

<http://bit.ly/restjfokus>

RESTful Domain Application Protocols

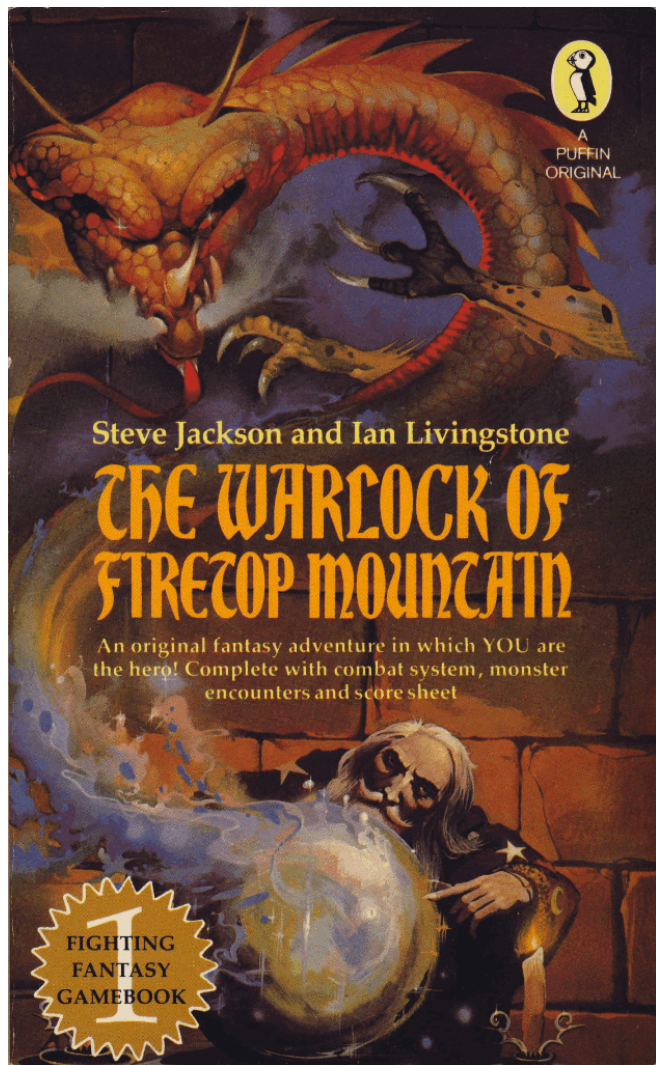
Ian Robinson

<http://ianSrobinson.com>
@ianSrobinson
ianSrobinson@gmail.com

ThoughtWorks®



Pick your path



79-80

hinges. Listening at the door, you hear strange mutterings and the clatter of what could be pots and pans. Whatever is in there, there are several of them. Do you want to go through the door (turn to 159) or turn back (turn to 237)?

79

The passageway ends in front of you in a dead end. If you wish to search for secret passageways, turn to 137. If not, return to the crossroads at 267

80

The key fits the lock and opens the door. You find yourself in a large boathouse. Various boats, in different stages of construction, are lying around. Apart from the door behind you, there is another in the north wall. As you enter, the Skeletons stop their work and crane their bony necks around to look at you. They pick up planks of wood and hammers and advance towards you. There are five of them. Do you.

- Smile nervously and back out of the door into the passage? Turn to 129
- Tell them you've come about buying a boat? Turn to 123
- Tell them you're their new boss and order them back to work? Turn to 195
- Draw your sword and prepare for battle? Turn to 140

195-197

flies through the air directly at him, stops centimetres from his chest and falls to the floor. He looks up and smiles at you with an evil, gloating smile. What can you do:

- Draw your sword and advance? Turn to 142
- Try something else from your backpack? Turn to 105

195

This is a rather unlikely story, considering that they see very few humans around. Nevertheless, Skeletons are pretty dim - you knew this and that's why you tried the story. Roll one die. If you roll a 1 or 2, they don't believe you and keep on advancing. Turn to 140.

A 3 or 4 means that they aren't sure, and send two of their number off through the north door whilst the rest hold you at bay with their weapons. Turn to 164

A roll of 5 or 6 means they've believed you and they all get back to work! Turn to 9. Add 2 LUCK points

196

You search the room. Try as you may you cannot find the secret switch to open the door in the bookshelf - the old man must have locked it from the inside. You do find 5 Gold Pieces in a drawer in the table. You decide to return to the junction to the south. Turn to 280

