Embracing Concurrency

for Fun, Utility & Simpler Code

Michael Sparks
BBC R&D, http://www.kamaelia.org/Home

Ignite Leeds, Jan 2009

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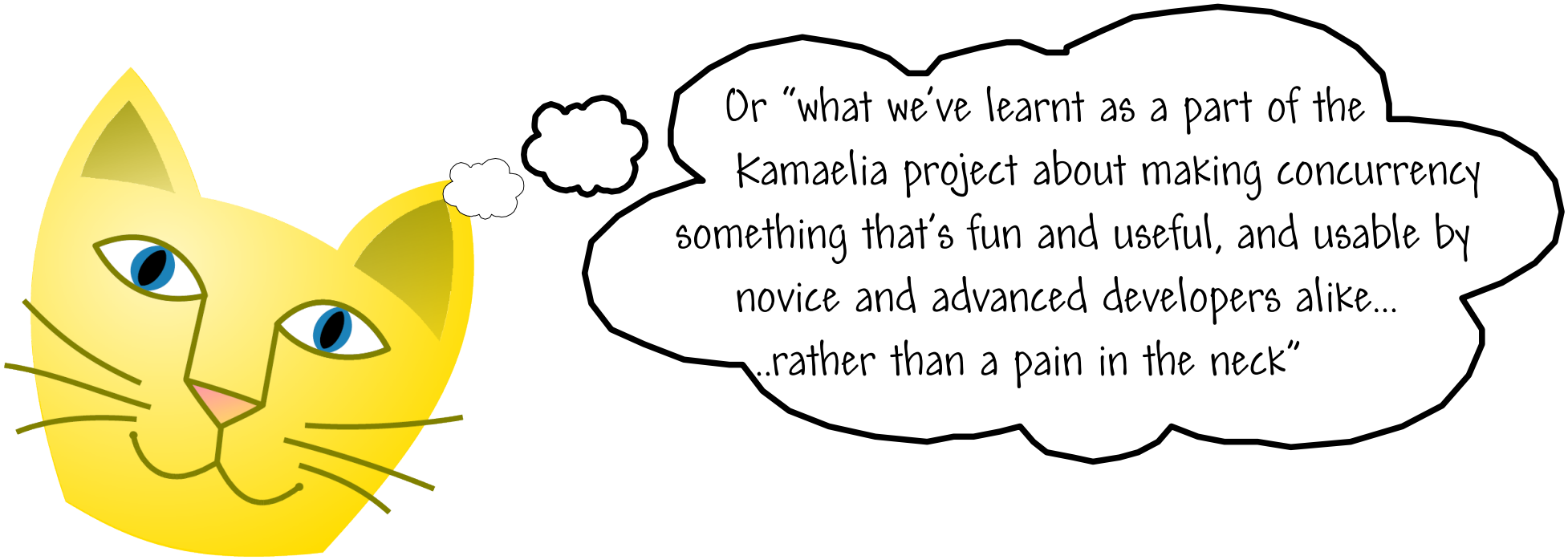

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Why?

Opportunity!

Hardware finally going massively concurrent ...

.... PS3, high end servers, trickling down to desktops, laptops)

"many hands make light work" but **Viewed** as Hard

... do we just have crap tools?

Problems

"And **one** language to in the darkness bind them"

... **can** just we **REALLY** abandon 50 years of code for Erlang, Haskell and occam?

We're Taught Wrong

Fundamental Control Structures

... in imperative languages **number greater than 3!**

Control Structure	Traditional Abstraction	Biggest Pain Points
Sequence	Function	Global Var
Selection	Function	Global Var
Iteration	Function	Global Var
Parallel	Thread	Shared Data

