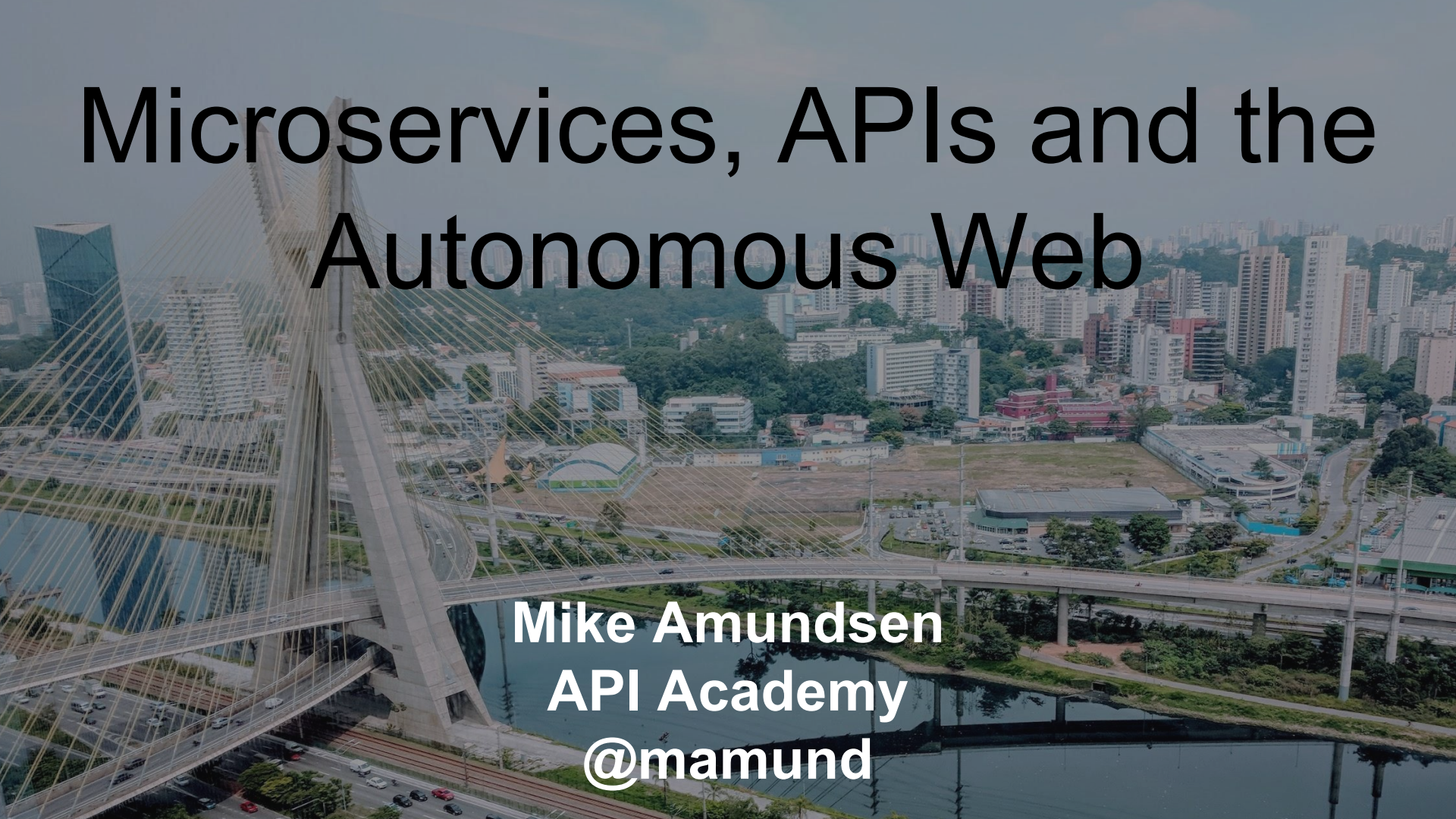
Microservices, APIs and the Autonomous Web



Mike Amundsen
API Academy
@mamund

Mike Amundsen
@mamund

apiacademy.co

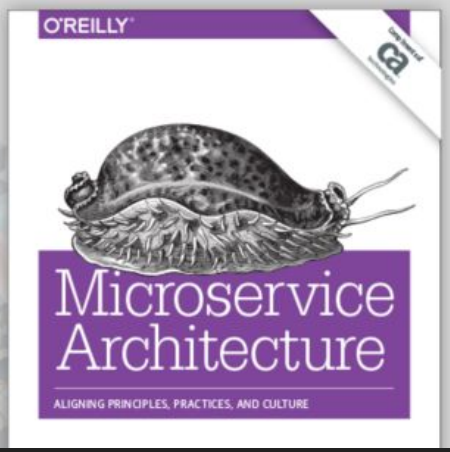
ca technologies

Microservice Architecture: Aligning Principles, Practices, and Culture

Microservices is the next evolution in software architecture designed to help organizations embrace continual change in the digital economy. But how do you design and apply an effective microservice architecture?

This new book from O'Reilly provides comprehensive guidance through seven valuable chapters that give you a deep-dive into:

- The benefits and principles of microservices
- A design-based approach to microservice architecture
- Lessons for applying microservices in practice



g.mamund.com/msabook

A Look Ahead

- Programming the Network
- Microservices
- APIs
- Autonomy
- The Next Big Thing

A Force to Reckon With

2000

DOT MATRIX WITH STEREO SOUND
BATTERY
Nintendo GAME BOY™
SELECT
START
B
A

GSM
TM

MOTOROLA
MOTOROLA
TIMEPORT
Menu
tri-band

"REST emphasizes scalability of component interactions, generality of interfaces, independent deployment of components, and intermediary components."

-- Roy Fielding, 2000

salesforce

salesforce.com
Home
Accounts
Contacts
Opportunities
Forecasts
Secure Customer Login
Contact Us
Company Profile
Join Our Tea
User Name
Password
Go!
Sign up!
Take advantage of the benefits of salesforce.com.
Just Sign On!
Online Sales Force Automation
Exploit the power of the Internet to access, manage and share all of your business' sales information…safely, securely, immediately.

"Salesforce.com is the first solution that truly leverages the Internet to offer the functionality of enterprise class software at a mere fraction of the cost."

-- Marc Benioff, 2000

Software-as-a-Service (SaaS)

"One of the most highly valued American cloud computing companies with a market cap above $90 billion."

-- Wikipedia, 2018

2006

```
1  /**
2  * <p><code>MuleServer</code> is a simple
3  application that represents a local
4  *Mule Server daemon.It is initalised with a
5  mule-configuration.xml file.
6  *
7  *@author Ross Mason
8  *@Version $ Revision: 1.0 $
9
10
```

MuleSoft, Inc. is a software company that provides integration software for connecting applications, data and devices.

-- Wikipedia

Ross Mason

Platform-as-a-Service (PaaS)

2018

"Mulesoft … was acquired by Salesforce.com Inc. in a $6.5 billion deal."

-- Wall Street Journal, May 2018

Programming the Network

Programming the Network

"There is no simultaneity at a distance."

-- Pat Helland (2005)

Pat Helland

"Data on the Inside vs. Data on the Outside, Helland (2005) http://cidrdb.org/cidr2005/papers/P12.pdf

Programming the Network

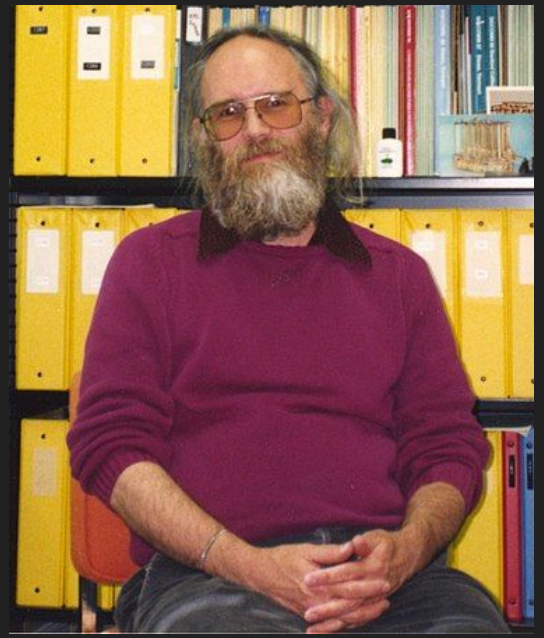
- Sending Data Packets
- Establishing a Network of Machines
- Creating Solutions on the Network

onfig
s IP Configuration
rnet adapter server:
Connection-specific DNS Suffix
IP Address
Subnet Mask
Default Gateway

