Project Shield

How we use Beam to defend democracy and free expression, and how we got started!

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Staff Engineer - Google

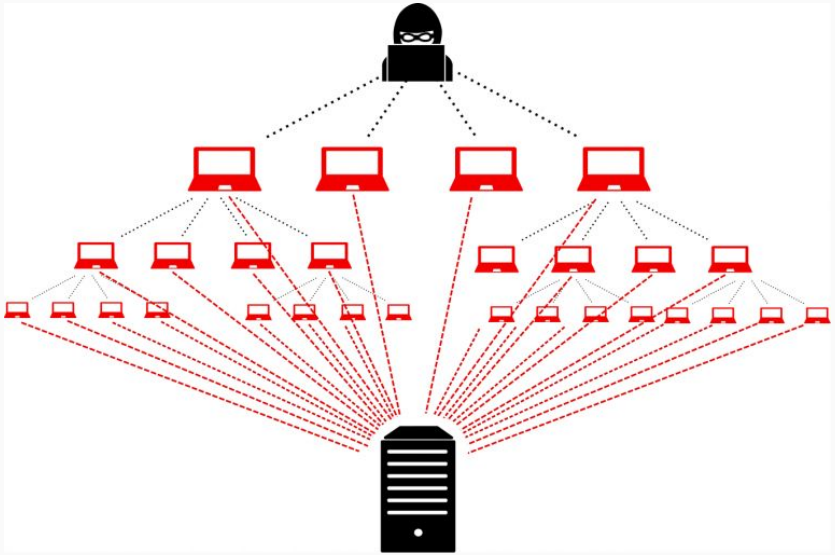
BEAM SUMMIT

September 4-5, 2024

Sunnyvale, CA. USA

DDoS Attacks

- **D**istributed **D**enial of **S**ervice
- Common attack to take down websites
- Requires no special access



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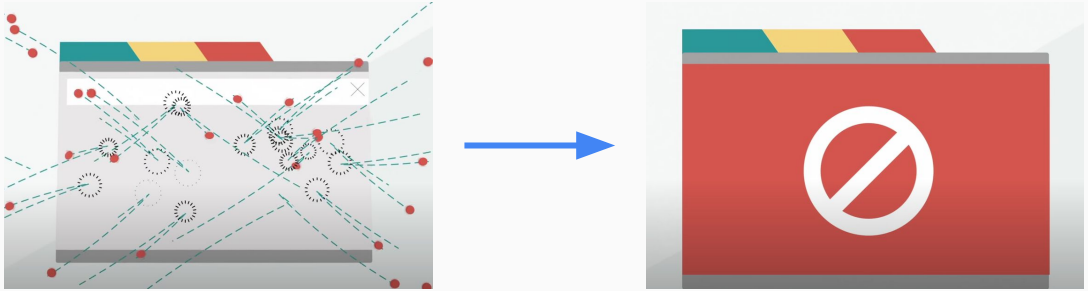
Self-Defense is Hard

- Huge volume of traffic overloads server
- Cannot defend against alone



Impact of DDoS

Bits

SECURITY

Cyberattacks Rise as Ukraine Crisis Spills to Internet

By NICOLE PERLROTH MARCH 4, 2014 6:47 PM 4 Comments

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ME AND EARL AND THE DYING GIRL

The crisis in Ukraine has spread to the Internet, where hackers from both sides are launching large cyberattacks against opposing news organizations.

Security experts say that they are currently witnessing unusually large denial-of-service attacks, also called DDoS attacks, in which hackers flood a website with traffic to knock it offline. The attacks have been directed at both pro-Western and pro-Russian Ukrainian news sites.

In at least one case, hackers successfully defaced the website of the Kremlin-financed news network Russia Today, replacing headlines and articles containing the word "Russia" with the word "nazi."

Experts say the attacks on pro-Western Ukrainian news sites closely

THE VERGE

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US & WORLD

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Before protests, Hong Kong news sites were hit with the largest DDoS ever

By Russell Brandom on November 21, 2014 05:59 pm Email @russellbrandom

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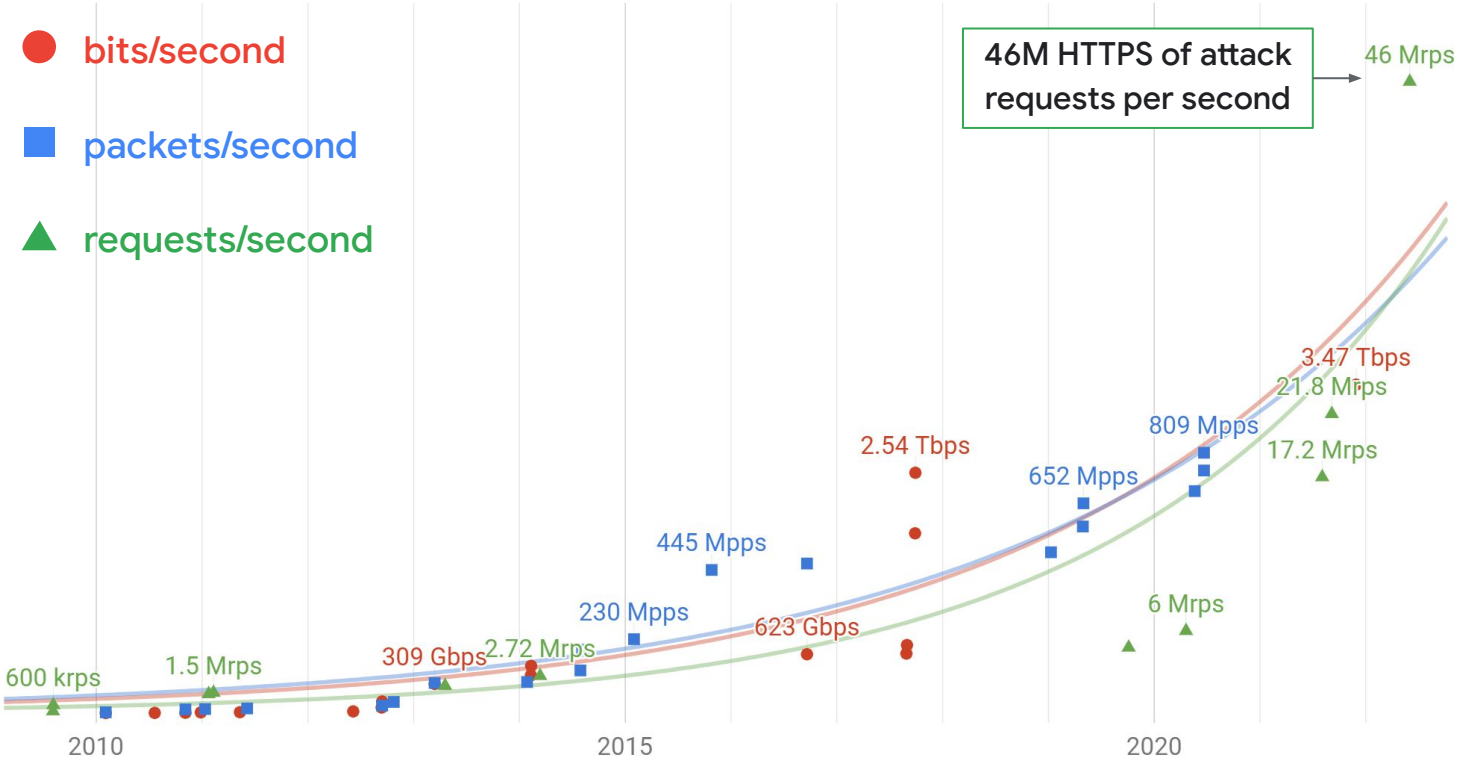
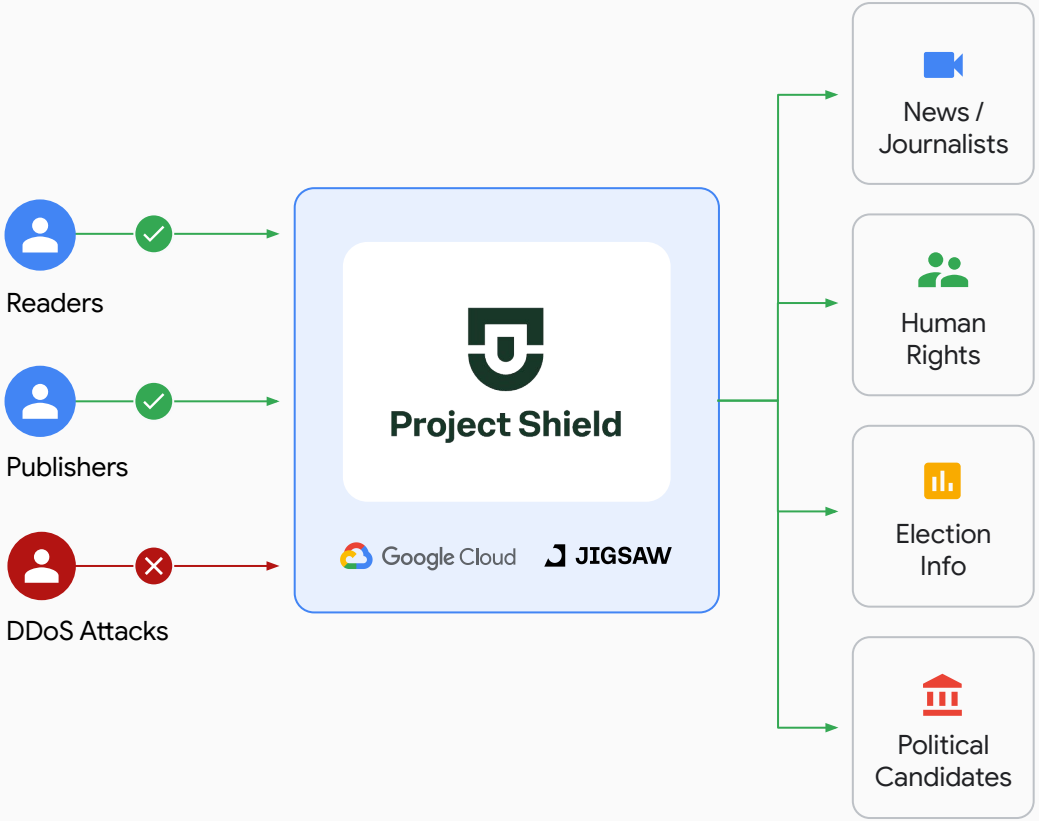
Growing in Size

