MONITORING TESTBED EXPERIMENTS WITH PROMETHEUS

Reading Course in Advanced Performance Monitoring and Profiling of Cloud Computing Applications

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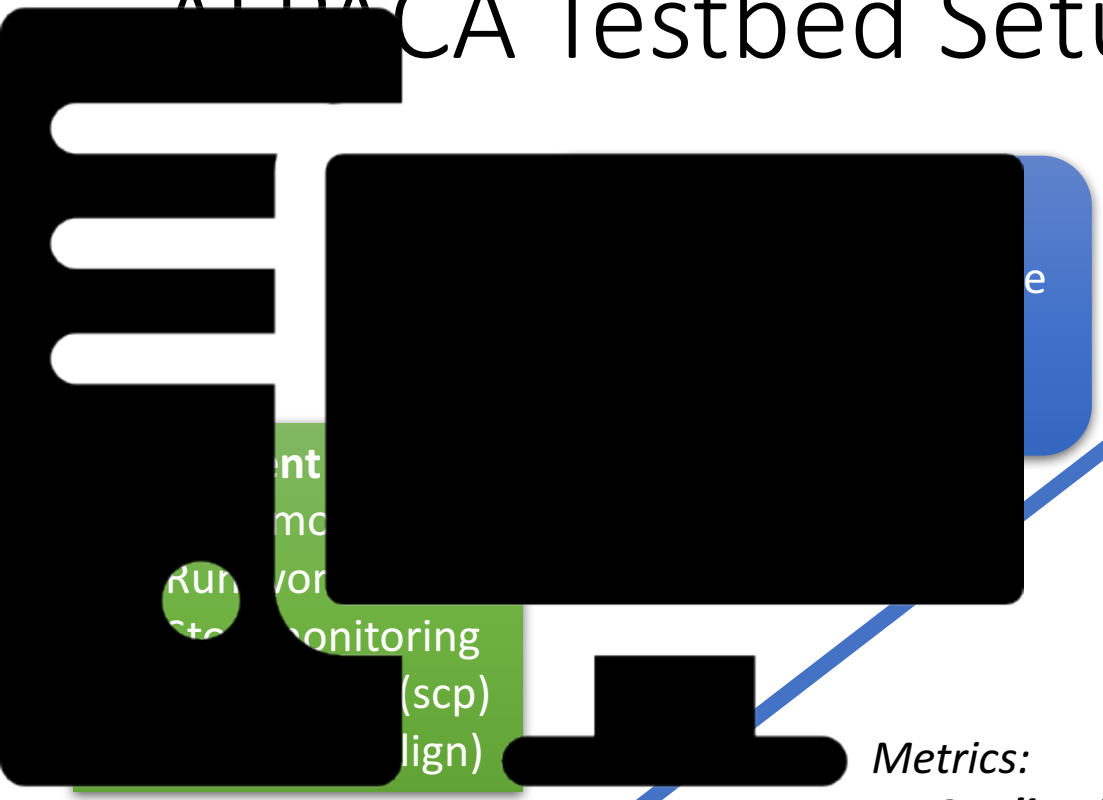
Opening Thought

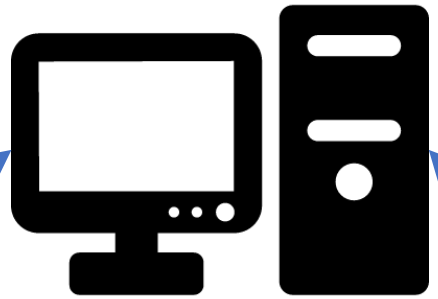
We are “Distributed System” Research Group…

… so we theoretically should do research on Distributed Systems…

... but who evaluated his/her solution in a **real** **distributed** testbed?

