ESUG 2019: Concurrency

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RMod

Who am I

(i have less hair now, same appetite)

- **2002 - 2012**
  - Software engineer/developer in the private sector
  - Teaching programming
- **2012 - 2019**
  - Research engineer @ Ecole de mines & INRIA.
- **2019 - ????**
  - Starting a PhD :)

Process

In computing, a **process** is an instance of a computer program that is being sequentially executed[1] by a computer system that has the ability to run several computer programs concurrently.

2 **a** **(1)** **:** a natural phenomenon marked by gradual changes that lead toward a particular result

// the *process* of growth

(2) **:** a continuing natural or biological activity or function

// such life *processes* as breathing

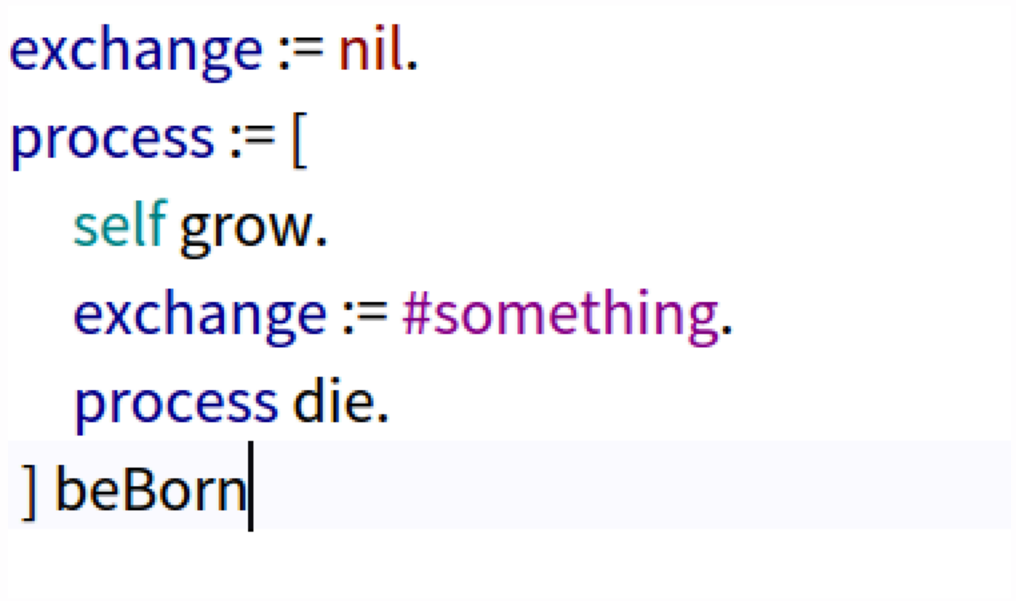
b **:** a series of actions or operations conducing to an end

especially **:** a continuous operation or treatment especially in manufacture

Processes: Living entities

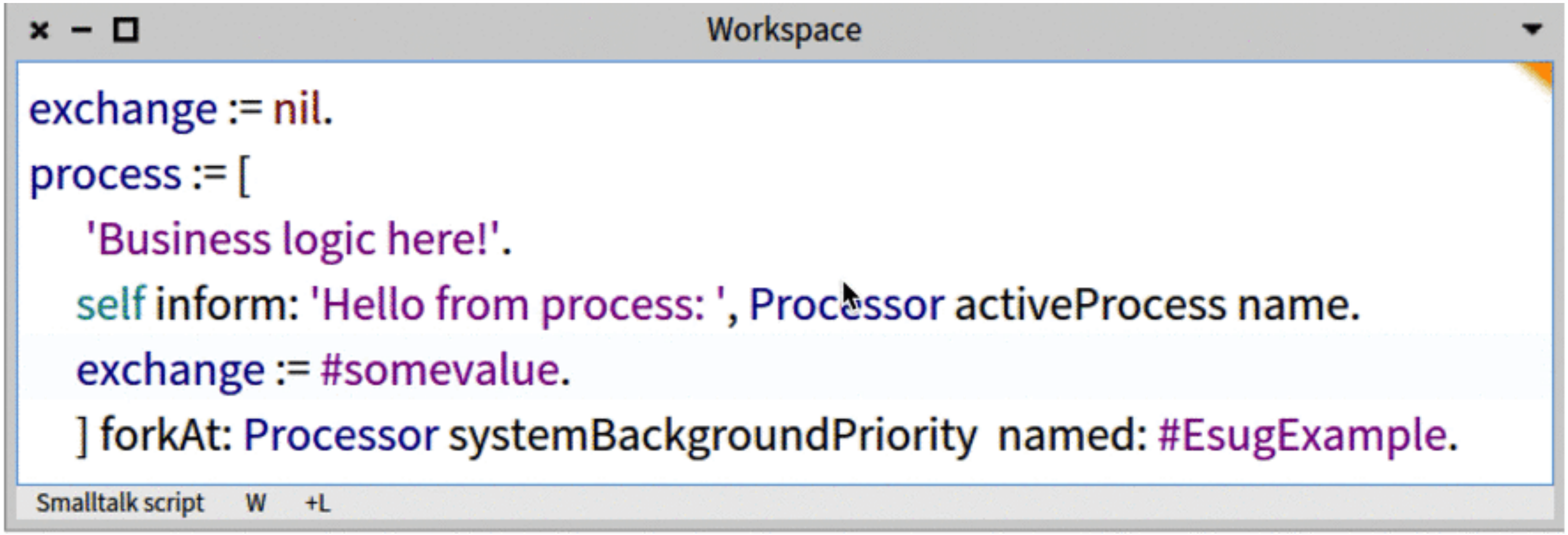
Life cycle

- Born
- Grow
- Reproduce / Exchange
- Die



```
exchange := nil.
process := [
    self grow.
    exchange := #something.
    process die.
] beBorn
```

Processes in Pharo



```
exchange := nil.
process := [
    'Business logic here!'.
   self inform: 'Hello from process: ', Processor activeProcess name.
   exchange := #somevalue.
   ] forkAt: Processor systemBackgroundPriority  named: #EsugExample.
```

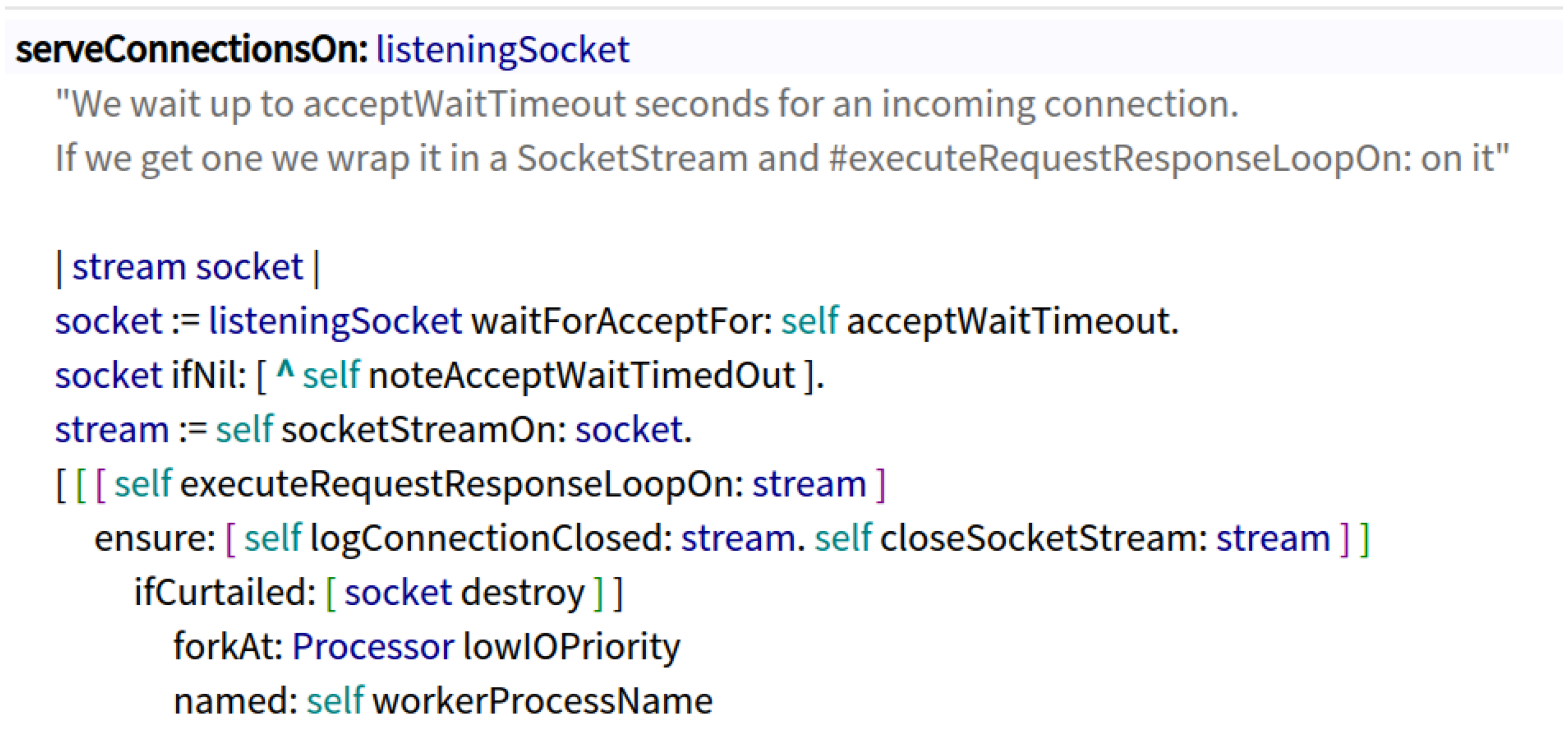
Processes: example of usage

```
resetCompletionDelay
    "Open the popup after 100ms and only after certain characters"
    self stopCompletionDelay.
    self isMenuOpen ifTrue: [ ^ self ].
    editor atCompletionPosition ifFalse: [ ^ self ].

    completionDelay := [
        (Delay forMilliseconds: NECPreferences popupAutomaticDelay) wait.
        UIManager default defer:  [
           editor atCompletionPosition ifTrue: [ self openMenu ]]
     ] fork.
```

Processes: example of usage

Processes: example of usage

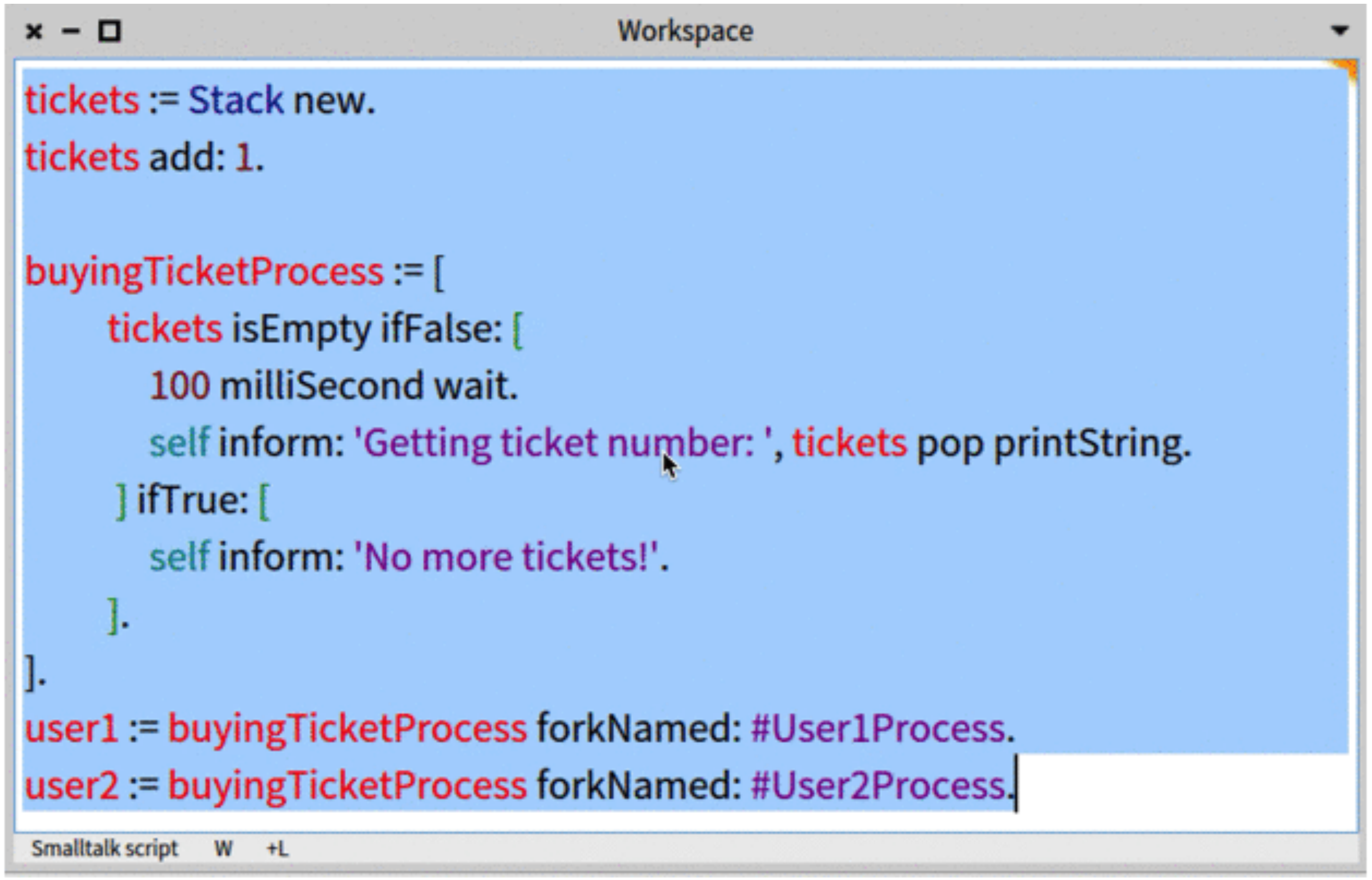


```
serveConnectionsOn: listeningSocket
    "We wait up to acceptWaitTimeout seconds for an incoming connection.
    If we get one we wrap it in a SocketStream and #executeRequestResponseLoopOn: on it"

    | stream socket |
    socket := listeningSocket waitForAcceptFor: self acceptWaitTimeout.
    socket ifNil: [ ^ self noteAcceptWaitTimedOut ].
    stream := self socketStreamOn: socket.
    [ [ [ self executeRequestResponseLoopOn: stream ]
        ensure: [ self logConnectionClosed: stream. self closeSocketStream: stream ] ]
            ifCurtailed: [ socket destroy ] ]
                forkAt: Processor lowIOPriority
                named: self workerProcessName
```

Processes: example of usage

Processes: example of usage



```
tickets := Stack new.
tickets add: 1.

buyingTicketProcess := [
    tickets isEmpty ifFalse: [
        100 milliSecond wait.
        self inform: 'Getting ticket number: ', tickets pop printString.
    ] ifTrue: [
        self inform: 'No more tickets!'.
    ].
].
user1 := buyingTicketProcess forkNamed: #User1Process.
user2 := buyingTicketProcess forkNamed: #User2Process.
```

Processes: example of usage

RMod

Manage process's life cycle is painful

- When to start a process?
- When to kill a process?
- How to keep a process alive?
- How to synchronise them?

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What is TaskIt

- Task focused concurrency framework
- Open source (https://github.com/sbragagnolo/taskit)
- Used in projects where performance matters (PhaROS, Makros, Fog, etc)
- 6 years old

Why TaskIt

- Synchronise different tasks
- Unlock development perspectives
  - Process lifecycle agnostic
  - Process lifecycle fanatic

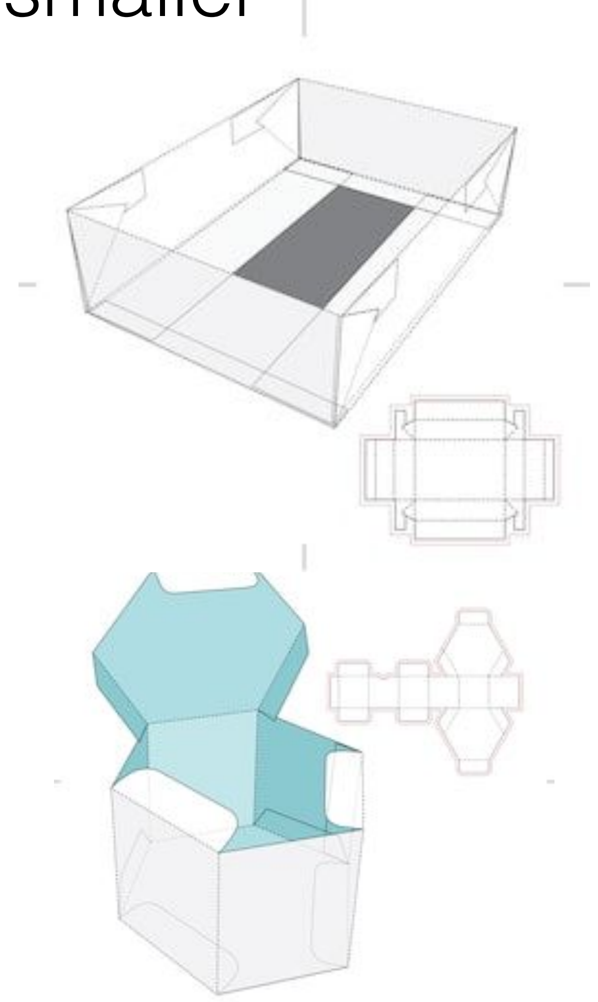
TaskIT blueprints

CONFIDENTIAL

Tasks

like programs, but smaller

- Objects
- Reusable computation units
- Process agnostic
- Built up from
  - Message send
  - Blocks



Task Examples

```
[ 'Happened' logCr ] schedule.
```

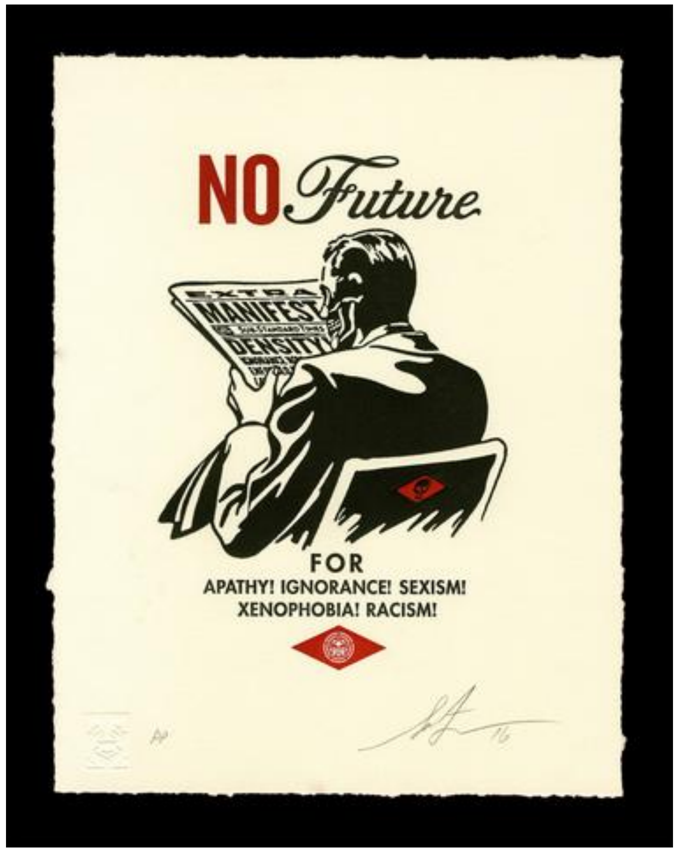
we do not care about when this task would be executed, not either it result

```
future := [ 2 + 2 ] future.
```

we do not care about when it will be executed, yet we do care about the result

Scheduled Task

- The task will be executed at some point
- Does not matter when
- No need of synchronisation

