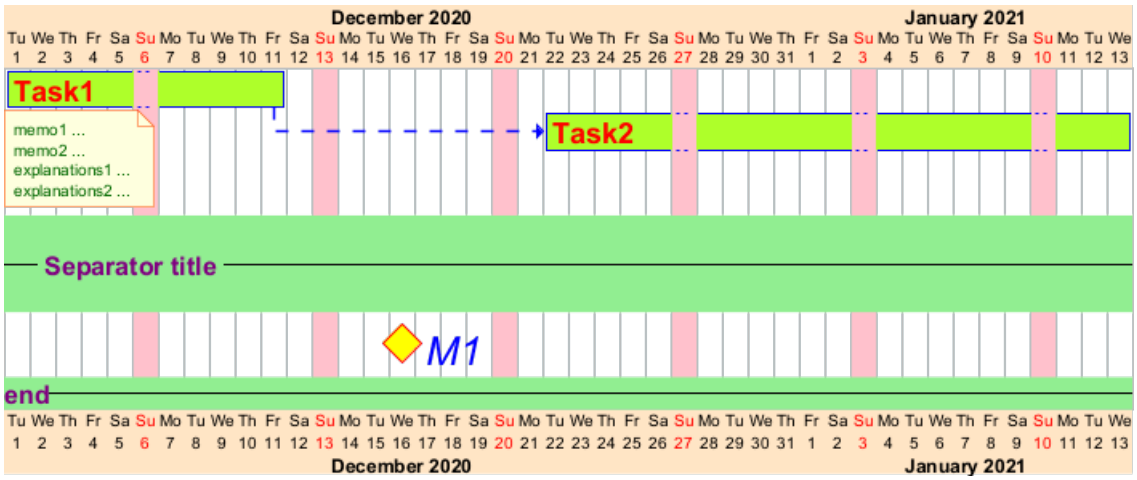


[Ref. QA-10835, QA-12045, QA-11877 and PR-438]

16.25.3 With style (full example)

```
@startgantt
<style>
ganttDiagram {
task {
FontName Helvetica
FontColor red
FontSize 18
FontStyle bold
BackGroundColor GreenYellow
LineColor blue
}
milestone {
FontColor blue
FontSize 25
FontStyle italic
BackGroundColor yellow
LineColor red
}
note {
FontColor DarkGreen
FontSize 10
LineColor OrangeRed
}
arrow {
FontName Helvetica
FontColor red
FontSize 18
FontStyle bold
BackGroundColor GreenYellow
LineColor blue
LineStyle 8.0;13.0
LineThickness 3.0
}
separator {
BackgroundColor lightGreen
LineStyle 8.0;3.0
LineColor red
LineThickness 1.0
FontSize 16
FontStyle bold
FontColor purple
Margin 5
Padding 20
}
timeline {
    BackgroundColor Bisque
}
closed {
BackgroundColor pink
FontColor red
}
}
</style>
Project starts the 2020-12-01

[Task1] requires 10 days
sunday are closed
```

```
note bottom
  memo1 ...
  memo2 ...
  explanations1 ...
  explanations2 ...
end note

[Task2] requires 20 days
[Task2] starts 10 days after [Task1]'s end
-- Separator title --
[M1] happens on 5 days after [Task1]'s end

<style>
separator {
    LineColor black
Margin 0
Padding 0
}
</style>

-- end --
@endgantt
```



[Ref. QA-13570, QA-13672]

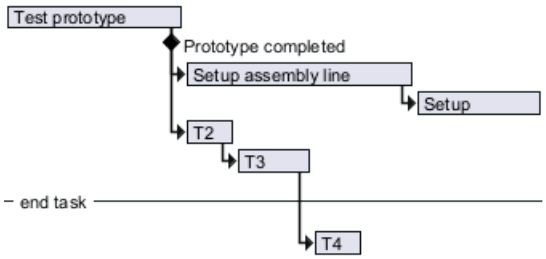
TODO: DONE *Thanks for style for Separator and all style for Arrow (thickness...)*

16.25.4 Clean style

With style, you can also clean a Gantt diagram *(showing tasks, dependencies and relative durations only - but no actual start date and no actual scale)*:

```
@startgantt
<style>
ganttDiagram {
  timeline {
    LineColor transparent
    FontColor transparent
 }
}
</style>

hide footbox
[Test prototype] requires 7 days
```

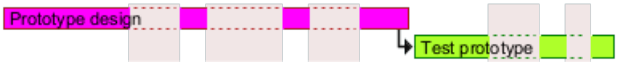
```
[Prototype completed] happens at [Test prototype]'s end
[Setup assembly line] requires 9 days
[Setup assembly line] starts at [Test prototype]'s end
then [Setup] requires 5 days
[T2] requires 2 days and starts at [Test prototype]'s end
then [T3] requires 3 days
-- end task --
then [T4] requires 2 days
@endgantt
```



[Ref. QA-13971]

Or:

```
@startgantt
<style>
ganttDiagram {
  timeline {
    LineColor transparent
    FontColor transparent
  }
  closed {
    FontColor transparent
  }
}
</style>

hide footbox
project starts the 2018/04/09
saturday are closed
sunday are closed
2018/05/01 is closed
2018/04/17 to 2018/04/19 is closed
[Prototype design] requires 9 days
[Test prototype] requires 5 days
[Test prototype] starts at [Prototype design]'s end
[Prototype design] is colored in Fuchsia/FireBrick
[Test prototype] is colored in GreenYellow/Green
@endgantt
```

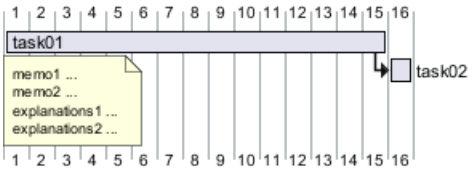


[Ref. QA-13464]

16.26 Add notes

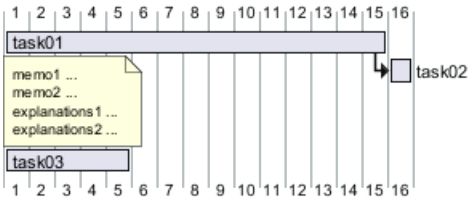
```
@startgantt
[task01] requires 15 days
```

```
note bottom
  memo1 ...
  memo2 ...
  explanations1 ...
  explanations2 ...
end note

[task01] -> [task02]

@endgantt
```



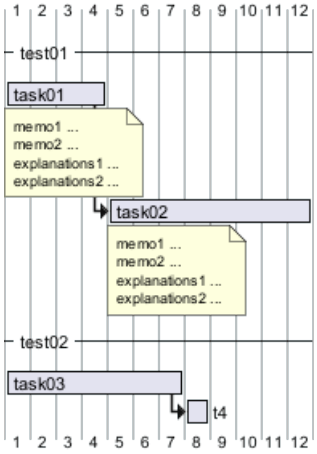
Example with overlap.

```
@startgantt
[task01] requires 15 days
note bottom
  memo1 ...
  memo2 ...
  explanations1 ...
  explanations2 ...
end note

[task01] -> [task02]
[task03] requires 5 days

@endgantt
```




```
@startgantt

-- test01 --

[task01] requires 4 days
note bottom
'note left
memo1 ...
memo2 ...
explanations1 ...
explanations2 ...
end note

[task02] requires 8 days
[task01] -> [task02]
note bottom
'note left
memo1 ...
memo2 ...
explanations1 ...
```

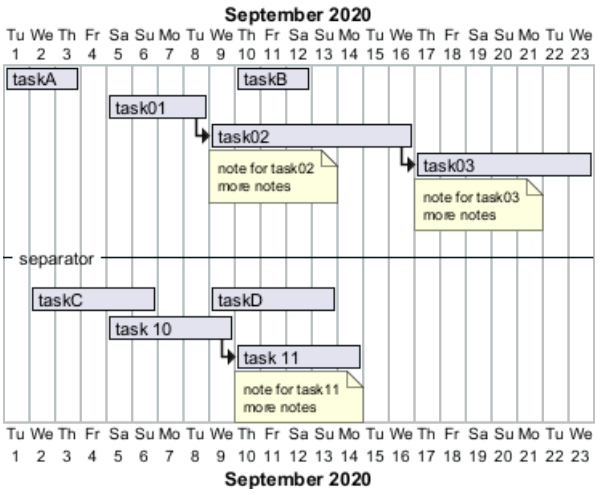
```
explanations2 ...
end note
-- test02 --

[task03] as [t3] requires 7 days
[t3] -> [t4]
@endgantt
```



TODO: DONE *Thanks for correction (of #386 on v1.2020.18) when overlapping*

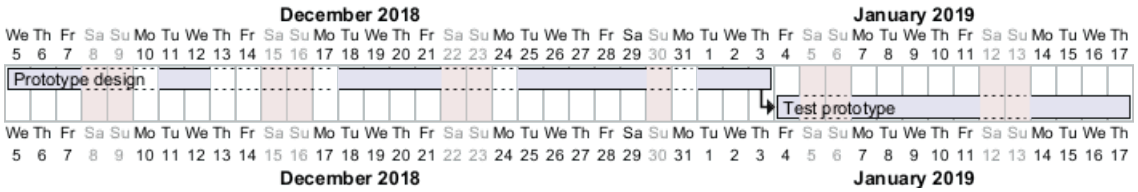
```
@startgantt

Project starts 2020-09-01

[taskA] starts 2020-09-01 and requires 3 days
[taskB] starts 2020-09-10 and requires 3 days
[taskB] displays on same row as [taskA]

[task01] starts 2020-09-05 and requires 4 days

then [task02] requires 8 days
note bottom
  note for task02
  more notes
end note

then [task03] requires 7 days
note bottom
  note for task03
  more notes
end note

-- separator --

[taskC] starts 2020-09-02 and requires 5 days
[taskD] starts 2020-09-09 and requires 5 days
[taskD] displays on same row as [taskC]

[task 10] starts 2020-09-05 and requires 5 days
then [task 11] requires 5 days
note bottom
  note for task11
  more notes
end note
```

```
@endgantt
```



16.27 Pause tasks

```
@startgantt
Project starts the 5th of december 2018
saturday are closed
sunday are closed
2018/12/29 is opened
[Prototype design] requires 17 days
[Prototype design] pauses on 2018/12/13
[Prototype design] pauses on 2018/12/14
[Prototype design] pauses on monday
[Test prototype] starts at [Prototype design]'s end and requires 2 weeks
@endgantt
```

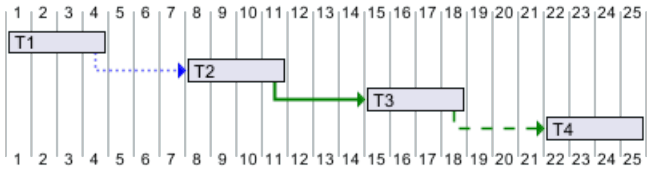


16.28 Change link colors

You can change link colors:

- with this syntax: `with <color> <style> link`

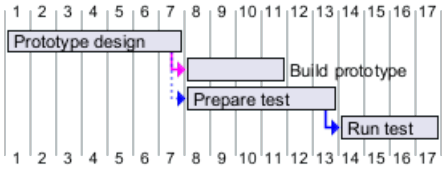
```
@startgantt
[T1] requires 4 days
[T2] requires 4 days and starts 3 days after [T1]'s end with blue dotted link
[T3] requires 4 days and starts 3 days after [T2]'s end with green bold link
[T4] requires 4 days and starts 3 days after [T3]'s end with green dashed link
@endgantt
```



- or directly by using arrow style

```
@startgantt
```

```
<style>
ganttDiagram {
arrow {
LineColor blue
}
}
</style>
[Prototype design] requires 7 days
[Build prototype] requires 4 days
[Prepare test] requires 6 days
[Prototype design] -[#FF00FF]-> [Build prototype]
[Prototype design] -[dotted]-> [Prepare test]
Then [Run test]  requires 4 days
@endgantt
```



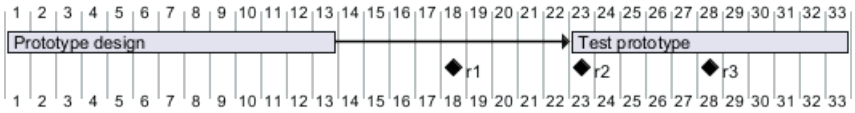
[Ref. QA-13693]

16.29 Tasks or Milestones on the same line

You can put Tasks or Milestones on the same line, with this syntax:

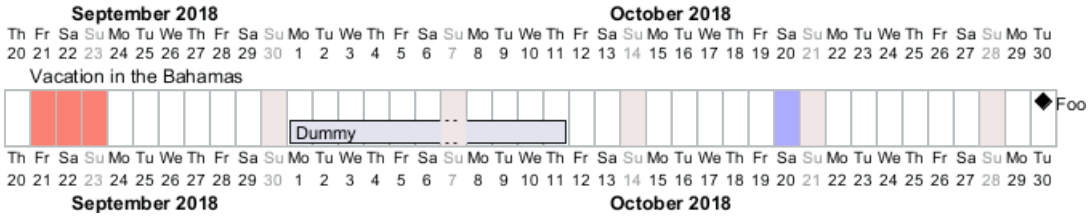
- `[T|M] displays on same row as [T|M]`

```
@startgantt
[Prototype design] requires 13 days
[Test prototype] requires 4 days and 1 week
[Test prototype] starts 1 week and 2 days after [Prototype design]'s end
[Test prototype] displays on same row as [Prototype design]
[r1] happens on 5 days after [Prototype design]'s end
[r2] happens on 5 days after [r1]'s end
[r3] happens on 5 days after [r2]'s end
[r2] displays on same row as [r1]
[r3] displays on same row as [r1]
@endgantt
```



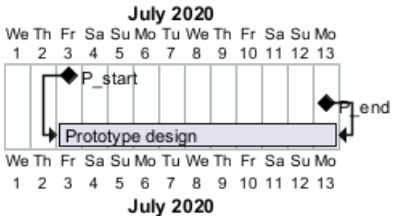
16.30 Highlight today

```
@startgantt
Project starts the 20th of september 2018
sunday are close
2018/09/21 to 2018/09/23 are colored in salmon
2018/09/21 to 2018/09/30 are named [Vacation in the Bahamas]

today is 30 days after start and is colored in #AAF
[Foo] happens 40 days after start
[Dummy] requires 10 days and starts 10 days after start

@endgantt
```



16.31 Task between two milestones

```
@startgantt
project starts on 2020-07-01
[P_start] happens 2020-07-03
[P_end]   happens 2020-07-13
[Prototype design] occurs from [P_start] to [P_end]
@endgantt
```



16.32 Grammar and verbal form

Verbal form	Example
[T] starts	
[M] happens	

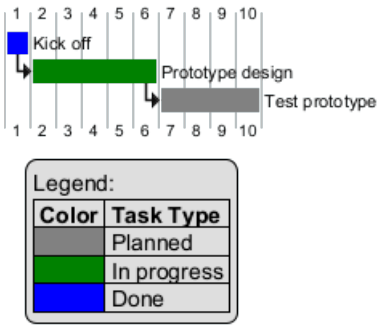
16.33 Add title, header, footer, caption or legend

```
@startgantt

header some header

footer some footer

title My title

[Prototype design] requires 13 days

legend
The legend
end legend

caption This is caption

@endgantt
```

(See also: Common commands)

16.34 Add color on legend

```
@startgantt
[Kick off] requires 1 days and is colored in blue
then [Prototype design] requires 5 days
[Test prototype] requires 4 days
[Test prototype] starts at [Prototype design]'s end
[Prototype design] is colored in Green
[Test prototype] is colored in gray

legend
Legend:
|= Color |= Task Type |
|<#gray> | Planned |
|<#Green>| In progress |
|<#blue> | Done |
end legend

@endgantt
```



[Ref. QA-19021]

16.35 Removing Foot Boxes (example for all scale)

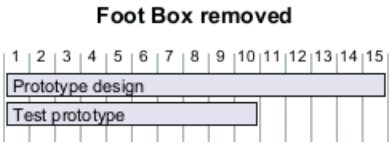
You can use the `hide footbox` keywords to remove the foot boxes of the gantt diagram *(as for sequence diagram)*.

Examples on:

- daily scale *(without project start)*

```
@startgantt

hide footbox
title Foot Box removed

[Prototype design] requires 15 days
```

```
[Test prototype] requires 10 days
@endgantt
```

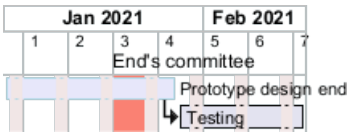


- daily scale

```
@startgantt

Project starts the 20th of september 2017
[Prototype design] as [TASK1] requires 13 days
[TASK1] is colored in Lavender/LightBlue

hide footbox
@endgantt
```

- weekly scale

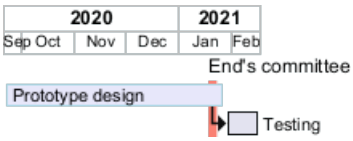
```
@startgantt
hide footbox

printscale weekly
saturday are closed
sunday are closed

Project starts the 1st of january 2021
[Prototype design end] as [TASK1] requires 19 days
[TASK1] is colored in Lavender/LightBlue
[Testing] requires 14 days
[TASK1]->[Testing]

2021-01-18 to 2021-01-22 are named [End's committee]
2021-01-18 to 2021-01-22 are colored in salmon
@endgantt
```



- monthly scale

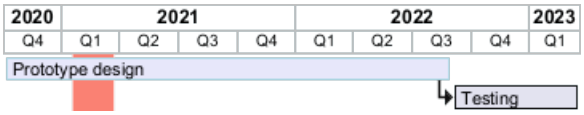
```
@startgantt

hide footbox

projectscale monthly
Project starts the 20th of september 2020
[Prototype design] as [TASK1] requires 130 days
[TASK1] is colored in Lavender/LightBlue
[Testing] requires 20 days
[TASK1]->[Testing]

2021-01-18 to 2021-01-22 are named [End's committee]
```

```
2021-01-18 to 2021-01-22 are colored in salmon
@endgantt
```



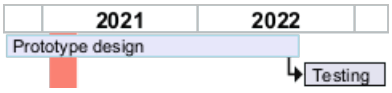
- quarterly scale

```
@startgantt

hide footbox

projectscale quarterly
Project starts the 1st of october 2020
[Prototype design] as [TASK1] requires 700 days
[TASK1] is colored in Lavender/LightBlue
[Testing] requires 200 days
[TASK1]->[Testing]

2021-01-18 to 2021-03-22 are colored in salmon
@endgantt
```



- yearly scale

```
@startgantt

hide footbox

projectscale yearly
Project starts the 1st of october 2020
[Prototype design] as [TASK1] requires 700 days
[TASK1] is colored in Lavender/LightBlue
[Testing] requires 200 days
[TASK1]->[Testing]

2021-01-18 to 2021-03-22 are colored in salmon
@endgantt
```



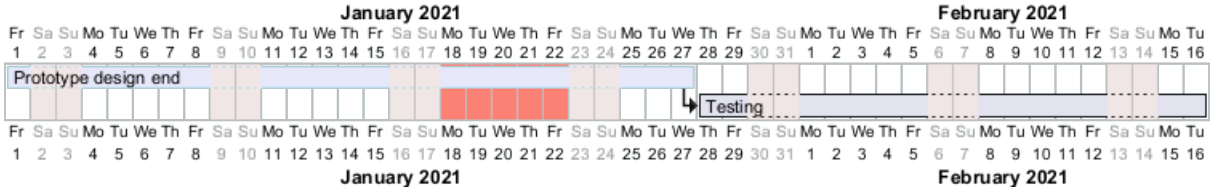
16.36 Language of the calendar

You can choose the language of the Gantt calendar, with the `language <xx>` command where `<xx>` is the ISO 639 code of the language.

16.36.1 English *(en, by default)*

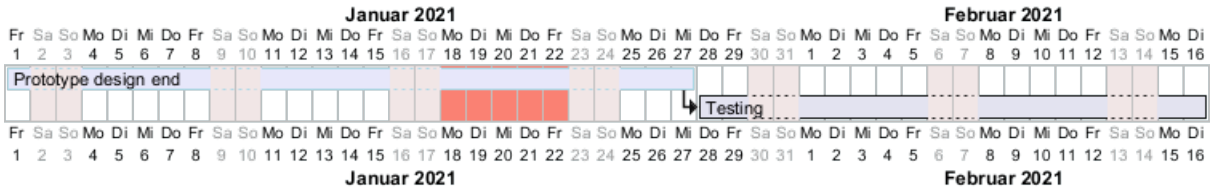
```
@startgantt
saturday are closed
sunday are closed

Project starts 2021-01-01
[Prototype design end] as [TASK1] requires 19 days
```

```
[TASK1] is colored in Lavender/LightBlue
[Testing] requires 14 days
[TASK1]->[Testing]

2021-01-18 to 2021-01-22 are colored in salmon
@endgantt
```



16.36.2 Deutsch (de)

```
@startgantt
language de
saturday are closed
sunday are closed

Project starts 2021-01-01
[Prototype design end] as [TASK1] requires 19 days
[TASK1] is colored in Lavender/LightBlue
[Testing] requires 14 days
[TASK1]->[Testing]

2021-01-18 to 2021-01-22 are colored in salmon
@endgantt
```

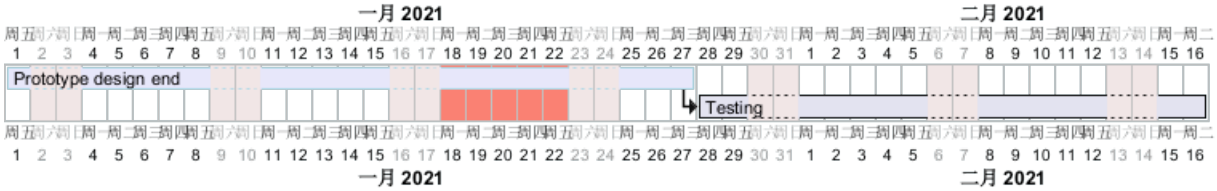


16.36.3 Japanese (ja)

```
@startgantt
language ja
saturday are closed
sunday are closed

Project starts 2021-01-01
[Prototype design end] as [TASK1] requires 19 days
[TASK1] is colored in Lavender/LightBlue
[Testing] requires 14 days
[TASK1]->[Testing]

2021-01-18 to 2021-01-22 are colored in salmon
@endgantt
```

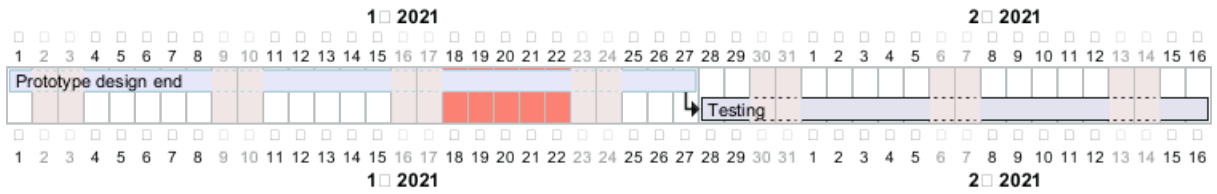
16.36.4 Chinese (zh)

```
@startgantt
language zh
saturday are closed
sunday are closed

Project starts 2021-01-01
[Prototype design end] as [TASK1] requires 19 days
[TASK1] is colored in Lavender/LightBlue
[Testing] requires 14 days
[TASK1]->[Testing]

2021-01-18 to 2021-01-22 are colored in salmon
@endgantt
```



16.36.5 Korean (ko)

```
@startgantt
language ko
saturday are closed
sunday are closed

Project starts 2021-01-01
[Prototype design end] as [TASK1] requires 19 days
[TASK1] is colored in Lavender/LightBlue
[Testing] requires 14 days
[TASK1]->[Testing]

2021-01-18 to 2021-01-22 are colored in salmon
@endgantt
```

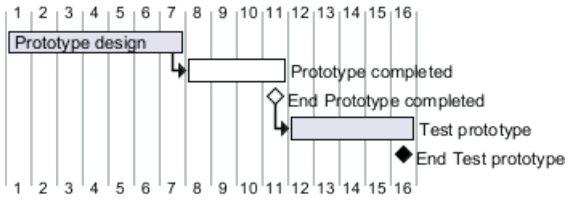


16.37 Delete Tasks or Milestones

You can mark some Tasks or Milestones as `deleted` instead of normally completed to distinguish tasks that may possibly have been discarded, postponed or whatever.

```
@startgantt
[Prototype design] requires 1 weeks
then [Prototype completed] requires 4 days
[End Prototype completed] happens at [Prototype completed]'s end
then [Test prototype] requires 5 days
[End Test prototype] happens at [Test prototype]'s end

[Prototype completed] is deleted
[End Prototype completed] is deleted
```

```
@endgantt
```

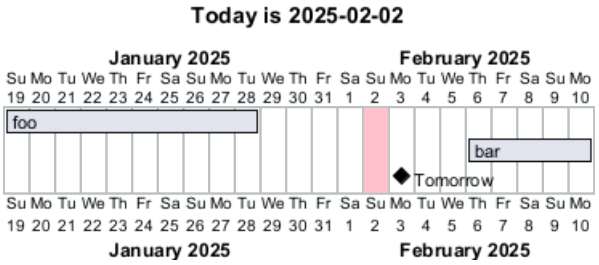


[Ref. QA-9129]

16.38 Start a project, a task or a milestone a number of days before or after today

You can start a project, a task or a milestone a number of days before or after today, using the builtin functions `%now` and `%date`:

```
@startgantt
title Today is %date("YYYY-MM-dd")
!$now = %now()
!$past = %date("YYYY-MM-dd", $now - 14*24*3600)
Project starts $past
today is colored in pink
[foo] requires 10 days
[bar] requires 5 days and starts %date("YYYY-MM-dd", $now + 4*24*3600)
[Tomorrow] happens %date("YYYY-MM-dd", $now + 1*24*3600)
@endgantt
```

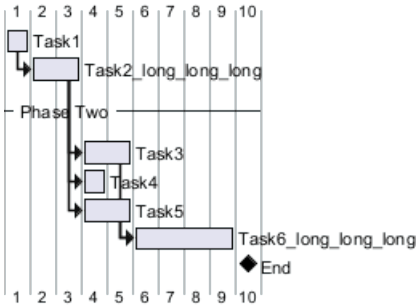


[Ref. QA-16285]

16.39 Change Label position

16.39.1 The labels are near elements *(by default)*

```
@startgantt
[Task1] requires 1 days
then [Task2_long_long_long] as [T2] requires 2 days
-- Phase Two --
then [Task3] as [T3] requires 2 days
[Task4] as [T4] requires 1 day
[Task5] as [T5] requires 2 days
[T2] -> [T4]
[T2] -> [T5]
[Task6_long_long_long] as [T6] requires 4 days
[T3] -> [T6]
[T5] -> [T6]
[End] happens 1 day after [T6]'s end
@endgantt
```

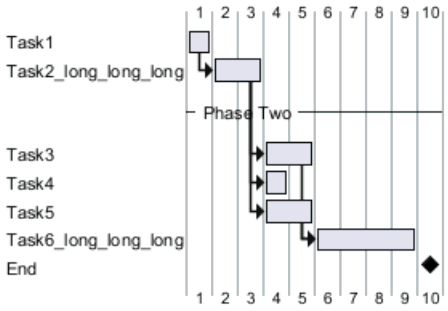


To change the label position, you can use the command `label`:

16.39.2 Label on first column

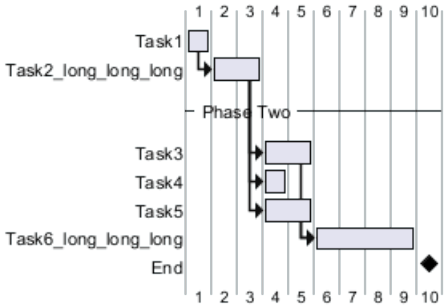
- Left aligned

```
@startgantt
Label on first column and left aligned
[Task1] requires 1 days
then [Task2_long_long_long] as [T2] requires 2 days
-- Phase Two --
then [Task3] as [T3] requires 2 days
[Task4] as [T4] requires 1 day
[Task5] as [T5] requires 2 days
[T2] -> [T4]
[T2] -> [T5]
[Task6_long_long_long] as [T6] requires 4 days
[T3] -> [T6]
[T5] -> [T6]
[End] happens 1 day after [T6]'s end
@endgantt
```



- Right aligned

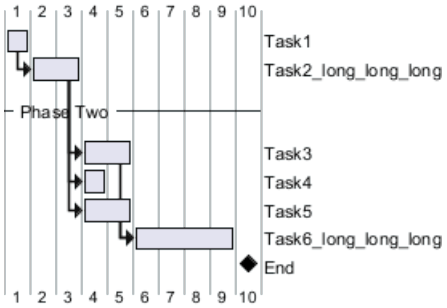
```
@startgantt
Label on first column and right aligned
[Task1] requires 1 days
then [Task2_long_long_long] as [T2] requires 2 days
-- Phase Two --
then [Task3] as [T3] requires 2 days
[Task4] as [T4] requires 1 day
[Task5] as [T5] requires 2 days
[T2] -> [T4]
[T2] -> [T5]
[Task6_long_long_long] as [T6] requires 4 days
[T3] -> [T6]
[T5] -> [T6]
[End] happens 1 day after [T6]'s end
@endgantt
```



16.39.3 Label on last column

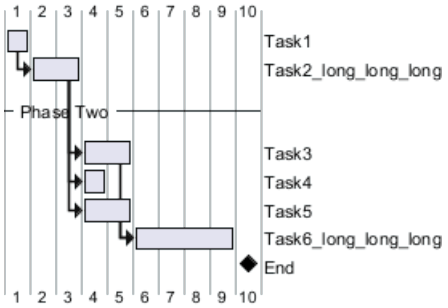
- Left aligned

```
@startgantt
Label on last column and left aligned
[Task1] requires 1 days
then [Task2_long_long_long] as [T2] requires 2 days
-- Phase Two --
then [Task3] as [T3] requires 2 days
[Task4] as [T4] requires 1 day
[Task5] as [T5] requires 2 days
[T2] -> [T4]
[T2] -> [T5]
[Task6_long_long_long] as [T6] requires 4 days
[T3] -> [T6]
[T5] -> [T6]
[End] happens 1 day after [T6]'s end
@endgantt
```



- Right aligned

```
@startgantt
Label on last column and right aligned
[Task1] requires 1 days
then [Task2_long_long_long] as [T2] requires 2 days
-- Phase Two --
then [Task3] as [T3] requires 2 days
[Task4] as [T4] requires 1 day
[Task5] as [T5] requires 2 days
[T2] -> [T4]
[T2] -> [T5]
[Task6_long_long_long] as [T6] requires 4 days
[T3] -> [T6]
[T5] -> [T6]
[End] happens 1 day after [T6]'s end
@endgantt
```


1 2 3 4 5 6 7 8 9 10
Task1
Task2_long_long_long
Phase Two
Task3
Task4
Task5
Task6_long_long_long
End
1 2 3 4 5 6 7 8 9 10

[Ref. QA-12433]

17 MindMap

A **MindMap diagram**, in the context of **PlantUML**, is an effective tool for **brainstorming**, organizing ideas, and project planning. MindMap diagrams, or mind maps, are **visual representations** of information, where central ideas branch out into related topics, creating a spider-web of concepts. PlantUML facilitates the creation of these diagrams with its simple, **text-based syntax**, allowing for the efficient organization and visualization of complex ideas.

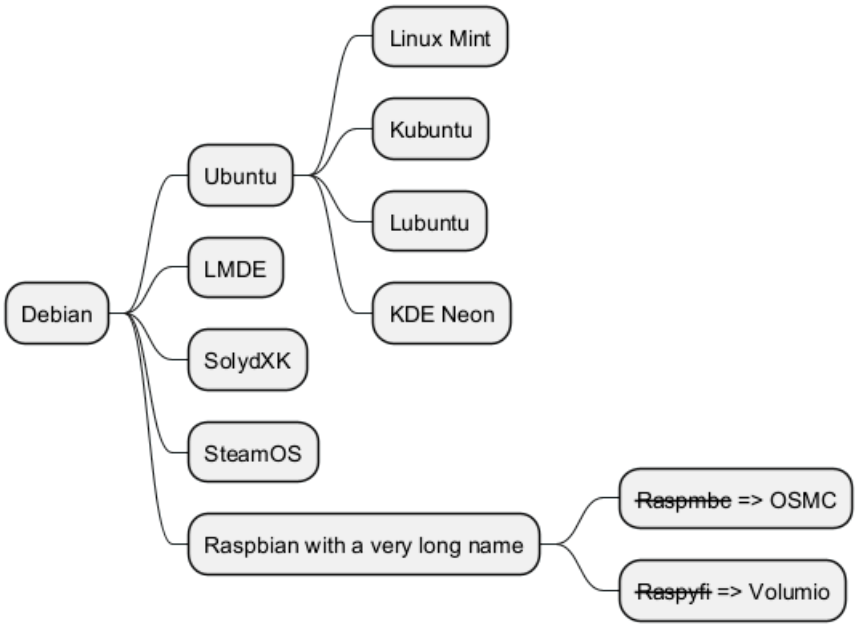
Using PlantUML for MindMaps is particularly advantageous due to its **integration with other tools** and systems. This integration streamlines the process of incorporating mind maps into larger project documentation. PlantUML's text-based approach also enables easy modification and **version control** of the mind maps, making it a dynamic tool for collaborative brainstorming and idea development.

MindMaps in PlantUML can be used for various purposes, from outlining the structure of a project to brainstorming product features or business strategies. The **hierarchical and intuitive layout** of mind maps helps in identifying relationships between different ideas and concepts, making it easier to see the bigger picture and to pinpoint areas that require further exploration. This makes PlantUML an invaluable tool for project managers, developers, and business analysts who require a method to visually organize and present complex information in a clear and concise manner.

17.1 OrgMode syntax

This syntax is compatible with OrgMode

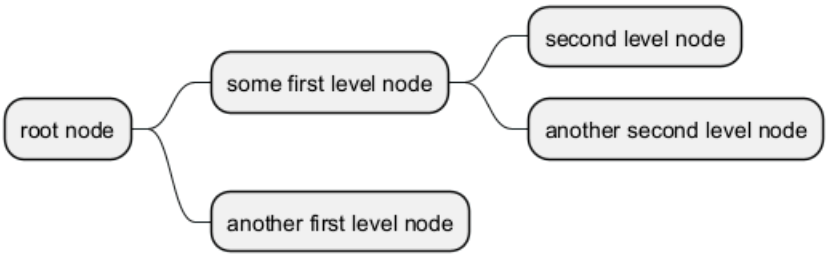
```
@startmindmap
* Debian
** Ubuntu
*** Linux Mint
*** Kubuntu
*** Lubuntu
*** KDE Neon
** LMDE
** SolydXK
** SteamOS
** Raspbian with a very long name
*** <s>Raspmbc</s> => OSMC
*** <s>Raspyfi</s> => Volumio
@endmindmap
```



17.2 Markdown syntax

This syntax is compatible with Markdown

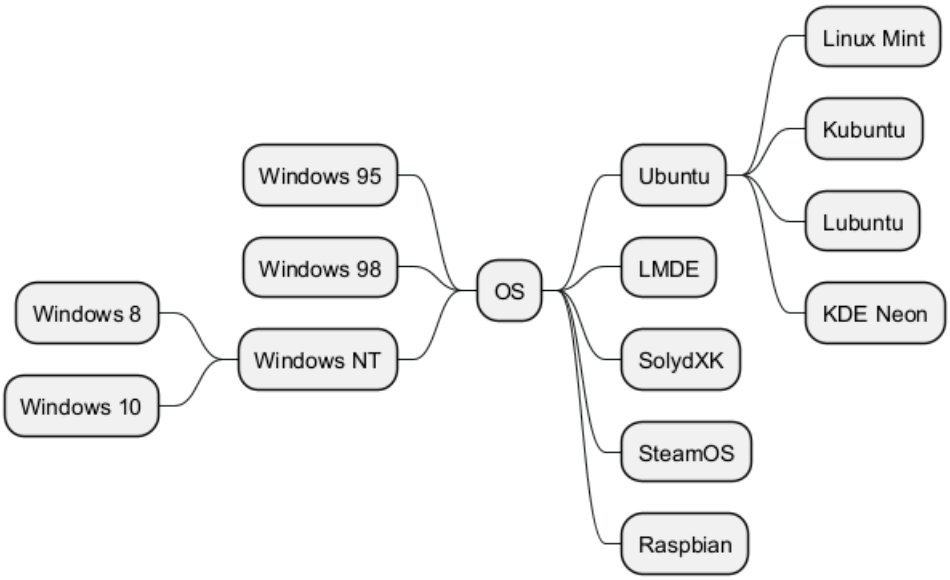
```
@startmindmap
* root node
* some first level node
* second level node
* another second level node
* another first level node
@endmindmap
```



17.3 Arithmetic notation

You can use the following notation to choose diagram side.

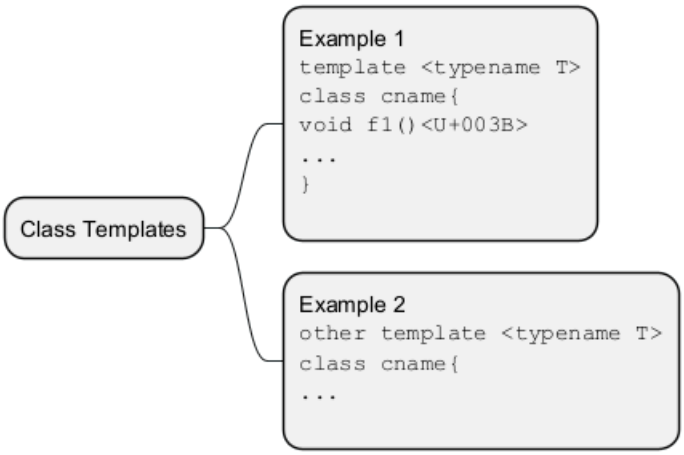
```
@startmindmap
+ OS
++ Ubuntu
+++ Linux Mint
+++ Kubuntu
+++ Lubuntu
+++ KDE Neon
++ LMDE
++ SolydXK
++ SteamOS
++ Raspbian
-- Windows 95
-- Windows 98
-- Windows NT
--- Windows 8
--- Windows 10
@endmindmap
```



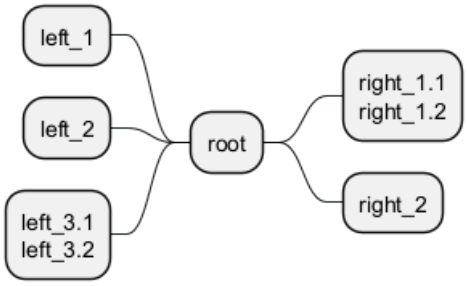
17.4 Multilines

You can use : and ; to have multilines box.

```
@startmindmap
* Class Templates
**:Example 1
<code>
template <typename T>
class cname{
void f1()<U+003B>
...
}
</code>
;
**:Example 2
<code>
other template <typename T>
class cname{
...
</code>
;
@endmindmap
```



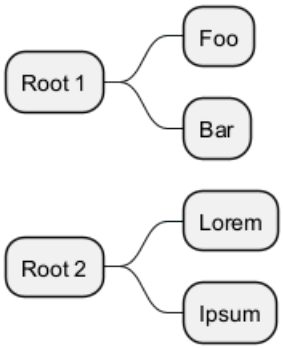

```
@startmindmap
+ root
**:right_1.1
right_1.2;
++ right_2

left side

-- left_1
-- left_2
**:left_3.1
left_3.2;
@endmindmap
```



17.5 Multiroot Mindmap

You can create multiroot mindmap, as:

```
@startmindmap
* Root 1
** Foo
** Bar
* Root 2
** Lorem
** Ipsum
@endmindmap
```



[Ref. QH-773]

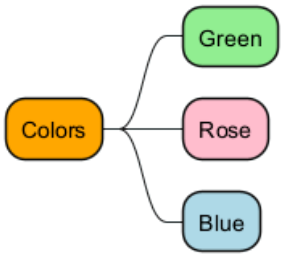
17.6 Colors

It is possible to change node color.

17.6.1 With inline color

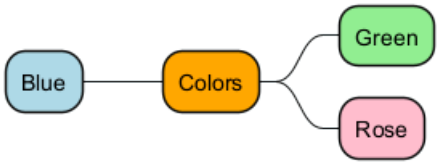
- OrgMode syntax mindmap

```
@startmindmap
*[#Orange] Colors
**[#lightgreen] Green
**[#FFBBCC] Rose
**[#lightblue] Blue
@endmindmap
```



- Arithmetic notation syntax mindmap

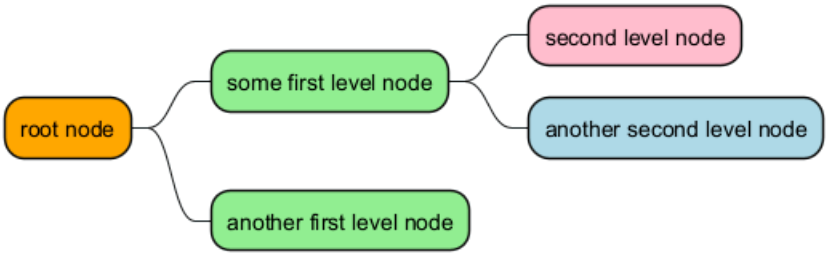
```
@startmindmap
+[#Orange] Colors
++[#lightgreen] Green
++[#FFBBCC] Rose
--[#lightblue] Blue
@endmindmap
```



- Markdown syntax mindmap

```
@startmindmap
*[#Orange] root node
```

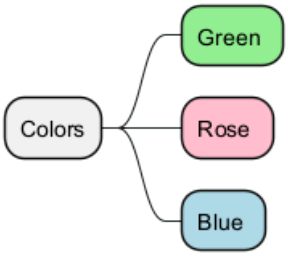
```
 *[#lightgreen] some first level node
  *[#FFBBCC] second level node
  *[#lightblue] another second level node
 *[#lightgreen] another first level node
@endmindmap
```



17.6.2 With style color

- OrgMode syntax mindmap

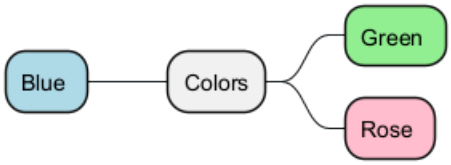
```
@startmindmap
<style>
mindmapDiagram {
  .green {
    BackgroundColor lightgreen
  }
  .rose {
    BackgroundColor #FFBBCC
  }
  .your_style_name {
    BackgroundColor lightblue
  }
}
</style>
* Colors
** Green <<green>>
** Rose <<rose>>
** Blue <<your_style_name>>
@endmindmap
```



- Arithmetic notation syntax mindmap

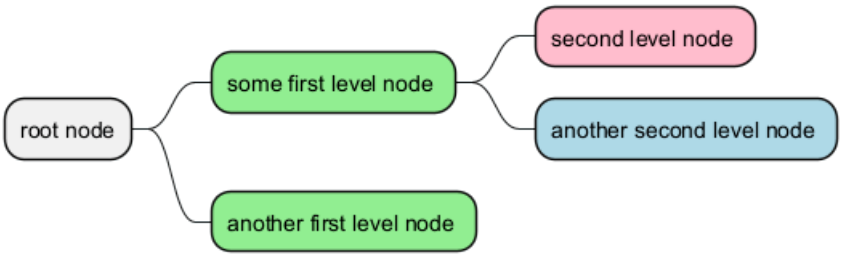
```
@startmindmap
<style>
mindmapDiagram {
  .green {
    BackgroundColor lightgreen
  }
  .rose {
```

```
    BackgroundColor #FFBBCC
  }
  .your_style_name {
    BackgroundColor lightblue
  }
}
</style>
+ Colors
++ Green <<green>>
++ Rose <<rose>>
-- Blue <<your_style_name>>
@endmindmap
```



- Markdown syntax mindmap

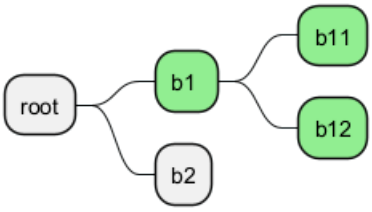
```
@startmindmap
<style>
mindmapDiagram {
  .green {
    BackgroundColor lightgreen
  }
  .rose {
    BackgroundColor #FFBBCC
  }
  .your_style_name {
    BackgroundColor lightblue
  }
}
</style>
* root node
 * some first level node <<green>>
  * second level node <<rose>>
  * another second level node <<your_style_name>>
 * another first level node <<green>>
@endmindmap
```



- Apply style to a branch

```
@startmindmap
<style>
mindmapDiagram {
  .myStyle * {
```

```
    BackgroundColor lightgreen
  }
}
</style>
+ root
++ b1 <<myStyle>>
+++ b11
+++ b12
++ b2
@endmindmap
```

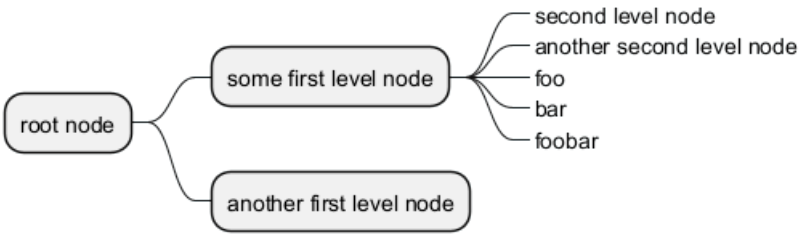


[Ref. GA-920]

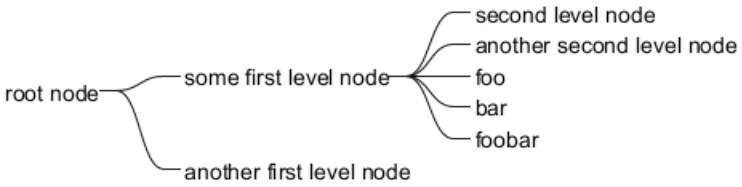
17.7 Removing box

You can remove the box drawing using an underscore.