ALPACA Testbed Setup

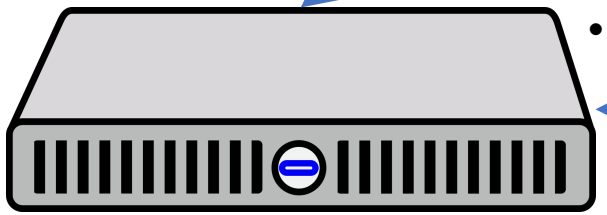


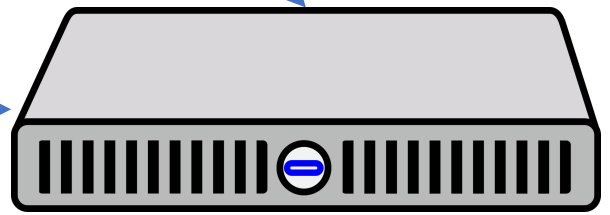


Controller
- Controls experiments
- Hosts ALPACA controller
- Analyses results

Metrics:
- ***Power budget***
- ***Power consumption***
- *Application config*

Metrics:
- ***Application performance***
- *Application workload*





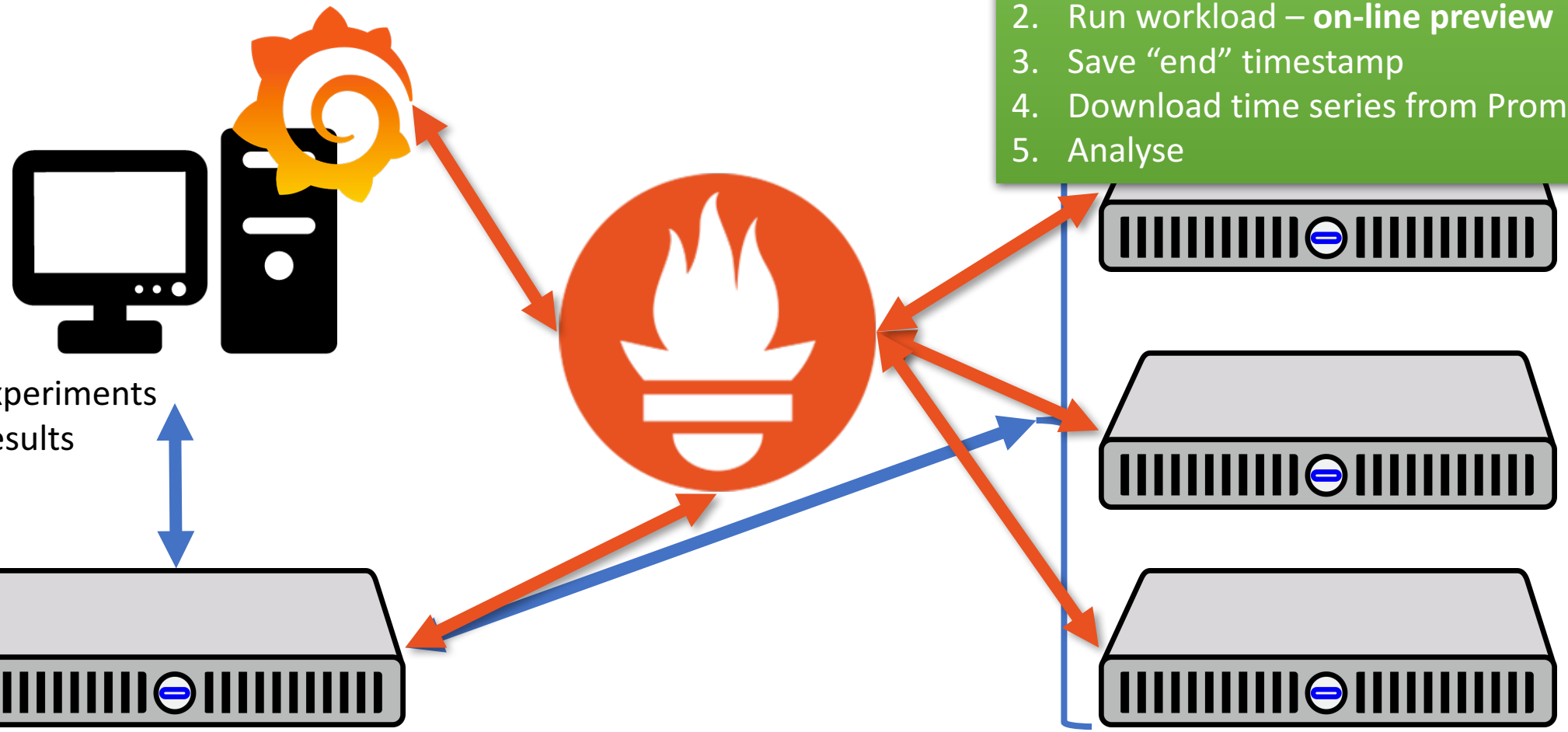
Workload Generator
- Sends application requests
- Monitors application performance