Usually Skipped

Lost or duplicate update are most common bugs

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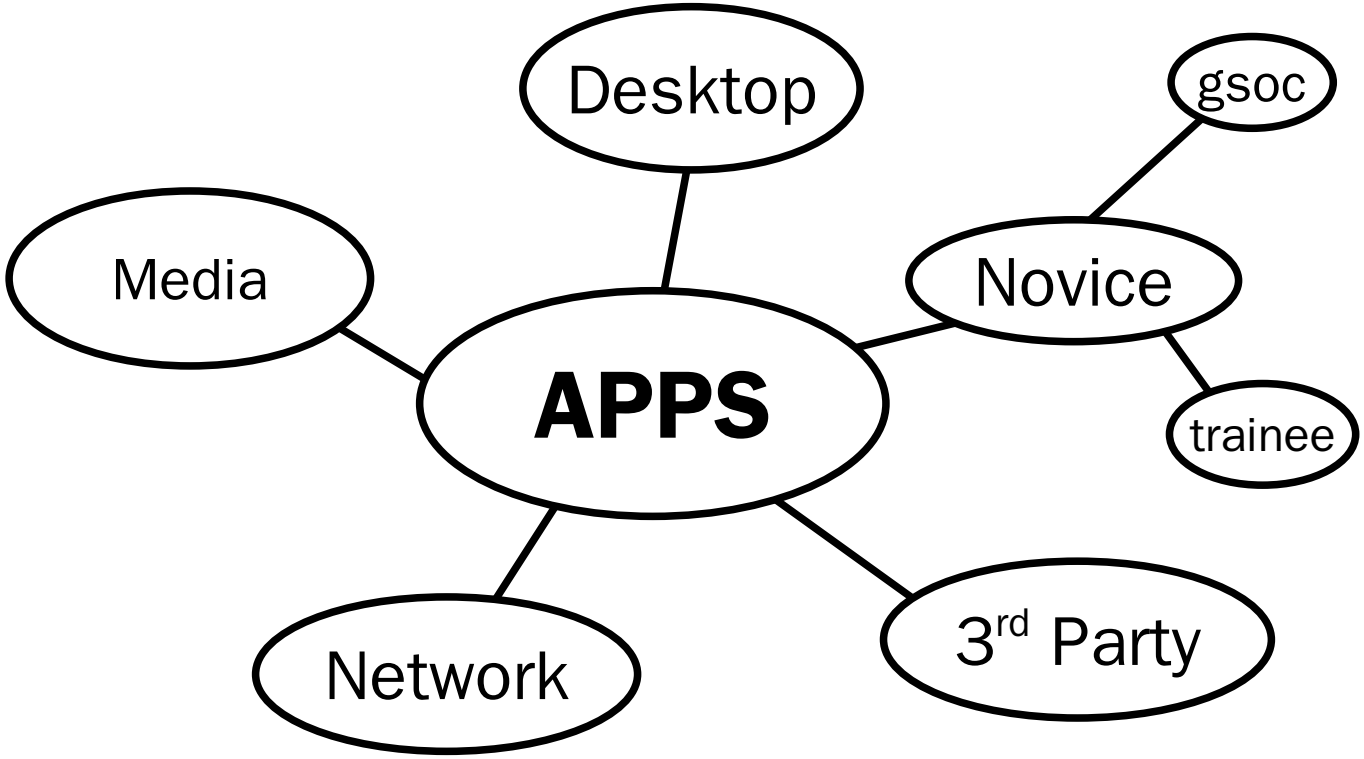
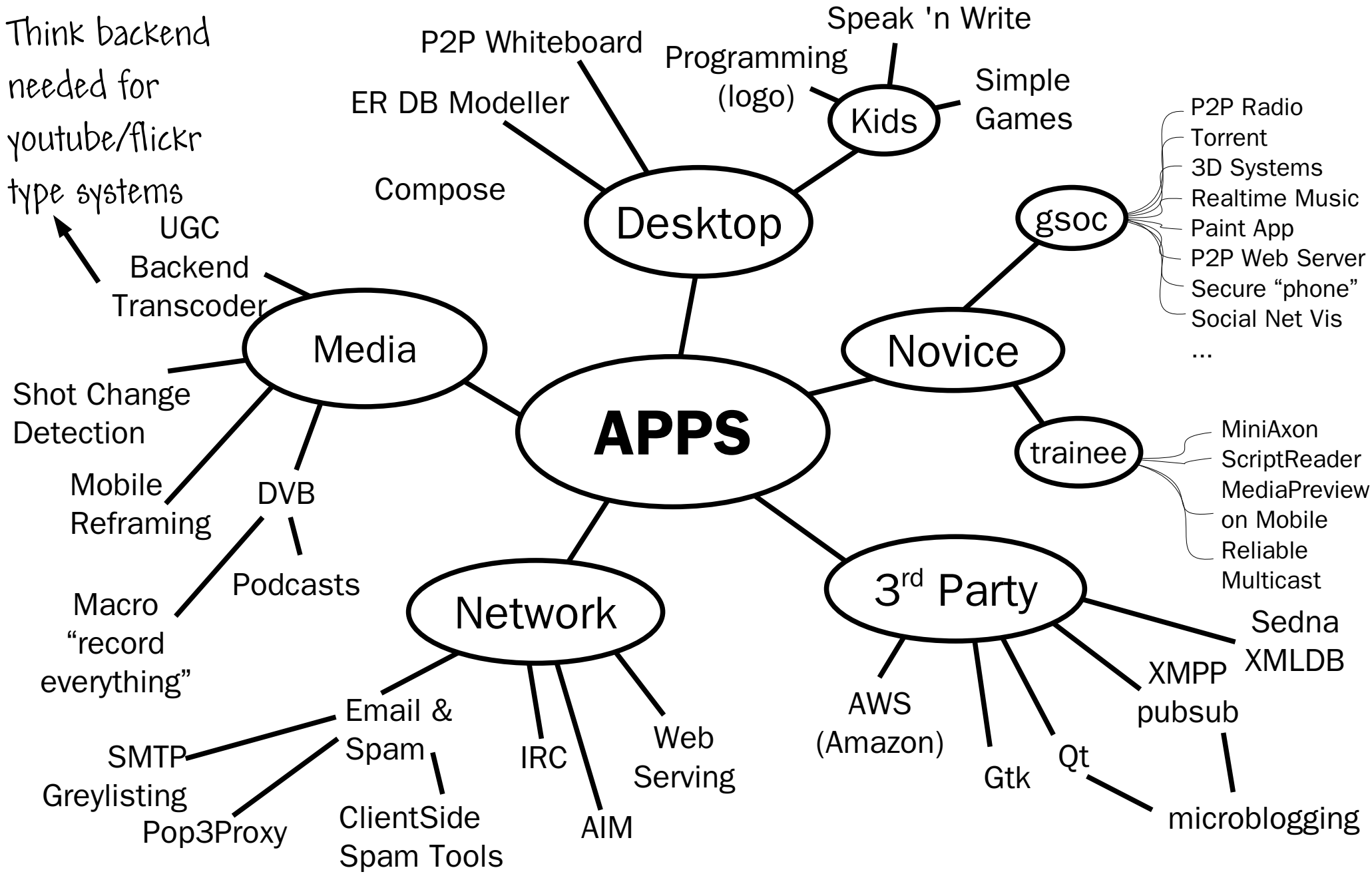

