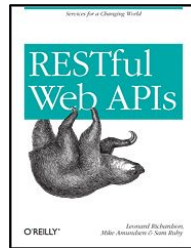


RESTful Microservices from the Ground Up

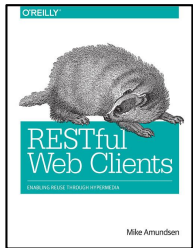
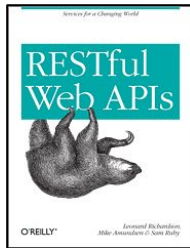


Mike Amundsen
API Academy
@mamund



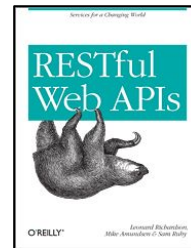
Agenda

- 9:00 - 9:45 : What are RESTful Microservices?
- 9:45 - 10:30 : Models, Messages, and Vocabularies
- 10:30 - 10:45 : BREAK
- 10:45 - 11:30 : Runtime Service Infrastructure
- 11:30 - 12:15 : The Adaptable System
- 12:15 - 12:30 : Summary

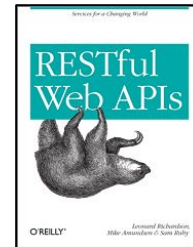


Materials

- Laptop w/ wifi
- NodeJS
- Browser and cURL
- Your favorite editor
- Github and Heroku
- Pen and Paper

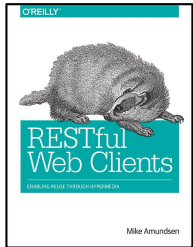
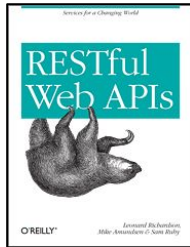


What are RESTful Microservices?



What are RESTful Microservices?

- Microservices
- RESTful-ness
- Microservice Constraints
- *Analysis Exercise*

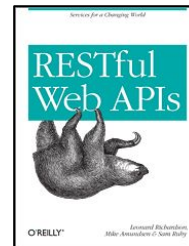
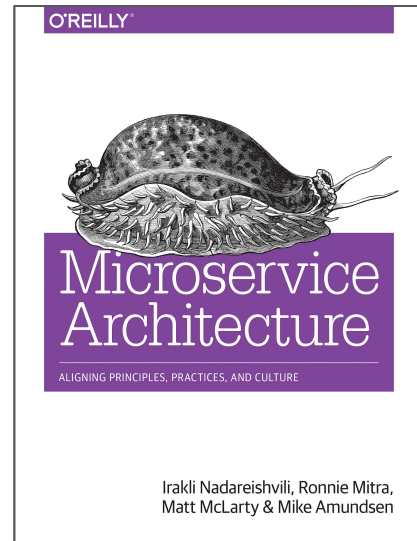


Microservices

"A microservice is an independently deployable component of bounded scope that supports interoperability through message-based communication. Microservice architecture is a style of engineering highly automated, evolvable software systems made up of capability-aligned microservices."



<http://g.mamund.com/msabook>

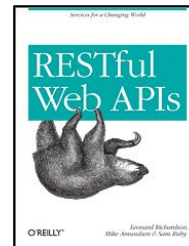
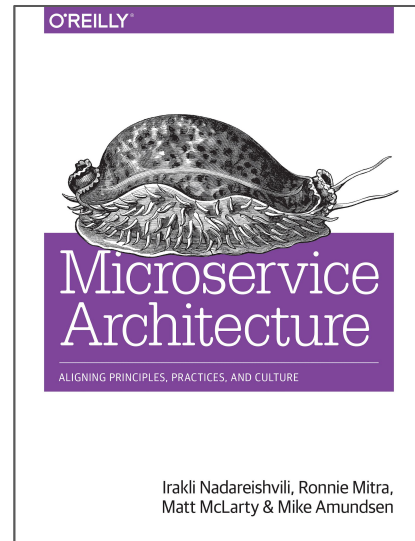


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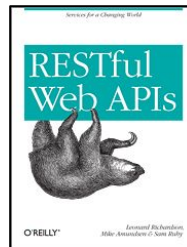
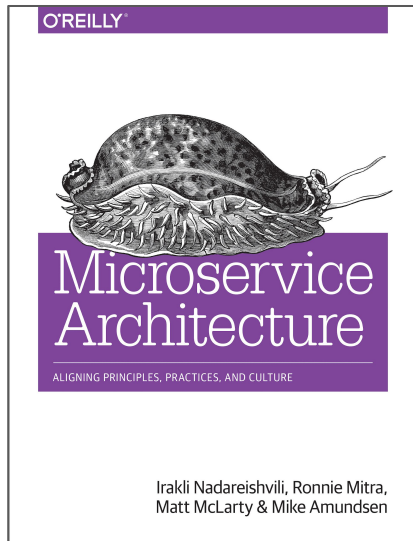


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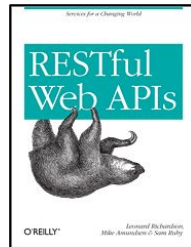
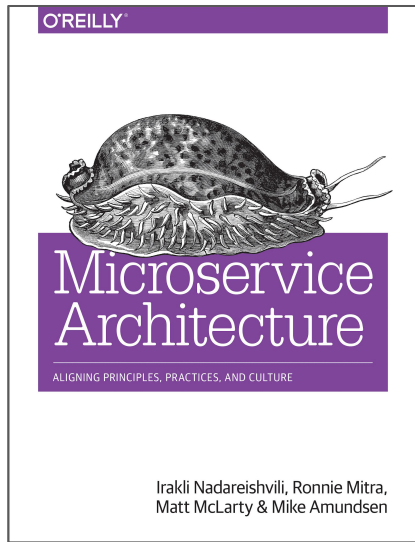


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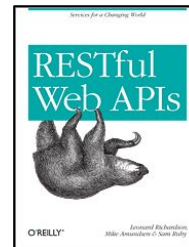
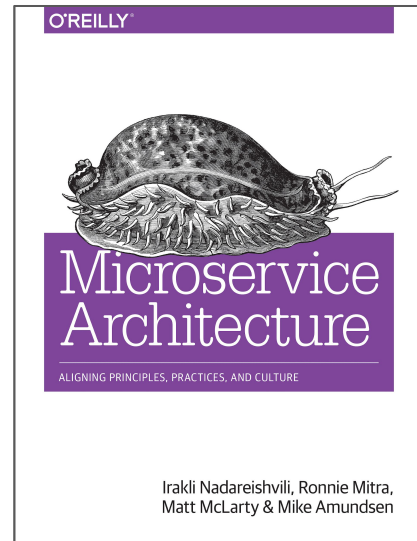