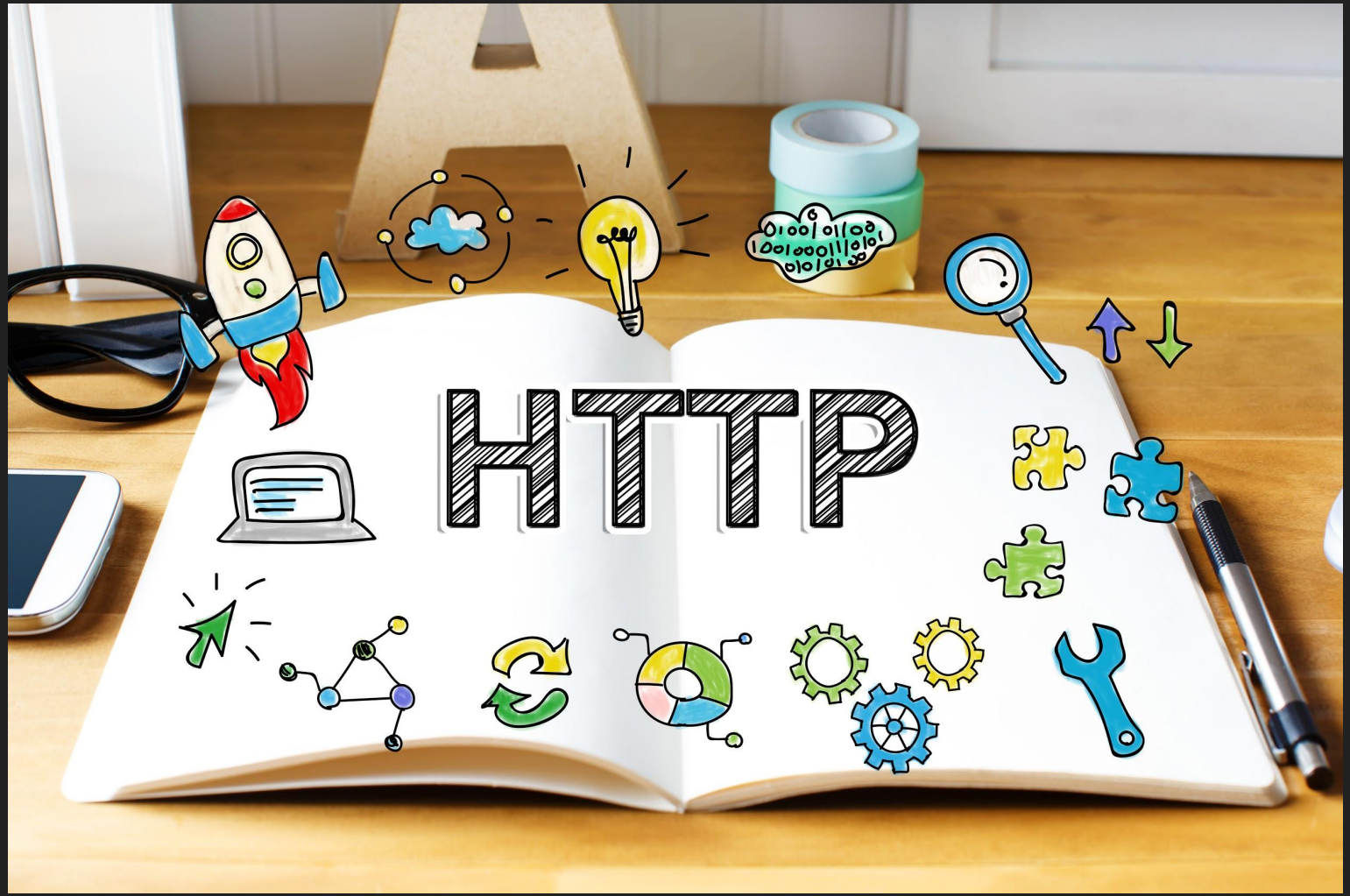
TCP/IP : Packets

"Be conservative in what you send, be liberal in what you accept."

-- Robustness Principle



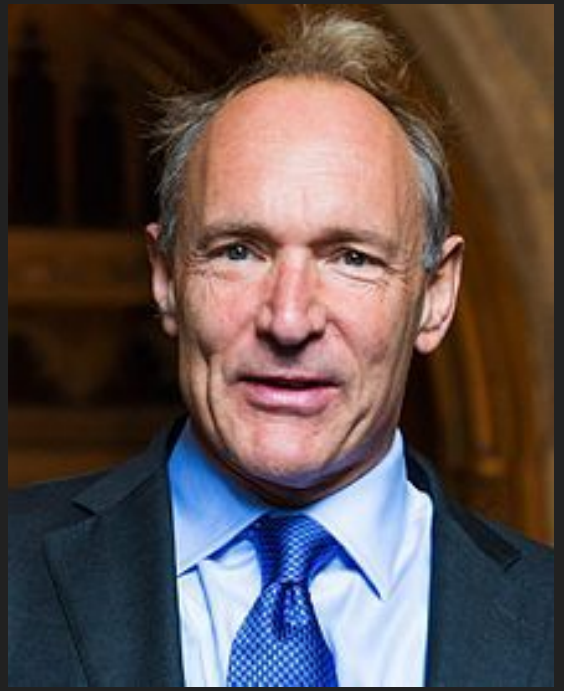
Jon Postel


HTTP

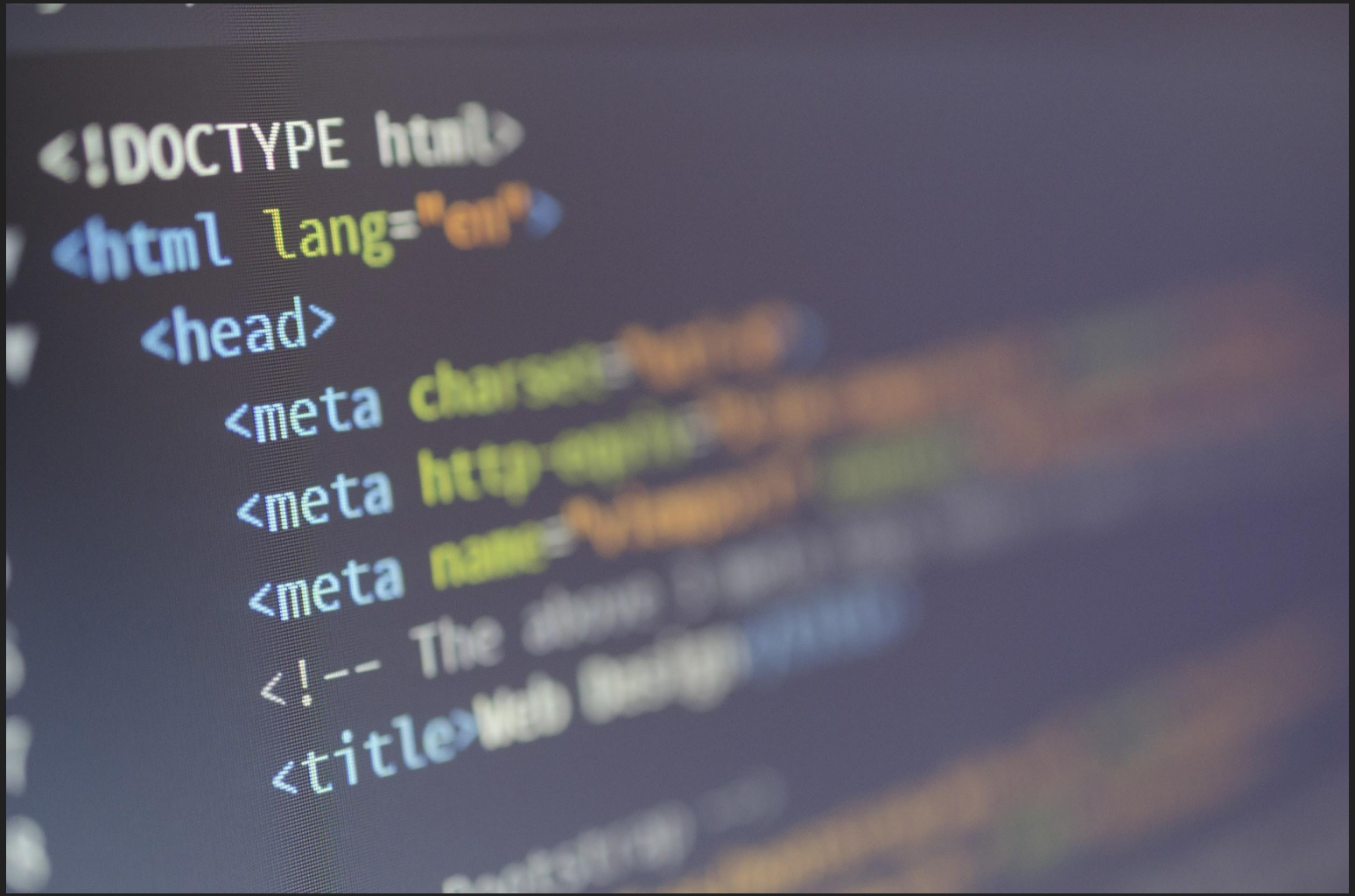
HTTP: Messages

"HTTP is an application protocol for distributed, collaborative, and hypermedia information systems."

