Reducing MTTR and False Escalations: Event Correlation at LinkedIn

Michael Kehoe

Staff Site Reliability Engineer
LinkedIn

False Escalations

Have you ever?

- Been woken because your service is unhealthy because of a dependency?
- Been woken because someone believes your service is responsible?
- Spent hours trying to work out why your service is broken?

Agenda

- Project Problem Statement
- Project Goals
- Architecture Considerations
- Correlation Engine Overview
- Results & Takeaways
- Questions

Michael Kehoe

$ whoami

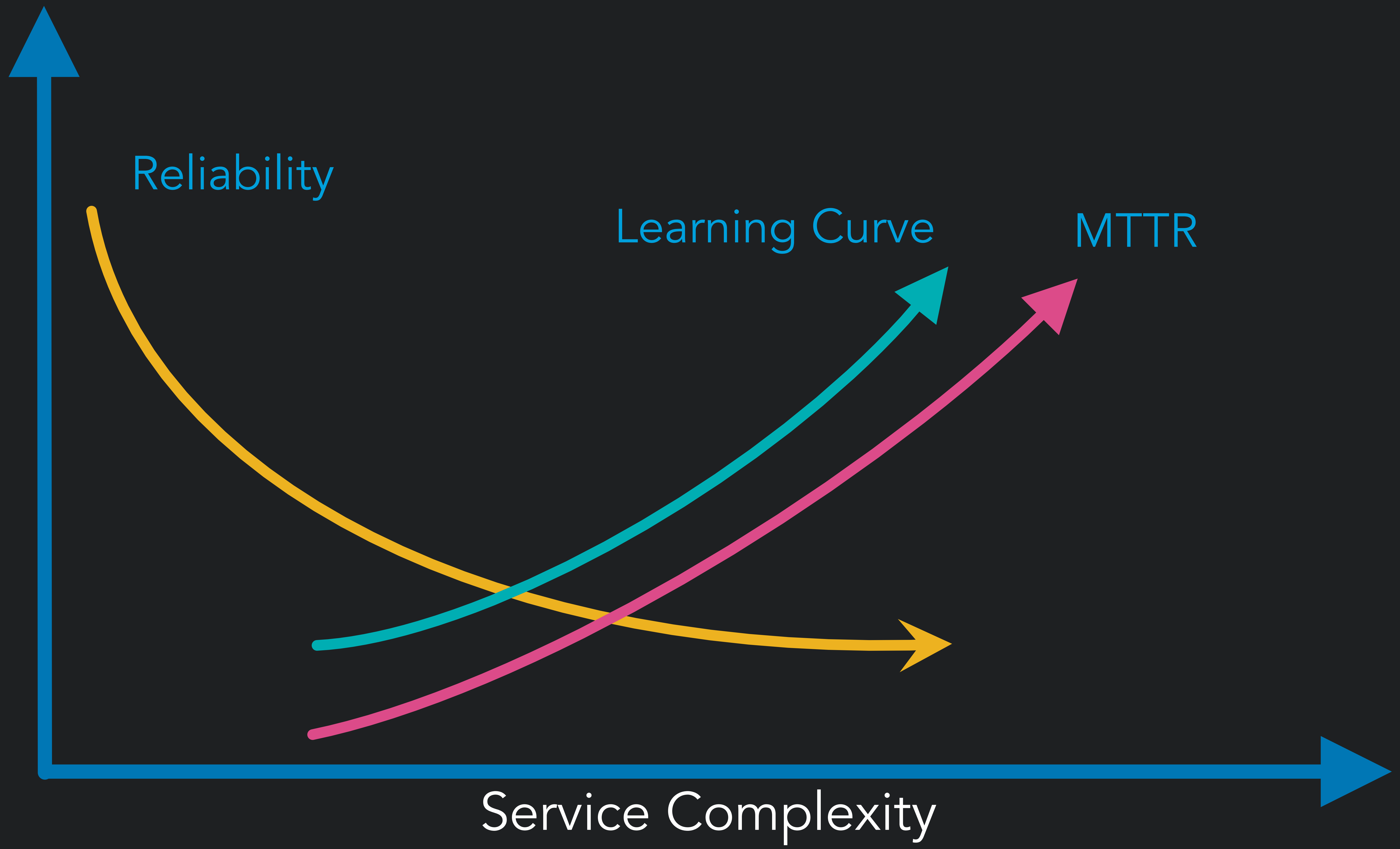
- Staff Site Reliability Engineer (SRE) @ LinkedIn
- Production-SRE team
- Funny accent = Australian + 3 years American

Michael Kehoe

$ whatis PROD-SRE

- Production-SRE
  - **Develop applications to improve MTTD and MTTR**
  - **Build tools for efficient site issue troubleshooting, issue detection & correlation**
  - Provide direction on site monitoring
  - Assist in restoring stability to services during site critical issues

Problem Statement



Problem Statement

Project Technical Goal

Find problem with a service between a given time period (or ongoing) using:

Unified API

Web Frontend

Problem Statement

Project Success Criteria

- Reduce MTTR on incidents

- Reduce false/ needless escalations

Problem Statement

Expected Use-Cases

Applicable use-cases:

- A service has high latency or error rates
  - Find the problematic service(s)

Non-applicable use-cases:

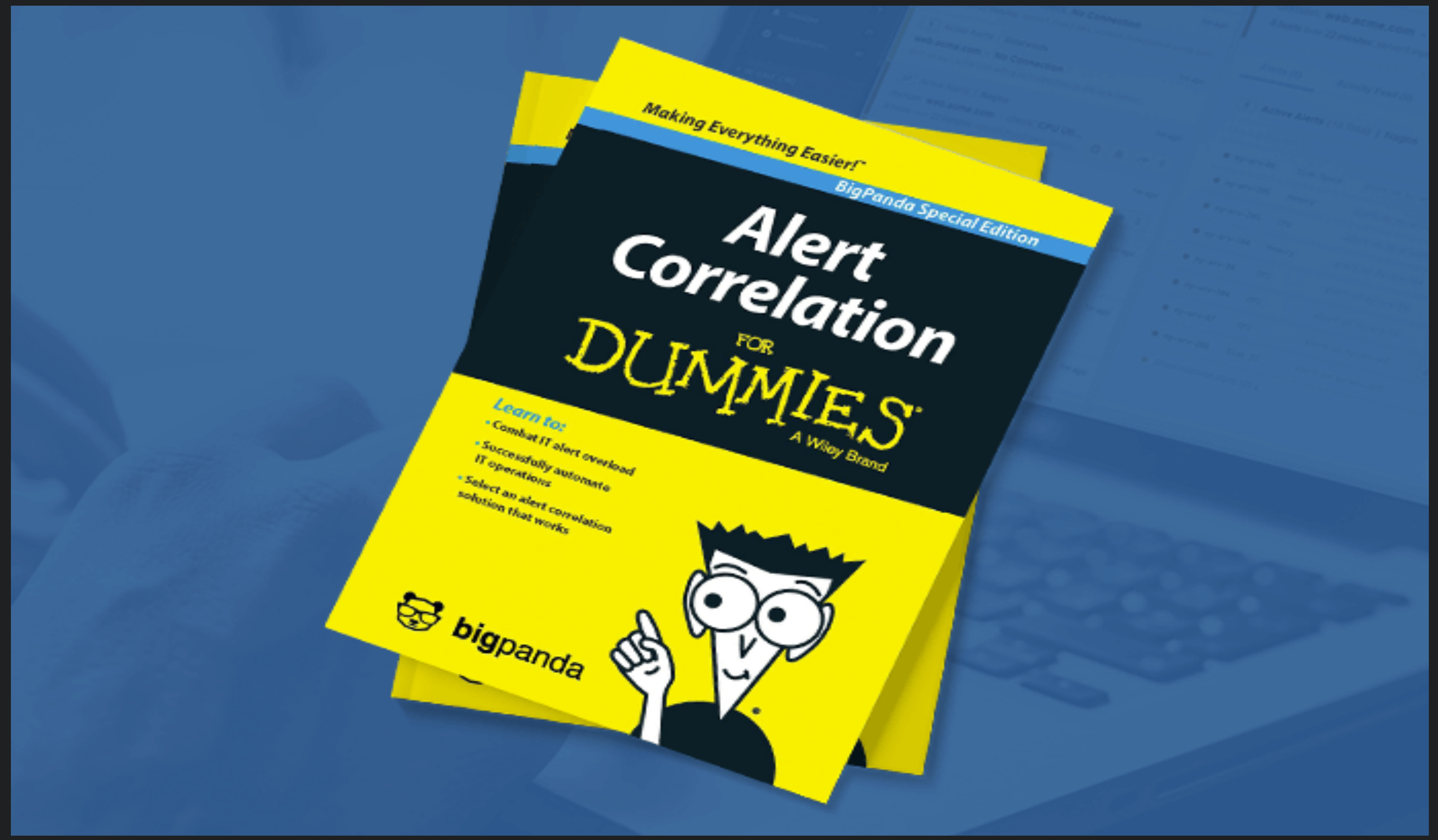
- External monitoring services show slow page-load times

Architecture Considerations

Real-Time metrics analytics (stream processing)

Projected sales of main products in 2013
Distribution of market share among the major industry players
Share of market activity
Passive market share
Projected sales of main products in 2013

Ad-Hoc metrics Analytics


Making Everything Easier!
BigPanda Special Edition
Alert Correlation
FOR
DUMMIES
A Wiley Brand
Learn to:
• Combat IT alert overload
• Successfully automate IT operations
• Select an alert correlation solution that works
bigpanda

Alert Correlation

Architecture Considerations

Evaluation

- Real-Time metrics analytics (stream processing)
  - Pros
    - Fast response time
    - Ability to do advanced analytics in real-time
  - Cons
    - Resource intensive (especially at LinkedIn scale)

Architecture Considerations

Evaluation

- Ad-Hoc metric analytics
  - Pros
    - Smaller resource footprint
  - Cons
    - Analysis time is slow

Architecture Considerations

Evaluation

- Alert Correlation
  - Pros
    - Leverage already existing alerts
    - Strong signal-to-noise ratio
  - Cons
    - Analysis constrained to alerts only (boolean state)

Architecture Considerations

Evaluation

- Real-time analytics is expensive, but useful

- Ad-Hoc metric analytics is slower, but cheaper

  - Alert Correlation gives us strong signal

Correlation Engine Overview

At LinkedIn, we had two smaller projects that we could leverage

- Drilldown + Site-Stabilizer
  - Near-Time metric analytics & event correlation
- Invisualize
  - Alert Correlation

Existing knowledge available

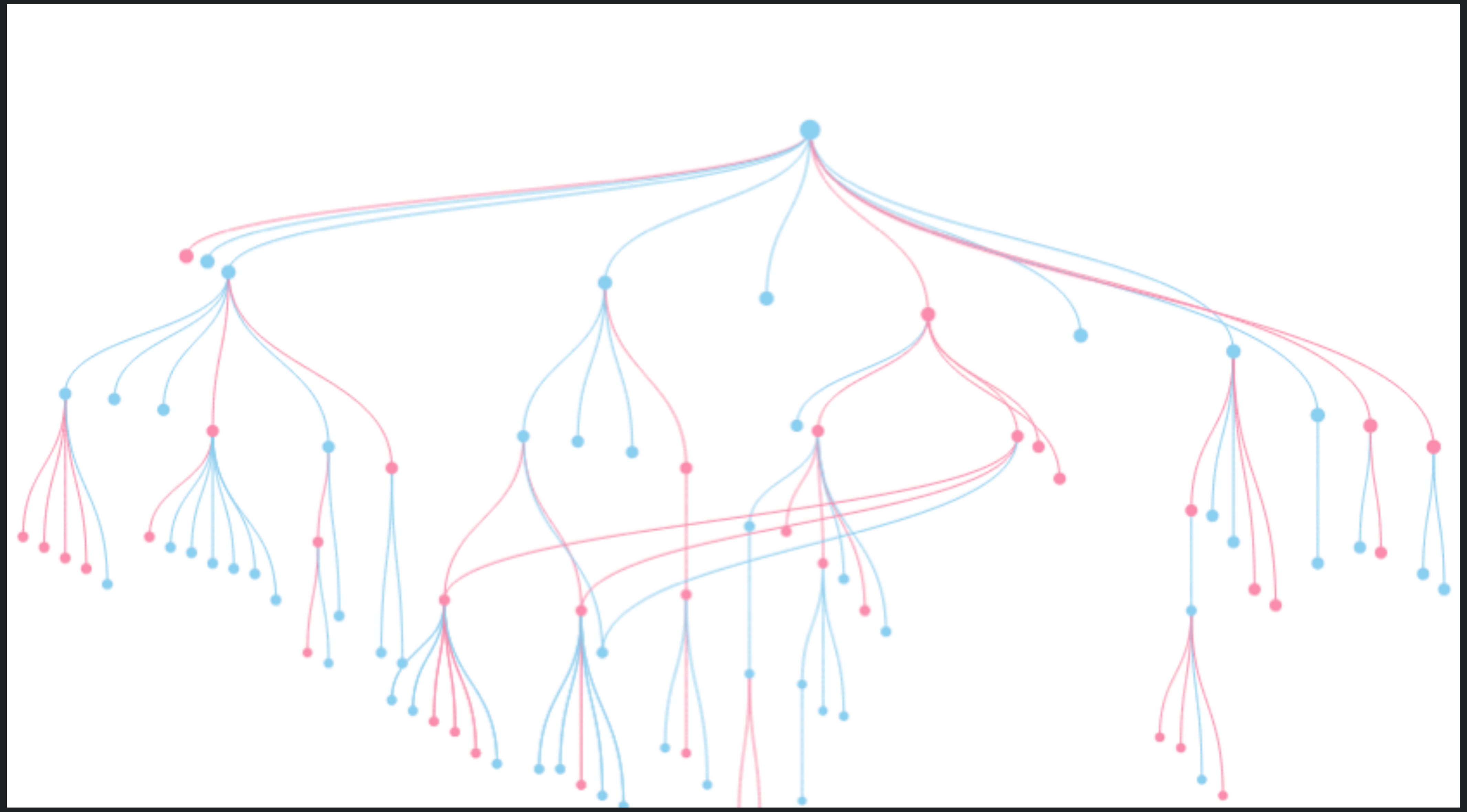
Correlation Engine Overview

Where to get started

The ability to correlate is great!