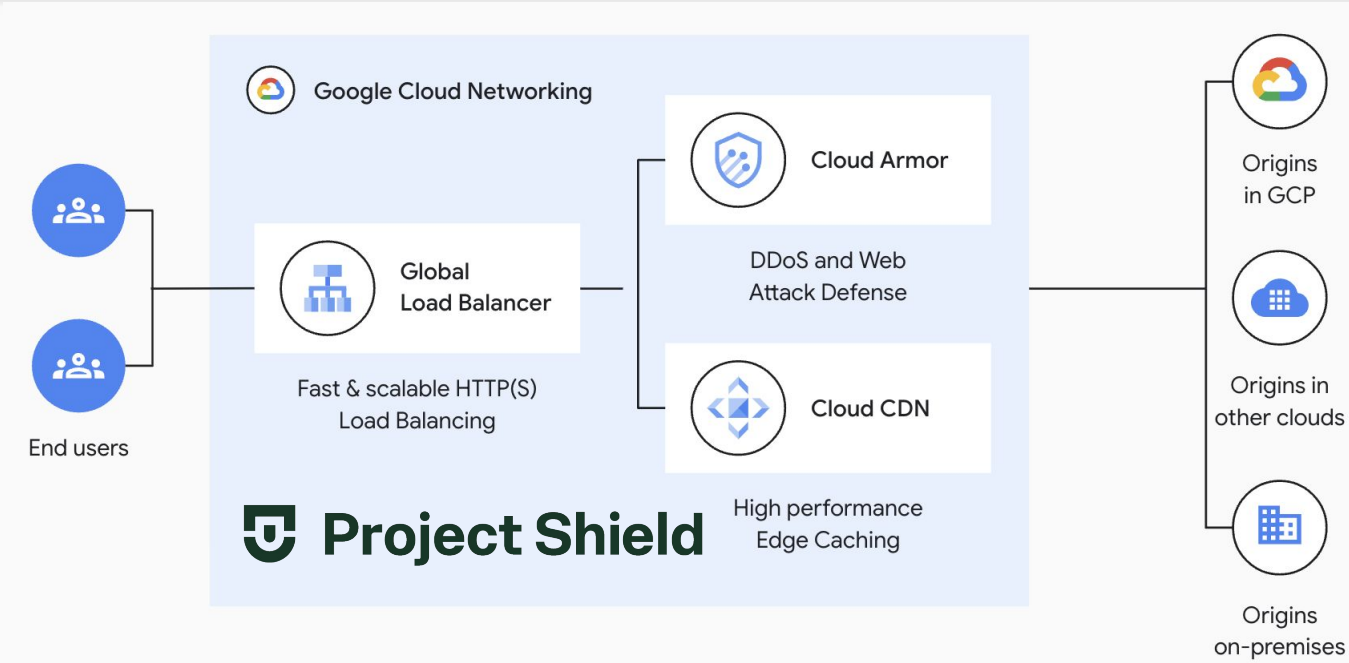


Project Shield

- Support elections
- Protect information
- Free defense



Built on Cloud Networking



Same technologies, infrastructure, and teams that deliver, scale and protect Google apps with billions of users

Built on Cloud Networking

One of the largest networks in the world

40 cloud regions (+10 announced)

