TWO SIGMA

Cloud Computing

Background and Key Concepts

Scott Rich
scott.rich@twosigma.com

April 2017

Agenda/Outline

Introduction - guest speakers from Two Sigma

Definition and history of Cloud Computing

Shared responsibility model
- IaaS, PaaS, SaaS

AWS emergence and market dominance

Netflix adoption use case

Cloud Native Services, e.g BigQuery

Guest Speakers

Scott Rich - Manager of Public Cloud:

- April 10 - “Background and Key Concepts of Cloud Computing”

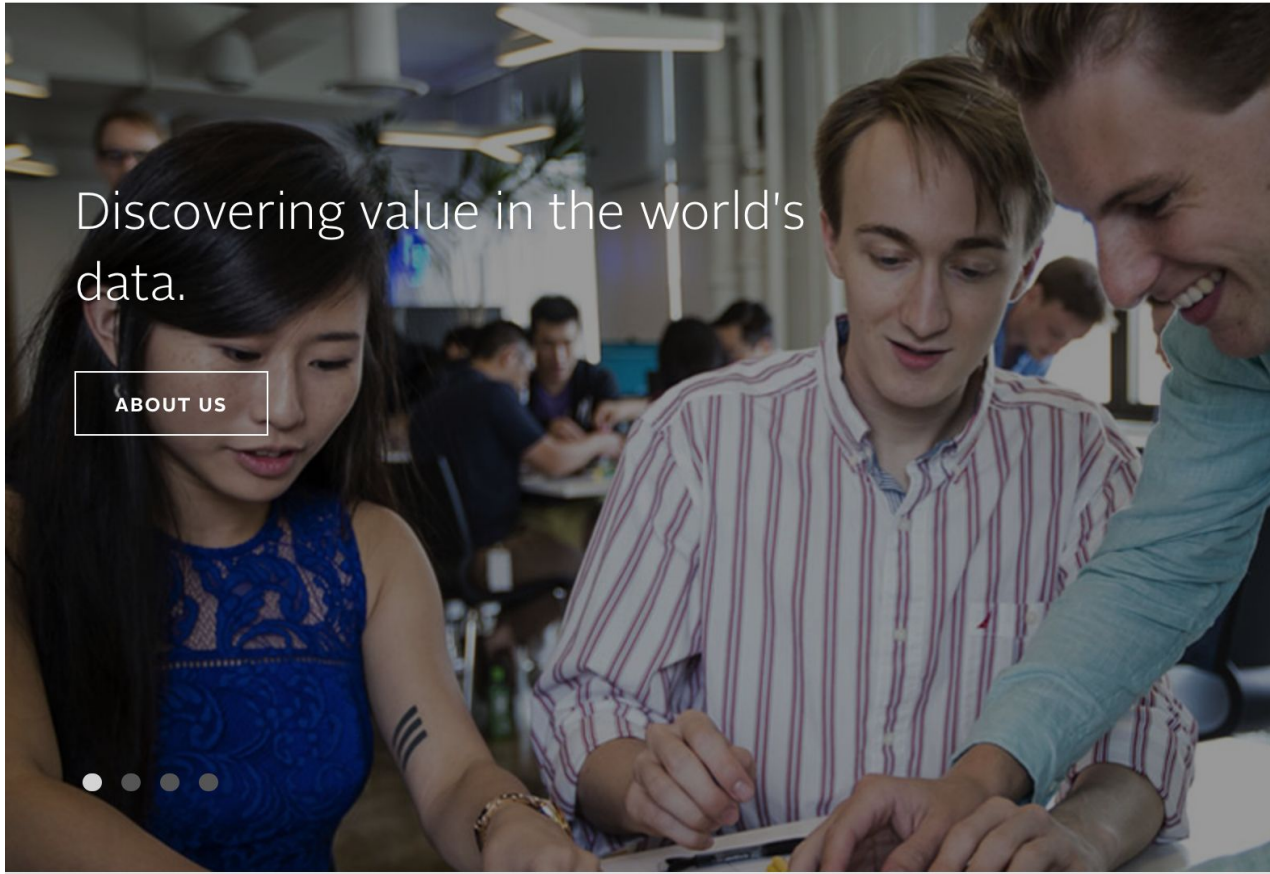
Graeme Dixon - Head of Insurance Engineering

