

Beyond DevOps: How Netflix Bridges the Gap

Josh Evans - Director of Operations Engineering

November 16, 2015



Fall 2013

Technical Debt

- Java 6
- Perforce
- Single Master Jenkins
- Ant
- CentOS
- Asgard/Mimir



How do we drive broad-based change?

The Paved Road

- Java 7
- Stash
- Jenkins Shards
- Gradle
- Ubuntu



That's great but...

Some said

- You're overloading us
- Too many projects
- Poor targeting

Others said

- What took you so long?
- We've moved on
- Now we need to migrate

We're paying a high tax

Organizational Debt

- Expectations gap
 - Division of labor
 - Timing of solutions
 - Leadership
- Affects
 - Reputation
 - Relationships
 - Lost opportunities



How do we bridge the gap?

“Remember that TIME is money...”



Time is a form of currency

Our time today...

- Product Engineering
- Operations Engineering
- Challenges & Strategies



Our time today...

- **Product Engineering**
- Operations Engineering
- Challenges & Strategies



NETFLIX

Product Innovation

winning moments of truth





Friends' Favorites



Archer

2009 TV-MA 36 episodes



Sophisticated spy Archer may have the coolest gadgets, but he still has issues when it comes to dealing with his boss – who also is his mother.

H. Jon Benjamin, Judy Greer,
Amber Nash

My List



TV Shows, TV Action &
Adventure

NETFLIX ORIGINAL BLOODLINE

★★★★★ 2015 TV-MA 1 Season HD

We're not bad people, but we did a bad thing.

The Rayburns seem to have the perfect life in their lovely Florida town. But nobody's perfect -- especially the Rayburns.



TV Dramas

WORLD WAR



TV Comedies

E
ADES



Continuous Innovation

- Every facet of the product
- 1400 AB tests in the last year & accelerating



But wait, there's more...