But you need to understand dependencies

Build a callgraph!



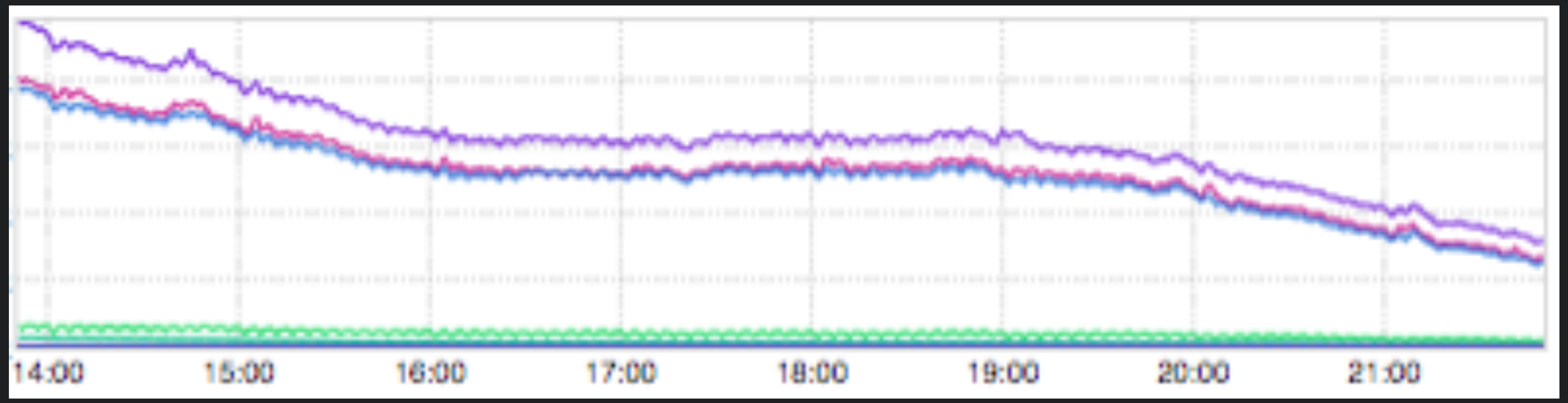
Correlation Engine Overview

Callgraph

LinkedIn applications emit metrics on a per-API and per-dependency basis

Map metrics to understand dependencies

Simple to build callgraph platform!

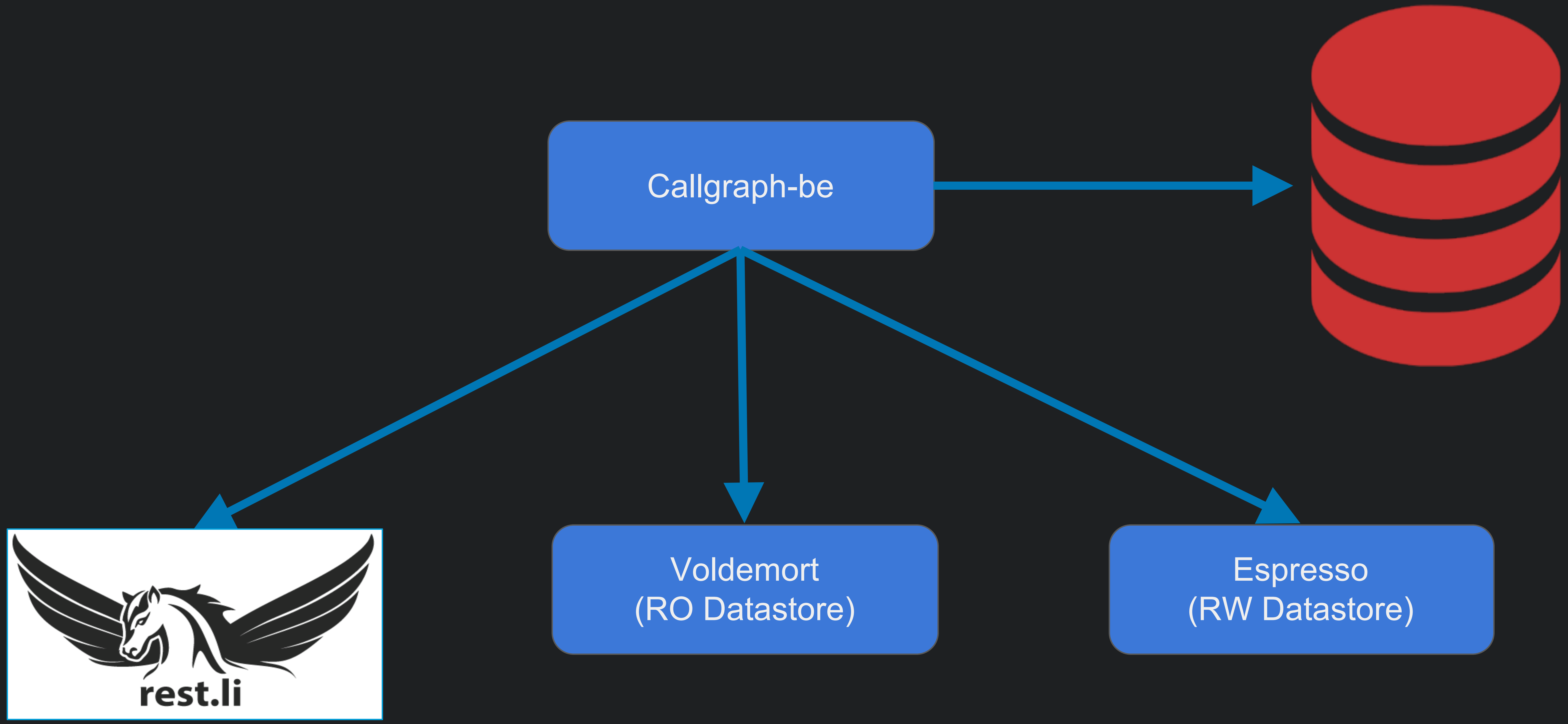


Correlation Engine Overview

Callgraph

Collect:

- Call count
- Latency



Correlation Engine Overview

drilldown (Near-Time analytics)

