



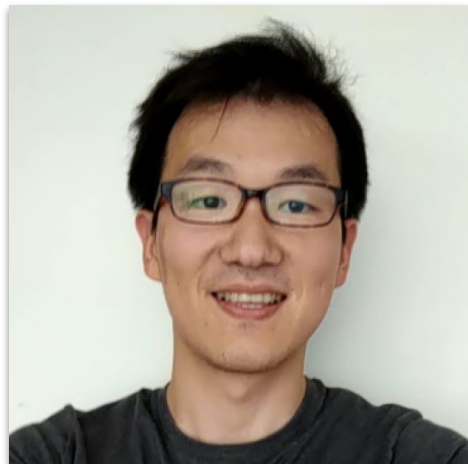
# Beyond Distributed Tracing

**SREcon22 Americas**

**March 15 2022**

**Speaker:** Kyusoon Lee ([qsoonlee@google.com](mailto:qsoonlee@google.com))

# CUI Attribution team @ Google

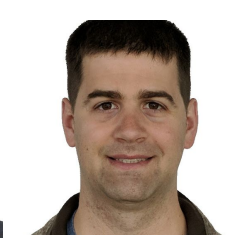
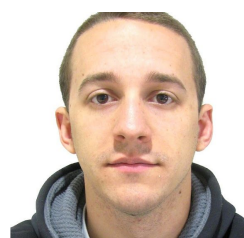
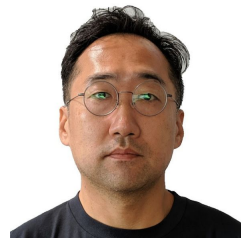
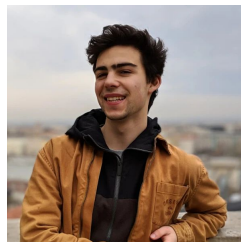


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# Featuring works by





2020-11-11

“YouTube is down”



# Incident log

- T0 First automated **alert** (SLO fast burn)
- T2 Another YouTube **alert**
- T4 **Escalation** to YT oncall “**YouTube is down**”
- T5 **Escalation** to YT tech lead, “**YouTube is down**”
- T8 **Escalation** to YT leadership, “**large traffic increases, lots of things down**”
- T9 More **alerts**
- T9 Suspects an **ongoing push**; proceeds to revert
- T10 **Unusual spike in traffic** reported
- T10 “Frontend is seeing **errors from service X**”
- T11 “What’s happening is service X is down”
- T12 “What is service X in this context”
- T12 More **alerts**
- T13 “Cluster y seems to be **crashing a lot**”
- T13 “going to page service X oncall”
- T14 Yet more **alerts**
- T14 First external comms: “working to fix it”
- ...



TeamYouTube ✓  
@TeamYouTube

If you’re having trouble watching videos on YouTube right now, you’re not alone – our team is aware of the issue and working on a fix. We’ll follow up here with any updates.



2020-11-11

“YouTube doesn’t work”

Pick a product

youtube\_main\_app ▼

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Pick a CUI

WATCH ▼

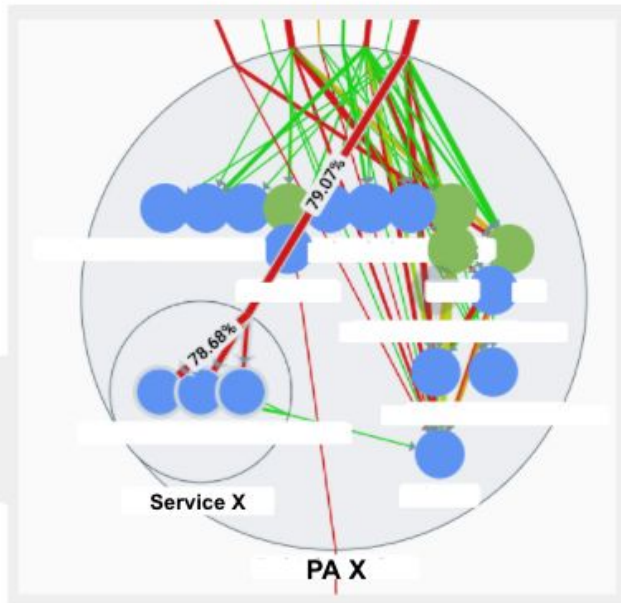
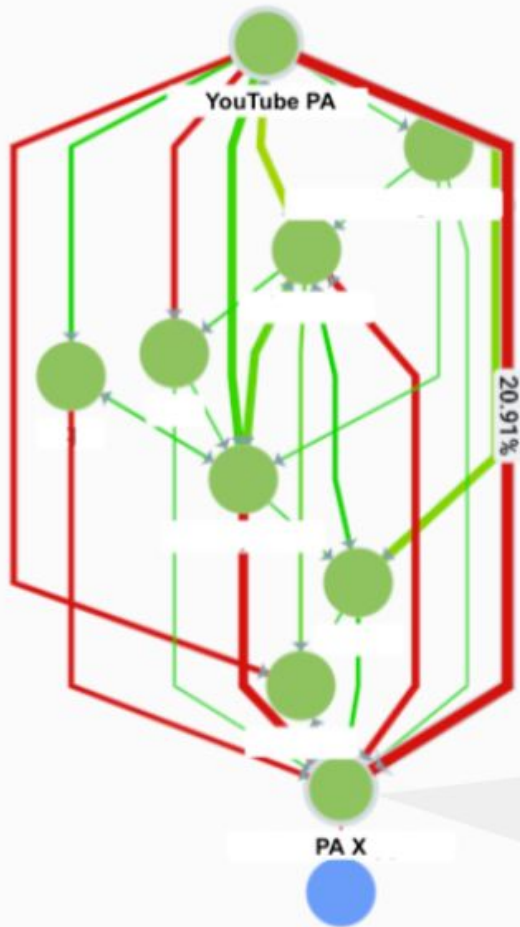
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Pick a metric

