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Faculty of Informatics

Jopera
Process Support for Web Services

Push-Enabling RESTful Business Processes

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6.12.2011

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RESTful Business Processes

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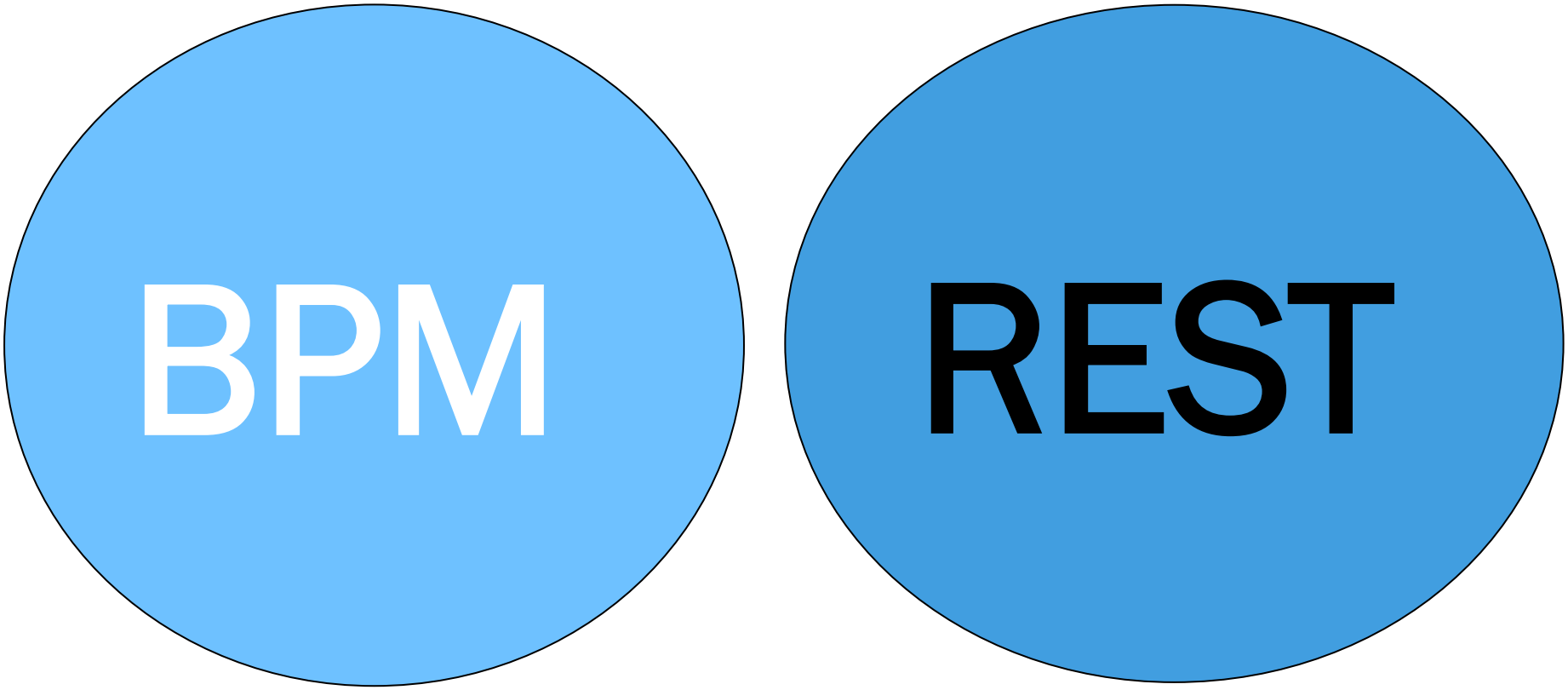
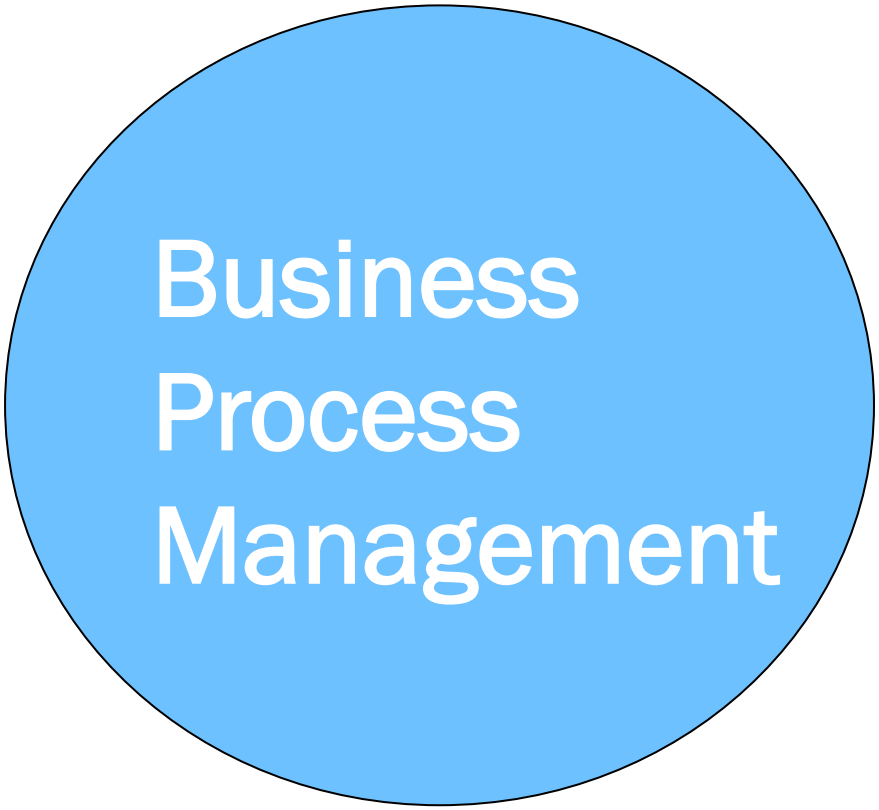
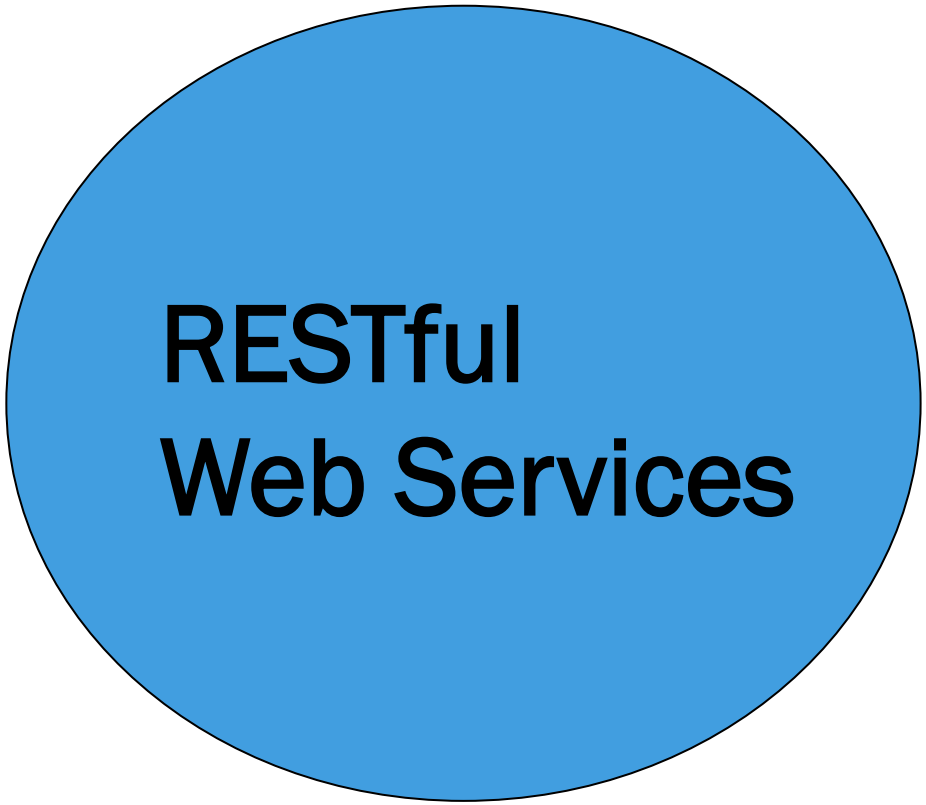
Abstract

- Representational State Transfer (REST) as an architectural style for service design has seen substantial uptake in the past years. However, some areas such as Business Process Modeling (BPM) and push services so far have not been addressed in the context of REST principles.
- In this work, we look at how both BPM and push can be combined so that business processes can be modeled and observed in a RESTful way. Based on this approach, clients can subscribe to be notied when certain states in a business process are reached. Our goal is to design an architecture that brings REST's claims of loose coupling and good scalability to the area of BPM, and still allow process-driven composition and interaction between resources to be modeled.







WS-* Standards Stack

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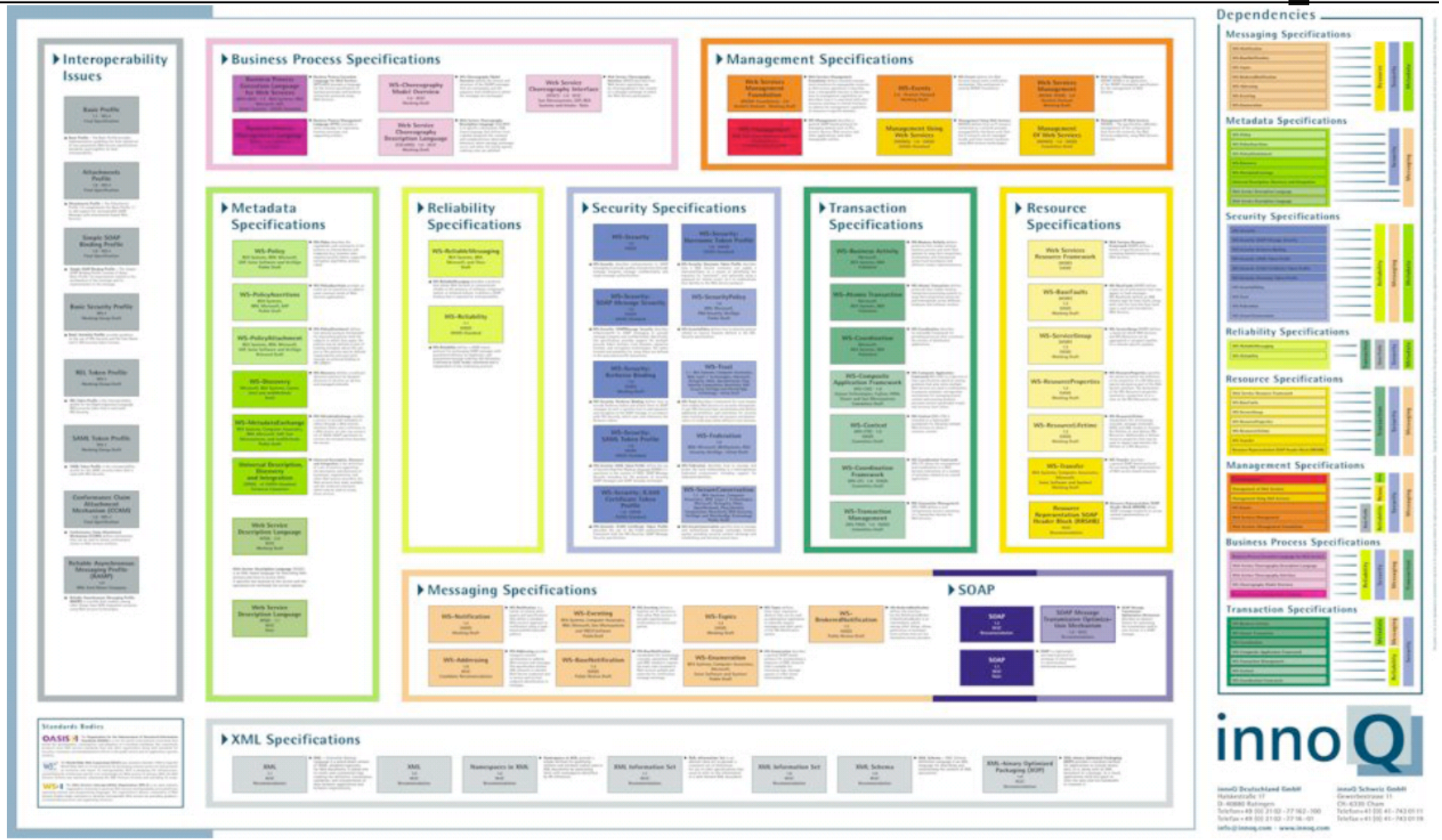