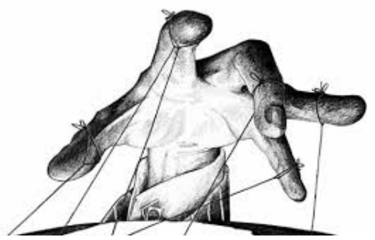


Scheduled Task

My call

```
   client := Client new.
   client id: UUID new.
[   self inform: 'save client: '.
client id asString ] schedule.
self save: client.
```

The Invisible hand of running strategy



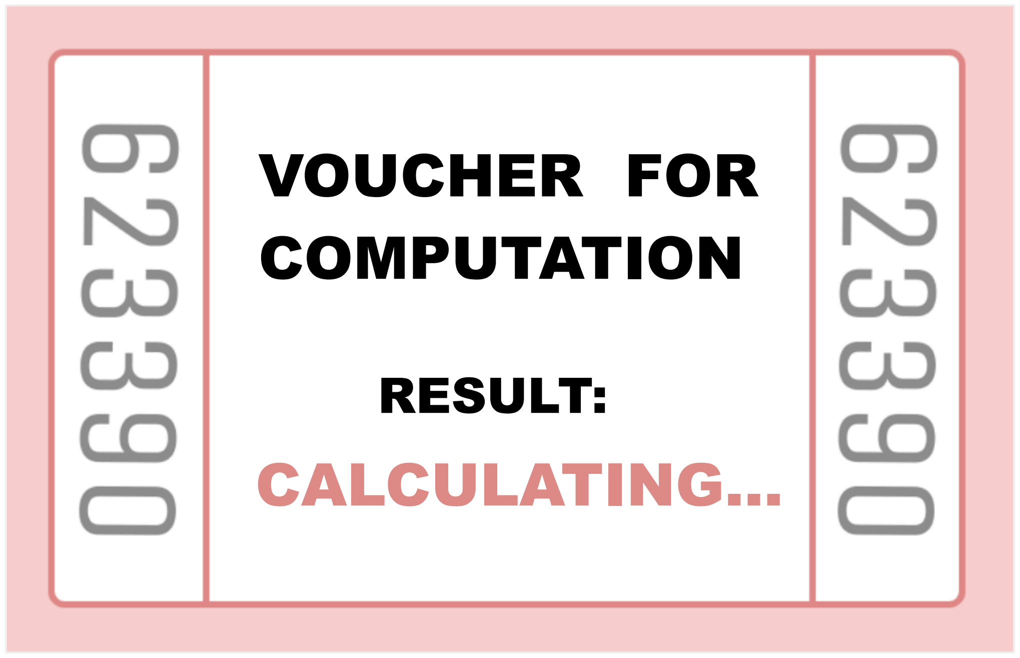
```
[ self inform: 'save client: '.
   client id asString ]
```

Futures

- Objects
- Represent the future of a computation
- Process agnostic

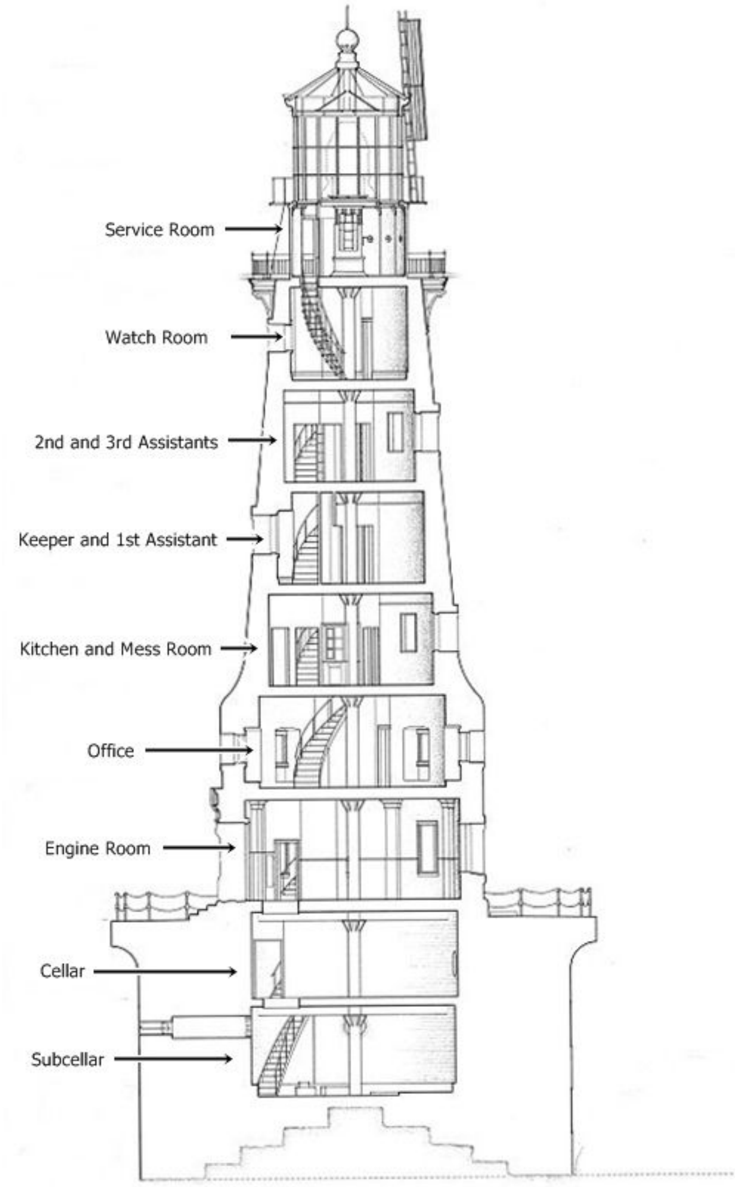
Futures

- As mean for getting the computed task result



Futures

- As mean of synchronisation
  - Synchronous
  - Asynchronous
  - Tasks combination



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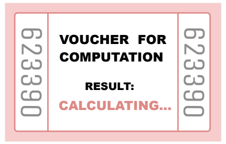
Synchronous

My call

```
future := [
stream write: data.
stream read
] future.
```

```
response := future synchronizeTimeout: 10 seconds.
```



```
self execute: line.
```

The Invisible hand of running strategy

```
stream write: data.
v := stream read
future deploy: v
```

- **synchronous**
- asynchronous
- task combination

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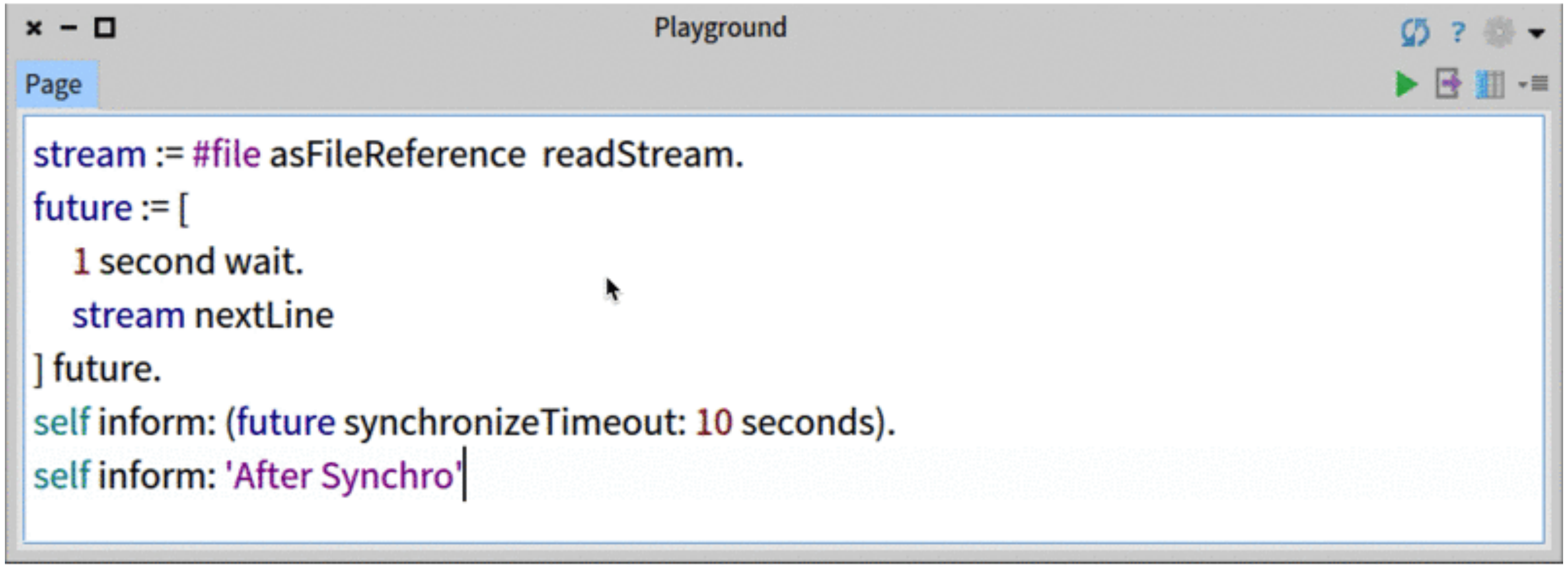
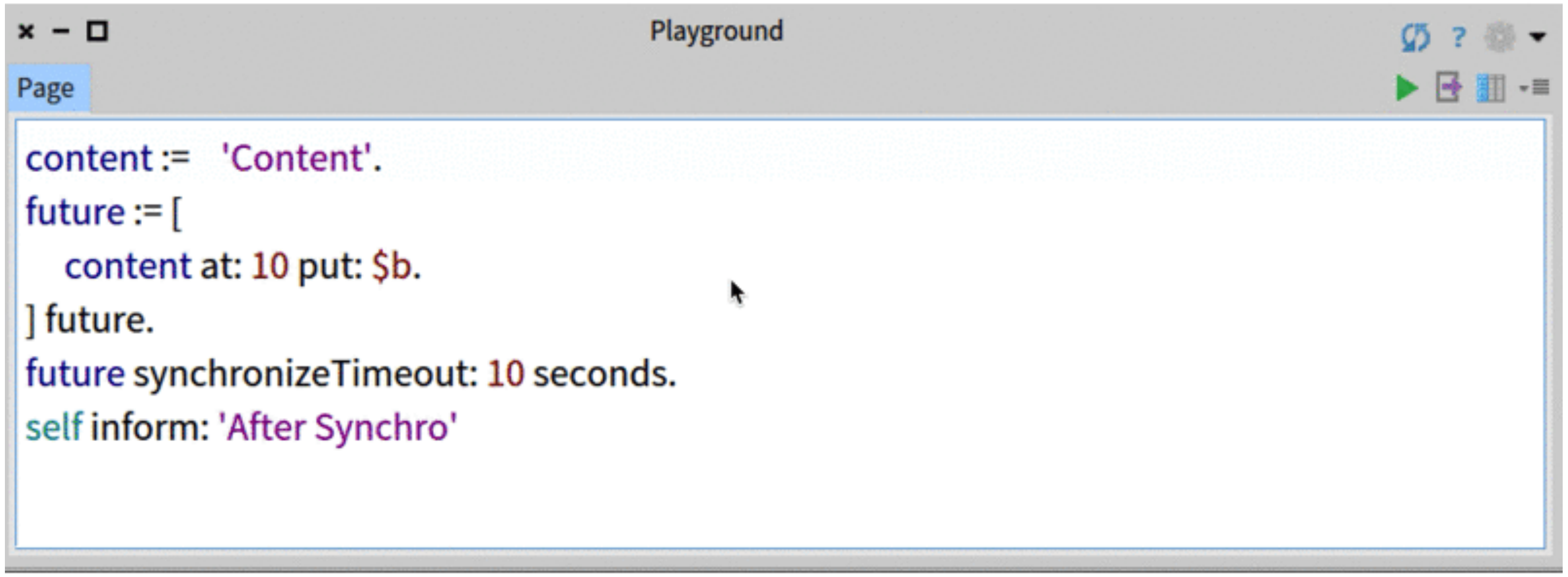
Synchronous



```
stream := #file asFileReference  readStream.
future := [
    1 second wait.
    stream nextLine
] future.
self inform: (future synchronizeTimeout: 10 seconds).
self inform: 'After Synchro'
```

- **synchronous**
- asynchronous
- task combination

Synchronous



```
content :=   'Content'.
future := [
   content at: 10 put: $b.
] future.
future synchronizeTimeout: 10 seconds.
self inform: 'After Synchro'
```

- **synchronous**
- asynchronous
- task combination

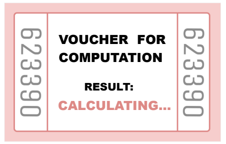
Asynchronous

My call

```
future := [
stream write: data.
stream read
] future.
future onSuccessDo:
[ :v |
   self execute: v.
]
```

The Invisible hand
of running strategy

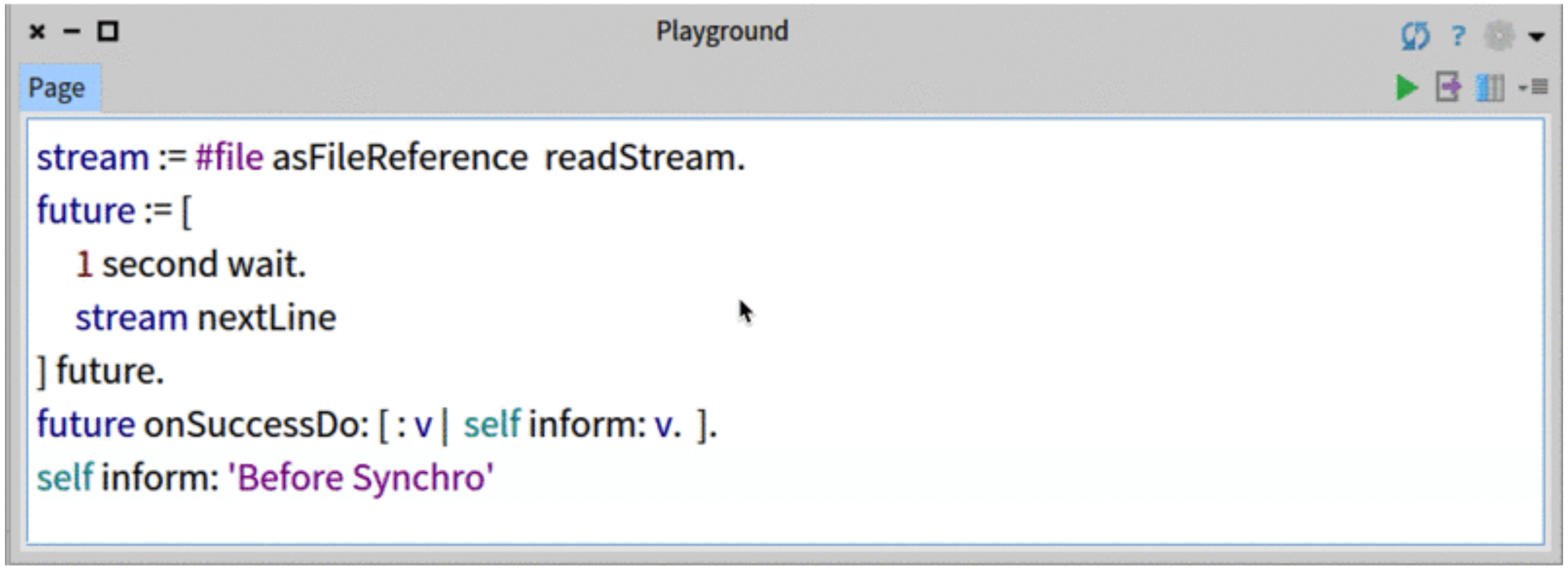
```
stream write: data.
 v := stream read
 future deploy: v
```



```
self execute: v.
```

- synchronous
- **asynchronous**
- task combination

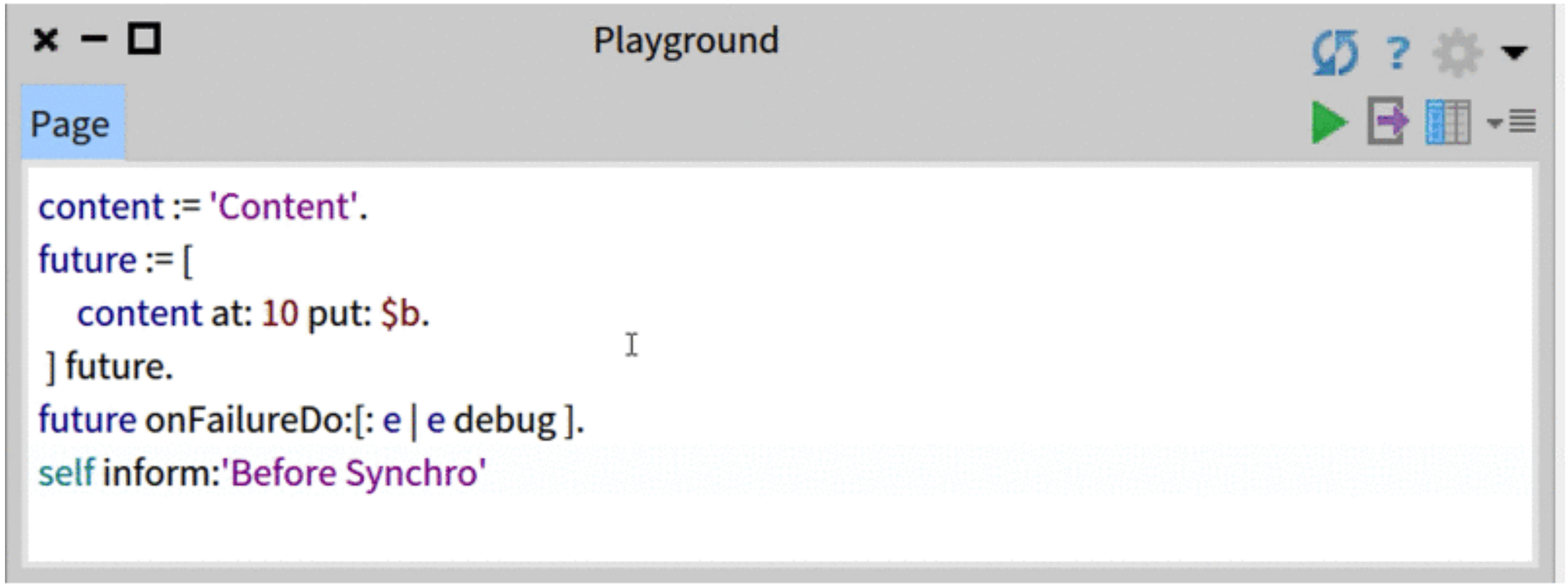
Asynchronous



```
stream := #file asFileReference  readStream.
future := [
   1 second wait.
   stream nextLine
] future.
future onSuccessDo: [ : v |  self inform: v.  ].
self inform: 'Before Synchro'
```

- synchronous
- **asynchronous**
- task combination

Asynchronous

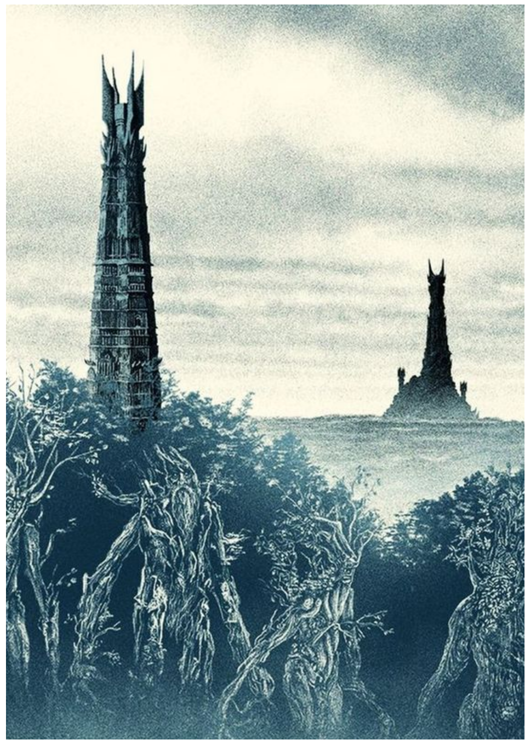


```
content := 'Content'.
future := [
    content at: 10 put: $b.
] future.
future onFailureDo:[: e | e debug ].
self inform:'Before Synchro'
```