Error percentage (ser... ▼

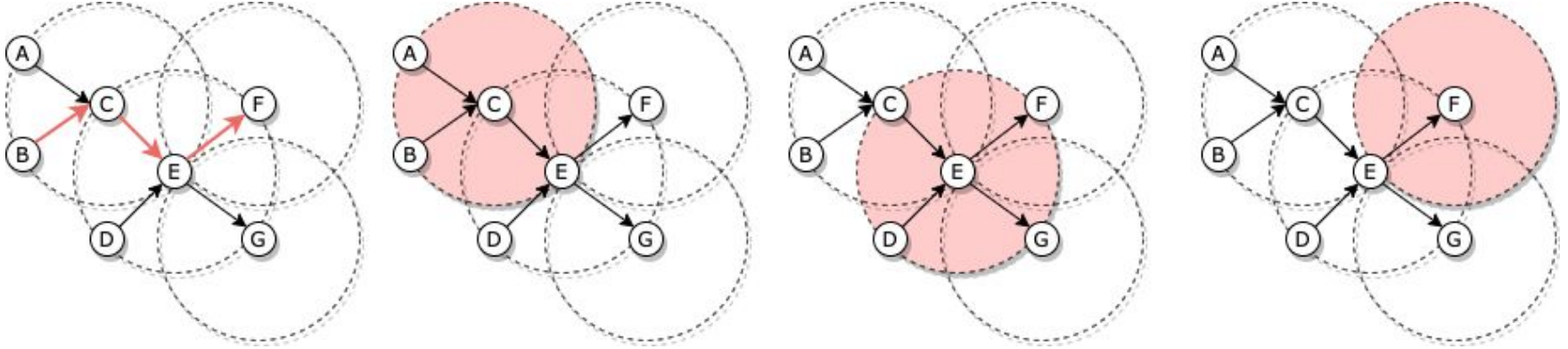
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Query



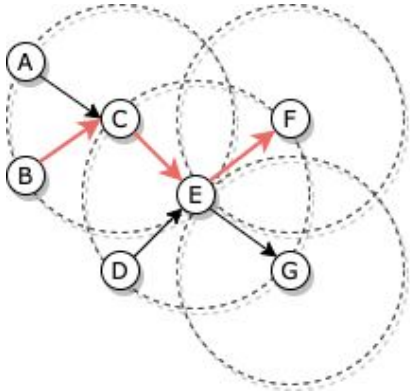


# Server metrics



- All requests that go through the server
- One-hop only

# Distributed tracing



From “Dapper, a Large-Scale Distributed Systems Tracing Infrastructure”  
<https://research.google/pubs/pub36356/>

See also <https://cloud.google.com/trace/docs/reference>

- Per-request
- Multi-hop (end-to-end)



