Cloud Native at Netflix
What Changed?

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Cloud Native

Netflix Architecture

NetflixOSS

Cloud Native

What is it?

Why?

Engineers

Solve hard problems

Build amazing and complex things

Fix things when they break

Strive for perfection

Perfect code

Perfect hardware

Perfectly operated

But perfection takes too long…

Compromises…

Time to market vs. Quality

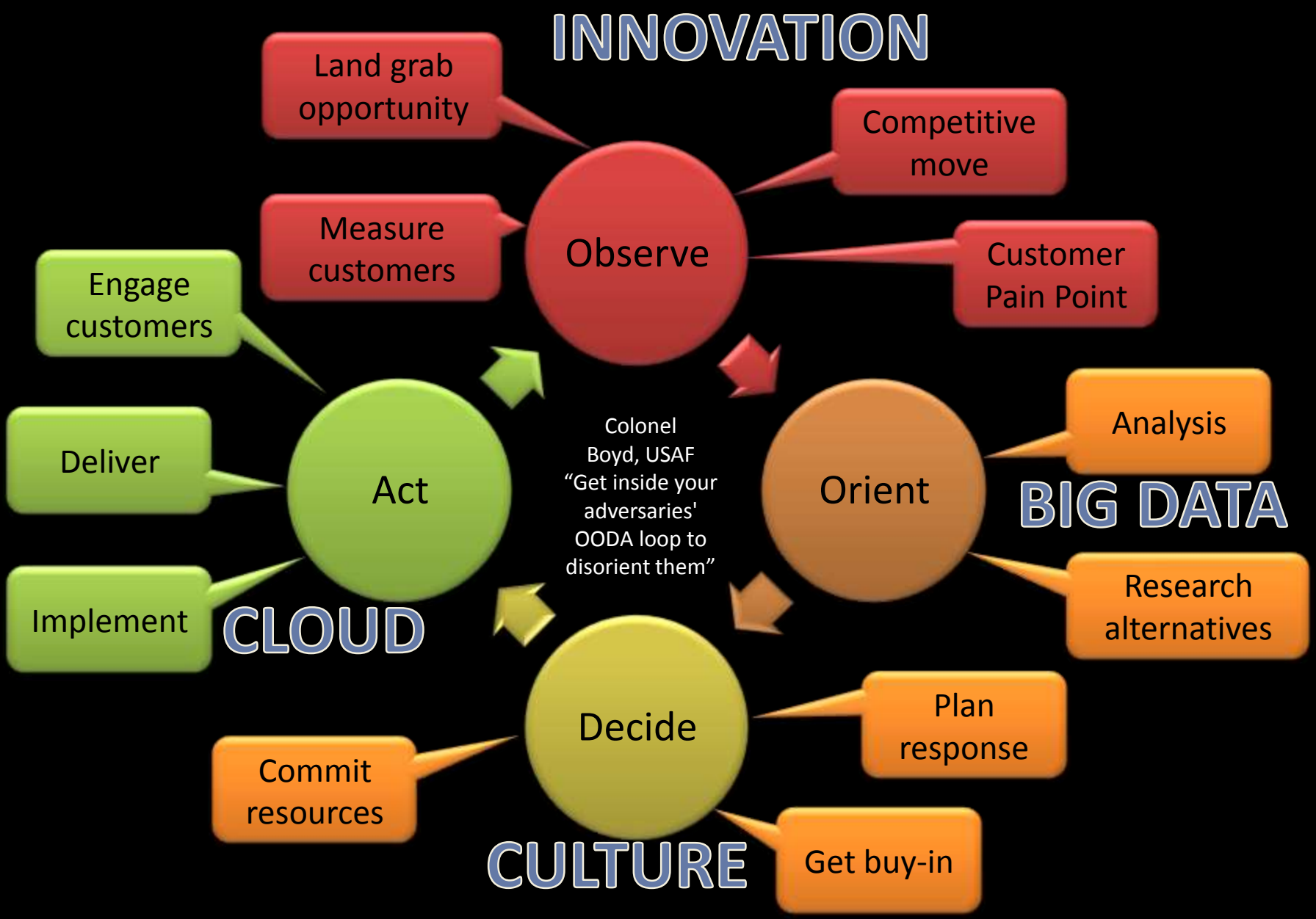
Utopia remains out of reach

Where time to market wins big

Making a land-grab

Disrupting competitors (OODA)

Anything delivered as web services


INNOVATION
Land grab opportunity
Competitive move
Measure customers
Observe
Customer Pain Point
Engage customers
Deliver
Act
Colonel Boyd, USAF "Get inside your adversaries' OODA loop to disorient them"
Orient
Analysis
BIG DATA
Research alternatives
Implement
CLOUD
Decide
Plan response
Commit resources
CULTURE
Get buy-in

How Soon?

Code features in days instead of months

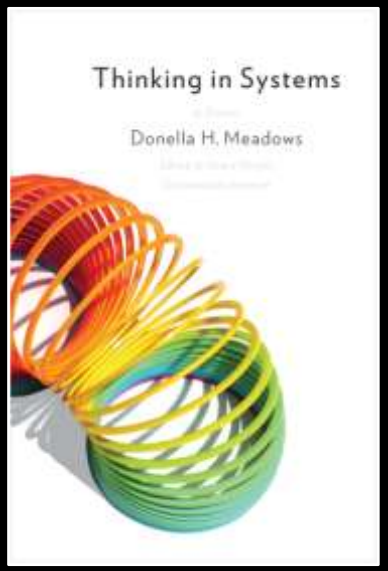
Get hardware in minutes instead of weeks

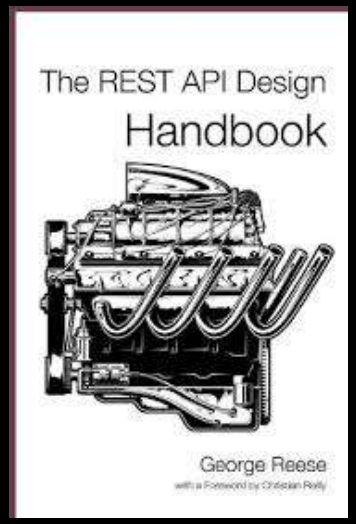
Incident response in seconds instead of hours

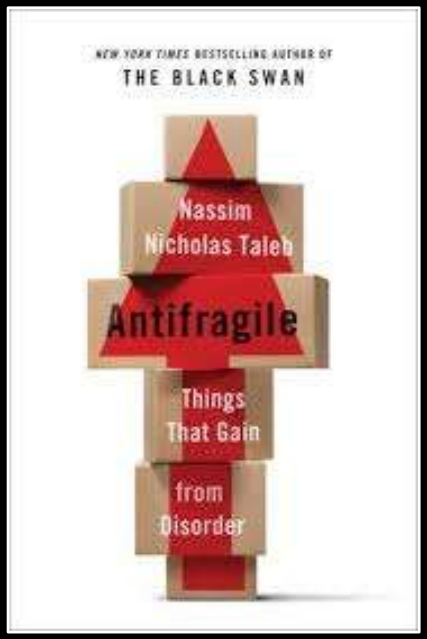
A new engineering challenge

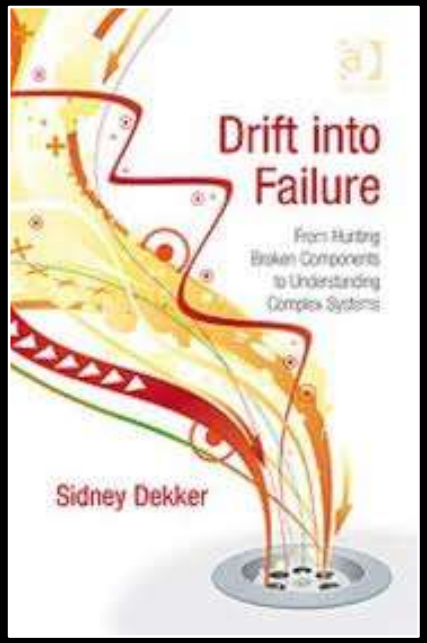
Construct a highly agile and highly available service from ephemeral and assumed broken components