- April 12 - “Best practices and practical experience in the Cloud”

David Palaitis - Modeling Compute Infrastructure

- April 17 - “Scheduling Work on Large Heterogeneous Compute Clusters”

About Two Sigma



Important Legal Information

The views expressed herein are not necessarily the views of Two Sigma Investments, LP or any of its affiliates (collectively, “Two Sigma”). The information presented herein is only for informational and educational purposes and is not an offer to sell or the solicitation of an offer to buy any securities or other instruments. Additionally, the information is not intended to provide, and should not be relied upon for investment, accounting, legal or tax advice. Two Sigma makes no representations, express or implied, regarding the accuracy or completeness of this information, and you accept all risks in relying on the above information for any purpose whatsoever.

About Me

27 years at IBM, in RTP, Rome, and Zurich, building developer tools and working on IBM's Bluemix Cloud

Founding member of the IBM Eclipse team

Started Two Sigma's Public Cloud effort two years ago

From one pilot project to ~1 Data Center on Public Cloud in 2 years

What is Cloud Computing? And where did it come from?

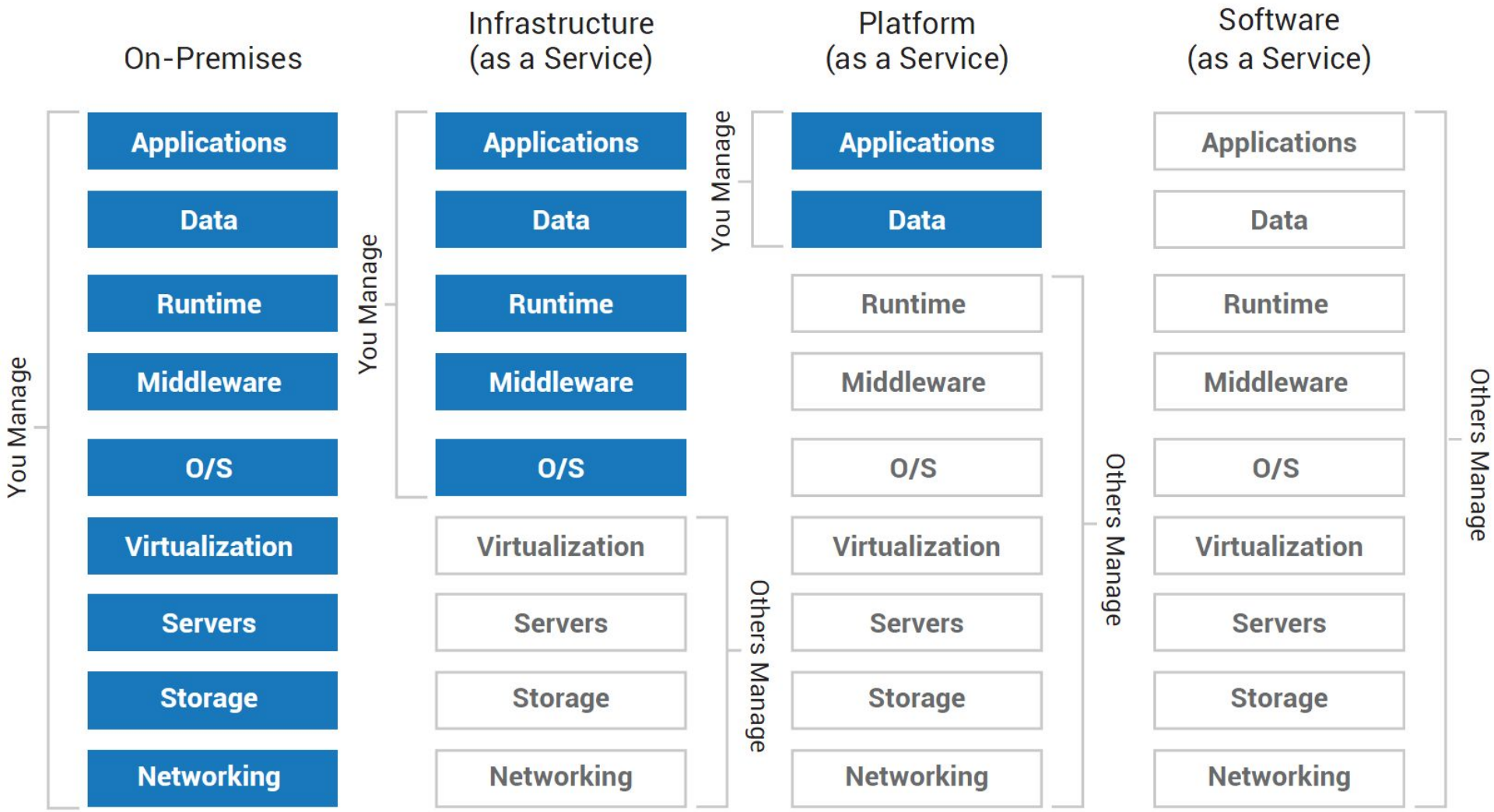
Essential characteristics from NIST(2011):

