Intro to Prometheus

With a dash of operations & observability

Richard Hartmann & Frederic Branczyk
@TwitchiH & @fredbrancz

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Who are we?

- Richard ”RichiH” Hartmann
  - Swiss army chainsaw at SpaceNet
  - Project lead for building one of the most modern datacenters in Europe
  - Debian Developer
  - FOSDEM, DebConf, DENOGx, PromCon staff
  - Prometheus team member
- Frederic Branczyk
  - Red Hat (previously CoreOS)
  - All things Prometheus / Kubernetes
  - Kubernetes SIG-Instrumentation lead
  - Prometheus team member

Time split

1. 1/3 Prometheus
2. 1/3 Observability
3. 1/3 Questions

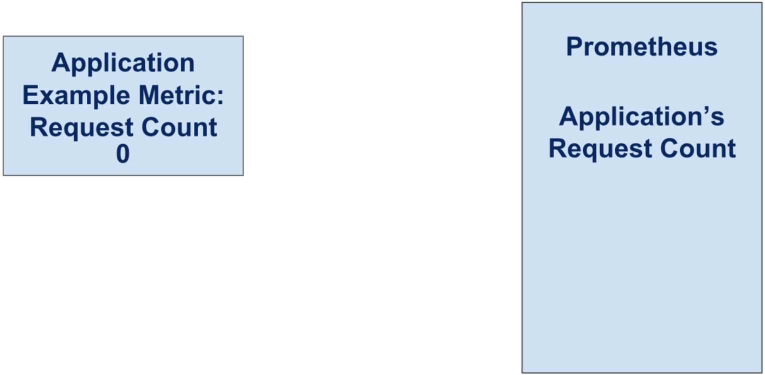
Show of hands

- Who has heard of Prometheus?
- Who is considering to use Prometheus?
- Who is POCing Prometheus?
- Who uses Prometheus in production?

Prometheus 101

- Inspired by Google's Borgmon
- Time series database
- unit64 millisecond timestamp, float64 value
- Instrumentation & exporters
- Not for event logging
- Dashboarding via Grafana