Desktop
gsoc
Media
Novice
APPS
trainee
Network
3rd Party



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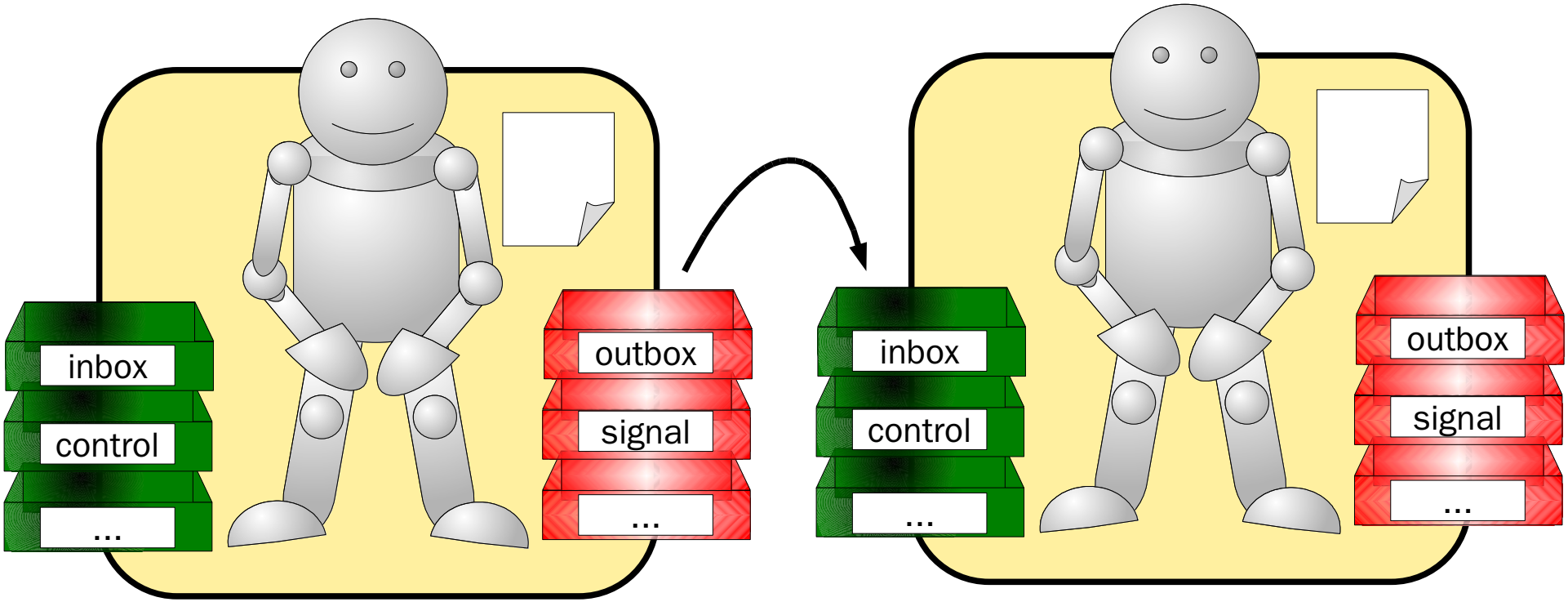
Core Approach:

Concurrent things with comms points

Generally send messages

Keep data private, don't share



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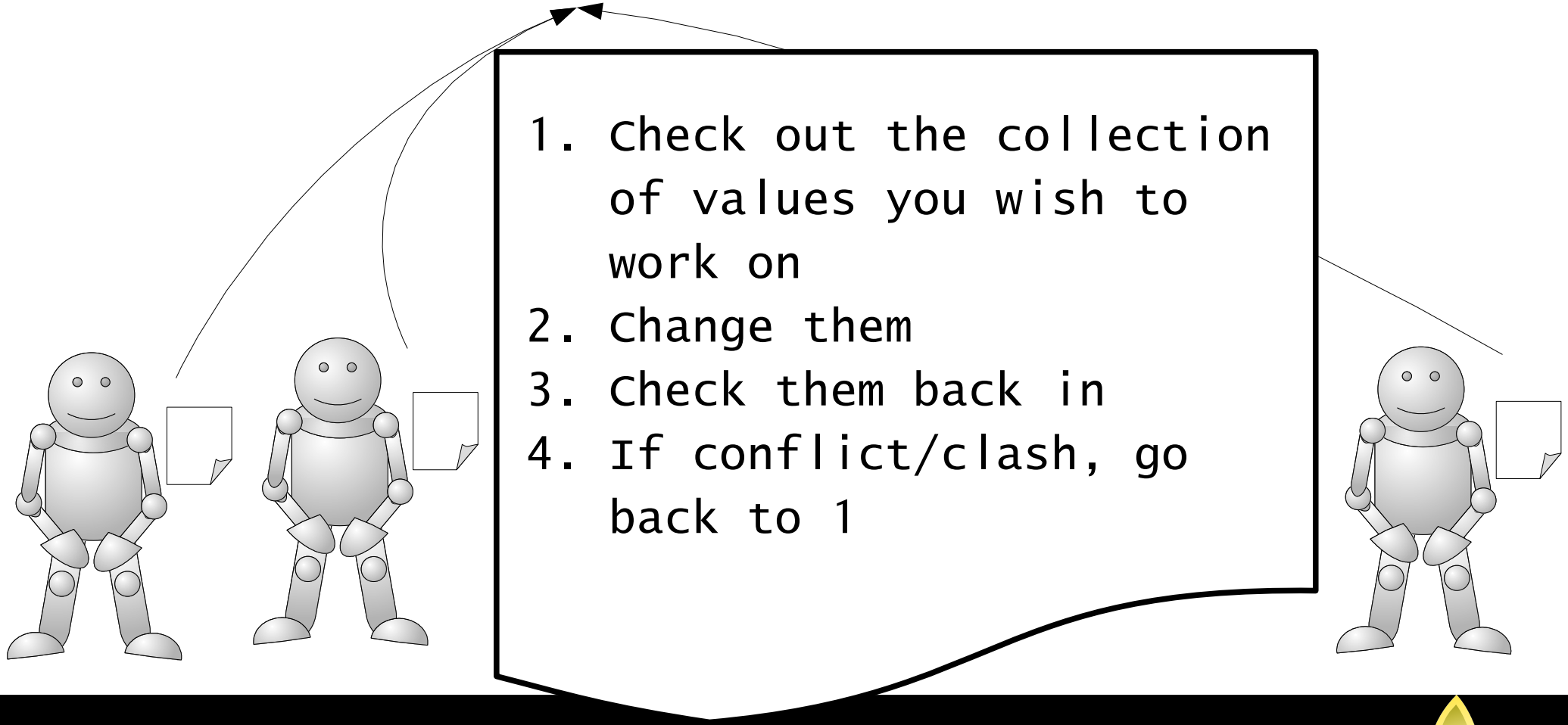
But I must share data?