197

At the top of the stairs the passage turns sharply to

Warlock of Firetop Mountain Protocol

- Go north
- Defeat goblin
- Take key
- Unlock door
- Go east
- Solve riddle

Fighting Fantasy Transfer Protocol

- Numbered prose paragraphs
- Multiple choices keyed to numbered paragraphs

Hypermedia

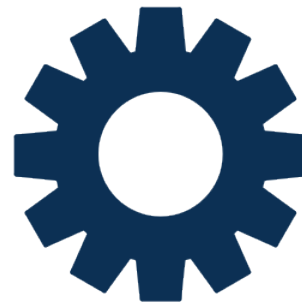
As
the

Engine

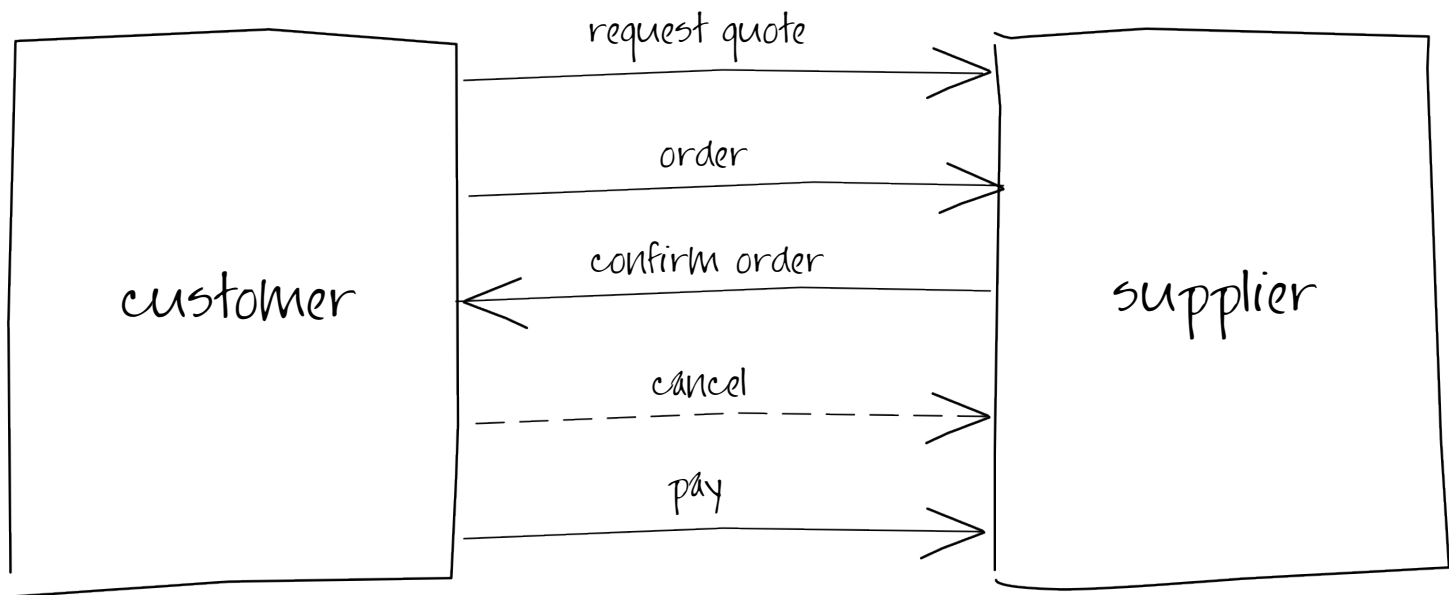
of

Application

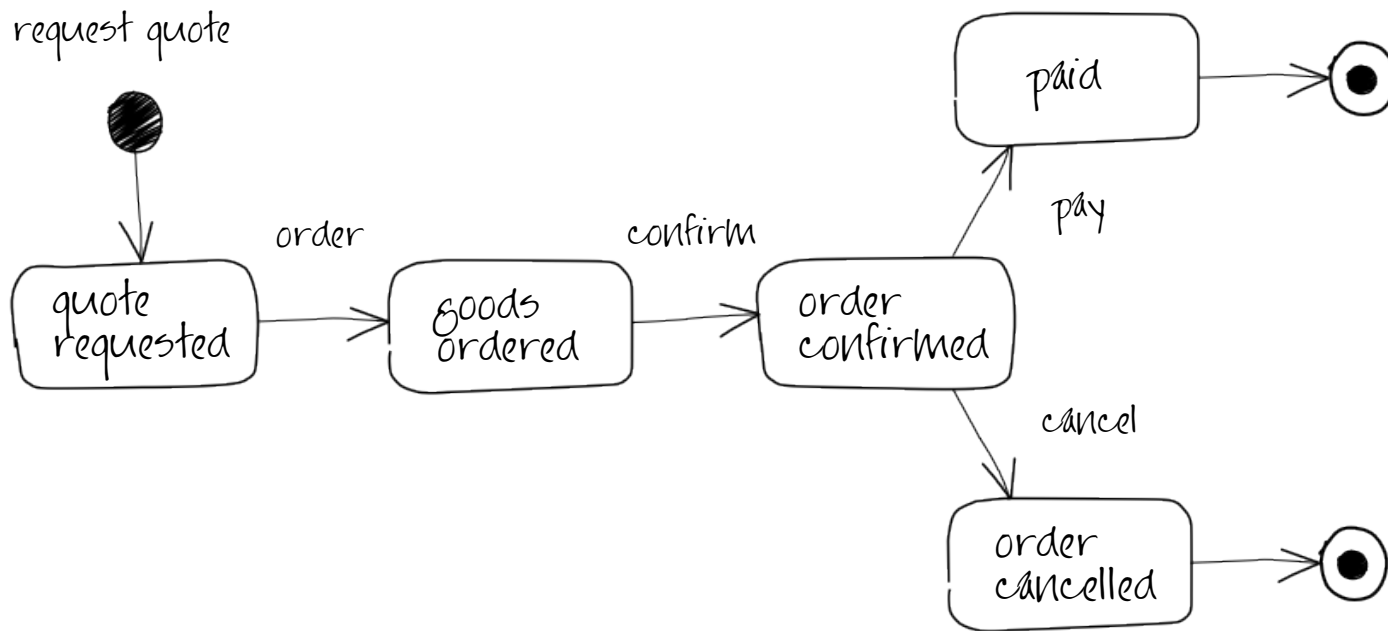
State



Procurement



Procurement application state transitions

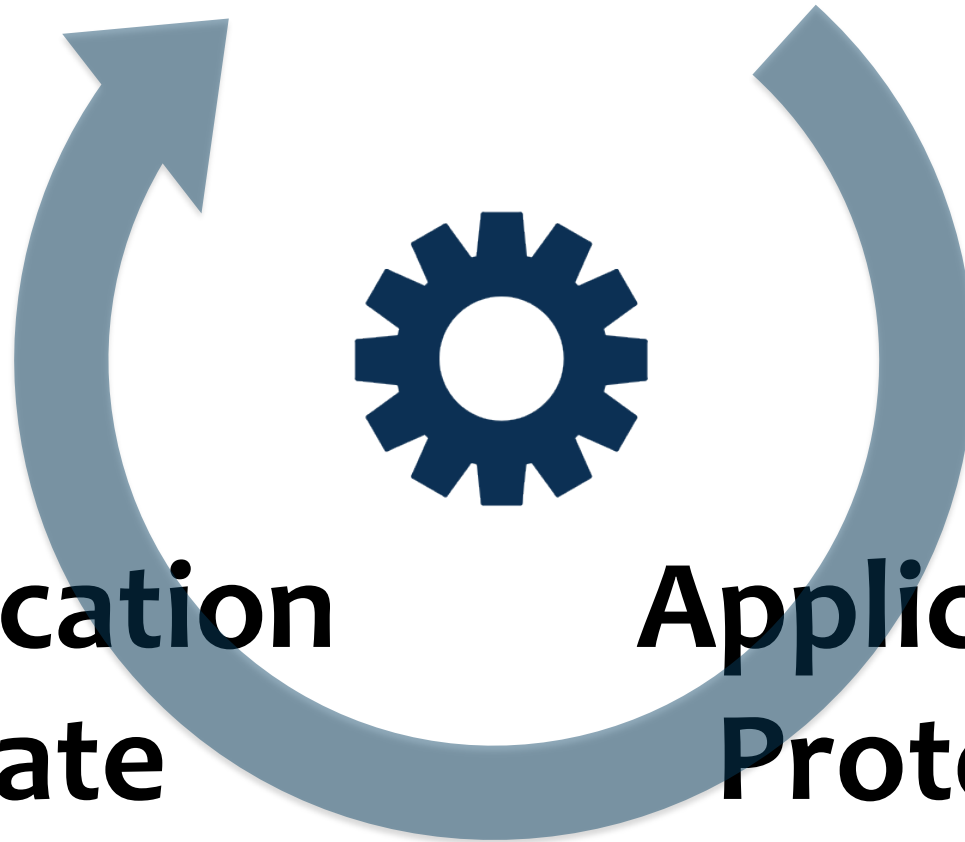


Releasing value

Application

**Application
State**

**Application
Protocol**



Example: Procurement App



Application start

Request

```
GET /shop HTTP/1.1  
Host: restbucks.com
```

Response

```
HTTP/1.1 200 OK  
Date: Mon, 26 Jul 2010 10:00:00 GMT  
Cache-Control: public, max-age=86400  
Content-Type: application/restbucks+xml  
Content-Length: ...
```

```
<shop xmlns="http://schemas.restbucks.com/shop"  
  xmlns:rb="http://relations.restbucks.com/">  
  <link rel="rb:rfq"  
    href="http://restbucks.com/request-for-quote"  
    type="application/restbucks+xml" />  
</shop>
```

Links and semantic context



```
<link rel="payment"  
  href="https://payments.example.org/payments/1010"  
  type="application/xhtml+xml"/>
```

```
<link rel="rb:rfq"  
  href="http://restbucks.com/request-for-quote"  
  type="application/restbucks+xml"/>
```



Registered

payment

Indicates a resource where payment is accepted

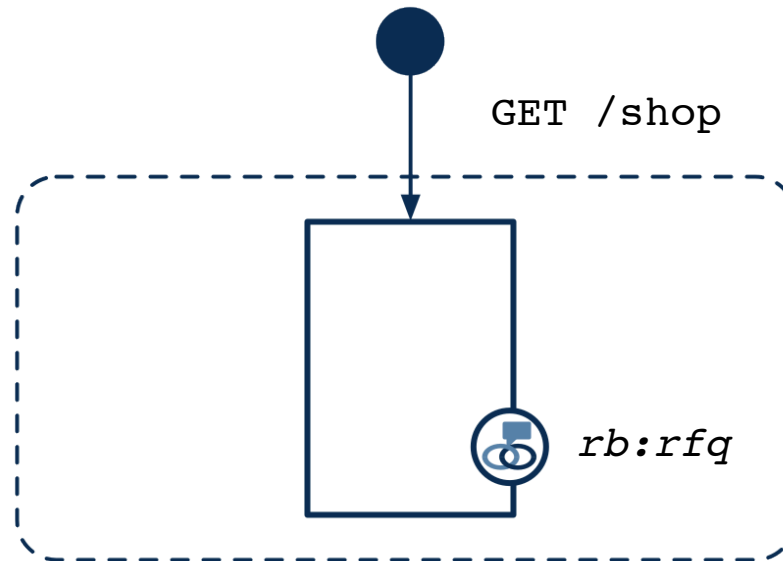
Extension

rb:rfq

Indicates a resource where a quote can be requested

Started

Started



Design strategies

Entry point

Advertise capabilities

Caching

Store infrequently changing representations closer to client

Get request-for-quote form

Request

```
GET /request-for-quote HTTP/1.1  
Host: restbucks.com
```

Response

```
HTTP/1.1 200 OK  
Date: Mon, 26 Jul 2010 10:00:05 GMT  
Cache-Control: public, max-age=86400  
Content-Type: application/restbucks+xml  
Content-Length: ...
```

```
<model xmlns="http://www.w3.org/2002/xforms"  
  schema="http://schemas.restbucks.com/shop.xsd">  
  <instance/>  
  <submission  
    resource="http://restbucks.com/quotes"  
    method="post"  
    mediatype="application/restbucks+xml" />  
</model>
```