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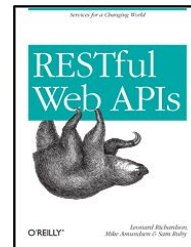
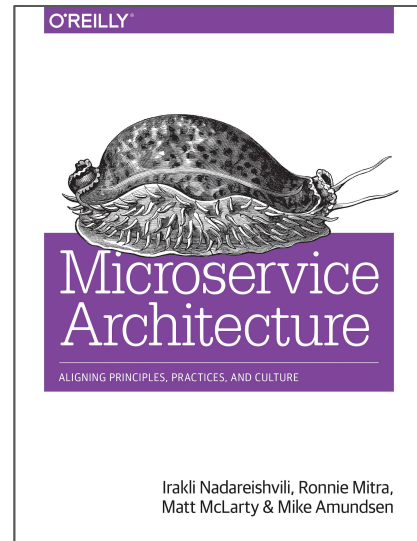


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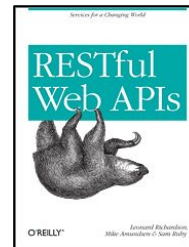
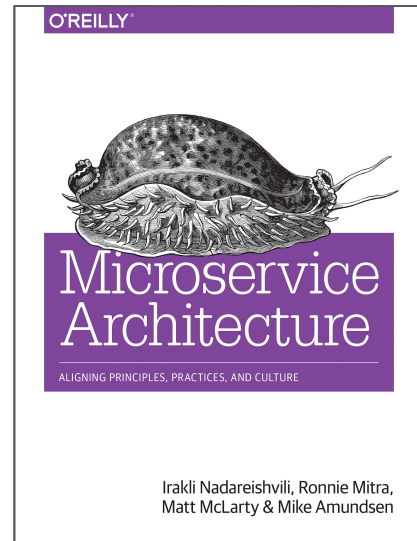


Microservices

- Independently deployable
- Bounded scope
- Message-based
- Highly automated
- Evolvable



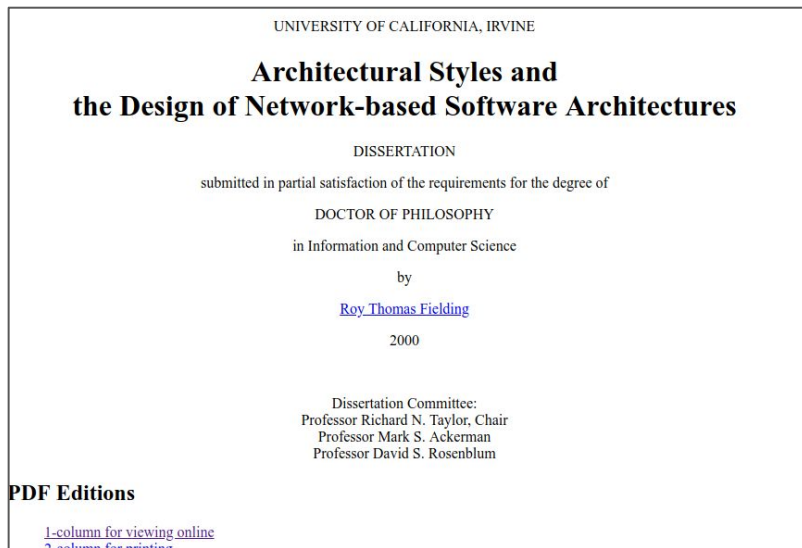
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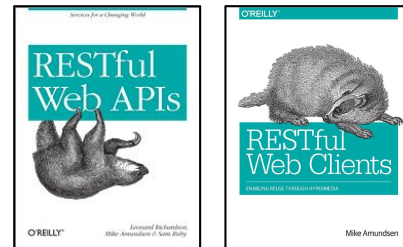
RESTful-ness

"This dissertation defines a framework for understanding software architecture via architectural styles and demonstrates how styles can be used to guide the architectural design of network-based application software."

- Fielding, 2000



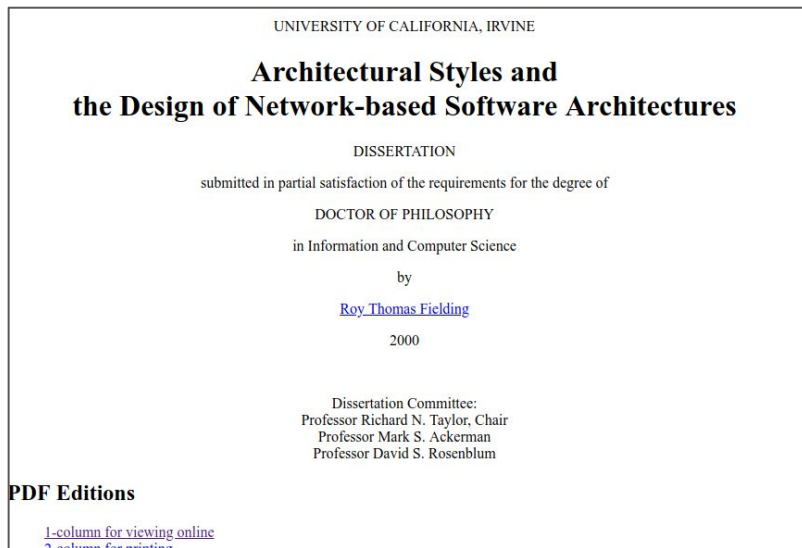
<https://www.ics.uci.edu/~fielding/pubs/dissertation/top.htm>