Use Software Transactional Memory
ie version control for variables.



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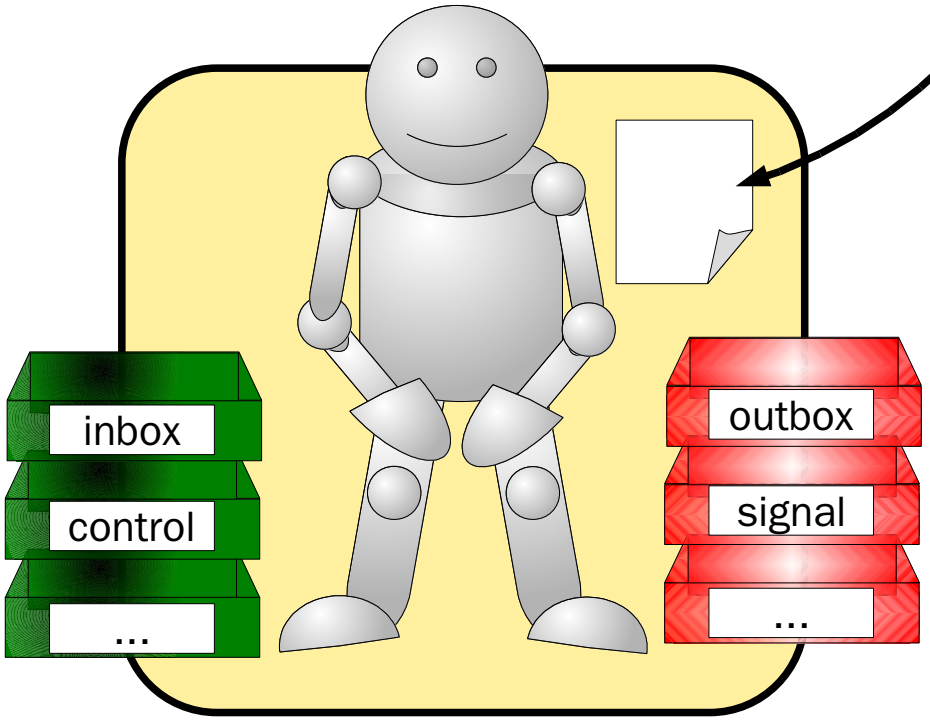
Perspectives in APIs! (1/2)

1st, 2nd, 3rd Person

1st Person - **I** change my state

2nd Person – **YOU** want to me to do something (**you** send **me** a message)



3rd Person – **Bla** should do something (**I** send a message)

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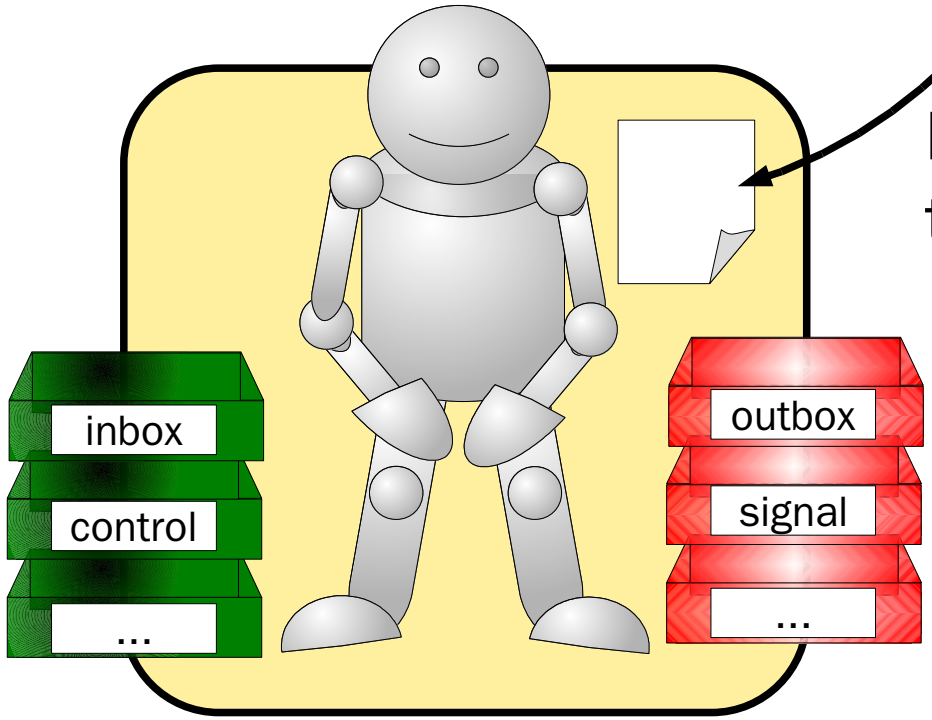
Perspectives in APIs! (2/2)