121 zones

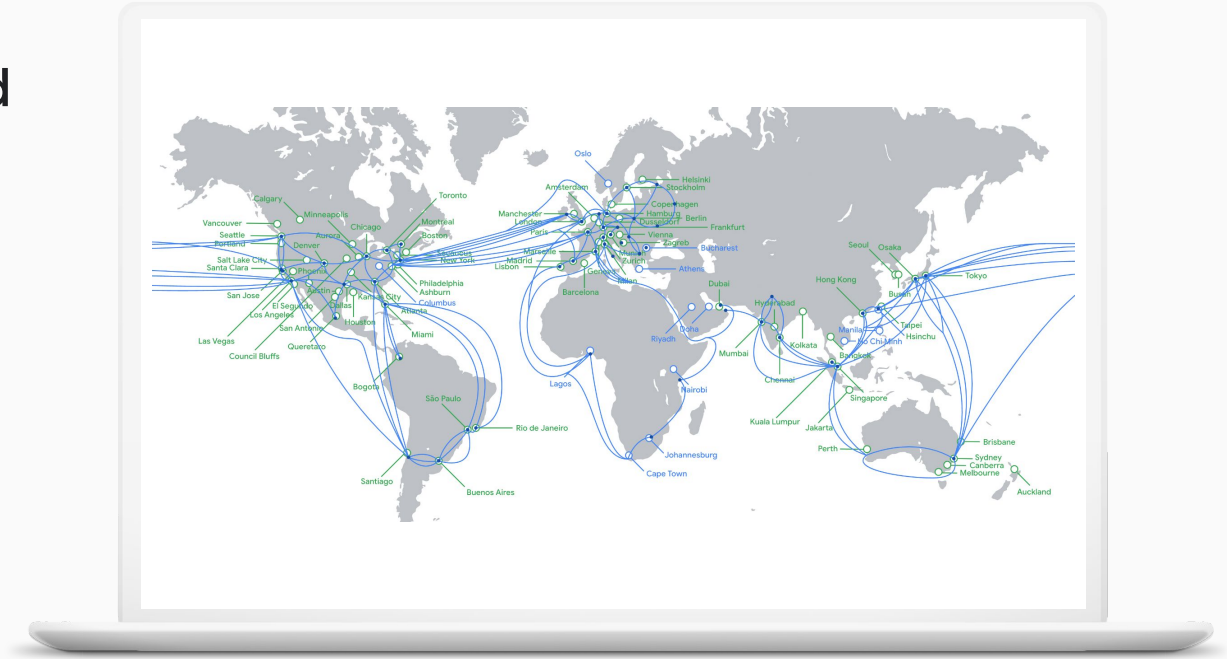
187 network edge locations

29 subsea cables

200+ countries and territories

100+ interconnect locations

100%
Renewable on an annual basis since 2017



https://cloud.google.com/about/locations

Defense Results

- 99.9% DDoS attack traffic volume mitigated
- >99.99% uptime for DDoS Attack victims
- Continuous attack identification and real-time defenses tuning for best results.

Project Shield

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Impact of Shield

WIRED BACKCHANNEL BUSINESS CULTURE GEAR IDEAS MORE SIGN IN SUBSCRIBE

ANDY GREENBERG SECURITY FEB 24, 2016 10:00 AM

Google Wants to Save News Sites From Cyberattacks—For Free

It hopes to extend its so-called Project Shield DDOS attack protection to tens of thousands of websites.

Project Shield

Mykhailo Fedorov presented the first Ukraine Peace Prize to Google

Google has also expanded cybersecurity for Ukrainian accounts. Project Shield has become very important for our state resources and media - Ukraine is grateful for free unlimited protection against DDoS attacks.

GOOGLE NEWS INITIATIVE

Project Shield: Defending Maka Angola

Security & Identity

Google mitigated the largest DDoS attack to date, peaking above 398 million rps

October 10, 2023

KrebsonSecurity

In-depth security news and investigation

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How Google Took on Mirai, KrebsOnSecurity

Security & Identity

How Project Shield helped protect U.S. midterm elections from DDoS attacks

Google CEO Sundar Pichai announces Project Shield in first visit to Europe

In his first public appearance in Europe after becoming Google's CEO, Sundar Pichai made important product announcements aimed at publishers, including the launch of Project Shield

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Data-driven Defense

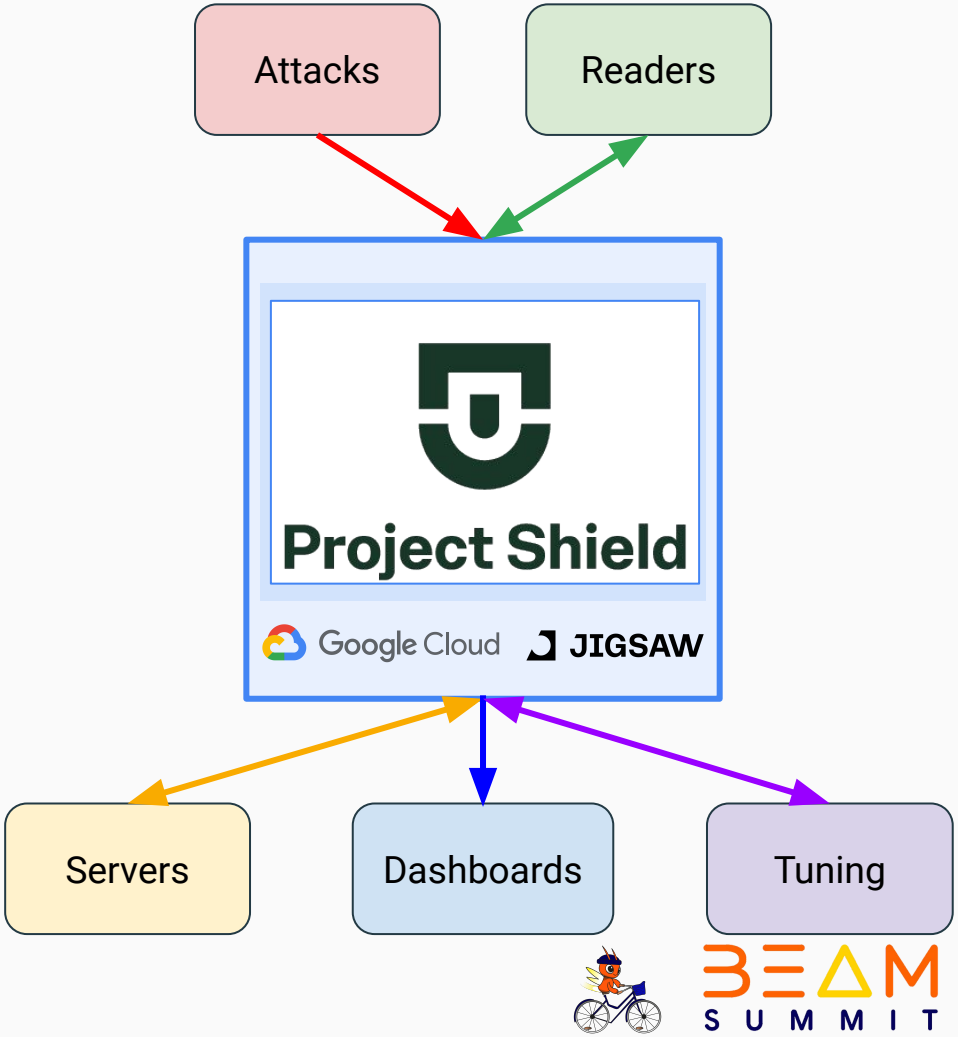
Shield handles many types of data

Traffic is served and analyzed

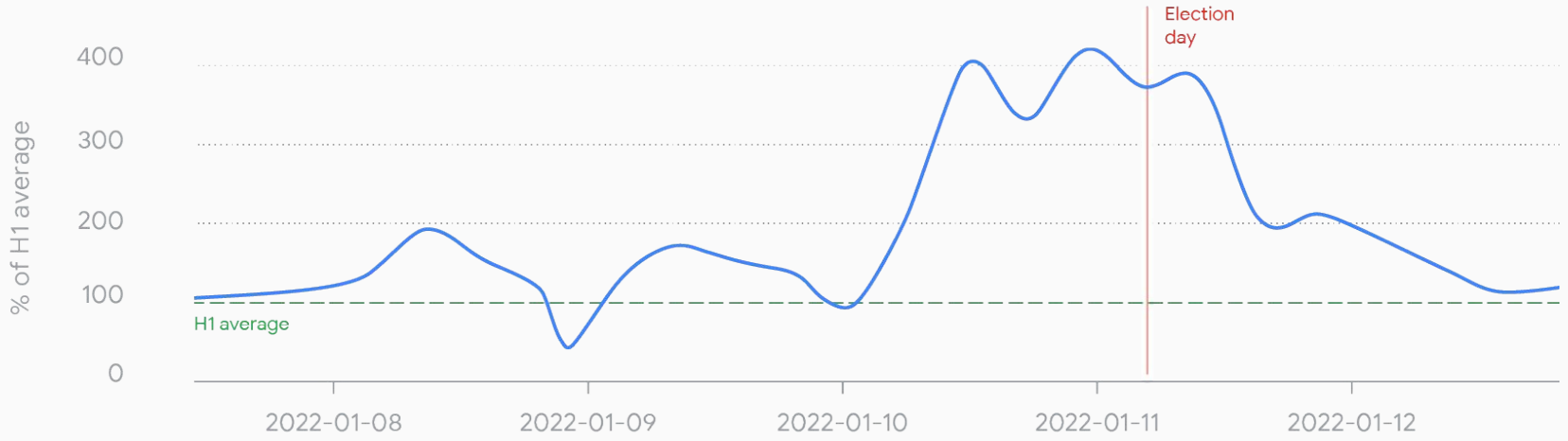
- Served from cache
- Rate limited
- Sent to hosting server