Control data (forms)



HTML

```
<form name="input "  
  action="/registration"  
  method="post"  
  enctype="application/x-www-form-urlencoded">  
  <input type="text" name="user" />  
  <input type="submit" value="Submit" />  
</form>
```

XForms

```
<model xmlns="http://www.w3.org/2002/xforms"  
  schema="http://schemas.restbucks.com/rfq.xsd">  
  <instance/>  
  <submission  
    resource="http://restbucks.com/quotes"  
    method="post"  
    mediatype="application/restbucks+xml" />  
</model>
```

Submit request for quote

Request

POST /quotes HTTP/1.1

Host: restbucks.com

Content-Type: application/restbucks+xml

Content-Length: ...

```
<shop xmlns="http://schemas.restbucks.com/shop">
  <items>
    <item>
      <description>Costa Rica Tarrazu</description>
      <amount>250g</amount>
    </item>
    <item>
      <description>Elephant Beans</description>
      <amount>250g</amount>
    </item>
  </items>
</shop>
```

Return quote

Response

HTTP/1.1 201 Created

Date: Mon, 26 Jul 2010 10:01:00 GMT

Location: <http://restbucks.com/quotes/1234>

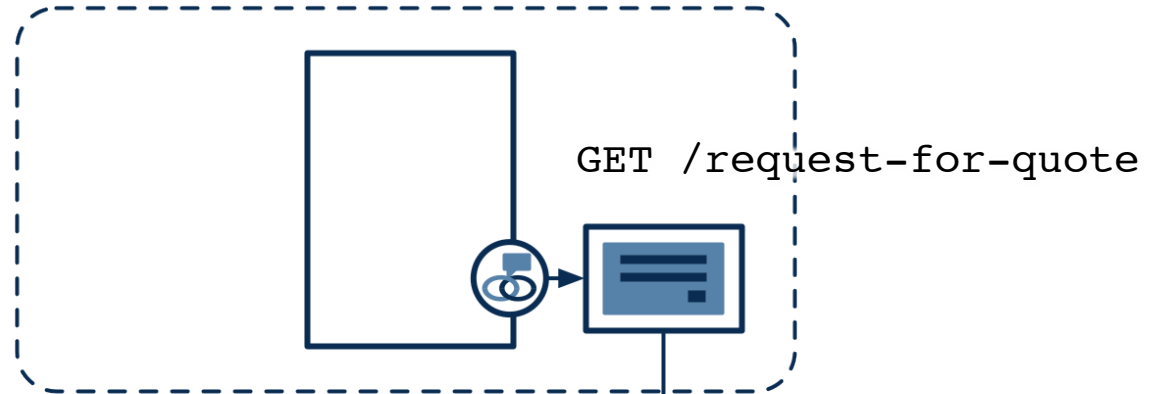
Content-Type: application/restbucks+xml

Content-Length: ...

```
<shop xmlns="http://schemas.restbucks.com/shop"
  xmlns:rb="http://relations.restbucks.com/">
  <items>
    <item>...</item>
    <item>...</item>
  </items>
  <link rel="self"
    href="http://restbucks.com/quotes/1234"
    type="application/restbucks+xml" />
  <link rel="rb:order-form"
    href="http://restbucks.com/order-forms/1234"
    type="application/restbucks+xml" />
</shop>
```