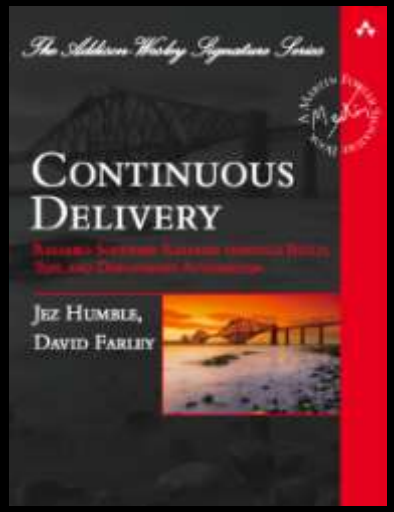
Inspiration

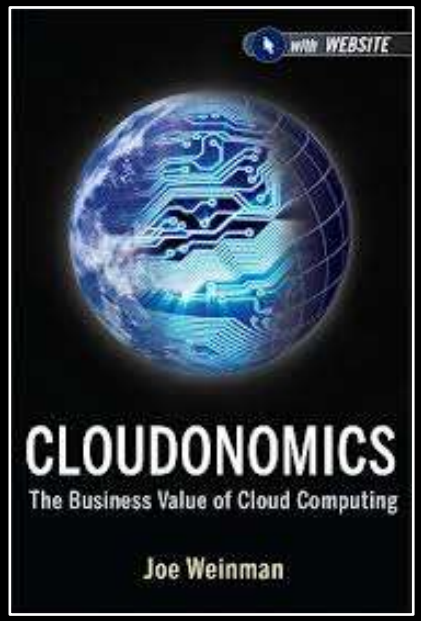












How to get to Cloud Native

Freedom and Responsibility for Developers

Decentralize and Automate Ops Activities

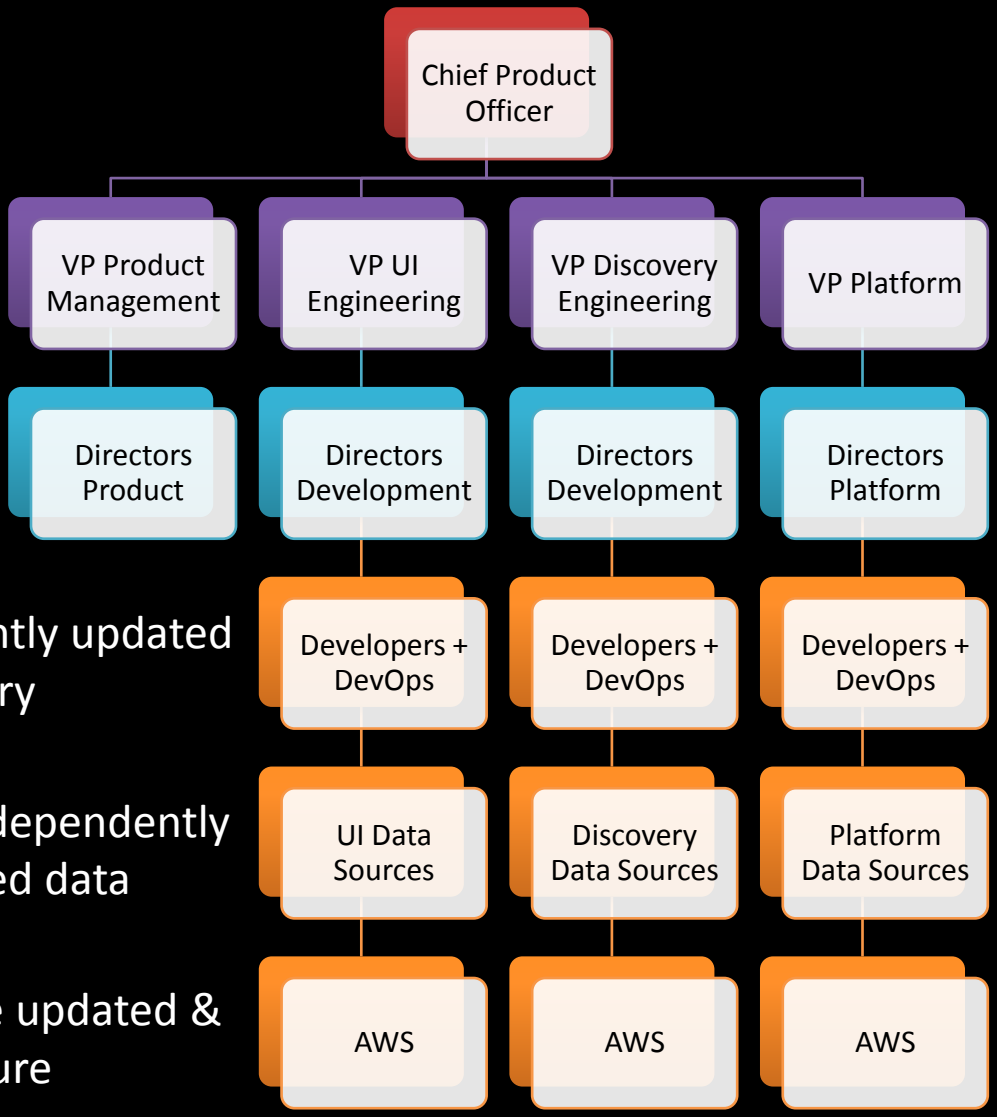
Integrate DevOps into the Business Organization

Re-Org!

Four Transitions

- Management: Integrated Roles in a Single Organization
  - Business, Development, Operations -> BusDevOps
- Developers: Denormalized Data – NoSQL
  - Decentralized, scalable, available, polyglot
- Responsibility from Ops to Dev: Continuous Delivery
  - Decentralized small daily production updates
- Responsibility from Ops to Dev: Agile Infrastructure - Cloud
  - Hardware in minutes, provisioned directly by developers

Netflix BusDevOps Organization



Code, independently updated continuous delivery

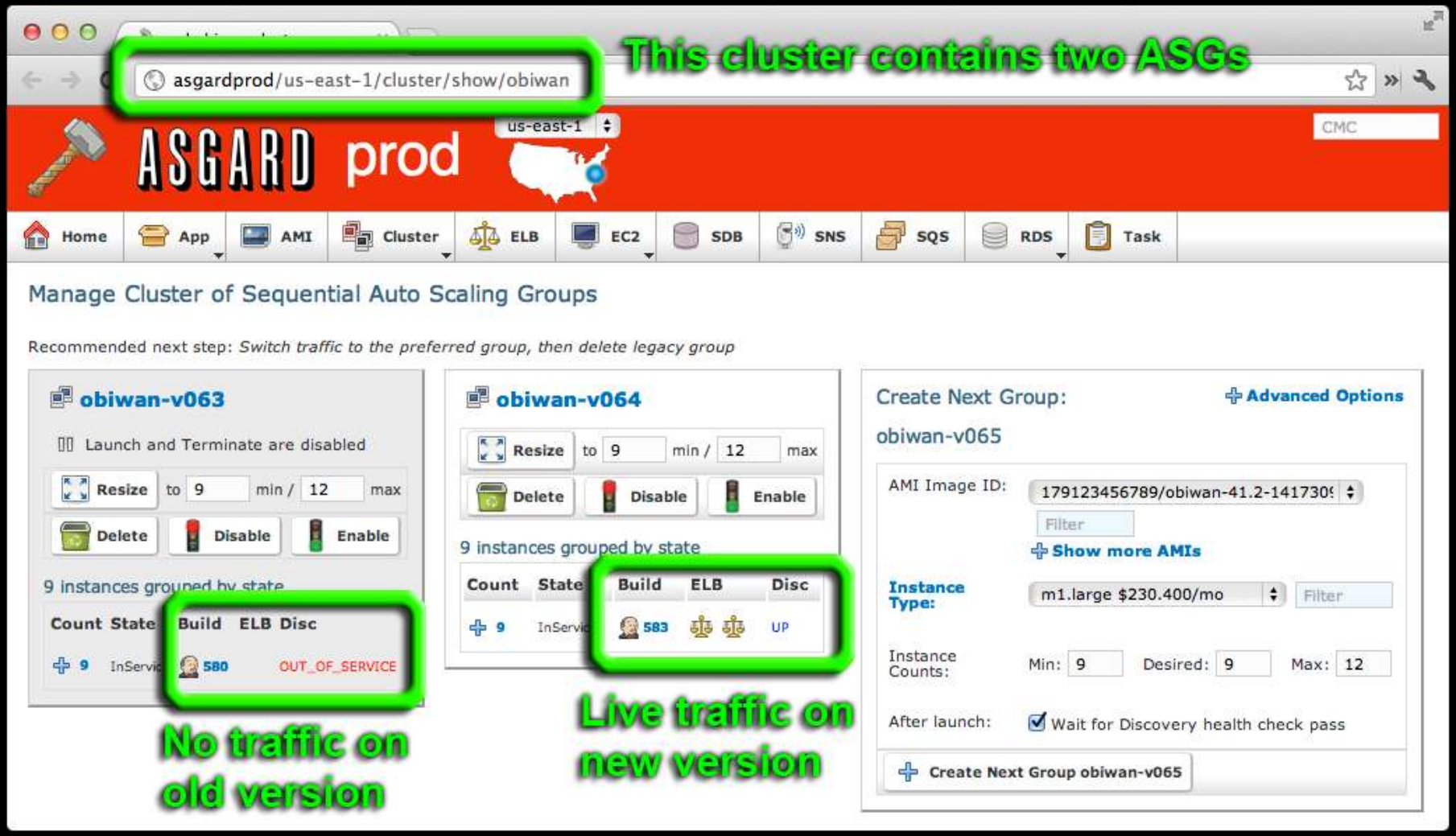
Denormalized, independently updated and scaled data