Users are shown metrics

Defenses are improved



Logs at Uneven Scale



Project Shield defended 4x the usual number of attacks during Oct-Nov'22.

The attacks were against political parties and elections-related news.

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Costly Analysis

- Redundant calculation
- Poor serving latency

DDoS Traffic Logs

Many Use Cases

Repeated Lookups

Expensive

Slow

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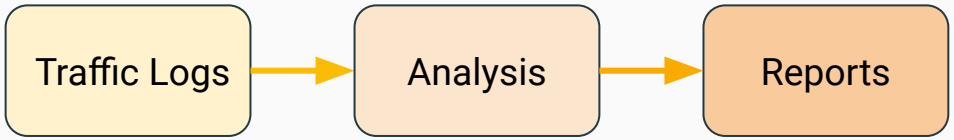
Bespoke Preprocessing



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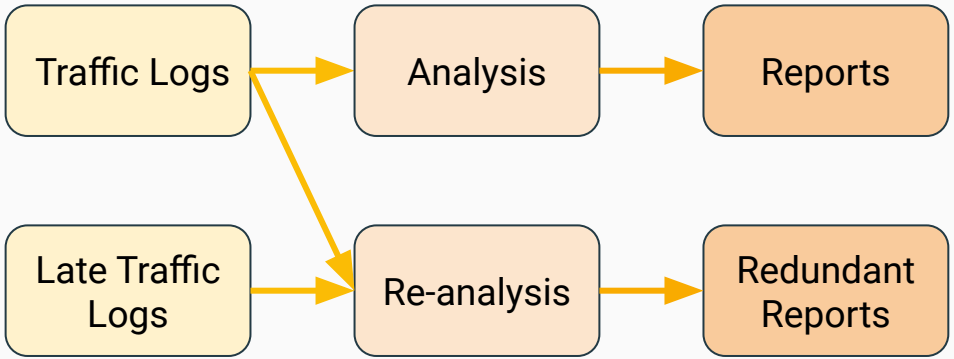
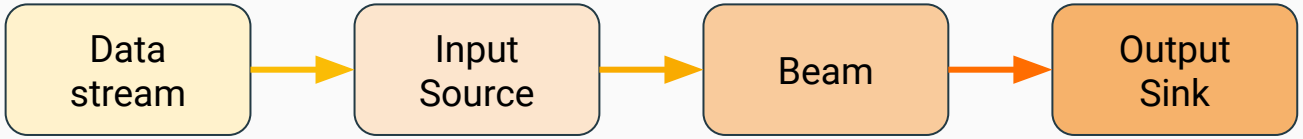
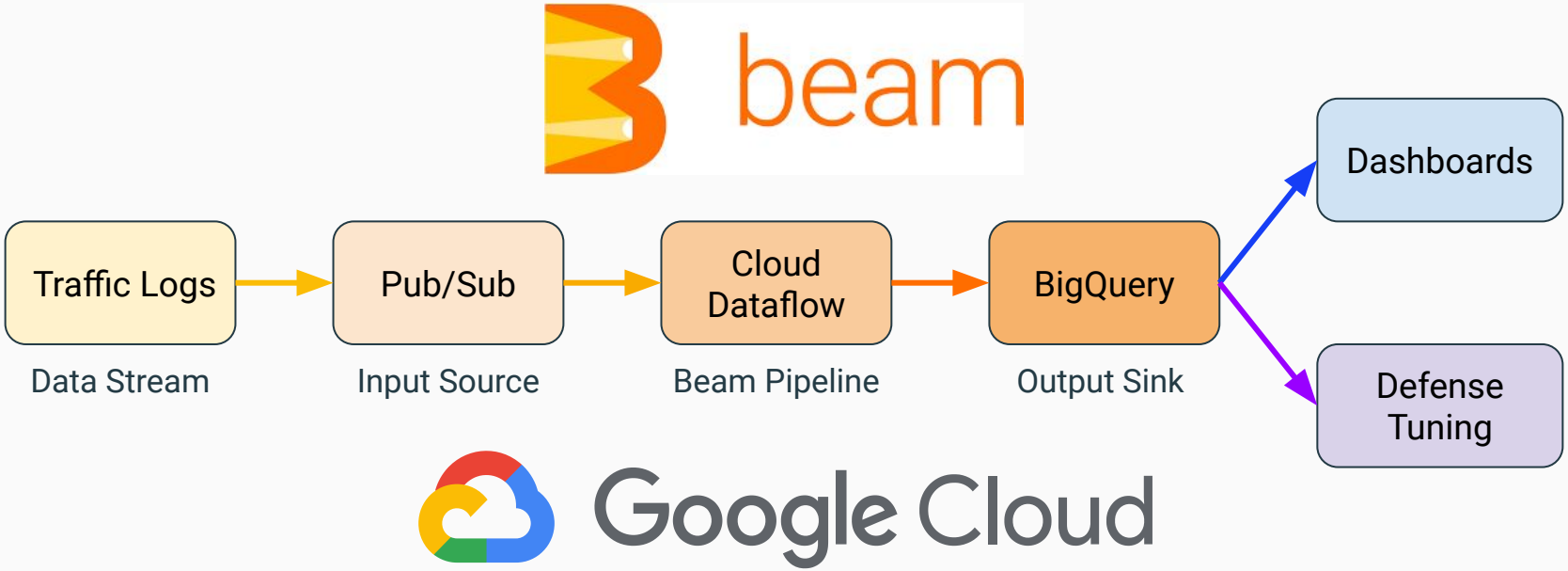
Falling behind



