Dynamic Scores for Interactive Music

INScore 1.0

Dominique Fober <fober@grame.fr>

Conférences/Rencontres - GRAME - 29 Avril 2013 - UJM Saint Etienne

INScore

An Environment for the Design of Augmented Live Music Scores

An opened graphic space

- Symbolic music notation [GMN, MusicXML]
- Text, images, vectorial graphic, video
- Sound and gestures graphic representations

INScore

An Environment for the Design of Augmented Live Music Scores

An opened graphic space

- Symbolic music notation [GMN, MusicXML]
- Text, images, vectorial graphic, video
- Sound and gestures graphic representations

A synchronized time space

- Time synchronization in the graphic space

INScore

An Environment for the Design of Augmented Live Music Scores

An opened graphic space

- Symbolic music notation [GMN, MusicXML]
- Text, images, vectorial graphic, video
- Sound and gestures graphic representations

A synchronized time space

- Time synchronization in the graphic space

A scriptable environment

- a message based API (OSC extended)

INScore

An Environment for the Design of Augmented Live Music Scores

An opened graphic space

- Symbolic music notation [GMN, MusicXML]
- Text, images, vectorial graphic, video
- Sound and gestures graphic representations

A synchronized time space

- Time synchronization in the graphic space

A scriptable environment

- a message based API (OSC extended)

Events based interaction capabilities

INScore

An Environment for the Design of Augmented Live Music Scores

An opened graphic space

- Symbolic music notation [GMN, MusicXML]
- Text, images, vectorial graphic, video
- Sound and gestures graphic representations

A synchronized time space

- Time synchronization in the graphic space

A scriptable environment

- a message based API (OSC extended)

Events based interaction capabilities

A set of ressources

- a multi-platforms score viewer
- an open source C/C++ library

INScore

An Environment for the Design of Augmented Live Music Scores

An opened graphic space

- Symbolic music notation [GMN, MusicXML]
- Text, images, vectorial graphic, video
- Sound and gestures graphic representations

A synchronized time space

- Time synchronization in the graphic space

A scriptable environment

- a message based API (OSC extended)

A set of ressources

- a multi-platforms score viewer
- an open source C/C++ library

Events based interaction capabilities

http://inscore.sf.net

Performance representation

Hypothesis

Approach the graphic of a signal as a *graphic signal*.

Performance representation

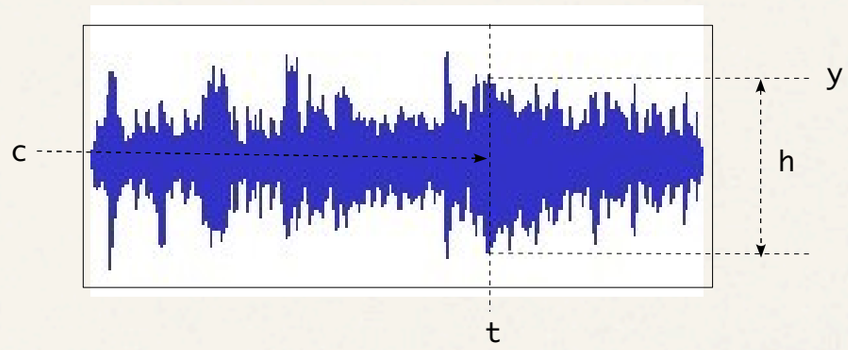
Hypothesis

Approach the graphic of a signal as a *graphic signal*.

A graphic signal

A composite signal made of:

- a *y* signal
- a thickness signal
- a color signal



Performance representation

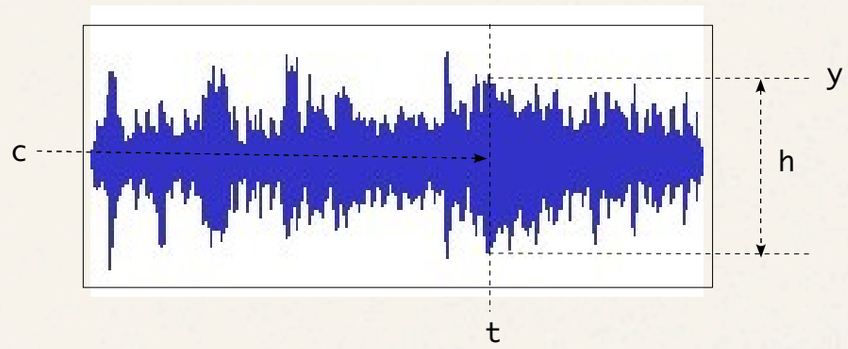
Hypothesis

Approach the graphic of a signal as a *graphic signal*.

A graphic signal

A composite signal made of:

- a y signal
- a thickness signal
- a color signal



Consider a signal S defined as a time function: $f(t) : \mathbb{R} \to \mathbb{R}^3 = (y, h, c) \mid y, h, c \in \mathbb{R}$

Performance representation

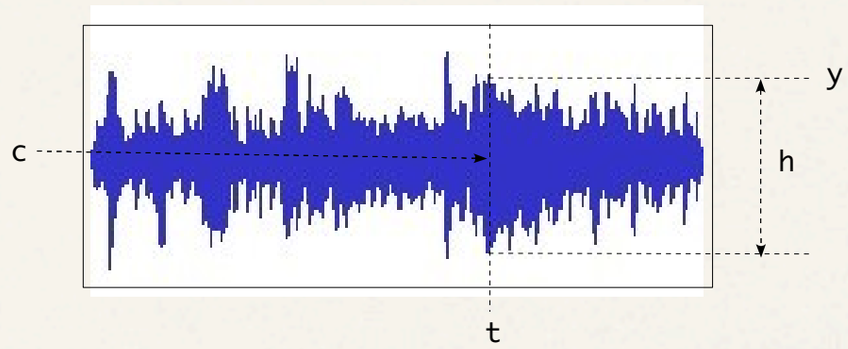
Hypothesis

Approach the graphic of a signal as a *graphic signal*.

A graphic signal

A composite signal made of:

- a y signal
- a thickness signal
- a color signal



Consider a signal S defined as a time function: $f(t) : \mathbb{R} \to \mathbb{R}^3 = (y, h, c) \mid y, h, c \in \mathbb{R}$

This signal could be directly drawn (i.e. without additional computation)

Performance representation

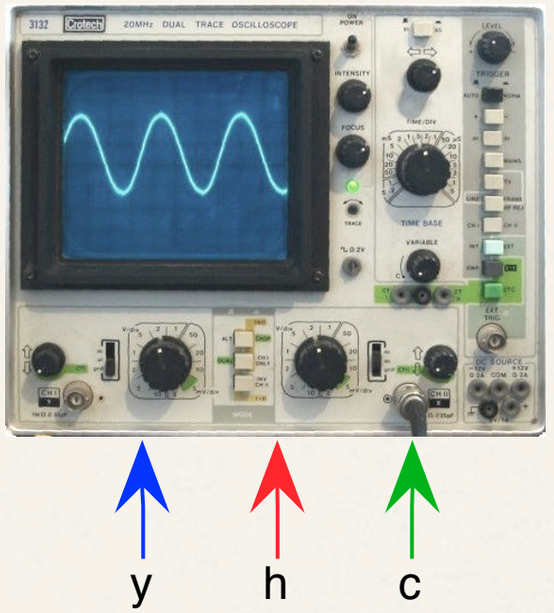
Hypothesis

Approach the graphic of a signal as a *graphic signal*.

A graphic signal

A composite signal made of:

- a y signal
- a thickness signal
- a color signal



Consider a signal S defined as a time function: $f(t) : \mathbb{R} \rightarrow \mathbb{R}^3 = (y, h, c) \mid y, h, c \in \mathbb{R}$

This signal could be directly drawn (i.e. without additional computation)

Performance representation
System expressivity

Examples

Performance representation
System expressivity

Examples

$$g = S_{f0} \,/\, k_t \,/\, k_c$$

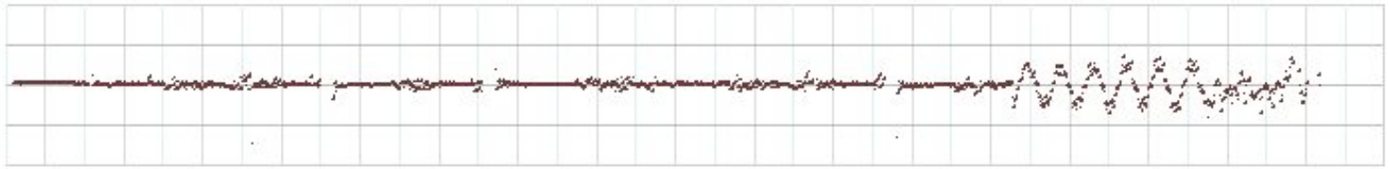
S_{f0} : fundamental frequency

k_t : constant thickness signal

k_c : constant color signal

Performance representation
System expressivity

Examples



$$g = S_{f0} - S_{fr} \;/\; k_t \;/\; k_c$$

S_{f0} : fundamental frequency

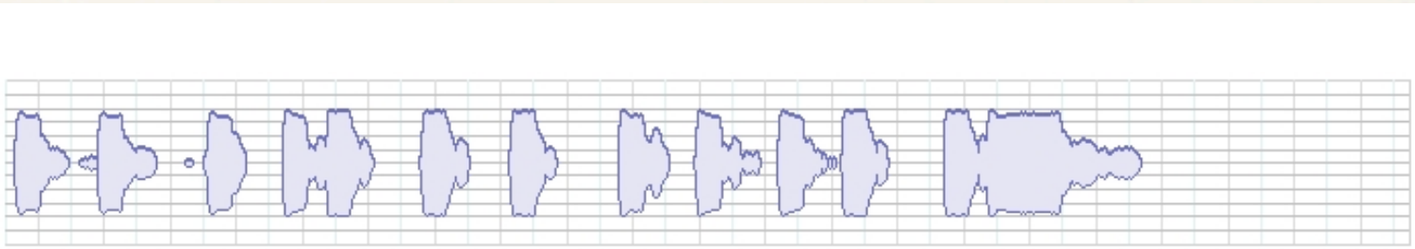
S_{fr} : reference frequency

k_t : constant thickness signal

k_c : constant color signal

Performance representation
System expressivity

Examples



$g = k_y \ / \ S_{rms} \ / \ k_c$

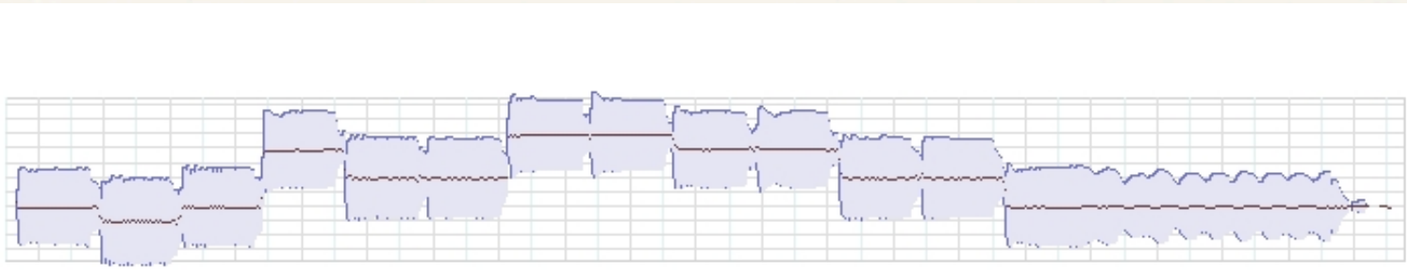
S_{rms} : RMS signal

k_y : constant *y* signal

k_c : constant color signal

Performance representation
System expressivity

Examples



$g = S_{f0} \ / \ S_{rms} \ / \ k_c$

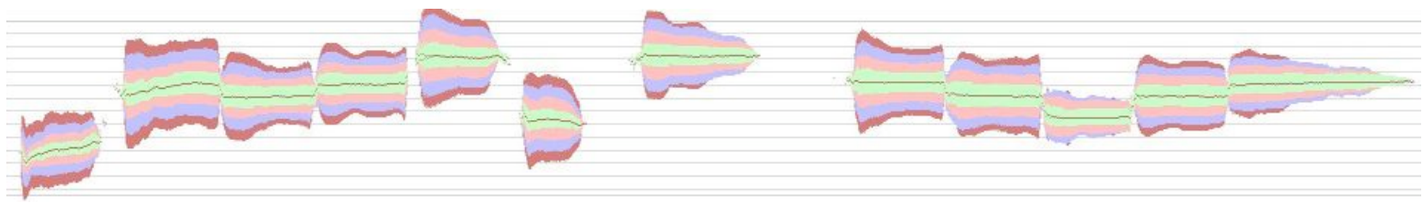
S_{rms} : RMS signal

S_{f0} : fundamental frequency

k_c : constant color signal

Performance representation
System expressivity

Examples



$g0 = S_{f0} \ / \ S_{rms0} \ / \ k_c0$

S_{f0} : fundamental frequency

S_{rms0} : f0 RMS values

$g1 = S_{f0} \ / \ S_{rms1} + S_{rms0} \ / \ k_c1$

S_{rms1} : f1 RMS values

$g2 = S_{f0} / \ S_{rms2} + S_{rms1} + S_{rms0} \ / \ k_c2$

S_{rms2} : f2 RMS values

...