Generating, scraping, and persisting times series

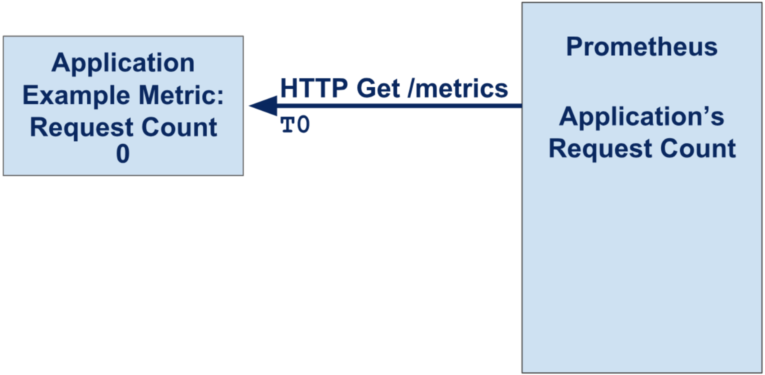


Application
Example Metric:
Request Count
0

Prometheus

Application's
Request Count

Generating, scraping, and persisting times series



Application
Example Metric:
Request Count
0

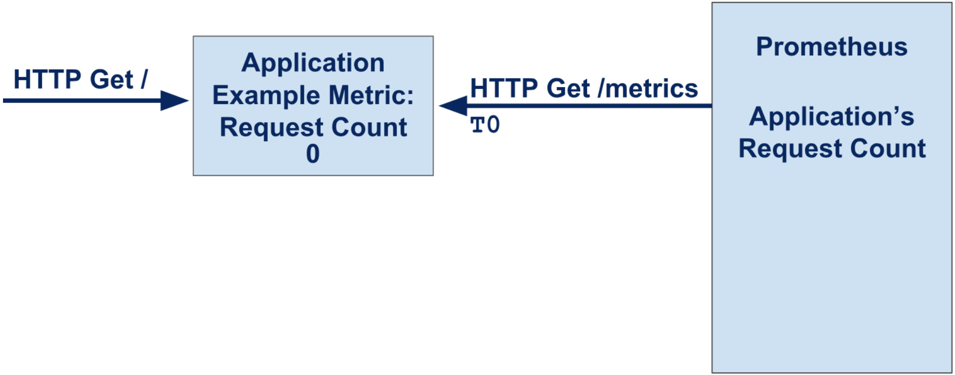
HTTP Get /metrics

T0

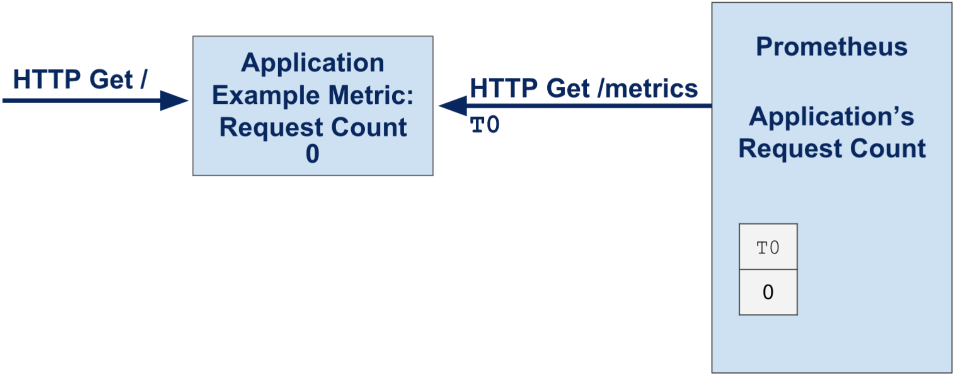
Prometheus

Application's
Request Count

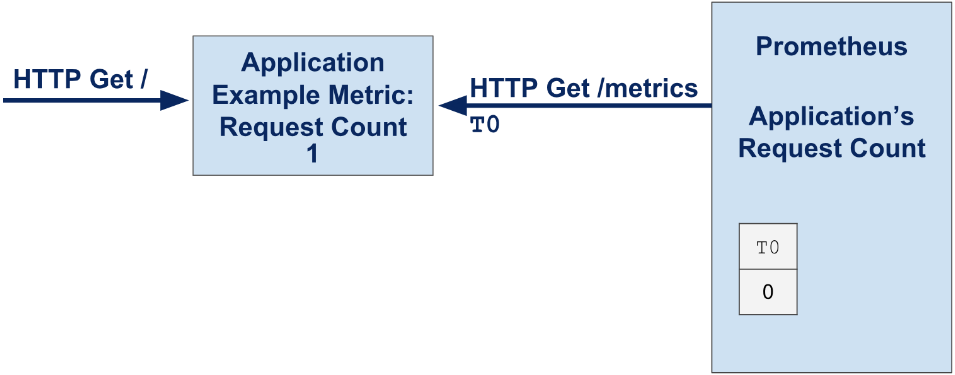
Generating, scraping, and persisting times series



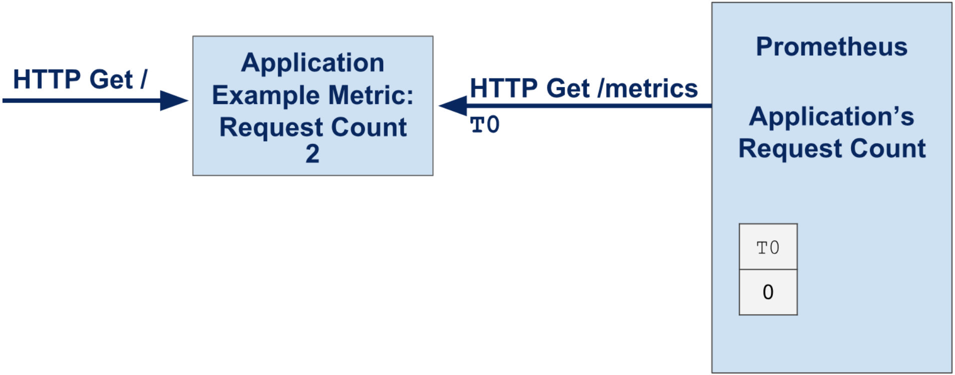
Generating, scraping, and persisting times series



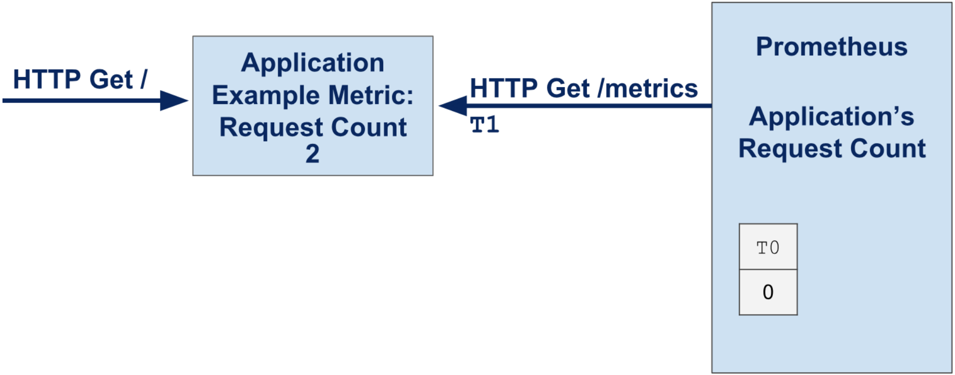
Generating, scraping, and persisting times series