Data Pipelines

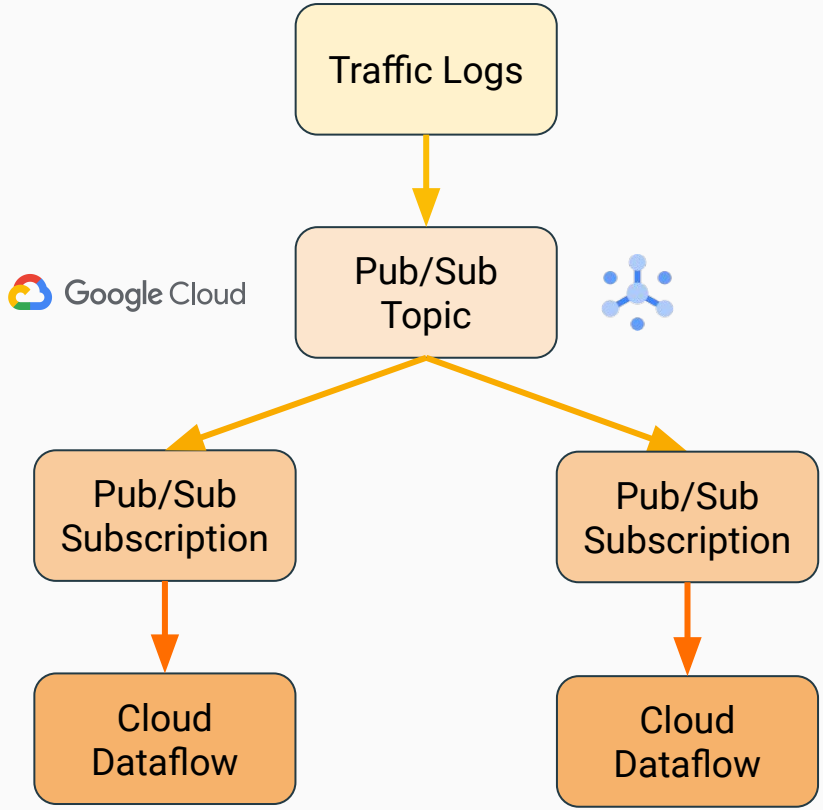


Beam on Google Cloud



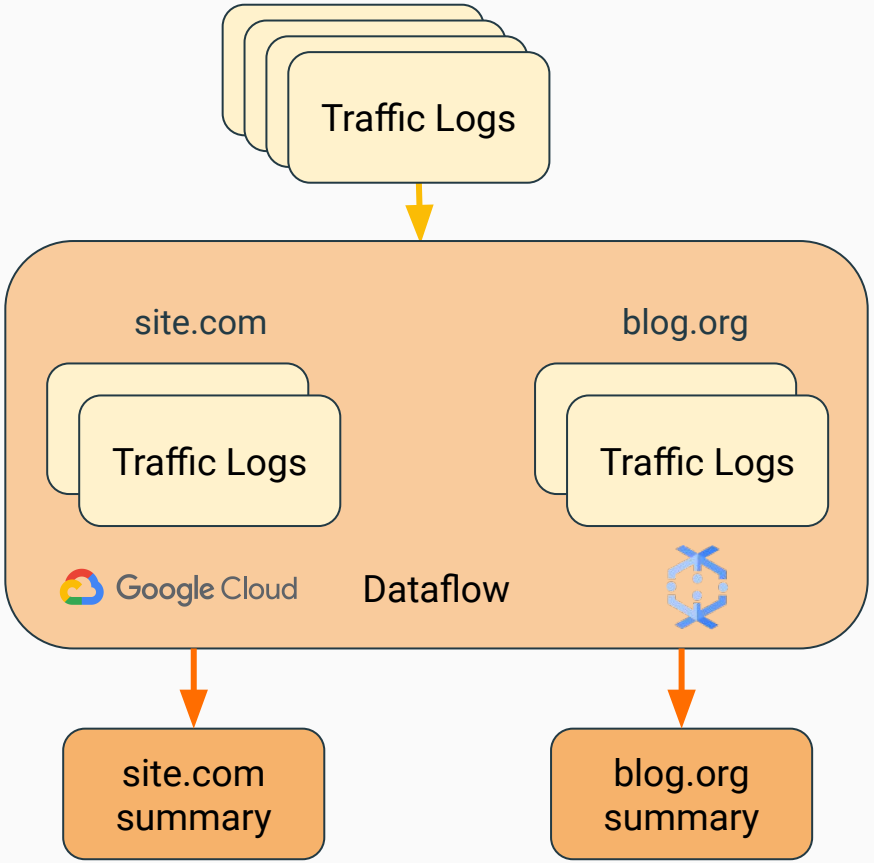
Streaming and Pub/Sub

- Real-time analytics
- Guaranteed delivery
- Throughput metrics
- Multiple pipelines



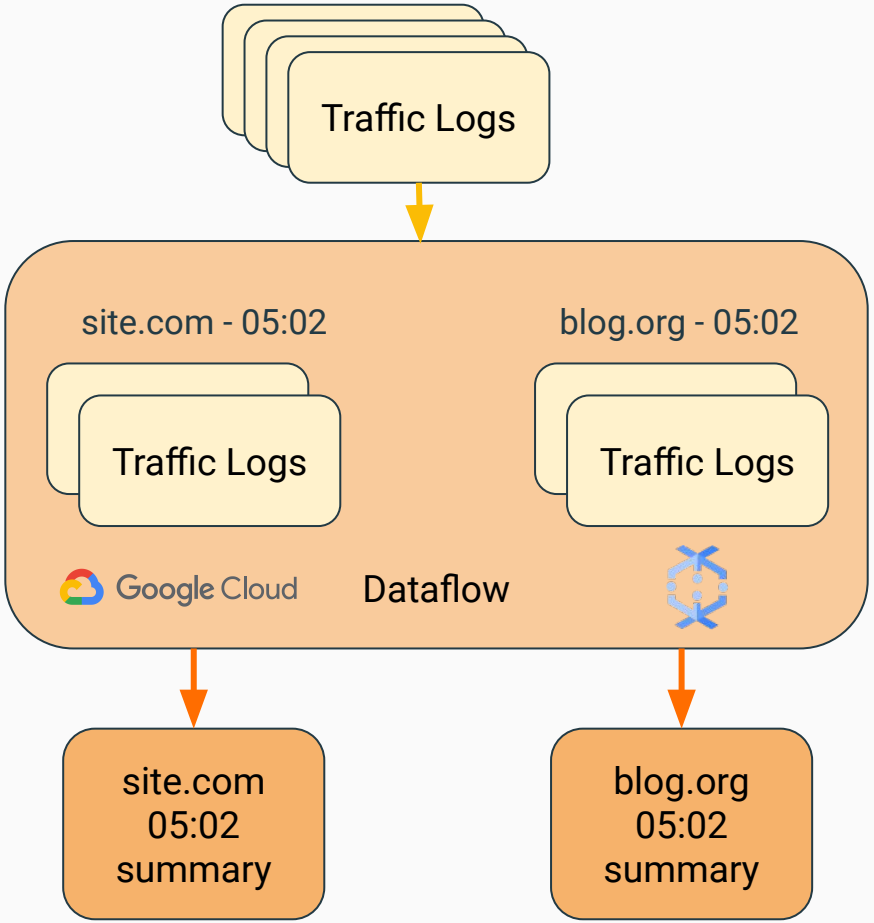
Grouping and Reducing

- Many logs -> some reports
- Reduce to constant size
- Group by important distinguishers
- Add a key
  - beam.Map



