Twitter's Production Scale

Mesos and Aurora Operations

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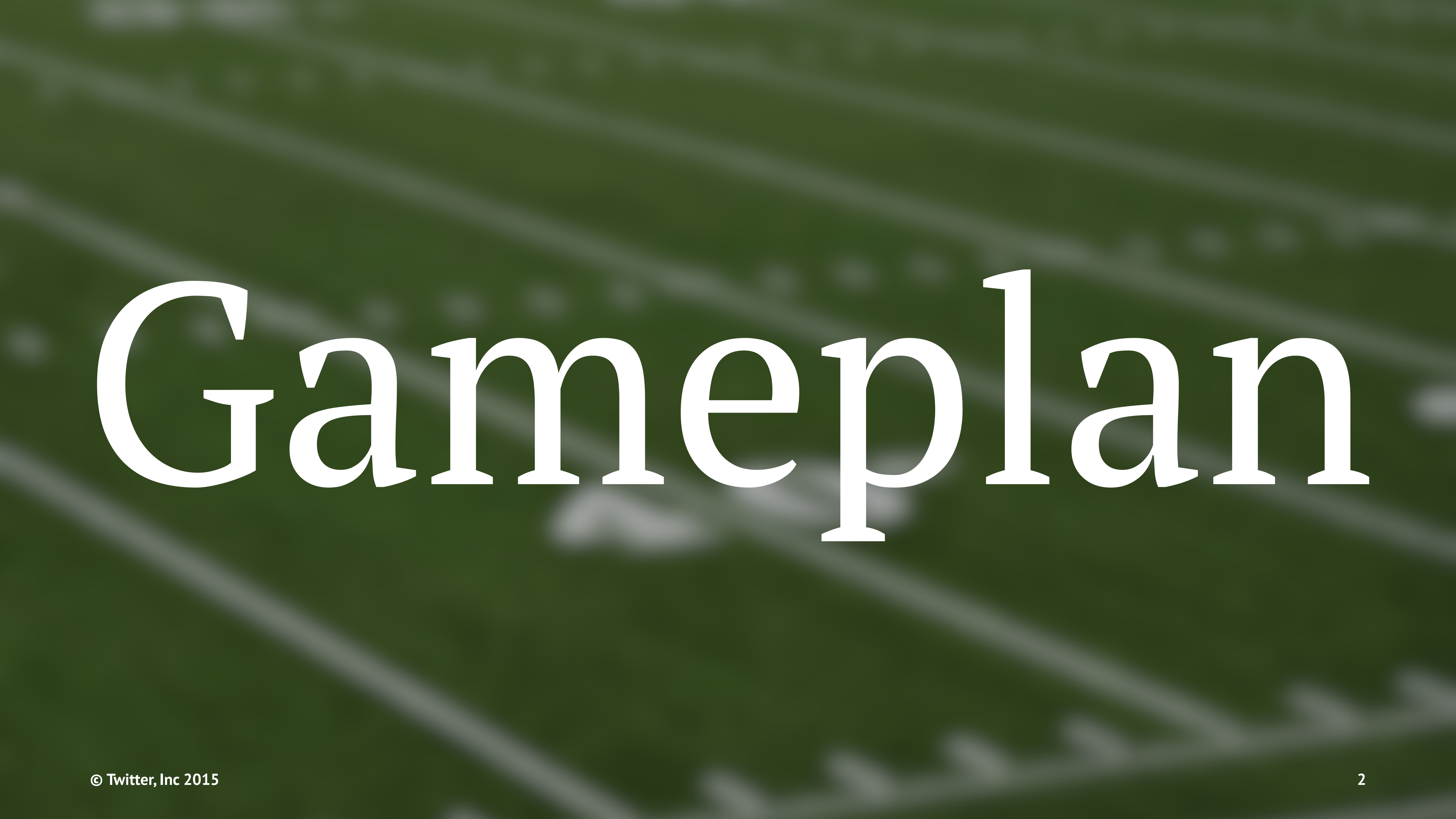
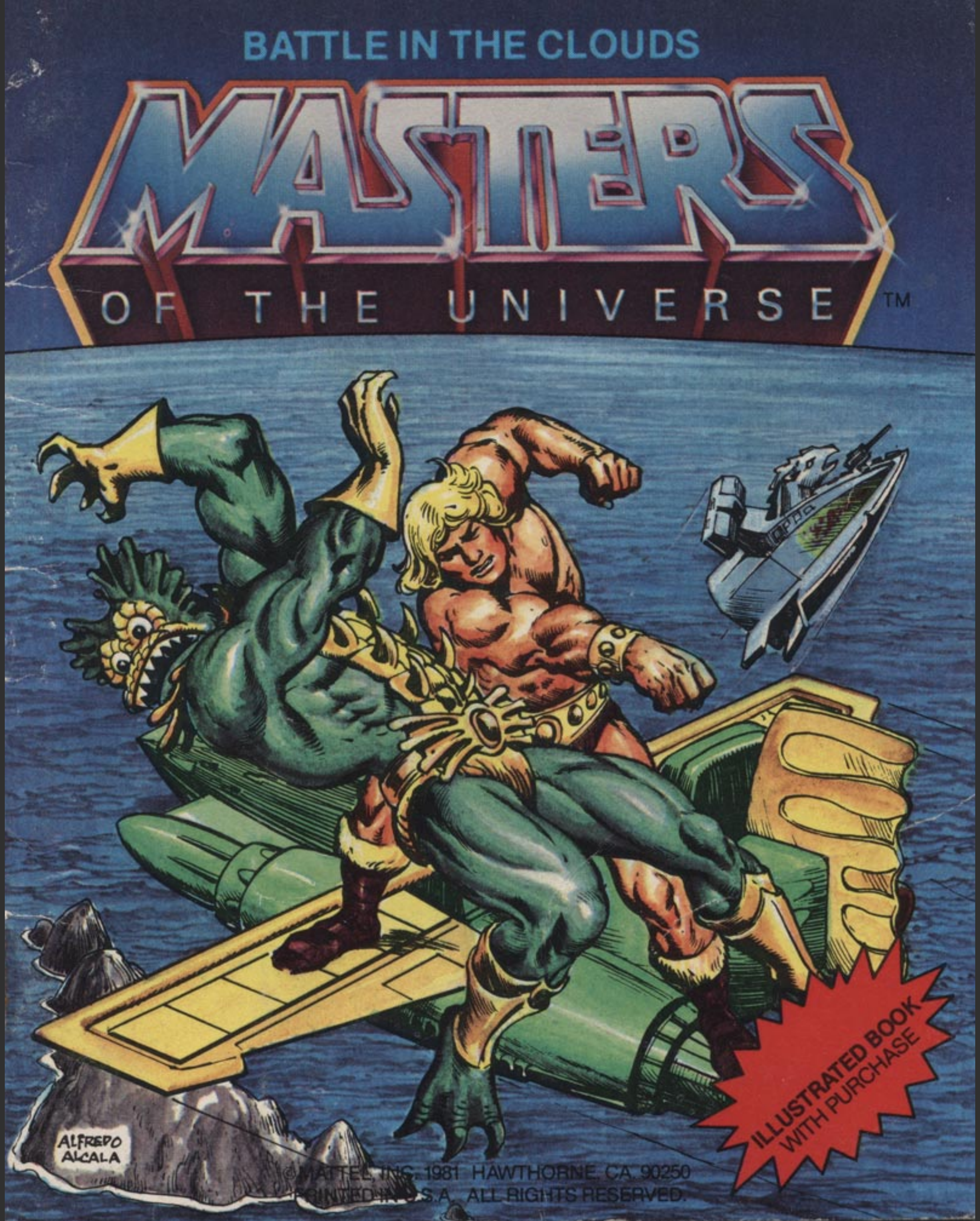