$g = g2 \ / \ g1 \ / \ g0$

INScore OSC Messages

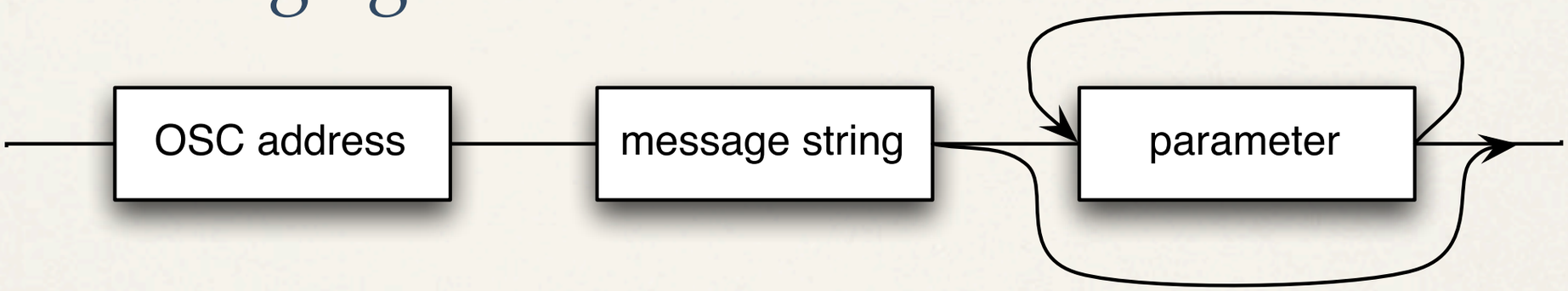
An «object oriented» approach

INScore OSC Messages

An «object oriented» approach

- The OSC address is like an object pointer.
- An OSC message is similar to an object method call.
- The OSC address space is dynamic.

OSC message general format

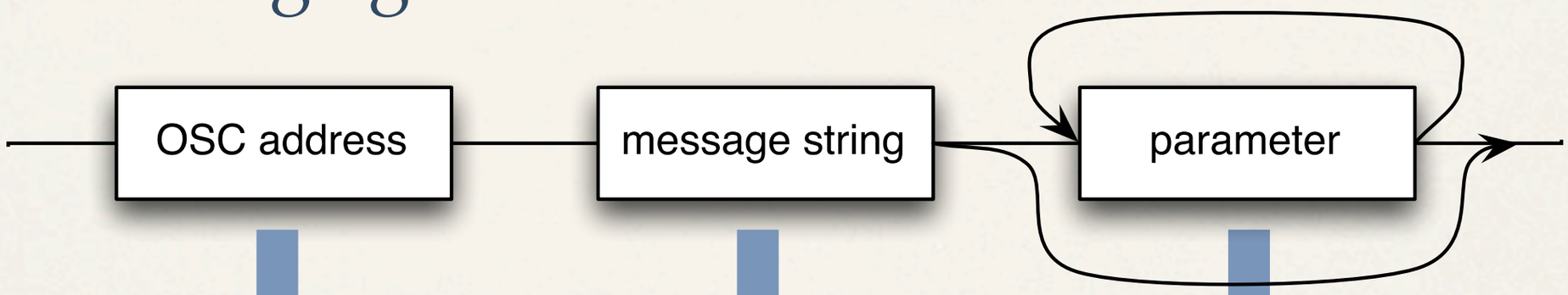


INScore OSC Messages

An «object oriented» approach

- The OSC address is like an object pointer.
- An OSC message is similar to an object method call.
- The OSC address space is dynamic.

OSC message general format

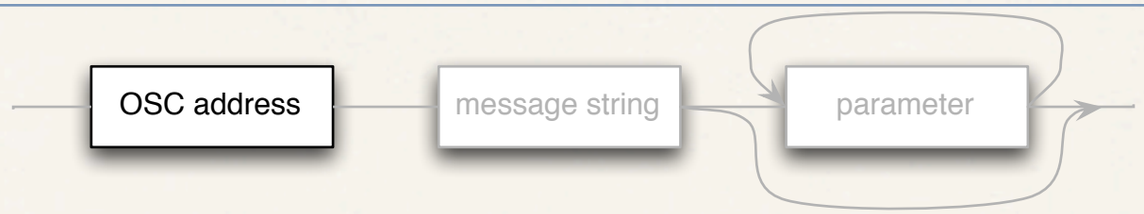


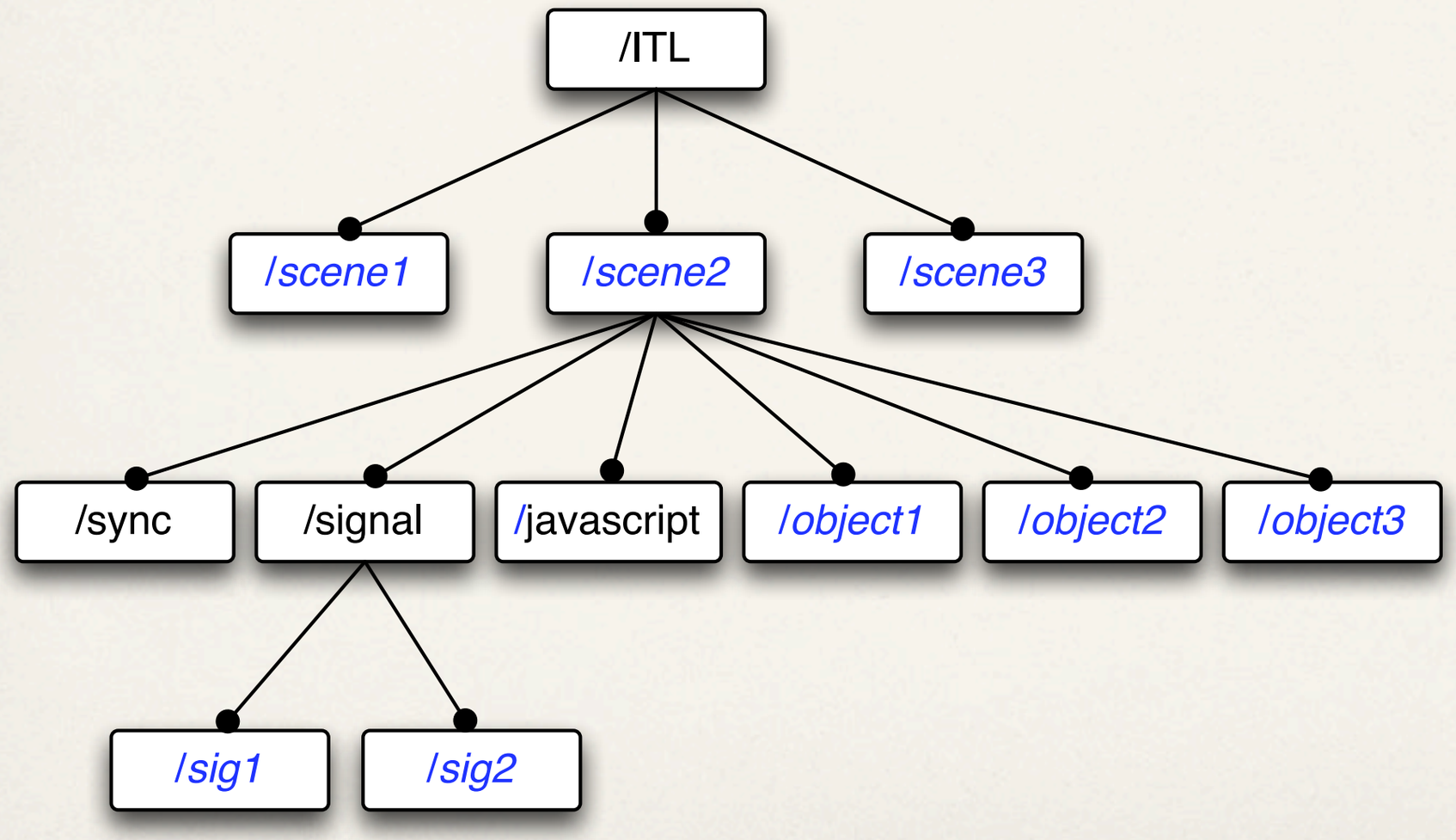
Example

```
/ITL/scene/score  color   255 128 40 150
```