Server metrics

**All requests**

One-hop

Dist. tracing

Per-request

**Multi-hop**



Server metrics

**All requests**

One-hop

**A set of requests**

**Multi-hop**

Dist. tracing

Per-request

**Multi-hop**

# CUI (Critical User Interaction) attribution



**CUI:** a frequently used or highly important end-user interaction. Also used to refer the metadata.

**Format:**  
“<product>/<interaction>”

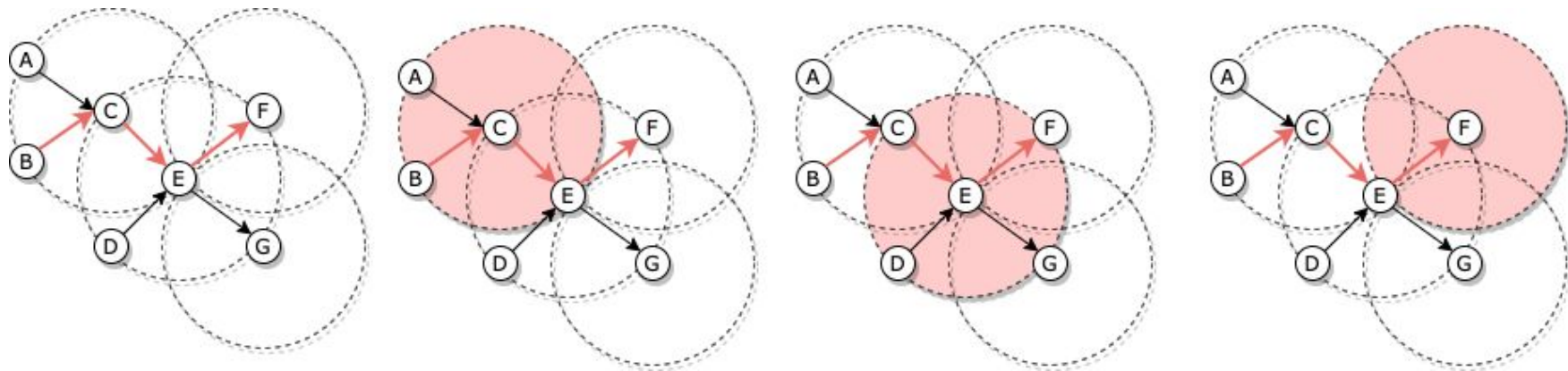
**Example:**  
*youtube/WATCH*

**Baggage:** key-value pairs propagated with a distributed request

**Reference:**  
<https://www.w3.org/TR/baggage/>

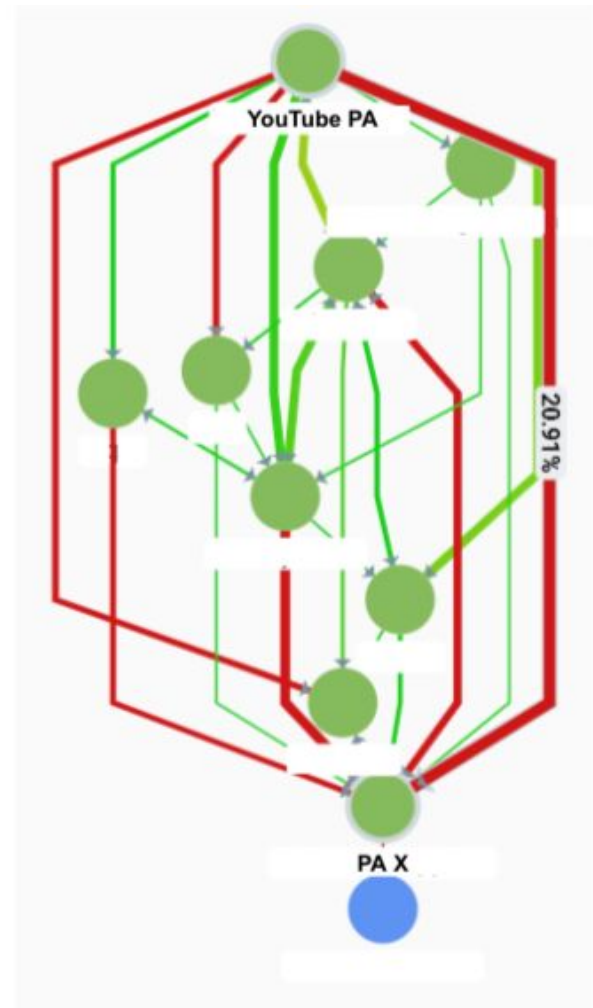
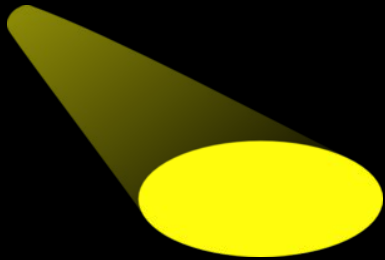
**Example:**  
*baggage: productCui=youtube/WATCH*