Host
- Hosts applications

Power Shepherd Testbed Setup

Experiment protocol

0. *Deploy monitoring framework*
1. Save “start” timestamp
2. Run workload – **on-line preview**
3. Save “end” timestamp
4. Download time series from Prometheus
5. Analyse



Controller

- Controls experiments
- Analyses results

Workload Generator

- Sends application requests
- Monitors application performance

Cluster Controller

Host

- Hosts applications
- ALPACA controllers

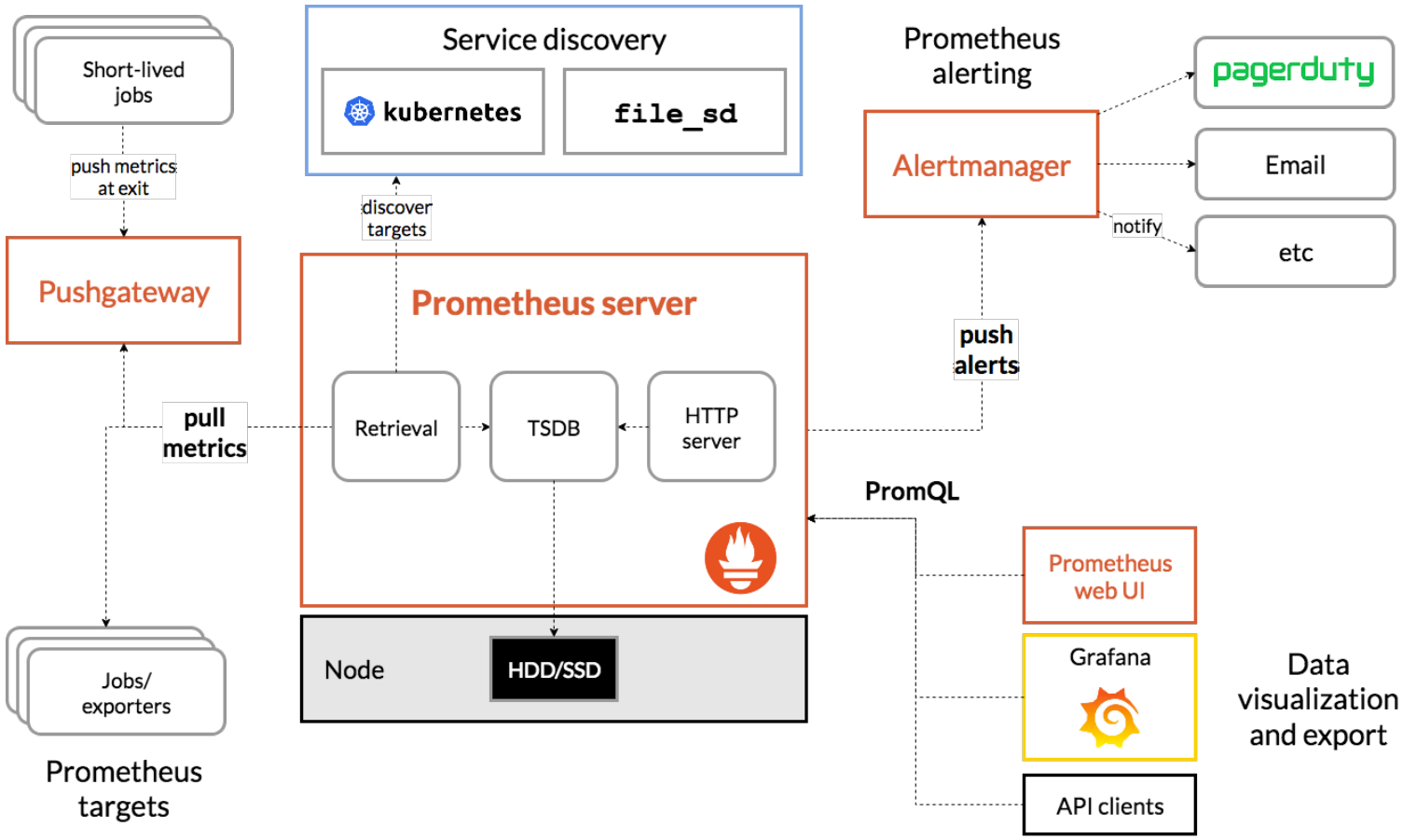
Prometheus

- an open-source systems **monitoring and alerting toolkit**
- originally built at SoundCloud*
- started in 2012, public release in 2015
- has a very active developer and user community
- is now a standalone open source project and maintained independently of any company
- joined the Cloud Native Computing Foundation in 2016