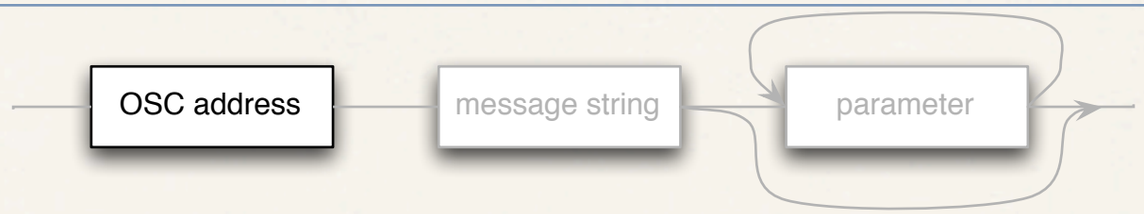
```
score->color(255, 128, 40, 150)
```

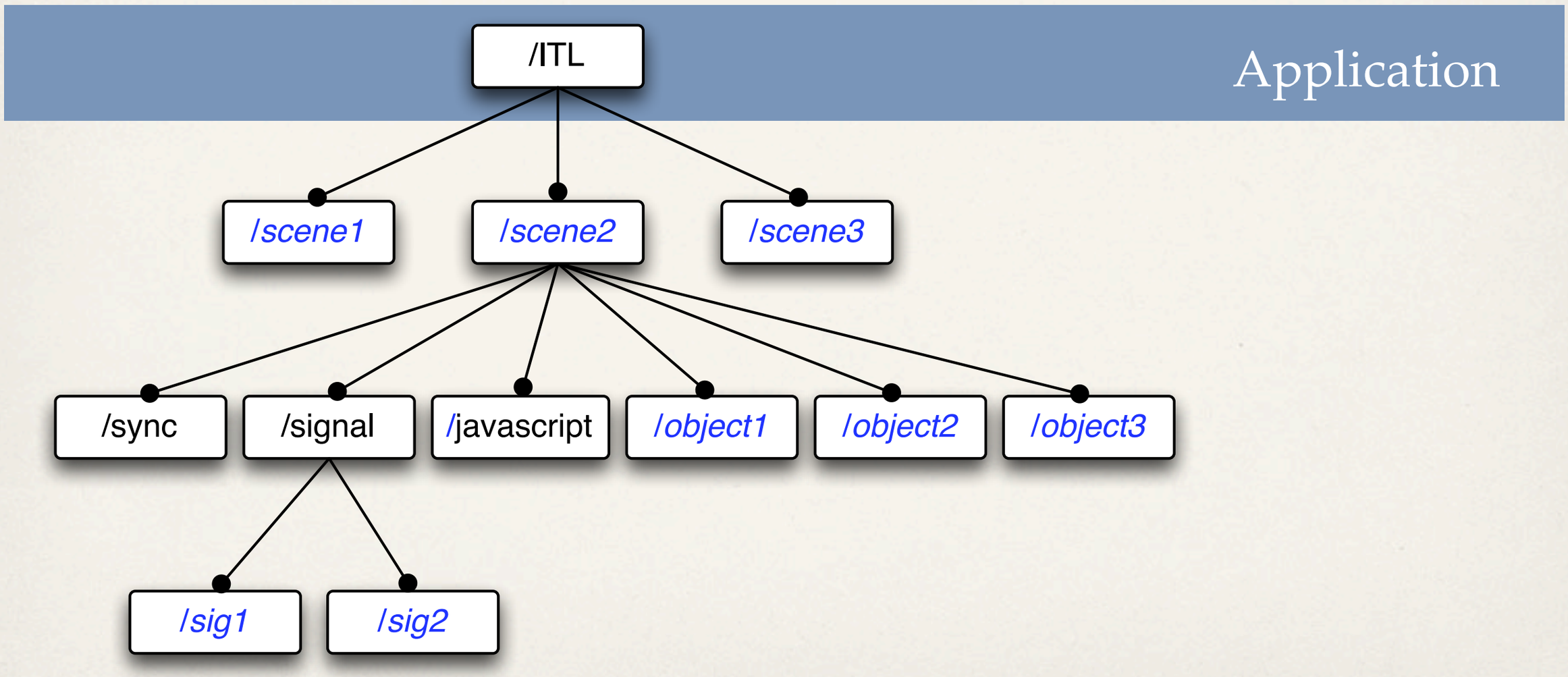
INScore OSC Address Space



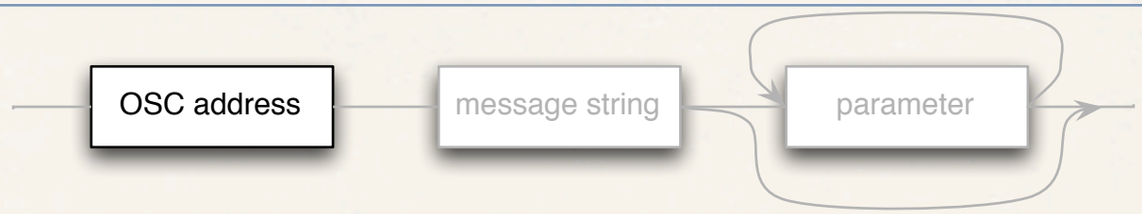


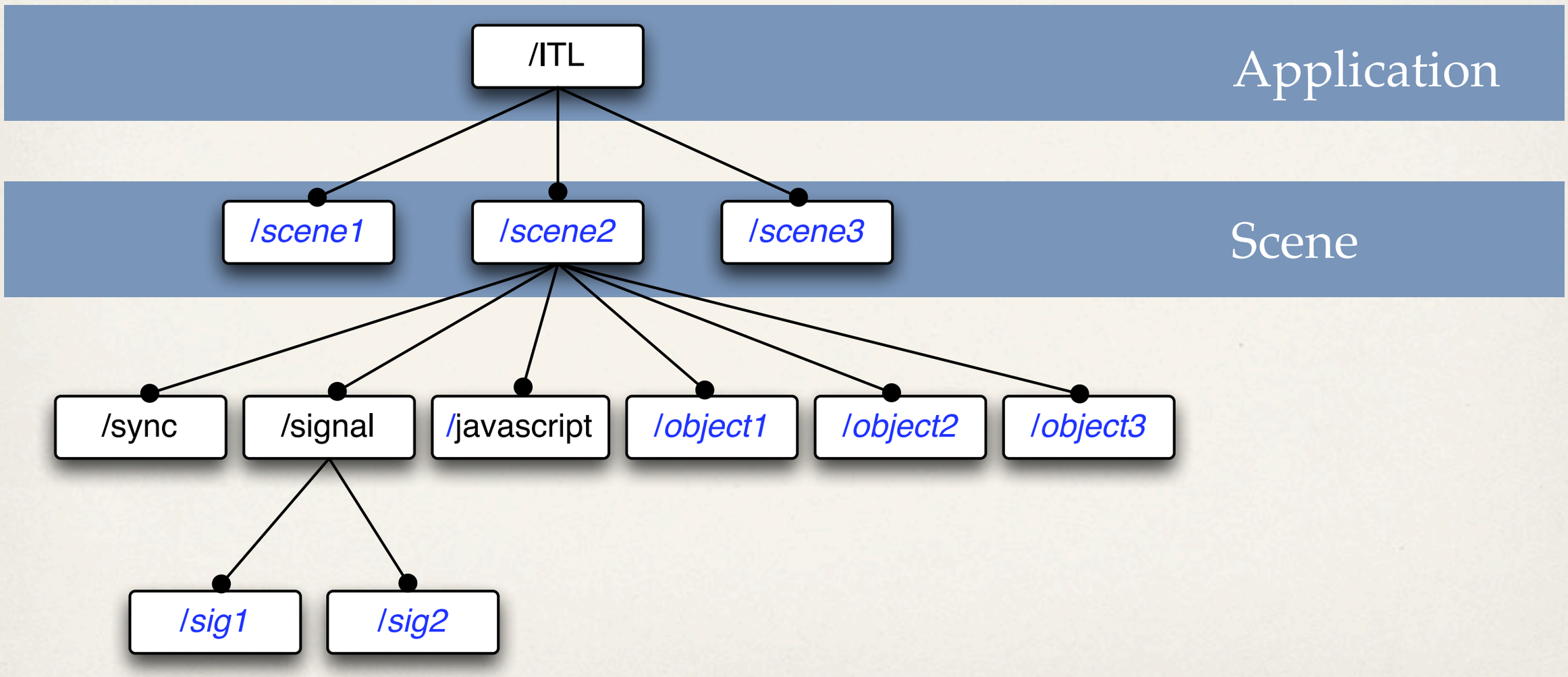
INScore OSC Address Space



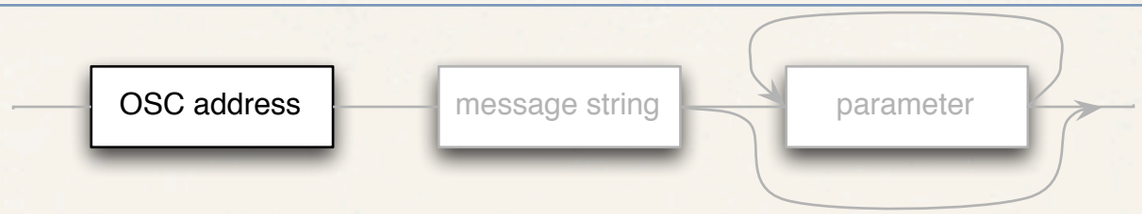


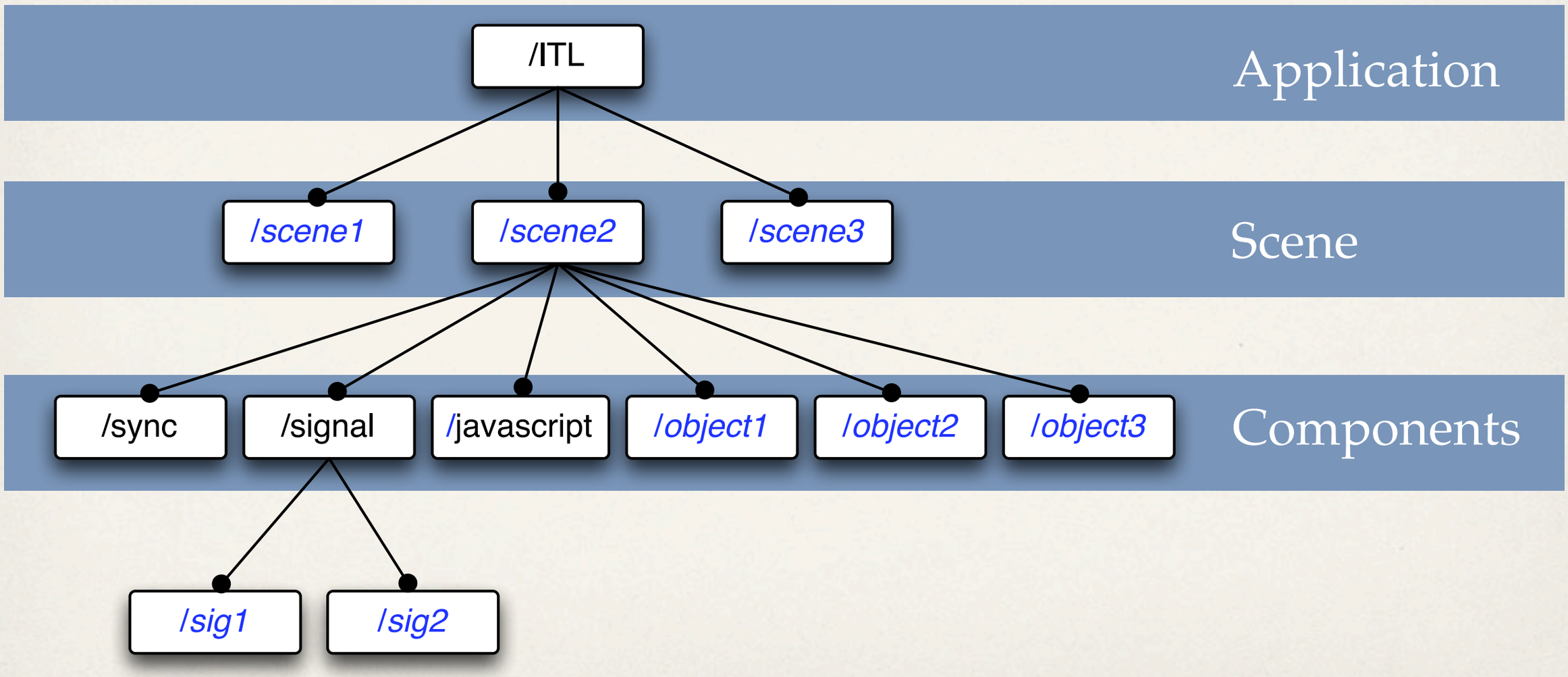
INScore OSC Address Space



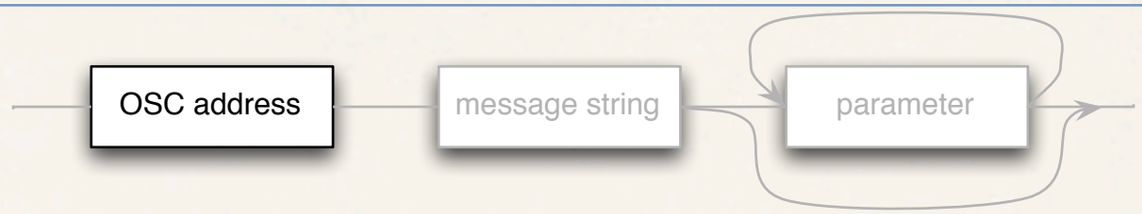


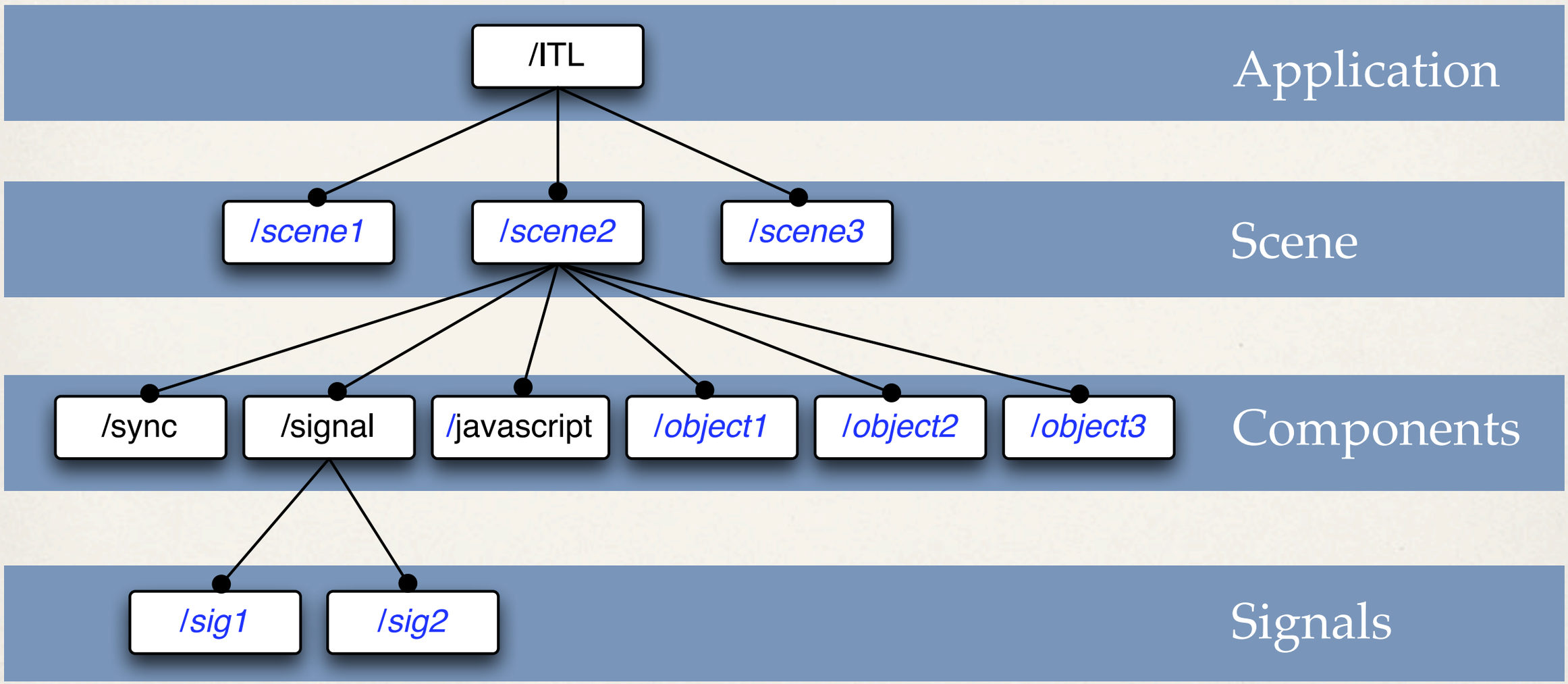
INScore OSC Address Space





INScore OSC Address Space





INScore

DEMO

INScore 1.0

- New scripting capabilities.
- Interactive features extension.
- Gesture following

Scripting language

Generalization of extended addresses.

Valid addresses:

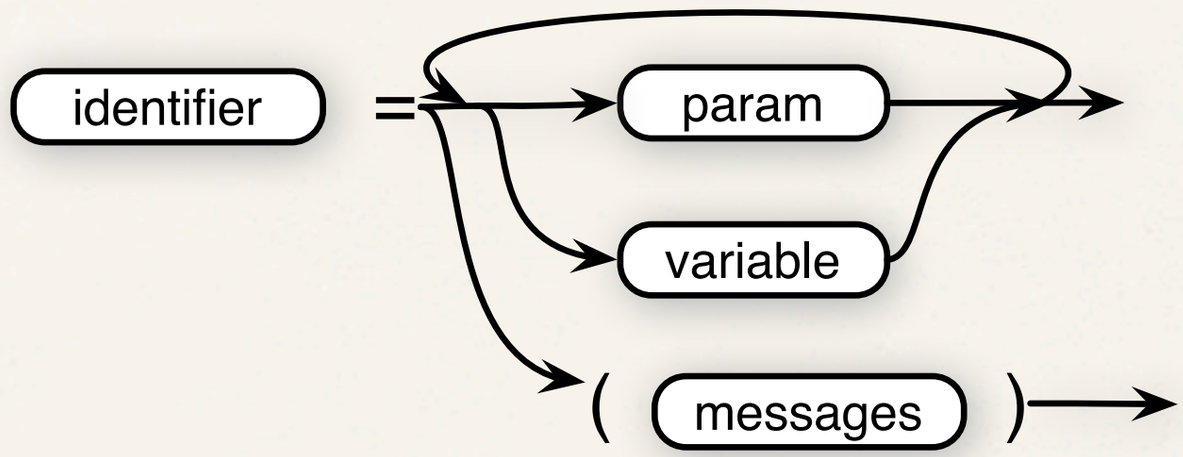
```
/ITL/scene/score

192.168.1.5:7000/ITL/scene/score

localhost:7001/world
```

Scripting language

Variables