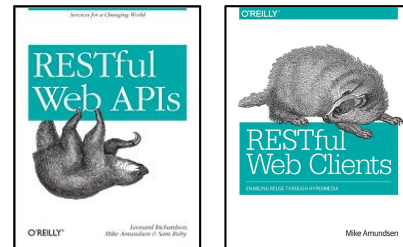
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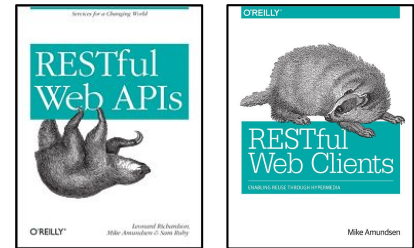
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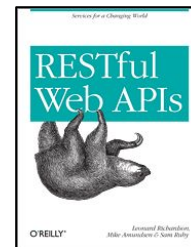
RESTful-ness



RESTful-ness

Properties

- Performance
- Scalability
- Simplicity
- Modifiability
- Visibility
- Portability
- Reliability



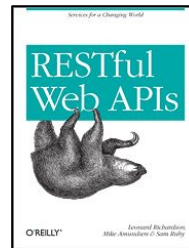
RESTful-ness

Properties

- Performance
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+ Requirements

- Low-Entry Barrier
- Extensibility
- Distributed Hypermedia
- Internet Scale



RESTful-ness

Properties

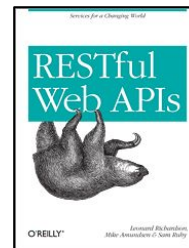
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+ Requirements

- Low-Entry Barrier
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= Constraints

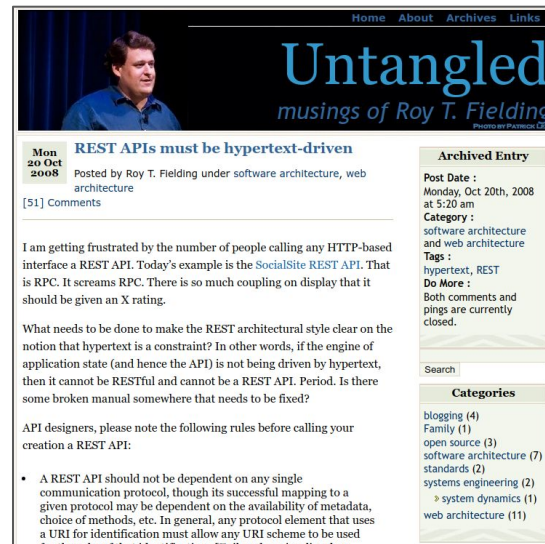
- Client-Server
- Stateless
- Cache
- Uniform Interface
- Layered System
- Code on Demand



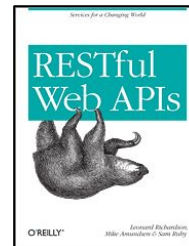
RESTful-ness

"When I say hypertext, I mean the simultaneous presentation of information and controls such that the information becomes the affordance through which the user (or automaton) obtains choices and selects actions."

- Fielding, 2008



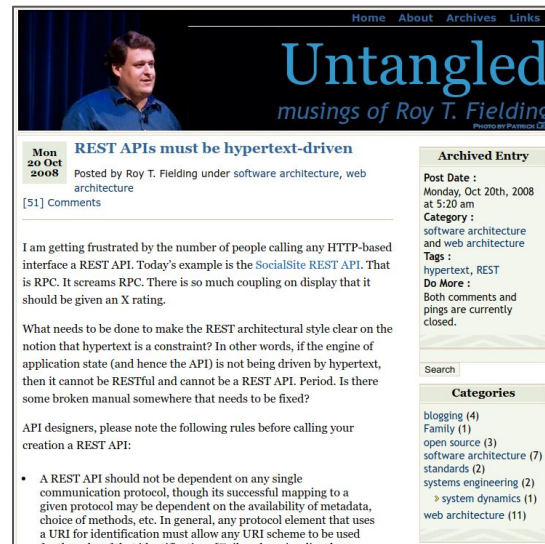
<http://roy.gbiv.com/untangled/2008/rest-apis-must-be-hypertext-driven>



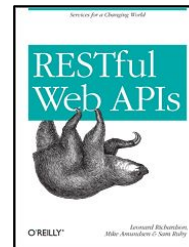
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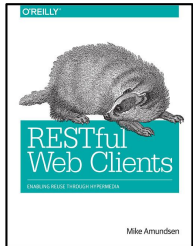
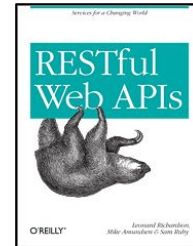
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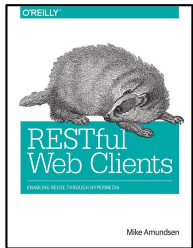
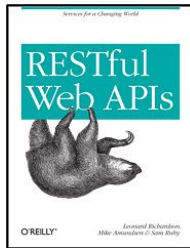


Fielding's REST ticks many of the boxes for Microservices

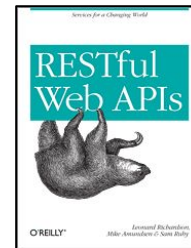


Microservice Constraints

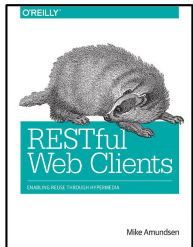
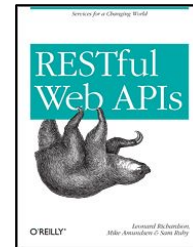
- Manage only service-state, not client state (no persistent sessions)
- Rely on Uniform Interface protocols (HTTP, MQTT, CoAP, etc.)
- Communicate in Structured Formats (HTML, Atom, Cj, HAL, etc.)
- Support Shared Vocabularies (ALPS, DCAP, etc.)
- Support Advertising, Discovery, and Health-Check



Analysis Exercise

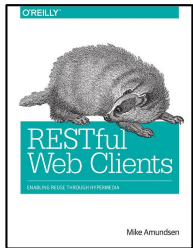
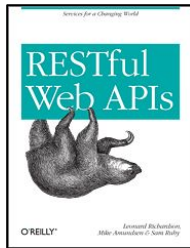


Models, Messages, and Vocabularies



Models, Messages, and Vocabularies

- Models on the Inside
- Messages on the Outside
- Vocabularies Everywhere
- *Design Exercise*



Data on the Inside vs. Data on the Outside

"This paper proposes there are a number of seminal differences between data inside a service and data sent into the space outside of the service boundary."