- synchronous
- **asynchronous**
- task combination

Task combination

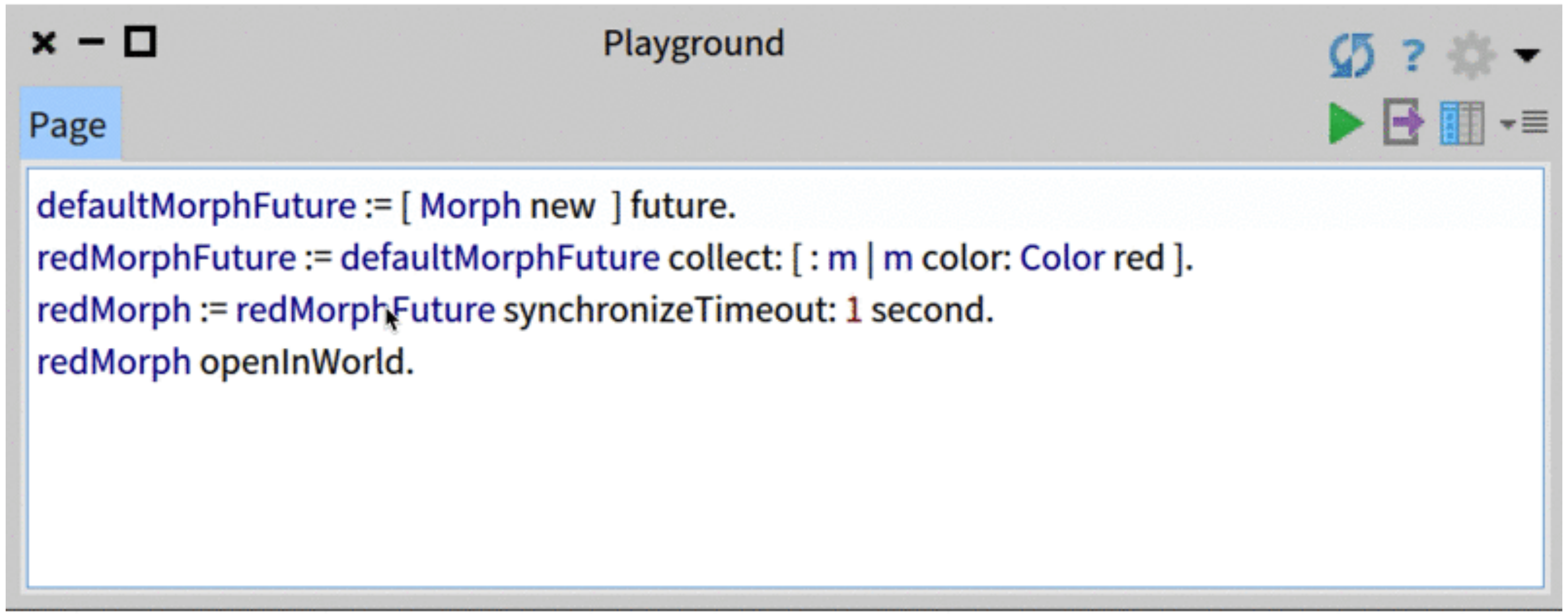
- Reinforce sequence
- Transform results
- Trigger new processes



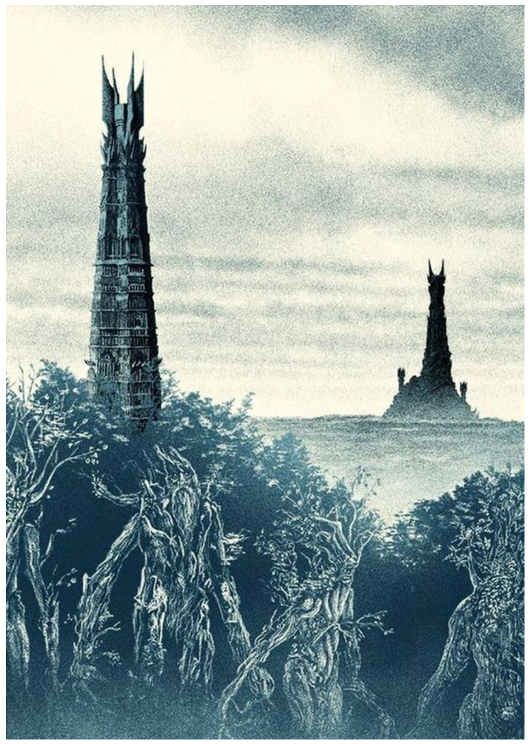
- synchronous
- asynchronous
- **task combination**

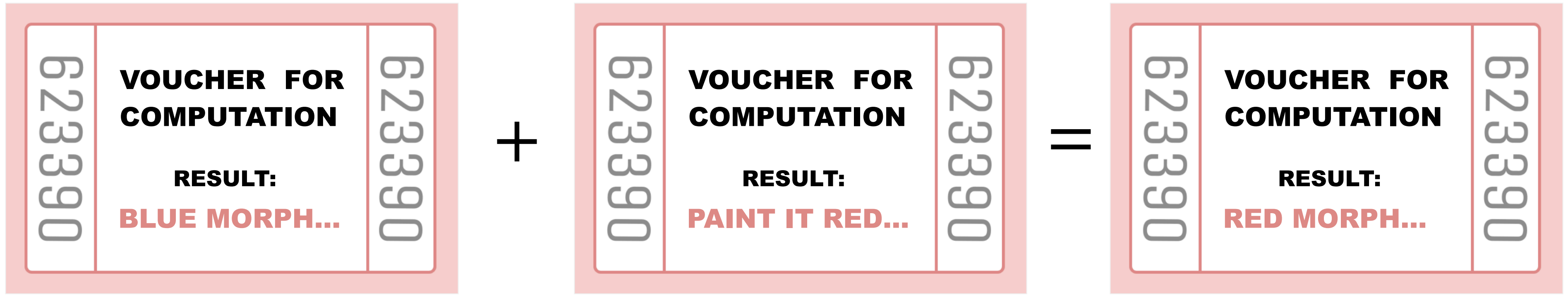
Collect

Run in sequence



```
defaultMorphFuture := [ Morph new ] future.
redMorphFuture := defaultMorphFuture collect: [ : m | m color: Color red ].
redMorph := redMorphFuture synchronizeTimeout: 1 second.
redMorph openInWorld.
```

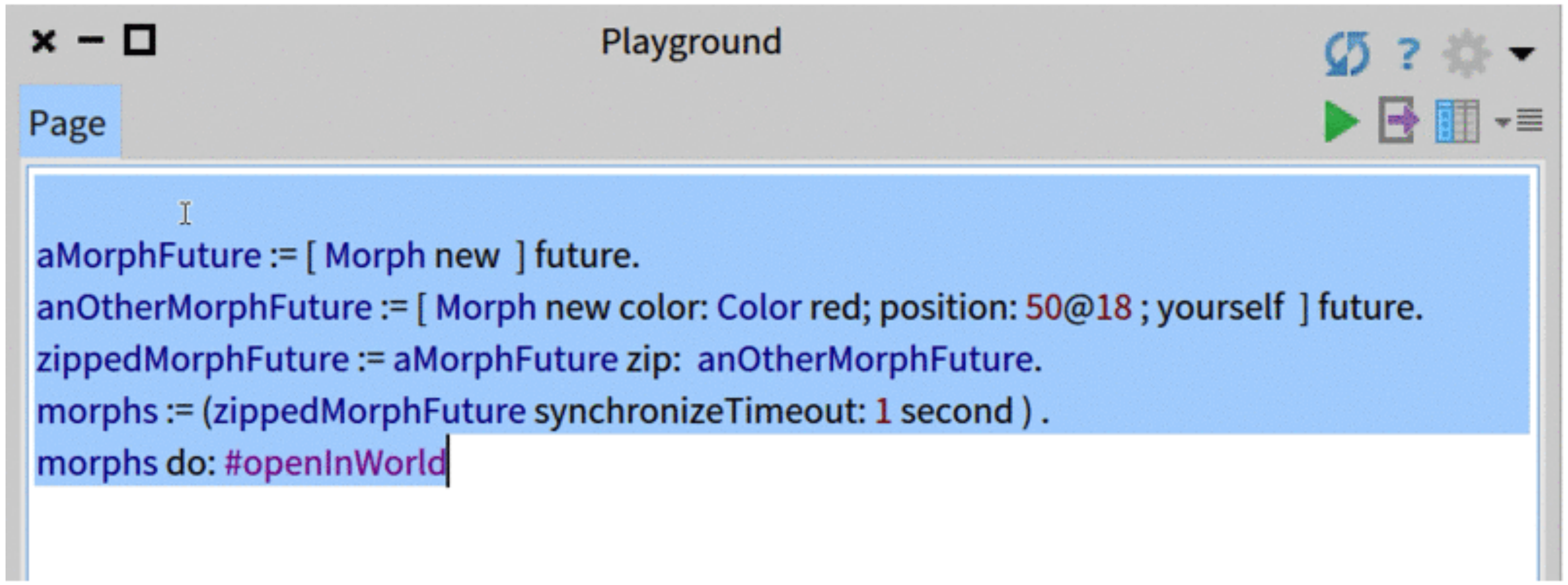




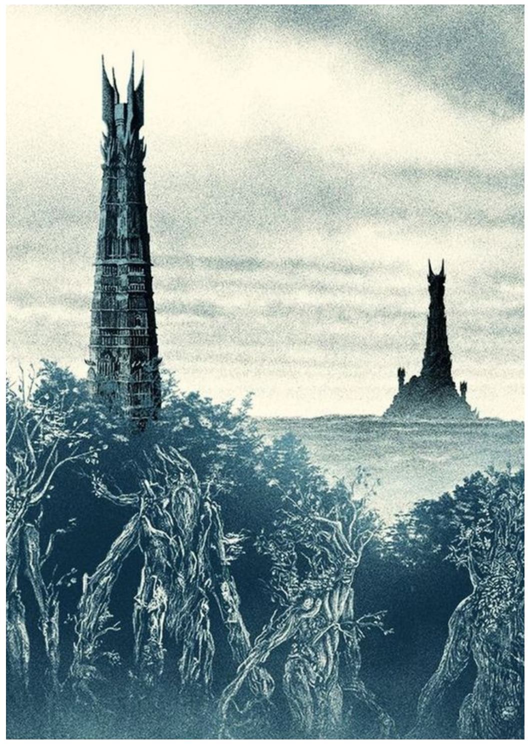
- synchronous
- asynchronous
- **task combination**

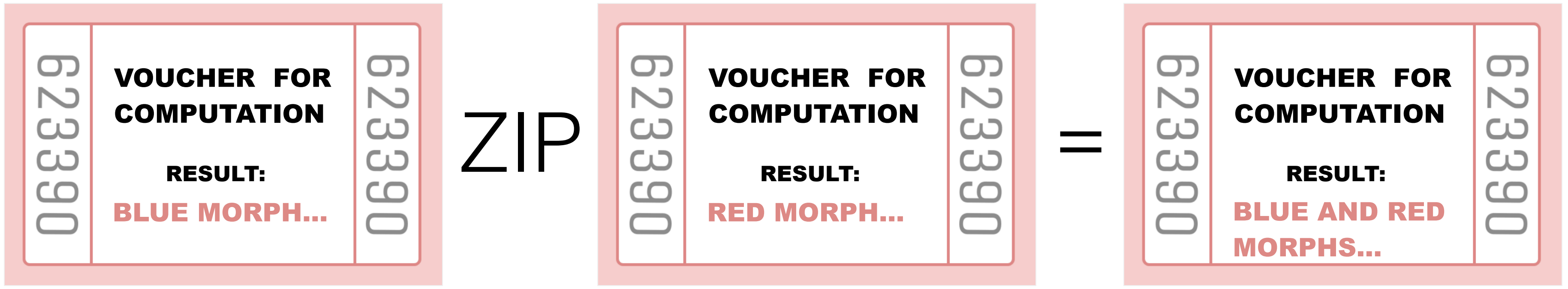
Zip

Run concurrently and join



```
aMorphFuture := [ Morph new ] future.
anOtherMorphFuture := [ Morph new color: Color red; position: 50@18 ; yourself ] future.
zippedMorphFuture := aMorphFuture zip:  anOtherMorphFuture.
morphs := (zippedMorphFuture synchronizeTimeout: 1 second ) .
morphs do: #openInWorld
```

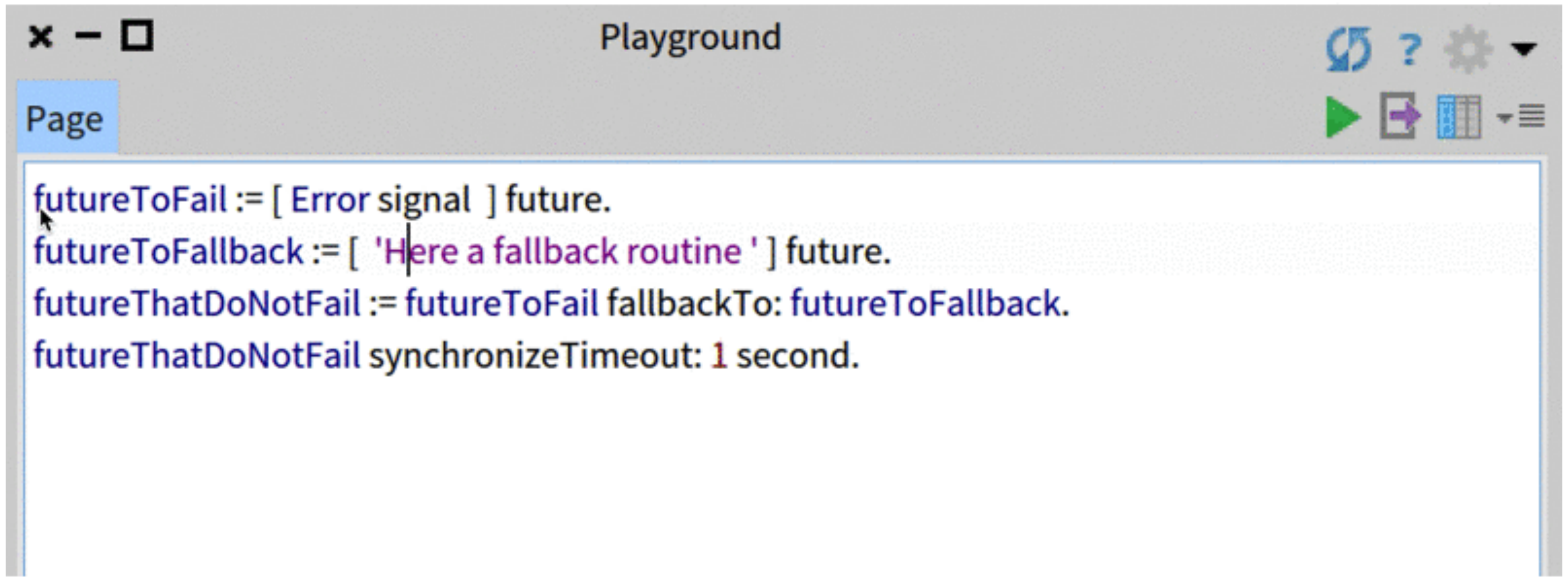




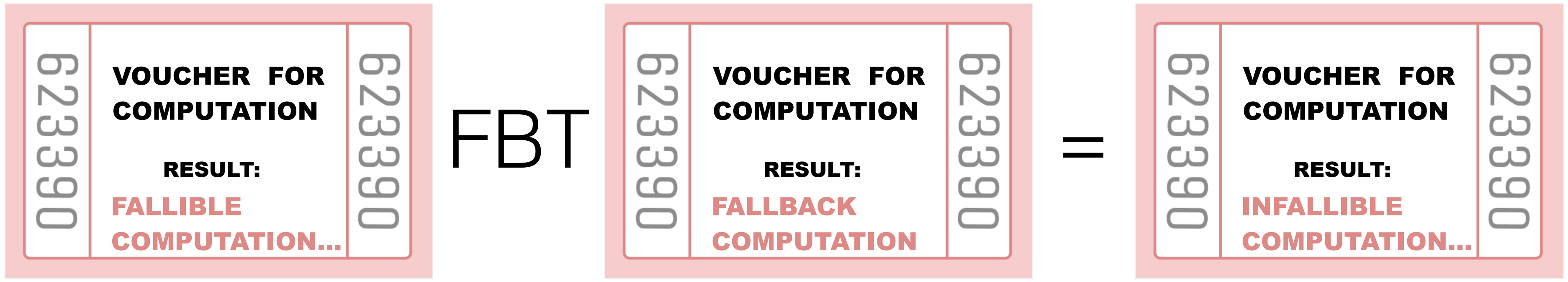
- synchronous
- asynchronous
- **task combination**

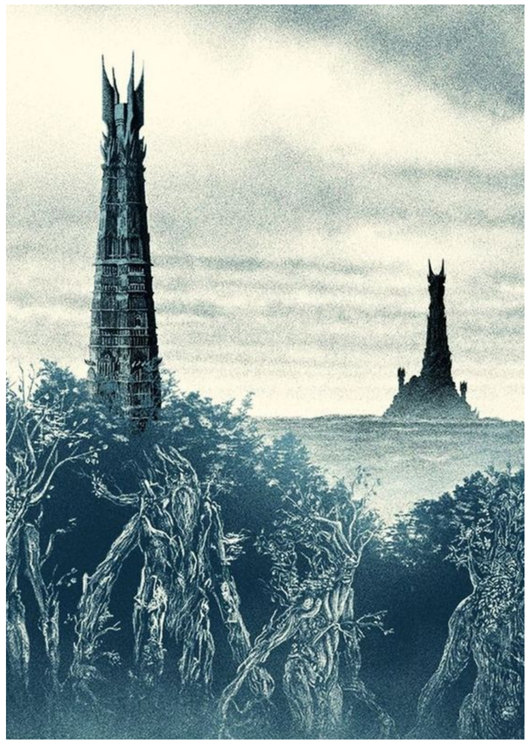
Fallback To

Run concurrently, responds conditionally



```
futureToFail := [ Error signal ] future.
futureToFallback := [ 'Here a fallback routine ' ] future.
futureThatDoNotFail := futureToFail fallbackTo: futureToFallback.
futureThatDoNotFail synchronizeTimeout: 1 second.
```



