

Tackling complexity in giant systems

Approaches at Google, Microsoft, Amazon, Netflix & VMware

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accenture



AOL



Google

vmware



Microsoft



French

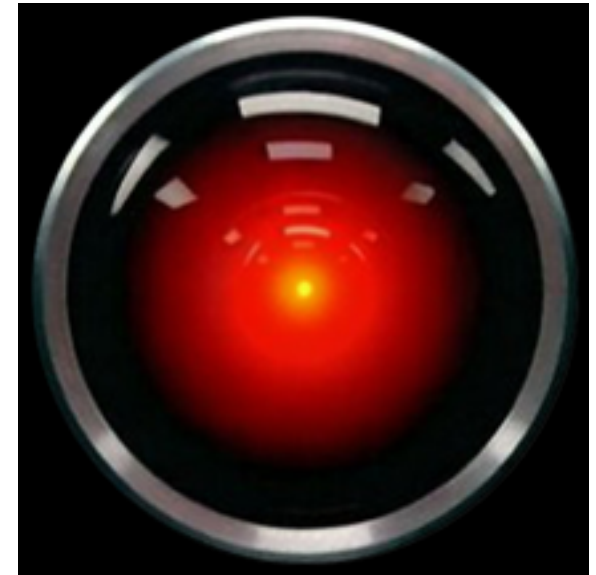
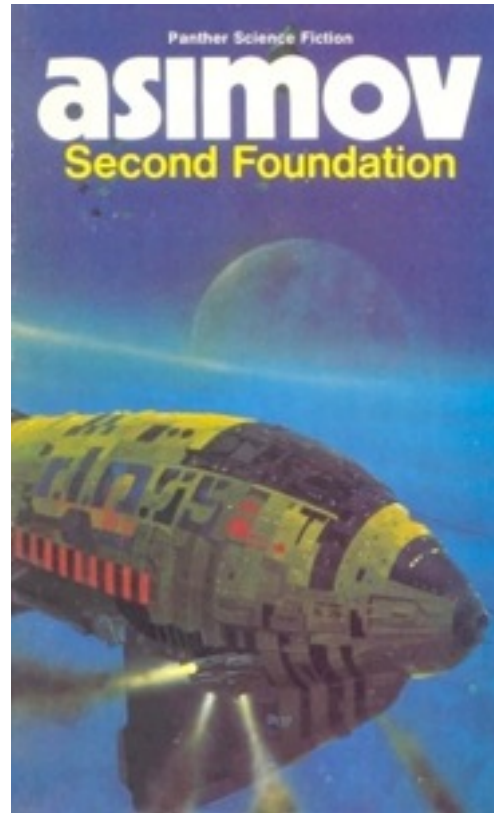
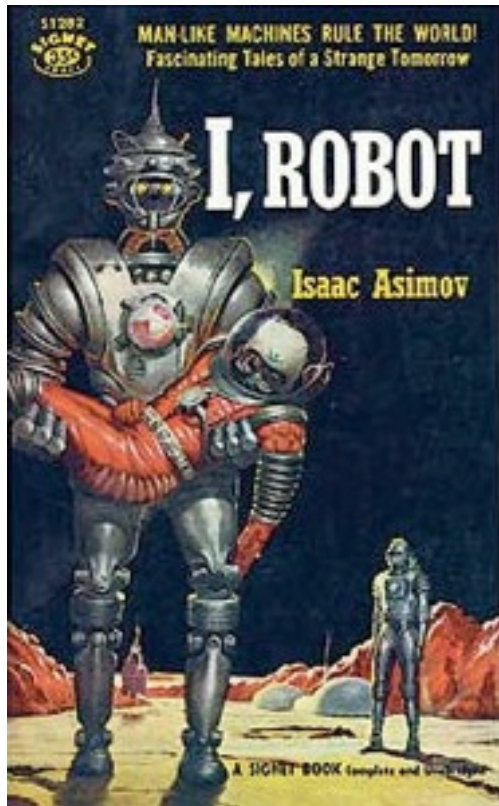
Polyglot

Server Side

San Francisco

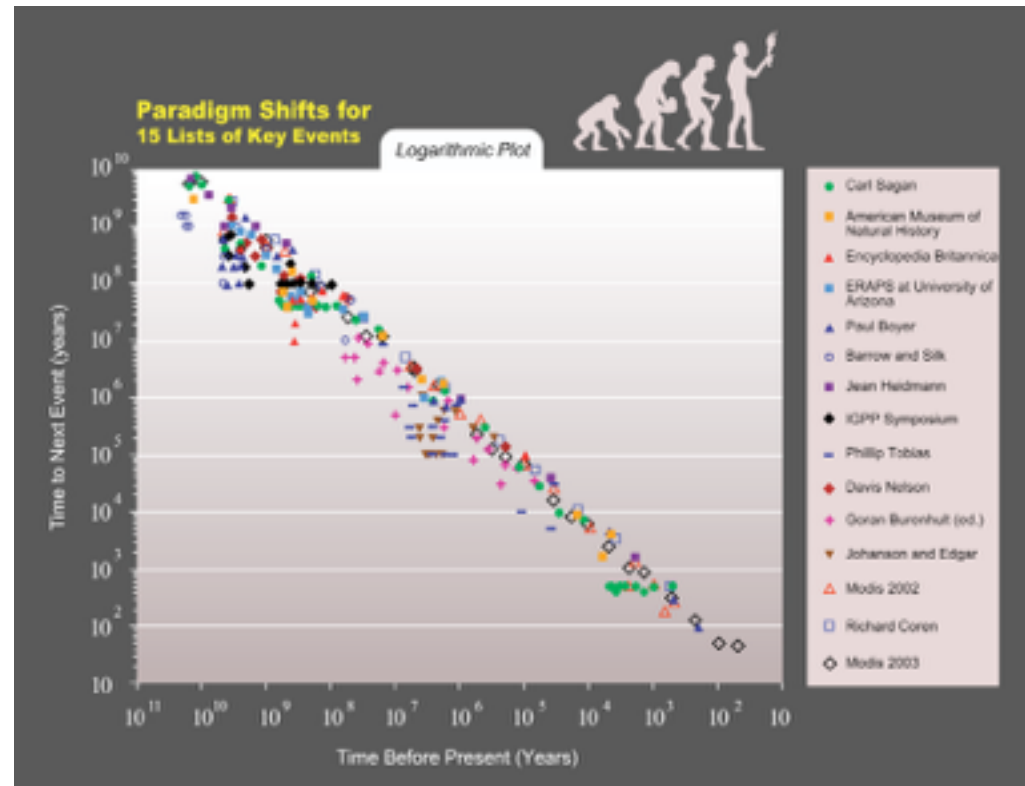
Developer Relations

Dreams Of my childhood



Accelerando / Singularity, in a Galaxy far far away

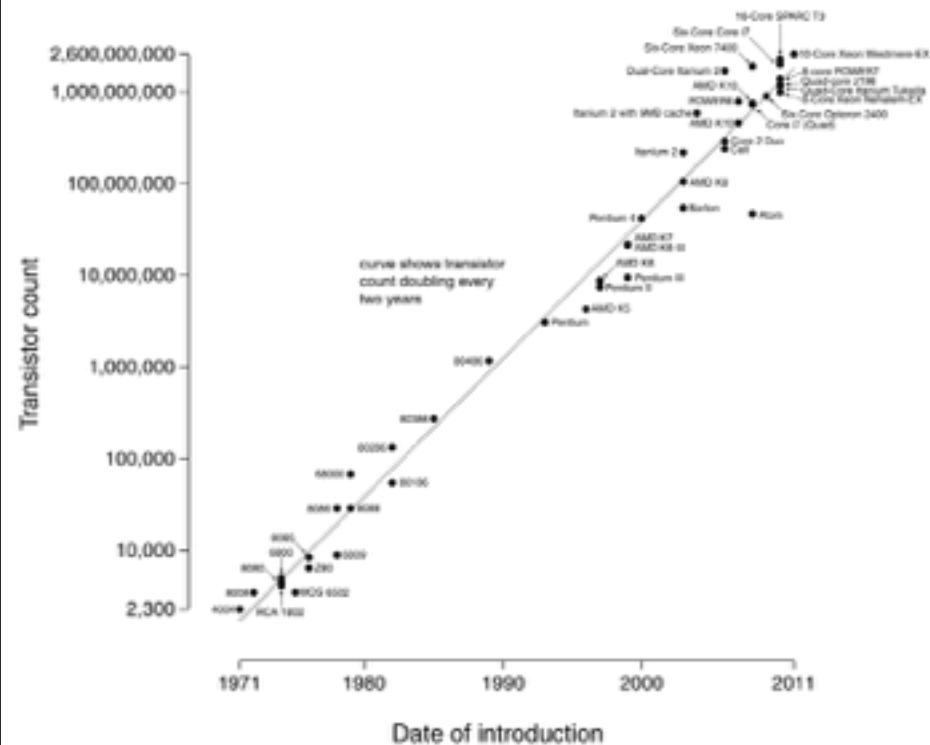
- Even if we automate ourselves out of a job every 10 years
- ...I don't think the singularity is near!



