Fermilab U.S. DEPARTMENT OF ENERGY Office of Science

Adding Observability to the Managed Tokens Service

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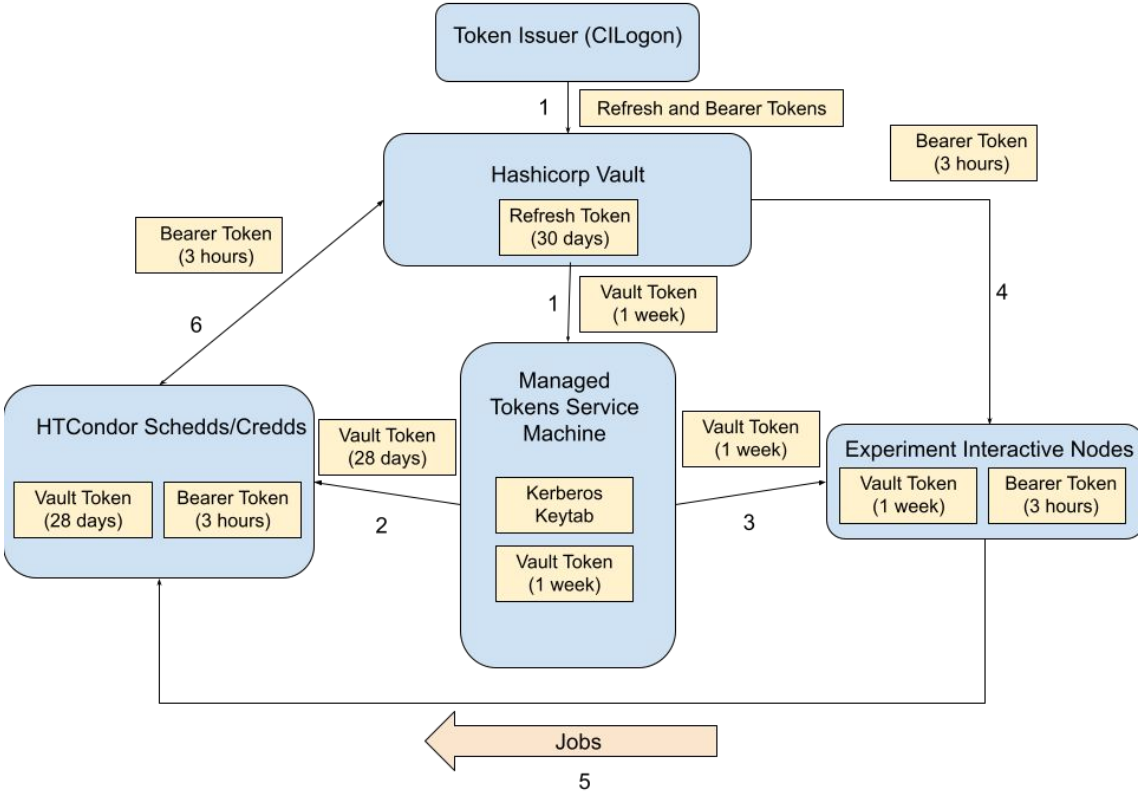
FABRIC FOR FRONTIER EXPERIMENTS

What is the Managed Tokens Service?

- Store production vault tokens in condor *credds*
- Push production vault tokens to interactive nodes, keep them refreshed
- Written in Go (performant, easy/safe concurrency, avoid Python “dependency hell”)

Where the service fits in



Executables of Managed Tokens Service

- **`token-push`:**
  - Stores vault token in HTCondor credd for experiment/role combination and push copies of vault token to interactive nodes
  - Notifies experiment stakeholders and operators if there is any error
  - Runs every hour.
- **`refresh-uids-from-ferry`:**
  - Queries FERRY to pull down the applicable UIDs for the configured UNIX accounts
  - Runs daily each morning
- **`run-onboarding-managed-tokens`:**
  - Onboards a new experiment or experiment account to the Managed Tokens Service
  - Run as needed

