Netflix in the Cloud

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Who, Why, What

Netflix in the Cloud

Cloud Challenges and Learnings

~~Systems and Operations Architecture~~

(see presentation at 15:50-16:50)

Netflix Inc.

With more than 20 million subscribers in the United States and Canada, Netflix, Inc. is the world's leading Internet subscription service for enjoying movies and TV shows.

<u>International Expansion</u>

We plan to expand into an additional market in the second half of 2011… If the second market meets our expectations… we will continue to invest and expand aggressively in 2012.

Source: http://ir.netflix.com

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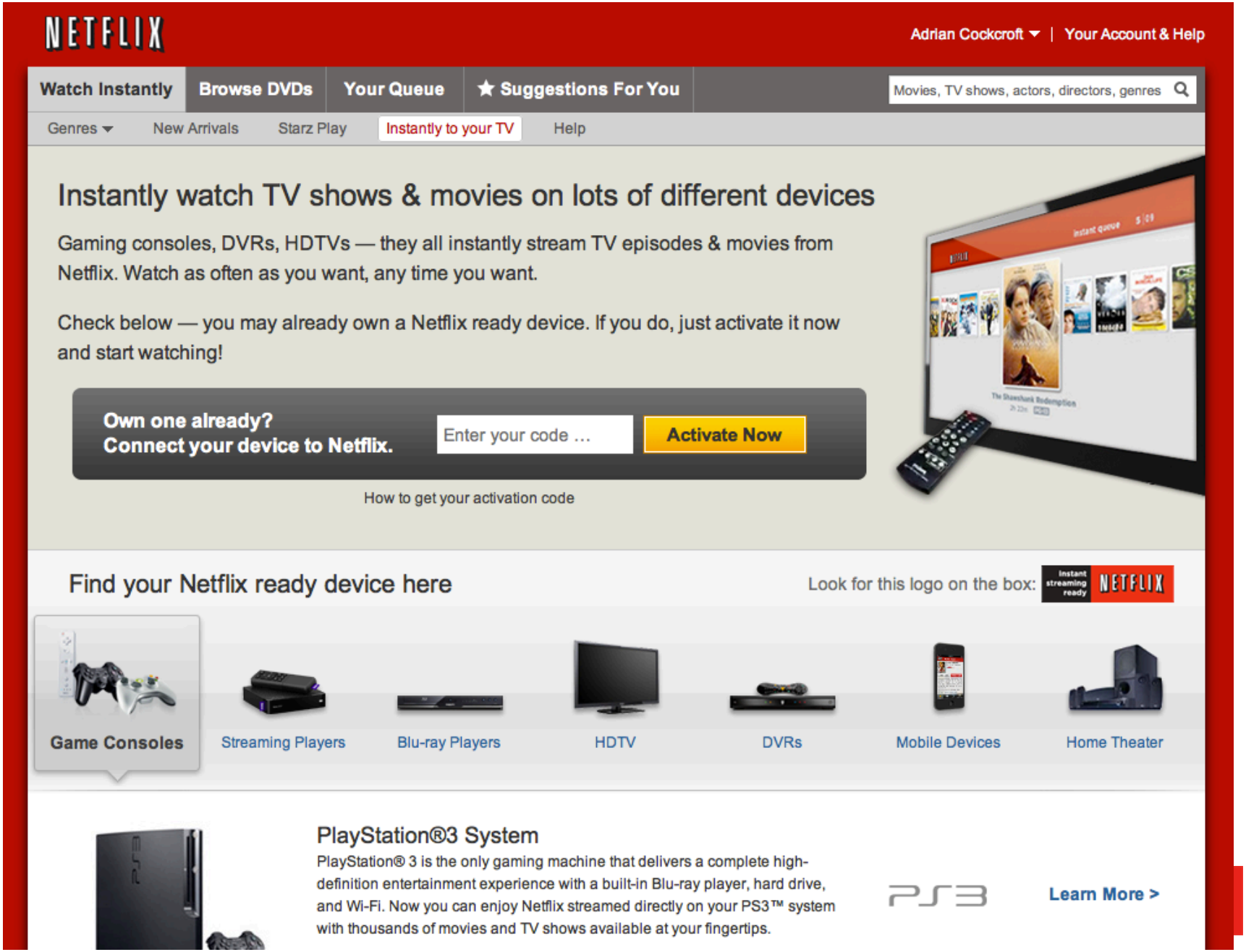
Unlimited streaming for $7.99/month, large and growing catalog of movies and TV



