Help protect your datacenters with safety constraints

Etienne Perot and Christina Schulman, Google

Datacenter automation at Google

- Datacenter machine management is complex
- It’s easier to safeguard the automation than to fix everything that uses it.

Datacenter automation at Google

Google uses automation to handle datacenter machine activity

- repairs
- installs
- decommissions

Educational Experience #1

That time we erased our entire Content Delivery Network

Educational Experience #1

- Engineer attempts to manually send **1** rack of CDN machines to Diskerase

Educational Experience #1

- Query bug causes ALL the CDN machines to go to Diskerase
  - Result: slow user queries, internal network congestion, 2 days of manual cleanup

Educational Experience #2

That time we decommissioned all our Tunneling Load Balancers

Educational Experience #2

- Dedicated switches used to be used as TLBs for all traffic entering the datacenters

Educational Experience #2

- A utility script was used to send retired switches to decom

Educational Experience #2

- Whoops. The underlying data has changed.
- Specifically, the script now matches *all* the TLBs as retired.

Educational Experience #2

- We got lucky: TLBs kept serving because they didn’t know they’d been decommed.

How can we prevent this?

- Completely different root causes
- But: common patterns for root causes

Common Failure Patterns

- Overmatching / inadequate limiting
- Code rot / changing nature of data
- Complex interdependent systems
- Unsafe releases and rollouts

So how do we protect our machines?

- Common patterns, but different systems
- Different root causes
- Same mechanism of destruction

So how do we protect our machines?

So use a central mechanism to mitigate risk

So how do we protect our machines?

So use a central mechanism to mitigate risk

- and bake it into your automation

{{Magic transition slide}}

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Safety Constraint Checking as a Service *(SCCaaS)*

- Production infrastructure at Google: It's Complicated™.
- But:

"Production Shall Keep Running."

(encoded as: "SLOs Shall Be Respected.")

- Let's write an RPC service to keep this true!

SRSly?

- *"Are you serious?"*
- Est. 2009
- Prevented many outages.

What can go ~~wrong~~ at all?

- Enumerate production workflows.
- Figure out blast radius.

Example workflows

- Machine upgrades
- Storage drains
- Migrating VMs
- Pushing datacenter-wide configs
- Shutting down racks

Now what?

- Sanity-checks and rate-limits
- Look at your SLOs for inspiration!

Constraint pattern #1

- **Rate limits**:
  Allow `N` `things` per `period` per `bucket`.

  "Allow at most 1% of TLBs per 1h per datacenter to be sent to decom."

Constraint pattern #2

- **Concurrency limits**:
  Allow at most `N` concurrent `things`
  per `bucket`.
  "Allow at most 5% of CDN machines per datacenter to be rebooting before allowing more."

Constraint pattern #3

- **Sanity/policy checks**:
  Only approve `thing` if `condition` is true.

  "Can only reboot a machine that has no VMs running on it."

Constraint pattern #4

- **Service-specific health checks**:
  Prevent disruption to `service` if it is bad.

  "Can't impact Google Web Search
  if its oncaller got paged recently."

Constraint pattern #5

- **Automatic braking**:
  Stop approving `things` if recent approvals caused `pain`.

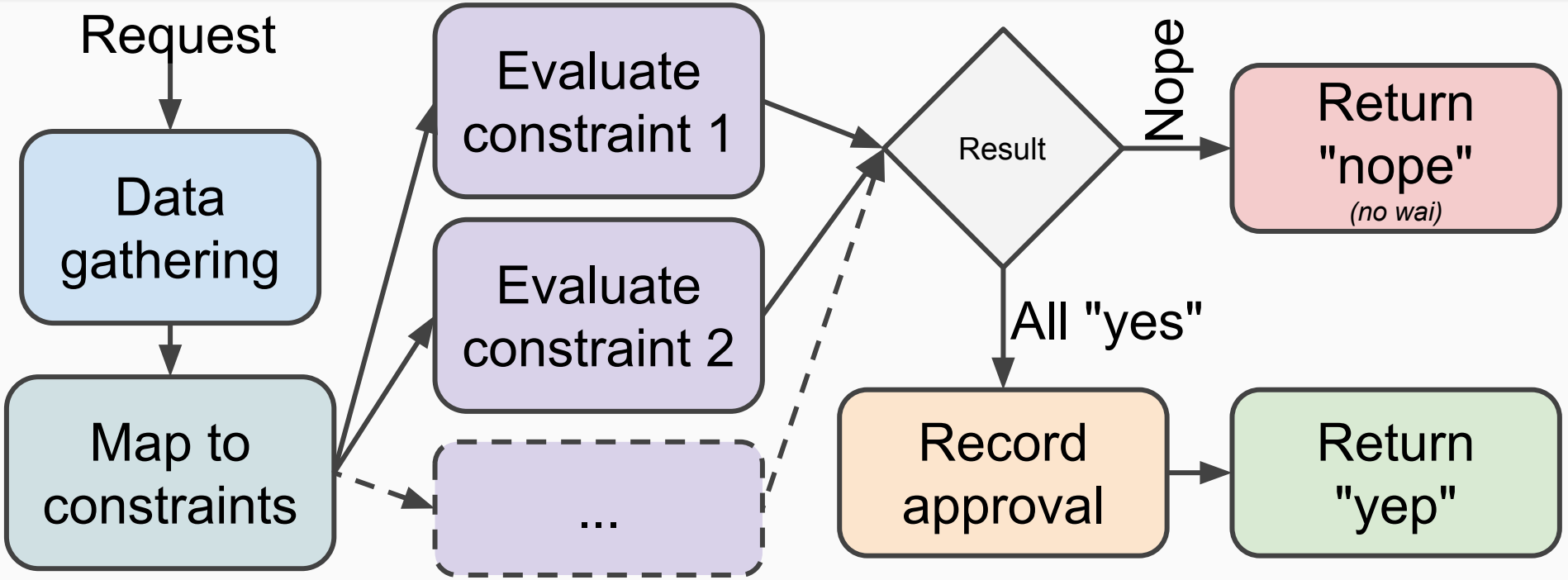
  "Don't upgrade rackswitches if recent rackswitch upgrades resulted in broken rackswitches."

