MONITORING WITH LANDSCAPE

HEPCloud Developers Workshop

2021-03-10

LANDSCAPE GUIDE

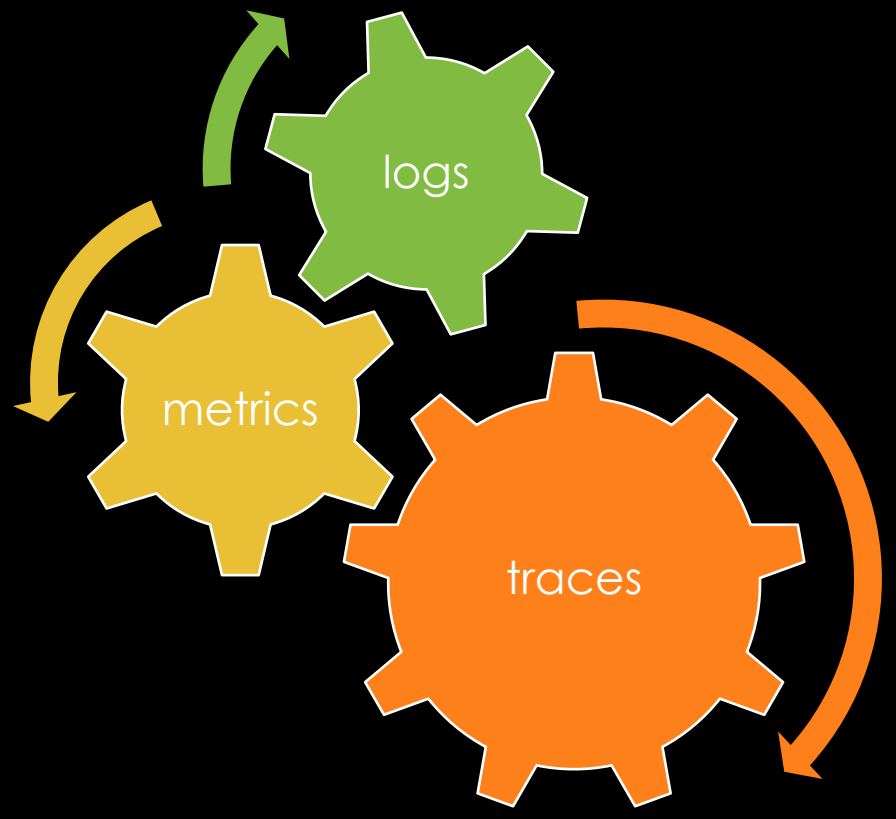
https://landscape.fnal.gov/docs/

Connection details and examples

(SSO Required)

MONITORING

- Monitoring or *observability* is a broad subject, which involves the collection, storing, and querying/visualizing of three main types of data:
  - logs
  - metrics
  - traces
- These work together to provide the developer and operator with a complete picture and support rapid responses



LOGGING

- Logging is the simplest form of monitoring, which begins the moment a programmer writes their first "Hello, world!" program. Logs describe in detail what an application is doing (or not doing sometimes).
- In monitoring terms, most logs are really events:
  - **what** happened
  - **when** it happened
  - **why** it happened
  - **who/what** caused the event
  - **what type** of event/severity
- **DO NOT LOG SECRETS OR SENSITIVE INFORMATION**

STRUCTURED LOGGING

```
time="2021-03-09T21:55:27Z" level=info msg="handled request"
duration=453.906118ms length=0 method=GET origin=71.57.54.226
path=/job/42595777.0@jobsub02.fnal.gov/ traceid=296731105f77ab6c
```

- Use a structured logging library, e.g. structlog for Python and logrus for Go
- Use a standard, easily parsed format like logfmt or json. Custom parsers (e.g. grok) are fragile.
- Try to keep related info in a single log event, and/or provide some way to connect events (e.g. a unique trace ID)
- Exception: debug/trace logs, can become unwieldy and are only useful for someone looking at them in context. Generally should be disabled in production.

COLLECTING LOGS

- Application should write logs to stdout/stderr or a file. Collect logs with **filebeat**, **promtail**, or a docker plugin.
  - Send logs to **Kafka** if they were collected by filebeat (or logstash), are well-structured, and contain fields that you'll want to do analytics on. These will be put into **Elasticsearch.**
  - Send logs to **Loki** if they are mainly for troubleshooting. These will be immediately viewable in **Grafana**.
- Sometimes you may want to publish <u>key events</u> separate from other logs, you can send these to **Kafka**, **RabbitMQ** (via AMQP or STOMP protocols), or the **Ingest** service.

