

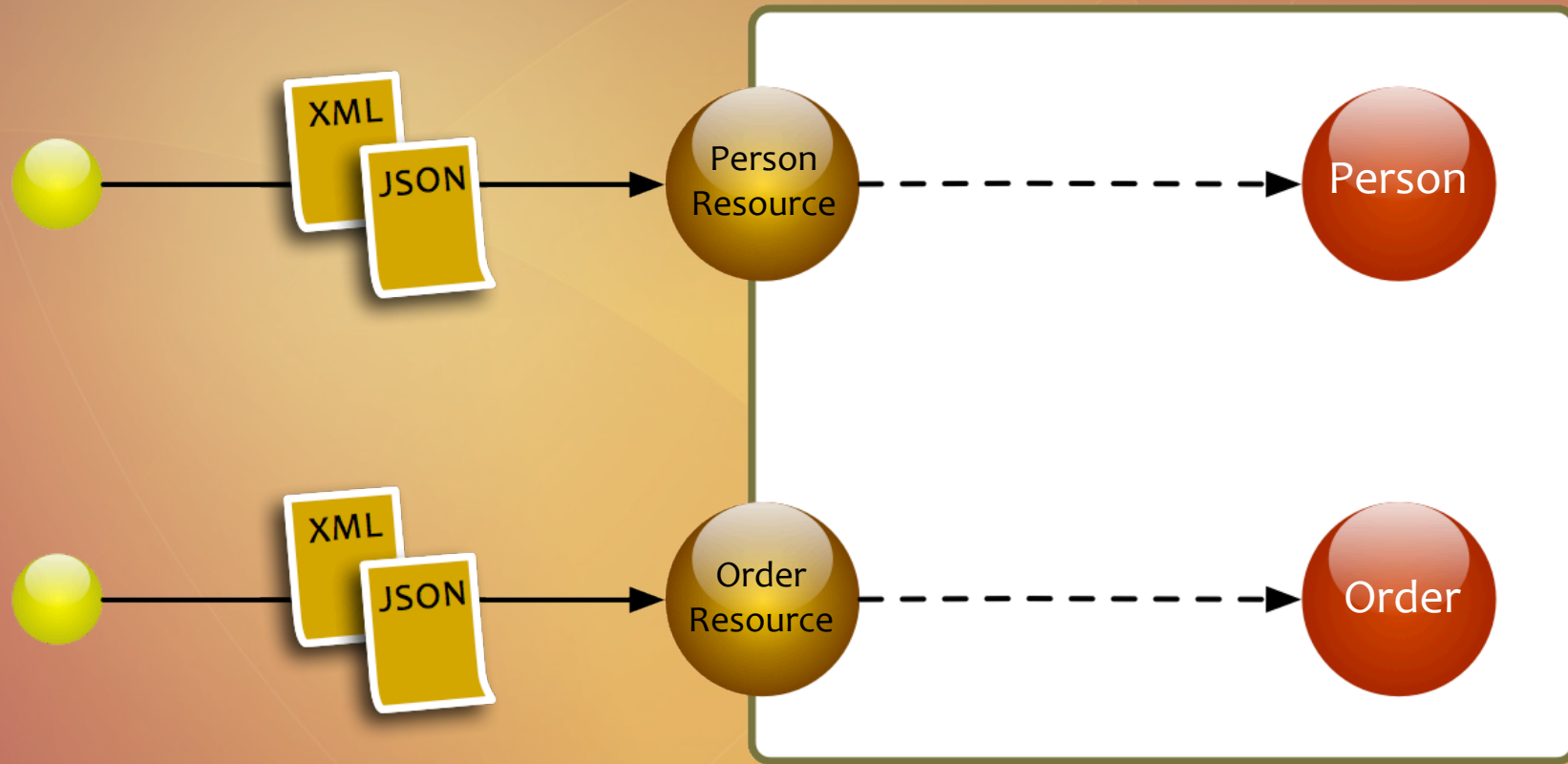
The Counterintuitive Web

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ThoughtWorks®

Resources are information resources, not domain objects



Design smell: overloaded POST

Overloaded POST

Server has to peer inside entity body

```
POST /orders/123 HTTP/1.1  
Host: restbucks.com
```

```
<loyalty-card>
```

```
...
```

```
</loyalty-card>
```

```
POST /orders/123 HTTP/1.1  
Host: restbucks.com
```

```
<drink>
```

```
...
```

```
</drink>
```

Design smell: other overloads

Other overloads

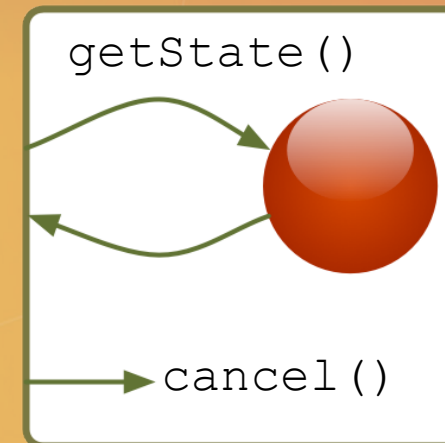
Server has to interrogate resource state *prior* to dispatching to appropriate handler