On-demand self-service.
Broad network access.
Resource pooling.
Rapid elasticity.
Measured service.

What is Cloud Computing? And where did it come from?

The ACM paper picks up on a really crucial detail:

“Finally, organizations that perform batch analytics can use the "cost associativity" of cloud computing to finish computations faster: using 1,000 EC2 machines for one hour costs the same as using one machine for 1,000 hours.”


On-Premises
Infrastructure (as a Service)
Platform (as a Service)
Software (as a Service)
You Manage
Applications
Data
Runtime
Middleware
O/S
Virtualization
Servers
Storage
Networking
You Manage
Applications
Data
Runtime
Middleware
O/S
Virtualization
Servers
Storage
Networking
Others Manage
You Manage
Applications
Data
Runtime
Middleware
O/S
Virtualization
Servers
Storage
Networking
Others Manage
Applications
Data
Runtime
Middleware
O/S
Virtualization
Servers
Storage
Networking
Others Manage

I love this sticker by Chris Watterston

About those computers...

It's true, stuff happens. But they've got lots of computers. If one breaks, you can get another with an API call.

And if you don't like this guy's computer, it's not that hard to move to someone else's.

They're really good at operating thousands of computers. Better than you.

They're very likely better at securing a large network of computers than you are.

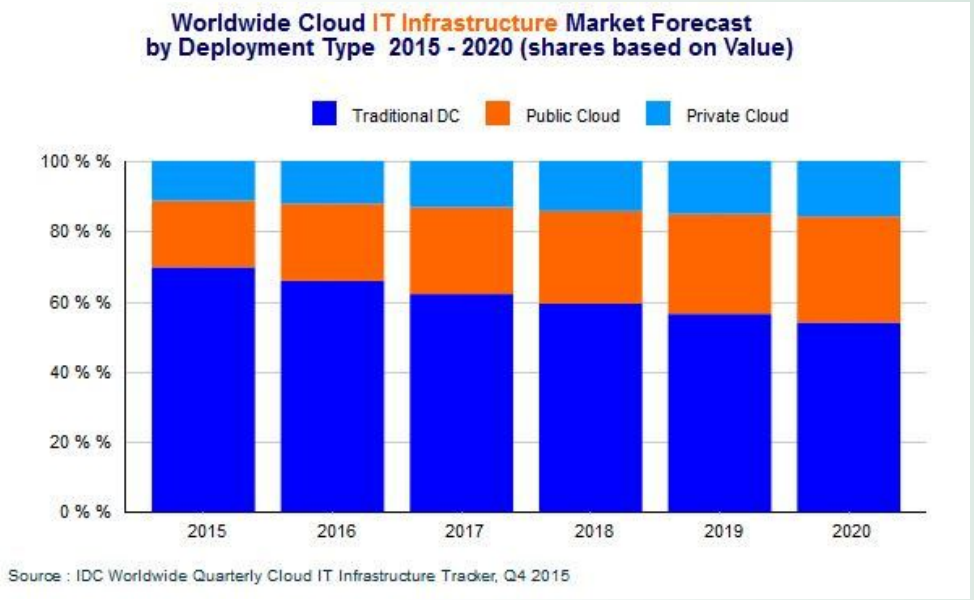
Why now?