CLOUD NATIVE
COMPUTING FOUNDATION

* started by Matt T. Proud before he joined SoundCloud

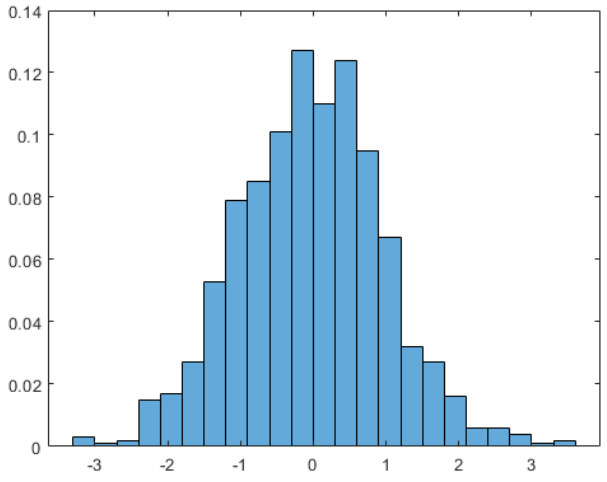
Architecture

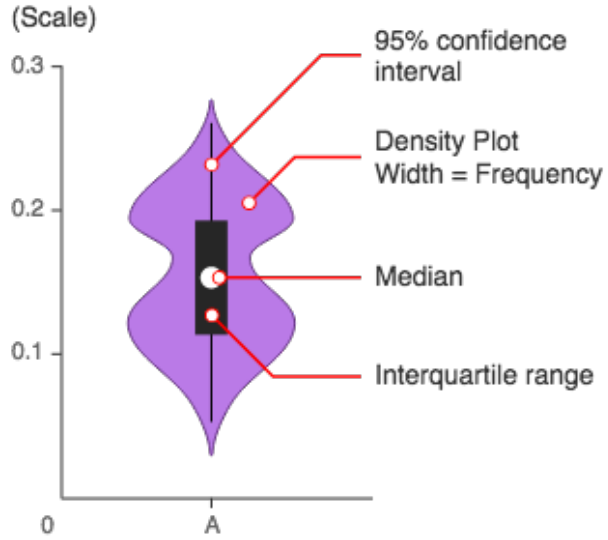


Data Model

- Prometheus fundamentally stores all data as time series
- Metric names and labels
  - Every time series is uniquely identified by its *metric name* and a set of *key-value pairs*, also known as *labels*
- Samples
  - Samples form the actual time series data
    Each sample consists of:
    - a float64 value
    - a millisecond-precision timestamp

Metric Types





Counter **Gauge** **Histogram** **Summary**

* “Currently only differentiated in the client libraries, Prometheus server does not yet make use of the type information and flattens all data into untyped time series. This may change in the future.”