Cloud, self service updated & scaled infrastructure

Decentralized Deployment

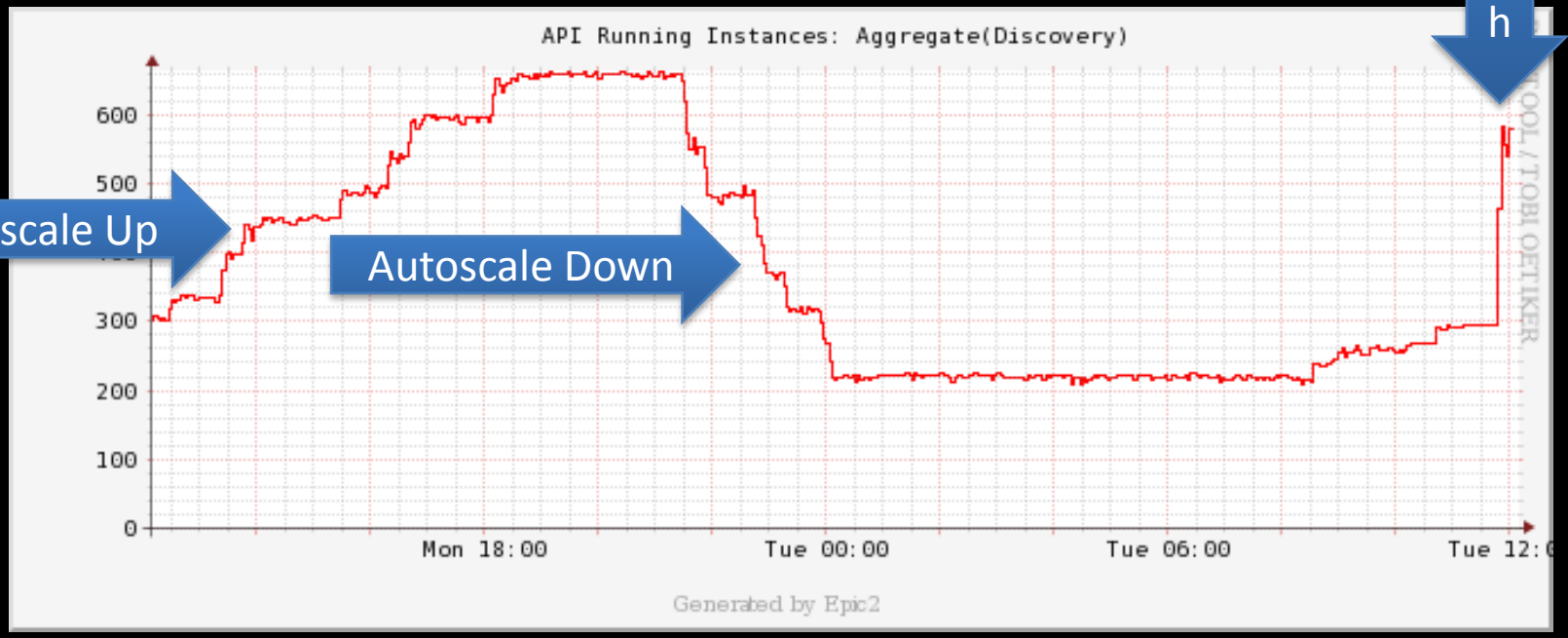
Asgard Developer Portal

http://techblog.netflix.com/2012/06/asgard-web-based-cloud-management-and.html



Ephemeral Instances

- Largest services are autoscaled
- Average lifetime of an instance is 36 hours

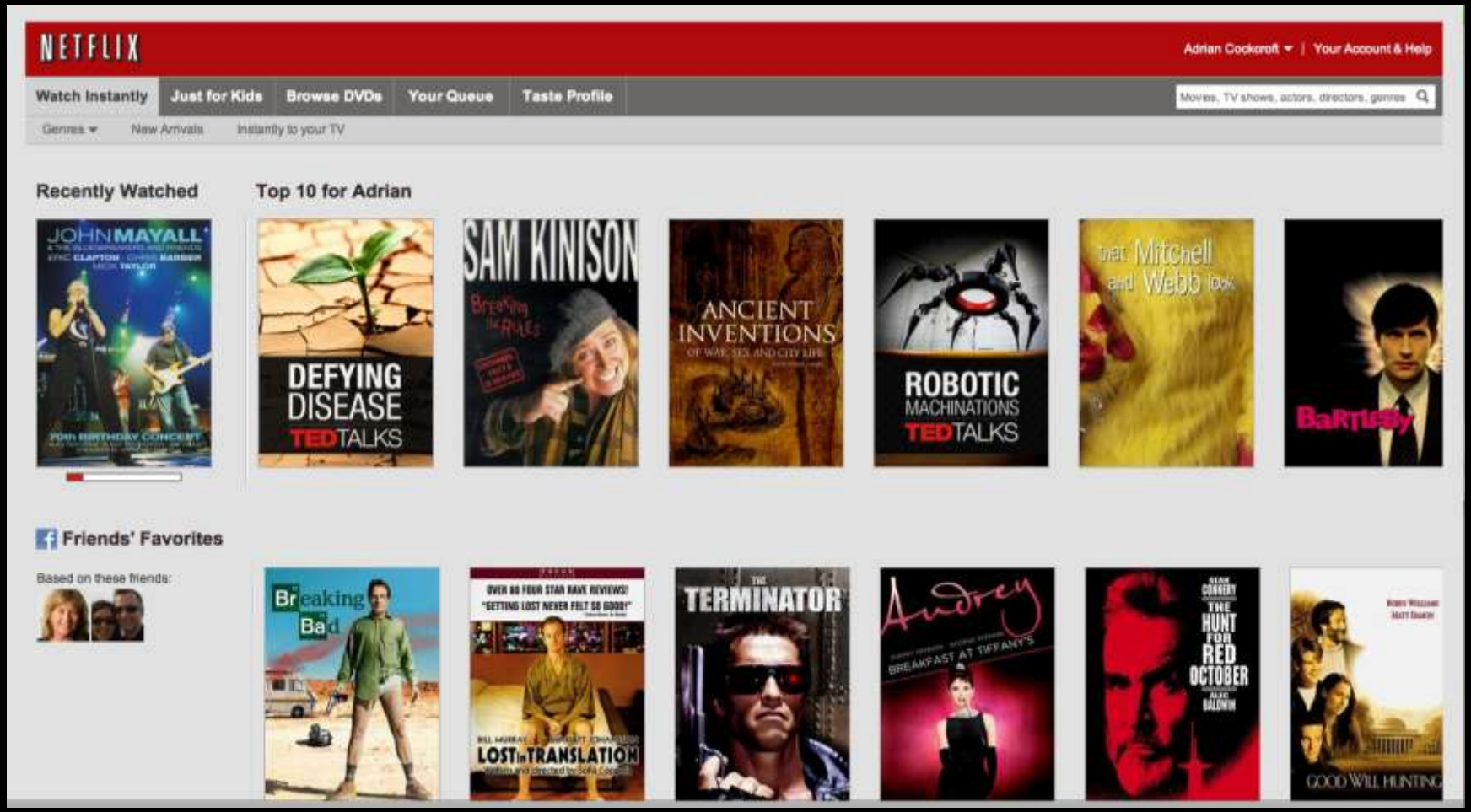


Netflix Streaming

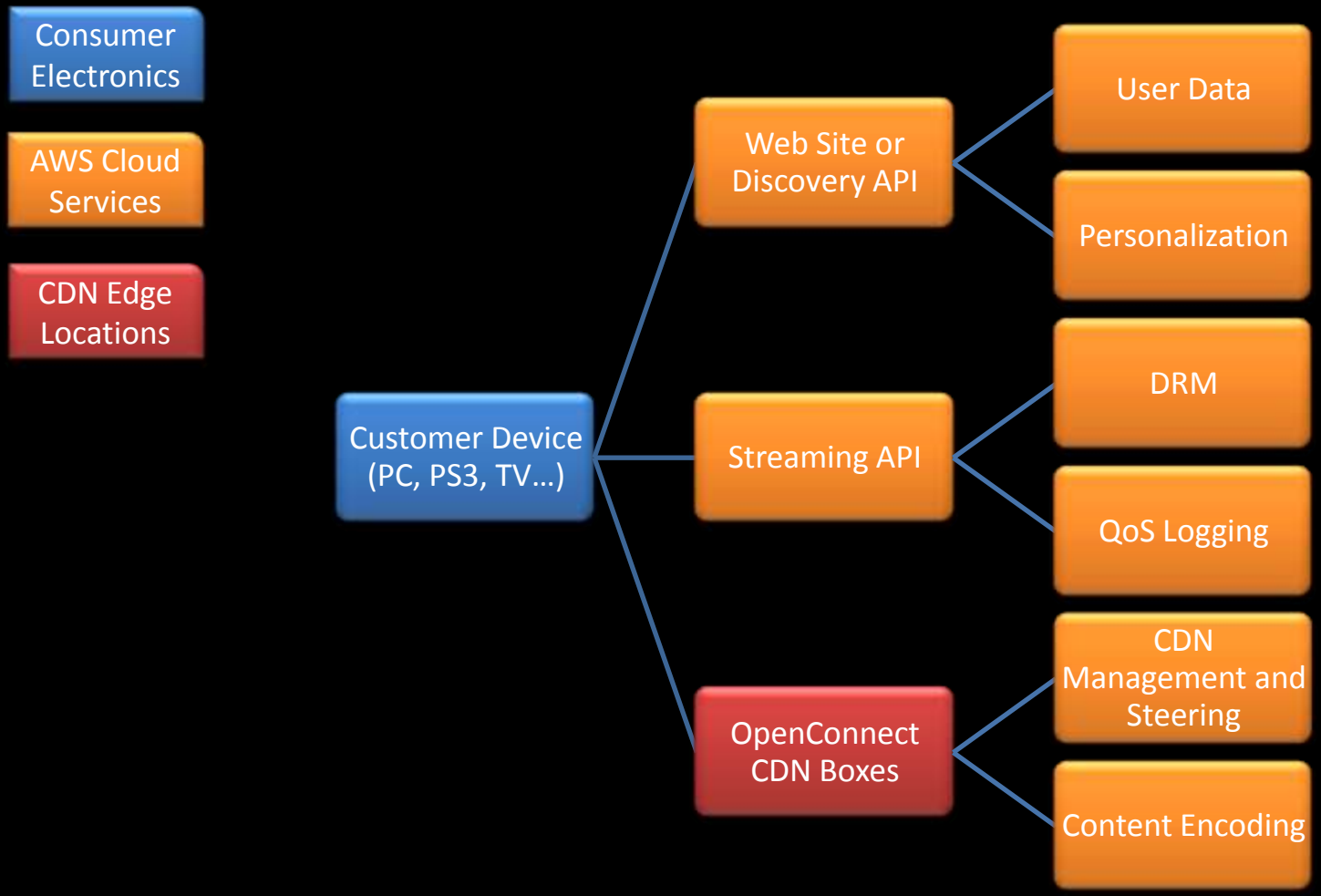
A Cloud Native Application based on an open source platform

Netflix Member Web Site Home Page

Personalization Driven – How Does It Work?



