

A scenic view of a forest with a clear blue sky in the background. The foreground is filled with dense green trees, and the background shows a hazy horizon line under a bright sky.

# Scaling the Future

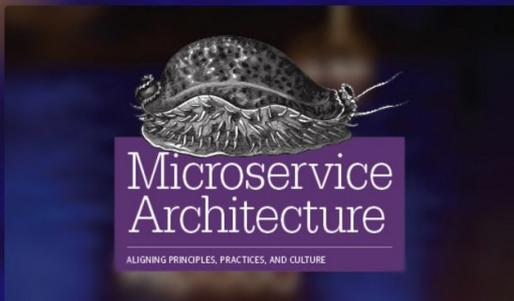
Mike Amundsen  
@mamund  
API Academy at CA



**Mike Amundsen**  
**@mamund**



EBOOK



## MICROSERVICE ARCHITECTURE: ALIGNING PRINCIPLES, PRACTICES & CULTURE

DESIGN AND APPLY MICROSERVICES TO EMBRACE CONTINUAL  
CHANGE IN THE DIGITAL ECONOMY

READ MORE

Creating Evolvable Hypermedia Applications



*Building*

# Hypermedia APIs with HTML5 & Node

O'REILLY®

*Mike Amundsen*

Services for a Changing World

# RESTful Web APIs



O'REILLY®

*Leonard Richardson,  
Mike Amundsen & Sam Ruby*

O'REILLY®



# RESTful Web Clients

ENABLING REUSE THROUGH HYPERMEDIA

Mike Amundsen

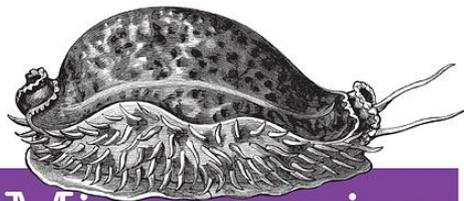
Creating Evolvable Hypermedia Applications



*Building*  
Hypermedia  
APIs with  
HTML5 &

O'REILLY®

O'REILLY®



Microservice  
Architecture

ALIGNING PRINCIPLES, PRACTICES, AND CULTURE

Irakli Nadareishvili, Ronnie Mitra,  
Matt McLarty & Mike Amundsen

Services for a Changing World

RESTful  
APIs



*Leonard Richardson,  
Mike Amundsen & Sam Ruby*

O'REILLY®



RESTful  
Web Clients

ENABLING REUSE THROUGH HYPERMEDIA

Mike Amundsen

Creating Evolvable Hypermedia Applications



Building  
Hypermedia  
APIs with  
HTML5 &

O'REILLY®

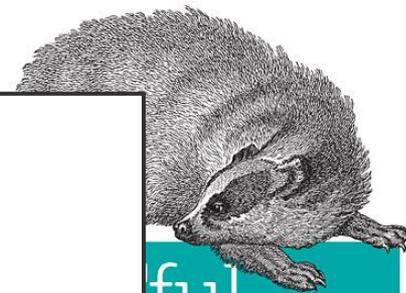
Services for a Changing World

RESTful  
API



Mike A

O'REILLY®

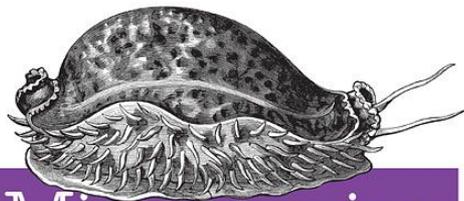


RESTful  
Clients

HYPERMEDIA

Mike Amundsen

O'REILLY®



Microservice  
Architecture

ALIGNING PRINCIPLES, PRACTICES, AND CULTURE

Irakli Nadareishvili, Ronnie Mitra,  
Matt McLarty & Mike Amundsen

Design and Build Great APIs

Mike Amundsen

The Pragmatic Bookshelf  
Raleigh, North Carolina

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

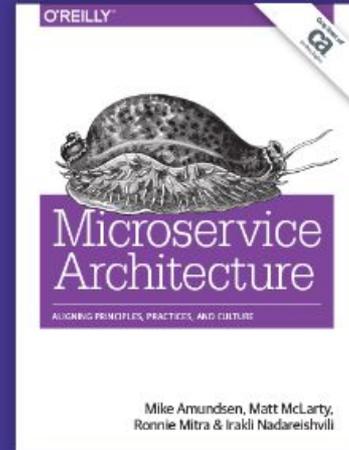


## Microservice Architecture: Aligning Principles, Practices, and Culture

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 book 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



# Scaling



# scale<sup>3</sup>

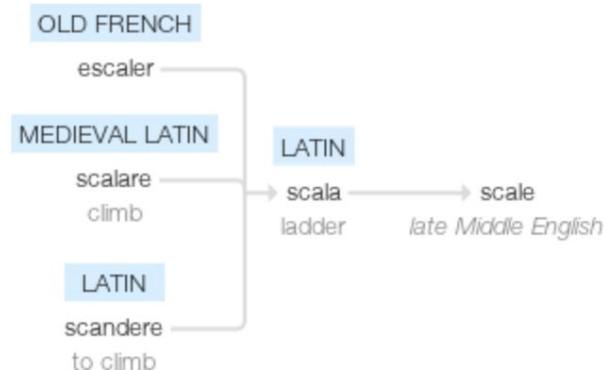
/skāl/ 

*verb*

gerund or present participle: **scaling**

1. climb up or over (something high and steep).  
"thieves scaled an 8-foot fence"  
*synonyms:* **climb**, **ascend**, go up, clamber up, scramble up, **mount**, shinny (up); *historical* **escalade**  
"thieves scaled the fence"
2. represent in proportional dimensions; reduce or increase in size according to a common scale.  
"scaled plans of the house"
  - (of a quantity or property) be variable according to a particular scale.