```
color = 200 200 200;
colorwithalpha = $color 100;
msgsvar = (  localhost:7001/world "Hello",
             localhost:7001/world "how are you?" );
```

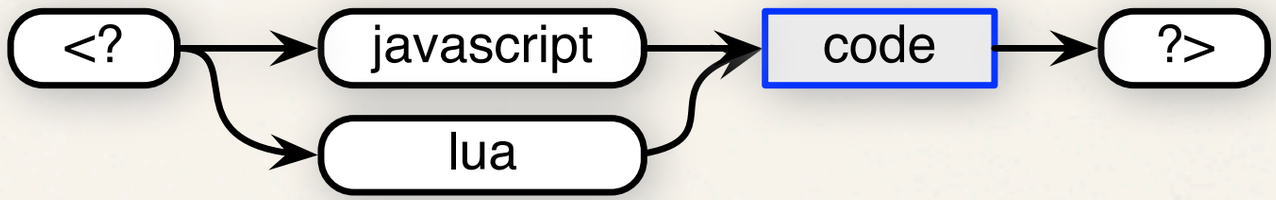
Scripting language

Messages as parameters

```
/ITL/scene/out set  txt "INScore version is" $(/ITL get version);
```

Scripting language

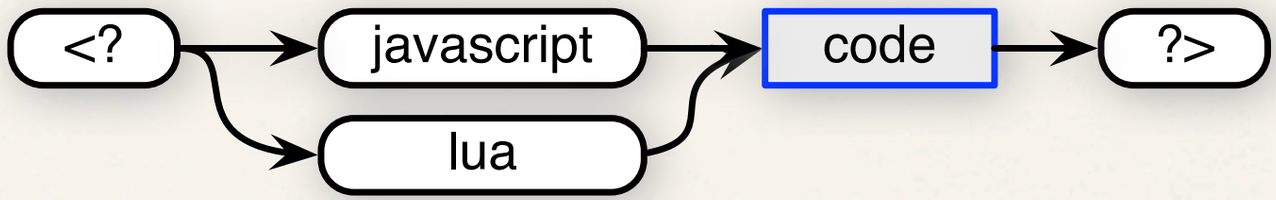
Algorithmic scripts



Javascript and Lua supported.
Valid INScore script expected as output.

Scripting language

Algorithmic scripts



Javascript and Lua supported.
Valid INScore script expected as output.

Javascript engine available from OSC:

```
/ITL/scene/javascript run 'myJSFunction()'
```

Misc. features

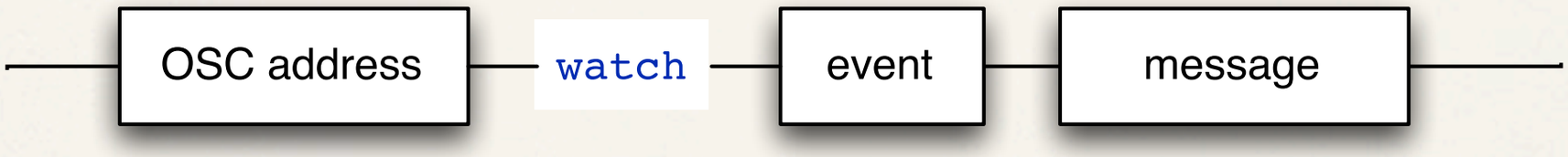
- new 'push' and 'pop' messages.
- new 'forward' message at application level.
- new 'stats' virtual node at application level
- ...