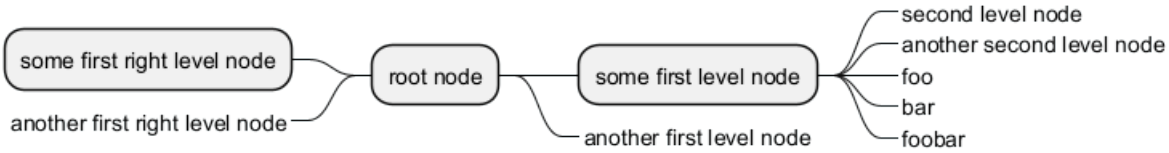
```
@startmindmap
* root node
** some first level node
***_ second level node
***_ another second level node
***_ foo
***_ bar
***_ foobar
** another first level node
@endmindmap
```




```
@startmindmap
*_ root node
**_ some first level node
***_ second level node
***_ another second level node
***_ foo
***_ bar
***_ foobar
**_ another first level node
@endmindmap
```



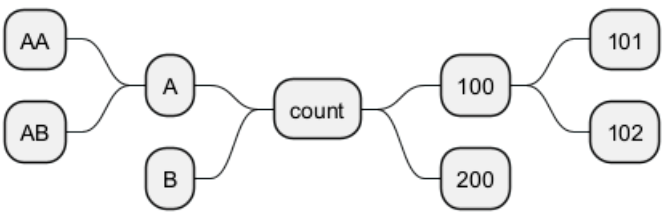

```
@startmindmap
+ root node
++ some first level node
+++_ second level node
+++_ another second level node
+++_ foo
+++_ bar
+++_ foobar
++_ another first level node
-- some first right level node
--_ another first right level node
@endmindmap
```



17.8 Changing diagram direction

It is possible to use both sides of the diagram.

```
@startmindmap
* count
** 100
*** 101
*** 102
** 200

left side

** A
*** AA
*** AB
** B
@endmindmap
```



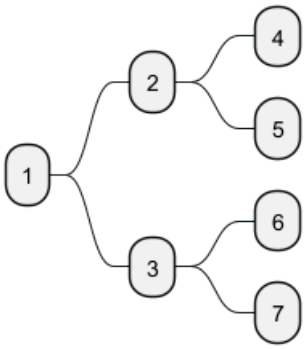
17.9 Change (whole) diagram orientation

You can change (whole) diagram orientation with:

- `left to right direction` *(by default)*
- `top to bottom direction`
- `right to left direction`
- `bottom to top direction` *(not yet implemented/issue then use workaround)*

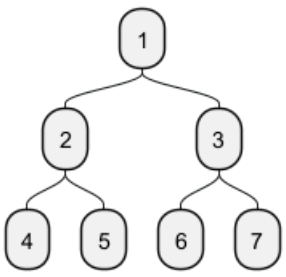
17.9.1 Left to right direction *(by default)*

```
@startmindmap
* 1
** 2
*** 4
*** 5
** 3
*** 6
*** 7
@endmindmap
```



17.9.2 Top to bottom direction

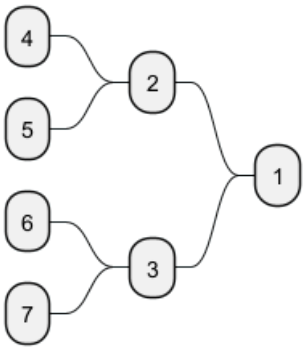
```
@startmindmap
top to bottom direction
* 1
** 2
*** 4
*** 5
** 3
*** 6
*** 7
@endmindmap
```



17.9.3 Right to left direction

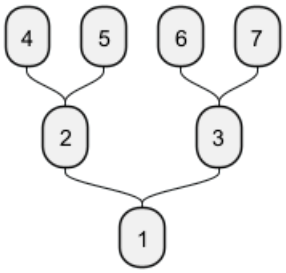
```
@startmindmap
right to left direction
```

```
* 1
** 2
*** 4
*** 5
** 3
*** 6
*** 7
@endmindmap
```



17.9.4 Bottom to top direction

```
@startmindmap
top to bottom direction
left side
* 1
** 2
*** 4
*** 5
** 3
*** 6
*** 7
@endmindmap
```

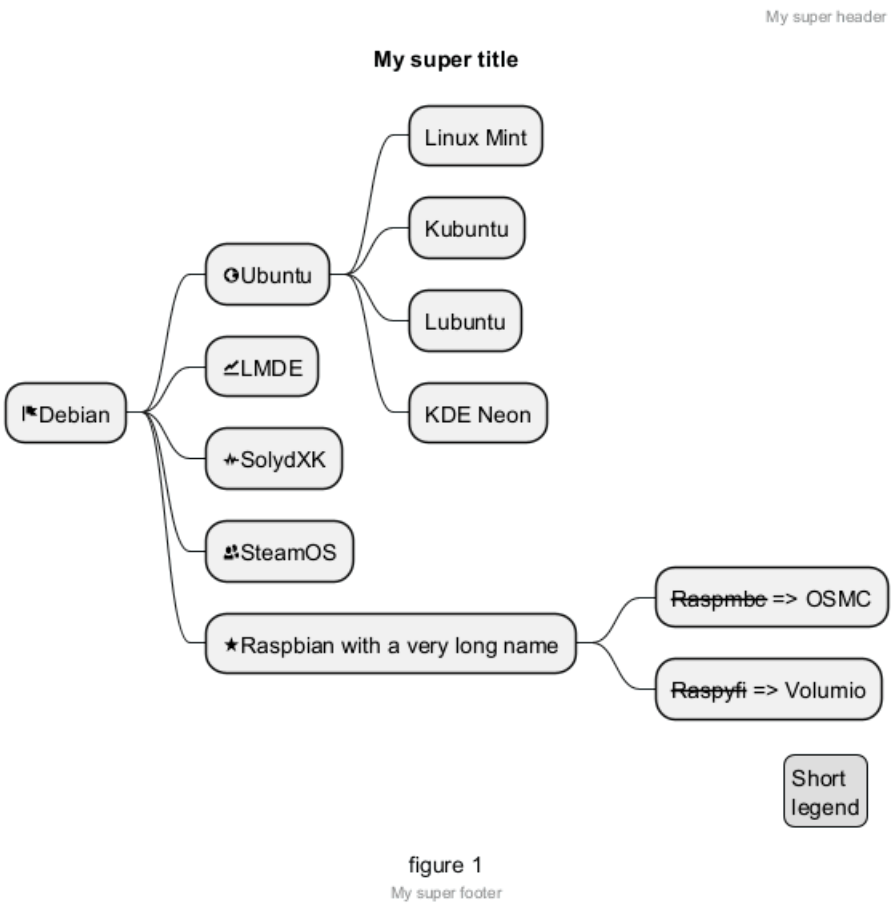


[Ref. QH-1413]

17.10 Complete example

```
@startmindmap
caption figure 1
title My super title

* <&flag>Debian
** <&globe>Ubuntu
*** Linux Mint
*** Kubuntu
*** Lubuntu
```

```
*** KDE Neon
** <&graph>LMDE
** <&pulse>SolydXK
** <&people>SteamOS
** <&star>Raspbian with a very long name
*** <s>Raspmbc</s> => OSMC
*** <s>Raspyfi</s> => Volumio

header
My super header
endheader

center footer My super footer

legend right
  Short
  legend
endlegend
@endmindmap
```

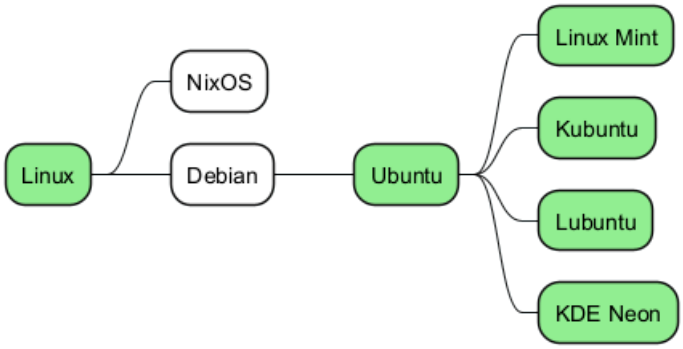


17.11 Changing style

17.11.1 node, depth

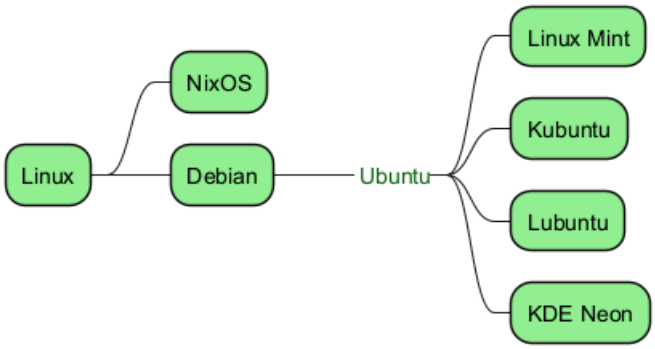
```
@startmindmap
<style>
mindmapDiagram {
    node {
        BackgroundColor lightGreen
```

```
    }
    :depth(1) {
      BackGroundColor white
    }
}
</style>
* Linux
** NixOS
** Debian
*** Ubuntu
**** Linux Mint
**** Kubuntu
**** Lubuntu
**** KDE Neon
@endmindmap
```



17.11.2 boxless

```
@startmindmap
<style>
mindmapDiagram {
  node {
    BackgroundColor lightGreen
  }
  boxless {
    FontColor darkgreen
  }
}
</style>
* Linux
** NixOS
** Debian
***_ Ubuntu
**** Linux Mint
**** Kubuntu
**** Lubuntu
**** KDE Neon
@endmindmap
```

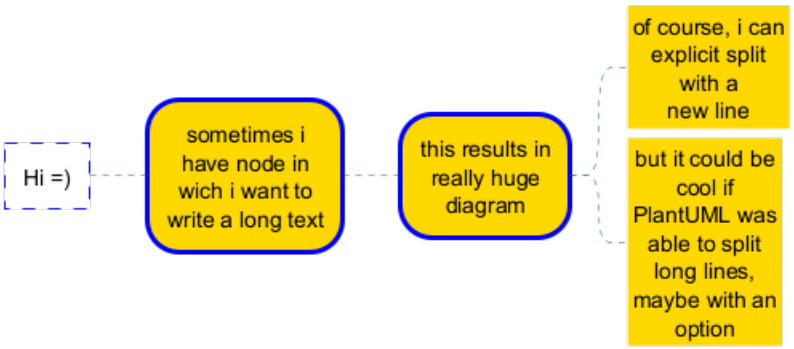


17.12 Word Wrap

Using `MaximumWidth` setting you can control automatic word wrap. Unit used is pixel.

```
@startmindmap


<style>
node {
    Padding 12
    Margin 3
    HorizontalAlignment center
    LineColor blue
    LineThickness 3.0
    BackgroundColor gold
    RoundCorner 40
    MaximumWidth 100
}

rootNode {
    LineStyle 8.0;3.0
    LineColor red
    BackgroundColor white
    LineThickness 1.0
    RoundCorner 0
    Shadowing 0.0
}

leafNode {
    LineColor gold
    RoundCorner 0
    Padding 3
}

arrow {
    LineStyle 4
    LineThickness 0.5
    LineColor green
}
</style>

* Hi =)
** sometimes i have node in wich i want to write a long text
*** this results in really huge diagram
**** of course, i can explicit split with a\nnew line
```

```
**** but it could be cool if PlantUML was able to split long lines, maybe with an option

@endmindmap
```

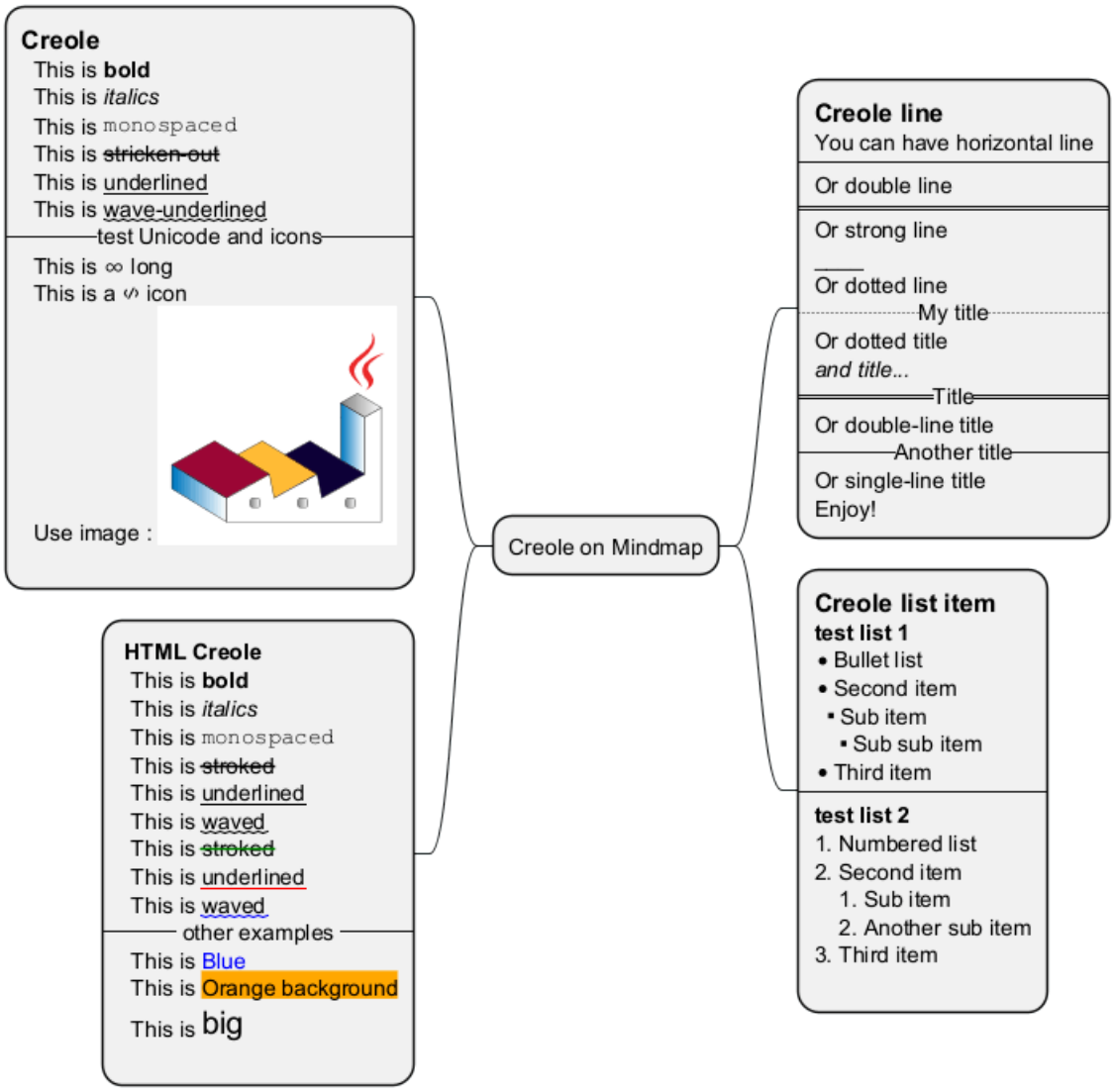


17.13 Creole on Mindmap diagram

You can use Creole or HTML Creole on Mindmap:

```
@startmindmap
* Creole on Mindmap
left side
**:==Creole
  This is **bold**
  This is //italics//
  This is ""monospaced""
  This is --stricken-out--
  This is __underlined__
  This is ~~wave-underlined~~
--test Unicode and icons--
  This is <U+221E> long
  This is a <&code> icon
  Use image : <img:https://plantuml.com/logo3.png>
;
**: <b>HTML Creole
  This is <b>bold</b>
  This is <i>italics</i>
  This is <font:monospaced>monospaced</font>
  This is <s>stroked</s>
  This is <u>underlined</u>
  This is <w>waved</w>
  This is <s:green>stroked</s>
  This is <u:red>underlined</u>
  This is <w:#0000FF>waved</w>
-- other examples --
  This is <color:blue>Blue</color>
  This is <back:orange>Orange background</back>
  This is <size:20>big</size>
;
right side
**:==Creole line
You can have horizontal line
----
Or double line
====
Or strong line
____
```

```
Or dotted line
..My title..
Or dotted title
//and title... //
==Title==
Or double-line title
--Another title--
Or single-line title
Enjoy!;
**:==Creole list item
**test list 1**
* Bullet list
* Second item
** Sub item
*** Sub sub item
* Third item
----
**test list 2**
# Numbered list
# Second item
## Sub item
## Another sub item
# Third item
;
@endmindmap
```


Creole
This is bold
This is italics
This is monospaced
This is stricken-out
This is underlined
This is wave-underlined
test Unicode and icons
This is ∞ long
This is a ‹/› icon
Use image :
HTML Creole
This is bold
This is italics
This is monospaced
This is stroked
This is underlined
This is waved
This is stroked
This is underlined
This is waved
other examples
This is Blue
This is Orange background
This is big
Creole on Mindmap
Creole line
You can have horizontal line
Or double line
Or strong line
Or dotted line
My title
Or dotted title
and title...
Title
Or double-line title
Another title
Or single-line title
Enjoy!
Creole list item
test list 1
• Bullet list
• Second item
▪ Sub item
▪ Sub sub item
• Third item
test list 2
1. Numbered list
2. Second item
1. Sub item
2. Another sub item
3. Third item

[Ref. QA-17838]

18 Work Breakdown Structure (WBS)

A Work Breakdown Structure (WBS) diagram is a key **project management tool** that breaks down a project into smaller, more **manageable components** or tasks. It's essentially a **hierarchical decomposition** of the total scope of work to be carried out by the project team to accomplish the project objectives and create the required deliverables.

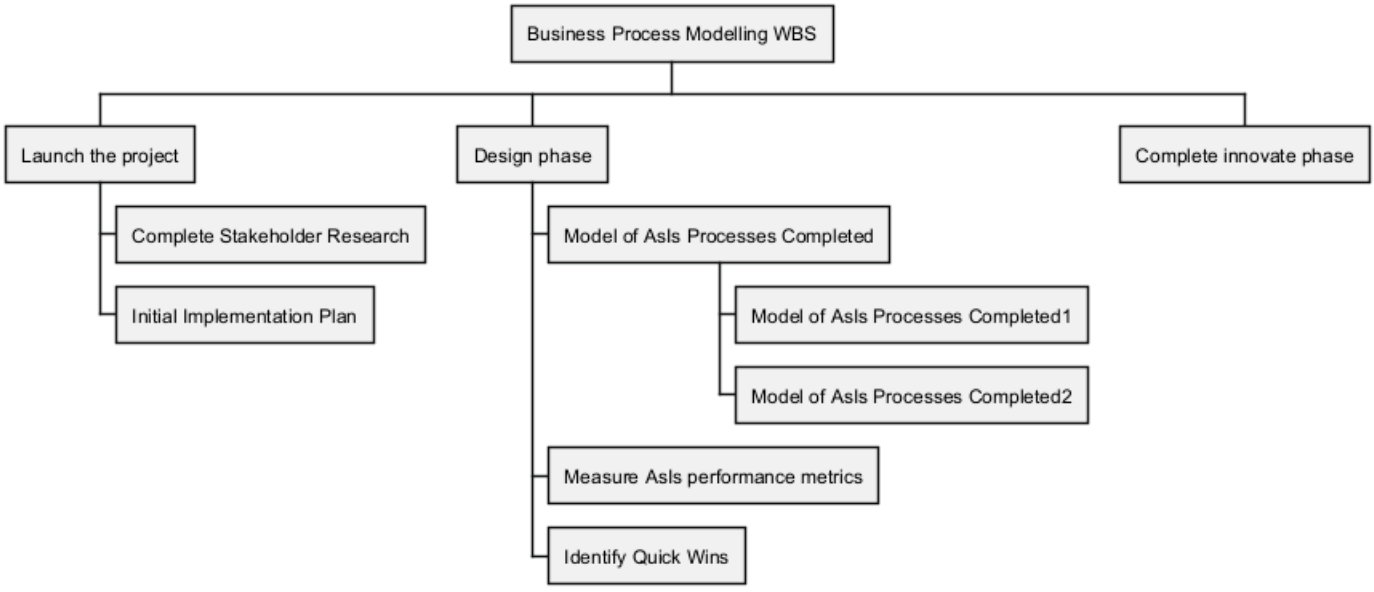
PlantUML can be particularly useful for creating **WBS diagrams**. Its **text-based diagramming** means that creating and updating a WBS is as straightforward as editing a text document, which is especially beneficial for managing changes over the project's lifecycle. This approach allows for easy integration with **version control systems**, ensuring that all changes are tracked and the history of the WBS evolution is maintained.

Moreover, PlantUML's compatibility with various other tools enhances its utility in **collaborative environments**. Teams can easily integrate their WBS diagrams into broader project documentation and management systems. The simplicity of PlantUML's syntax allows for quick adjustments, which is crucial in **dynamic project environments** where the scope and tasks may frequently change. Therefore, using PlantUML for WBS diagrams combines the clarity of **visual breakdown** with the agility and control of a **text-based system**, making it a valuable asset in **efficient project management**.

18.1 OrgMode syntax

This syntax is compatible with OrgMode

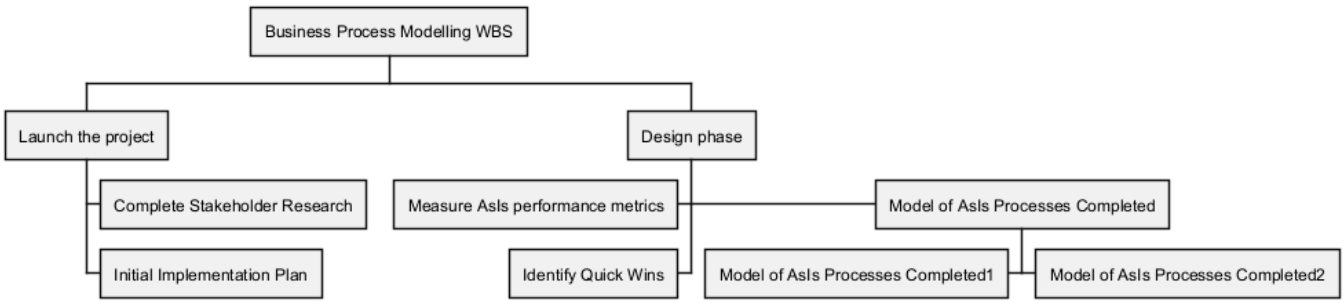
```
@startwbs
* Business Process Modelling WBS
** Launch the project
*** Complete Stakeholder Research
*** Initial Implementation Plan
** Design phase
*** Model of AsIs Processes Completed
**** Model of AsIs Processes Completed1
**** Model of AsIs Processes Completed2
*** Measure AsIs performance metrics
*** Identify Quick Wins
** Complete innovate phase
@endwbs
```



18.2 Change direction

You can change direction using < and >

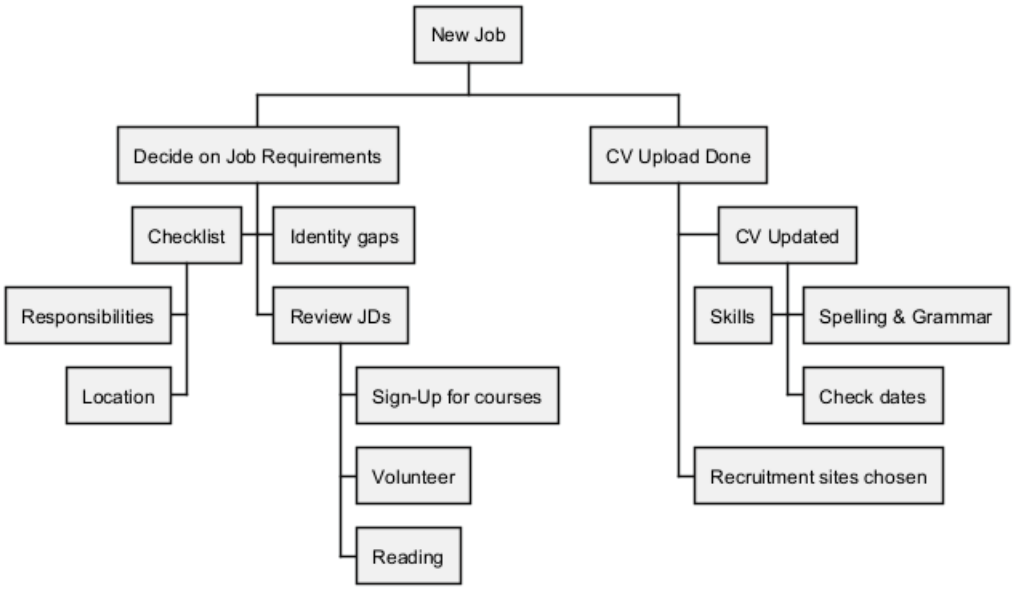
```
@startwbs
* Business Process Modelling WBS
** Launch the project
*** Complete Stakeholder Research
*** Initial Implementation Plan
** Design phase
*** Model of AsIs Processes Completed
****< Model of AsIs Processes Completed1
****> Model of AsIs Processes Completed2
***< Measure AsIs performance metrics
***< Identify Quick Wins
@endwbs
```



18.3 Arithmetic notation

You can use the following notation to choose diagram side.

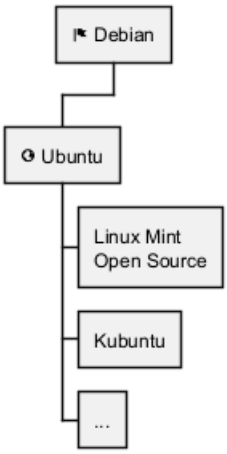
```
@startwbs
+ New Job
++ Decide on Job Requirements
+++ Identity gaps
+++ Review JDs
++++ Sign-Up for courses
++++ Volunteer
++++ Reading
++- Checklist
+++- Responsibilities
+++- Location
++ CV Upload Done
+++ CV Updated
++++ Spelling & Grammar
++++ Check dates
---- Skills
+++ Recruitment sites chosen
@endwbs
```



18.4 Multilines

You can use : and ; to have multilines box, as on MindMap.

```
@startwbs
* <&flag> Debian
** <&globe> Ubuntu

***:Linux Mint
Open Source;

*** Kubuntu
*** ...
@endwbs
```



[Ref. QA-13945]

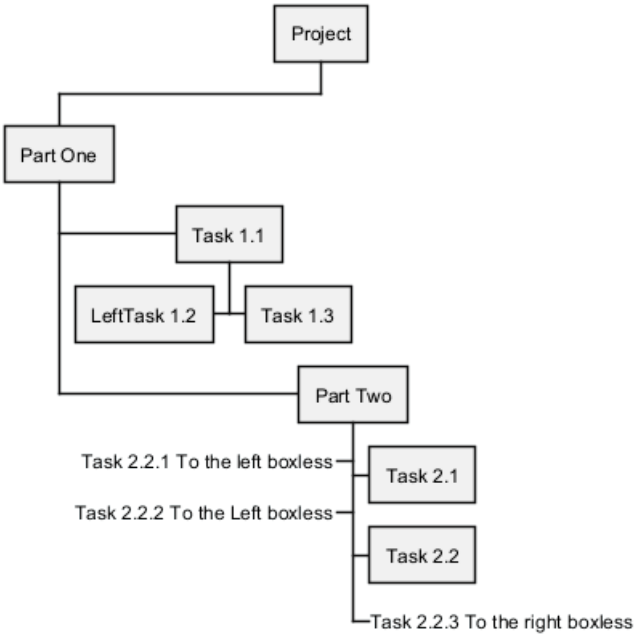
18.5 Removing box

You can use underscore _ to remove box drawing.

18.5.1 Boxless on Arithmetic notation

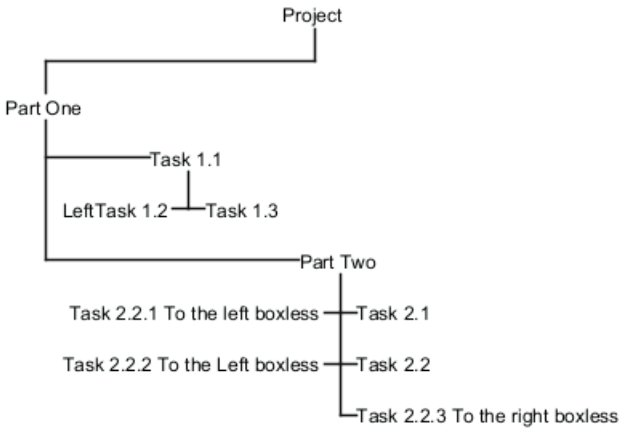
18.5.2 Several boxless node

```
@startwbs
+ Project
 + Part One
  + Task 1.1
   - LeftTask 1.2
   + Task 1.3
  + Part Two
   + Task 2.1
   + Task 2.2
   -_ Task 2.2.1 To the left boxless
   -_ Task 2.2.2 To the Left boxless
   +_ Task 2.2.3 To the right boxless
@endwbs
```



18.5.3 All boxless node

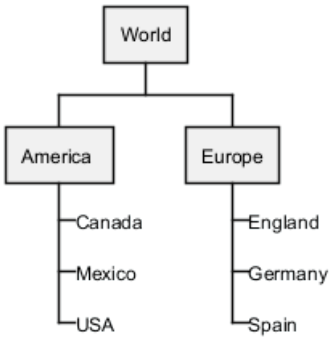
```
@startwbs
+_ Project
 +_ Part One
  +_ Task 1.1
   -_ LeftTask 1.2
   +_ Task 1.3
  +_ Part Two
   +_ Task 2.1
   +_ Task 2.2
   -_ Task 2.2.1 To the left boxless
   -_ Task 2.2.2 To the Left boxless
   +_ Task 2.2.3 To the right boxless
@endwbs
```



18.5.4 Boxless on OrgMode syntax

18.5.5 Several boxless node

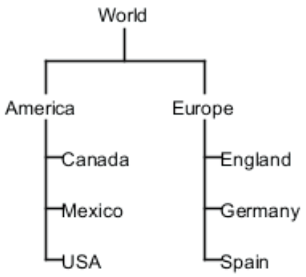
```
@startwbs
* World
** America
***_ Canada
***_ Mexico
***_ USA
** Europe
***_  England
***_  Germany
***_  Spain
@endwbs
```



[Ref. QA-13297]

18.5.6 All boxless node

```
@startwbs
*_ World
**_ America
***_ Canada
***_ Mexico
***_ USA
**_ Europe
***_  England
***_  Germany
***_  Spain
@endwbs
```



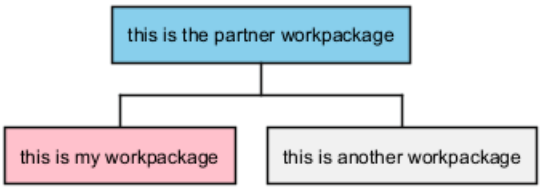
[Ref. QA-13355]

18.6 Colors (with inline or style color)

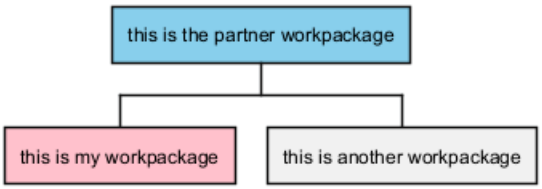
It is possible to change node color:

- with inline color

```
@startwbs
*[#SkyBlue] this is the partner workpackage
**[#pink] this is my workpackage
** this is another workpackage
@endwbs
```




```
@startwbs
+[#SkyBlue] this is the partner workpackage
++[#pink] this is my workpackage
++ this is another workpackage
@endwbs
```

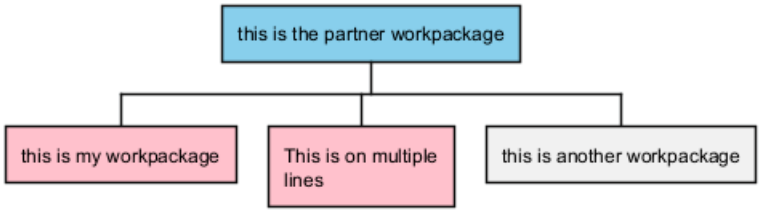


[Ref. QA-12374, only from v1.2020.20]

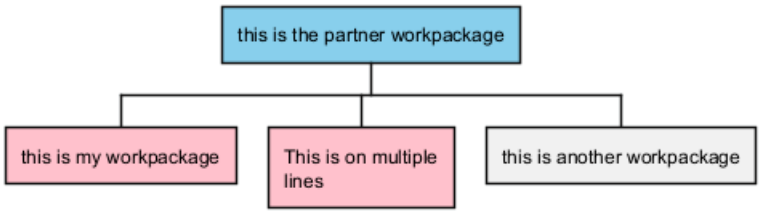
- with style color

```
@startwbs
<style>
wbsDiagram {
  .pink {
      BackgroundColor pink
  }
  .your_style_name {
      BackgroundColor SkyBlue
  }
}
</style>
* this is the partner workpackage <<your_style_name>>
** this is my workpackage <<pink>>
```

```
**:This is on multiple
lines; <<pink>>
** this is another workpackage
@endwbs
```




```
@startwbs
<style>
wbsDiagram {
  .pink {
      BackgroundColor pink
  }
  .your_style_name {
      BackgroundColor SkyBlue
  }
}
</style>
+ this is the partner workpackage <<your_style_name>>
++ this is my workpackage <<pink>>
++:This is on multiple
lines; <<pink>>
++ this is another workpackage
@endwbs
```

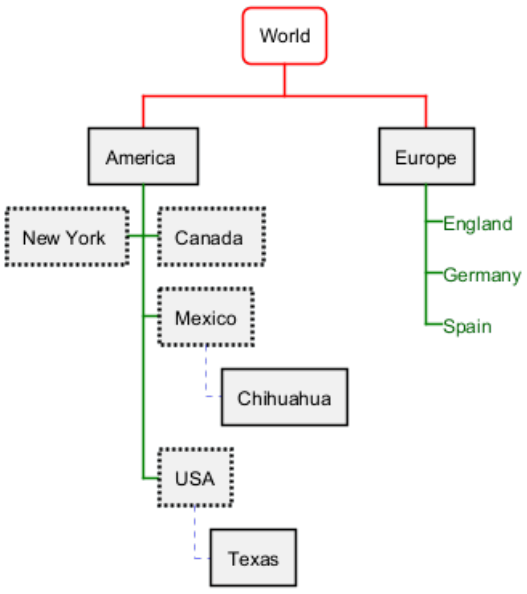


18.7 Using style

It is possible to change diagram style.

```
@startwbs
<style>
wbsDiagram {
  // all lines (meaning connector and borders, there are no other lines in WBS) are black by default
  Linecolor black
  arrow {
    // note that connector are actually "arrow" even if they don't look like as arrow
    // This is to be consistent with other UML diagrams. Not 100% sure that it's a good idea
    // So now connector are green
    LineColor green
  }
  :depth(0) {
      // will target root node
      BackgroundColor White
      RoundCorner 10
      LineColor red
      // Because we are targetting depth(0) for everything, border and connector for level 0 will be
```

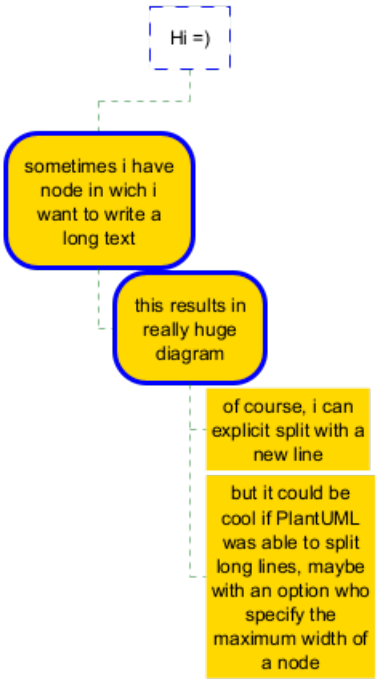
```
  }
  arrow {
    :depth(2) {
      // Targetting only connector between Mexico-Chihuahua and USA-Texas
      LineColor blue
      LineStyle 4
      LineThickness .5
    }
  }
  node {
    :depth(2) {
      LineStyle 2
      LineThickness 2.5
    }
  }
  boxless {
    // will target boxless node with '_'
    FontColor darkgreen
  }
}
</style>
* World
** America
*** Canada
*** Mexico
**** Chihuahua
*** USA
**** Texas
***< New York
** Europe
***_  England
***_  Germany
***_  Spain
@endwbs
```



18.8 Word Wrap

Using `MaximumWidth` setting you can control automatic word wrap. Unit used is pixel.

```
@startwbs


<style>
node {
    Padding 12
    Margin 3
    HorizontalAlignment center
    LineColor blue
    LineThickness 3.0
    BackgroundColor gold
    RoundCorner 40
    MaximumWidth 100
}

rootNode {
    LineStyle 8.0;3.0
    LineColor red
    BackgroundColor white
    LineThickness 1.0
    RoundCorner 0
    Shadowing 0.0
}

leafNode {
    LineColor gold
    RoundCorner 0
    Padding 3
}

arrow {
    LineStyle 4
    LineThickness 0.5
    LineColor green
}
</style>

* Hi =)
** sometimes i have node in wich i want to write a long text
*** this results in really huge diagram
**** of course, i can explicit split with a\nnew line
**** but it could be cool if PlantUML was able to split long lines, maybe with an option who specify

@endwbs
```

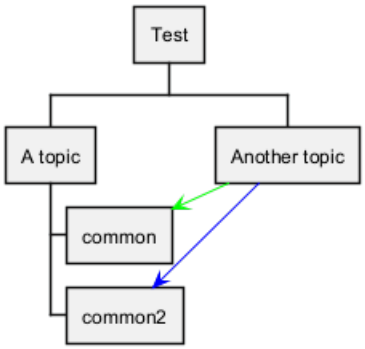


18.9 Add arrows between WBS elements

You can add arrows between WBS elements.

Using alias with as:

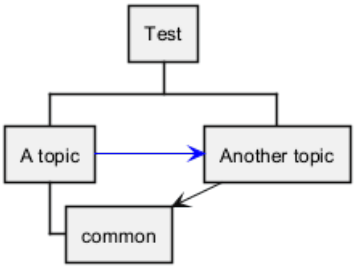
```
@startwbs
<style>
.foo {
  LineColor #00FF00;
}
</style>
* Test
** A topic
*** "common" as c1
*** "common2" as c2
** "Another topic" as t2
t2 -> c1 <<foo>>
t2 ..> c2 #blue
@endwbs
```



Using alias in parentheses:

```
@startwbs
* Test
```

```
**(b) A topic
***(c1) common
**(t2) Another topic
t2 --> c1
b -> t2 #blue
@endwbs
```



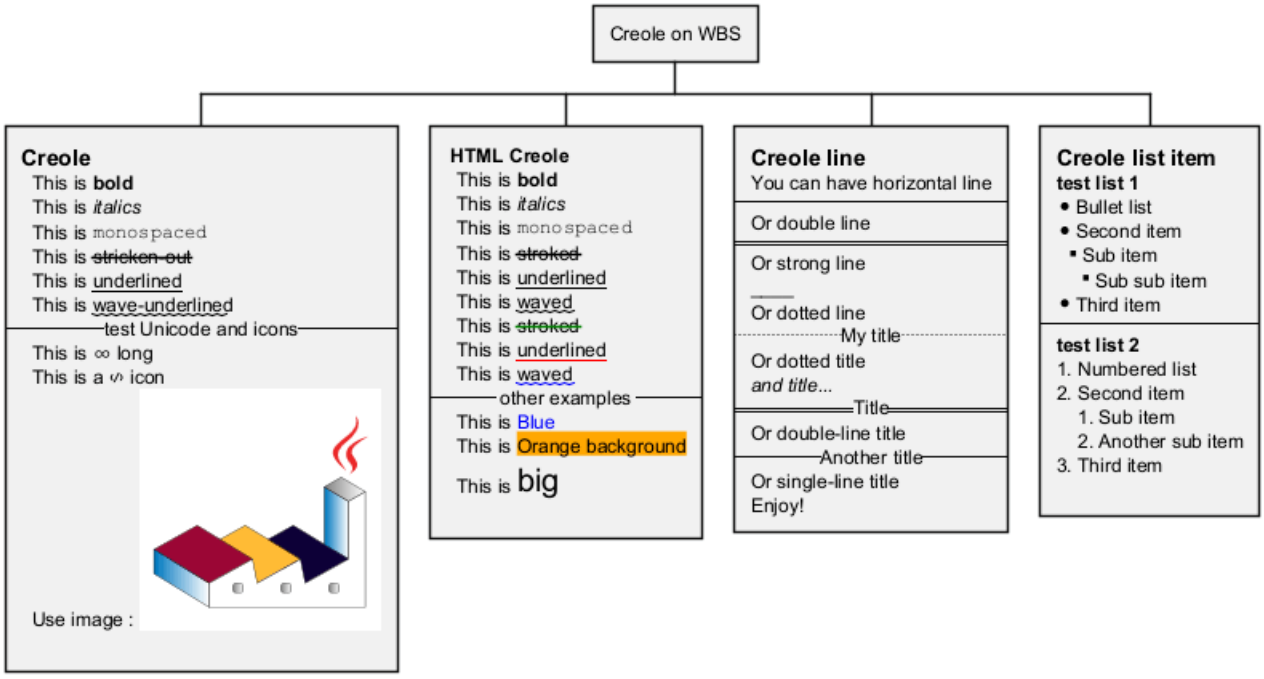
[Ref. QA-16251]

18.10 Creole on WBS diagram

You can use Creole or HTML Creole on WBS:

```
@startwbs
* Creole on WBS
**:==Creole
  This is **bold**
  This is //italics//
  This is ""monospaced""
  This is --stricken-out--
  This is __underlined__
  This is ~~wave-underlined~~
--test Unicode and icons--
  This is <U+221E> long
  This is a <&code> icon
  Use image : <img:https://plantuml.com/logo3.png>
;
**: <b>HTML Creole
  This is <b>bold</b>
  This is <i>italics</i>
  This is <font:monospaced>monospaced</font>
  This is <s>stroked</s>
  This is <u>underlined</u>
  This is <w>waved</w>
  This is <s:green>stroked</s>
  This is <u:red>underlined</u>
  This is <w:#0000FF>waved</w>
-- other examples --
  This is <color:blue>Blue</color>
  This is <back:orange>Orange background</back>
  This is <size:20>big</size>
;
**:==Creole line
You can have horizontal line
----
Or double line
====
Or strong line
____
Or dotted line
```

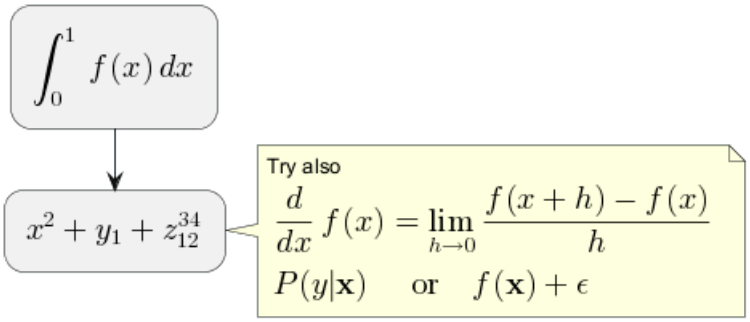
```
..My title..
Or dotted title
//and title... //
==Title==
Or double-line title
--Another title--
Or single-line title
Enjoy!;
**:==Creole list item
**test list 1**
* Bullet list
* Second item
** Sub item
*** Sub sub item
* Third item
----
**test list 2**
# Numbered list
# Second item
## Sub item
## Another sub item
# Third item
;
@endwbs
```



19 Maths

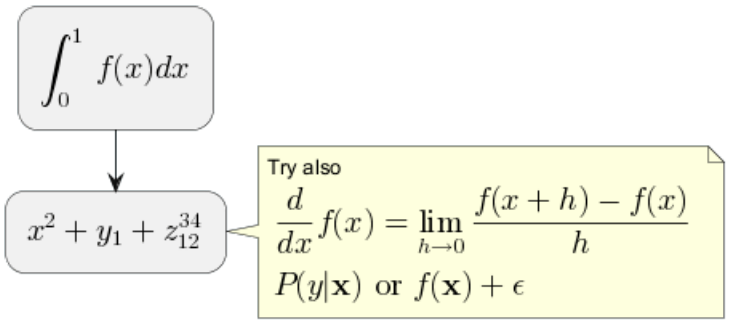
Within PlantUML, you can use AsciiMath notation:

```
@startuml
:<math>int_0^1f(x)dx</math>;
:<math>x^2+y_1+z_12^34</math>;
note right
Try also
<math>d/dxf(x)=lim_(h->0)(f(x+h)-f(x))/h</math>
<math>P(y|bb"x") or f(bb"x")+epsilon</math>
end note
@enduml
```



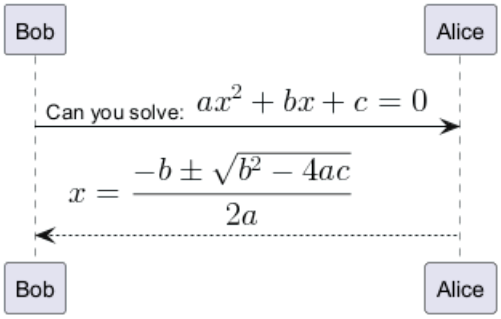
or JLaTeXMath notation:

```
@startuml
:<latex>\int_0^1f(x)dx</latex>;
:<latex>x^2+y_1+z_{12}^{34}</latex>;
note right
Try also
<latex>\dfrac{d}{dx}f(x)=\lim\limits_{h \to 0}\dfrac{f(x+h)-f(x)}{h}</latex>
<latex>P(y|\mathbf{x}) \mbox{ or } f(\mathbf{x})+\epsilon</latex>
end note
@enduml
```



Here is another example:

```
@startuml
Bob -> Alice : Can you solve: <math>ax^2+bx+c=0</math>
Alice --> Bob: <math>x = (-b+-sqrt(b^2-4ac))/(2a)</math>
@enduml
```



19.1 Standalone diagram

You can also use `@startmath`/`@endmath` to create standalone AsciiMath formula.

```
@startmath
f(t)=(a_0)/2 + sum_(n=1)^ooa_ncos((npit)/L)+sum_(n=1)^oo b_n\ sin((npit)/L)
@endmath
```

$$f(t) = \frac{a_0}{2} + \sum_{n=1}^{\infty} a_n \cos\left(\frac{n\pi t}{L}\right) + \sum_{n=1}^{\infty} b_n \ \sin\left(\frac{n\pi t}{L}\right)$$

Or use `@startlatex`/`@endlatex` to create standalone JLaTeXMath formula.

```
@startlatex
\sum_{i=0}^{n-1} (a_i + b_i^2)
@endlatex
```

$$\sum_{i=0}^{n-1} (a_i + b_i^2)$$

19.2 How is this working?

To draw those formulas, PlantUML uses two open source projects:

- AsciiMath that converts AsciiMath notation to LaTeX expression;
- JLatexMath that displays mathematical formulas written in LaTeX. JLaTeXMath is the best Java library to display LaTeX code.