-- Pat Helland, 2005

Data on the Outside versus Data on the Inside

Pat Helland
Microsoft Corporation
One Microsoft Way
Redmond, WA
USA
PHelland@Microsoft.com

Abstract

Recently, a lot of interest has been shown in SOA (Service Oriented Architectures). In these systems, there are multiple services each with its own code and data, and ability to operate independently of its partners. In particular, atomic transactions with two-phase commit do not occur across multiple services because this necessitates holding locks while another service decides the outcome of the transaction. This paper proposes there are a number of seminal differences between data inside a service and data sent into the space outside of the service boundary. We then consider objects, SQL, and XML as different representations of data. Each of these models has strengths and weaknesses when applied to the inside and outside of the service boundary. The paper concludes that the strength of each of these models in one area is derived from essential characteristics underlying its weakness in the other area.

1.1 Service Oriented Architectures

Service Oriented Architecture characterizes a collection of independent and autonomous services. Each service comprises a chunk of code and data that is private to that service. Services are different than the classic application living in a silo and interacting only with humans in that they are interconnected with messages to other services.

Services communicate with each other exclusively through messages. No knowledge of the partner service is shared other than the message formats and the sequences of the messages that are expected. It is explicitly allowed (and, indeed, expected) that the partner service may be implemented with heterogeneous technology at all levels of the stack including hardware, operating system, database, middleware, and/or application vendor or implementation team.

The essence of SOA lies in *independent* services which are *interconnected* with messaging.

1.2 Bounding Trust via Encapsulation

Services interact via a collection of messages whose formats (schema) and business semantics are well defined. Each service will only do limited things for its partner services based upon the well defined message.

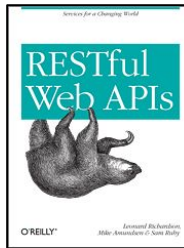
The act of defining a limited set of behaviors provides a very firm encapsulation of the service. The only way to interact with the service is via the prescribed messages each of which will invoke application logic to decide if and when to access the data encapsulated within the

1. Introduction

Service Oriented Architectures (SOA) is an exciting topic of discussion lately. While we can easily look to the past and see examples of large enterprise solutions that we can now characterize as SOA, the discussion of this applications style as a design paradigm is relatively recent. This section attempts to describe what is meant by

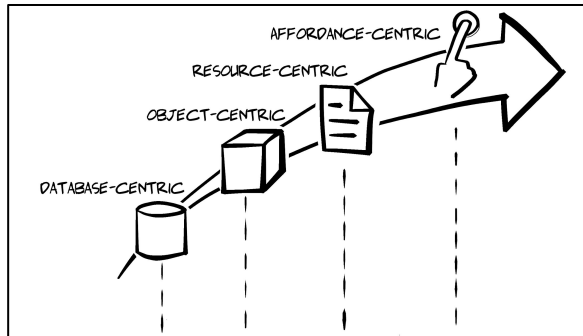


cidrdb.org/cidr2005/papers/P12.pdf

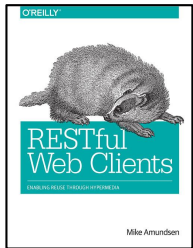
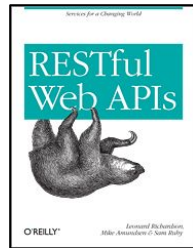


Models on the Inside

- Inside is immediate, transactional
- Data storage models (`customers.db`, `orders.db`)
- Programming object models (`objCustomer`)
- Inside is local, controllable
- Inside relies on a shared "now"

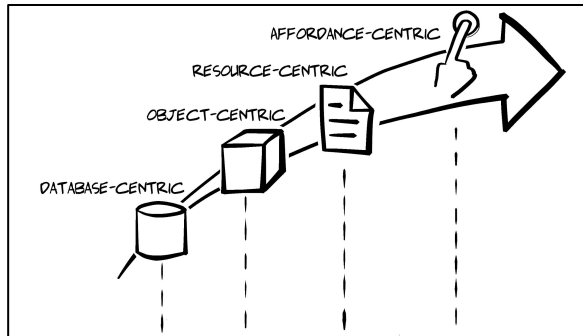


<http://amundsen.com/talks/2017-07-chattanooga/>

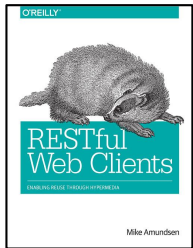
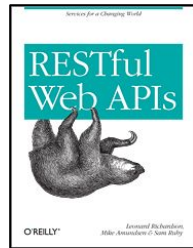


Messages on the Outside

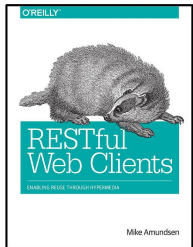
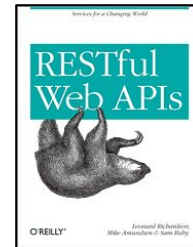
- Outside is always in the past, non-transactional
- Resource models (`/customers/`, `/orders/`)
- Message models (`customer.html`, `order.html`)
- Outside is remote, uncontrollable
- There is no shared "now"



<http://amundsen.com/talks/2017-07-chattanooga/>

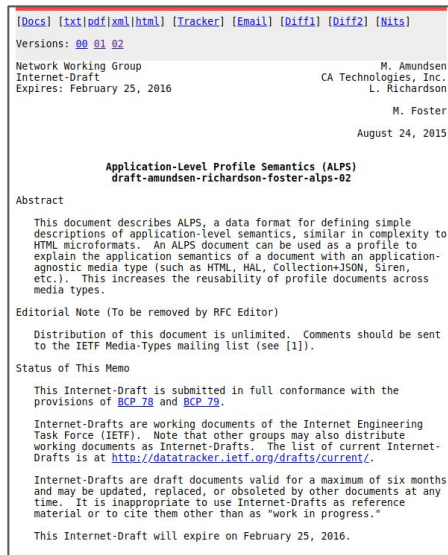


If the models are different inside and out, what is shared?