INScore

DEMO

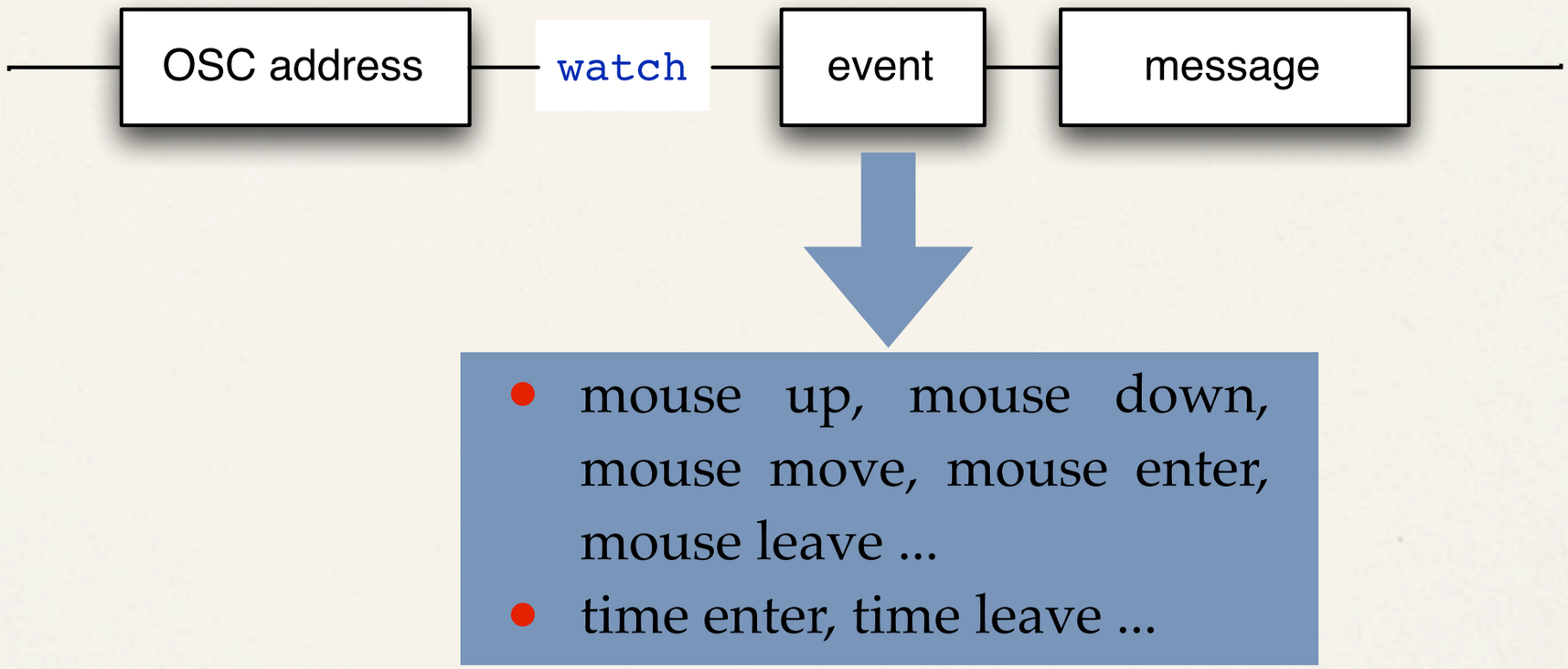
Interaction Messages

Basic principle



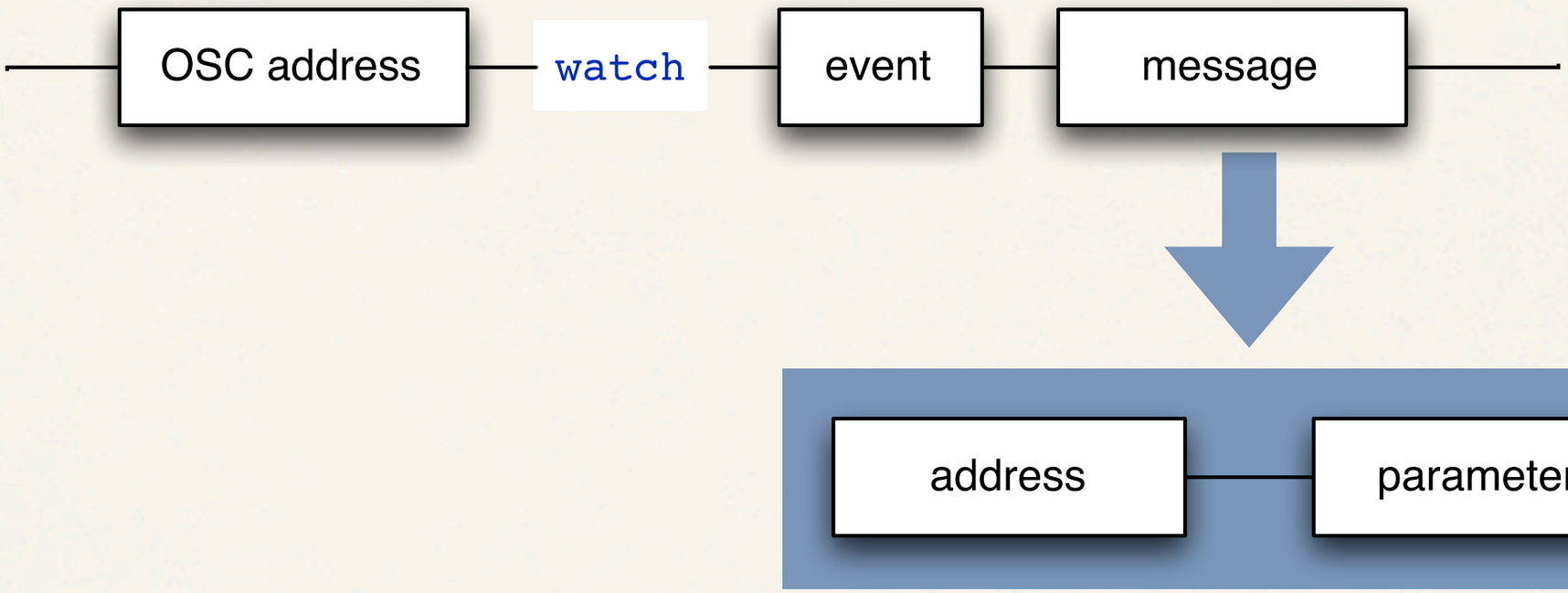
Interaction Messages

Basic principle



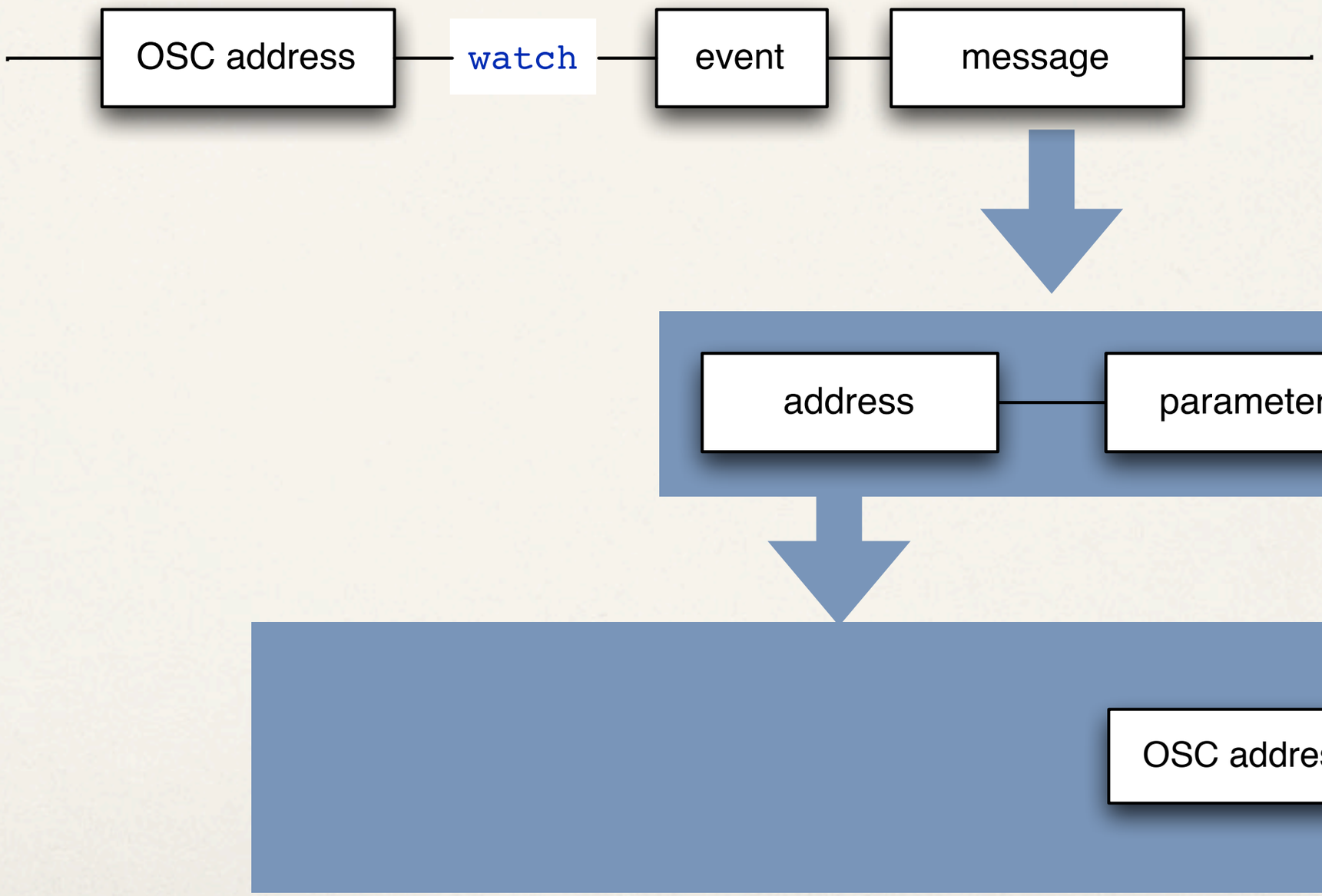
Interaction Messages

Basic principle



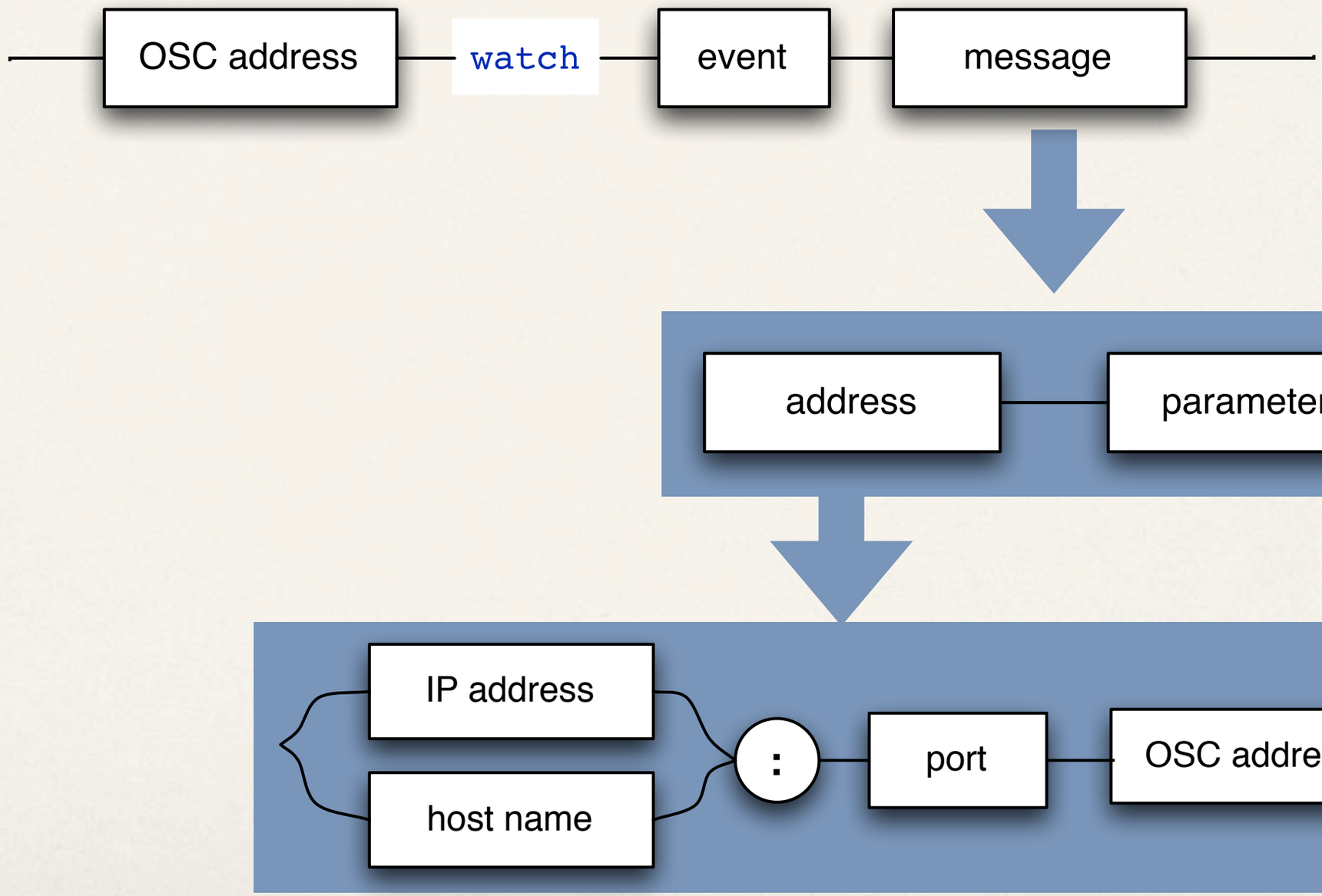
Interaction Messages

Basic principle



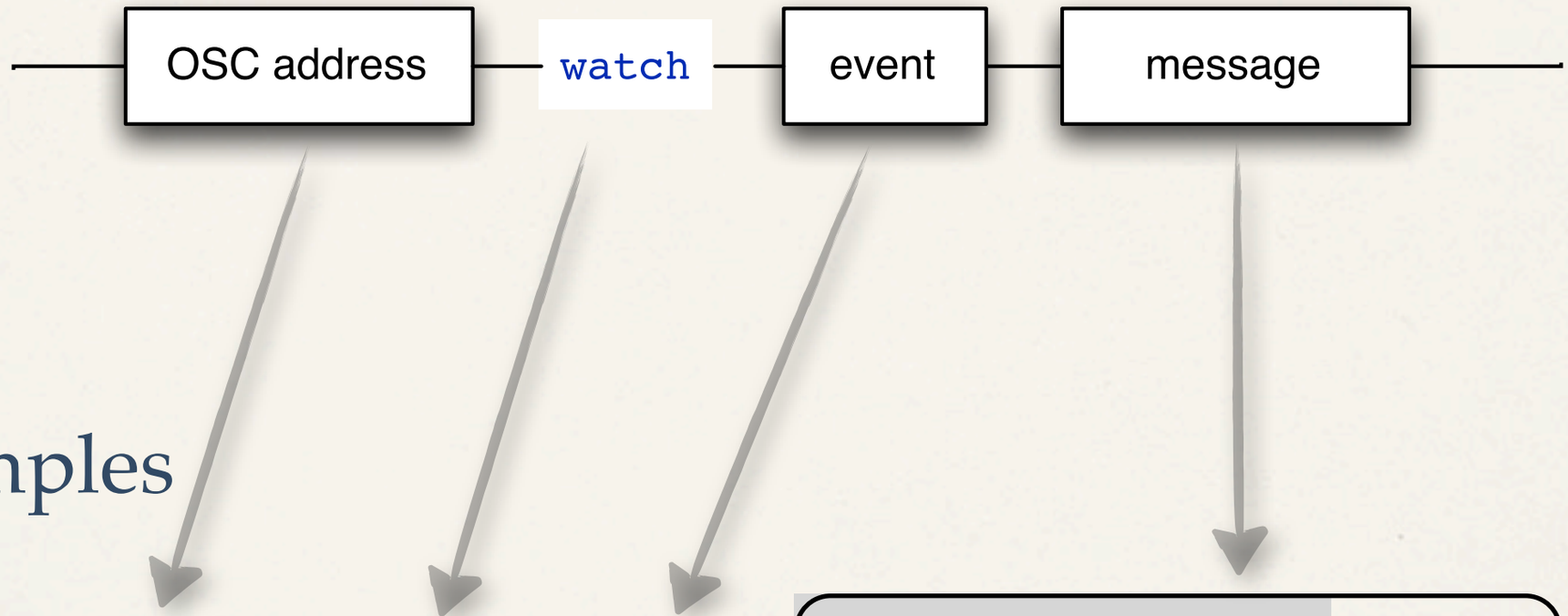
Interaction Messages

Basic principle



Interaction Messages

Basic principle

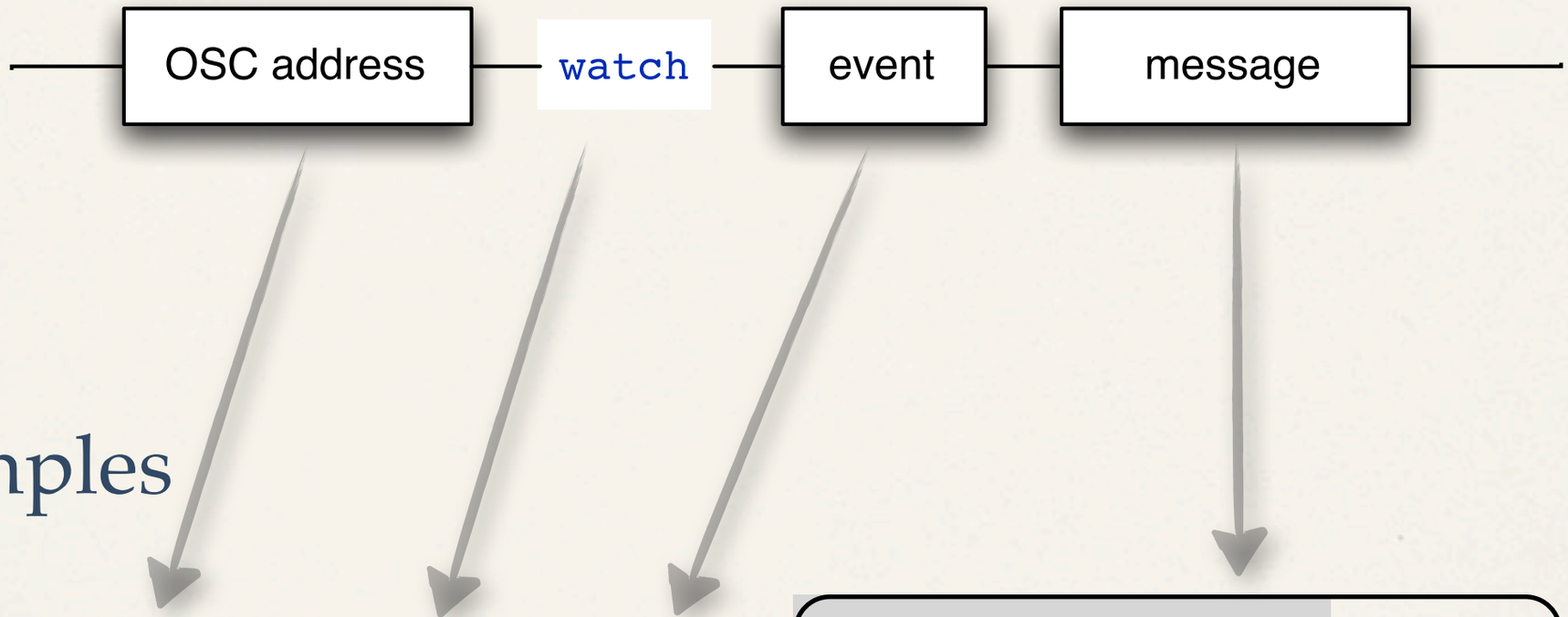


Examples

```
/ITL/scene/myObject watch mouseDown /ITL/scene/myObject show 0
```

Interaction Messages

Basic principle



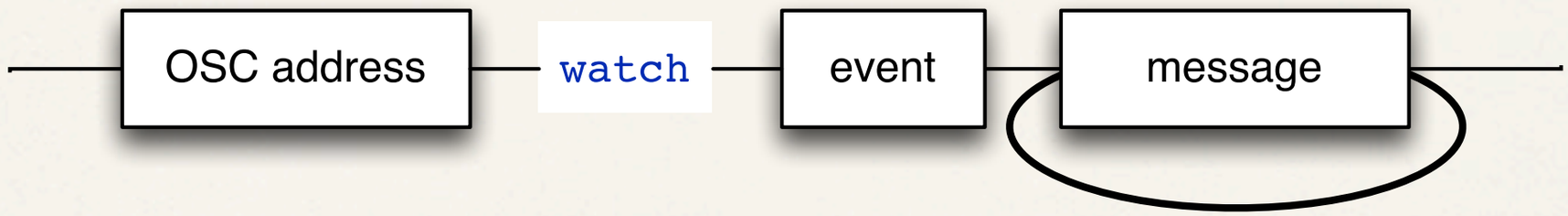
Examples

```
/ITL/scene/myObject watch mouseDown /ITL/scene/myObject show 0

/ITL/scene/myObject watch mouseDown host.domain.org:12100/an/address start
```

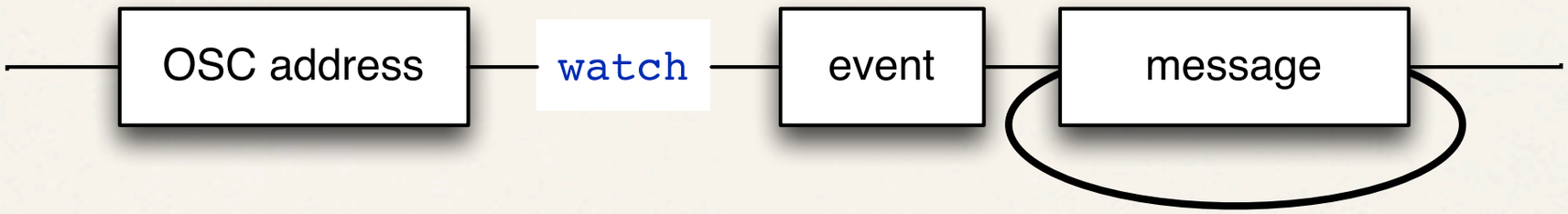
Interaction Messages

Messages list



Interaction Messages

Messages list

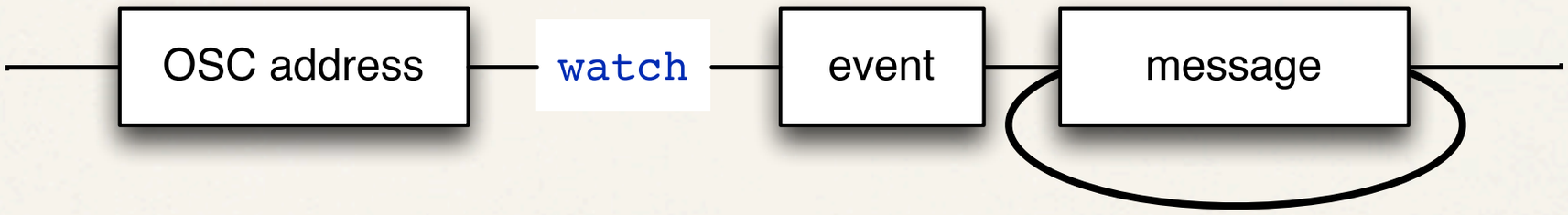


‘watch’ messages are first class parameters

```
/ITL/scene/myObject watch event task1 then
                    watch event task2 then
                    watch event task3 then
                    watch event task4 then
                    ...
```

Interaction Messages

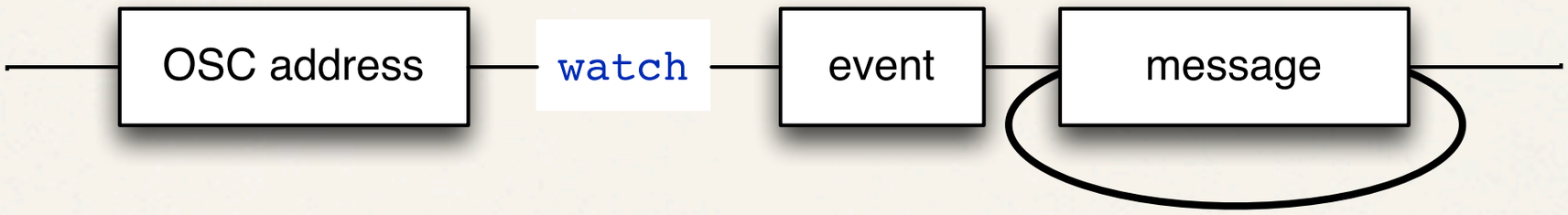
Messages list




```
/ITL/scene/rect watch mouseDown (
   /ITL/scene/rect color 76 254 212 200,