METRICS

- While logs describe the details of what an application is doing, metrics provide aggregate high-level insight into the process, collected at some regular frequency to allow for trending and anomaly identification
- **Internal** metrics are collected within the process and expose the internal state.
- **External**, or blackbox, metrics are collected by some other service, and reflect the status from the perspective of a user or client
- Metrics may be published via **push**, where the service sends the metrics directly to the monitoring service, e.g. **Graphite**, **Statsd**
- … or by **pull**, where the monitoring service "scrapes" the metrics, typically over HTTP, e.g. **Prometheus**

PROMETHEUS

- Prometheus is a service for collecting, storing, and querying system and service metrics. It has a standard exposition format (which as evolved into the standard OpenMetrics) and a rich ecosystem of libraries for publishing metrics.
  - Libraries typically include HTTP server, if service does not already have one or wants to publish metrics on separate interface or port
- Some cases where the pull-based model used by Prometheus is not appropriate, e.g. short-lived processes, services behind firewall
  - push metrics to the Prometheus Pushgateway
  - push metrics to **Graphite** or **Statsd**. Note that many Prometheus client libraries can *also* push directly to Graphite!
  - Push metrics in document format to **Kafka** or **Ingest**

TRACING

- Distributed tracing provides a way to connect events across services, processes, or threads. A trace is typically instantiated by a single end-user request, and is then propagated through the services associated with servicing that request. It helps operators and developers determine *where* and *why* failures occur, and identify potential bottlenecks
- Landscape runs the Jaeger service to collect traces that conform to the OpenTracing/OpenTelemetry standards and make them viewable in the **Jaeger** frontend and in **Grafana**.

SUMMARY

- Collect and publish general service logs to Loki or Elasticsearch (through Kafka)
- Collect and publish internal service and process metrics with Prometheus/OpenMetrics/OpenTelementry library.
- Publish key event data, possibly with metrics, in JSON to Kafka. Set up digest processes to enrich and/or summarize the data if necessary.
- For distributed systems, use Jaeger/OpenTracing to publish tracing data.
- Monitor user-facing services with Blackbox monitoring.
- Set up alerts in Grafana to notify operations of unexpected conditions.

DEMO TIME!

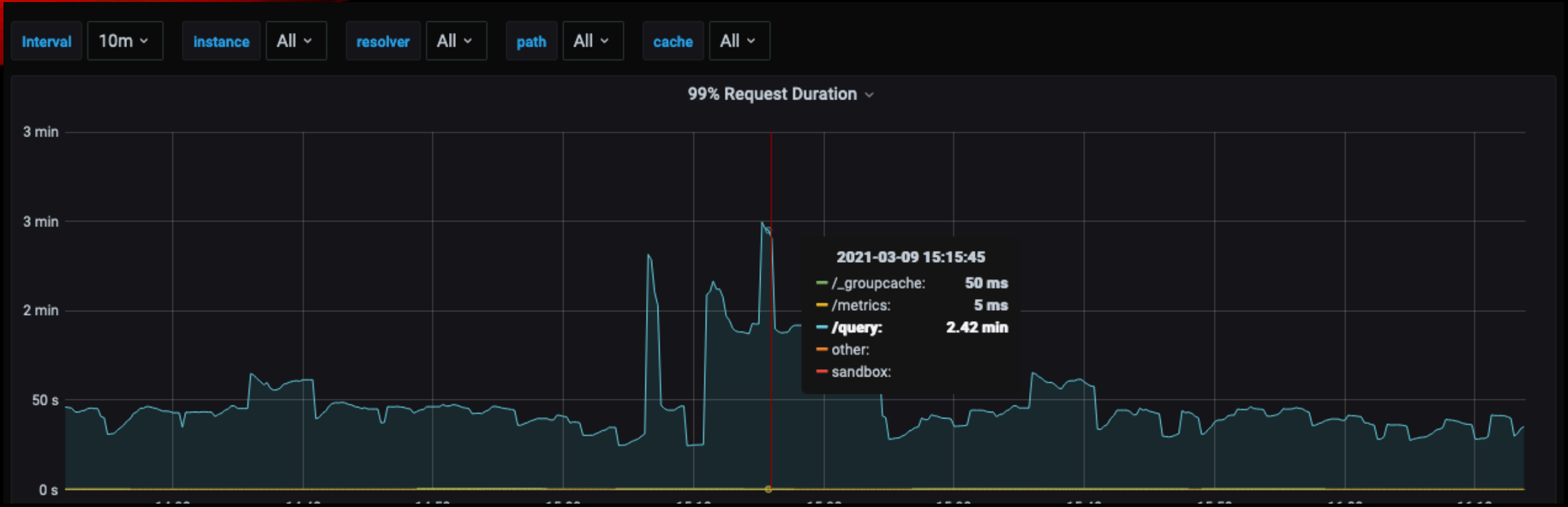
Metrics, Logging and Tracing with Prometheus, Loki, and Jaeger