Normal operation of *token-push*

1. Uses a kerberos service principal to authenticate to the Hashicorp vault server
2. Sets appropriate credkey in `HTGETTOKENOPTS` based on kerberos principal → Lets `condor_vault_storer/htgettoken` know where the refresh token is in the vault
3. `condor_vault_storer`
    a. Resets the refresh token in the vault and obtains a vault token
    b. Stores this vault token in the HTCondor *credd*
4. Pushes this vault token to experiment interactive nodes
5. Notifies experiment stakeholders and/or operators if there is any error in any of the previous steps

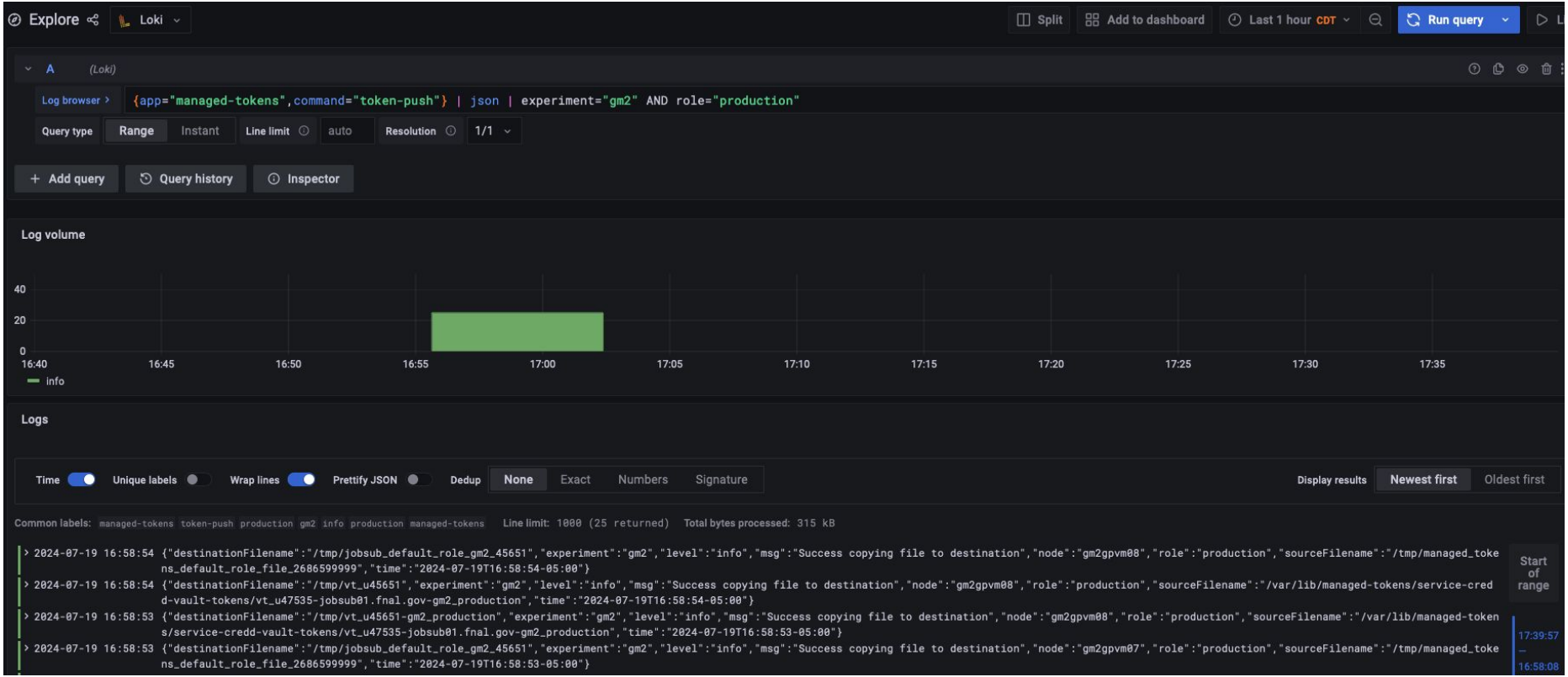
Components to keep track of

- All of the operations on the last slide plus:
- Configuration parsing
- Local sqllite database reads/writes
- Notification generation/sending
- Most of these operations (with exception of `condor_vault_storer`) are done concurrently
- How do we monitor all of this?