-- Wikipedia



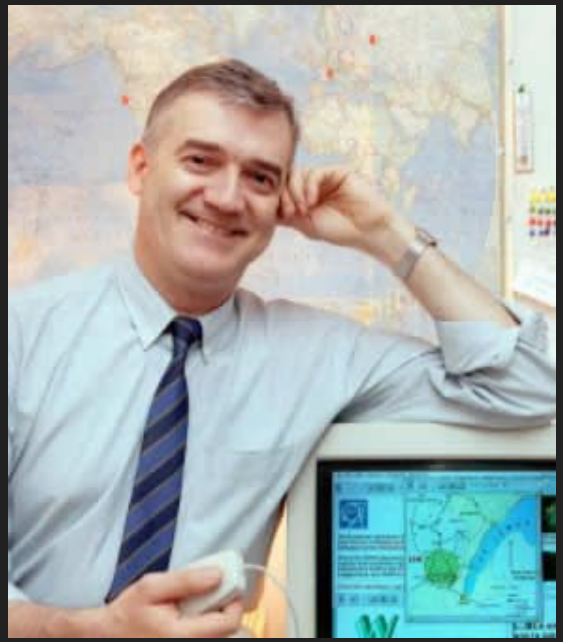
Tim Berners-Lee


<!DOCTYPE html>
<html lang="en">
<head>
<meta
<meta
<meta
<!-- The
<title>

HTML: Solutions

"HTML is the standard markup language for creating web pages and web applications. "

-- Wikipedia



Robert Cailliau

Three Levels of System Design

Three Levels of System Design

- Functionality
- Intentionality
- Autonomy

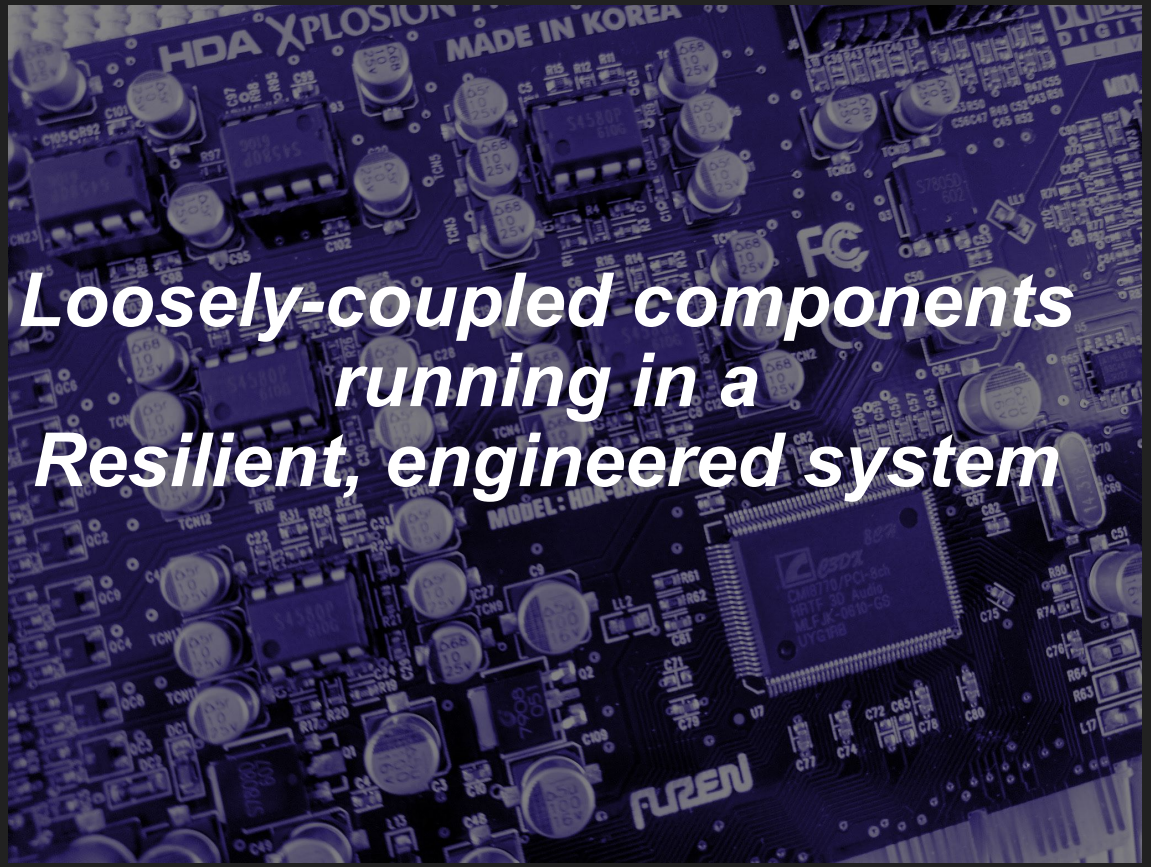
func·tion·al·i·ty

/ˌfəNG(k)SHəlˈadē/

noun

1. the quality of being suited to serve a purpose well; practicality.
   "I like the feel and functionality of this bakeware"

Functionality : Microservices



Functionality : Microservices

“Bugs will happen. They cannot be eliminated, so they must be survived instead.”

-- Michael T. Nygard

The Pragmatic Programmers
Release It!
Second Edition
Design and Deploy
Production-Ready Software
Michael T. Nygard
BETA

Nygard Stability Patterns

- **Timeout**
- **Circuit Breaker**
- **Bulkhead**
- **Steady State**
- **Fail Fast**
- **Handshaking**

- Caching : A capacity pattern referenced here, too

in·ten·tion·al·i·ty

/inˌten(t)SHəˈhaləd**ē**/

noun

the fact of being deliberate or purposive.

- PHILOSOPHY
  the quality of mental states (e.g., thoughts, beliefs, desires, hopes) that consists in their being directed toward some object or state of affairs.

API

abbreviation

1. application programming interface

Allie
Should I get the new Blackberry Torch?
Chats (2)
Rick
Erik M. New pin-
I'm bbming u from my new playbook
Contacts (26)
Rick
BC Ferries lol.
Seriously?
Doing what?
Hey what are
q
w
e
t
i
o
p
a
s
g
l
aA
z
v
b
Space
BlackBerry

APIs allow us to unlock hidden business value

- Create New Applications
- Identify New Revenue Streams
- Initiate New Businesses

"The sign of a well-designed object is when people who use it can do things with it that the designer never imagined."

-- Donald Norman

Good APIs make interaction easy

au·ton·o·my

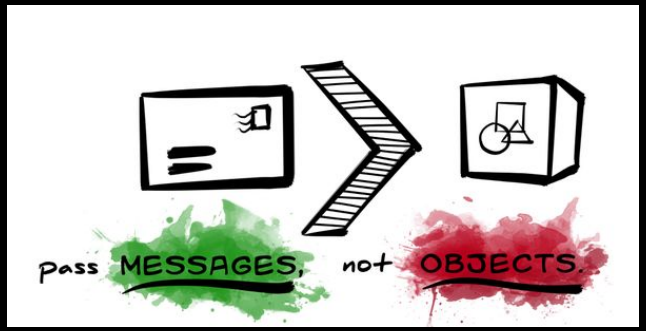
/ôtänəmē/

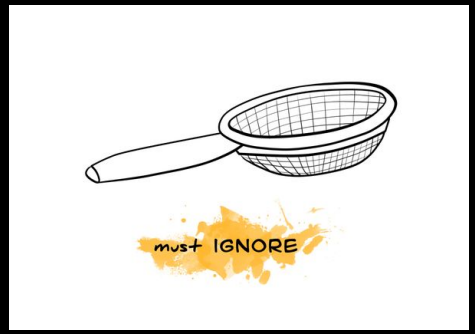
noun

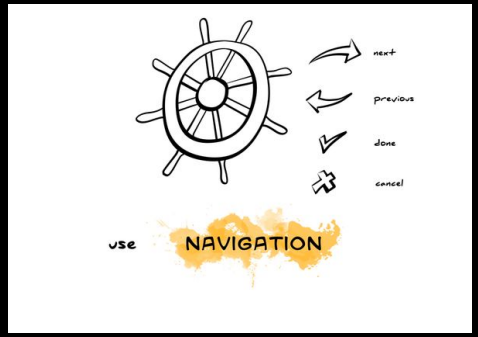
- freedom from external control or influence; independence.
  "economic autonomy is still a long way off for many women"
  synonyms: self-government, self-rule, home rule, self-determination, independence, sovereignty, freedom
  "the rebels called for regional autonomy and self-government"