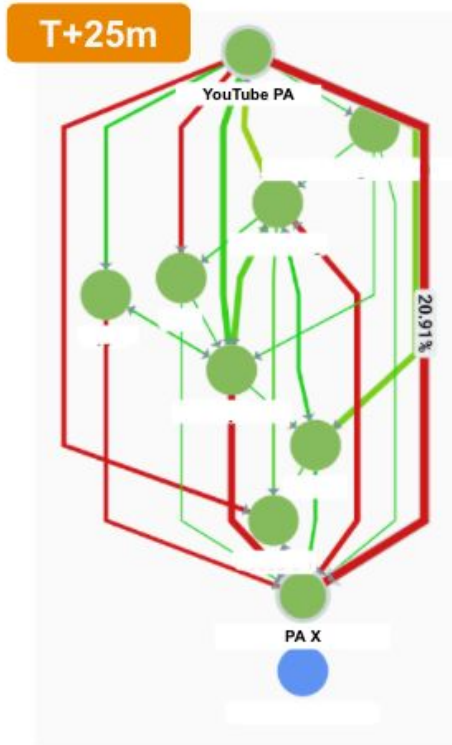
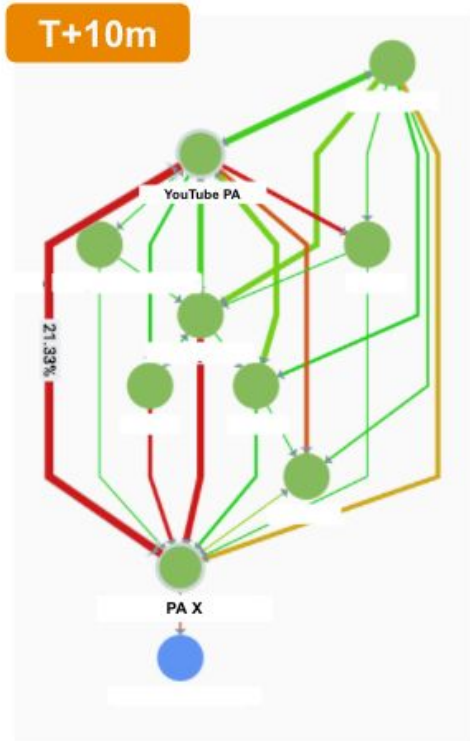
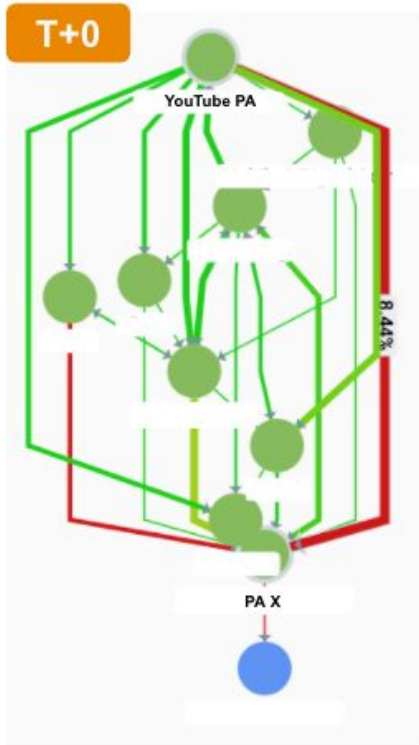
# CUI attribution



- Per-CUI
- Multi-hop (end-to-end)