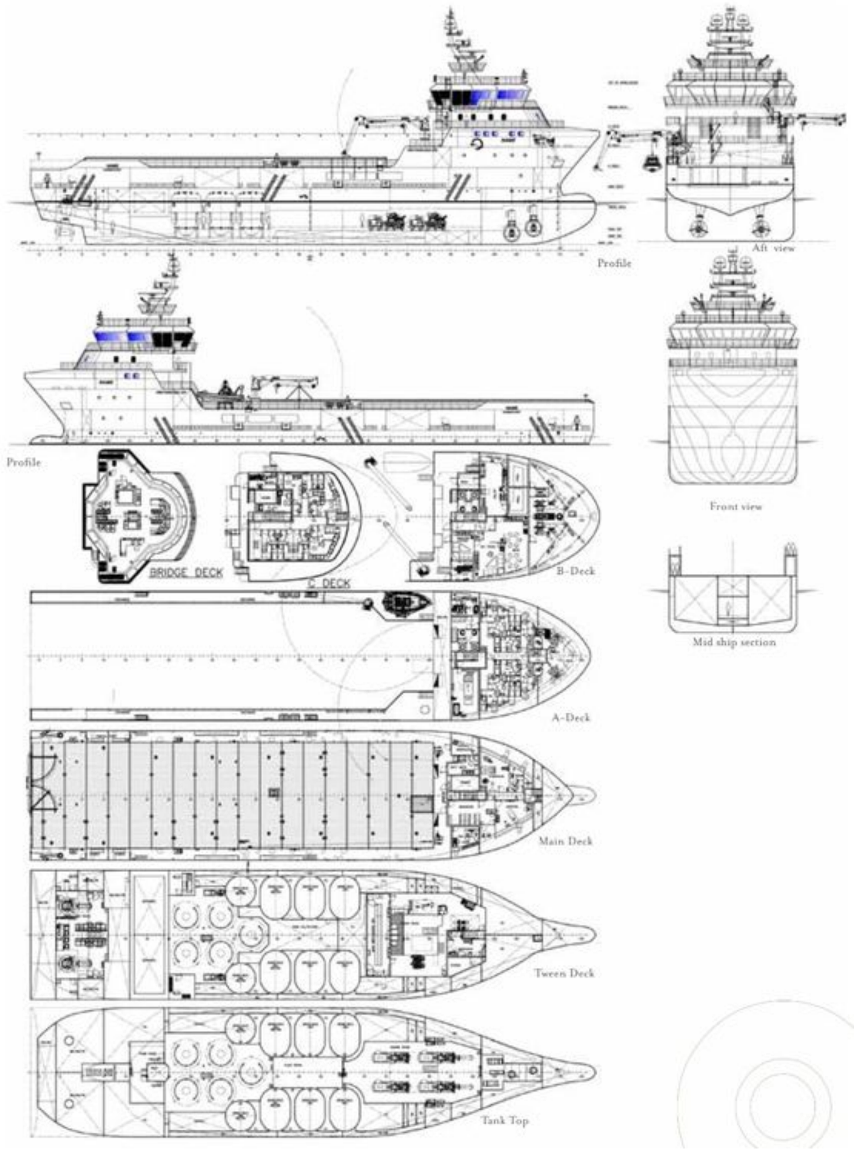


- synchronous
- asynchronous
- **task combination**

Runners

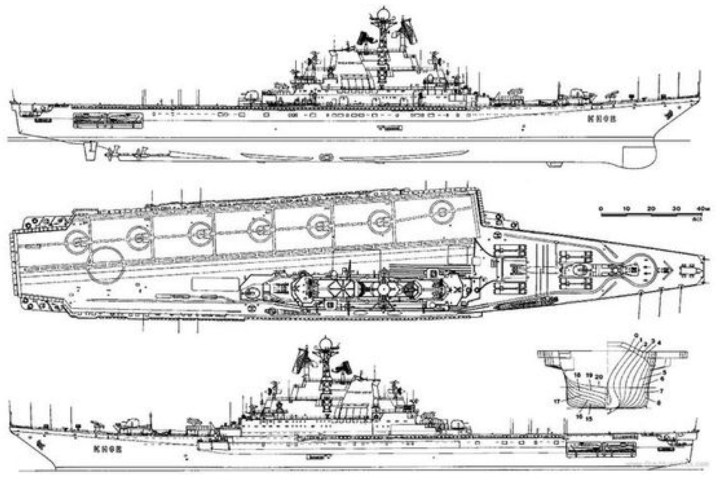
Runners

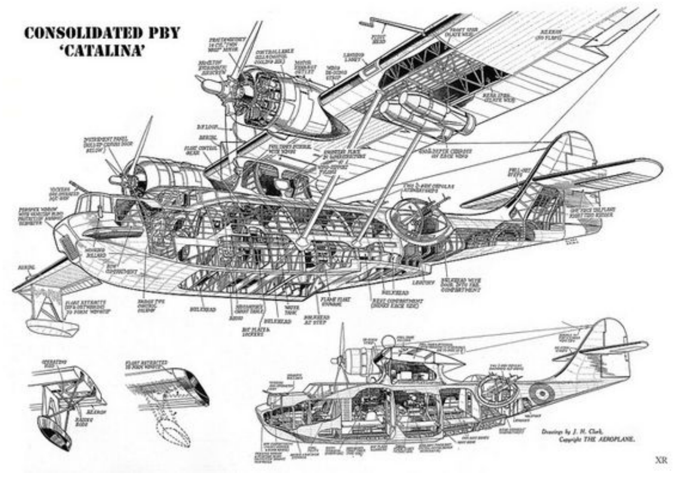
- Objects
- Represent the processing architecture
    1. How
    2. Where
    3. When



Runners

- Same process
- New process
- Worker
- Worker pool
- Service





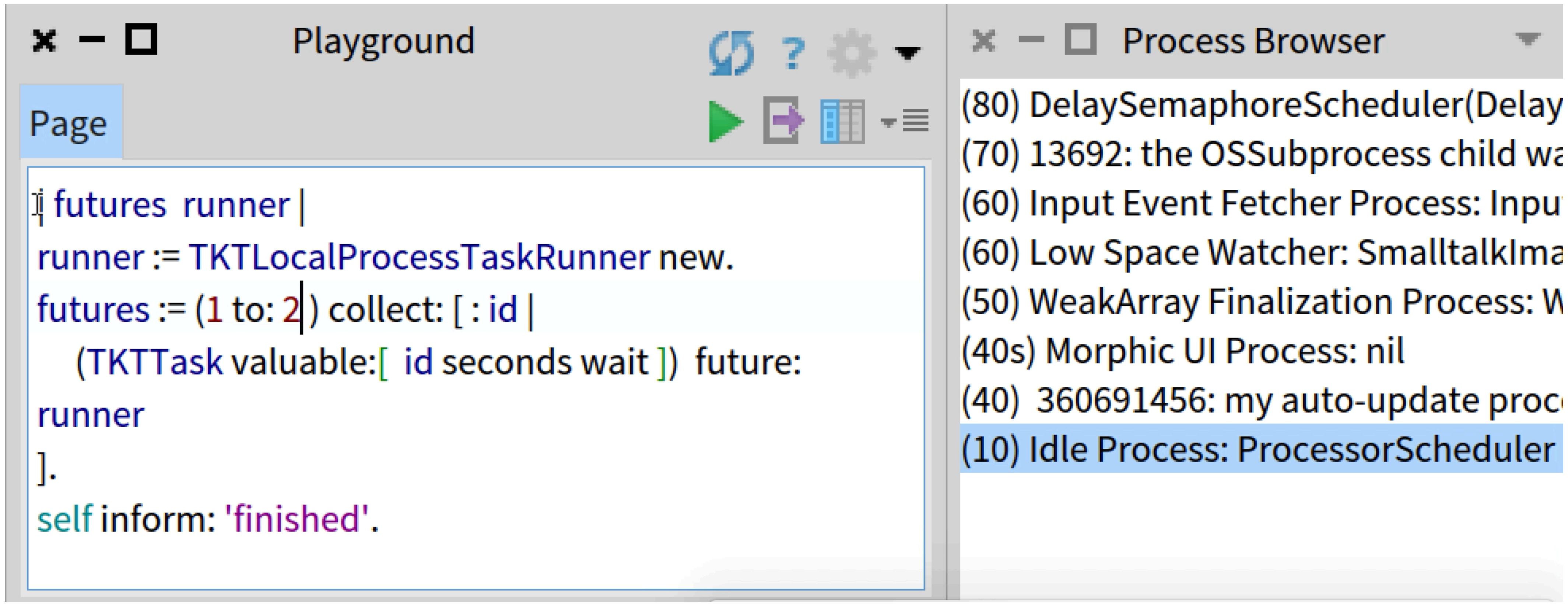
Same Process

- Simple to instantiate
- Non lifecycle control required
- Handy for debugging simple errors

```
| aFuture |

aFuture := (TKTTask valuable: [ " do something " ])
            future: TKTLocalProcessTaskRunner  new.
(TKTTask valuable: [ " do something " ])
            schedule: TKTLocalProcessTaskRunner new.
```

- **Same process**
- UI Runner
- New process
- Worker
- Worker pool
- Service

Same Process



```
| futures  runner |
runner := TKTLocalProcessTaskRunner new.
futures := (1 to: 2) collect: [ : id |
   (TKTTask valuable:[  id seconds wait ])  future:
runner
].
self inform: 'finished'.
```

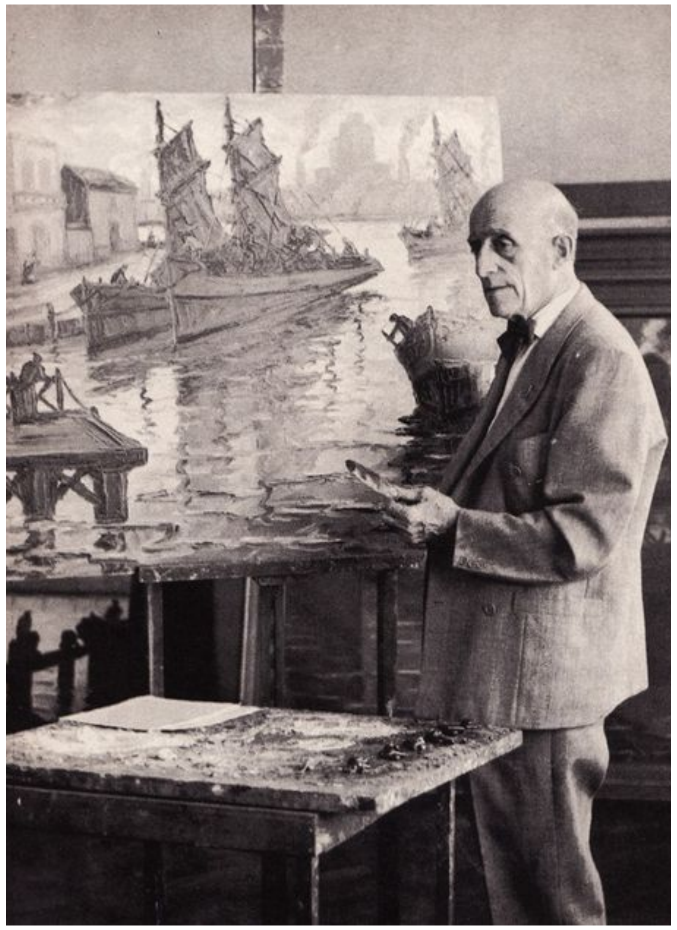
```
(80) DelaySemaphoreScheduler(Delay
(70) 13692: the OSSubprocess child wa
(60) Input Event Fetcher Process: Inpu
(60) Low Space Watcher: SmalltalkIma
(50) WeakArray Finalization Process: W
(40s) Morphic UI Process: nil
(40)  360691456: my auto-update proc
(10) Idle Process: ProcessorScheduler
```

- **Same process**
- UI Runner
- New process
- Worker
- Worker pool
- Service

UI Runner

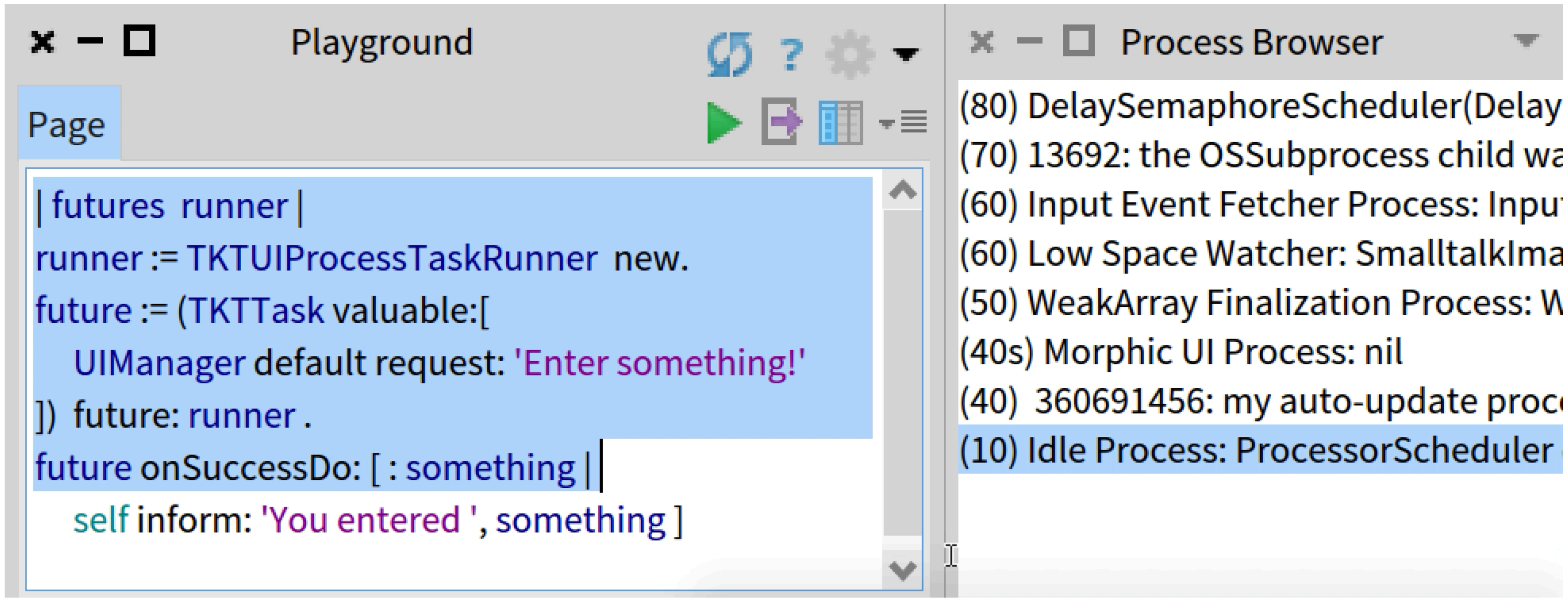
- Simple to instantiate
- Non lifecycle control required
- Handy for UI tasks

```
| aFuture  |

aFuture := (TKTTask valuable: [ " do something " ])
            future: TKTUIProcessTaskRunner new.
(TKTTask valuable: [ " do something " ])
            schedule: TKTUIProcessTaskRunner new.
```



- Same process
- **UI Runner**
- New process
- Worker
- Worker pool
- Service

UI Runner



```
| futures  runner |
runner := TKTUIProcessTaskRunner  new.
future := (TKTTask valuable:[
   UIManager default request: 'Enter something!'
]) future: runner .
future onSuccessDo: [ : something | |
   self inform: 'You entered ', something ]
```

```
(80) DelaySemaphoreScheduler(Delay
(70) 13692: the OSSubprocess child wa
(60) Input Event Fetcher Process: Inpu
(60) Low Space Watcher: SmalltalkIma
(50) WeakArray Finalization Process: W
(40s) Morphic UI Process: nil
(40)  360691456: my auto-update proc
(10) Idle Process: ProcessorScheduler
```

- Same process
- **UI Runner**
- New process
- Worker
- Worker pool
- Service

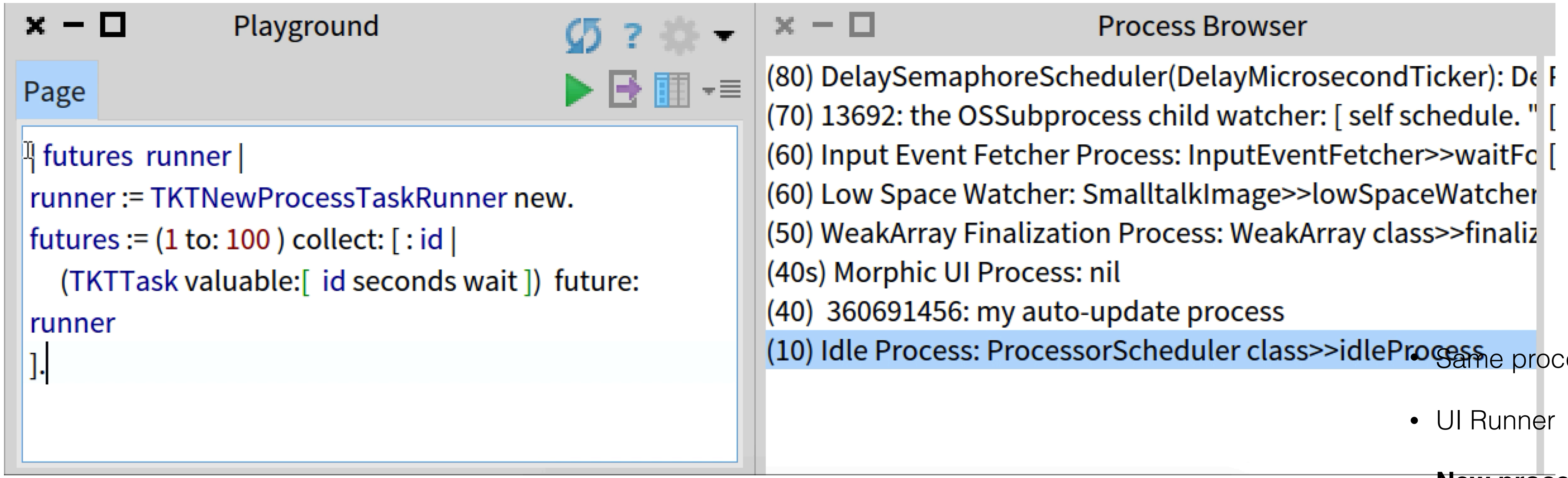
New-Process

- Simple to instantiate
- Lifecycle managed automatically: The process dies after the execution of the task
- Handy for executing tasks at the moment

```
| aFuture |

aFuture := (TKTTask valuable: [ " do something " ])
            future: TKTNewProcessTaskRunner new.
(TKTTask valuable: [ " do something " ])
            schedule: TKTNewProcessTaskRunner new.
```

- Same process
- UI Runner
- **New process**
- Worker
- Worker pool
- Service

New-Process



```
| futures  runner |
runner := TKTNewProcessTaskRunner new.
futures := (1 to: 100 ) collect: [ : id |
   (TKTTask valuable:[  id seconds wait ])  future:
runner
].
```

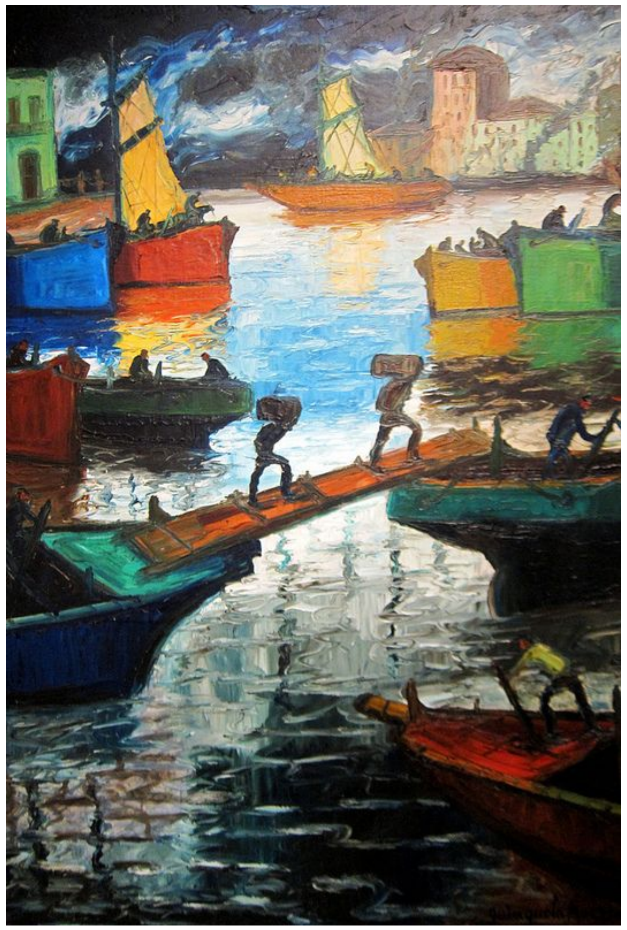
```
(80) DelaySemaphoreScheduler(DelayMicrosecondTicker): De
(70) 13692: the OSSubprocess child watcher: [ self schedule. "
(60) Input Event Fetcher Process: InputEventFetcher>>waitFo
(60) Low Space Watcher: SmalltalkImage>>lowSpaceWatcher
(50) WeakArray Finalization Process: WeakArray class>>finaliz
(40s) Morphic UI Process: nil
(40)  360691456: my auto-update process
(10) Idle Process: ProcessorScheduler class>>idleProcess
```