Started to Quote Requested

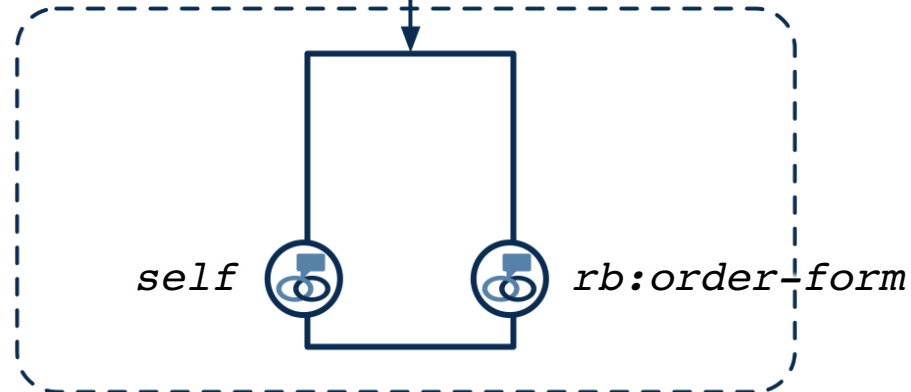
Started



POST /quotes



Quote Requested



Design strategies

Typed link to form

Link relation describes meaning of form in context of current representation

Inline control data

Form provides inline control data—HTTP idioms

Collection

POST form to collection resource

Navigate to order form

Request

```
GET /order-forms/1234  
Host: restbucks.com
```

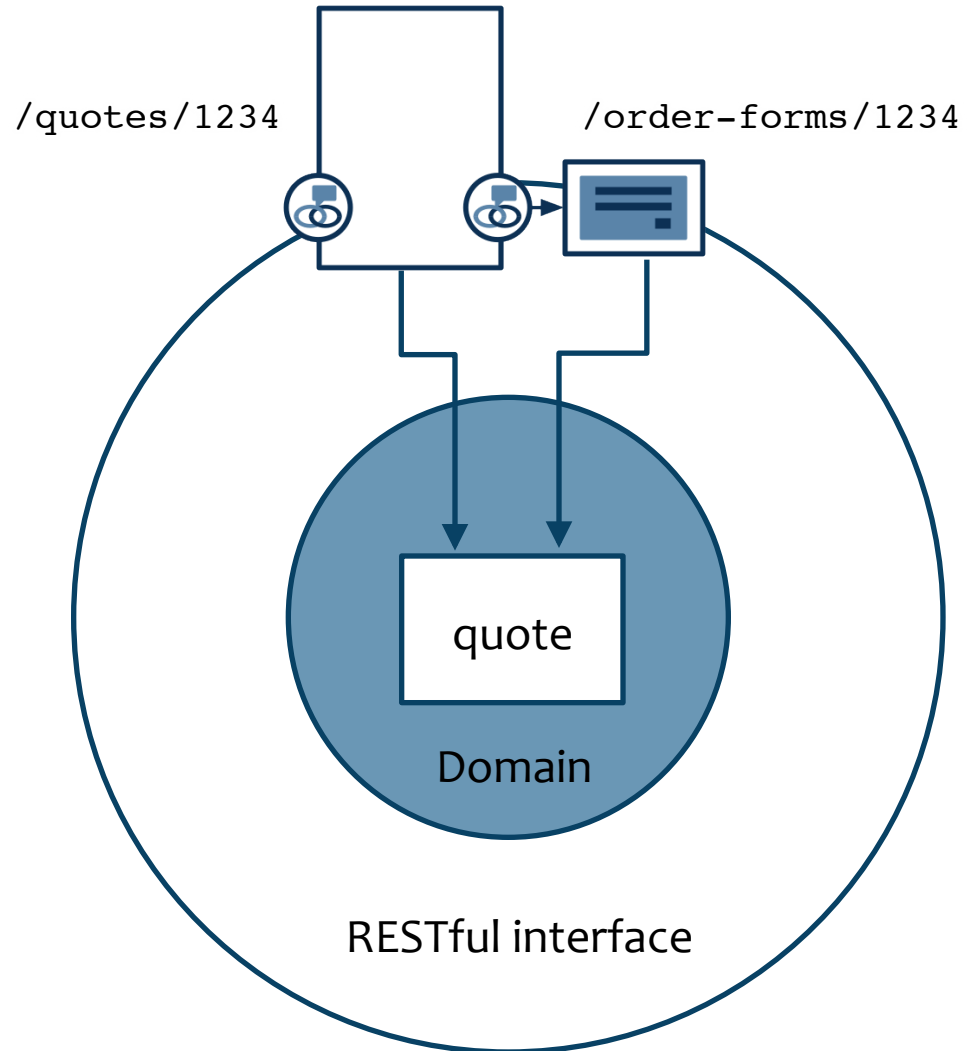
Return order form

Response

```
HTTP/1.1 200 OK
Cache-Control: public
Date: Mon, 26 Jul 2010 10:01:05 GMT
Expires: Mon, 02 Aug 2010 10:01:00 GMT
Content-Type: application/restbucks+xml
Content-Length: ...
Content-Location: http://restbucks.com/quotes/1234
```

```
<model xmlns="http://www.w3.org/2002/xforms">
  <instance>
    <shop xmlns="http://schemas.restbucks.com/shop">
      <items>...</items>
      <link rel="self"
            href="http://restbucks.com/quotes/1234"
            type="application/restbucks+xml" />
    </shop>
  </instance>
  <submission
    resource="http://restbucks.com/orders?c=99fe97e1
      ➡ & s=k2awEpciJkd2X8rt3NmgDg8AyUo%3D"
    method="post"
    mediatype="application/restbucks+xml" />
</model>
```

Resources adapt the domain for hypermedia clients



Submit order form

Request

POST /orders?c=99fe97e1&s=k2awEpciJkd2X8rt3NmgDg8AyUo%3D HTTP/1.1

Host: restbucks.com

Content-Type: application/restbucks+xml

Content-Length: ...

```
<shop xmlns="http://schemas.restbucks.com/shop">
  <items>
    <item>
      <description>Costa Rica Tarrazu</description>
      <amount>250g</amount>
      <price currency="GBP">4.40</price>
    </item>
    <item>
      <description>Elephant Beans</description>
      <amount>250g</amount>
      <price currency="GBP">5.30</price>
    </item>
  </items>
  <link rel="self"
    href="http://restbucks.com/quotes/1234"
    type="application/restbucks+xml" />
</shop>
```

Indicate order submitted successfully

Response

HTTP/1.1 202 Accepted

Cache-Control: no-store

Date: Mon, 26 Jul 2010 10:02:00 GMT

Location: <http://restbucks.com/orders/9876>

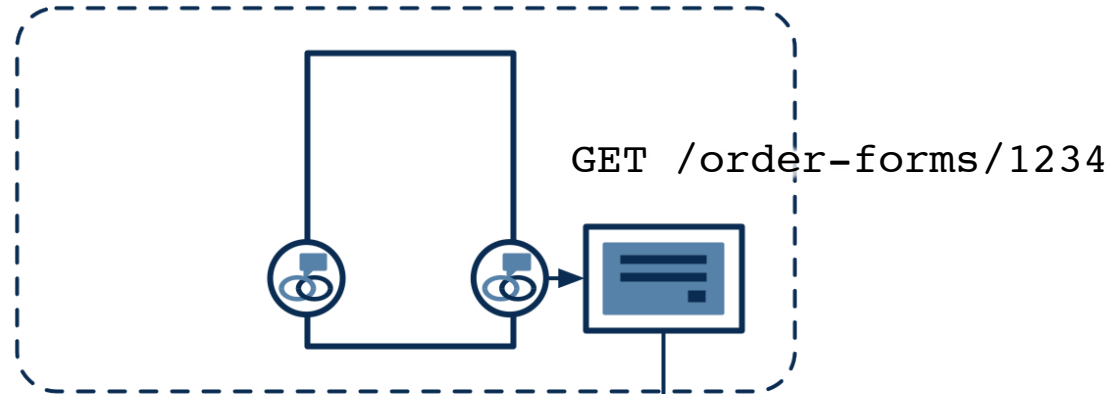
Content-Type: application/restbucks+xml

Content-Length: ...

```
<shop xmlns="http://schemas.restbucks.com/shop"
  xmlns:rb="http://relations.restbucks.com/">
  <status>Initializing</status>
  <link rel="rb:order"
    href="http://restbucks.com/orders/9876"
    type="application/restbucks+xml" />
</shop>
```

Quote Requested to Goods Ordered

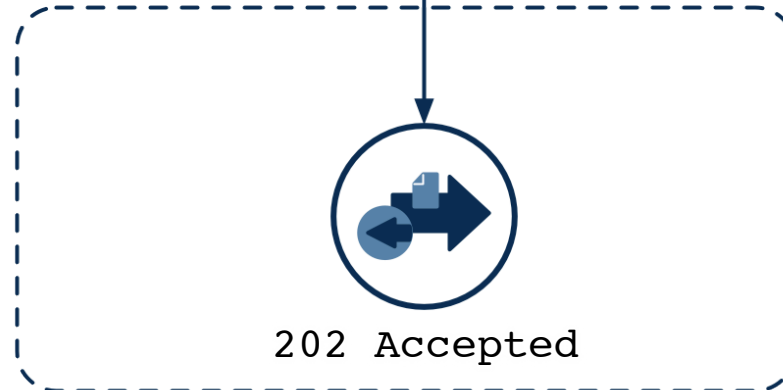
Quote Requested



POST /orders?c=99fe97e1&s=k2awEpciJkd2X8rt3NmgDg8AyUo%3D



Goods Ordered



Design strategies

Prefilled form

Alternate representation of quote data, adapted for submitting an order

One-time URI

Tamper proofing

202 Accepted

Long-running operations

Successfully accepted request but result is not immediately available

Check state of order

Request

```
GET /orders/9876 HTTP/1.1  
Host: restbucks.com
```

Response

```
HTTP/1.1 404 Not Found
```


Check state of order again

Request

```
GET /orders/9876 HTTP/1.1  
Host: restbucks.com
```

Return order

Response

HTTP/1.1 200 OK

Cache-Control: public, max-age=0

Date: Mon, 26 Jul 2010 10:05:00 GMT

ETag: "4d3e88c9"

Content-Type: application/restbucks+xml

```
<shop xmlns="http://schemas.restbucks.com/shop"
  xmlns:rb="http://relations.restbucks.com/">
  <status>Awaiting Payment</status>
  <items>...</items>
  <link rel="self"
    href="http://restbucks.com/orders/9876"
    type="application/restbucks+xml"/>
  <link rel="rb:quote"
    href="http://restbucks.com/quotes/1234"
    type="application/restbucks+xml"/>
  <link rel="payment"
    href="https://example.org/payments/1010"
    type="application/xhtml+xml"/>
  <link rel="rb:cancellation"
    href="http://restbucks.com/orders/9876/cancel"
    type="application/restbucks+xml"/>
</shop>
```

ETag header

Opaque “checksum” of resource state

When resource changes, entity tag changes

Strategies: hash, file attribute, GUID, version number, etc.