# Night and day difference



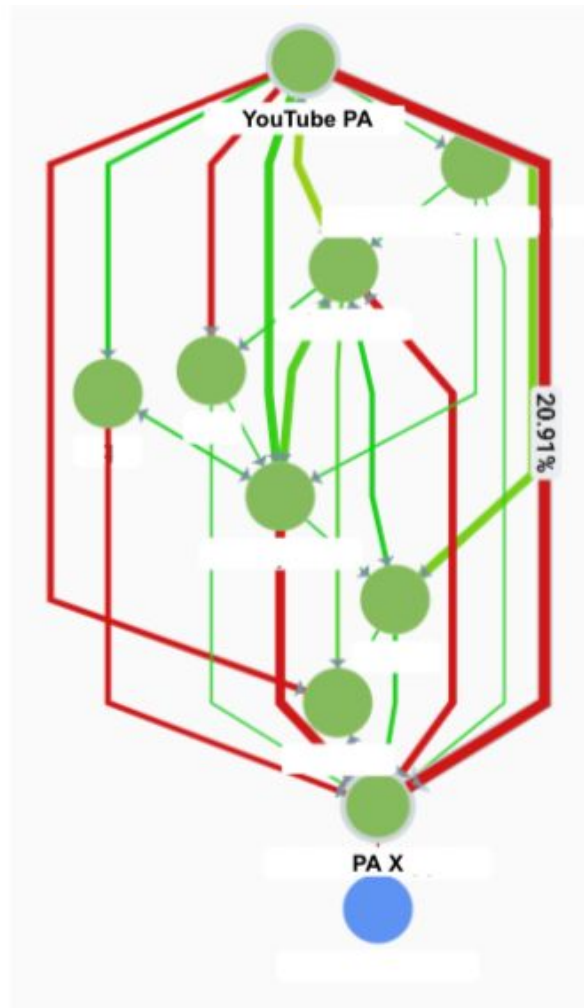


Google internal

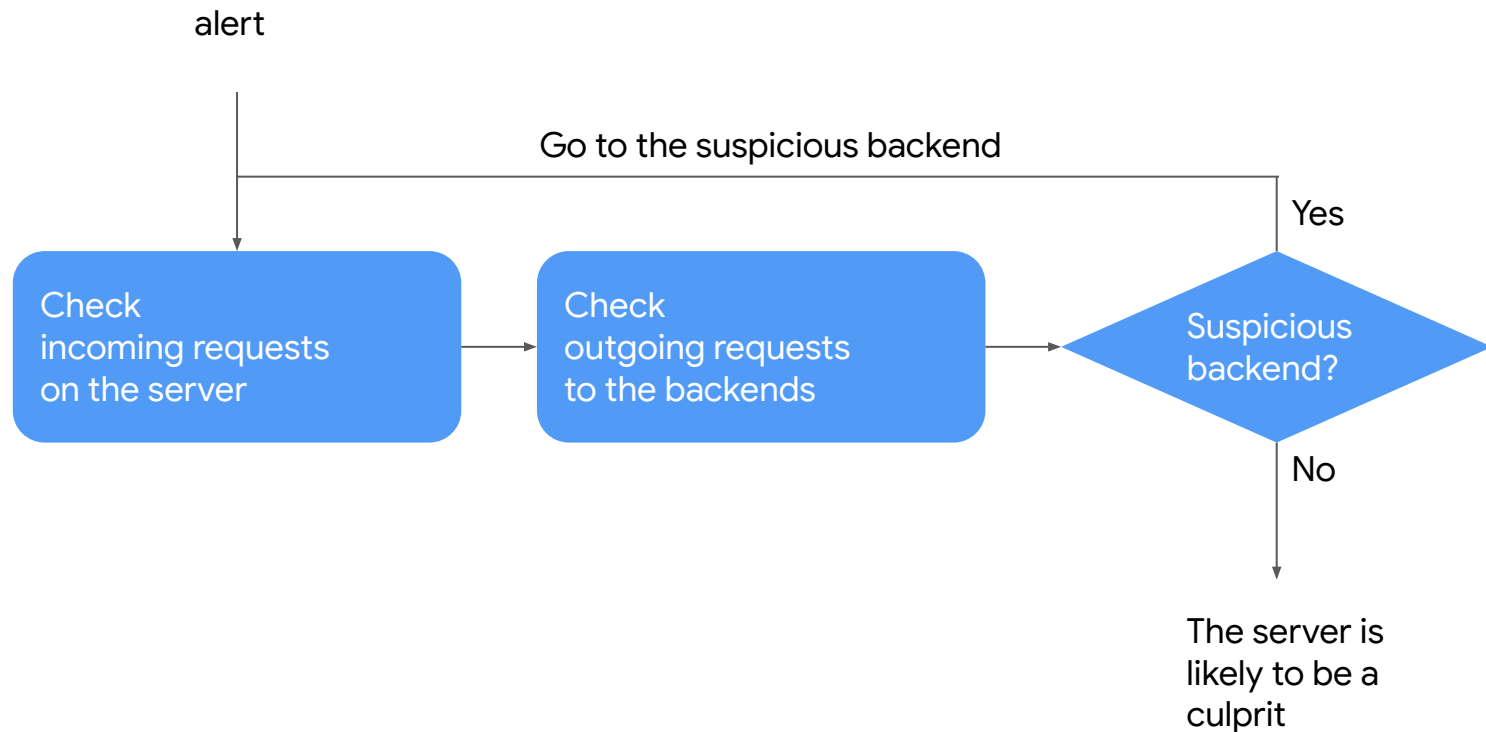


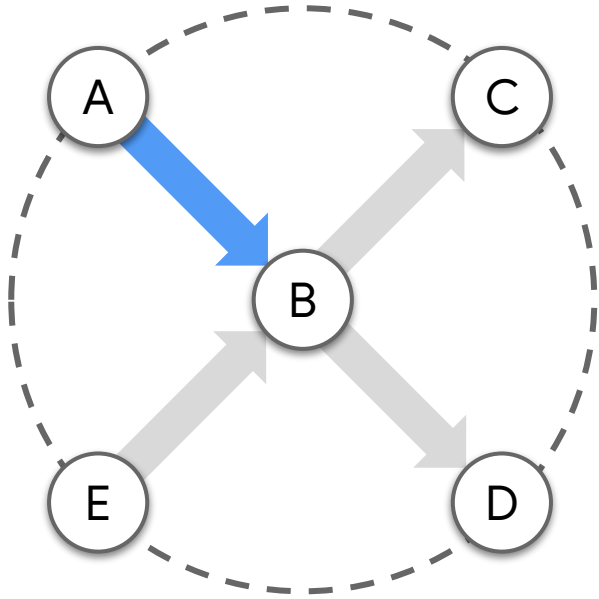
# Root-causing

an issue caused by  
a service multiple hops away

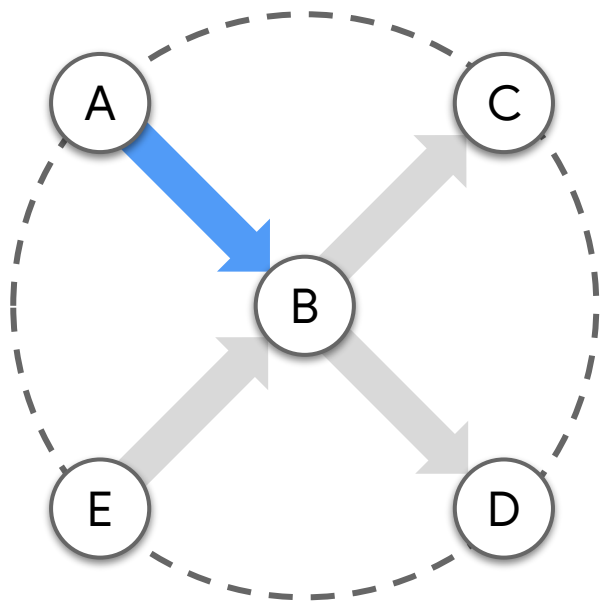