Case Study: **Lens** API

LENS METRICS

- HTTP request metrics published with Prometheus Go library: https://landscape.fnal.gov/lens/metrics

```
http_request_duration_seconds_bucket{path="/query",le="0.005"} 50948
http_request_duration_seconds_bucket{path="/query",le="0.01"} 51110
http_request_duration_seconds_bucket{path="/query",le="0.025"} 51327
http_request_duration_seconds_bucket{path="/query",le="0.05"} 55991
http_request_duration_seconds_bucket{path="/query",le="0.1"} 58578
http_request_duration_seconds_bucket{path="/query",le="0.25"} 64500
http_request_duration_seconds_bucket{path="/query",le="0.5"} 99190
http_request_duration_seconds_bucket{path="/query",le="1"} 101526
http_request_duration_seconds_bucket{path="/query",le="2.5"} 102930
http_request_duration_seconds_bucket{path="/query",le="5"} 103725
http_request_duration_seconds_bucket{path="/query",le="10"} 104539
http_request_duration_seconds_bucket{path="/query",le="25"} 105082
http_request_duration_seconds_bucket{path="/query",le="50"} 105128
http_request_duration_seconds_bucket{path="/query",le="100"} 105164
http_request_duration_seconds_bucket{path="/query",le="250"} 105164
http_request_duration_seconds_bucket{path="/query",le="+Inf"} 105164
http_request_duration_seconds_sum{path="/query"} 35873.17846150313
http_request_duration_seconds_count{path="/query"} 105164
```



ALERT! 99TH PERCENTILE THRESHOLD EXCEEDED (GRAFANA)

(not a real alert, we don't guarantee quite that good of a response)

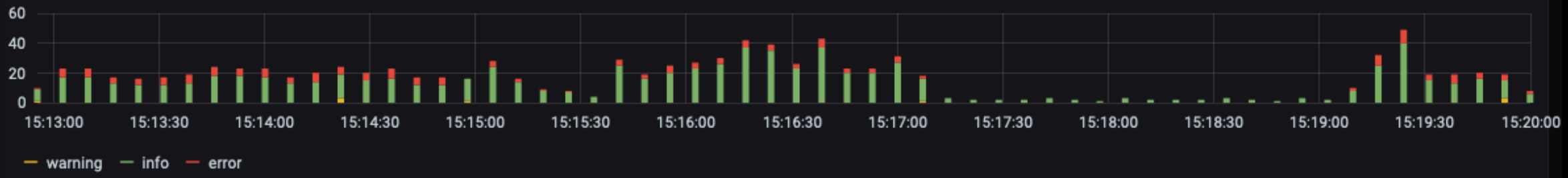
```
histogram_quantile(0.99,rate(http_request_duration_seconds_bucket{job="lens",instance=~"$instance"}[$interval]))
```

Loki | Split | 2021-03-09 15:10:15 to 2021-03-09 15:20:00 | Clear All | Run Query | Live

Log labels `{compose_service="lens"}` Line limit auto 1.0s

+ Add query | Query history | Query inspector

Logs



Time | Unique labels | Wrap lines | Dedup: None | Exact | Numbers | Signature | Flip results order

Common labels: frontend lens frontend_lens_1 stderr Limit: 1000 (1000 returned) Total bytes processed: 392 kB

```
> 2021-03-09 15:20:00 time="2021-03-09T21:20:00Z" level=info msg="queried elasticsearch" response="200 OK" url="https://fifemon-es.fnal.gov/fifebatch-events-*/_search"
> 2021-03-09 15:20:00 time="2021-03-09T21:20:00Z" level=error msg="error parsing time" error="parsing time \"\" as \"2006-01-02T15:04:05Z07:00\": cannot parse \"\" as \"2006\""
```