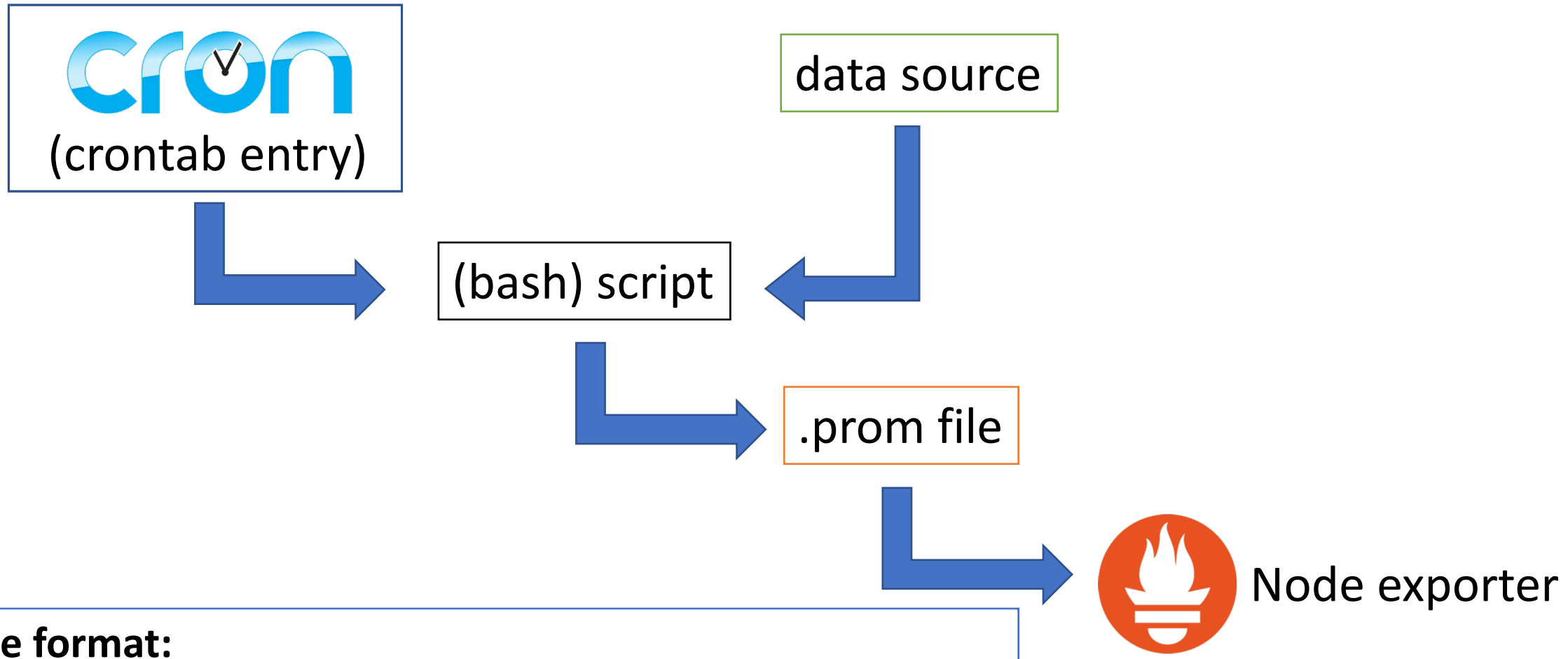
Jobs and Instances

- *“Google-like” terminology*
- an endpoint you can scrape is called an *instance*, usually corresponding to a single process
- a collection of instances with the same purpose, a process replicated for scalability or reliability for example, is called a *job*

Exposing Metrics to Prometheus

- Third-party exporters (indirect)
  - Databases
  - Hardware related – e.g., **Node exporter**
  - Messaging systems
  - Storage
  - HTTP – e.g. Apache, HAProxy
  - APIs
  - Logging
  - Other monitoring systems
  - Miscellaneous - Xen
- Software exposing Prometheus metrics
  - Collectd
  - Docker Daemon
  - Kubernetes
- Client libraries (direct instrumentation)
  - Go
  - Java or Scala
  - Python
  - Ruby
  - and other …