Logs with Loki

- Standard logs at /var/log/managed-tokens on managed tokens machine
  - One regular log, one debug log per executable
- But searching through those can be tedious: Send logs to **Loki**
- Queryable log store FE via LogQL:
  - `{app="managed-tokens",command="token-push"} | json | experiment="gm2" AND role="production"`
- Simply required adding a configured Loki hook to existing logging library - INFO and higher-level logs are sent to Loki

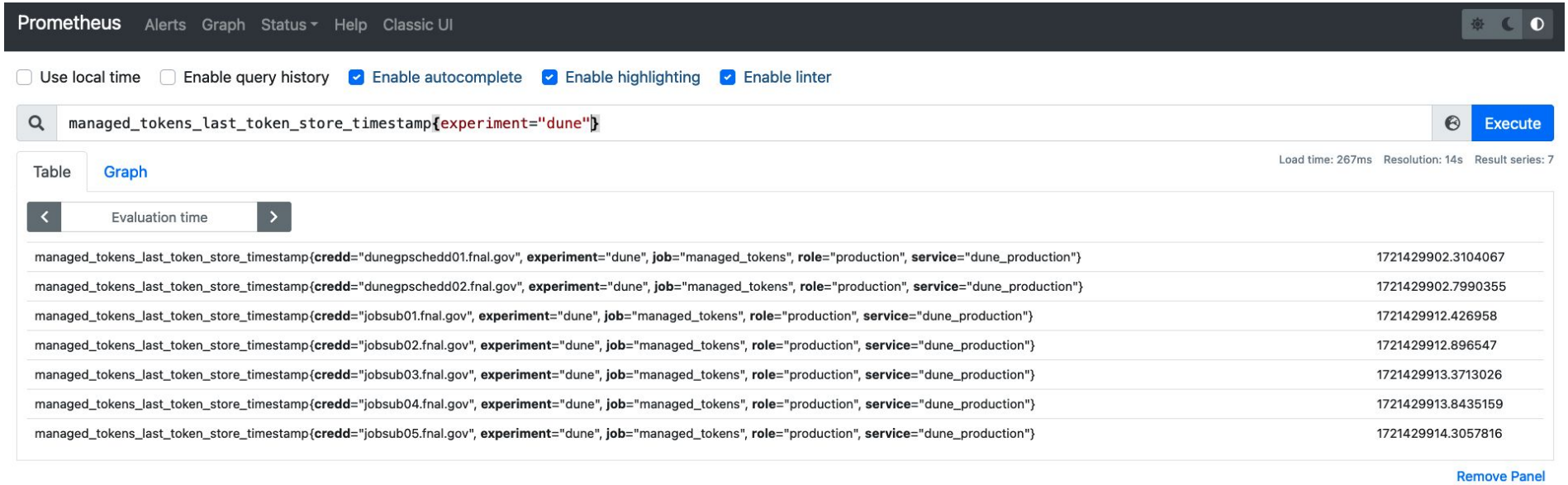
Logs with Loki (2)



Metrics

- Prometheus metrics pushed each run to a Landscape pushgateway
- Standard prometheus setup is for web services; for batch processes like this, need to use pushgateway: extra webserver that can receive metrics, then serves them to normal Prometheus server
- Metrics
  - `managed_tokens_stage_duration_seconds`: Per executable, per stage (setup, processing, cleanup). How long each stage took to run.
  - `managed_tokens_last_ferry_refresh`: Timestamp of when `refresh-uids-from-ferry` executable last got information from FERRY.
  - `managed_tokens_failed_services_push_count`: Count of how many services registered a failure to push a vault token to a node in the current run of `token-push`. Basically, a failure count.
  - `managed_tokens_last_token_push_timestamp`: Timestamp of when `token-push` last pushed a particular service vault token to a particular node.
  - `Managed_tokens_last_token_store_timestamp:` Timestamp of when `token-push` last stored a particular service vault token in a particular credd.
  - And more!