1st, 2nd, 3rd Person

private real methods

Messages from public inboxes

Messages sent to public outboxes



Also, think about stdin

Also, think about stdout

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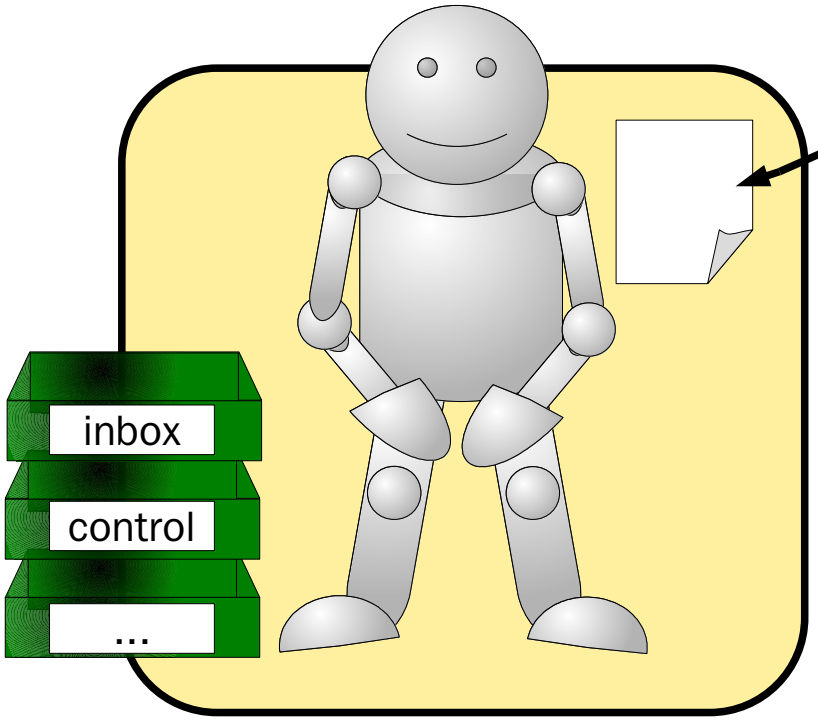
Actor Systems

Distinction **can** be unclear, potential source of ambiguity*

private real methods

Messages from public inboxes



No outbox concept

Possible issues with rate limiting*

Hardcodes recipient in the sender

*system dependent issue

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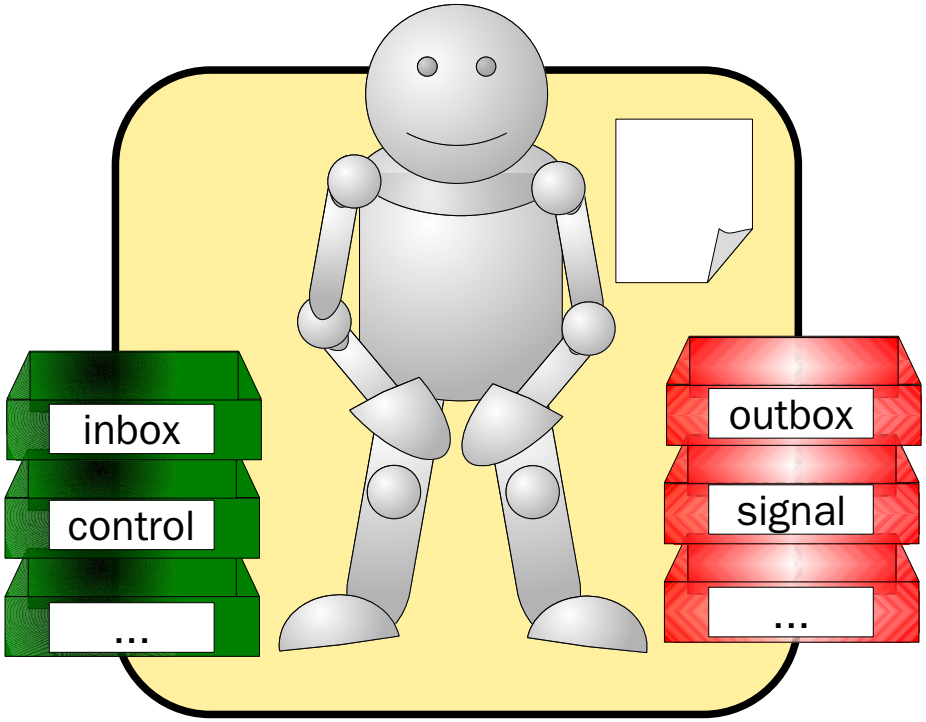
Advantages of outboxes



No hardcoding of recipient allows:

- Late Binding
- Dynamic rewiring

Concurrency Patterns as Reusable Code

... a concurrency DSL

A Core Concurrency DSL

```
Pipeline(A,B,C)
Graphline(A=A,B=B, C=C, linkages = {})
Tpipe(cond, C)
Seq(A,B,C), PAR(), ALT()
Backplane("name"), PublishTo("name"), SubscribeTo("name")
Carousel(...)
PureTransformer(...)
StatefulTransformer(...)
PureServer(...)
MessageDemuxer(...)
Source(*messages)
NullSink
```

Some of these are *work in progress* – they've been identified as useful, but not implemented as chassis, yet

