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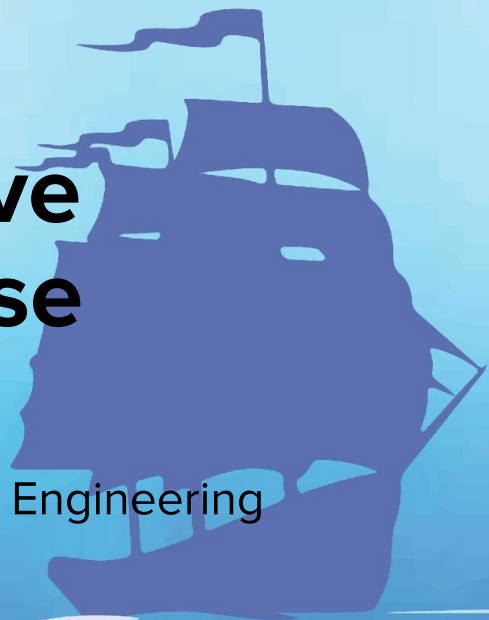
CloudNativeCon

Europe 2018

# Building a Cloud Native Culture in an Enterprise

The New York Times

Deep Kapadia, Director of Delivery and Site Reliability Engineering  
Tony Li, Site Reliability Engineer



# Agenda



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- What is the NYT technology enterprise?
- Transforming and planning for "the cloud"
- Proving the concept (demo)
- Culture and tooling shifts
- There is more work to do

# The NYT engineering enterprise



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## Abridged history of NYT on the internet:

- 1974 computers arrive in the newsroom
- 1994 @times on AOL
- 1996 **officially online at [www.nytimes.com](http://www.nytimes.com)**
- 2010 first foray into public cloud infrastructure
- 2016 plan to shut down data centers
- 2018 [www.nytimes.com](http://www.nytimes.com) is cloud native
  - Running on Kubernetes
- 2018 data-centers shut down
  - 300+ apps migrated to AWS or GCP

Welcome! **First-time** users [register here](#) or [take a QuickTour](#) of the site.

The screenshot shows the New York Times website from Tuesday, November 12, 1996. The masthead includes the text "The New York Times ON THE WEB" and "knicks NEW! celtics one on one newyork.boston.com". The navigation menu lists sections such as Front Page, Politics, Business, and Op-Ed. The main article is titled "Two Aircraft Collide In Air Near Delhi, Killing About 350".

[Help Center](#) | [Low Graphics](#)

PLEASE OPEN YOUR WINDOW TO THE WIDTH OF THIS LINE OF TEXT.

Copyright 1996 The New York Times



- Homepage
- Section fronts
- Articles
- Interactives
- Graphics
- Videos
- Slideshows
- Search

The screenshot shows the New York Times homepage. At the top, there are navigation links for 'SECTIONS', 'SEARCH', and language options (ENGLISH, 中文 (CHINESE), ESPAÑOL). The main header features the 'The New York Times' logo, the date 'Tuesday, May 1, 2018', and weather information for New York City (73°F, Dew -0.72°F). Below the header is a horizontal menu with categories like World, U.S., Politics, N.Y., Business, Opinion, Tech, Science, Health, Sports, Arts, Books, Style, Food, Travel, Magazine, and T Magazine. A featured article titled 'Cooking' is highlighted with a photo of food and the text 'Helpful videos, tempting results. Experience NYT Cooking for \$1.25 per week. START TODAY'. The main content area is divided into several sections: 'Mueller Has List of Questions for Trump' (with a photo of Robert S. Mueller III), 'The Democrats' Real Diversity Problem', 'Opinion' (with a sub-section 'The Real Villain Behind Our New Gilded Age'), 'The Loving Place for Children: That Assumes Beauty', 'Donald Trump, Live and Unfiltered!', 'Letting Sprint and T-Mobile Merge is a Terrible Idea', 'Editorial: The Implausible Promise of a T-Mobile-Sprint Merger', 'Reader Center', 'The Crossword', 'Barracoon', and 'Federal authorities are cracking down on sales of liquid nicotine and electronic cigarettes in misleading packaging'. The bottom of the page features a 'Mosquito and Tick Infections Are Surging, C.D.C. Says' article with a photo of a mosquito.