## Origin

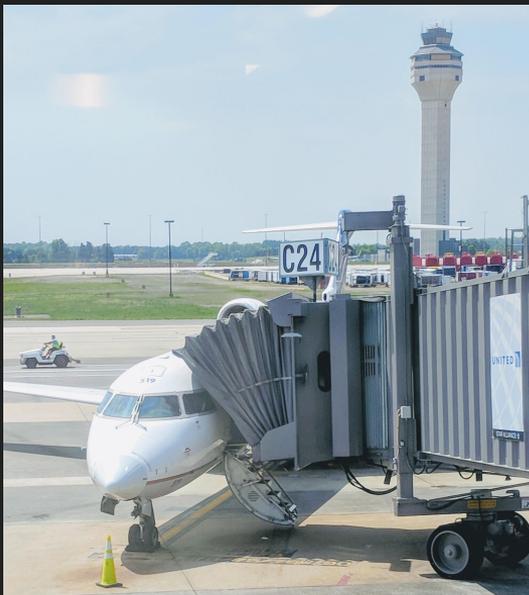


*Networks*

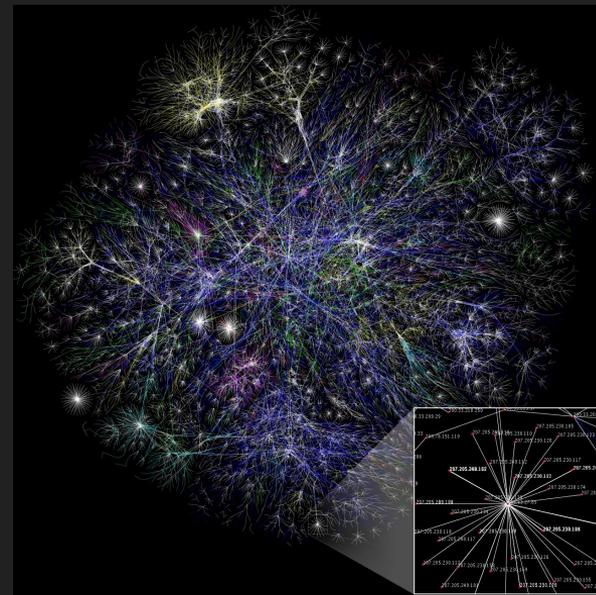
**Traveling**

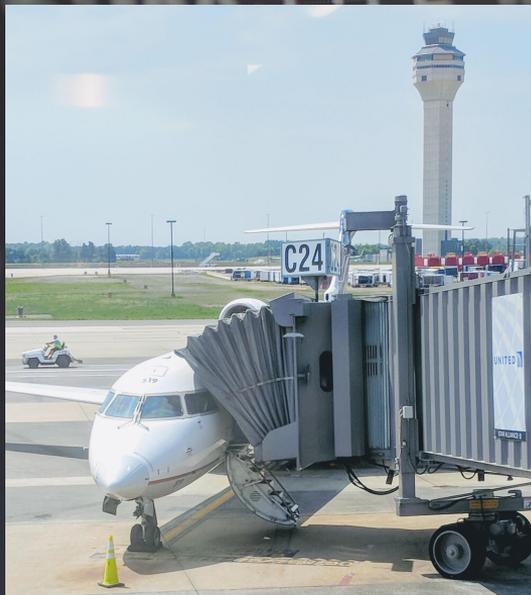


# Traveling

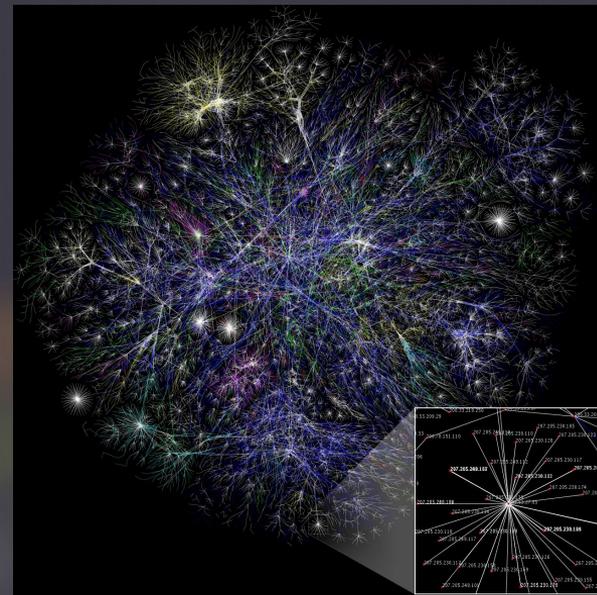


# Traveling the Network





# Programming the Network



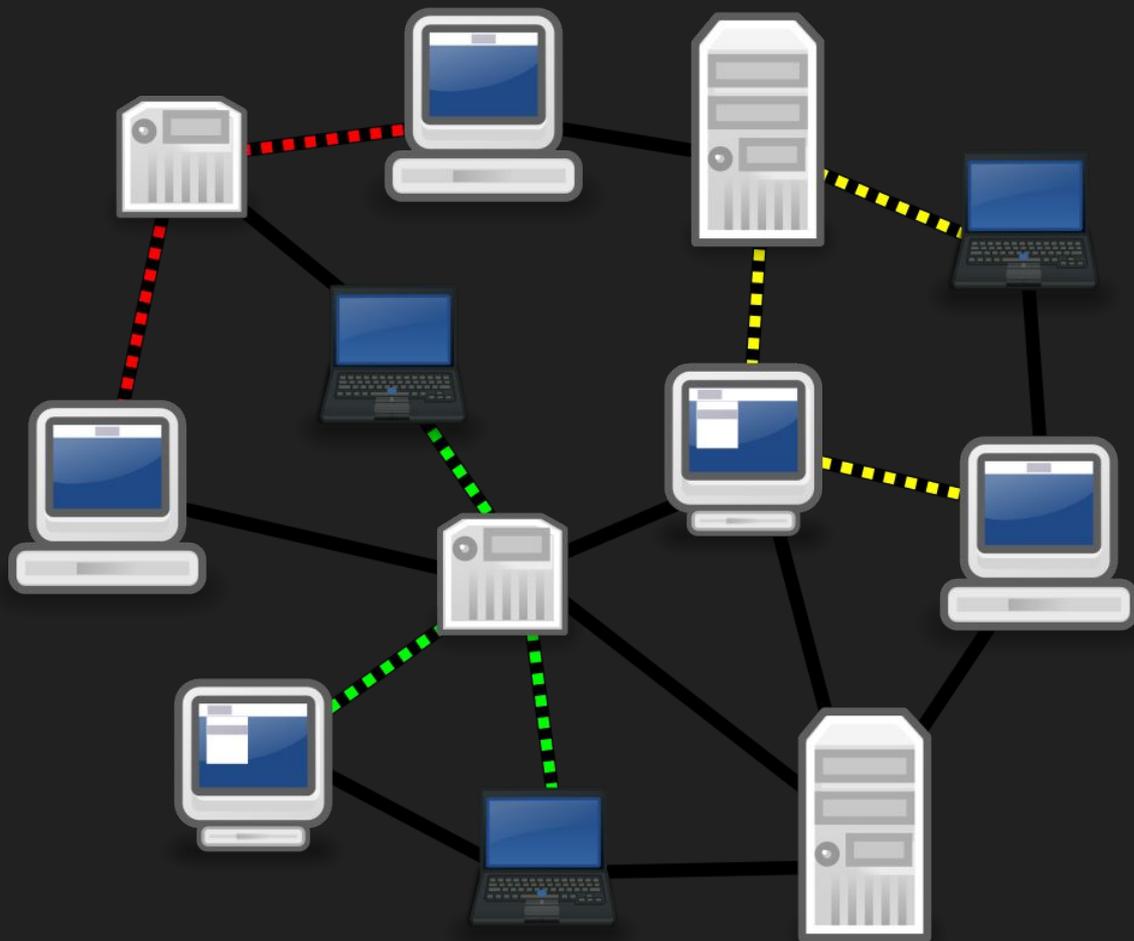
RedBoot(tm) bootstrap and debug environment [RAM]  
(Panasonic Avionics Corporation) release, version ("560328-212" v "1.07" b "0126"  
- built 15:35:59, May 22 2013

Platform: SM-02 (I386)  
Copyright (C) 2000, 2001, 2002, Red Hat, Inc.

RAM: 0x00000000-0x000a0000, 0x00100000-0x01000000 available  
Current Boot Count is 0

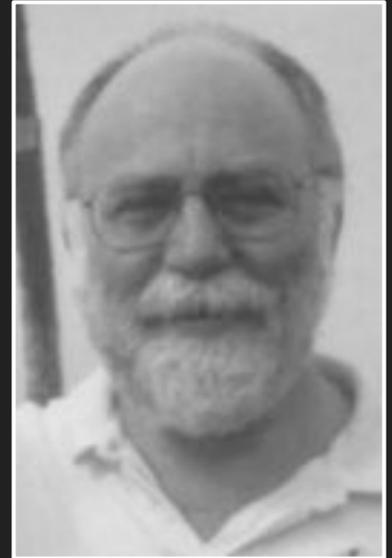
verifying MBR... Fix MBR:  
Partition 0: already exists  
Partition 1: already exists  
Partition 2: already exists  
Partition 3: already exists

verifying image... OK.  
== Executing kernel in 5 seconds - enter ^C to abort  
Load Address 0x00000000  
Image length 0x00e2f5d5  
Loading kernel binary...  
Read image signature... 1f 8b  
Decompressing image...



# Fallacies of Distributed Computing (1994)

1. The network is reliable.
2. Latency is zero.
3. Bandwidth is infinite.
4. The network is secure.
5. Topology doesn't change.
6. There is one administrator.
7. Transport cost is zero.
8. The network is homogeneous.



**L Peter Deutsch**

# Programming the Network

*"There is no simultaneity at a distance."*

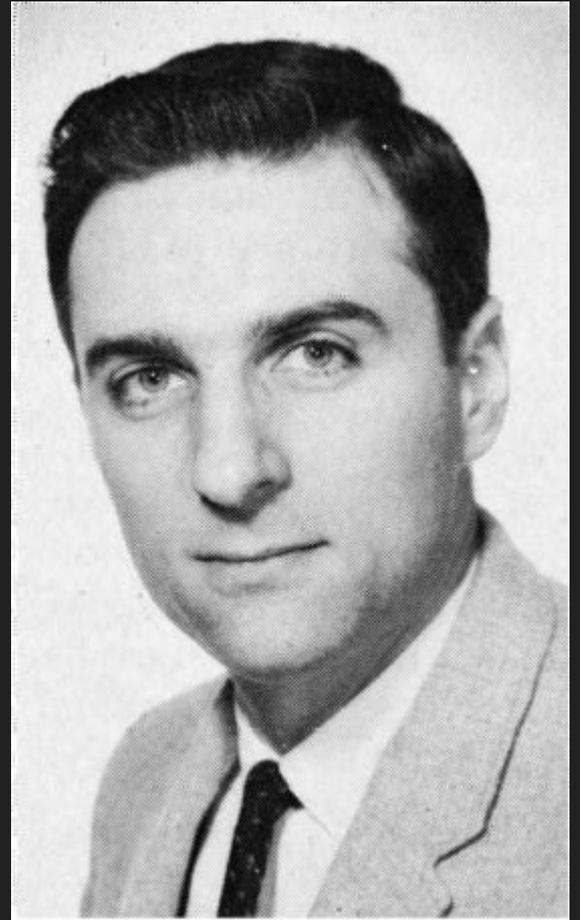
*-- Pat Helland (2005)*



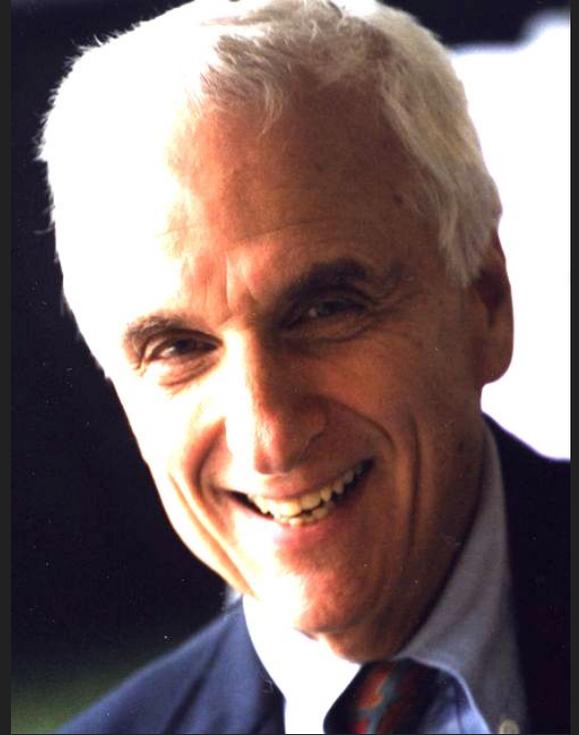
**Pat Helland**

*Communities*

*"How Committees Invent"*  
-- Mel Conway, 1967



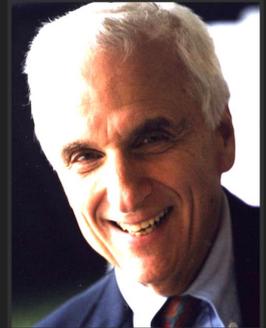
*"How Committees Invent"*  
-- Mel Conway, 1967