Gameplan

- **Background**
  - Using a central system to manage containers
- **Annoyances**
  - For Users and Operators
  - Running 10s of thousands of hosts
- **Outages**
  - Worst Case Scenarios
  - What to do when they happen


BATTLE IN THE CLOUDS
MASTERS
OF THE UNIVERSE ™
ALFREDO ALCALA
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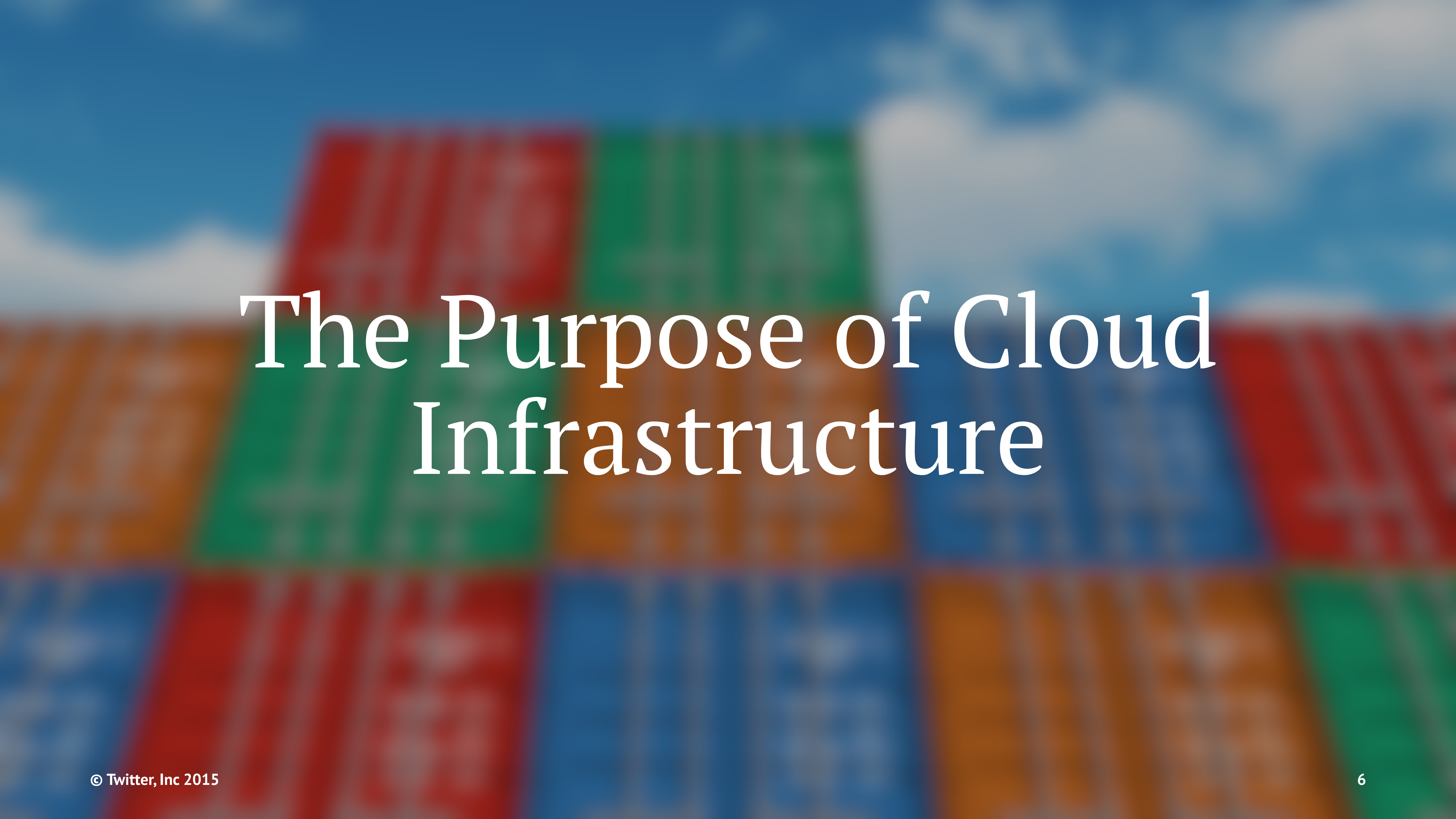
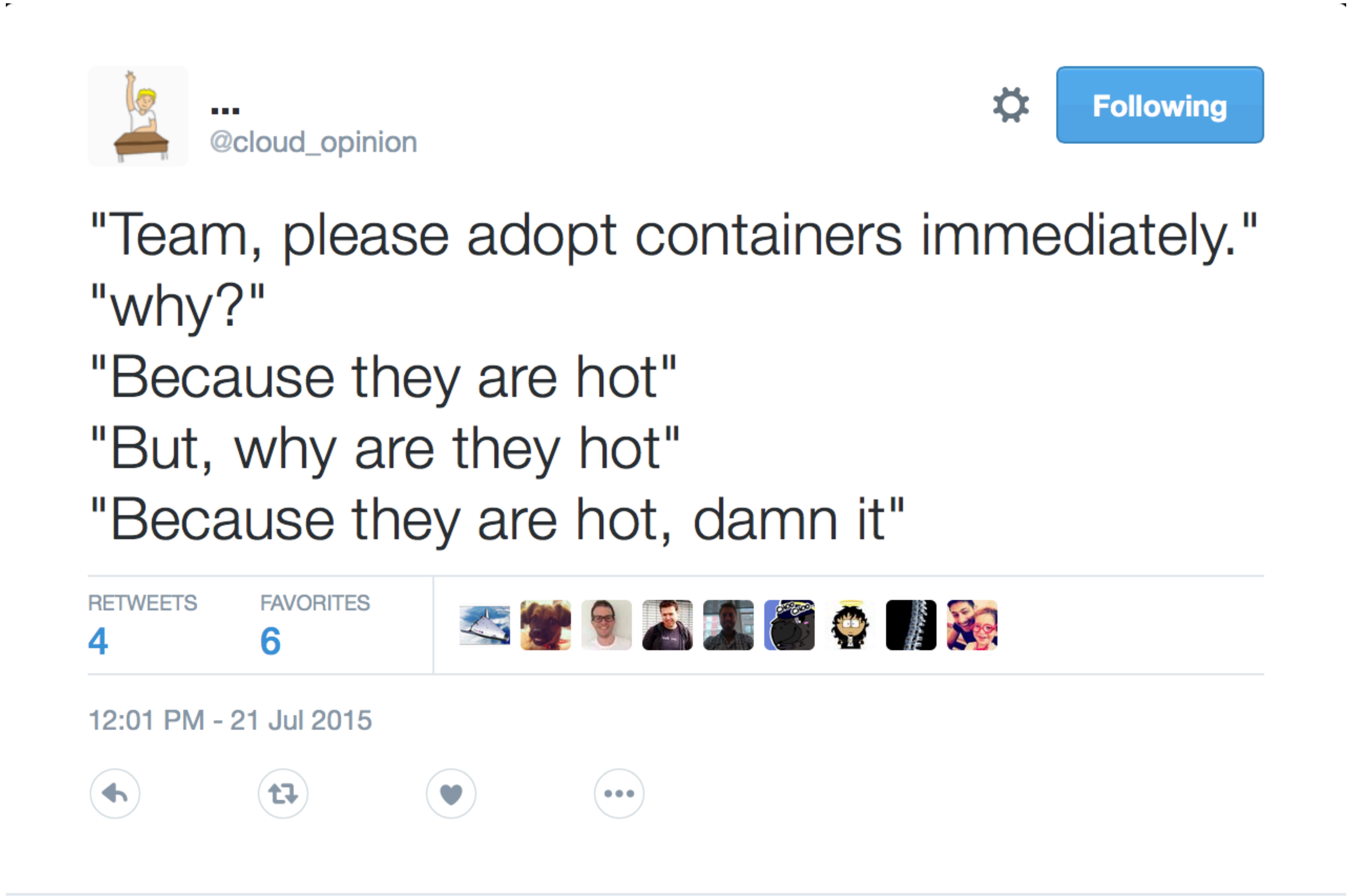
Tales from the Front Lines