Patterns for Autonomous APIs

Four Design Patterns
Four Basic Principles
Four Shared Agreements

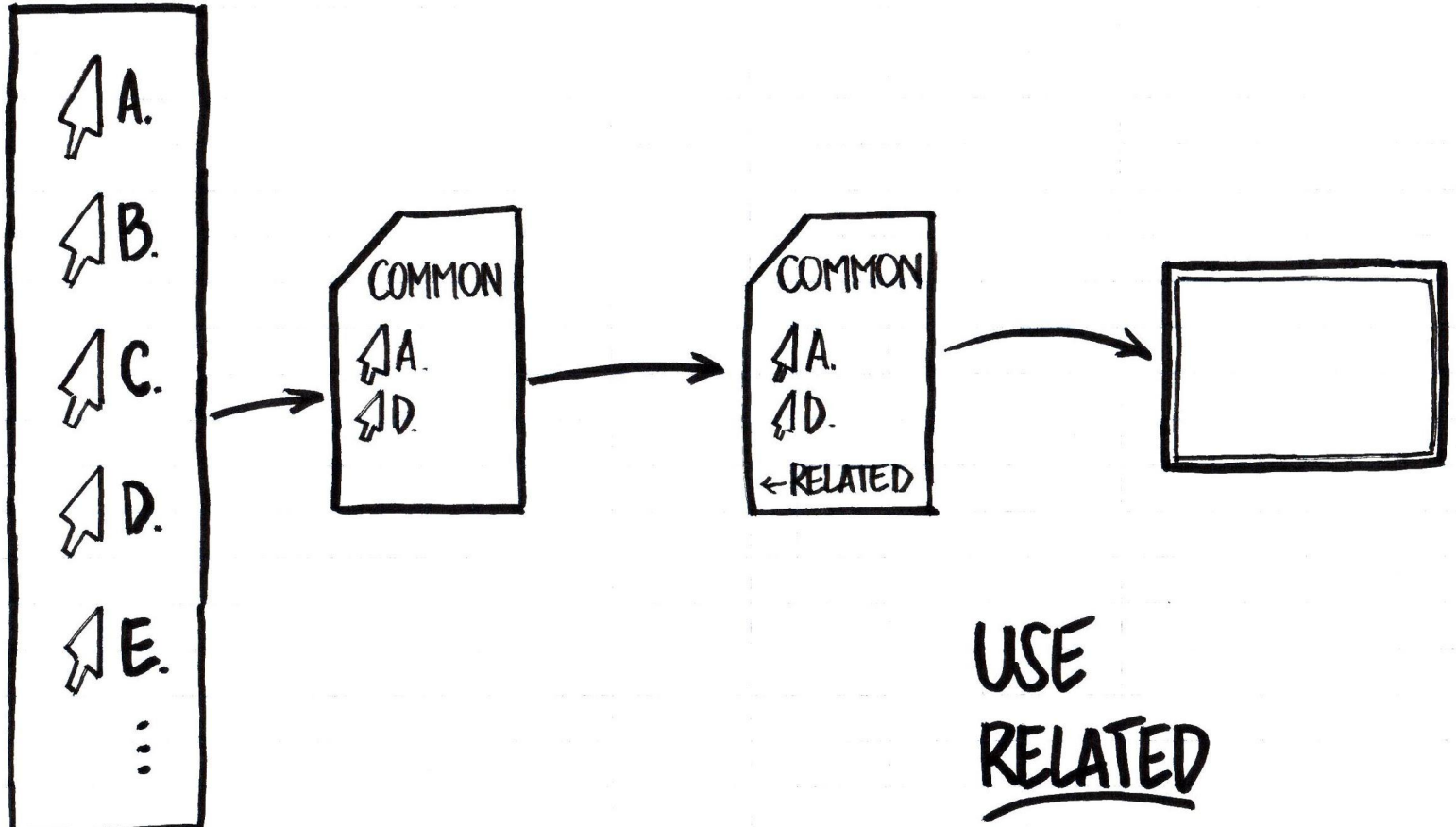






Four Shared Agreements

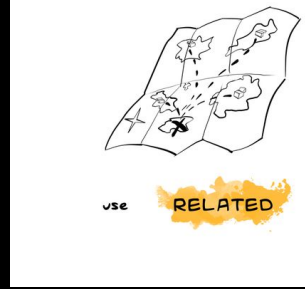
use RELATED


A.
B.
C.
D.
E.
COMMON
A.
D.
COMMON
A.
D.
←RELATED
USE
RELATED

Use Related

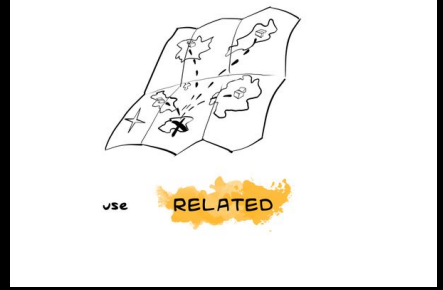
Services SHOULD return a RELATED LINK that responds with ALL the possible actions for this context.

```
*** REQUEST
GET /orders/123 HTTP/1.1
  Host: example.org
  Accept: application/vnd.hal+json

*** RESPONSE
HTTP/1.1 200 OK
  Content-Type: application/vnd.hal+json
  Content-Length: XXXX

{
  "_links": {
    "self": {"href" : "..."},
    "approve": {"href" : "..."},
    "related": {"href" : "/orders/123?related"}
    ...
}
```



```
*** REQUEST
GET /orders/123 HTTP/1.1
  Host: example.org
  Accept: application/vnd.hal+json

*** RESPONSE
HTTP/1.1 200 OK
  Content-Type: applicat
  Content-Length: XXXX

{
  "_links": {
    "self": {"href" : ".
    "approve": {"href" :
    "related": {"href" :
    ...
}
```

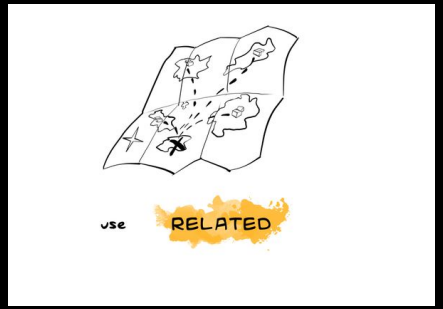
```
*** RESPONSE
HTTP/1.1 200 OK
  Content-Type: application/vnd.hal+json
  Content-Length: XXXX

{
  "_links": {
    "self": {"href" : "..."},
    "approve": {"href" : "..."},
    "cancel": {"href" : "..."},
    "modify": {"href" : "..."},
    "transfer": {"href" : "..."},
    "review": {"href" : "..."},
    "rush": {"href" : "..."},
    "related": {"href" : "/orders/123?related"}
    ...
}
```

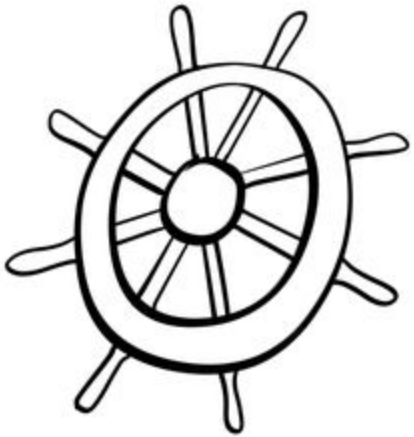


Use Related

What problem does this solve?

Machines can now “look up”
the available affordances.





