Introduction to Prometheus

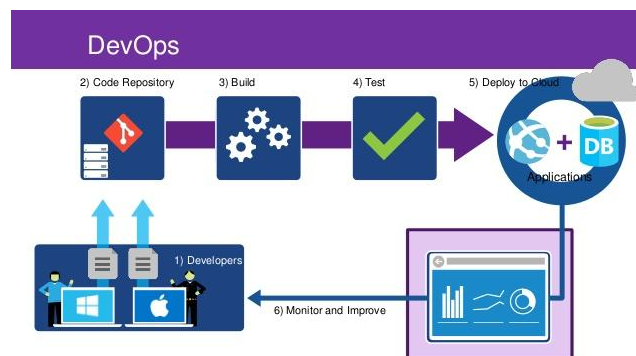---

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► Monitoring: What it is & why to

- Agility is essential to keeping pace
- Software teams expected to move faster, test earlier, and release more frequently, all while improving quality and reducing costs

Monitoring: What it is & why to

Ensure that a system or service is:

- Available
- Fast
- Correct
- Efficient
- etc.

Monitoring: What it is & why to

Potential Problems:
- Disk full ————————→ no new data stored
- Software ——————→ bug, request errors
- High temperature ————→ hardware failure
- Network outage ———→ services cannot communicate
- Low memory utilization——→ money wasted

Monitoring: What it is & why to

Need to observe your systems to get insight into:

- Request/event rates
- Latency
- Errors
- Resource usage
- Temperature, humidity, …

…and then react when something looks bad

Monitoring: What it is & why to

What is required for monitoring?

- Gather operational metrics
- Raise alert
  - To human (via ticket/SMS/Email/…)
  - To automated handler/agent
- Support issue resolution (data for root cause analysis)
- Analyze trends & effects/impact of change

2 ▶ What is Prometheus?

▶ What is Prometheus?

Metrics-based monitoring & alerting stack

- Metrics collection and storage
- Querying, alerting, dashboarding
- For all levels of the stack!

Made for dynamic cloud/container environments

What is Prometheus?

A quick overview of what Prometheus is about:
- **Gather metrics** into database
  - Scheduled pull/harvest/scrape actions – **HTTP/TCP** requests
  - Provide exporters (adapters) that expose metrics
- Make metrics available to consuming systems and humans
  - Such as **Grafana** (for dashboarding), **REST APIs**, through Prometheus UI (The Expression Browser) – **Graphs**, **Console**, **PromQL**
- Analyze metrics according to **alert rules** and determine if alerts are "**firing**"
- Act on firing alerts and send **notifications**

What is Prometheus?
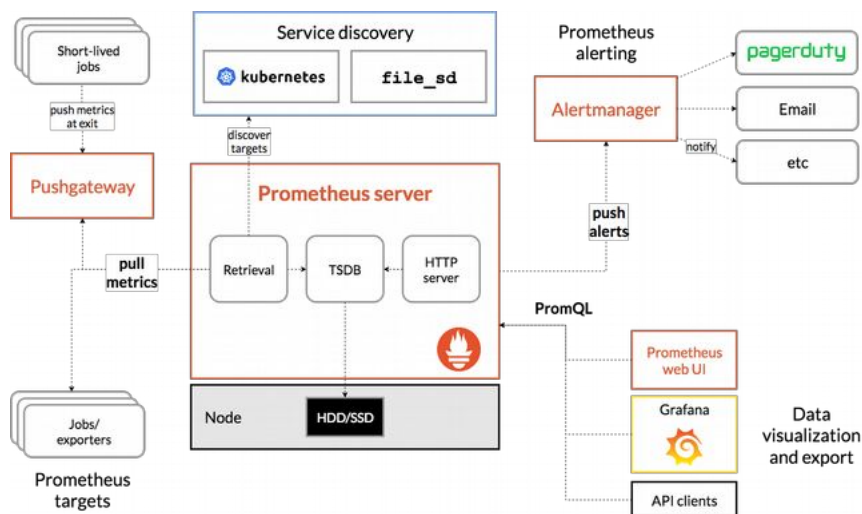
Terminology

- **Prometheus Server**: The main server that scrapes and stores the scraped metrics in a time series database

- **Time-series Database:** Designed to store data that changes with time

- **Scrape:** Prometheus server uses a pulling method to retrieve metrics

- **Target:** The Prometheus server's clients that it retrieves info from (Linux/Windows Server, single app, db, Apache server, etc.)