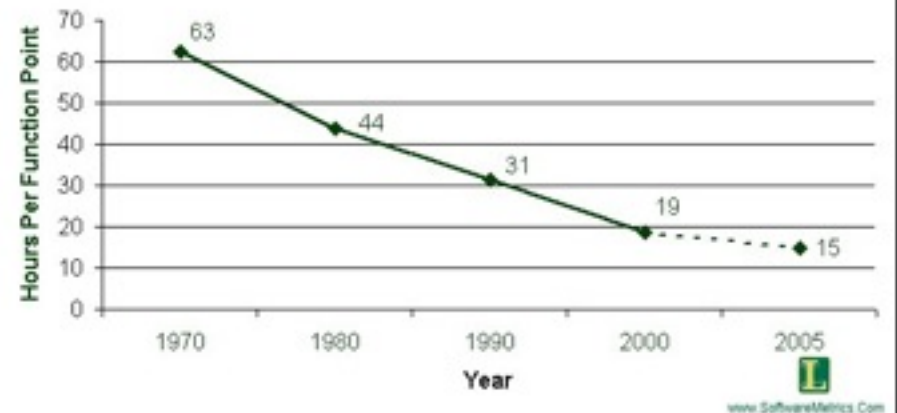
Moore's Law is for Hardware Only

- Does not apply to software
- Productivity gains not keeping up with hardware and bandwidth
- Writing software is hard, painful, and still very much a craft

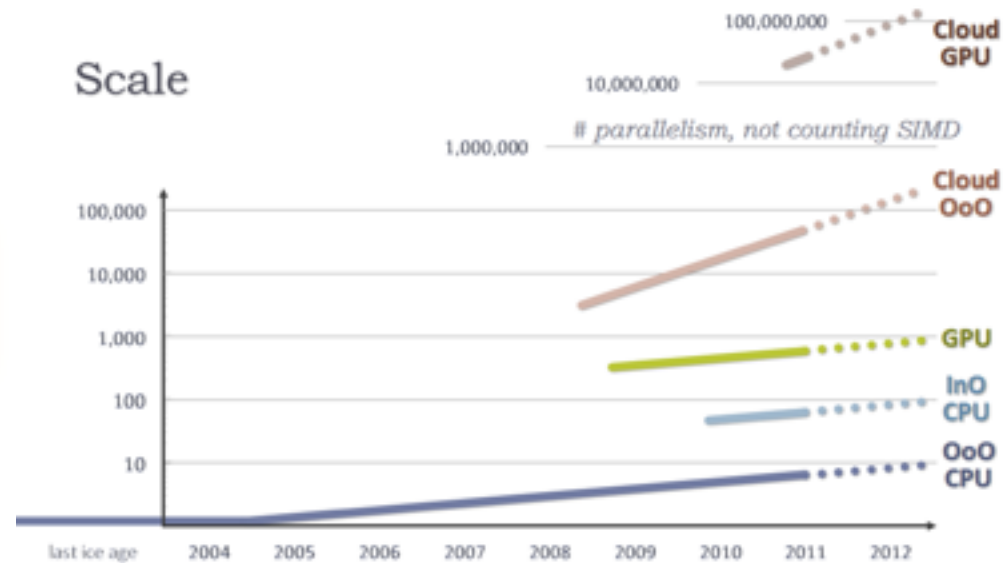
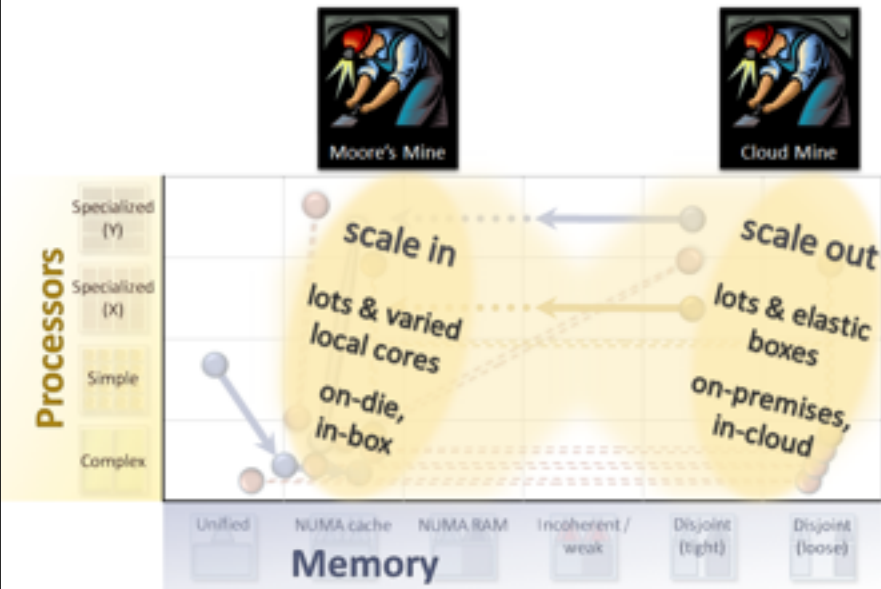
Microprocessor Transistor Counts 1971-2011 & Moore's Law



Hours Per Function Point Since 1970



Moore's Law's free lunch is over



- Herb Sutter, Welcome to the Jungle
<http://herbsutter.com/welcome-to-the-jungle/>

Architecture Changes: 60's Mainframe



Architecture Changes: 80's Client-Server



Architecture Changes: 90's Web



Architecture Changes: 2010's Cloud, HTML5, Mobile



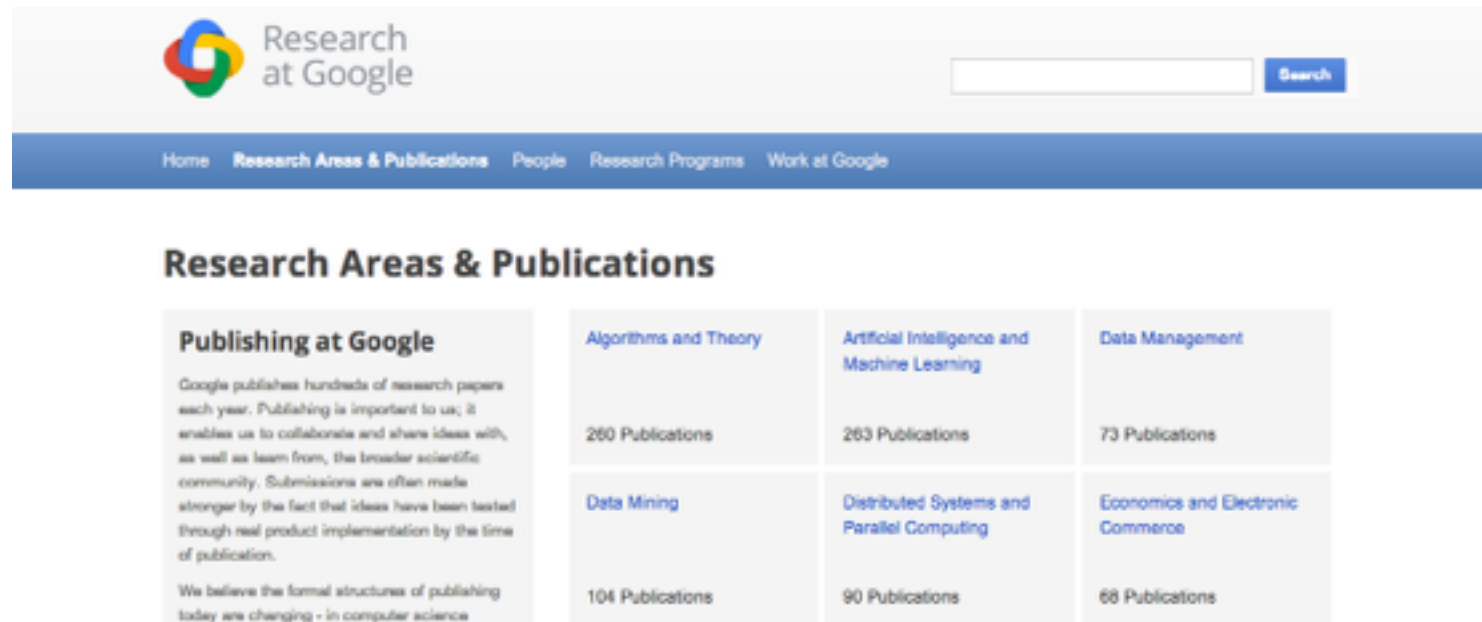
Cloud started at Consumer websites solving their needs

- Google, Amazon, Yahoo, Facebook, Twitter
- Large Data Sets
- Storage Capacity growing faster than Moore's Law
- Fast Networks
- Vertical -> Horizontal scalability
- Open Source Software
- Virtualization
- Cloud is a productization of these infrastructures
 - Public Clouds Services: Amazon, Microsoft, Google
 - Open Source Software: Hadoop, Open Stack, Eucalyptus, Cloud Foundry, OpenShift

***“The future is already here
— it's just not very evenly
distributed”***

William Gibson

- Horizontal scalability 2004: Map/Reduce (Hadoop)
- NoSQL 2006: Bigtable (Mongo, Cassandra, HBase, Riak)
- Real Time analytics 2010: Dremel, BigQuery (Impala)
- Horizontally Scalable SQL 2012: Spanner, F1 / Amazon Redshift



The screenshot shows the 'Research at Google' website. At the top is the Google logo and the text 'Research at Google'. Below this is a search bar and a 'Search' button. A navigation bar contains links for 'Home', 'Research Areas & Publications', 'People', 'Research Programs', and 'Work at Google'. The main section is titled 'Research Areas & Publications' and features a grid of research areas with their respective publication counts.