- Homepage
- Section fronts
- Articles
- Interactives
- Graphics
- Videos
- Slideshows
- Search

The screenshot shows the New York Times homepage for the 2018 Pyeongchang Olympics. The page features a navigation bar with 'SECTIONS', 'HOME', and 'SEARCH' options, along with a 'LOG IN' button. The main headline is '평창 2018' (Pyeongchang 2018) with a sub-headline 'Complete coverage of the 2018 Olympic Games in Pyeongchang, South Korea.' Below this, there are several article teasers:

- With Olympics Over, Team Korea Goes Back to Being 2 Countries**: Athletes from North and South Korea waved the flags of their own countries as they arrived for the closing ceremony. Only time will tell whether Olympic diplomacy has had a lasting effect. (February 25, 2018 - By MOTOIKO RICH)
- John Shuster and the U.S. Curling Team Win First Gold Medal**: Shuster's crew won its first-ever gold medal in curling after a huge, 5-point end against Sweden, the top-ranked team in the world. (February 24, 2018 - By SCOTT GACCIOIA)
- South Korea's 'Garlic Girls' Fall to Sweden in Olympic Curling**: The women's curling team from a garlic-growing region had become an international sensation with a strong showing, but could not overcome Sweden. (February 25, 2018 - By KAREN CROUSE)
- Ester Ledecka Makes History With Gold Medals in Snowboarding and Skiing**: Ledecka, of the Czech Republic, won the gold medal in snowboarding parallel giant slalom and skiing super-G. (February 23, 2018 - By KAREN CROUSE)

At the bottom, there is a 'Medal Count' section with a progress bar for various countries: NOR (14 gold, 14 silver, 11 bronze), GER (14 gold, 10 silver, 7 bronze), CAN (11 gold, 8 silver, 10 bronze), USA (9 gold, 8 silver, 6 bronze), and NED (8 gold, 6 silver, 6 bronze). Below the medal count are several smaller article teasers with images and titles:

- Meet Walter Winans, the Ultimate Two-Event Olympic Medalist
- Team U.S.A.? More Like Team Minnesota
- U.S. Biathletes Boycott Russia Event
- Russian Bobsledder Fails Doping Test
- Russia, the Olympics' Awkward Guest



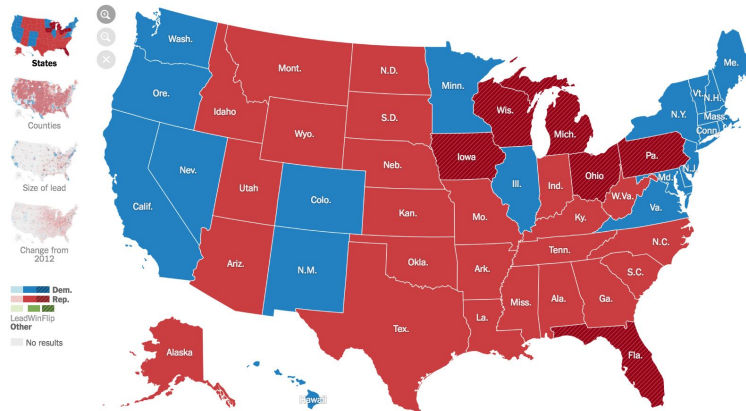
- Homepage
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- Graphics
- Videos
- Slideshows
- Search

President    Senate    House    Forecast    Exit Polls    State Results

## Presidential Election Results: Donald J. Trump Wins

AUG. 9, 2017, 9:00 AM ET

Donald J. Trump won [the Electoral College](#) with 304 votes compared to 227 votes for Hillary Clinton. Seven electors voted for someone other than their party's candidate.