Now: It's clear we've reached mainstream acceptance for Cloud Computing.

Mainframe->mini-computers-> client/server->Web->Cloud

Why?

- Time -> trust
- AWS success stories
- If you don't, your competitor will
- Gartner hype cycle



AWS Dominance of the Cloud (“IaaS” market)

AWS represents ~40% of the total IaaS/PaaS market
- The next ten competitors combine for the next 40%

AWS Origin story
- The fable of excess capacity is not true
- Traditional tech companies remained skeptical beyond 2010

IBM and Microsoft saw the Cloud as a threat to their existing enterprise businesses for way too long
- Margins on the Cloud are a paltry 25% compared to 80% on Enterprise software
- But margins on the Cloud are a massive 25% compared to the paltry 2% on online book sales!

Image source: Gartner

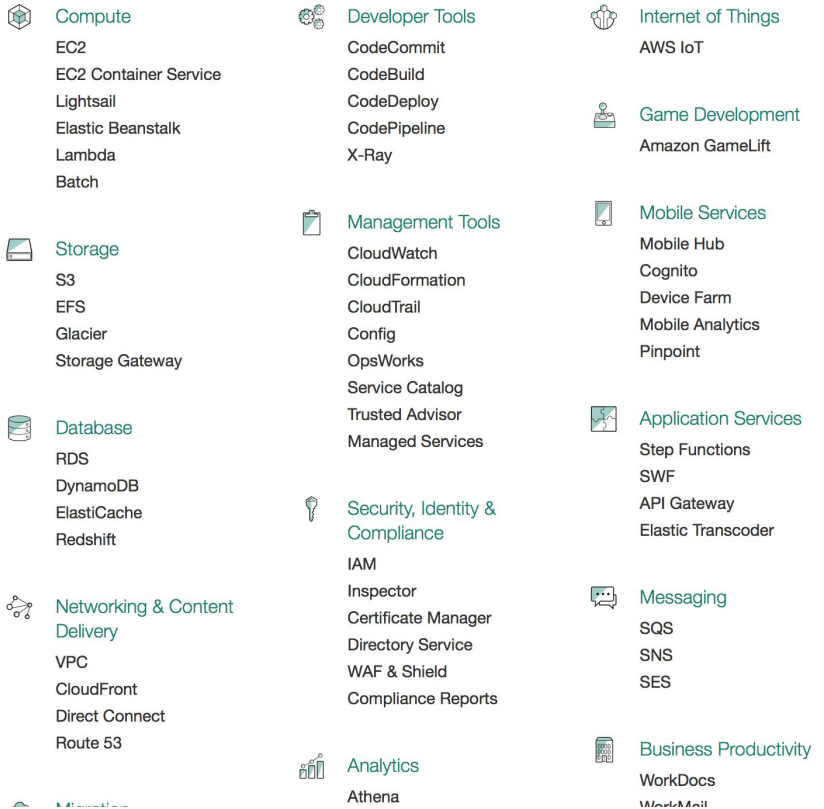
AWS Cloud Scope

Infrastructure Services

Amazon Elastic Compute Cloud
Amazon SimpleDB
Amazon Simple Storage Service
Amazon Simple Queue Service

AWS Premium Support

AWS “Console”
Circa 2007



AWS Console
today

How you buy in the Cloud

Most Cloud services are “pay for what you use” based on various usage metrics, e.g. machine hours, storage TB hours, TB queried

Ideally, you rent what you need and then turn it off. You can rent fractional machines.