Cancel

```
DELETE /orders/123 HTTP/1.1  
Host: restbucks.com
```

Complete

```
DELETE /orders/123 HTTP/1.1  
Host: restbucks.com
```



Operation-oriented vs. resource-oriented design

CreateOrder

SearchOrders

Operations

AmendOrder

ReserverOrder

CompleteOrder

CancelOrder

AddDrink

RemoveDrink

Resources

GET
PUT
POST
DELETE

Order

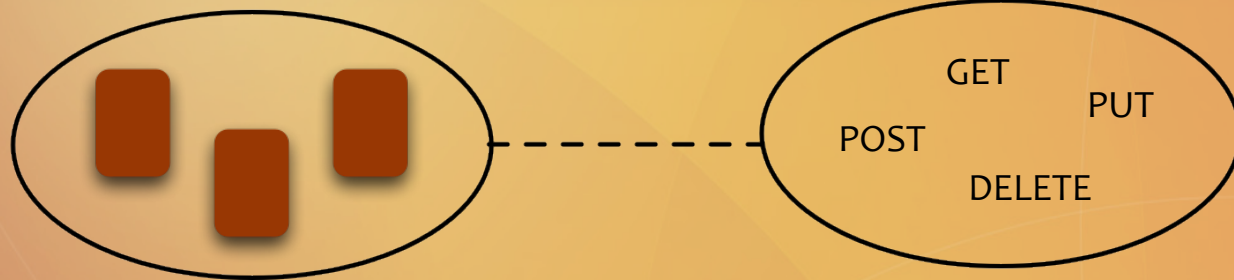
GET
PUT
POST
DELETE

Drink

GET
PUT
POST
DELETE

Fulfillment

Specialization and innovation depend on an open set



HTTP verbs

Verb	Safe?	Idempotent?	Description
GET	✓	✓	Retrieve representation
PUT	✗	✓	Store representation
POST	✗	✗	Annotate, append to resource identified by URI
DELETE	✗	✓	Delete resource

Safe

No side-effects for which client is responsible

Idempotent

“Absolute” side effects

DELETE != cancel: don't map domain operations onto verbs

HTTP verbs are the humble servants of the hypermedia state apparatus

Stable, well-understood characteristics

Safety

Idempotency

Do the same-old-same-old in the same-old way

Transferring representations of state

No surprises

No additional semantics

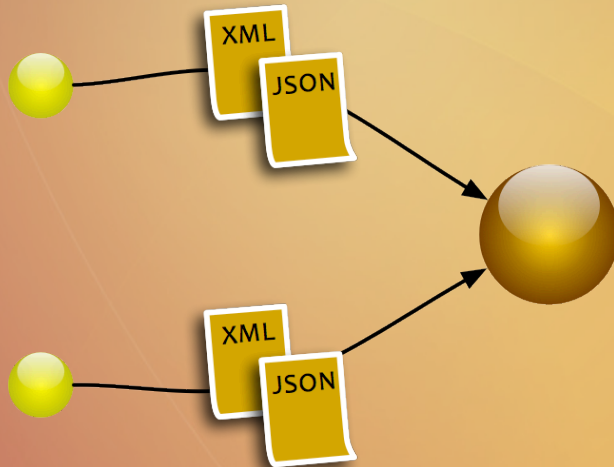
No innovation



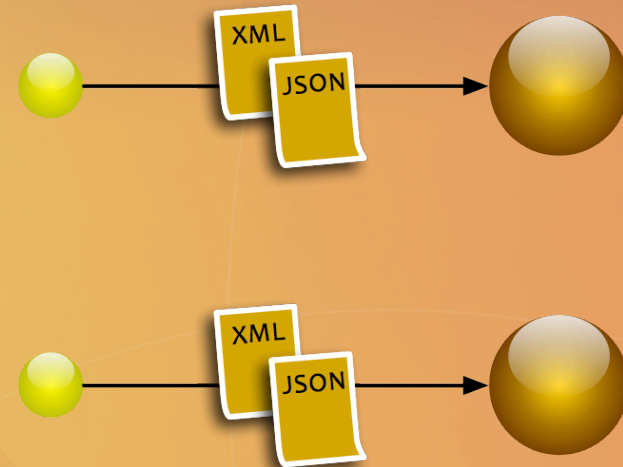
Clients deal with URIs (and representations), not resources

Resources can be identified and addressed by multiple URIs

`http://restbucks.com:8080/s/ref=gh_ty_1256`



`http://restbucks.com:8080/s/ref=gh_ty_1256`



`http://restbucks.com:8080/s/latest`

`http://restbucks.com:8080/s/latest`

Problems

Cannot determine URI equality

Cache invalidation

Design smell: overloaded POST

Overloaded POST

Server has to peer inside entity body

```
POST /orders/123 HTTP/1.1  
Host: restbucks.com
```

```
<loyalty-card>  
...  
</loyalty-card>
```

```
POST /orders/123/discounts HTTP/1.1  
Host: restbucks.com
```

```
<loyalty-card>  
...  
</loyalty-card>
```

```
POST /orders/123 HTTP/1.1  
Host: restbucks.com
```

```
<drink>  
...  
</drink>
```

```
POST /orders/123 HTTP/1.1  
Host: restbucks.com
```

```
<drink>  
...  
</drink>
```

Design smell: other overloads

Other overloads

Server has to interrogate resource state *prior* to dispatching to appropriate handler