- Same process
- UI Runner
- **New process**
- Worker
- Worker pool
- Service

Worker

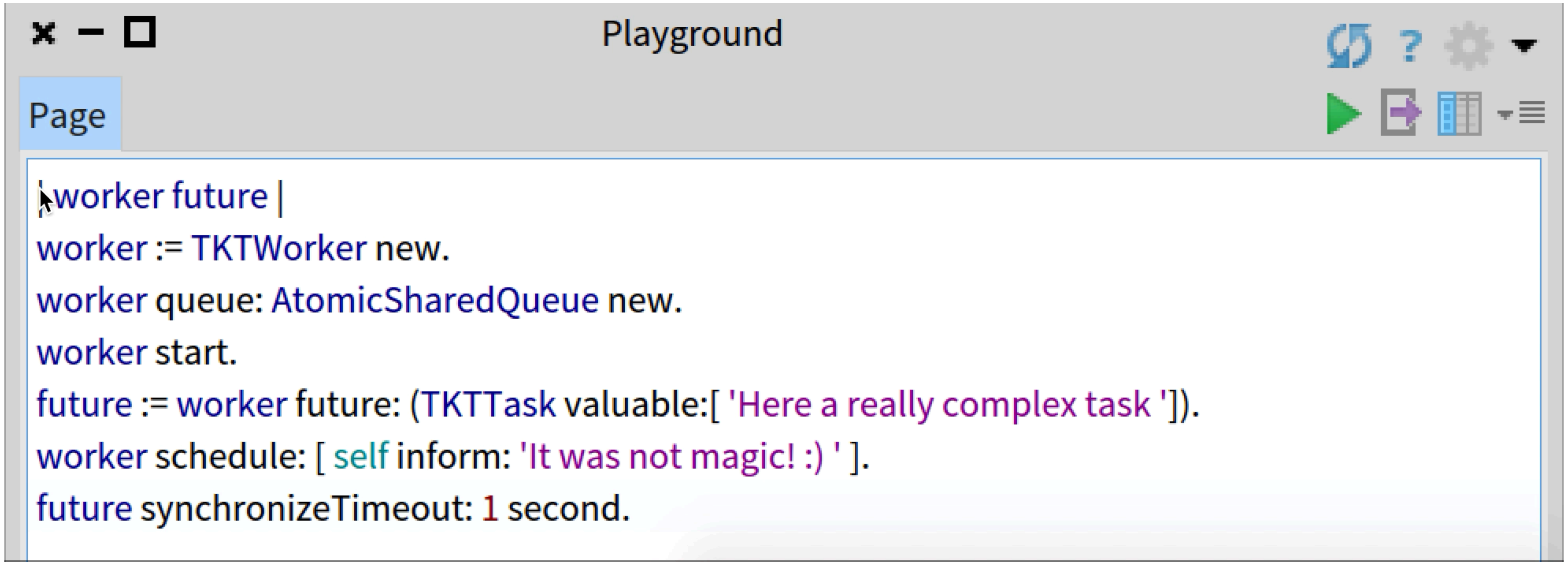
- Instantiation requires to hold the worker reference
- Lifecycle managed by garbage collection & Watch dog
- Handy for reusing the same process

```
| aFuture worker |
worker := TKTWorker new.
worker queue: AtomicSharedQueue new.
worker start.

aFuture := (TKTTask valuable: [ " do something " ])
            future: worker.
(TKTTask valuable: [ " do something " ])
            schedule: worker.
```



- Same process
- UI Runner
- New process
- **Worker**
- Worker pool
- Service

Worker



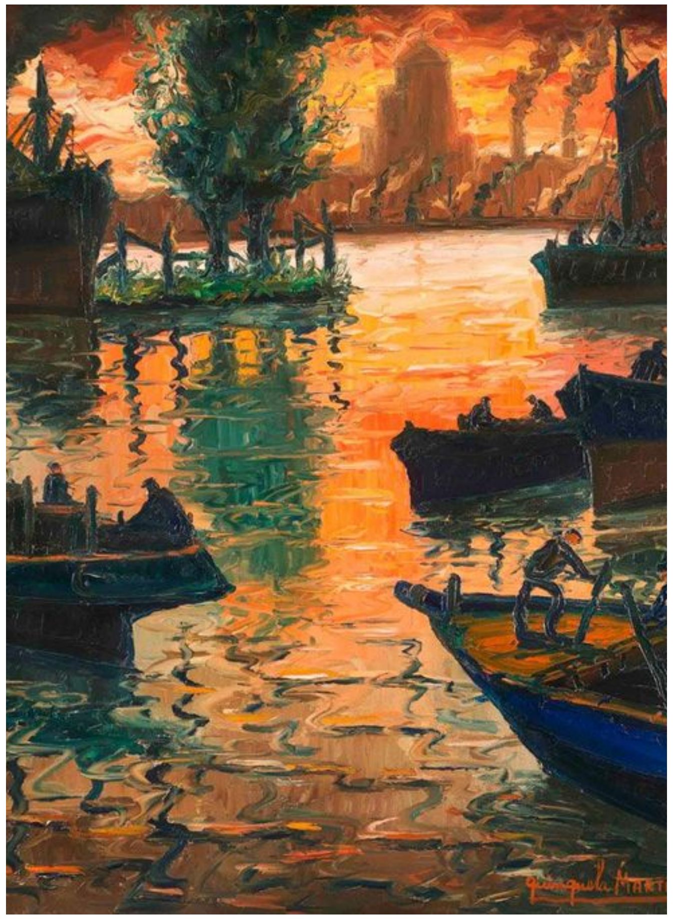
```
| worker future |
worker := TKTWorker new.
worker queue: AtomicSharedQueue new.
worker start.
future := worker future: (TKTTask valuable:[ 'Here a really complex task ']).
worker schedule: [ self inform: 'It was not magic! :) ' ].
future synchronizeTimeout: 1 second.
```

- Same process
- UI Runner
- New process
- **Worker**
- Worker pool
- Service

Worker-Pool

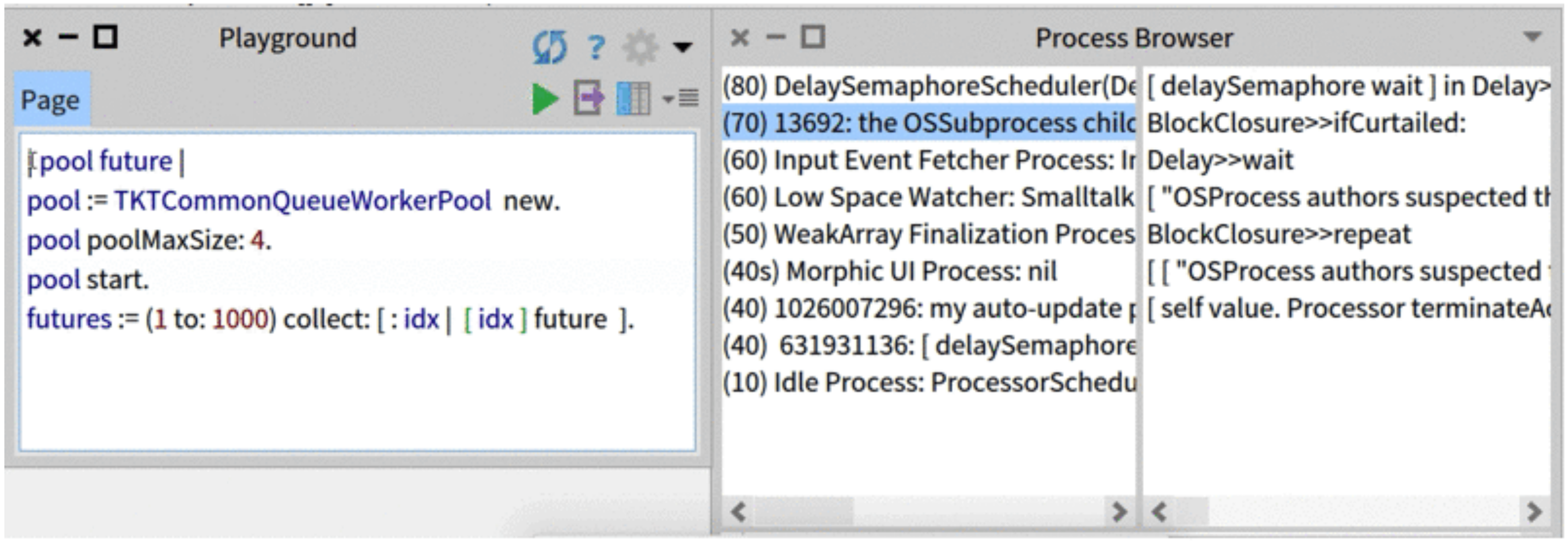
- Instantiation requires to hold the worker reference
- Lifecycle managed by garbage collection & Watch dog
- Handy for reusing the same process and control the system's load

```
| aFuture  pool |

pool := TKTCommonQueueWorkerPool new.
pool poolMaxSize: 4. " default value "

aFuture := (TKTTask valuable: [ " do something " ])
              future: pool.
(TKTTask valuable: [ " do something " ])
              schedule: pool.
```



- Same process
- UI Runner
- New process
- Worker
- **Worker pool**
- Service

Worker-Pool



```
| pool future |
pool := TKTCommonQueueWorkerPool new.
pool poolMaxSize: 4.
pool start.
futures := (1 to: 1000) collect: [ :idx | [ idx ] future ].
```

```
(80) DelaySemaphoreScheduler(De     [ delaySemaphore wait ] in Delay>
(70) 13692: the OSSubprocess chilc  BlockClosure>>ifCurtailed:
(60) Input Event Fetcher Process: Ir Delay>>wait
(60) Low Space Watcher: Smalltalk   [ "OSProcess authors suspected tl
(50) WeakArray Finalization Proces  BlockClosure>>repeat
(40s) Morphic UI Process: nil       [ [ "OSProcess authors suspected
(40) 1026007296: my auto-update p   [ self value. Processor terminateAc
(40) 631931136: [ delaySemaphore
(10) Idle Process: ProcessorSchedu
```

- Same process
- UI Runner
- New process
- Worker
- **Worker pool**
- Service

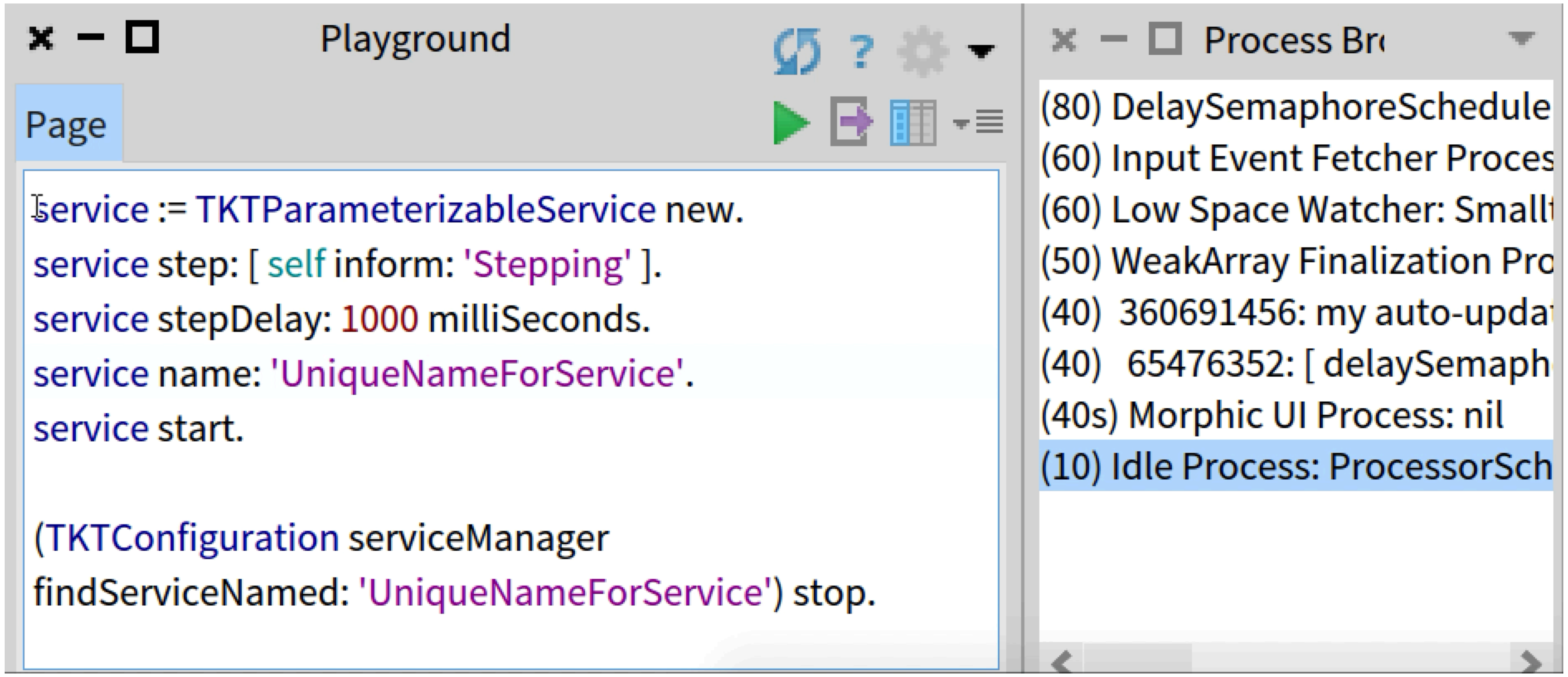
Service

- Instantiation requires to set the task before starting the service, and also requires an unique name
- Lifecycle managed by the user by start/stop/restart
- Handy for providing services/daemons

```
| service  |

service := TKTParameterizableService new.
service stepDelay: 500 milliSeconds.
service name: 'Unique-Service-Name'.
service step: [ self inform: ' Tick ' ].
service start.
```

- Same process
- UI Runner
- New process
- Worker
- Worker pool
- **Service**

Service



```
service := TKTParameterizableService new.
service step: [ self inform: 'Stepping' ].
service stepDelay: 1000 milliSeconds.
service name: 'UniqueNameForService'.
service start.

(TKTConfiguration serviceManager
findServiceNamed: 'UniqueNameForService') stop.
```

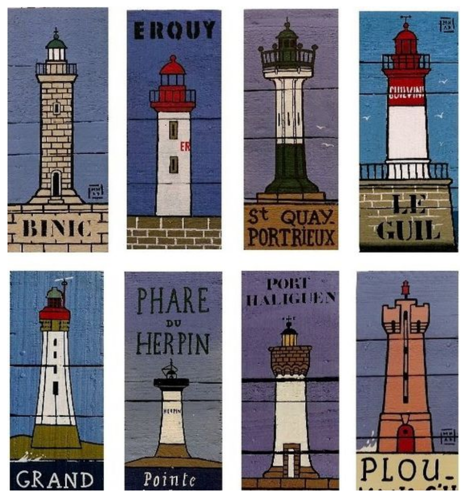
```
(80) DelaySemaphoreSchedule
(60) Input Event Fetcher Proces
(60) Low Space Watcher: Smallt
(50) WeakArray Finalization Pro
(40)  360691456: my auto-upda
(40)   65476352: [ delaySemaph
(40s) Morphic UI Process: nil
(10) Idle Process: ProcessorSch
```

- Same process
- UI Runner
- New process
- Worker
- Worker pool
- **Service**

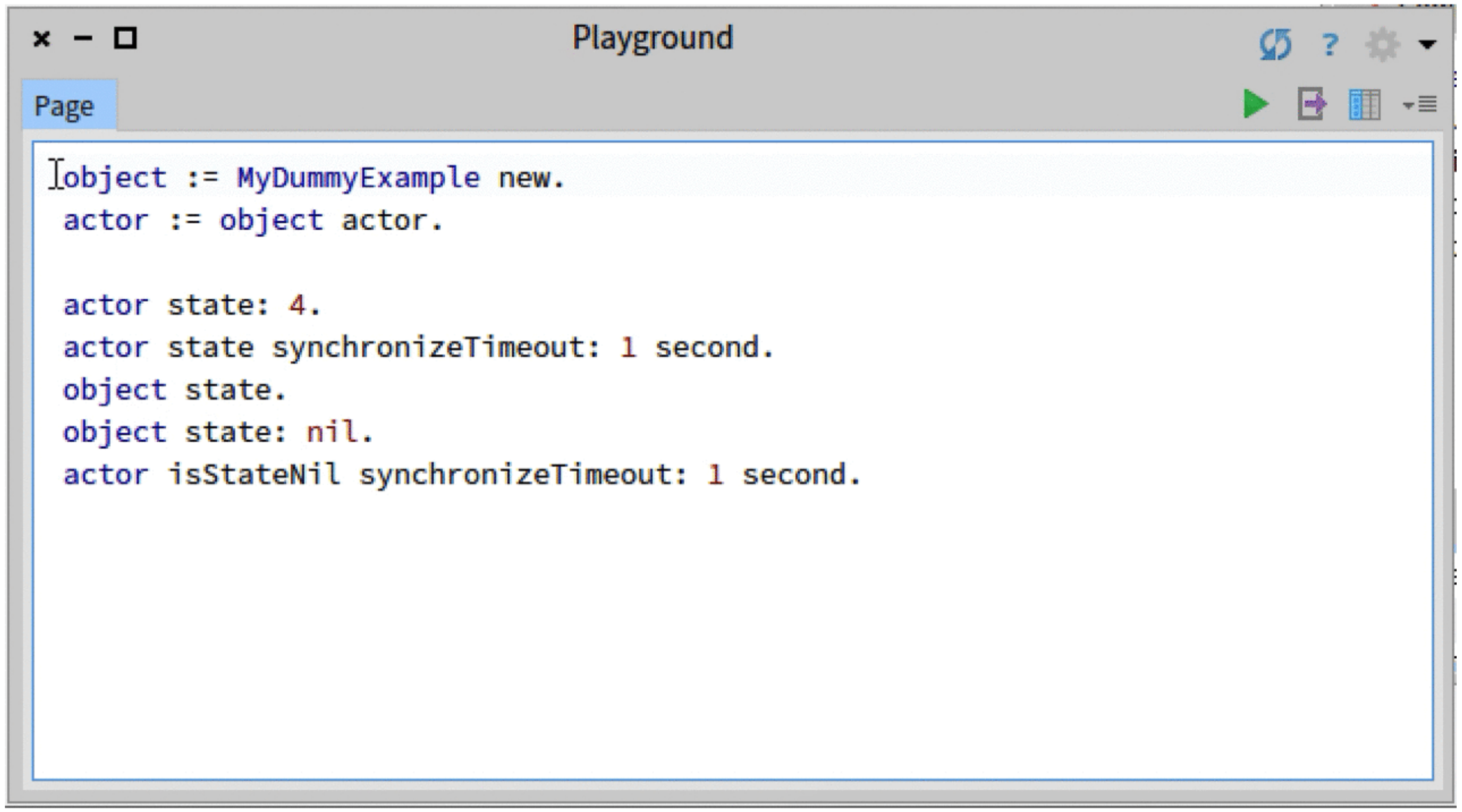
Appendix 1: Extensions

TaskIt Extensions: ActIt

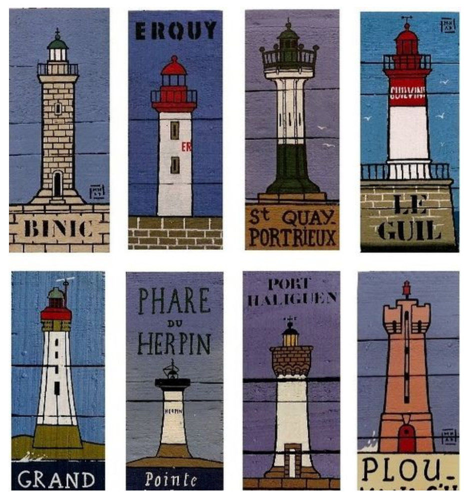
- Provides an ActTalk inspired implementation
- Provides processing flavours
  - Worker
  - UI
  - Same process