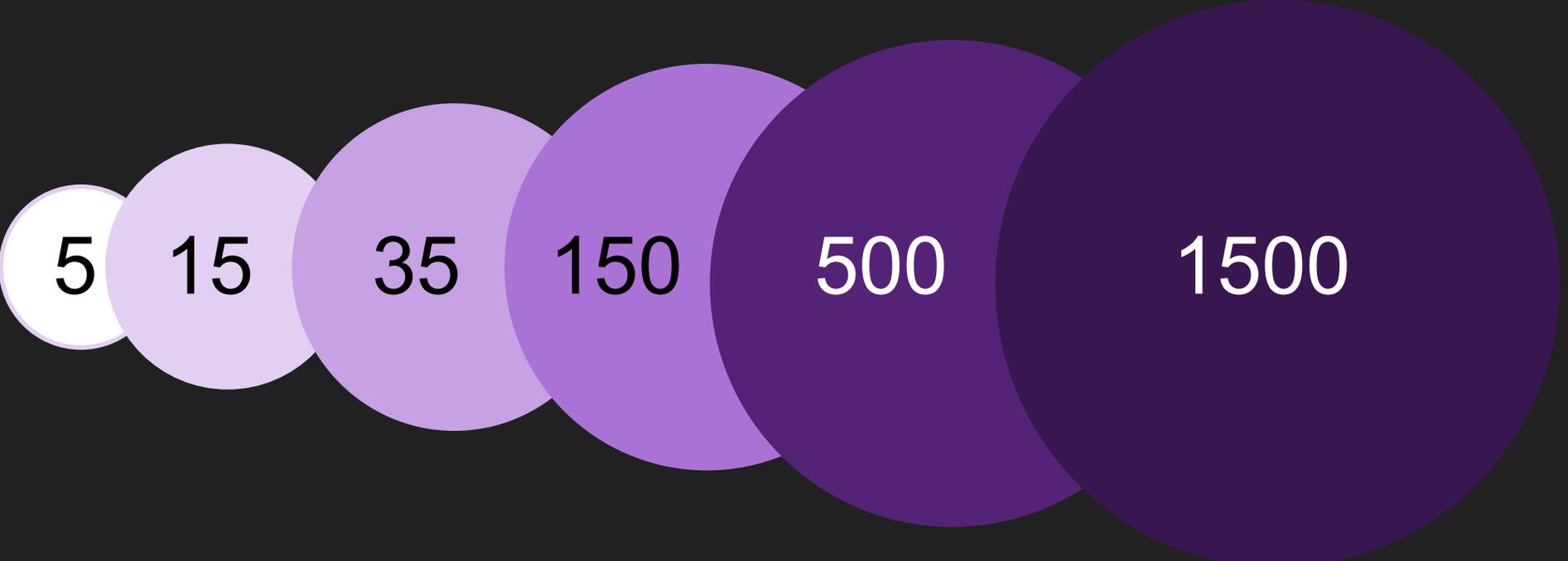
# Conway's Four Laws

- Communication dictates design
- There is never enough time to do it right, but there is always enough time to do it over.
- There is a homomorphism from the linear graph of a system to the linear graph of its design organization.
- Large systems tend to disintegrate during development, qualitatively more so than with small systems.

<http://www.melconway.com/Home/pdf/committees.pdf>



*Individuals*



5

15

35

150

500

1500

***Dunbar's Number***

[https://en.wikipedia.org/wiki/Dunbar%27s\\_number](https://en.wikipedia.org/wiki/Dunbar%27s_number)

# Dunbar Groups

Intimate friends: 5

Trusted friends: 15

Close friends: 35

Casual friends: 150

-- Robin Dunbar, 1992



# Kleiber's Law

Metabolic rate scales to the  $\frac{3}{4}$  power of the animal's mass

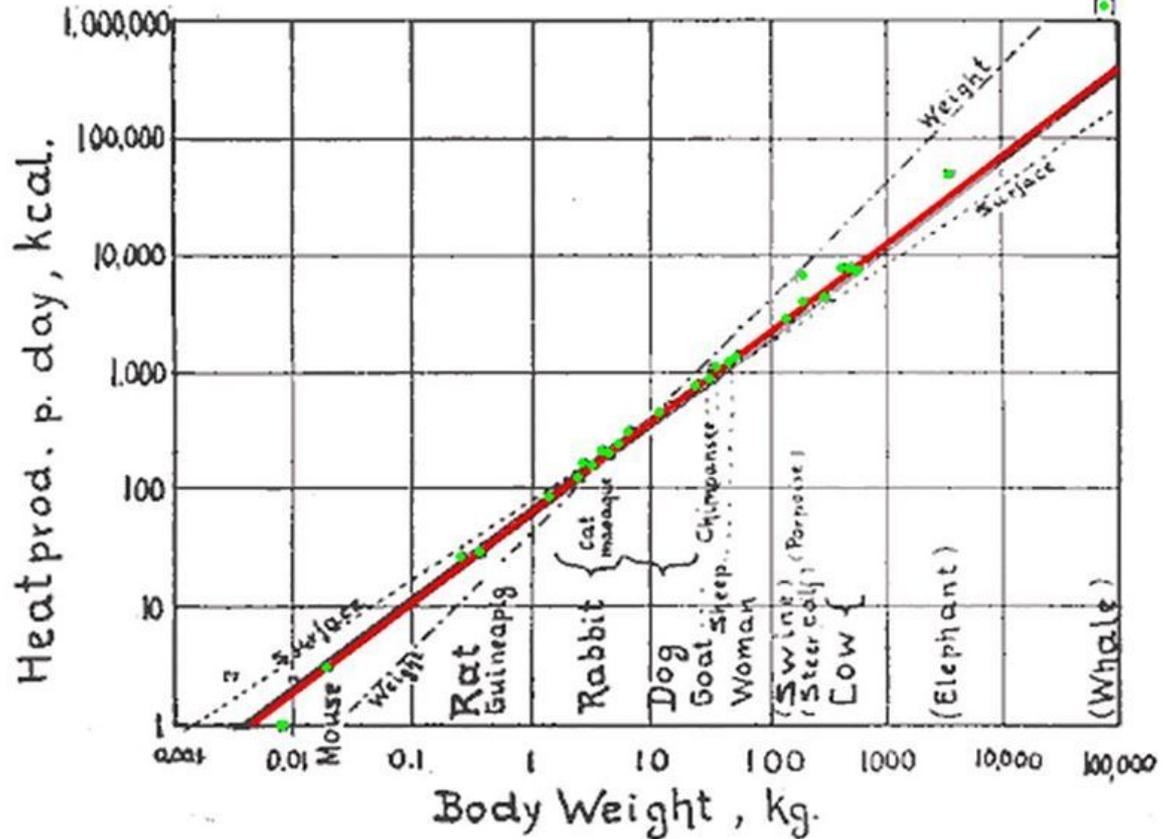
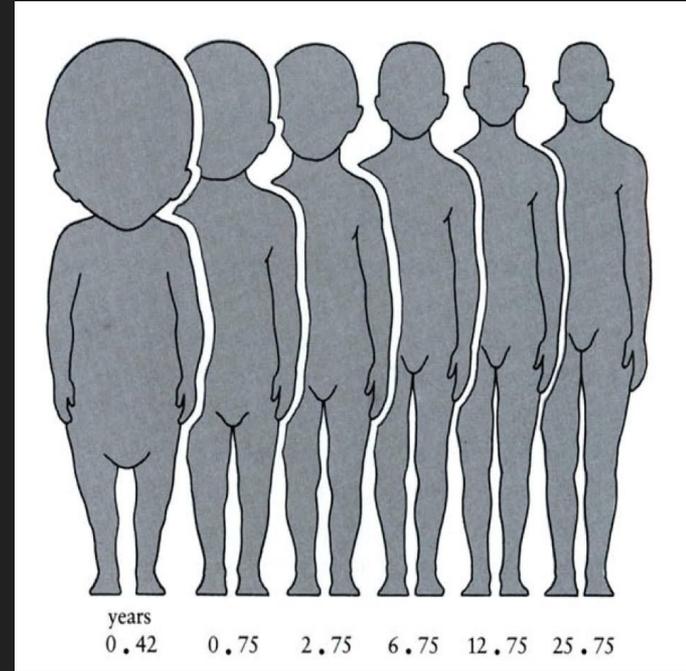


Fig. 1. Log. metabol. rate/log body weight

# Allometry

*"The study of the relationship of body size to shape, anatomy, physiology and finally behaviour."*



# Allometry

*"[W]hat I am adding to the picture is the link to fragility, how fragility is necessarily tied to scale."*

*-- Nassim Taleb*



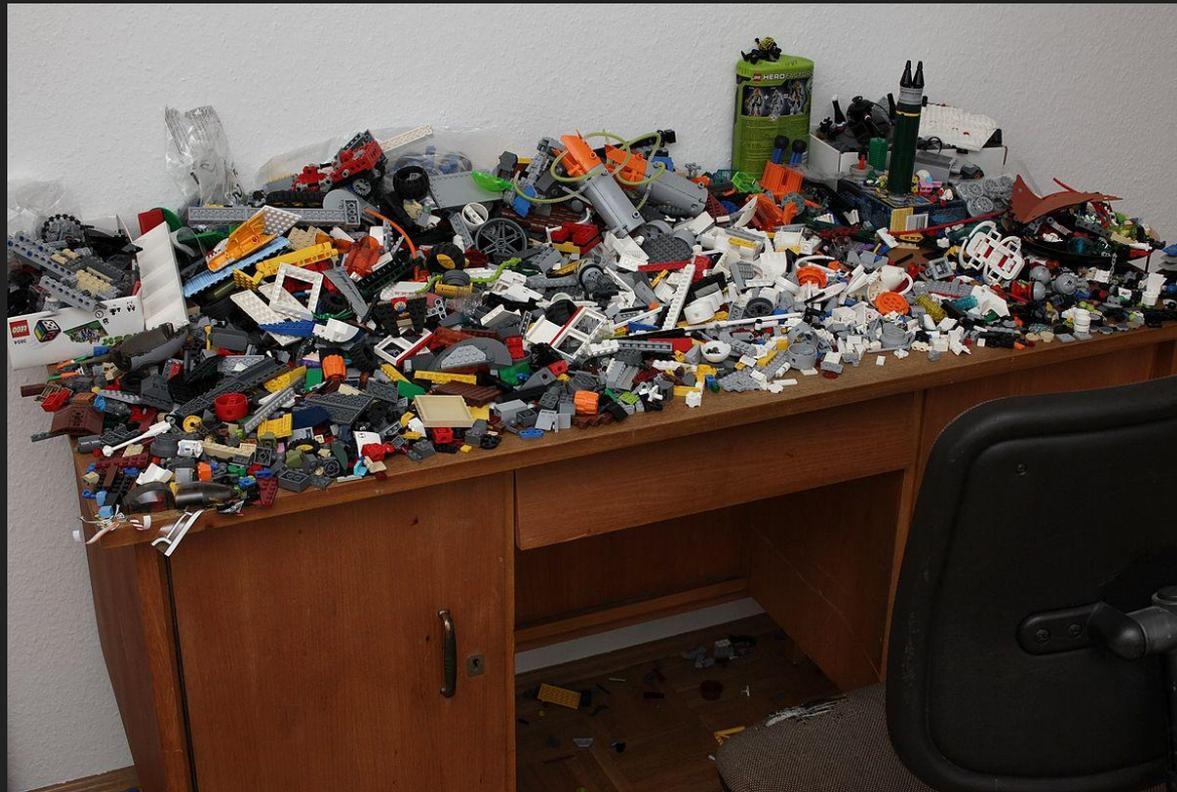
# Symptoms



**Symptom:** Any subjective evidence of disease. In contrast, a sign is objective. Blood coming out a nostril is a sign; it is apparent to the patient, physician, and others.