API

```
Check(Entity, Intent) → (bool, string)
```

- `Entity`: What is being *affected*.
- `Intent`: What is being *done*.
- Returns:
  Whether it's safe to go ahead, and why/why not.

Request handling



Safety² constraint service

- SRSly's configuration itself can be bad

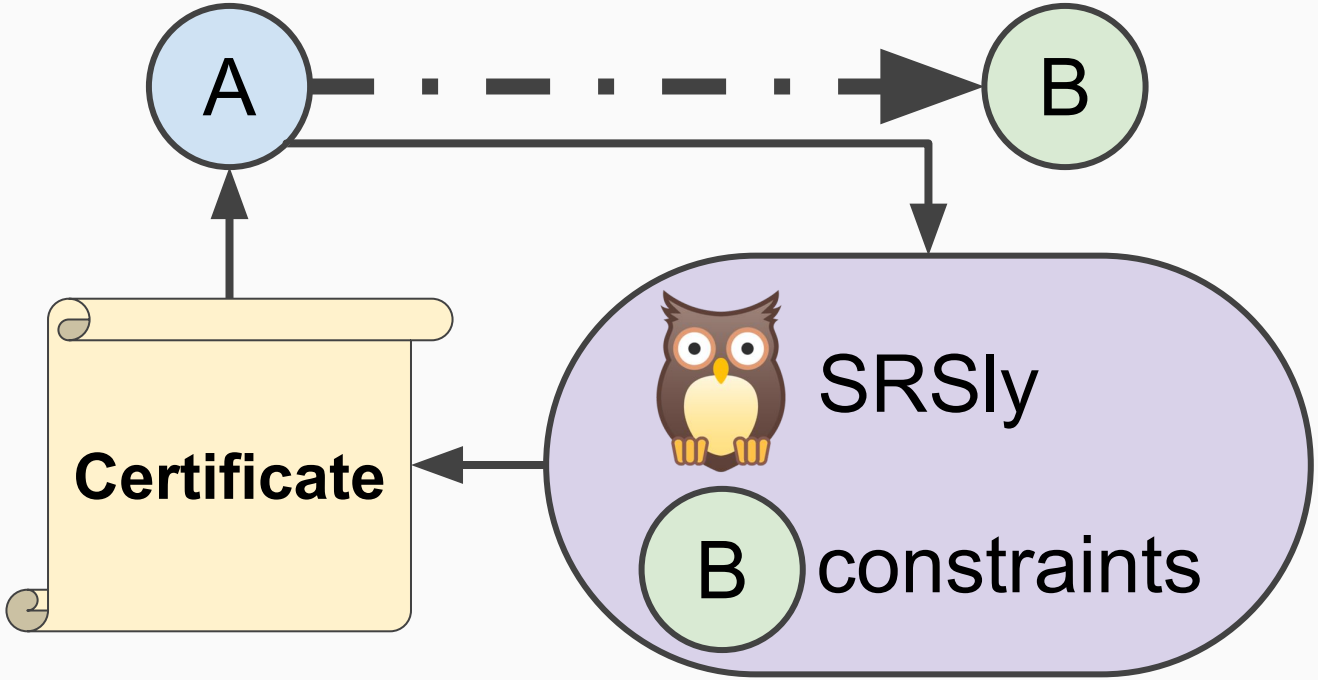
How to avoid?

- Regression tests for config mapping
- Internal sanity checks
- Big Red Button™
- **Shard it! Slow rollout!**

Behavior overrides

- Want to do ***Something Special***™?
  - Roll out kernel faster to patch a vulnerability
  - Prevent extra disruptions during demos
- Override behavior!
  - Force approval/rejection, disable constraint, tweak params
  - Auto expiry & max duration
  - Keyed by `Entity` and/or `Intent`

Enforcing safety checks



tl;dlisten

- Production gets more complicated over time
- Automation can go horribly wrong
- Apply defensive design
  - Protect it {early, often, well}

Questions?

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