Research Area	Publications
Publishing at Google <i>Google publishes hundreds of research papers each year. Publishing is important to us; it enables us to collaborate and share ideas with, as well as learn from, the broader scientific community. Submissions are often made stronger by the fact that ideas have been tested through real product implementation by the time of publication.</i> <i>We believe the formal structures of publishing today are changing - in computer science</i>	
Algorithms and Theory	260 Publications
Artificial Intelligence and Machine Learning	263 Publications
Data Management	73 Publications
Data Mining	104 Publications
Distributed Systems and Parallel Computing	90 Publications
Economics and Electronic Commerce	68 Publications



Google Cloud Platform

Compute



App Engine



Compute Engine

Storage



Cloud Storage



Cloud Datastore



Cloud SQL

Big Data/Analysis



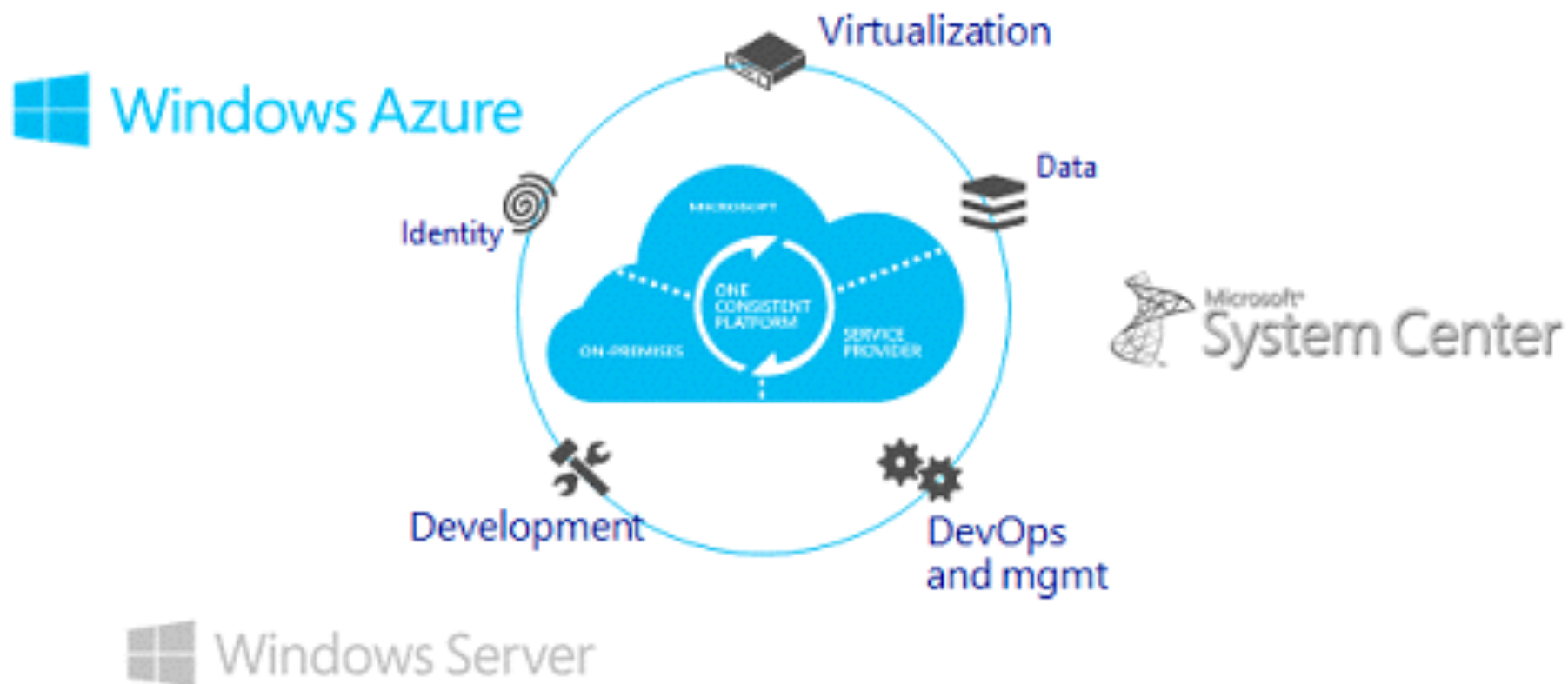
BigQuery

Services



Cloud Endpoints

Microsoft "Cloud OS" Hybrid Solution



Microsoft - We do Java!



SALES: 020-889-875

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PORTAL

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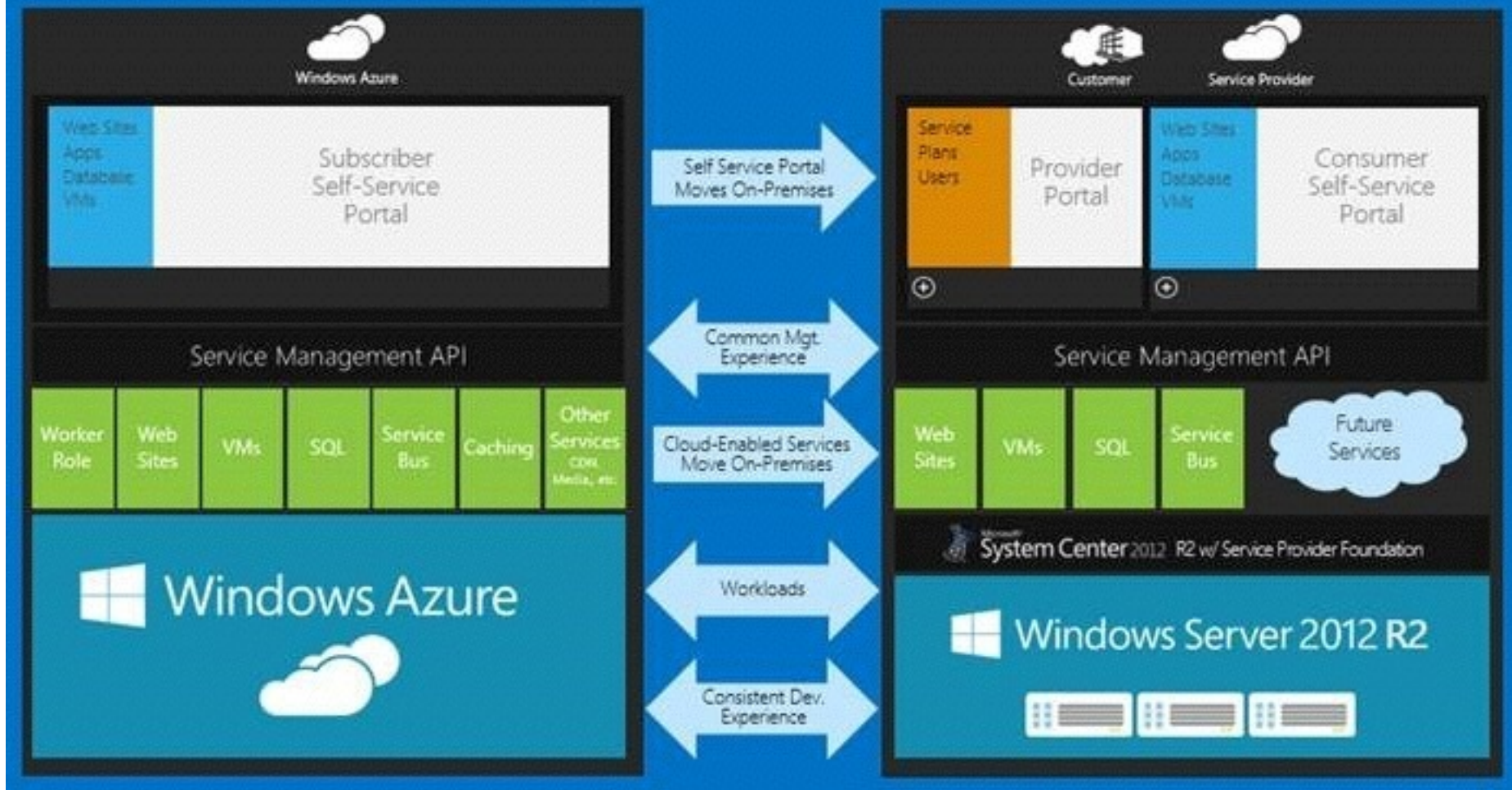
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Or buy now »