Textfile Collector + cron

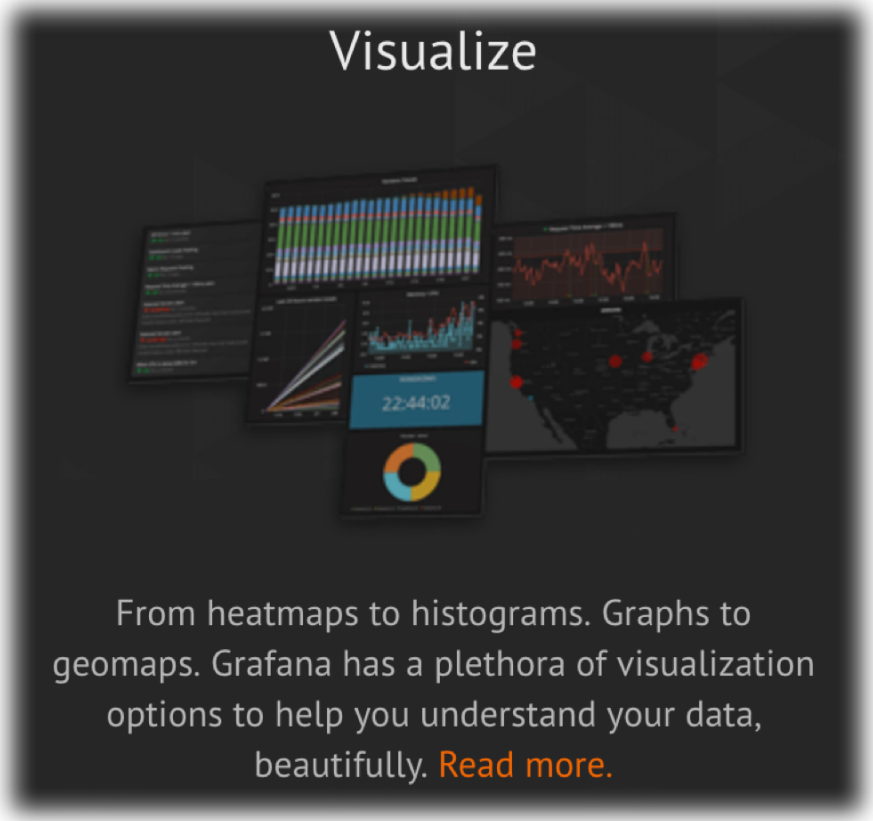


.prom file format:
metric_name {label_name="label_value", …} value [timestamp]

Grafana

“The analytics platform for all your metrics

Grafana allows you to **query**, **visualize**, alert on and understand your metrics no matter where they are stored. Create, explore, and share dashboards with your team and foster a data driven culture.”



- hundreds of dashboards and plugins in the official library
- open source: https://github.com/grafana/grafana
- Grafana includes built-in support for Prometheus

“They were connecting to Prometheus BEFORE it was cool.”

Deployment Options

- Deploy directly on your machines
  - Prometheus
  - Grafana
  - Node Exporter
- Use **Swarmprom** - a starter kit for Docker Swarm monitoring
  - Very easy to deploy
  - Requires all the machines to be part of Docker Swarm
  - Still capable of monitoring things outside of Docker
  - https://github.com/stefanprodan/swarmprom

Exporting Data

- **Styx**
  - Export Prometheus data as CSV or directly plot with gnuplot & matplotlib
  - https://github.com/go-pluto/styx
  - https://promcon.io/2017-munich/slides/lightning-talks-day1-06.pdf
  - *Didn't manage to make it work…*
- **My own script**
  - Download data using API (JSONformat)
  - Convert to CSV (using **jq** - https://stedolan.github.io/jq/)

Alternatives

- Kapacitor + InfluxDB
  - similar scope
  - supports event logging
  - open-core model

- Graphite
  - scope: time series data base

- OpenTSDB
  - a distributed time series database based on Hadoop and HBase

- Nagios
  - primarily about alerting based on the exit codes of scripts

Monitoring Agents Comparative Study

https://wiki.opnfv.org/display/fastpath/Monitoring+Agents+Comparative+Study

Conclusions

- Use monitoring “external” to your solution - Prometheus can help with that!

- We can create a common library for monitoring our testbed experiments!