You build it, you run it

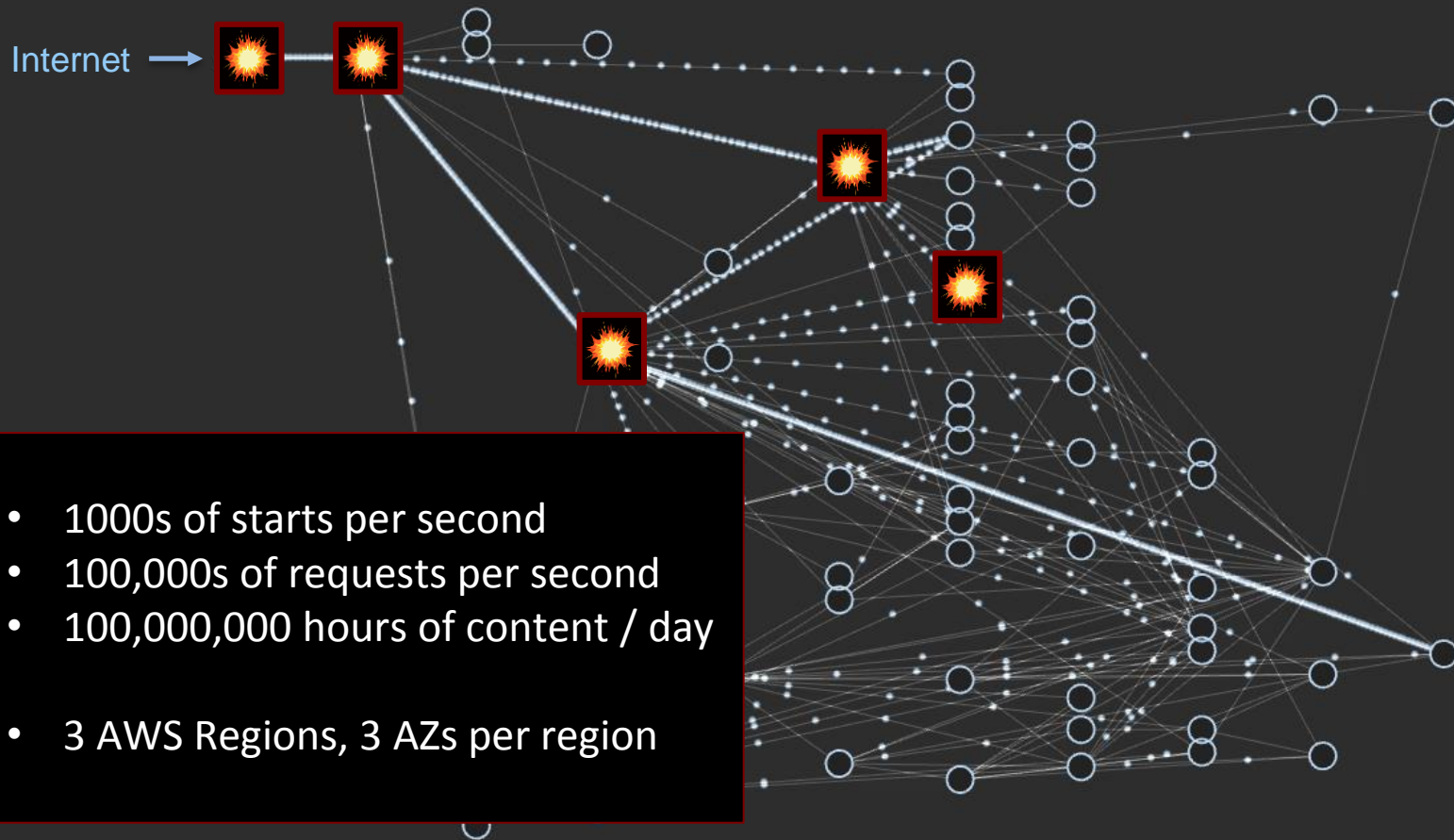
Build It

- design
- code
- build
- bake
- test
- deploy

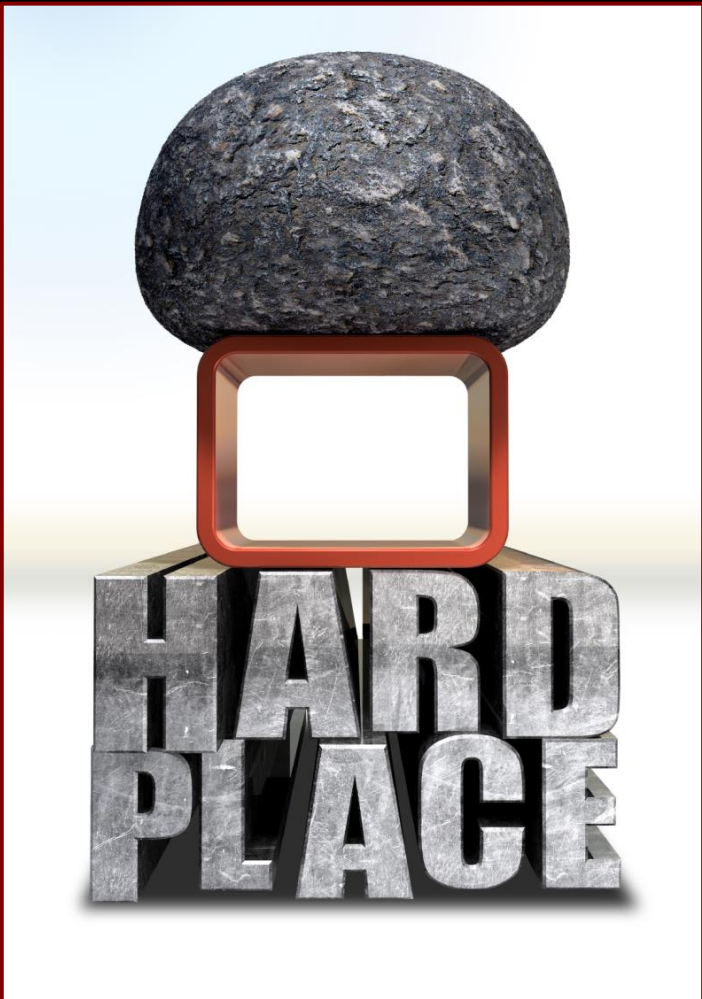
Run It

- configure
- monitor
- triage
- fix

...at scale, globally



- 1000s of starts per second
- 100,000s of requests per second
- 100,000,000 hours of content / day
- 3 AWS Regions, 3 AZs per region



Relentless product innovation

Building & running micro-services at scale, globally

Our time today...

- Product Engineering
- **Operations Engineering**
- Challenges & Strategies



The Gap

DevOps is a software development method that emphasizes the roles of both software developers and other information-technology (IT) professionals with an emphasis on IT Operations.

- Wikipedia

Why? How?

Operational Excellence



Quality

Velocity

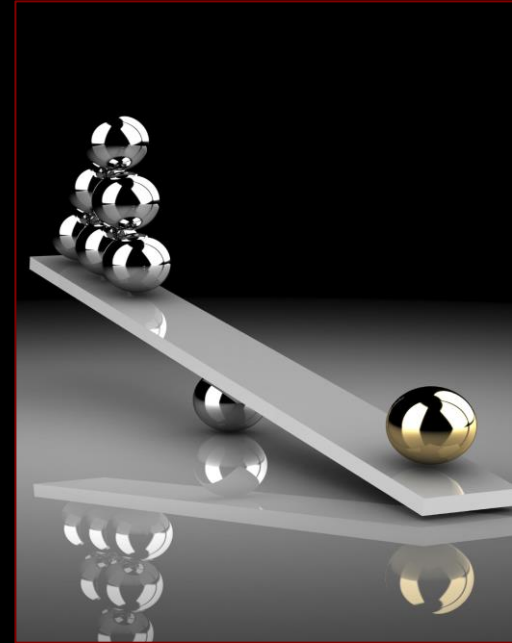
Operational Excellence is the continuous improvement of the management, design, and function of operational environments to achieve greater quality, velocity, and competitive advantage.