   /ITL/scene/rect watch mouseDown (
      /ITL/scene/rect scale 1.4,
      /ITL/scene/rect color 212 76 254 200,
      /ITL/scene/rect watch mouseDown (
         /ITL/scene/rect angle 22.5 ,
         /ITL/scene/rect color 212 254 76 200,
         /ITL/scene/rect watch mouseDown (
            /ITL/scene load 'DROP-ME.inscore')
      )
   )
);
```

Interaction Messages

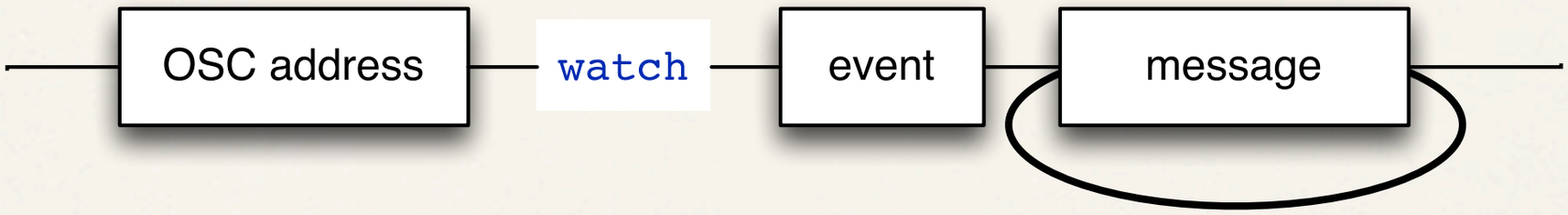
Messages list




```
/ITL/scene/rect watch mouseDown (
   /ITL/scene/rect color 76 254 212 200,
   /ITL/scene/rect watch mouseDown (
      /ITL/scene/rect scale 1.4,
      /ITL/scene/rect color 212 76 254 200,
      /ITL/scene/rect watch mouseDown (
         /ITL/scene/rect angle 22.5 ,
         /ITL/scene/rect color 212 254 76 200,
         /ITL/scene/rect watch mouseDown (
            /ITL/scene load 'DROP-ME.inscore')
      )
   )
);
```

Interaction Messages

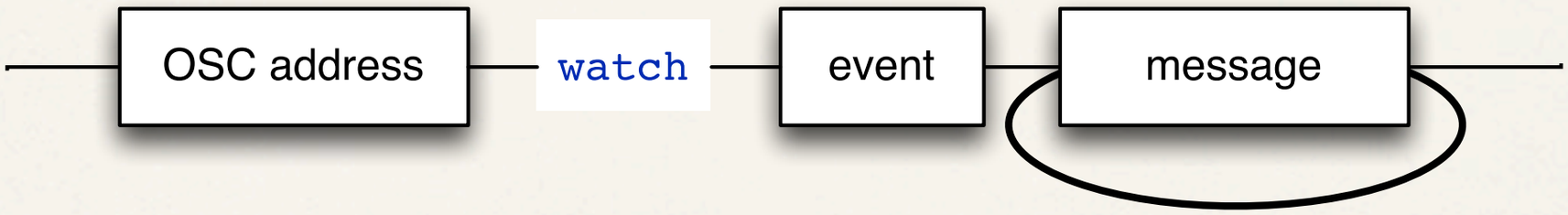
Messages list




```
/ITL/scene/rect watch mouseDown (
   /ITL/scene/rect color 76 254 212 200,
   /ITL/scene/rect watch mouseDown (
      /ITL/scene/rect scale 1.4,
      /ITL/scene/rect color 212 76 254 200,
      /ITL/scene/rect watch mouseDown (
         /ITL/scene/rect angle 22.5 ,
         /ITL/scene/rect color 212 254 76 200,
         /ITL/scene/rect watch mouseDown (
            /ITL/scene load 'DROP-ME.inscore')
      )
   )
);
```