Terminology

- **Alert Manager:** Component responsible for handling alerts

- **Exporter**: Target libraries that convert and export existing metrics into Prometheus format

- **Instance:** The endpoint that is scraped

- **Job:** A collection of instances with the same purpose

Terminology

- Prometheus pulls (**scrape**) metrics from a client (**target**) over **http** and places the data into its **time series database** that you can query using its own query language: **promQL**

- Prometheus uses "**exporters**" that are installed/configured on the clients in order to convert and expose their metrics in a Prometheus format

- The **AlertManager** receives metrics from the Prometheus server, makes sense of the metrics and then forwards an alert to the chosen notification system
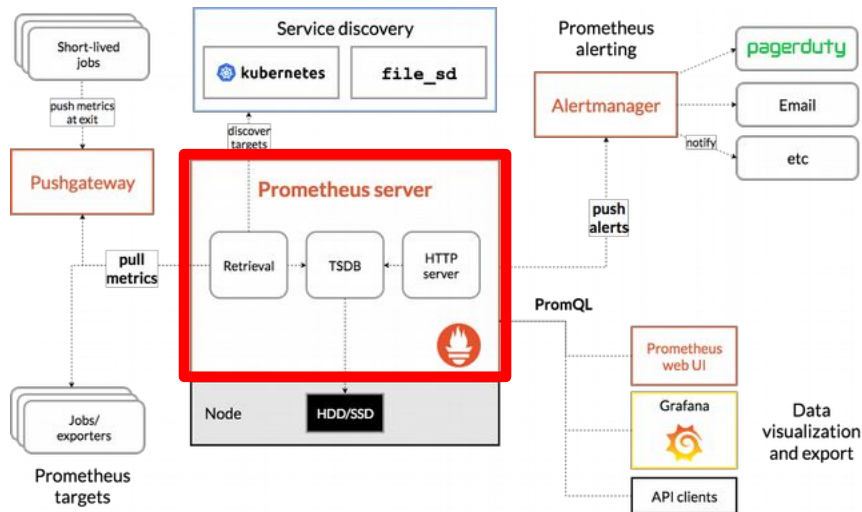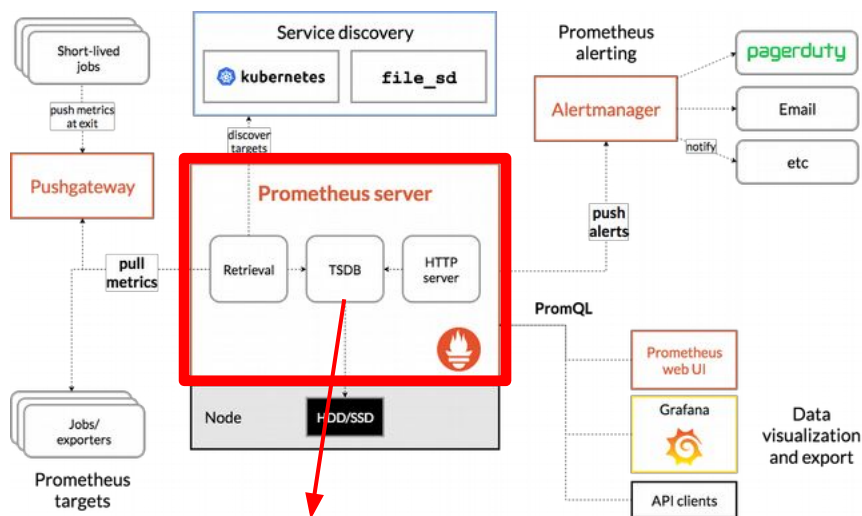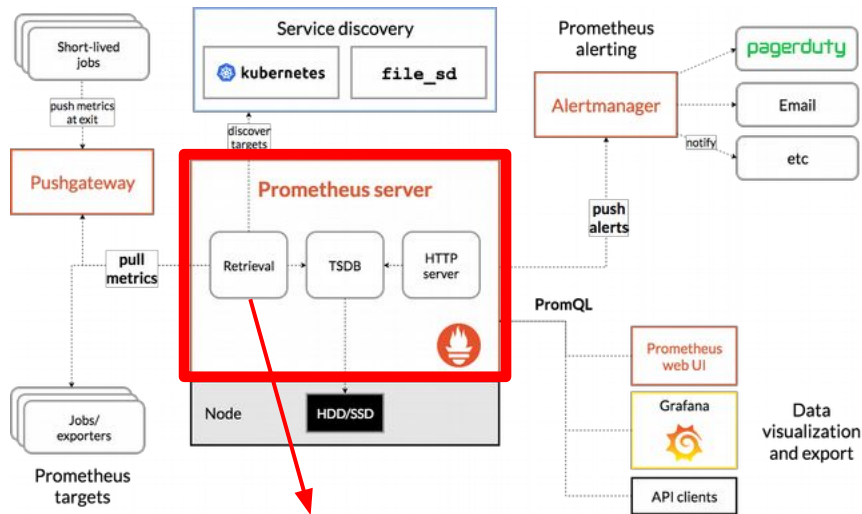
3 How Prometheus works