Using callgraph, identifies high-value dependencies (and the associated metrics)

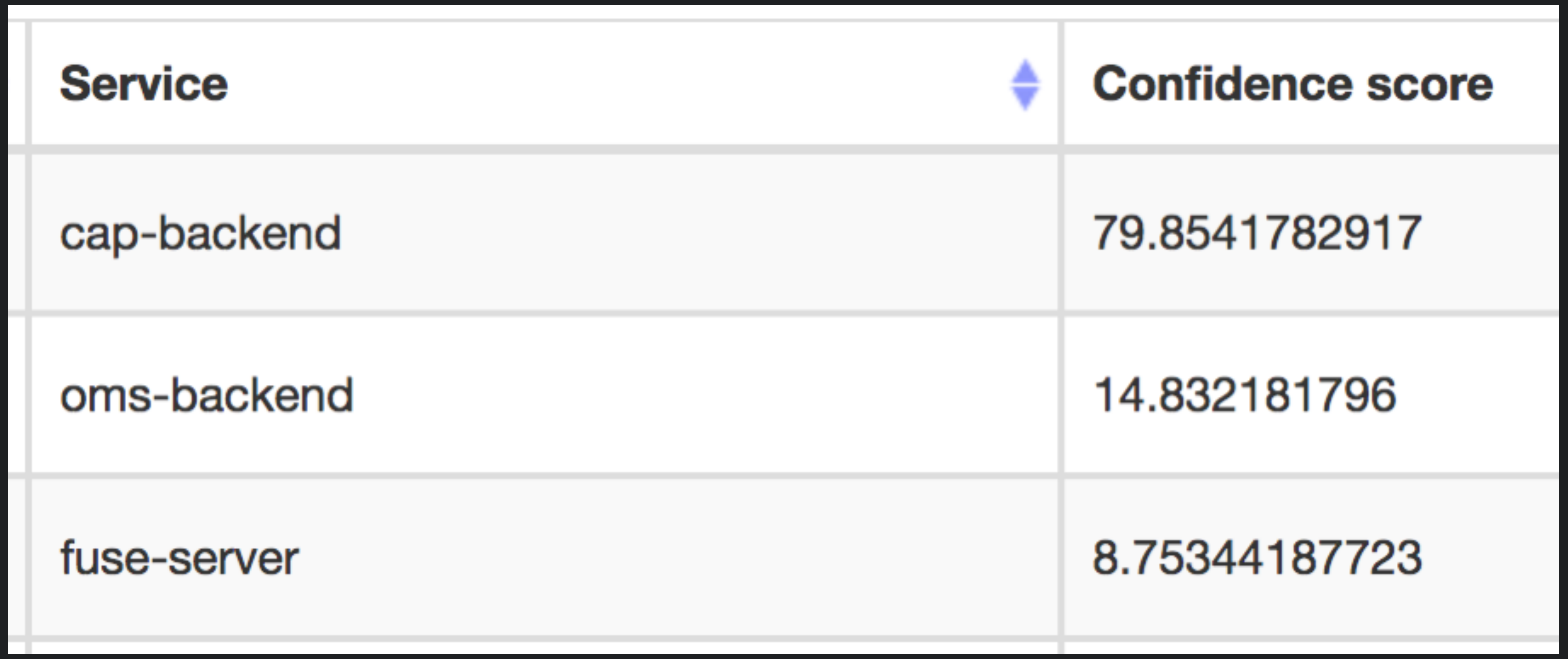
In 5min chunks, analyses high-value metrics

- Using a k-means unsupervised algorithm, find similar trends between service metrics

Queryable API

Outputs correlation confidence scores

- Normalised between 0-100



Service	Confidence score
cap-backend	79.8541782917
oms-backend	14.832181796
fuse-server	8.75344187723

Correlation Engine Overview

inVisualize (Alert Correlation)