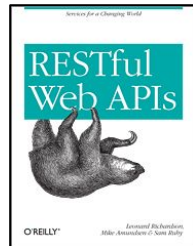


Vocabularies Everywhere

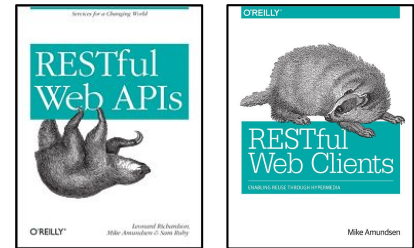
- Vocabulary is how humans share (language, slang, etc.)
- We use the same vocabulary for many models
- Vocabularies delineate domains (medicine, IT, etc.)
- IT vocabularies already exist:
 - Dublin Core
 - schema.org
 - microformats
 - IANA Link Relation Values
- ALPS is a media-type and protocol independent description format



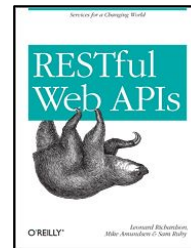
<https://tools.ietf.org/html/draft-amundsen-richardson-foster-alps-02>



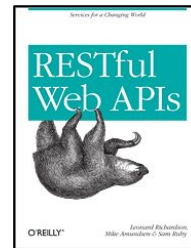
Design Exercise



BREAK

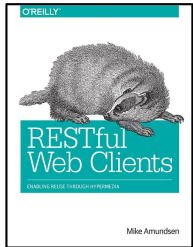
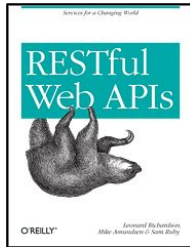


Runtime Service Infrastructure



Runtime Service Infrastructure

- Advertising Services
- Discovering Services
- Health Checking
- *Discovery Exercise*



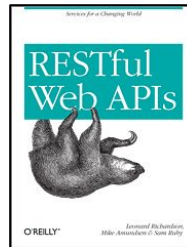
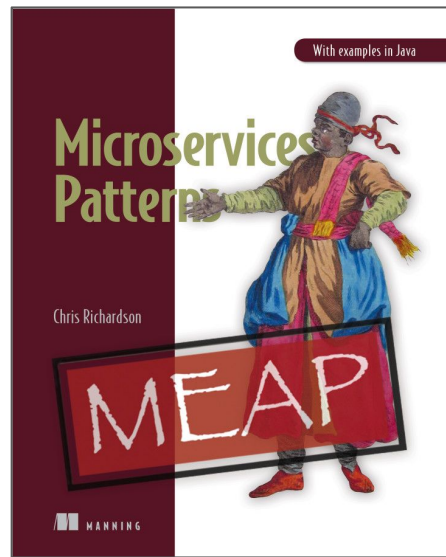
Advertising Services

"A service instance is responsible for registering itself with the service registry. On startup the service instance registers itself (host and IP address) with the service registry and makes itself available for discovery. The client must typically periodically renew its registration so that the registry knows it is still alive. On shutdown, the service instance unregisters itself from the service registry."

-- microservices.io



<http://microservices.io/patterns/self-registration.html>



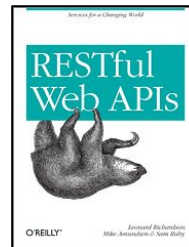
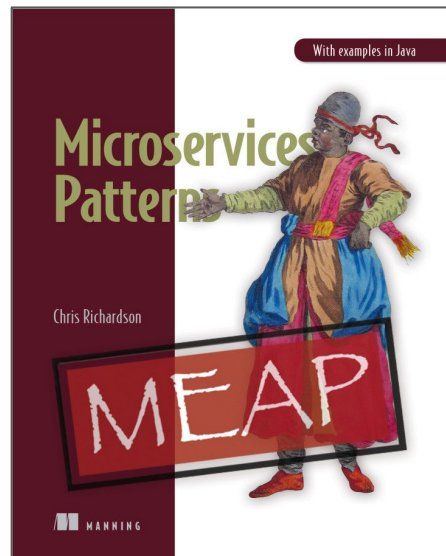
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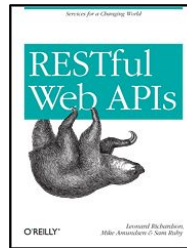
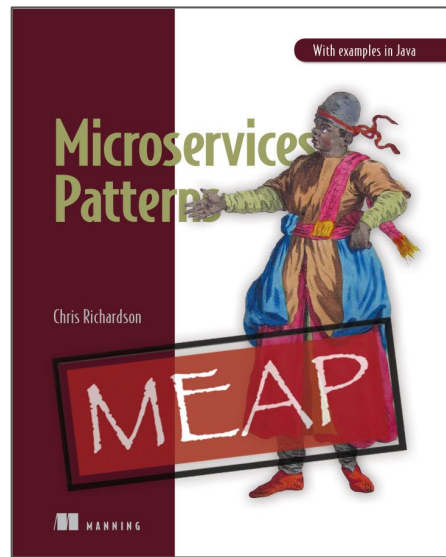


Advertising Services

- Register upon startup
- De-Register at shutdown
- Renew at intervals
- De-Register after crashes



<http://microservices.io/patterns/self-registration.html>

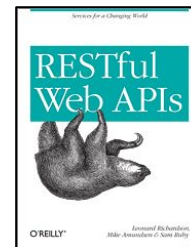
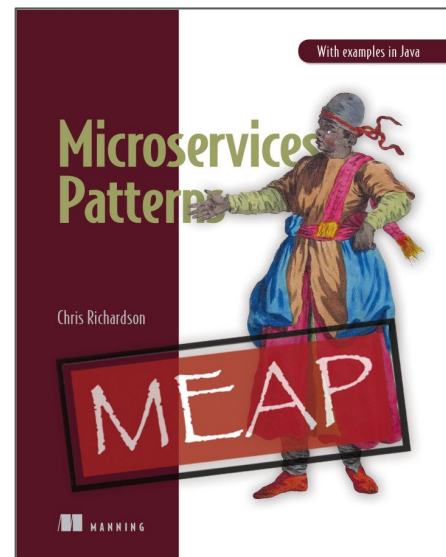


