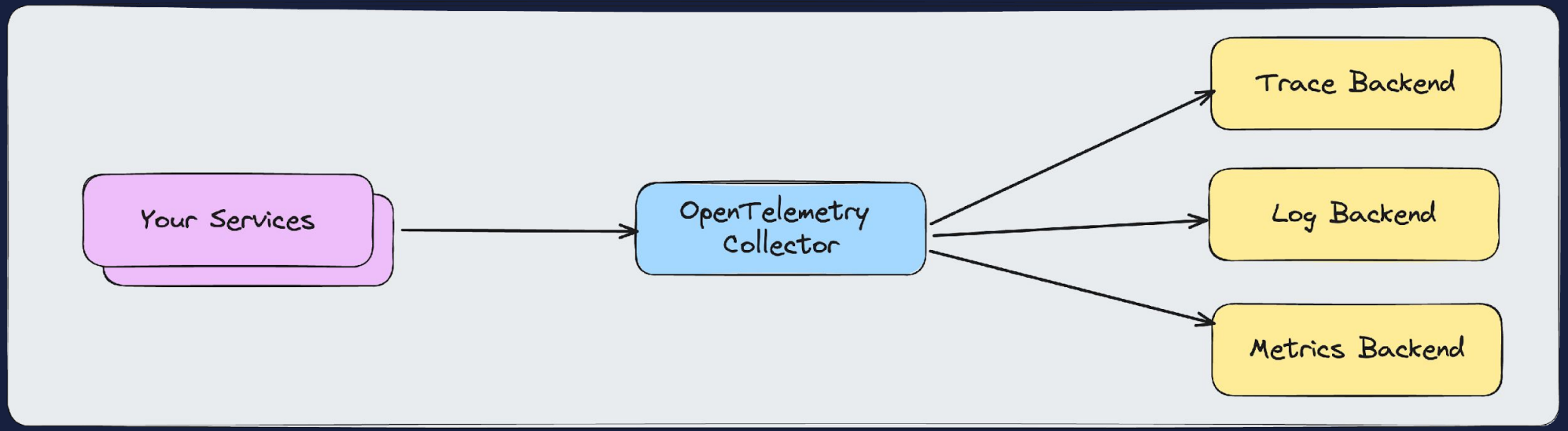
O11y in One:

ClickHouse® as a Unified Telemetry Database

How I usually start...



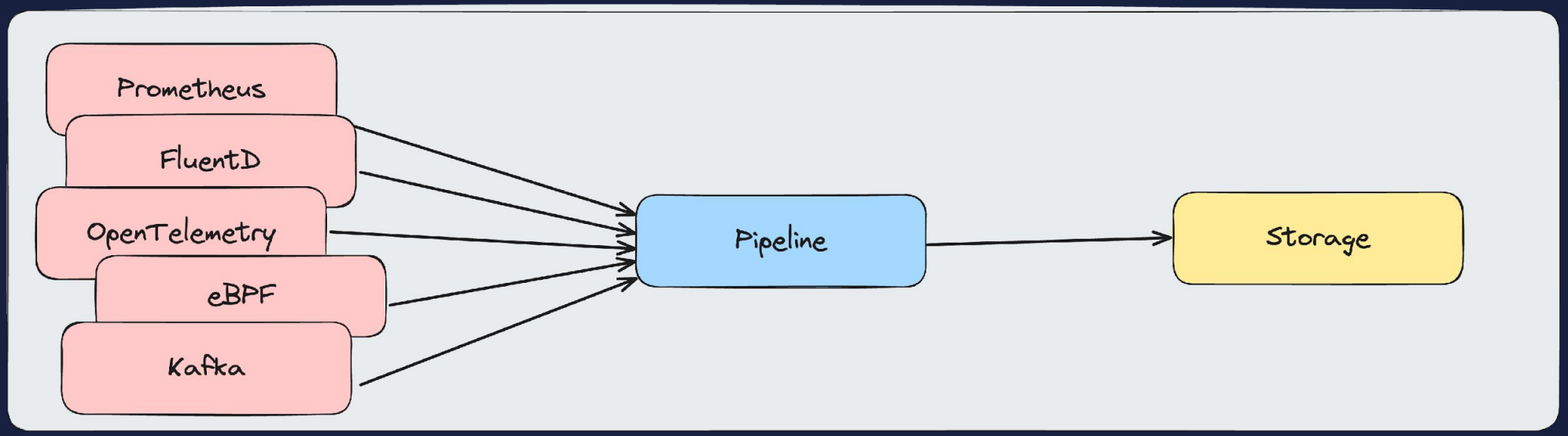
"The OpenTelemetry project does not include any kind of database or backend UI."

6

Minimum no. of o11y tools deployed by a typical organization

— Grafana State of Observability Report, 2023

What we really need...



Josh Lee

Open Source Advocate

Altinity

We are but humble open source contributors

Agenda

01 — What's the problem with disparate systems?

02 — ClickHouse for Observability

03 — Full-stack Solutions

Challenges with Disparate Telemetry Systems

Josh Lee • Altinity • SREDay London Q3 2025

What are we storing?