How Prometheus works

How Prometheus works

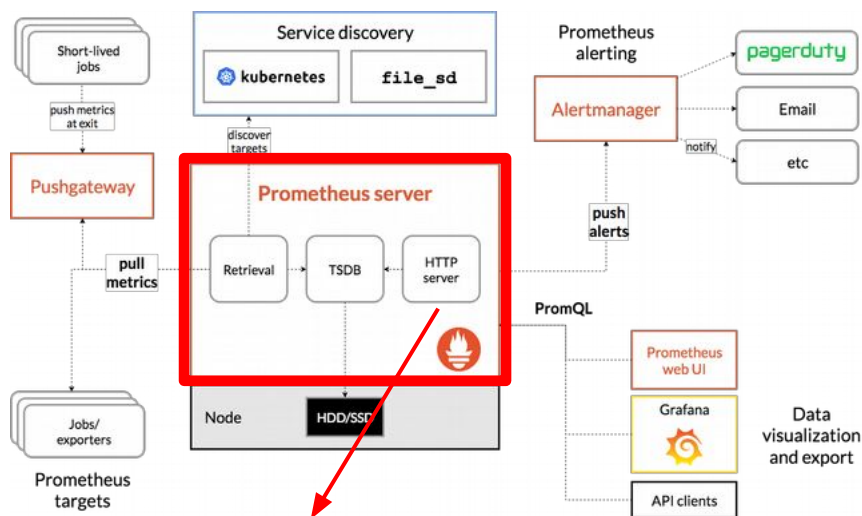**Time Series Database: Stores the metrics**

How Prometheus works

Data Retrieval Worker: Pulls metrics data

How Prometheus works

HTTP Server: Accepts promQL queries

How Prometheus works

- Prometheus server monitors **targets** and each target has **metrics** that are monitored.

<table>
<tr><td>

Targets
- Linux/Windows Server
- Single application
- Services like db
- Web servers
- etc.

</td><td>

Metrics
- CPU/RAM/Disk usage
- Exceptions count
- Requests count
- Requests duration
- etc.