Adrian Cockcroft

- Director, Architecture for Cloud Systems, Netflix Inc.
  - Previously Director for Personalization Platform
- Distinguished Availability Engineer, eBay Inc. 2004-7
  - Founding member of eBay Research Labs
- Distinguished Engineer, Sun Microsystems Inc. 1988-2004
  - 2003-4 Chief Architect High Performance Technical Computing
  - 2001 Author: *Capacity Planning for Web Services*
  - 1999 Author: *Resource Management*
  - 1995 & 1998 Author: *Sun Performance and Tuning*
  - 1996 Japanese Edition of *Sun Performance and Tuning*
    - SPARC & Solarisパフォーマンスチューニング (サンソフトプレスシリーズ)

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Why is Netflix Talking about Cloud?

Netflix is Path-finding

The Cloud ecosystem is evolving very fast

Share with and learn from the cloud community

We want to use clouds, not build them

Cloud technology should be a commodity

Public cloud and open source for agility and scale

Why Use Cloud?

For Better Business Agility
For Unpredictable Business Growth

Netflix could not build new datacenters fast enough

Capacity growth is accelerating, unpredictable

Product launch spikes - iPhone, Wii, PS3, XBox

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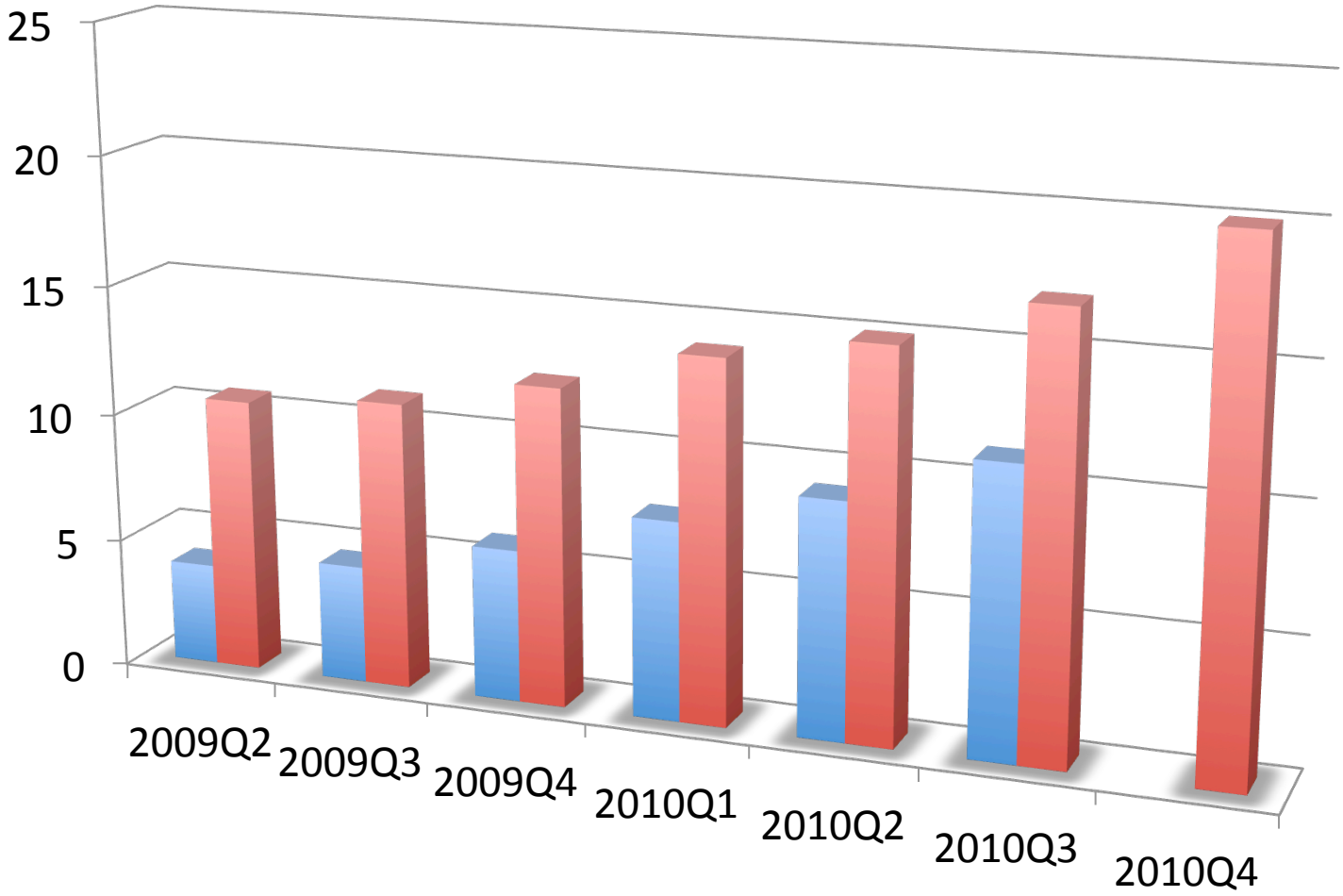
20 Million Customers