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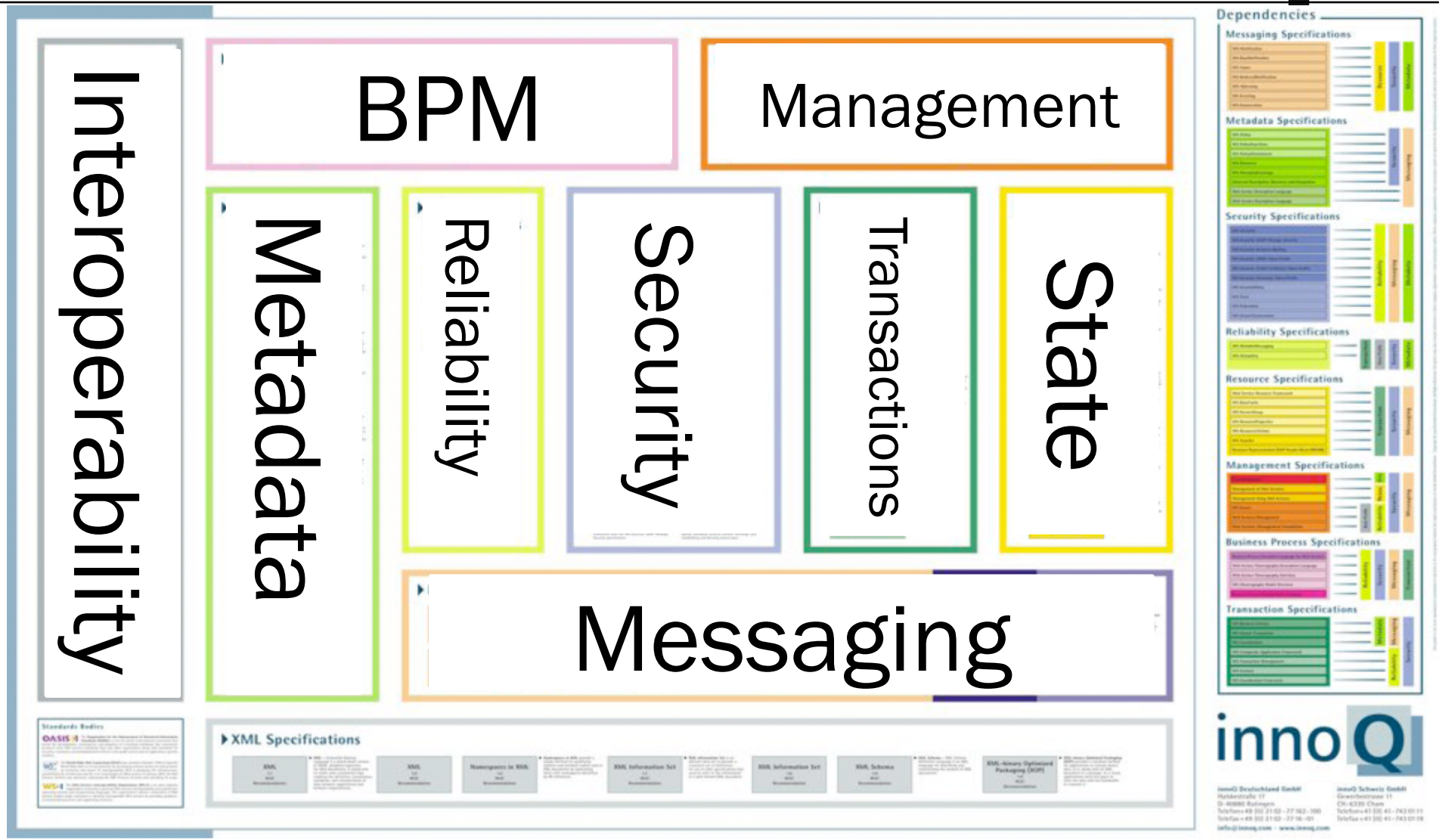
WS-* Standards Stack



Can you do it with REST?

RESTful APIs...

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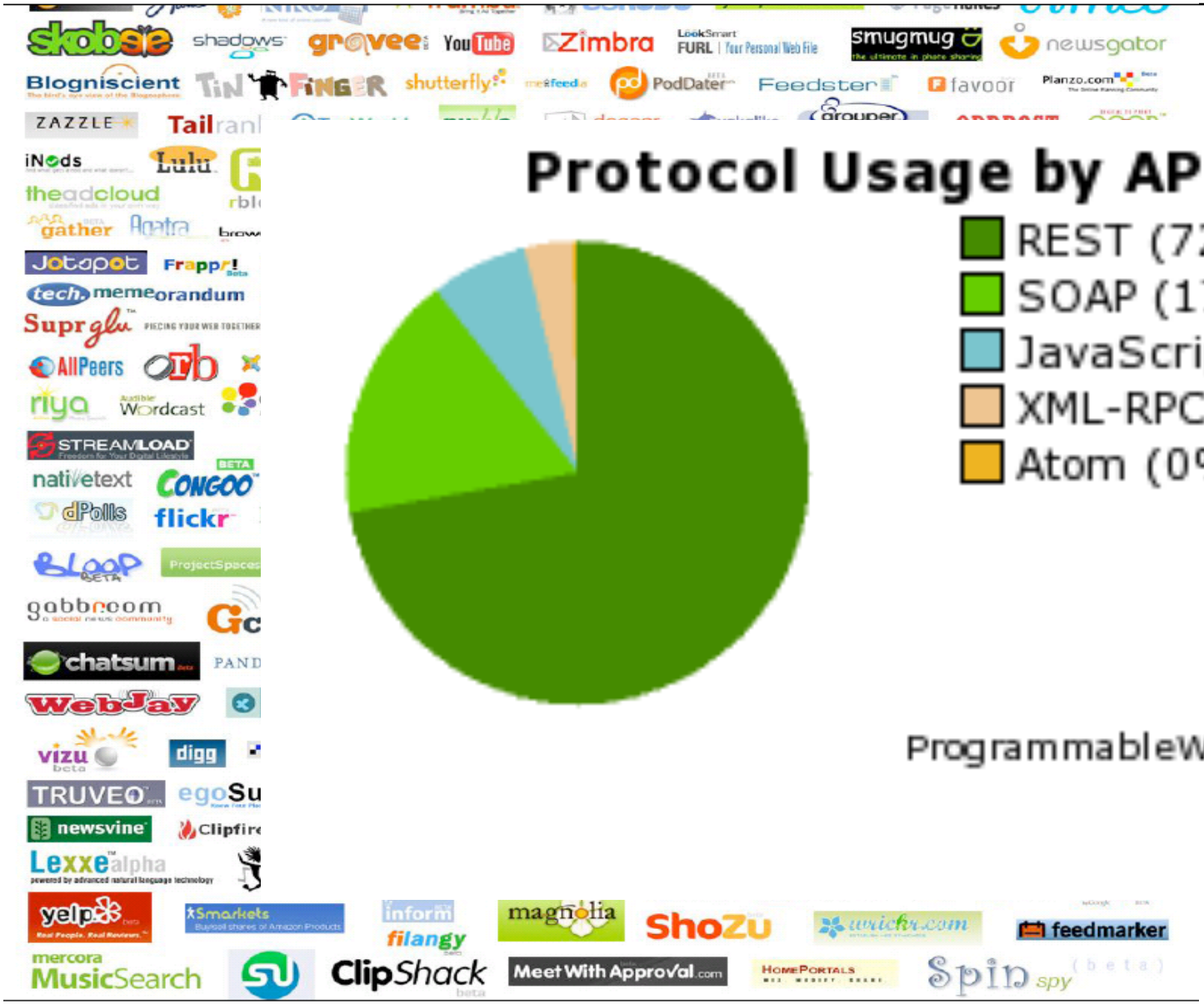
RESTful APIs...



From REST-*

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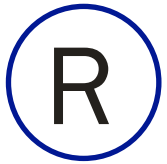
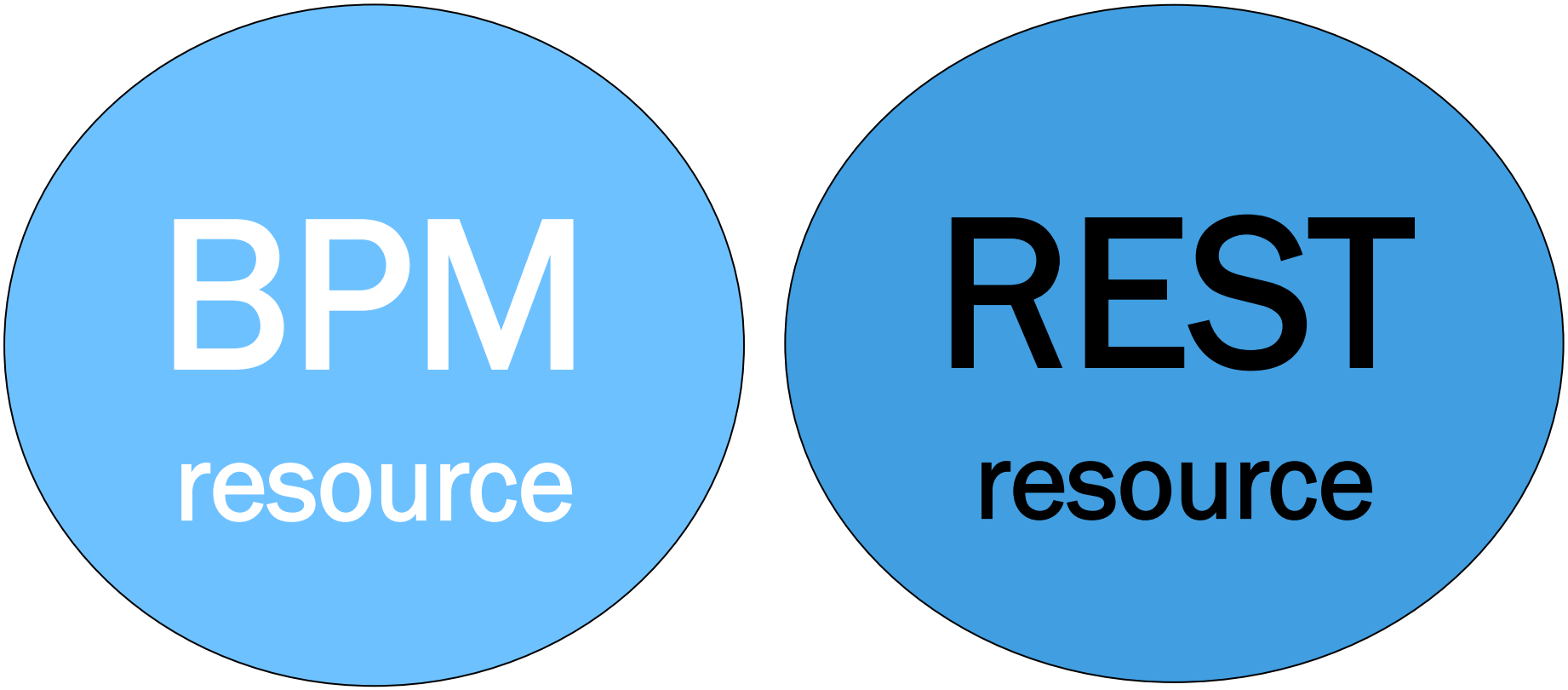
> “We believe there is huge potential to marrying REST with workflow and BPM.
>
> [...]
>
> Combined with the architecture of the Web, a workflow service can provide both a truly **simple, portable, and flexible** way to build workflow driven integrations and applications.”