Conditional GET

If-None-Match: <etag value>

“Return a full response only if the resource *has* changed”

304 Not Modified

Conditional POST/PUT

If-Match: <etag value>

“Process this request only if the resource *hasn't* changed”

412 Precondition Failed

Goods Ordered to Order Confirmed

Goods
Ordered



GET /orders/9876



Order
Confirmed

rb:quote



payment



self



rb:cancellation



Design strategies

Polling

Client guarantees delivery of notification

ETag

Efficient re-querying

Cache but revalidate strategy

Tradeoff between bandwidth usage and consistency

Navigate to payment form

Request

```
GET https://example.org/payments/1010 HTTP/1.1
```

Return payment form

Response

```
HTTP/1.1 200 OK
Cache-Control: no-store
Date: Mon, 26 Jul 2010 10:05:05 GMT
Content-Type: application/xhtml+xml
Content-Length: ...
```

```
<html xmlns="http://www.w3.org/1999/xhtml">
  <head>
    <title>Payment</title>
  </head>
  <body>
    <form method="post"
      action="https://example.org/payments/1010"
      enctype="application/x-www-form-urlencoded">
      <input type="text" name="card-type" />
      <input type="text" name="name" />
      <input type="text" name="card-number" />
      <input type="text" name="security-code" />
      <input type="submit" value="Submit" />
    </form>
  </body>
</html>
```

Submit payment details

Request

```
POST https://example.org/payments/1010 HTTP/1.1  
Content-Type: application/x-www-form-urlencoded  
Content-Length: ...
```

```
card-type=Visa+Debit&name=MR+JOHN+SMITH  
➔ &card-number=4876512418675010&security-code=212
```

Confirm payment

Response

```
HTTP/1.1 200 OK
Cache-Control: no-store
Date: Mon, 26 Jul 2010 10:06:00 GMT
Content-Type: application/xhtml+xml
Content-Length: ...
```

```
<html xmlns="http://www.w3.org/1999/xhtml">
  <head>
    <title>Payment Confirmation</title>
  </head>
  <body>
    <form method="post"
      action="http://restbucks.com/payments/9876"
      enctype="application/x-www-form-urlencoded">
      <input type="hidden"
        name="confirmation-id">6a0806ca</input>
      <input type="continue" value="Continue"/>
    </form>
  </body>
</html>
```

Notify Restbucks

Request

```
POST /payments/9876 HTTP/1.1
Host: restbucks.com
Content-Type: application/x-www-form-urlencoded
Content-Length: ...
```

```
confirmation-id=6a0806ca
```

Response

```
HTTP/1.1 303 See Other
Date: Mon, 26 Jul 2010 10:06:02 GMT
Location: http://restbucks.com/orders/9876
```

Get order

Request

GET /orders/9876 HTTP/1.1

Host: restbucks.com

If-None-Match: "4d3e88c9"

Return order

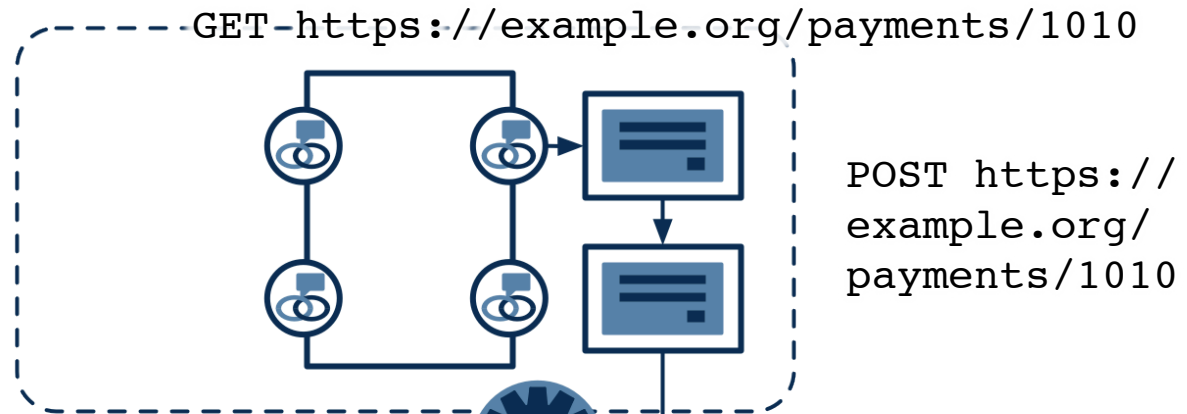
Response

```
HTTP/1.1 200 OK
Cache-Control: public, max-age=0
Date: Mon, 26 Jul 2010 10:06:05 GMT
ETag: "5612cfaa"
Content-Type: application/restbucks+xml
Content-Length: ...
```

```
<shop xmlns="http://schemas.restbucks.com/shop"
  xmlns:rb="http://relations.restbucks.com/">
  <status>Paid</status>
  <items>
    <item>...</item>
    <item>...</item>
  </items>
  <link rel="self"
    href="http://restbucks.com/orders/9876"
    type="application/restbucks+xml" />
  <link rel="rb:quote"
    href="http://restbucks.com/quotes/1234"
    type="application/restbucks+xml" />
</shop>
```

Order Confirmed to Paid

Order
Confirmed



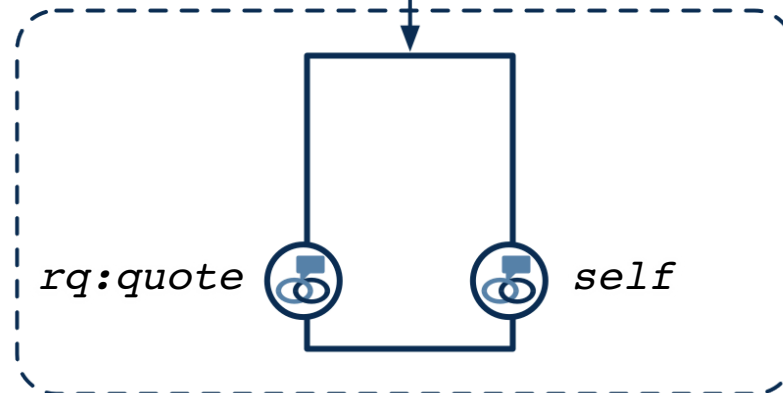
303 See Other



POST `/payments/9876`

GET `/orders/9876`

Paid



Design strategies

Protocol and media type composition

3rd party resources and protocol

Idempotent POST

Implement idempotency on server side

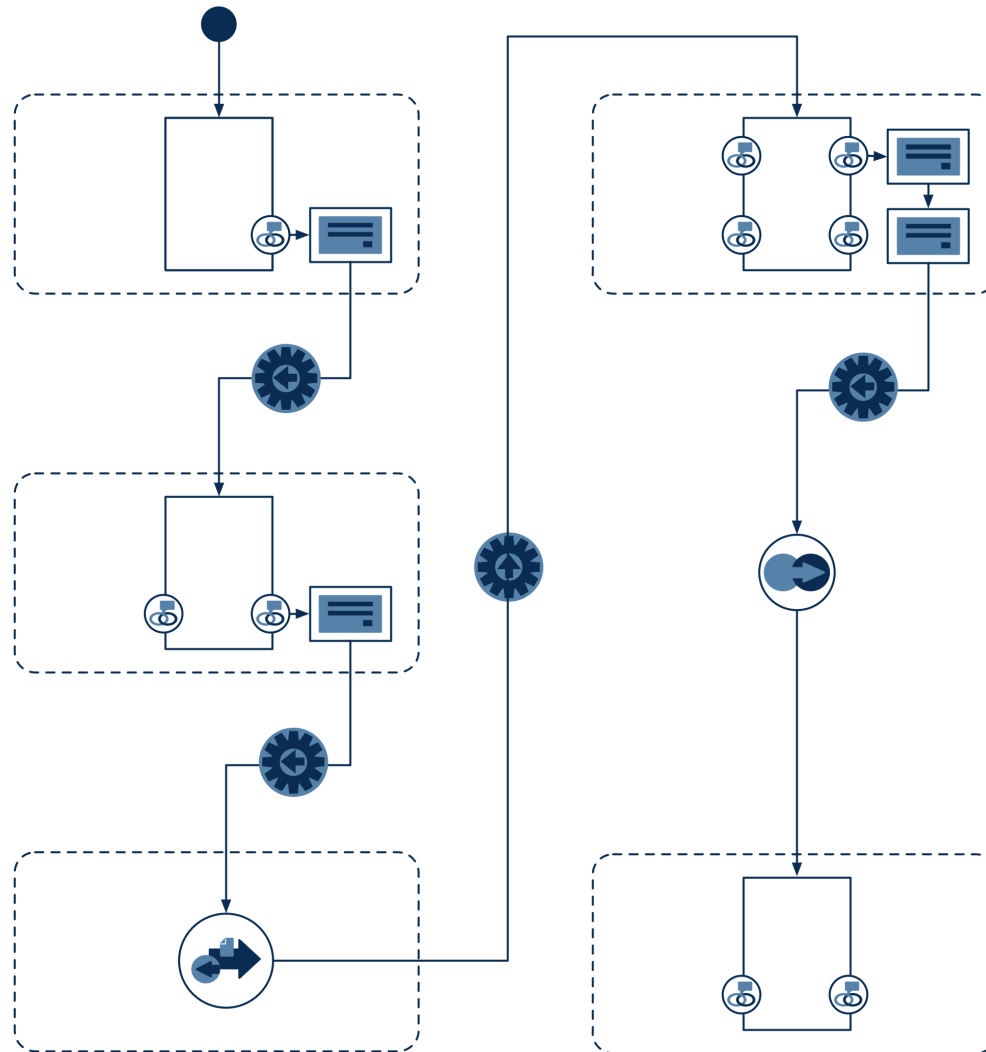
Client still expects POST to be non-idempotent