### Places that tend to vote ...

#### Much more Democratic

STATE	DEM.	REP.	OTH.	% RPT.
Calif.	62%	32%	3%	100%
D.C.	91%	4%	2%	100%
Hawaii	62%	30%	4%	100%

#### Somewhat more Democratic

STATE	DEM.	REP.	OTH.	% RPT.
Conn.	65%	41%	3%	100%
Del.	63%	42%	3%	100%
Ill.	65%	38%	4%	100%

#### Like the country as a whole

STATE	DEM.	REP.	OTH.	% RPT.
Colo.	48%	43%	5%	100%
Fla.	47%	49%	2%	100%
Iowa	42%	51%	4%	100%

#### Somewhat more Republican

STATE	DEM.	REP.	OTH.	% RPT.
Ariz.	45%	48%	4%	100%
Ga.	45%	50%	3%	100%
Ind.	38%	57%	5%	100%

#### Much more Republican

STATE	DEM.	REP.	OTH.	% RPT.
Ala.	34%	62%	2%	100%
Alaska	37%	61%	6%	100%
Ark.	34%	61%	3%	100%

# New Products (Cooking)



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The screenshot shows a web interface for a cooking site. At the top left is the 'Cooking' logo. A search bar contains the text 'What would you like to cook?'. To the right are three menu items: 'WHAT TO COOK THIS WEEK', 'COOKING GUIDES', and 'YOUR RECIPE BOX' (with 'Deep Kapadia' listed below it). A settings gear icon is also present. The main content area features a large image of several cookies on a baking sheet. A white text box on the right side of the image contains the recipe title 'Cowboy Cookies', a description 'A classic enhanced with oats, pecans, coconut and cinnamon.', and the author's name 'MARIAN BURROS'. A red circular badge with the text 'RECIPE OF THE DAY' is positioned above the text box. At the bottom left of the image, there are icons for 'Save To Recipe Box', Facebook, Pinterest, and a share icon.

**Cooking** 🔍 What would you like to cook?

WHAT TO COOK THIS WEEK | COOKING GUIDES | YOUR RECIPE BOX (Deep Kapadia) ⚙️

**RECIPE OF THE DAY**

## Cowboy Cookies

A classic enhanced with oats, pecans, coconut and cinnamon.

**MARIAN BURROS**

Save To Recipe Box | f | p | ↗

# New Products (Games)




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**The Mini**  
Tuesday, May 1, 2018  
By JOEL FAGLIANO



**The Crossword**  
Tuesday, May 1, 2018  
Want to play online? [Subscribe Today!](#)



**Tips & Tricks**  
10 Puzzles

[READ ABOUT TODAY'S PUZZLE ON WORDPLAY](#)

### Featured Article



### How to Solve The New York Times Crossword

A Guide by DEB AMLEN  
With patience and practice anyone can learn to solve crosswords. [Read More](#)

### Logic Puzzles



## Tuesday May 1, 2018

The Daily Crossword • By JACOB STULBERG • Edited by WILL SHORTZ

Print

Across Lite



4:50

Rebus Clear Reveal Check

### 65D Go (for)



### ACROSS

- 44 *rock-a-dye-dye setting*
- 45 Yen
- 47 Gait faster than a walk
- 48 More than none but less than all
- 50 Morrison who wrote "Beloved"
- 52 Word stamped on an invoice
- 56 Good place to fish from
- 59 Salient
- 61 Kovalchuk of the N.H.L.
- 62 African game
- 64 Obstacle ... or any one of four black squares in this puzzle?
- 66 Bishop's headdress
- 68 Polynesian land east of Fiji
- 69 Greek letter that represents the golden ratio
- 70 Figure in many a sci-fi film
- 71 Part of a cattle roundup

### DOWN

- 37 Bit of wear for Colonel Sanders
- 38 As well
- 39 Prone (to)
- 41 Harlem sights
- 43 Take another crack at
- 46 Latin American seafood dish
- 49 Pitcher Hershiser
- 51 White House family with the dog Bo
- 52 Strong wines
- 53 Going on
- 54 Vapid
- 55 Word before City or after Fort on Midwest maps
- 57 Stanley who wrote "The Magic Kingdom"
- 58 Hit below the belt
- 60 Skier's convenience
- 63 Large coffee holders
- 65 Go (for)



# And everything behind the scenes



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- CMS (content management system)
- APIs
- Subscription services
- Consumer revenue
- Advertising platform
- Archives
- Mobile platforms

# The NYT engineering enterprise



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- The IT team transformed into infrastructure and product teams
- Organic growth sprouted many product and platform teams
- The way people consume information shifted drastically with the advent of mobile platforms, social media, etc
- We had to move **fast**