Cancel

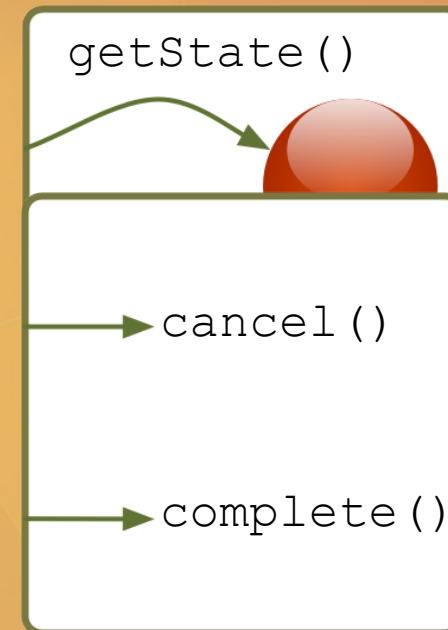
```
DELETE /orders/123 HTTP/1.1  
Host: restbucks.com
```

**Cancel
Complete**

```
DELETE /orders/123 HTTP/1.1  
Host: restbucks.com
```

Complete

```
POST /orders/123/end HTTP/1.1  
Host: restbucks.com
```



Intention should be “written on the wire”

Part

Description

URI

Identifies target of request

Verb

Document-oriented method semantics, plus idempotency and safety expectations

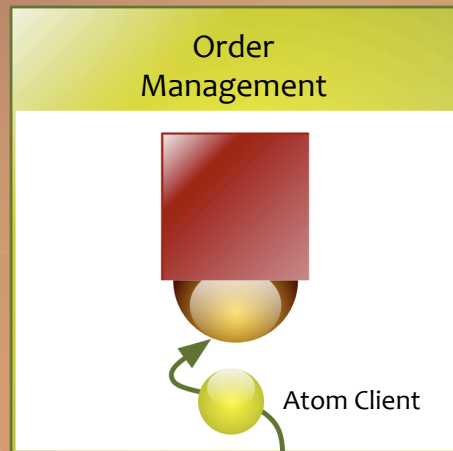
Accept/
Content-Type

Preferred representation format and information element processing model

Other headers

Additional processing context

Guaranteed delivery? GET it yourself

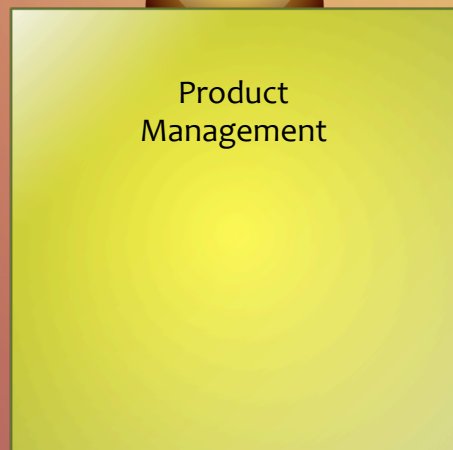


Co-located, time-ordered entries
No lost or out-of-order messages

GET is safe and idempotent
Same *result*
Different *data*



`http://restbucks.com/products/notifications`



HTTP = ???



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55-166

HTTP: an application transfer protocol

Term

Application

Transfer

Protocol

Description

Transacted at application layer of network stack, in user agent and server software

For the purpose of coordinating the transfer of documents

According to rules that determine legitimate interactions between client and server

Benefits

Coordination protocol (status codes)

+

Self-describing processing context (headers)

+

Safety and idempotency characteristics (verbs)