**Anxiety**, low back pain, and **fatigue** are all symptoms; only the patient can perceive them.

# Too Slow



# Too Slow

*"Data and services are stuck inside isolated applications within the enterprise."*

*-- Tung and Biltz, Accenture*



# Too Costly



# Too Costly

*"It is about renovating at the core, as opposed to getting rid of the core."*

*-- Hung LeHong, Gartner*



# Too Brittle/Unreliable

		COMPLEXITY				
		C1	C2	C3	C4	C5
SIZE	S1	100	250	400	550	700
	S2	175	325	475	625	775
	S3	250	400	550	700	850
	S4	325	475	625	775	625
	S5	400	550	700	850	1000

<https://www.infoq.com/articles/standish-chaos-2015>

# Too Brittle/Unreliable

*"Lower the risk of change through tools and culture."*

*-- John Allspaw, Etsy*



*Subjective*

# Infections



**Infection:** The invasion and multiplication of microorganisms such as bacteria, viruses, and parasites that are not normally present within the body. An infection may cause no symptoms and be subclinical, or it may cause symptoms and be clinically apparent. An infection may remain localized, or it may spread

# meme

/mēm/ 

*noun*

noun: **meme**; plural noun: **memes**

an element of a culture or system of behavior that may be considered to be passed from one individual to another by nongenetic means, especially imitation.