How Netflix Streaming Works



Nov 2012 Streaming Bandwidth

	Upstream		Downstream		Aggregate	
Rank	Application	Share	Application	Share	Application	Share
1	BitTorrent	36.8%	Netflix	33.0%	Netflix	28.8%
2	HTTP	9.83%	YouTube	14.8%	YouTube	13.1%
3	Skype	4.76%	HTTP	12.0%	HTTP	11.7%
4	Netflix	4.51%	BitTorrent	5.89%	BitTorrent	10.3%
5	SSL	3.73%	iTunes	3.92%	iTunes	3.43%
6	YouTube	2.70%	MPEG	2.22%	SSL	2.23%
7	PPStream	1.65%	Flash Video	2.21%	MPEG	2.05%
8	Facebook	1.62%	SSL	1.97%	Flash Video	2.01%
9	Apple PhotoStream	1.46%	Amazon Video	1.75%	Facebook	1.50%
10	Dropbox	1.17%	Facebook	1.48%	RTMP	1.41%
	Top 10	**68.24%**	**Top 10**	**79.01%**	**Top 10**	**76.54%**

sandvine

Table 3 - Top 1 Peak Period Applications (North America, Fixed Access)

March 2013

Mean Bandwidth +39% 6mo

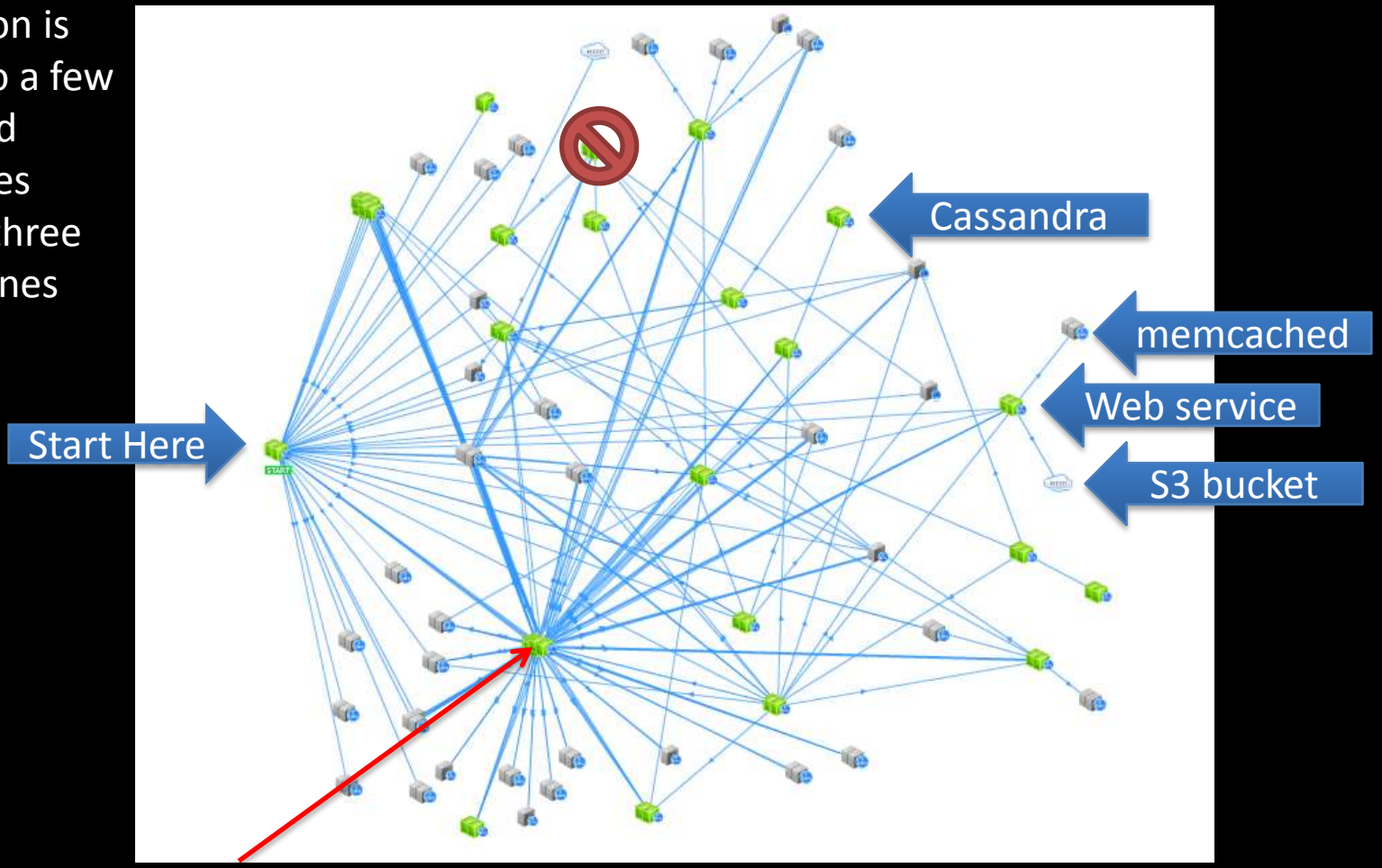
	Upstream		Downstream		Aggregate	
Rank	Application	Share	Application	Share	Application	Share
1	BitTorrent	34.81%	Netflix	32.25%	Netflix	28.88%
2	HTTP	7.53%	YouTube	17.11%	YouTube	15.43%
3	SSL	5.81%	HTTP	11.11%	HTTP	10.66%
4	Netflix	5.38%	BitTorrent	5.57%	BitTorrent	9.23%
5	Skype	4.88%	MPEG	2.58%	SSL	2.39%
6	YouTube	3.71%	Hulu	2.41%	MPEG	2.30%
7	Facebook	1.71%	iTunes	1.90%	Hulu	2.16%
8	Apple Photostream	1.34%	SSL	1.89%	iTunes	1.71%
9	Dropbox	1.21%	Flash Video	1.72%	Flash Video	1.53%
10	Carbonite	0.99%	Facebook	1.48%	Facebook	1.52%
Top 10		**67.38%**		**78.03%**		**75.82%**

sandvine

Real Web Server Dependencies Flow

(Netflix Home page business transaction as seen by AppDynamics)

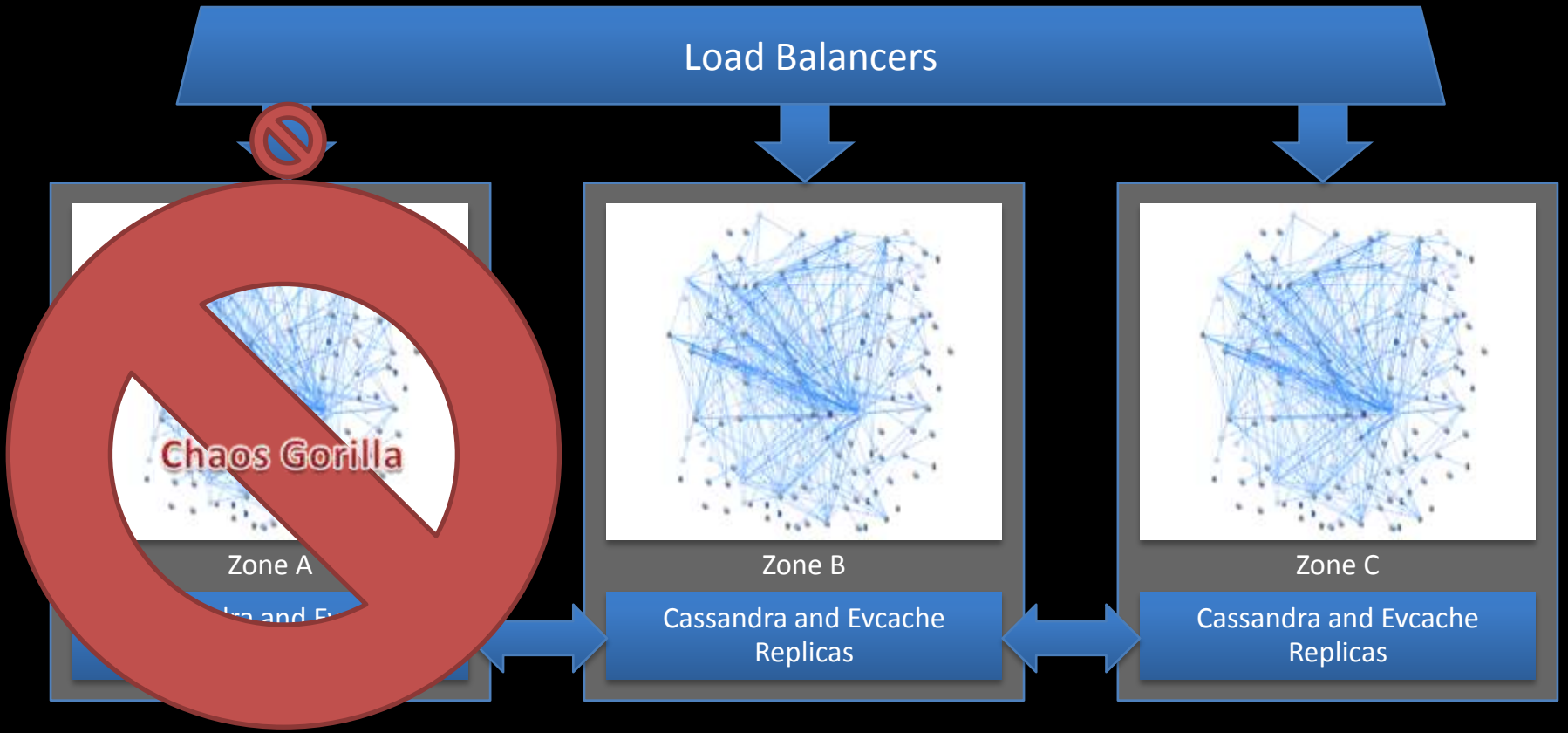
Each icon is three to a few hundred instances across three AWS zones