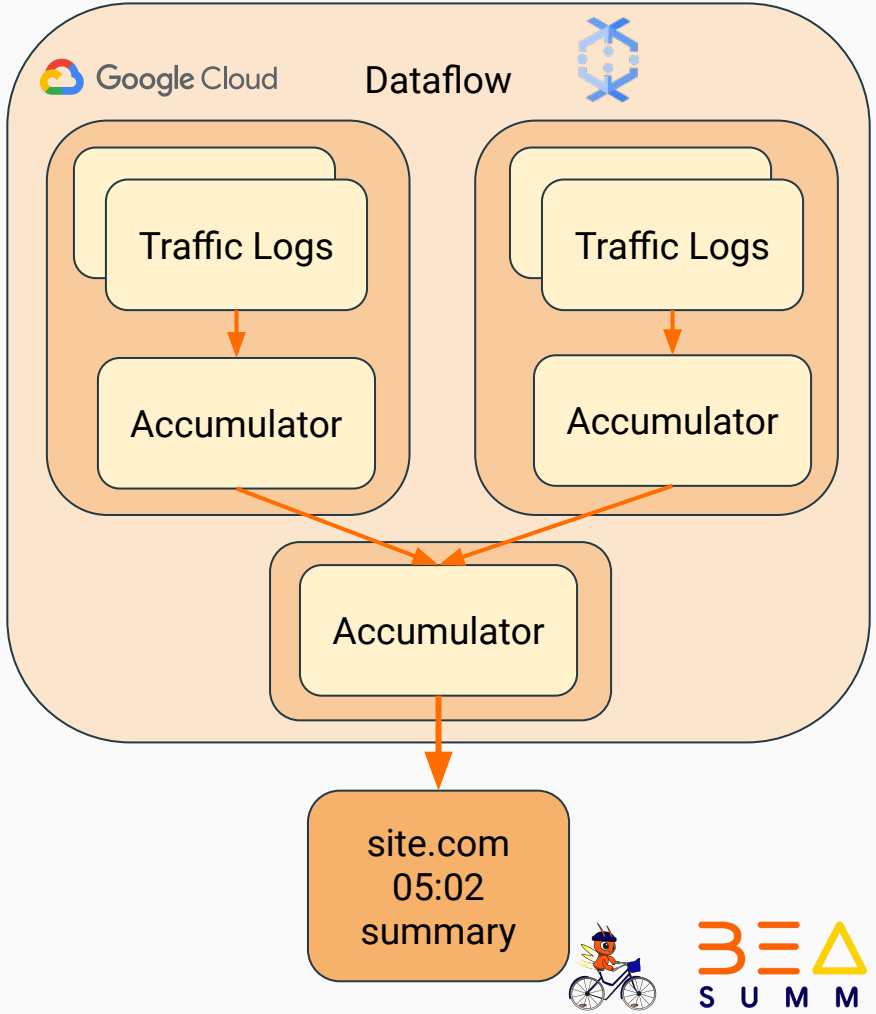
Windowing

- Keep data moving
- Window by time
  - beam.WindowInto



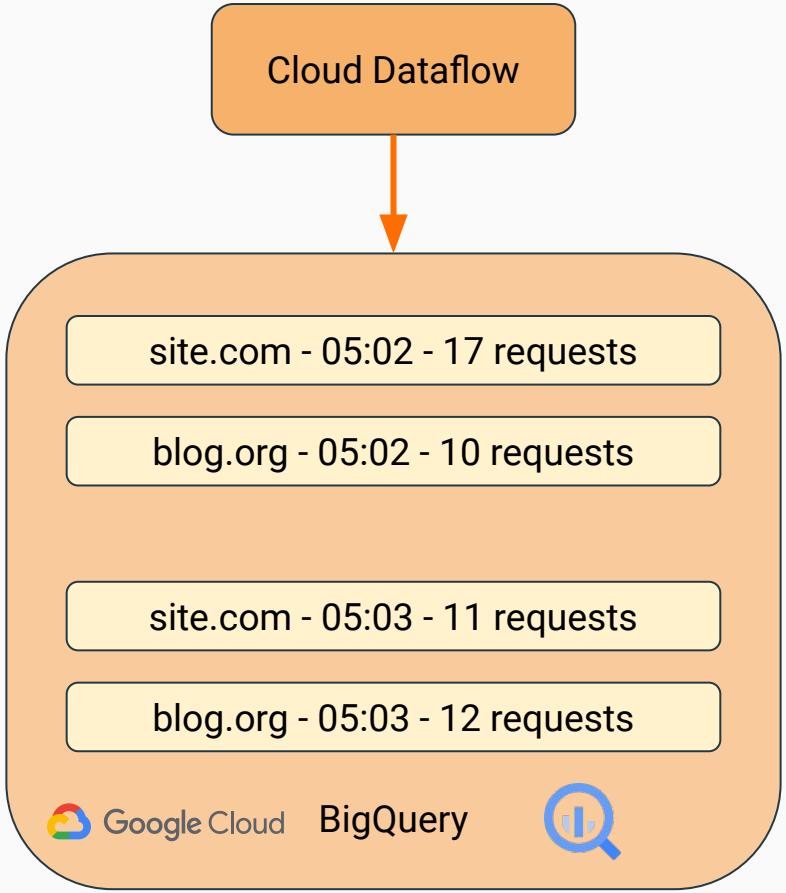
Accumulating Results

- Process groups of data
  - beam.CombinePerKey
- Operate at scale
  - Summarize data
  - Merge summaries
  - Output result



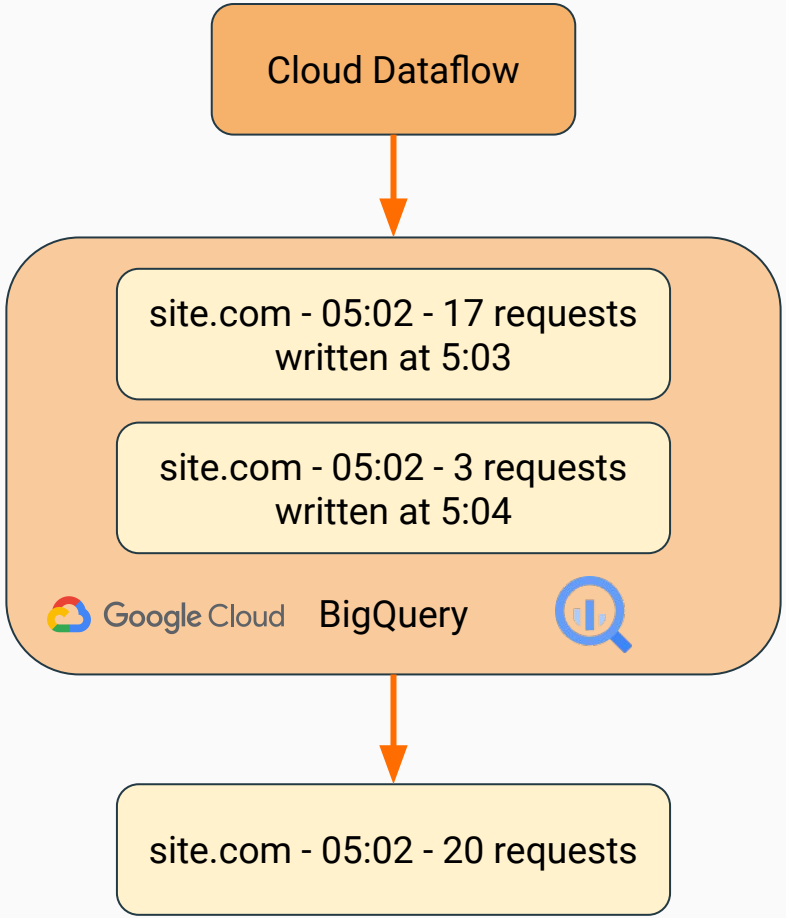
Storing Results

- Put results somewhere
- One result per group, per window
- Many output types
- Fit needs of the service