http://www.jboss.org/reststar/specifications/workflow.html

REST in one slide

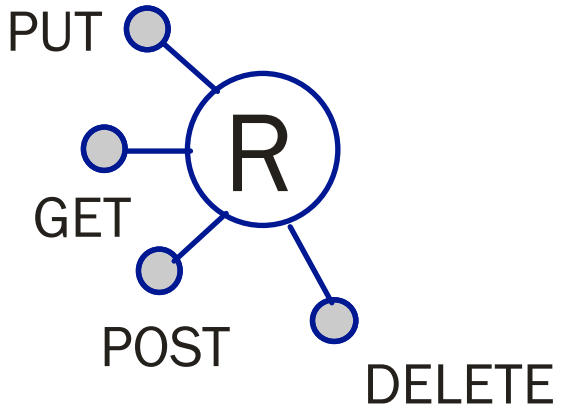
- Web Services expose their data and functionality trough **resources** identified by **URI**





REST in one slide

- Web Services expose their data and functionality trough **resources** identified by **URI**
- **Uniform Interface** constraint: Clients interact with resources through a fix set of verbs.
  Example HTTP:
  GET (read), POST (create), PUT (update), DELETE



- **Multiple representations** for the same resource
- **Hyperlinks** model resource relationships and valid state transitions for dynamic protocol description and discovery

From REST-*

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"We believe there is huge potential to marrying REST with workflow and BPM.

- The HATEOAS (hypermedia and linking) principal of REST is logically a dynamic state machine and **fits very well** with how workflow and BPM systems are designed.
- Combined with the architecture of the Web, a workflow service can provide both a truly simple, portable, and flexible way to build workflow driven integrations and applications."

http://www.jboss.org/reststar/specifications/workflow.html

Business Process Management

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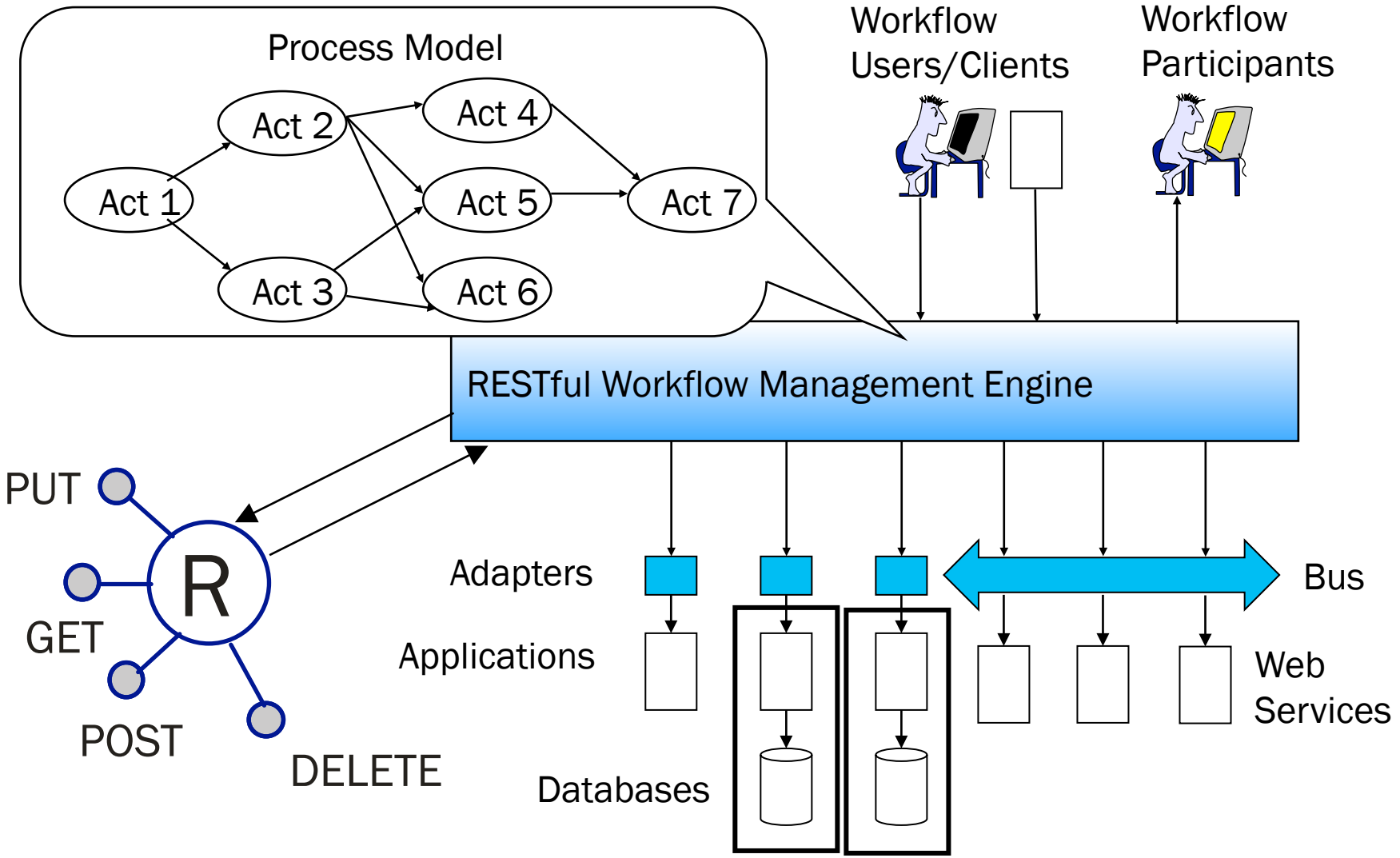