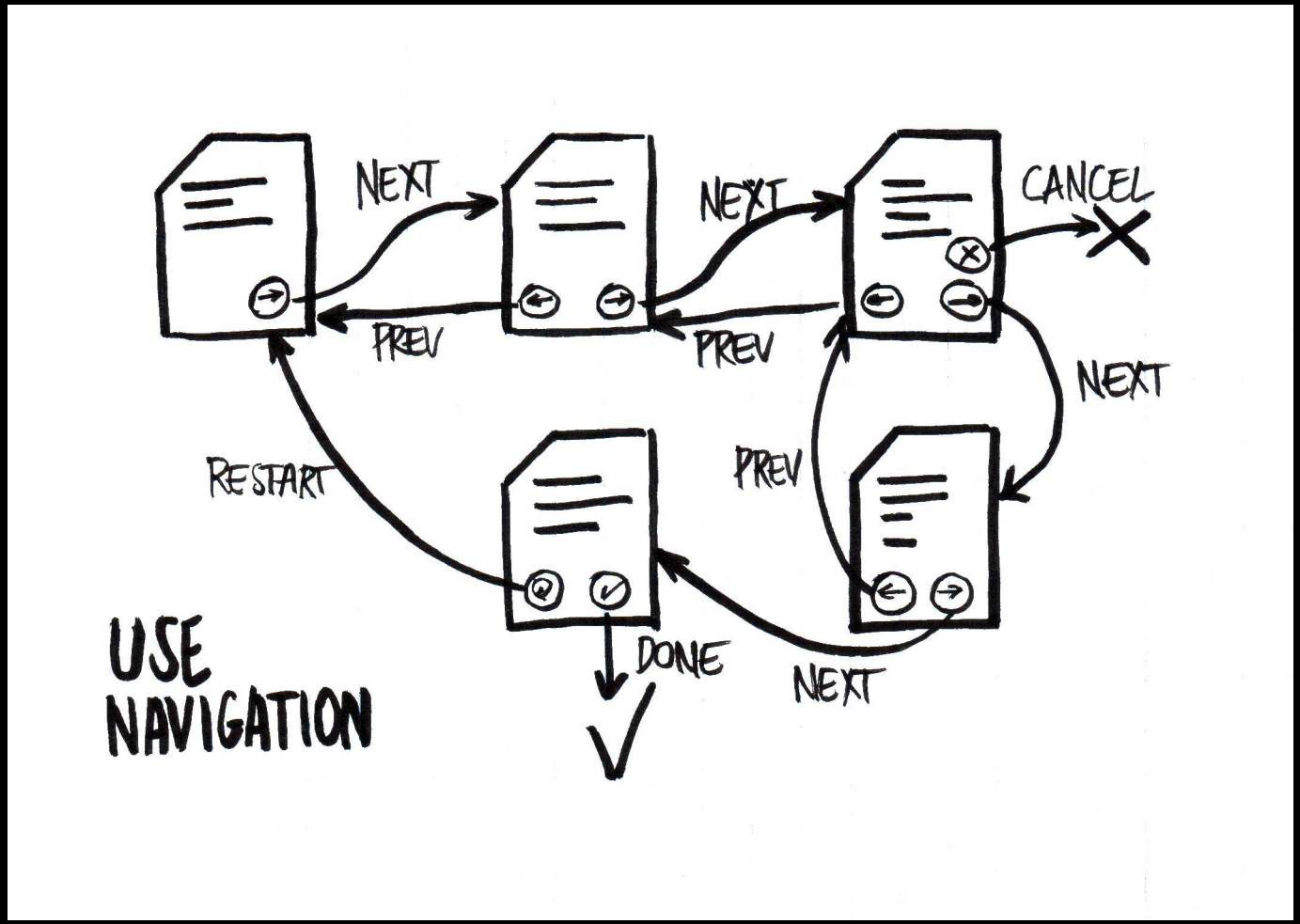
next

previous

done

cancel

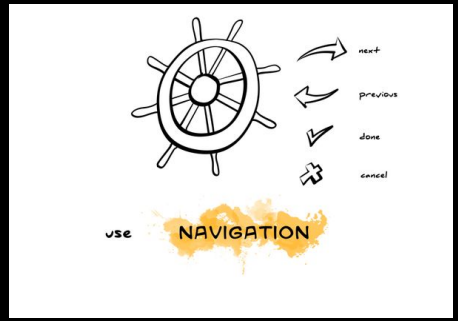
use NAVIGATION


NEXT
NEXT
CANCEL
PREV
PREV
NEXT
RESTART
PREV
DONE
NEXT
USE
NAVIGATION

Use Navigation

Services SHOULD provide "next/previous" LINK to handle multi-step workflow with "cancel", "restart", & "done."

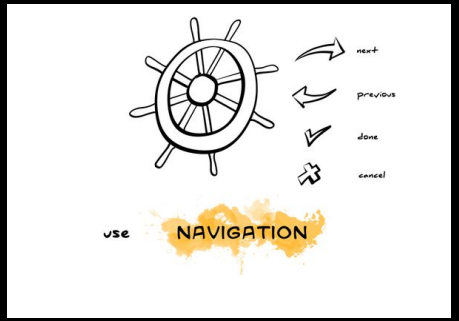
```
// evaulate options
var lookingFor = "next";
var msg = getCurrentResponseBody();
switch (lookingFor) {
  case "done":
    if(msg.findNavigation(lookingFor)) {
      processDone(msg);
    }
    break;
  case "cancel":
    if(msg.findNavigation(lookingFor)) {
      processCancel(msg);
    }
    break;
  case "restart":
    if(msg.findNavigation("restart")) {
      processRestart(msg);
    }
    break;
  case "previous":
    if(msg.findNavigation("previous")) {
      processPrevious(msg);
    }
    break;
  case "next":
    if(msg.findNavigation("next")) {
      processNext(msg);
```

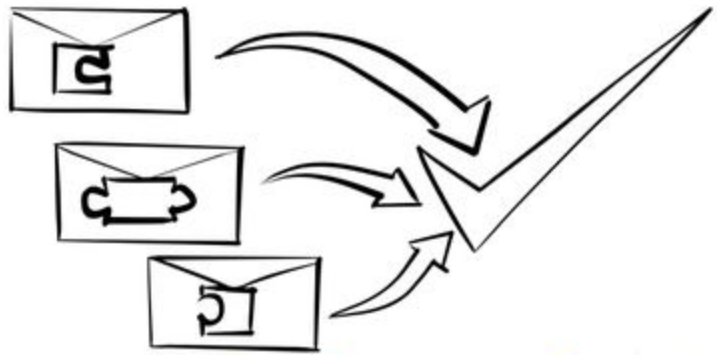


Use Navigation

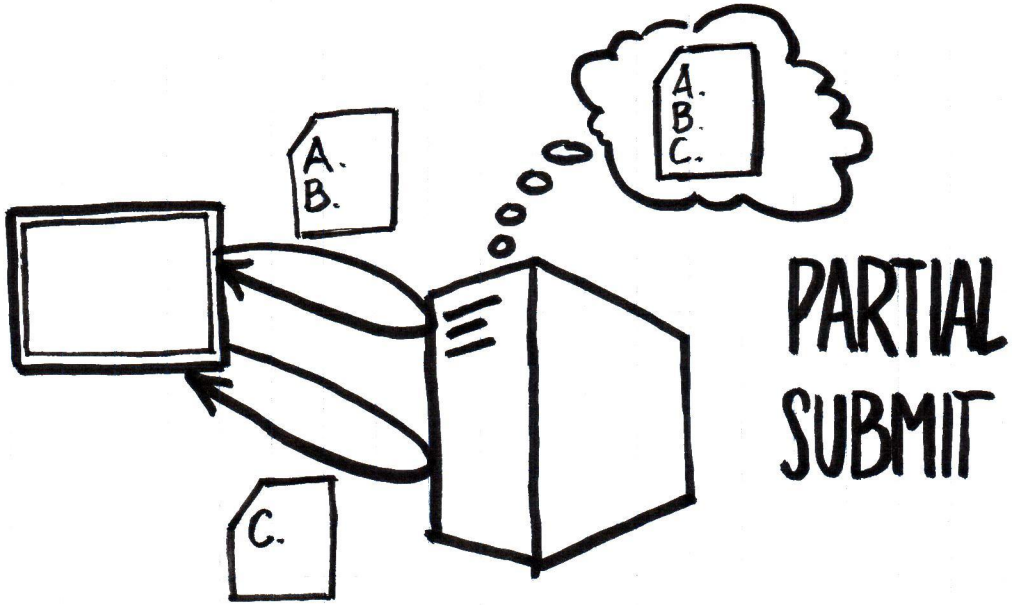
What problem does this solve?

Machines can now navigate through a long series of steps safely.





PARTIAL SUBMIT

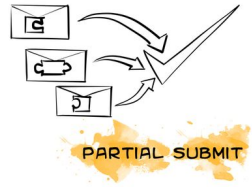


PARTIAL SUBMIT

Partial Submit

Services SHOULD accept partially filled-in FORM and return a new FORM with the remaining fields.

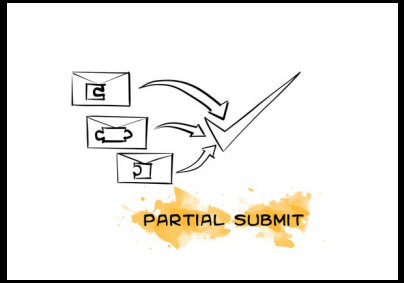
```
// partial submit processing
...
case "POST":
  neededInputs = processForm(suppliedInputs);
  if(neededInputs.length>0) {
    responseBody = generateForm(
      neededInputs,
      actions["done","cancel","restart","previous"]
    );
  }
  else {
    responseBody = generateResults();
  }
  break
...
```

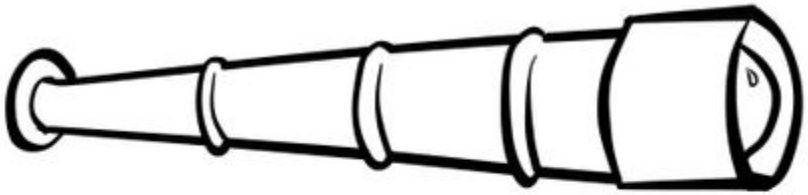


Partial Submit

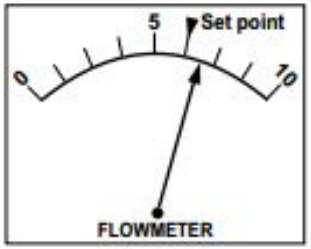
What problem does this solve?

Machines can now interact in small parts and not always be perfect.