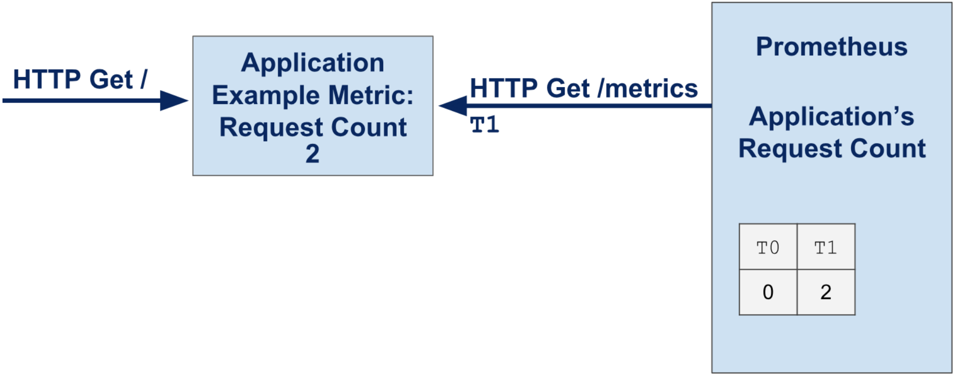
Generating, scraping, and persisting times series



Generating, scraping, and persisting times series



Generating, scraping, and persisting times series



HTTP Get /

Application
Example Metric:
Request Count
2

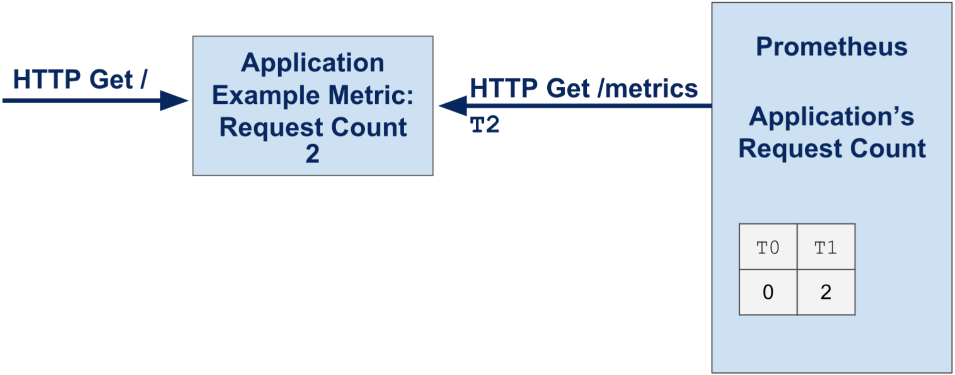
HTTP Get /metrics
T1

Prometheus

Application's
Request Count

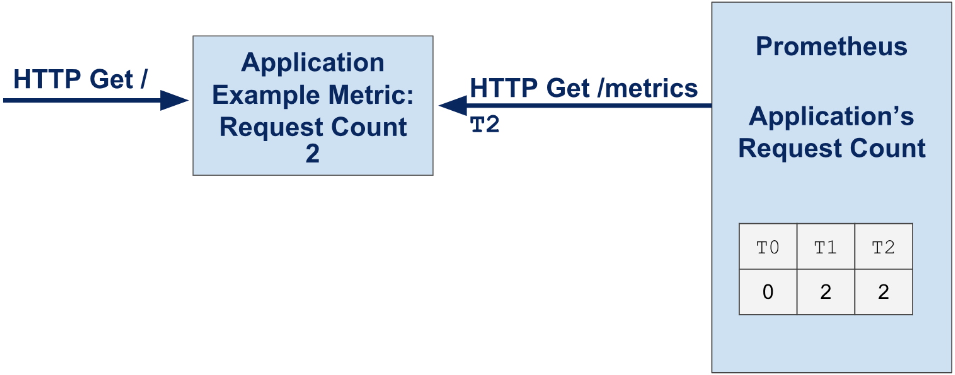
T0	T1
0	2

Generating, scraping, and persisting times series



T0	T1
0	2

Generating, scraping, and persisting times series



HTTP Get /

Application
Example Metric:
Request Count
2

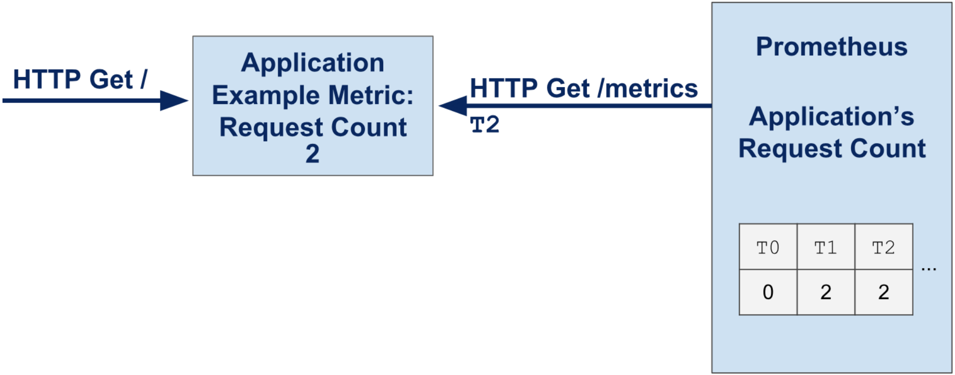
HTTP Get /metrics
T2

Prometheus

Application's
Request Count

T0	T1	T2
0	2	2

Generating, scraping, and persisting times series



T0	T1	T2
0	2	2

Main selling points

- Highly dynamic, built-in service discovery
- No hierarchical model, n-dimensional label set
- PromQL: for processing, graphing, alerting, and export
- Simple operation
- Highly efficient

Working assumptions & concepts

- Prometheus is a pull-based system
- Black-box monitoring: Looking at a service from the outside (Does the server answer to HTTP requests?)
- White-box monitoring: Instrumention code from the inside (How much time does this subroutine take?)
- Every service should have its own metrics endpoint
- Hard API commitments within major versions
- No built-in TLS yet, use reverse proxies for now

Time series

- Time series are recorded values which change over time
- Individual events are usually merged into counters and/or histograms
- Changing values are recorded as gauges
- Typical examples
    - Access rates to a webserver (counter)
    - Temperatures in a datacenter (gauge)

Efficiency

- 1,000,000+ samples/second no problem on currect hardware
- 200,000 samples/second/core
- 16 bytes/sample compressed to 1.36 bytes/sample
- Cheap ingestion & storage means more data for you

Exposition format

```
http_requests_total{env="prod",method="post",code="200"} 1027
http_requests_total{env="prod",method="post",code="400"} 3
http_requests_total{env="prod",method="post",code="500"} 12
http_requests_total{env="prod",method="get",code="200"} 20
http_requests_total{env="test",method="post",code="200"} 372
http_requests_total{env="test",method="post",code="400"} 75
```

PromQL vs SQL

```
avg by(city) (temperature_celsius{country="germany"})

SELECT city, AVG(value) FROM temperature_celsius WHERE \
 country="germany" GROUP BY city

rate(errors{job="foo"}[5m]) / rate(total{job="foo"}[5m])