Microsoft - Hybrid

Cloud OS Consistent Experiences



Microsoft - Multi Cloud

The Cloud OS Network

Leading Service Providers Deliver Solutions on the Microsoft Cloud Platform

OPERATE IN MORE THAN  **90 MARKETS** AROUND THE WORLD

RUN MORE THAN  **425** DATACENTERS

SERVE OVER  **3 MILLION** CUSTOMERS

MANAGE MORE THAN **2.4 MILLION**  **SERVICES**




Primary markets of Cloud OS network providers

<http://www.microsoft.com/en-us/server-cloud/cloud-os-network.aspx>

 Microsoft

The Fabric Controller (FC)

- The “kernel” of the cloud operating system

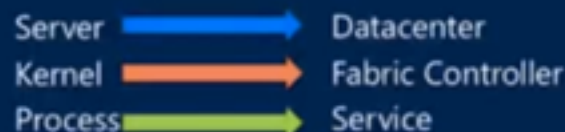
- Manages datacenter hardware
- Manages Windows Azure services

- Four main responsibilities:

- Datacenter resource allocation
- Datacenter resource provisioning
- Service lifecycle management
- Service health management

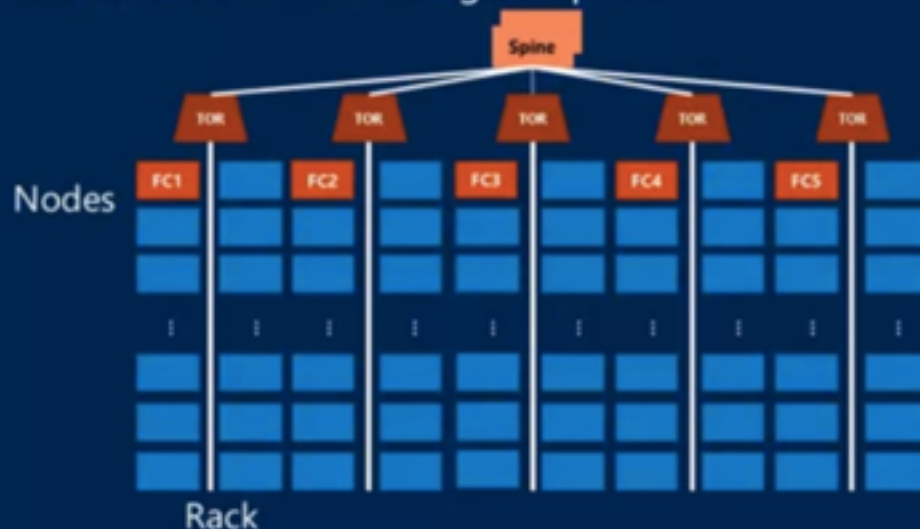
- Inputs:

- From hardware: description of the hardware and network resources it will control
- From users: service model and binaries for cloud applications



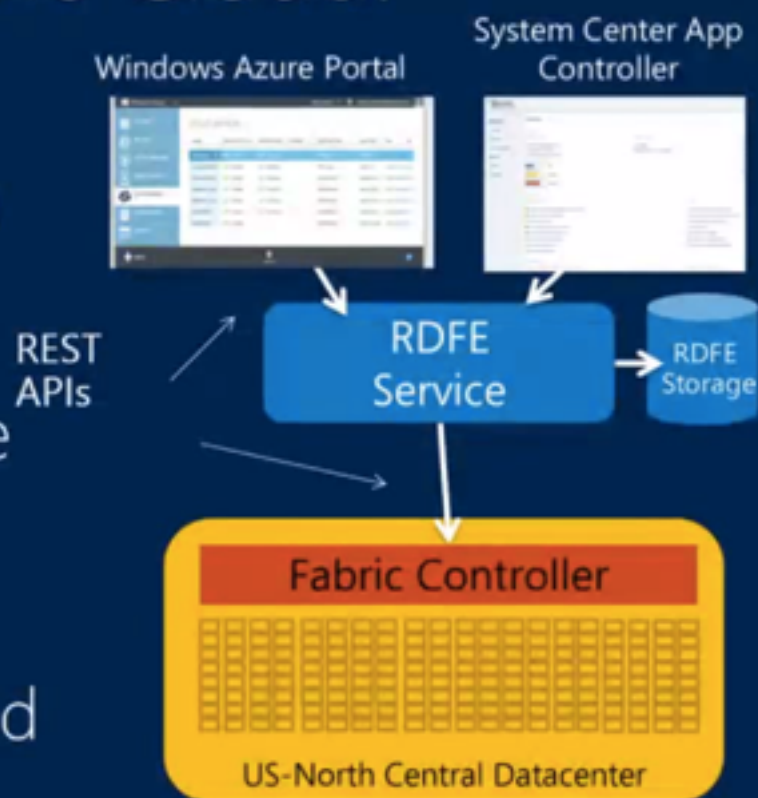
Inside a Cluster

- FC is a distributed, stateful application running on nodes
- Five instances for availability
 - One FC instance is the primary and all others keep view of world in sync
 - Supports rolling upgrade, and services continue to run even if FC fails entirely
 - Can tolerate one instance failure during an update



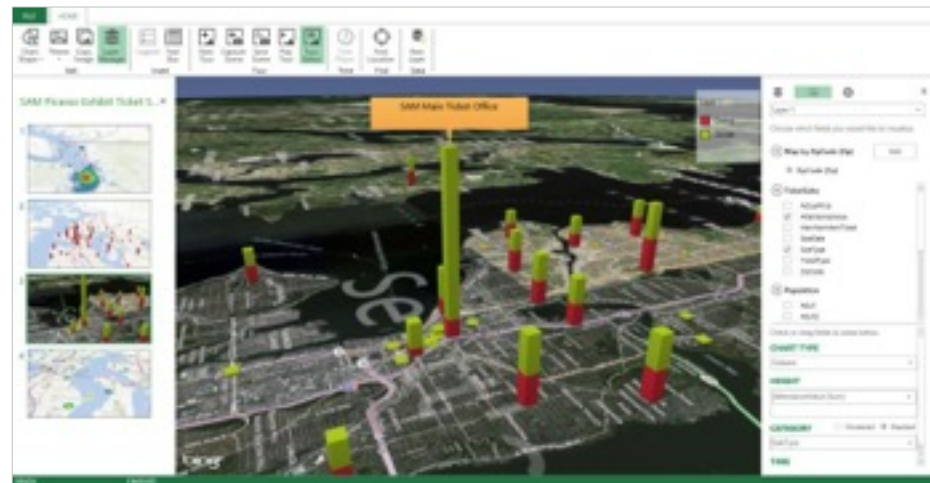
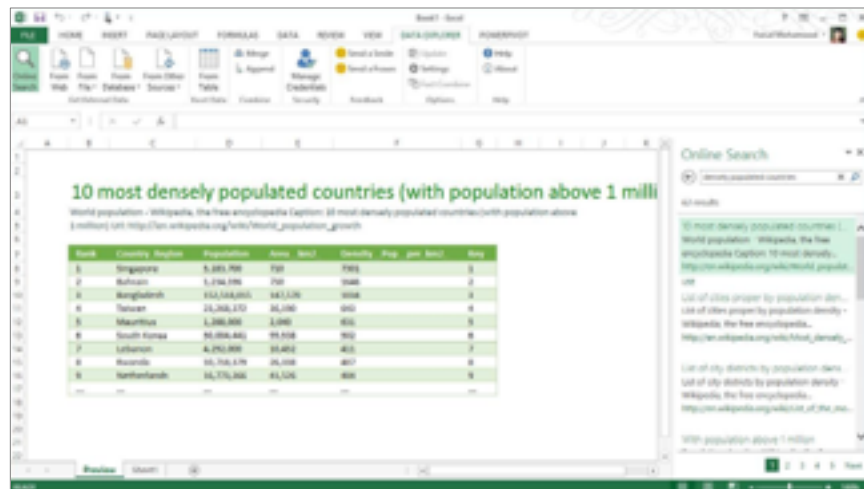
Deploying a Service to the Cloud:

- Package deployed to RDFE
 - Windows Azure portal
 - System Center App Controller provides IT Pro upload experience
 - Powershell provides scripting interface
 - Visual Studio publish
- RDFE stores service in its storage account
 - Converts it to FC "instance model"
 - Sends service to a Fabric Controller (FC)
- FC stores image in repository and deploys service



Microsoft Big Data Usability

- Agility in Data -> Insight
- Excel PowerBI + Azure HD Insight





Database

DynamoDB

Predictable and Scalable NoSQL Data Store

ElastiCache

In-Memory Cache

RDS

Managed Relational Database

Redshift

Managed Petabyte-Scale Data Warehouse

Storage & CDN

S3

Scalable Storage in the Cloud

EBS

Networked Attached Block Device

CloudFront

Global Content Delivery Network

Glacier

Archive Storage in the Cloud

Storage Gateway

Integrates On-Premises IT with Cloud Storage

Import Export

Ship Large Datasets

Cross-Service

Support

Phone & email fast-response 24X7 Support

Marketplace

Buy and sell Software and Apps

Management Console

UI to manage AWS services

SDKs, IDE kits and CLIs

Develop, integrate and manage services

Analytics

Elastic MapReduce

Managed Hadoop Framework

Kinesis

Real-Time Data Stream Processing

Data Pipeline

Orchestration for Data-Driven Workflows

Compute & Networking

EC2

Virtual Servers in the Cloud

VPC

Virtual Secure Network

ELB

Load balancing Service

WorkSpaces

Virtual Desktops in the cloud

Auto Scaling

Automatically scale up and down

DirectConnect

Dedicated Network Connection to AWS

Route 53

Scalable Domain Name System

Deployment & Management

CloudFormation

Templated AWS Resource Creation

CloudWatch

Resource and Application Monitoring

Elastic Beanstalk

AWS Application Container

IAM

Secure AWS Access Control

CloudTrail

User Activity Logging

OpsWorks

DevOps Application Management Service

CloudHSM

Hardware-based key storage for compliance

App Services

CloudSearch

Managed Search Service

Elastic Transcoder

Easy-to-use Scalable Media Transcoding

SES

Email Sending Service

SNS

Push Notification Service

SQS

Message Queue Service

SWF

Workflow Service for Coordinating App Components

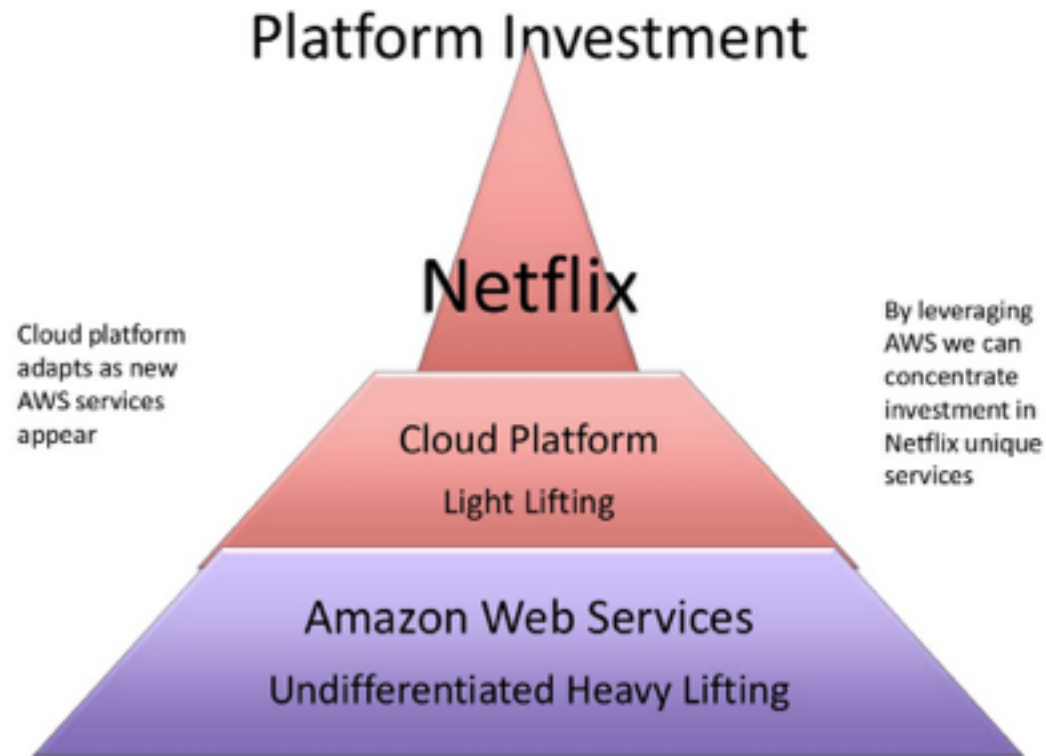
AppStream

Low-latency Application Streaming

AWS Global Physical Infrastructure
(Geographical Regions, Availability Zones, Edge Locations)

Amazon

- 2 pizza teams, focused on services
- Eventual consistency (Dynamo paper)
- Use OSS but don't contribute much
- Elastic Beanstalk PaaS .NET, Java, Node.js, PHP, Python, Ruby
- PaaS partners: Heroku, Cloud Foundry
- VPC, but no complete hybrid story. Eucalyptus.



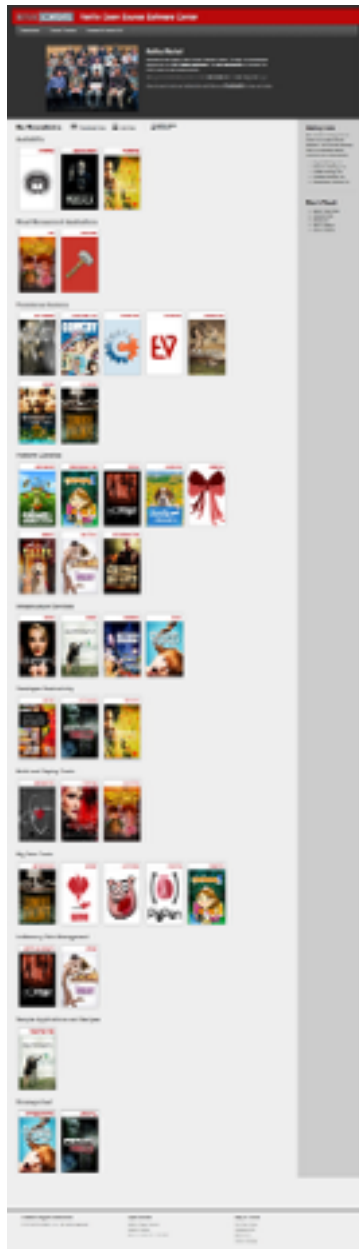
rapid evolution, low mtbiamsh

“mean time between idea and making stuff happen”

functionality and scale now, portability coming

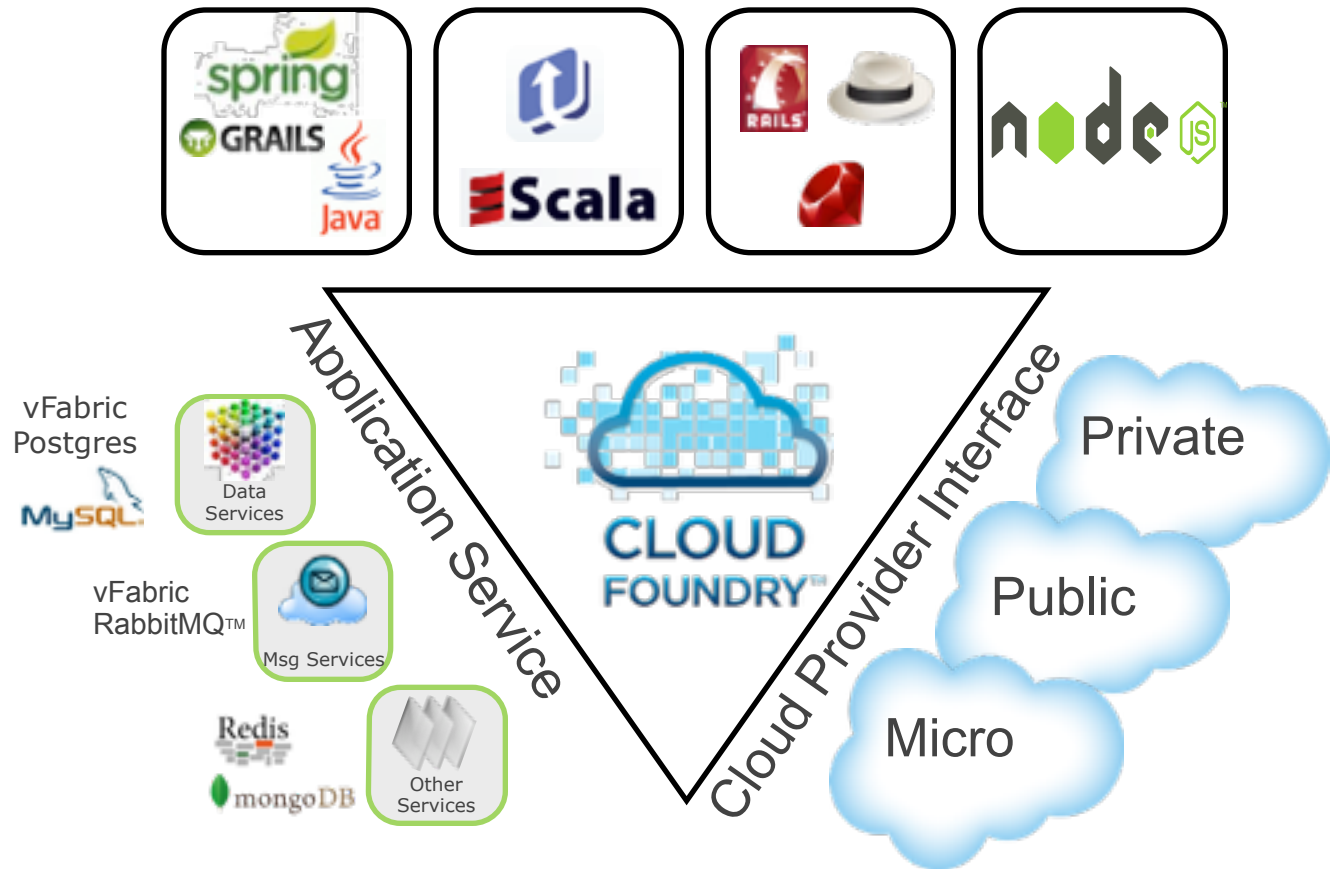
source <http://www.slideshare.net/adrianco/netflixoss-meetup>