Interaction Messages

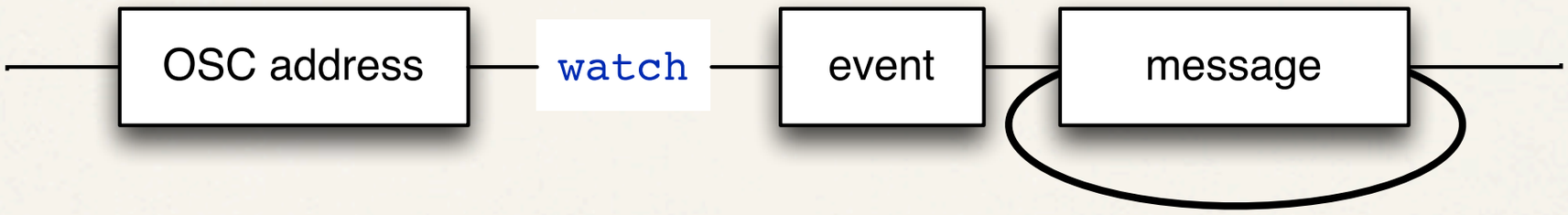
Messages list




```
/ITL/scene/rect watch mouseDown (
   /ITL/scene/rect color 76 254 212 200,
   /ITL/scene/rect watch mouseDown (
      /ITL/scene/rect scale 1.4,
      /ITL/scene/rect color 212 76 254 200,
      /ITL/scene/rect watch mouseDown (
         /ITL/scene/rect angle 22.5 ,
         /ITL/scene/rect color 212 254 76 200,
         /ITL/scene/rect watch mouseDown (
            /ITL/scene load 'DROP-ME.inscore')
      )
   )
);
```

Interaction Messages

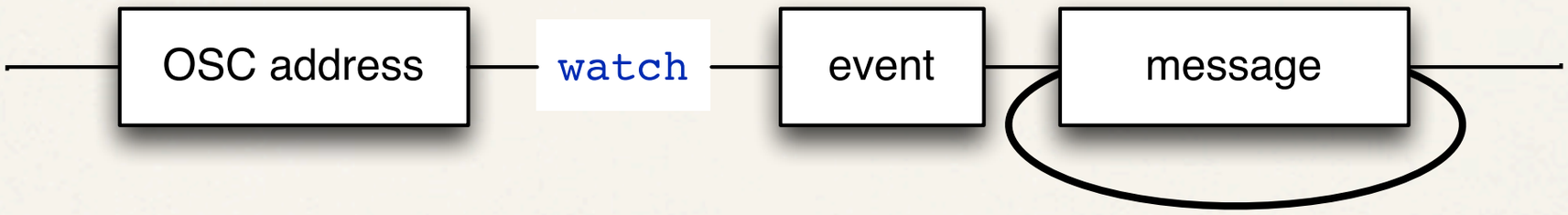
Messages list




```
/ITL/scene/rect watch mouseDown (
   /ITL/scene/rect color 76 254 212 200,
   /ITL/scene/rect watch mouseDown (
      /ITL/scene/rect scale 1.4,
      /ITL/scene/rect color 212 76 254 200,
      /ITL/scene/rect watch mouseDown (
         /ITL/scene/rect angle 22.5 ,
         /ITL/scene/rect color 212 254 76 200,
         /ITL/scene/rect watch mouseDown (
            /ITL/scene load 'DROP-ME.inscore')
      )
   )
);
```

Interaction Messages

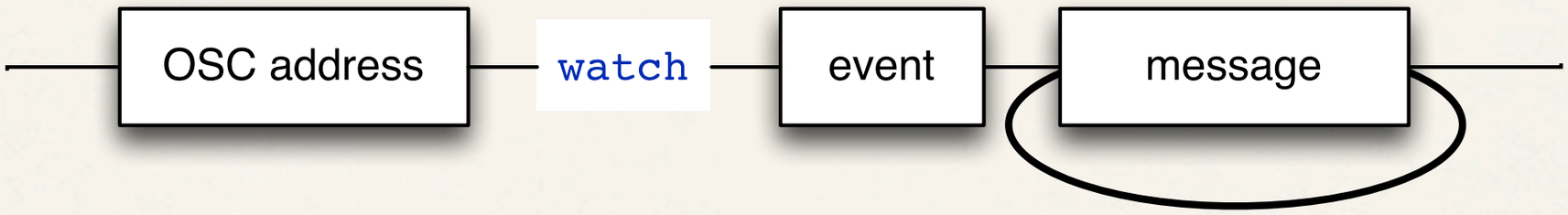
Messages list




```
/ITL/scene/rect watch mouseDown (
   /ITL/scene/rect color 76 254 212 200,
   /ITL/scene/rect watch mouseDown (
      /ITL/scene/rect scale 1.4,
      /ITL/scene/rect color 212 76 254 200,
      /ITL/scene/rect watch mouseDown (
         /ITL/scene/rect angle 22.5 ,
         /ITL/scene/rect color 212 254 76 200,
         /ITL/scene/rect watch mouseDown (
            /ITL/scene load 'DROP-ME.inscore')
      )
   )
);
```

Interaction Messages

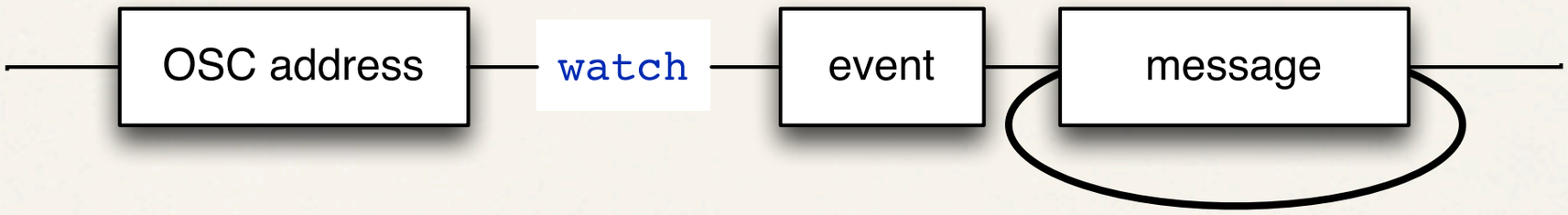
Messages list




```
/ITL/scene/rect watch mouseDown (
   /ITL/scene/rect color 76 254 212 200,
   /ITL/scene/rect watch mouseDown (
      /ITL/scene/rect scale 1.4,
      /ITL/scene/rect color 212 76 254 200,
      /ITL/scene/rect watch mouseDown (
         /ITL/scene/rect angle 22.5 ,
         /ITL/scene/rect color 212 254 76 200,
         /ITL/scene/rect watch mouseDown (
            /ITL/scene load 'DROP-ME.inscore')
      )
   )
);
```

Interaction Messages

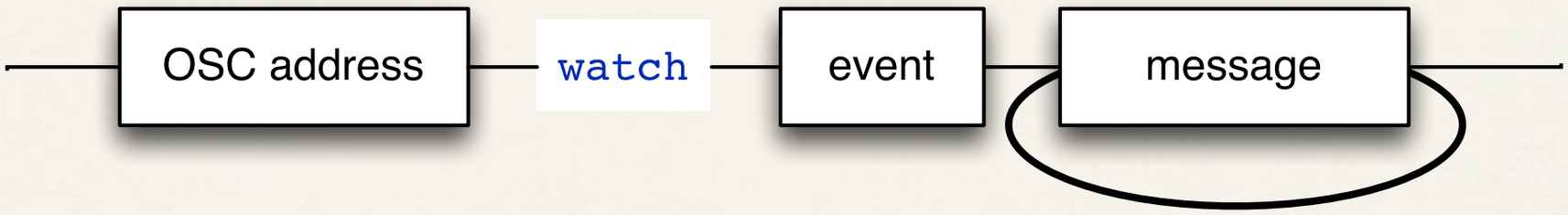
Messages list




```
/ITL/scene/rect watch mouseDown (
   /ITL/scene/rect color 76 254 212 200,
   /ITL/scene/rect watch mouseDown (
      /ITL/scene/rect scale 1.4,
      /ITL/scene/rect color 212 76 254 200,
      /ITL/scene/rect watch mouseDown (
         /ITL/scene/rect angle 22.5 ,
         /ITL/scene/rect color 212 254 76 200,
         /ITL/scene/rect watch mouseDown (
            /ITL/scene load 'DROP-ME.inscore')
      )
   )
);
```

Interaction Messages

Messages list




```
/ITL/scene/rect watch mouseDown (
   /ITL/scene/rect color 76 254 212 200,
   /ITL/scene/rect watch mouseDown (
      /ITL/scene/rect scale 1.4,
      /ITL/scene/rect color 212 76 254 200,
      /ITL/scene/rect watch mouseDown (
         /ITL/scene/rect angle 22.5 ,
         /ITL/scene/rect color 212 254 76 200,
         /ITL/scene/rect watch mouseDown (
            /ITL/scene load 'DROP-ME.inscore')
      )
   )
);
```

Interaction Messages

Similar behavior in the time domain

```
/ITL/scene/cursor watch timeEnter 0 1 1 1
            ( /ITL/scene load 'DROP-ME-timebased.inscore' );
/ITL/scene/cursor watch timeEnter 1 1 2 1
            ( /ITL/scene/rect color 76 254 212 200 );
/ITL/scene/cursor watch timeEnter 2 1 3 1
            ( /ITL/scene/rect scale 1.4 ,
              /ITL/scene/rect color 212 76 254 200 );
/ITL/scene/cursor watch timeEnter 3 1 4 1
            ( /ITL/scene/rect angle 22.5 ,
              /ITL/scene/rect color 212 254 76 200 );
/ITL/scene/cursor watch timeEnter 4 1 50 1
            ( /ITL/scene/cursor date 0 1 );
```

Interaction Messages

Example : page turning

```
/ITL/scene/cursor watch timeEnter 0 1 8 1
                                    ( /ITL/scene/score page 1 );
/ITL/scene/cursor watch timeEnter 8 1 16 1
                                    ( /ITL/scene/score page 2 );
/ITL/scene/cursor watch timeEnter 16 1 24 1
                                    ( /ITL/scene/score page 3 );
/ITL/scene/cursor watch timeEnter 24 1 32 1
                                    ( /ITL/scene/score page 4 );
```

Interaction Messages

Infinite loop

```
/ITL/scene/obj watch mouseDown (
        /ITL/scene/obj push,
        /ITL/scene/obj do something,
        /ITL/scene/obj watch mouseDown (
             /ITL/scene/obj do anotherthing,
             /ITL/scene/obj pop
        )
);
```

Interaction Messages

3 iterations

```
/ITL/scene/obj watch mouseDown (
        /ITL/scene/obj do something,
        /ITL/scene/obj watch mouseDown (
              /ITL/scene/obj do anotherthing,
              /ITL/scene/obj pop
        )
);
/ITL/scene/obj push;
/ITL/scene/obj push;
```

INScore

DEMO

Gesture Follower

- A new object based on IRCAM Gesture Follower library.
- Similar to signals from input viewpoint.
- Implements specific interaction events.