# The initial foray into the cloud



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Started dabbling in AWS in 2010:

- Treated it like our data center; **closely guarded access**
- **Unable to scale** infrastructure processes based on needs
  - Ticket and approval workflow for things that could be automated
  - Automation wasn't considering newer DevOps principles
- Apps were built around these constraints and turned into a lot of **spaghetti architecture**
  - Lack of 12 Factor Apps, secret stores, service discovery, autohealing
- We underwent a **misguided CD effort** with every team determining their deployment pipelines and tools
  - Considerably fragmented our stack with 5+ deployment systems

# Starting a transformation



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More concerted effort in 2016:

- Formation of the Delivery Engineering team
  - Mix of developers across the org with devops experience / interest
- **Focus towards developer experience**
- Use modern methods to build and deploy apps
  - Lots of interest in running apps in containers
  - A couple teams dabbled in container orchestration in isolation
    - Mesos/Marathon, Nomad, Kubernetes, Swarm
- Kubernetes hype and **availability of managed K8s** on GKE
- Team rebuilding the web platform was interested in deploying to containers

# What is "Delivery Engineering"?

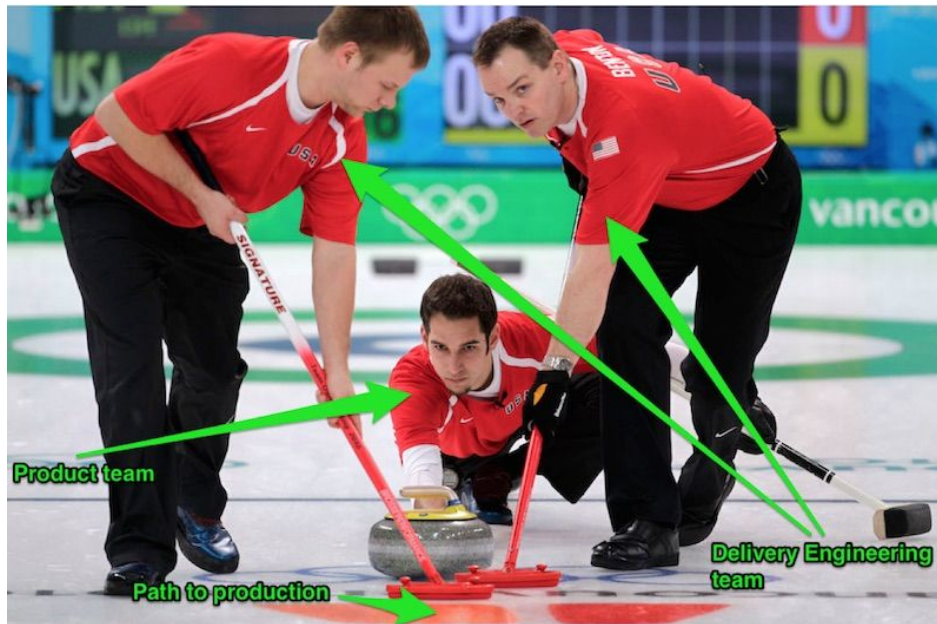


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From Greg Dziemidowicz: <http://gregdmd.com/blog/2015/07/19/delivery-engineering-team/>

# Using (more) modern tools



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- GitOps
  - GitHub driven workflow
- Drone (drone.io)
  - Pipeline as code
- Terraform
  - Infrastructure as code
- Vault
  - Actually manage secrets the right way, policies as code

Also noticed that many of the tooling we gravitated towards was written in Go (yay for standards)!