Netflix

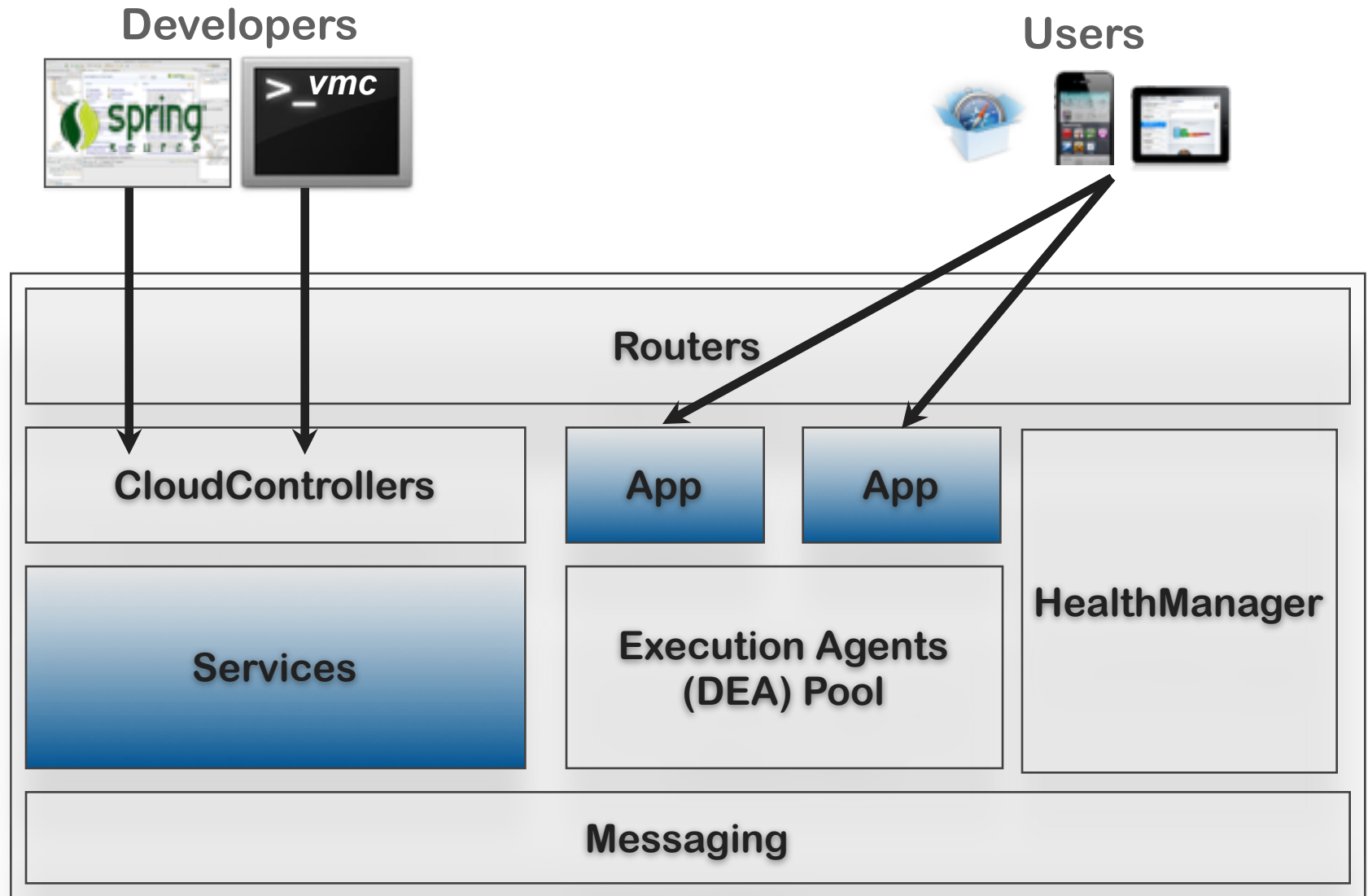


VMWare / Pivotal CloudFoundry

- Open Source: Apache 2 Licensed
- multi language/frameworks
- multi services
- multi cloud

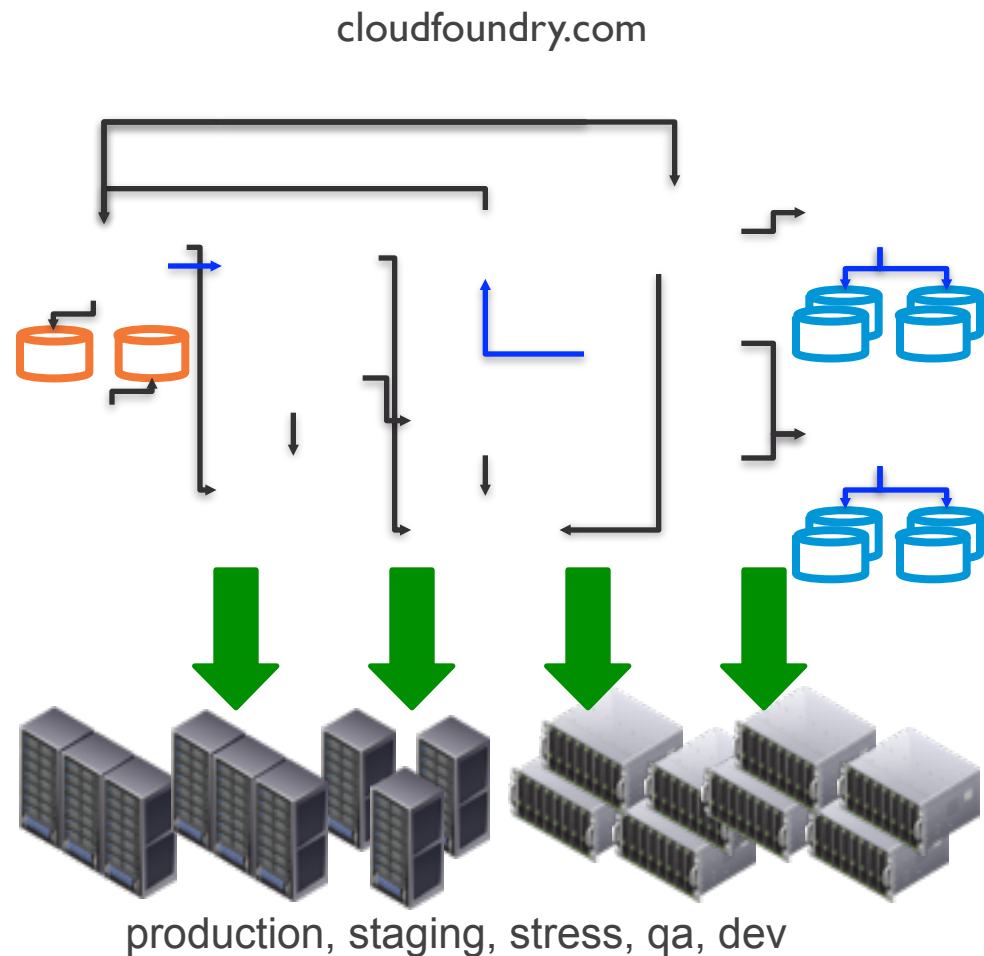


Cloud Foundry Logical View



Production Grade Cloud Foundry Clusters

- 500 – 5,000 VMs
- 40+ unique node types
- 75+ unique software packages
- 75+ unique environments
- 2x/week cf.com updates
- 24x7x365 non-stop operation
- No-downtime deployments
- Reliable, robust, repeatable deployments, updates, capacity adjustments
- Small teams manage many instances