Metrics (2)

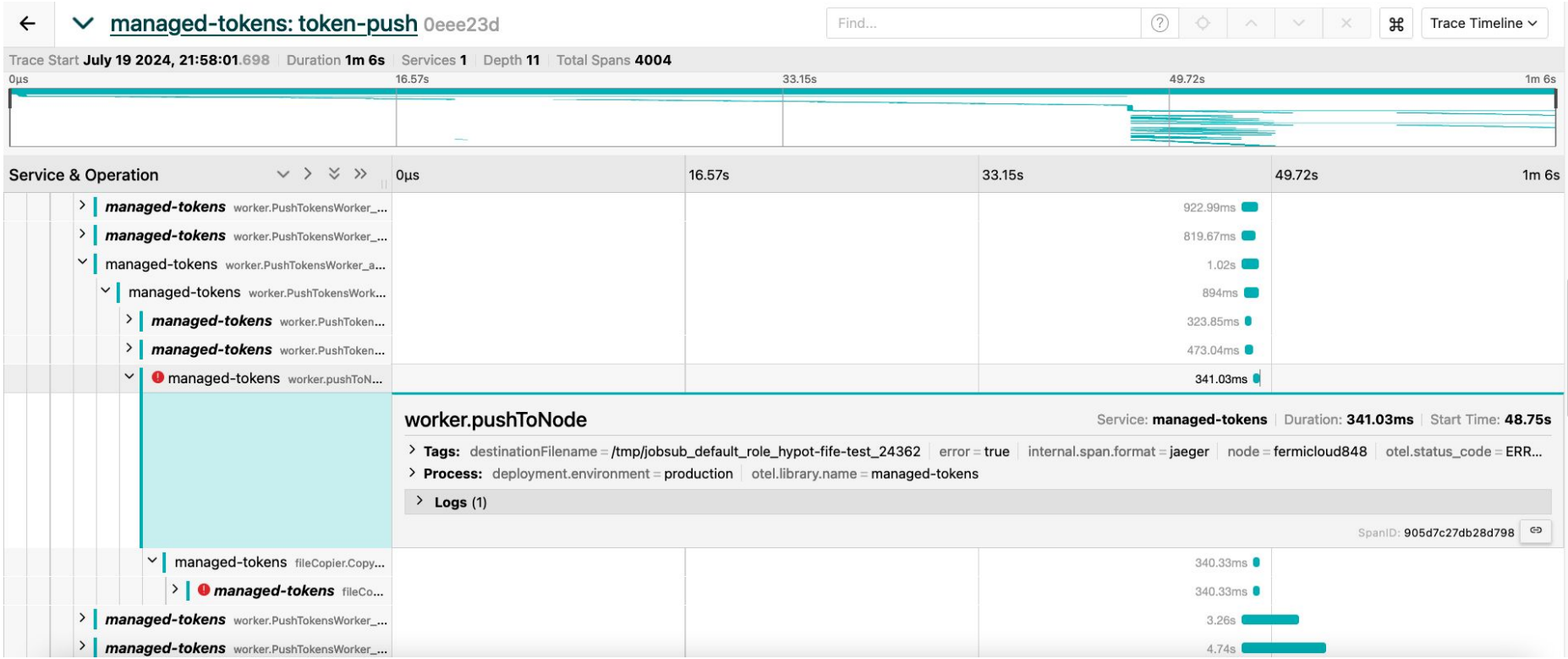

Prometheus
Alerts
Graph
Status
Help
Classic UI
Use local time
Enable query history
Enable autocomplete
Enable highlighting
Enable linter
managed_tokens_last_token_store_timestamp{experiment="dune"}
Execute
Table
Graph
Load time: 267ms
Resolution: 14s
Result series: 7
Evaluation time
managed_tokens_last_token_store_timestamp{credd="dunegpschedd01.fnal.gov", experiment="dune", job="managed_tokens", role="production", service="dune_production"} 1721429902.3104067
managed_tokens_last_token_store_timestamp{credd="dunegpschedd02.fnal.gov", experiment="dune", job="managed_tokens", role="production", service="dune_production"} 1721429902.7990355
managed_tokens_last_token_store_timestamp{credd="jobsub01.fnal.gov", experiment="dune", job="managed_tokens", role="production", service="dune_production"} 1721429912.426958
managed_tokens_last_token_store_timestamp{credd="jobsub02.fnal.gov", experiment="dune", job="managed_tokens", role="production", service="dune_production"} 1721429912.896547
managed_tokens_last_token_store_timestamp{credd="jobsub03.fnal.gov", experiment="dune", job="managed_tokens", role="production", service="dune_production"} 1721429913.3713026