- 10s of machines to **10s of Thousands**
- Migrated hundreds of services from bare-metal
- Build and deploy pipeline is on YouTube



The Purpose of Cloud Infrastructure

@cloud_opinion[1]



...
@cloud_opinion

"Team, please adopt containers immediately."
"why?"
"Because they are hot"
"But, why are they hot"
"Because they are hot, damn it"

RETWEETS 4
FAVORITES 6

12:01 PM - 21 Jul 2015

[1] https://twitter.com/cloud_opinion/status/623568543771045888

Why to Use Containers

- Ease of managing a service
- Abstraction from base infrastructure
- One team to manage low-level provisioning, maintenance, and repair

Ease of Mangaging a Service

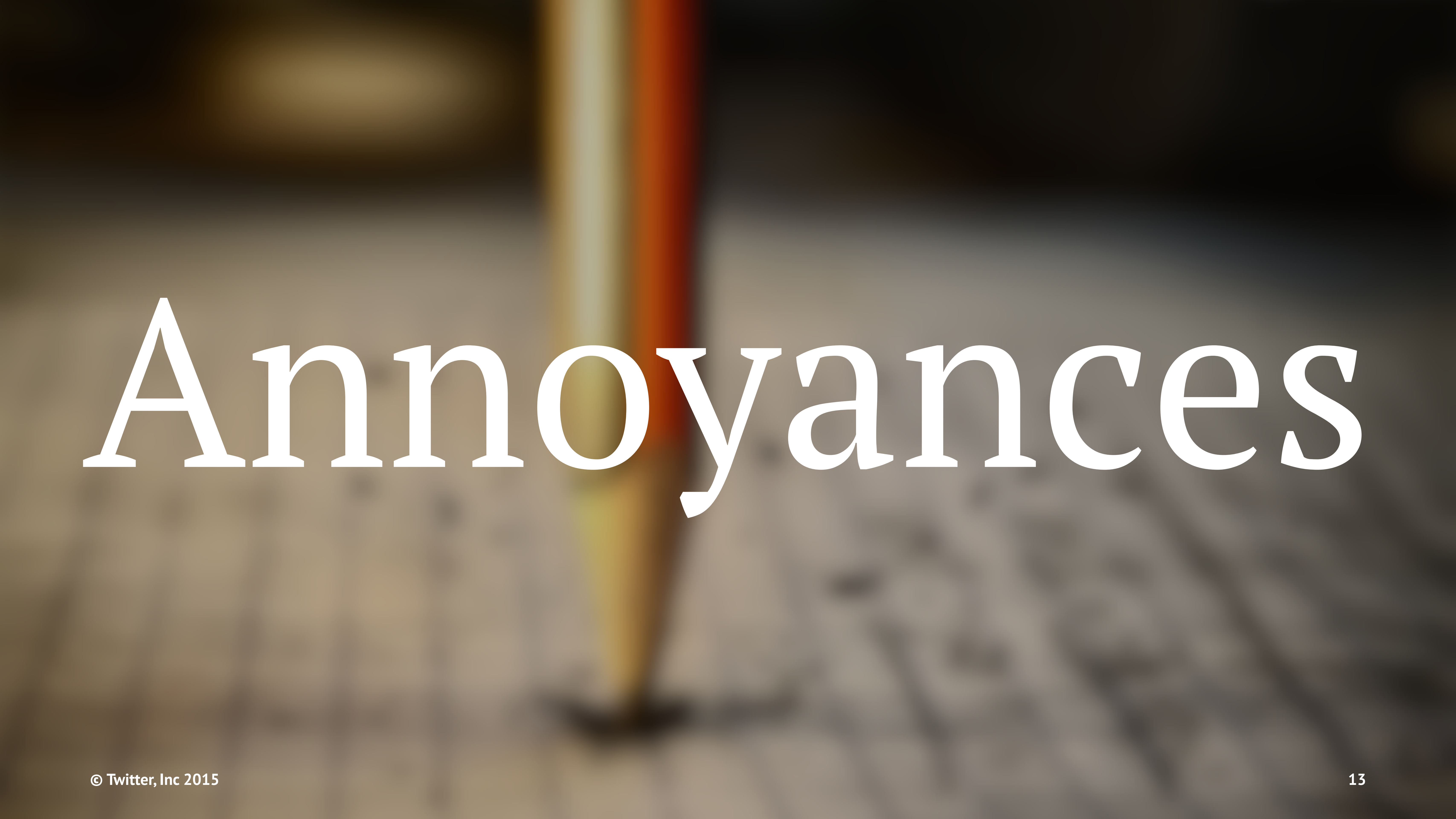
- Mesos is an excellent resource manager
- Aurora is an excellent Service Scheduler
  - Provides a state machine for service lifecycle
- Users build services on Opinionated Infrastructure
- SREs can focus on their service's reliability, not kernel upgrades