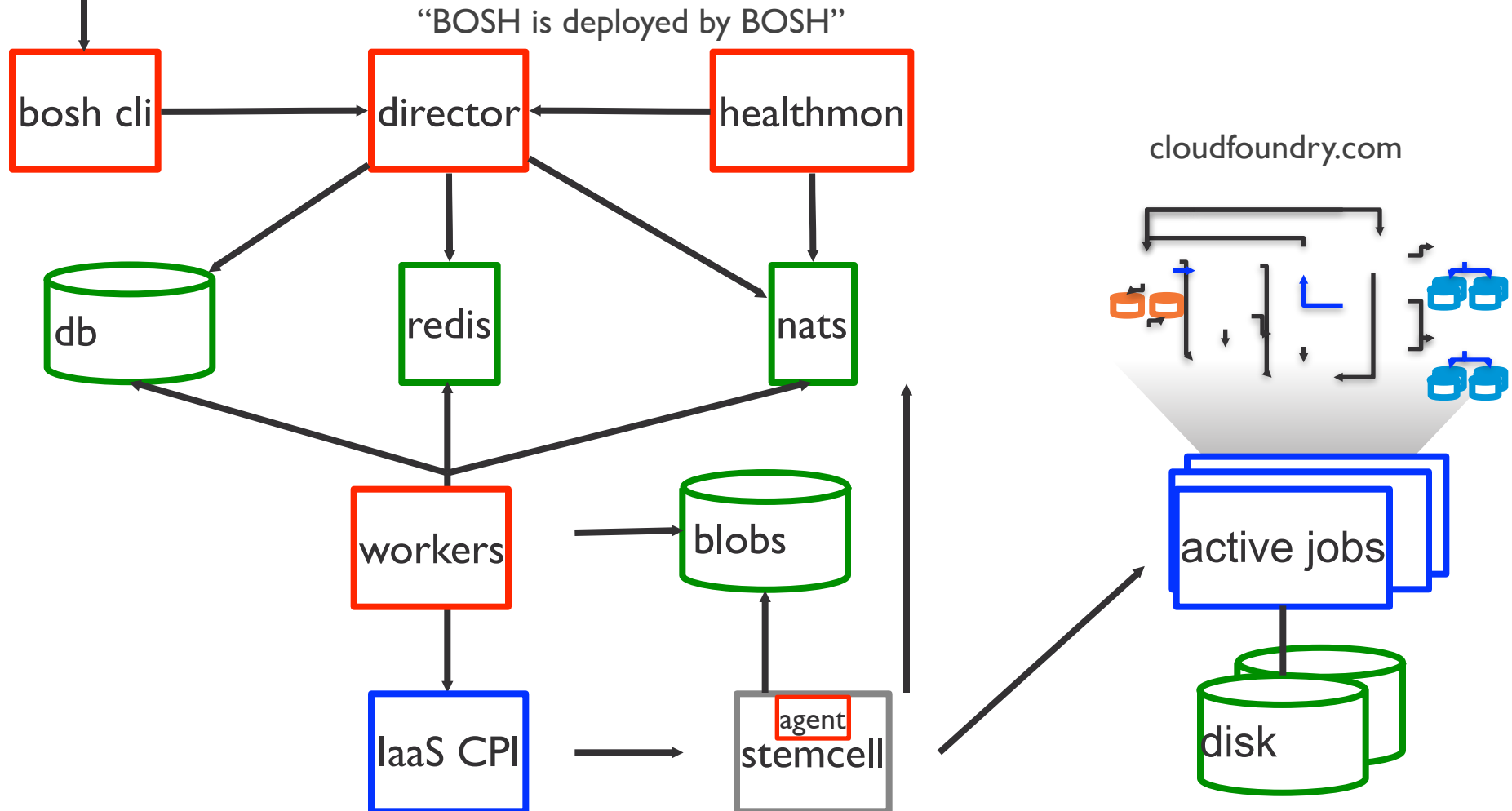


Google style problem → *Google style solution*

BOSH: under the hood



BOSH User



IaaS neutral by design

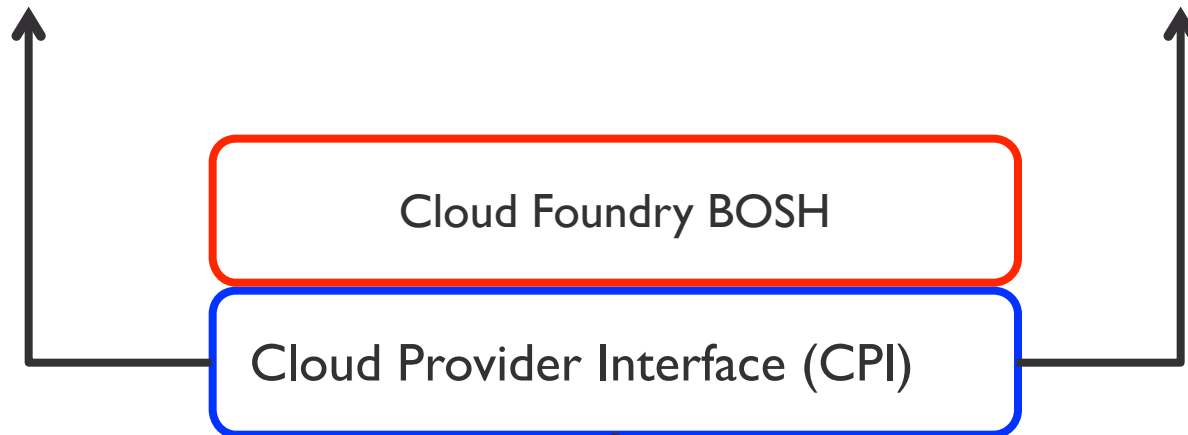


vSphere: battle tested implementation, *thousands of deployments*

vCloud Director: “*work in progress*”, 2H 2012



CPI: code complete
functional status: “*work in progress*”