Metrics, traces, logs, profiles, events

Resource metadata

Graphs & topologies

Snapshots & deltas

Configuration

Is There a Silver Bullet?

Real-time analytics

Efficient compression

Full-text search

Relational

Petabyte-scale

No. Obviously.

... but ClickHouse comes pretty close.

Introducing ClickHouse

- SQL-compatible
- Massively scaleable
- Really, really fast

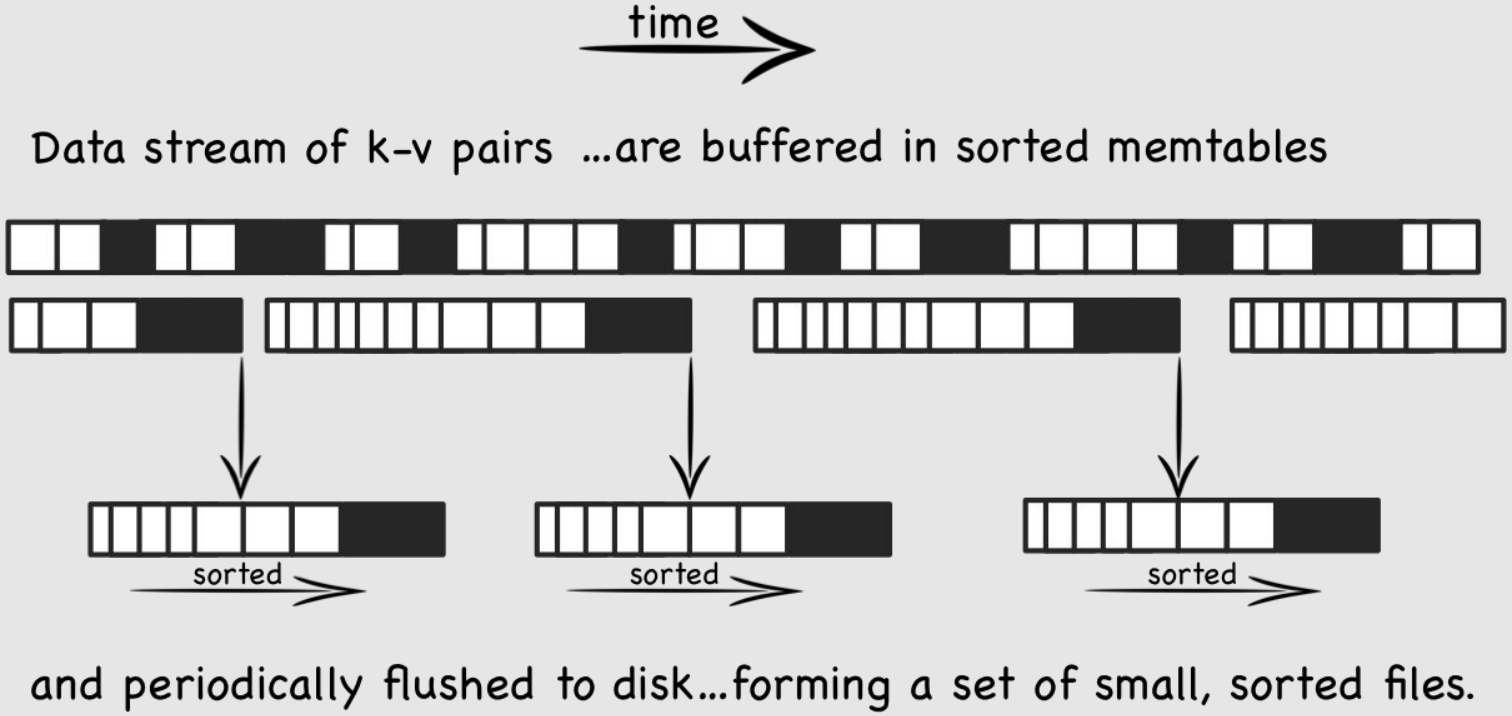
ClickHouse for Observability

Telemetry is WORM

Write-Once, Read-Many

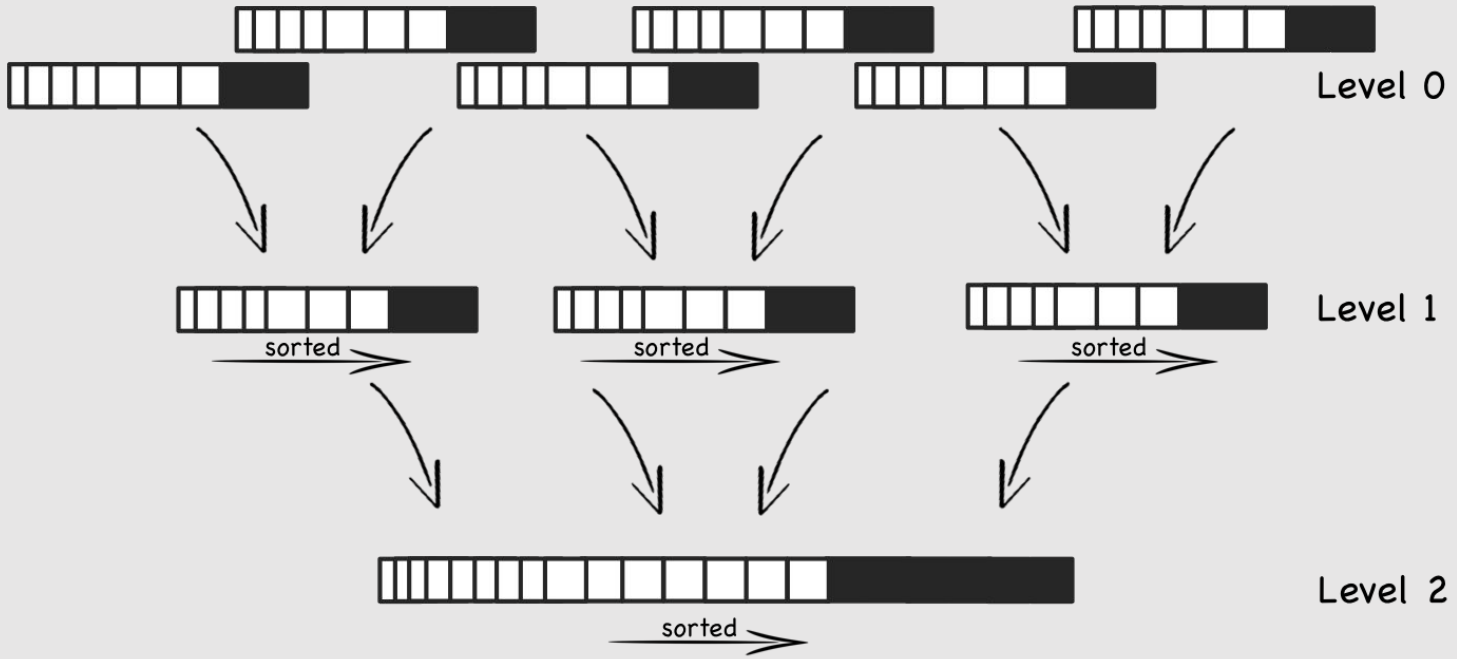
B-Trees: Optimized for Reads

Log-Structured Merge Trees: Optimized for ingestion



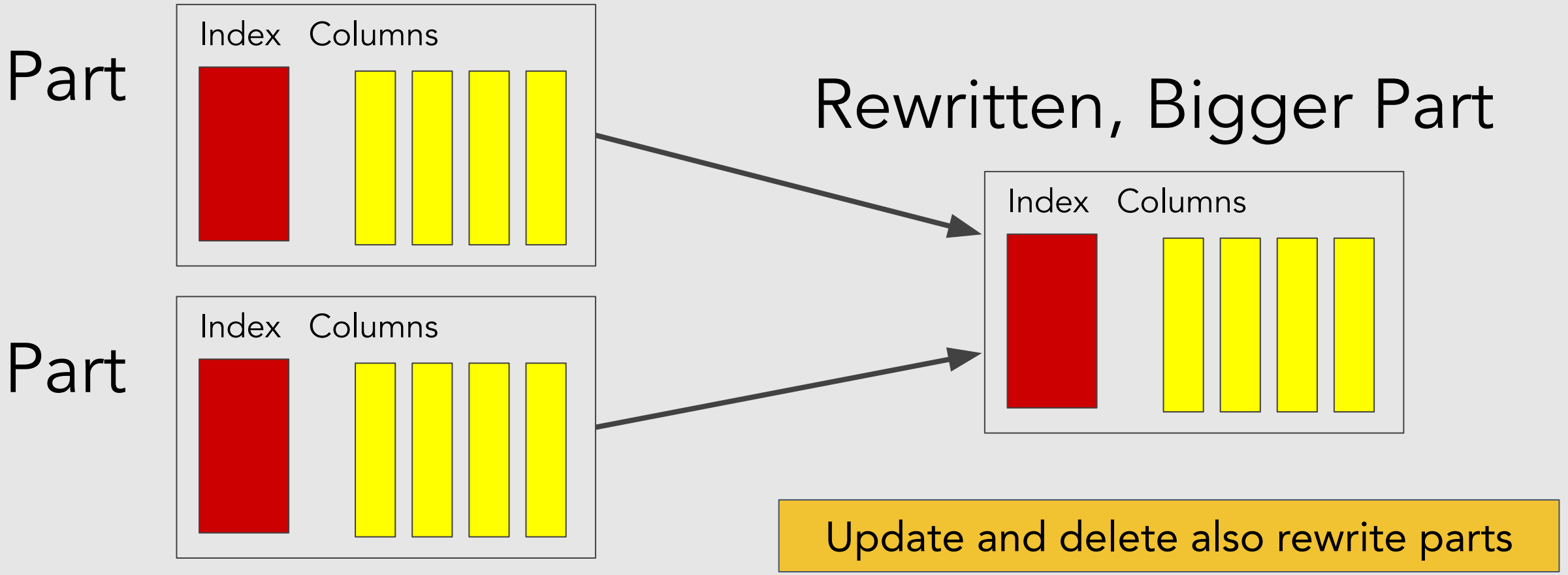
http://www.benstopford.com/2015/02/14/log-structured-merge-trees/