# Proof of concept



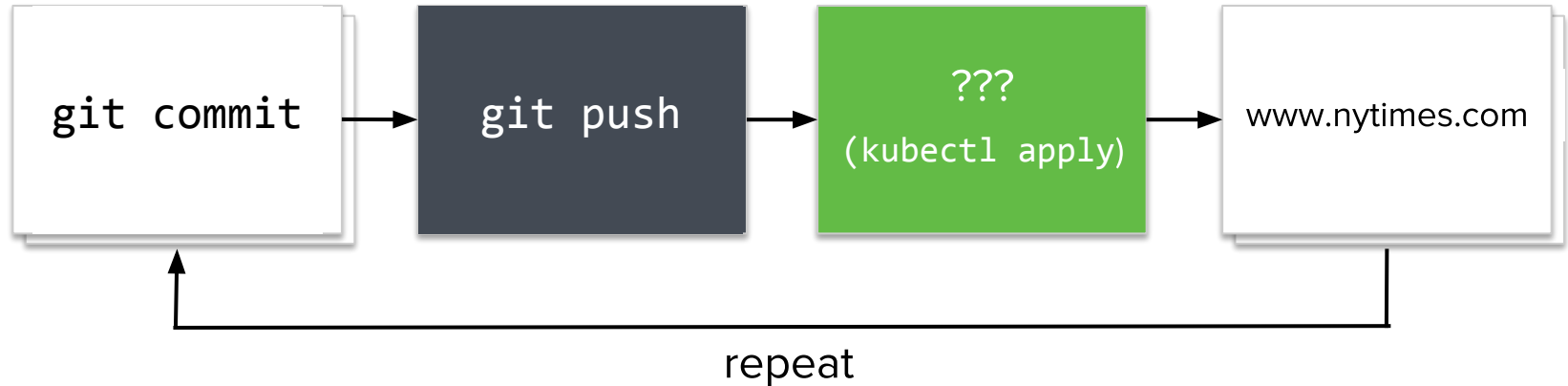
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With a team willing to try something new, we put together a proof of concept around a well known but **powerful idea**:



# Demo time



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1. Update code
2. Update credentials
3. `git push`
4. CI/CD
5. Deployed and live 👍



```

1  name: "KUBE_PROXY"
2  value: "https://kubernetes-master:443/api/v1/namespaces/kube-system"
3
4  name: "KUBE_PROXY_HOST"
5  value: "kubernetes-master"
6
7  volumeMounts:
8  - name: kube-proxy-secret
9    mountPath: /etc/kubernetes
10   name: kube-proxy-secret
11
12 resources:
13   requests:
14     memory: 100Mi
15     cpu: 100m
16   limits:
17     memory: 100Mi
18     cpu: 100m
19
20 containers:
21   - name: kube-proxy
22     image: "kubernetes/kube-proxy"
23     args:
24       - "--hostname-override=$(hostname)"
25       - "--logtostderr"
26       - "--v=2"
27       - "--config=/etc/kubernetes/config/kube-proxy.conf"
28       - "--secret-dir=/etc/kubernetes/secret"
29     volumeMounts:
30       - name: kube-proxy-secret
31         mountPath: /etc/kubernetes/secret
32     ports:
33       - containerPort: 10250
34         protocol: TCP
35     resources:
36       requests:
37         memory: 100Mi
38         cpu: 100m
39       limits:
40         memory: 100Mi
41         cpu: 100m

```

# KubeCon Europe 2018 PRD

Helm chart: kube-cone  
 App Name: kube-cone  
 App Version: 0.1.0  
 Page Background Color: #f0f0f0

- KUBERNETES\_SERVICE\_HOST=kubernetes-master
- KUBERNETES\_PORT\_443\_TCP=tcp://kubernetes-master:443
- HELLO\_WORLD\_SERVICE\_PORT\_443\_TCP=tcp://kubernetes-master:443
- HELLO\_WORLD\_SERVICE\_PORT\_443\_TCP\_ADDR=kubernetes-master
- HELLO\_WORLD\_SERVICE\_PORT\_443\_TCP\_PORT=443
- HELLO\_WORLD\_SERVICE\_PORT\_443\_TCP\_PROTO=tcp
- HELLO\_WORLD\_SERVICE\_PORT\_443\_TCP\_ADDR\_IP=10.0.0.1
- HELLO\_WORLD\_SERVICE\_PORT\_443\_TCP\_PORT\_IP=443
- HELLO\_WORLD\_SERVICE\_PORT\_443\_TCP\_PROTO\_IP=tcp
- HELLO\_WORLD\_SERVICE\_PORT\_443\_TCP\_ADDR\_IP\_PORT\_IP=tcp://10.0.0.1:443
- HELLO\_WORLD\_SERVICE\_PORT\_443\_TCP\_ADDR\_IP\_PORT\_IP\_PROTO\_IP=tcp://10.0.0.1:443/tcp
- HELLO\_WORLD\_SERVICE\_PORT\_443\_TCP\_ADDR\_IP\_PORT\_IP\_PROTO\_IP\_IP\_PORT\_IP=tcp://10.0.0.1:443/tcp/10.0.0.1:443
- HELLO\_WORLD\_SERVICE\_PORT\_443\_TCP\_ADDR\_IP\_PORT\_IP\_PROTO\_IP\_IP\_PORT\_IP\_IP\_PORT\_IP=tcp://10.0.0.1:443/tcp/10.0.0.1:443/tcp/10.0.0.1:443
- HELLO\_WORLD\_SERVICE\_PORT\_443\_TCP\_ADDR\_IP\_PORT\_IP\_PROTO\_IP\_IP\_PORT\_IP\_IP\_PORT\_IP\_IP\_PORT\_IP=tcp://10.0.0.1:443/tcp/10.0.0.1:443/tcp/10.0.0.1:443/tcp/10.0.0.1:443