BPM with REST

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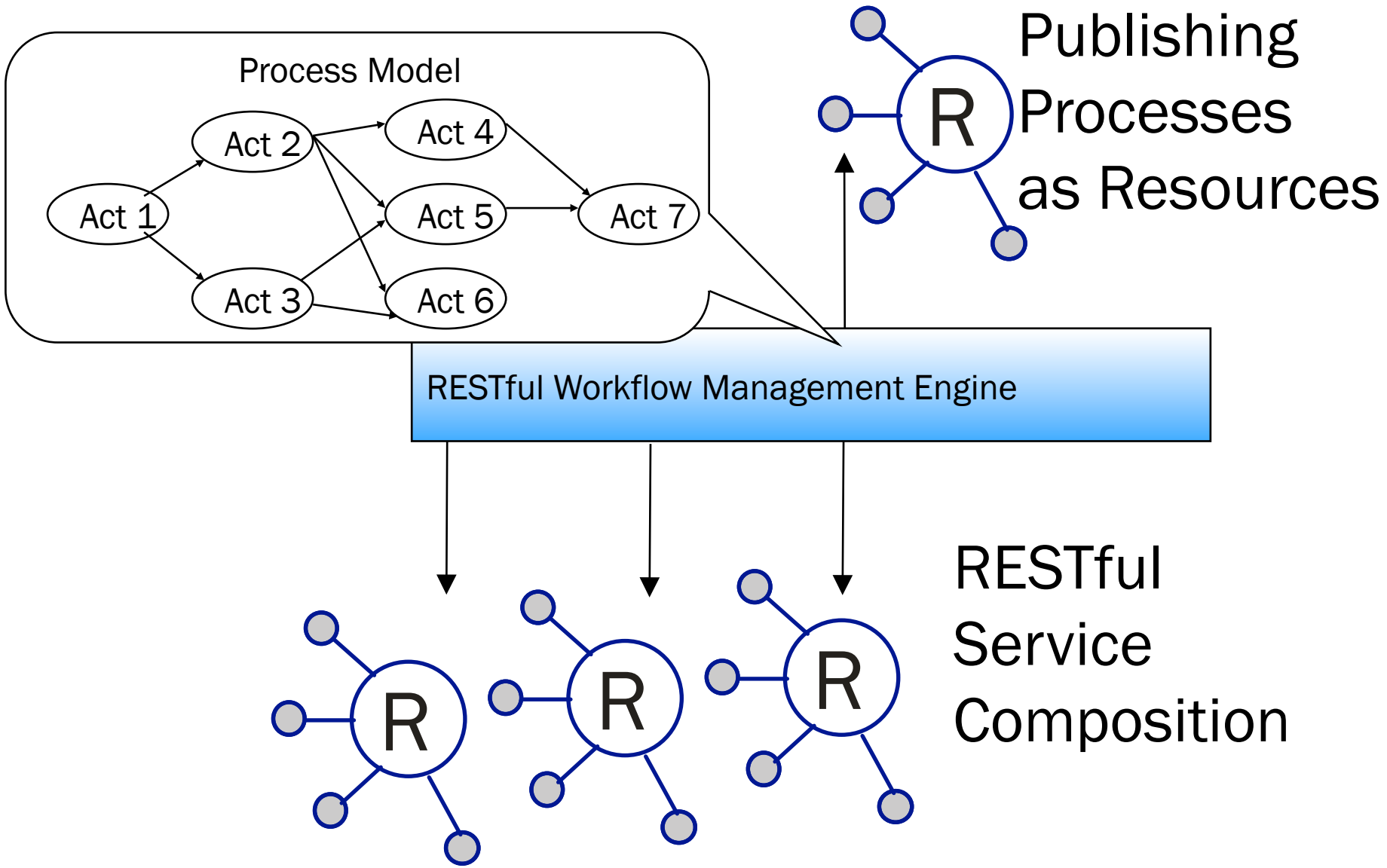
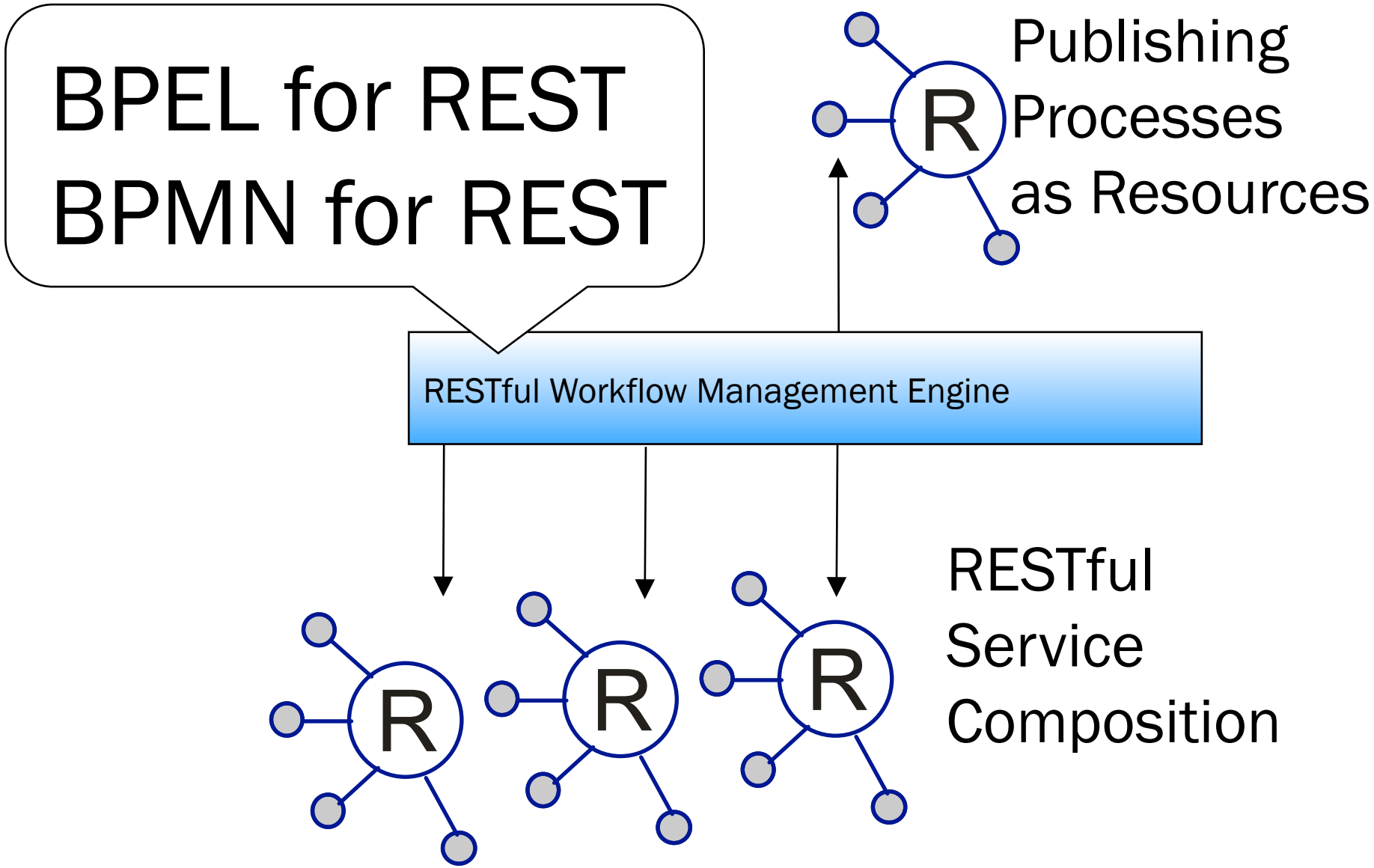
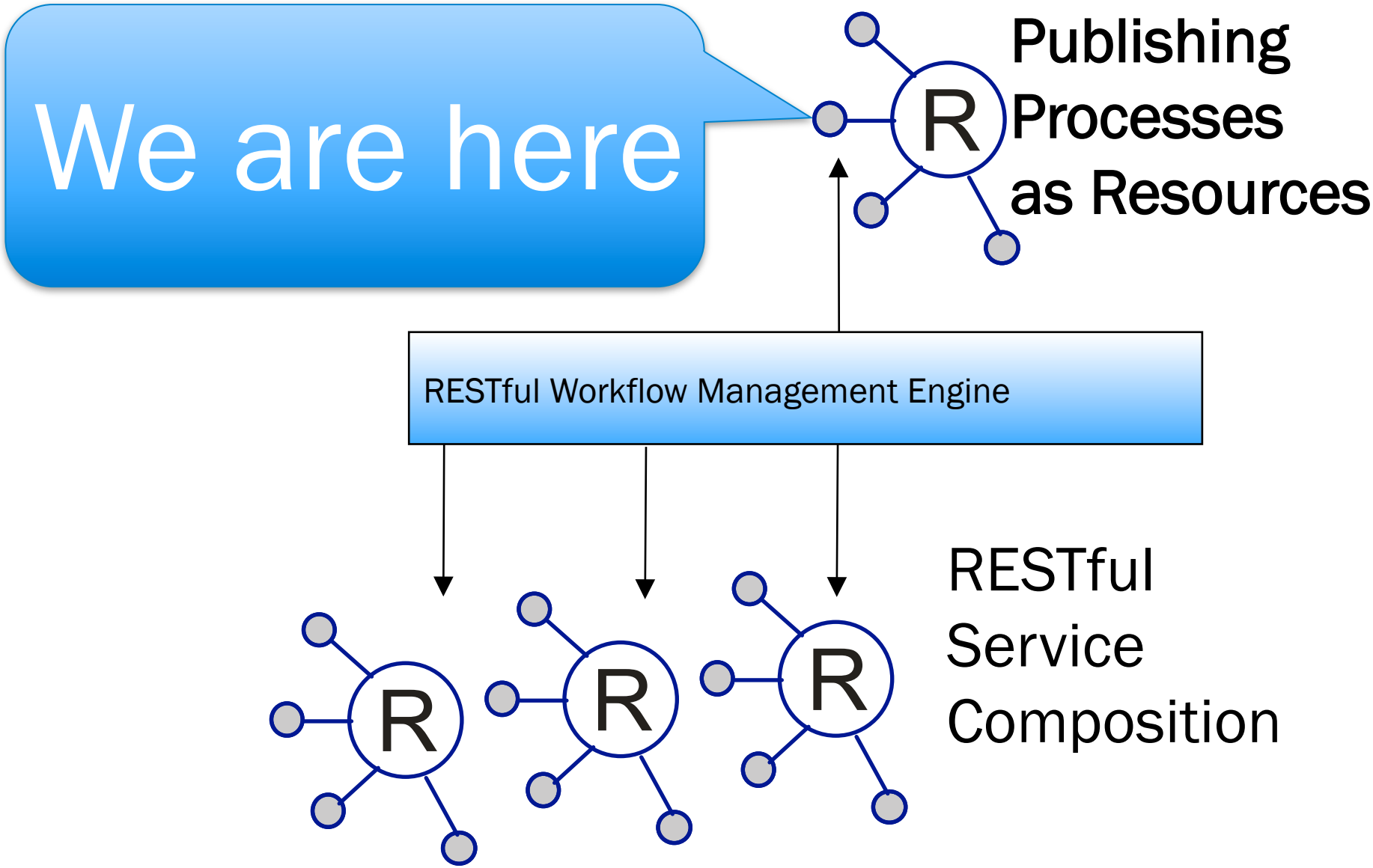
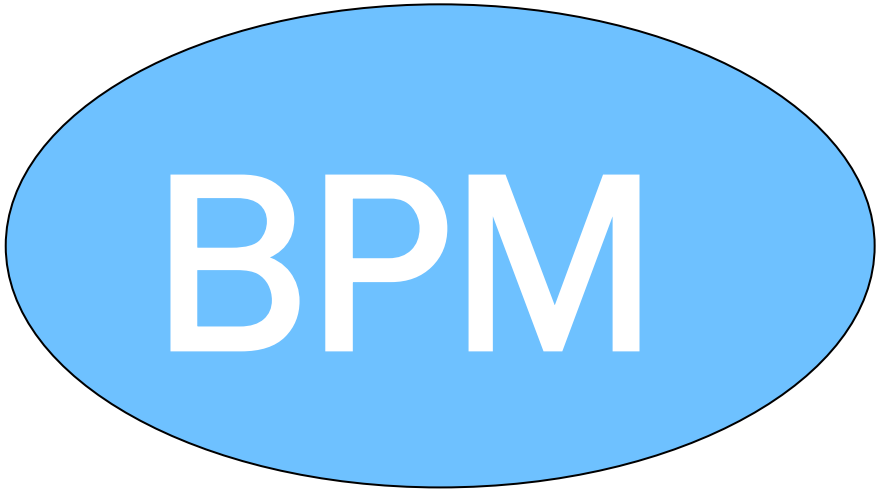