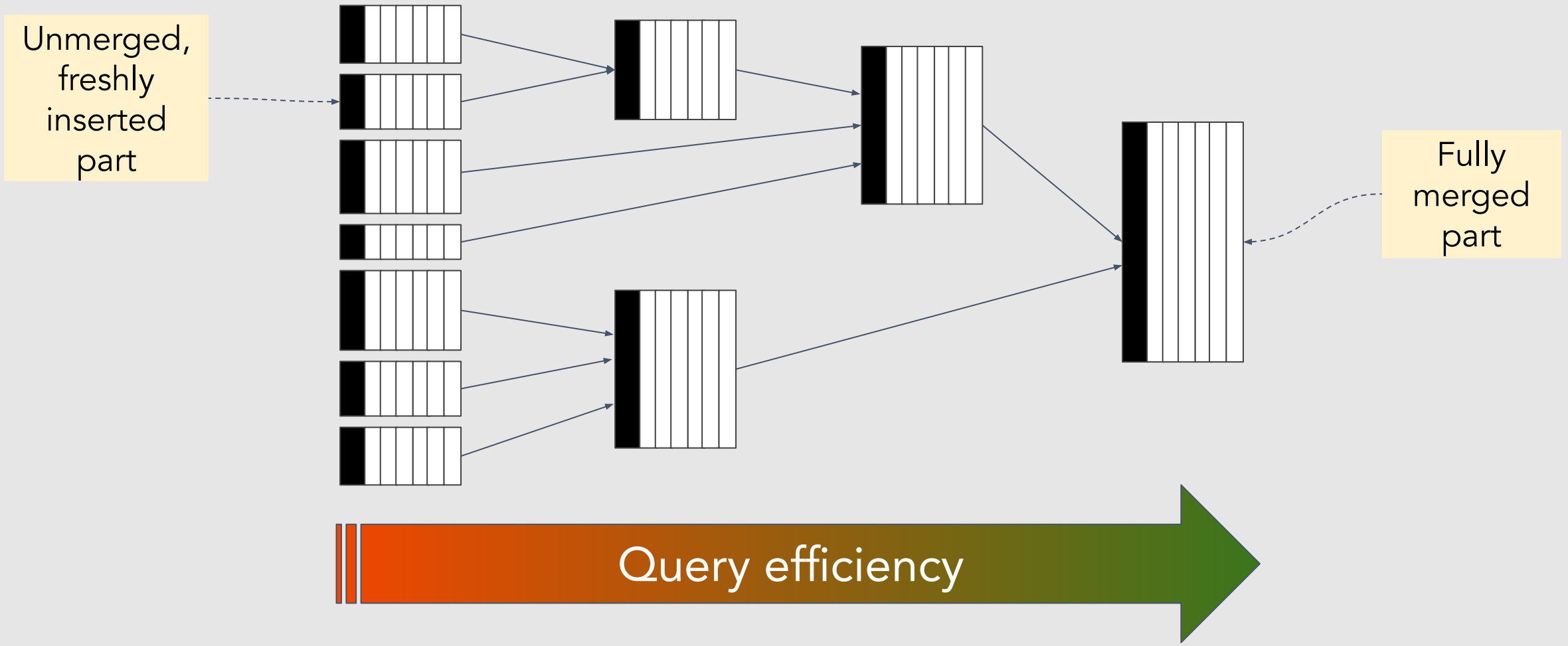
Log-Structured Merge Trees: Background compaction



Compaction continues creating fewer, larger and larger files

http://www.benstopford.com/2015/02/14/log-structured-merge-trees/


Part
Index
Columns
Part
Index
Columns
Rewritten, Bigger Part
Index
Columns
Update and delete also rewrite parts


Unmerged, freshly inserted part
Fully merged part
Query efficiency

How does this help?