At AWS, for example, you can buy the same VM capacity in three different ways:

- On demand - full retail price, e.g. R3.8XLARGE =$2.66/hr
- Reserved - commit to a volume, earn a discount = $1.41/$0.93/hr
- Spot Instances! - bid for excess capacity, aim for $0.60/hr

Netflix Move to AWS

Reasons to move to the Cloud:

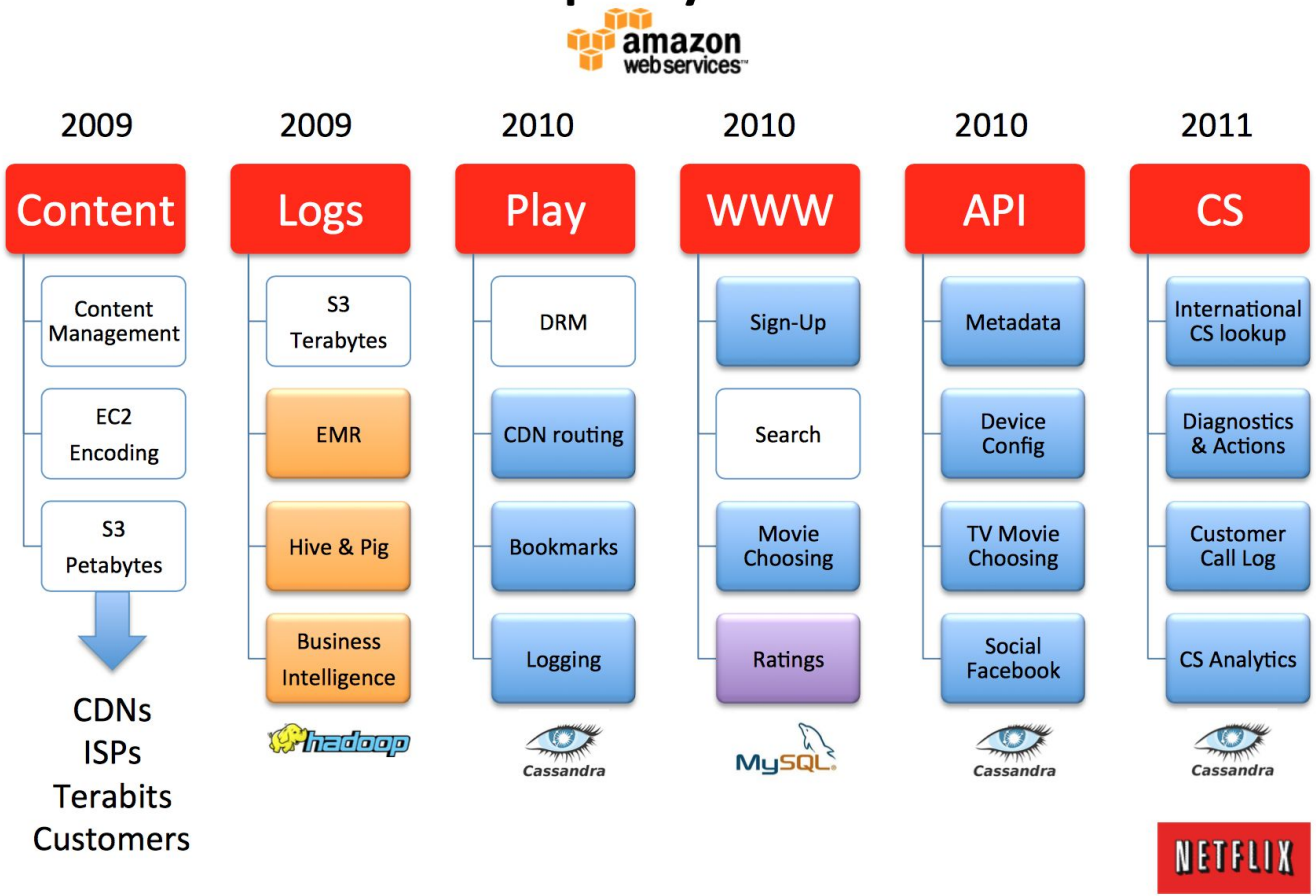
- Low cost of entry
- Cost savings/focus
- Elasticity
- Developer productivity and enjoyment