2010-Q3 year/year +52% Total and +145% Streaming



Source: http://ir.netflix.com

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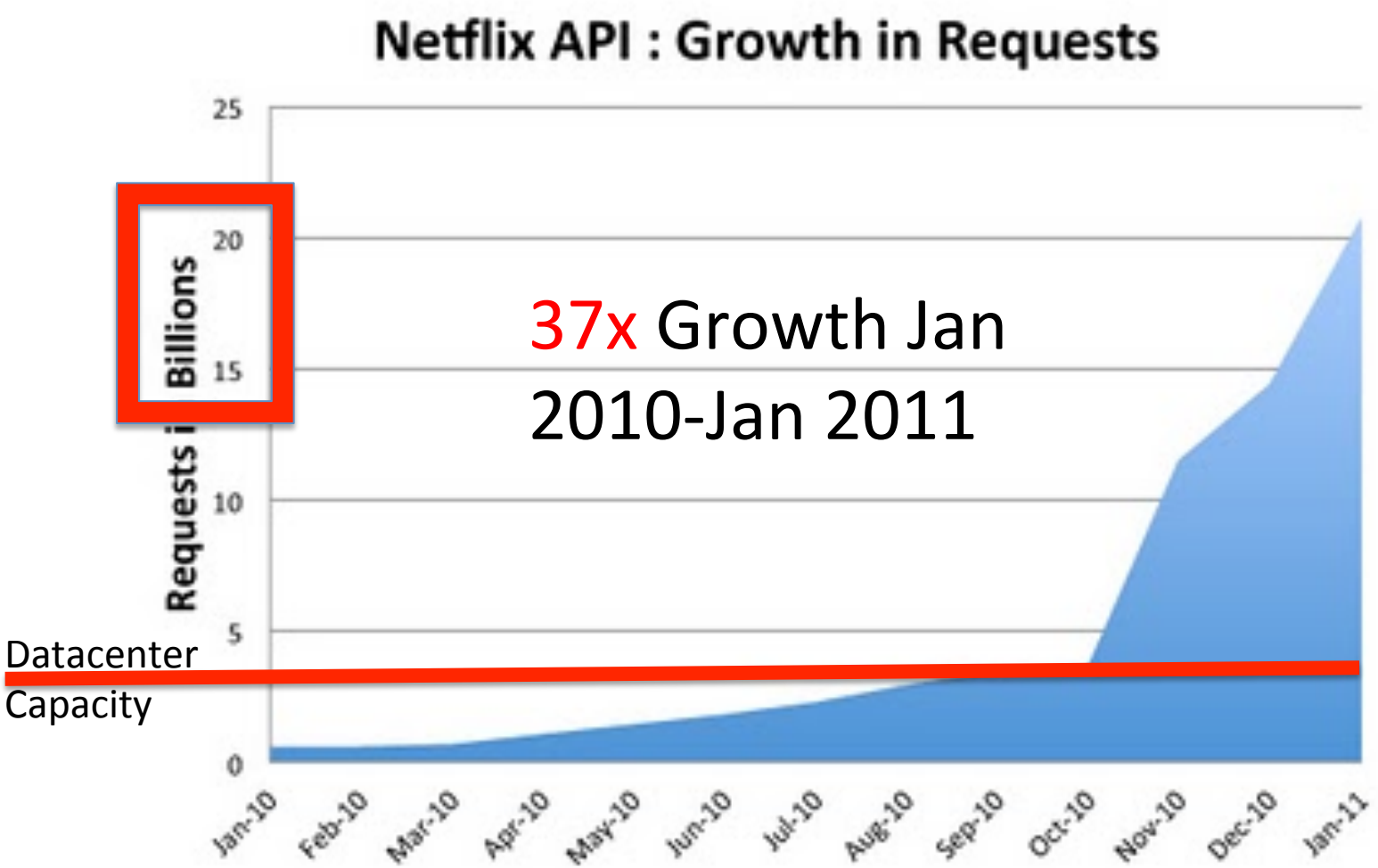
Out-Growing Data Center