managed_tokens_last_token_store_timestamp{credd="jobsub04.fnal.gov", experiment="dune", job="managed_tokens", role="production", service="dune_production"} 1721429913.8435159
managed_tokens_last_token_store_timestamp{credd="jobsub05.fnal.gov", experiment="dune", job="managed_tokens", role="production", service="dune_production"} 1721429914.3057816
Remove Panel

Tracing

- While metrics and logs give great insight into issues that crop up, traces help visualize WHERE in the program flow something went wrong
- Serve as a visual index rather than grepping through the logs
- Then, for more details, you can go to the logs if needed

- We added OpenTelemetry tracing that gets sent to Landscape Jaeger Tracing collector
- For example: https://landscape.fnal.gov/jaeger/trace/0eee23d1cfd43126e6dc3d2d184f9007

Tracing (2)



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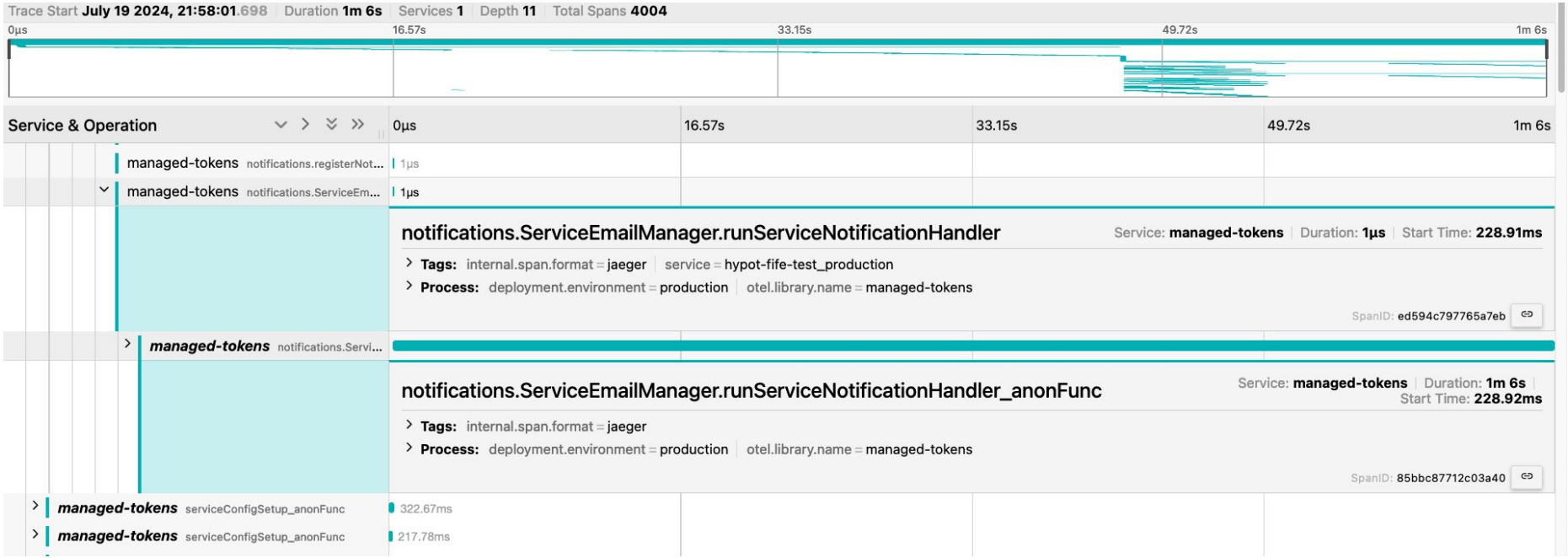
Tracing to visualize concurrency (3)



We can see here that a *hypot-fife-test_production* `ServiceNotificationHandler` is launched concurrently and stays alive for almost the entire run - waiting for messages, like the one the previous slide's error would have generated - you can SEE the concurrency!