ASCIIMathTeXImg.js is small enough to be integrated into PlantUML standard distribution.

And since 2021 (V1.2021.8), `ASCIIMathTeXImg.js` was ported on JAVA in PlantUML with `ASCIIMathTeXImg.java` and since 2024 (V1.2024.5) there was some more corrections and improvements *(with the `The-Lum/ASCIIMathTeXImg` Project)*.

Since JLatexMath is bigger, you have to download it separately, then unzip the 4 jar files (*batik-all-1.7.jar*, *jlatexmath-minimal-1.0.3.jar*, *jlm_cyrillic.jar* and *jlm_greek.jar*) in the same folder as PlantUML.jar.

20 Information Engineering Diagrams

Information Engineering diagrams are an extension to the existing Class Diagrams.

This extension adds:

- Additional relations for the Information Engineering notation;
- An `entity` alias that maps to the class diagram `class`;
- An additional visibility modifier `*` to identify mandatory attributes.

Otherwise, the syntax for drawing diagrams is the same as for class diagrams. All other features of class diagrams are also supported.

See also Chen Entity Relationship Diagrams.

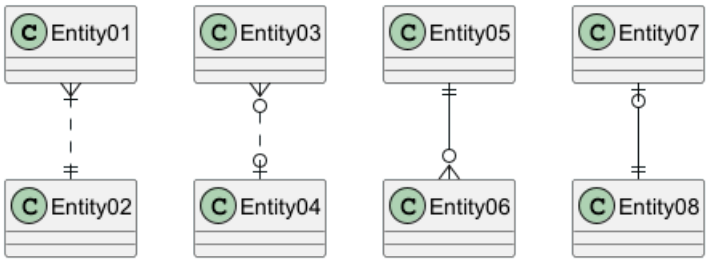
[Ref. GH-31]

20.1 Information Engineering Relations

Type	Symbol
Zero or One	`|o--`
Exactly One	`||--`
Zero or Many	`}o--`
One or Many	`}|--`

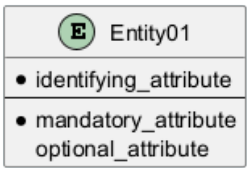
Examples:

```
@startuml
Entity01 }|..|| Entity02
Entity03 }o..o| Entity04
Entity05 ||--o{ Entity06
Entity07 |o--|| Entity08
@enduml
```



20.2 Entities

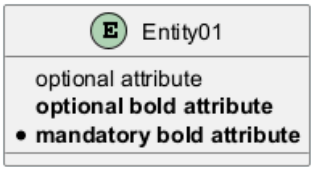
```
@startuml
entity Entity01 {
  * identifying_attribute
  --
  * mandatory_attribute
  optional_attribute
}
@enduml
```



Again, this is the normal class diagram syntax (aside from use of `entity` instead of `class`). Anything that you can do in a class diagram can be done here.

The `*` visibility modifier can be used to identify mandatory attributes. A space can be used after the modifier character to avoid conflicts with the creole bold:

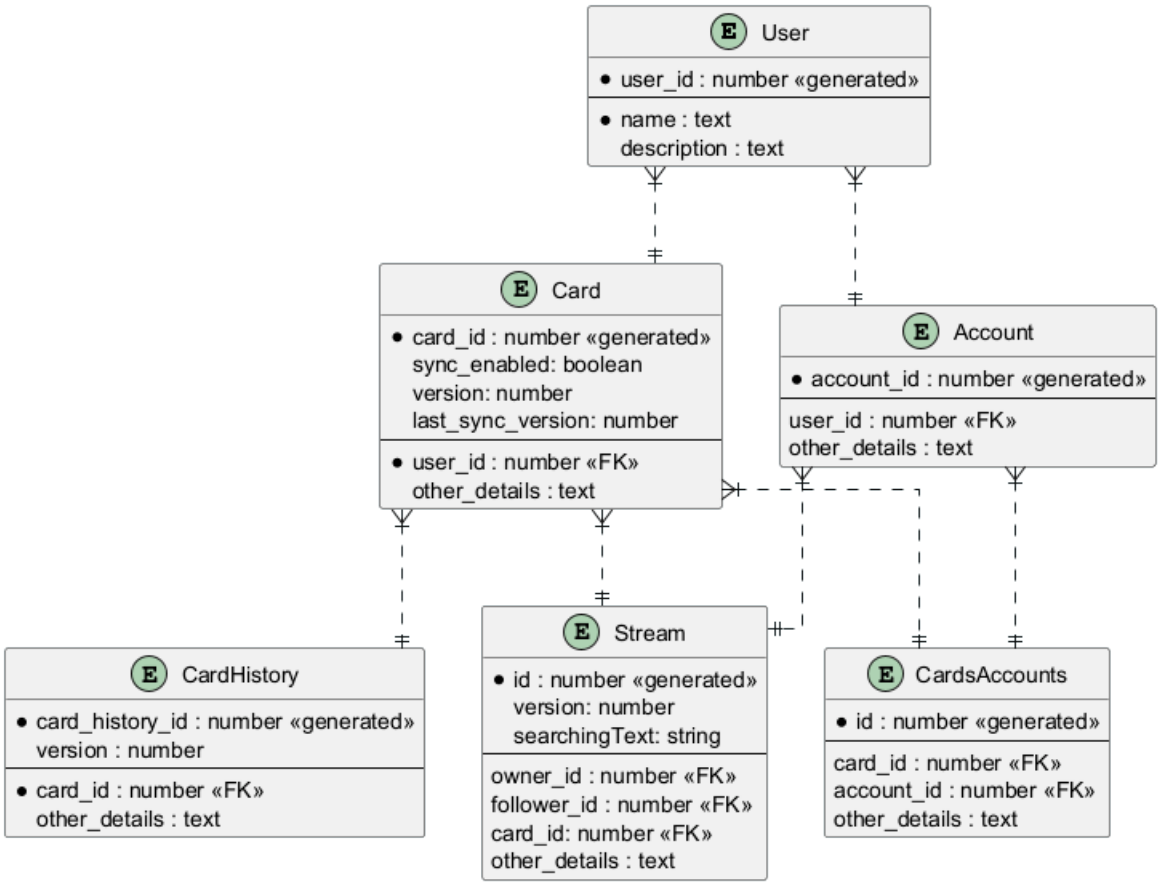
```
@startuml
entity Entity01 {
   optional attribute
   **optional bold attribute**
   * **mandatory bold attribute**
}
@enduml
```



20.3 Complete Example

```
@startuml

' hide the spot
' hide circle

' avoid problems with angled crows feet
skinparam linetype ortho

entity "User" as e01 {
  *user_id : number <<generated>>
  --
  *name : text
  description : text
}

entity "Card" as e02 {
  *card_id : number <<generated>>
  sync_enabled: boolean
  version: number
  last_sync_version: number
  --
  *user_id : number <<FK>>
  other_details : text
}

entity "CardHistory" as e05 {
  *card_history_id : number <<generated>>
  version : number
  --
  *card_id : number <<FK>>
  other_details : text
}

entity "CardsAccounts" as e04 {
  *id : number <<generated>>
  --
  card_id : number <<FK>>
```

```
  account_id : number <<FK>>
  other_details : text
}


entity "Account" as e03 {
  *account_id : number <<generated>>
  --
  user_id : number <<FK>>
  other_details : text
}

entity "Stream" as e06 {
  *id : number <<generated>>
  version: number
  searchingText: string
  --
  owner_id : number <<FK>>
  follower_id : number <<FK>>
  card_id: number <<FK>>
  other_details : text
}


e01 }|..|| e02
e01 }|..|| e03

e02 }|..|| e05

e02 }|..|| e04
e03 }|..|| e04

e02 }|..|| e06
e03 }|..|| e06


@enduml
```



Currently the crows feet do not look very good when the relationship is drawn at an angle to the entity. This can be avoided by using the `linetype ortho` skinparam.

21 Common Commands in PlantUML

Discover the fundamental commands universally applicable across all diagram types in PlantUML. These commands allow you to inject versatility and personalized details into your diagrams. Below, we breakdown these common commands into three major categories:

21.0.1 Global Elements

- **Comments:** Add remarks or explanatory notes in your diagram script to convey additional information or to leave reminders for further modifications.
- **Notes:** Incorporate supplementary information directly onto your diagram to aid in understanding or to highlight important aspects.
- **Size Control:** Adjust the dimensions of various elements to suit your preferences, ensuring a balanced and well-proportioned diagram.
- **Title and Captions:** Define a fitting title and add captions to elucidate the context or to annotate specific parts of your diagram.

21.0.2 Creole Syntax Description

Harness the power of Creole syntax to further format the content of any element within your diagram. This wiki markup style allows for:

- **Text Formatting:** Customize the appearance of your text with various styles and alignments.
- **Lists:** Create ordered or unordered lists to present information neatly.
- **Links:** Integrate hyperlinks to facilitate quick navigation to relevant resources.

21.0.3 Style Control Command

Gain complete control over the presentation style of your diagram elements using the `style` command. Utilize this to:

- **Define Styles:** Set uniform styles for elements to maintain a cohesive visual theme.
- **Customize Colors:** Choose specific colors for various elements to enhance visual appeal and to create distinct classifications.

Explore these commands to create diagrams that are both functional and aesthetically pleasing, tailoring each element to your exact specifications.

21.1 Comments

21.1.1 Simple comment

Everything that starts with `simple quote '` is a comment.

```
@startuml
'Line comments use a single apostrophe
@enduml
```

21.1.2 Block comment

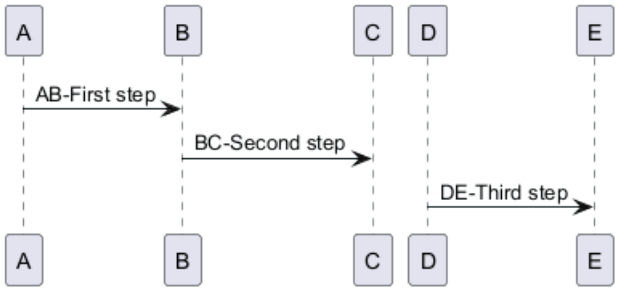
Block comment use C-style comments except that instead of `*` you use an apostrophe `'`, then you can also put comments on several lines using `/'` to start and `'/` to end.

```
@startuml
/'
many lines comments
here
'/
@enduml
```

[Ref. QA-1353]

Then you can also put block comment on the same line, as:

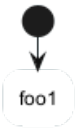
```
@startuml
/' case 1 '/   A -> B : AB-First step
               B -> C : BC-Second step
/' case 2 '/   D -> E : DE-Third step
@enduml
```



[Ref. QA-3906 and QA-3910]

21.1.3 Full example

```
@startuml
skinparam activity {
    ' this is a comment
    BackgroundColor White
    BorderColor Black /' this is a comment '/
    BorderColor Red  ' this is not a comment and this line is ignored
}

start
:foo1;
@enduml
```



[Ref. GH-214]

21.2 Zoom

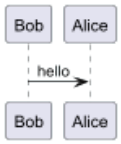
You can use the `scale` command to zoom the generated image.

You can use either *a number* or *a fraction* to define the scale factor. You can also specify either `width` or `height` (*in pixel*). And you can also give both `width` and `height`: the image is scaled to fit inside the specified dimension.

- `scale 1.5`
- `scale 2/3`
- `scale 200 width`
- `scale 200 height`
- `scale 200*100`
- `scale max 300*200`
- `scale max 1024 width`

- `scale max 800 height`

```
@startuml
scale 180*90
Bob->Alice : hello
@enduml
```

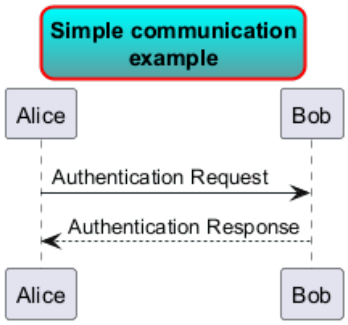


21.3 Title

The `title` keywords is used to put a title. You can add newline using `\n` in the title description.

Some skinparam settings are available to put borders on the title.

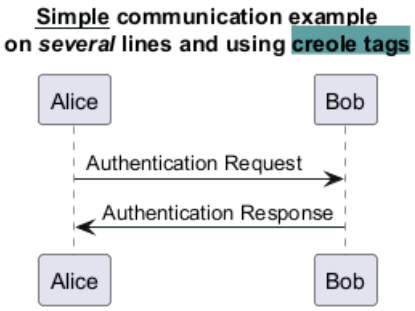
```
@startuml
skinparam titleBorderRoundCorner 15
skinparam titleBorderThickness 2
skinparam titleBorderColor red
skinparam titleBackgroundColor Aqua-CadetBlue

title Simple communication\nexample

Alice -> Bob: Authentication Request
Bob --> Alice: Authentication Response

@enduml
```



You can use creole formatting in the title.

You can also define title on several lines using `title` and `end title` keywords.

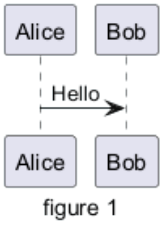
```
@startuml

title
 <u>Simple</u> communication example
 on <i>several</i> lines and using <back:cadetblue>creole tags</back>
end title

Alice -> Bob: Authentication Request
Bob -> Alice: Authentication Response

@enduml
```



21.4 Caption

There is also a `caption` keyword to put a caption under the diagram.

```
@startuml

caption figure 1
Alice -> Bob: Hello

@enduml
```



21.5 Footer and header

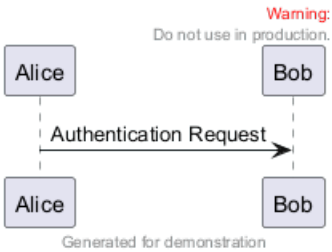
You can use the commands `header` or `footer` to add a footer or a header on any generated diagram.

You can optionally specify if you want a `center`, `left` or `right` footer/header, by adding a keyword.

As with title, it is possible to define a header or a footer on several lines.

It is also possible to put some HTML into the header or footer.

```
@startuml
Alice -> Bob: Authentication Request

header
<font color=red>Warning:</font>
Do not use in production.
endheader

center footer Generated for demonstration

@enduml
```

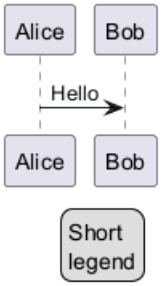


21.6 Legend the diagram

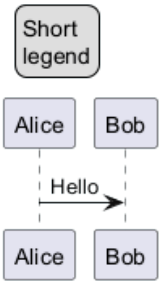
The `legend` and `end legend` are keywords is used to put a legend.

You can optionally specify to have `left`, `right`, `top`, `bottom` or `center` alignment for the legend.

```
@startuml
Alice -> Bob : Hello
legend right
  Short
  legend
endlegend
@enduml
```




```
@startuml
Alice -> Bob : Hello
legend top left
  Short
  legend
endlegend
@enduml
```

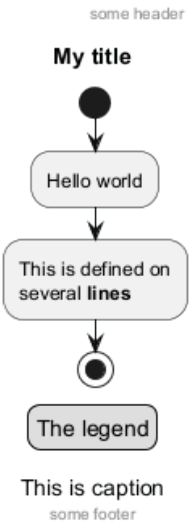


21.7 Appendix: Examples on all diagram

21.7.1 Activity

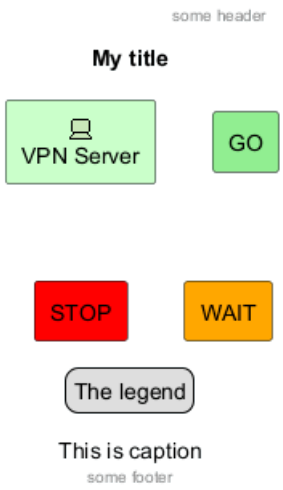
```
@startuml
header some header

footer some footer

title My title

caption This is caption

legend
The legend
end legend

start
```

```
:Hello world;
:This is defined on
several **lines**;
stop

@enduml
```



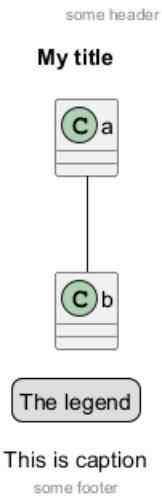
21.7.2 Archimate

```
@startuml
header some header

footer some footer

title My title

caption This is caption

legend
The legend
end legend

archimate #Technology "VPN Server" as vpnServerA <<technology-device>>

rectangle GO #lightgreen
rectangle STOP #red
rectangle WAIT #orange

@enduml
```



21.7.3 Class

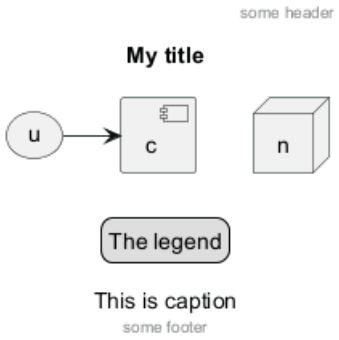
```
@startuml
header some header

footer some footer

title My title

caption This is caption

legend
The legend
end legend

a -- b

@enduml
```



21.7.4 Component, Deployment, Use-Case

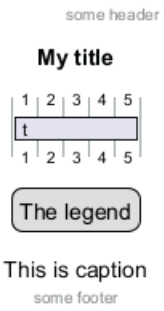
```
@startuml
header some header

footer some footer
```

```
title My title

caption This is caption

legend
The legend
end legend

node n
(u) -> [c]

@enduml
```



21.7.5 Gantt project planning

```
@startgantt
header some header

footer some footer

title My title

caption This is caption

legend
The legend
end legend


[t] lasts 5 days

@endgantt
```

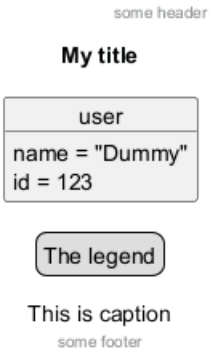


TODO: DONE *[(Header, footer) corrected on V1.2020.18]*

21.7.6 Object

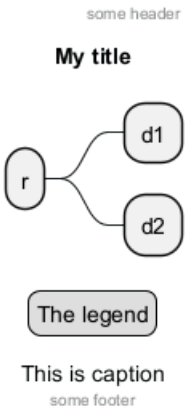
```
@startuml
```

```
header some header

footer some footer

title My title

caption This is caption

legend
The legend
end legend

object user {
  name = "Dummy"
  id = 123
}

@enduml
```



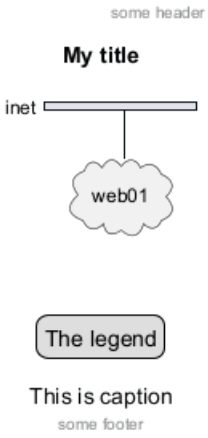
21.7.7 MindMap

```
@startmindmap
header some header

footer some footer

title My title

caption This is caption

legend
The legend
end legend

* r
** d1
** d2

@endmindmap
```



21.7.8 Network (nwdiag)

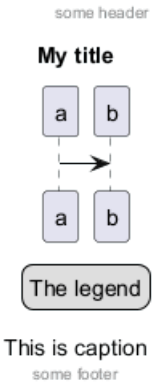
```
@startuml
header some header

footer some footer

title My title

caption This is caption

legend
The legend
end legend

nwdiag {
  network inet {
      web01 [shape = cloud]
  }
}

@enduml
```



21.7.9 Sequence

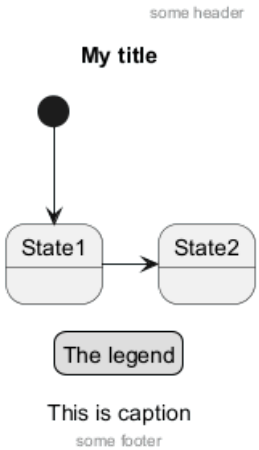
```
@startuml
header some header

footer some footer
```

```
title My title

caption This is caption

legend
The legend
end legend

a->b
@enduml
```



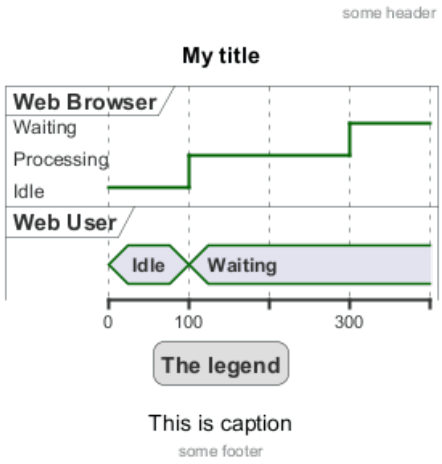
21.7.10 State

```
@startuml
header some header

footer some footer

title My title

caption This is caption

legend
The legend
end legend

[*] --> State1
State1 -> State2

@enduml
```



21.7.11 Timing

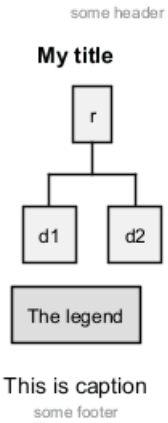
```
@startuml
header some header

footer some footer

title My title

caption This is caption

legend
The legend
end legend

robust "Web Browser" as WB
concise "Web User" as WU

@0
WU is Idle
WB is Idle

@100
WU is Waiting
WB is Processing

@300
WB is Waiting

@enduml
```



21.7.12 Work Breakdown Structure (WBS)

```
@startwbs
header some header

footer some footer

title My title

caption This is caption

legend
```

```
The legend
end legend

* r
** d1
** d2

@endwbs
```



TODO: DONE *[Corrected on V1.2020.17]*

21.7.13 Wireframe (SALT)

```
@startsalt
header some header

footer some footer

title My title

caption This is caption

legend
The legend
end legend

{+
  Login    | "MyName   "
  Password | "****     "
  [Cancel] | [  OK   ]
}
@endsalt
```

TODO: DONE *[Corrected on V1.2020.18]*

21.8 Appendix: Examples on all diagram with style

TODO: DONE

FYI:

- all is only good for **`Sequence diagram`**
- `title`, `caption` and `legend` are good for all diagrams except for **`salt diagram`**

TODO: FIXME

- Now *(test on 1.2020.18-19)* `header`, `footer` are not good for **all other diagrams** except only for **`Sequence diagram`**.

To be fix; Thanks

TODO: FIXME

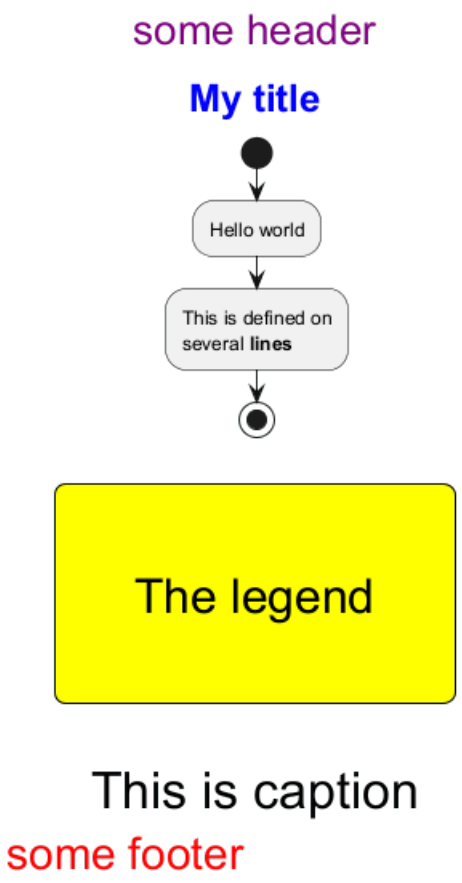
Here are tests of `title`, `header`, `footer`, `caption` or `legend` on all the diagram with the debug style:

```
<style>
title {
  HorizontalAlignment right
  FontSize 24
  FontColor blue
}

header {
  HorizontalAlignment center
  FontSize 26
  FontColor purple
}

footer {
  HorizontalAlignment left
  FontSize 28
  FontColor red
}

legend {
  FontSize 30
  BackGroundColor yellow
  Margin 30
  Padding 50
}

caption {
  FontSize 32
}
</style>
```

21.8.1 Activity

```
@startuml
<style>
title {
  HorizontalAlignment right
  FontSize 24
  FontColor blue
}
```

```
header {
  HorizontalAlignment center
  FontSize 26
  FontColor purple
}

footer {
  HorizontalAlignment left
  FontSize 28
  FontColor red
}

legend {
  FontSize 30
  BackGroundColor yellow
  Margin 30
  Padding 50
}

caption {
  FontSize 32
}
</style>
header some header

footer some footer

title My title

caption This is caption

legend
The legend
end legend

start
:Hello world;
:This is defined on
several **lines**;
stop

@enduml
```



21.8.2 Archimate

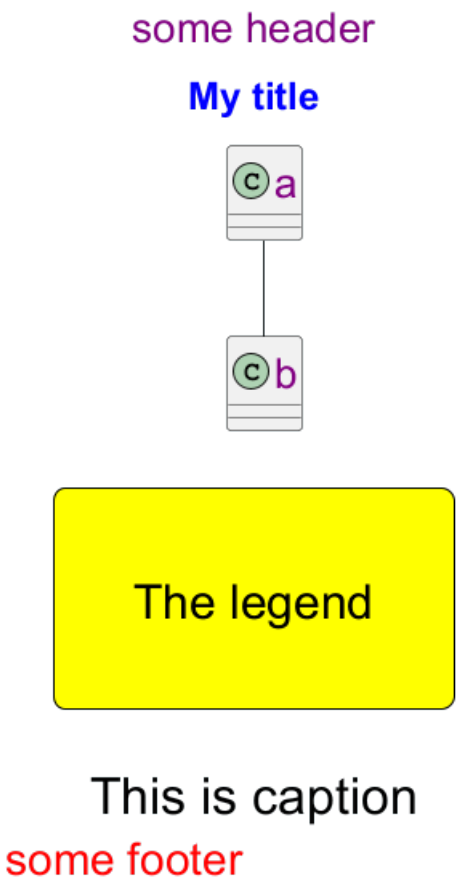
```
@startuml
<style>
title {
  HorizontalAlignment right
  FontSize 24
  FontColor blue
}

header {
  HorizontalAlignment center
  FontSize 26
  FontColor purple
}

footer {
  HorizontalAlignment left
  FontSize 28
  FontColor red
}

legend {
  FontSize 30
  BackGroundColor yellow
  Margin 30
  Padding 50
}
```

```
caption {
  FontSize 32
}
</style>
header some header

footer some footer

title My title

caption This is caption

legend
The legend
end legend

archimate #Technology "VPN Server" as vpnServerA <<technology-device>>

rectangle GO #lightgreen
rectangle STOP #red
rectangle WAIT #orange

@enduml
```

21.8.3 Class

```
@startuml
<style>
title {
  HorizontalAlignment right
  FontSize 24
```

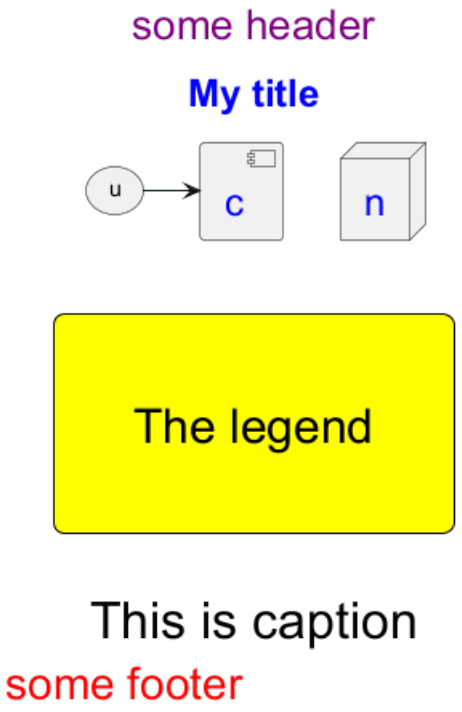
```
  FontColor blue
}

header {
  HorizontalAlignment center
  FontSize 26
  FontColor purple
}

footer {
  HorizontalAlignment left
  FontSize 28
  FontColor red
}

legend {
  FontSize 30
  BackGroundColor yellow
  Margin 30
  Padding 50
}

caption {
  FontSize 32
}
</style>
header some header

footer some footer

title My title

caption This is caption

legend
The legend
end legend

a -- b

@enduml
```



21.8.4 Component, Deployment, Use-Case

```
@startuml
<style>
title {
  HorizontalAlignment right
  FontSize 24
  FontColor blue
}

header {
  HorizontalAlignment center
  FontSize 26
  FontColor purple
}

footer {
  HorizontalAlignment left
  FontSize 28
  FontColor red
}

legend {
  FontSize 30
  BackGroundColor yellow
  Margin 30
  Padding 50
}
```

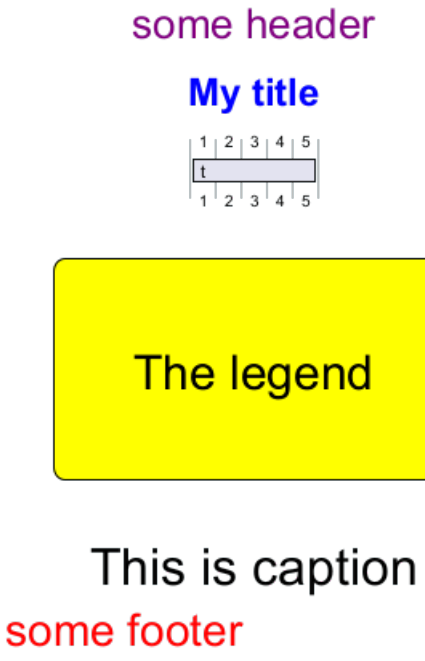
```
caption {
  FontSize 32
}
</style>
header some header

footer some footer

title My title

caption This is caption

legend
The legend
end legend

node n
(u) -> [c]

@enduml
```



21.8.5 Gantt project planning

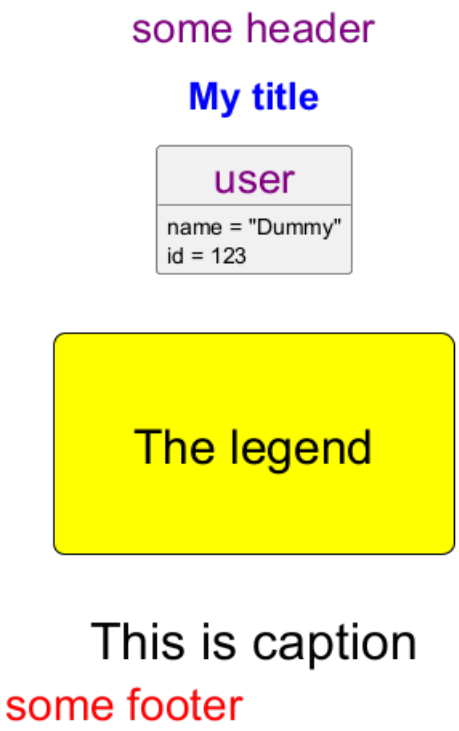
```
@startgantt
<style>
title {
  HorizontalAlignment right
  FontSize 24
  FontColor blue
}

header {
  HorizontalAlignment center
  FontSize 26
  FontColor purple
```

```
}

footer {
  HorizontalAlignment left
  FontSize 28
  FontColor red
}

legend {
  FontSize 30
  BackGroundColor yellow
  Margin 30
  Padding 50
}

caption {
  FontSize 32
}
</style>
header some header

footer some footer

title My title

caption This is caption

legend
The legend
end legend


[t] lasts 5 days

@endgantt
```



21.8.6 Object

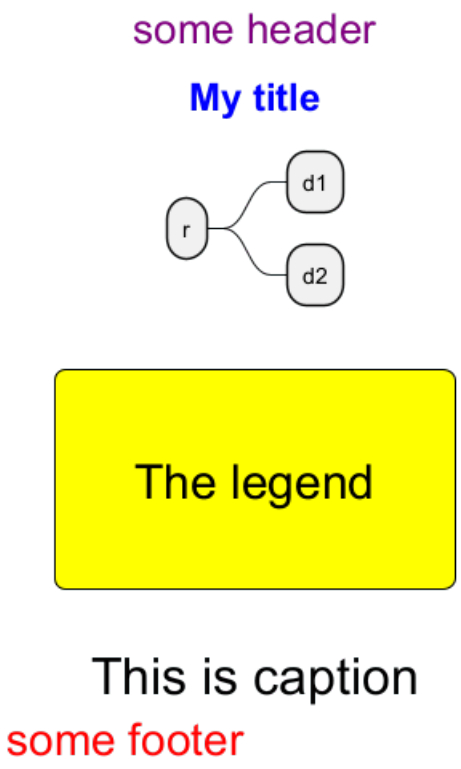
```
@startuml
<style>
title {
  HorizontalAlignment right
  FontSize 24
  FontColor blue
}

header {
  HorizontalAlignment center
  FontSize 26
  FontColor purple
}

footer {
  HorizontalAlignment left
  FontSize 28
  FontColor red
}

legend {
  FontSize 30
  BackGroundColor yellow
  Margin 30
  Padding 50
}

caption {
  FontSize 32
}
</style>
header some header

footer some footer

title My title

caption This is caption

legend
The legend
end legend

object user {
  name = "Dummy"
  id = 123
}

@enduml
```



21.8.7 MindMap

```
@startmindmap
<style>
title {
  HorizontalAlignment right
  FontSize 24
  FontColor blue
}

header {
  HorizontalAlignment center
  FontSize 26
  FontColor purple
}

footer {
  HorizontalAlignment left
  FontSize 28
  FontColor red
}

legend {
  FontSize 30
  BackGroundColor yellow
  Margin 30
  Padding 50
}

caption {
  FontSize 32
}
</style>
header some header
```

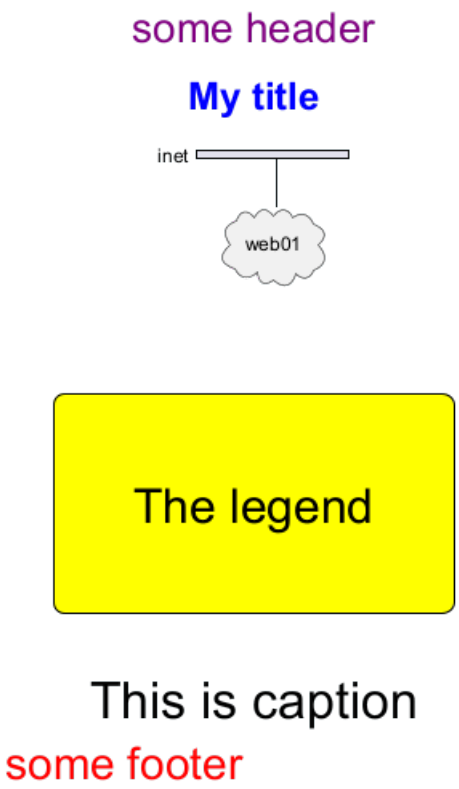
```
footer some footer

title My title

caption This is caption

legend
The legend
end legend

* r
** d1
** d2

@endmindmap
```



21.8.8 Network (nwdiag)

```
@startuml
<style>
title {
  HorizontalAlignment right
  FontSize 24
  FontColor blue
}

header {
  HorizontalAlignment center
  FontSize 26
  FontColor purple
}
```

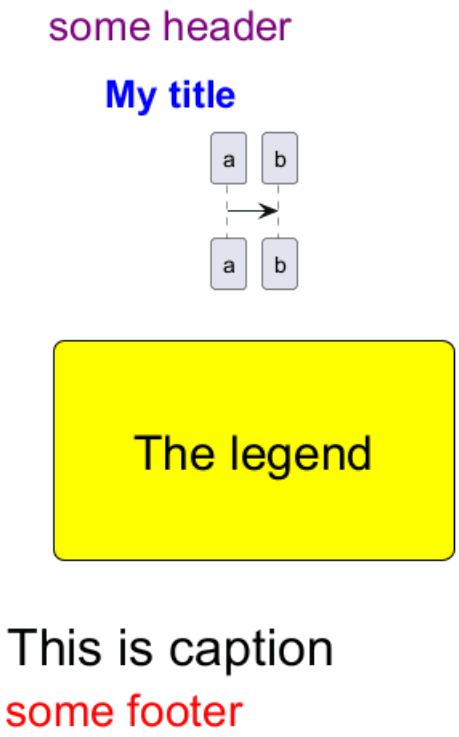
```
footer {
  HorizontalAlignment left
  FontSize 28
  FontColor red
}

legend {
  FontSize 30
  BackGroundColor yellow
  Margin 30
  Padding 50
}

caption {
  FontSize 32
}
</style>
header some header

footer some footer

title My title

caption This is caption

legend
The legend
end legend

nwdiag {
  network inet {
      web01 [shape = cloud]
  }
}

@enduml
```



21.8.9 Sequence

```
@startuml
<style>
title {
  HorizontalAlignment right
  FontSize 24
  FontColor blue
}

header {
  HorizontalAlignment center
  FontSize 26
  FontColor purple
}

footer {
  HorizontalAlignment left
  FontSize 28
  FontColor red
}

legend {
  FontSize 30
  BackGroundColor yellow
  Margin 30
  Padding 50
}

caption {
  FontSize 32
}
</style>
```

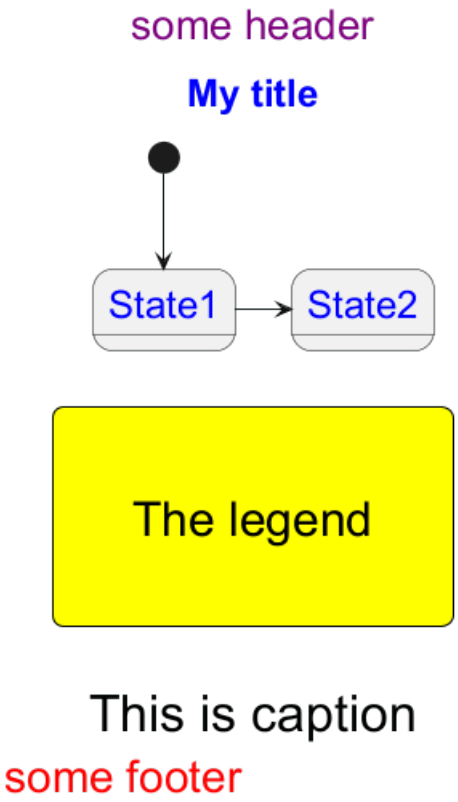
```
header some header

footer some footer

title My title

caption This is caption

legend
The legend
end legend

a->b
@enduml
```



21.8.10 State

```
@startuml
<style>
title {
  HorizontalAlignment right
  FontSize 24
  FontColor blue
}

header {
  HorizontalAlignment center
  FontSize 26
  FontColor purple
}

footer {
  HorizontalAlignment left
  FontSize 28
```

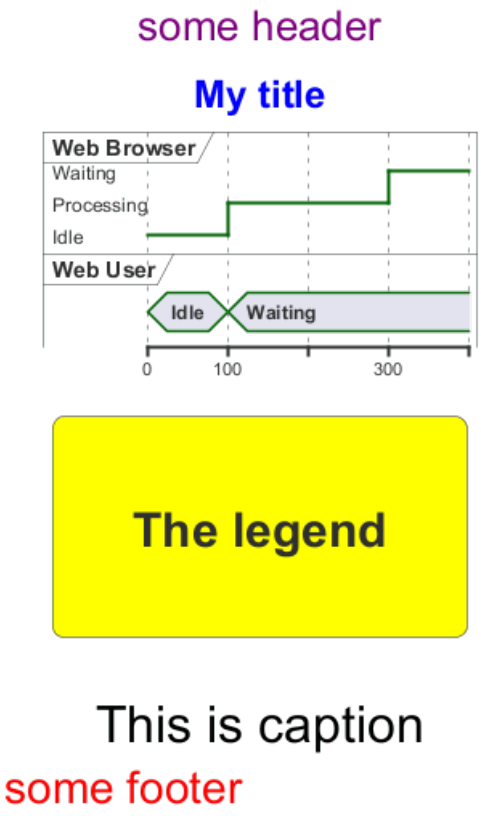
```
  FontColor red
}

legend {
  FontSize 30
  BackGroundColor yellow
  Margin 30
  Padding 50
}

caption {
  FontSize 32
}
</style>
header some header

footer some footer

title My title

caption This is caption

legend
The legend
end legend

[*] --> State1
State1 -> State2

@enduml
```



21.8.11 Timing

```
@startuml
<style>
title {
  HorizontalAlignment right
  FontSize 24
  FontColor blue
}

header {
  HorizontalAlignment center
  FontSize 26
  FontColor purple
}

footer {
  HorizontalAlignment left
  FontSize 28
  FontColor red
}

legend {
  FontSize 30
  BackGroundColor yellow
  Margin 30
  Padding 50
}

caption {
  FontSize 32
}
</style>
header some header

footer some footer

title My title

caption This is caption

legend
The legend
end legend

robust "Web Browser" as WB
concise "Web User" as WU

@0
WU is Idle
WB is Idle

@100
WU is Waiting
WB is Processing

@300
WB is Waiting
```

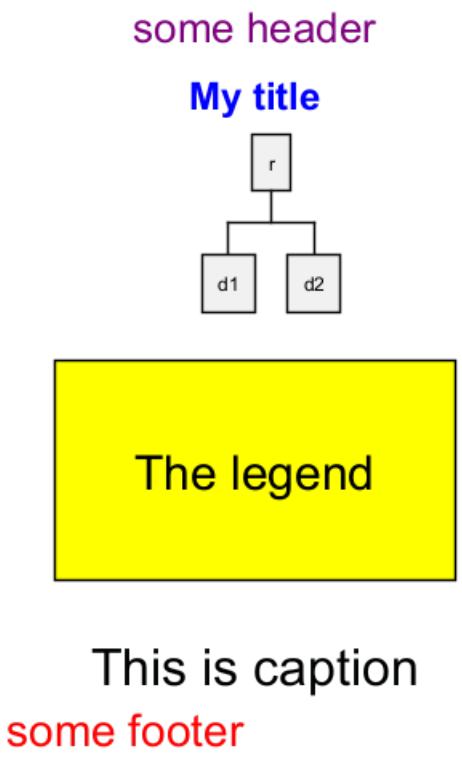
```
@enduml
```



21.8.12 Work Breakdown Structure (WBS)

```
@startwbs
<style>
title {
  HorizontalAlignment right
  FontSize 24
  FontColor blue
}

header {
  HorizontalAlignment center
  FontSize 26
  FontColor purple
}

footer {
  HorizontalAlignment left
  FontSize 28
  FontColor red
}

legend {
  FontSize 30
  BackGroundColor yellow
  Margin 30
  Padding 50
}
```

```
caption {
  FontSize 32
}
</style>
header some header

footer some footer

title My title

caption This is caption

legend
The legend
end legend

* r
** d1
** d2

@endwbs
```



21.8.13 Wireframe (SALT)

TODO: FIXME Fix all (`title`, `caption`, `legend`, `header`, `footer`) for salt. **TODO:** FIXME