## Origin

GREEK

mimēma

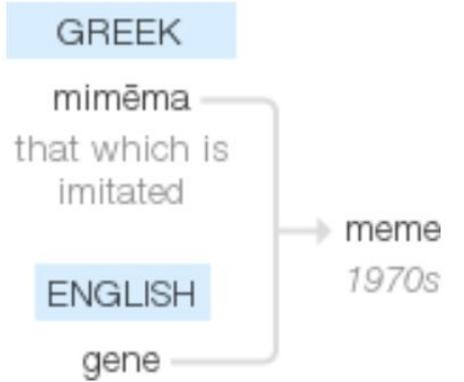
that which is  
imitated

ENGLISH

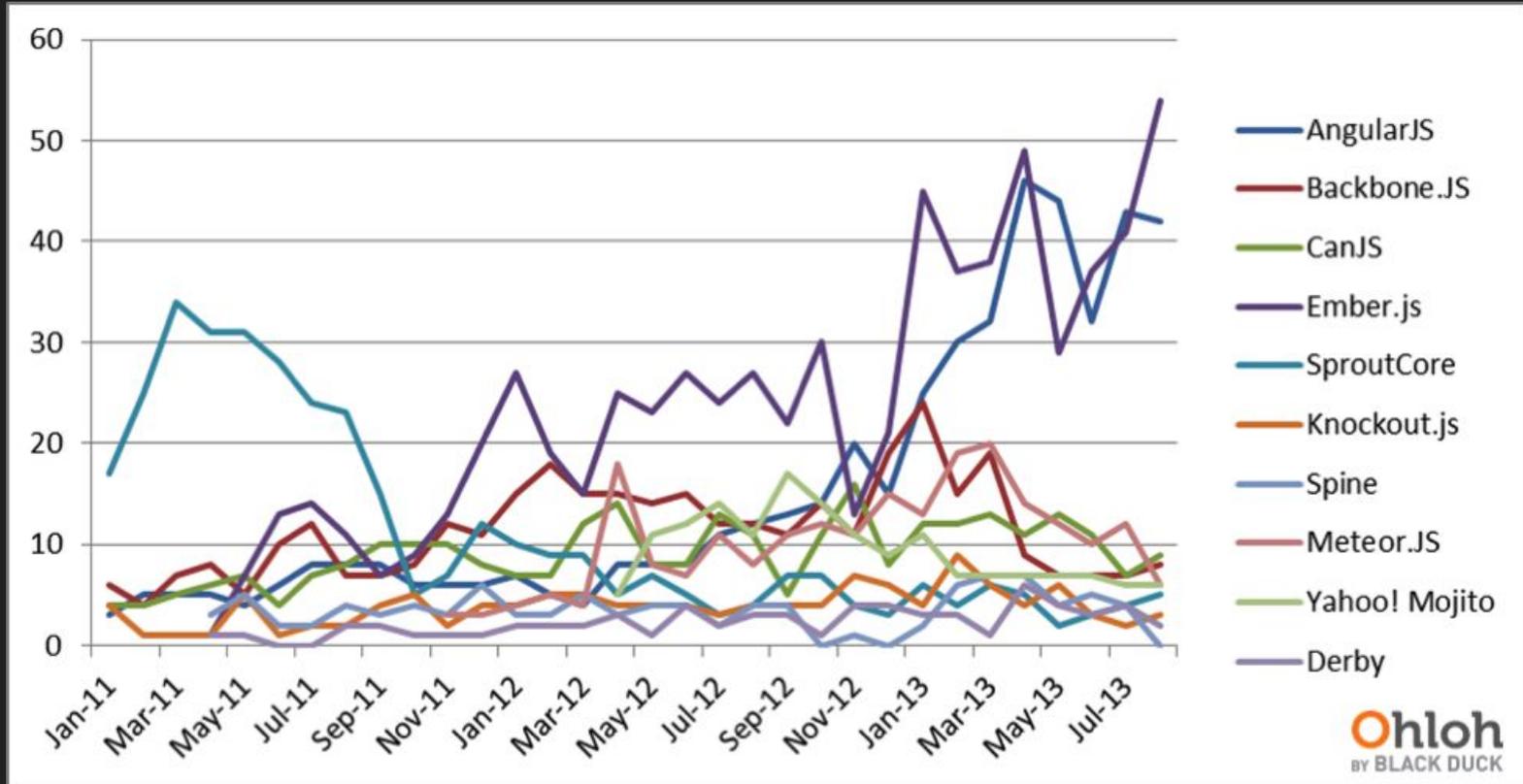
gene

meme

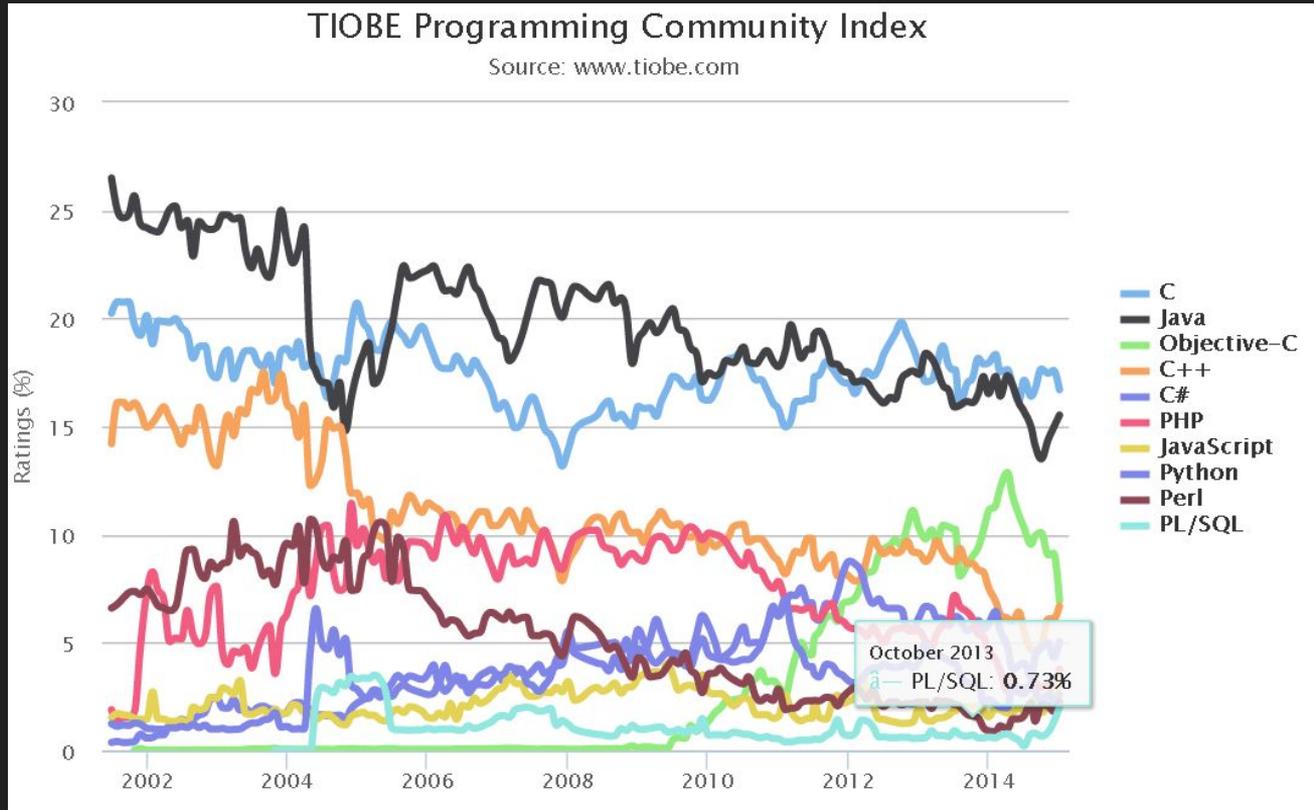
1970s



# Programming Memes

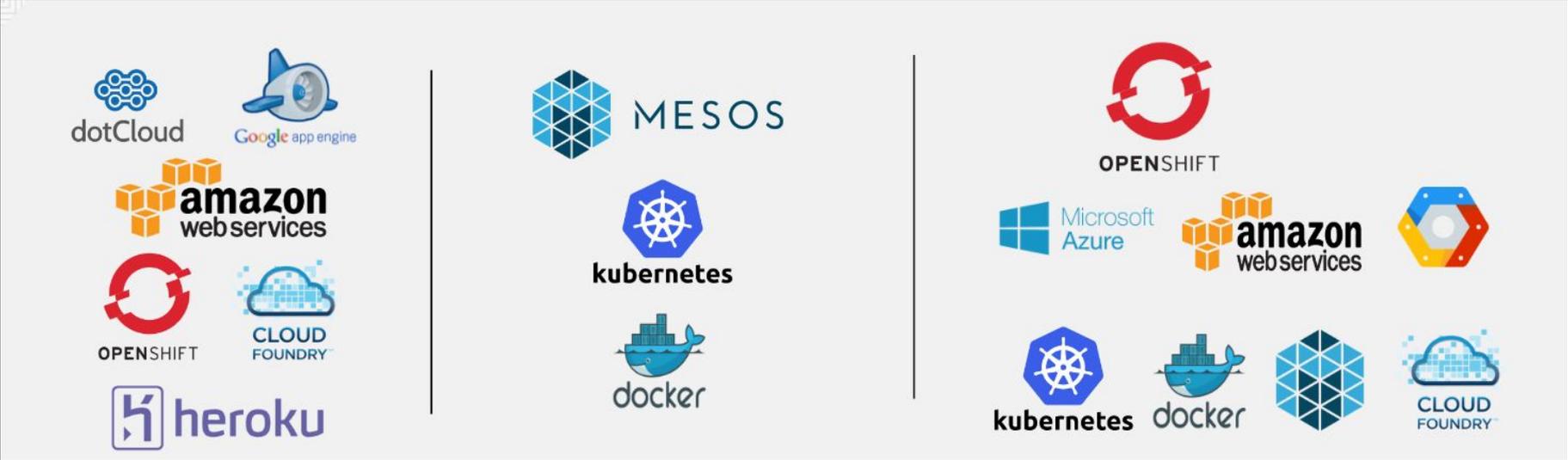


# Programming Memes





# Infrastructure Memes



<https://blog.openshift.com/open-service-broker-api-platform-evolution/>

# System Control Memes

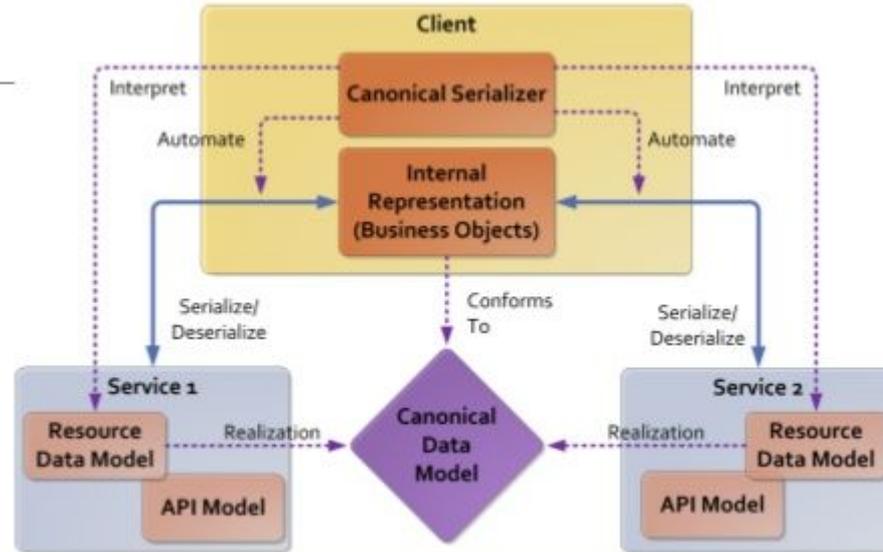
## Canonical Serializer

**No DTOs**, no need to code transformations

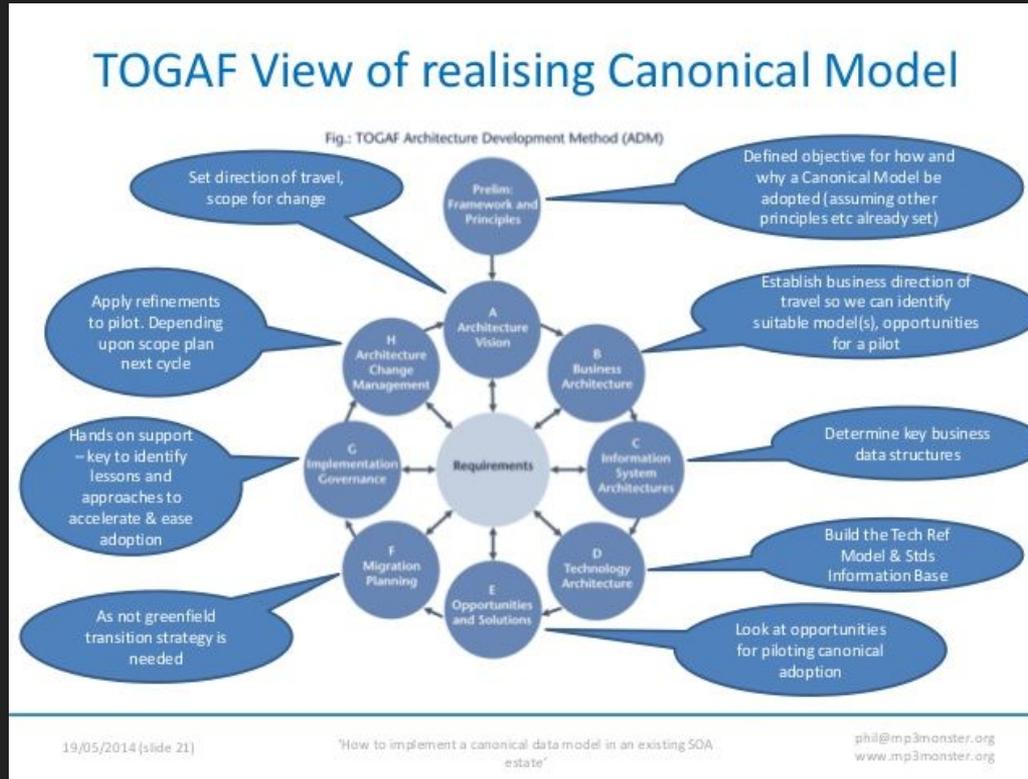
**Single object graph** serialized to multiple RDMs, message formats.

**Canonical classes/interfaces** can be used as business objects.

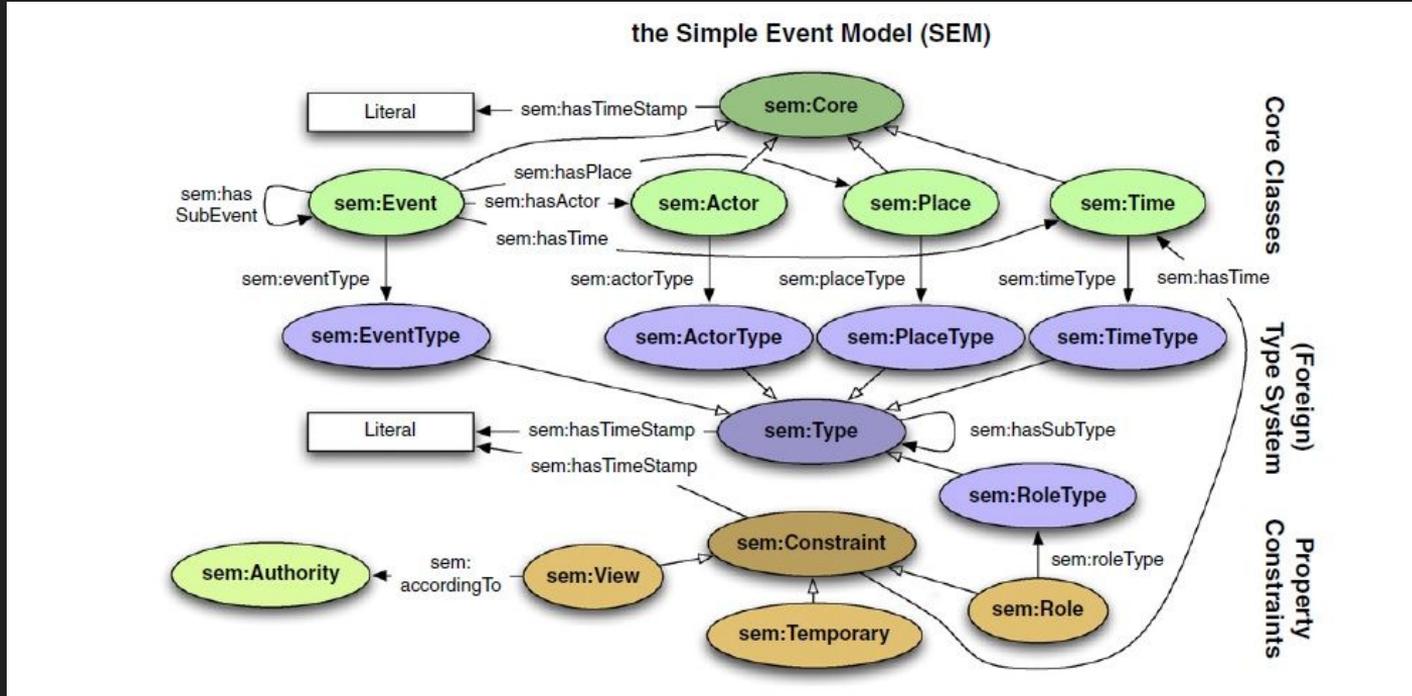
**Flexibility:** pluggable formats for canonical model, RDM, object graph and media type.