Operations Engineering is the application of software engineering practices to achieve and sustain operational excellence.

- Engineering Tools
- Insight & Real-time Analytics
- Performance & Reliability

Operations Engineering

- Service provider
- Operational excellence driver
- Cross-cutting solutions
- Undifferentiated heavy lifting



Our time today...

- Product Engineering
- Operations Engineering
- **Challenges & Strategies**



Remember that feedback?

- You're overloading us
- What took you so long?

- We made assumptions
 - Requirements – what & when
 - Time for non-product work

How do we...

- Move from assumptions to knowledge
- Affect change without imposing a tax?
- Achieve and sustain operational excellence?



Time is a form of currency

5 strategies for success in time-based economies

software & organizational engineering

1. Reach out



Talk to your engineering customers

- What are your biggest operational pain points?
- How can we help?
- How well are we meeting your needs today?
- What would you like to see from us in the future?

Listen

Shower, rinse, repeat

Grease the Squeaky Wheels

- low tolerance for tax
- more vocal than most



What they wanted

- High impact solutions
- Clarity on deliverables
- Lower operational tax
- Leadership, innovation, and partnership

Our commitments

- Deliver on solutions
- Better road map definition & communication
- A more aggressive stance on automation
- Deeper investment into leadership, innovation, planning

2. Make an impact

- Apply what you've learned
- Deliver what matters





- global cloud console
- end to end delivery
- automation platform

- velocity with confidence

Filters

Clear All

Unpin

SEARCH

ACCOUNT

-
- prod
-
-
- test

REGION

-
- eu-west-1
-
-
- us-east-1
-
-
- us-west-2

STACK

-
- ci
-
-
- debug
-
-
- delivery
-
-
- int
-
-
- mayank
-
-
- noss
-
-
- perf
-
-
- playbackmonkey
-
-
- primer
-
-
- primerci
-
-
- prod
-
-
- sandbox
-
-
- squeeze
-
-
- staging
-
-
- test
-
-
- testdata

Clusters

Show

 Instances with details

Create Server Group

PROD

api-prod

1184 ▲ / 1 ◆ : 99%

EU-WEST-1

V159: Build: #4220

206 ▲ / 1 ◆ : 99%

US-EAST-1

V175: Build: #4220

520 ▲ : 100%

US-WEST-2

V335: Build: #4220

458 ▲ : 100%



i-8940274d

Instance Actions

Insight

INSTANCE INFORMATION

Launched: 2015-11-14 08:09:09 PST

In: prod us-west-2b

Type: c3.8xlarge

Server Group: api-prod-v335

VPC: None (EC2 Classic)