inVisualize analyses alerts (in realtime) from each service

Use callgraph to calculate the unhealthy service and affected services

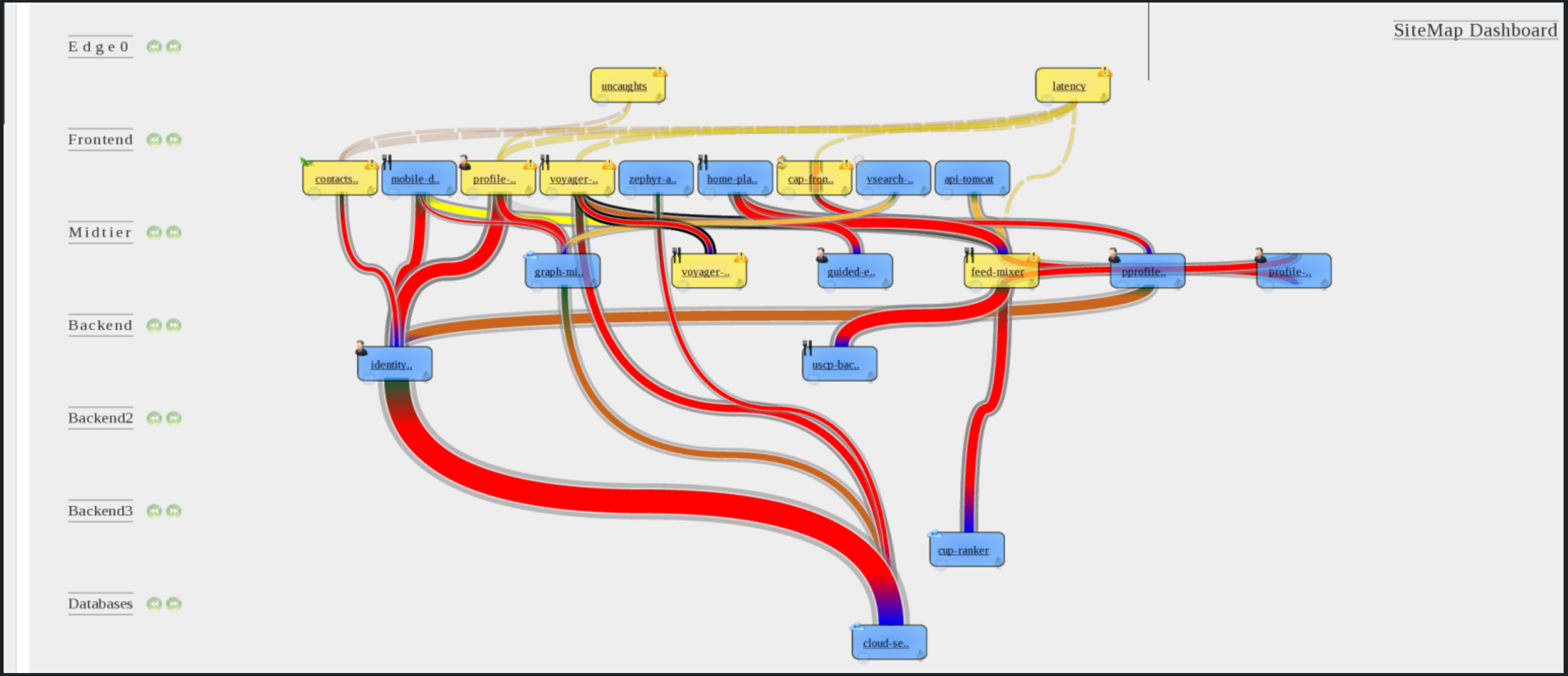
Queryable API

- Results normalised between 0-100

Visualizes impact

Correlation Engine Overview

inVisualize



Correlation Engine Overview

Site-Stabilizer

Backend service

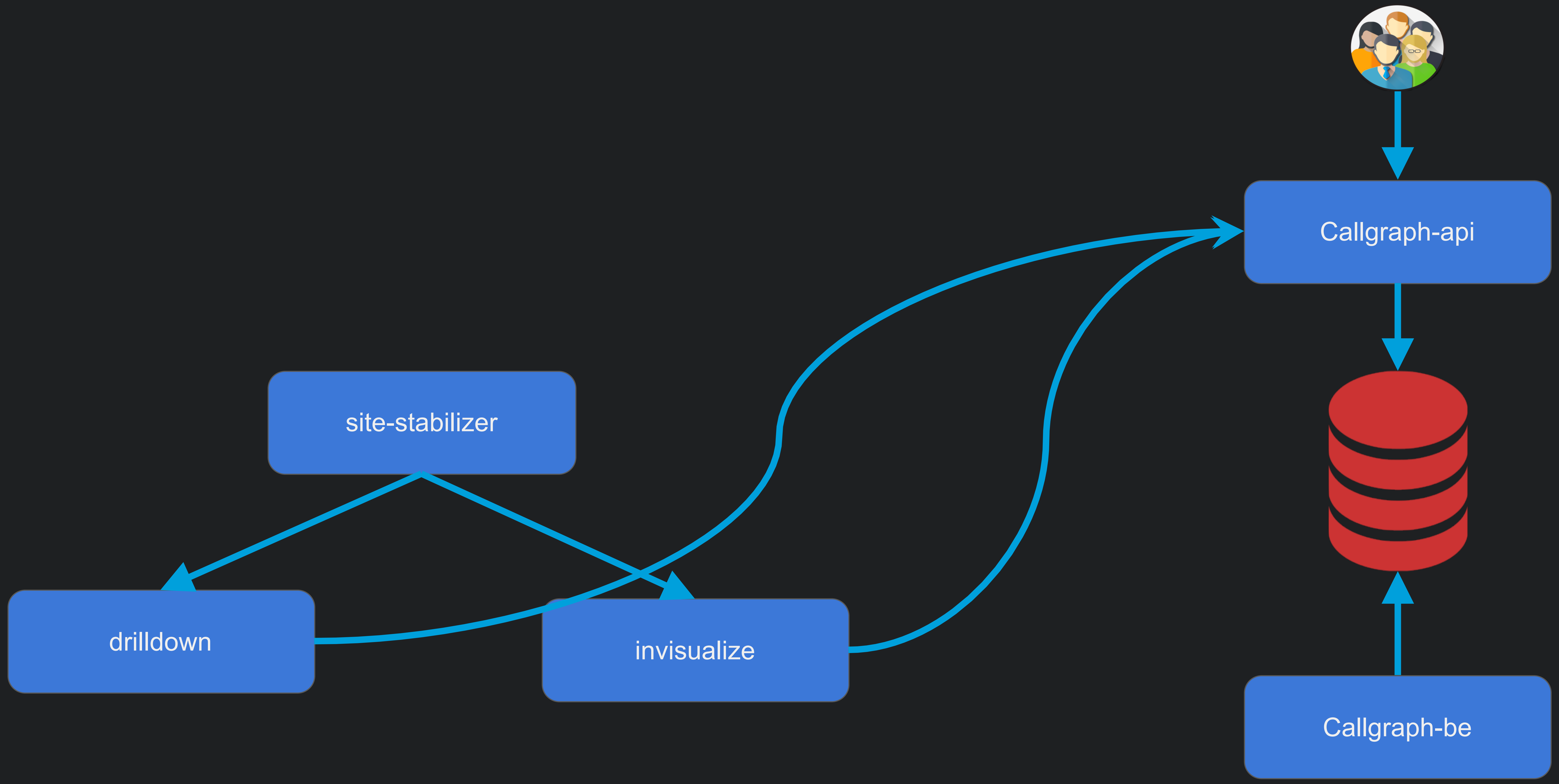
- Collates recommendations from Drilldown & inVisualize

Decorates recommendations with:

- Scheduled changes
- Deployment events
- A/B experiment changes

Correlation Engine Overview

Architecture



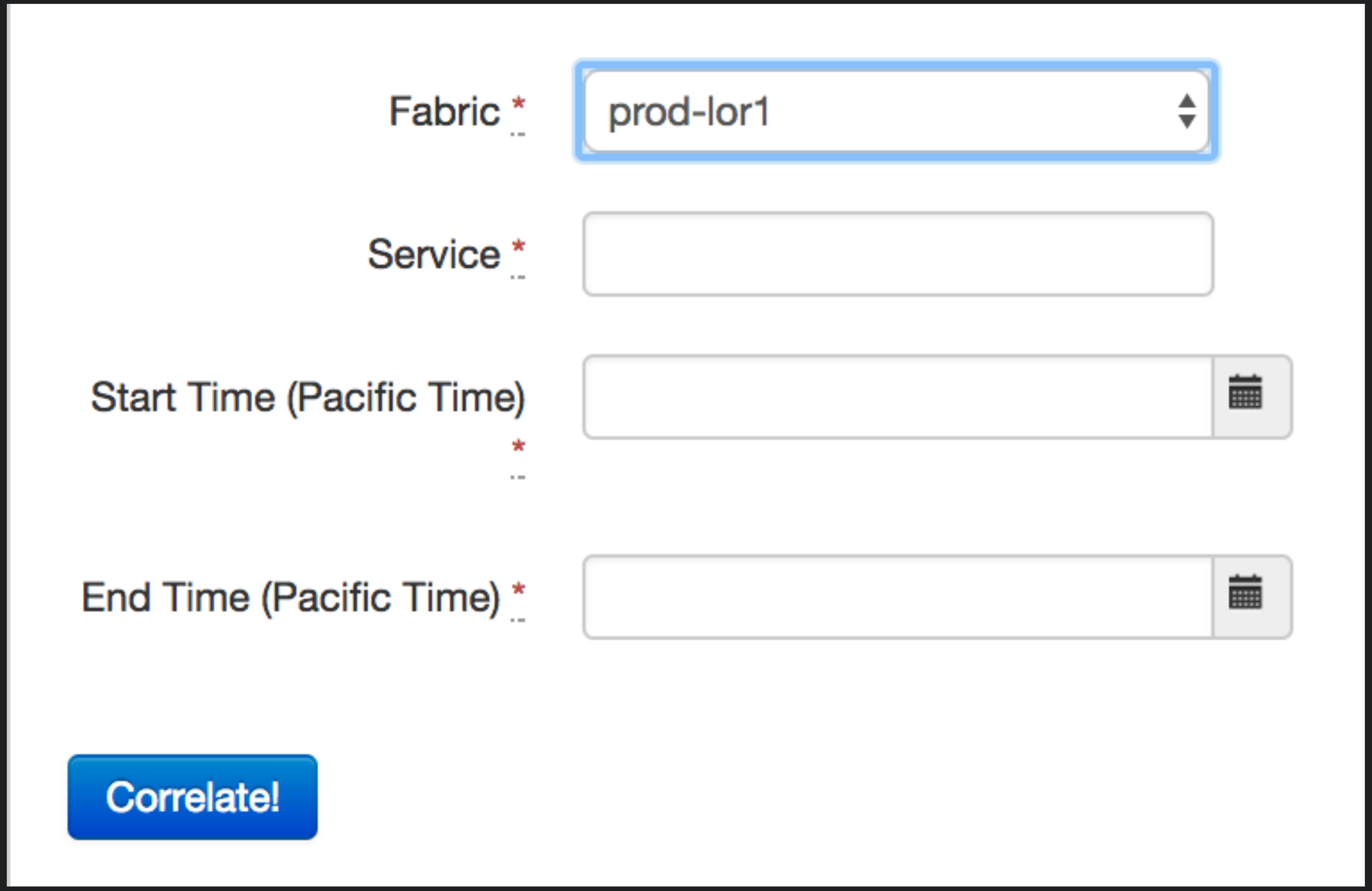
Correlation Engine Overview

Correlate-fe

API for automation

- Auto-remediation
- Alert suppressing

UI for manual introspection



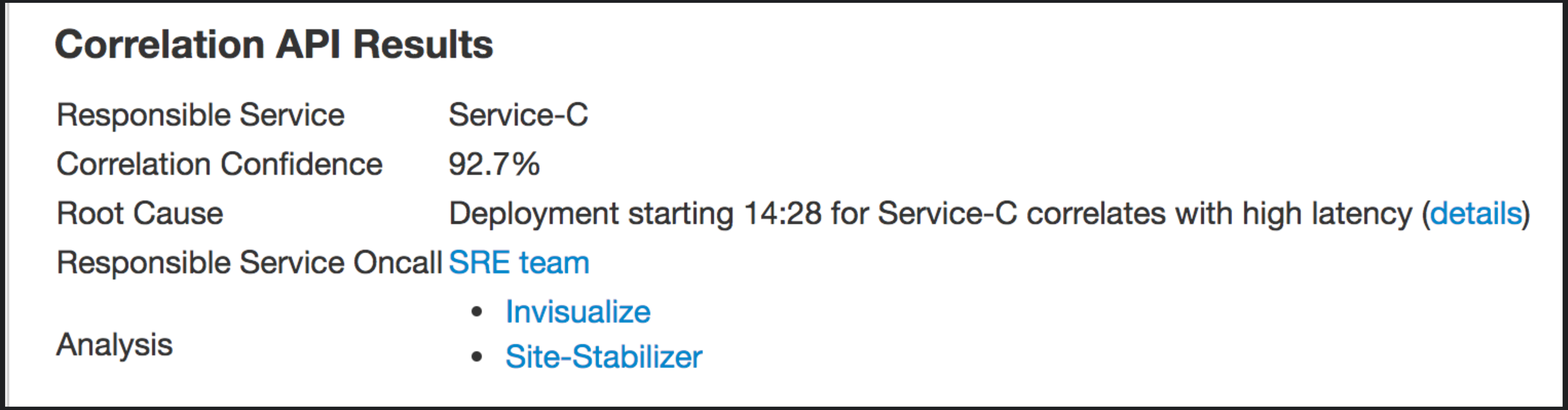
Fabric *	prod-lor1
Service *	
Start Time (Pacific Time) *	
End Time (Pacific Time) *	

Correlation Engine Overview

Correlate-fe

User Interfaces gives

- Responsible service
- Correlation Confidence
- Root cause
- SRE team
- Analysis