# System Control Memes

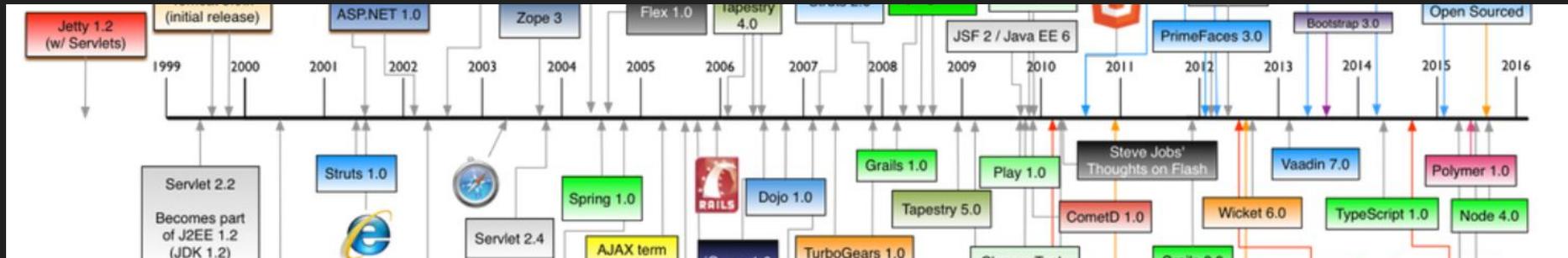


# System Control Memes



# Memes

- They're powerful
- They can evolve
- They may be beneficial for a time
- They may outlive their usefulness
- They may never go away



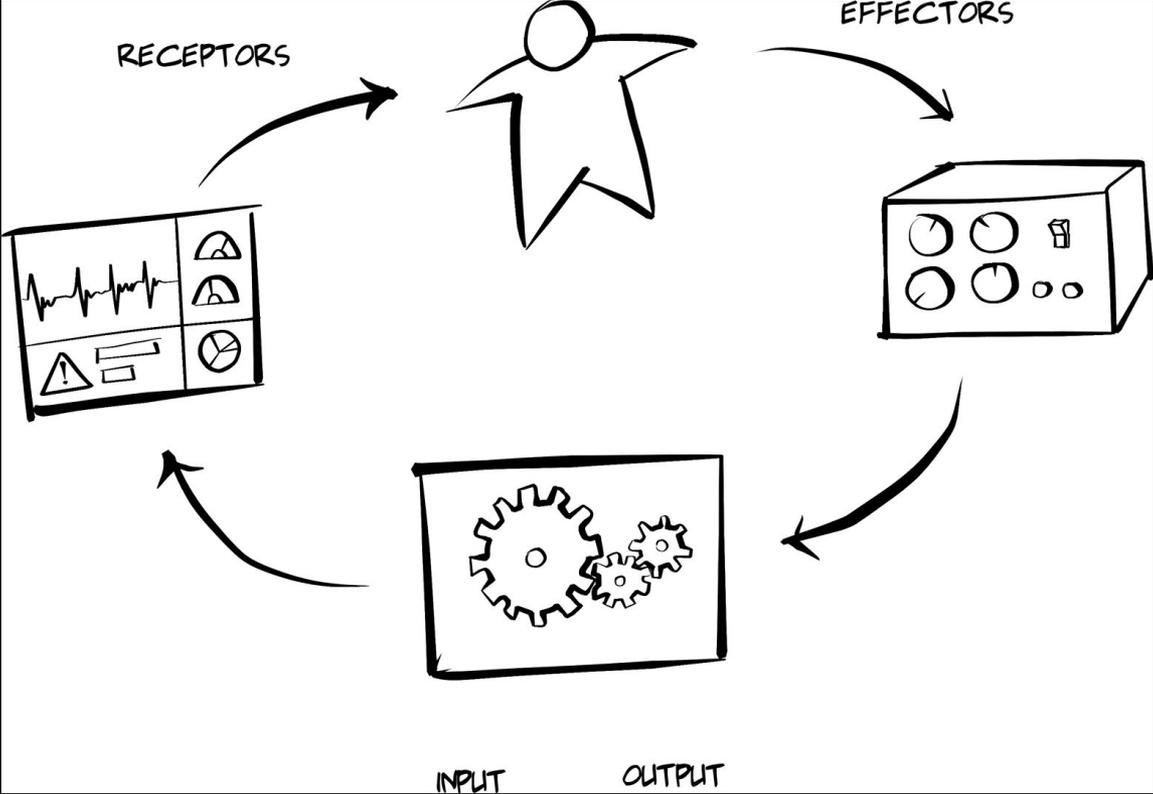
# Long-Term Cures



- Cure:** 1. To heal, to make well, to restore to good health. 2. A time without recurrence of a disease so that the risk of recurrence is small.
3. Particularly in the past, a course of treatment. For example, take a cure at a spa.

The word cure comes from the Latin cura meaning care, concern or attention.