STATUS

Discovery

▲ Up Health Check | Status

DNS

SECURITY GROUPS

LOGS

NETFLIX CONFIGURATION



Permalink

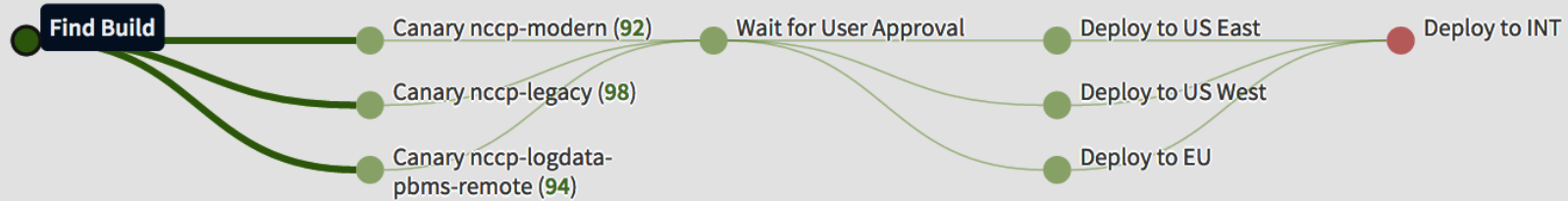
Pipelines - Automated Global Delivery

1 Push to PROD with Canary (modern, legacy, logdata)

Trigger: Enabled

Configure

Start Manual Execution



Hide Details ✕

FIND BUILD DETAILS

✓ FIND BUILD

Step	Started	Duration	Status
Find Build	2015-11-10 08:00:03 PST	00:19	COMPLETED

Jenkins Config

Task Status

Task

- ✓ Start Jenkins Job
- ✓ Wait For Jenkins Job Start
- ✓ Monitor Jenkins Job

Duration

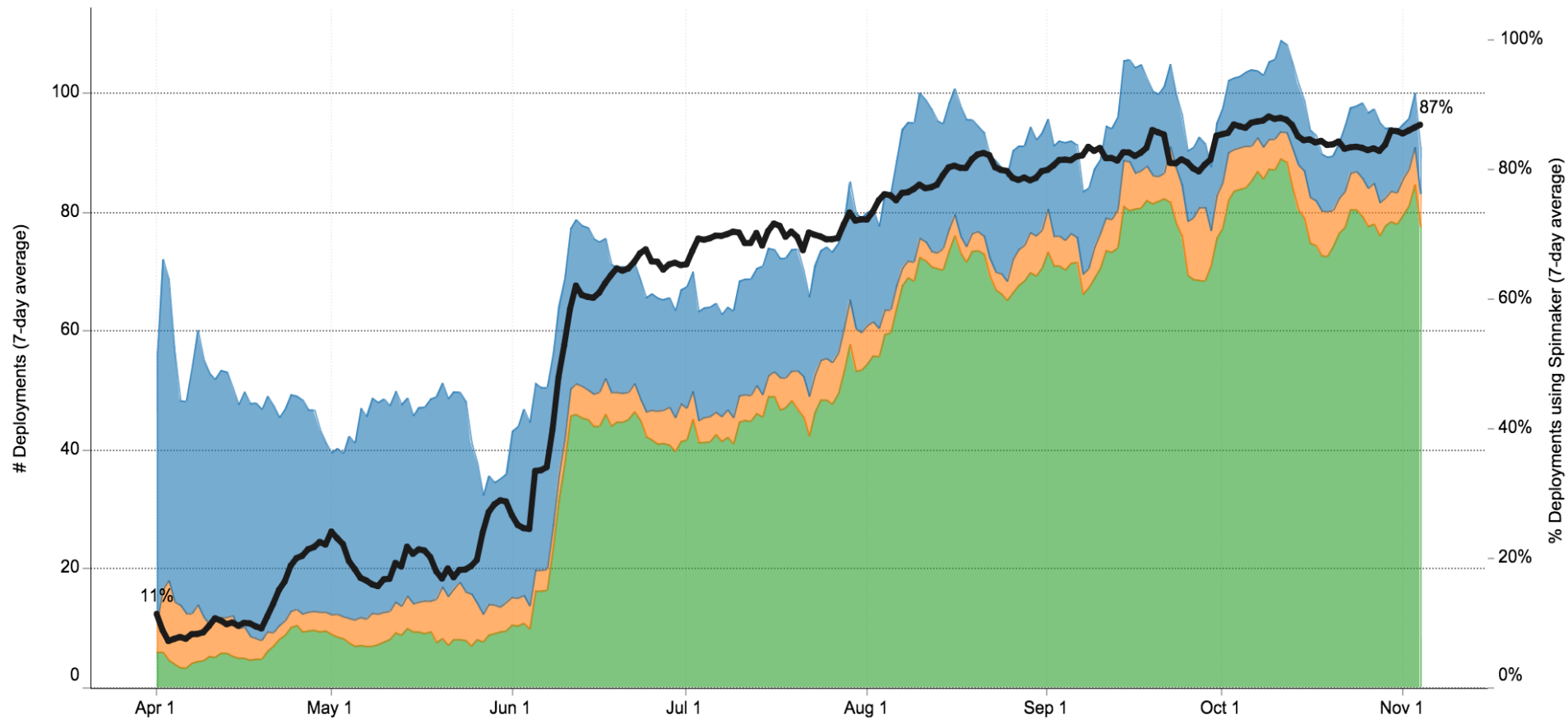
00:00
00:13
00:05

Spinnaker Adoption

This dashboard tracks Spinnaker adoption for Prod Deployments based on the source app in Chronos events (asg - create).