# Potential root-causing workflow?

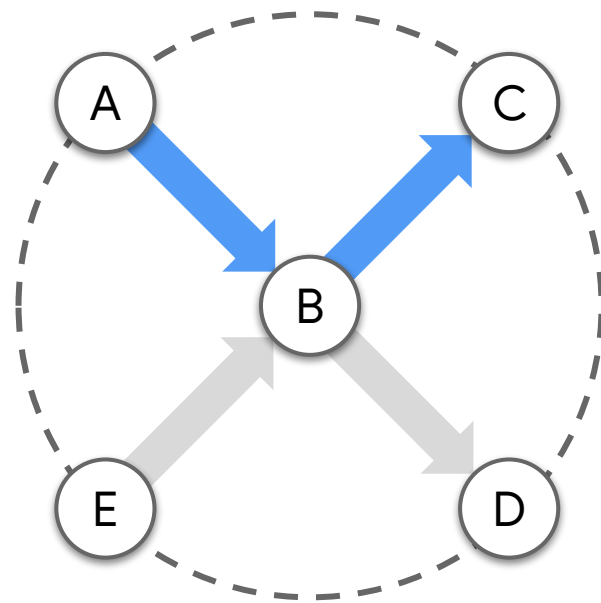




**Without** CUI attribution

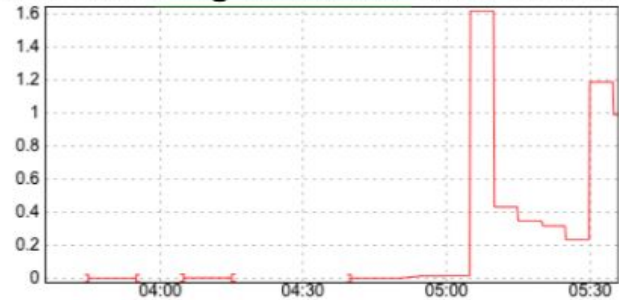


**Without** CUI attribution



**With** CUI attribution

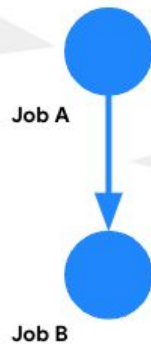
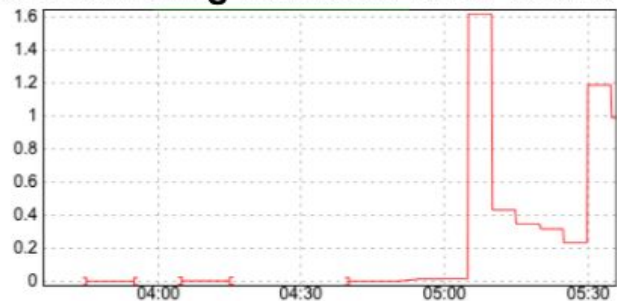
## Errors returning from Job A for CUI X