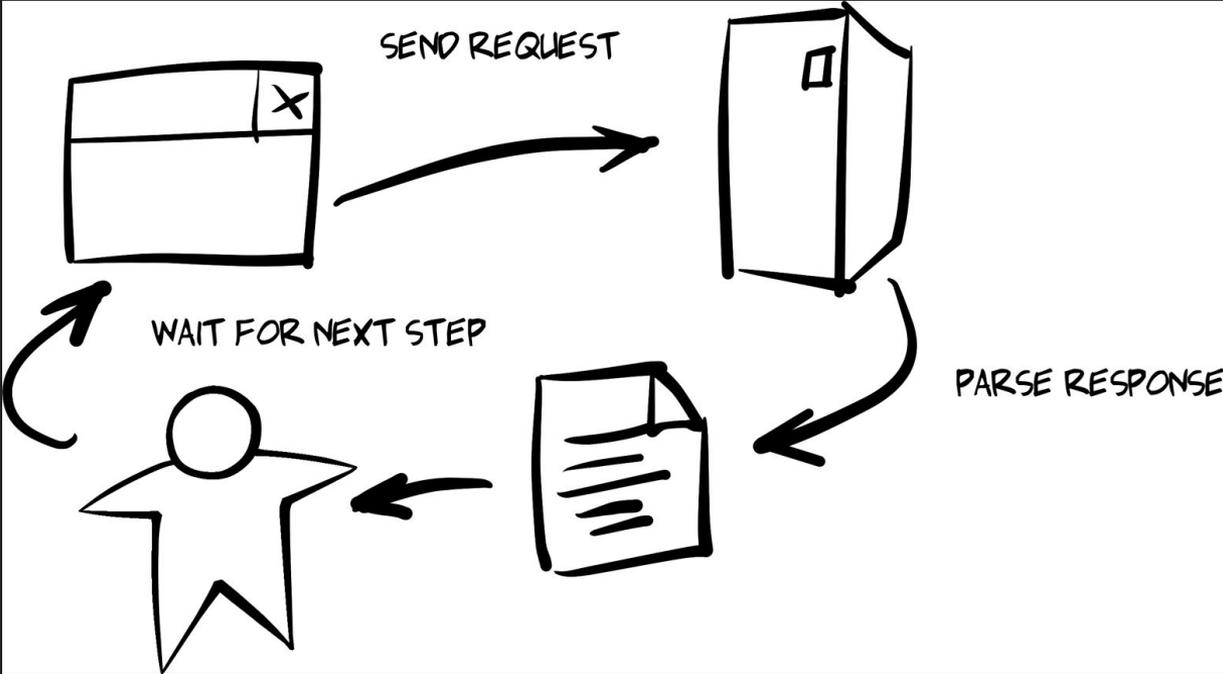
# Cycles as a guide

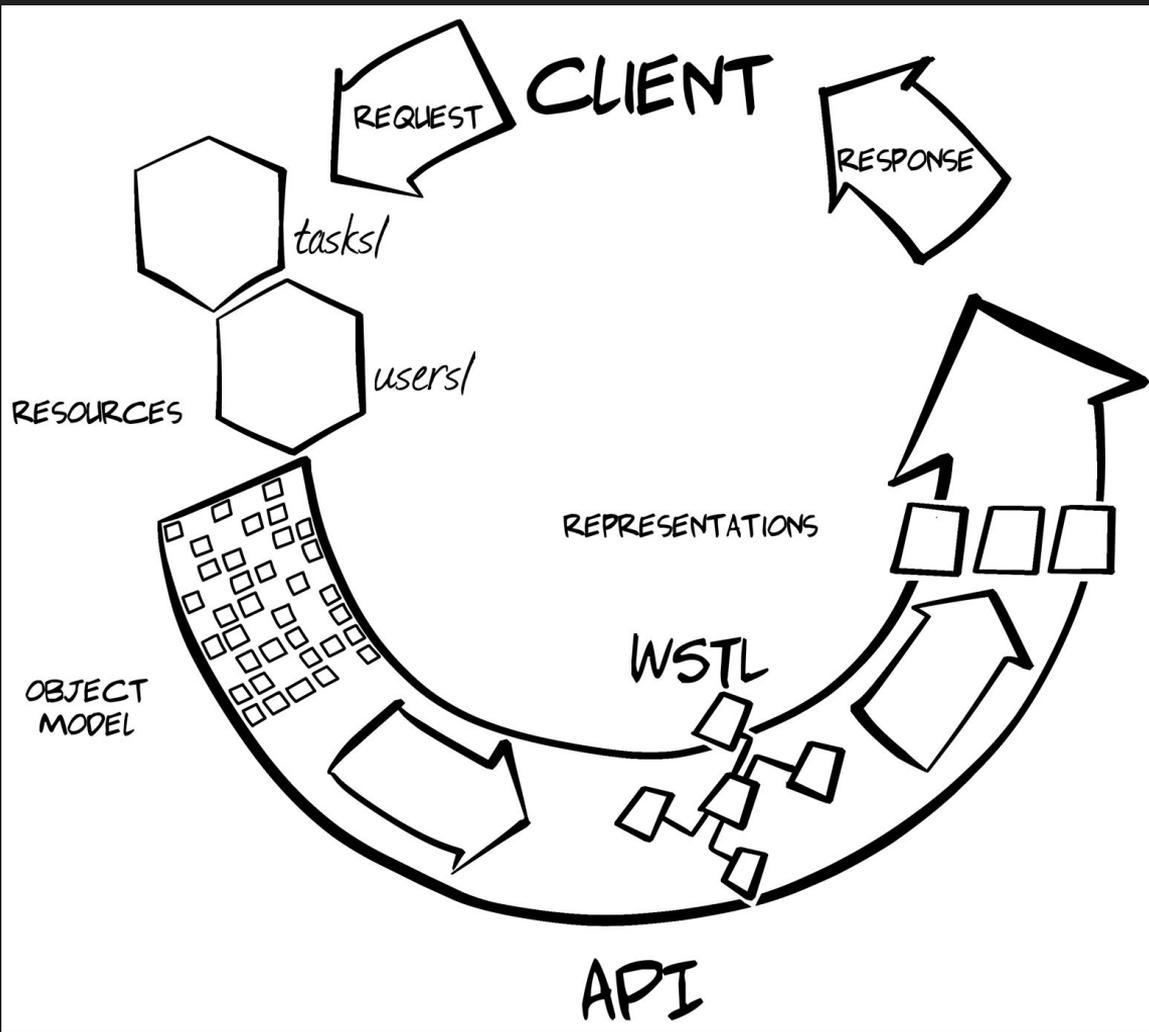


# Cycles as a guide

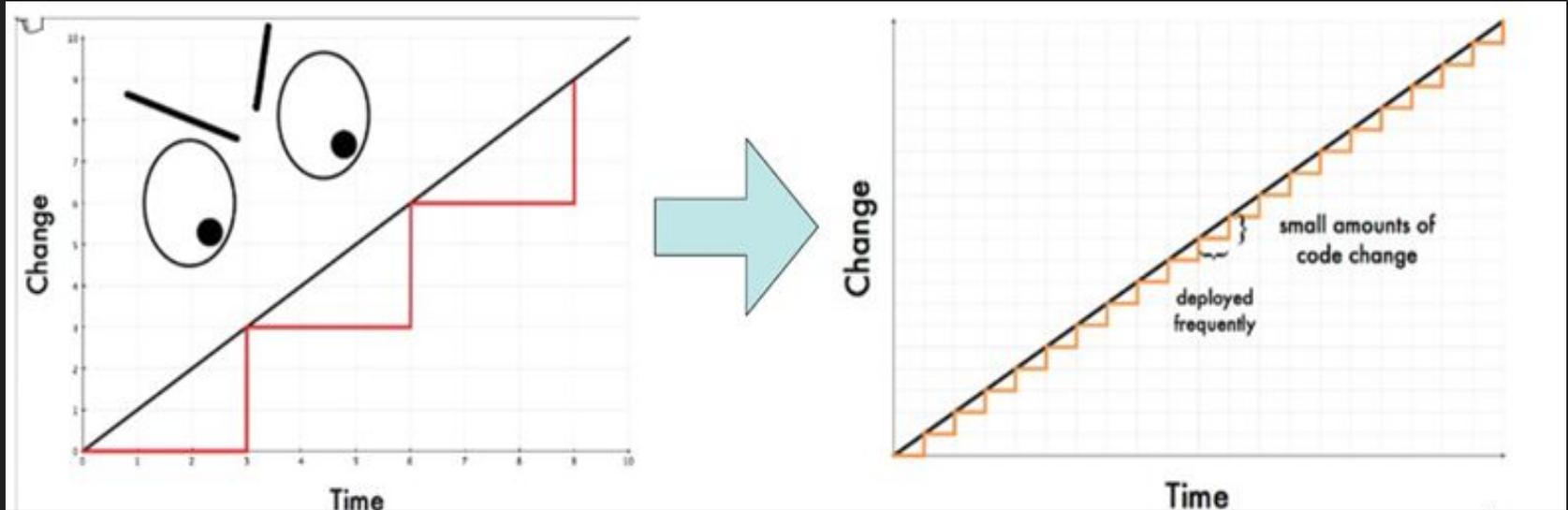


# Cycles as a guide





# Incremental/Validate-able



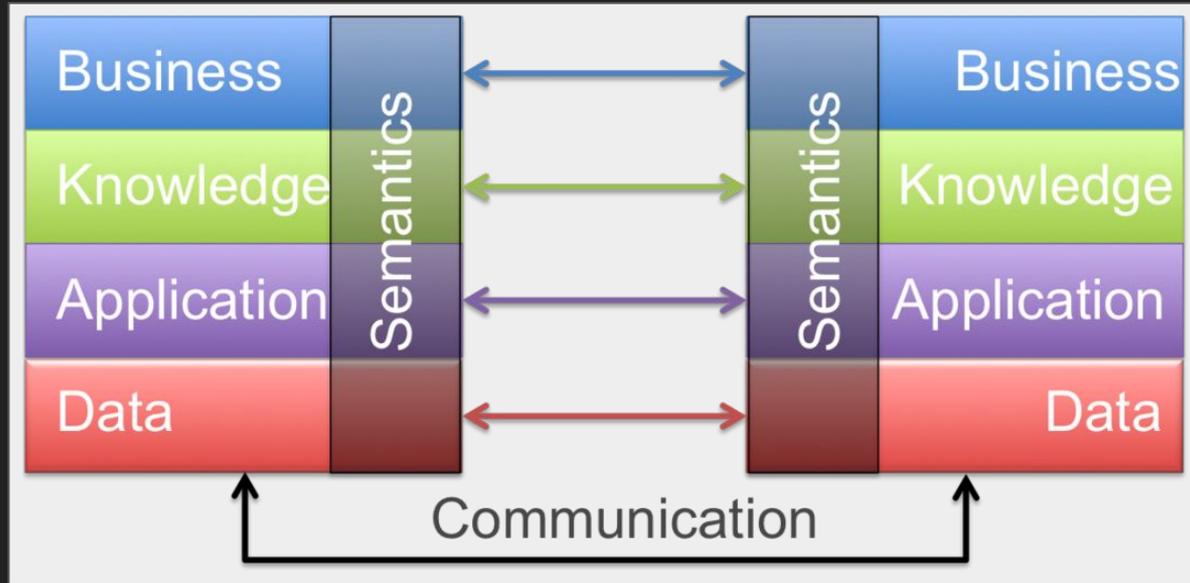
# Incremental/Validate-able

*"Incremental change may just be **the next big thing** this decade."*

*-- Sandeep Kishore, HCL Technologies*



# Eco-systems



# Eco-systems

*"Interoperation is peer to peer. Integration is where a system is subsumed within another."*

*-- Michael Platt, Microsoft*



***Harmonizing Speed and Safety at Scale***



***Harmonizing Speed and Safety at Scale***



***Harmonizing Speed and Safety at Scale***

So...