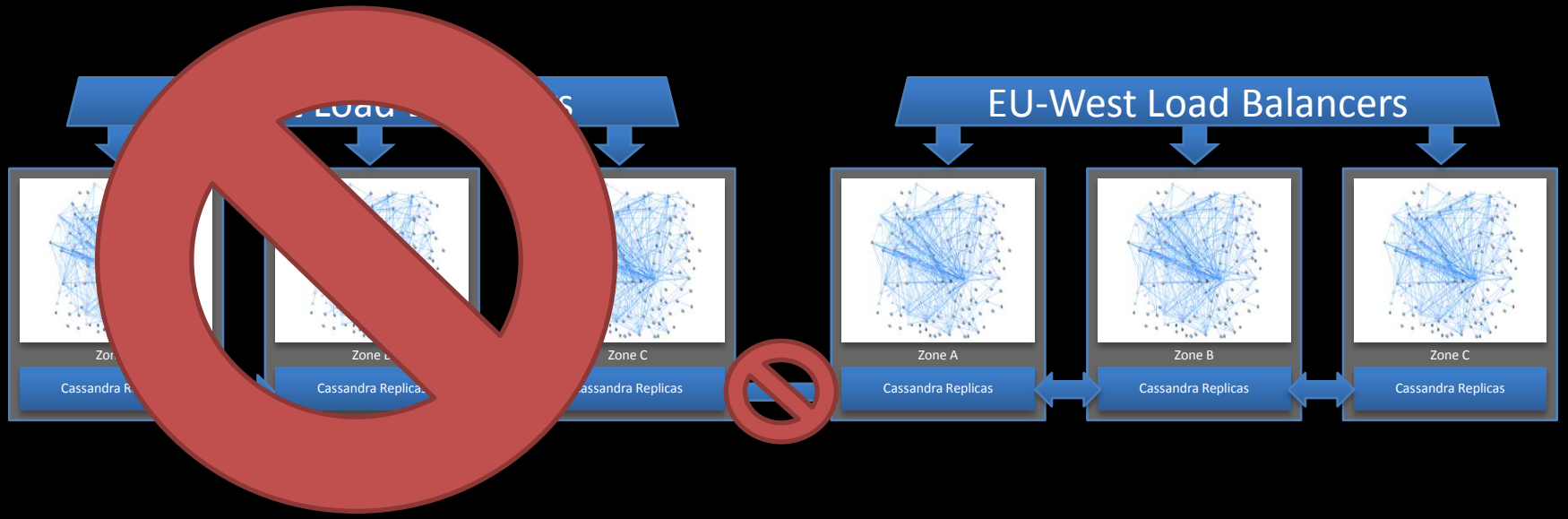
Personalization movie group choosers
(for US, Canada and Latam)