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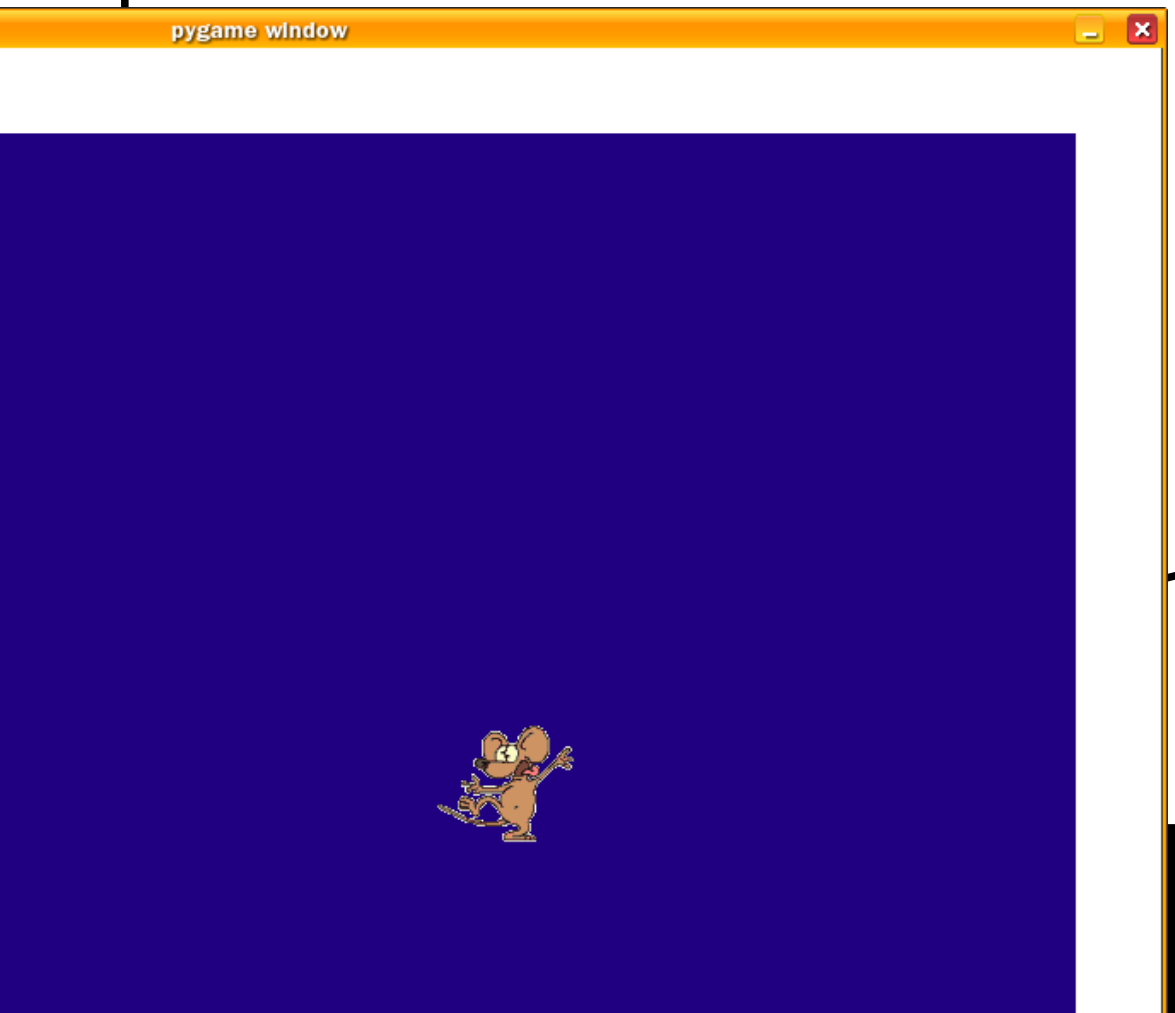
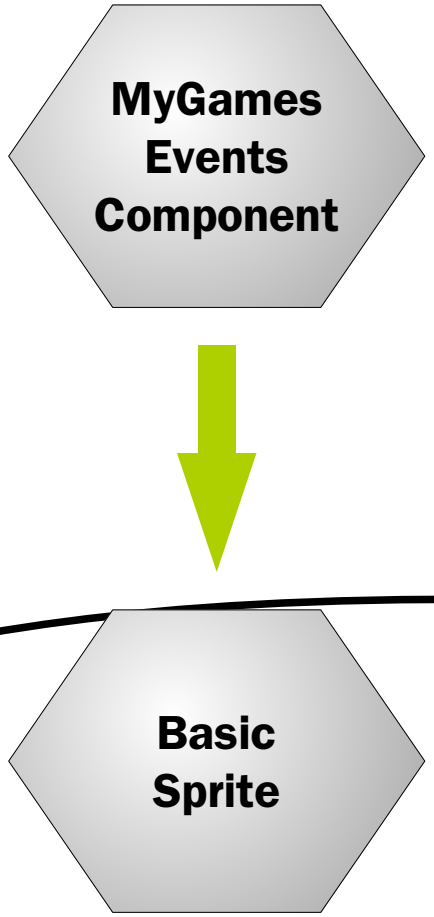
Pipeline Example