Advertising Services

CODE EXAMPLE HERE



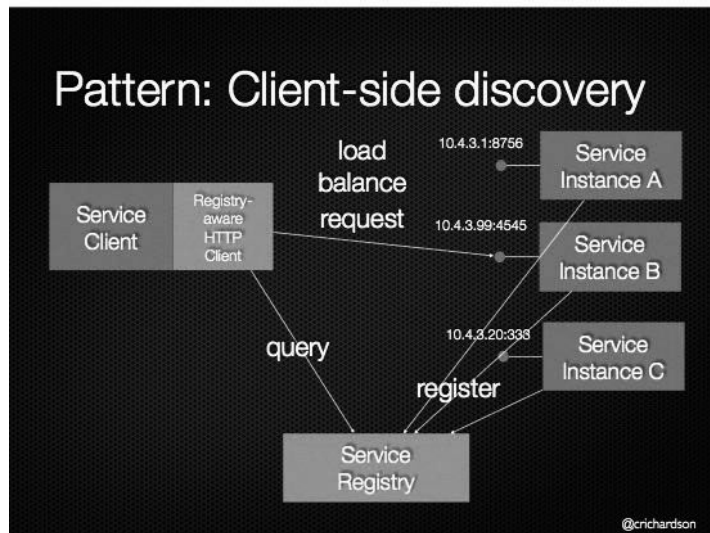
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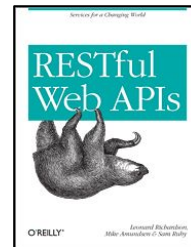
Discovering Services

"When making a request to a service, the client obtains the location of a service instance by querying a Service Registry, which knows the locations of all service instances."

-- microservices.io



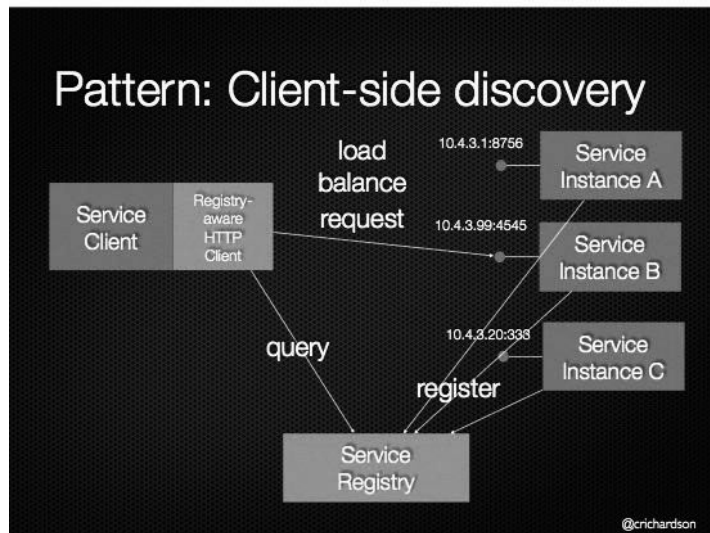
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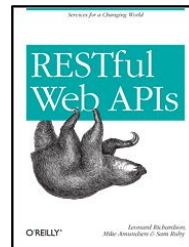
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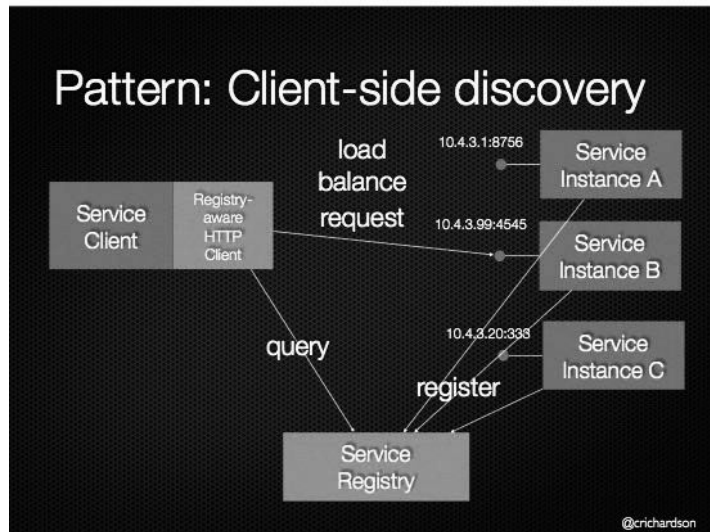


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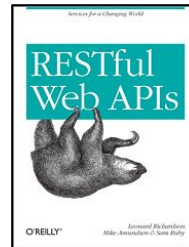


Discovering Services

- Configure client w/ **registryURL**
- Query Registry w/ **serviceURI**
- Registry returns **serviceURL**
- Client uses **serviceURL**
- Renewal optional

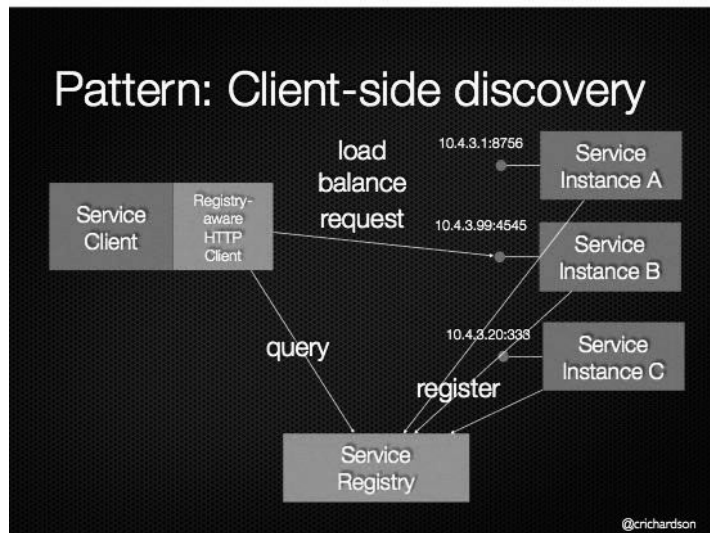


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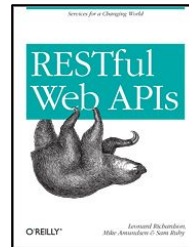


Discovering Services

CODE EXAMPLE



<http://microservices.io/patterns/client-side-discovery.html>



Health Checking

"A service has an health check API endpoint (e.g. HTTP /health) that returns the health of the service. A health check client - a monitoring service, service registry or load balancer - periodically invokes the endpoint to check the health of the service instance."