Keeping up with Developer Trends

	In production at Netflix
• Big Data/Hadoop	2009
• AWS Cloud	2009
• Application Performance Management	2010
• Integrated DevOps Practices	2010
• Continuous Integration/Delivery	2010
• NoSQL	2010
• Platform as a Service; Fine grain SOA	2010
• Social coding, open development/github	2011

* From Adrian Cockcroft(Netflix) GotoCon 2012 presentation

Netflix Deployed on AWS



* From Adrian Cockcroft(Netflix) GotoCon 2012 presentation

So: “While you’re in there…”

1. Code for failure
2. Be resilient
3. Stateless middle tiers
4. Service-oriented architectures

Netflix Datacenter vs. Cloud Arch

Anti-Architecture	
Central SQL Database	Distributed Key/Value NoSQL
Sticky In-Memory Session	Shared Memcached Session
Chatty Protocols	Latency Tolerant Protocols
Tangled Service Interfaces	Layered Service Interfaces
Instrumented Code	Instrumented Service Patterns
Fat Complex Objects	Lightweight Serializable Objects
Components as Jar Files	Components as Services

NETFLIX

* From Adrian Cockcroft(Netflix) GotoCon 2012 presentation

Cloud Native Services (~SaaS)

High-value, but vendor-specific Services, such as:

- Big Database: Google BigQuery, AWS Athena and Aurora
- Deep/Machine Learning: Google Cloud ML, AWS Machine Learning, IBM Watson
- Vertical Deep Learning models-as-a-Service (Speech, video, sentiment)

Evaluate cost/benefit carefully

Pick an Open Source API to preserve portability, e.g. Apache Beam, Mesos, Kubernetes, SQL

BigQuery as the Ultimate Cloud Native Service

Insanely-scalable SQL Database in the sky

Pay as you go for storage and queries

Accessed by REST API, CLI, Jupyter notebook

Imagine operating your own Internet-scale distributed database

Benchmarking BigQuery

See http://tech.marksblogg.com/billion-nyc-taxi-rides-bigquery.html

1.1 billion taxi rides, 104GB data

Loaded in 24 minutes

Typical queries run in ~2 seconds: “select count of all rides grouped by taxi type”

This obviously justifies paying some premium and accepting some degree of lock-in

Conclusion

Public Cloud Computing is emerging as the primary model for computing going forward.

AWS is the dominant provider, but has good competition.

Decide what your goals are for adoption, and be strategic about it.

Be intentional about the trade-offs you make.

Enjoy Graeme and David’s talks...


Thank you!


Backup/Reference

Suggested reading

- A View of Cloud Computing
  - http://cacm.acm.org/magazines/2010/4/81493-a-view-of-cloud-computing/fulltext
- NIST definition of Cloud Computing - 2011
  - http://nvlpubs.nist.gov/nistpubs/Legacy/SP/nistspecialpublication800-145.pdf
- The origin of Amazon Web Services:
  - https://blog.hackerrank.com/how-amazon-web-services-surged-out-of-nowhere/
- Netflix migration story (GOTO 2012 • Globally Distributed Cloud Application at Netflix • Adrian Cockcroft)
  - https://www.youtube.com/watch?v=Mn0_Xmw4rQs
  - http://gotocon.com/dl/goto-aar-2012/slides/AdrianCockcroft_GloballyDistributedCloudApplicationsAtNetflix.pdf