# Shifting instead of lifting



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We realized that a lift and shift was not going to be easy. Compared to a datacenter, the cloud has:

- Different **networking** designs
- Different **security** models and restrictions
- Different IAM and **access** to resources
- Different **costs**
- Different (expanded) **features** and services
- Different levels of **reliability** and **support** models
- Different **tools** available

# Shifting instead of lifting



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Factoring in these differences, it is **easier to lean in and shift** into a cloud native mentality, using the migration as an opportunity to move the needle forward.

Embracing this gave us an **opportunity to improve** the developer experience, velocity, and productivity.

Replicating a traditional datacenter model in the cloud was unlikely to work, fit, or scale in this paradigm.

We **made mistakes**, but here are our big learnings.



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# Shifting Processes

# Shifting processes (1)



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## **Culture shift:**

- Instill application / service ownership and destiny

## **Tooling shift:**

- Team-ownership of GCP projects for developer freedom
- PagerDuty for everyone



Google Cloud Platform



# Shifting processes (2)



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## **Culture shift:**

- Ticket-based to self-service underlied tooling transformation

## **Tooling shift:**

- Write simple scripts developers can run using off the shelf tools (gcloud, kubectl)
- Write documentation, step-by-step guides, and link to tutorials

# Shifting processes (3)



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## **Culture shift:**

- Educate developers on best practices

## **Tooling shift:**

- Teach 12FA (the Twelve-Factor App) and have example apps
- Containers: what are they and how to use them



# Shifting processes (4)



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## Culture shift:

- Design, discuss, and work in the open

## Tooling shift:

- Write RFCs (Request For Comments):
  - Architecture proposals
  - Use of cloud services
  - Best practices
  - Decision changes





# Shifting processes (5)



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## Culture shift:

- Kubernetes / GCP training and developer ramp up

## Tooling shift:

- In person training sessions for developers
- Share and read case studies, blog posts, tutorials, and videos





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# Shifting Development

# Shifting development (1)



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## Culture shift:

- Use it instead of build it

## Tooling shift:

- Stop rolling custom instances and leverage the managed service / version in the cloud
- Use off-the-shelf / open source projects that follow standards



# Shifting development (2)



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## **Culture shift:**

- Iterate faster and gain confidence in a modern CI/CD process

## **Tooling shift:**

- Drone.io and its container-based plugin ecosystem
- Simple yet flexible pipeline as code versioned with projects
- Drop the assumptions and baggage of Jenkins for a new start