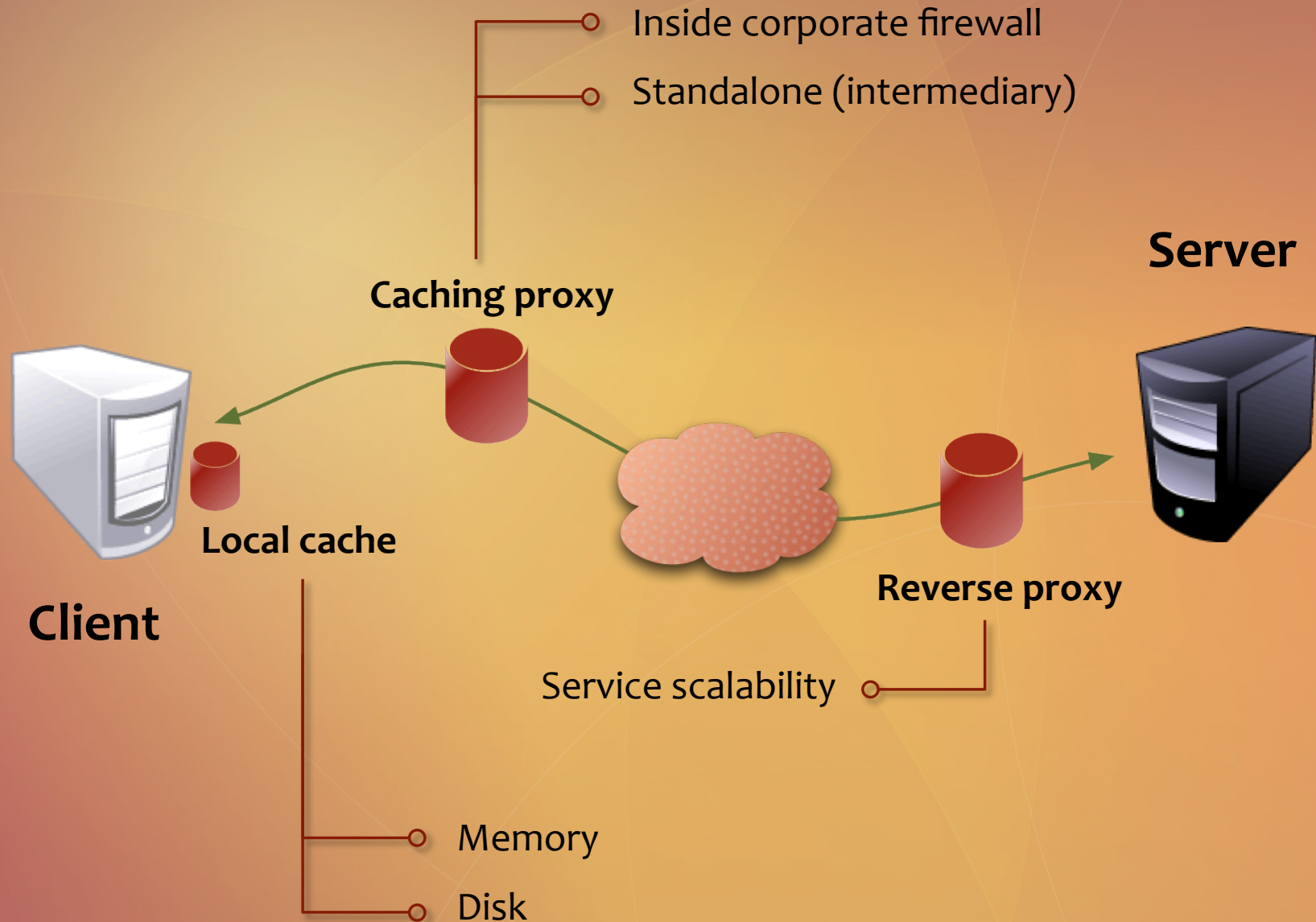


Optimize for the common case

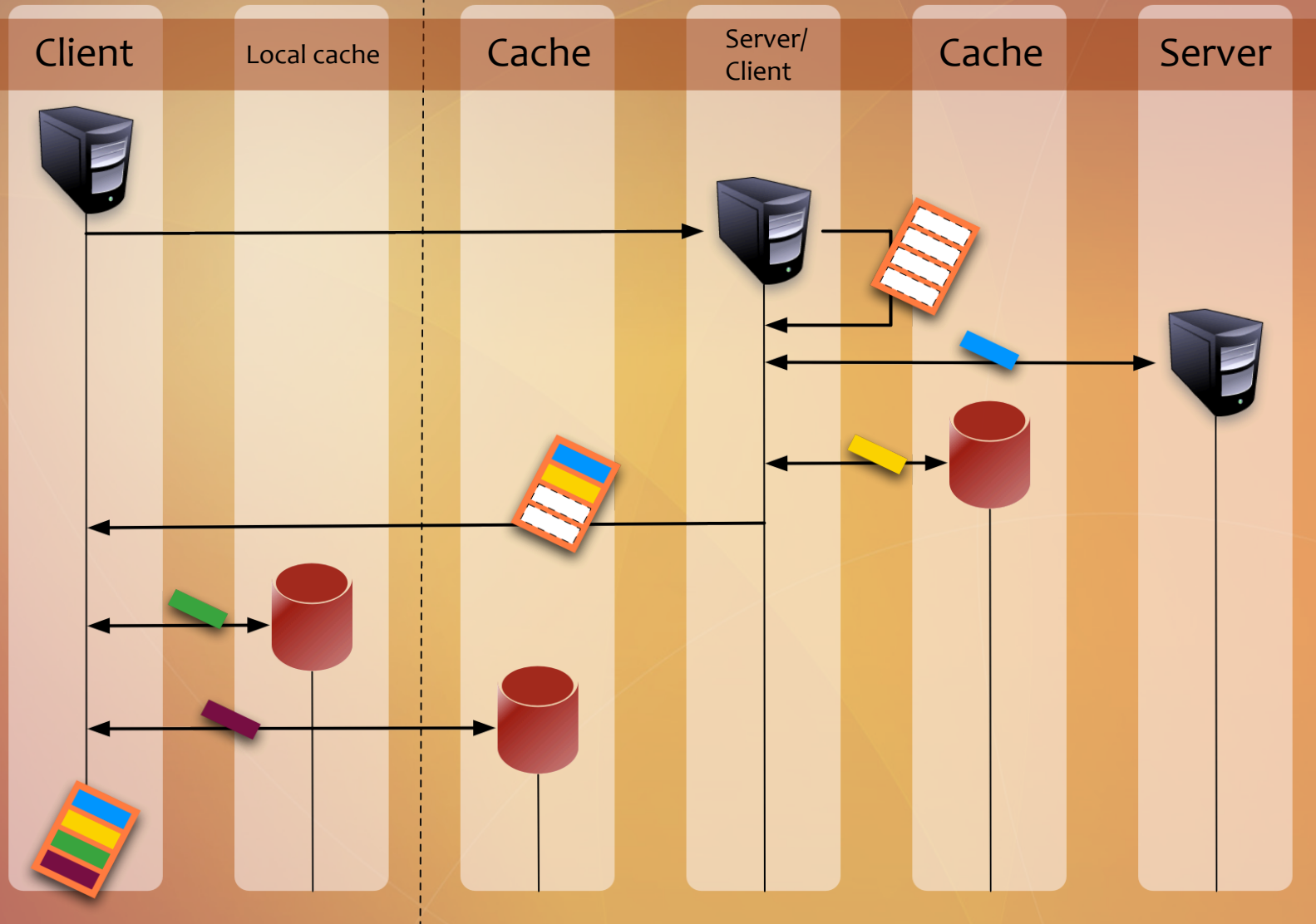
=

GET

GET connected: design for caching



Cache by freshness



See also: <http://martinfowler.com/bliki/SegmentationByFreshness.html>

A web of data

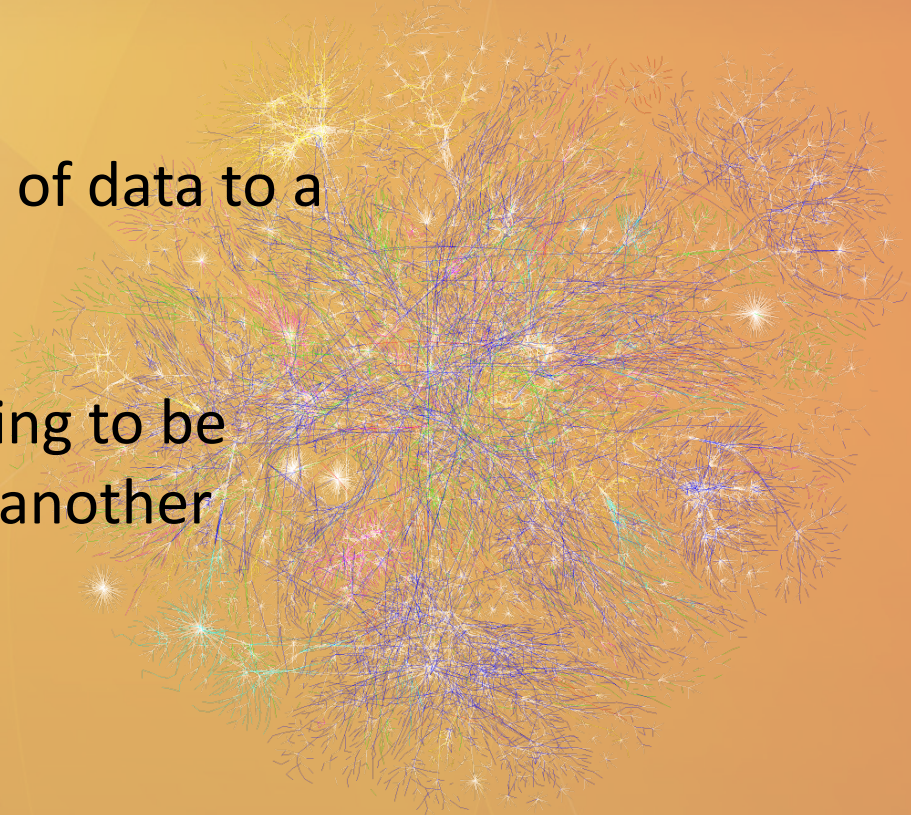


@mfeathers: Good OO = Tell, don't ask. Good FP = Ask, don't tell. #speakerconf

OO relationship between things, FP relationship between facts (@marick) #speakerconf

Web is the partial application of data to a user or application goal

Residual data structures waiting to be completed by the transfer of another representation of state



Facts: that's data, and CRUD, right?