405 Method Not Allowed for subsequent POSTs

Resource state as a function of state of other resources

Order state partly function of state of payment resource

Enriching and transitioning application state





Media Types

Representation formats
Hypermedia controls
Processing models



Link Relations

Semantic context for links



HTTP Idioms

Coordinate data transfer

Procurement API



Media Types

`application/restbucks+xml`
`application/xhtml+xml`



Link relations

`self`
`payment`



Schemas

`http://schemas.restbucks.com/shop`



Hypermedia controls

`<link>` element

XForms 1.1



Link relations

`rb:quote`

`rb:order-form`

`rb:cancellation`

`rb:order`

`rb:rfq`



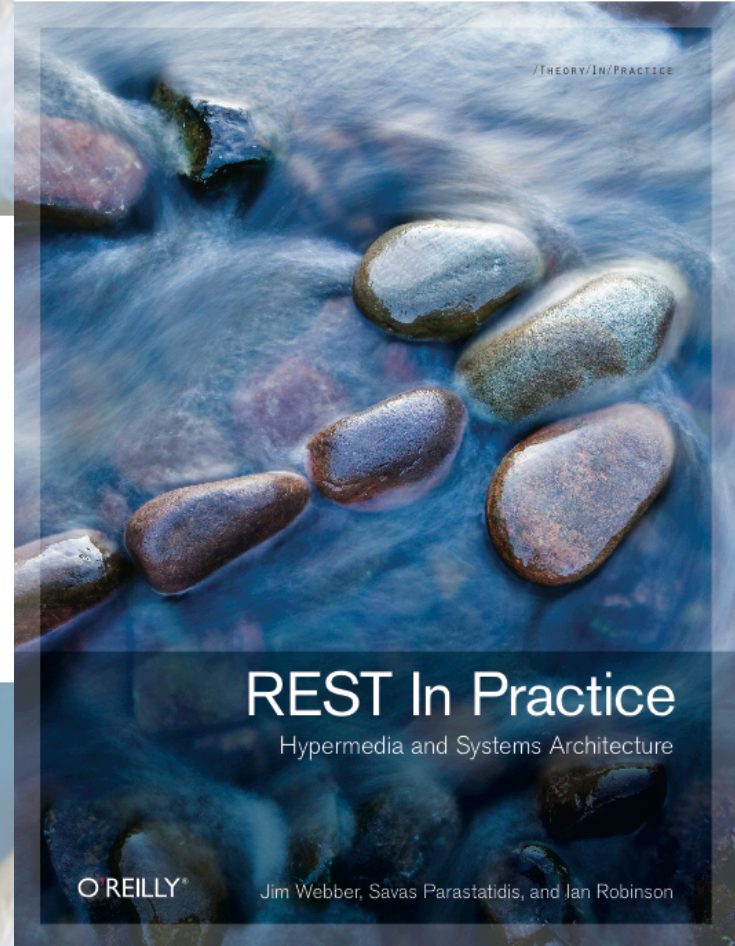
Processing model

XForms 1.1 Core

Thank you

<http://ianSrobinson.com>
@ianSrobinson
ianSrobinson@gmail.com

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Benefits

Decoupled

Client not bound to proprietary operations or protocols
“Workflow” can be evolved independently of clients

Distributed

Fewer bottlenecks
Dedicate processing resource only where necessary
Easily incorporate 3rd party resources