</td></tr>
</table>

How Prometheus works

Prometheus stores metrics as human-readable text-based format


```
← → C ⌂        ⓘ localhost:3000/metrics

# TYPE http_server_requests_total counter
# HELP http_server_requests_total The total number of HTTP requests handled by the Rack application.
http_server_requests_total{code="200",method="get",path="/"} 1.0
# TYPE http_server_request_duration_seconds histogram
# HELP http_server_request_duration_seconds The HTTP response duration of the Rack application.
http_server_request_duration_seconds_bucket{method="get",path="/",le="0.005"} 0.0
http_server_request_duration_seconds_bucket{method="get",path="/",le="0.01"} 0.0
http_server_request_duration_seconds_bucket{method="get",path="/",le="0.025"} 0.0
http_server_request_duration_seconds_bucket{method="get",path="/",le="0.05"} 0.0
http_server_request_duration_seconds_bucket{method="get",path="/",le="0.1"} 0.0
http_server_request_duration_seconds_bucket{method="get",path="/",le="0.25"} 0.0
http_server_request_duration_seconds_bucket{method="get",path="/",le="0.5"} 1.0
http_server_request_duration_seconds_bucket{method="get",path="/",le="1"} 1.0
http_server_request_duration_seconds_bucket{method="get",path="/",le="2.5"} 1.0
http_server_request_duration_seconds_bucket{method="get",path="/",le="5"} 1.0
http_server_request_duration_seconds_bucket{method="get",path="/",le="10"} 1.0
http_server_request_duration_seconds_bucket{method="get",path="/",le="+Inf"} 1.0
http_server_request_duration_seconds_sum{method="get",path="/"} 0.251396
http_server_request_duration_seconds_count{method="get",path="/"} 1.0
# TYPE http_server_exceptions_total counter
# HELP http_server_exceptions_total The total number of exceptions raised by the Rack application.
```
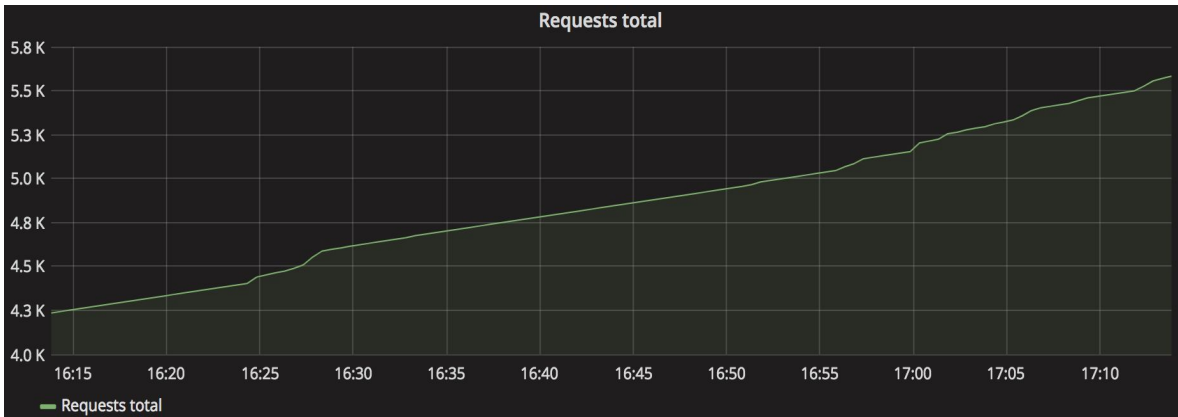
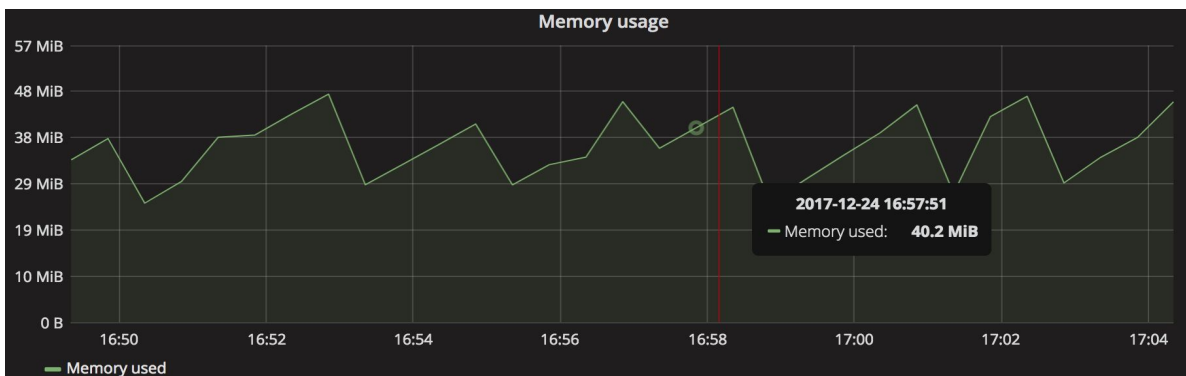**HELP:** description of what metric is
TYPE: metric type