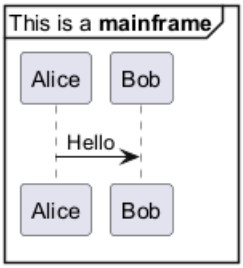
```
@startsalt
<style>
title {
  HorizontalAlignment right
  FontSize 24
  FontColor blue
}
```

```
header {
  HorizontalAlignment center
  FontSize 26
  FontColor purple
}

footer {
  HorizontalAlignment left
  FontSize 28
  FontColor red
}

legend {
  FontSize 30
  BackGroundColor yellow
  Margin 30
  Padding 50
}

caption {
  FontSize 32
}
</style>
@startsalt
header some header

footer some footer

title My title

caption This is caption

legend
The legend
end legend

{+
  Login    | "MyName   "
  Password | "****     "
  [Cancel] | [  OK   ]
}
@endsalt
```

21.9 Mainframe

```
@startuml
mainframe This is a **mainframe**
```

```
Alice->Bob : Hello
@enduml
```

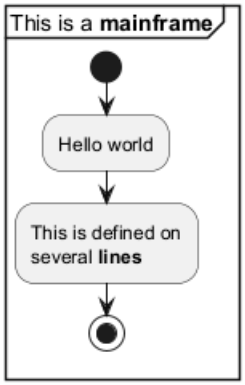


[Ref. QA-4019 and Issue#148]

21.10 Appendix: Examples of Mainframe on all diagram

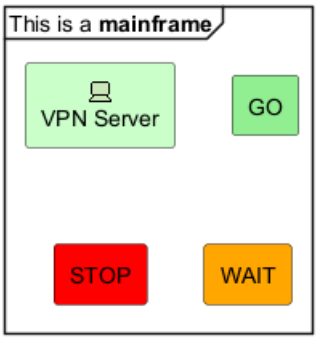
21.10.1 Activity

```
@startuml
mainframe This is a **mainframe**

start
:Hello world;
:This is defined on
several **lines**;
stop
@enduml
```



21.10.2 Archimate

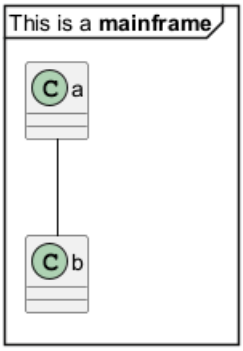
```
@startuml
mainframe This is a **mainframe**

archimate #Technology "VPN Server" as vpnServerA <<technology-device>>
rectangle GO #lightgreen
rectangle STOP #red
rectangle WAIT #orange
@enduml
```



TODO: FIXME Cropped on the top and on the left **TODO:** FIXME

21.10.3 Class

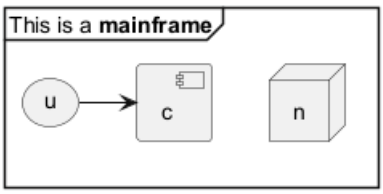
```
@startuml
mainframe This is a **mainframe**

a -- b
@enduml
```



TODO: FIXME Cropped on the top and on the left **TODO:** FIXME

21.10.4 Component, Deployment, Use-Case

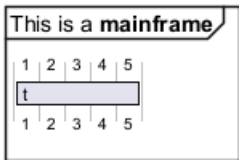
```
@startuml
mainframe This is a **mainframe**

node n
(u) -> [c]
@enduml
```



TODO: FIXME Cropped on the top and on the left **TODO:** FIXME

21.10.5 Gantt project planning

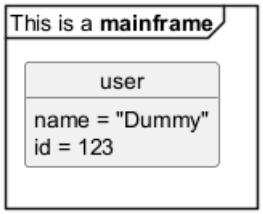
```
@startgantt
mainframe This is a **mainframe**

[t] lasts 5 days
@endgantt
```



TODO: FIXME Cropped on the top and on the left **TODO:** FIXME

21.10.6 Object

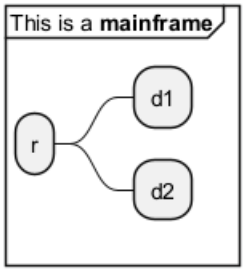
```
@startuml
mainframe This is a **mainframe**

object user {
  name = "Dummy"
  id = 123
}
@enduml
```



TODO: FIXME Cropped on the top! **TODO:** FIXME

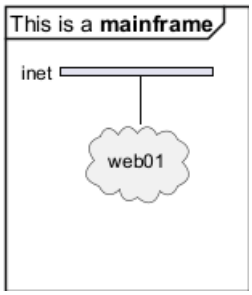
21.10.7 MindMap

```
@startmindmap
mainframe This is a **mainframe**

* r
** d1
** d2
@endmindmap
```



21.10.8 Network (nwdiag)

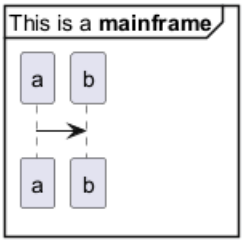
```
@startuml
mainframe This is a **mainframe**

nwdiag {
  network inet {
      web01 [shape = cloud]
  }
}
@enduml
```



TODO: FIXME Cropped on the top! **TODO:** FIXME

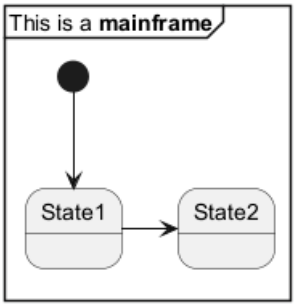
21.10.9 Sequence

```
@startuml
mainframe This is a **mainframe**

a->b
@enduml
```



21.10.10 State

```
@startuml
mainframe This is a **mainframe**

[*] --> State1
State1 -> State2
@enduml
```

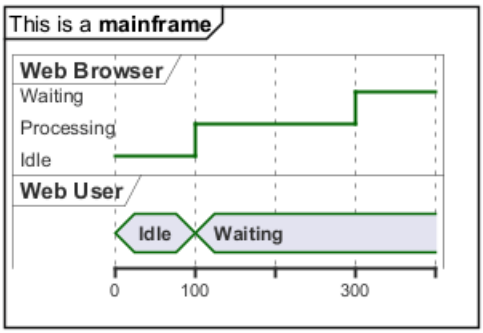


TODO: FIXME Cropped on the top and on the left **TODO:** FIXME

21.10.11 Timing

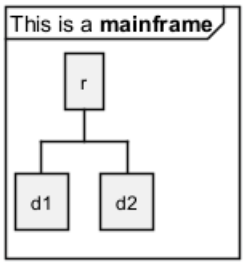
```
@startuml
mainframe This is a **mainframe**

robust "Web Browser" as WB
concise "Web User" as WU
@0
WU is Idle
```

```
WB is Idle
@100
WU is Waiting
WB is Processing
@300
WB is Waiting
@enduml
```



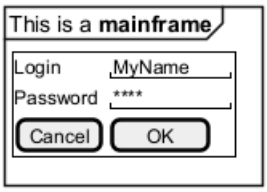
21.10.12 Work Breakdown Structure (WBS)

```
@startwbs
mainframe This is a **mainframe**
* r
** d1
** d2
@endwbs
```



21.10.13 Wireframe (SALT)

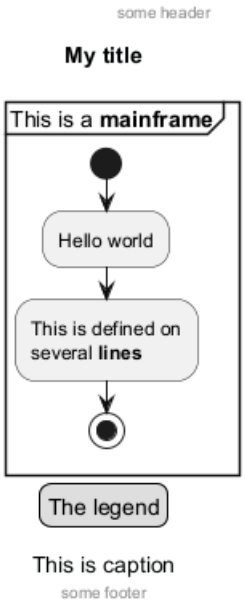
```
@startsalt
mainframe This is a **mainframe**
{+
  Login    | "MyName   "
  Password | "****     "
  [Cancel] | [  OK   ]
}
@endsalt
```



21.11 Appendix: Examples of title, header, footer, caption, legend and mainframe on all diagram

21.11.1 Activity

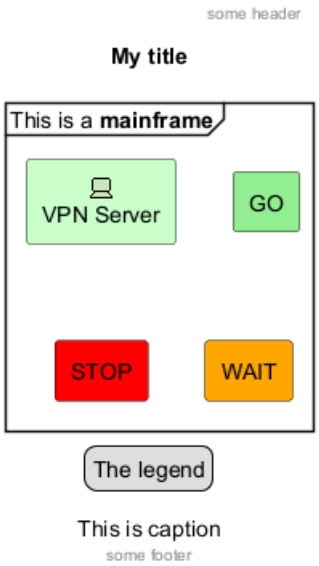
```
@startuml
mainframe This is a **mainframe**
header some header

footer some footer

title My title

caption This is caption

legend
The legend
end legend

start
:Hello world;
:This is defined on
several **lines**;
stop

@enduml
```



21.11.2 Archimate

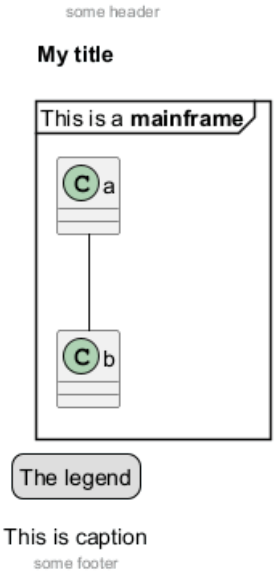
```
@startuml
mainframe This is a **mainframe**
header some header

footer some footer

title My title

caption This is caption
```

```
legend
The legend
end legend

archimate #Technology "VPN Server" as vpnServerA <<technology-device>>

rectangle GO #lightgreen
rectangle STOP #red
rectangle WAIT #orange

@enduml
```



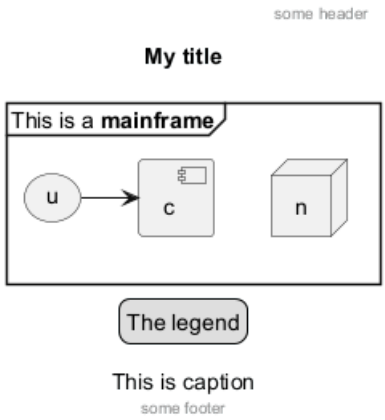
21.11.3 Class

```
@startuml
mainframe This is a **mainframe**
header some header

footer some footer

title My title

caption This is caption

legend
The legend
end legend

a -- b

@enduml
```



21.11.4 Component, Deployment, Use-Case

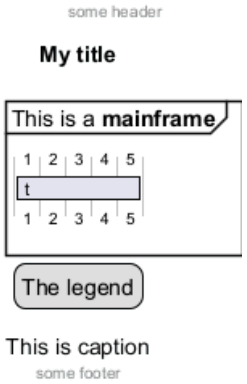
```
@startuml
mainframe This is a **mainframe**
header some header

footer some footer

title My title

caption This is caption

legend
The legend
end legend

node n
(u) -> [c]

@enduml
```



21.11.5 Gantt project planning

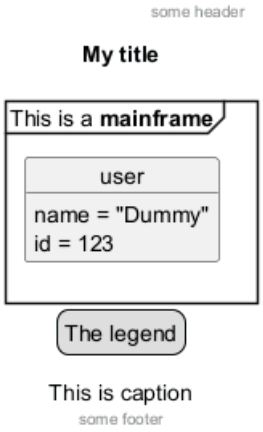
```
@startgantt
mainframe This is a **mainframe**
header some header
```

```
footer some footer

title My title

caption This is caption

legend
The legend
end legend


[t] lasts 5 days

@endgantt
```



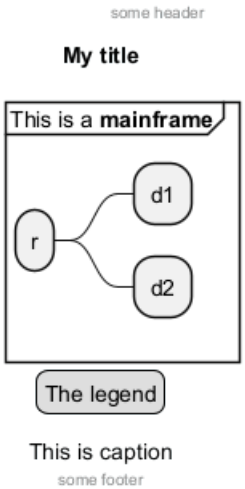
21.11.6 Object

```
@startuml
mainframe This is a **mainframe**
header some header

footer some footer

title My title

caption This is caption

legend
The legend
end legend

object user {
  name = "Dummy"
  id = 123
}

@enduml
```



21.11.7 MindMap

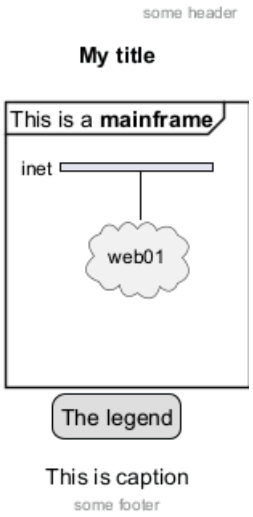
```
@startmindmap
mainframe This is a **mainframe**
header some header

footer some footer

title My title

caption This is caption

legend
The legend
end legend

* r
** d1
** d2

@endmindmap
```



21.11.8 Network (nwdiag)

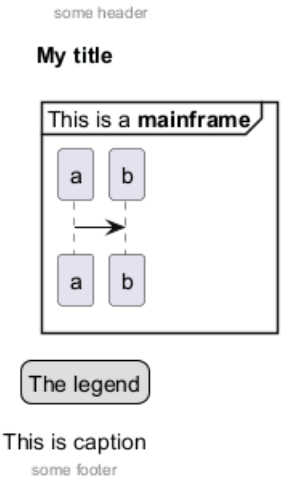
```
@startuml
mainframe This is a **mainframe**
header some header
```

```
footer some footer

title My title

caption This is caption

legend
The legend
end legend

nwdiag {
  network inet {
      web01 [shape = cloud]
  }
}

@enduml
```



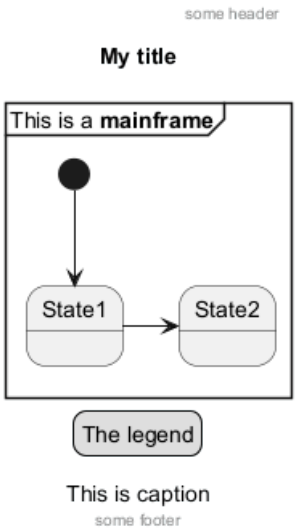
21.11.9 Sequence

```
@startuml
mainframe This is a **mainframe**
header some header

footer some footer

title My title

caption This is caption

legend
The legend
end legend

a->b
@enduml
```



21.11.10 State

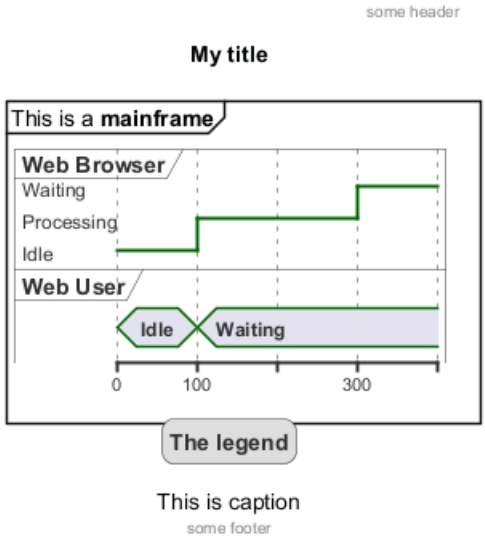
```
@startuml
mainframe This is a **mainframe**
header some header

footer some footer

title My title

caption This is caption

legend
The legend
end legend

[*] --> State1
State1 -> State2

@enduml
```



21.11.11 Timing

```
@startuml
mainframe This is a **mainframe**
```

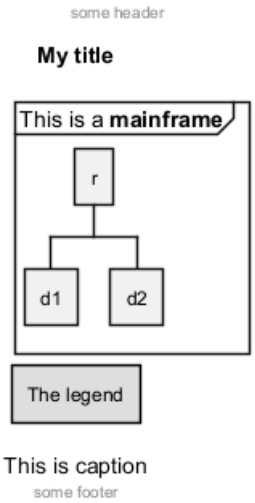
```
header some header

footer some footer

title My title

caption This is caption

legend
The legend
end legend

robust "Web Browser" as WB
concise "Web User" as WU

@0
WU is Idle
WB is Idle

@100
WU is Waiting
WB is Processing

@300
WB is Waiting

@enduml
```



21.11.12 Work Breakdown Structure (WBS)

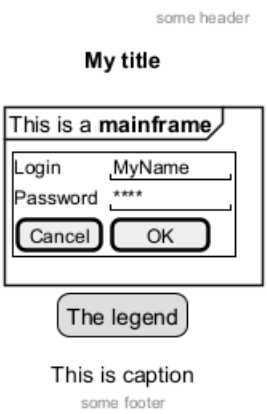
```
@startwbs
mainframe This is a **mainframe**
header some header

footer some footer

title My title

caption This is caption
```

```
legend
The legend
end legend

* r
** d1
** d2

@endwbs
```



21.11.13 Wireframe (SALT)

```
@startsalt
mainframe This is a **mainframe**
header some header

footer some footer

title My title

caption This is caption

legend
The legend
end legend

{+
  Login    | "MyName   "
  Password | "****     "
  [Cancel] | [  OK   ]
}
@endsalt
```


some header
My title
This is a mainframe
Login
MyName
Password
****
Cancel
OK
The legend
This is caption
some footer

22 Creole

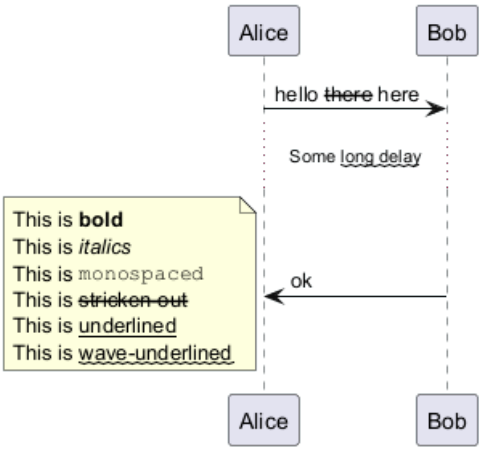
Creole is a lightweight common markup language for various wikis. A light-weight Creole engine is integrated in PlantUML to have a standardized way to emit styled text.

All diagrams support this syntax.

Note that compatibility with HTML syntax is preserved.

22.1 Emphasized text

```
@startuml
Alice -> Bob : hello --there-- here
... Some ~~long delay~~ ...
Bob -> Alice : ok
note left
  This is **bold**
  This is //italics//
  This is ""monospaced""
  This is --stricken-out--
  This is __underlined__
  This is ~~wave-underlined~~
end note
@enduml
```



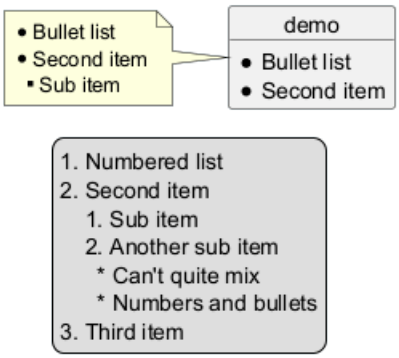
22.2 Lists

You can use numbered and bulleted lists in node text, notes, etc.

TODO: FIXME You cannot quite mix numbers and bullets in a list and its sublist.

```
@startuml
object demo {
  * Bullet list
  * Second item
}
note left
  * Bullet list
  * Second item
  ** Sub item
end note

legend
  # Numbered list
  # Second item
  ## Sub item
```

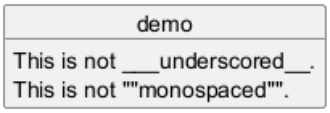
```
  ## Another sub item
        * Can't quite mix
        * Numbers and bullets
  # Third item
end legend
@enduml
```



22.3 Escape character

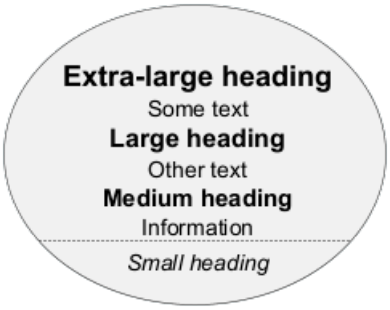
You can use the tilde ~ to escape special creole characters.

```
@startuml
object demo {
  This is not ~___underscored__.
  This is not ~""monospaced"".
}
@enduml
```



22.4 Headings

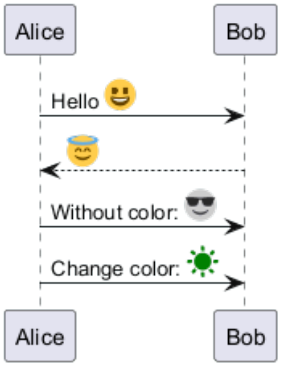
```
@startuml
usecase UC1 as "
= Extra-large heading
Some text
== Large heading
Other text
=== Medium heading
Information
....
==== Small heading"
@enduml
```



22.5 Emoji

All emojis from Twemoji (see EmojiTwo on Github) are available using the following syntax:

```
@startuml
Alice -> Bob : Hello <:1f600:>
return <:innocent:>
Alice -> Bob : Without color: <#0:sunglasses:>
Alice -> Bob : Change color: <#green:sunny:>
@enduml
```



Unlike Unicode Special characters that depend on installed fonts, the emoji are always available. Furthermore, emoji are already colored, but you can recolor them if you like (see examples above).

One can pick emoji from the emoji cheat sheet, the Unicode full-emoji-list, or the flat list emoji.txt in the plantuml source.

You can also use the following PlantUML command to list available emoji:

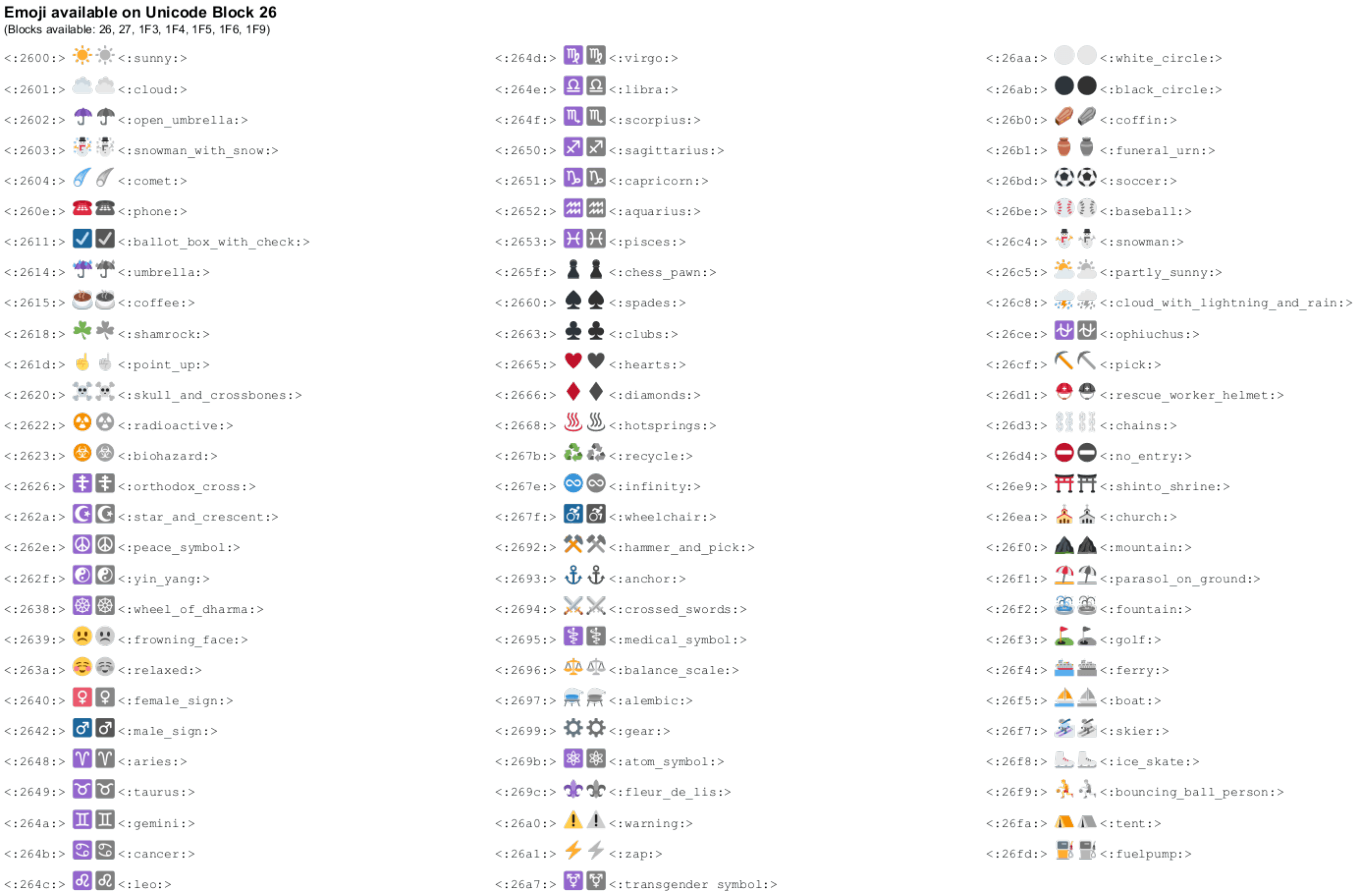
```
@startuml
emoji <block>
@enduml
```

As of 13 April 2023, you can select between 1174 emoji from the following Unicode blocks:

- Unicode block 26: 83 emoji
- Unicode block 27: 33 emoji
- Unicode block 1F3: 246 emoji
- Unicode block 1F4: 255 emoji
- Unicode block 1F5: 136 emoji
- Unicode block 1F6: 181 emoji
- Unicode block 1F9: 240 emoji

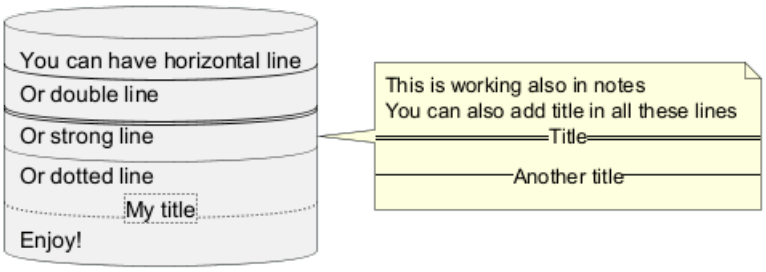
22.5.1 Unicode block 26

```
@startuml
emoji 26
@enduml
```



22.6 Horizontal lines

```
@startuml
database DB1 as "
You can have horizontal line
----
Or double line
====
Or strong line

----
Or dotted line
..My title..
Enjoy!
"
note right
  This is working also in notes
  You can also add title in all these lines
  ==Title==
  --Another title--
end note

@enduml
```



22.7 Links

You can also use URL and links.

Simple links are define using two square brackets (or three square brackets for field or method on class diagram).

Example:

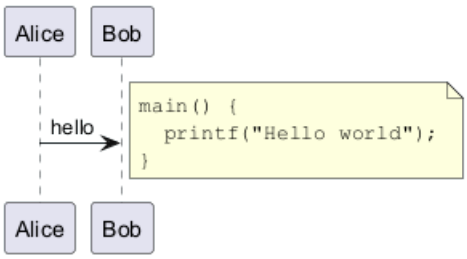
- `[[http://plantuml.com]]`
- `[[http://plantuml.com This label is printed]]`
- `[[http://plantuml.com{Optional tooltip} This label is printed]]`

URL can also be authenticated.

22.8 Code

You can use `<code>` to display some programming code in your diagram (sorry, syntax highlighting is not yet supported).

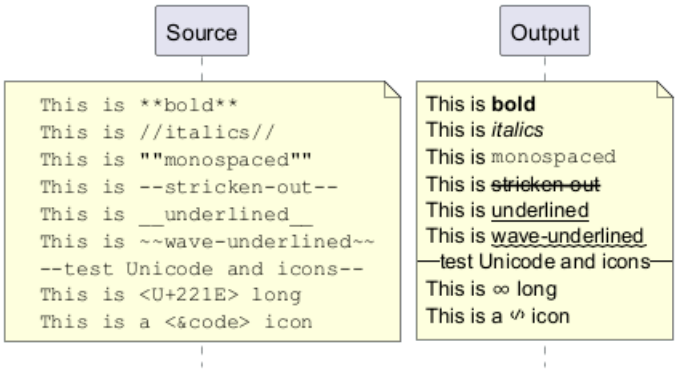
```
@startuml
Alice -> Bob : hello
note right
<code>
main() {
  printf("Hello world");
}
</code>
end note
@enduml
```



This is especially useful to illustrate some PlantUML code and the resulting rendering:

```
@startuml
hide footbox
note over Source
<code>
  This is **bold**
  This is //italics//
  This is ""monospaced""
  This is --stricken-out--
  This is __underlined__
```

```
  This is ~~wave-underlined~~
  --test Unicode and icons--
  This is <U+221E> long
  This is a <&code> icon
</code>
end note
/note over Output
  This is **bold**
  This is //italics//
  This is ""monospaced""
  This is --stricken-out--
  This is __underlined__
  This is ~~wave-underlined~~
  --test Unicode and icons--
  This is <U+221E> long
  This is a <&code> icon
end note
@enduml
```

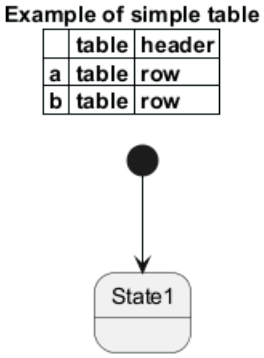


22.9 Table

22.9.1 Create a table

It is possible to build table, with | separator.

```
@startuml
skinparam titleFontSize 14
title
  Example of simple table
  |= |= table |= header |
  | a | table | row |
  | b | table | row |
end title
[*] --> State1
@enduml
```



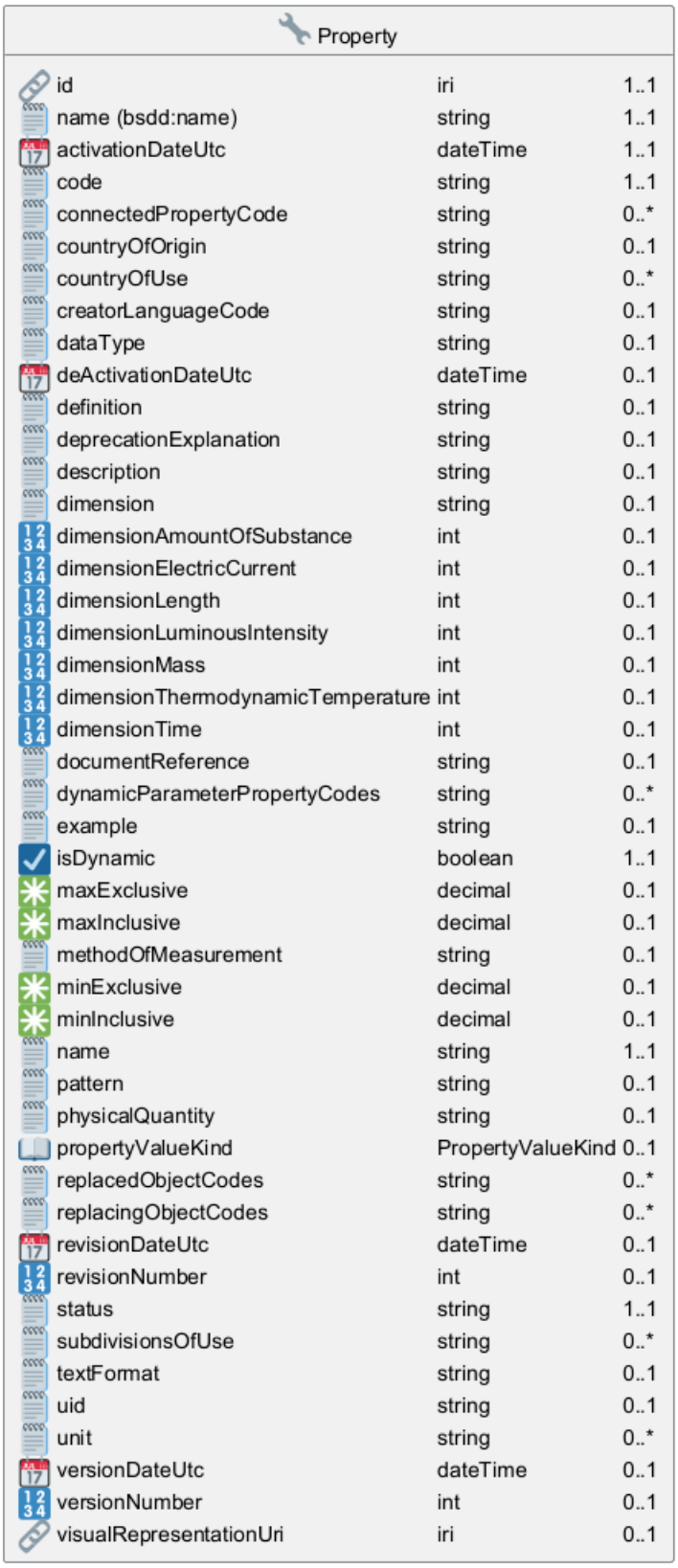
22.9.2 Align fields using Table

You can use a table to align ”fields” of class members. The example below (taken from buildingSmart Data Dictionary shows for each member: icon, name, datatype and cardinality. Use the `<#transparent,#transparent>` color specification so table cells have no foreground and background color.

(The example also shows the use of icons)

```
@startuml
hide empty members
hide circle

class "<:wrench:> Property" as Property {
<#transparent,#transparent>|<:link:>| id| iri| 1..1|
|<:spiral_notepad:>| name (bsdd:name)| string| 1..1|
|<:calendar:>| activationDateUtc| dateTime| 1..1|
|<:spiral_notepad:>| code| string| 1..1|
|<:spiral_notepad:>| connectedPropertyCode| string| 0..*|
|<:spiral_notepad:>| countryOfOrigin| string| 0..1|
|<:spiral_notepad:>| countryOfUse| string| 0..*|
|<:spiral_notepad:>| creatorLanguageCode| string| 0..1|
|<:spiral_notepad:>| dataType| string| 0..1|
|<:calendar:>| deActivationDateUtc| dateTime| 0..1|
|<:spiral_notepad:>| definition| string| 0..1|
|<:spiral_notepad:>| deprecationExplanation| string| 0..1|
|<:spiral_notepad:>| description| string| 0..1|
|<:spiral_notepad:>| dimension| string| 0..1|
|<:1234:>| dimensionAmountOfSubstance| int| 0..1|
|<:1234:>| dimensionElectricCurrent| int| 0..1|
|<:1234:>| dimensionLength| int| 0..1|
|<:1234:>| dimensionLuminousIntensity| int| 0..1|
|<:1234:>| dimensionMass| int| 0..1|
|<:1234:>| dimensionThermodynamicTemperature| int| 0..1|
|<:1234:>| dimensionTime| int| 0..1|
|<:spiral_notepad:>| documentReference| string| 0..1|
|<:spiral_notepad:>| dynamicParameterPropertyCodes| string| 0..*|
|<:spiral_notepad:>| example| string| 0..1|
|<:ballot_box_with_check:>| isDynamic| boolean| 1..1|
|<:eight_spoked_asterisk:>| maxExclusive| decimal| 0..1|
|<:eight_spoked_asterisk:>| maxInclusive| decimal| 0..1|
|<:spiral_notepad:>| methodOfMeasurement| string| 0..1|
|<:eight_spoked_asterisk:>| minExclusive| decimal| 0..1|
|<:eight_spoked_asterisk:>| minInclusive| decimal| 0..1|
|<:spiral_notepad:>| name| string| 1..1|
|<:spiral_notepad:>| pattern| string| 0..1|
|<:spiral_notepad:>| physicalQuantity| string| 0..1|
|<:book:>| propertyValueKind| PropertyValueKind| 0..1|
|<:spiral_notepad:>| replacedObjectCodes| string| 0..*|
|<:spiral_notepad:>| replacingObjectCodes| string| 0..*|
|<:calendar:>| revisionDateUtc| dateTime| 0..1|
|<:1234:>| revisionNumber| int| 0..1|
|<:spiral_notepad:>| status| string| 1..1|
|<:spiral_notepad:>| subdivisionsOfUse| string| 0..*|
|<:spiral_notepad:>| textFormat| string| 0..1|
|<:spiral_notepad:>| uid| string| 0..1|
|<:spiral_notepad:>| unit| string| 0..*|
|<:calendar:>| versionDateUtc| dateTime| 0..1|
|<:1234:>| versionNumber| int| 0..1|
|<:link:>| visualRepresentationUri| iri| 0..1|
}
```

```
@enduml
```

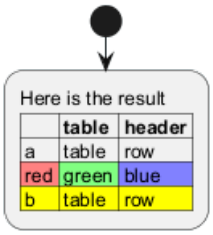


You can also try to use tabs `\t` and `skinparam tabSize n` to align fields, but this doesn't work so well: *[Ref. QA-3820]*

22.9.3 Add color on rows or cells

You can specify background colors of rows and cells:

```
@startuml
start
:Here is the result
|= |= table |= header |
| a | table | row |
|<#FF8080> red |<#80FF80> green |<#8080FF> blue |
<#yellow>| b | table | row |;
@enduml
```



22.9.4 Add color on border and text

You can also specify colors of text and borders.

```
@startuml
title
<#lightblue,#red>|=  Step  |=  Date  |=  Name  |=  Status  |=  Link  |
<#lightgreen>|  1.1  |  TBD  | plantuml news |<#Navy><color:OrangeRed><b> Unknown  | [[https://plantu
end title
@enduml
```

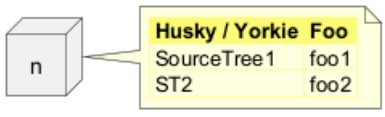
Step	Date	Name	Status	Link
1.1	TBD	plantuml news	Unknown	plantuml news

[Ref. QA-7184]

22.9.5 No border or same color as the background

You can also set the border color to the same color as the background.

```
@startuml
node n
note right of n
  <#FBFB77,#FBFB77>|= Husky / Yorkie |= Foo |
  | SourceTree1 | foo1 |
  | ST2 | foo2 |
end note
@enduml
```

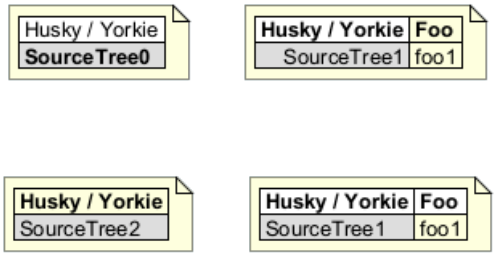


[Ref. QA-12448]

22.9.6 Bold header or not

= as the first char of a cell indicates whether to make it bold (usually used for headers), or not.

```
@startuml
note as deepCSS0
  |<#white> Husky / Yorkie |
  |=<#gainsboro> SourceTree0 |
endnote

note as deepCSS1
  |= <#white> Husky / Yorkie |= Foo |
  |<#gainsboro><r> SourceTree1 | foo1 |
endnote

note as deepCSS2
  |= Husky / Yorkie |
  |<#gainsboro> SourceTree2 |
endnote

note as deepCSS3
  <#white>|= Husky / Yorkie |= Foo |
  |<#gainsboro> SourceTree1 | foo1 |
endnote
@enduml
```



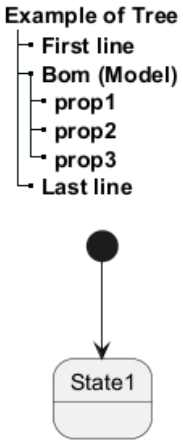
[Ref. QA-10923]

22.10 Tree

You can use `|_` characters to build a tree.

On common commands, like title:

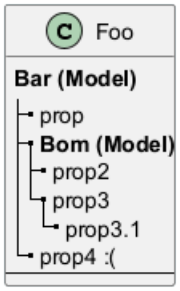
```
@startuml
skinparam titleFontSize 14
title
  Example of Tree
  |_ First line
  |_ **Bom (Model)**
    |_ prop1
    |_ prop2
    |_ prop3
  |_ Last line
end title
[*] --> State1
@enduml
```



On Class diagram.

(Please note how we have to use an empty second compartment, else the parentheses in **(Model)** cause that text to be moved to a separate first compartment):

```
@startuml
class Foo {
**Bar (Model)**
|_ prop
|_ **Bom (Model)**
  |_ prop2
  |_ prop3
    |_ prop3.1
|_ prop4 :(
--
}
@enduml
```

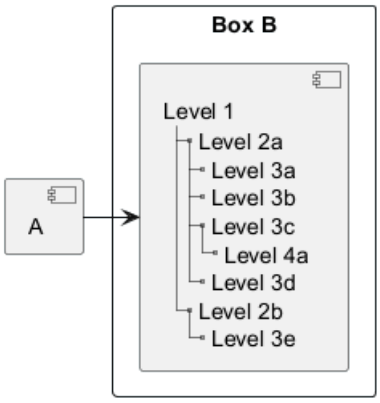


[Ref. QA-3448]

On Component or Deployment diagrams:

```
@startuml
[A] as A
rectangle "Box B" {
    component B [
        Level 1
        |_ Level 2a
          |_ Level 3a
          |_ Level 3b
          |_ Level 3c
            |_ Level 4a
          |_ Level 3d
        |_ Level 2b
          |_ Level 3e
```

```
    ]
}
A -> B
@enduml
```

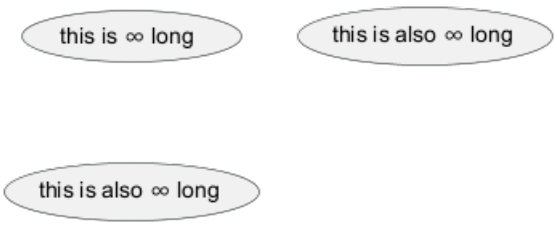


[Ref. QA-11365]

22.11 Special characters

It's possible to use any unicode character, either directly or with syntax `&#nnnnnn;` (decimal) or `<U+XXXXX>` (hex):

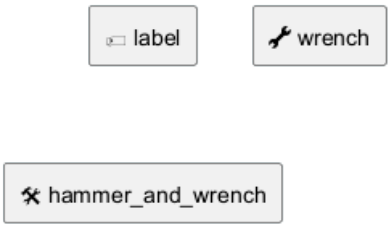
```
@startuml
usecase direct as "this is ∞ long"
usecase ampHash as "this is also ∞ long"
usecase angleBrackets as "this is also <U+221E> long"
@enduml
```



Please note that not all Unicode chars appear correctly, depending on installed fonts.

- You can use the listfonts command with a test string of your desired characters, to see which fonts may include them.
- For characters that are emoji, it's better to use the Emoji notation that doesn't depend on installed fonts, and the emoji are colored.
- The PlantUML server has the "Noto Emoji" font that has most emoji. If you want to render diagrams on your local system, you should check which fonts you have.
- Unfortunately "Noto Emoji" lacks normal chars, so you need to switch fonts, eg

```
@startuml
rectangle "<font:Noto Emoji><U+1F3F7></font> label"
rectangle "<font:Noto Emoji><U+1F527></font> wrench"
rectangle "<font:Noto Emoji><U+1F6E0></font> hammer_and_wrench"
@enduml
```



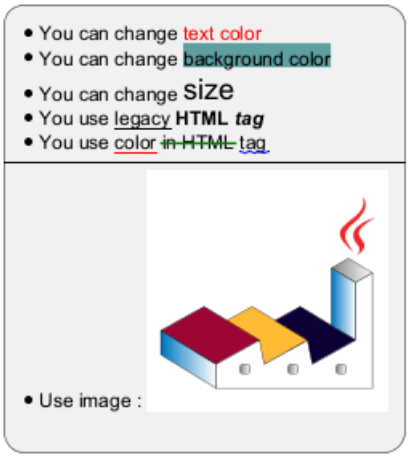
See Issue 72 for more details.