Abstraction from Base Infrastructure

- Abstract away user-space from operator-space
- Decouple Operating System upgrades from Application upgrades
- Different JVMs, different deploy cadence
  - Prevent your infrastructure teams from becoming TPMs

One Team to Provision, Maintain, and Repair

- Not every team needs to write deploy scripts
- No longer wait for hardware to show up
- Simple and standard checks for hardware problems



Annoyances

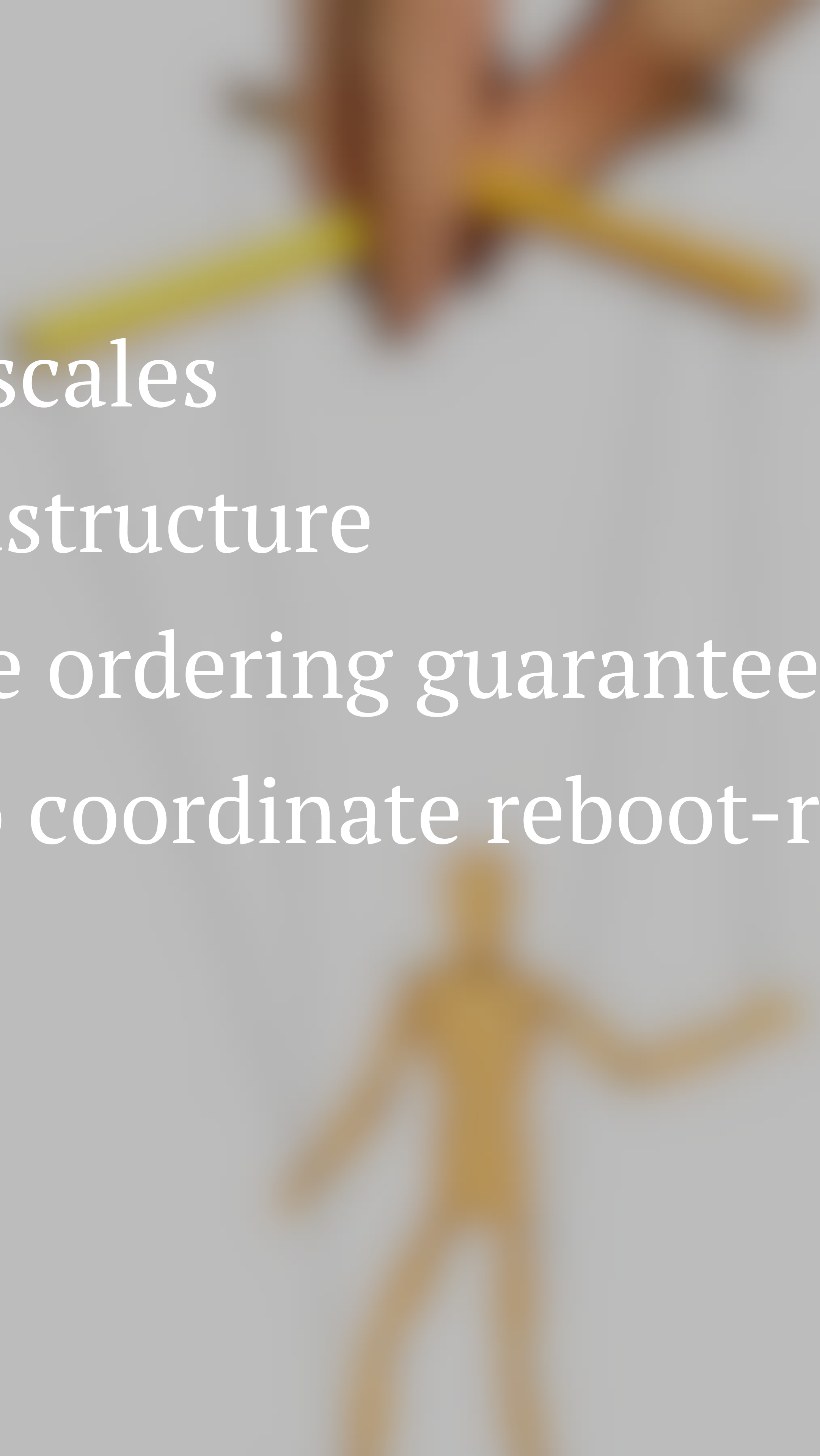
For Users

- Service Configuration
  - Lots of knobs to tweak
- Aurora Client v1 to v2 migration
- SSL Certificates in Python
  - Keep client's certs up to date
- Resource Isolation
  - Clarifying throttling, OOM

For Operators

- Building Python eggs with native dependencies
- Deploying Mesos and Aurora
  - Aurora provides excellent deploy automation
  - How does Aurora get deployed?
  - AURORA-1075: An instance on each host

Puppet



- Obviously, it scales
- Mutable Infrastructure
- Does not have ordering guarantees
  - Difficult to coordinate reboot-required deploys

Something is missing

Analogy - The Network

- The Network (switches, routers, hosts)
  - Well-supported
  - Mission Critical - *everyone* relies on it
- IPMI Network
  - out-of-band
  - Select few users
  - When "The Network" is down, better hope it works

Analogy - The Network

- Aurora/Mesos are "The Network"
- What is our "IPMI" or "backdoor" network?