Count By

App

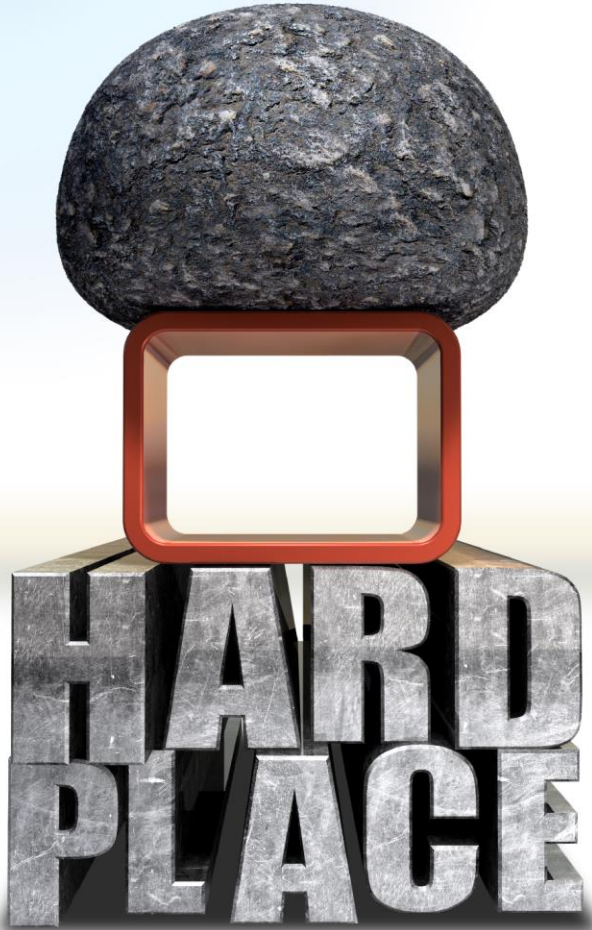




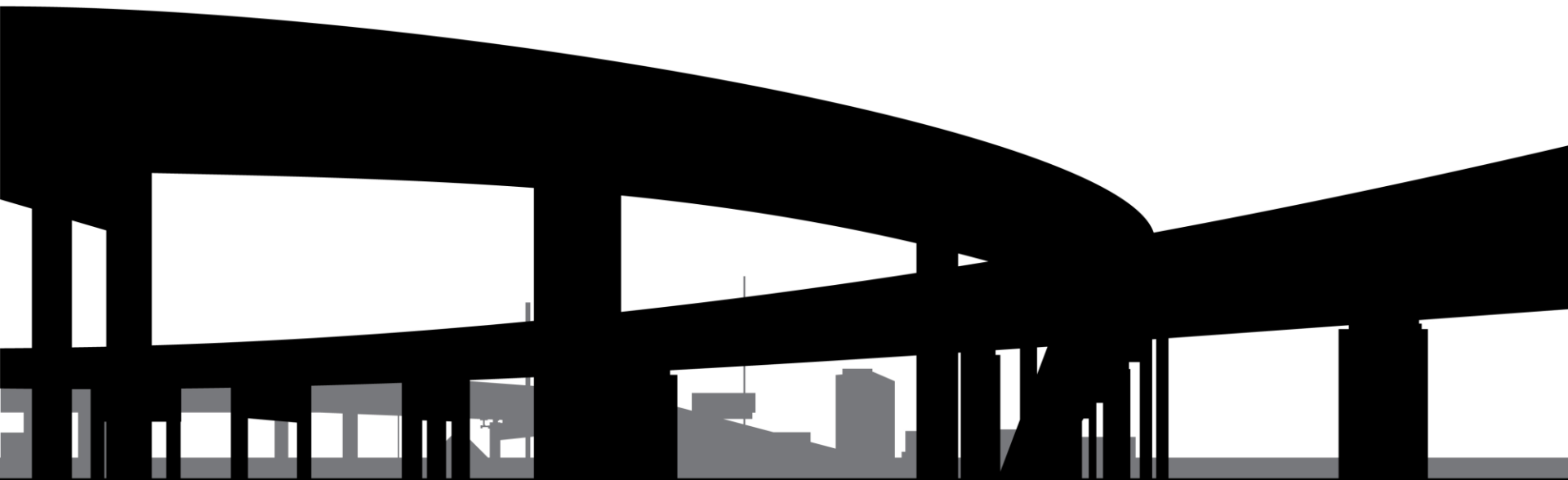
3. Make it easy to do the right thing

Supply & Demand

- Engineering time is scarce
- We must do more heavy lifting



Provide on-ramps



- Spinnaker manual step
- Automated migrations – Mimir

Automate proven practices

Production Ready?



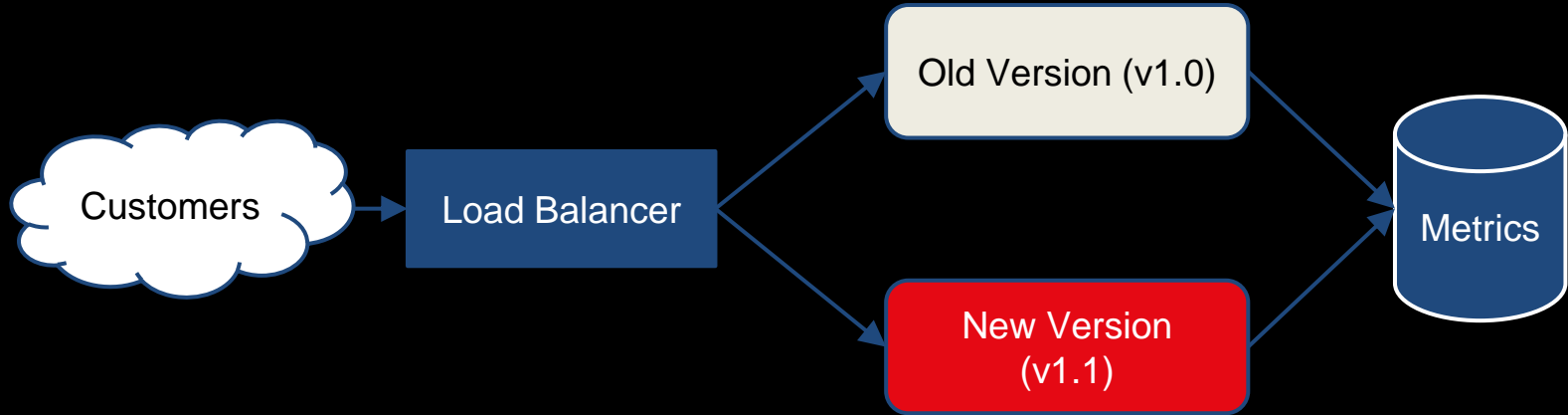
- Alerting and Monitoring
- Apache & Tomcat Hardening
- Automated Canary Analysis
- Autoscaling
- Chaos Participation
- Consistent Naming
- ELB Configuration
- Healthcheck Configured
- Red-Black Pipeline
- Squeeze Testing
- Timeout & Fallback Tuning
- Workload Reliability