BPM with REST



BPM with REST

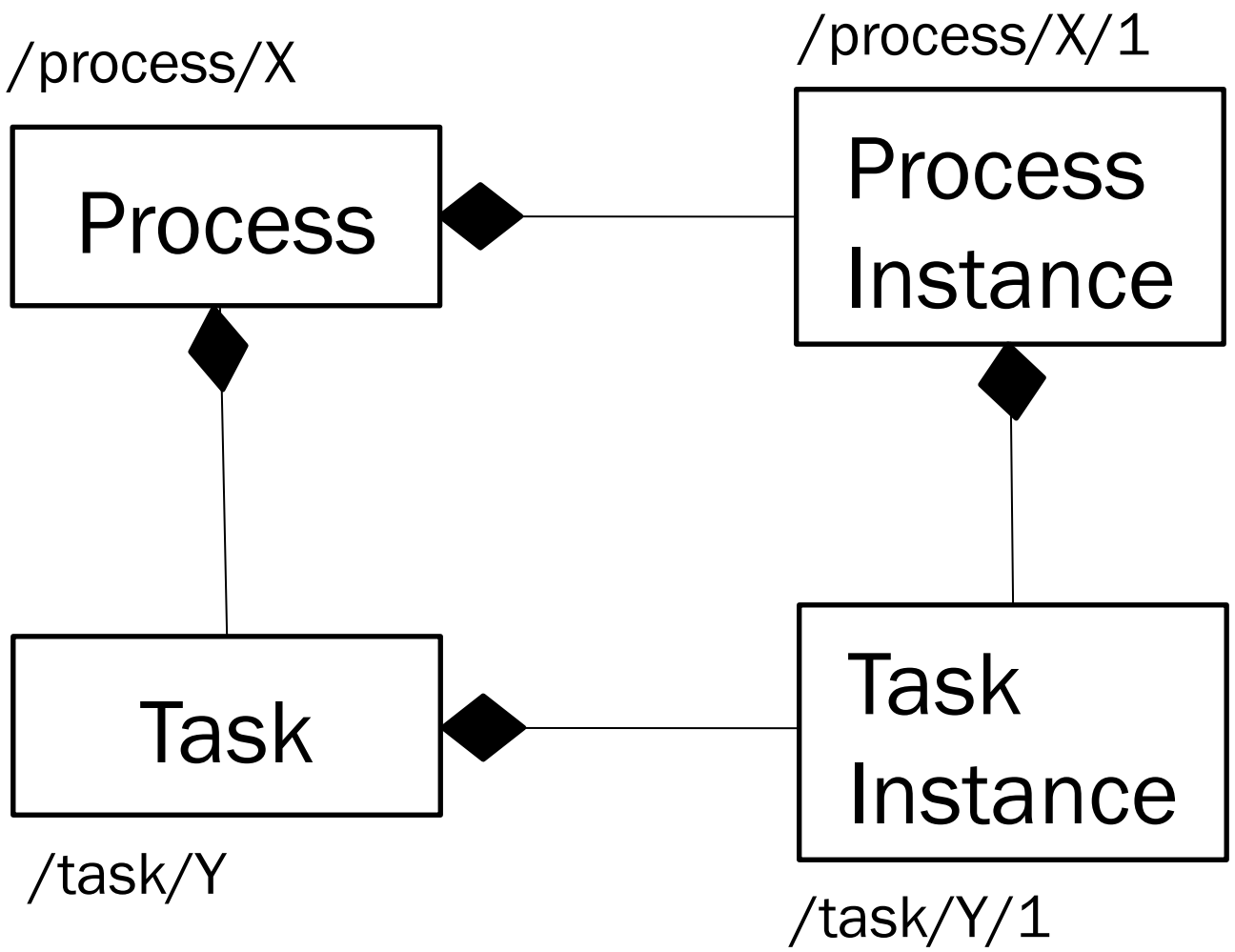




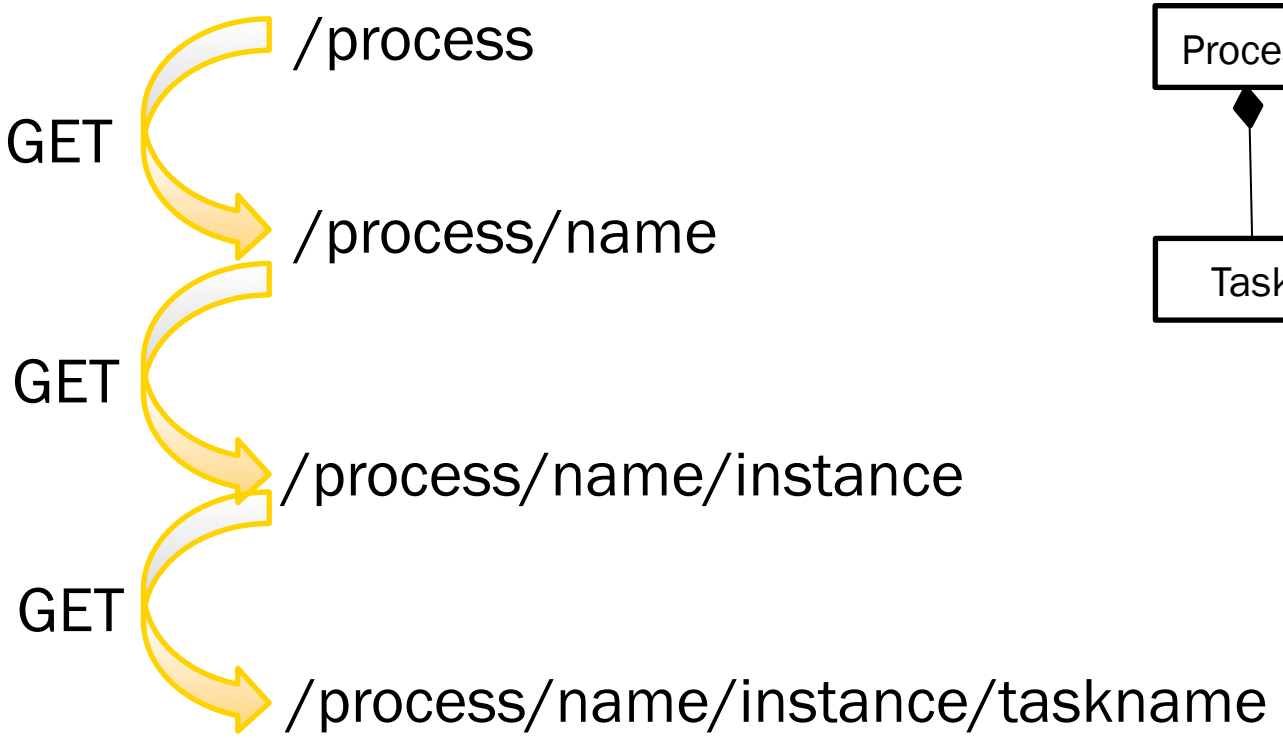
- Processes
- Tasks
- Control Flow
- Data Flow
- …

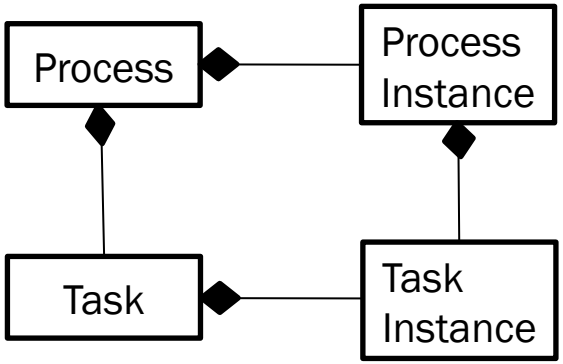
- Resources/URIs
- Uniform Interface
- Representations
- Hypermedia

Everything is a resource



Hypermedia





Follow links to discover the processes deployed as resources

Representations

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Web page with form to start a new process instance

ContentType:
text/html

BPMN2.0 process source code

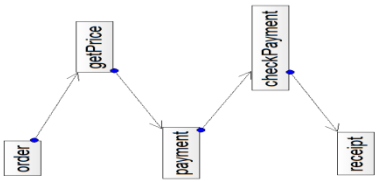
ContentType:
application/bpmn+xml

GET /process/name

ContentType:
text/plain

Basic textual description of the process

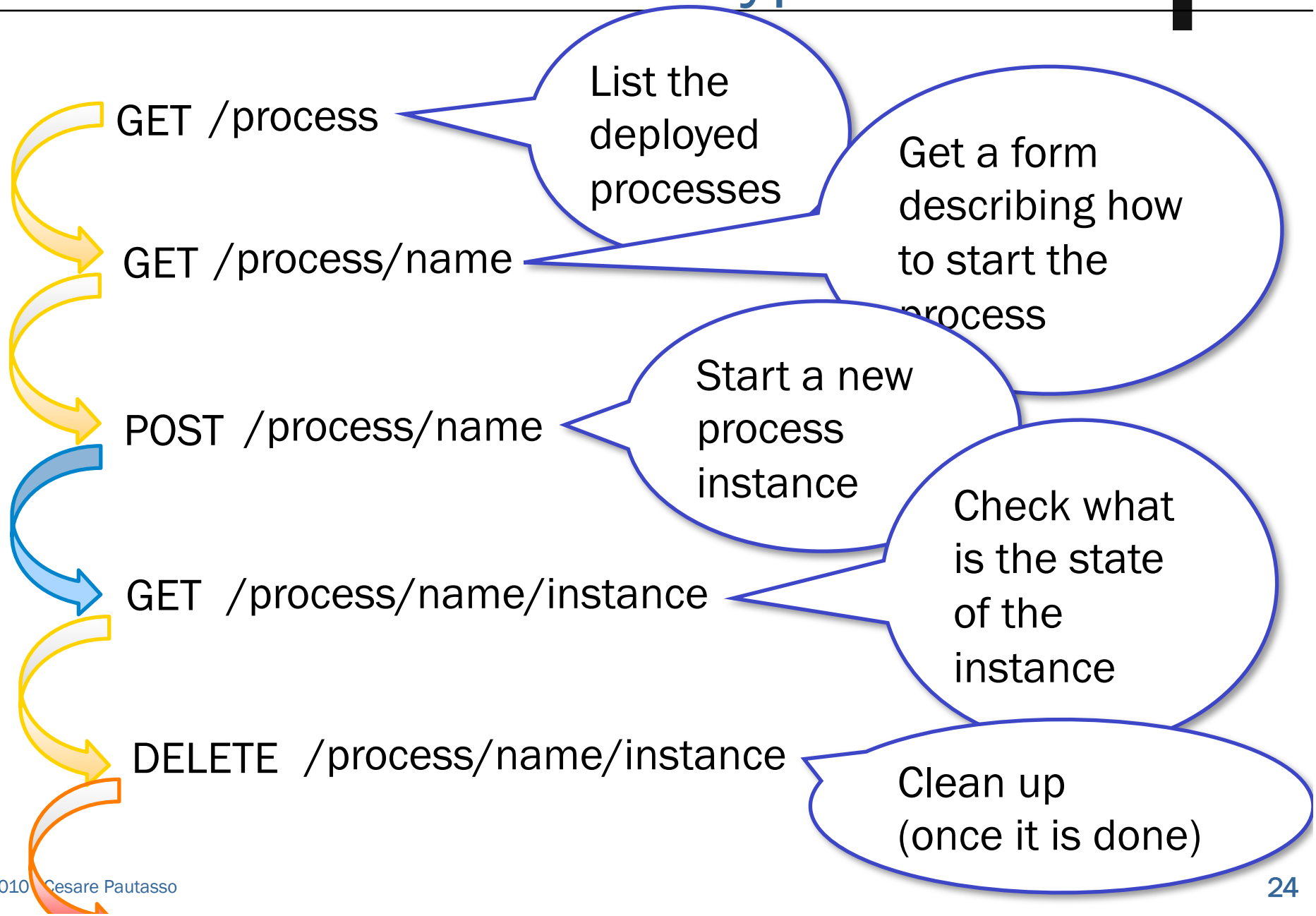
ContentType:
image/svg+xml



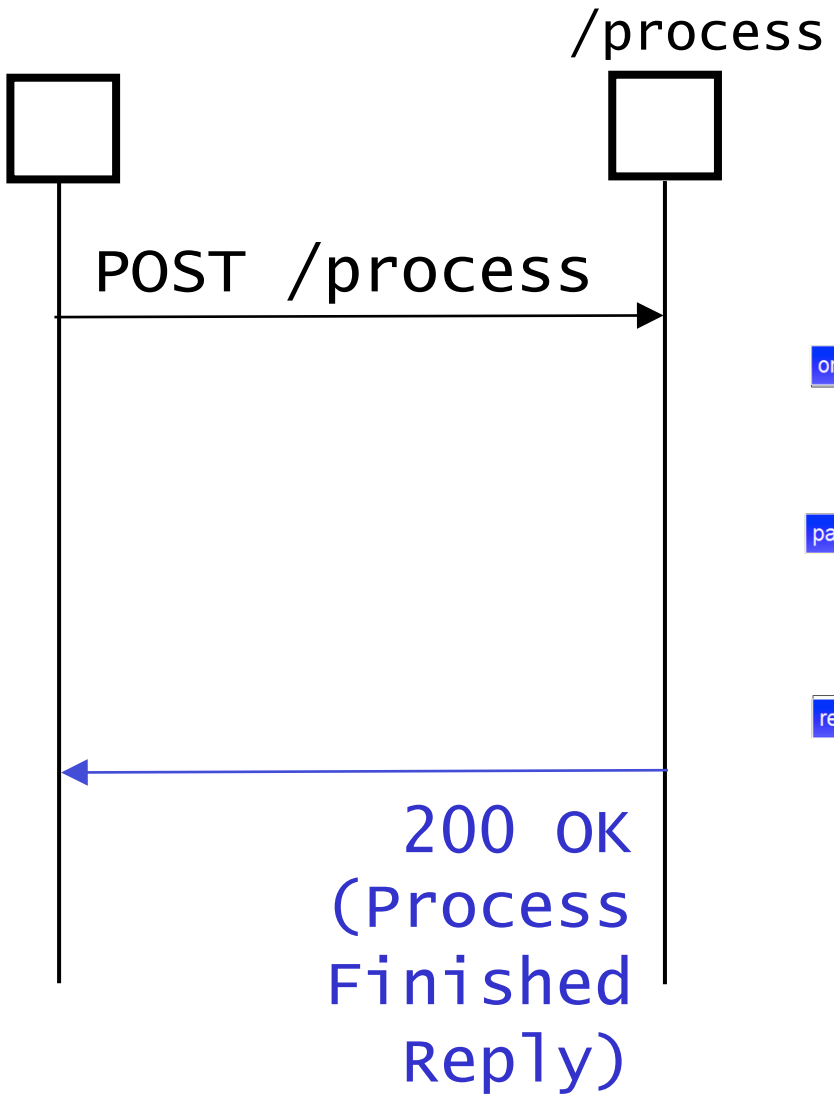
ContentType:
application/json

Process metadata in JSON

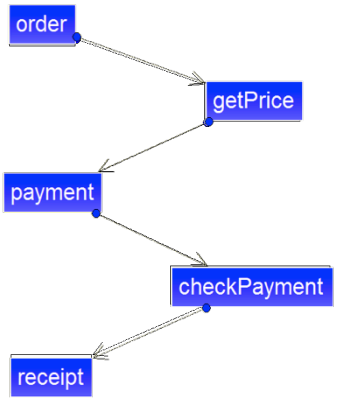
Uniform Interface and Hypermedia



Starting or **Running** processes?