http://techblog.netflix.com/2011/02/redesigning-netflix-api.html



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Netflix.com is now ~100% Cloud

Account sign-up is currently being moved to cloud

All international product will be cloud based

USA specific logistics remains in the Datacenter

Leverage AWS Scale
“the biggest public cloud”

AWS investment in tooling and automation

Use many AWS zones for high availability, scalability

AWS skills are most common on resumes…

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Leverage AWS Feature Set
“the market leader”

EC2, S3, SDB, SQS, EBS, EMR, ELB, ASG, IAM, RDB, VPC…

http://aws.amazon.com/jp

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Amazon Cloud Terminology

See http://aws.amazon.com/ for details
This is not a full list of Amazon Web Service features

- AWS – Amazon Web Services (common name for Amazon cloud)
- AMI – Amazon Machine Image (archived boot disk, Linux, Windows etc. plus application code)
- EC2 – Elastic Compute Cloud
  - Range of virtual machine types m1, m2, c1, cc, cg. Varying memory, CPU and disk configurations.
  - Instance – a running computer system. Ephemeral, when it is de-allocated nothing is kept.
  - Reserved Instances – pre-paid to reduce cost for long term usage
  - Availability Zone – datacenter with own power and cooling hosting cloud instances
  - Region – group of Availability Zones – US-East, US-West, EU-Eire, Asia-Singapore, Asia-Japan
- ASG – Auto Scaling Group (instances booting from the same AMI)
- S3 – Simple Storage Service (http access)
- EBS – Elastic Block Storage (network disk filesystem can be mounted on an instance)
- RDB – Relational Data Base (managed MySQL master and slaves)
- SDB – Simple Data Base (hosted http based NoSQL data store)
- SQS – Simple Queue Service (http based message queue)
- SNS – Simple Notification Service (http and email based topics and messages)
- EMR – Elastic Map Reduce (automatically managed Hadoop cluster)
- ELB – Elastic Load Balancer
- EIP – Elastic IP (stable IP address mapping assigned to instance or ELB)
- VPC – Virtual Private Cloud (extension of enterprise datacenter network into cloud)
- IAM – Identity and Access Management (fine grain role based security keys)