Production Ready?

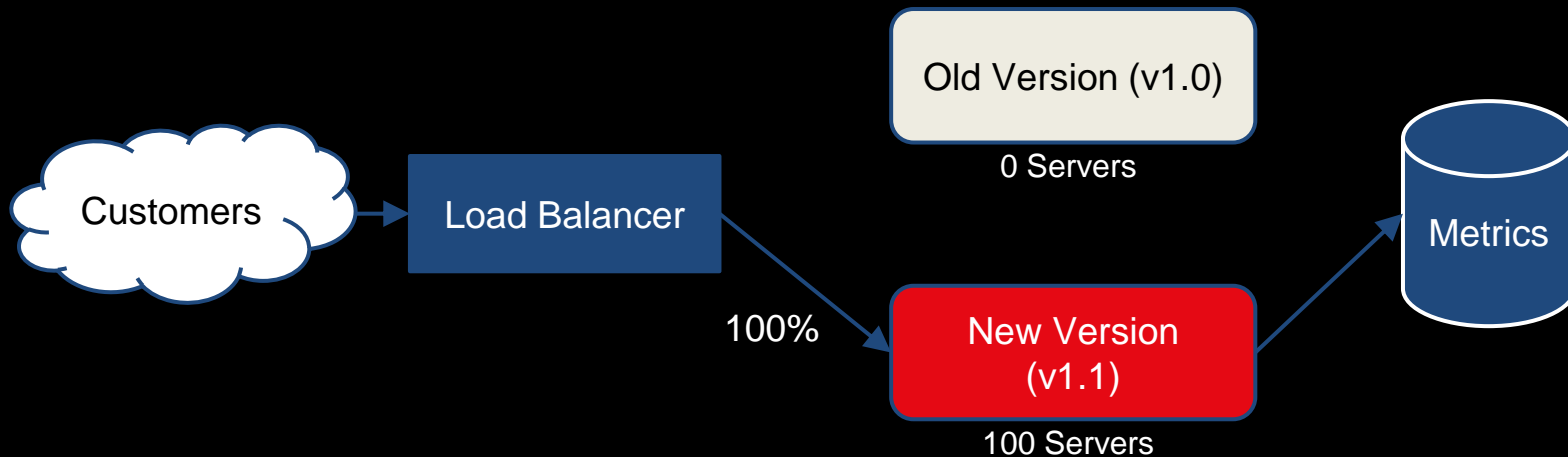


- Alerting and Monitoring
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- **Automated Canary Analysis**
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Canaries



Canaries



Automated Canary Analysis

Define

- Metrics
- A threshold

Every n minutes

- Classify metrics
- Compute score
- Make a decision

The screenshot displays the Canary Analysis dashboard. At the top, there is a navigation bar with 'CANARY ANALYSIS', 'About', and 'Help'. The main content area shows a 'Canary Score: 92.6%' with a green 'PASS' badge. Below this, there is a report summary: 'Report Date: Sat Jun 06 2015 07:05:13 GMT-0700 (PDT)', 'Region: us-west-2.prod', 'Canary:', 'Type: cluster', and 'Duration: PT4H'. The 'Metric Analysis' section features a table with columns for Group Name, metrics, Deviation, and Score. A filter box is present above the table. The table lists several metrics, with 'system' highlighted. To the right, a 'Tag: system' section shows a 'Score: 100%' with a green 'PASS' badge and a list of 8 metrics with their respective deviations and status indicators.