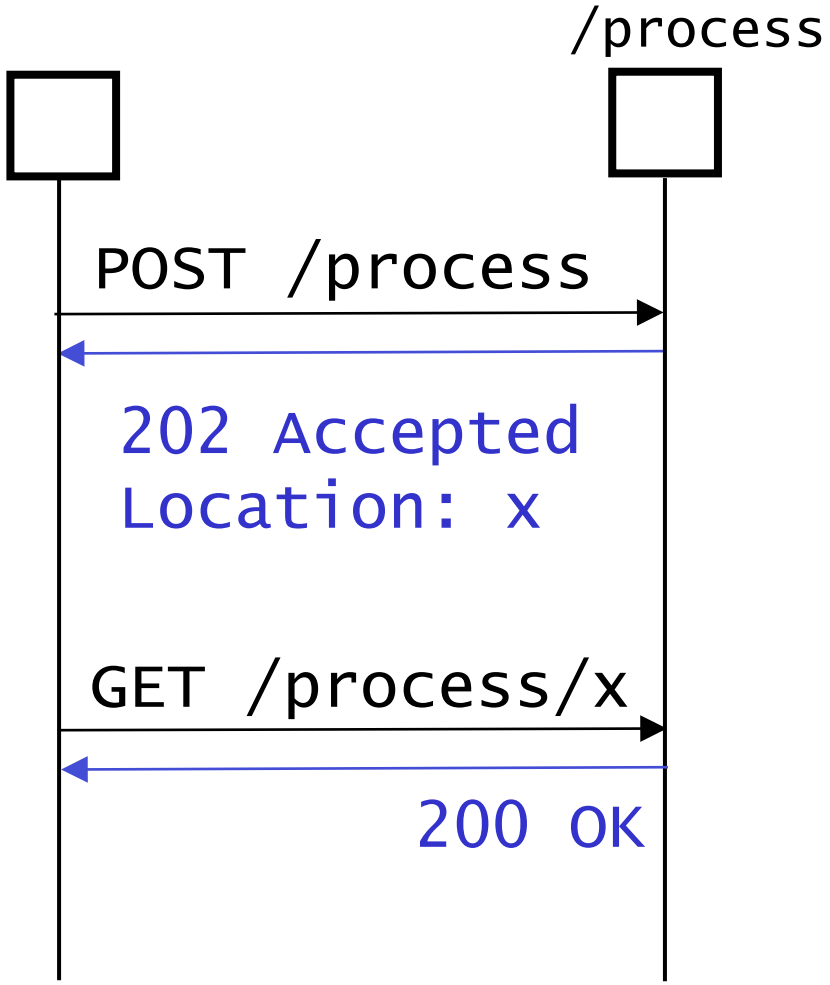


- Should the client be kept waiting for the process to run until completion?



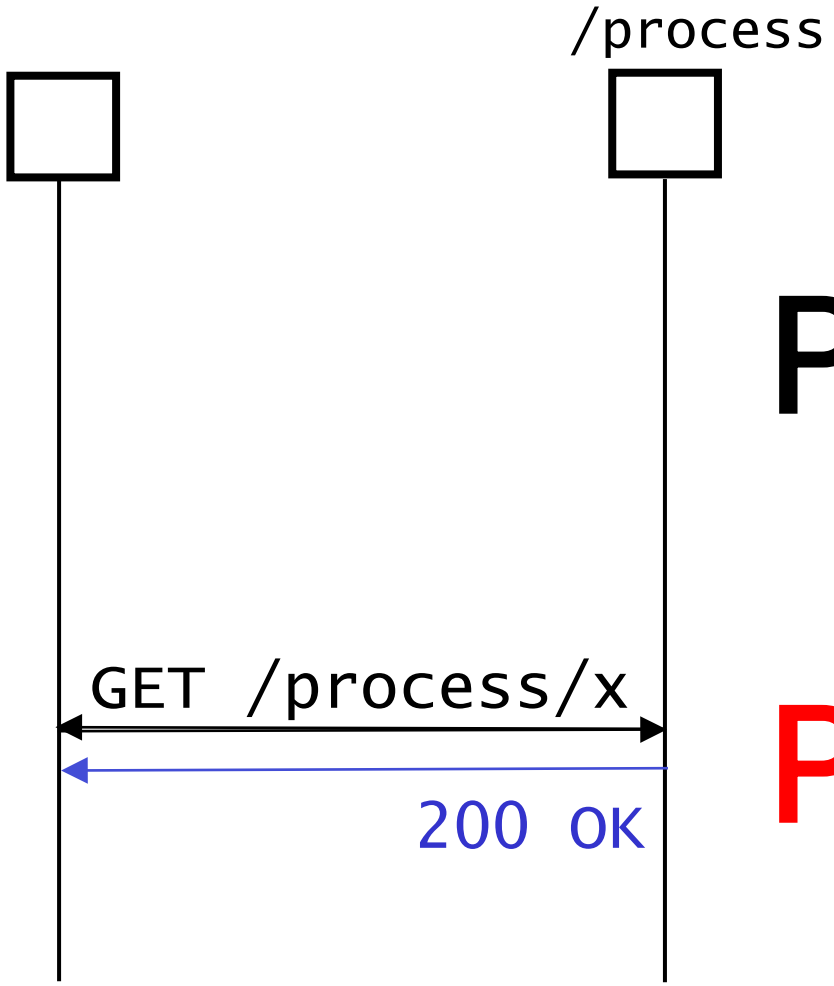
- Clients may want to block until the whole process has completed its execution (or it decides to reply to them)

Starting or Running processes?



- The client starting a long running process is redirected to a location x representing the newly started process instance
- The process and the client run asynchronously
- The client may retrieve the current state of the process instance at any time

Push vs. Pull Notification



- Problem: how can the process instance tell the client that it has reached a certain state?

PULL

- Easy to use a PULL-based event notification with HTTP

PUSH

- Can we also support PUSH-based event notification with HTTP?

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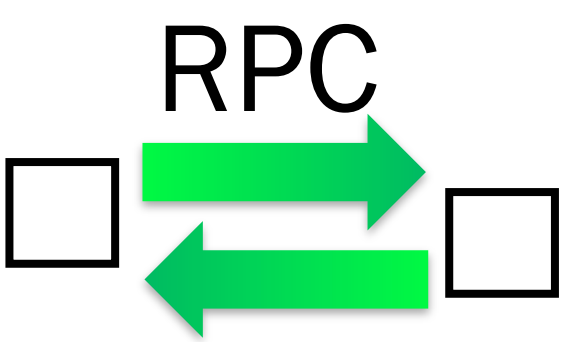
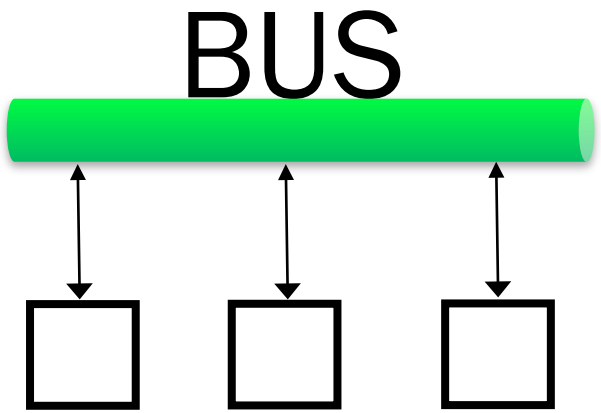
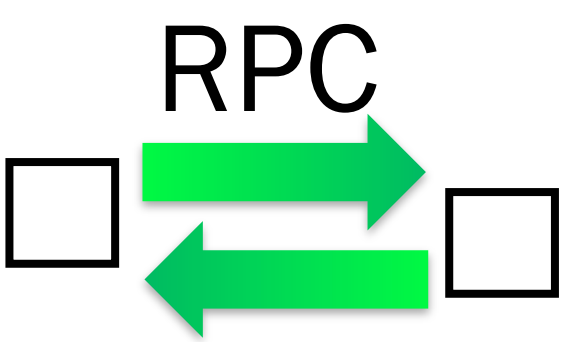
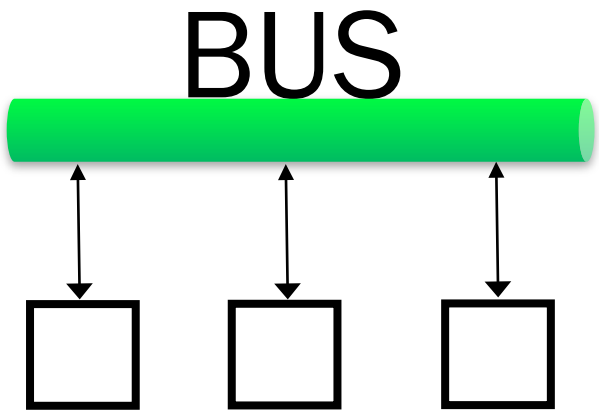
What is your SOA connector?

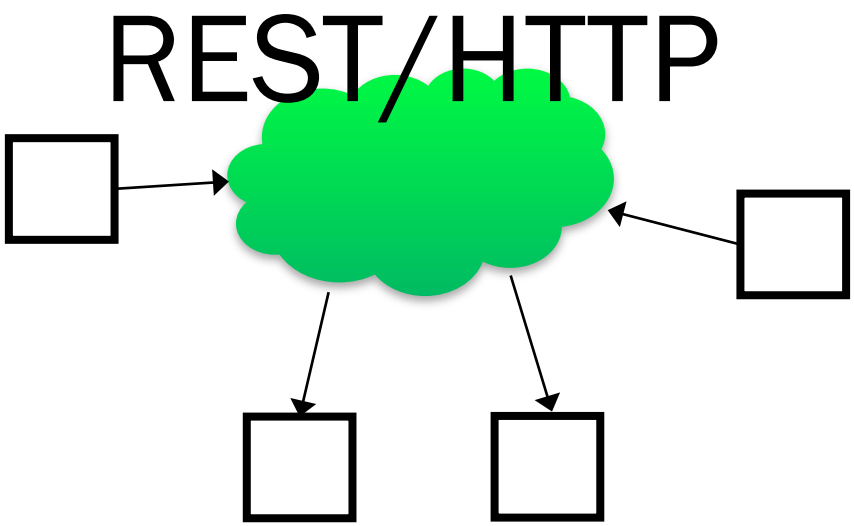




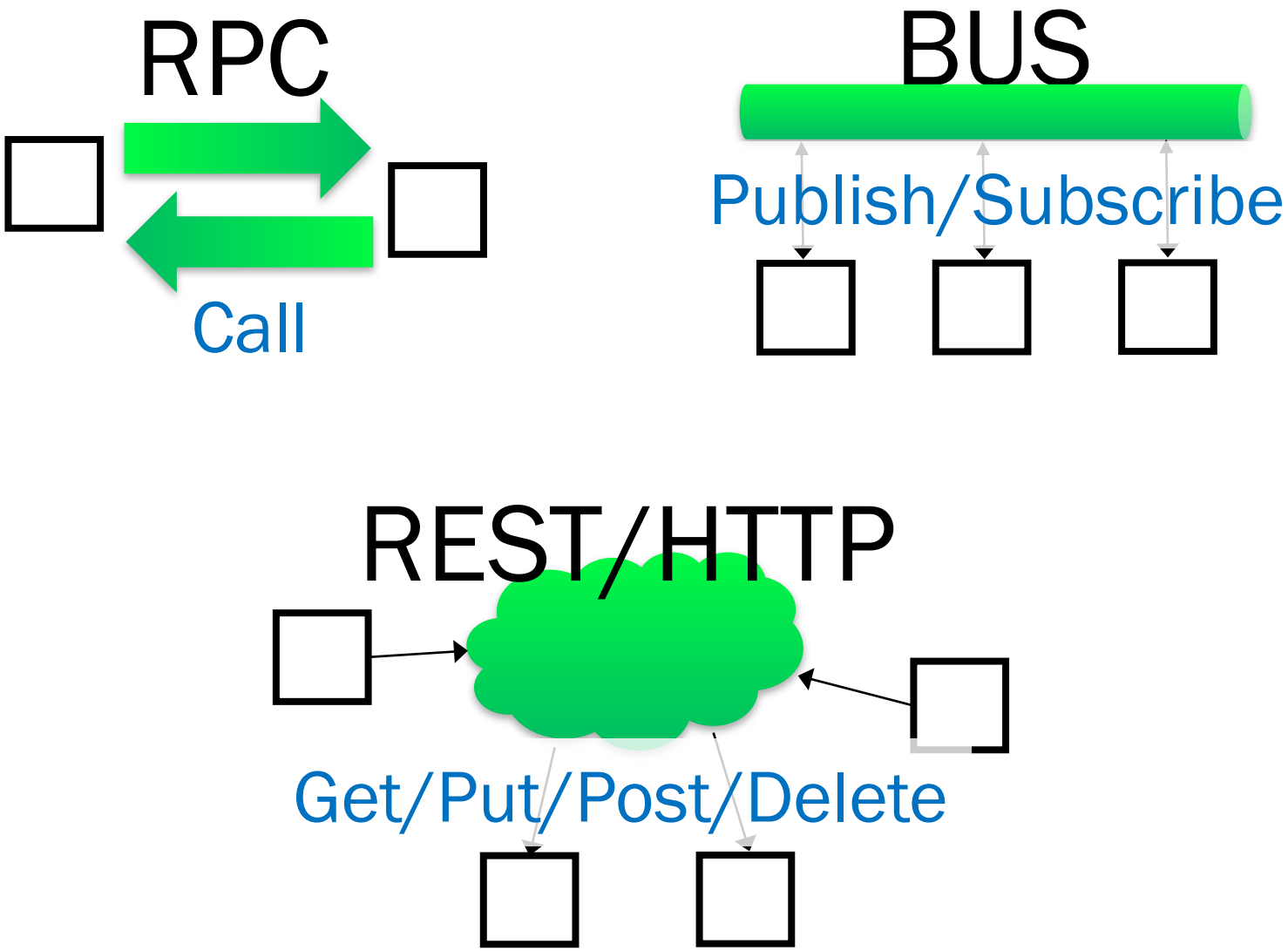
What is your SOA connector?