- Fast writes
- Time-friendly
- Easy cleanup
- Cost-effective

Data Transformation & Management

- Materialized Views
- TTL
- Tiered storage

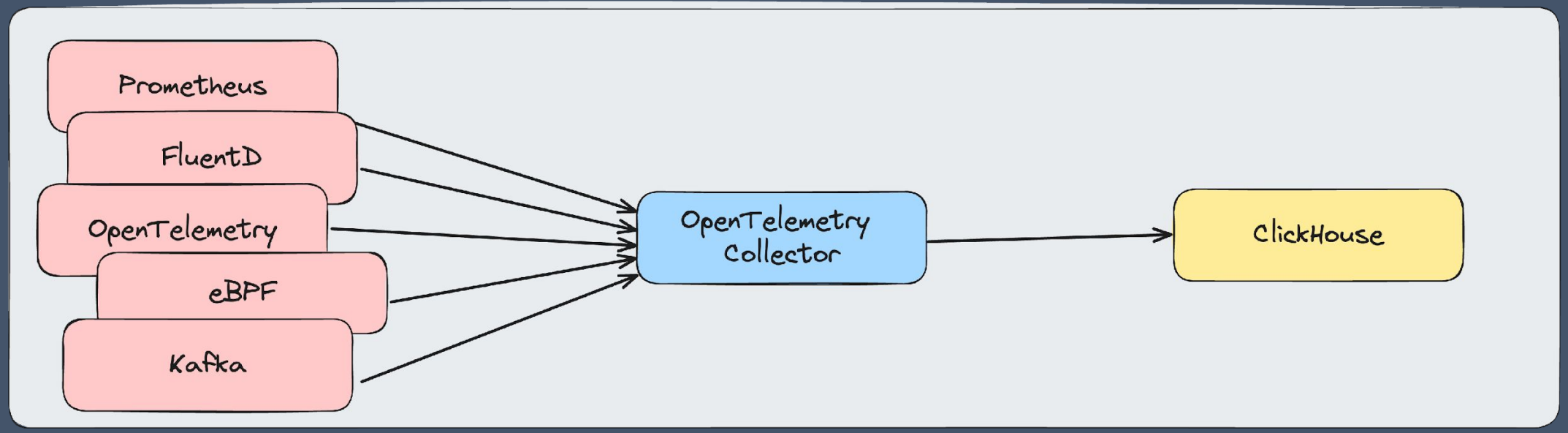
Integrations

- Grafana Datasource Plugin
- Jaeger w/ ClickHouse backend
- cLoki
- Kafka table engine

New & Upcoming

- Time Series Table Engine
- PromQL Support
- Awesome compression for JSON columns / arbitrary schema

Integrations via OpenTelemetry



More Benefits

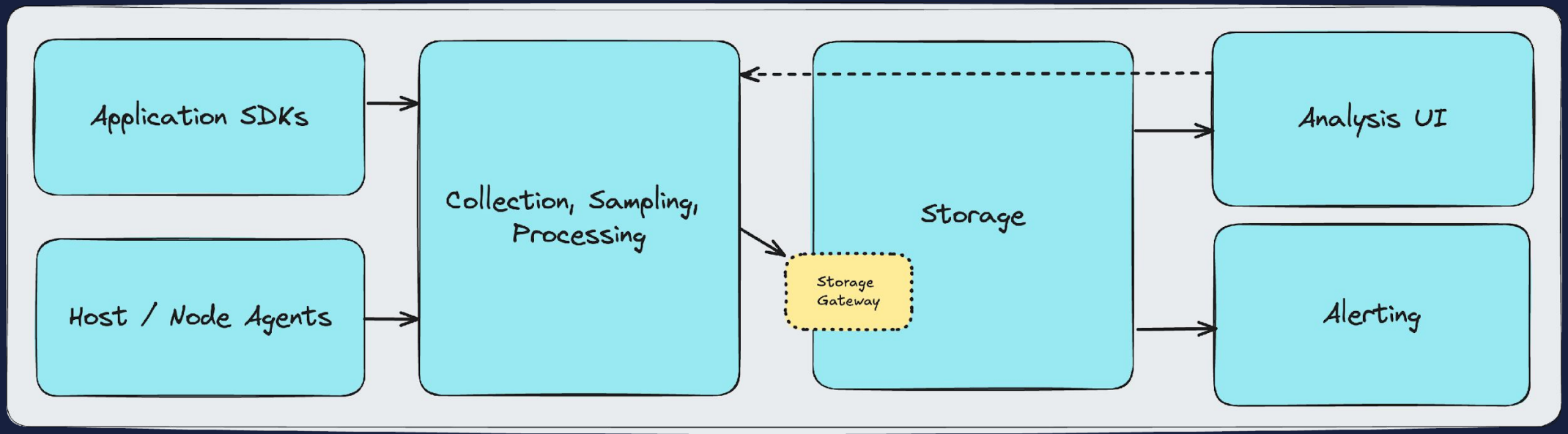
- Excellent compression, even with variable schemas
- Practically unlimited cardinality
- Horizontally scalable ingestion & querying

Challenges

- SQL is not PromQL*
- Overly complex for small data volumes*
- Not a turn-key solution

"The OpenTelemetry project does not include any kind of database or *backend UI*."