Three Balanced Availability Zones

Test with Chaos Gorilla



Isolated Regions

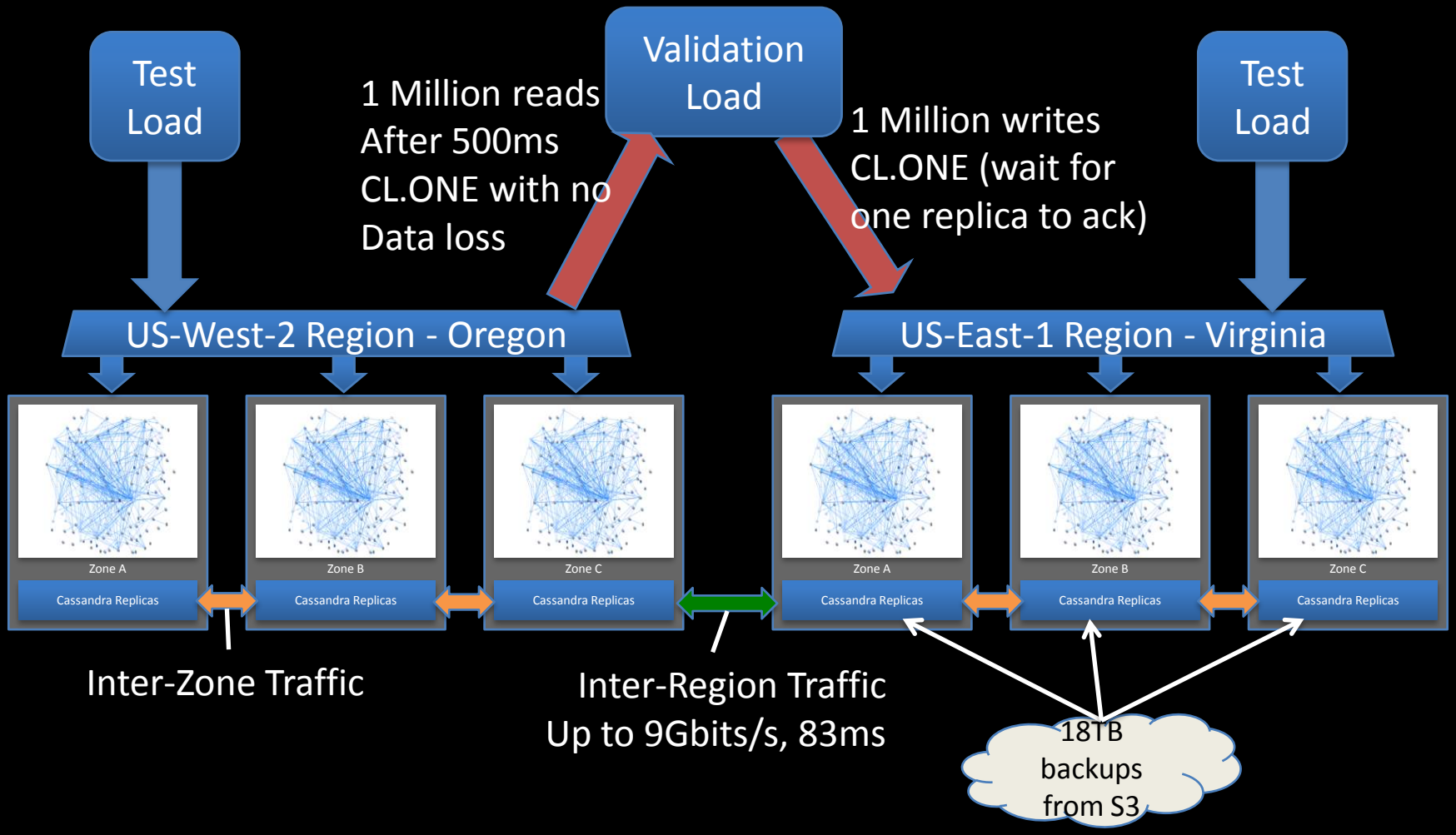


Cross Region Use Cases

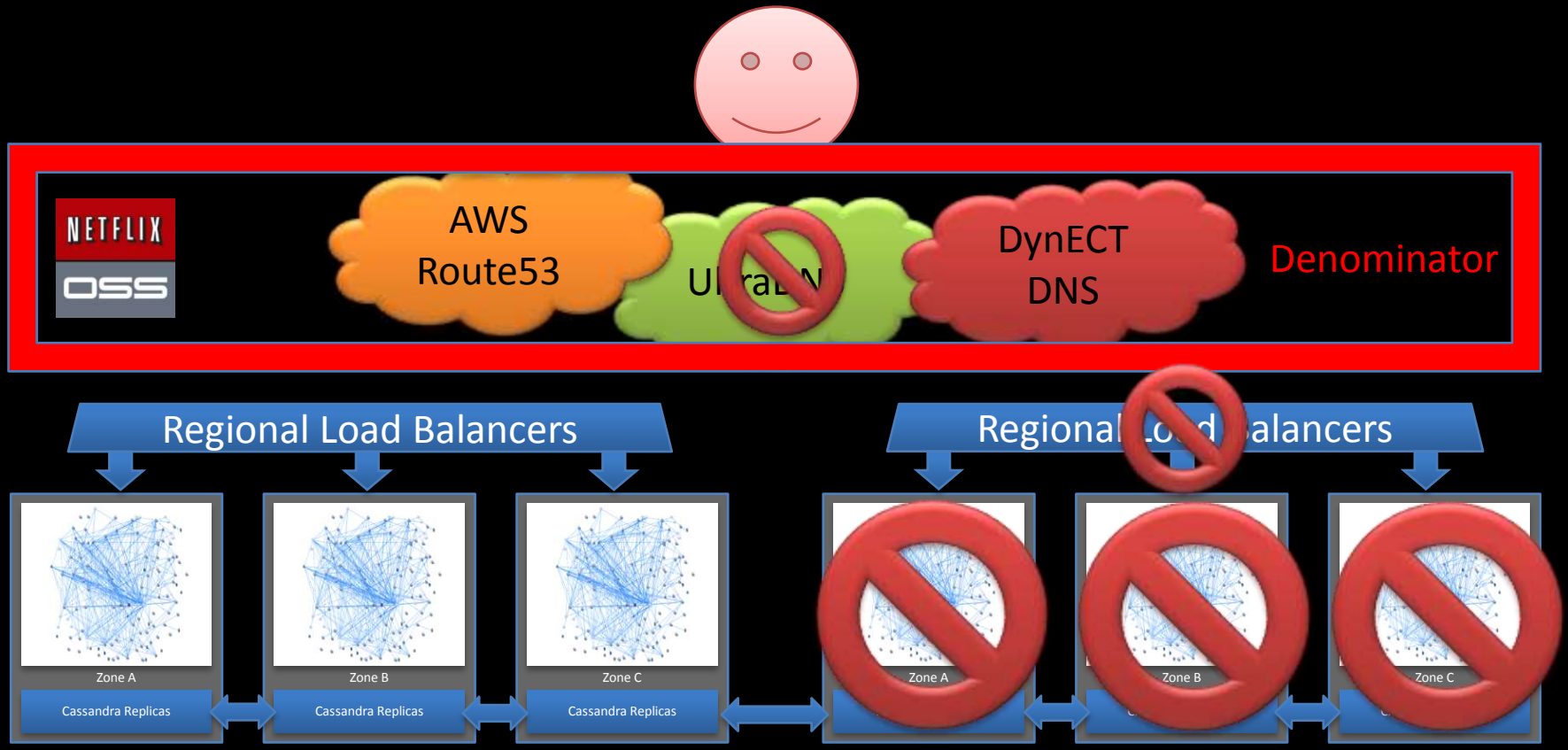
- Geographic Isolation
  - US to Europe replication of subscriber data
  - Read intensive, low update rate
  - Production use since late 2011
- Redundancy for regional failover
  - US East to US West replication of everything
  - Includes write intensive data, high update rate
  - Testing now

Benchmarking Global Cassandra

Write intensive test of cross region replication capacity
16 x hi1.4xlarge SSD nodes per zone = 96 total
192 TB of SSD in six locations up and running Cassandra in 20 min



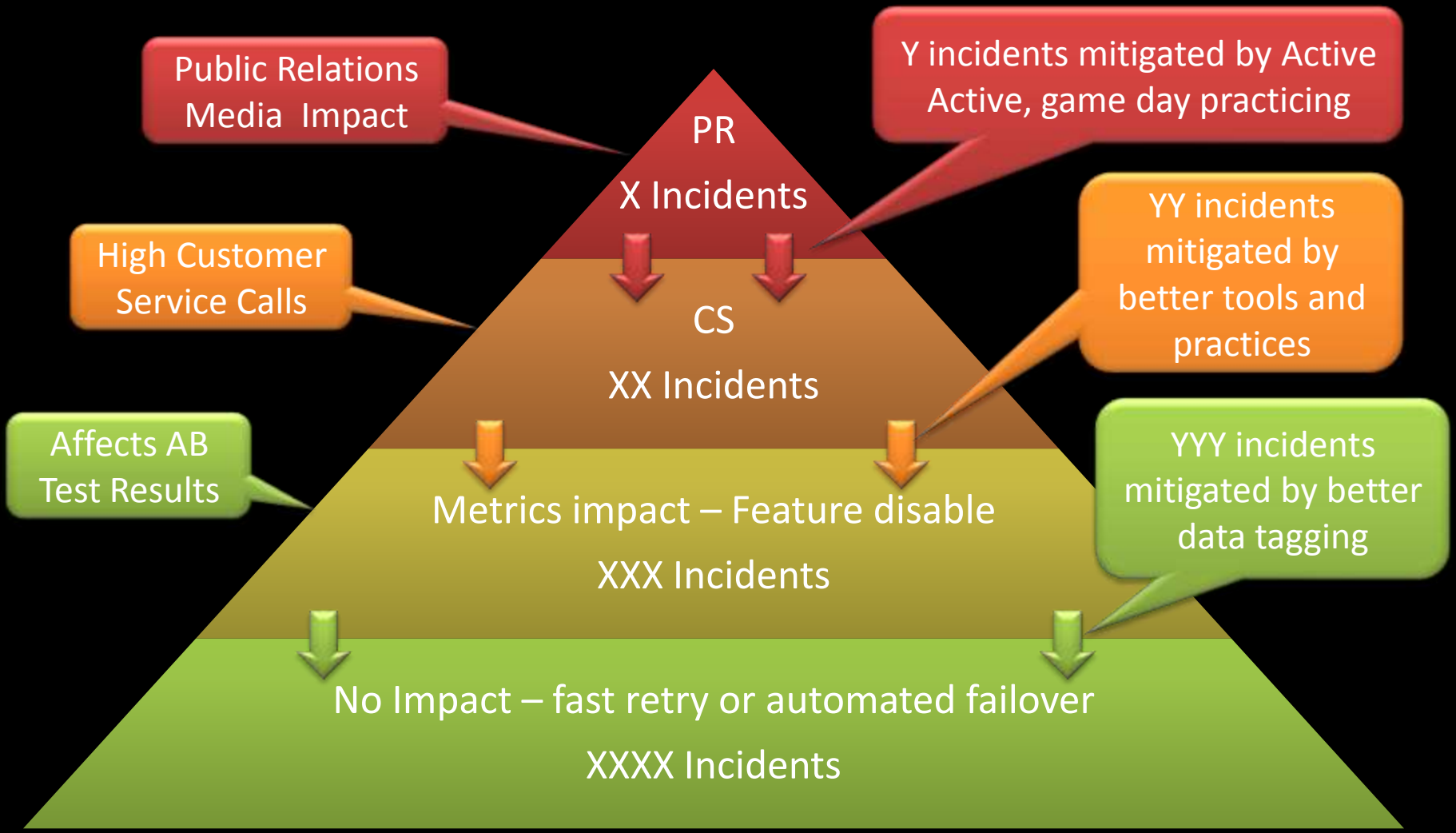
Managing Multi-Region Availability



Denominator – manage traffic via multiple DNS providers with Java code

2013 Timeline - Concept Jan, Code Feb, OSS March, Production use May

Incidents – Impact and Mitigation



Cloud Security

Automated attack surface monitoring

Crypto key store management (CloudHSM)

Scale to resist DDOS attacks

http://www.slideshare.net/jason_chan/resilience-and-security-scale-lessons-learned

What Changed?

"Impossible" deployments are easy

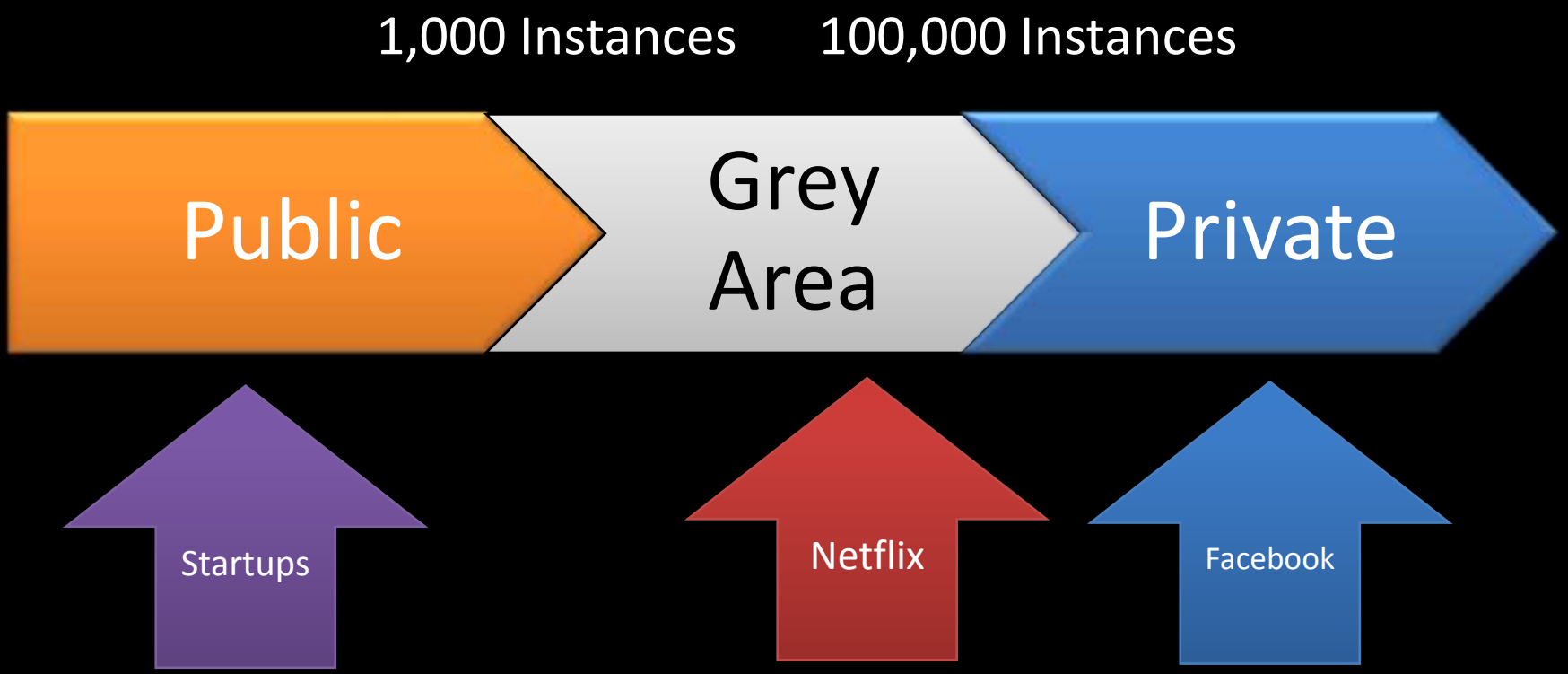
Jointly building code with vendors in public