-- microservice.io



<https://inadarei.github.io/rfc-healthcheck/>

Network Working Group	I. Nadareishvili
Internet-Draft	January 16, 2018
Intended status: Informational	
Expires: July 20, 2018	

Health Check Response Format for HTTP APIs
draft-inadarei-api-health-check-00

Abstract

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Note to Readers

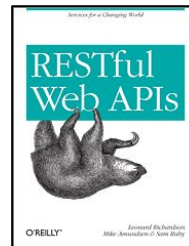
RFC EDITOR: please remove this section before publication

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-- microservice.io



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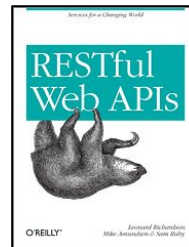
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Health Checking

- Services support health-checks
- Services renew with the registry
- Registry drops service on failed checks
- Registry drops service on expired renewals



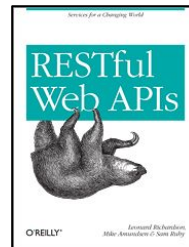
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Health Checking

CODE EXAMPLE



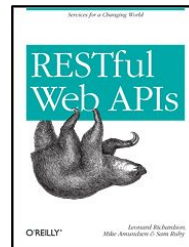
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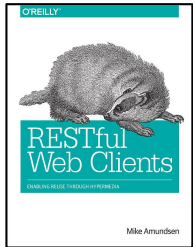
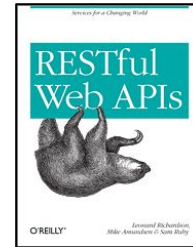
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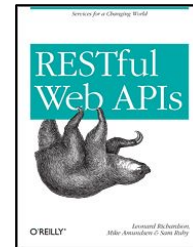
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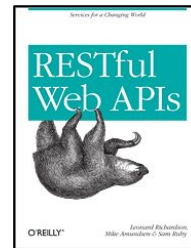
Discovery patterns are the DNS of application services.



Discovery Exercise

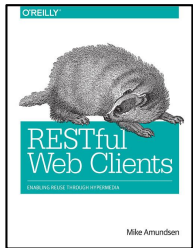
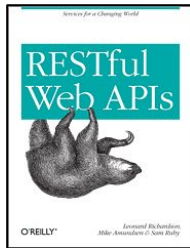


The Adaptable System



The Adaptable System

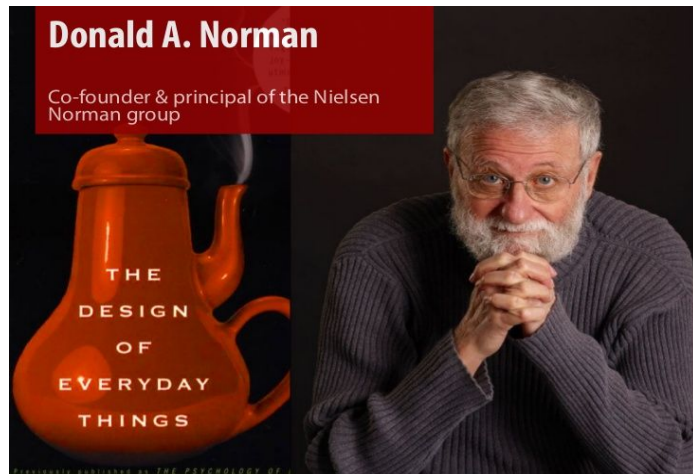
- Service/API Designers
- Evolvable Providers
- Adaptable Consumers
- *Adaptation Exercise*



Service/API Designers

"The value of a well-designed object is when it has such a rich set of affordances that the people who use it can do things with it that the designer never imagined."

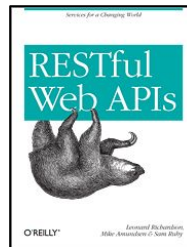
-- Donald Norman, 1994



@jnd1er

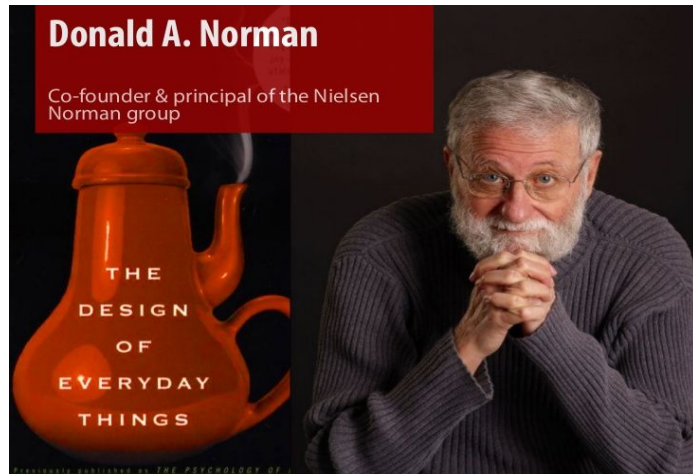


https://en.wikipedia.org/wiki/The_Design_of_Everyday_Things



Service/API Designers

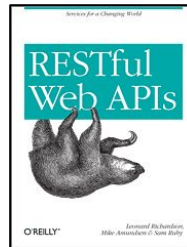
- Promise message models, not object types
- Document link identifiers, not URLs
- Publish vocabularies, not API definitions



@jnd1er



https://en.wikipedia.org/wiki/The_Design_of_Everyday_Things



Evolvable Providers

"When people are building on top of our API, we're really asking them to trust us with the time they're investing in building their applications. And to earn that trust, we can't make changes [to the API] that would cause their code to break."

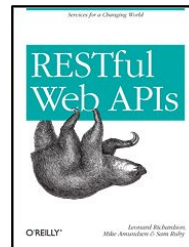
-- Jason Rudolph, Github (2013)



@jasonrudolph



<https://www.slideshare.net/yandex/api-design-at-github-jason-rudolph-github>



Evolvable Providers

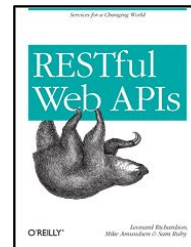
- Don't take things away
- Don't change the meaning of things
- Make all additions optional