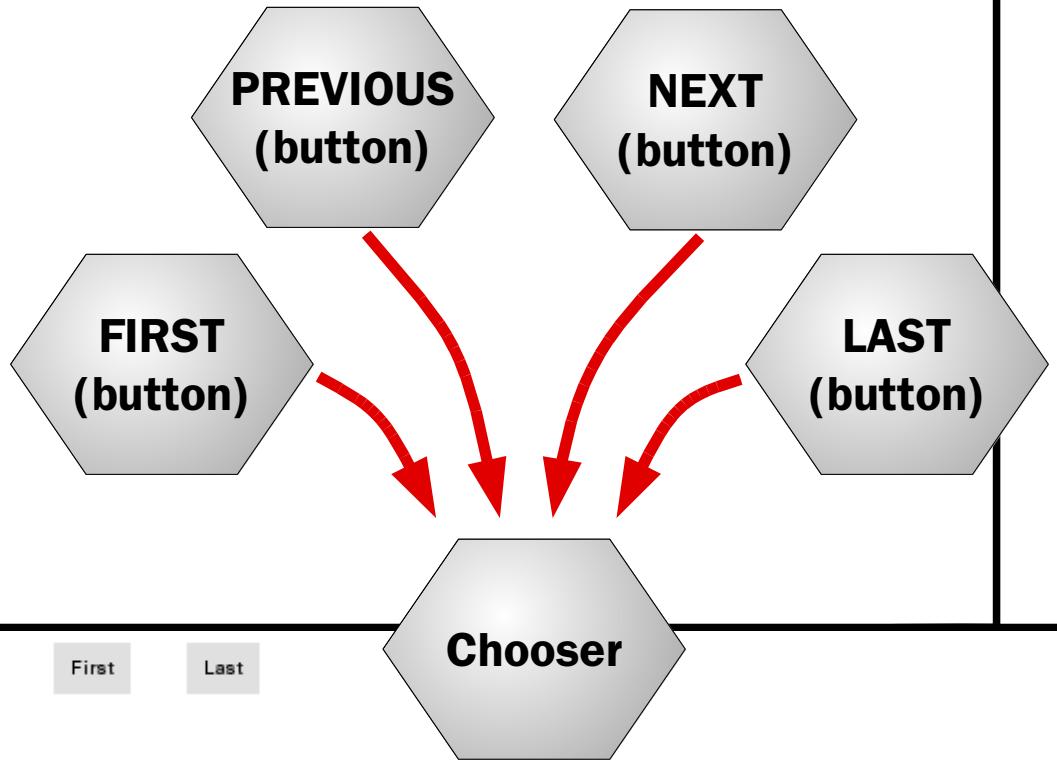
```
Pipeline(
    MyGamesEventsComponent(up="p", down="l", left="a", right="s"),
    BasicSprite("cat.png", name = "cat", border=40),
).activate()
```

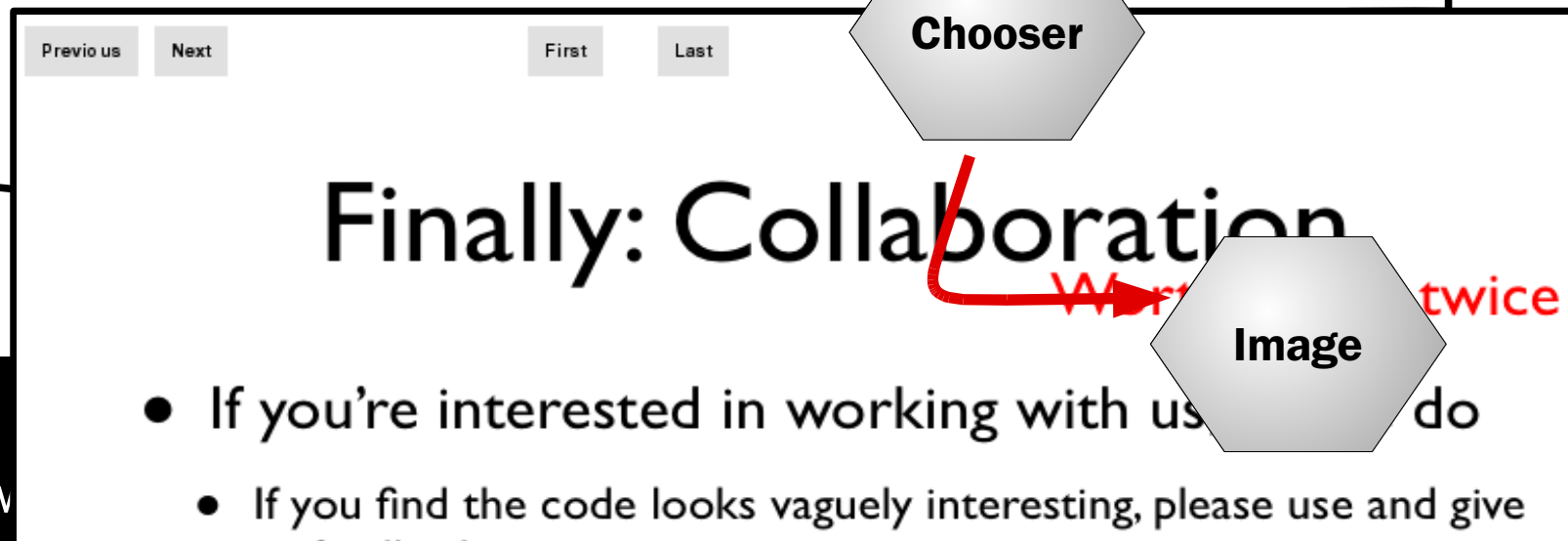




Graphline Example

```
Graphline(
  NEXT = Button(...),
  PREVIOUS = Button(...),
  FIRST = Button(...),
  LAST = Button(...),
  CHOOSER = Chooser(...),
  IMAGE = Image(...),
  ...
).run()
```