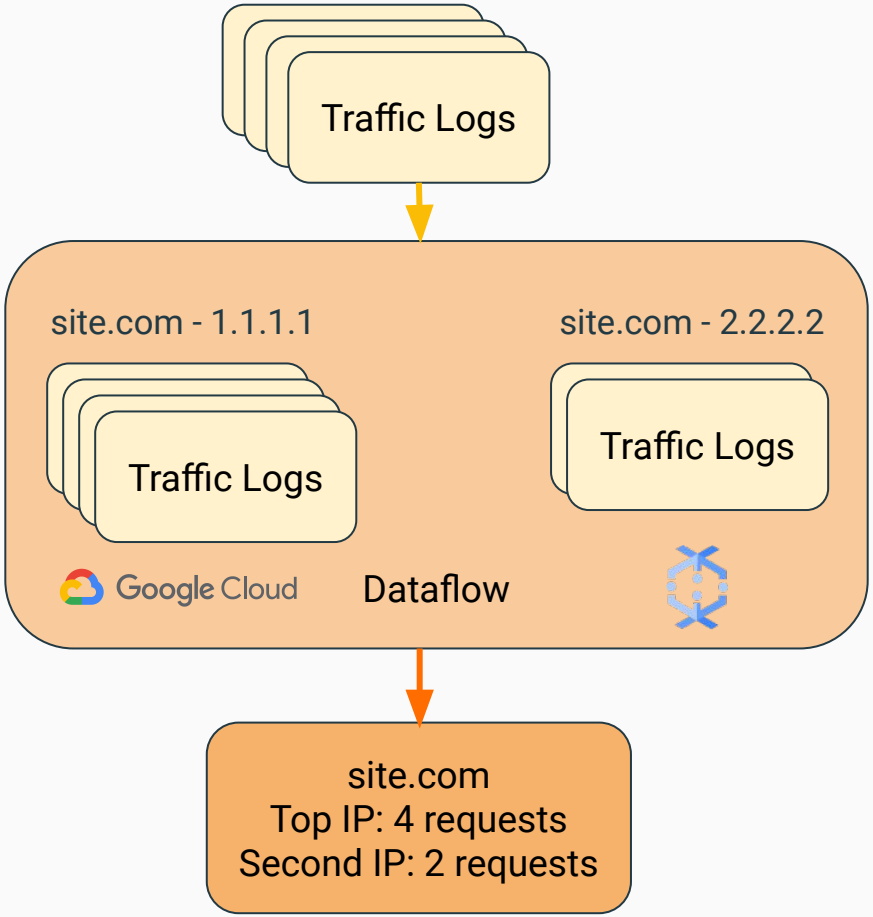
Dealing with Stragglers

- Write their own report (next window) OR
- Wait for input watermark
  - beam.transforms.window
- Decide if data can combine later



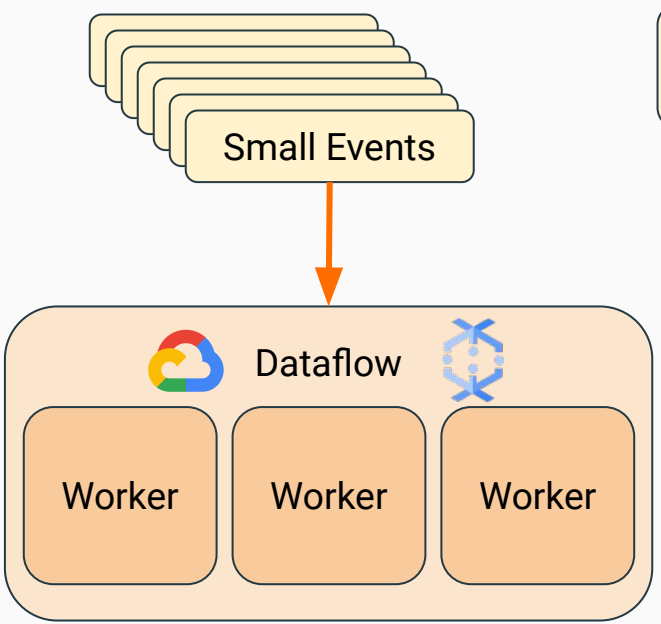
Handling PII

- Aggregate but don't store
- Hash top values
- Wait for watermark

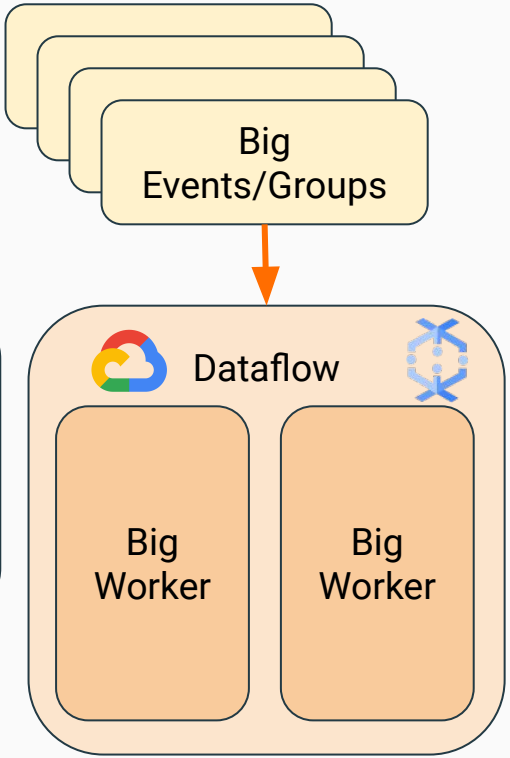


Adapting

- Scaling
  - Worker count
  - CPU / Memory per machine
- Cloud Dataflow
  - Autoscaling