@jasonrudolph



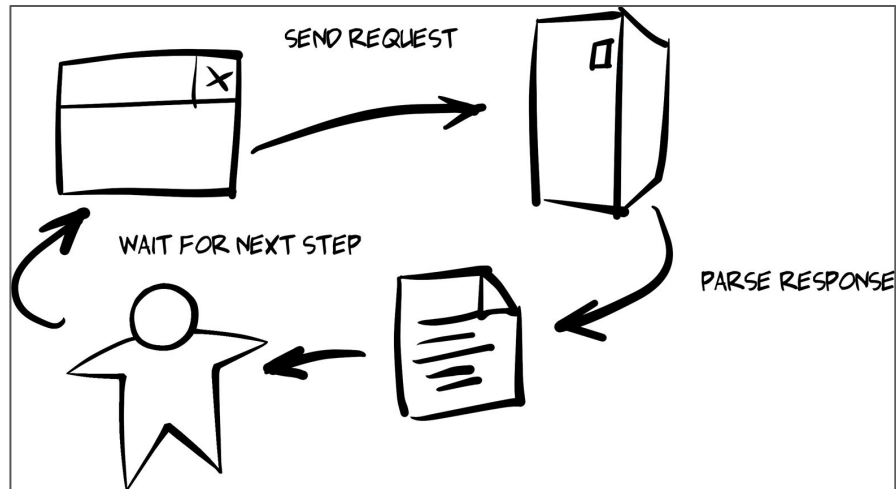
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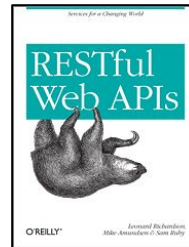
Adaptable Consumers

"When you can build a client that doesn't have to memorize the solution ahead of time you can start building clients who are 'smart' enough to adapt to new possibilities as the service presents them."

-- Mike Amundsen, 2016

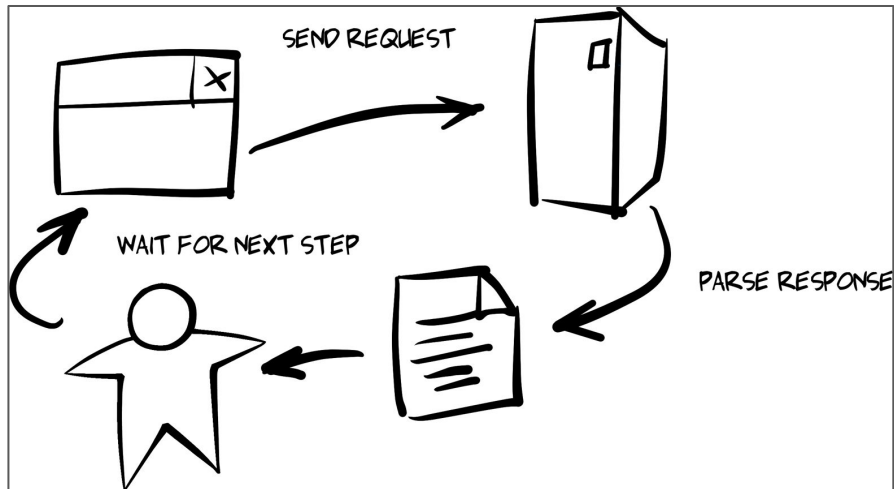


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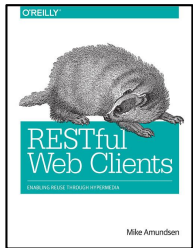
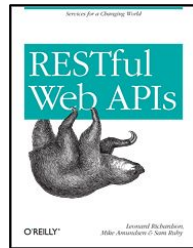


Adaptable Consumers

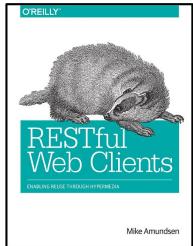
- Code defensively
- Code to the media type
- Leverage the API vocabulary
- React to link relations for workflow



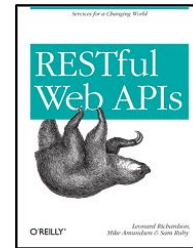
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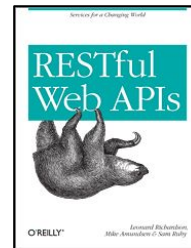
Providers evolve via humans, consumers adapt via code.



Adaptation Exercise

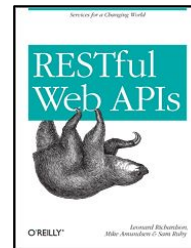


Summary



Summary

- A RESTful Design
- Message-Oriented Implementation
- Discovery Patterns
- Emergent Adaptability

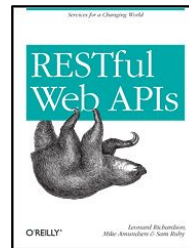


A RESTful Design

- Microservices means independent & loosely-coupled
- REST properties are close to Microservice properties
- Adopt Microservice Constraints



@Fielding

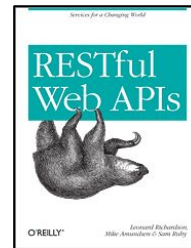


Message-Oriented Implementation

- Models on the Inside
- Messages on the Outside
- Vocabularies Everywhere

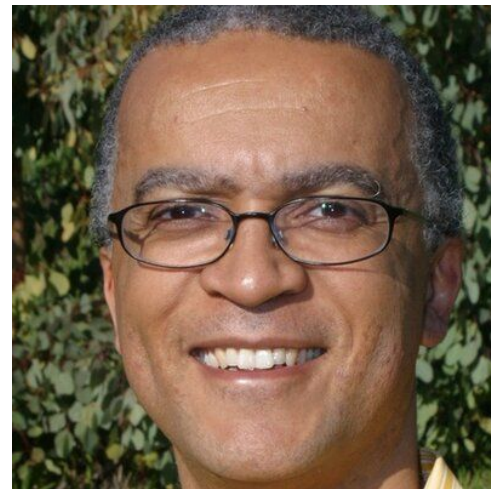


@PatHelland

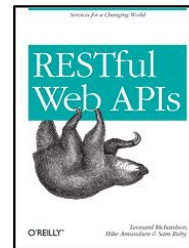


Discovery Patterns

- Advertising Services
- Discovering Services
- Health Checking/Renewals



@CRichardson

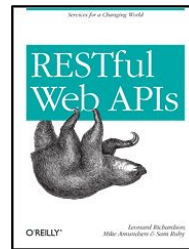


Emergent Adaptability

- Designers promise messages
- Services implement non-breaking changes
- Consumers code defensively



@mamund



RESTful Microservices from the Ground Up

Mike Amundsen
API Academy
@mamund