Highly available and secure despite scale and speed

The DIY Question

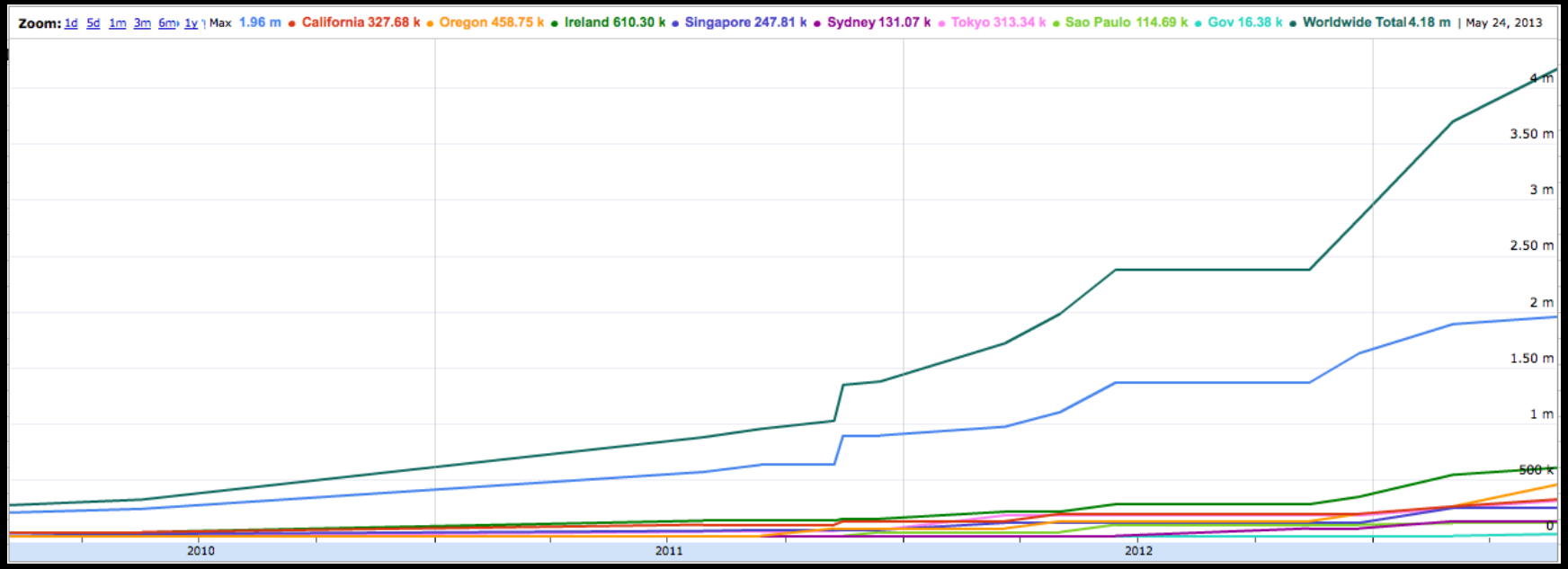
Why doesn’t Netflix build and run its own cloud?

Fitting Into Public Scale



How big is Public?

AWS Maximum Possible Instance Count 4.2 Million – May 2013
Growth >10x in Three Years, >2x Per Annum - http://bit.ly/awsiprange



AWS upper bound estimate based on the number of public IP Addresses
Every provisioned instance gets a public IP by default (some VPC don't)