We need a complete observability solution



SigNoz
Coroot
qryn
HyperDX / ClickStack
DIY

Coroot

Batteries-included, no-code observability

coroot :~# | default | search for apps and nodes | last hour

Overview

HEALTH | SERVICE MAP | TRACES | NODES | DEPLOYMENTS | COSTS

search | namespaces: monitoring | application | control-plane | monitoring | +

2 SLO violation | 2 Warning | 3 Errors in logs | 0 Integration required | 19 OK

Application	Type	Errors	Latency	Upstreams	Instances	Restarts	CPU	Mem	I/O load	Disk	Net	DNS	Logs
monitoring-checkoutservice	golang	–	10s	8/9	1/1	–	shortage	–	–	–	0.8ms	–	–
monitoring-emailservice		–	10s	1/1	1/1	–	shortage	–	–	–	<0.1ms	–	–
chi-monitoringdb-monitoring-0-0	clickhouse	–	2s	–	1/1	–	–	–	0.004	100%	–	–	14 unique errors
monitoring-prometheus-server	prometheus	–	633ms	1/1	1/1	–	–	–	–	–	failed conns	–	–
monitoring-frontend		<1%	10s	6/7	1/1	–	–	–	–	–	2ms	–	2 unique errors
monitoring-opentelemetry-collector-...	golang	–	4s	1/1	2/2	–	–	–	–	–	0.8ms	–	4 unique errors
monitoring-otelcol	golang	–	602ms	4/4	1/1	–	–	–	–	–	<0.1ms	–	1 unique error
monitoring-accountingservice		–	–	2/2	1/1	–	–	–	–	–	0.9ms	–	–
monitoring-adservice	java	–	27ms	2/2	1/1	–	–	–	–	–	<0.1ms	–	–
monitoring-cartservice	dotnet	–	249ms	3/3	1/1	–	–	–	–	–	0.8ms	–	–
monitoring-currencyservice		–	3s	1/1	1/1	–	–	–	–	–	0.7ms	–	–
monitoring-flagd	golang	–	10s	1/1	1/1	–	–	–	–	–	<0.1ms	–	–
monitoring-frauddetectionservice	java	–	–	3/3	1/1	–	–	–	–	–	0.1ms	–	–

Coroot 1.5.0 is available 🎉 Changelog (how to upgrade)

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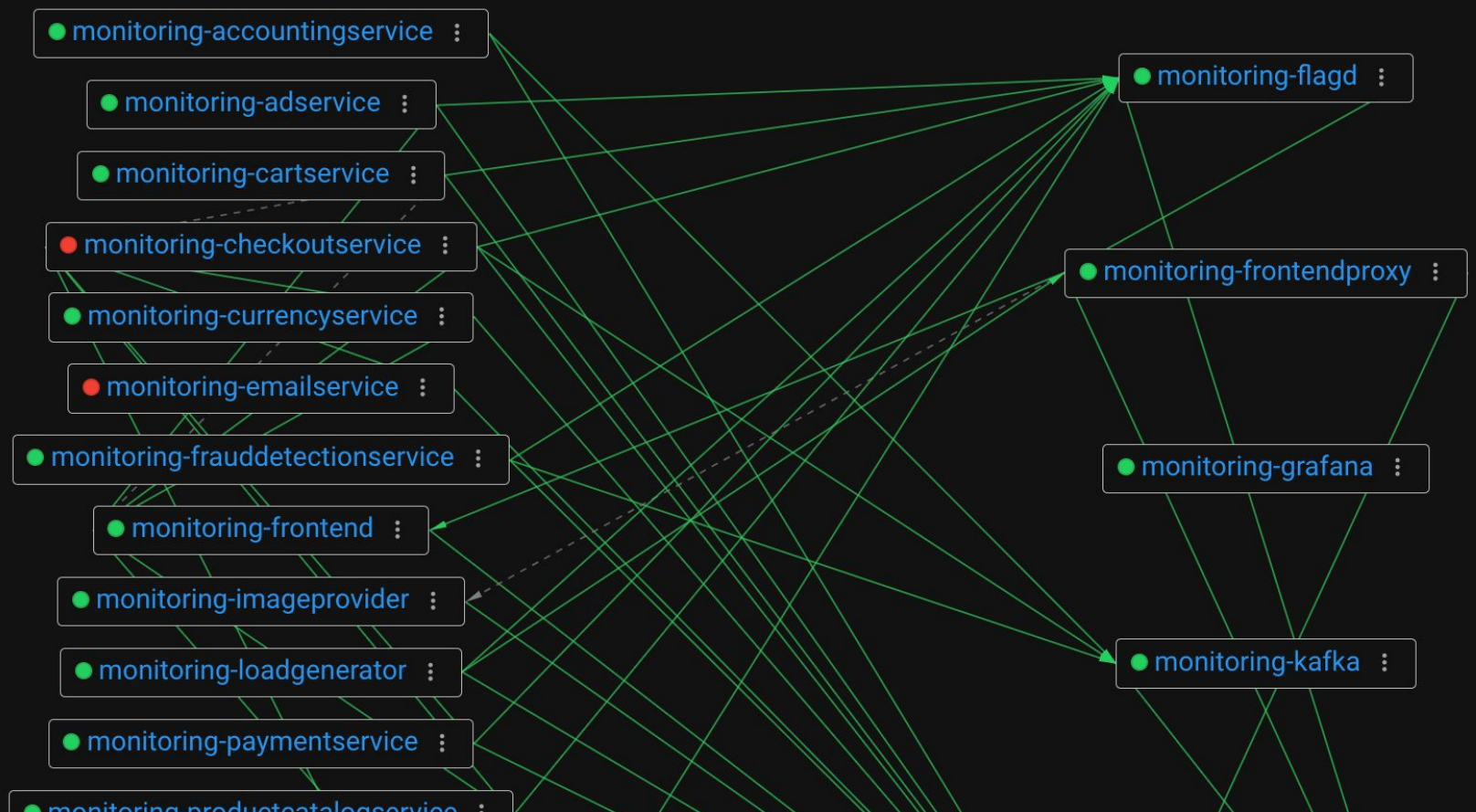
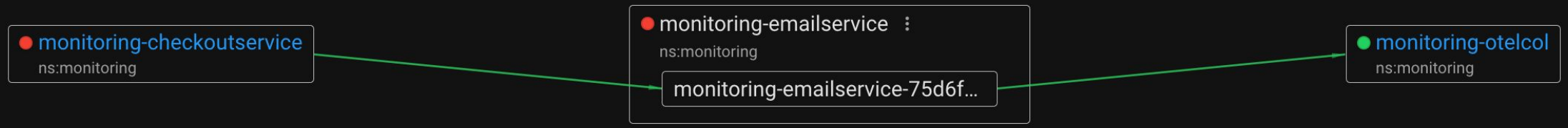