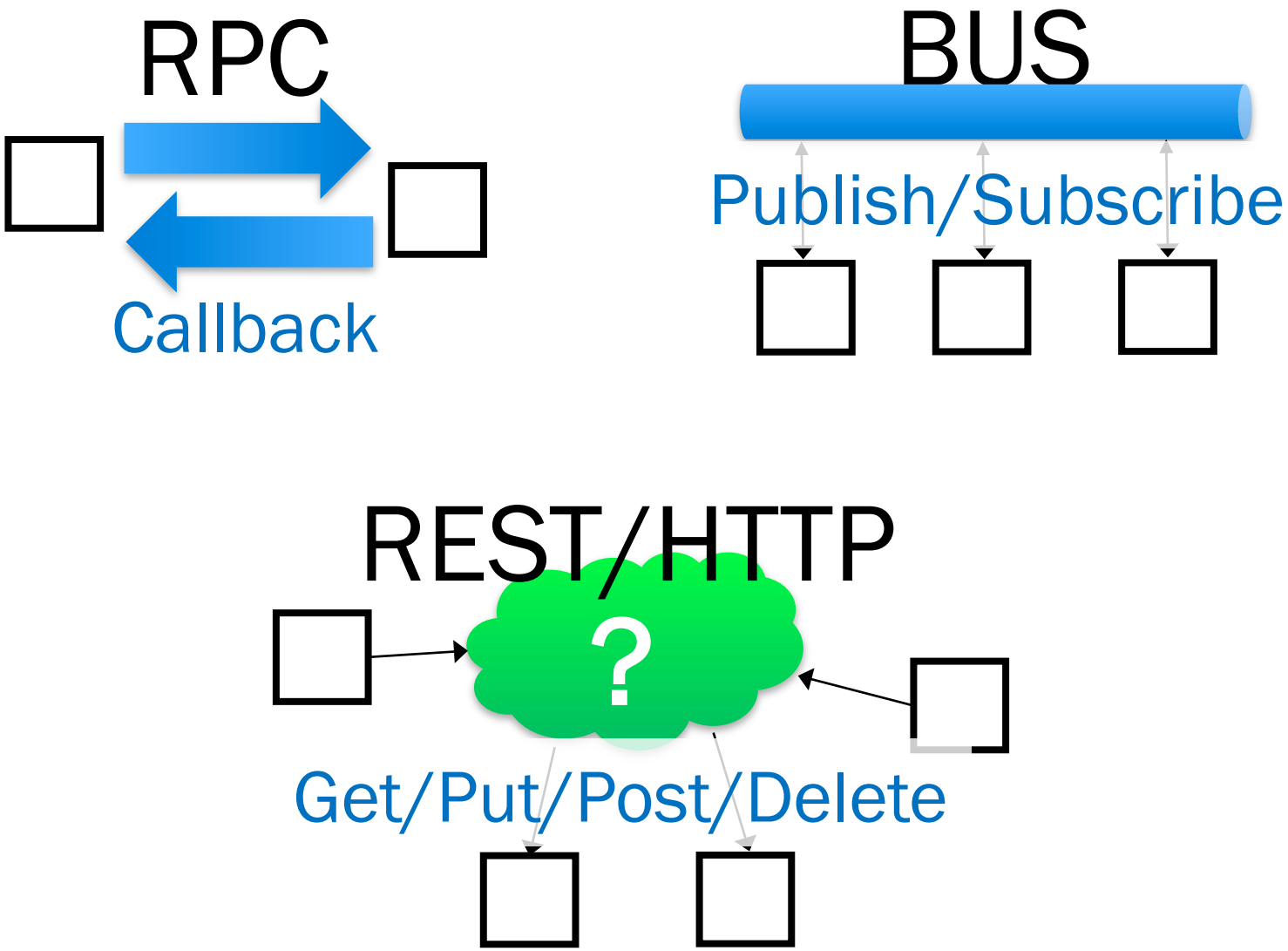




REST as a new connector



What about event notifications?



Solutions

1. Web Feeds (PubSubHubbub)
2. HTTP Long Polling
3. Inverted REST (HTTP Callbacks)
4. WebSockets
5. (XMPP)

Representations

ContentType:

application/atom+xml

Web feed representing the collection of process instances with links to each instance

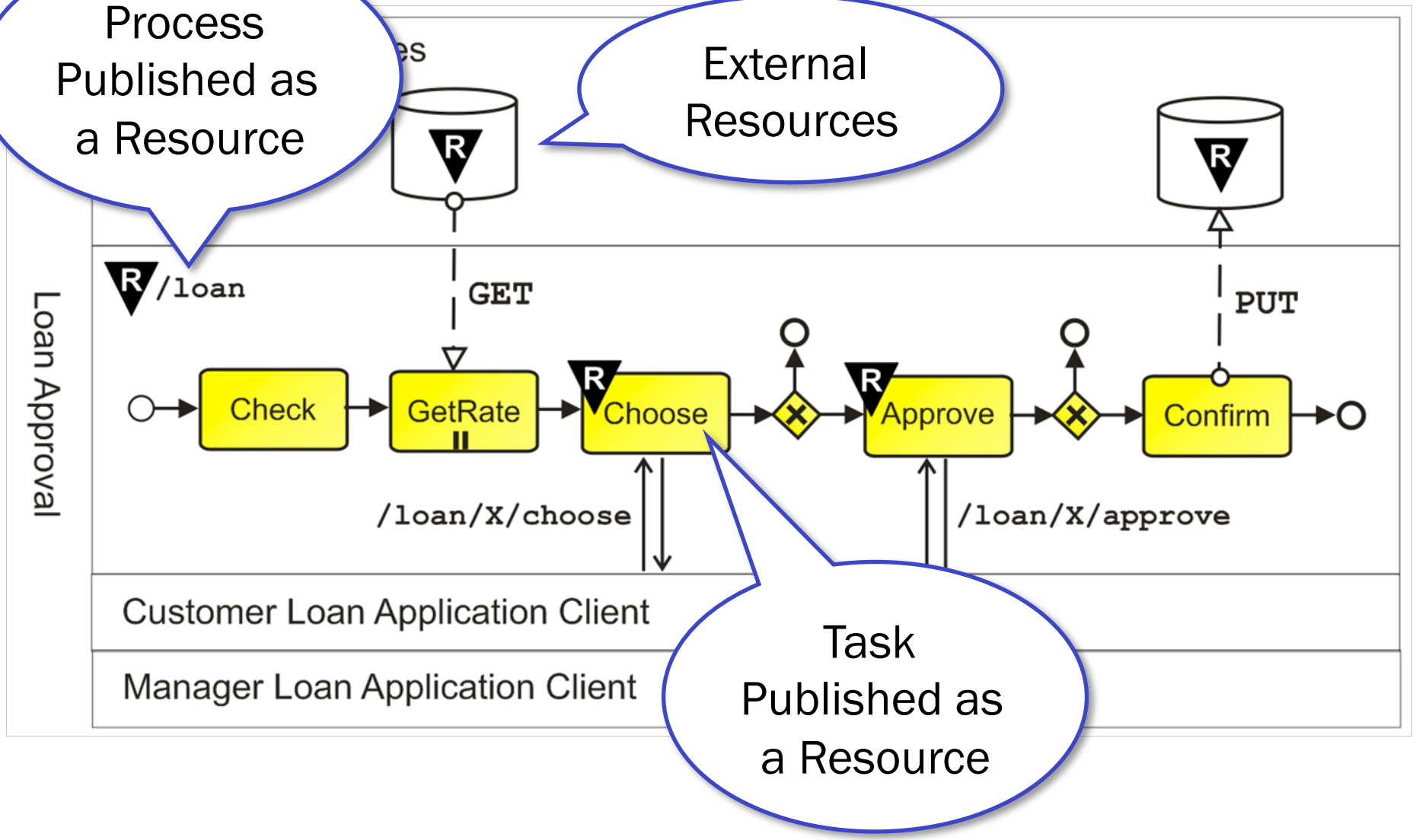
Representations

ContentType:

application/atom+xml

Web feed representing
the current state of the
process instance
(collection of task instances)

Loan Approval Example



Process as a Web Feed

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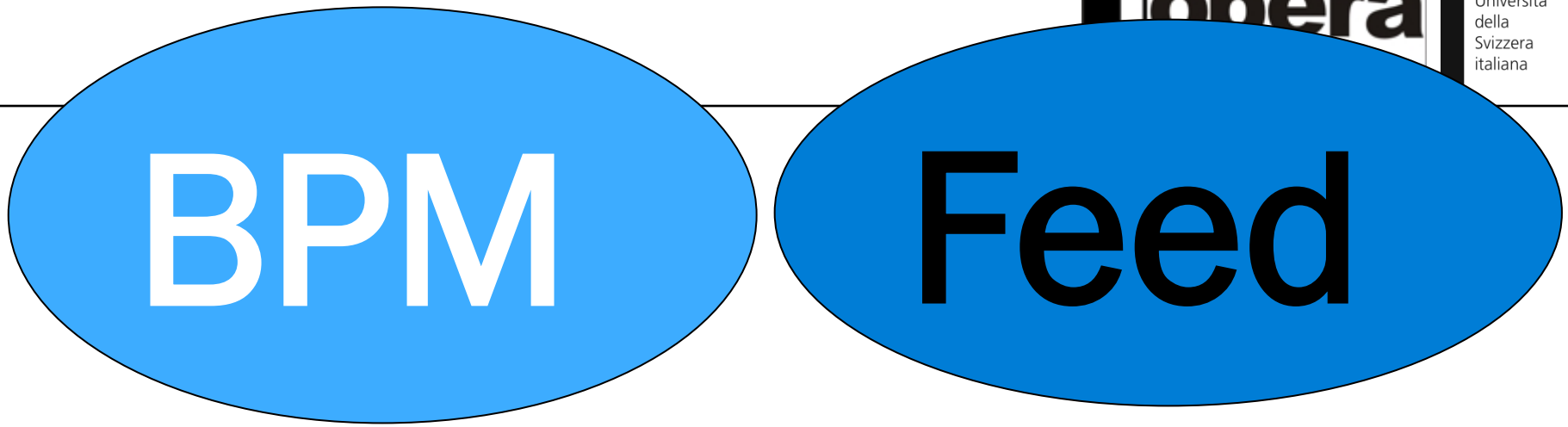
```
<?xml version="1.0" encoding="utf-8"?>
<feed xmlns="http://www.w3.org/2005/Atom">
 <title>Loan Approval Process</title>
 <subtitle>Instance x</subtitle>
 <link href="http://rest.jopera.org/loan/x" rel="self" />
 <link href="http://rest.jopera.org/loan" rel="template" />
 <link href="http://pubsubhubbub.appspot.com/" rel="hub" />
 <id>http://rest.jopera.org/loan/x</id>
 <updated>2011-06-10T11:11:30Z</updated>
 <author><name>Cesare Pautasso</name><email>cp@jopera.org</email></author>
 <entry>
  <title>Choose Task (Ready)</title>
  <link href="http://rest.jopera.org/loan/x/choose" />
  <id>http://rest.jopera.org/loan/x/choose</id>
  <updated>2011-06-10T11:12:20Z</updated>
  <summary>State: ready</summary>
 </entry>
 <entry>
  <title>Approve Task (Waiting)</title>
  <link href="http://rest.jopera.org/loan/x/approve" />
  <id>http://rest.jopera.org/loan/x/approve</id>
  <updated>2011-06-10T11:11:30Z</updated>
  <summary>State: waiting</summary>
 </entry>
</feed>
```