Gesture Follower

Operating modes

- learning state.
- following state.
- idle state

Address space

```
/ITL/scene/myFollower
/ITL/scene/myFollower/gestureA
/ITL/scene/myFollower/gestureB
...
```

Gestures

Gesture states

- active state.
- idle state

Gestures

Gesture states

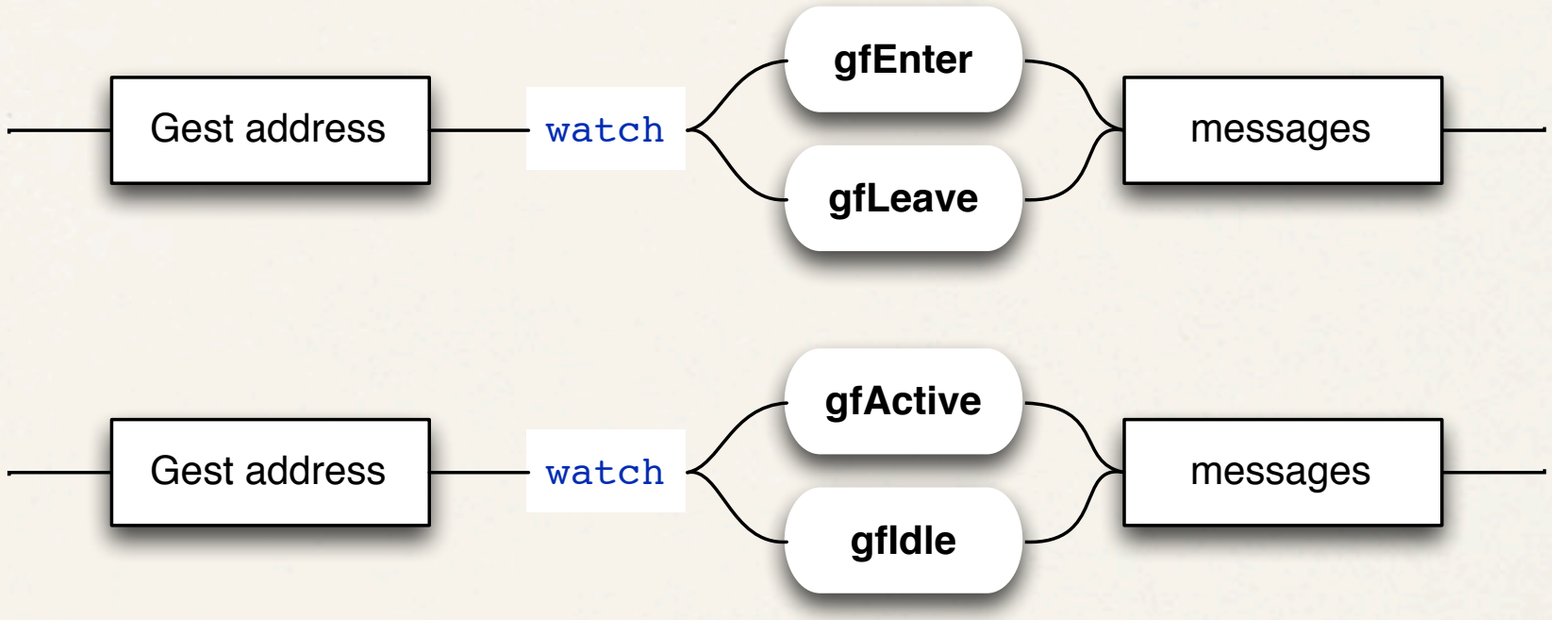
- active state.

---------- likelihood threshold

- idle state

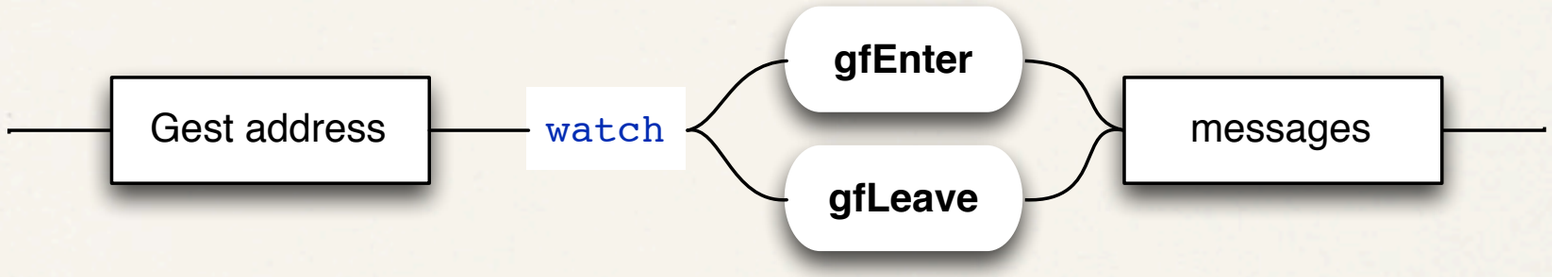
Gesture Events

Events

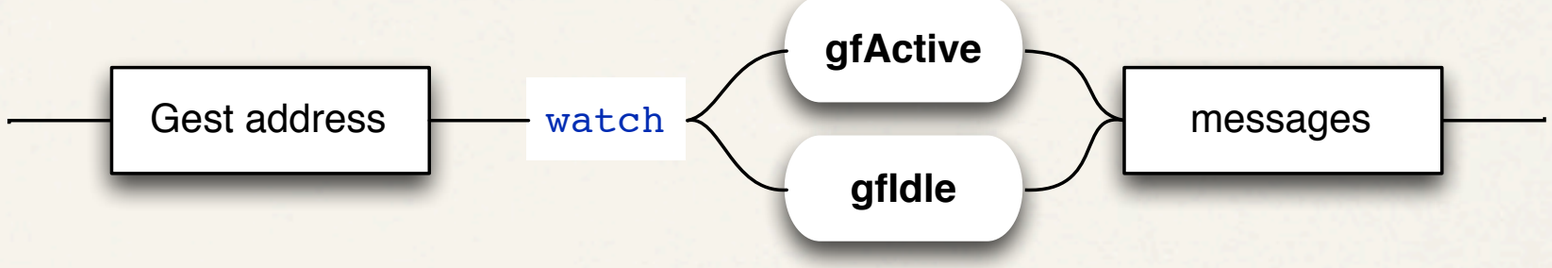


Gesture Events

Events

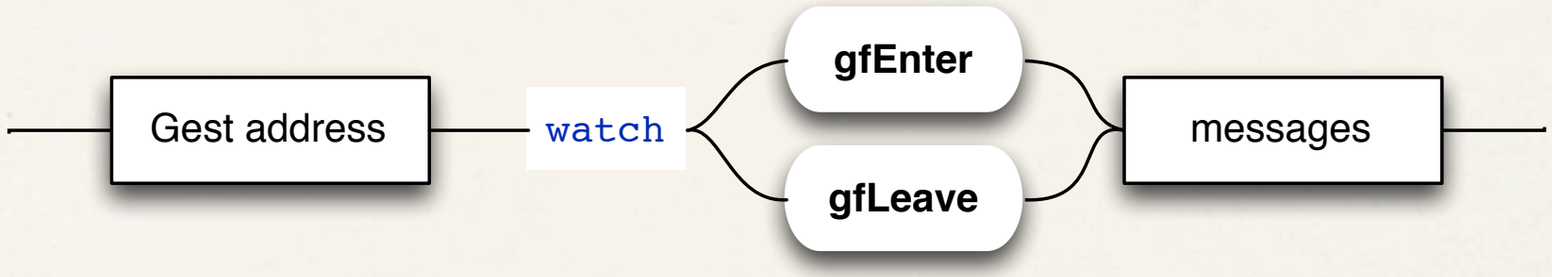


Streams

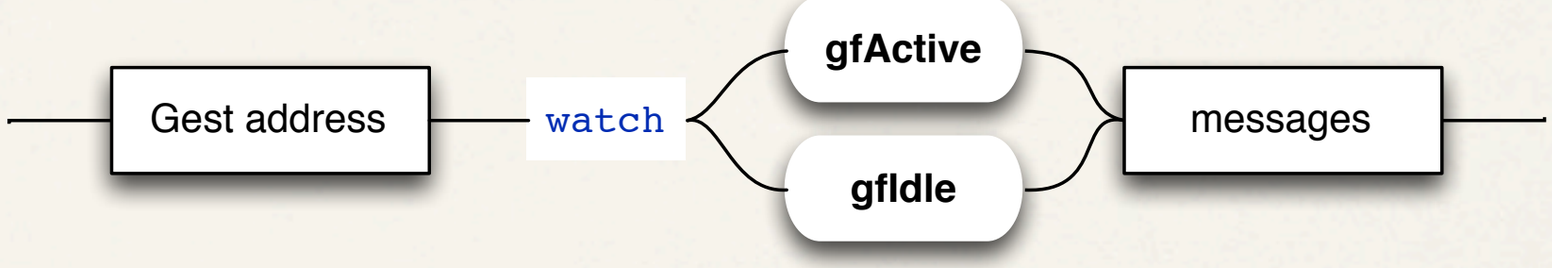


Gesture Events

Events



Streams

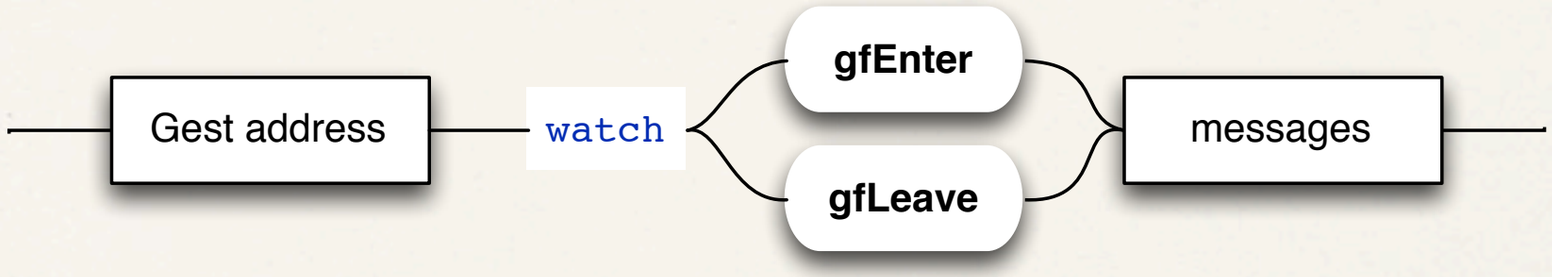


Variables

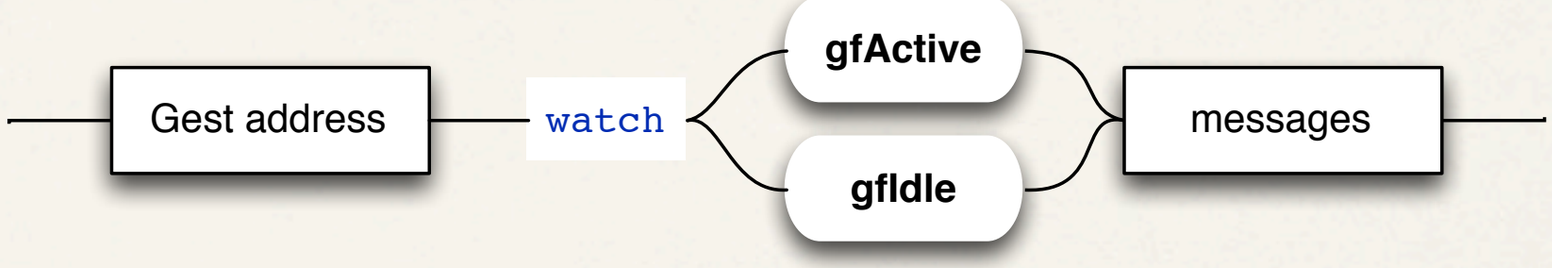
- $gflikelihood
- $gfpos
- $gfspeed

Gesture Events

Events



Streams



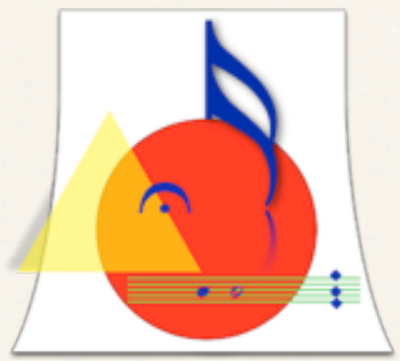
Variables

- $gflikelihood [low, high]
- $gfpos [low, high]
- $gfspeed [low, high]

INScore

DEMO

INScore



http://inscore.sf.net

open source™