“[our customers] base their success on us failing in the same way”

“Instead of being behavior-centric with our computer systems, we look at them as just being CRUD, and we basically say we are going to ignore the fact that we are going to do anything with them”

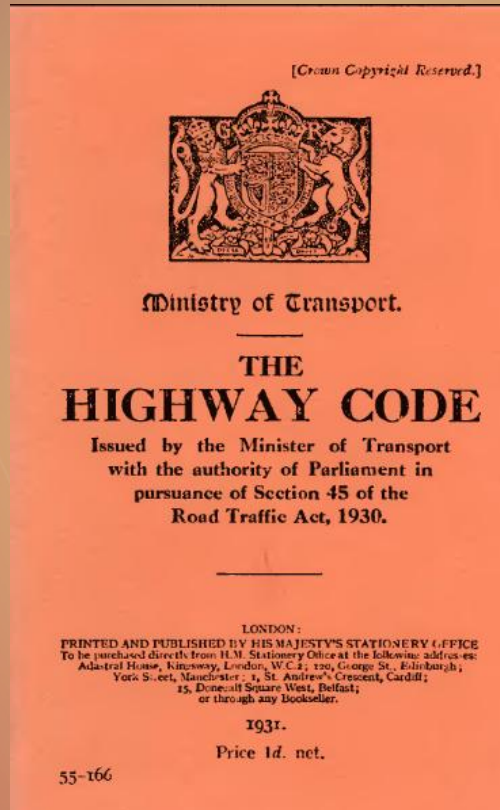
Greg Young on Our Grand Failure
<http://herdingcode.com/?p=189>

Achieving balance: design and implementation guidelines

1. Design applications in terms of ***application protocol state machines***
2. Implement them in terms of ***resource lifecycles*** and the ***rules that associate resources***
3. Advertise/document them using ***media types, link relation values*** and ***HTTP idioms***