22.12 Legacy HTML

You can mix Creole with the following HTML tags:

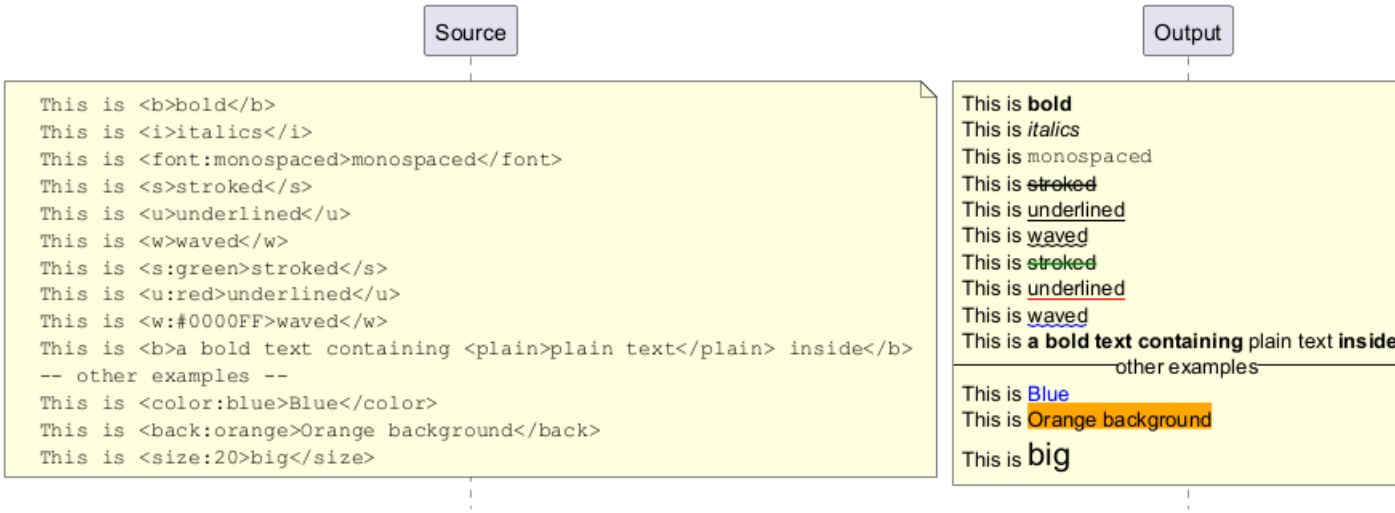
- `<b>` for bold text
- `<u>` or `<u:#AAAAAA>` or `<u:[[color|colorName]]>` for underline
- `<i>` for italic
- `<s>` or `<s:#AAAAAA>` or `<s:[[color|colorName]]>` for strike text
- `<w>` or `<w:#AAAAAA>` or `<w:[[color|colorName]]>` for wave underline text
- `<plain>` for plain text
- `<color:#AAAAAA>` or `<color:[[color|colorName]]>`
- `<back:#AAAAAA>` or `<back:[[color|colorName]]>` for background color
- `<size:nn>` to change font size
- `<img:file>` : the file must be accessible by the filesystem
- `<img:https://plantuml.com/logo3.png>` : the URL must be available from the Internet
- `{scale:nn}` to change image size, eg `<img:file.png{scale=0.3}>`

```
@startuml
:* You can change <color:red>text color</color>
* You can change <back:cadetblue>background color</back>
* You can change <size:18>size</size>
* You use <u>legacy</u> <b>HTML <i>tag</i></b>
* You use <u:red>color</u> <s:green>in HTML</s> <w:#0000FF>tag</w>
----
* Use image : <img:https://plantuml.com/logo3.png>
;
@enduml
```



22.12.1 Common HTML element

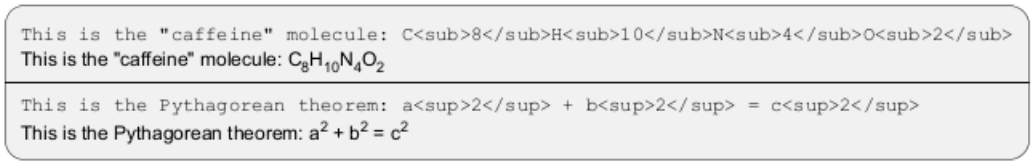
```
@startuml
hide footbox
note over Source
<code>
  This is <b>bold</b>
  This is <i>italics</i>
  This is <font:monospaced>monospaced</font>
  This is <s>stroked</s>
  This is <u>underlined</u>
  This is <w>waved</w>
  This is <s:green>stroked</s>
  This is <u:red>underlined</u>
  This is <w:#0000FF>waved</w>
  This is <b>a bold text containing <plain>plain text</plain> inside</b>
  -- other examples --
  This is <color:blue>Blue</color>
  This is <back:orange>Orange background</back>
  This is <size:20>big</size>
</code>
end note
/note over Output
  This is <b>bold</b>
  This is <i>italics</i>
  This is <font:monospaced>monospaced</font>
  This is <s>stroked</s>
  This is <u>underlined</u>
  This is <w>waved</w>
  This is <s:green>stroked</s>
  This is <u:red>underlined</u>
  This is <w:#0000FF>waved</w>
  This is <b>a bold text containing <plain>plain text</plain> inside</b>
  -- other examples --
  This is <color:blue>Blue</color>
  This is <back:orange>Orange background</back>
  This is <size:20>big</size>
end note
@enduml
```



[Ref. QA-5254 for `plain`]

22.12.2 Subscript and Superscript element [sub, sup]

```
@startuml
:<code>
This is the "caffeine" molecule: C<sub>8</sub>H<sub>10</sub>N<sub>4</sub>O<sub>2</sub>
</code>
This is the "caffeine" molecule: C<sub>8</sub>H<sub>10</sub>N<sub>4</sub>O<sub>2</sub>
----
<code>
This is the Pythagorean theorem: a<sup>2</sup> + b<sup>2</sup> = c<sup>2</sup>
</code>
This is the Pythagorean theorem: a<sup>2</sup> + b<sup>2</sup> = c<sup>2</sup>;
@enduml
```

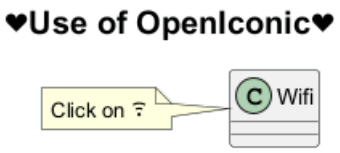


22.13 OpenIconic

OpenIconic is a very nice open-source icon set. Those icons are integrated in the creole parser, so you can use them out-of-the-box.

Use the following syntax: `<&ICON_NAME>`.

```
@startuml
title: <size:20><&heart>Use of OpenIconic<&heart></size>
class Wifi
note left
  Click on <&wifi>
end note
@enduml
```



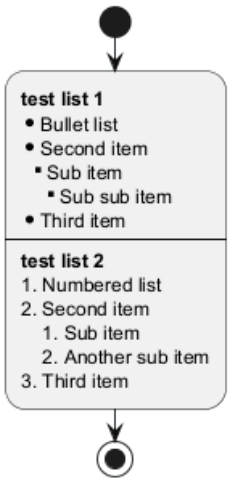
The complete list is available with the following special command:

```
@startuml
listopeniconic
@enduml
```

22.14 Appendix: Examples of "Creole List" on all diagrams

22.14.1 Activity

```
@startuml
start
:**test list 1**
* Bullet list
* Second item
** Sub item
*** Sub sub item
* Third item
----
**test list 2**
# Numbered list
# Second item
## Sub item
## Another sub item
# Third item;
stop
@enduml
```



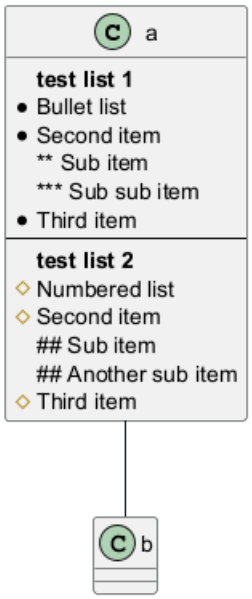
22.14.2 Class

TODO: FIXME

- *Sub item*
- *Sub sub item*

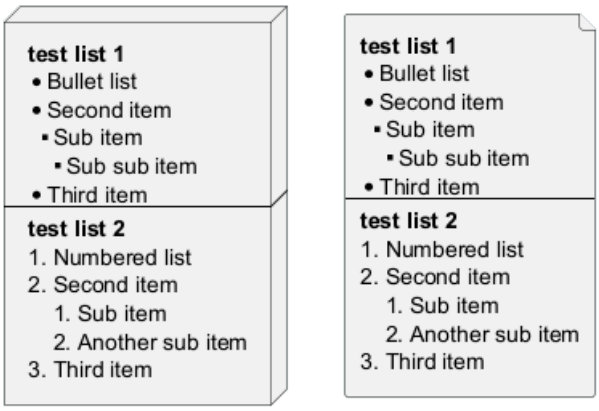
TODO: FIXME

```
@startuml

class a {
**test list 1**
* Bullet list
* Second item
** Sub item
*** Sub sub item
* Third item
----
**test list 2**
# Numbered list
# Second item
## Sub item
## Another sub item
# Third item
}

a -- b

@enduml
```



22.14.3 Component, Deployment, Use-Case

```
@startuml
node n [
**test list 1**
* Bullet list
* Second item
** Sub item
*** Sub sub item
* Third item
----
**test list 2**
# Numbered list
# Second item
## Sub item
## Another sub item
# Third item
]

file f as "
**test list 1**
* Bullet list
* Second item
** Sub item
*** Sub sub item
* Third item
----
**test list 2**
# Numbered list
# Second item
## Sub item
## Another sub item
# Third item
"
@enduml
```



TODO: DONE *[Corrected in V1.2020.18]*

22.14.4 Gantt project planning

N/A

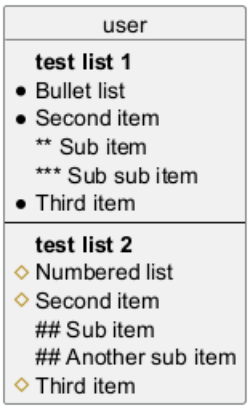
22.14.5 Object

TODO: FIXME

- *Sub item*
- *Sub sub item*

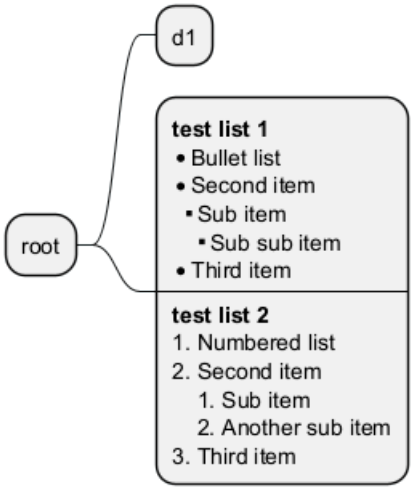
TODO: FIXME

```
@startuml
object user {
**test list 1**
* Bullet list
* Second item
** Sub item
*** Sub sub item
* Third item
----
**test list 2**
# Numbered list
# Second item
## Sub item
## Another sub item
# Third item
}

@enduml
```



22.14.6 MindMap

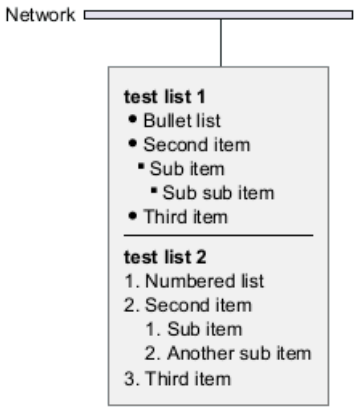
```
@startmindmap

* root
** d1
**:**test list 1**
* Bullet list
* Second item
** Sub item
*** Sub sub item
* Third item
----
**test list 2**
# Numbered list
# Second item
## Sub item
## Another sub item
# Third item;


@endmindmap
```



22.14.7 Network (nwdiag)

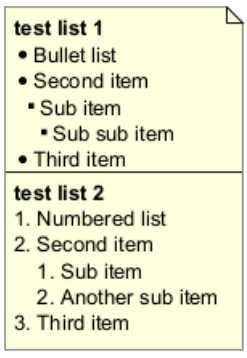
```
@startuml
nwdiag {
```

```
  network Network {
      Server [description="**test list 1**\n* Bullet list\n* Second item\n** Sub item\n*** Sub sub i
}
@enduml
```



22.14.8 Note

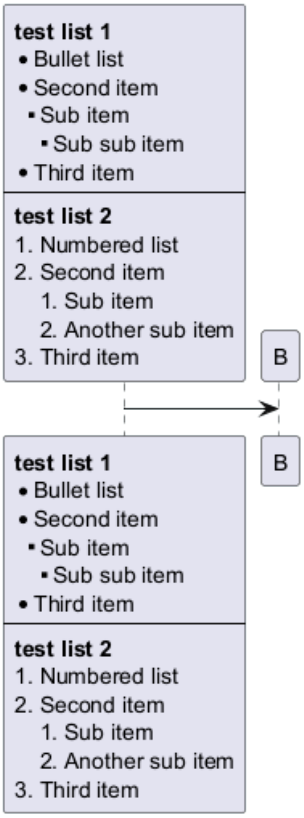
```
@startuml
note as n
**test list 1**
* Bullet list
* Second item
** Sub item
*** Sub sub item
* Third item
----
**test list 2**
# Numbered list
# Second item
## Sub item
## Another sub item
# Third item
end note
@enduml
```



22.14.9 Sequence

```
@startuml
<style>
participant {HorizontalAlignment left}
</style>
```

```
participant Participant [
**test list 1**
* Bullet list
* Second item
** Sub item
*** Sub sub item
* Third item
----
**test list 2**
# Numbered list
# Second item
## Sub item
## Another sub item
# Third item
]

participant B

Participant -> B
@enduml
```

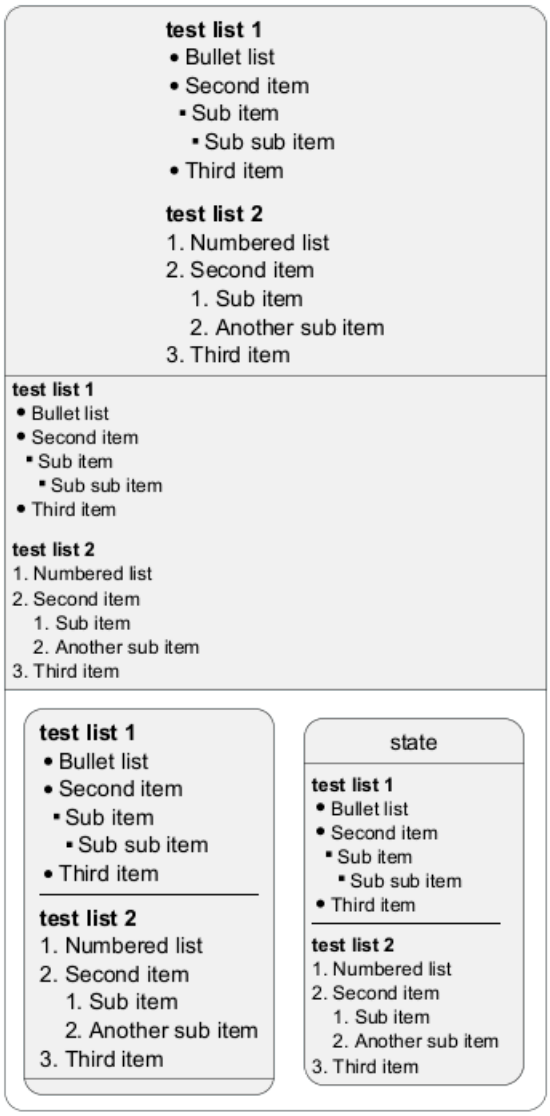


[Ref. QA-15232]

22.14.10 State

```
@startuml
<style>
stateDiagram {
title {HorizontalAlignment left}
}
</style>
state "**test list 1**\n* Bullet list\n* Second item\n** Sub item\n*** Sub sub item\n* Third item\n-
a: **test list 1**\n* Bullet list\n* Second item\n** Sub item\n*** Sub sub item\n* Third item\n----\
```

```
state "**test list 1**\n* Bullet list\n* Second item\n** Sub item\n*** Sub sub item\n* Third item\n-
state : **test list 1**\n* Bullet list\n* Second item\n** Sub item\n*** Sub sub item\n* Third item\n
}
@enduml
```

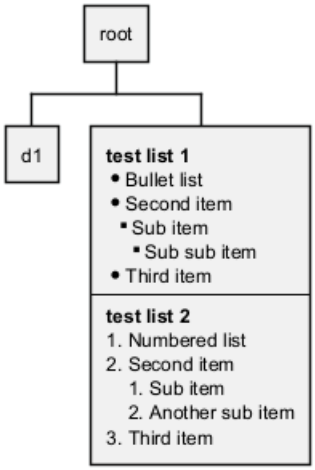


[Ref. QA-16978]

22.14.11 WBS

```
@startwbs

* root
** d1
**:**test list 1**
* Bullet list
* Second item
** Sub item
*** Sub sub item
* Third item
----
**test list 2**
# Numbered list
# Second item
```

```
## Sub item
## Another sub item
# Third item;

@endwbs
```

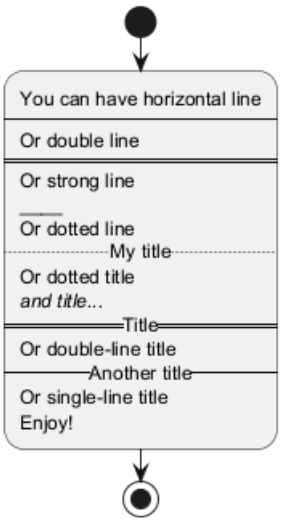


22.15 Appendix: Examples of "Creole horizontal lines" on all diagrams

22.15.1 Activity

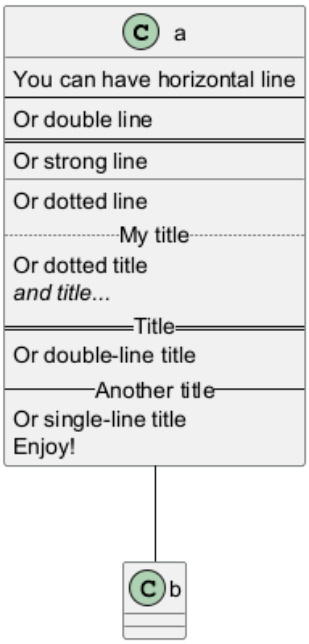
TODO: FIXME strong line ____ **TODO:** FIXME

```
@startuml
start
:You can have horizontal line
----
Or double line
====
Or strong line
____
Or dotted line
..My title..
Or dotted title
//and title... //
==Title==
Or double-line title
--Another title--
Or single-line title
Enjoy!;
stop
@enduml
```



22.15.2 Class

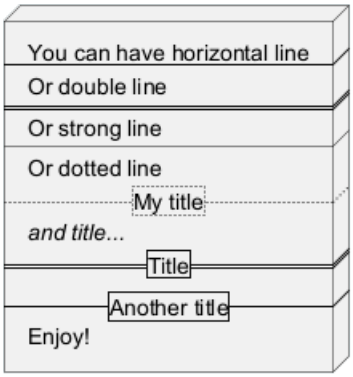
```
@startuml

class a {
You can have horizontal line
----
Or double line
====
Or strong line
____
Or dotted line
..My title..
Or dotted title
//and title... //
==Title==
Or double-line title
--Another title--
Or single-line title
Enjoy!
}

a -- b

@enduml
```

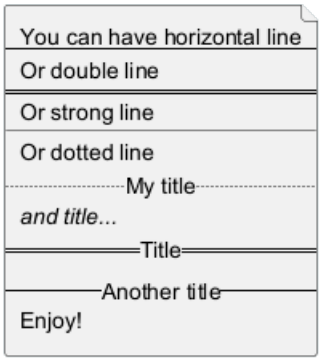


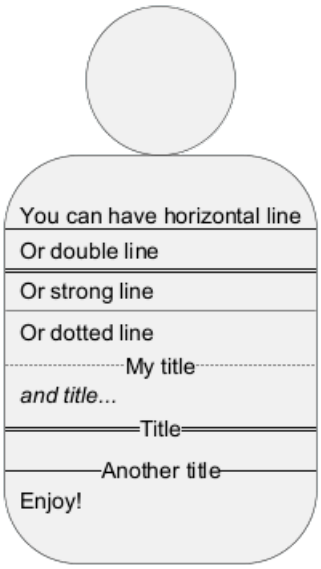
22.15.3 Component, Deployment, Use-Case

```
@startuml
node n [
You can have horizontal line
----
Or double line
====
Or strong line
____
Or dotted line
..My title..
//and title... //
==Title==
--Another title--
Enjoy!
]

file f as "
You can have horizontal line
----
Or double line
====
Or strong line
____
Or dotted line
..My title..
//and title... //
==Title==
--Another title--
Enjoy!
"

person p [

You can have horizontal line
----
```

```
Or double line
====
Or strong line
----
Or dotted line
..My title..
//and title... //
==Title==
--Another title--
Enjoy!

]
@enduml
```







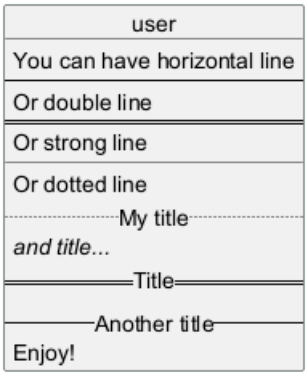
22.15.4 Gantt project planning

N/A

22.15.5 Object

```
@startuml
object user {
You can have horizontal line
----
Or double line
====
```

```
Or strong line
____
Or dotted line
..My title..
//and title... //
==Title==
--Another title--
Enjoy!
}

@enduml
```

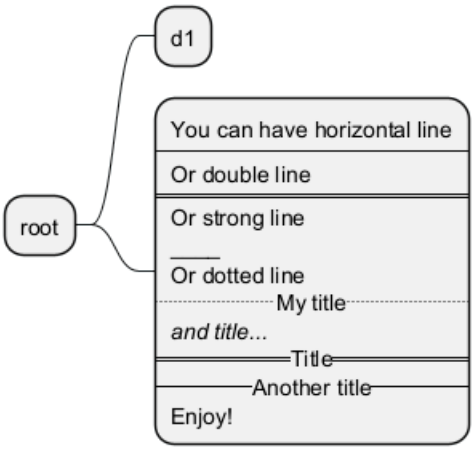


TODO: DONE *[Corrected on V1.2020.18]*

22.15.6 MindMap

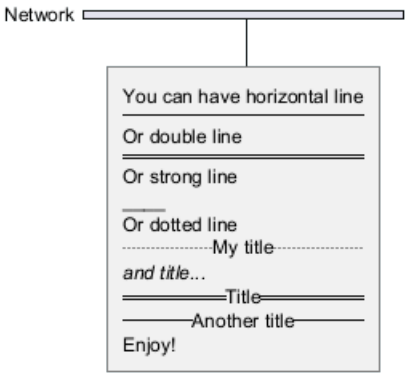
TODO: FIXME strong line ____ **TODO:** FIXME

```
@startmindmap

* root
** d1
**:You can have horizontal line
____
Or double line
====
Or strong line
____
Or dotted line
..My title..
//and title... //
==Title==
--Another title--
Enjoy!;

@endmindmap
```



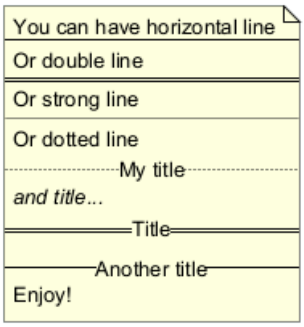
22.15.7 Network (nwdiag)

```
@startuml
nwdiag {
  network Network {
      Server [description="You can have horizontal line\n----\nOr double line\n====\nOr strong line\n
}
@enduml
```



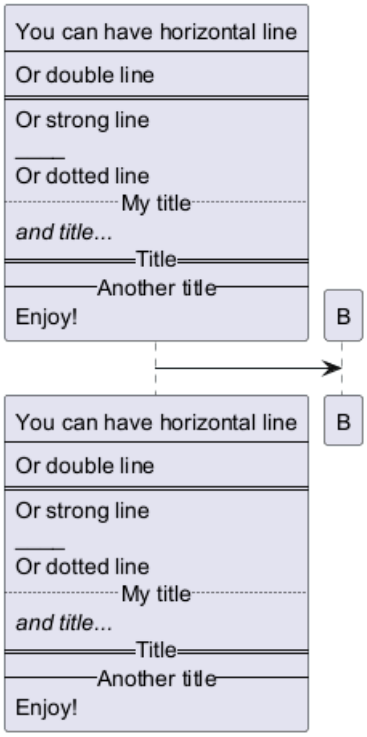
22.15.8 Note

```
@startuml
note as n
You can have horizontal line
----
Or double line
====
Or strong line
----
Or dotted line
..My title..
//and title... //
==Title==
--Another title--
Enjoy!
end note
@enduml
```



22.15.9 Sequence

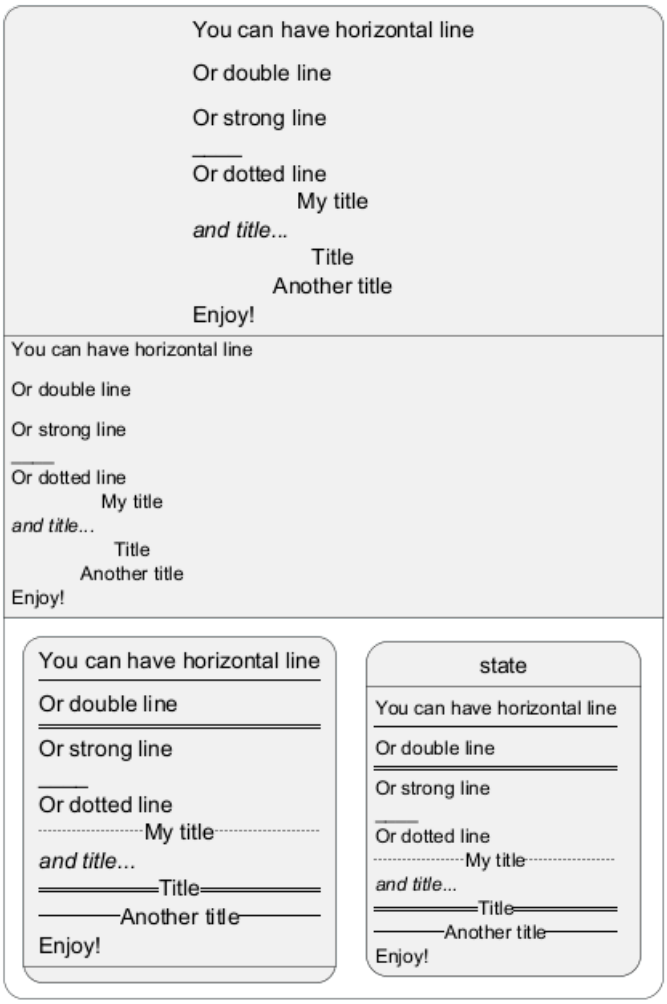
```
@startuml
<style>
participant {HorizontalAlignment left}
</style>
participant Participant [
You can have horizontal line
----
Or double line
====
Or strong line
----
Or dotted line
..My title..
//and title... //
==Title==
--Another title--
Enjoy!
]

participant B

Participant -> B
@enduml
```



[Ref. QA-15232]

22.15.10 State

```
@startuml
<style>
stateDiagram {
title {HorizontalAlignment left}
}
</style>
state "You can have horizontal line\n----\nOr double line\n====\nOr strong line\n____\nOr dotted line
a: You can have horizontal line\n----\nOr double line\n====\nOr strong line\n____\nOr dotted line\n.
state "You can have horizontal line\n----\nOr double line\n====\nOr strong line\n____\nOr dotted line
state : You can have horizontal line\n----\nOr double line\n====\nOr strong line\n____\nOr dotted li
}
@enduml
```

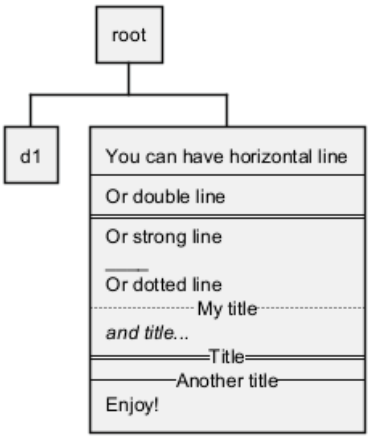


[Ref. QA-16978, GH-1479]

22.15.11 WBS

TODO: FIXME strong line `____` **TODO:** FIXME

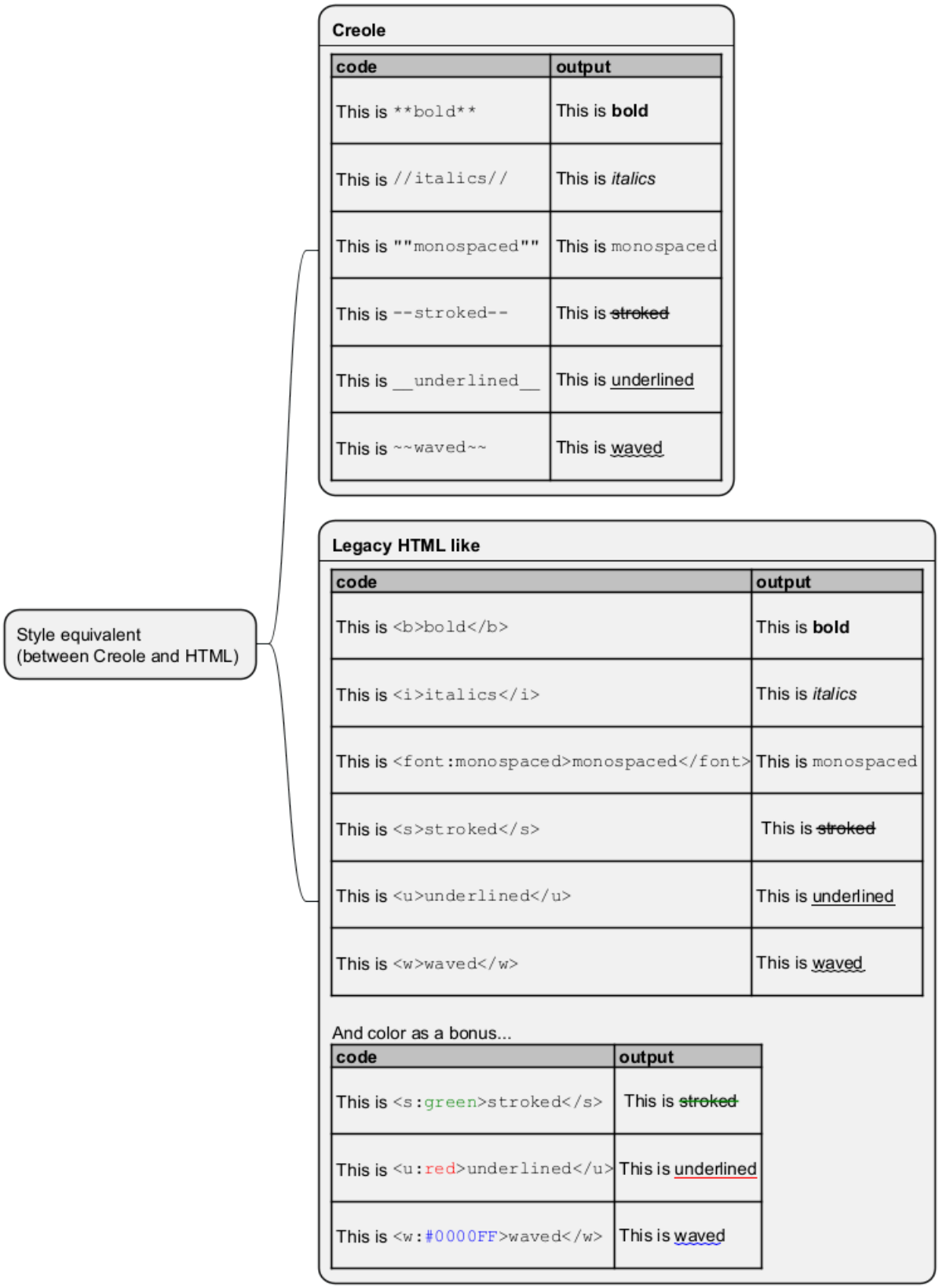
```
@startwbs

* root
** d1
**:You can have horizontal line
----
Or double line
====
Or strong line
____
Or dotted line
..My title..
//and title... //
==Title==
--Another title--
Enjoy!;

@endwbs
```



22.16 Style equivalent (between Creole and HTML)

Style	Creole	Legacy HTML like
bold	This is **bold**	This is bold
italics	This is //italics//	This is italics
monospaced	This is ""monospaced""	This is <font:monospaced>monospaced
stroked	This is --stroked--	This is <s>stroked</s>
underlined	This is __underlined__	This is <u>underlined</u>
waved	This is ~~~	This is <w>waved</w>

```
@startmindmap
* Style equivalent\n(between Creole and HTML)
**:**Creole**
----
<#silver>|= code|= output|
| \n This is ""~**bold**""\n | \n This is **bold** |
| \n This is ""~//italics//""\n | \n This is //italics// |
| \n This is ""~""monospaced~"" ""\n | \n This is ""monospaced"" |
| \n This is ""~--stroked--""\n | \n This is --stroked-- |
| \n This is ""~__underlined__""\n |  \n This is __underlined__ |
| \n This is ""<U+007E><U+007E>waved<U+007E><U+007E>""\n | \n This is ~~waved~~ |;
**:<b>Legacy HTML like
----
<#silver>|= code|= output|
| \n This is ""~<b>bold</b>""\n | \n This is <b>bold</b> |
| \n This is ""~<i>italics</i>""\n | \n This is <i>italics</i> |
| \n This is ""~<font:monospaced>monospaced</font>""\n | \n This is <font:monospaced>monospaced</font
| \n This is ""~<s>stroked</s>""\n | \n  This is <s>stroked</s> |
| \n This is ""~<u>underlined</u>""\n | \n This is <u>underlined</u> |
| \n This is ""~<w>waved</w>""\n | \n This is <w>waved</w> |

And color as a bonus...
<#silver>|= code|= output|
| \n This is ""~<s:""<color:green>""green""</color>"">stroked</s>""\n | \n  This is <s:green>stroked
| \n This is ""~<u:""<color:red>""red""</color>"">underlined</u>""\n | \n This is <u:red>underlined</
| \n This is ""~<w:""<color:#0000FF>""#0000FF""</color>"">waved</w>""\n | \n This is <w:#0000FF>wave
@endmindmap
```


Style equivalent
(between Creole and HTML)
Creole
code
output
This is **bold**
This is bold
This is //italics//
This is italics
This is ""monospaced""
This is monospaced
This is --stroked--
This is stroked
This is __underlined__
This is underlined
This is ~~waved~~
This is waved
Legacy HTML like
code
output
This is bold
This is bold
This is italics
This is italics
This is <font:monospaced>monospaced
This is monospaced
This is <s>stroked</s>
This is stroked
This is <u>underlined</u>
This is underlined
This is <w>waved</w>
This is waved
And color as a bonus...
code
output
This is <s:green>stroked</s>
This is stroked
This is <u:red>underlined</u>
This is underlined
This is <w:#0000FF>waved</w>
This is waved

23 Defining and using sprites

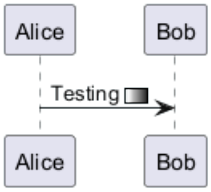
A *Sprite* is a small graphic element that can be used in diagrams.

In PlantUML, sprites are monochrome and can have either 4, 8 or 16 gray level.

To define a sprite, you have to use a hexadecimal digit between 0 and F per pixel.

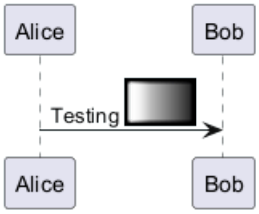
Then you can use the sprite using `<$XXX>` where `XXX` is the name of the sprite.

```
@startuml
sprite $foo1 {
  FFFFFFFFFFFFFFF
  F0123456789ABCF
  F0123456789ABCF
  F0123456789ABCF
  F0123456789ABCF
  F0123456789ABCF
  F0123456789ABCF
  F0123456789ABCF
  F0123456789ABCF
  F0123456789ABCF
  FFFFFFFFFFFFFFF
}
Alice -> Bob : Testing <$foo1>
@enduml
```



You can scale the sprite.

```
@startuml
sprite $foo1 {
  FFFFFFFFFFFFFFF
  F0123456789ABCF
  F0123456789ABCF
  F0123456789ABCF
  F0123456789ABCF
  F0123456789ABCF
  F0123456789ABCF
  F0123456789ABCF
  F0123456789ABCF
  F0123456789ABCF
  FFFFFFFFFFFFFFF
}
Alice -> Bob : Testing <$foo1{scale=3}>
@enduml
```

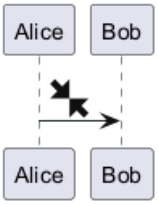


23.1 Inline SVG sprite

You can also use inlined SVG for sprites.

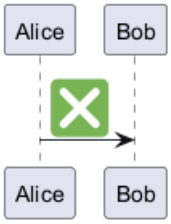
Only a tiny subset of SVG directives is possible, so you probably have to compress existing SVG files using https://vecta.io/nano. *[Ref. GH-1066]*

```
@startuml
sprite foo1 <svg width="8" height="8" viewBox="0 0 8 8">
<path d="M1 0l-1 1 1.5 1.5-1.5 1.5h4v-4l-1.5 1.5-1.5-1.5zm3 4v4l1.5-1.5 1.5 1.5 1-1-1.5-1.5 1.5-1.5h
</svg>

Alice->Bob : <$foo1*3>
@enduml
```



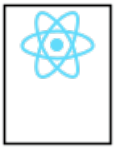
Another example:

```
@startuml
sprite foo1 <svg viewBox="0 0 36 36">
<path fill="#77B255" d="M36 32c0 2.209-1.791 4-4 4H4c-2.209 0-4-1.791-4-4V4c0-2.209 1.791-4 4-4h28c2
<path fill="#FFF" d="M21.529 18.00618.238-8.238c.977-.976.977-2.559 0-3.535-.977-.977-2.559-.977-3.53
</svg>

Alice->Bob : <$foo1>

@enduml
```



You can also use rotation:

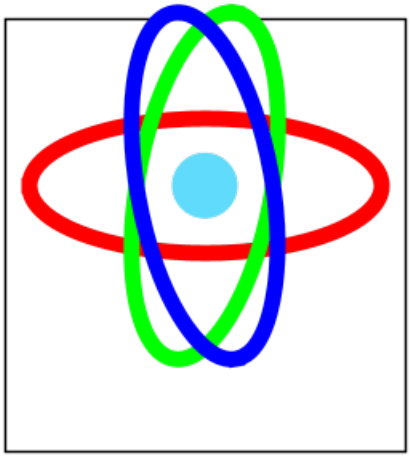
```
@startuml
sprite react <svg viewBox="0 0 230 230">
<circle cx="115" cy="115" r="20.5" fill="#61dafb"/>
<ellipse rx="110" ry="42"  cx="115" cy="115" stroke="#61dafb" stroke-width="10" fill="none"/>
<ellipse rx="110" ry="42"  cx="115" cy="115" stroke="#61dafb" stroke-width="10" fill="none" transfor
<ellipse rx="110" ry="42"  cx="115" cy="115" stroke="#61dafb" stroke-width="10" fill="none" transfor
</svg>

rectangle <$react{scale=0.2}>
@enduml
```



And you can use color:

```
@startuml
sprite react <svg viewBox="0 0 230 230">
<circle cx="115" cy="102" r="20.5" fill="#61dafb"/>
```

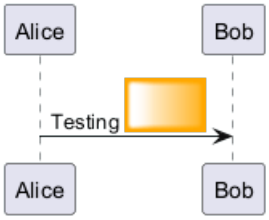
```
<ellipse rx="110" ry="42"  cx="115" cy="102" stroke="#ff0000" stroke-width="10" fill="none"/>
<g transform="rotate(100 115 102)">
<ellipse rx="110" ry="42"  cx="115" cy="102" stroke="#00ff00" stroke-width="10" fill="none"/>
</g>
<g transform="rotate(-100 115 102)">
<ellipse rx="110" ry="42"  cx="115" cy="102" stroke="#0000ff" stroke-width="10" fill="none"/>
</g>
</svg>

rectangle <$react{scale=1}>
@enduml
```



23.2 Changing colors

Although sprites are monochrome, it's possible to change their color.

```
@startuml
sprite $foo1 {
  FFFFFFFFFFFFFFF
  F0123456789ABCF
  F0123456789ABCF
  F0123456789ABCF
  F0123456789ABCF
  F0123456789ABCF
  F0123456789ABCF
  F0123456789ABCF
  F0123456789ABCF
  F0123456789ABCF
  FFFFFFFFFFFFFFF
}
Alice -> Bob : Testing <$foo1,scale=3.4,color=orange>
@enduml
```



23.3 Encoding Sprite

To encode sprite, you can use the command line like:

```
java -jar plantuml.jar -encodesprite 16z foo.png
```

where `foo.png` is the image file you want to use (it will be converted to gray automatically).

After `-encodesprite`, you have to specify a format: `4, 8, 16, 4z, 8z` or `16z`.

The number indicates the gray level and the optional `z` is used to enable compression in sprite definition.

23.4 Importing Sprite

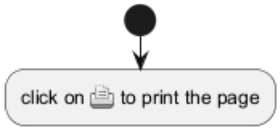
You can also launch the GUI to generate a sprite from an existing image.

Click in the menubar then on `File/Open Sprite Window`.

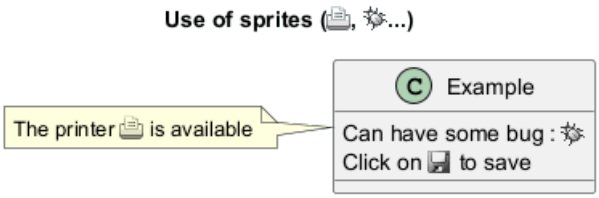
After copying an image into you clipboard, several possible definitions of the corresponding sprite will be displayed : you will just have to pickup the one you want.

23.5 Examples

```
@startuml
sprite $printer [15x15/8z] NOtH3W0W208HxFz_kMAhj7lHWpa1XC716sz0Pq4MVPEWfBHIuxP3L6kbTcizR8tAhzaqFvXwvl
start
:click on <$printer> to print the page;
@enduml
```




```
@startuml
 sprite $bug [15x15/16z] PKzR2i0m2BFMi15p__FEjQEqB1z27aeqCqixa8S4OT7C53cKpsHpaYPDJY_12MHM-BLRyywPhrrl
 sprite $printer [15x15/8z] NOtH3W0W208HxFz_kMAhj7lHWpa1XC716sz0Pq4MVPEWfBHIuxP3L6kbTcizR8tAhzaqFvXwv
 sprite $disk {
   444445566677881
   436000000009991
   43600000000ACA1
   53700000001A7A1
   53700000012B8A1
   53800000123B8A1
   63800001233C9A1
   634999AABBC99B1
   744566778899AB1
   7456AAAAA99AAB1
   8566AFC228AABB1
   8567AC8118BBBB1
   867BD4433BBBBB1
   39AAAAABBBBBBC1
}

 title Use of sprites (<$printer>, <$bug>...)

 class Example {
 Can have some bug : <$bug>
 Click on <$disk> to save
 }

 note left : The printer <$printer> is available

@enduml
```



23.6 StdLib

The PlantUML StdLib includes a number of ready icons in various IT areas such as architecture, cloud services, logos etc. It including AWS, Azure, Kubernetes, C4, product Logos and many others. To explore these libraries:

- Browse the Github folders of PlantUML StdLib
- Browse the source repos of StdLib collections that interest you. Eg if you are interested in logos you can find that it came from gilbarbara-plantuml-sprites, and quickly find its

sprites-list. (The next section shows how to list selected sprites but unfortunately that's in grayscale whereas this custom listing is in color.)

- Study the in-depth Hitchhiker's Guide to PlantUML, eg sections Standard Library Sprites and PlantUML Stdlib Overview

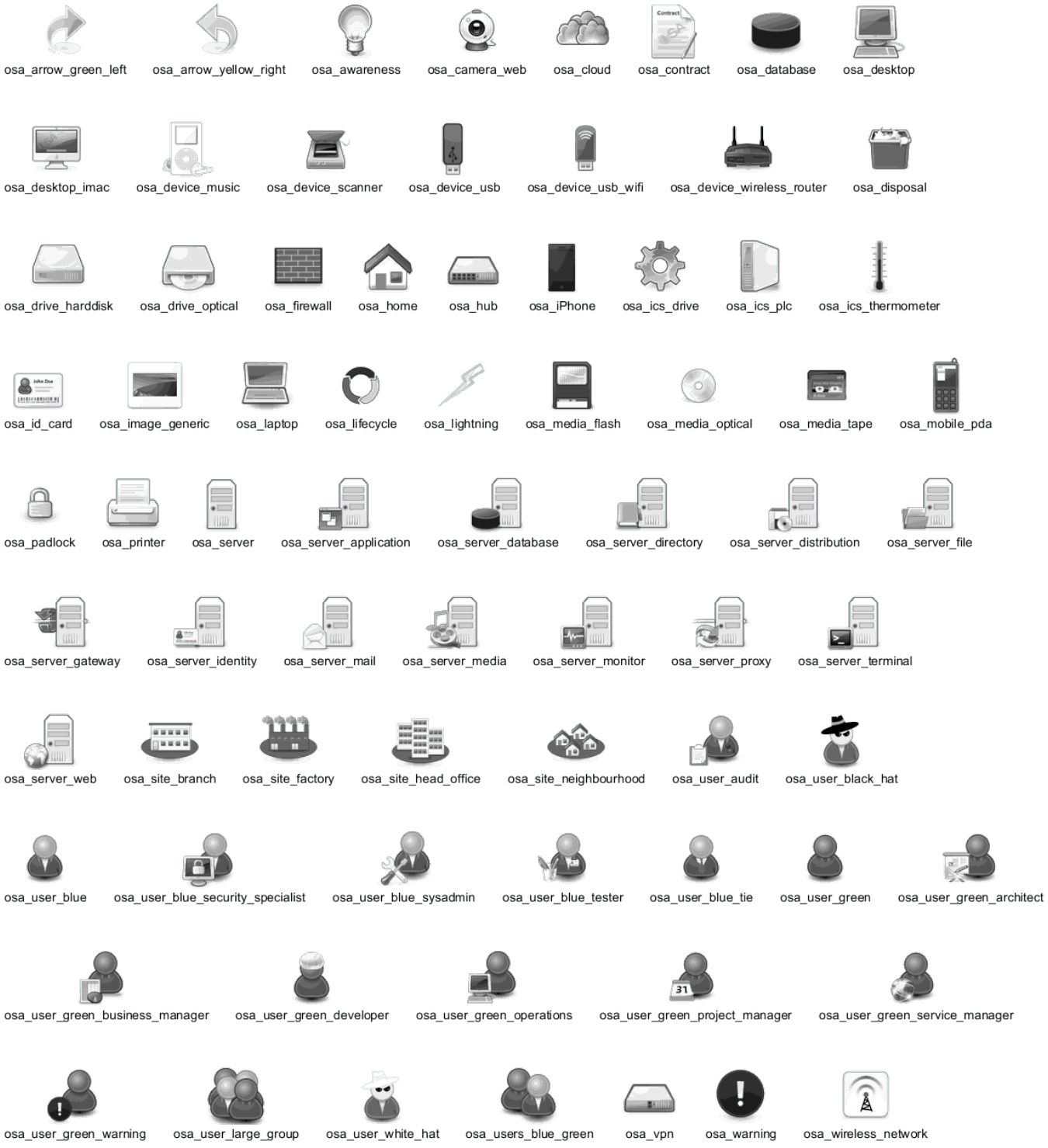
23.7 Listing Sprites

You can use the `listsprites` command to show available sprites:

- Used on its own, it just shows ArchiMate sprites
- If you include some sprite libraries in your diagram, the command shows all these sprites, as explained in View all the icons with listsprites.