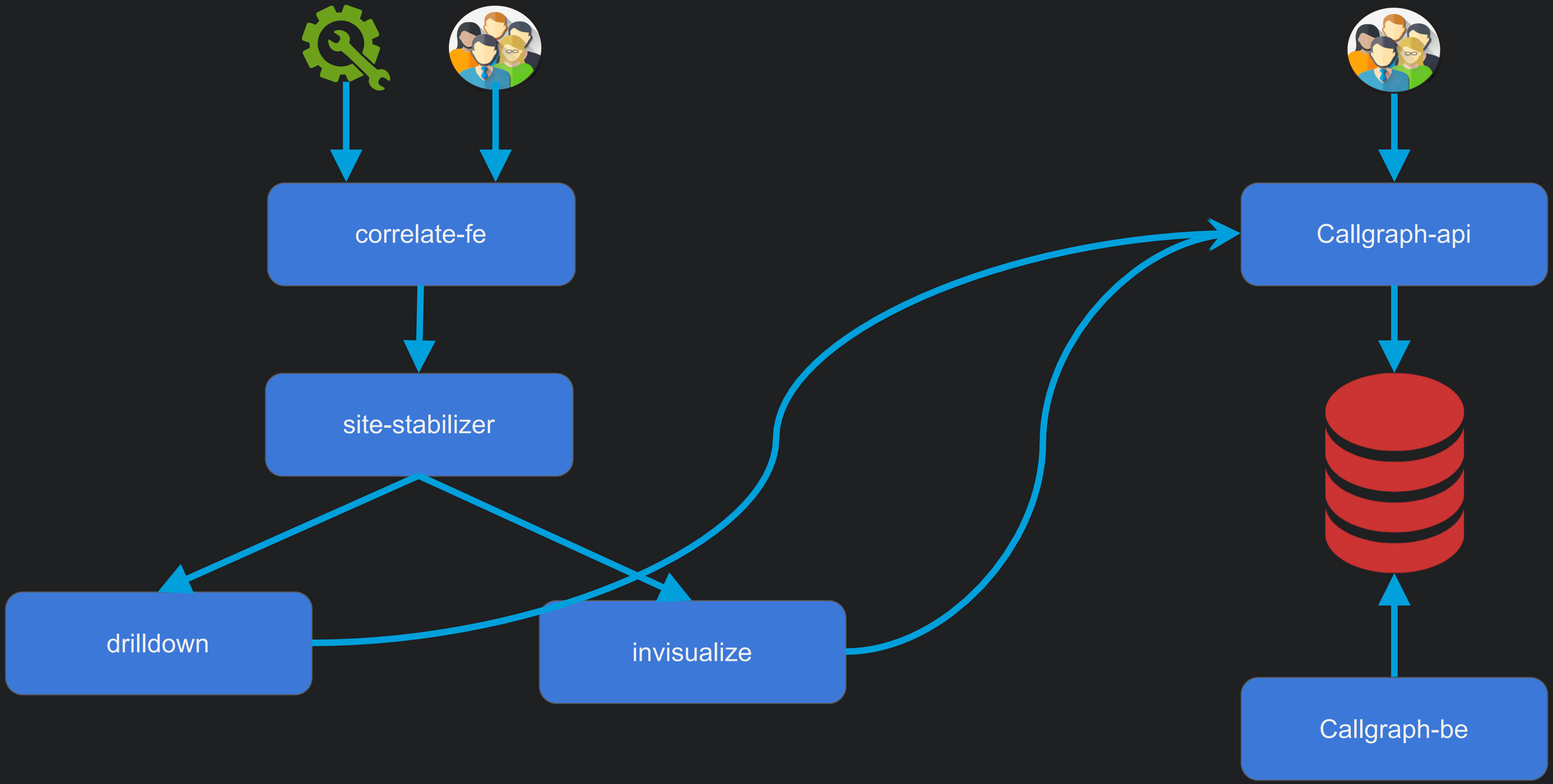


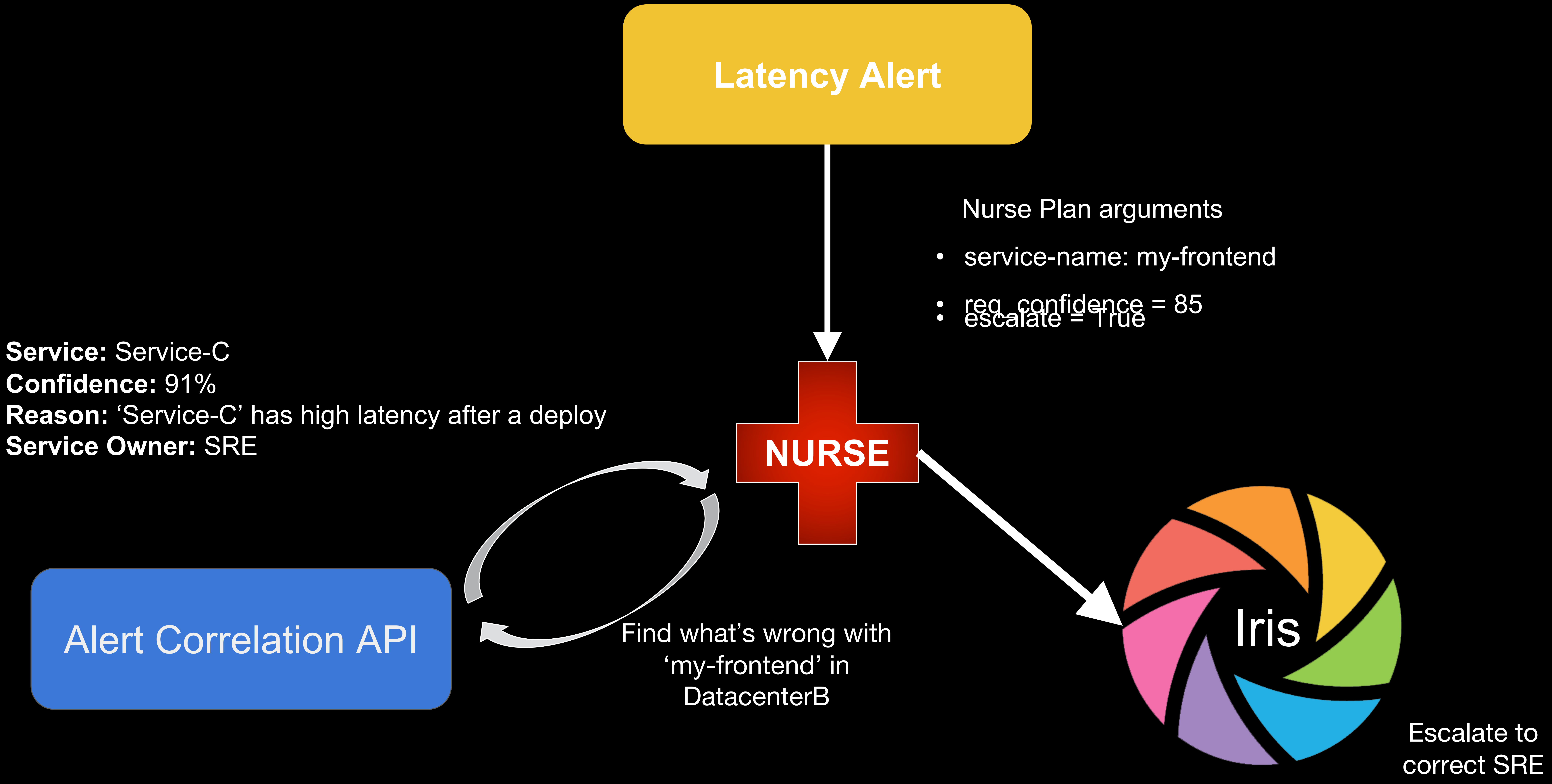
Correlation API Results

Responsible Service	Service-C
Correlation Confidence	92.7%
Root Cause	Deployment starting 14:28 for Service-C correlates with high latency (details)
Responsible Service Oncall	SRE team
Analysis	• Invisualize • Site-Stabilizer

Correlation Engine Overview

Architecture





Latency Alert

Nurse Plan arguments

- service-name: my-frontend
- req_confidence = 85
- escalate = True

Service: Service-C
Confidence: 91%
Reason: ‘Service-C’ has high latency after a deploy
Service Owner: SRE

NURSE

Alert Correlation API

Find what’s wrong with
‘my-frontend’ in
DatacenterB

Iris

Escalate to
correct SRE

Early Results

Siteops (NOC) has greater visibility on the site

Reducing MTTR

Reducing false escalations

Conclusion

Understand what correlation approach makes sense for you

Understand your dependencies

Build, Integrate and benefit!