Canary Score: 92.6% PASS

Report Date: Sat Jun 06 2015 07:05:13 GMT-0700 (PDT)
Region: us-west-2.prod
Canary:
Type: cluster
Duration: PT4H

Metric Analysis

Show pass low high nodata Filter

Group Name	metrics	Deviation	Score
failure	1		100% PASS
m5l	3		67% FAILED
success	1		100% PASS
system	8		100% PASS
latency	13		100% PASS
errors	5		80% MARGINAL
requests	13		100% PASS

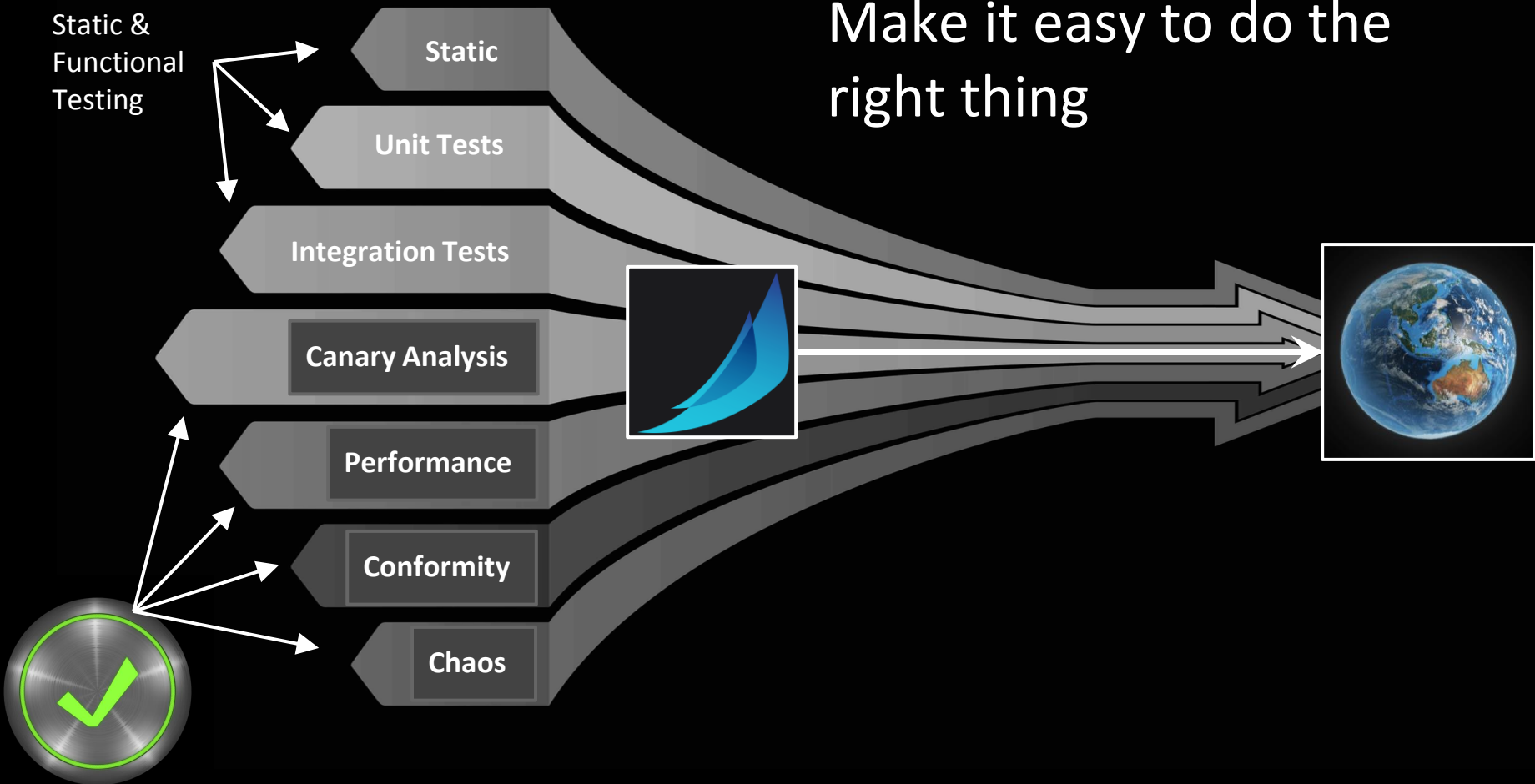
Tag: system

Score: 100% PASS

8 Metrics

Group Name	Deviation	Status
Log Count	0%	PASS
Heap Used	-2.3%	PASS
Atlas Legacy Metric Count	+0.2%	PASS
Heap Max	0%	PASS
Atlas Direct Metric Count	-0.1%	PASS
CPU normalized by RPS	-8.8%	PASS
Load Average	-8.9%	PASS
Log Parsing Errors	+0.1%	PASS

Static &
Functional
Testing



Make it easy to do the
right thing



4. Reduce the cost of change



Continuous, Broad-based Change

- Ongoing migrations
- Library propagation
- 100s of micro-services
- Complex dependencies



Change Engineering

- Locate
- Communicate
- Facilitate



Who owns this artifact, repository, service?

- Automated forensics
 - Who last touched x?
 - What team?
 - Who was their manager?

Whitepages

- Workday wrapper
 - App & REST API
- Organization hierarchy
- Metadata
- Change log

Netflix White Pages

Who are you looking for?