Coroot 1.5.0 is available 🎉 Changelog (how to upgrade)

coroot :~# | default | search for apps and nodes | last hour

Applications / monitoring-emailservice



SLO | INSTANCES | CPU | MEMORY | NET | LOGS | PROFILING | TRACING

Errors: 1 error occurred

Condition: the number of messages with the ERROR and CRITICAL severity levels > 0

Using container logs (configure)

Filter:

Filter messages | Query

View:

Messages | Patterns | Newest first | Oldest first | Limit: 100

ClickStack

Bundled OTel + ClickHouse + HyperDX (visualization and query UI)

HyperDX

Search

Saved Searches ⌘K

No saved searches

Chart Explorer

Alerts

Client Sessions

Dashboards

+ Create Dashboard

Saved Dashboards ⌘K

No saved dashboards

PRESETS

ClickHouse

Services

Kubernetes

Team Settings

Get Started 2/3

~~Connect to ClickHouse~~

Set up your database connection

jlee@altinity.com

Clickhouse Dashboard

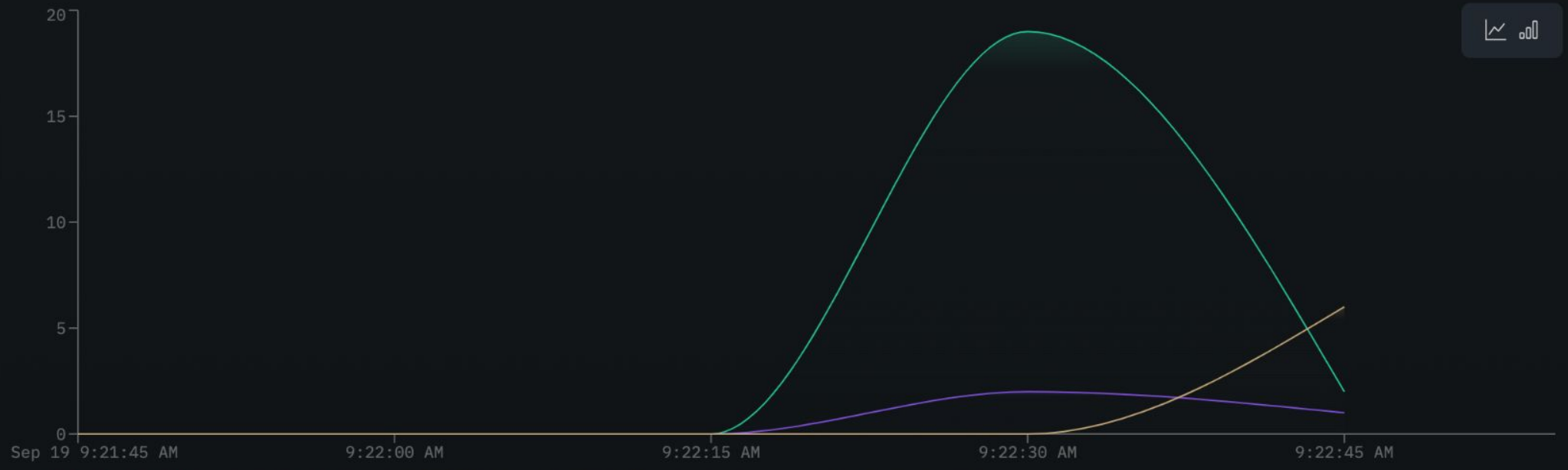
Local ClickHouse

Sep 19 09:21:55 - Sep 19 09:22:55

Select | Inserts | Infrastructure

Query Latency

Query Count by Table



coroot

- eBPF-based Node-Agent
- OTLP ingestion via Collector Gateway
- Uses (mostly) standard OpenTelemetry Exporter schema + new schema for profiles

clickstack

- OTel-collector based agent
- Uses standard OTel-exporter schema
- Schema-Agnostic Visualization UI
- More info @ 3PM

qryn

- Uses on its own collector exporter / collector distribution
- Exposes Tempo, Loki, OTLP, and Prometheus APIs
- Projects into compatible formats using Materialized Views