(Example from Hitchhikers Guide to PlantUML)

```
@startuml
!define osaPuml https://raw.githubusercontent.com/Crashedmind/PlantUML-opensecurityarchitecture2-ico
!include osaPuml/Common.puml
!include osaPuml/User/all.puml
!include osaPuml/Hardware/all.puml
!include osaPuml/Misc/all.puml
!include osaPuml/Server/all.puml
!include osaPuml/Site/all.puml

listsprites

' From The Hitchhiker's Guide to PlantUML
@enduml
```



Most collections have files called `all` that allow you to see a whole sub-collection at once. Else you need to find the sprites that interest you and include them one by one. Unfortunately, the version of a collection included in StdLib often does not have such `all` files, so as you see above we include the collection from github, not from StdLib.

All sprites are in grayscale, but most collections define specific macros that include appropriate (vendor-specific) colors.

24 Skinparam command

You can change colors and font of the drawing using the `skinparam` command.

Example:

```
skinparam backgroundColor transparent
```

Important: `skinparam` is being phased out, see comments in issue#1464. It is still supported for simple cases (and for backward compatibility), but users should migrate to style, which supports more complex cases.

24.1 Usage

You can use this command :

- In the diagram definition, like any other commands,
- In an included file,
- In a configuration file, provided in the command line or the ANT task.

24.2 Nested

To avoid repetition, it is possible to nest definition. So the following definition :

```
skinparam xxxxParam1 value1
skinparam xxxxParam2 value2
skinparam xxxxParam3 value3
skinparam xxxxParam4 value4
```

is strictly equivalent to:

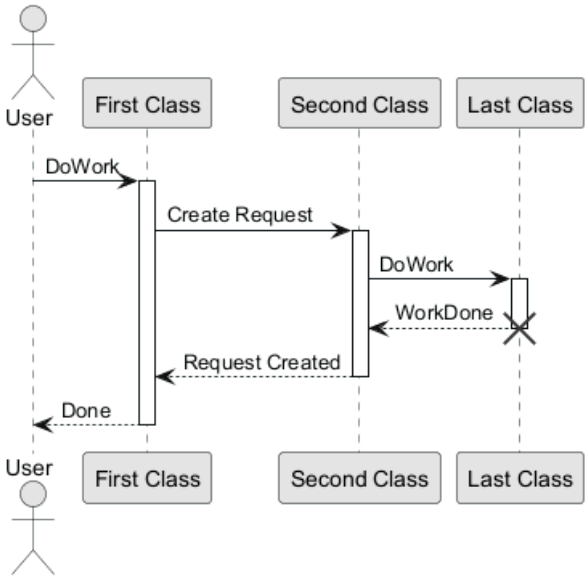
```
skinparam xxxx {
    Param1 value1
    Param2 value2
    Param3 value3
    Param4 value4
}
```

24.3 Black and White

You can force the use of a black&white output using `skinparam monochrome true` command.

```
@startuml

skinparam monochrome true

actor User
participant "First Class" as A
participant "Second Class" as B
participant "Last Class" as C

User -> A: DoWork
activate A

A -> B: Create Request
activate B

B -> C: DoWork
activate C
C --> B: WorkDone
destroy C
```

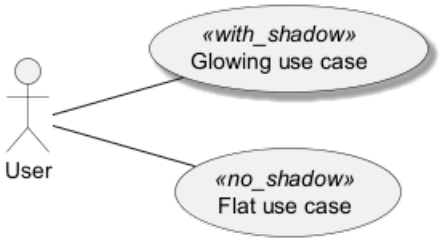
```
B --> A: Request Created
deactivate B

A --> User: Done
deactivate A

@enduml
```



24.4 Shadowing

You can disable the shadowing using the `skinparam shadowing false` command.

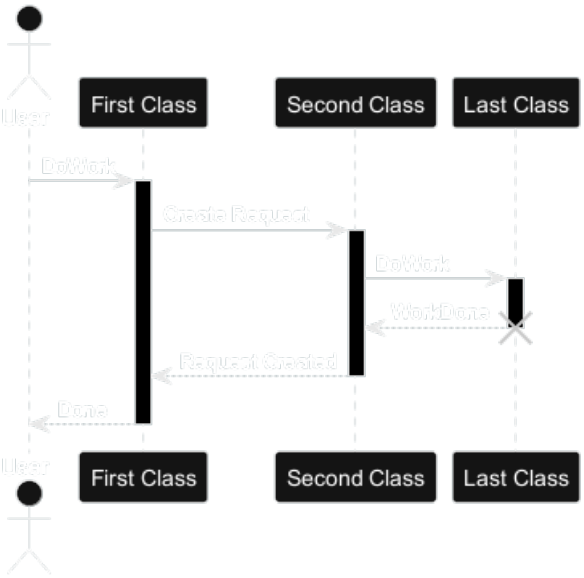
```
@startuml

left to right direction

skinparam shadowing<<no_shadow>> false
skinparam shadowing<<with_shadow>> true

actor User
(Glowing use case) <<with_shadow>> as guc
(Flat use case) <<no_shadow>> as fuc
User -- guc
User -- fuc

@enduml
```



24.5 Reverse colors

You can force the use of a black&white output using `skinparam monochrome reverse` command. This can be useful for black background environment.

```
@startuml

skinparam monochrome reverse

actor User
participant "First Class" as A
participant "Second Class" as B
participant "Last Class" as C

User -> A: DoWork
activate A

A -> B: Create Request
activate B

B -> C: DoWork
activate C
C --> B: WorkDone
destroy C

B --> A: Request Created
deactivate B

A --> User: Done
deactivate A

@enduml
```



24.6 Colors

You can use either standard color name or RGB code.

```
@startuml
colors
@enduml
```

`transparent` can only be used for background of the image.

24.7 Font color, name and size

You can change the font for the drawing using `xxxFontColor`, `xxxFontSize` and `xxxFontName` parameters.

Example:

```
skinparam classFontColor red
skinparam classFontSize 10
skinparam classFontName Aapex
```

You can also change the default font for all fonts using `skinparam defaultFontName`.

Example:

```
skinparam defaultFontName Aapex
```

Please note the fontname is highly system dependent, so do not over use it, if you look for portability. `Helvetica` and `Courier` should be available on all systems.

A lot of parameters are available. You can list them using the following command:

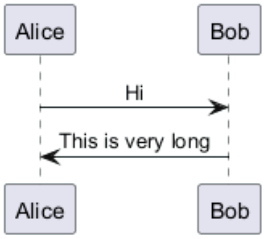
```
java -jar plantuml.jar -language
```

24.8 Text Alignment

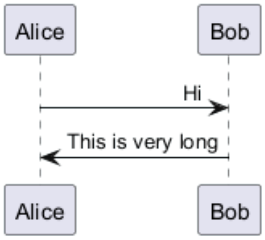
Text alignment can be set to `left`, `right` or `center` in `skinparam sequenceMessageAlign`. You can also use `direction` or `reverseDirection` values to align text depending on arrow direction.

Param name	Default value	Comment
sequenceMessageAlign	left	Used for messages in sequence diagrams
sequenceReferenceAlign	center	Used for `ref over` in sequence diagrams

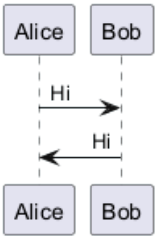
```
@startuml
skinparam sequenceMessageAlign center
Alice -> Bob : Hi
Bob -> Alice : This is very long
@enduml
```




```
@startuml
skinparam sequenceMessageAlign right
Alice -> Bob : Hi
Bob -> Alice : This is very long
@enduml
```



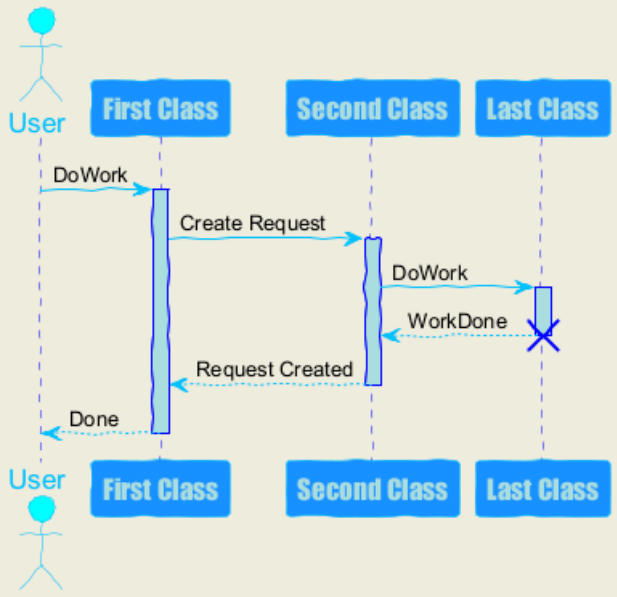

```
@startuml
skinparam sequenceMessageAlign direction
Alice -> Bob : Hi
Bob -> Alice: Hi
@enduml
```



24.9 Examples

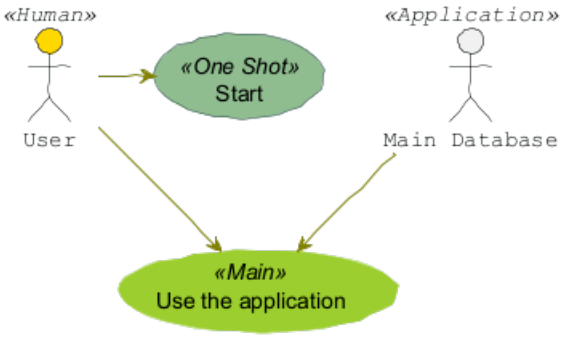
```
@startuml
skinparam backgroundColor #EEEBDC
skinparam handwritten true

skinparam sequence {
ArrowColor DeepSkyBlue
ActorBorderColor DeepSkyBlue
LifeLineBorderColor blue
LifeLineBackgroundColor #A9DCDF

ParticipantBorderColor DeepSkyBlue
ParticipantBackgroundColor DodgerBlue
ParticipantFontName Impact
ParticipantFontSize 17
ParticipantFontColor #A9DCDF

ActorBackgroundColor aqua
ActorFontColor DeepSkyBlue
ActorFontSize 17
ActorFontName Aapex
```

```
}

actor User
participant "First Class" as A
participant "Second Class" as B
participant "Last Class" as C

User -> A: DoWork
activate A

A -> B: Create Request
activate B

B -> C: DoWork
activate C
C --> B: WorkDone
destroy C

B --> A: Request Created
deactivate B

A --> User: Done
deactivate A
@enduml
```

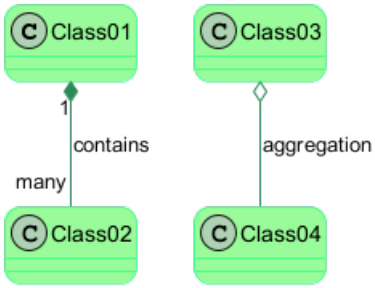



```
@startuml
skinparam handwritten true

skinparam actor {
BorderColor black
FontName Courier
        BackgroundColor<< Human >> Gold
}

skinparam usecase {
BackgroundColor DarkSeaGreen
BorderColor DarkSlateGray

BackgroundColor<< Main >> YellowGreen
```

```
BorderColor<< Main >> YellowGreen

ArrowColor Olive
}

User << Human >>
:Main Database: as MySql << Application >>
(Start) << One Shot >>
(Use the application) as (Use) << Main >>

User -> (Start)
User --> (Use)

MySql --> (Use)
@enduml
```

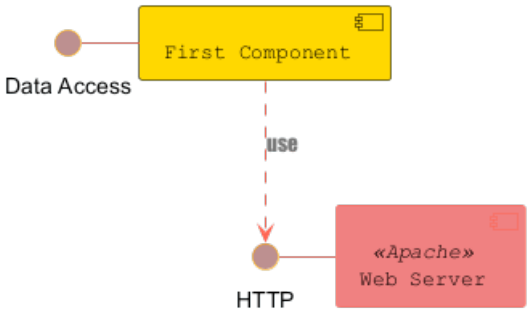



```
@startuml
skinparam roundcorner 20
skinparam class {
BackgroundColor PaleGreen
ArrowColor SeaGreen
BorderColor SpringGreen
}
skinparam stereotypeCBackgroundColor YellowGreen

Class01 "1" *-- "many" Class02 : contains

Class03 o-- Class04 : aggregation
@enduml
```

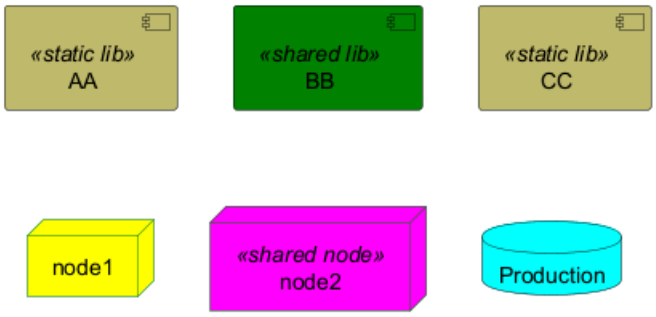



```
@startuml
skinparam interface {
  backgroundColor RosyBrown
  borderColor orange
}

skinparam component {
  FontSize 13
```

```
  BackgroundColor<<Apache>> LightCoral
  BorderColor<<Apache>> #FF6655
  FontName Courier
  BorderColor black
  BackgroundColor gold
  ArrowFontName Impact
  ArrowColor #FF6655
  ArrowFontColor #777777
}

() "Data Access" as DA
[Web Server] << Apache >>

DA - [First Component]
[First Component] ..> () HTTP : use
HTTP - [Web Server]
@enduml
```




```
@startuml
[AA] <<static lib>>
[BB] <<shared lib>>
[CC] <<static lib>>

node node1
node node2 <<shared node>>
database Production

skinparam component {
    backgroundColor<<static lib>> DarkKhaki
    backgroundColor<<shared lib>> Green
}

skinparam node {
borderColor Green
backgroundColor Yellow
backgroundColor<<shared node>> Magenta
}
skinparam databaseBackgroundColor Aqua
@enduml
```



24.10 List of all skinparam parameters

You can use `-language` on the command line or generate a "diagram" with a list of all the skinparam parameters using :

- `help skinparams`
- `skinparameters`

24.10.1 Command Line: -language command

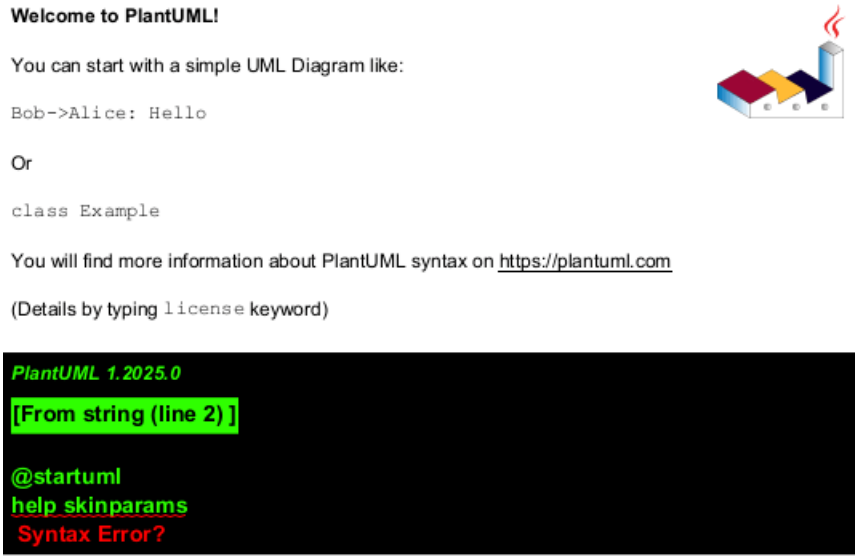
Since the documentation is not always up to date, you can have the complete list of parameters using this command:

```
java -jar plantuml.jar -language
```

24.10.2 Command: help skinparams

That will give you the following result, from this page *(code of this command)*: CommandHelpSkinparam.java

```
@startuml
help skinparams
@enduml
```



24.10.3 Command: skinparameters

```
@startuml
skinparameters
@enduml
```

ActivityBackgroundColor
ActivityBorderColor
ActivityBorderThickness
ActivityDiamondFontColor
ActivityDiamondFontName
ActivityDiamondFontSize
ActivityDiamondFontStyle
ActivityFontColor
ActivityFontName
ActivityFontSize
ActivityFontStyle
ActorBackgroundColor
ActorBorderColor
ActorFontColor
ActorFontName
ActorFontSize
ActorFontStyle
ActorStereotypeFontColor
ActorStereotypeFontName
ActorStereotypeFontSize
ActorStereotypeFontStyle
AgentBorderThickness
AgentFontColor
AgentFontName
AgentFontSize
AgentFontStyle
AgentStereotypeFontColor
AgentStereotypeFontName
AgentStereotypeFontSize
AgentStereotypeFontStyle
ArchimateBorderThickness
ArchimateFontColor
ArchimateFontName
ArchimateFontSize
ArchimateFontStyle
ArchimateStereotypeFontColor
ArchimateStereotypeFontName
ArchimateStereotypeFontSize
ArchimateStereotypeFontStyle
ArrowFontColor
ArrowFontName
ArrowFontSize
ArrowFontStyle
ArrowHeadColor
ArrowLollipopColor
ArrowMessageAlignment
ArrowThickness
ArtifactFontColor
ArtifactFontName
ArtifactFontSize
ArtifactFontStyle
ArtifactStereotypeFontColor
ArtifactStereotypeFontName
ArtifactStereotypeFontSize
ArtifactStereotypeFontStyle
BackgroundColor
BiddableBackgroundColor
BiddableBorderColor
BoundaryFontColor
BoundaryFontName
BoundaryFontSize
BoundaryFontStyle
BoundaryStereotypeFontColor
BoundaryStereotypeFontName
BoundaryStereotypeFontSize
BoundaryStereotypeFontStyle
BoxPadding
CaptionFontColor
CaptionFontName
CaptionFontSize
CaptionFontStyle
CardBorderThickness
CardFontColor
CardFontName
CardFontSize
CardFontStyle
CardStereotypeFontColor
CardStereotypeFontName
CardStereotypeFontSize
CardStereotypeFontStyle
CircledCharacterFontColor
CircledCharacterFontName
CircledCharacterFontSize
CircledCharacterFontStyle
CircledCharacterRadius
ClassAttributeFontColor
ClassAttributeFontName
ClassAttributeFontSize
ClassAttributeFontStyle
ClassAttributeIconSize
ClassBackgroundColor
ClassBorderColor
ClassBorderThickness
ClassFontColor
ClassFontName
ClassFontSize
ClassFontStyle
ClassStereotypeFontColor
ClassStereotypeFontName
ClassStereotypeFontSize
ClassStereotypeFontStyle
CloudFontColor
CloudFontName
CloudFontSize
CloudFontStyle
CloudStereotypeFontColor
CloudStereotypeFontName
CloudStereotypeFontSize
CloudStereotypeFontStyle
ColorArrowSeparationSpace
ComponentBorderThickness
ComponentFontColor
ComponentFontName
ComponentFontSize
ComponentFontStyle
ComponentStereotypeFontColor
ComponentStereotypeFontName
ComponentStereotypeFontSize
ComponentStereotypeFontStyle
ComponentStyle
ConditionEndStyle
ConditionStyle
ControlFontColor
ControlFontName
ControlFontSize
ControlFontStyle
ControlStereotypeFontColor
ControlStereotypeFontName
ControlStereotypeFontSize
ControlStereotypeFontStyle
DatabaseFontColor
DatabaseFontName
DatabaseFontSize
DatabaseFontStyle
DatabaseStereotypeFontColor
DatabaseStereotypeFontName
DatabaseStereotypeFontSize
DatabaseStereotypeFontStyle
DefaultFontColor
DefaultFontName
DefaultFontSize
DefaultFontStyle
DefaultMonospacedFontName
DefaultTextAlignment
DesignedBackgroundColor
DesignedBorderColor
DesignedDomainBorderThickness
DesignedDomainFontColor
DesignedDomainFontName
DesignedDomainFontSize
DesignedDomainFontStyle
DesignedDomainStereotypeFontColor
DesignedDomainStereotypeFontName
DesignedDomainStereotypeFontSize
DesignedDomainStereotypeFontStyle
DiagramBorderColor
DiagramBorderThickness
DomainBackgroundColor
DomainBorderColor
DomainBorderThickness
DomainFontColor
DomainFontName
DomainFontSize
DomainFontStyle
DomainStereotypeFontColor
DomainStereotypeFontName
DomainStereotypeFontSize
DomainStereotypeFontStyle
Dpi
EntityFontColor
EntityFontName
EntityFontSize
EntityFontStyle
EntityStereotypeFontColor
EntityStereotypeFontName
EntityStereotypeFontSize
EntityStereotypeFontStyle
FileFontColor
FileFontName
FileFontSize
FileFontStyle
FileStereotypeFontColor
FileStereotypeFontName
FileStereotypeFontSize
FileStereotypeFontStyle
FixCircleLabelOverlapping
FolderFontColor
FolderFontName
FolderFontSize
FolderFontStyle
FolderStereotypeFontColor
FolderStereotypeFontName
FolderStereotypeFontSize
FolderStereotypeFontStyle
FooterFontColor
FooterFontName
FooterFontSize
FooterFontStyle
FrameFontColor
FrameFontName
FrameFontSize
FrameFontStyle
FrameStereotypeFontColor
FrameStereotypeFontName
FrameStereotypeFontSize
FrameStereotypeFontStyle
GenericDisplay
Guillemet
Handwritten
HeaderFontColor
HeaderFontName
HeaderFontSize
HeaderFontStyle
HexagonBorderThickness
HexagonFontColor
HexagonFontName
HexagonFontSize
HexagonFontStyle
HexagonStereotypeFontColor
HexagonStereotypeFontName
HexagonStereotypeFontSize
HexagonStereotypeFontStyle
HyperlinkColor
HyperlinkUnderline
IconIEMandatoryColor
IconPackageBackgroundColor
IconPackageColor
IconPrivateBackgroundColor
IconPrivateColor
IconProtectedBackgroundColor
IconProtectedColor
IconPublicBackgroundColor
IconPublicColor
InterfaceFontColor
InterfaceFontName
InterfaceFontSize
InterfaceFontStyle
InterfaceStereotypeFontColor
InterfaceStereotypeFontName
InterfaceStereotypeFontSize
InterfaceStereotypeFontStyle
LabelFontColor
LabelFontName
LabelFontSize
LabelFontStyle
LabelStereotypeFontColor
LabelStereotypeFontName
LabelStereotypeFontSize
LabelStereotypeFontStyle
LegendBorderThickness
LegendFontColor
LegendFontName
LegendFontSize
LegendFontStyle
LexicalBackgroundColor
LexicalBorderColor
LifelineStrategy
Linetype
MachineBackgroundColor
MachineBorderColor
MachineBorderThickness
MachineFontColor
MachineFontName
MachineFontSize
MachineFontStyle
MachineStereotypeFontColor
MachineStereotypeFontName
MachineStereotypeFontSize
MachineStereotypeFontStyle
MaxAsciiMessageLength
MaxMessageSize
MinClassWidth
Monochrome
NodeFontColor
NodeFontName
NodeFontSize
NodeFontStyle
NodeStereotypeFontColor
NodeStereotypeFontName
NodeStereotypeFontSize
NodeStereotypeFontStyle
Nodesep
NoteBackgroundColor
NoteBorderColor
NoteBorderThickness
NoteFontColor
NoteFontName
NoteFontSize
NoteFontStyle
NoteShadowing
NoteTextAlignment
ObjectAttributeFontColor
ObjectAttributeFontName
ObjectAttributeFontSize
ObjectAttributeFontStyle
ObjectBorderThickness
ObjectFontColor
ObjectFontName
ObjectFontSize
ObjectFontStyle
ObjectStereotypeFontColor
ObjectStereotypeFontName
ObjectStereotypeFontSize
ObjectStereotypeFontStyle
PackageBorderThickness
PackageFontColor
PackageFontName
PackageFontSize
PackageFontStyle
PackageStereotypeFontColor
PackageStereotypeFontName
PackageStereotypeFontSize
PackageStereotypeFontStyle
PackageStyle
PackageTitleAlignment
Padding
PageBorderColor
PageExternalColor
PageMargin
ParticipantFontColor
ParticipantFontName
ParticipantFontSize
ParticipantFontStyle
ParticipantPadding
ParticipantStereotypeFontColor
ParticipantStereotypeFontName
ParticipantStereotypeFontSize
ParticipantStereotypeFontStyle
PartitionBorderThickness
PartitionFontColor
PartitionFontName
PartitionFontSize
PartitionFontStyle
PathHoverColor
PersonBorderThickness
PersonFontColor
PersonFontName
PersonFontSize
PersonFontStyle
PersonStereotypeFontColor
PersonStereotypeFontName
PersonStereotypeFontSize
PersonStereotypeFontStyle
QueueBorderThickness
QueueFontColor
QueueFontName
QueueFontSize
QueueFontStyle
QueueStereotypeFontColor
QueueStereotypeFontName
QueueStereotypeFontSize
QueueStereotypeFontStyle
Ranksep
RectangleBorderThickness
RectangleFontColor
RectangleFontName
RectangleFontSize
RectangleFontStyle
RectangleStereotypeFontColor
RectangleStereotypeFontName
RectangleStereotypeFontSize
RectangleStereotypeFontStyle
RequirementBackgroundColor
RequirementBorderColor
RequirementBorderThickness
RequirementFontColor
RequirementFontName
RequirementFontSize
RequirementFontStyle
RequirementStereotypeFontColor
RequirementStereotypeFontName
RequirementStereotypeFontSize
RequirementStereotypeFontStyle
ResponseMessageBelowArrow
RoundCorner
SameClassWidth
SequenceActorBorderThickness
SequenceArrowThickness
SequenceBoxBorderColor
SequenceBoxFontColor
SequenceBoxFontName
SequenceBoxFontSize
SequenceBoxFontStyle
SequenceDelayFontColor
SequenceDelayFontName
SequenceDelayFontSize
SequenceDelayFontStyle
SequenceDividerBorderThickness
SequenceDividerFontColor
SequenceDividerFontName
SequenceDividerFontSize
SequenceDividerFontStyle
SequenceGroupBodyBackgroundColor
SequenceGroupBorderThickness
SequenceGroupFontColor
SequenceGroupFontName
SequenceGroupFontSize
SequenceGroupFontStyle
SequenceGroupHeaderFontColor
SequenceGroupHeaderFontName
SequenceGroupHeaderFontSize
SequenceGroupHeaderFontStyle
SequenceLifeLineBorderColor
SequenceLifeLineBorderThickness
SequenceMessageAlignment
SequenceMessageTextAlignment
SequenceNewpageSeparatorColor
SequenceParticipant
SequenceParticipantBorderThickness
SequenceReferenceAlignment
SequenceReferenceBackgroundColor
SequenceReferenceBorderThickness
SequenceReferenceFontColor
SequenceReferenceFontName
SequenceReferenceFontSize
SequenceReferenceFontStyle
SequenceReferenceHeaderBackgroundColor
SequenceStereotypeFontColor
SequenceStereotypeFontName
SequenceStereotypeFontSize
SequenceStereotypeFontStyle
Shadowing
StackFontColor
StackFontName
StackFontSize
StackFontStyle
StackStereotypeFontColor
StackStereotypeFontName
StackStereotypeFontSize
StackStereotypeFontStyle
StateAttributeFontColor
StateAttributeFontName
StateAttributeFontSize
StateAttributeFontStyle
StateBorderColor
StateFontColor
StateFontName
StateFontSize
StateFontStyle
StateMessageAlignment
StereotypePosition
StorageFontColor
StorageFontName
StorageFontSize
StorageFontStyle
StorageStereotypeFontColor
StorageStereotypeFontName
StorageStereotypeFontSize
StorageStereotypeFontStyle
Style
SvglinkTarget
SwimlaneBorderThickness
SwimlaneTitleFontColor
SwimlaneTitleFontName
SwimlaneTitleFontSize
SwimlaneTitleFontStyle
SwimlaneWidth
SwimlaneWrapTitleWidth
TabSize
TimingFontColor
TimingFontName
TimingFontSize
TimingFontStyle
TitleBorderRoundCorner
TitleBorderThickness
TitleFontColor
TitleFontName
TitleFontSize
TitleFontStyle
UsecaseBorderThickness
UsecaseFontColor
UsecaseFontName
UsecaseFontSize
UsecaseFontStyle
UsecaseStereotypeFontColor
UsecaseStereotypeFontName
UsecaseStereotypeFontSize
UsecaseStereotypeFontStyle
WrapWidth

24.10.4 All Skin Parameters on the Ashley's PlantUML Doc

You can also view each skinparam parameters with its results displayed at the page `All Skin Parameters` of `Ashley's PlantUML Doc`:

- https://plantuml-documentation.readthedocs.io/en/latest/formatting/all-skin-params.html.

25 Preprocessing

Some preprocessing capabilities are included in **PlantUML**, and available for *all* diagrams.

Those functionalities are very similar to the C language preprocessor, except that the special character `#` has been changed to the exclamation mark `!`.

25.1 Variable definition [=, ?=]

Although this is not mandatory, we highly suggest that variable names start with a `$`.

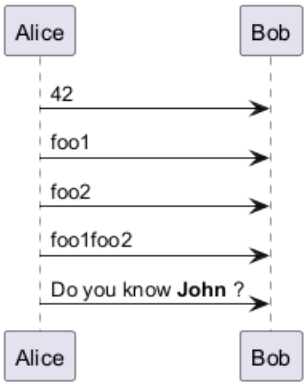
There are three types of data:

- **Integer number** *(int)*;
- **String** *(str)* - these must be surrounded by single quote or double quote;
- **JSON** (JSON) - either JSON Array or JSON Object or JSON value created by `%str2json`.

(for JSON variable definition and usage, see more details on Preprocessing-JSON page)

Variables created outside function are **global**, that is you can access them from everywhere (including from functions). You can emphasize this by using the optional `global` keyword when defining a variable.

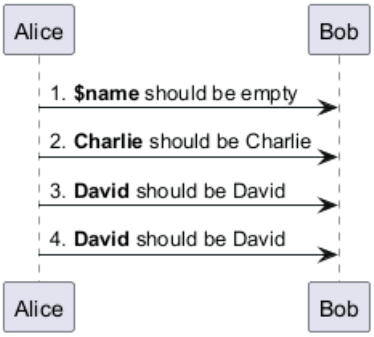
```
@startuml
!$a  = 42
!$ab = "foo1"
!$cd = "foo2"
!$ef = $ab + $cd
!$foo = { "name": "John", "age" : 30 }

Alice -> Bob : $a
Alice -> Bob : $ab
Alice -> Bob : $cd
Alice -> Bob : $ef
Alice -> Bob : Do you know **$foo.name** ?
@enduml
```



You can also assign a value to a variable, only if it is not already defined, with the syntax: `!$a ?= "foo"`

```
@startuml
Alice -> Bob : 1. **$name** should be empty

!$name ?= "Charlie"
Alice -> Bob : 2. **$name** should be Charlie

!$name = "David"
Alice -> Bob : 3. **$name** should be David

!$name ?= "Ethan"
Alice -> Bob : 4. **$name** should be David
```

```
@enduml
```



25.2 Boolean expression

25.2.1 Boolean representation [0 is false]

There is not real boolean type, but PlantUML use this integer convention:

- Integer `0` means `false`
- and any non-null number (as `1`) or any string (as `"1"`, or even `"0"`) means `true`.

[Ref. QA-9702]

25.2.2 Boolean operation and operator [&&, ||, ()]

You can use boolean expression, in the test, with :

- *parenthesis* `()`;
- *and operator* `&&`;
- *or operator* `||`.

(See next example, within `if` test.)

25.2.3 Boolean builtin functions [%false(), %true(), %not(<exp>), %boolval(<exp>)]

For convenience, you can use those boolean builtin functions:

- `%false()`
- `%true()`
- `%not(<exp>)`
- `%boolval(<exp>)`

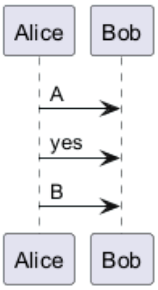
[See also Builtin functions] [Ref. PR-1873]

25.3 Conditions [!if, !else, !elseif, !endif]

- You can use expression in condition.
- *else* and *elseif* are also implemented

```
@startuml
!$a = 10
!$ijk = "foo"
Alice -> Bob : A
!if ($ijk == "foo") && ($a+10>=4)
Alice -> Bob : yes
!else
Alice -> Bob : This should not appear
!endif
```

```
Alice -> Bob : B
@enduml
```

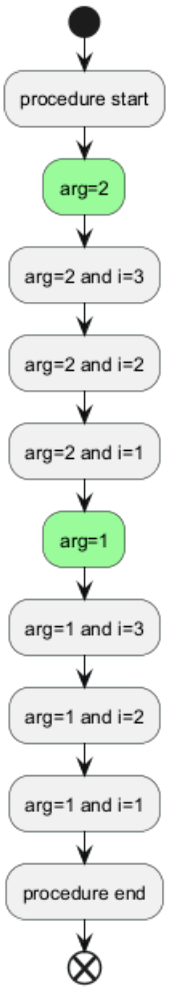


25.4 While loop [!while, !endwhile]

You can use `!while` and `!endwhile` keywords to have repeat loops.

25.4.1 While loop (on Activity diagram)

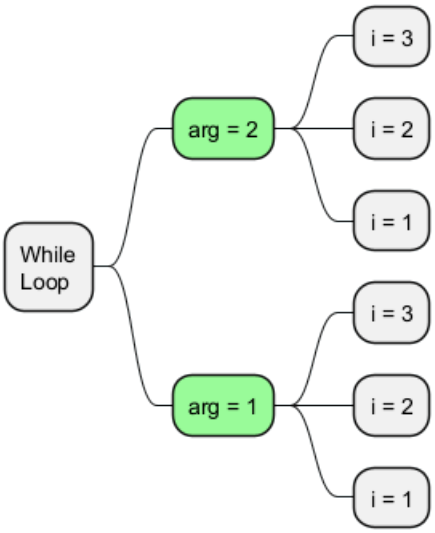
```
@startuml
!procedure $foo($arg)
  :procedure start;
  !while $arg!=0
    !$i=3
    #palegreen:arg=$arg;
    !while $i!=0
      :arg=$arg and i=$i;
      !$i = $i - 1
    !endwhile
    !$arg = $arg - 1
  !endwhile
  :procedure end;
!endprocedure

start
$foo(2)
end
@enduml
```



[Adapted from QA-10838]

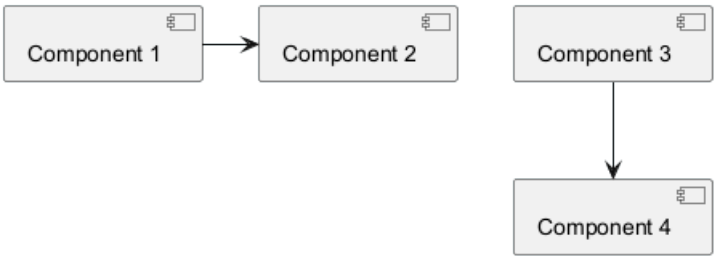
25.4.2 While loop (on Mindmap diagram)

```
@startmindmap
!procedure $foo($arg)
  !while $arg!=0
    !$i=3
    **[#palegreen] arg = $arg
    !while $i!=0
      *** i = $i
      !$i = $i - 1
    !endwhile
    !$arg = $arg - 1
  !endwhile
!endprocedure

*:While
Loop;
$foo(2)
@endmindmap
```



25.4.3 While loop (on Component/Deployment diagram)

```
@startuml
!procedure $foo($arg)
  !while $arg!=0
    [Component $arg] as $arg
    !$arg = $arg - 1
  !endwhile
!endprocedure

$foo(4)

1->2
3-->4
@enduml
```



[Ref. QA-14088]

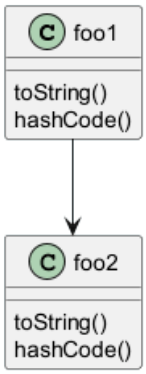
25.5 Procedure [!procedure, !endprocedure]

- Procedure names *should* start with a `$`
- Argument names *should* start with a `$`
- Procedures can call other procedures

Example:

```
@startuml
!procedure $msg($source, $destination)
  $source --> $destination
!endprocedure
```

```
!procedure $init_class($name)
  class $name {
    $addCommonMethod()
  }
!endprocedure


!procedure $addCommonMethod()
  toString()
  hashCode()
!endprocedure


$init_class("foo1")
$init_class("foo2")
$msg("foo1", "foo2")
@enduml
```



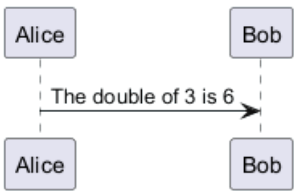
Variables defined in procedures are **local**. It means that the variable is destroyed when the procedure ends.

25.6 Return function [!function, !endfunction]

A return function does not output any text. It just define a function that you can call:

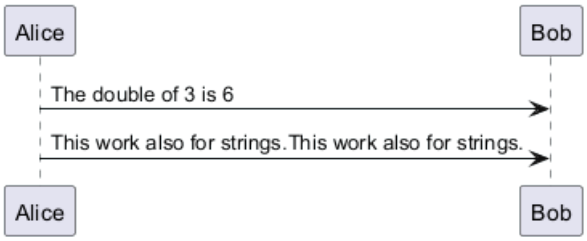
- directly in variable definition or in diagram text
- from other return functions
- from procedures
- Function name *should* start with a `$`
- Argument names *should* start with a `$`

```
@startuml
!function $double($a)
!return $a + $a
!endfunction

Alice -> Bob : The double of 3 is $double(3)
@enduml
```



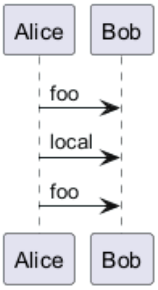
It is possible to shorten simple function definition in one line:

```
@startuml
!function $double($a) !return $a + $a

Alice -> Bob : The double of 3 is $double(3)
Alice -> Bob : $double("This work also for strings.")
@enduml
```



As in procedure (void function), variable are local by default (they are destroyed when the function is exited). However, you can access to global variables from function. However, you can use the `local` keyword to create a local variable if ever a global variable exists with the same name.

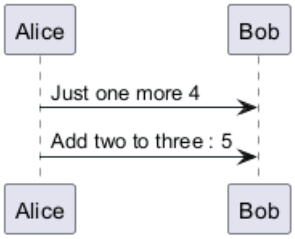
```
@startuml
!function $dummy()
!local $ijk = "local"
!return "Alice -> Bob : " + $ijk
!endfunction

!global $ijk = "foo"

Alice -> Bob : $ijk
$dummy()
Alice -> Bob : $ijk
@enduml
```



25.7 Default argument value

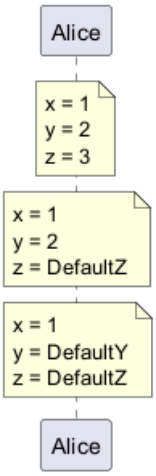
In both procedure and return functions, you can define default values for arguments.

```
@startuml
!function $inc($value, $step=1)
!return $value + $step
!endfunction

Alice -> Bob : Just one more $inc(3)
Alice -> Bob : Add two to three : $inc(3, 2)
@enduml
```



Only arguments at the end of the parameter list can have default values.

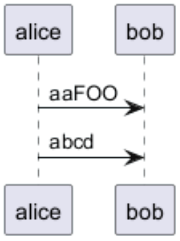
```
@startuml
!procedure defaulttest($x, $y="DefaultY", $z="DefaultZ")
note over Alice
  x = $x
  y = $y
  z = $z
end note
!endprocedure

defaulttest(1, 2, 3)
defaulttest(1, 2)
defaulttest(1)
@enduml
```



25.8 Unquoted procedure or function [!unquoted]

By default, you have to put quotes when you call a function or a procedure. It is possible to use the `unquoted` keyword to indicate that a function or a procedure does not require quotes for its arguments.

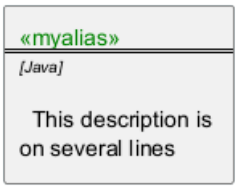
```
@startuml
!unquoted function id($text1, $text2="FOO") !return $text1 + $text2

alice -> bob : id(aa)
alice -> bob : id(ab,cd)
@enduml
```



25.9 Keywords arguments

Like in Python, you can use keywords arguments :

```
@startuml

!unquoted procedure $element($alias, $description="", $label="", $technology="", $size=12, $colour="
rectangle $alias as "
<color:$colour><<$alias>></color>
==$label==
//<size:$size>[$technology]</size>//

  $description"
!endprocedure

$element(myalias, "This description is %newline()on several lines", $size=10, $technology="Java")
@enduml
```

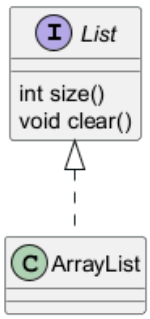


25.10 Including files or URL [!include, !include_many, !include_once]

Use the `!include` directive to include file in your diagram. Using URL, you can also include file from Internet/Intranet. Protected Internet resources can also be accessed, this is described in URL authentication.

Imagine you have the very same class that appears in many diagrams. Instead of duplicating the description of this class, you can define a file that contains the description.

```
@startuml

interface List
List : int size()
List : void clear()
List <|.. ArrayList
@enduml
```



File List.iuml

```
interface List
List : int size()
List : void clear()
```

The file `List.iuml` can be included in many diagrams, and any modification in this file will change all diagrams that include it.

You can also put several `@startuml/@enduml` text block in an included file and then specify which block you want to include adding `!0` where `0` is the block number. The `!0` notation denotes the first diagram.

For example, if you use `!include foo.txt!1`, the second `@startuml/@enduml` block within `foo.txt` will be included.

You can also put an id to some `@startuml/@enduml` text block in an included file using `@startuml(id=MY_OWN_ID)` syntax and then include the block adding `!MY_OWN_ID` when including the file, so using something like `!include foo.txt!MY_OWN_ID`.

By default, a file can only be included once. You can use `!include_many` instead of `!include` if you want to include some file several times. Note that there is also a `!include_once` directive that raises an error if a file is included several times.

25.11 Including Subpart [!startsub, !endsub, !includesub]

You can also use `!startsub NAME` and `!endsub` to indicate sections of text to include from other files using `!includesub`. For example:

file1.puml:

```
@startuml

A -> A : stuff1
!startsub BASIC
B -> B : stuff2
!endsub
C -> C : stuff3
!startsub BASIC
D -> D : stuff4
!endsub
@enduml
```

file1.puml would be rendered exactly as if it were:

```
@startuml

A -> A : stuff1
B -> B : stuff2
C -> C : stuff3
D -> D : stuff4
@enduml
```

However, this would also allow you to have another file2.puml like this:

file2.puml

```
@startuml

title this contains only B and D
!includesub file1.puml!BASIC
@enduml
```

This file would be rendered exactly as if:

```
@startuml

title this contains only B and D
B -> B : stuff2
D -> D : stuff4
@enduml
```

25.12 Builtin functions [%]

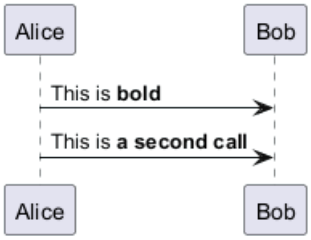
Some functions are defined by default. Their name starts by `%`

Name	Description
%boolval	Convert a value *(String, Integer, JSON value)* to boolean value
%call_user_func	Invoke a return function by its name with given arguments.
%chr	Return a character from a give Unicode value
%darken	Return a darken color of a given color with some ratio
%date	Retrieve current date. You can provide an optional format for the date
	You can provide another optional time (on epoch format)
%dec2hex	Return the hexadecimal string (String) of a decimal value (Int)
%dirpath	Retrieve current dirpath
%feature	Check if some feature is available in the current PlantUML running version
%false	Return always `false`
%file_exists	Check if a file exists on the local filesystem
%filename	Retrieve current filename
%function_exists	Check if a function exists
%get_all_theme	Retreive a JSON Array of all PlantUML theme
%get_all_stdlib	Retreive a JSON Array of all PlantUML stdlib names
%get_all_stdlib	Retreive a JSON Object of all PlantUML stdlib information
%get_variable_value	Retrieve some variable value
%getenv	Retrieve environment variable value
%hex2dec	Return the decimal value (Int) of a hexadecimal string (String)
%hsl_color	Return the RGBa color from a HSL color `%hsl_color(h, s, l)` or `%hsl_color(h, s, l,`
%intval	Convert a String to Int
%invoke_procedure	Dynamically invoke a procedure by its name, passing optional arguments to the called proce
%is_dark	Check if a color is a dark one
%is_light	Check if a color is a light one
%lighten	Return a lighten color of a given color with some ratio
%load_json	Load JSON data from local file or external URL
%lower	Return a lowercase string
%mod	Return the remainder of division of two integers (modulo division)
%newline	Return a newline
%not	Return the logical negation of an expression
%now	Return the current epoch time
%ord	Return a Unicode value from a given character
%lighten	Return a lighten color of a given color with some ratio
%random()	Return randomly the integer `0` or `1`
%random(n)	Return randomly an interger between `0` and `n - 1`
%random(min, max)	Return randomly an interger between `min` and `max - 1`
%reverse_color	Reverse a color using RGB
%reverse_hsluv_color	Reverse a color using HSLuv
%set_variable_value	Set a global variable
%size	Return the size of any string or JSON structure
%splitstr	Split a string into an array based on a specified delimiter.
%splitstr_regex	Split a string into an array based on a specified REGEX.
%string	Convert an expression to String
%strlen	Calculate the length of a String
%strpos	Search a substring in a string
%substr	Extract a substring. Takes 2 or 3 arguments
%true	Return always `true`
%upper	Return an uppercase string
%variable_exists	Check if a variable exists
%version	Return PlantUML current version

25.13 Logging [!log]

You can use `!log` to add some log output when generating the diagram. This has no impact at all on the diagram itself. However, those logs are printed in the command line's output stream. This could be useful for debug purpose.