# Symptoms



# Symptoms

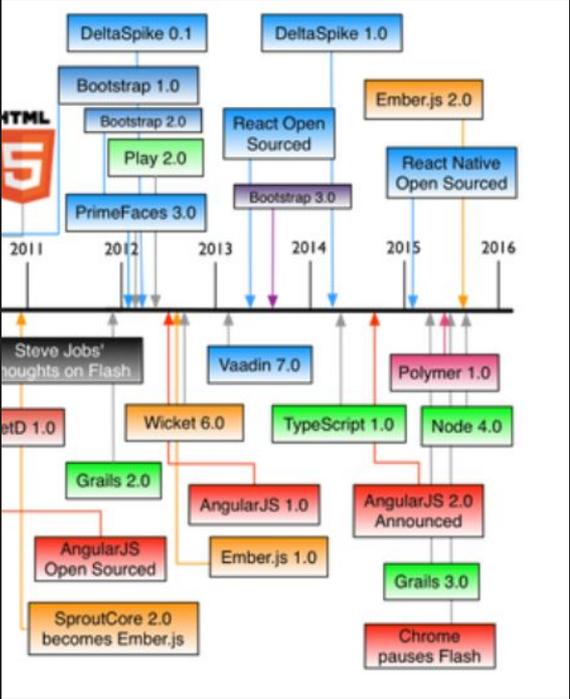


# Symptoms

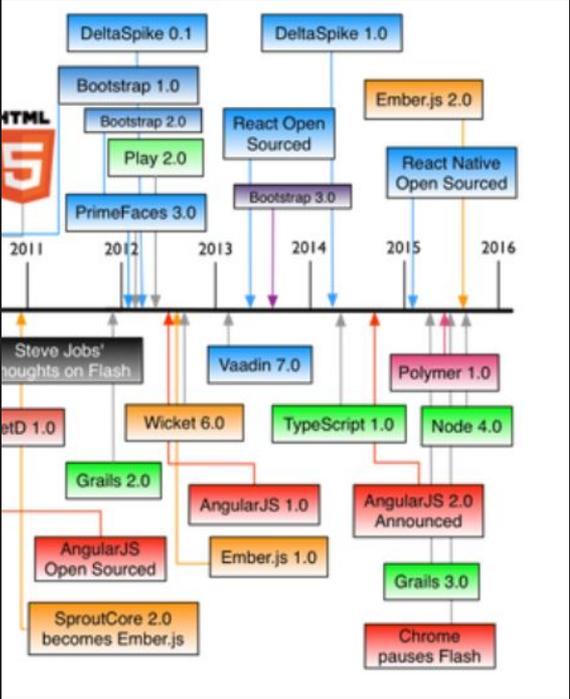


COMPLEXITY				
	C2	C3	C4	
0	250	400	550	700
5	325	475	625	775
0	400	550	700	850
5	475	625	775	850
0	550	700	850	1000

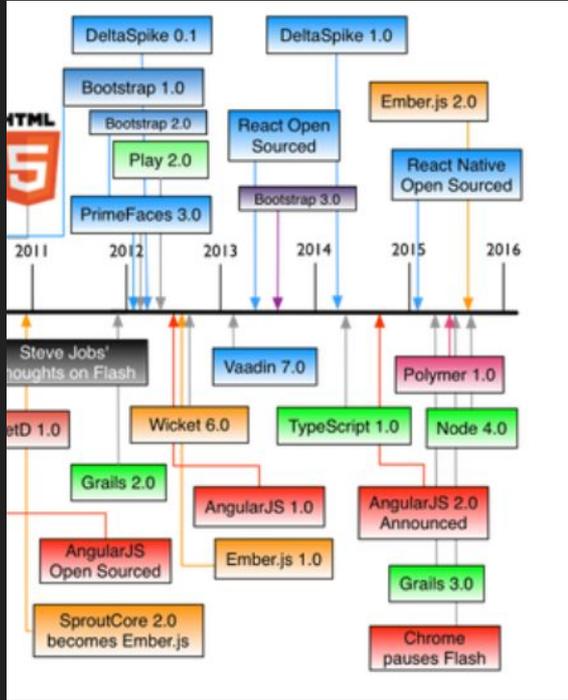
# Memes



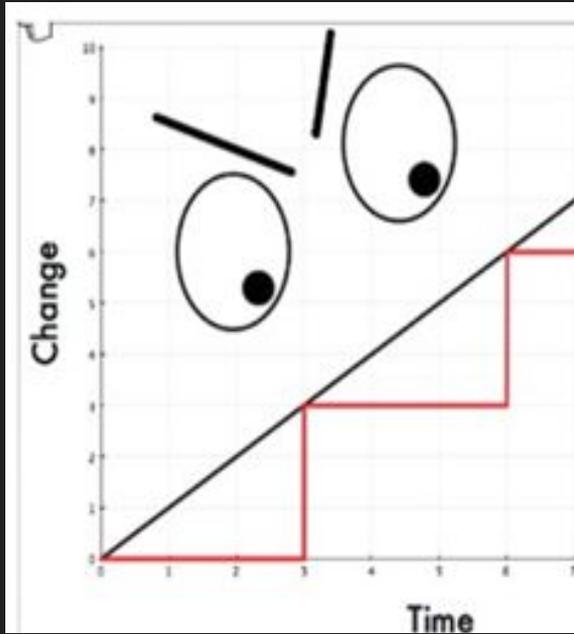
# Memes



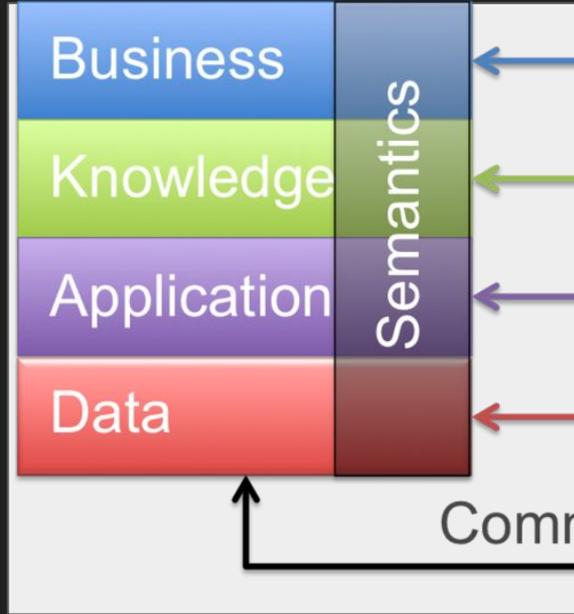
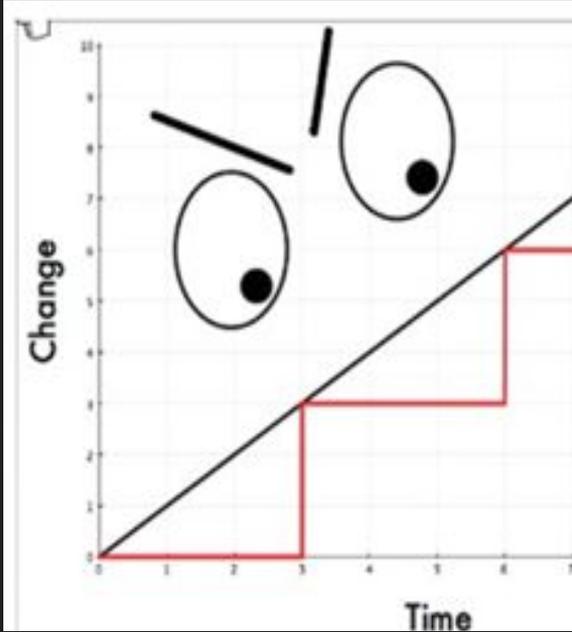
# Memes



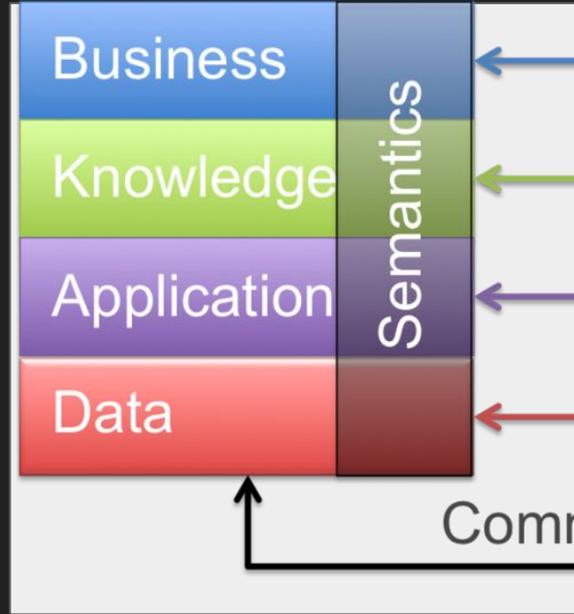
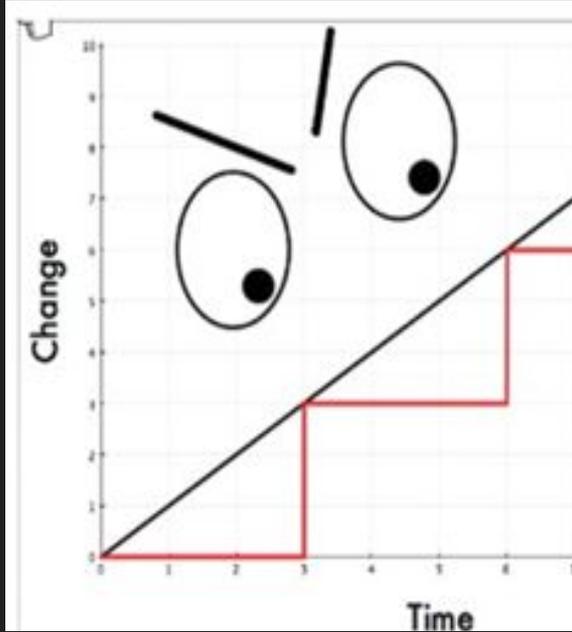
# Long-Term



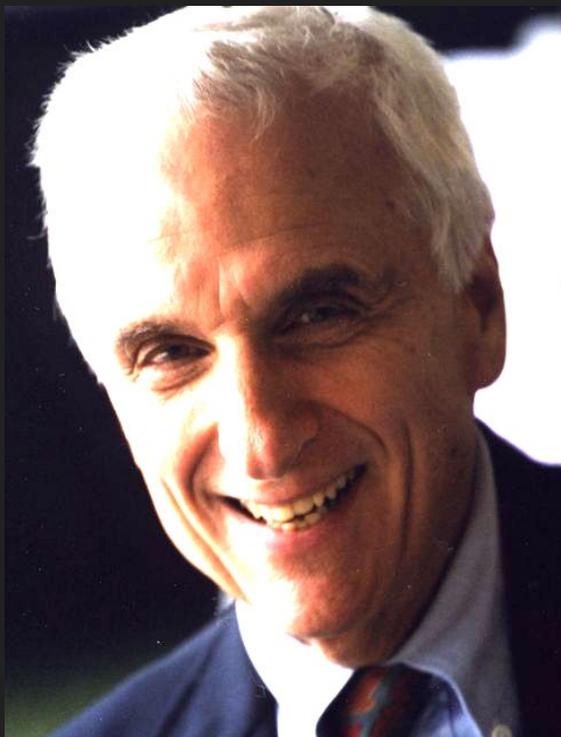
# Long-Term



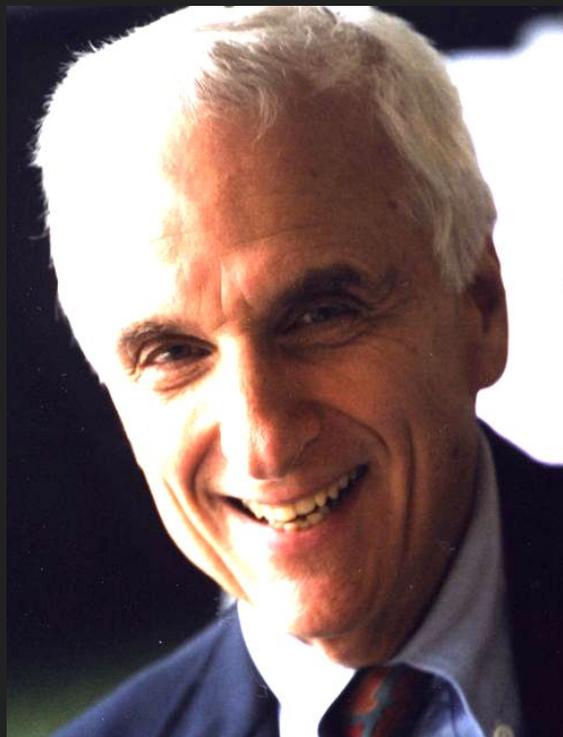
# Long-Term



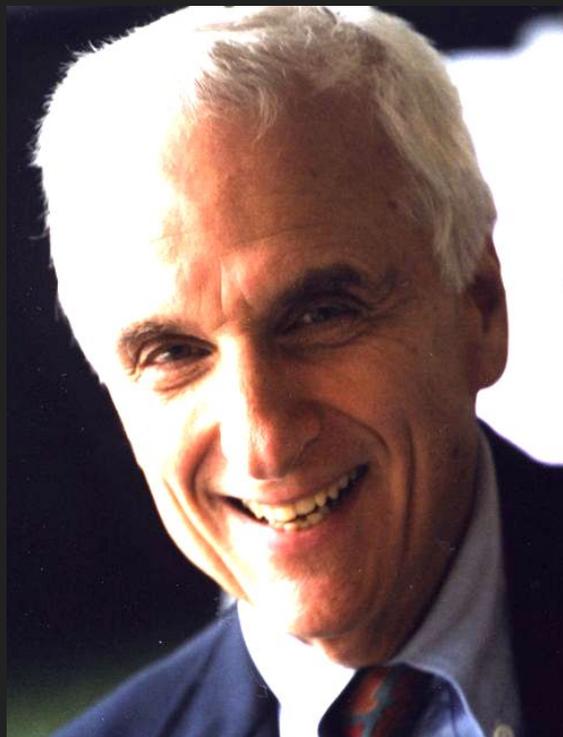
# Scaling



# Scaling



# Scaling



*"The best way to  
predict the future  
is to invent it."*

*-- Alan Kay*



"The  
pre

ay to  
the  
inve

Man Kay



*"The best software  
architecture 'knows' what  
changes often and makes that  
easy."*

*-- Paul Clements  
Carnegie-Mellon*



A wide-angle landscape photograph showing a dense forest of tall, green pine trees in the foreground and middle ground. The trees are mostly conifers, with some bare branches visible. In the distance, a valley or plain is visible, with a few buildings and more trees. The sky is a clear, pale blue. The word "Questions" is written in a large, white, sans-serif font, centered over the middle of the image.

Questions



# Scaling the Future

Mike Amundsen  
@mamund  
API Academy at CA