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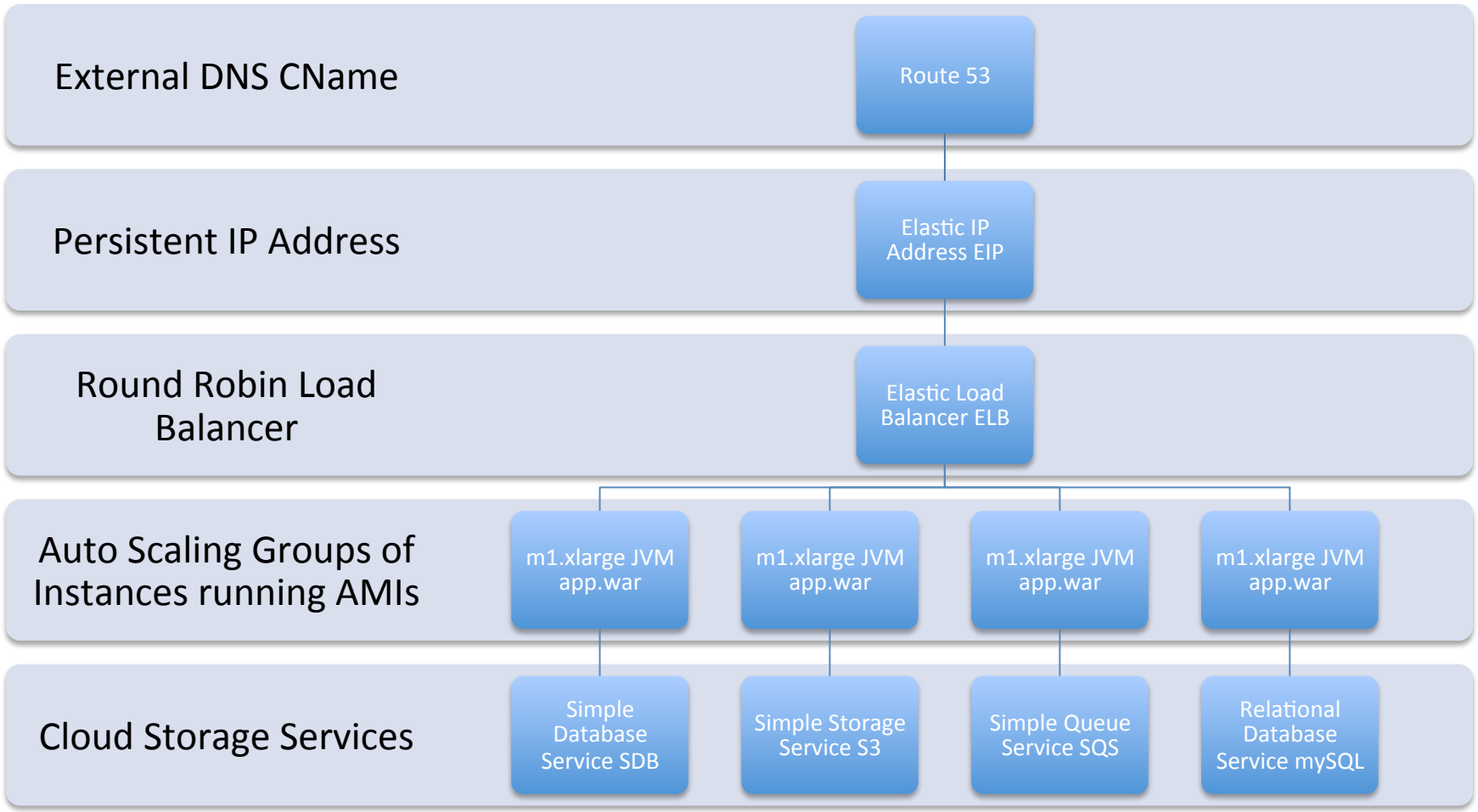
Simple AWS Architecture

Automatic configuration of this using “CloudFormation” and “Elastic Beanstalk”



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"The cloud lets its users focus on delivering differentiating business value instead of wasting valuable resources on the ***undifferentiated heavy lifting*** *that makes up most of IT infrastructure."*

Werner Vogels

Amazon CTO

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We want to use clouds, we don't have time to build them