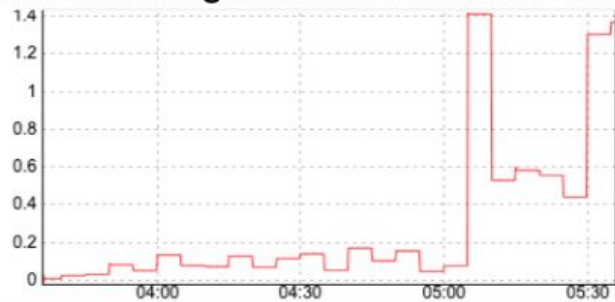
Job A



## Errors returning from Job A for CUI X



## Errors returning from Job B to A for CUI X



**Errors returning from Job A for CUI X**



Job A

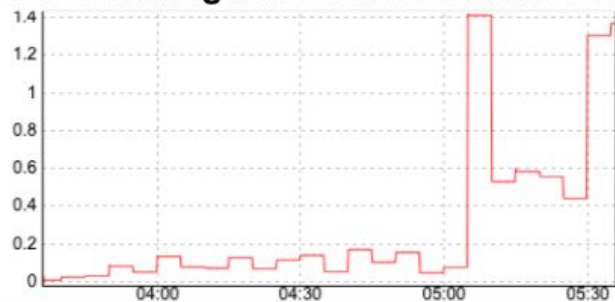


Job B



Job C

**Errors returning from Job B to A for CUI X**



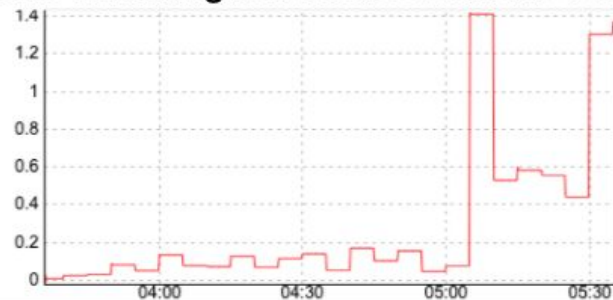
**Errors returning from Job C to B for CUI X**