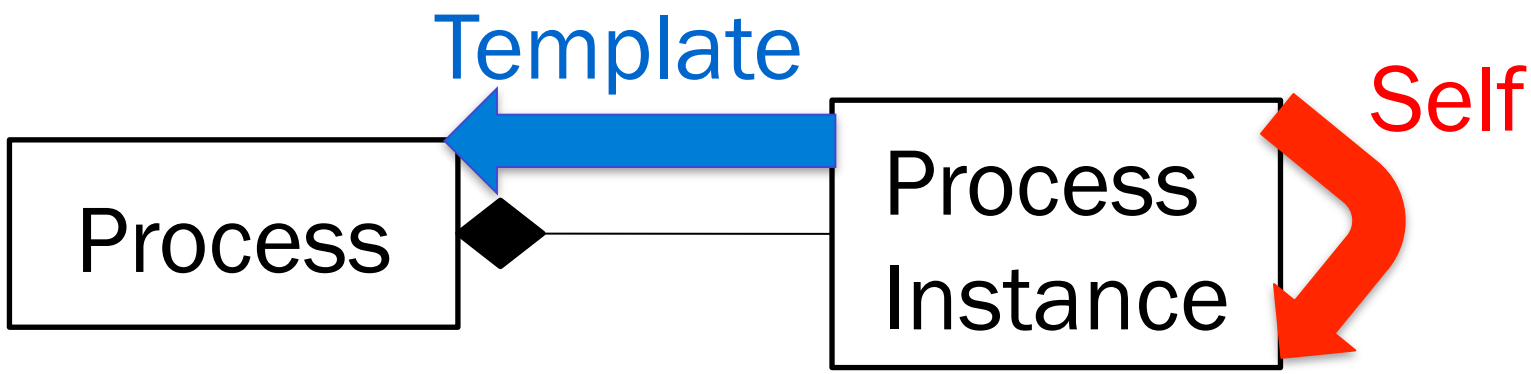


- Process Instance
- Task
- Process User
- Task State
- Task Timestamp
- Task Instance URI

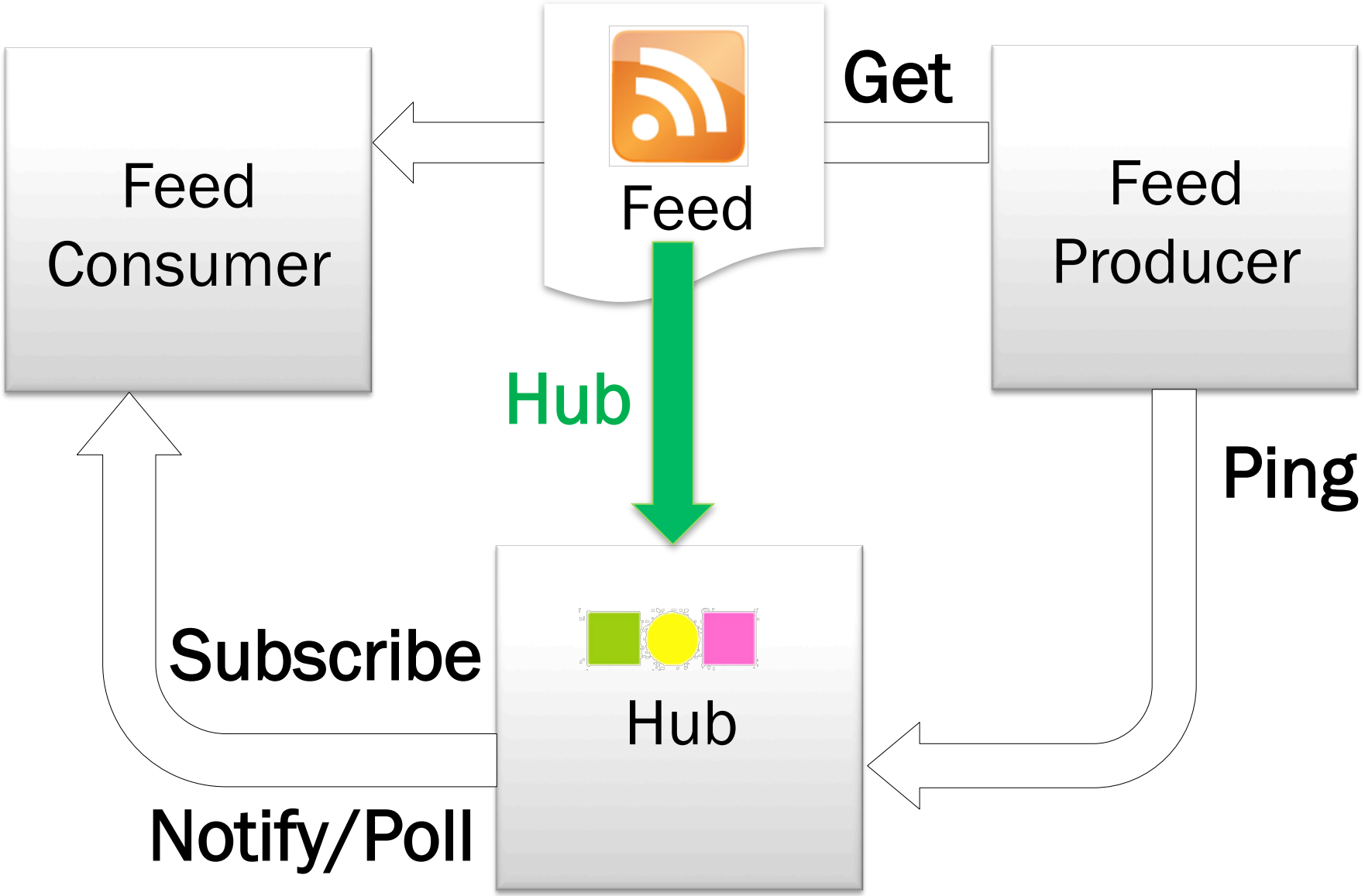
- Feed
- Feed Entry
- Feed Author
- Summary
- Updated
- Link

Link Relations

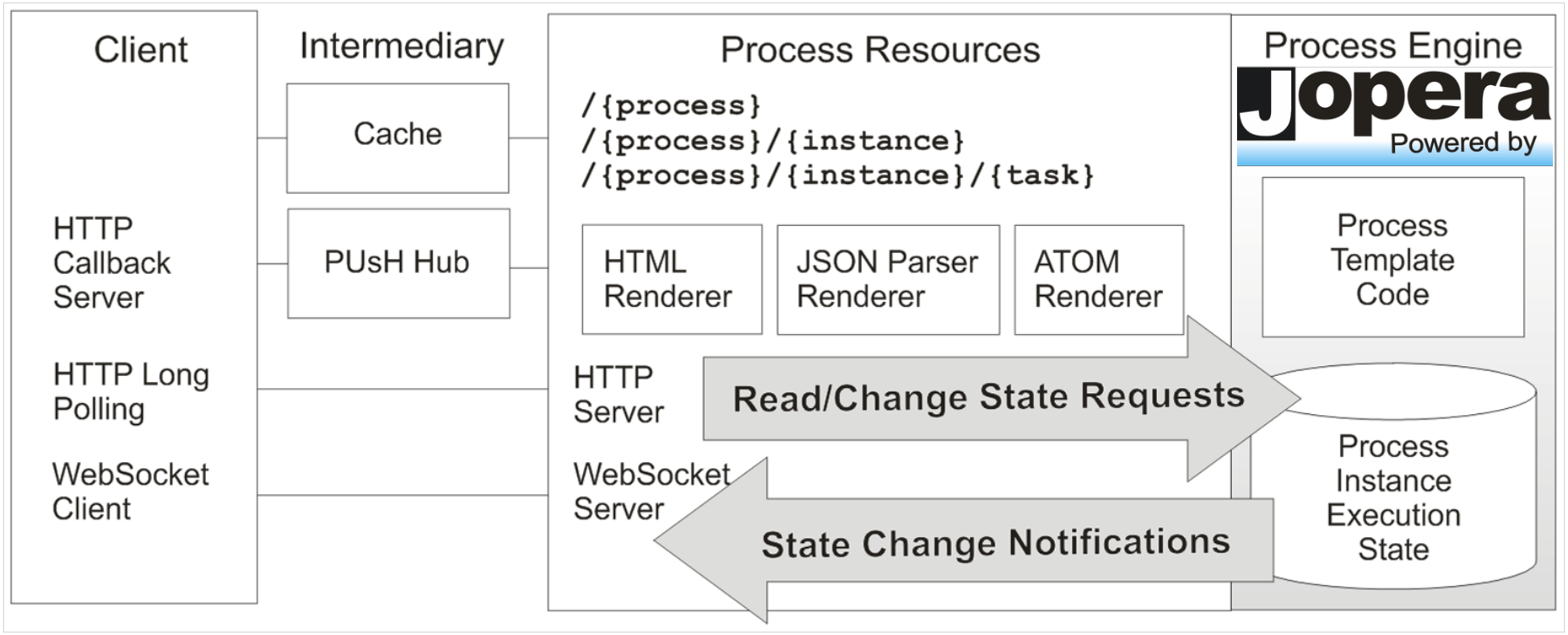

```
<?xml version="1.0" encoding="utf-8"?>
<feed xmlns="http://www.w3.org/2005/Atom">
 <title>Loan Approval Process</title>
 <subtitle>Instance x</subtitle>
 <link href="http://rest.jopera.org/loan/x" rel="self"/>
 <link href="http://rest.jopera.org/loan" rel="template"”/>
 <link href="http://pubsubhubbub.appspot.com/" rel="hub“/>
 <id>http://rest.jopera.org/loan/x</id>
</feed>
```



PubSubHubbub



Architecture



http://www.jopera.org/

Conclusion

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- Thanks to hypermedia, URIs and the HTTP uniform interface, REST resources are a very good abstraction to publish executable business processes on the Web
- RESTful HTTP is good enough to interact without any extension with process execution engines to drive the execution of process and task instances and to deliver notifications
- The state of a process instance can be projected to be represented as a standard Web feed
- The PubSubHubbub protocol can be used as an optimization to scale the corresponding delivery of notication callbacks

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Benjamin Carlyle,
Thomas Erl,
Cesare Pautasso,
SOA with REST,
Prentice Hall, 2012

10th International Conference on Business Process Management (BPM 2012)

September 3-6 2012, Tallinn, Estonia

http://bpm2012.ut.ee

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ws://rest.2012

Third International Workshop on RESTful Design

16-20 April 2012, Lyon, France

http://ws-rest.org/2012

PhD Positions Available

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