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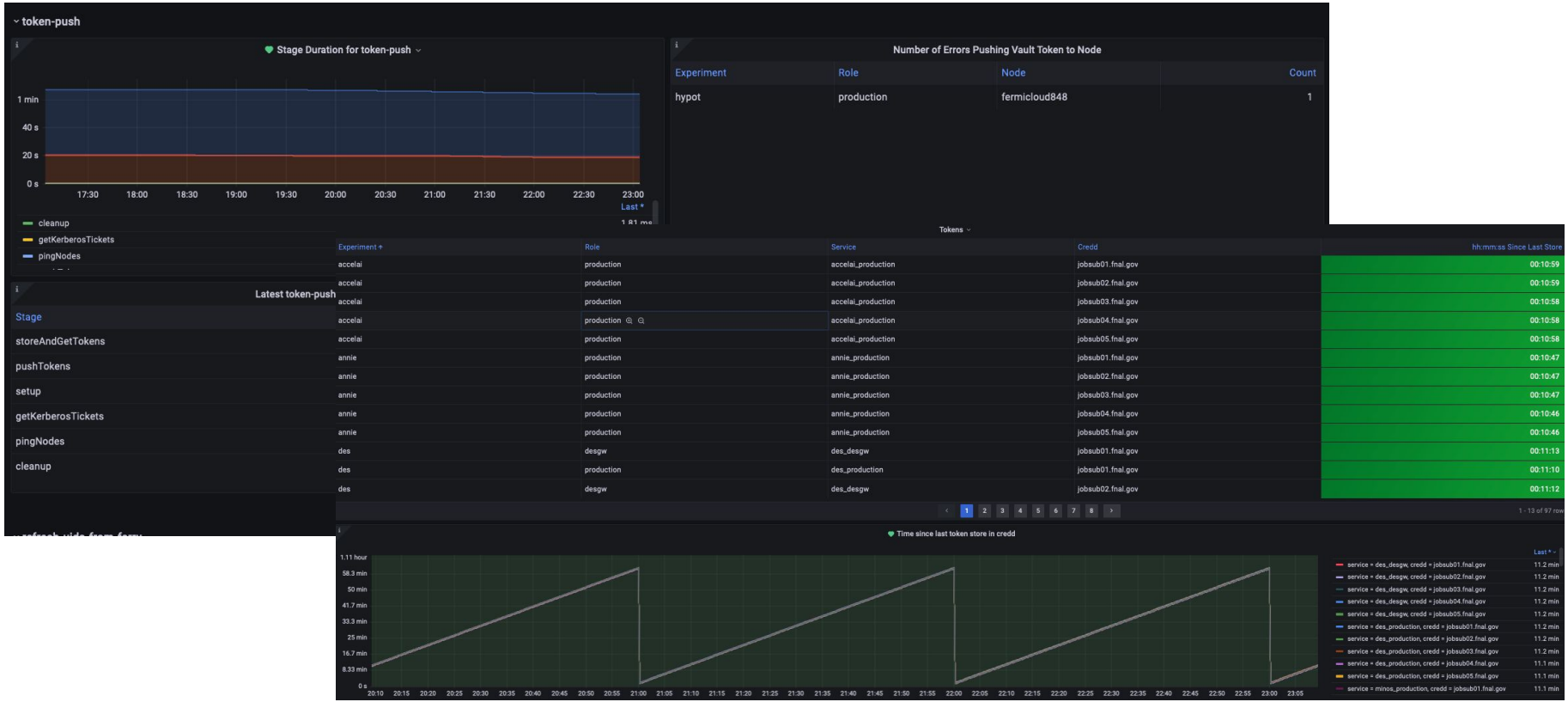
Dashboards