**Errors returning from Job A for CUI X**



**Errors returning from Job B to A for CUI X**



**Errors returning from Job C to B for CUI X**

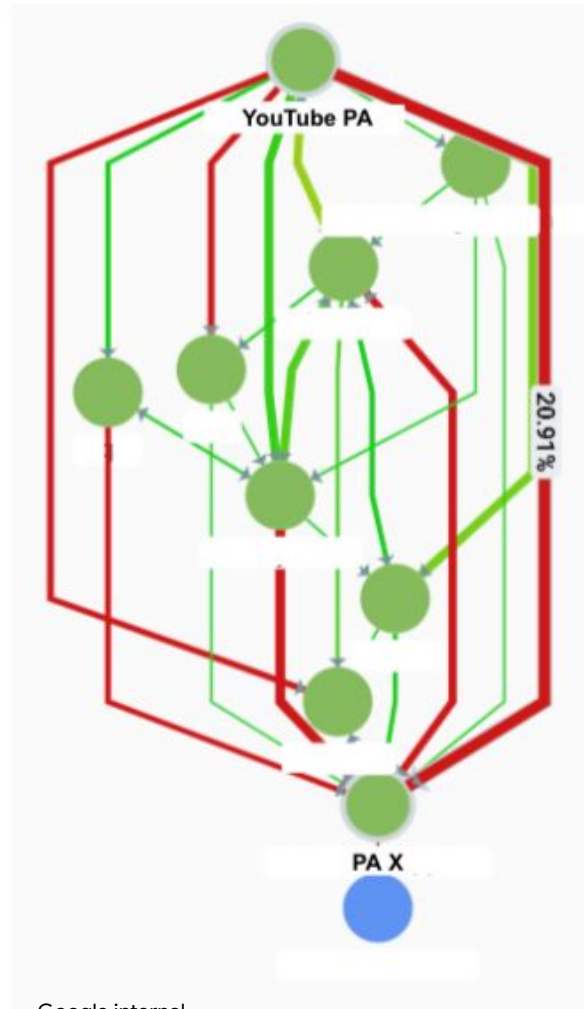


**Errors returning from Job D to C for CUI X**

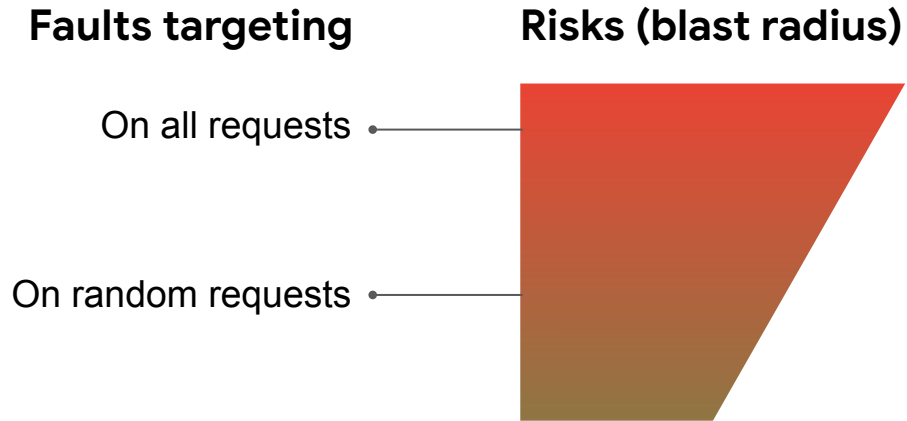




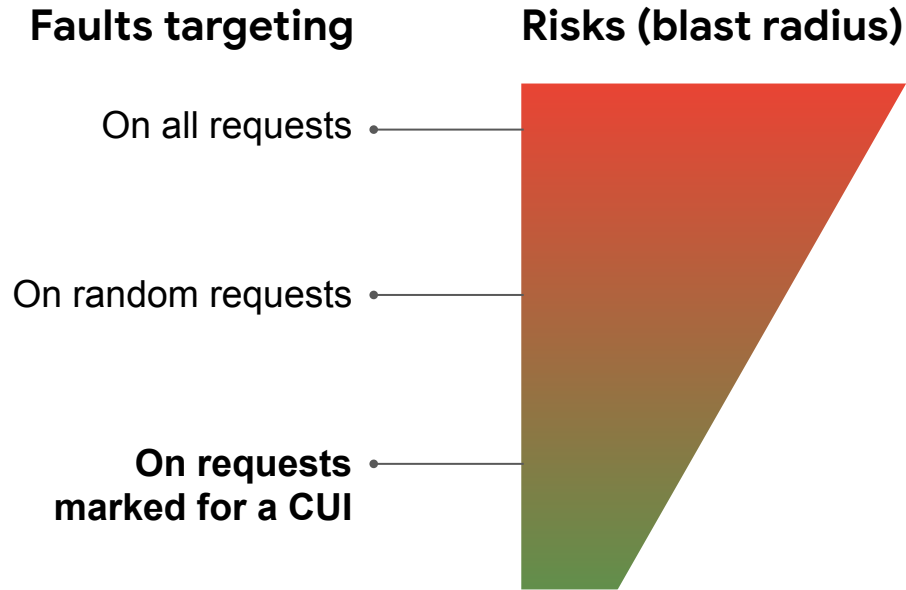
# Safer Chaos Engineering



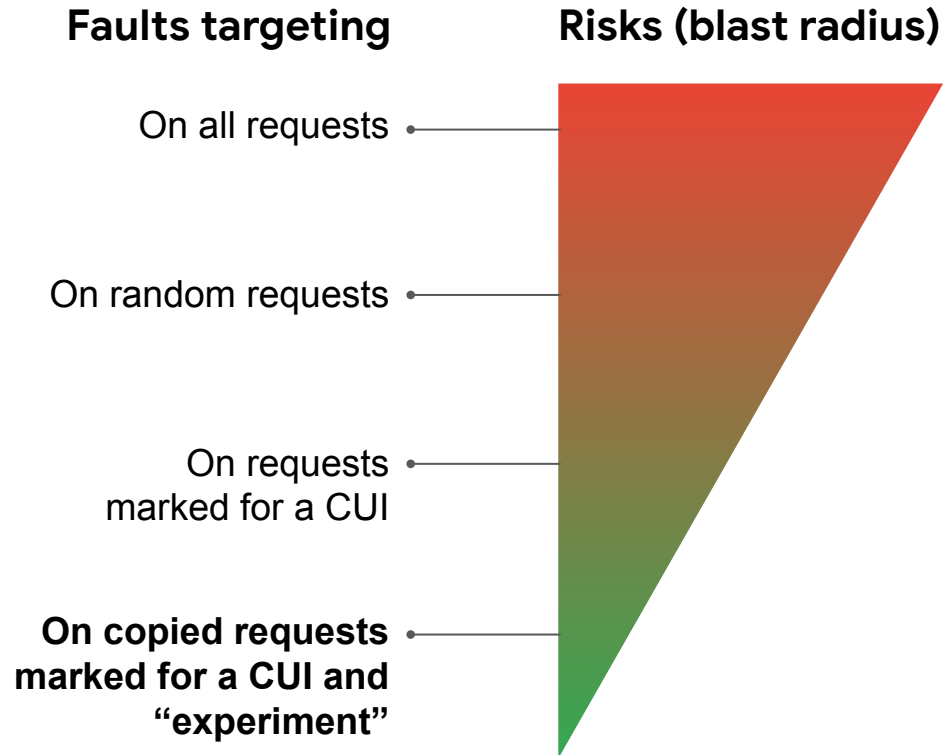
# Safer Chaos engineering



# Safer Chaos engineering



# Safer Chaos engineering



# Beyond distributed tracing

## Simple idea

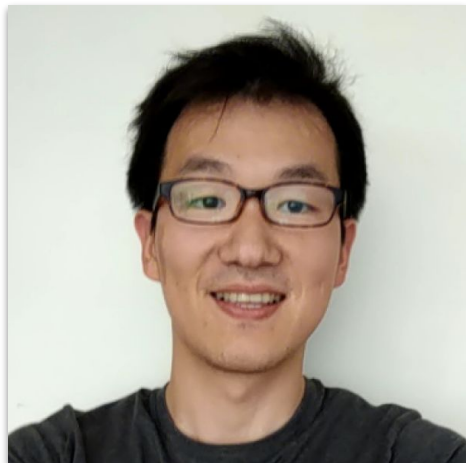
- **Propagate** a piece of metadata (e.g. CUI) w/ request
- **Gather** system performance metrics **by the propagating metadata** (and the peer)

## Easily adoptable

- **Baggage mechanism** in distributed tracing solutions
- <https://www.w3.org/TR/baggage/>



# Thank you!



**Beyond Distributed Tracing**

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