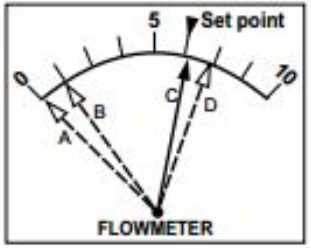


STATE WATCH



SIGNAL

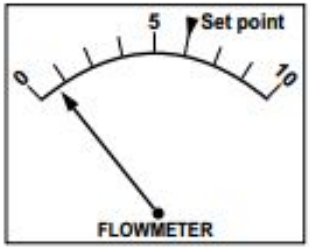
- Keep at set point
- Use deviation as error signal
- Track continuously



SIGN

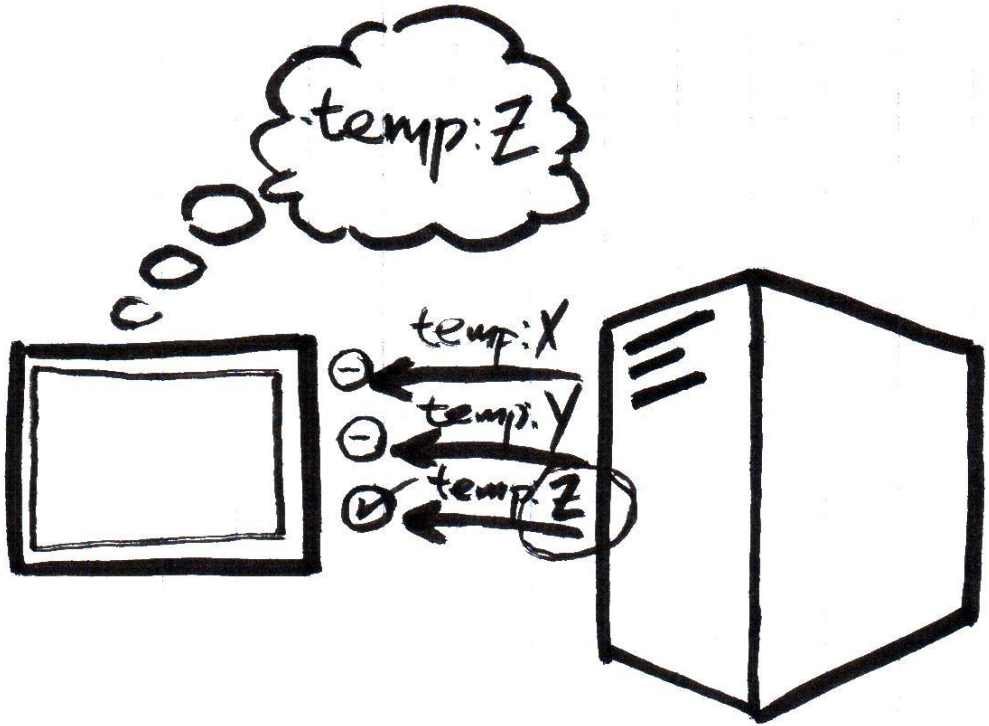
Stereotype acts

If Valve Open	If C, ok If D, adjust flow
If Valve Closed	If A, ok If B, recalibrate meter



SYMBOL

If, after calibration, is still B, begin to read meter and speculate functionally (could be a leak)



STATE
WATCH

State Watch

Services SHOULD allow clients to subscribe to WATCH VALUES so that clients can determine "done."

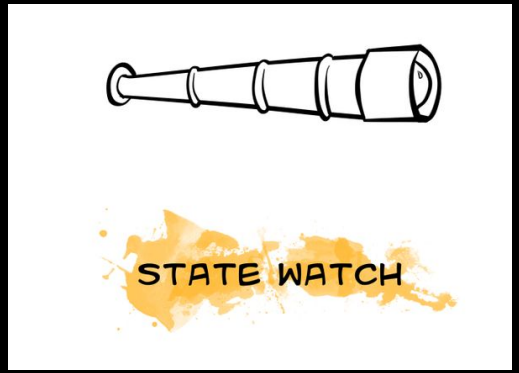
```
*** REQUEST
POST /heat-mgmt HTTP/1.1
     Host: example.org
     Content-Type: application/x-www-form-urlencoded
     Accept: application/vnd.collection+json
     Prefer: state-watch="sensor5,temp13"

     sensor5=increase by .5c;

*** RESPONSE
HTTP/1.1 200 OK
     Content-Type: application/collection+json
     Preference-Applied: state-watch="sensor5,sensor13"
     Content-Location: /heat-mgmt

     {"collection" :
       {
         "items" : [
           ...
           {
             "href" : "/heat-mgmt/sensor5",
             data: [
               {"name" : "device", "value" : "sensor5"},
               {"name" : "reading", "value" : "14.5c"}
             ]
           }
           ...
         ]
       }
     }
```

STATE WATCH

Use State Watch

What problem does this solve?

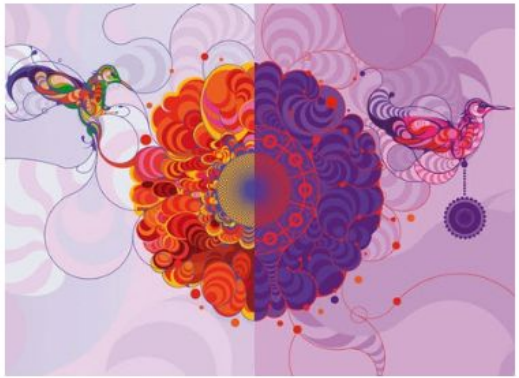
Machines can now set their own goals and act accordingly.



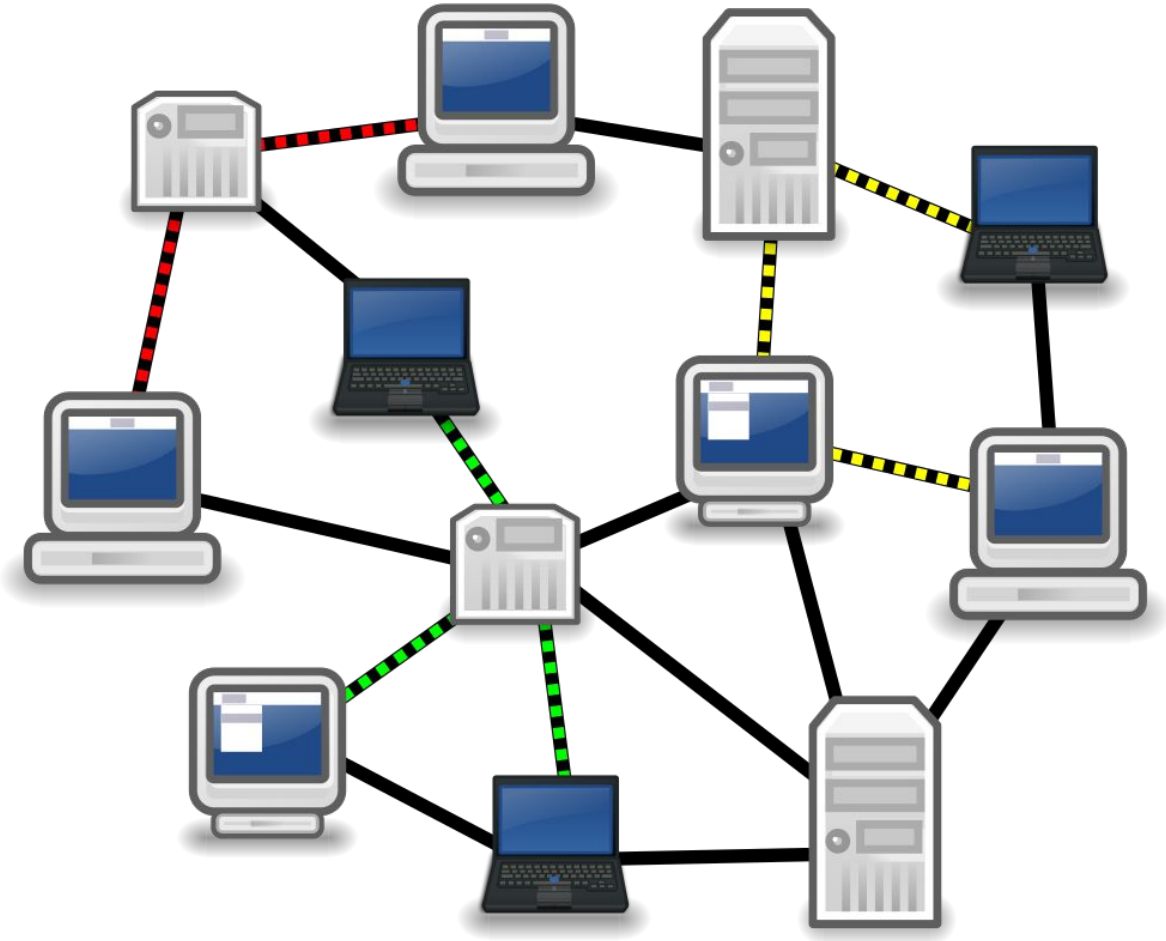
Monetizing the Future

API Imperative: From IT Concern to Business Mandate

Because they allow technology assets to be reused across and beyond the enterprise, APIs are becoming a strategic business imperative.