TaskIt Extensions: ActIt



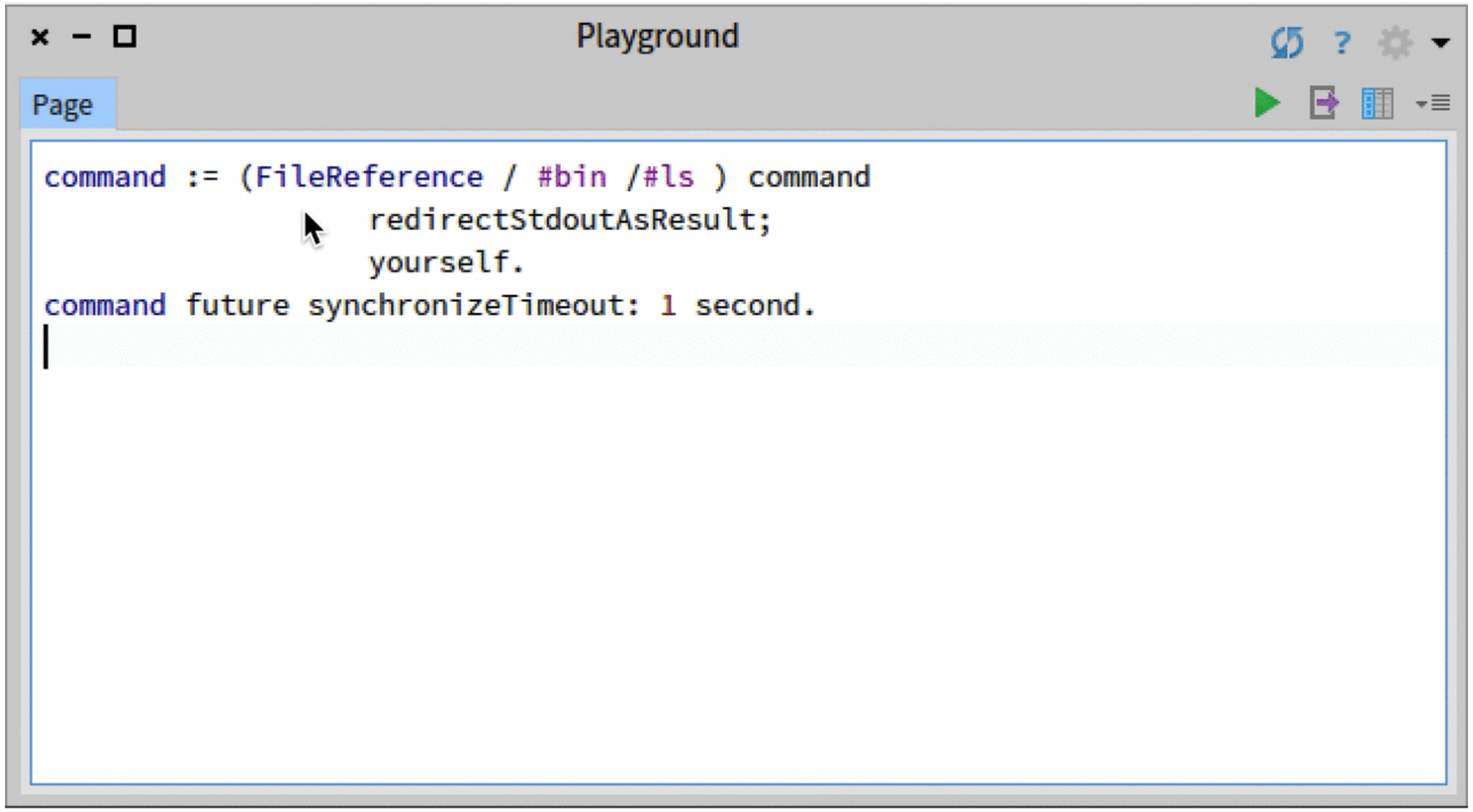
```
object := MyDummyExample new.
actor := object actor.

actor state: 4.
actor state synchronizeTimeout: 1 second.
object state.
object state: nil.
actor isStateNil synchronizeTimeout: 1 second.
```



TaskIt Extensions: Shell

- Provides a new kind of task
- Is based on OS-Subprocess
- Allows to transform standard output into results

TaskIt Extensions: Shell

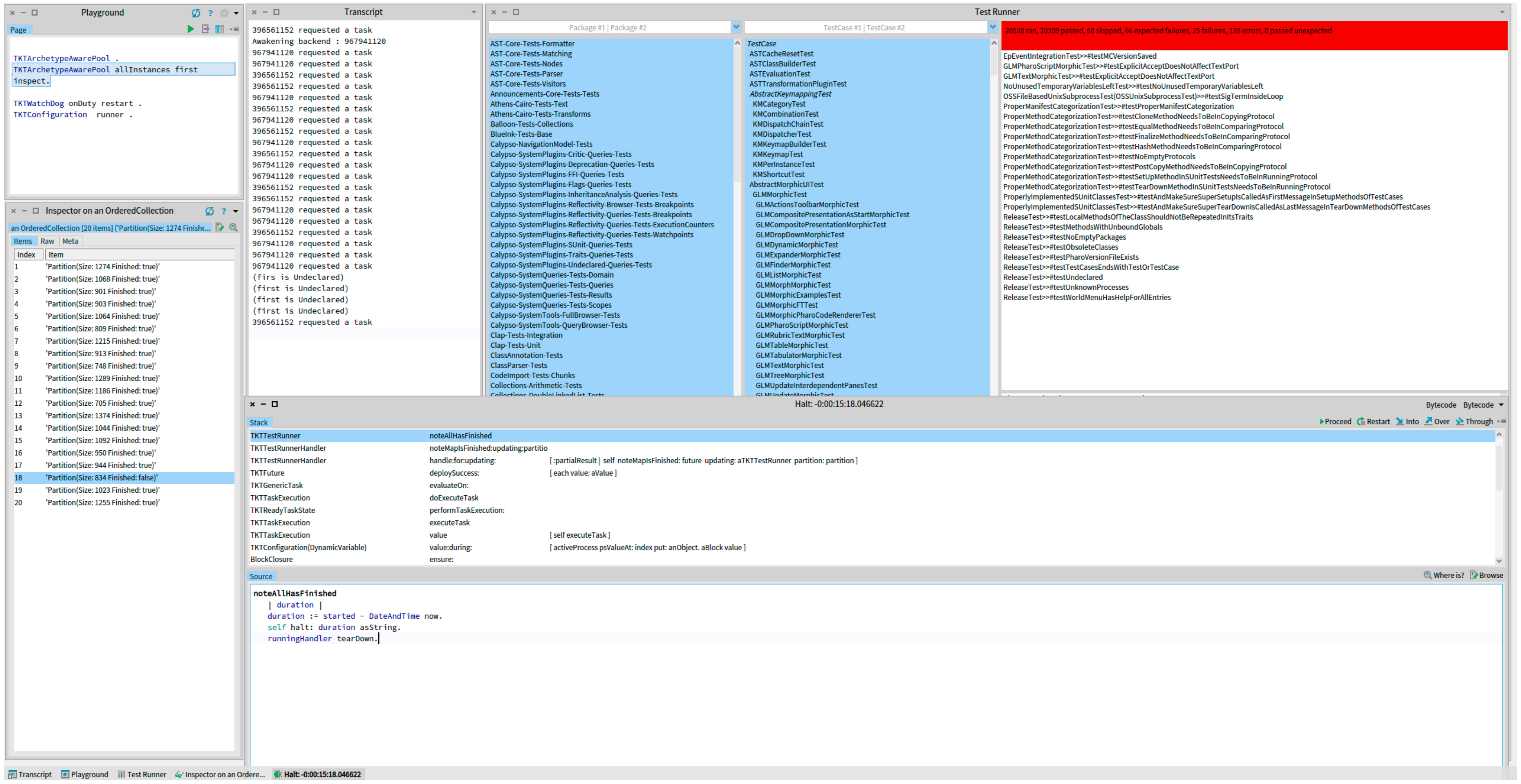


```
command := (FileReference / #bin /#ls ) command
                redirectStdoutAsResult;
                yourself.
command future synchronizeTimeout: 1 second.
```

TaskIt Extensions: ForkIt

- Master / slave architecture
- Reuse most of the task it and task it shell architecture
- Alpha state, but improving fast

ForkIt



Playground

```
TKTArchetypeAwarePool .
TKTArchetypeAwarePool allInstances first
inspect.

TKTWatchDog onDuty restart .
TKTConfiguration  runner .
```

Inspector on an OrderedCollection

an OrderedCollection [20 items] ('Partition(Size: 1274 Finishe...

Index	Item
1	'Partition(Size: 1274 Finished: true)'
2	'Partition(Size: 1068 Finished: true)'
3	'Partition(Size: 901 Finished: true)'
4	'Partition(Size: 903 Finished: true)'
5	'Partition(Size: 1064 Finished: true)'
6	'Partition(Size: 809 Finished: true)'
7	'Partition(Size: 1215 Finished: true)'
8	'Partition(Size: 913 Finished: true)'
9	'Partition(Size: 748 Finished: true)'
10	'Partition(Size: 1289 Finished: true)'
11	'Partition(Size: 1186 Finished: true)'
12	'Partition(Size: 705 Finished: true)'
13	'Partition(Size: 1374 Finished: true)'
14	'Partition(Size: 1044 Finished: true)'
15	'Partition(Size: 1092 Finished: true)'
16	'Partition(Size: 950 Finished: true)'
17	'Partition(Size: 944 Finished: true)'
18	'Partition(Size: 834 Finished: false)'
19	'Partition(Size: 1023 Finished: true)'
20	'Partition(Size: 1255 Finished: true)'

Transcript

```
396561152 requested a task
Awakening backend : 967941120
967941120 requested a task
967941120 requested a task
396561152 requested a task
396561152 requested a task
967941120 requested a task
396561152 requested a task
967941120 requested a task
396561152 requested a task
967941120 requested a task
396561152 requested a task
967941120 requested a task
967941120 requested a task
396561152 requested a task
396561152 requested a task
967941120 requested a task
967941120 requested a task
396561152 requested a task
967941120 requested a task
967941120 requested a task
967941120 requested a task
(firs is Undeclared)
(first is Undeclared)
(first is Undeclared)
(first is Undeclared)
396561152 requested a task
```

Test Runner

Package #1 | Package #2

AST-Core-Tests-Formatter
AST-Core-Tests-Matching
AST-Core-Tests-Nodes
AST-Core-Tests-Parser
AST-Core-Tests-Visitors
Announcements-Core-Tests-Tests
Athens-Cairo-Tests-Text
Athens-Cairo-Tests-Transforms
Balloon-Tests-Collections
BlueInk-Tests-Base
Calypso-NavigationModel-Tests
Calypso-SystemPlugins-Critic-Queries-Tests
Calypso-SystemPlugins-Deprecation-Queries-Tests
Calypso-SystemPlugins-FFI-Queries-Tests
Calypso-SystemPlugins-Flags-Queries-Tests
Calypso-SystemPlugins-InheritanceAnalysis-Queries-Tests
Calypso-SystemPlugins-Reflectivity-Browser-Tests-Breakpoints
Calypso-SystemPlugins-Reflectivity-Queries-Tests-Breakpoints
Calypso-SystemPlugins-Reflectivity-Queries-Tests-ExecutionCounters
Calypso-SystemPlugins-Reflectivity-Queries-Tests-Watchpoints
Calypso-SystemPlugins-SUnit-Queries-Tests
Calypso-SystemPlugins-Traits-Queries-Tests
Calypso-SystemPlugins-Undeclared-Queries-Tests
Calypso-SystemQueries-Tests-Domain
Calypso-SystemQueries-Tests-Queries
Calypso-SystemQueries-Tests-Results
Calypso-SystemQueries-Tests-Scopes
Calypso-SystemTools-FullBrowser-Tests
Calypso-SystemTools-QueryBrowser-Tests
Clap-Tests-Integration
Clap-Tests-Unit
ClassAnnotation-Tests
ClassParser-Tests
CodeImport-Tests-Chunks
Collections-Arithmetic-Tests

TestCase #1 | TestCase #2

TestCase
ASTCacheResetTest
ASTClassBuilderTest
ASTEvaluationTest
ASTTransformationPluginTest
AbstractKeymappingTest
KMCategoryTest
KMCombinationTest
KMDispatchChainTest
KMDispatcherTest
KMKeymapBuilderTest
KMKeymapTest
KMPerInstanceTest
KMShortcutTest
AbstractMorphicUITest
GLMMorphicTest
GLMActionsToolbarMorphicTest
GLMCompositePresentationAsStartMorphicTest
GLMCompositePresentationMorphicTest
GLMDropDownMorphicTest
GLMDynamicMorphicTest
GLMExpanderMorphicTest
GLMFinderMorphicTest
GLMListMorphicTest
GLMMorphMorphicTest
GLMMorphicExamplesTest
GLMMorphicFTTest
GLMMorphicPharoCodeRendererTest
GLMPharoScriptMorphicTest
GLMRubricTextMorphicTest
GLMTableMorphicTest
GLMTabulatorMorphicTest
GLMTextMorphicTest
GLMTreeMorphicTest
GLMUpdateInterdependentPanesTest

20538 ran, 20309 passed, 68 skipped, 66 expected failures, 25 failures, 138 errors, 0 passed unexpected

```
EpEventIntegrationTest>>#testMCVersionSaved
GLMPharoScriptMorphicTest>>#testExplicitAcceptDoesNotAffectTextPort
GLMTextMorphicTest>>#testExplicitAcceptDoesNotAffectTextPort
NoUnusedTemporaryVariablesLeftTest>>#testNoUnusedTemporaryVariablesLeft
OSSFileBasedUnixSubprocessTest(OSSUnixSubprocessTest)>>#testSigTermInsideLoop
ProperManifestCategorizationTest>>#testProperManifestCategorization
ProperMethodCategorizationTest>>#testCloneMethodNeedsToBeInCopyingProtocol
ProperMethodCategorizationTest>>#testEqualMethodNeedsToBeInComparingProtocol
ProperMethodCategorizationTest>>#testFinalizeMethodNeedsToBeInComparingProtocol
ProperMethodCategorizationTest>>#testHashMethodNeedsToBeInComparingProtocol
ProperMethodCategorizationTest>>#testNoEmptyProtocols
ProperMethodCategorizationTest>>#testPostCopyMethodNeedsToBeInCopyingProtocol
ProperMethodCategorizationTest>>#testSetUpMethodInSUnitTestsNeedsToBeInRunningProtocol
ProperMethodCategorizationTest>>#testTearDownMethodInSUnitTestsNeedsToBeInRunningProtocol
ProperlyImplementedSUnitClassesTest>>#testAndMakeSureSuperSetupIsCalledAsFirstMessageInSetupMethodsOfTestCases
ProperlyImplementedSUnitClassesTest>>#testAndMakeSureSuperTearDownIsCalledAsLastMessageInTearDownMethodsOfTestCases
ReleaseTest>>#testLocalMethodsOfTheClassShouldNotBeRepeatedInItsTraits
ReleaseTest>>#testMethodsWithUnboundGlobals
ReleaseTest>>#testNoEmptyPackages
ReleaseTest>>#testObsoleteClasses
ReleaseTest>>#testPharoVersionFileExists
ReleaseTest>>#testTestCasesEndsWithTestOrTestCase
ReleaseTest>>#testUndeclared
ReleaseTest>>#testUnknownProcesses
ReleaseTest>>#testWorldMenuHasHelpForAllEntries
```

Halt: -0:00:15:18.046622

Stack

TKTTestRunner	noteAllHasFinished	
TKTTestRunnerHandler	noteMapIsFinished:updating:partitio	
TKTTestRunnerHandler	handle:for:updating:	[:partialResult | self noteMapIsFinished: future updating: aTKTTestRunner partition: partition]
TKTFuture	deploySuccess:	[each value: aValue]
TKTGenericTask	evaluateOn:	
TKTTaskExecution	doExecuteTask	
TKTReadyTaskState	performTaskExecution:	
TKTTaskExecution	executeTask	
TKTTaskExecution	value	[self executeTask]
TKTConfiguration(DynamicVariable)	value:during:	[activeProcess psValueAt: index put: anObject. aBlock value]
BlockClosure	ensure:	

Source

```
noteAllHasFinished
   | duration |
   duration := started - DateAndTime now.
   self halt: duration asString.
   runningHandler tearDown.
```

TaskIt Extensions: ForkIt

- Provides an extension for building images
- Provides a new runner: Remote Worker

TaskIt Extensions: ForkIt

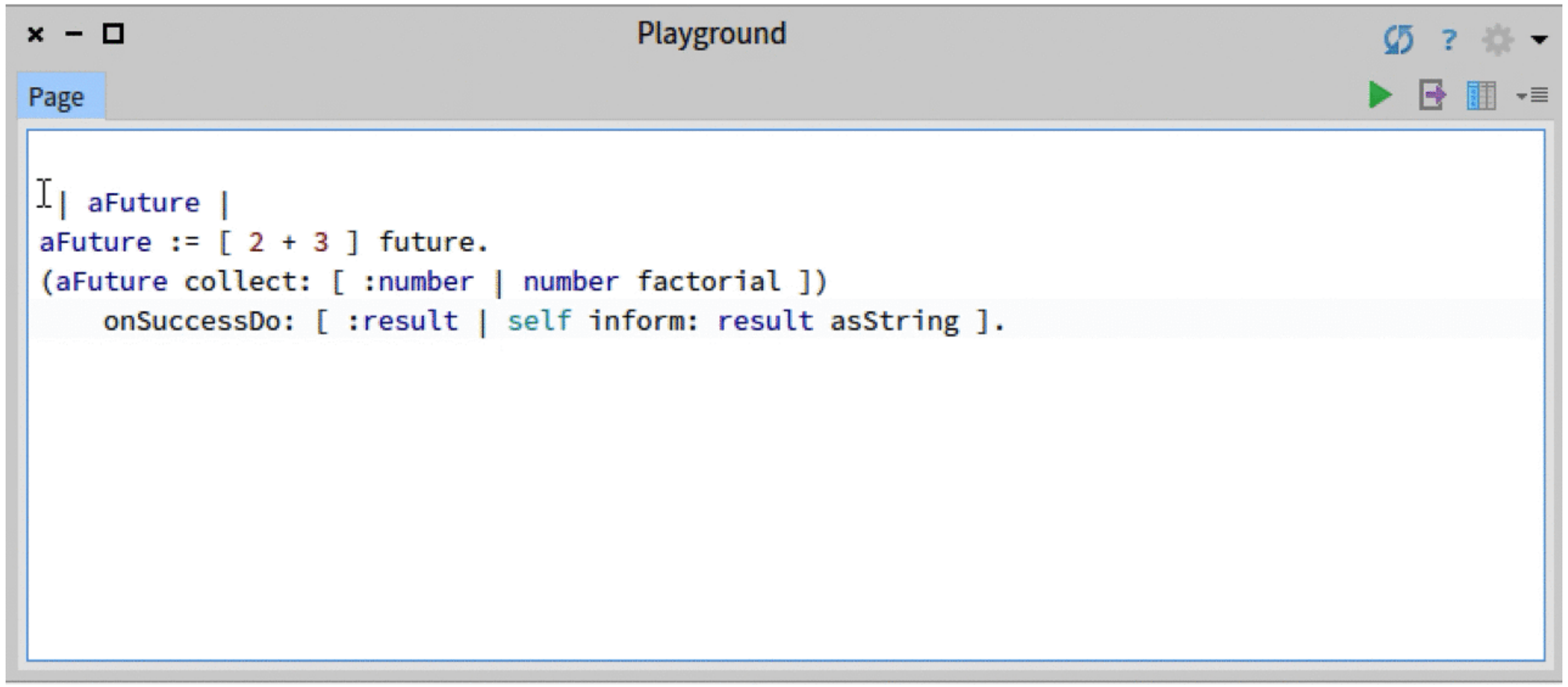
- Working on adapting to the industrial standards
  - Process communication Message queue (RabbitMq)
  - Building process (Puppet/ Vagrant/Others / not yet decided)