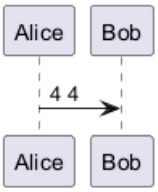
```
@startuml
!function bold($text)
!$result = "<b>"+ $text +"</b>"
!log Calling bold function with $text. The result is $result
!return $result
!endfunction

Alice -> Bob : This is bold("bold")
Alice -> Bob : This is bold("a second call")
@enduml
```



25.14 Memory dump [!dump_memory]

You can use `!dump_memory` to dump the full content of the memory when generating the diagram. An optional string can be put after `!dump_memory`. This has no impact at all on the diagram itself. This could be useful for debug purpose.

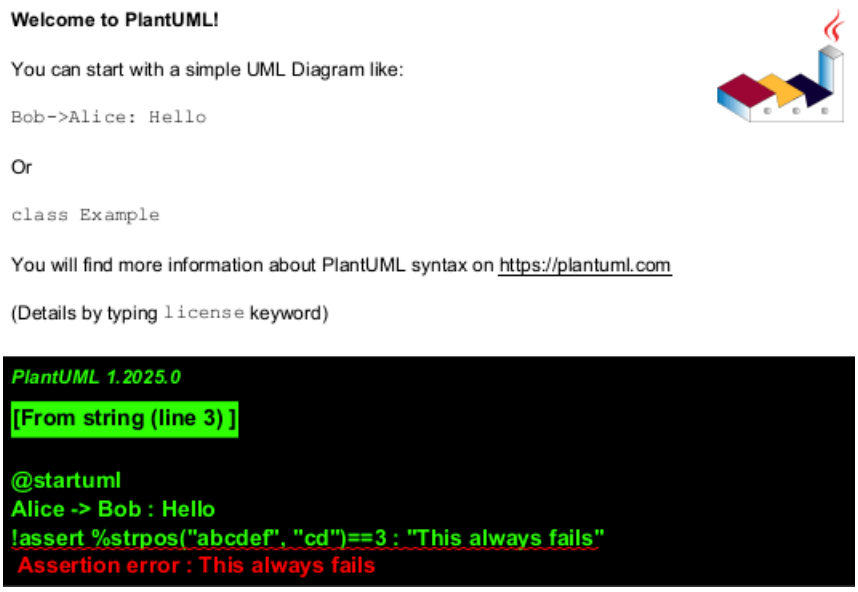
```
@startuml
!function $inc($string)
!$val = %intval($string)
!log value is $val
!dump_memory
!return $val+1
!endfunction

Alice -> Bob : 4 $inc("3")
!unused = "foo"
!dump_memory EOF
@enduml
```



25.15 Assertion [!assert]

You can put assertions in your diagram.

```
@startuml
Alice -> Bob : Hello
!assert %strpos("abcdef", "cd")==3 : "This always fails"
@enduml
```



25.16 Building custom library [!import, !include]

It's possible to package a set of included files into a single .zip or .jar archive. This single zip/jar can then be imported into your diagram using `!import` directive.

Once the library has been imported, you can `!include` file from this single zip/jar.

Example:

```
@startuml

!import /path/to/customLibrary.zip
' This just adds "customLibrary.zip" in the search path

!include myFolder/myFile.iuml
' Assuming that myFolder/myFile.iuml is located somewhere
' either inside "customLibrary.zip" or on the local filesystem

...
```

25.17 Search path

You can specify the java property `plantuml.include.path` in the command line.

For example:

```
java -Dplantuml.include.path="c:/mydir" -jar plantuml.jar atest1.txt
```

Note the this -D option has to put before the -jar option. -D options after the -jar option will be used to define constants within plantuml preprocessor.

25.18 Argument concatenation [##]

It is possible to append text to a macro argument using the `##` syntax.

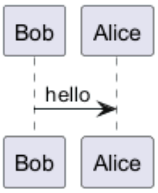
```
@startuml
!unquoted procedure COMP_TEXTGENCOMP(name)
[name] << Comp >>
interface Ifc << IfcType >> AS name##Ifc
name##Ifc - [name]
!endprocedure
COMP_TEXTGENCOMP(dummy)
@enduml
```

25.19 Dynamic invocation [%invoke_procedure(), %call_user_func()]

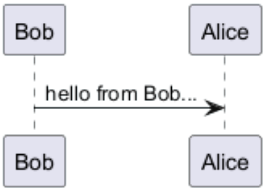
You can dynamically invoke a procedure using the special `%invoke_procedure()` procedure. This procedure takes as first argument the name of the actual procedure to be called. The optional following arguments are copied to the called procedure.

For example, you can have:

```
@startuml
!procedure $go()
  Bob -> Alice : hello
!endprocedure

!$wrapper = "$go"

%invoke_procedure($wrapper)
@enduml
```

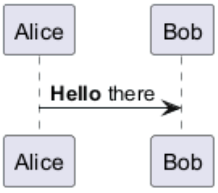



```
@startuml
!procedure $go($txt)
  Bob -> Alice : $txt
!endprocedure

%invoke_procedure("$go", "hello from Bob...")
@enduml
```



For return functions, you can use the corresponding special function `%call_user_func()` :

```
@startuml
!function bold($text)
!return "<b>"+ $text +"</b>"
!endfunction

Alice -> Bob : %call_user_func("bold", "Hello") there
@enduml
```



25.20 Evaluation of addition depending of data types [+]

Evaluation of `$a + $b` depending of type of `$a` or `$b`

```
@startuml
title
<#LightBlue>|= |=  $a |=  $b |=  <U+0025>string($a + $b)|
<#LightGray>| type | str | str | str (concatenation) |
| example |= "a" |= "b" |= %string("a" + "b") |
<#LightGray>| type | str | int | str (concatenation) |
| ex.|= "a" |=  2  |= %string("a" + 2)   |
<#LightGray>| type | str | int | str (concatenation) |
| ex.|=  1  |= "b" |= %string(1 + "b")   |
<#LightGray>| type | bool | str | str (concatenation) |
| ex.|= <U+0025>true() |= "b" |= %string(%true() + "b") |
<#LightGray>| type | str | bool | str (concatenation) |
| ex.|= "a" |= <U+0025>false() |= %string("a" + %false()) |
<#LightGray>| type |  int  |  int | int (addition of int) |
| ex.|=  1  |=  2  |= %string(1 + 2)     |
<#LightGray>| type |  bool  |  int | int (addition) |
| ex.|= <U+0025>true() |= 2 |= %string(%true() + 2) |
<#LightGray>| type |  int  |  bool | int (addition) |
| ex.|=  1  |= <U+0025>false() |= %string(1 + %false()) |
<#LightGray>| type |  int  |  int | int (addition) |
| ex.|=  1  |=  <U+0025>intval("2")  |= %string(1 + %intval("2")) |
end title
@enduml
```

	$a	$b	%string($a + $b)
type	str	str	str (concatenation)
example	"a"	"b"	ab
type	str	int	str (concatenation)
ex.	"a"	2	a2
type	str	int	str (concatenation)
ex.	1	"b"	1b
type	bool	str	str (concatenation)
ex.	%true()	"b"	1b
type	str	bool	str (concatenation)
ex.	"a"	%false()	a0
type	int	int	int (addition of int)
ex.	1	2	3
type	bool	int	int (addition)
ex.	%true()	2	3
type	int	bool	int (addition)
ex.	1	%false()	1
type	int	int	int (addition)
ex.	1	%intval("2")	3

25.21 Preprocessing JSON

You can extend the functionality of the current Preprocessing with JSON Preprocessing features:

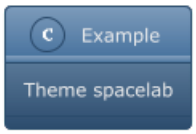
- JSON Variable definition
- Access to JSON data
- Loop over JSON array

(See more details on Preprocessing-JSON page)

25.22 Including theme [!theme]

Use the `!theme` directive to change the default theme of your diagram.

```
@startuml
!theme spacelab
class Example {
  Theme spacelab
}
@enduml
```



You will find more information on the dedicated page.

25.23 Migration notes

The current preprocessor is an update from some legacy preprocessor.

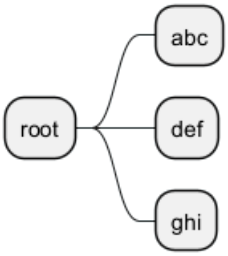
Even if some legacy features are still supported with the actual preprocessor, you should not use them any more (they might be removed in some long term future).

- You should not use `!define` and `!definelong` anymore. Use `!function`, `!procedure` or variable definition instead.
  - `!define` should be replaced by return `!function`
  - `!definelong` should be replaced by `!procedure`.
- `!include` now allows multiple inclusions : you don't have to use `!include_many` anymore
- `!include` now accepts a URL, so you don't need `!includeurl`
- Some features (like `%date%`) have been replaced by builtin functions (for example `%date()`)
- When calling a legacy `!definelong` macro with no arguments, you do have to use parenthesis. You have to use `my_own_definelong()` because `my_own_definelong` without parenthesis is not recognized by the new preprocessor.

Please contact us if you have any issues.

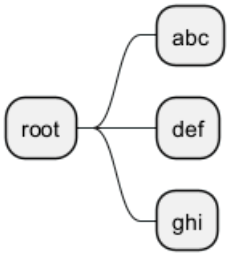
25.24 %splitstr builtin function

```
@startmindmap
!$list = %splitstr("abc~def~ghi", "~")

* root
!foreach $item in $list
  ** $item
!endfor
@endmindmap
```



Similar to:

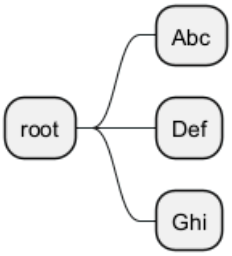
```
@startmindmap
* root
!foreach $item in ["abc", "def", "ghi"]
  ** $item
!endfor
@endmindmap
```



[Ref. QA-15374]

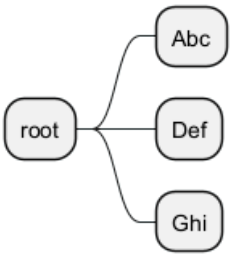
25.25 %splitstr_regex builtin function

```
@startmindmap
!$list = %splitstr_regex("AbcDefGhi", "(?=[A-Z])")

* root
!foreach $item in $list
  ** $item
!endfor
@endmindmap
```



Similar to:

```
@startmindmap
* root
!foreach $item in ["Abc", "Def", "Ghi"]
  ** $item
!endfor
@endmindmap
```



[Ref. QA-18827]

25.26 %get_all_theme builtin function

You can use the `%get_all_theme()` builtin function to retreive a JSON array of all PlantUML theme.

```
@startjson
%get_all_theme()
@endjson
```

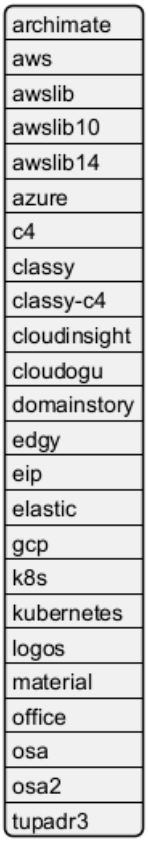
[from version 1.2024.4]

25.27 %get_all_stdlib builtin function

25.27.1 Compact version (only standard library name)

You can use the `%get_all_stdlib()` builtin function to retreive a JSON array of all PlantUML stdlib names.

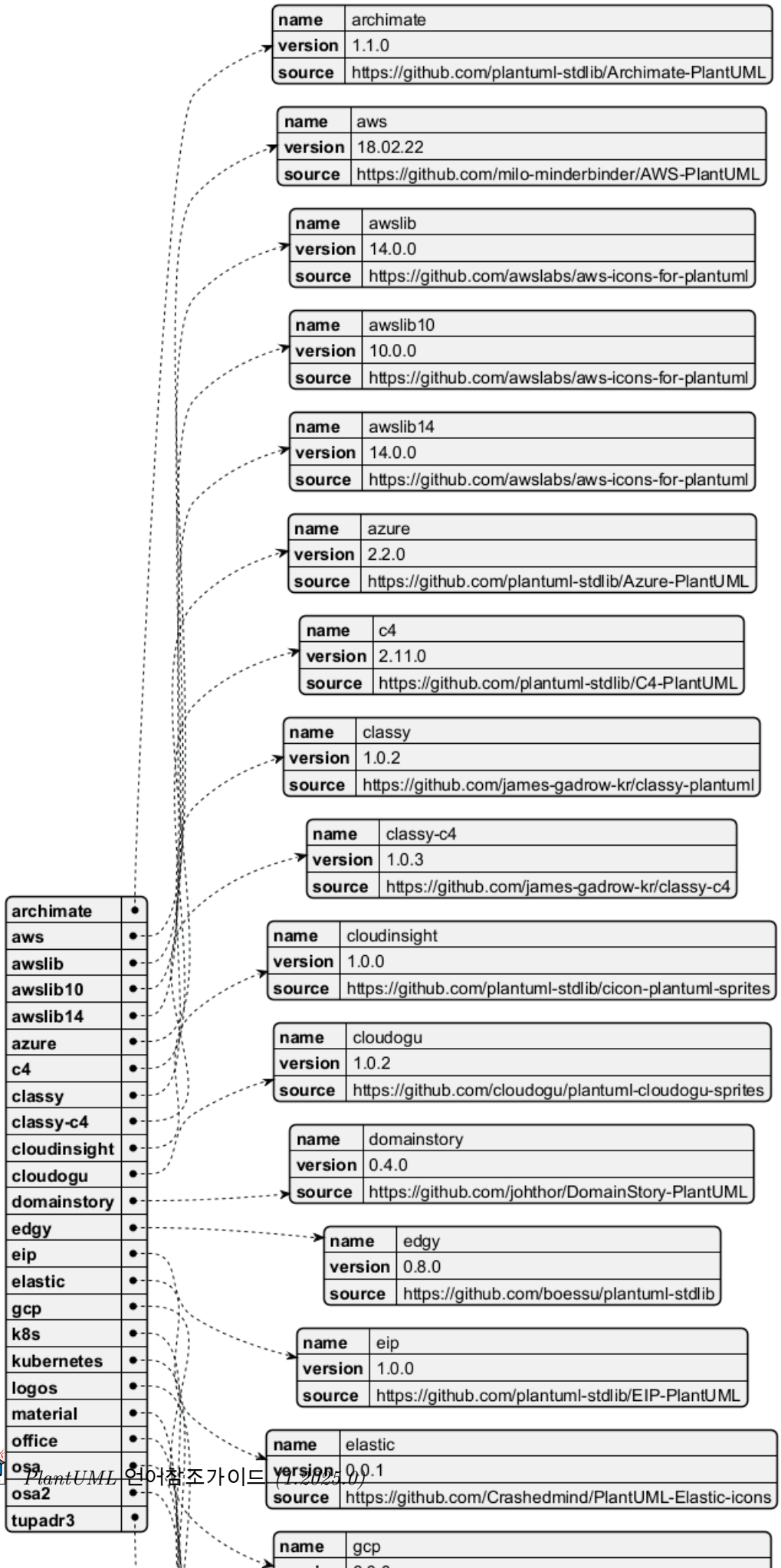
```
@startjson
%get_all_stdlib()
@endjson
```



25.27.2 Detailed version (with version and source)

With whatever parameter, you can use `%get_all_stdlib(detailed)` to retreive a JSON object of all PlantUML stdlib.

```
@startjson
%get_all_stdlib(detailed)
@endjson
```


archimate
aws
awslib
awslib10
awslib14
azure
c4
classy
classy-c4
cloudinsight
cloudogu
domainstory
edgy
eip
elastic
gcp
k8s
kubernetes
logos
material
office
osa
osa2
tupadr3
name archimate
version 1.1.0
source https://github.com/plantuml-stdlib/Archimate-PlantUML
name aws
version 18.02.22
source https://github.com/milo-minderbinder/AWS-PlantUML
name awslib
version 14.0.0
source https://github.com/awslabs/aws-icons-for-plantuml
name awslib10
version 10.0.0
source https://github.com/awslabs/aws-icons-for-plantuml
name awslib14
version 14.0.0
source https://github.com/awslabs/aws-icons-for-plantuml
name azure
version 2.2.0
source https://github.com/plantuml-stdlib/Azure-PlantUML
name c4
version 2.11.0
source https://github.com/plantuml-stdlib/C4-PlantUML
name classy
version 1.0.2
source https://github.com/james-gadrow-kr/classy-plantuml
name classy-c4
version 1.0.3
source https://github.com/james-gadrow-kr/classy-c4
name cloudinsight
version 1.0.0
source https://github.com/plantuml-stdlib/cicon-plantuml-sprites
name cloudogu
version 1.0.2
source https://github.com/cloudogu/plantuml-cloudogu-sprites
name domainstory
version 0.4.0
source https://github.com/johthor/DomainStory-PlantUML
name edgy
version 0.8.0
source https://github.com/boessu/plantuml-stdlib
name eip
version 1.0.0
source https://github.com/plantuml-stdlib/EIP-PlantUML
name elastic
version 0.0.1
source https://github.com/Crashedmind/PlantUML-Elastic-icons
name gcp

[from version 1.2024.4]

25.28 %random builtin function

You can use the %random builtin function to retreive a random integer.

Nb param.	Input	Output
0	%random()	returns *0* or *1*
1	%random(n)	returns an interger between *0* and *n - 1*
2	%random(min, max)	returns an interger between *min* and *max - 1*

```
@startcreole
| Nb param. | Input | Output |
| 0 | <U+0025>random()       | %random()     |
| 1 | <U+0025>random(5)      | %random(5)    |
| 2 | <U+0025>random(7, 15) | %random(7, 15) |
@endcreole
```

Nb param.	Input	Output
0	%random()	1
1	%random(5)	4
2	%random(7, 15)	9

[from version 1.2024.2]

25.29 %boolval builtin function

You can use the %boolval builtin function to manage boolean value.

```
@startcreole
<#ccc>|= Input                                  |= Output |
| <U+0025>boolval(1)                            | %boolval(1) |
| <U+0025>boolval(0)                            | %boolval(0) |
| <U+0025>boolval(<U+0025>true())               | %boolval(%true()) |
| <U+0025>boolval(<U+0025>false())              | %boolval(%false()) |
| <U+0025>boolval(true)                         | %boolval(true) |
| <U+0025>boolval(false)                        | %boolval(false) |
| <U+0025>boolval(TRUE)                         | %boolval(TRUE) |
| <U+0025>boolval(FALSE)                        | %boolval(FALSE) |
| <U+0025>boolval("true")                       | %boolval("true") |
| <U+0025>boolval("false")                      | %boolval("false") |
| <U+0025>boolval(<U+0025>str2json("true"))     | %boolval(%str2json("true")) |
| <U+0025>boolval(<U+0025>str2json("false"))    | %boolval(%str2json("false")) |
@endcreole
```

Input	Output
%boolval(1)	1
%boolval(0)	0
%boolval(%true())	1
%boolval(%false())	0
%boolval(true)	1
%boolval(false)	0
%boolval(TRUE)	1
%boolval(FALSE)	0
%boolval("true")	1
%boolval("false")	0
%boolval(%str2json("true"))	1
%boolval(%str2json("false"))	0

[Ref. PR-1873, from version 1.2024.7]

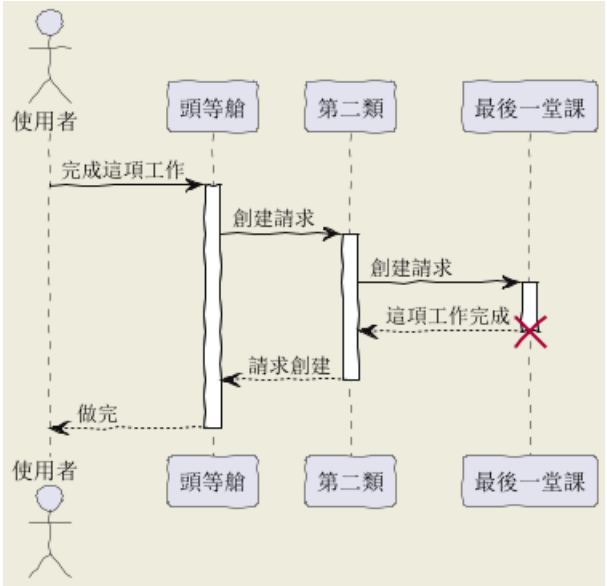
26 Unicode

The PlantUML language use *letters* to define actor, usecase and so on.

But *letters* are not only A-Z latin characters, it could be *any kind of letter from any language*.

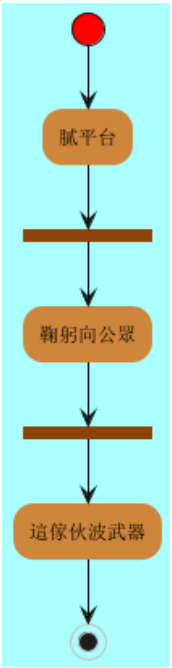
26.1 Examples

```
@startuml
skinparam handwritten true
skinparam backgroundColor #EEEBDC

actor 使用者
participant "頭等艙" as A
participant "第二類" as B
participant "最後一堂課" as 別的東西

使用者 -> A: 完成這項工作
activate A

A -> B: 創建請求
activate B

B -> 別的東西: 創建請求
activate 別的東西
別的東西 --> B: 這項工作完成
destroy 別的東西

B --> A: 請求創建
deactivate B

A --> 使用者: 做完
deactivate A
@enduml
```

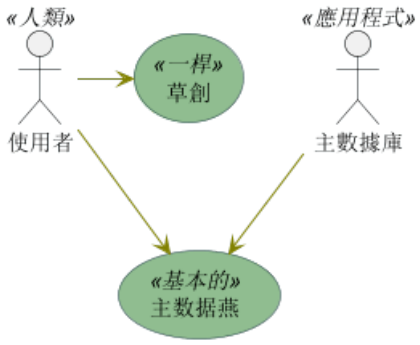



```
@startuml

(*) --> "膩平台"
--> === S1 ===
--> 鞠躬向公眾
--> === S2 ===
```

```
--> 這傢伙波武器
--> (*)

skinparam backgroundColor #AAFFFF
skinparam activityStartColor red
skinparam activityBarColor SaddleBrown
skinparam activityEndColor Silver
skinparam activityBackgroundColor Peru
skinparam activityBorderColor Peru
@enduml
```




```
@startuml

skinparam usecaseBackgroundColor DarkSeaGreen
skinparam usecaseArrowColor Olive
skinparam actorBorderColor black
skinparam usecaseBorderColor DarkSlateGray

使用者 << 人類 >>
"主數據庫" as 數據庫 << 應用程式 >>
(草創) << 一桿 >>
"主数据燕" as (贏余) << 基本的 >>

使用者 -> (草創)
使用者 --> (贏余)

數據庫  --> (贏余)
@enduml
```



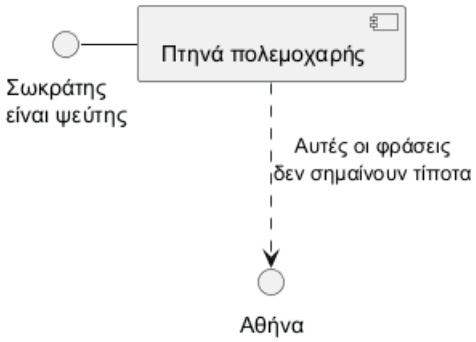
@startuml

() ”Σ ” as Σ

Σ - [Π]

[Π] ..> () A : A

@enduml



26.2 Charset

The default charset used when *reading* the text files containing the UML text description is system dependent.

Normally, it should just be fine, but in some case, you may want to the use another charset. For example, with the command line:

```
java -jar plantuml.jar -charset UTF-8 files.txt
```

Or, with the ant task:

```
<!-- Put images in c:/images directory -->
<target name="main">
<plantuml dir="./src" charset="UTF-8" />
```

Depending of your Java installation, the following charset should be available: `ISO-8859-1`, `UTF-8`, `UTF-16BE`, `UTF-16LE`, `UTF-16`.

26.3 Using Unicode Character on PlantUML

On PlantUML diagram, you can integrate:

- Special characters using `&#XXXX;` or `<U+XXXX>` form;
- Emoji using `<:XXXXX:>` or `<:NameOfEmoji:>`form.

27 PlantUML Standard Library

Welcome to the guide on PlantUML's official **Standard Library** (`stdlib`). Here, we delve into this integral resource that is now included in all official releases of PlantUML, facilitating a richer diagram creation experience. The library borrows its file inclusion convention from the "C standard library", a well-established protocol in the programming world.

27.0.1 Standard Library Overview

The Standard Library is a repository of files and resources, constantly updated to enhance your PlantUML experience. It forms the backbone of PlantUML, offering a range of functionalities and features to explore.

27.0.2 Contribution from the Community

A significant portion of the library's contents are generously provided by third-party contributors. We extend our heartfelt gratitude to them for their invaluable contributions that have played a pivotal role in enriching the library.

We encourage users to delve into the abundant resources the Standard Library offers, to not only enhance their diagram crafting experience but also possibly contribute and be a part of this collaborative endeavor.

27.1 List of Standard Library

You can list standard library folders using the special diagram:

```
@startuml
stdlib
@enduml
```

archimate
Version 1.1.0
Delivered by https://github.com/plantuml-stdlib/Archimate-PlantUML

aws
Version 18.02.22
Delivered by https://github.com/milo-minderbinder/AWS-PlantUML

awslib
Version 14.0.0
Delivered by https://github.com/awslabs/aws-icons-for-plantuml

awslib10
Version 10.0.0
Delivered by https://github.com/awslabs/aws-icons-for-plantuml

awslib14
Version 14.0.0
Delivered by https://github.com/awslabs/aws-icons-for-plantuml

azure
Version 2.2.0
Delivered by https://github.com/plantuml-stdlib/Azure-PlantUML

c4
Version 2.11.0
Delivered by https://github.com/plantuml-stdlib/C4-PlantUML

classy
Version 1.0.2
Delivered by https://github.com/james-gadrow-kr/classy-plantuml

classy-c4
Version 1.0.3
Delivered by https://github.com/james-gadrow-kr/classy-c4

cloudinsight
Version 1.0.0
Delivered by https://github.com/plantuml-stdlib/cicon-plantuml-sprites

cloudogu
Version 1.0.2
Delivered by https://github.com/cloudogu/plantuml-cloudogu-sprites

domainstory
Version 0.4.0
Delivered by https://github.com/johthor/DomainStory-PlantUML

edgy
Version 0.8.0
Delivered by https://github.com/boessu/plantuml-stdlib

eip
Version 1.0.0
Delivered by https://github.com/plantuml-stdlib/EIP-PlantUML

elastic
Version 0.0.1
Delivered by https://github.com/Crashedmind/PlantUML-Elastic-icons

gcp
Version 6.0.0
Delivered by https://github.com/Crashedmind/PlantUML-icons-GCP

k8s
Version 1.0.0
Delivered by https://github.com/dcasati/kubernetes-PlantUML

kubernetes
Version 5.3.45
Delivered by https://github.com/plantuml-stdlib/plantuml-kubernetes-sprites

logos
Version 1.1.0
Delivered by https://github.com/plantuml-stdlib/gilbarbara-plantuml-sprites

material
Version 0.0.1
Delivered by https://github.com/Templarian/MaterialDesign

office
Version 1.0.0
Delivered by https://github.com/Roemer/plantuml-office

osa

It is also possible to use the command line `java -jar plantuml.jar -stdlib` to display the same list.

Finally, you can extract the full standard library sources using `java -jar plantuml.jar -extractstdlib`. All files will be extracted in the folder `stdlib`.

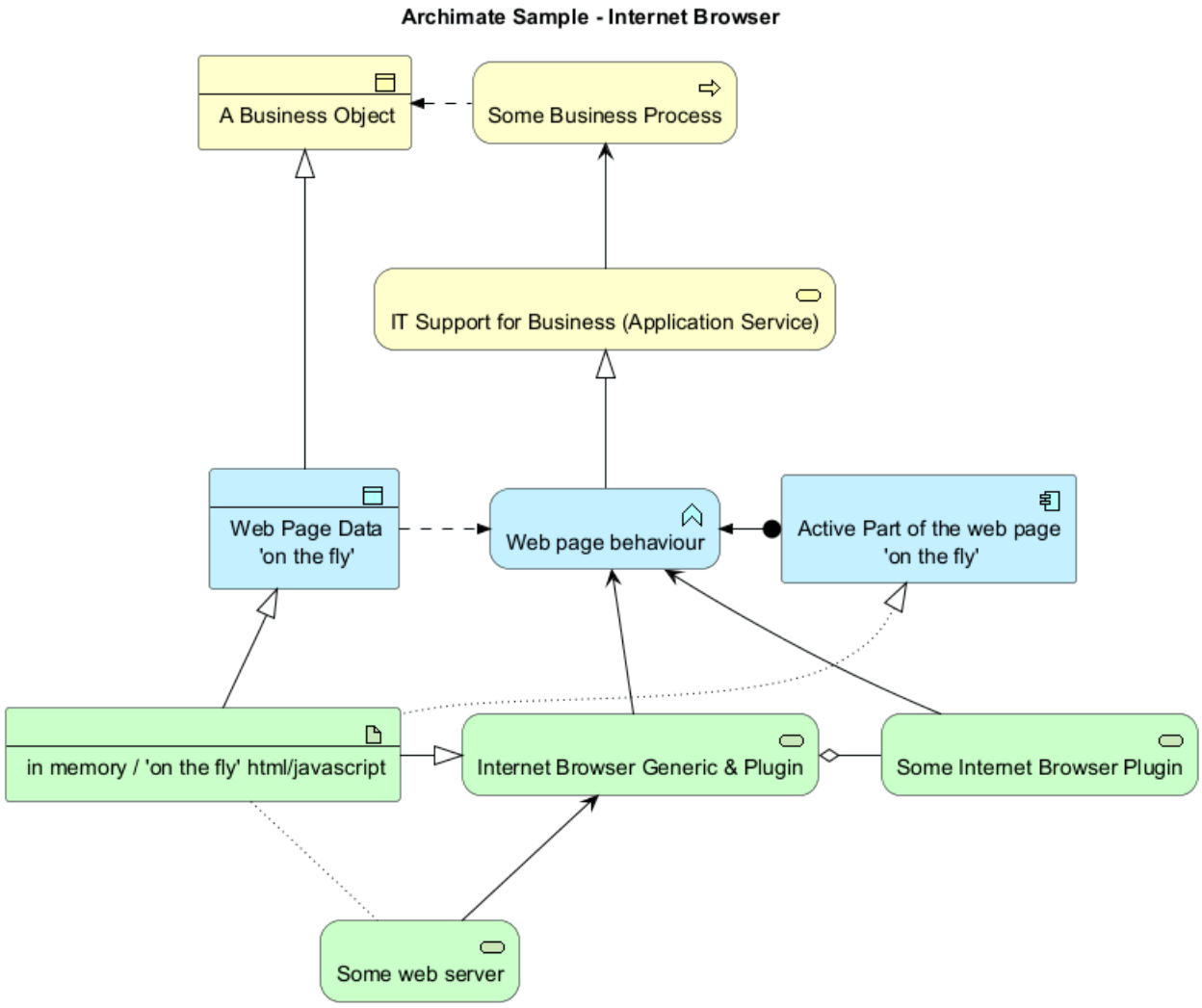
Sources used to build official PlantUML releases are hosted here https://github.com/plantuml/plantuml-stdlib. You can create Pull Request to update or add some library if you find it relevant.

27.2 ArchiMate [archimate]

Type	Link
stdlib	https://github.com/plantuml/plantuml-stdlib/tree/master/archimate
src	https://github.com/ebbypeter/Archimate-PlantUML
orig	https://en.wikipedia.org/wiki/ArchiMate

This repository contains ArchiMate PlantUML macros and other includes for creating Archimate Diagrams easily and consistantly.

```
@startuml
!include <archimate/Archimate>

title Archimate Sample - Internet Browser

' Elements
Business_Object(businessObject, "A Business Object")
Business_Process(someBusinessProcess,"Some Business Process")
Business_Service(itSupportService, "IT Support for Business (Application Service)")

Application_DataObject(dataObject, "Web Page Data \n 'on the fly'")
Application_Function(webpageBehaviour, "Web page behaviour")
Application_Component(ActivePartWebPage, "Active Part of the web page \n 'on the fly'")

Technology_Artifact(inMemoryItem,"in memory / 'on the fly' html/javascript")
Technology_Service(internetBrowser, "Internet Browser Generic & Plugin")
Technology_Service(internetBrowserPlugin, "Some Internet Browser Plugin")
Technology_Service(webServer, "Some web server")

'Relationships
Rel_Flow_Left(someBusinessProcess, businessObject, "")
Rel_Serving_Up(itSupportService, someBusinessProcess, "")
Rel_Specialization_Up(webpageBehaviour, itSupportService, "")
Rel_Flow_Right(dataObject, webpageBehaviour, "")
Rel_Specialization_Up(dataObject, businessObject, "")
Rel_Assignment_Left(ActivePartWebPage, webpageBehaviour, "")
Rel_Specialization_Up(inMemoryItem, dataObject, "")
Rel_Realization_Up(inMemoryItem, ActivePartWebPage, "")
Rel_Specialization_Right(inMemoryItem,internetBrowser, "")
Rel_Serving_Up(internetBrowser, webpageBehaviour, "")
Rel_Serving_Up(internetBrowserPlugin, webpageBehaviour, "")
Rel_Aggregation_Right(internetBrowser, internetBrowserPlugin, "")
Rel_Access_Up(webServer, inMemoryItem, "")
Rel_Serving_Up(webServer, internetBrowser, "")
@enduml
```



27.2.1 List possible sprites

You can list all possible sprites for Archimate using the following diagram:

```
@startuml
listsprite
@enduml
```

27.3 Amazon Labs AWS Library [awslib]

Type	Link
stdlib	https://github.com/plantuml/plantuml-stdlib/tree/master/awslib
src	https://github.com/awslabs/aws-icons-for-plantuml
orig	https://aws.amazon.com/en/architecture/icons/

The Amazon Labs AWS library provides PlantUML sprites, macros, and other includes for Amazon Web Services (AWS) services and resources.

Used to create PlantUML diagrams with AWS components. All elements are generated from the official AWS Architecture Icons and when combined with PlantUML and the C4 model, are a great way to communicate your design, deployment, and topology as code.

```
@startuml
!include <awslib/AWSCommon>
!include <awslib/InternetOfThings/IoTRule>
!include <awslib/Analytics/KinesisDataStreams>
!include <awslib/ApplicationIntegration/SimpleQueueService>

left to right direction

agent "Published Event" as event #fff

IoTRule(iotRule, "Action Error Rule", "error if Kinesis fails")
KinesisDataStreams(eventStream, "IoT Events", "2 shards")
SimpleQueueService(errorQueue, "Rule Error Queue", "failed Rule actions")

event --> iotRule : JSON message
iotRule --> eventStream : messages
iotRule --> errorQueue : Failed action message
@enduml
```

27.4 Azure library [azure]

Type	Link
stdlib	https://github.com/plantuml/plantuml-stdlib/tree/master/azure
src	https://github.com/RicardoNiepel/Azure-PlantUML/
orig	Microsoft Azure

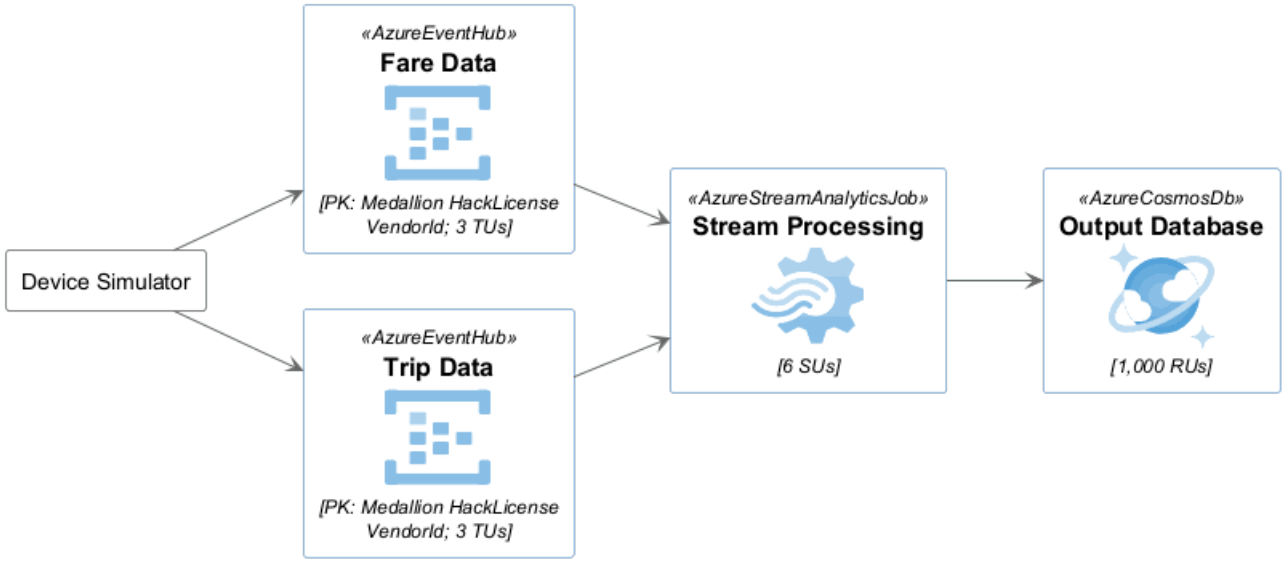
The Azure library consists of Microsoft Azure icons.

Use it by including the file that contains the sprite, eg: `!include <azure/Analytics/AzureEventHub>`. When imported, you can use the sprite as normally you would, using `<$sprite_name>`.

You may also include the `AzureCommon.puml` file, eg: `!include <azure/AzureCommon>`, which contains helper macros defined. With the `AzureCommon.puml` imported, you can use the `NAME_OF_SPRITE(parameters...)` macro.

Example of usage:

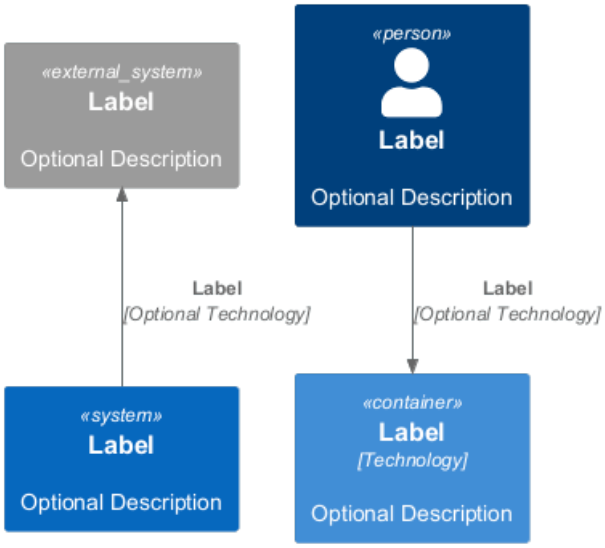
```
@startuml
!include <azure/AzureCommon>
!include <azure/Analytics/AzureEventHub>
!include <azure/Analytics/AzureStreamAnalyticsJob>
!include <azure/Databases/AzureCosmosDb>

left to right direction

agent "Device Simulator" as devices #fff

AzureEventHub(fareDataEventHub, "Fare Data", "PK: Medallion HackLicense VendorId; 3 TUs")
AzureEventHub(tripDataEventHub, "Trip Data", "PK: Medallion HackLicense VendorId; 3 TUs")
AzureStreamAnalyticsJob(streamAnalytics, "Stream Processing", "6 SUs")
AzureCosmosDb(outputCosmosDb, "Output Database", "1,000 RUs")

devices --> fareDataEventHub
devices --> tripDataEventHub
fareDataEventHub --> streamAnalytics
tripDataEventHub --> streamAnalytics
streamAnalytics --> outputCosmosDb
@enduml
```



27.5 C4 Library [C4]

Type	Link
stdlib	https://github.com/plantuml/plantuml-stdlib/tree/master/C4
src	https://github.com/plantuml-stdlib/C4-PlantUML
orig	https://en.wikipedia.org/wiki/C4_modelhttps://c4model.com

```
@startuml
!include <C4/C4_Container>

Person(personAlias, "Label", "Optional Description")
Container(containerAlias, "Label", "Technology", "Optional Description")
System(systemAlias, "Label", "Optional Description")

System_Ext(extSystemAlias, "Label", "Optional Description")

Rel(personAlias, containerAlias, "Label", "Optional Technology")

Rel_U(systemAlias, extSystemAlias, "Label", "Optional Technology")
@enduml
```



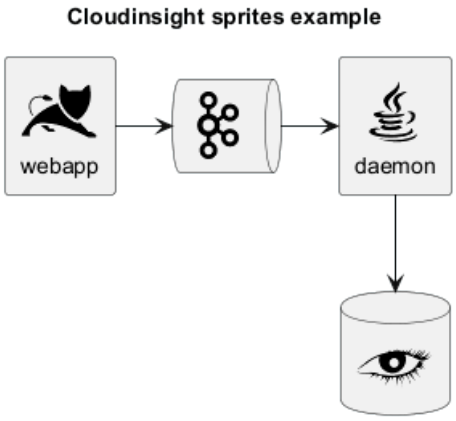
27.6 Cloud Insight [cloudinsight]

Type	Link
stdlib	https://github.com/plantuml/plantuml-stdlib/tree/master/cloudinsight
src	https://github.com/rabelenda/cicon-plantuml-sprites
orig	Cloudinsight icons

This repository contains PlantUML sprites generated from Cloudinsight icons, which can easily be used in PlantUML diagrams for nice visual representation of popular technologies.

```
@startuml
!include <cloudinsight/tomcat>
!include <cloudinsight/kafka>
!include <cloudinsight/java>
!include <cloudinsight/cassandra>

title Cloudinsight sprites example

skinparam monochrome true

rectangle "<$tomcat>\nwebapp" as webapp
```

```
queue "<$kafka>" as kafka
rectangle "<$java>\ndaemon" as daemon
database "<$cassandra>" as cassandra

webapp -> kafka
kafka -> daemon
daemon --> cassandra
@enduml
```



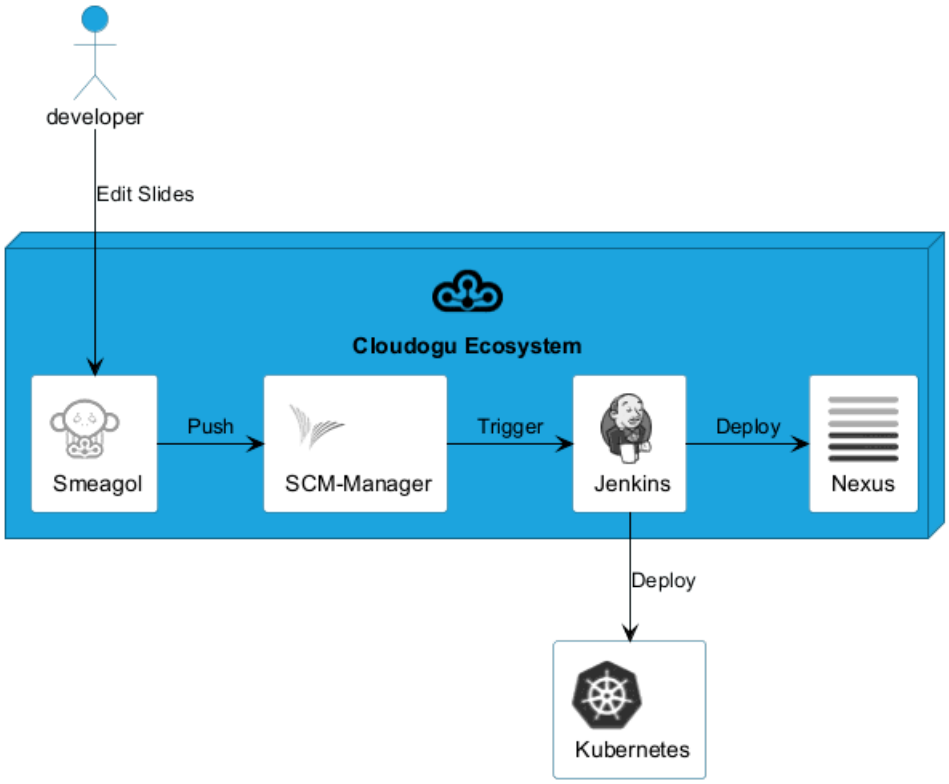
27.7 Cloudogu [cloudogu]

Type	Link
stdlib	https://github.com/plantuml/plantuml-stdlib/tree/master/cloudogu
src	https://github.com/cloudogu/plantuml-cloudogu-sprites
orig	https://cloudogu.com

The Cloudogu library provides PlantUML sprites, macros, and other includes for Cloudogu services and resources.

```
@startuml
!include <cloudogu/common>
!include <cloudogu/dogus/jenkins>
!include <cloudogu/dogus/cloudogu>
!include <cloudogu/dogus/scm>
!include <cloudogu/dogus/smeagol>
!include <cloudogu/dogus/nexus>
!include <cloudogu/tools/k8s>

node "Cloudogu Ecosystem" <<$cloudogu>> {
DOGU_JENKINS(jenkins, Jenkins) #ffffff
DOGU_SCM(scm, SCM-Manager) #ffffff
DOGU_SMEAGOL(smeagol, Smeagol) #ffffff
DOGU_NEXUS(nexus,Nexus) #ffffff
}

TOOL_K8S(k8s, Kubernetes) #ffffff

actor developer

developer --> smeagol : "Edit Slides"
smeagol -> scm : Push
scm -> jenkins : Trigger
jenkins -> nexus : Deploy
jenkins --> k8s : Deploy
```

```
@enduml
```



All cloudogu sprites

See all possible cloudogu sprites on plantuml-cloudogu-sprites.