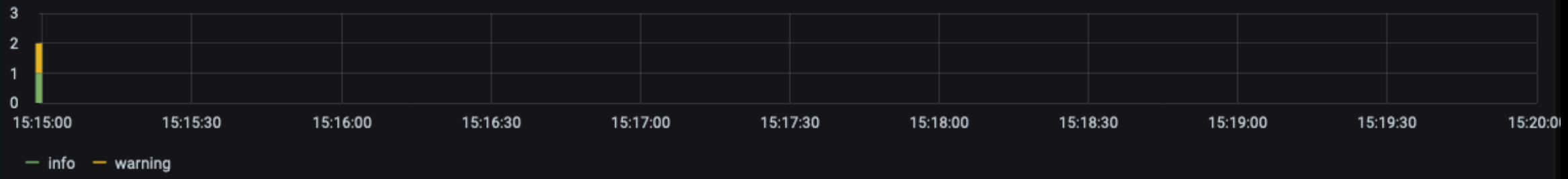
LET'S GO TO THE LOGS (LOKI)

Loki | Split | 2021-03-09 15:10:15 to 2021-03-09 15:20:00 | Clear All | Run Query | Live

Log labels `{compose_service="lens"} | logfmt | duration>120s` Line limit auto 0.8s

+ Add query | Query history | Query inspector

Logs



Time | Unique labels | Wrap lines | Dedup: None | Exact | Numbers | Signature | Flip results order

Common labels: 2m4.251728925s graphitesrv01.fnal.gov frontend_lens_1 frontend lens stderr 2021-03-09T21:15:03Z Limit: 1000 (2 returned) Total bytes processed: 470 kB

```
> 2021-03-09 15:15:03 time="2021-03-09T21:15:03Z" level=warning msg="slow query" duration=2m4.251728925s query="{\"query\":\"{submissions(group: \\\"dune\\\"
                      , from: \\\"2021-03-09T21:00:02\\\", to:\\\"now\\\"){id pomsTaskID done running idle held failed completed } }\",\"operationName\":nul
                      l}"
> 2021-03-09 15:15:03 time="2021-03-09T21:15:03Z" level=info msg="handled request" duration=2m4.251728925s duration_ns=124251728925 length=164 method=POST ori
                      gin=131.225.67.18 path=/query traceid=59a9b3c63401bdf5
```

FIND THE SLOW QUERY

```
2021-03-09 15:15:03 time="2021-03-09T21:15:03Z" level=info msg="handled request" duration=2m4.251728925s duration_ns=124251728925 length=164 method=POST origin=131.225.67.18 path=/query traceid=59a9b3c63401bdf5
```

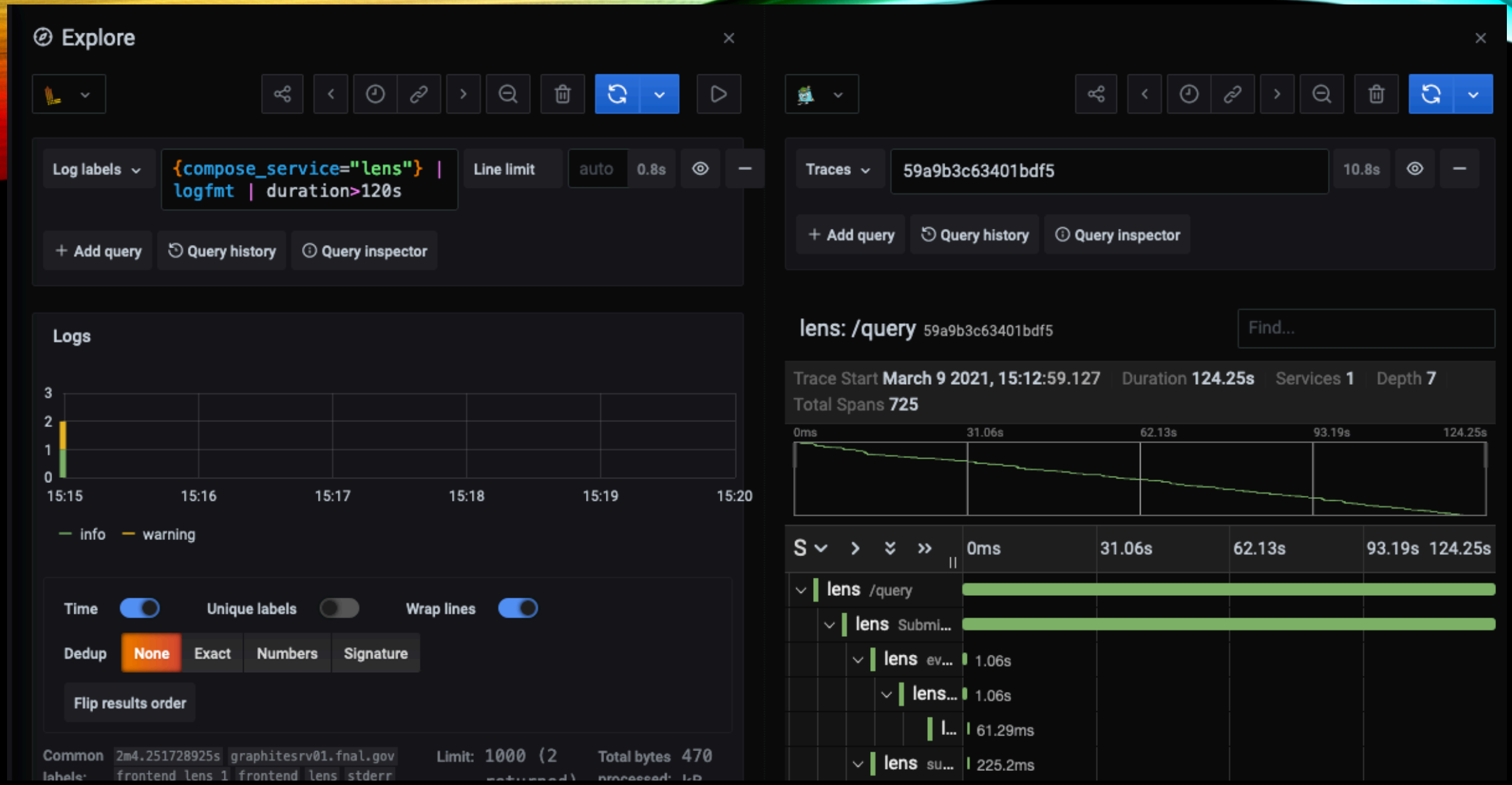
Log Labels:

path	/query
duration	2m4.251728925s
host	graphitesrv01.fnal.gov
container_name	frontend_lens_1
msg	handled request
origin	131.225.67.18
compose_project	frontend
compose_service	lens
method	POST
source	stderr
traceid	59a9b3c63401bdf5
duration_ns	124251728925
filename	/var/log/docker/9044350a27df73c326618f170421a83cb3f2b89136096ed8d77bc7415beaed85/json.log
time	2021-03-09T21:15:03Z
length	164
level	info

Parsed Fields:

trace	59a9b3c63401bdf5	Jaeger

OH LOOK, A TRACE ID!



LOOK THROUGH THE TRACE (JAEGER)

lens: /query 59a9b3c63401bdf5

Find...

Trace Start **March 9 2021, 15:12:59.127** | Duration **124.25s** | Services **1** | Depth **7** | Total Spans **725**

0ms | 31.06s | 62.13s | 93.19s | 124.25s

Service & Operation

0ms | 31.06s | 62.13s | 93.19s | 124.25s

- lens /query
  - lens Submissions

Submissions

Service: **lens** | Duration: **124.25s** | Start Time: **0.2ms**

Tags

internal.span.format	"proto"
query.constraint	"Jobsub_Group=="dune""
query.from	"2021-03-09T21:00:02"
query.group	"dune"
query.query	"Jobsub_Group:dune"
query.to	"now"

Process: client-uuid = **65c4363117823225** | hostname = **9044350a27df** | ip = **172.20.0.24** | jaeger.version = **Go-2.25.0**

SpanID: **4122d0071ac54dcb**

WOW THAT'S A **LOT** OF CALLS (A LOT OF JOBS)

DID SOMEONE SAY ENCORE?

Metrics, Logging and Tracing with Prometheus, Loki, and Jaeger

Case Study #2: **Jobview** job log viewer

Explore | Loki | Split | 2021-03-09 13:53:51 to 2021-03-09 13:57:36 | Clear All | Run Query | Live

Log labels `{compose_service="jobview"}` Line limit auto 0.5s

+ Add query | Query history | Query inspector

Logs

Time | Unique labels | Wrap lines | Dedup: None | Exact | Numbers | Signature | Flip results order