Thanks :)

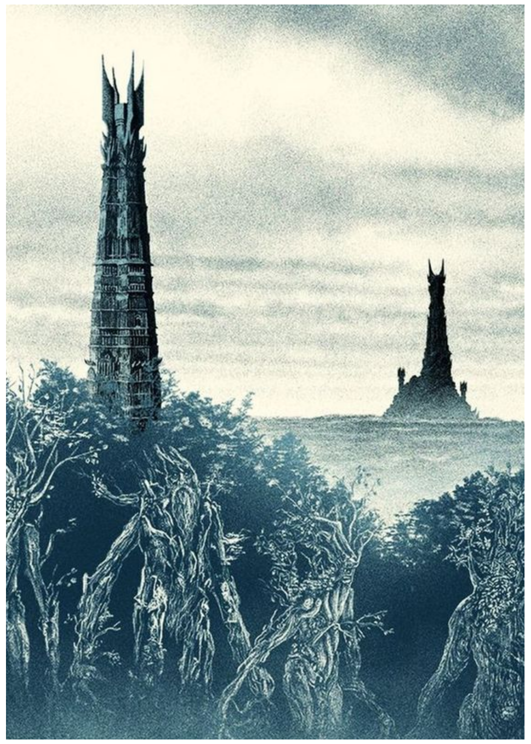
- Synchronise different tasks by using powerful and highly tested **futures**
- Delegate the lifecycle control to specialised **runners**, according with your domain
- Control the load of your image by using **pools** of processes
- Boost your productivity in concurrency by using a **mature** library used for user interaction and robotic communication
- https://github.com/sbragagnolo/taskit

Appendix 2: All the combinators

Combinations: Collect

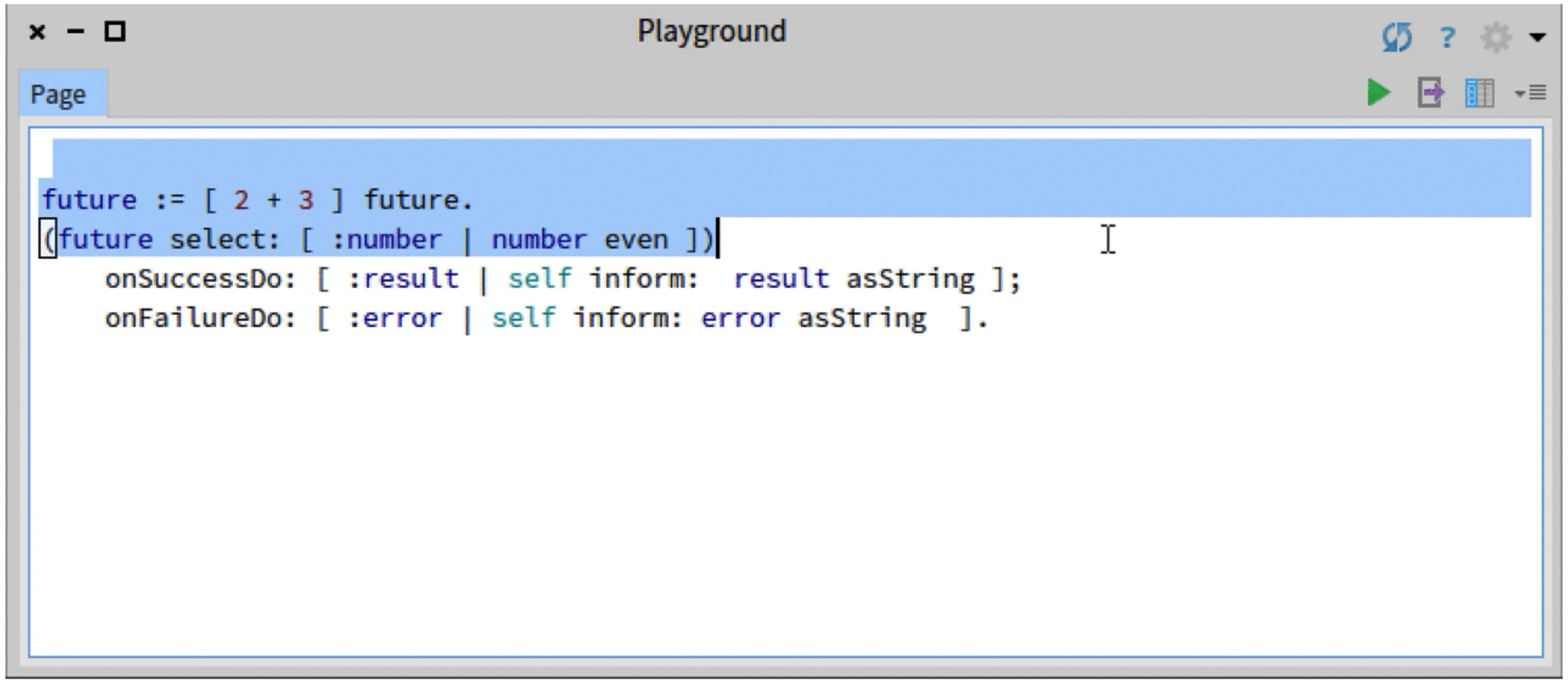


```
| aFuture |
aFuture := [ 2 + 3 ] future.
(aFuture collect: [ :number | number factorial ])
    onSuccessDo: [ :result | self inform: result asString ].
```

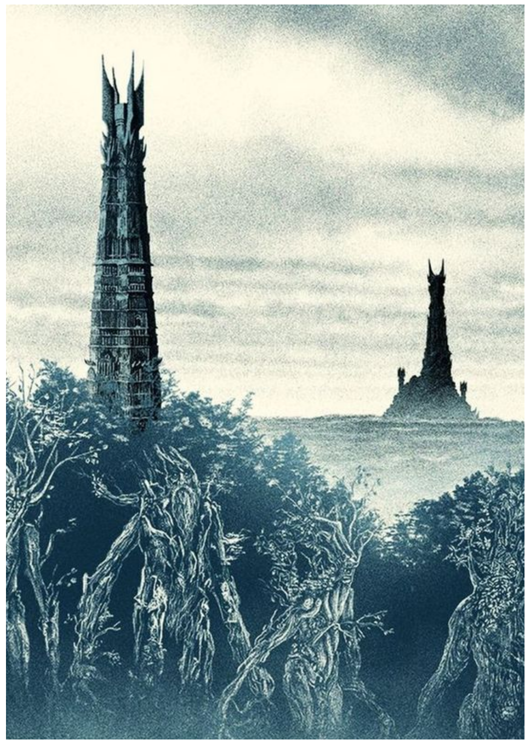


- synchronous
- asynchronous
- **task combination**

Combinations: Select

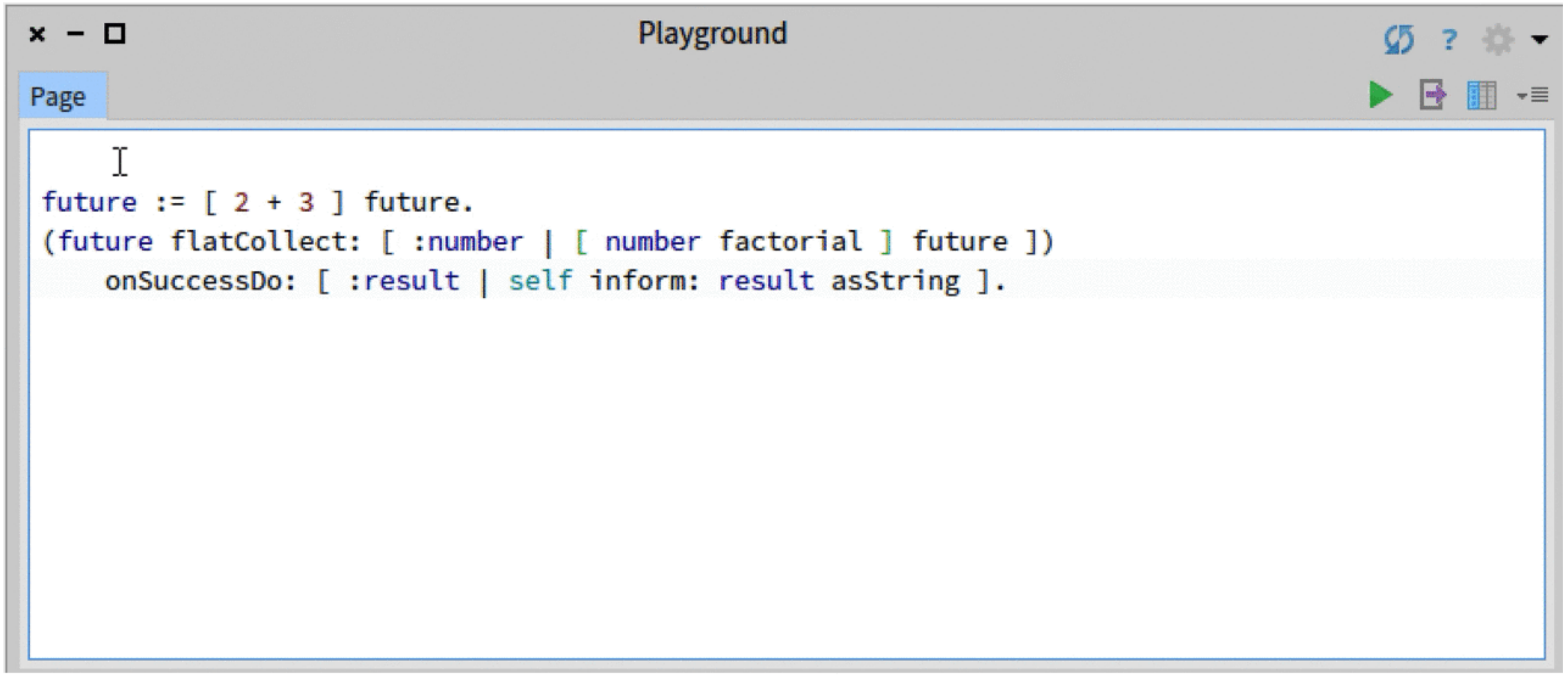


```
future := [ 2 + 3 ] future.
(future select: [ :number | number even ])
    onSuccessDo: [ :result | self inform:  result asString ];
    onFailureDo: [ :error | self inform: error asString  ].
```

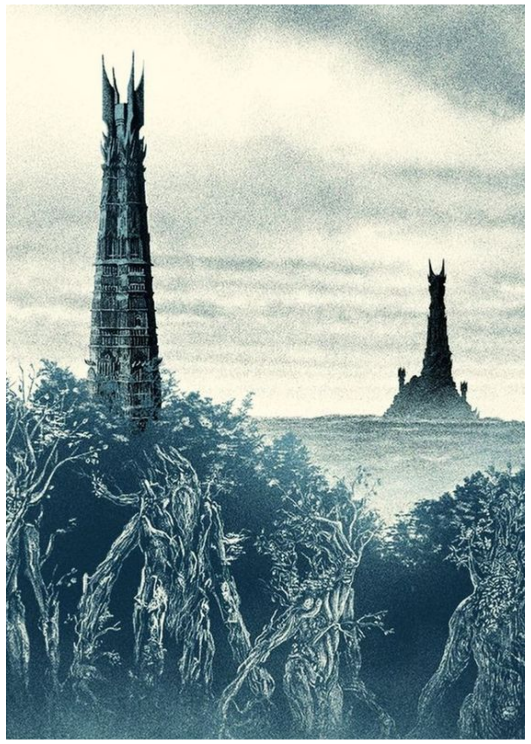


- synchronous
- asynchronous
- **task combination**

Combinations: Flat Collect

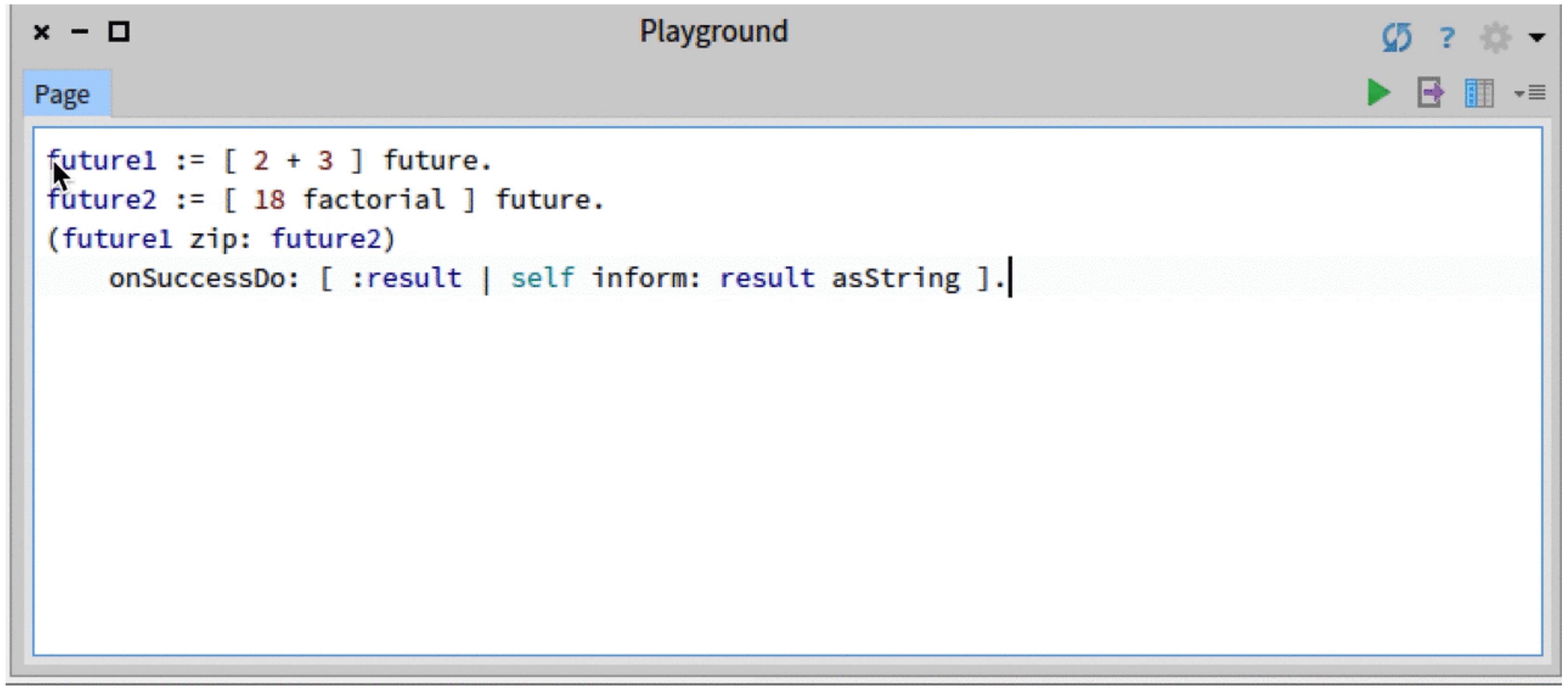


```
future := [ 2 + 3 ] future.
(future flatCollect: [ :number | [ number factorial ] future ])
    onSuccessDo: [ :result | self inform: result asString ].
```

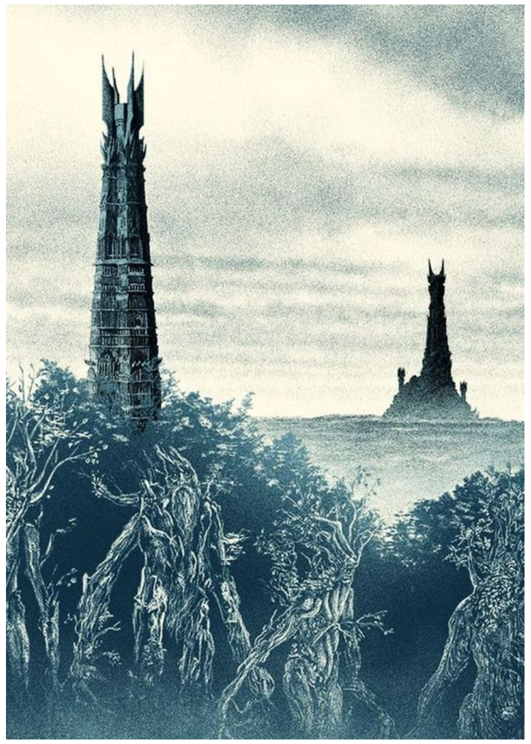


- synchronous
- asynchronous
- **task combination**

Combinations: Zip



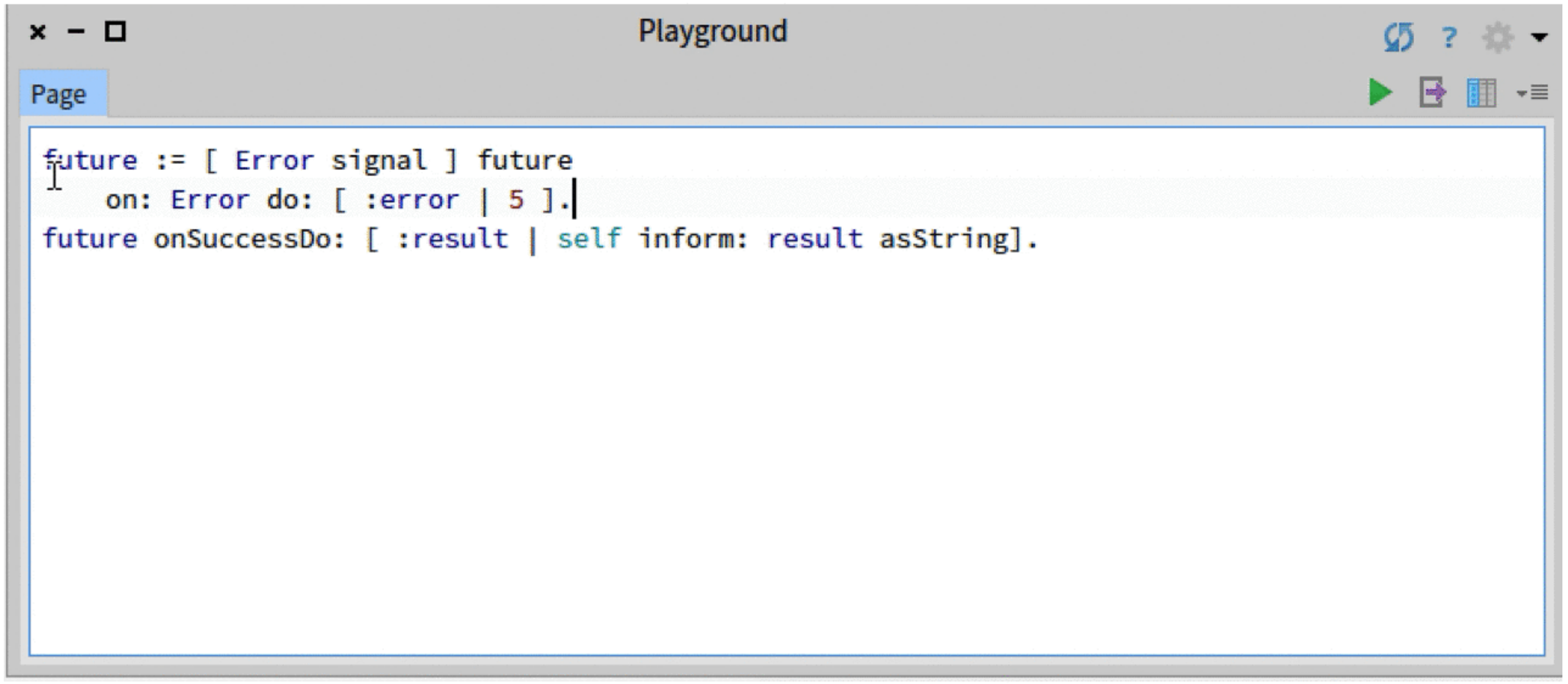
```
future1 := [ 2 + 3 ] future.
future2 := [ 18 factorial ] future.
(future1 zip: future2)
    onSuccessDo: [ :result | self inform: result asString ].
```