Metric Types

Counter: used for any value that **increases**, such as a request count or error count
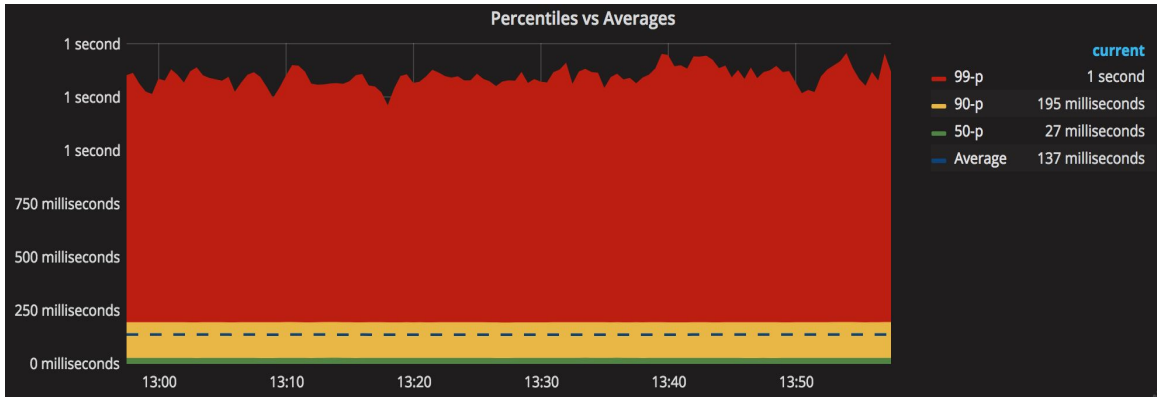
Metric Types

Gauge: used for values that **go down as well as up**, such as current memory usage or the number of items in a queue or the number of requests in progress

Metric Types

Histogram/Summary: measure the frequency of value observations. It tracks how long something takes or how big such as the size of a request.

Metric names and labels

- Every **time series** is uniquely identified by its **metric name** and optional **key-value pairs** called **labels**

- Notation:
  `<metric name>{<label name>=<label value>, ...}`

- For example:
  `api_http_requests_total{method="POST", handler="/messages"}`

Collecting Metrics

- Prometheus pulls metrics from the targets over HTTP:

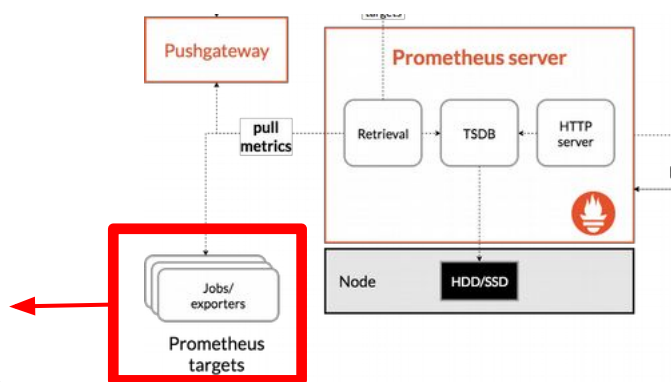 http://hostaddress: [port]/metrics

- Some services expose their metrics natively

- But many services requires an extra component that is called an **exporter**

Collecting Metrics

Exporter is a script or service that fetches metrics from the target, converts to correct format, and exposes **/metrics** so that Prometheus server can pull
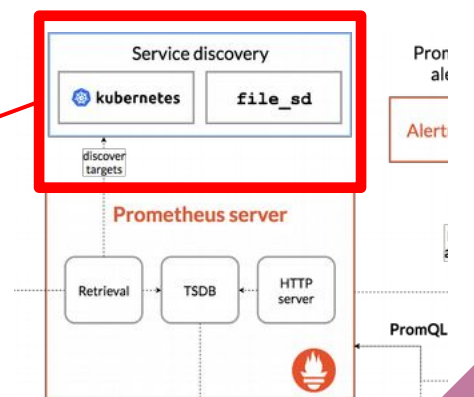
4 ▸ Configuring Prometheus

Configuring Prometheus

Prometheus is configured with **prometheus.yml** file that has the information of:

- which targets to scrape?
- at which interval?

Prometheus uses **service discovery** to find the targets mentioned in the YAML file