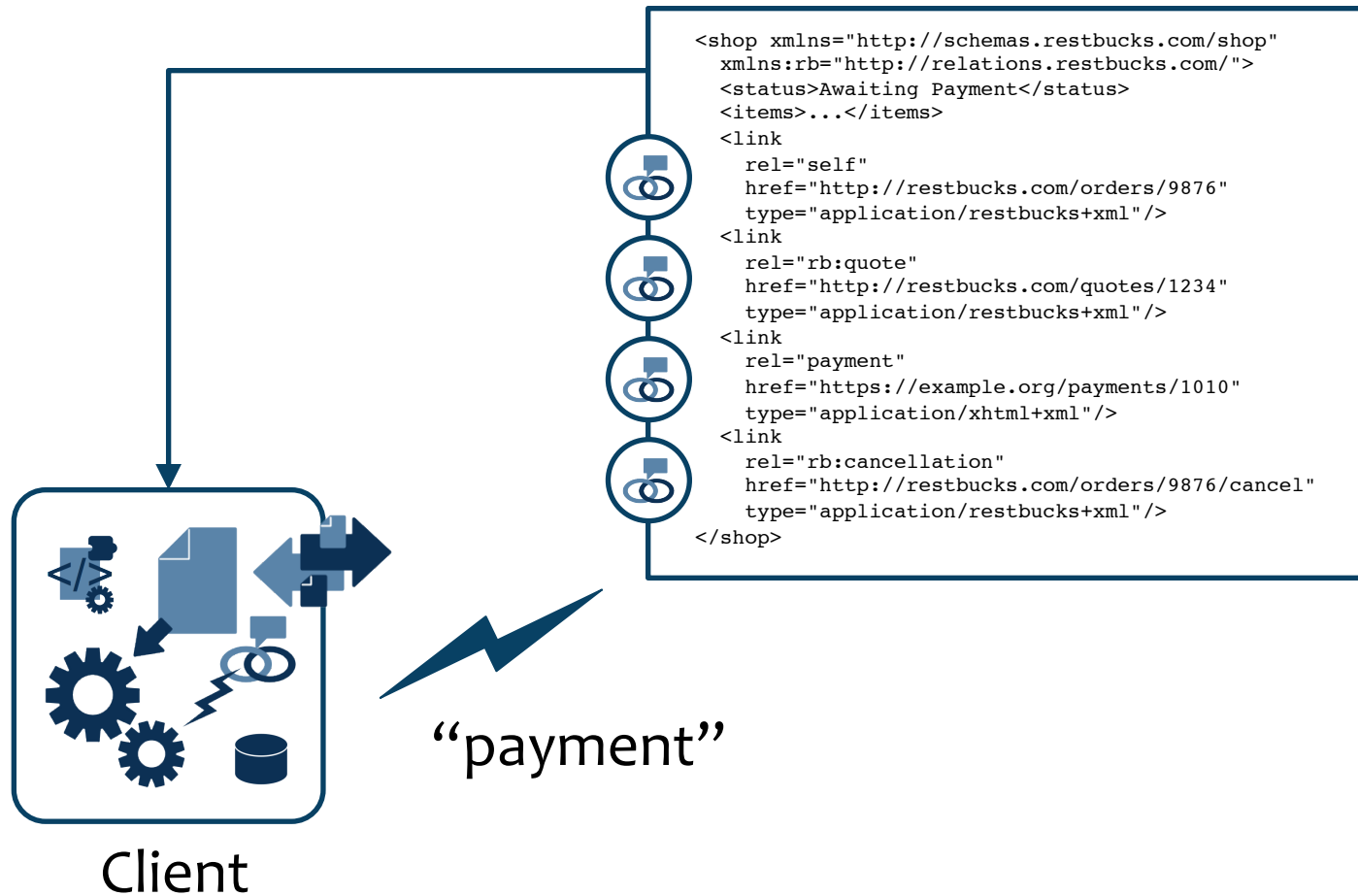
Divide and conquer

Discrete, simple, easily tested resources

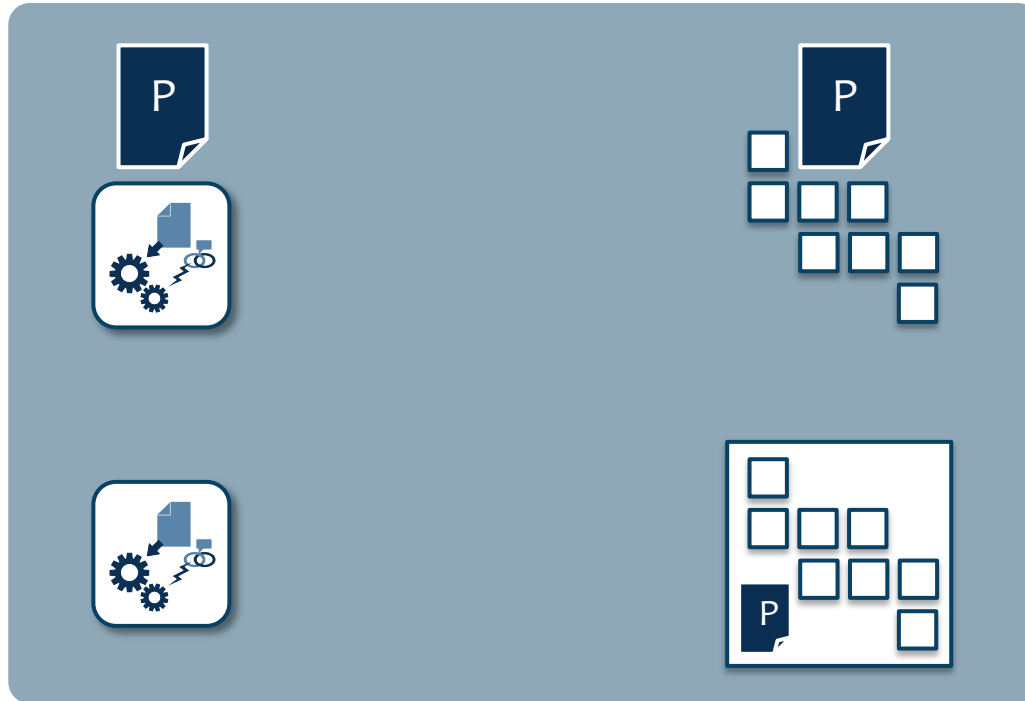
Commodity platform

HTTP clients, server frameworks, Web servers

Agents, events and hypermedia event handlers



Who applies the protocol?



Strong coupling



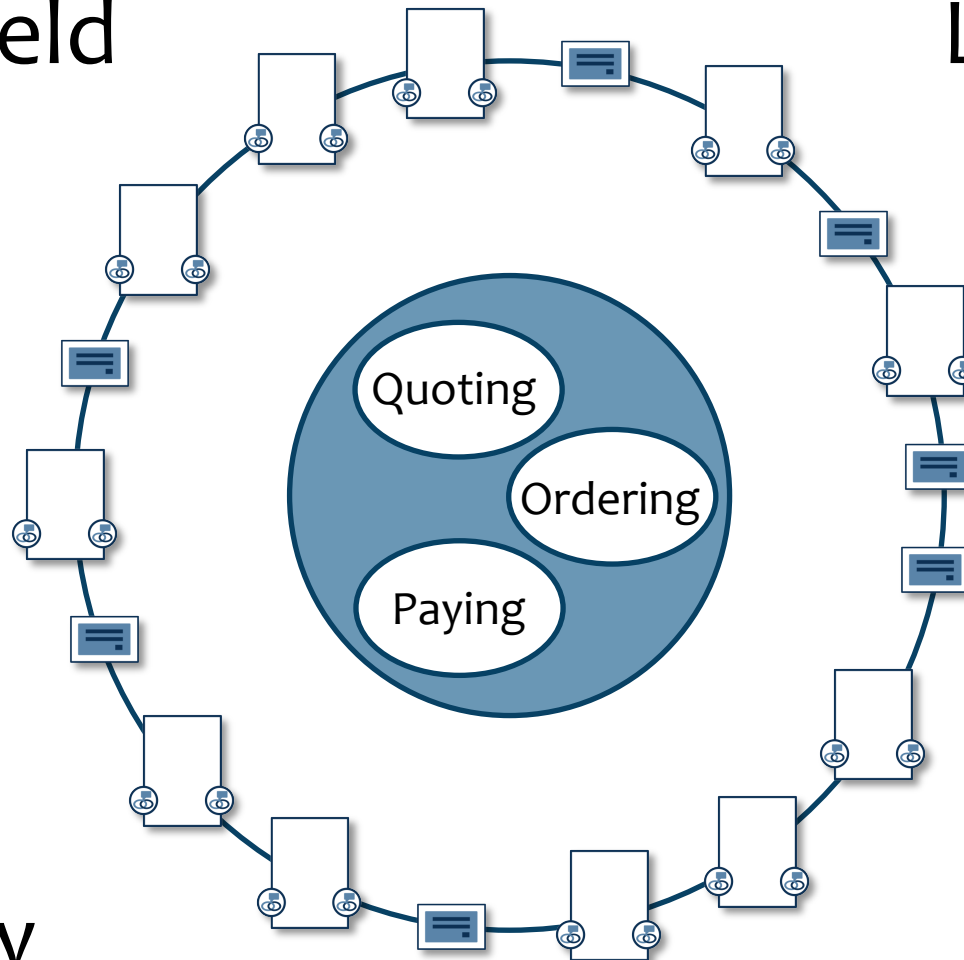
“Orchestration”
Application state
Bottleneck

“Choreography”
Resource state
Distributable
Discretely testable

RESTful interface adapts your domain for the Web

Greenfield

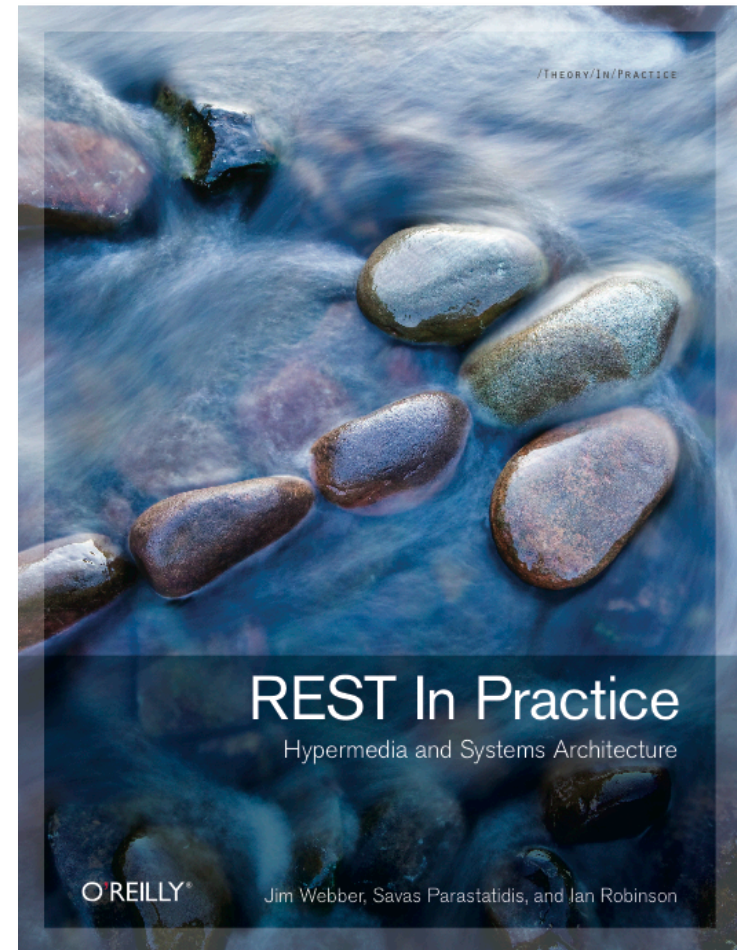
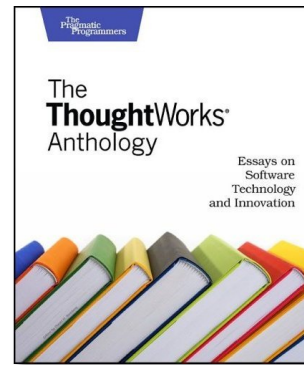
Legacy