# GitHub

# ~12k builds in the last 4 weeks

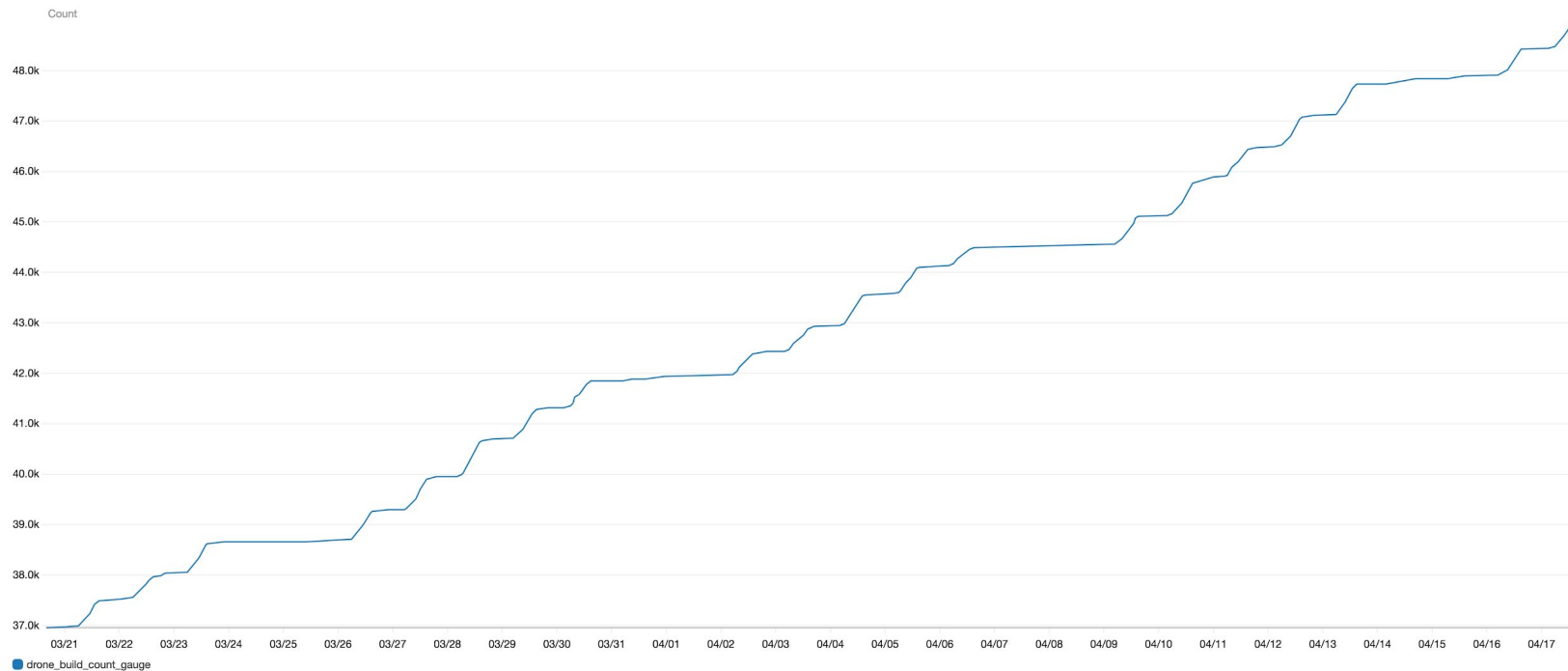


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# Shifting development (3)



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## Culture shift:

- Treat secrets like secrets

## Tooling shift:

- Own the Vault platform and evangelize its use
- Tooling makes onboarding easy and consistent across the org



HashiCorp

**Vault**

# Shifting development (4)



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## Culture shift:

- Decentralize the CDN and make it self-service to the teams

## Tooling shift:

- Break up fragile and centralized Varnish / routing logic
- Automate configuring the Fastly CDN to delegate logic ownership to the teams that control those services



HashiCorp

Terraform

# Shifting development (5)



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## Culture shift:

- Make costs visible to developers

## Tooling shift:

- Codify GCP project budgets
- Visualize and alert expenditures in Slack

```
---
budget:
  monthly: 2000
  alert_levels:
    - 10
    - 25
    - 50
    - 75
  alert_ouverage: 10
  notify:
    slack:
      - my-channel
      - @my-username
```



GCP Budget Bot APP 11:16 AM  
Budget report for [my-project](#)

June 1 2017 to June 10 2017: \$326.43





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# Shifting Communication

# Shifting communication (1)



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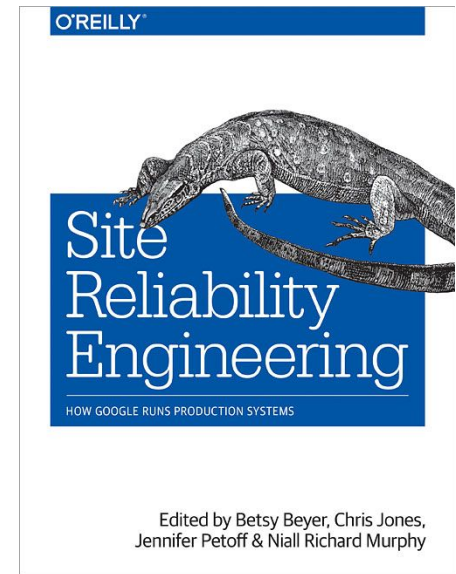
Europe 2018