Reed Hastings CEO



Neil Hunt Chief Product Officer



Yury Izrailevsky Vice President, Cloud and Platform Engineering



Josh Evans

Director of Operations Engineering
Operations Engineering

Product Management / Cloud and Platform Engineering / Operations Engineering

jevans@netflix.com

✉ In

Indirectly in

☐ Mobile phone: (###) ###-####

📍 LGB-124

🕒 Joined Netflix on 8/18/1999 (16y:2m:25d at Netflix)

👥 64 employee organization

👤 Leaders in this organization: 2 Director[s] 7 Manager[s]

json

Peers:



Jason Chan ⌵



Kurt Brown ⌵



Paul Ellwood ⌵



Ruslan Meshenberg ⌵



Stevan Vlaovic ⌵

Reports:



Coburn Watson Director, Performance & Reliability Engineering ⌵



Dianne Marsh Director of Engineering ⌵



Jeremy Tatelman Senior User Experience Designer



Roy Rapoport Manager, Insight Engineering ⌵

Krieger

- REST-based service
- Sources
 - Whitepages
 - Stash
 - Edda
 - Jenkins
 - Spinnaker
 - Etc...

```
{
  "content": {},
  "links": {
    "employees": {
      "href": "/api/employees/"
    },
    "projects": {
      "href": "/api/projects/"
    },
    "teams": {
      "href": "/api/teams/"
    },
    "applications": {
      "href": "/api/applications/"
    },
    "jobs": {
      "href": "/api/build/jobs"
    },
    "masters": {
      "href": "/api/build/masters"
    },
    "projectDistribution": {
      "href": "/api/teams/projectDistribution"
    }
  }
}
```

`/api/employees?q=jevans`

```
"employees": [  
  {  
    "id": "241",  
    "firstName": "Josh",  
    "lastName": "Evans",  
    "username": "jevans",  
    "email": "jevans@netflix.com",  
    "jobTitle": "Director of Operations Engineering",  
    "isManager": true,  
    "isCurrent": true,  
    "title": "Josh Evans (jevans) - Operations Engineering",  
    "_links": {  
      "self": {  
        "href": "/api/employees/241"  
      },  
      "manager": {  
        "href": "/api/employees/117890"  
      },  
      "team": {  
        "href": "/api/teams/f9134a81"  
      },  
      "projects": {  
        "href": "/api/teams/f9134a81/projects"  
      }  
    }  
  }  
]
```

Today – Targeted Coordination

- Security vulnerabilities
 - Who owns this service?
- Platform updates
 - Who is using this version of this library?



Future – Change Campaigns

Automated, efficient technical project management

- Communication
- Guidance
- Tracking

Low tax for TPMs & engineers



5. Develop Partnerships

Beyond supply & demand



Spinnaker 1.0 – 1H 2015

- Nearing completion
- Aggressive schedule
- Unexpected delays
- Commitment to June delivery

Edge Engineering

- Built their own continuous delivery solution
- Not positioned for engineering-wide support
- Believes common solutions

Partnership in Action

- Strong relationship
- Open discussions about concerns
- Decision - leaned forward

- +2 engineers on Spinnaker
- Successful 1.0 launch



Moving Forward Together

- Containers?
- Achieving alignment
- Collaborative exploration
 - Edge, Platform, Operations
 - A new paved road?



Payoffs

- Paved Road adopted
 - Adding new ones
 - Production Ready ongoing
 - Migrations easier
 - Reputation improving
- Improved
 - Service uptime
 - Rate of change



Putting it to the test in 2016

- Streaming production & test - EC2 Classic to VPC
- Highly cross-functional
- Complex dependencies
- Zero downtime



Stay tuned...

Five Strategies

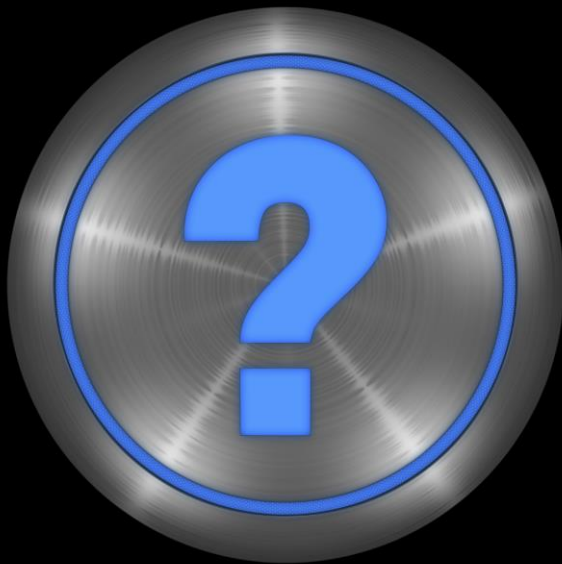
1. Reach out
2. Make an impact
3. Make it easy to do the right thing
4. Reduce the cost of change
5. Develop partnerships

Open Sourced!



<https://netflix.github.io/>

Questions?



Josh Evans

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