The Future

- Mesos SRE is building out a system using Ansible + ZooKeeper for coordination
- Remove as much *mutability* as possible
  - Still grant break-the-glass operability
- Filesystem Isolation empowers this
- Will test feasibility and, if successful, will Open Source

Outages

EASY DEPLOY THIS WEEK
JUST A SMALL SINGLE-PATCH DIFF
memegen.com

Third Worst Case Scenario

Rack- or host-level outage

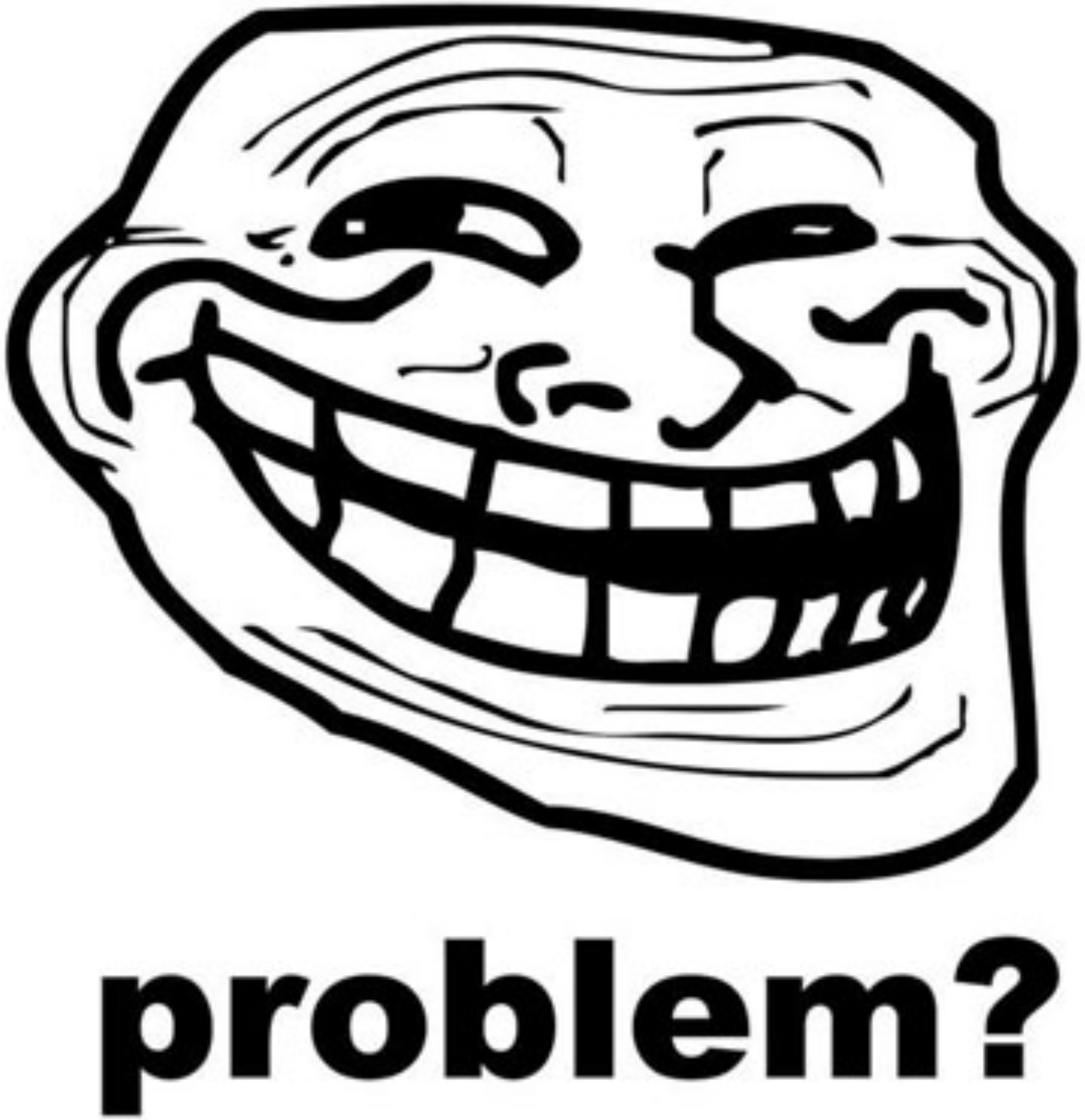
- For the most part, a non-issue
- If it hits your pager, you're using dedicated hosts or perhaps..

Cluster-wide config changes

- Pushed out slave configuration all out once
  - (Always slow-roll out changes)
- Slaves restarted to pick up changes, didn't come back, and were marked `LOST`
- Limit the slave removal rate
- *Stop the masters*
- Hit the BigRedButton™

Second Worst Case Scenario

- Aurora Schedulers
- Mesos Masters
- ZooKeeper Ensemble



Problems

- — No deploys
- — No tasks get rescheduled
- — No cron jobs fire
- — No task reconciliation

How can this happen?