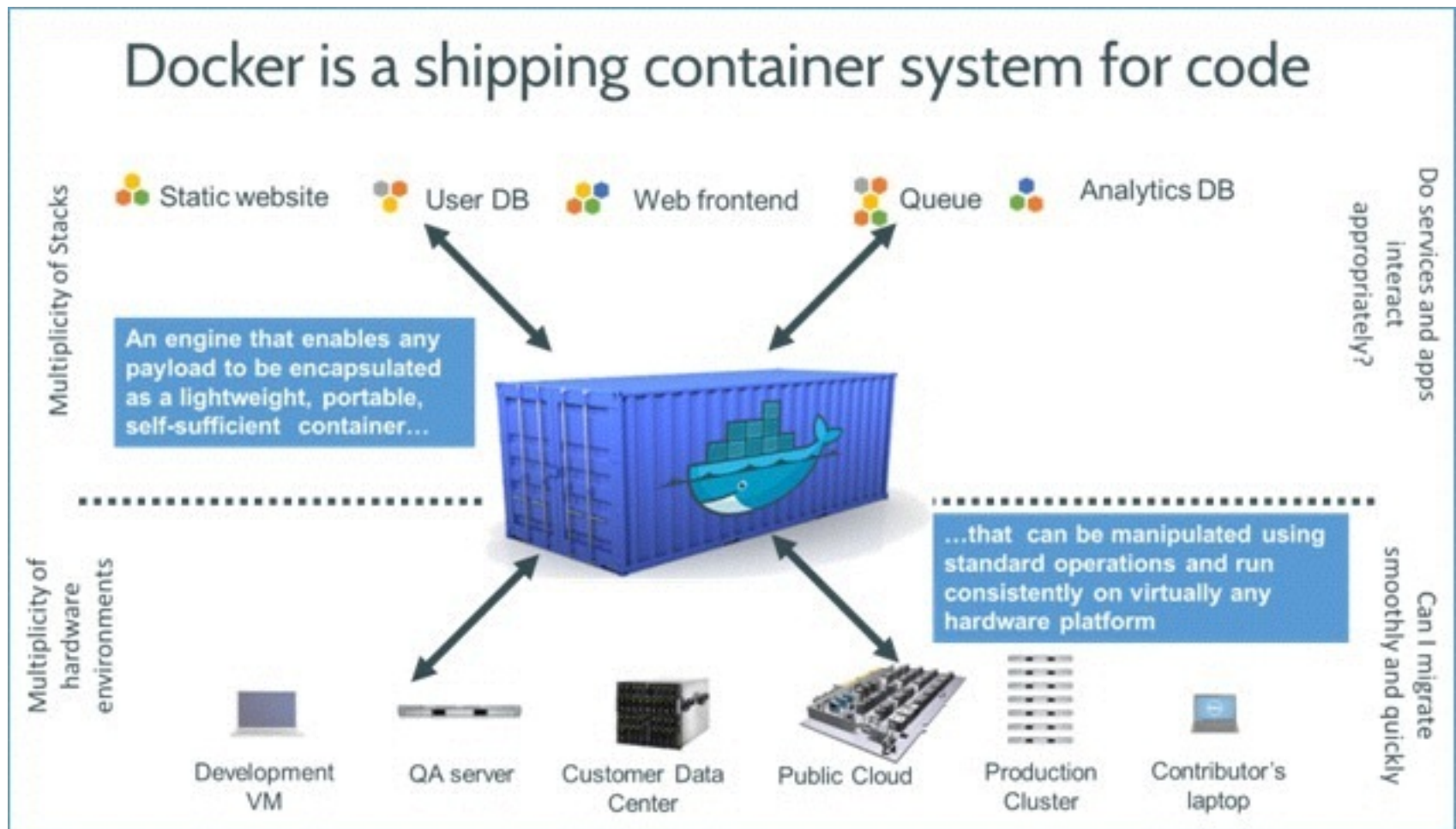


contribute: github.com/cloudfoundry/bosh

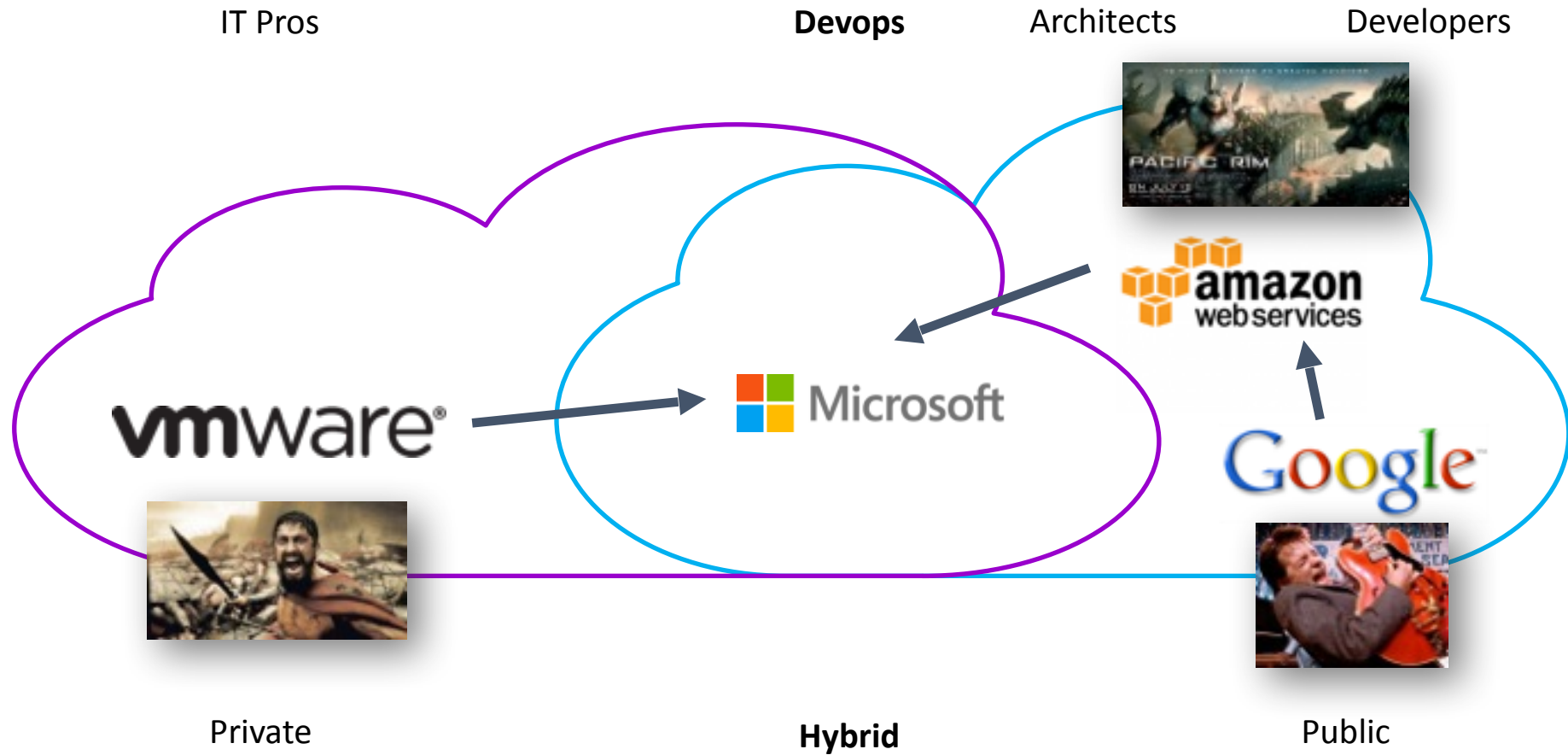


github.com/piston/openstack-bosh-cpi

Docker: IaaS -> PaaS continuum



Cloud Market



Building your Cloud

- Unit of scale: process -> service, kernel -> fabric, server -> datacenter
- Horizontally scalable uniform infrastructure for common workloads
- Set of managed Data services: SQL, Document, Graph
- Fabric to automate updates, monitoring
- Test and production lines blur: Monkeys, A/B Testing
- DevOps: Pizza box teams for each service, uniform tools
- Open Source: vendor independence, sharing the load, recruit
- IaaS/PaaS continuum, both useful, depends on needs
- Multi vendor, multi cloud, mix of proprietary and OSS
- Hardware / Software interaction to innovate, eg F1, SSD instances
- Vertical / Sovereign / Geo clouds
- Among Big 3, Microsoft is best positioned or Hybrid

Thank You!

 @WindowsAzure

 @chanezon

Website : www.windowsazure.com/

Books / Articles

- Nick Carr, The Big Switch
- Eric Raymond, The Art of Unix Programming
- Weinberg, Psychology of Computer Programming
- Wes python book
- Mark html5 book
- Kent Beck XP
- Hunt, Thomas, The Pragmatic Programmer
- Ade Oshineye, Apprenticeship Patterns
- Matt Cutt's Ignite Talk IO 2011, Trying different things
- Josh Bloch talk about api design
- Larry and Sergey, Anatomy of a Search Engine
- Rob Pike, The Practice of Programming

References

- Netflix OSS presentations source <http://www.slideshare.net/adrianco/netflixoss-meetup>
- Google Research papers
- Amazon architecture site
- Microsoft Azure center
- Mark Russinovich Azure architecture talk <http://channel9.msdn.com/Events/TechEd/NorthAmerica/2013/WAD-B402>
- Scott Guthrie's blog

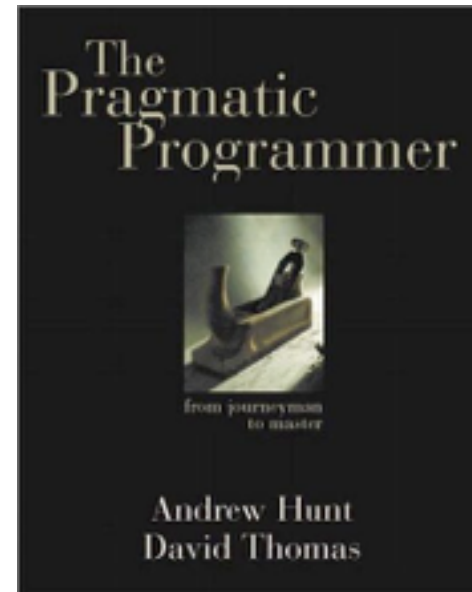
Papers / Talks

- Simon Wardley, Oscon 09 [“Cloud - Why IT Matters”](#)
- Tim O'Reilly article on internet os
- Peter Deutsch's [8 Fallacies of Distributed Computing](#)
- Brewer's [CAP Theorem](#)
- Gregor Hohpe's [Starbucks Does Not Use Two-Phase Commit](#)
- Herb Sutter, Welcome to the Jungle
<http://herbsutter.com/welcome-to-the-jungle/>
- Stuff I tag <http://www.delicious.com/chanezon/>
- More specifically <http://www.delicious.com/chanezon/cloudfoundry>
- My previous Talks <http://www.slideshare.net/chanezon>
- My list of favorite books
http://www.chanezon.com/pat/soft_books.html

Trends



Industry



Craft