A Cloud Native Open Source Platform

See netflix.github.com

Establish our solutions as Best Practices / Standards

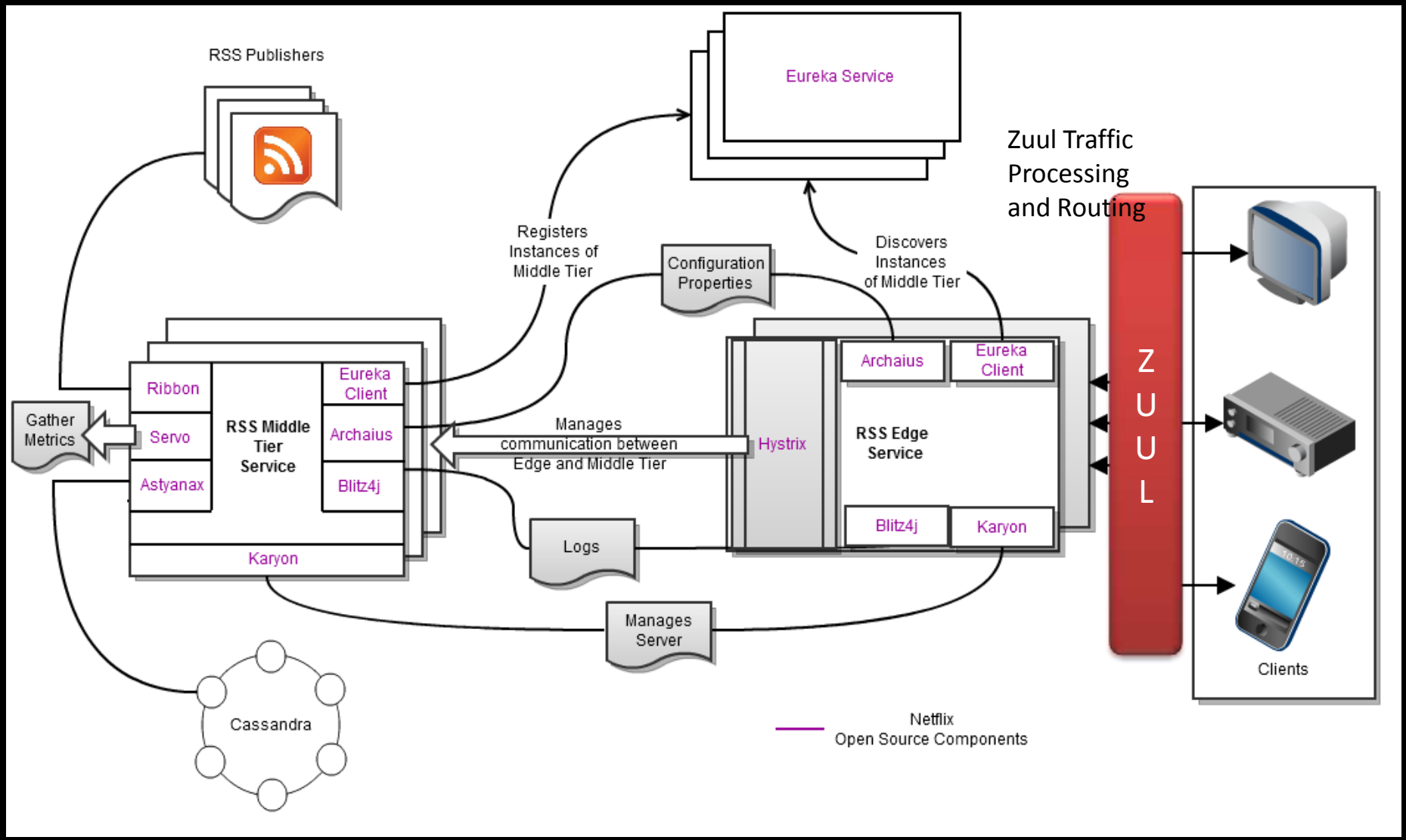
Hire, Retain and Engage Top Engineers

Goals

Build up Netflix Technology Brand

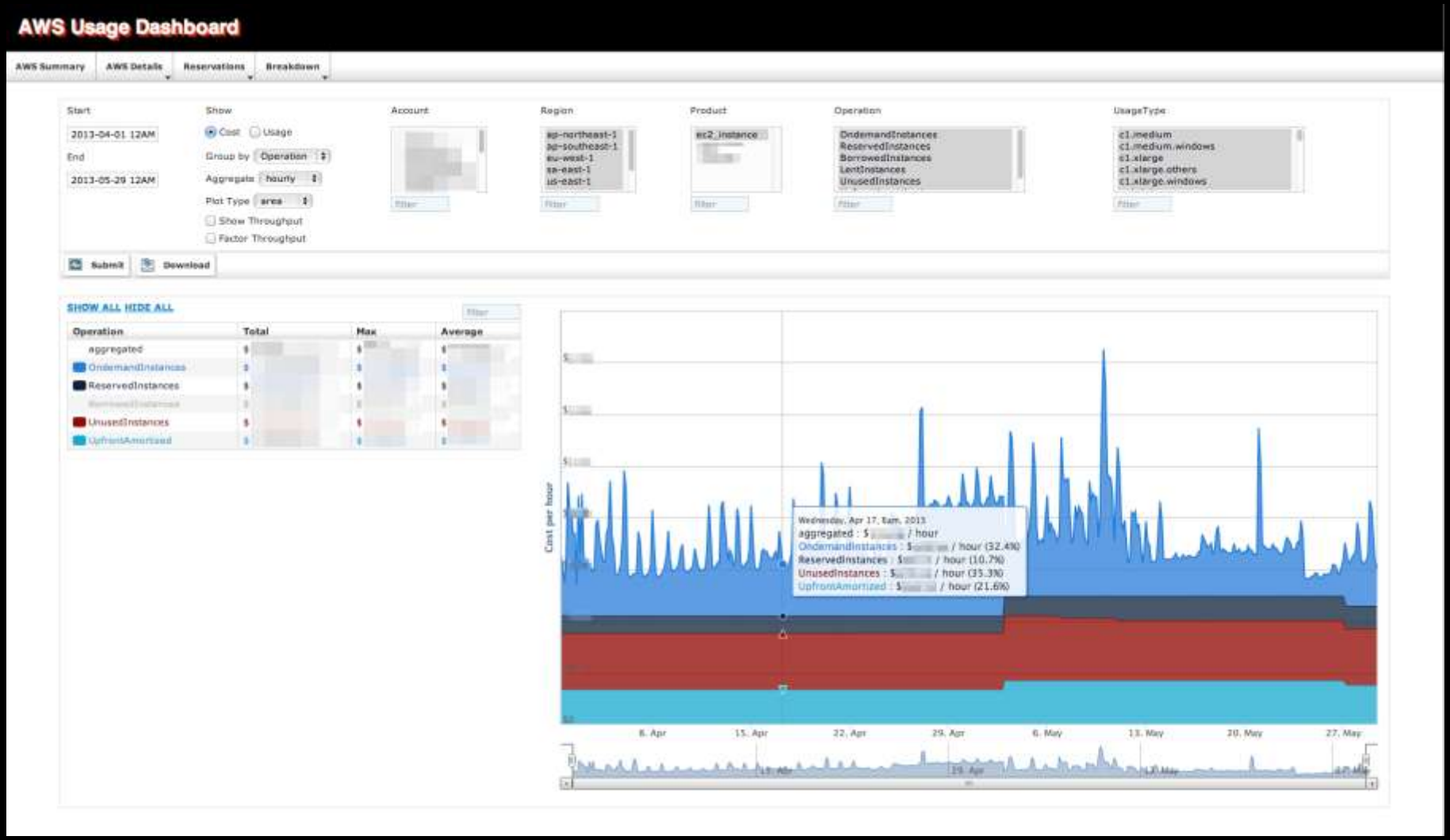
Benefit from a shared ecosystem

Example Application – RSS Reader



Ice – Detailed AWS "Chargeback"

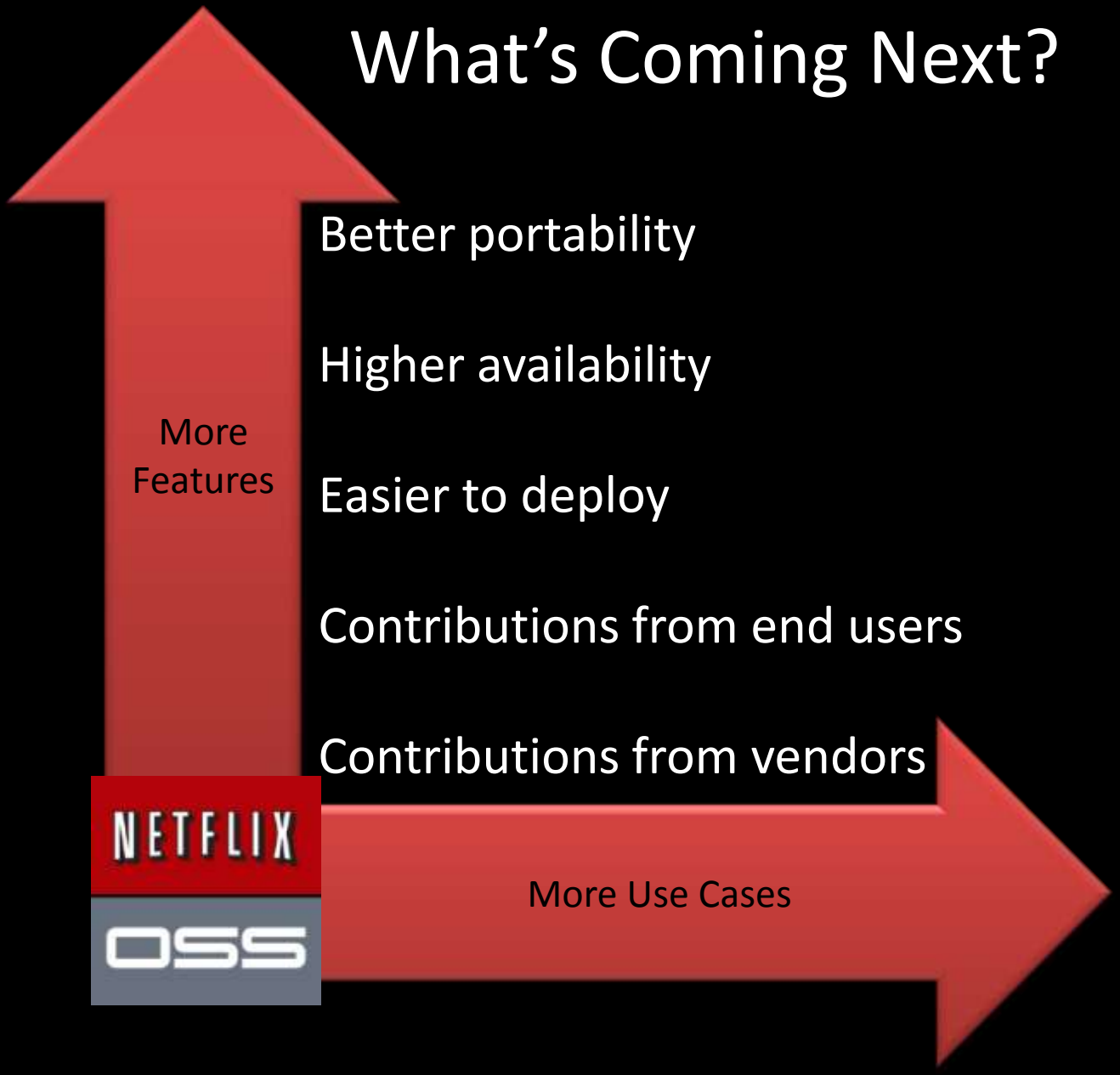
http://techblog.netflix.com/2013/06/announcing-ice-cloud-spend-and-usage.html



Boosting the @NetflixOSS Ecosystem

See netflix.github.com

What's Coming Next?



Vendor Driven Portability

Interest in using NetflixOSS for Enterprise Private Clouds

"It's done when it runs Asgard"
Functionally complete
Demonstrated March
Released June in V3.3

Offering $10K prize for integration work

Vendor and end user interest
Openstack "Heat" getting there
Paypal C3 Console based on Asgard

Functionality and scale now, portability coming

Moving from parts to a platform in 2013

Netflix is fostering a cloud native ecosystem

Rapid Evolution - Low MTBIAMSH

(Mean Time Between Idea And Making Stuff Happen)

Slideshare.net/Netflix Details

- Meetup S1E3 July – Featuring Contributors Eucalyptus, IBM, Paypal, Riot Games
  - http://techblog.netflix.com/2013/07/netflixoss-meetup-series-1-episode-3.html
- Lightning Talks March S1E2
  - http://www.slideshare.net/RuslanMeshenberg/netflixoss-meetup-lightning-talks-and-roadmap
- Lightning Talks Feb S1E1
  - http://www.slideshare.net/RuslanMeshenberg/netflixoss-open-house-lightning-talks
- Asgard In Depth Feb S1E1
  - http://www.slideshare.net/joesondow/asgard-overview-from-netflix-oss-open-house
- Security Architecture
  - http://www.slideshare.net/jason_chan/resilience-and-security-scale-lessons-learned/
- Cost Aware Cloud Architectures – with Jinesh Varia of AWS
  - http://www.slideshare.net/AmazonWebServices/building-costaware-architectures-jinesh-varia-aws-and-adrian-cockroft-netflix

What Changed?

Speed wins, Cloud Native helps you get there

NetflixOSS makes it easier for everyone to become Cloud Native

http://netflix.github.com
http://techblog.netflix.com
http://slideshare.net/Netflix

http://www.linkedin.com/in/adriancockcroft

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