Web

Application protocol, application state

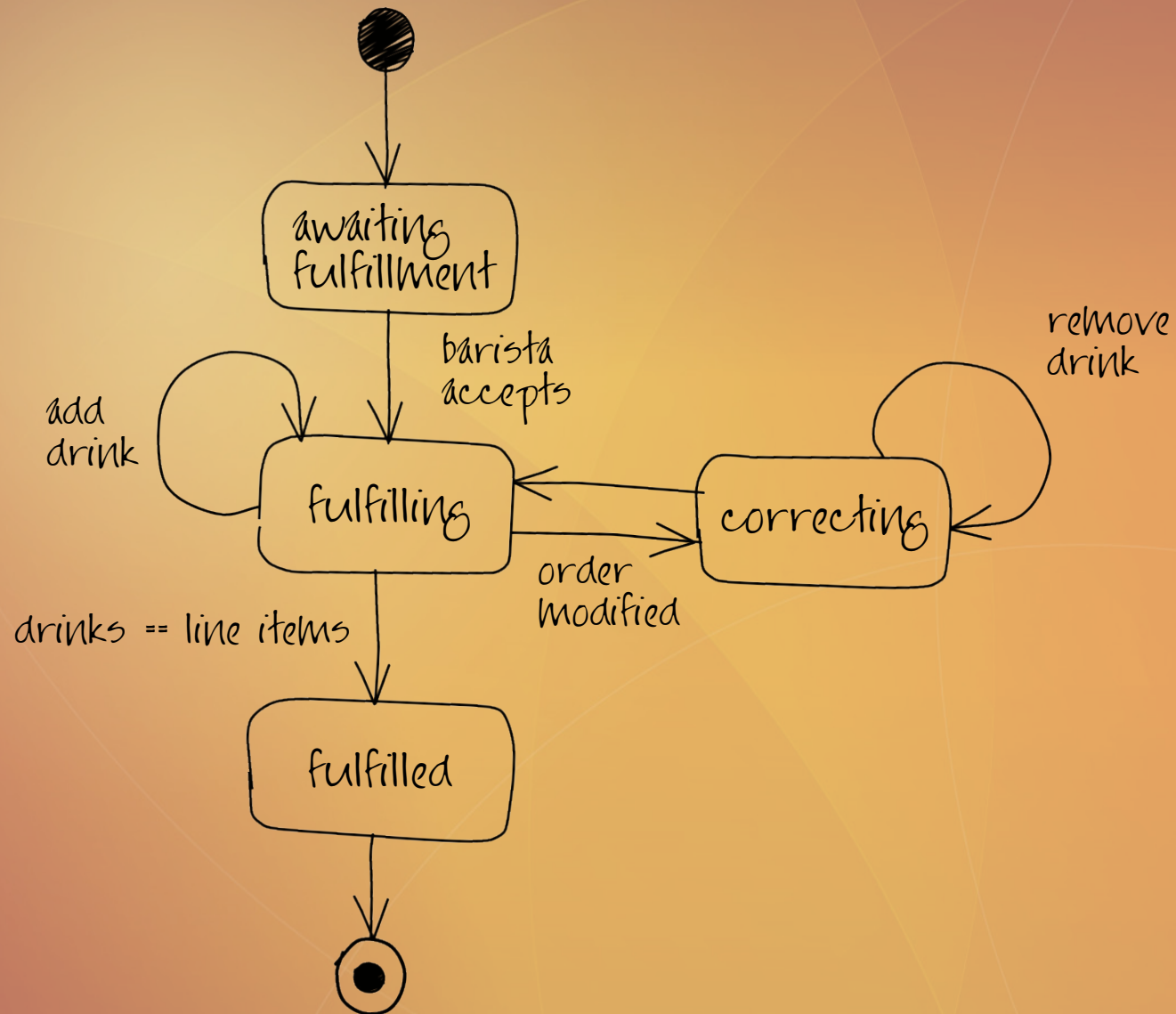


Application protocol

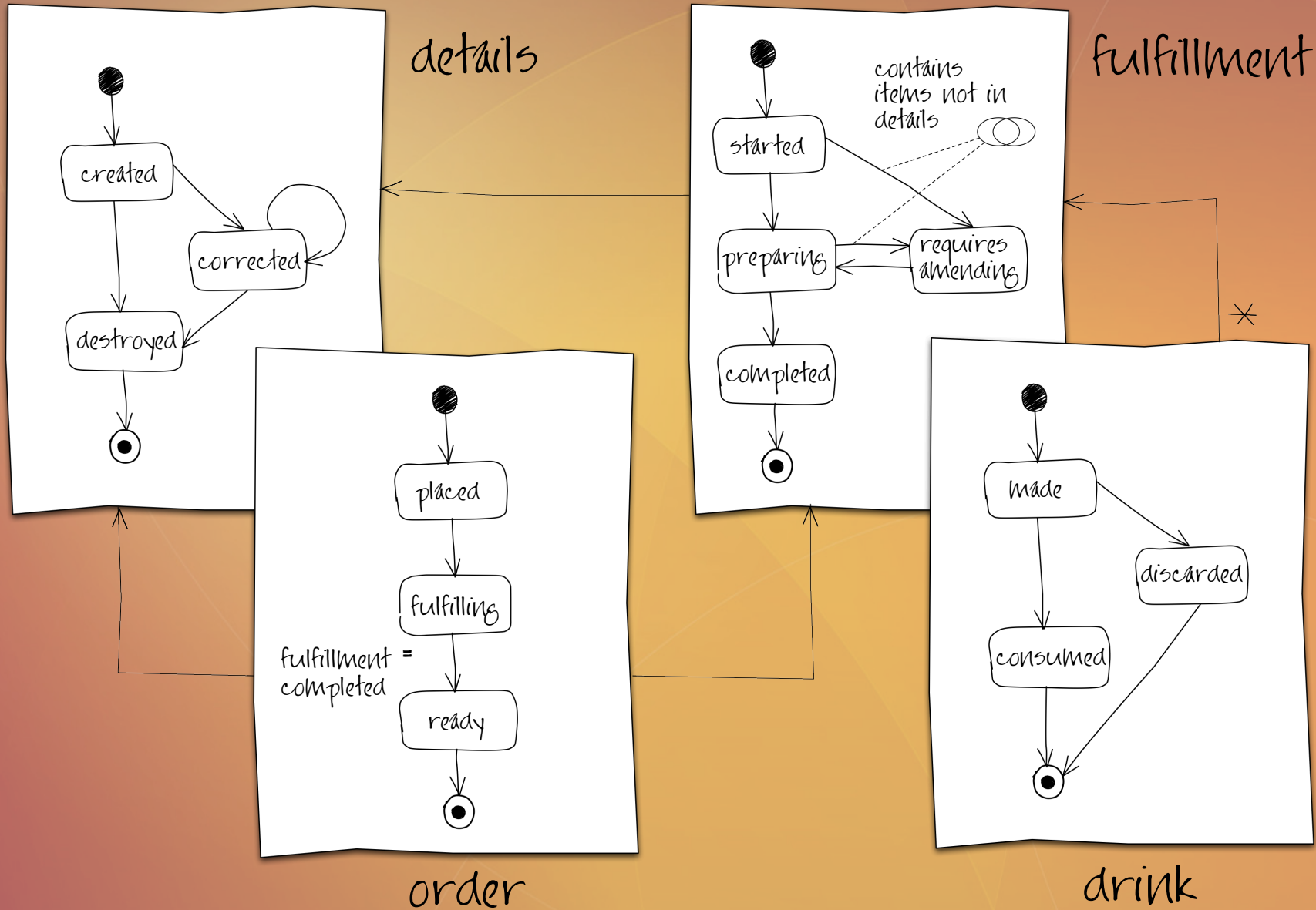


Application state

Order fulfillment application protocol