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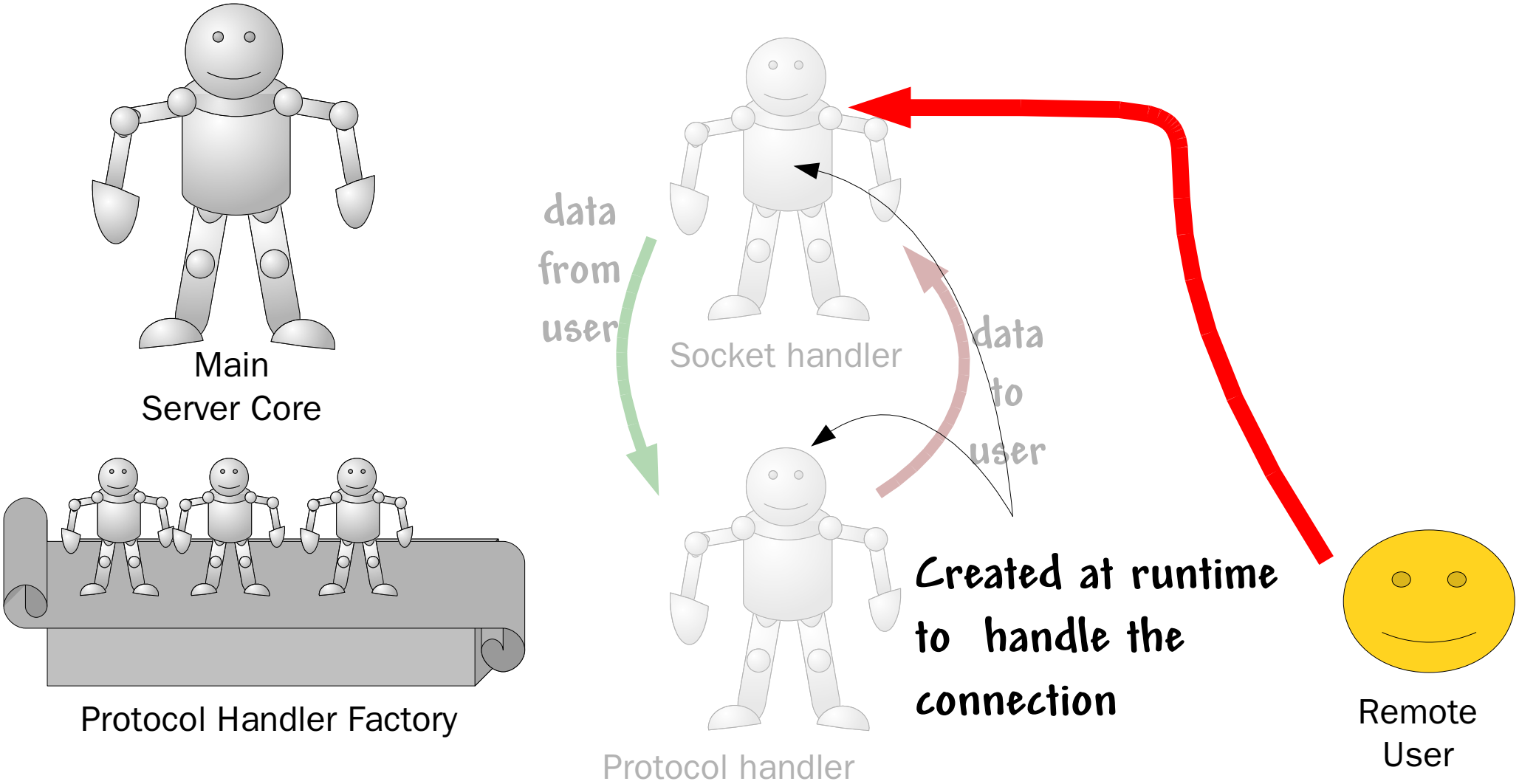
Server Example



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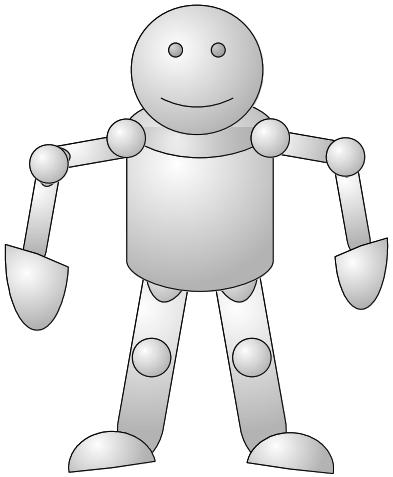
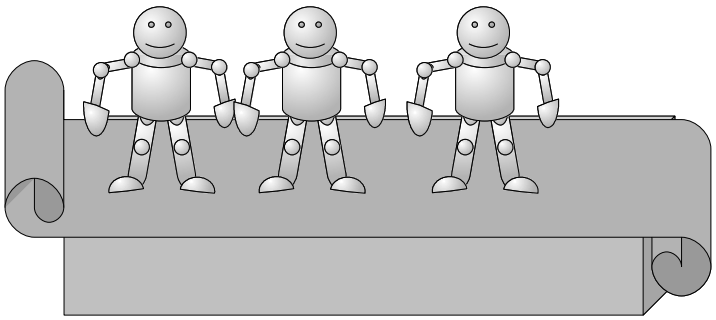
Server Example



Main
Server Core



Protocol Handler Factory

You therefore need to provide this bit.

Server Example

```
from Kamaelia.Chassis.ConnectedServer import ServerCore
from Kamaelia.Util.PureTransformer import PureTransformer

def greeter(*argv, **argd):
    return PureTransformer(lambda x: "hello" +x)

class GreeterServer(ServerCore):
    protocol=greeter
    port=1601

GreeterServer().run()
```


Backplane Example

```
# Streaming Server for raw DVB of Radio 1
Backplane(“Radio”).activate()

Pipeline(
   DVB_Multiplex(850.16, [6210], feparams), # RADIO ONE
   PublishTo("RADIO"),
).activate()

def radio(*argv,**argd):
     return SubscribeTo(“RADIO”)

ServerCore(protocol=radio, port=1600).run()
```


Thank you for listening!

If you have questions, grab me later :-)

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