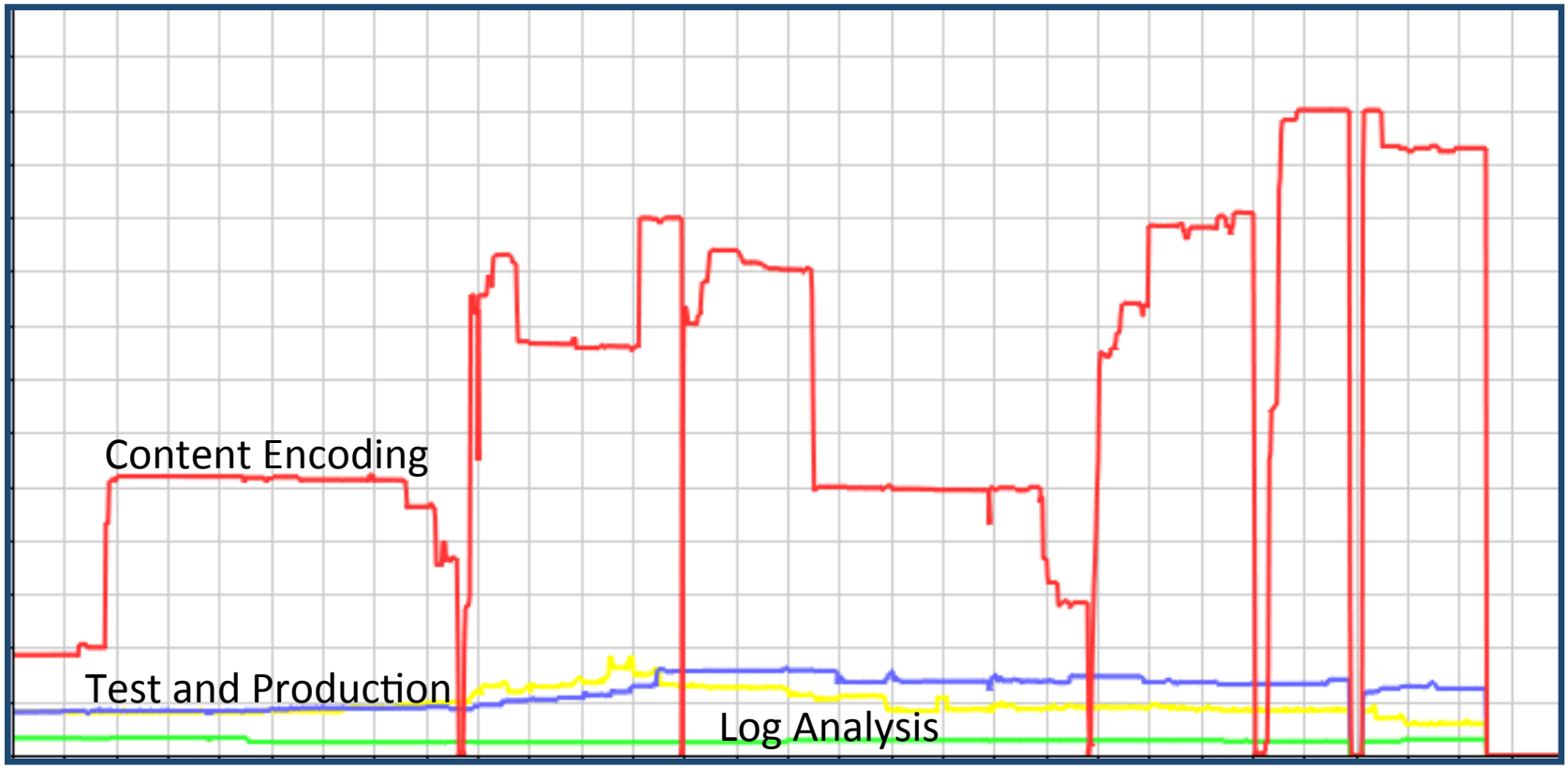
Public cloud for agility and scale

AWS because they are big enough to allocate thousands of instances per hour when we need to

Netflix EC2 Instances per Account

(summer 2010, production is much higher now…)

"Many Thousands"



"Several Months"

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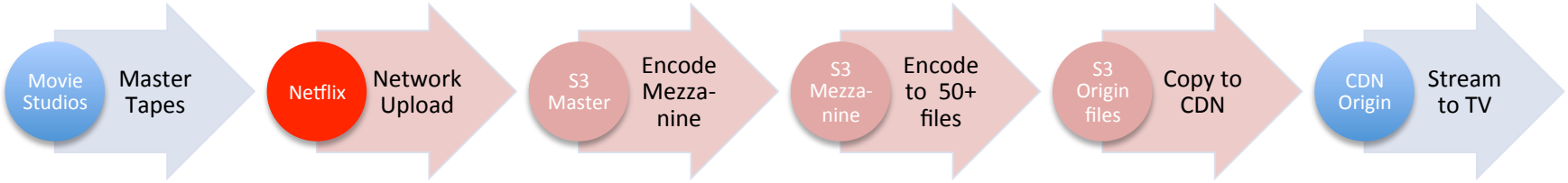
Netflix Deployed on AWS

Content	Logs	Play	WWW	API
Video Masters	S3	DRM	Search	Metadata
EC2	EMR Hadoop	CDN routing	Movie Choosing	Device Config
S3	Hive	Bookmarks	Ratings	TV Movie Choosing
Content Delivery Network CDN	Business Intelligence	Logging	Similars	Mobile iPhone

Cloud Encoding Pipeline



Licensed content is provided to Netflix as high quality master tapes
Many formats are reduced to a single high quality mezzanine format on S3
Individual formats and speeds are encoded in over 50 combinations
    Many formats for older and newer hardware and various game consoles
    Many speeds from mobile through standard and high definition
Static files are copied to each Content Delivery Network's "origin server"
CDNs migrate files to "edge servers" near the end user
Files stream to PC/Mac/iPad or TV over HTTP using "range get" to move chunks

