Tackling complexity in giant systems
Approaches at Google, Microsoft, Amazon, Netflix & VMware
@chanezon

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
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

- CHESS
- POKER
- FIGHTER COMBAT
- GUERRILLA ENGAGEMENT
- DESERT WARFARE
- AIR-TO-GROUND ACTIONS
- THEATERWIDE TACTICAL WARFARE
- THEATERWIDE BIOTOXIC AND CHEMICAL WARFARE
- GLOBAL THERMONUCLEAR WAR
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
Google

- 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
Microsoft "Cloud OS" Hybrid Solution

Windows Azure

Virtualization

Identity

Data

Development

DevOps and mgmt

Microsoft System Center

Windows Server
Try Oracle Software on Windows Azure

Bring your own license, or quickly spin up a Virtual Machine with a license already included to take advantage of the on-demand infrastructure scaling provided by Windows Azure. Oracle software including Java, Oracle Database and Oracle WebLogic Server are now available in the Windows Azure image gallery.

Try it now 👉

Or buy now ›
Cloud OS Consistent Experiences

Windows Azure

- Web Sites
- Apps
- Database
- VMs
- Subscriber
- Self-Service Portal

Service Management API

Worker Role: Web Sites, VMs, SQL, Service Bus, Caching, Other Services, CDR, Media, etc.

Common Mgmt. Experience

Cloud-Enabled Services Move On-Premises

Self-Service Portal Moves On-Premises

Consistent Dev. Experience

Future Services

Windows Server 2012 R2
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 Servers

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
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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
VMware / Pivotal CloudFoundry

- Open Source: Apache 2 Licensed
- multi language/frameworks
- multi services
- multi cloud
Cloud Foundry Logical View

Developers

CloudControllers

Services

Routers

App

App

Execution Agents (DEA) Pool

HealthManager

Messaging

Users

Developers

Users
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 is deployed by BOSH"

- BOSH User
- bosh cli
- director
- healthmon
- db
- redis
- nats
- workers
- blobs
- laaS CPI
- active jobs
- disk
- stemcell
- agent
- cloudfoundry.com
IaaS neutral by design

vSphere: battle tested implementation, *thousands of deployments*

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

Cloud Provider Interface (CPI)

Cloud Foundry BOSH

c contribute: github.com/cloudfoundry/bosh

github.com/piston/openstack-bosh-cpi

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

github.com/piston/openstack-bosh-cpi
Docker is a shipping container system for code

An engine that enables any payload to be encapsulated as a lightweight, portable, self-sufficient container...

...that can be manipulated using standard operations and run consistently on virtually any hardware platform
Cloud Market

IT Pros  Devops  Architects  Developers

Private  Hybrid  Public

vmware®  Microsoft  Google  amazon web services

PACIFIC RIM
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
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- Google Research papers
- Amazon architecture site
- Microsoft Azure center
- Scott Guthrie’s blog
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- 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/
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- My previous Talks http://www.slideshare.net/chanezon
- My list of favorite books
  http://www.chanezon.com/pat/soft_books.html