Schema Considerations

Schema Considerations

- ZSTD Compression
- Delta encoding
- Bloom filter indexes for maps (resources) and logs
- MergeTree, partitioned on time
- 7-day TTL

OpenTelemetry Collector Exporter for ClickHouse

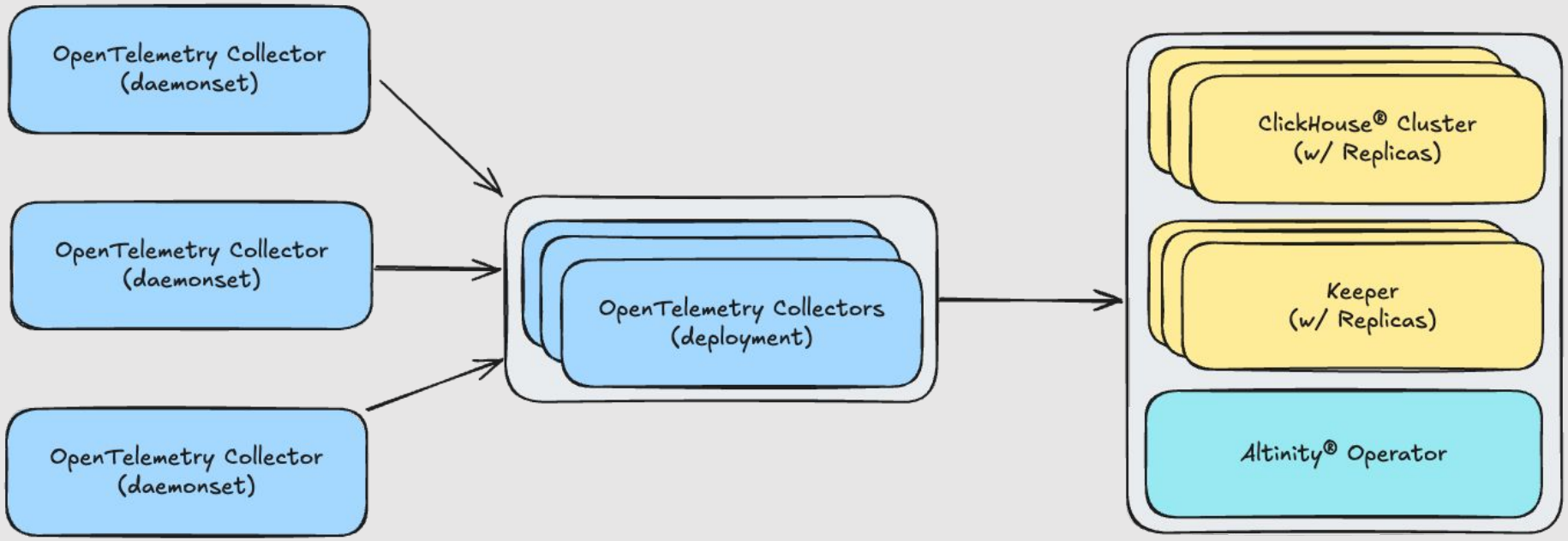
- Maps for metadata
- Efficient full-body text-search
- Materialized View for span durations

qryn

- Fingerprints for unique time series
- Indexed labels (via Materialized Views)
- Allows for efficient updates (ReplacingMergeTree)
- Null Engine for raw ingest

Scaling for Production

Managing Multiple Collectors



The Altinity Operator

- PVC management
- Rolling upgrades
- Built-in monitoring

Alerting & Other Considerations

Conclusion

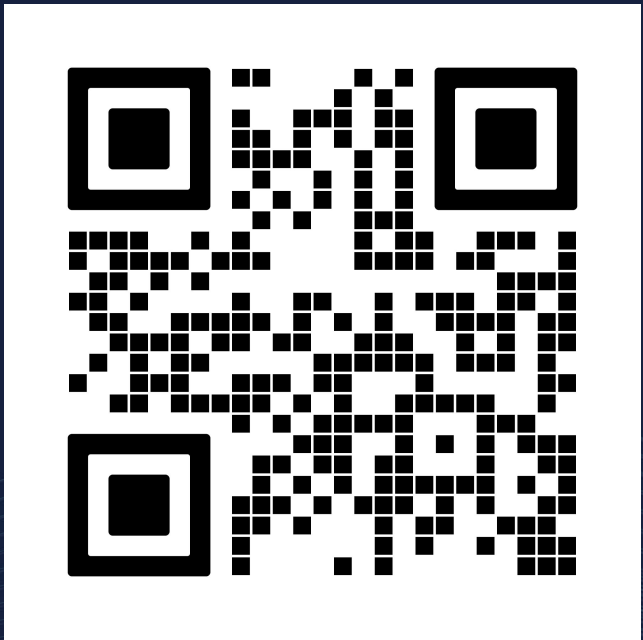
Why Unified Observability Storage?

Easier onboarding
Simplified management

Simplified scaling
Cost management

Cross-signal correlation with shared metadata

Thank You



London Meetup Oct 23rd - Open Lakehouses

My LinkedIn (will post slides)