Aurora

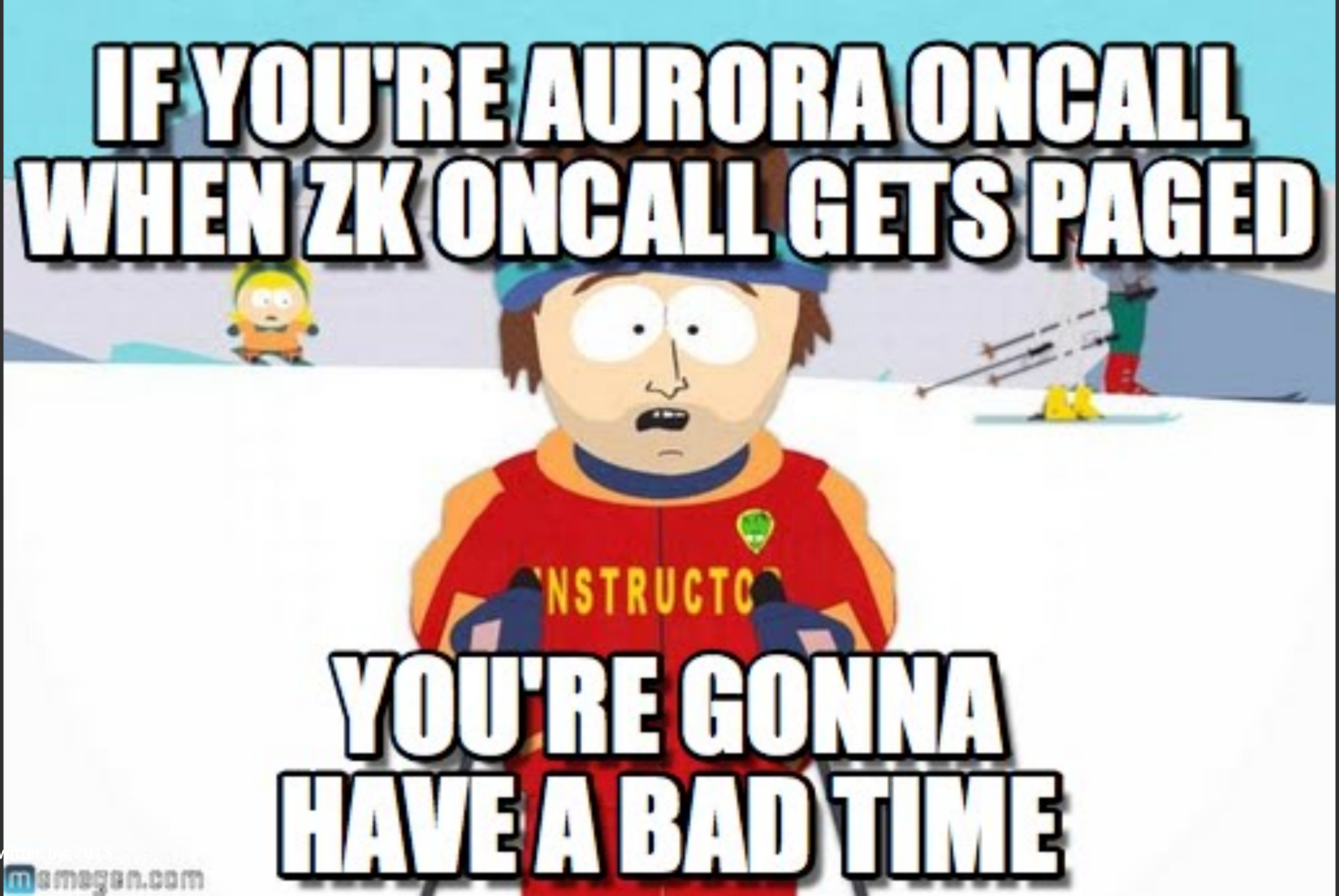
- Accidental deploy where no known scheduler could read the log
  - Again, invest in improved build/deploy pipeline
- Took much care changing quorum size
- TImeouts when writing to the Replicated Log
  - I/O Contention (log rotate)

Mesos

- Writes timing out to the replicated log
- ZooKeeper is a big one here

ZooKeeper

- Tune your ZK client settings correctly!
  - Set appropriate session timeout
- Never co-locate Service Discovery, Leader Election, other use case ensembles
- Emphasizes the importance of isolation for shared services
  - Good fences make good neighbors


IF YOU'RE AURORA ONCALL
WHEN ZK ONCALL GETS PAGED
INSTRUCTOR
YOU'RE GONNA
HAVE A BAD TIME
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Swapping ZooKeeper Ensembles - Aurora

- Well planned
- Thousands of lines of Python
- 95%+ Unit Test Coverage
- Hours of test cluster integration testing