Order fulfillment protocol resources



Resource state is a function of...

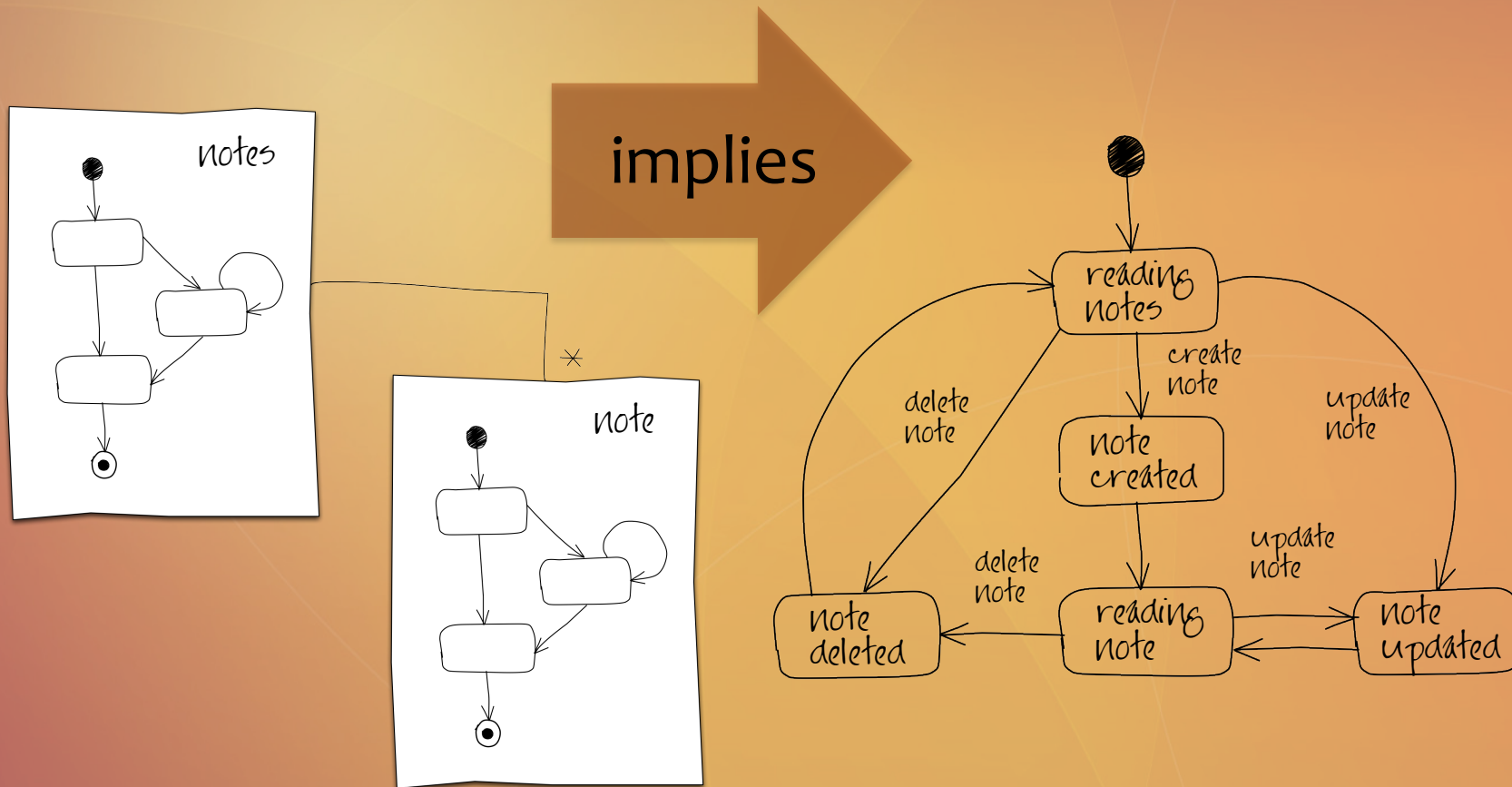
1. Value of information items belonging to resource
2. Application of business rules that relate a resource to other resources