SELECT errors.job, errors.instance, [...more labels...], \
 rate(errors.value, 5m) / rate(total.value, 5m) \
 FROM errors JOIN total ON [...all label equalities...] \
 WHERE errors.job="foo" AND total.job="foo"
```

Grafana

- Supports dozens of data sources
- Modern UI
- Allows for complex data manipulation and visualization
- Native Prometheus support
- New feature: Interactive exploration of Prometheus data

Toil

”Toil is manual, repeated work with no lasting benefit which scales linearly with your service”

- If teams are busy firefighting, they don’t have time to engineer
- Keep legacy systems working, but have clear path forward
- Keep extra effort on the team low, if possible
- Strive for immediate benefits
- Focus on removing repeated, manual tasks of no lasting benefit
- Show that you free up time and reduce toil

Sanity & sleep

- If it’s not actionable, it’s not an alert
- If it’s not urgent, it’s not an alert
- Important but non-urgent incidents are handled during business hours
- Predict your usage so you add capacity during business hours
- If there’s no playbook, it does not go into production
- If a service does not have proper SLOs and alerts, it does not go into production

Perspective & Incentives

”An engineer can talk for hours about source code; try that with the CEO”

- Managers: revenue, process execution
- Architects: clean design, process definition
- Product/Service owners: Powerful dashboards
- Team leads: morale, quick execution
- Operators: reduce toil, increase sleep

Tell everyone what they need to hear (but never lie)

Post-Mortems

- Mistakes happen
- It is important to learn from mistakes so not to repeat them
- To write a good incident report, there must be no fear of retribution
- Blame-free post-mortems allow everyone to document exactly what went wrong and in what order
- It is important to build trust among the teams and management

Leverage

- One combined system allows for correlation and combination
- Power usage against service load
- Optical networks against outside temperature
- Datacenter power feed load against new deployments
- ...and lots more
- Metrics are the starting point of most observability stories

Oracle

- One source of truth for
  - Tactical overview for current state
  - Dashboards for drill-down
  - Auto-generated PDFs for customers
  - Global SLO statements for sales
  - Usage exports for accounting
- If all you have is a hammer... choose your hammer well

Thanks!

Thanks for listening!

Questions?