- Fifemon dashboards:
  - Last token push by service/node: https://fifemon.fnal.gov/monitor/d/QOV9N_iIz/managed-tokens-service-time-since-last-token-push?orgId=1
  - Last token store in credd by service/credd (with alerts after 3 hrs of failure): https://fifemon.fnal.gov/monitor/d/w4mAD_iIk/managed-tokens-service-time-since-credd-store
  - Service Health Dashboard: https://fifemon.fnal.gov/monitor/d/bGDwH9mSz/managed-tokens-service-service-health

Dashboards (2)



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Alerting

- Use dashboards to send alerts to #fifealerts Slack channel
  - Time since a token was stored in condor *credd* > 3 hrs
  - Any stage from *refresh-uids-from-ferry* takes > 5 min
  - Time since UIDs refreshed from FERRY > 2 days
- Also, original notifications from *token-push* itself:
  - Emails to stakeholders, FIFE
  - Abridged version sent to #fifealerts

Future

- Pretty much done - no major work left in adding observability
- TODO: Export traces to new Landscape OpenTelemetry collector rather than current Landscape Jaeger collector
  - One function change, since library APIs between Jaeger/OpenTelemetry are nearly-identical
  - Then rest of tracing code in *managed tokens* should seamlessly plug-in

Summary

- Managed tokens service executables are multi-threaded with numerous concurrent operations running at any time
- Adding observability has helped us pinpoint issues very quickly when they occur:
  - *Alerting/dashboards* fed by *metrics* tells us that something went wrong
  - *Traces* show us very quickly in which components of which executable the issue occurred
  - *Logs* sent to Loki (INFO level) let us quickly find the exact operation within the relevant component that went wrong
  - Debug logs on the deployment machine can help us look at details of faulty operation
- All of these components working together has saved a LOT of troubleshooting time

Resources

- Github repo: https://github.com/fermitools/managed-tokens
- Wiki page: https://fifewiki.fnal.gov/wiki/Managed_Tokens_Service
- Loki: https://grafana.com/docs/loki/latest/
- Prometheus: https://prometheus.io/
- Prometheus Pushgateway: https://prometheus.io/docs/practices/pushing/
- Using Metrics in Grafana: https://prometheus.io/docs/visualization/grafana/
- OpenTelemetry Tracing: https://opentelemetry.io/docs/

Thank you!

Extra Slides

Loki Configuration with logrus

```
244             // Loki.  Example here taken from README: https://github.com/YuKitsune/lokirus/blob/main/README.md
245             lokiOpts := lokirus.NewLokiHookOptions().
246                     // Grafana doesn't have a "panic" level, but it does have a "critical" level
247                     // https://grafana.com/docs/grafana/latest/explore/logs-integration/
248                     WithLevelMap(lokirus.LevelMap{log.PanicLevel: "critical"}).
249                     WithFormatter(&log.JSONFormatter{}).
250                     WithStaticLabels(lokirus.Labels{
251                             "app":         "managed-tokens",
252                             "command":     currentExecutable,
253                             "environment": devEnvironmentLabel,
254                     })
255             lokiHook := lokirus.NewLokiHookWithOpts(
256                     viper.GetString("loki.host"),
257                     lokiOpts,
258                     log.InfoLevel,
259                     log.WarnLevel,
260                     log.ErrorLevel,
261                     log.FatalLevel)
262
263             log.AddHook(lokiHook)
```

Code to add loki hook to logrus logging library

[Link to code on Github]

Configuration for loki in managed tokens config file

```
loki:
  host: "http://fifelog.fnal.gov:3100"
```

Prometheus configuration

- Configuration to push metrics to pushgateway at http://fifelog.fnal.gov:9091
- Set up `MetricsRegistry` using prometheus Go client library and prometheus Go pushgateway library
- Set up metrics in each executable, like this (link to Github)

Tracing configuration

- Configuration to export all traces to https://landscape.fnal.gov/jaeger-collector/api/traces : note - there is now an OpenTelemetry-compatible trace collector that should be used instead
- Set up `TracerProvider` to export traces (example)
- Set up executables to use this `TracerProvider` when creating new spans (see here)
- In each operation/function, start a new span (example)