27.8 EDGY: An Open Source tool for collaborative Enterprise Design [edgy]

Type	Link
`stdlib`	https://github.com/plantuml/plantuml-stdlib/tree/master/edgy
`src`	https://github.com/boessu/plantuml-stdlib/tree/master/edgy
`orig`	https://enterprise.design/

blockquote "To become whole, enterprises must embrace a holistic, collaborative way of design: transcending silos, combining perspectives, looking for connections instead of divisions. An enterprise designed together works better together."

–Bard Papegaaij, Wolfgang Goebl and Milan Guenther, curators of EDGY 23 blockquote

EDGY helps to visualize, communicate, and co-design enterprises across different disciplines. EDGY is a design language that provides guidelines for enterprises to create effective and efficient digital products, services, and experiences. It was developed by the EDGY team with input from industry experts, researchers, and practitioners in order to address common challenges faced when developing complex systems. The foundation of Edgy is based on four key principles: simplicity, modularity, scalability, and adaptability. These principles are designed to help enterprises create products that can be easily maintained over time while also being able to scale up or down as needed. Additionally, the language provides a set of guidelines for designing user interfaces, data models, business processes, and more, making it an essential toolkit for any organization looking to improve their offerings.

27.8.1 Basic Elements and Interconnections

EDGY is an open-source language for enterprise design that uses only four base elements: people, activity, object, and outcome. These elements can be specialized into facet and intersection elements, which describe the enterprise from different perspectives: identity, architecture, and experience.

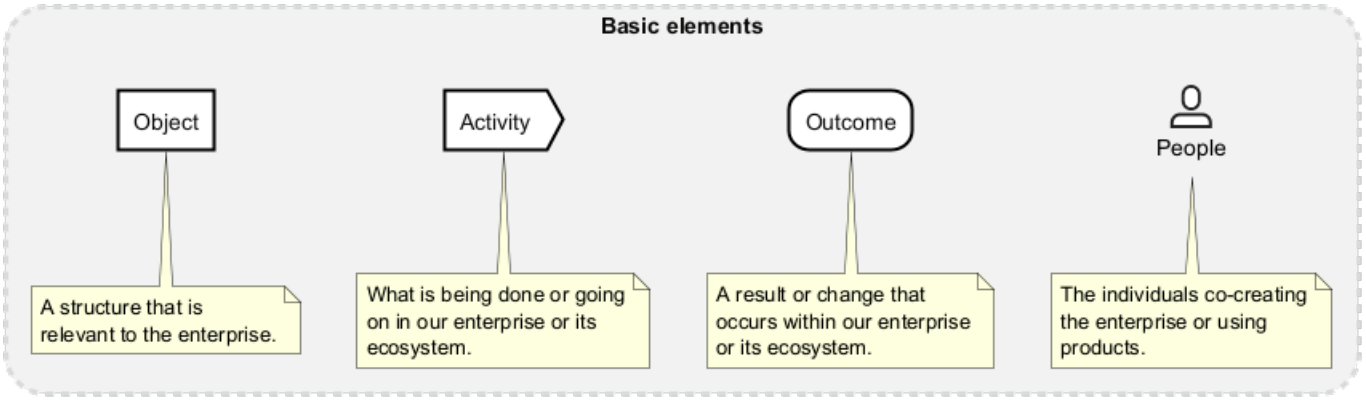
27.8.2 Elements

The basic syntax of an element or a facet is:

```
$element/facet("label", [identifier], [lightColor])
```

Parameter	Description
label	Mandatory: label of the element.
identifier	Dependant: Identifies the element (for creating relations). Optional if you don't link them to other elem
lightColor	Optional: 0 sets the standared color. 1 sets a lighter color. As default, facets do have lighter colors thar

```
@startuml
!include <edgy/edgy>

$baseFacet("Basic elements") {

  $people("People")
  note bottom
    The individuals co-creating
    the enterprise or using
    products.
  end note

  $outcome("Outcome")
  note bottom
    A result or change that
    occurs within our enterprise
    or its ecosystem.
  end note

  $activity("Activity")
  note bottom
   What is being done or going
   on in our enterprise or its
   ecosystem.
  end note

  $object("Object")
  note bottom
    A structure that is
    relevant to the enterprise.
  end note
}
@enduml
```



27.8.3 Relationships

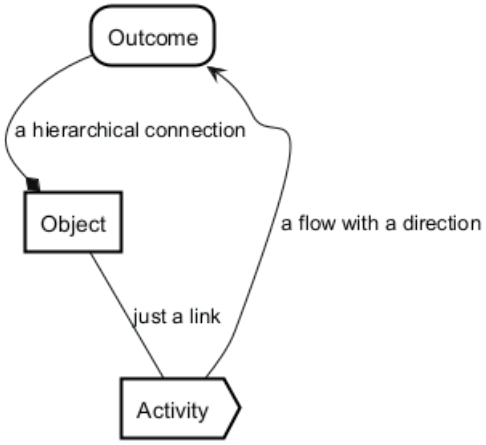
The elements (or facets) can be connected with three types of relationships: link, flow and tree.

```
$link/flow/tree(fromIdentifier, toIdentifier, ["Description"])
```

Parameter	Description
fromIdentifier	Mandatory: Identifies the starting element of a relation.
toIdentifier	Mandatory: Identifies the ending element of a relation.
label	Optional: label of the element.

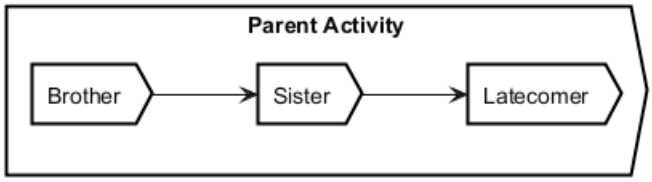
All relations can have a direction hint as a suffix (Up/Down/Left/Right). See examples in the chapter "Facets". While it does often help to give PlantUML (basically GraphViz) a direction hint, it not always helps. if you don't get the exact result you expect: don't waste too much lifetime on it.

```
@startuml
!include <edgy/edgy>

$outcome("Outcome", outcome)
$activity("Activity", activity)
$object("Object", object)

$link(object, activity, "just a link")
$flow(activity, outcome, "a flow with a direction")
$tree(outcome, object, "a hierarchical connection")
@enduml
```



There are quite some hierarchical linking in edgy. Or maps. So it is also possible to group/nesting elements:

```
@startuml
!include <edgy/edgy>

left to right direction

$activity("Parent Activity") {
  $activity("Brother", child1, 1)
  $activity("Sister", child2, 1)
  $activity("Latecomer", child3, 1)
}

$flow(child1, child2)
$flow(child2, child3)

@enduml
```



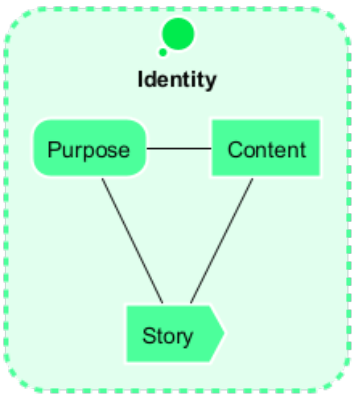
27.8.4 Facets

A facet is a perspective that relates to any enterprise, featuring a set of questions that an enterprise needs to answer in order to achieve a coherent design. There are three facets in EDGY: Identity, Architecture, and Experience. Each facet references five enterprise elements: three facet elements, and two intersection elements at the overlap with the neighbouring facets.

27.8.5 Identity

The Identity Facet describes why the enterprise exists and what it stands for.

```
@startuml
!include <edgy/edgy>

$identityFacet(Identity, identity) {
$content(Content, content)
$purpose(Purpose, purpose)
$story(Story, story)
}

$linkLeft(content, purpose)
$linkDown(content, story)
$linkDown(purpose, story)

@enduml
```

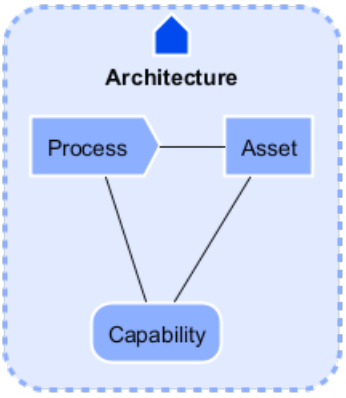


27.8.6 Architecture

The Architecture facet is about the structures and processes that enable the enterprise to operate and deliver.

```
@startuml
!include <edgy/edgy>

$architectureFacet(Architecture) {
$process(Process, process)
$asset(Asset, asset)
$capability(Capability, capability)
}
```

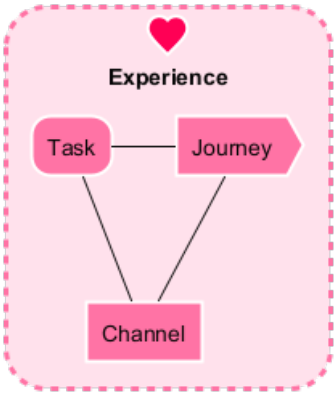
```
$linkRight(process, asset)
$linkDown(process, capability)
$linkDown(asset, capability)

@enduml
```



27.8.7 Experience

The Experience Facet is about the impact that the enterprise has on people and their lives through its interactions.

```
@startuml
!include <edgy/edgy>

$experienceFacet(Experience) {
$task(Task, task)
$journey(Journey, journey)
$channel(Channel, channel)
}

$linkRight(task, journey)
$linkDown(task, channel)
$linkDown(journey, channel)

@enduml
```

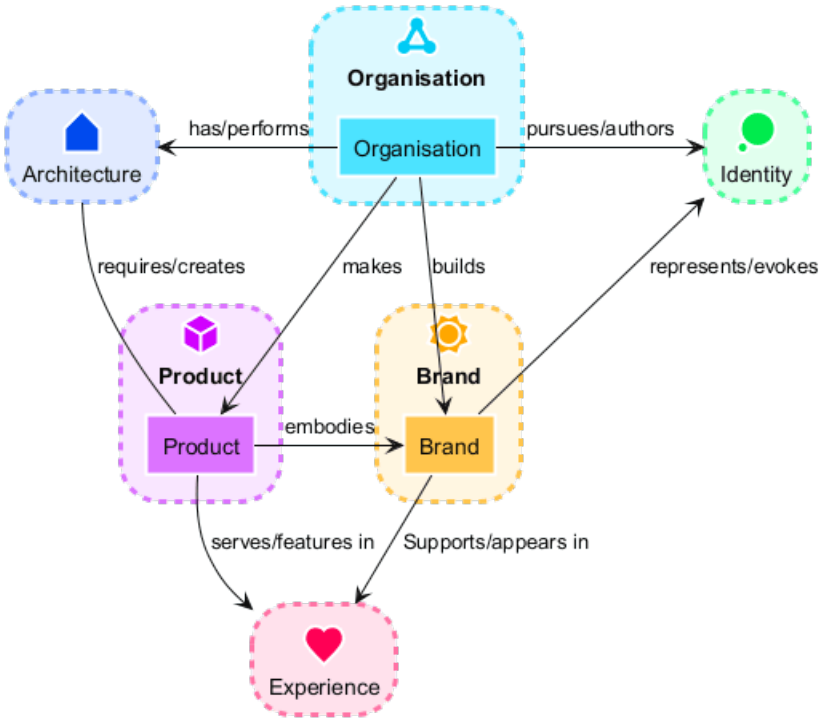


27.8.8 Intersections

Intersections are lenses that connect facets and disciplines, such as organisation, product, and brand.

```
@startuml
!include <edgy/edgy>

$experienceFacet(Experience, experience)
```

```
$architectureFacet(Architecture, architecture)
$identityFacet(Identity, identity)

$organisationFacet(Organisation, org) {
$organisation(Organisation, organisation)
}

$brandFacet(Brand) {
$brand(Brand, brand)
}

$productFacet(Product){
$product(Product, product)
}

$flow(brand, identity, "represents/evokes")
$flow(brand, experience, "Supports/appears in")

$flowLeft(organisation, identity, "pursues/authors")
$flowRight(organisation, architecture, "has/performs")

$flow(product, experience, "serves/features in")
$linkUp(product, architecture, "requires/creates")

$flow(organisation, brand, "builds")
$flow(organisation, product, "makes")
$flowLeft(product, brand, "embodies")

@enduml
```

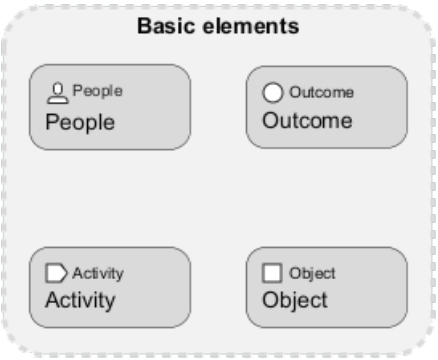


27.8.9 Alternative visual styling

Finally, there is also an alternative representation that focuses on rectangles with stereotypes. The approach described above is 100% compatible. It can therefore be activated with a simple swap from `!include <edgy/edgy>` to `!include <edgy/edgy2>`. This can sometimes be useful if the people involved

do not immediately know the color codes and concrete meanings of the EDGY elements by heart. Also color-blind people can benefit from this ;-)

```
@startuml
!include <edgy/edgy2>

$baseFacet("Basic elements") {
  $people("People")
  $outcome("Outcome")
  $activity("Activity")
  $object("Object")
}
@enduml
```



27.9 Elastic library [elastic]

Type	Link
stdlib	https://github.com/plantuml/plantuml-stdlib/tree/master/elastic
src	https://github.com/Crashedmind/PlantUML-Elastic-icons
orig	Elastic

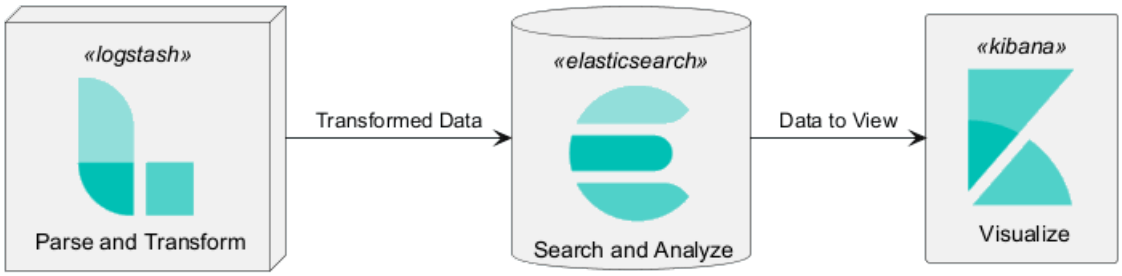
The Elastic library consists of Elastic icons. It is similar in use to the AWS and Azure libraries (it used the same tool to create them).

Use it by including the file that contains the sprite, eg: `!include elastic/elastic_search/elastic_search>`. When imported, you can use the sprite as normally you would, using `<$sprite_name>`.

You may also include the `common.puml` file, eg: `!include <elastic/common>`, which contains helper macros defined. With the `common.puml` imported, you can use the `NAME//OF//SPRITE(parameters...)` macro.

Example of usage:

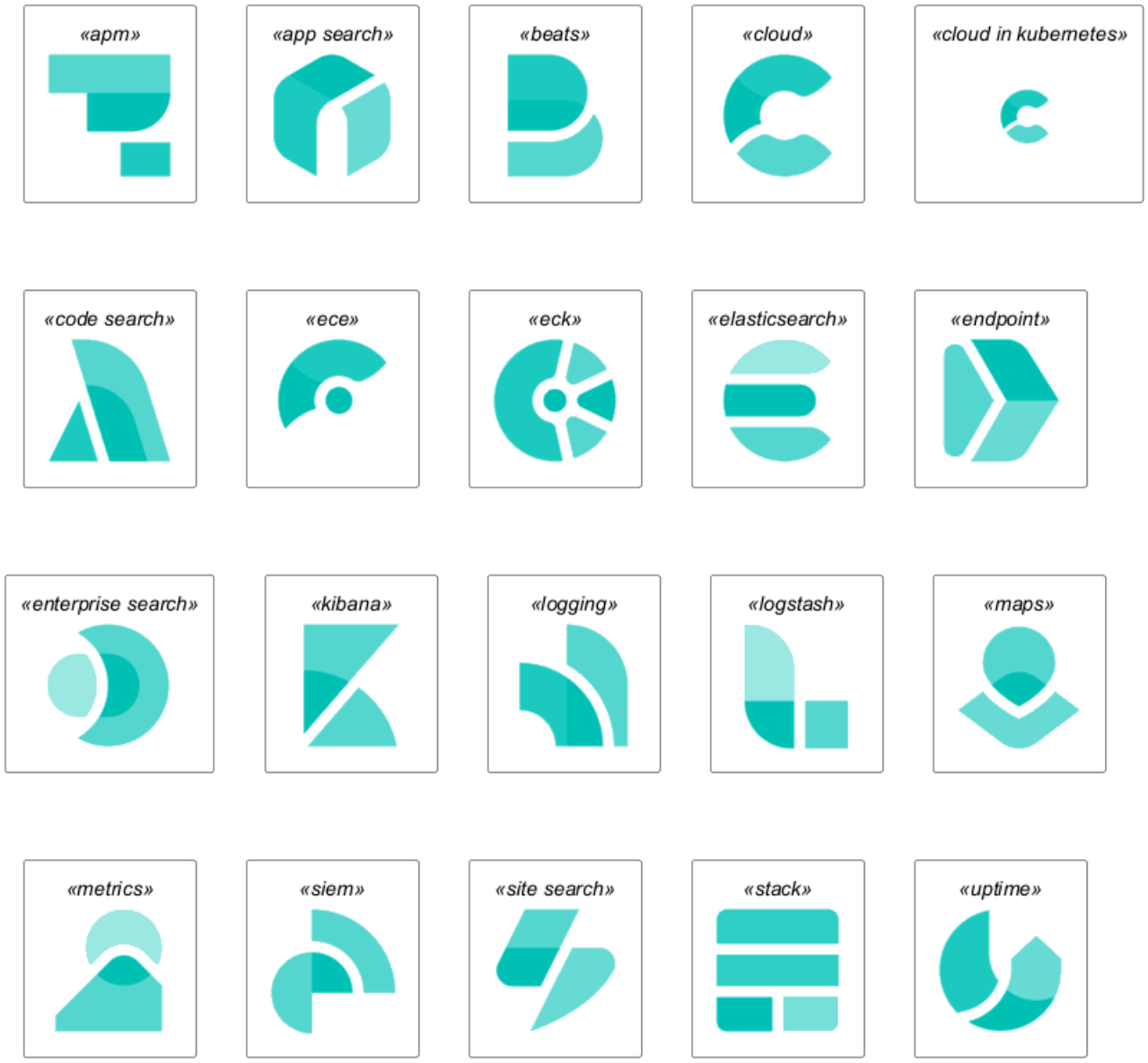
```
@startuml
!include <elastic/common>
!include <elastic/elasticsearch/elasticsearch>
!include <elastic/logstash/logstash>
!include <elastic/kibana/kibana>

ELASTICSEARCH(ElasticSearch, "Search and Analyze",database)
LOGSTASH(Logstash, "Parse and Transform",node)
KIBANA(Kibana, "Visualize",agent)

Logstash -right-> ElasticSearch: Transformed Data
ElasticSearch -right-> Kibana: Data to View
@enduml
```



All Elastic Sprite Set

```
@startuml
'Adapted from https://github.com/Crashedmind/PlantUML-Elastic-icons/blob/master/All.puml

'Elastic stuff here
'================================

!include <elastic/common>
!include <elastic/apm/apm>
!include <elastic/app_search/app_search>
!include <elastic/beats/beats>
!include <elastic/cloud/cloud>
!include <elastic/cloud_in_kubernetes/cloud_in_kubernetes>
!include <elastic/code_search/code_search>
!include <elastic/ece/ece>
!include <elastic/eck/eck>
' Beware of the difference between Crashedmind and plantuml-stdlib version: with '_' usage!
!include <elastic/elasticsearch/elasticsearch>
!include <elastic/endpoint/endpoint>
!include <elastic/enterprise_search/enterprise_search>
!include <elastic/kibana/kibana>
!include <elastic/logging/logging>
!include <elastic/logstash/logstash>
!include <elastic/maps/maps>
!include <elastic/metrics/metrics>
!include <elastic/siem/siem>
!include <elastic/site_search/site_search>
!include <elastic/stack/stack>
!include <elastic/uptime/uptime>

skinparam agentBackgroundColor White

APM(apm)
APP_SEARCH(app_search)
BEATS(beats)
CLOUD(cloud)
CLOUD_IN_KUBERNETES(cloud_in_kubernetes)
CODE_SEARCH(code_search)
ECE(ece)
ECK(eck)
ELASTICSEARCH(elastic_search)
ENDPOINT(endpoint)
ENTERPRISE_SEARCH(enterprise_search)
KIBANA(kibana)
LOGGING(logging)
LOGSTASH(logstash)
MAPS(maps)
METRICS(metrics)
```

```
SIEM(siem)
SITE_SEARCH(site_search)
STACK(stack)
UPTIME(uptime)
@enduml
```



27.10 Google Material Icons [material]

Type	Link
stdlib	https://github.com/plantuml/plantuml-stdlib/tree/master/material
src	https://github.com/Templarian/MaterialDesign
orig	Material Design Icons

This library consists of a free Material style icons from Google and other artists.

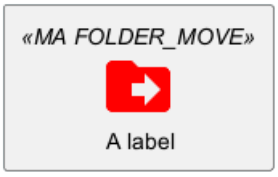
Use it by including the file that contains the sprite, eg: `!include <material/ma_folder_move>`. When imported, you can use the sprite as normally you would, using `<$ma_sprite_name>`. Notice that this library requires an `ma_` prefix on sprites names, this is to avoid clash of names if multiple sprites have the same name on different libraries.

You may also include the `common.puml` file, eg: `!include <material/common>`, which contains helper

macros defined. With the `common.puml` imported, you can use the `MA_NAME_OF_SPRITE(parameters...)` macro, note again the use of the prefix `MA_`.

Example of usage:

```
@startuml
!include <material/common>
' To import the sprite file you DON'T need to place a prefix!
!include <material/folder_move>

MA_FOLDER_MOVE(Red, 1, dir, rectangle, "A label")
@enduml
```



Notes:

When mixing sprites macros with other elements you may get a syntax error if, for example, trying to add a rectangle along with classes. In those cases, add `{` and `}` after the macro to create the empty rectangle.

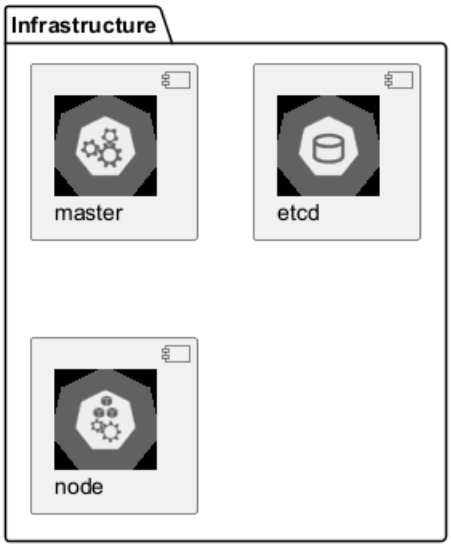
Example of usage:

```
@startuml
!include <material/common>
' To import the sprite file you DON'T need to place a prefix!
!include <material/folder_move>

MA_FOLDER_MOVE(Red, 1, dir, rectangle, "A label") {
}

class foo {
    bar
}
@enduml
```

27.11 Kubernetes [kubernetes]

Type	Link
stdlib	https://github.com/plantuml/plantuml-stdlib/tree/master/kubernetes
src	https://github.com/michiel/plantuml-kubernetes-sprites
orig	Kubernetes

```
@startuml
!include <kubernetes/k8s-sprites-unlabeled-25pct>
package "Infrastructure" {
  component "<$master>\nmaster" as master
  component "<$etcd>\netcd" as etcd
  component "<$node>\nnode" as node
}
@enduml
```

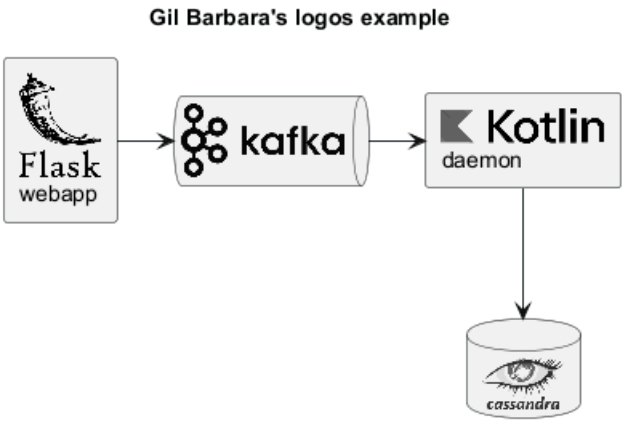


27.12 Logos [logos]

Type	Link
stdlib	https://github.com/plantuml/plantuml-stdlib/tree/master/logos
src	https://github.com/plantuml-stdlib/gilbarbara-plantuml-sprites
orig	Gil Barbara's logos

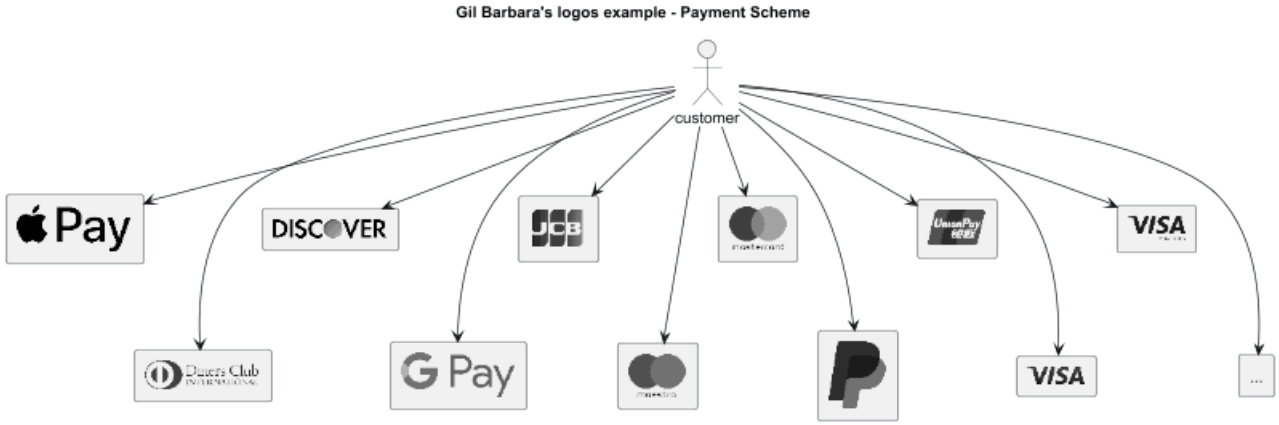
This repository contains PlantUML sprites generated from Gil Barbara's logos, which can easily be used in PlantUML diagrams for nice visual aid.

```
@startuml
!include <logos/flask>
!include <logos/kafka>
!include <logos/kotlin>
!include <logos/cassandra>

title Gil Barbara's logos example

skinparam monochrome true

rectangle "<$flask>\nwebapp" as webapp
queue "<$kafka>" as kafka
rectangle "<$kotlin>\ndaemon" as daemon
database "<$cassandra>" as cassandra

webapp -> kafka
kafka -> daemon
daemon --> cassandra
@enduml
```




```
@startuml
scale 0.7
!include <logos/apple-pay>
!include <logos/dinersclub>
!include <logos/discover>
!include <logos/google-pay>
!include <logos/jcb>
!include <logos/maestro>
!include <logos/mastercard>
!include <logos/paypal>
!include <logos/unionpay>
!include <logos/visaelectron>
!include <logos/visa>
' ...

title Gil Barbara's logos example - **Payment Scheme**

actor customer
rectangle "<$apple-pay>"    as ap
rectangle "<$dinersclub>"   as dc
rectangle "<$discover>"     as d
rectangle "<$google-pay>"   as gp
rectangle "<$jcb>"          as j
rectangle "<$maestro>"      as ma
rectangle "<$mastercard>"   as m
rectangle "<$paypal>"       as p
rectangle "<$unionpay>"     as up
rectangle "<$visa>"         as v
rectangle "<$visaelectron>" as ve
rectangle "..." as etc

customer --> ap
customer ---> dc
customer --> d
customer ---> gp
customer --> j
customer ---> ma
customer --> m
customer ---> p
customer --> up
customer ---> v
customer --> ve
customer ---> etc
```

```
@enduml
```



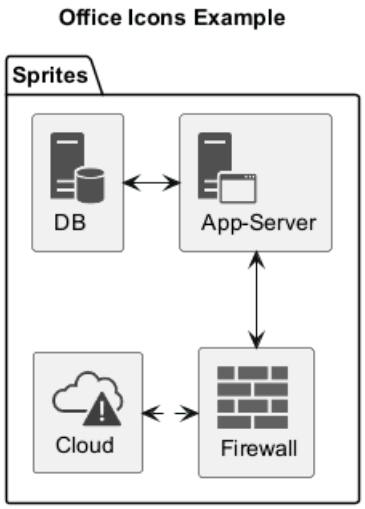
27.13 Office [office]

Type	Link
stdlib	https://github.com/plantuml/plantuml-stdlib/tree/master/office
src	https://github.com/Roemer/plantuml-office
orig	

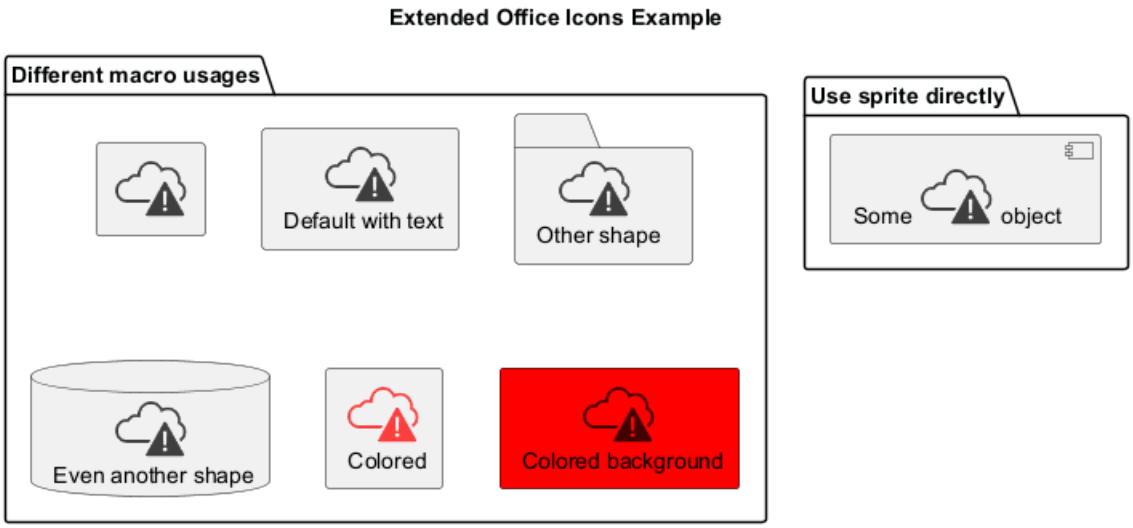
There are sprites (*.puml) and colored png icons available. Be aware that the sprites are all only monochrome even if they have a color in their name (due to automatically generating the files). You can either color the sprites with the macro (see examples below) or directly use the fully colored pngs. See the following examples on how to use the sprites, the pngs and the macros.

Example of usage:

```
@startuml
!include <tupadr3/common>

!include <office/Servers/database_server>
!include <office/Servers/application_server>
!include <office/Concepts/firewall_orange>
!include <office/Clouds/cloud_disaster_red>

title Office Icons Example

package "Sprites" {
    OFF_DATABASE_SERVER(db,DB)
    OFF_APPLICATION_SERVER(app,App-Server)
    OFF_FIREWALL_ORANGE(fw,Firewall)
    OFF_CLOUD_DISASTER_RED(cloud,Cloud)
    db <-> app
    app <--> fw
    fw <.left.> cloud
}
@enduml
```




```
@startuml
!include <tupadr3/common>

!include <office/servers/database_server>
!include <office/servers/application_server>
!include <office/Concepts/firewall_orange>
!include <office/Clouds/cloud_disaster_red>

' Used to center the label under the images
skinparam defaultTextAlignment center

title Extended Office Icons Example

package "Use sprite directly" {
    [Some <$cloud_disaster_red> object]
}

package "Different macro usages" {
    OFF_CLOUD_DISASTER_RED(cloud1)
    OFF_CLOUD_DISASTER_RED(cloud2,Default with text)
    OFF_CLOUD_DISASTER_RED(cloud3,Other shape,Folder)
    OFF_CLOUD_DISASTER_RED(cloud4,Even another shape,Database)
    OFF_CLOUD_DISASTER_RED(cloud5,Colored,Rectangle, red)
    OFF_CLOUD_DISASTER_RED(cloud6,Colored background) #red
}
@enduml
```



27.14 Open Security Architecture (OSA) [osa]

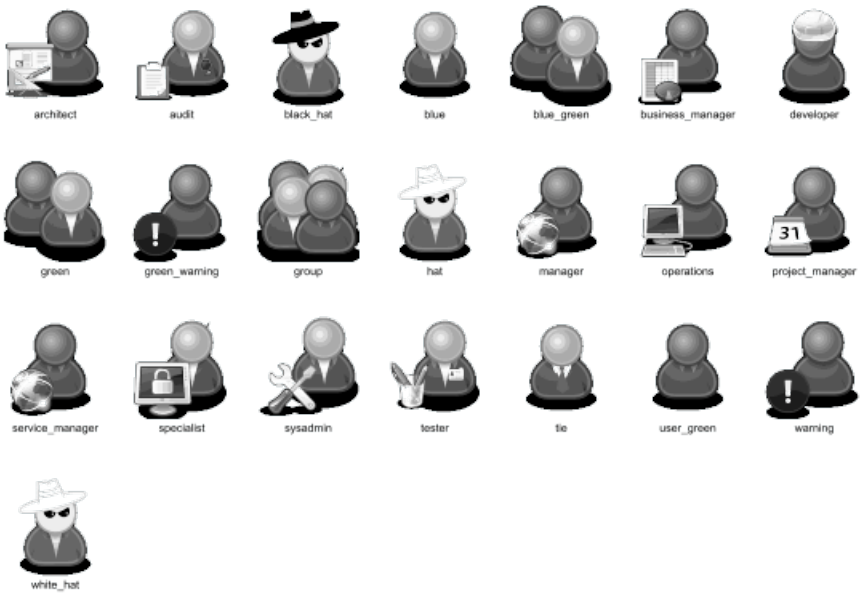
Type	Link
stdlib	https://github.com/plantuml/plantuml-stdlib/tree/master/osa
src	https://github.com/Crashedmind/PlantUML-opensecurityarchitecture-iconshttps://github.com/Crashedmin
orig	https://www.opensecurityarchitecture.org

```
@startuml
'Adapted from https://github.com/Crashedmind/PlantUML-opensecurityarchitecture-icons/blob/master/all
scale .5
!include <osa/arrow/green/left/left>
!include <osa/arrow/yellow/right/right>
!include <osa/awareness/awareness>
!include <osa/contract/contract>
!include <osa/database/database>
!include <osa/desktop/desktop>
!include <osa/desktop/imac/imac>
!include <osa/device_music/device_music>
!include <osa/device_scanner/device_scanner>
!include <osa/device_usb/device_usb>
!include <osa/device_wireless_router/device_wireless_router>
!include <osa/disposal/disposal>
!include <osa/drive_optical/drive_optical>
!include <osa/firewall/firewall>
!include <osa/hub/hub>
!include <osa/ics/drive/drive>
!include <osa/ics/plc/plc>
!include <osa/ics/thermometer/thermometer>
!include <osa/id/card/card>
!include <osa/laptop/laptop>
!include <osa/lifecycle/lifecycle>
!include <osa/lightning/lightning>
!include <osa/media_flash/media_flash>
!include <osa/media_optical/media_optical>
!include <osa/media_tape/media_tape>
!include <osa/mobile/pda/pda>
!include <osa/padlock/padlock>
!include <osa/printer/printer>
!include <osa/site_branch/site_branch>
!include <osa/site_factory/site_factory>
!include <osa/vpn/vpn>
```

```
!include <osa/wireless/network/network>

rectangle "OSA" {
rectangle "Left:\n <$left>"
rectangle "Right:\n <$right>"
rectangle "Awareness:\n <$awareness>"
rectangle "Contract:\n <$contract>"
rectangle "Database:\n <$database>"
rectangle "Desktop:\n <$desktop>"
rectangle "Imac:\n <$imac>"
rectangle "Device_music:\n <$device_music>"
rectangle "Device_scanner:\n <$device_scanner>"
rectangle "Device_usb:\n <$device_usb>"
rectangle "Device_wireless_router:\n <$device_wireless_router>"
rectangle "Disposal:\n <$disposal>"
rectangle "Drive_optical:\n <$drive_optical>"
rectangle "Firewall:\n <$firewall>"
rectangle "Hub:\n <$hub>"
rectangle "Drive:\n <$drive>"
rectangle "Plc:\n <$plc>"
rectangle "Thermometer:\n <$thermometer>"
rectangle "Card:\n <$card>"
rectangle "Laptop:\n <$laptop>"
rectangle "Lifecycle:\n <$lifecycle>"
rectangle "Lightning:\n <$lightning>"
rectangle "Media_flash:\n <$media_flash>"
rectangle "Media_optical:\n <$media_optical>"
rectangle "Media_tape:\n <$media_tape>"
rectangle "Pda:\n <$pda>"
rectangle "Padlock:\n <$padlock>"
rectangle "Printer:\n <$printer>"
rectangle "Site_branch:\n <$site_branch>"
rectangle "Site_factory:\n <$site_factory>"
rectangle "Vpn:\n <$vpn>"
rectangle "Network:\n <$network>"
}
@enduml
```


```
@startuml
scale .5
!include <osa/user/audit/audit>
'beware of 'hat-sprite'
!include <osa/user/black/hat/hat-sprite>
!include <osa/user/blue/blue>
!include <osa/user/blue/security/specialist/specialist>
!include <osa/user/blue/sysadmin/sysadmin>
!include <osa/user/blue/tester/tester>
!include <osa/user/blue/tie/tie>
!include <osa/user/green/architect/architect>
!include <osa/user/green/business/manager/manager>
!include <osa/user/green/developer/developer>
!include <osa/user/green/green>
!include <osa/user/green/operations/operations>
!include <osa/user/green/project/manager/manager>
!include <osa/user/green/service/manager/manager>
!include <osa/user/green/warning/warning>
!include <osa/user/large/group/group>
!include <osa/users/blue/green/green>
!include <osa/user/white/hat/hat>

listsprites
```

```
@enduml
```



27.15 Tupadr3 library [tupadr3]

Type	Link
stdlib	https://github.com/plantuml/plantuml-stdlib/tree/master/tupadr3
src	https://github.com/tupadr3/plantuml-icon-font-sprites
orig	https://github.com/tupadr3/plantuml-icon-font-sprites#icon-sets

This library contains several libraries of icons (including Devicons and Font Awesome).

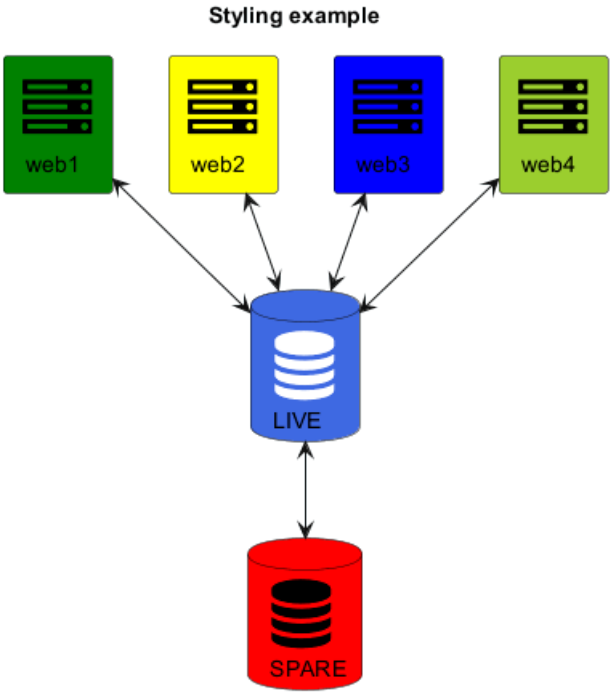
Use it by including the file that contains the sprite, eg: `!include <font-awesome/align_center>`. When imported, you can use the sprite as normally you would, using `<$sprite_name>`.

You may also include the `common.puml` file, eg: `!include <font-awesome/common>`, which contains helper macros defined. With the `common.puml` imported, you can use the `NAME_OF_SPRITE(parameters...)` macro.

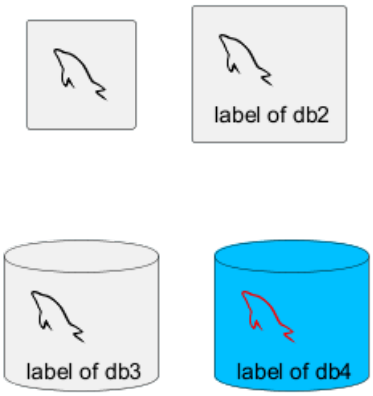
Example of usage:

```
@startuml
!include <tupadr3/common>
!include <tupadr3/font-awesome/server>
!include <tupadr3/font-awesome/database>

title Styling example

FA_SERVER(web1,web1) #Green
FA_SERVER(web2,web2) #Yellow
FA_SERVER(web3,web3) #Blue
FA_SERVER(web4,web4) #YellowGreen

FA_DATABASE(db1,LIVE,database,white) #RoyalBlue
FA_DATABASE(db2,SPARE,database) #Red

db1 <--> db2

web1 <--> db1
web2 <--> db1
web3 <--> db1
web4 <--> db1
```

```
@enduml
```




```
@startuml
!include <tupadr3/common>
!include <tupadr3/devicons/mysql>

DEV_MYSQL(db1)
DEV_MYSQL(db2,label of db2)
DEV_MYSQL(db3,label of db3,database)
DEV_MYSQL(db4,label of db4,database,red) #DeepSkyBlue
@enduml
```



27.16 AWS library [aws]

Type	Link
stdlib	https://github.com/plantuml/plantuml-stdlib/tree/master/aws
src	https://github.com/milo-minderbinder/AWS-PlantUML
orig	https://aws.amazon.com/en/architecture/icons/

Warning: We are thinking about deprecating this library.

So you should probably use `<awslib>` instead (see above).

hr

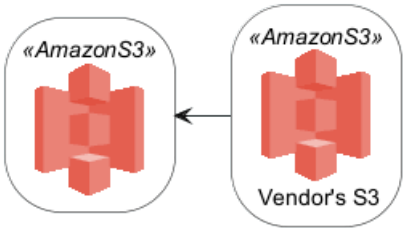
The AWS library consists of Amazon AWS icons, it provides icons of two different sizes (normal and large).

Use it by including the file that contains the sprite, eg: `!include <aws/Storage/AmazonS3/AmazonS3>`. When imported, you can use the sprite as normally you would, using `<$sprite_name>`.

You may also include the `common.puml` file, eg: `!include <aws/common>`, which contains helper macros defined. With the `common.puml` imported, you can use the `NAME_OF_SPRITE(parameters...)` macro.

Example of usage:

```
@startuml
!include <aws/common>
!include <aws/Storage/AmazonS3/AmazonS3>

AMAZONS3(s3_internal)
AMAZONS3(s3_partner,"Vendor's S3")
s3_internal <- s3_partner
@enduml
```



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