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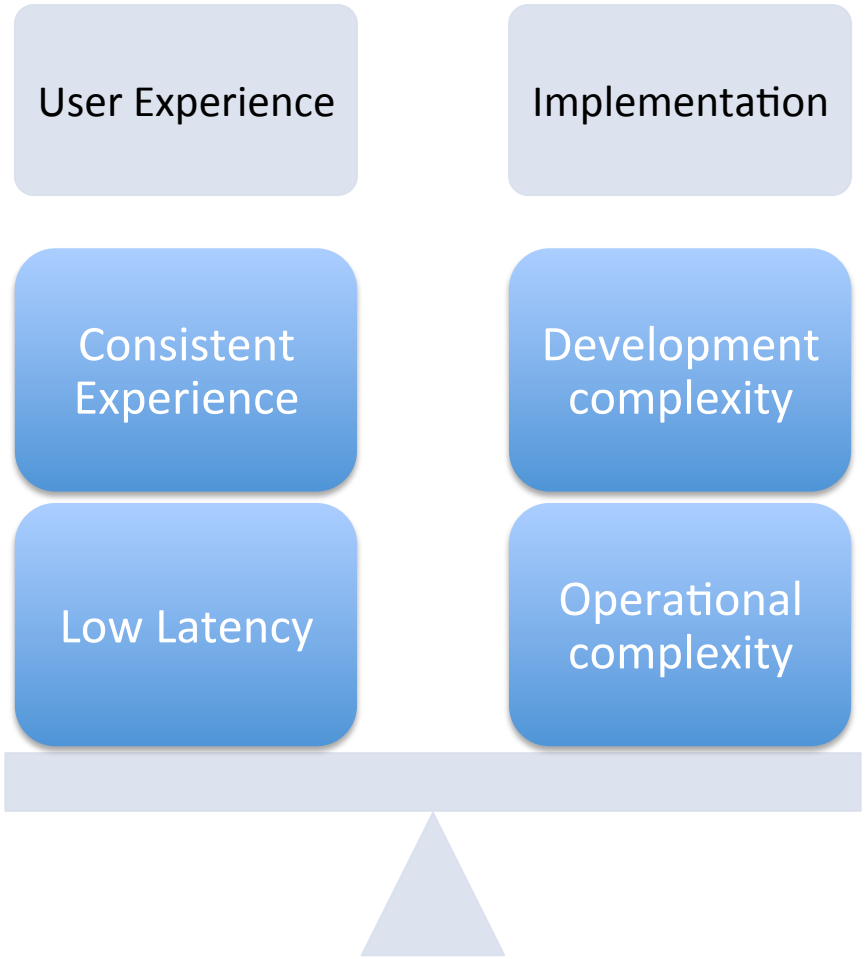
Cloud Architecture

Separate Talk for Details

15:50-16:50

Product Trade-off



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Learnings

- Datacenter oriented tools don't work
  - Ephemeral instances
  - High rate of change
  - Need too much hand-holding and manual setup
- Cloud Tools Don't Scale for Enterprise
  - Too many tools are "Startup" oriented
  - Built our own tools for 1000's of instances
  - Drove vendors to be dynamic, scale, add APIs
- Un-modified Datacenter Apps are Fragile
  - Too many datacenter oriented assumptions
  - We re-wrote our code base!
  - (We re-write it continuously anyway)

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Wrap Up

Implications for IT Operations

- Cloud is run by developer organization
  - Our IT department is Amazon Cloud
- Cloud capacity is much bigger than Datacenter
  - Datacenter oriented IT staffing is flat
  - We have no IT staff working on cloud
  - We have moved 3 people out of IT to write code
- Traditional IT Roles are going away
  - Don't need SA, DBA, Storage, Network admins

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Next Few Years…

- "System of Record" moves to Cloud (now)
  - Master copies of data live only in the cloud, with backups
  - Cut the datacenter to cloud replication link
- International Expansion – Global Clouds (later in 2011)
  - Rapid deployments to new markets
- Cloud Standardization?
  - Cloud features and APIs should be a commodity not a differentiator
  - Differentiate on scale and quality of service
  - Competition also drives cost down
  - Higher resilience and scalability

We would prefer to be an insignificant customer in a giant cloud

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Takeaway

Netflix is path-finding the use of public AWS cloud to replace in-house IT for non-trivial applications with hundreds of developers and thousands of systems.

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