Configuring Prometheus

Prometheus comes with a sample configuration file

at which interval targets will be scraped

rules for gathering metric values or creating alerts

Resources that Prometheus monitors


```
# my global config
global:
  scrape_interval:     15s # Set the scrape interval to every 15 seconds. Default is every 1 minute.
  evaluation_interval: 15s # Evaluate rules every 15 seconds. The default is every 1 minute.
  # scrape_timeout is set to the global default (10s).

# Alertmanager configuration
alerting:
  alertmanagers:
  - static_configs:
    - targets:
      # - alertmanager:9093

# Load rules once and periodically evaluate them according to the global 'evaluation_interval'.
rule_files:
  # - "first_rules.yml"
  # - "second_rules.yml"

# A scrape configuration containing exactly one endpoint to scrape:
# Here it's Prometheus itself.
scrape_configs:
  # The job name is added as a label `job=<job_name>` to any timeseries scraped from this config.
  - job_name: 'prometheus'

    # metrics_path defaults to '/metrics'
    # scheme defaults to 'http'.

    static_configs:
    - targets: ['localhost:9090']
```
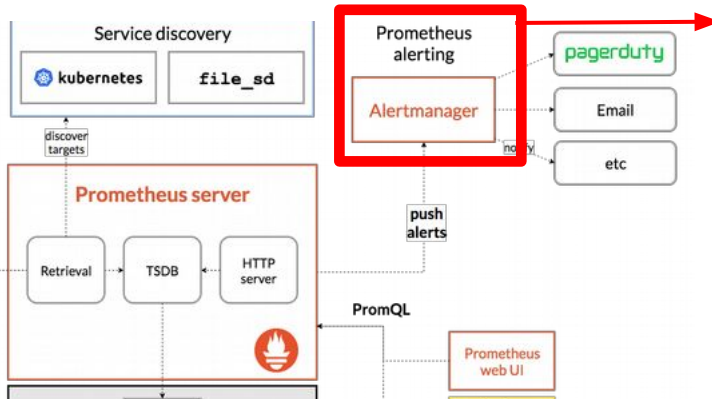
CLARUSWAY©
WAY TO REINVENT YOURSELF

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5 Alert Manager

CLARUSWAY©
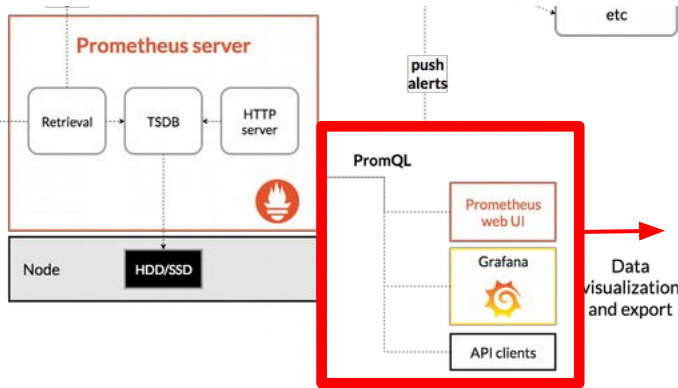WAY TO REINVENT YOURSELF

Alert Manager

Alertmanager fires alerts that are defined by rules in configuration file

6 Querying

Querying

promQL is used to visualize the data collected by Prometheus server

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Querying

- Example queries:

```
# Request counter for the User Directory service
http_requests_total{service="users-directory"}

# Request counter for the Billing History Service
http_requests_total{service="billing-history"}

# Overall request counter regardless of service
sum(http_requests_total)
```
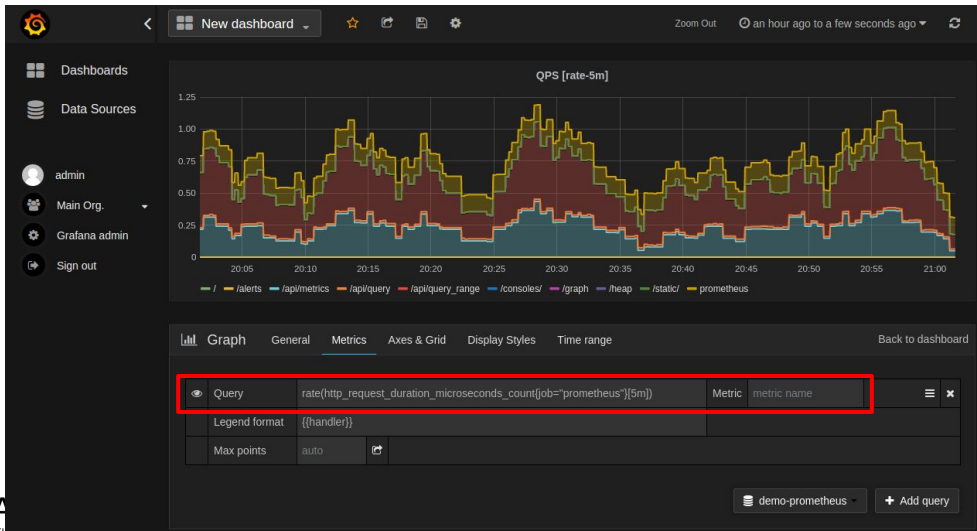
Querying

- Example query with Grafana:

THANKS!

Any questions?

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