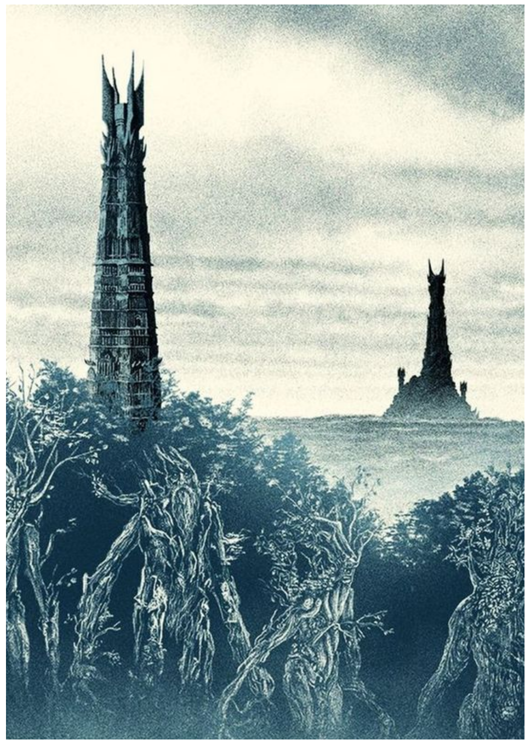
- synchronous
- asynchronous
- **task combination**

RMod

Combinations: On-Do



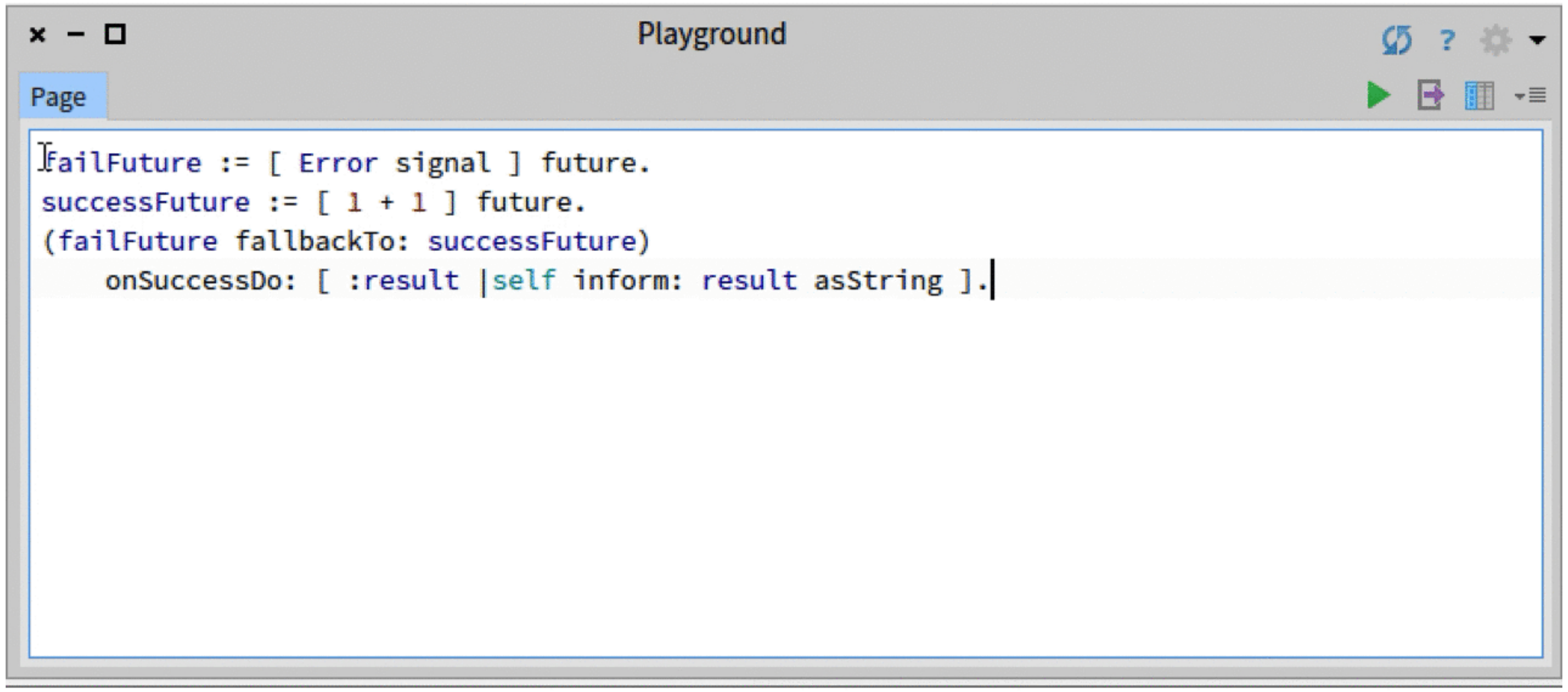
```
future := [ Error signal ] future
    on: Error do: [ :error | 5 ].
future onSuccessDo: [ :result | self inform: result asString].
```



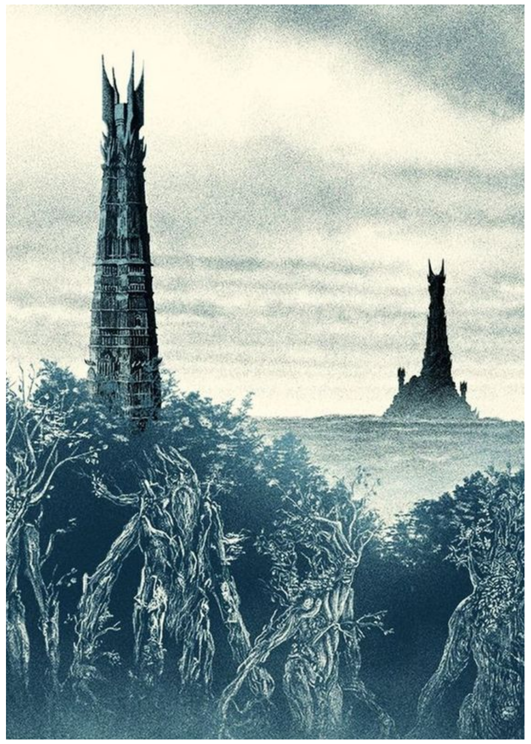
- synchronous
- asynchronous
- **task combination**

Inria inventeurs du monde numérique 50 ANS 1967 › 2017 › 2067 Imaginons notre futur

Combinations: Fallback To

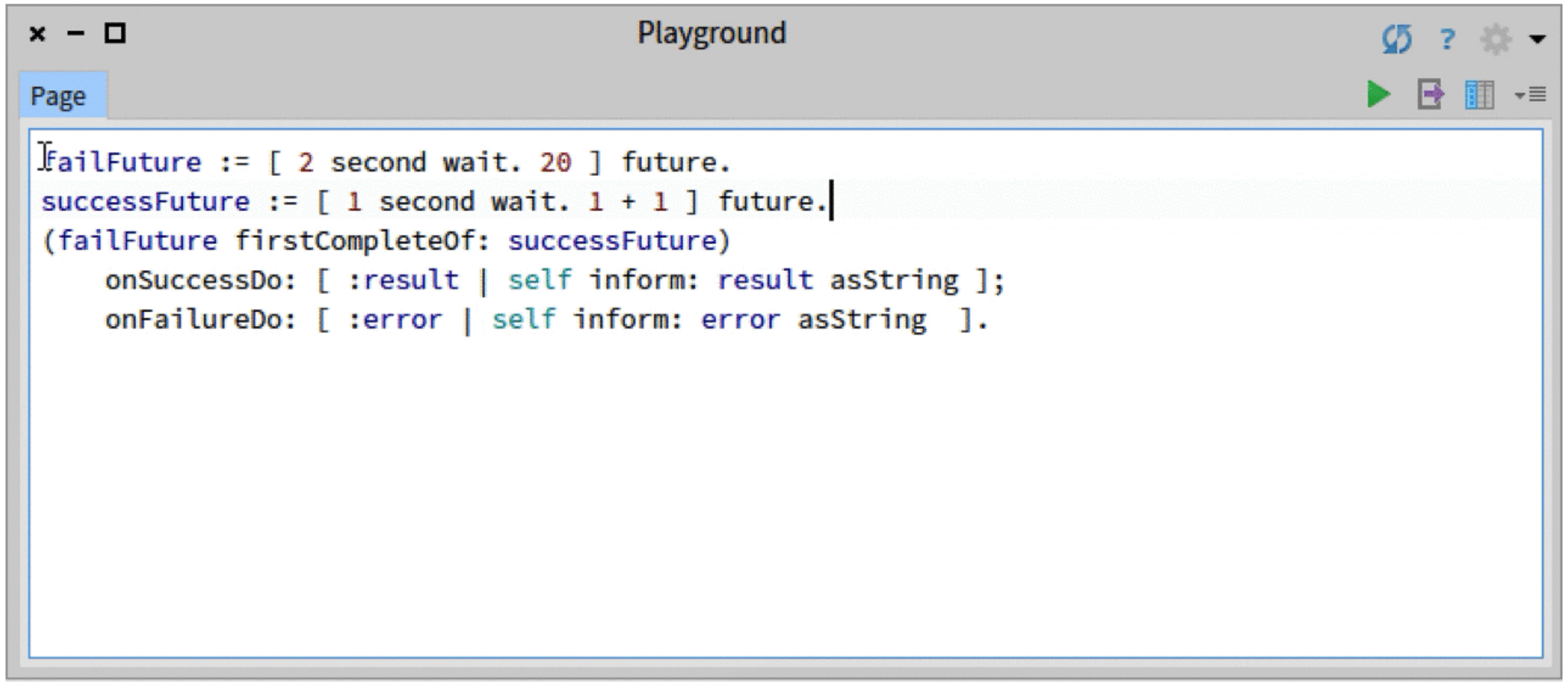


```
failFuture := [ Error signal ] future.
successFuture := [ 1 + 1 ] future.
(failFuture fallbackTo: successFuture)
    onSuccessDo: [ :result |self inform: result asString ].
```



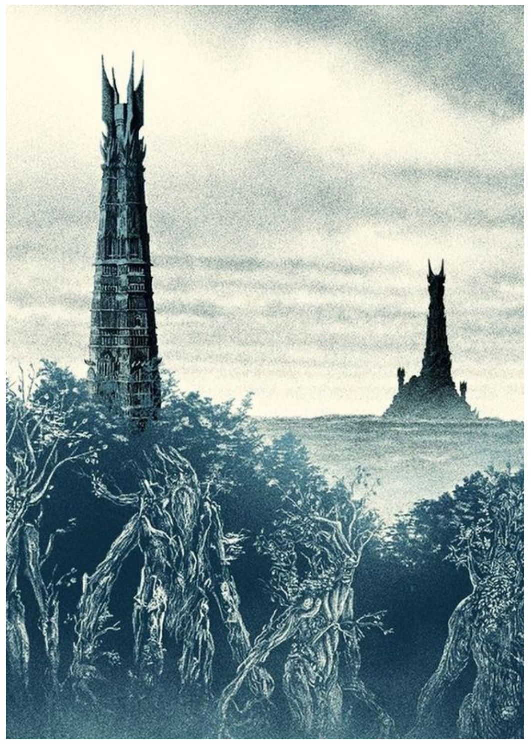
- synchronous
- asynchronous
- **task combination**

Combinations: First complete


Playground

Page

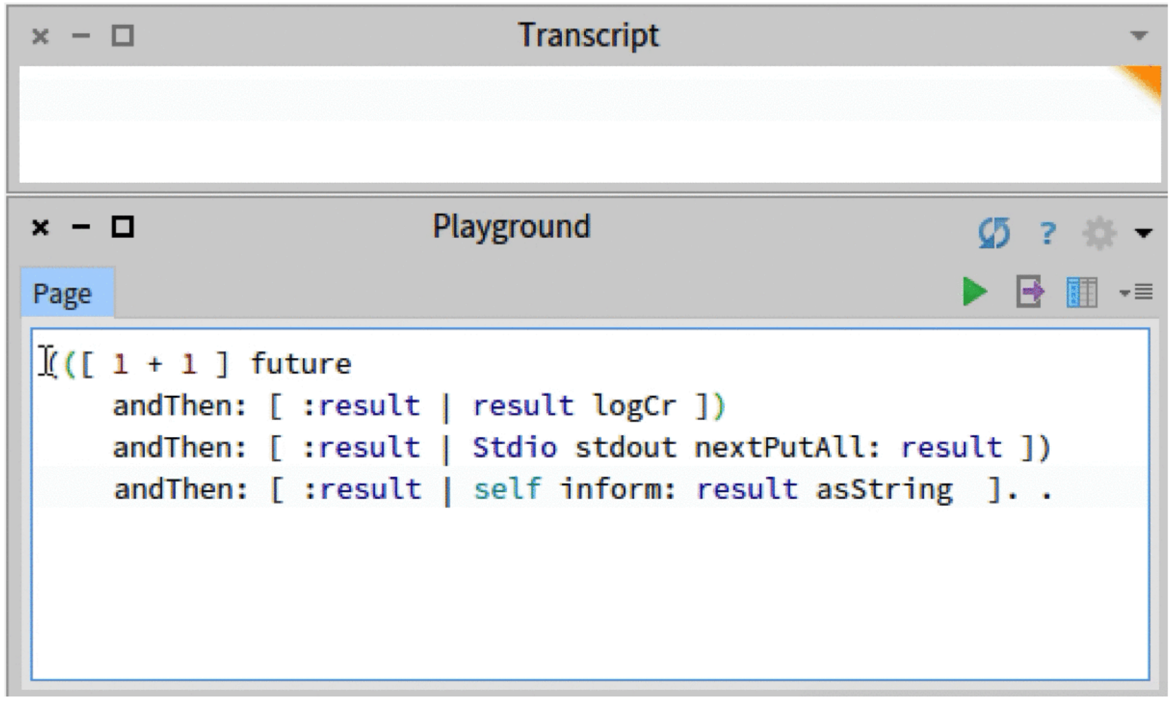
```
failFuture := [ 2 second wait. 20 ] future.
successFuture := [ 1 second wait. 1 + 1 ] future.
(failFuture firstCompleteOf: successFuture)
    onSuccessDo: [ :result | self inform: result asString ];
    onFailureDo: [ :error | self inform: error asString  ].
```



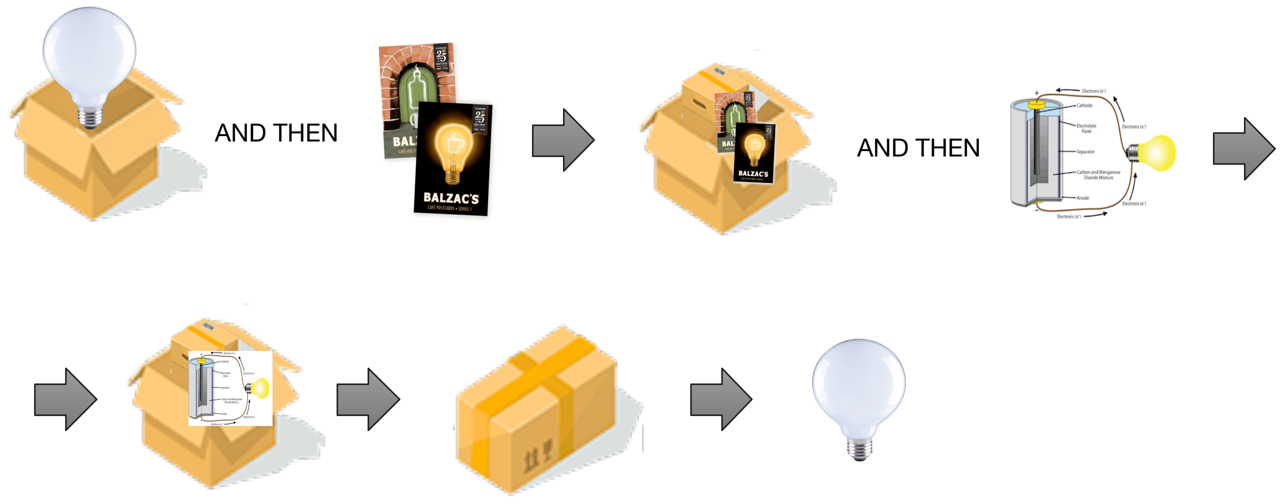
- synchronous
- asynchronous
- **task combination**

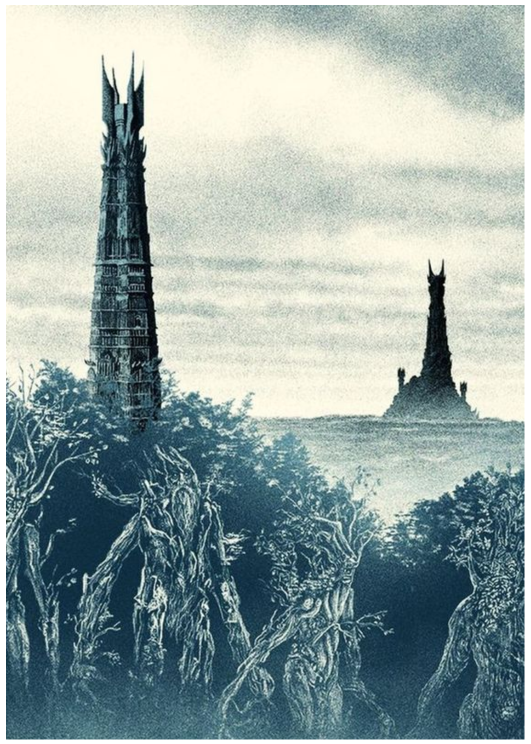
And then

Run in sequence



```
([ 1 + 1 ] future
    andThen: [ :result | result logCr ])
    andThen: [ :result | Stdio stdout nextPutAll: result ])
    andThen: [ :result | self inform: result asString  ]. .
```





- synchronous
- asynchronous
- **task combination**

Concurrence

- From old french “concurrencé”
  - Co-occurrence (Happening simultaneously)
  - Competition

Concurrence (CS)

Multiple computations happening at the same time, in the same system

or

Ability of different parts or units of a program, algorithm, or problem to be executed out-of-order or in partial order, without affecting the final outcome.

Concurrence (CS)

Why should we?

- Not blocking the user
- Enhancing the resources usage
  - Doing things in background (or while the CPU is idle)
  - Managing many time-consuming operations simultaneously (I/O)

Concurrency

- Sharing resources
- Maximising the overall performance, in detriment of the particular or individual performance