Common labels: `frontend_jobview_1` `stderr` `frontend` `jobview` Limit: 1000 (17 returned) Total bytes processed: 7 kB

```
> 2021-03-09 13:56:40 time="2021-03-09T19:56:40Z" level=info msg="handled request" duration=663.591637ms duration_ns=663591637 length=0 method=GET origin=179.157.71.156 path=/job/17953492.0@jobsub03.fnal.gov/fife_wrap_20210309_132347_674122_204_1_cluster.17953700.0.err traceid=69bec7f69fd8f8b0
> 2021-03-09 13:56:39 time="2021-03-09T19:56:39Z" level=error msg="graphql: unable to find info for 17953492.0@jobsub03.fnal.gov"
> 2021-03-09 13:56:24 time="2021-03-09T19:56:24Z" level=info msg="handled request" duration=554.650743ms duration_ns=554650743 length=0 method=GET origin=179.157.71.156 path=/job/17953492.0@jobsub03.fnal.gov/fife_wrap_20210309_132347_674122_1872_1_.log traceid=48679f701baf3ad6
> 2021-03-09 13:56:24 time="2021-03-09T19:56:24Z" level=error msg="graphql: unable to find info for 17953492.0@jobsub03.fnal.gov"
> 2021-03-09 13:56:09 time="2021-03-09T19:56:09Z" level=info msg="handled request" duration=544.475862ms duration_ns=544475862 length=0 method=GET origin=131.225.77.159 path=/job/17953492.0@jobsub03.fnal.gov/fife_wrap_20210309_132347_674122_559_1_cluster.17954055.0.out traceid=4907823b85f94066
> 2021-03-09 13:56:09 time="2021-03-09T19:56:09Z" level=error msg="graphql: unable to find info for 17953492.0@jobsub03.fnal.gov"
> 2021-03-09 13:56:08 time="2021-03-09T19:56:08Z" level=info msg="handled request" duration=560.028483ms duration_ns=560028483 length=0 method=GET origin=131.225.77.159 path=/job/17953492.0@jobsub03.fnal.gov/fife_wrap_20210309_132347_674122_559_1_cluster.17954055.0.err traceid=7c11a30220d040de
> 2021-03-09 13:56:08 time="2021-03-09T19:56:08Z" level=error msg="graphql: unable to find info for 17953492.0@jobsub03.fnal.gov"
```

WELL WE GOT TROUBLE (RIGHT HERE!)

Traces 69bec7f69fd8f8b0 0.7s

+ Add query | Query history | Query inspector

jobview: /job 69bec7f69fd8f8b0 Find...

Trace Start March 9 2021, 13:56:39.543 | Duration 663.63ms | Services 2 | Depth 13 | Total Spans 32

Service & Operation	0ms	165.91ms	331.81ms	497.72ms	663.63ms
jobview /job					
jobview identifyUser					
jobview job.ServeFile					
jobview job.authorizeAndServeFile					
jobview job.jobFromRequest	16.76ms				
jobview lens.GetJobInfo	16.74ms				
jobview job.authorizeRequestForJob	95.11ms				
jobview ferry.IsUserGroupSuperu...	38.63ms				
jobview ferry.IsUserGroupSuperu...	17.78ms				
jobview ferry.IsUserMemberOfGr...	21.81ms				
jobview ferry.DoesUserHaveRole...	16.83ms				
jobview jobsub.WriteFile	551.48ms				

TO THE TRACE!

lens job 14.42ms

lens events.GetJ... 0.3ms

lens jobs.GetJ... 14.07ms

lens Get 14.03ms

Get

Service: lens | Duration: 14.03ms | Start Time: 0.96ms

Tags: component = elasticsearch | db.index = fifebatch-jobs | db.instance = https://fifemon-es.fnal.gov | db.type = elasticsearch | error = true | internal.span.for...

Process: client-uuid = 65c4363117823225 | hostname = 9044350a27df | ip = 172.20.0.24 | jaeger.version = Go-2.25.0

Logs (1)

14.98ms

event	"error"
http.response	{ "_index": "fifebatch-jobs.01", "_type": "job", "_id": "17953492.0@jobsub03.fnal.gov", "found": false }
http.status	"404 Not Found"
message	"error response from server"

Log timestamps are relative to the start time of the full trace.

SpanID: 02d6425c4d9618b6

OH, SO IT REALLY WAS LENS AFTER ALL!

OTHER RESOURCES

- Monitoring for everyone
- How Humans see data
- Fool-Proof Kubernetes Dashboards for Sleep-Deprived Oncalls
- Stacked Area Graphs Are Not Your Friend
- Friends don't let friends abuse pie charts
- The SRE book: Practical Alerting from Time-Series

List at https://landscape.fnal.gov/docs/using/resources/