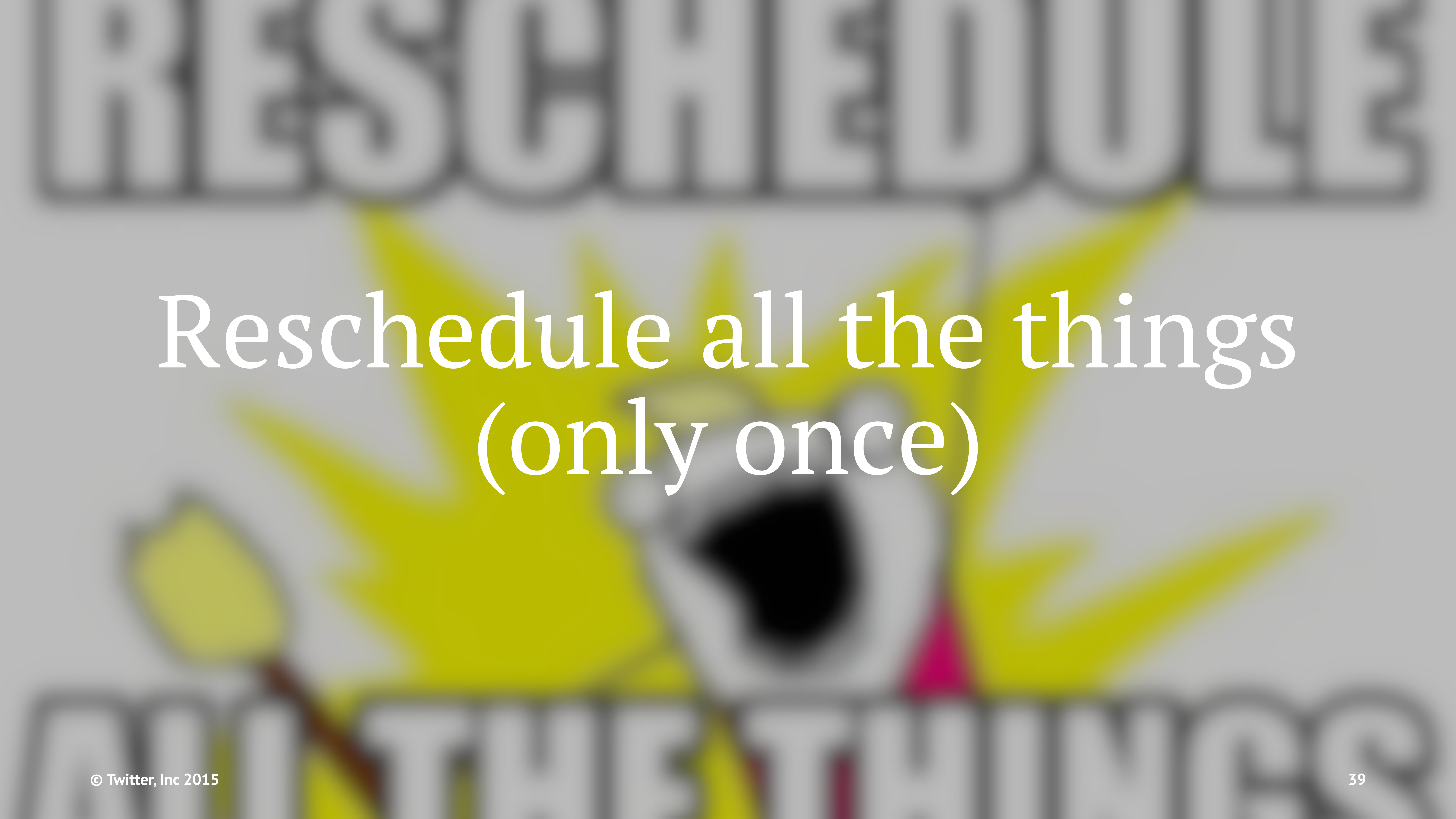
OE-0758
OE-0739
Blanik

Can you wing it?

Swapping ZooKeeper Ensembles - Mesos

- Ensemble for leader election was hammered by misbehaving clients
- Shut-down the masters
- Live-pivoted via a puppet change to the slaves
- Brought them back up

First Worst Case Scenario



Reschedule all the things (only once)

Reschedule all the things

- Master was paused (SysRq-T) for 17 minutes
- Mesos sent simultaneous "all slaves are `LOST`" message
- Aurora ~immediately marked all tasks `LOST`
- Aurora began rescheduling
- *DDOS'd by status updates*
- GC Executor launching slowed us down

Helpfully Unhelpful

- The GC Executor did its job, and reconciled the difference
- **All tasks were killed**

Pulling out of the nosedive

- Increased the `task_timeout`
- Lowered Aurora's scheduling rate
- Decreased interval of launching GC Executors
  - Now using Mesos' Task Reconciliation
- Could have slowly added slaves back as well

Improved

- Aurora's scheduling rate is *dramatically* improved
- More safeguards in both layers
    - Rate-limiting slave removal
    - Scheduler driver validates messages from elected master
- Task Reconciliation (no more out-of-band GC)

The Worst Case Scenario (Hasn't Happened Yet)

Lose the entire cluster

- Scheduler starts up *empty*
- Restore from Backup
  - If not.. users *must* resubmit all jobs

Prioritizing Reliability

- The Aurora and Mesos communities are *highly* receptive and supportive of the Operations Perspective
- These services are built for large, critical **production** infrastructure
- Entire enterprises rest on their ability to keep services up and running

Contact

- #aurora on freenode
- #mesos on freenode
- @Yasumoto
- @TwitterSRE