3rd Party

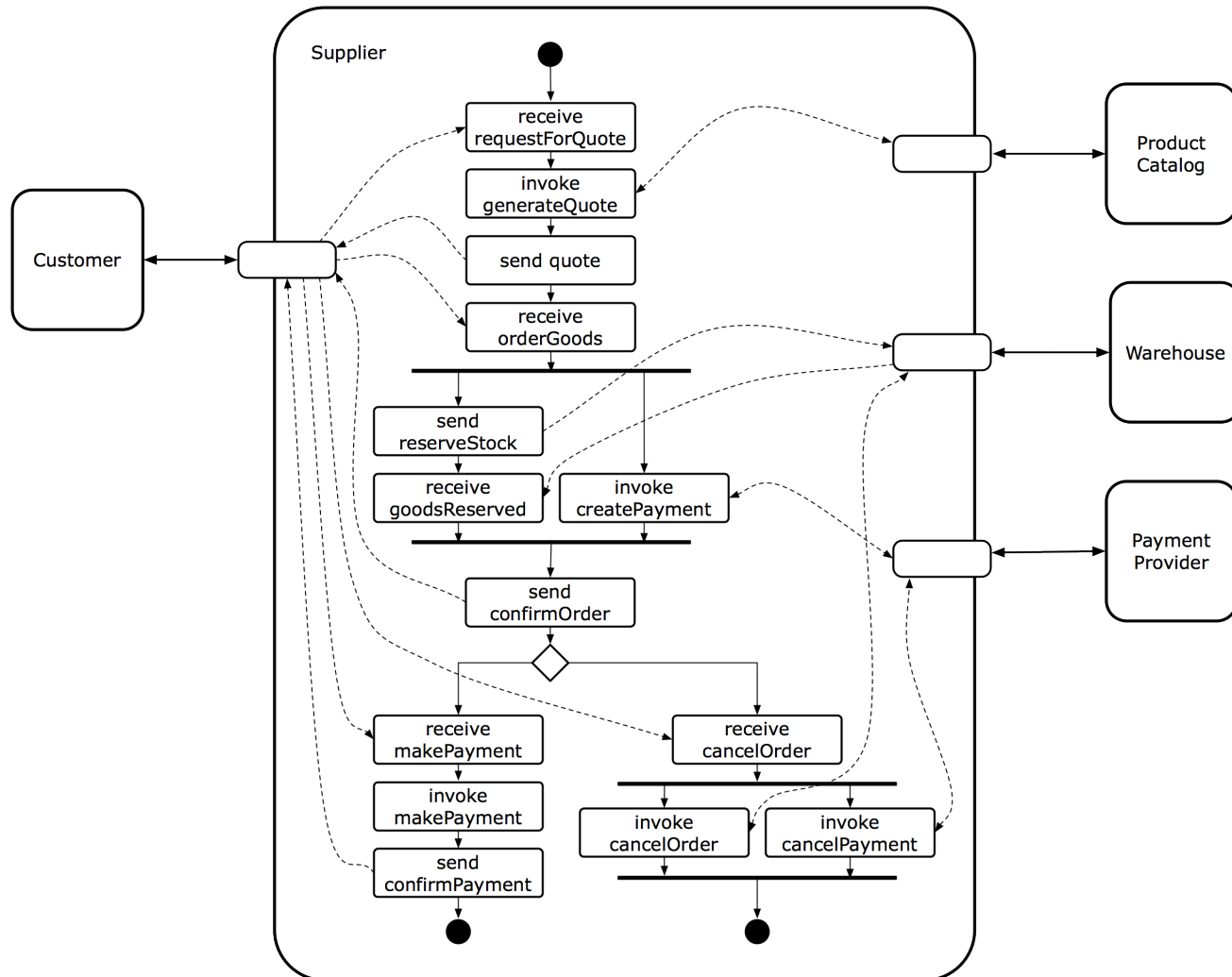
Who am I?

ThoughtWorks®

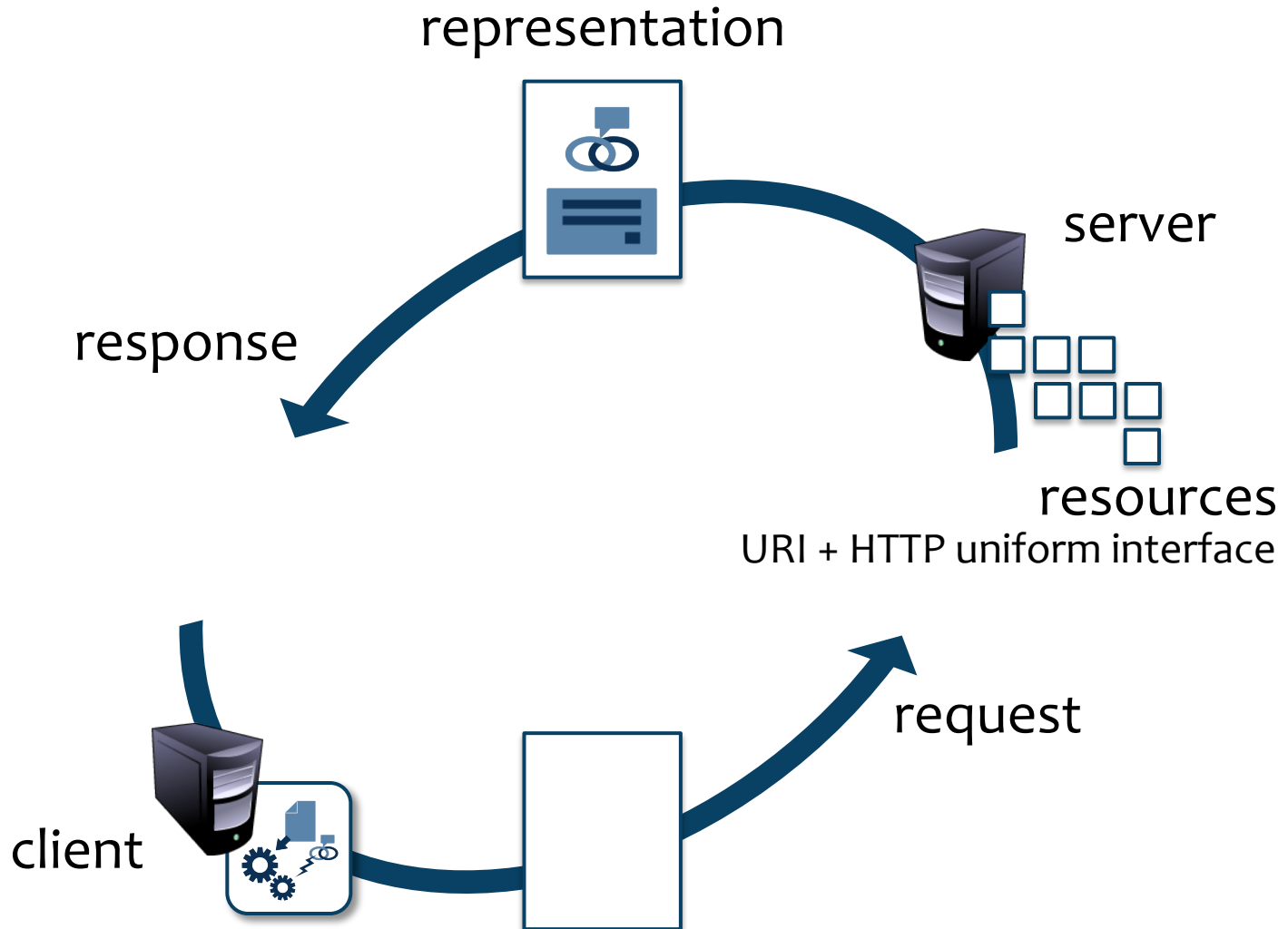


<http://ianSrobinson.com>
@ianSrobinson
ianSrobinson@gmail.com

Composition service



Hypermedia systems transform application state



A community of resources