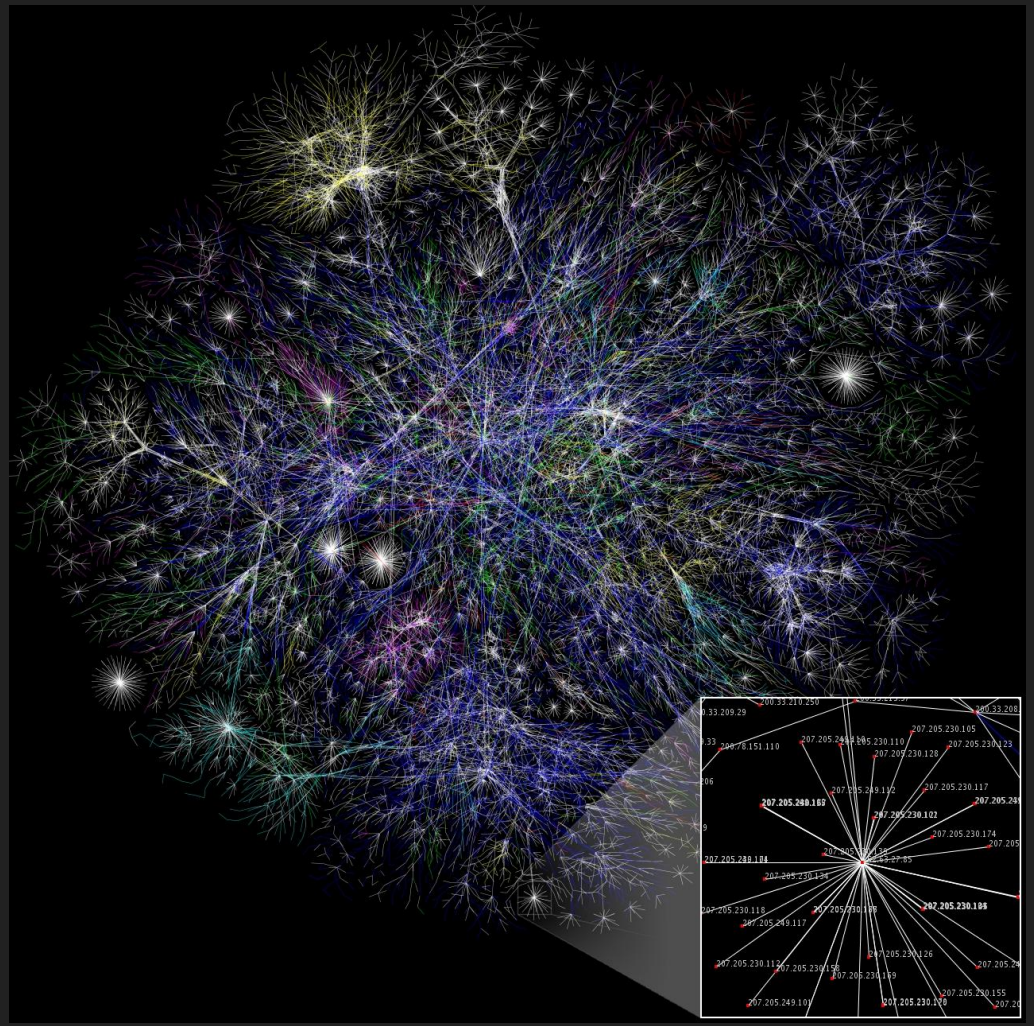
For many years, APIs have made it possible for solutions and systems to communicate with each other. Increasingly, companies value these often-overlooked technologies for another capability: They expose technology assets for



Closed System Focus

- Focus on what/who you can control
- Create APIs that express your business
- Build apps that understand your APIs (business)
- Collect Customers and Profits

Most companies are focused on monetizing their own APIs


200.33.210.250
207.205.230.105
207.205.230.123
207.205.230.128
207.205.230.117
207.205.230.174
207.205.230.134
207.205.230.118
207.205.249.117
207.205.230.126
207.205.230.112
207.205.230.158
207.205.230.169
207.205.249.101
207.205.230.155

Open System Focus

- Focus on what you can offer
- Create APIs that express your intentionality
- Build apps that have autonomy
- Collect Customers and Profits

The next companies will focus on monetizing other people's APIs

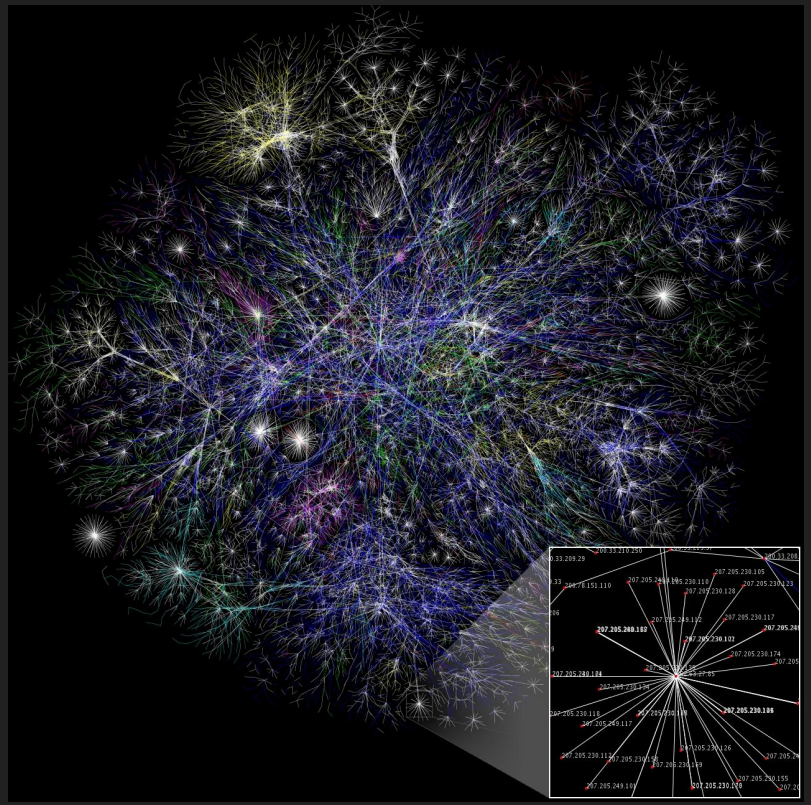
salesforce

So...

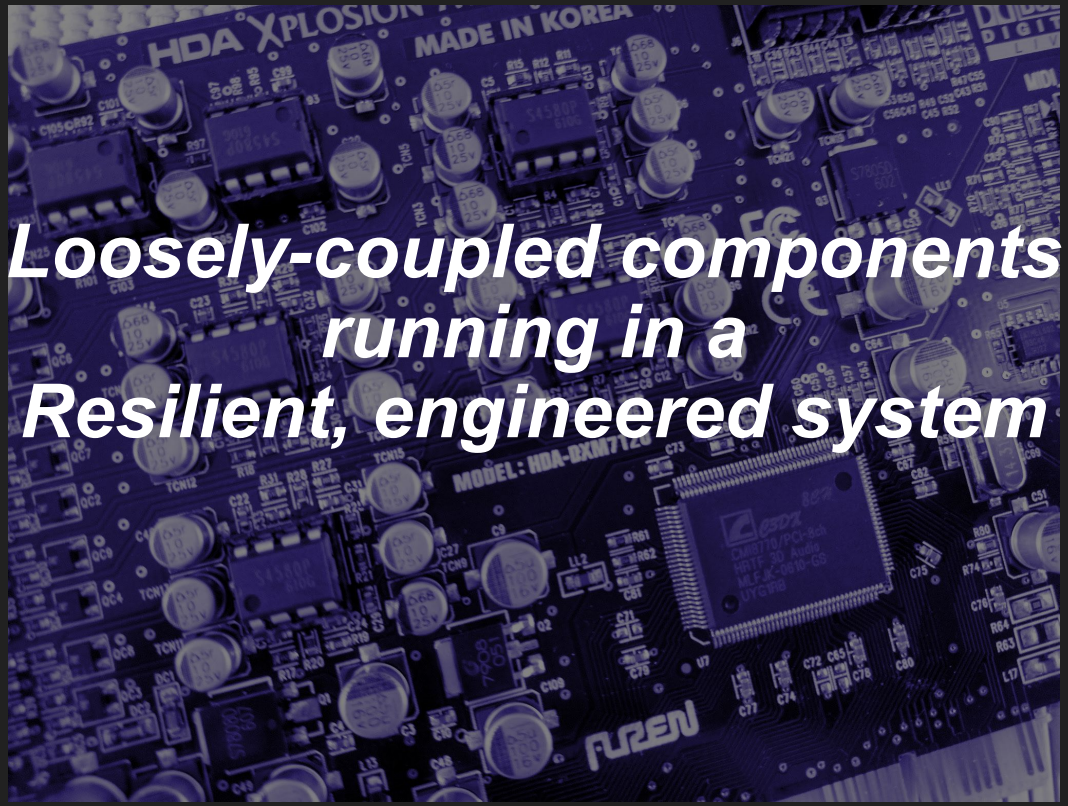
Looking to the Future...