## Culture shift:

- Scale Delivery Engineering support effectively to those who need it the most

## Tooling shift:

- DevOps team members became SREs
- Embed SREs on teams that are risky, migrating, or learning
- Office hours, shared scrums, shared goals, support over Slack



# Shifting communication (2)



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## Culture shift:

- Be ahead of change, instead of trying to consolidate change

## Tooling shift:

- Stay ahead of dev teams in best practices and technologies
- Attend conferences, learn from the community, and participate in alphas / betas to predict potential solutions and challenges



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Google Cloud



Altitude

# Shifting communication (3)



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## **Culture shift:**

- Be excited to shut things down
- Consolidate complex systems
- Be explicit and own dependencies

## **Tooling shift:**

- Avoid migrating outdated, snowflake, and complex systems
- Schematize or archive data (many pages as static HTML)
- Broadcast and "soft shut down" (disconnect) services far ahead of deadlines, finding "forgotten" dependencies

# Shifting communication (4)



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## Culture shift:

- Get feedback on processes and tools

## Tooling shift:

- Review and iterate on results from monthly / quarterly surveys
- Allow readers / users to contribute to the docs / tools





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# Shifts In Progress

# Shifts in progress (1)



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## **Culture shift:**

- Bring more SRE concepts to reality

## **Tooling shift:**

- Establish clear SLOs between product and development teams
- Continue education in SRE practices

# Shifts in progress (2)



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## Culture shift:

- Foster a shared view of reliability
- Provide early insight into service health

## Tooling shift:

- Instrument metrics in a common way, like Prometheus
- Organization-wide SLO dashboards in Grafana
- Internal status page and catalog of services



Prometheus





# Shifts in progress (3)



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## Culture shift:

- Enhance self-service methods / automation
- Reduce technical and support debt incurred during ramp-up

## Tooling shift:

- Iterate and fix non-ideal implementations
- Channel more SRE support to JIRA for coordination to reduce reactionary or non-prioritized work through Slack



App Engine



Amazon EKS

# Shifts in progress (4)



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## Culture shift:

- Integrate and automate validation
- Ramp up the Test Automation team

## Tooling shift:

- Run any and all tests in CI/CD pipelines, such as Blazemeter
- Integrate metrics and monitoring for analysis and rollbacks

 **BlazeMeter**

# Shifts in progress (5)



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## Culture shift:

- Integrate more cloud native technologies
- Think with the features and faults of the cloud in mind

## Tooling shift:

- Use a service mesh and service catalog to do the heavy lifting
- Track and graph services to prevent "forgotten" dependencies



**CLOUD NATIVE**  
COMPUTING FOUNDATION



# The CNCF is doing good things



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The NYT joined the CNCF to **invest in our own future**:

- Advocate and supporter of standard open tooling
- Gives us confidence when making choices
- Encourages best practices and vendor interoperability
- Sets quantitative targets for training and vendor support
- Rallies this large community to make active contributions

Join us



Working at the NYT is an opportunity to be **an agent of change**:

- Work and build with standard open tooling
- Help us build trust and confidence into our systems
- Practice best practices
- Contribute back to this community

Jobs: **[nyti.ms/technology](https://nyti.ms/technology)**

Blog: **[open.nytimes.com](https://open.nytimes.com)**

# Thanks!



Big shout outs to:

- The **team members of Delivery Engineering** who are not here today who did a lot of this work
- The **product & developers** at NYT, who are open to learning, changing, and actually executed the migrations to the cloud
- The **leadership** at NYT for dedicating the resources to do this

Jobs: **[nyti.ms/technology](https://nyti.ms/technology)**

Blog: **[open.nytimes.com](https://open.nytimes.com)**

Questions?



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