Horizontal Scaling

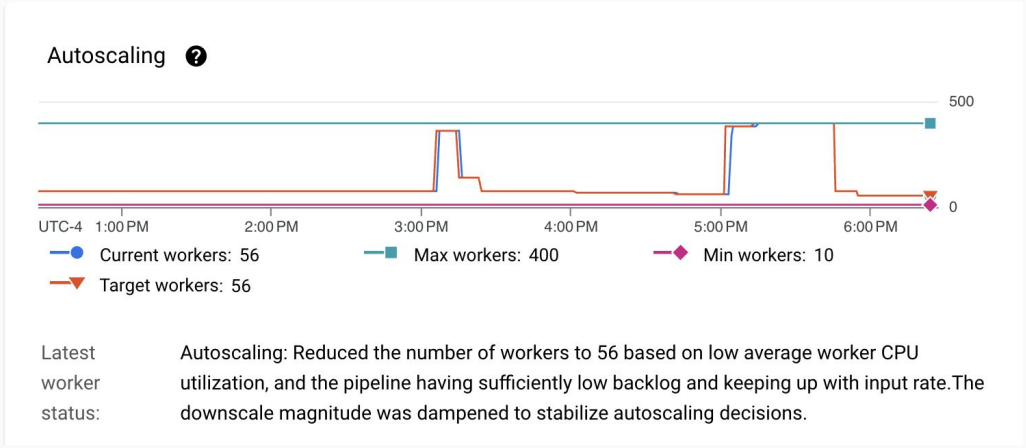


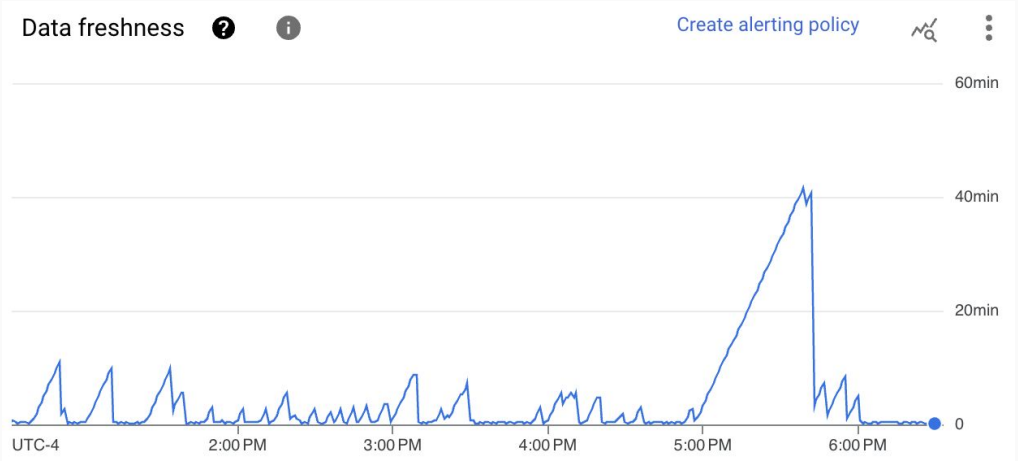
Vertical Scaling

10Krps -> 400Mrps

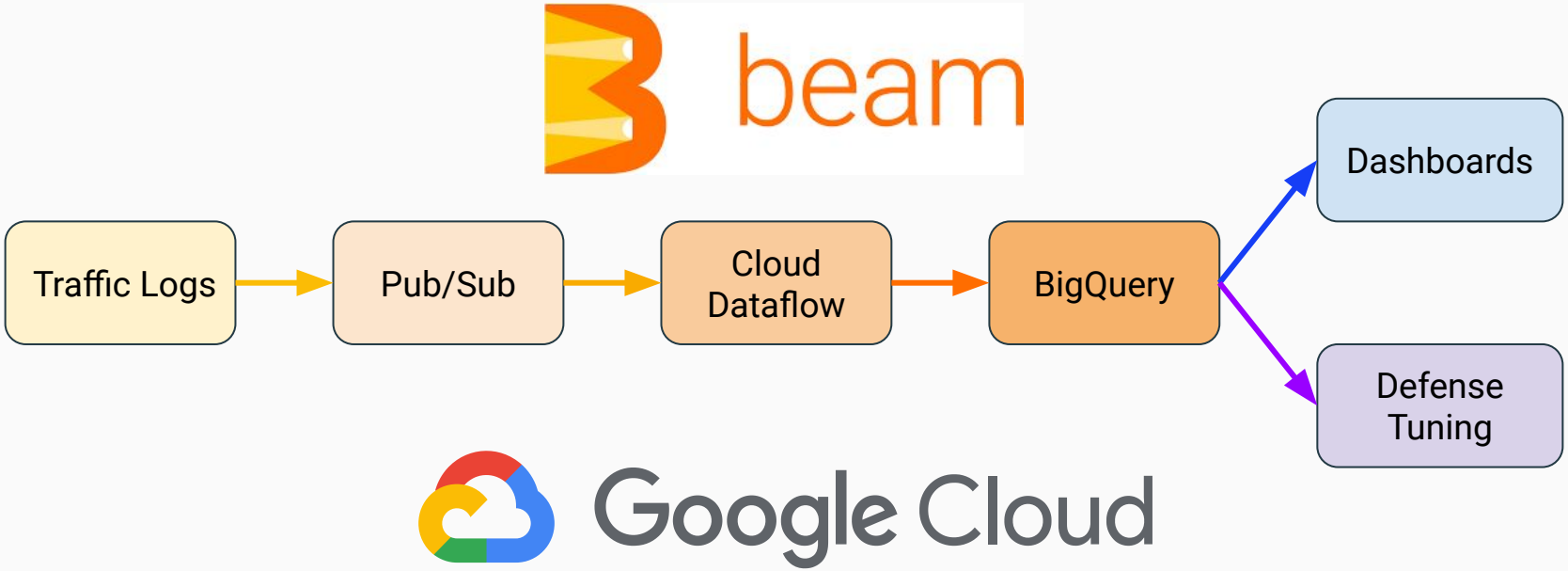
Forcing Smoothness

- Baseline provisioning
- Immediate capacity
- Balance with cost

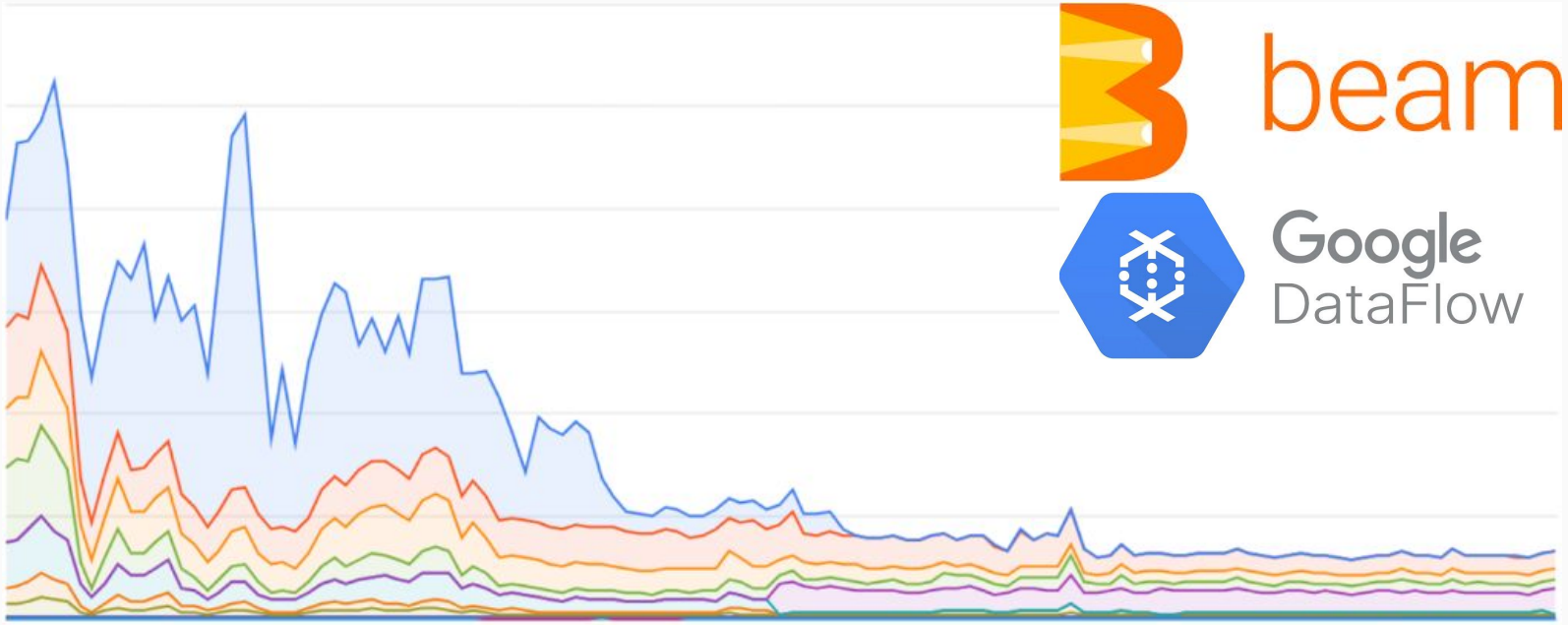




End Result


beam
Traffic Logs
Pub/Sub
Cloud Dataflow
BigQuery
Dashboards
Defense Tuning
Google Cloud

Reducing Costs



>90% savings over bespoke pre-processing!

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Keeping Content Online

- Support elections
- Protect news
- Empower human rights

Project Shield

Google Cloud

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Thank you!

Questions?

Marc Howard

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