See also FOREST: Functional Observer REST
<http://duncan-cragg.org/blog/post/forest-functional-observer-rest/>

Information resources \approx protocol resources

Of course, if you do want a CRUD protocol for an anemic domain...



Benefits of this approach

Rich protocol semantics

Networked resources realize an application protocol

Architectural properties

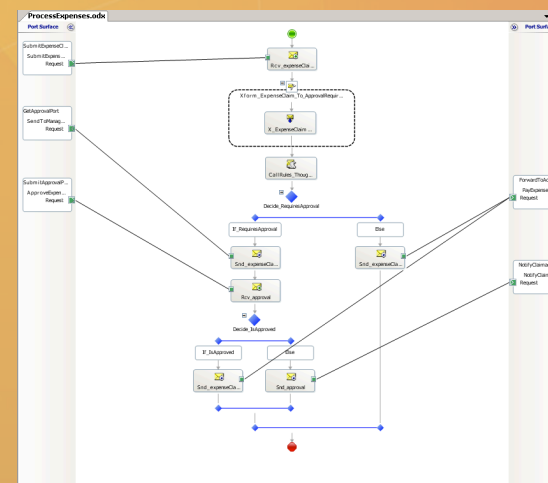
Loosely coupled (uniform interface)

Fault tolerant (stateless, self-contained requests)

Stateless (application state)

We're not implementing a process resource

Horizontally scalable



Drawbacks

Federation adds complexity

Application protocol is not encapsulated “as such”

Cache invalidation

Resource dependencies complicate cache invalidation

Contracts = link relations + media types + HTTP idioms

Part

Why

Link relations

What

Media types

How

HTTP idioms

Description

What is the meaning of the linked resource in the context of the current representation?

What representation formats and information element processing models does a resource recommend?

Which HTTP idioms must be used to transfer representations to/from a resource?

+ entry point URI(s)

Specification

Entry point

`http://restbucks.com/fulfillment`

Media type

`application/vnd.restbucks+xml`

Resources

Name	Description
Order	<code><status> values: placed, fulfilling, ready.</code>
Items	Order line items.
Fulfillment	<code><status> values: started, requires-amending, preparing, completed.</code>
Drink	Prepared drinks.

Specification (continued)

Link relations

edit

The linked resource can be used to edit the link's context.

To edit order details, `PUT` new order details to the edit link.

To remove a drink from an order, `DELETE` the linked resource.

`http://relations.restbucks.com/order`

Identifies the order with which the link context is associated.

`http://relations.restbucks.com/details`

Identifies the details of the order with which the link context is associated.

`http://relations.restbucks.com/fulfillment`

Identifies an instance of fulfillment of the link context.

The linked resource includes an `ETag` header.

Adding new drinks should be done with a conditional `POST`. If the fulfillment instance requires amending before a new drink can be added, the service responds with `412 Precondition Failed`.

Except...

**On the Web there are laws,
but no legal frameworks**

“Representation metadata does not constrain the receiving agent to process the representation data in one particular way”

<http://www.w3.org/2001/tag/doc/mime-respect>

Summary

Clients care more about URIs and representations than they do about the integrity of the resource space



HTTP makes the client responsible for the integrity of a sequence of requests, which is a good thing at scale



Implement application protocols (processes) as protocol resources, not domain resources

Hypermedia and Systems Architecture

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Jim Webber



Savas Parastatidis



Ian Robinson

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COUNT ME IN

ThoughtWorks is helping New York University's Interactive Telecommunications Program develop RapidFTR, a child-finder app that lets aid workers collect and share information about children in emergency situations, so they can be reunited with their families. The process, called Family Tracing and Reunification, is currently done on carbon paper.

RapidFTR is just one of the projects ThoughtWorks is involved in through our social engagement programme. We work with organisations who are using technology to solve pressing problems all over the world.

We will be holding code jam / project jam evenings in the coming weeks. We need your help with RapidFTR and other projects. It's a fun way to help save the world.

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