Team

Michael
Kehoe

Rusty
Wickell

Reynold
Perumpilly

Govindaluri
Kishore

Renjith
Rajan

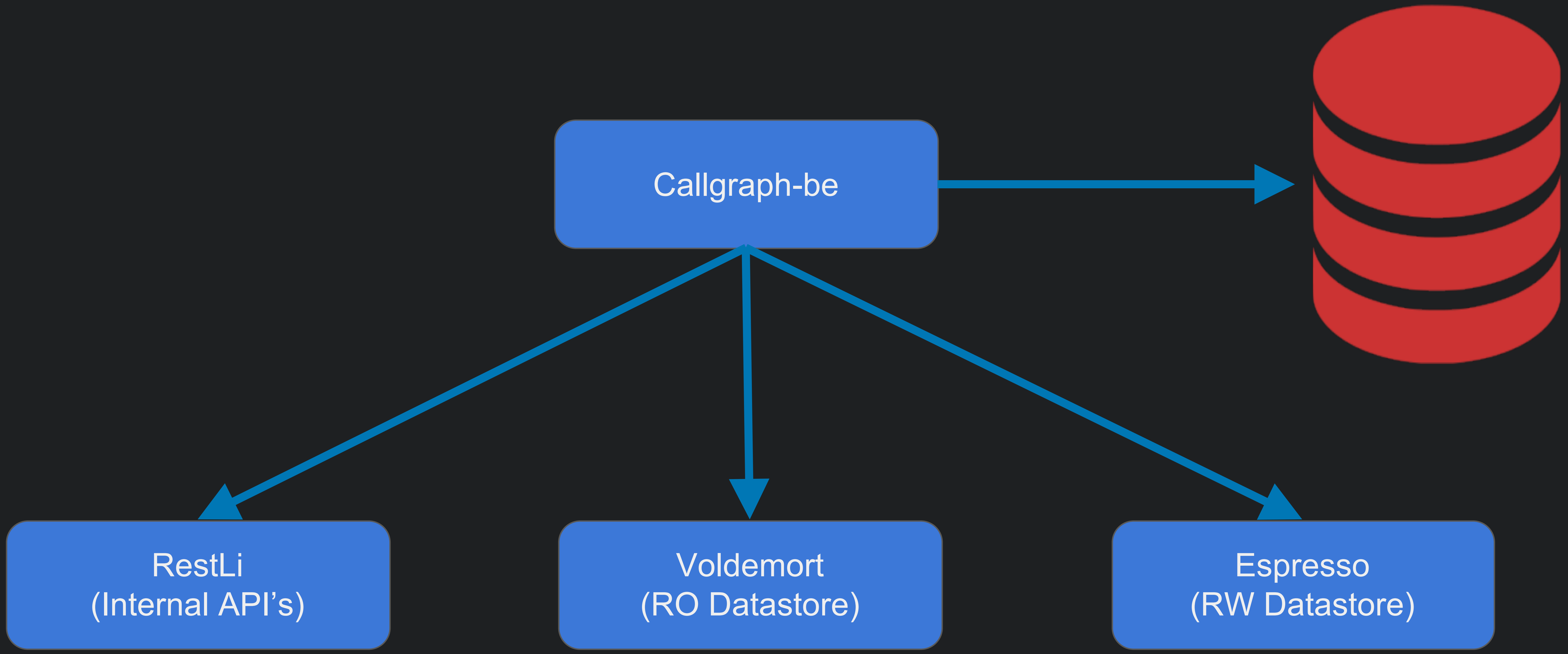
Questions?

Correlation Engine Overview

Callgraph

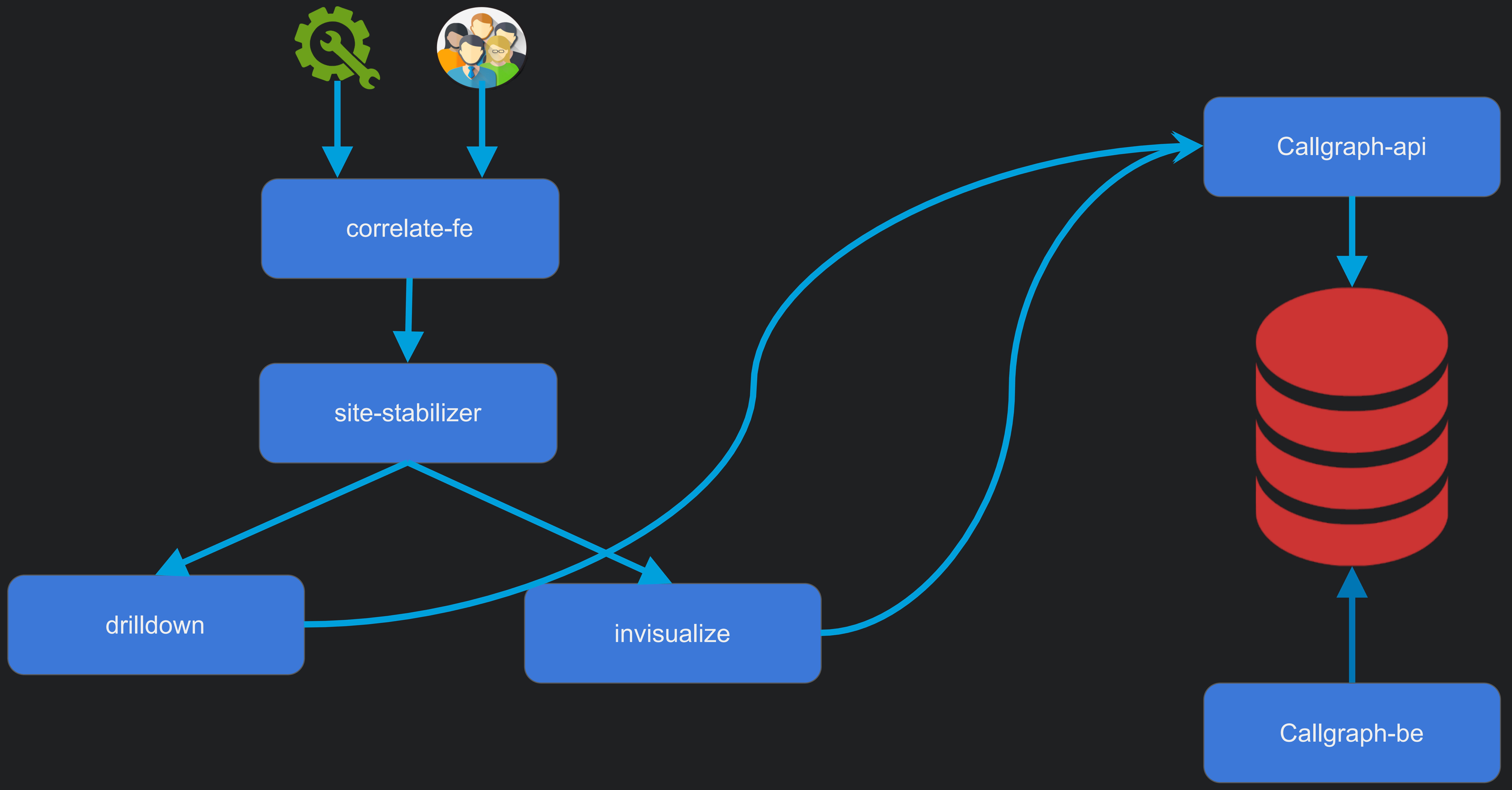
Call count

Latency



Correlation Engine Overview

Architecture


correlate-fe
site-stabilizer
drilldown
invisualize
Callgraph-api
Callgraph-be