- Focus on Programming the Network
- Microservices for Functionality
- APIs for Intentionality
- Patterns for Autonomy
- Aim to Monetize Other People's APIs

Focus on programming the network

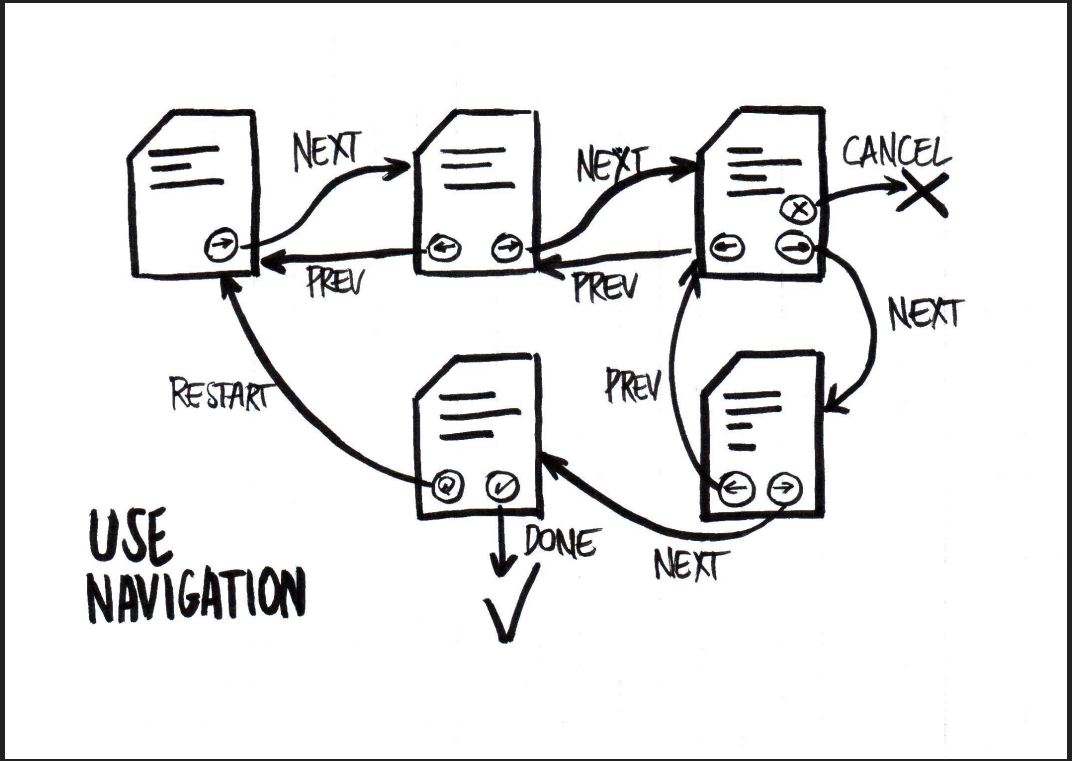


Build Microservices for Functionality



Create APIs for Intentionality

Apply Patterns for Autonomy

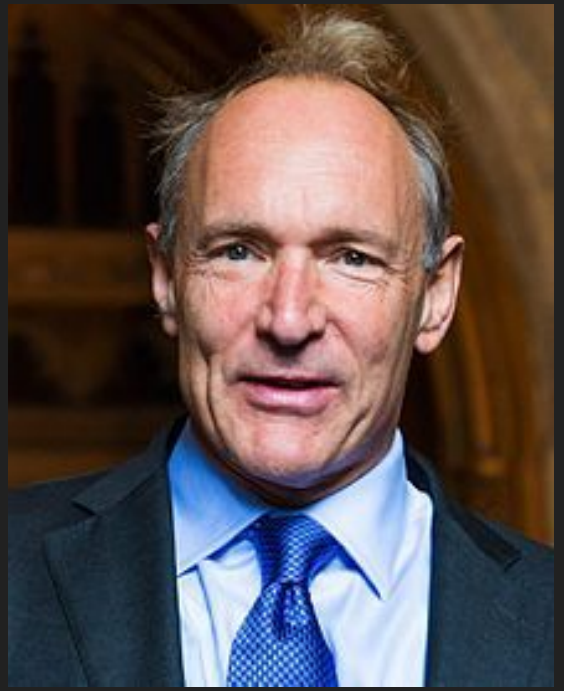


Aim to monetize other people's APIs

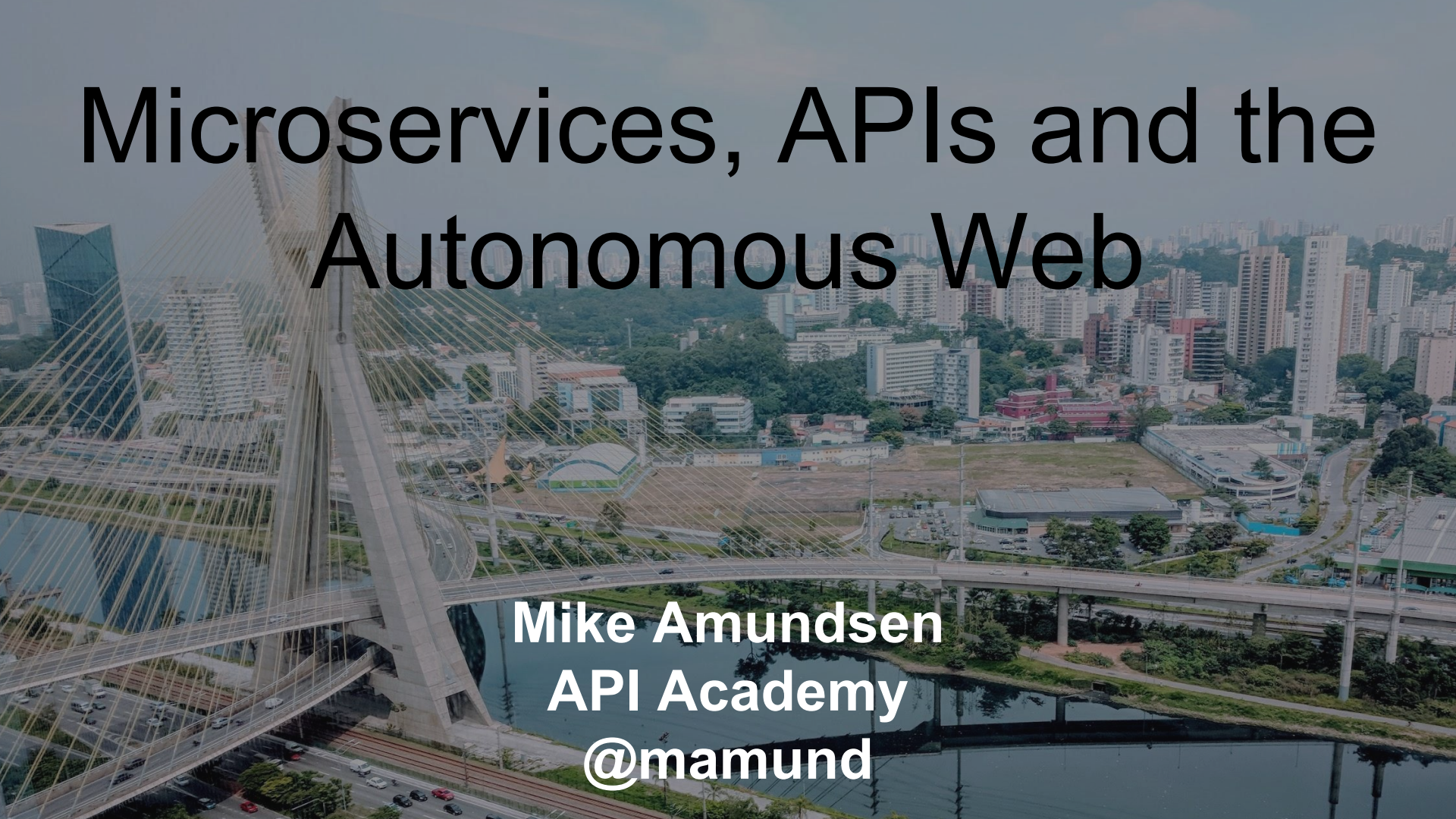
There's lots of opportunity ahead of us...

"The Web as I envisaged it, we have not seen it yet. The future is still so much bigger than the past."

-- Tim Berners-Lee



Microservices, APIs and the Autonomous Web



Mike Amundsen
API Academy
@mamund