

Infrastructure & System Monitoring

using Prometheus

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Goal

Learn how to monitor your infrastructure, systems and applications.

Agenda

- Monitoring
 - Introducing you to a Scary Movie
- Prometheus overview (demo's)
 - Running Prometheus
 - Gathering host metrics
 - Introducing Grafana
 - Monitoring Docker containers
 - Alerting
 - Instrumenting your own code
 - Service Discovery (Consul) integration

..Quick Inventory..

I am going to introduce
you to some bad movies









JURASSIC SHARK





Commonality
between
these movies?

Monitoring

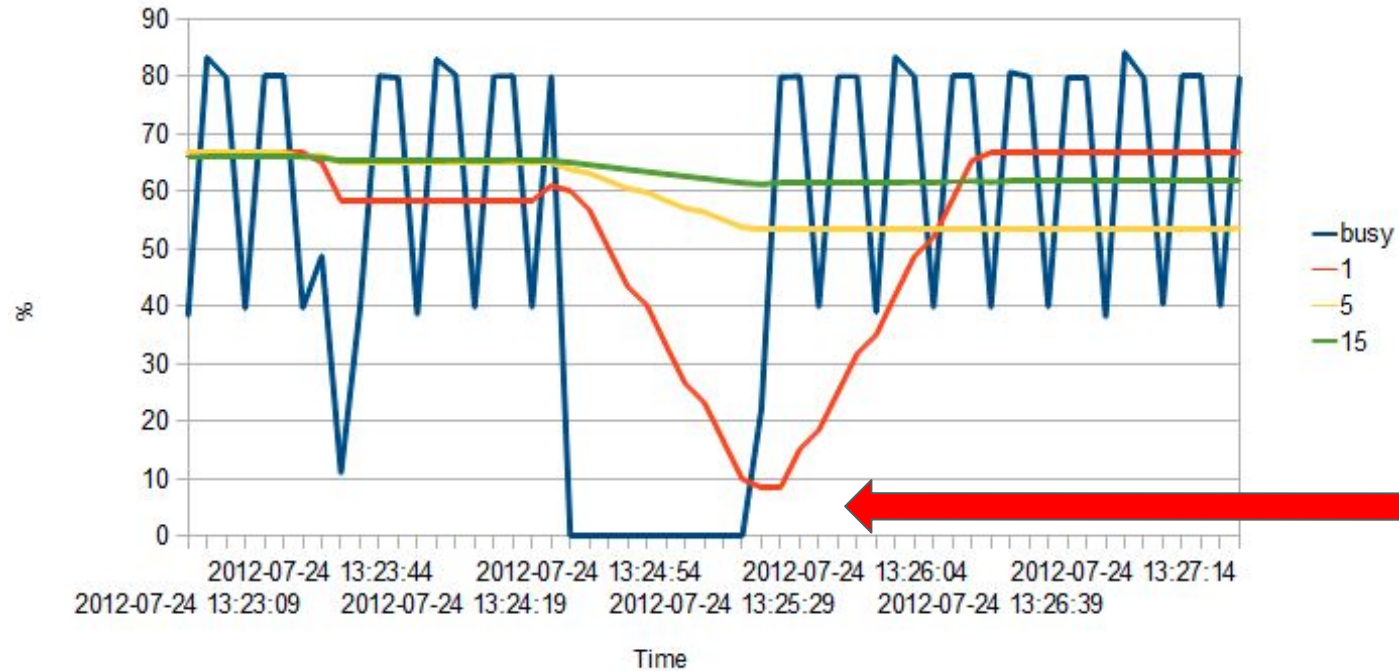


Our scary movie “The Happy Developer”

- Let's push out features
- I can demo so it works :)
- It works with 1 user, so it will work with multiple
- Don't worry about performance we will just scale using multiple machines/processes
- Logging is into place



Disaster Strikes



Did
anyone
notice?

Logging != Monitoring

Logging

“recording to diagnose a system”

```
127.0.0.1 - frank [10/Oct/2000:13:55:36 -0700] "GET /apache_pb.gif HTTP/1.0" 200 2326
```

Monitoring

“observation, checking and recording”

```
http_requests_total{method="post",code="200"} 1027 1395066363000
```

Vital Signs

14:21

Unit:

HR
bpm

200
90

154
(bpm)

NIBP
mmHg

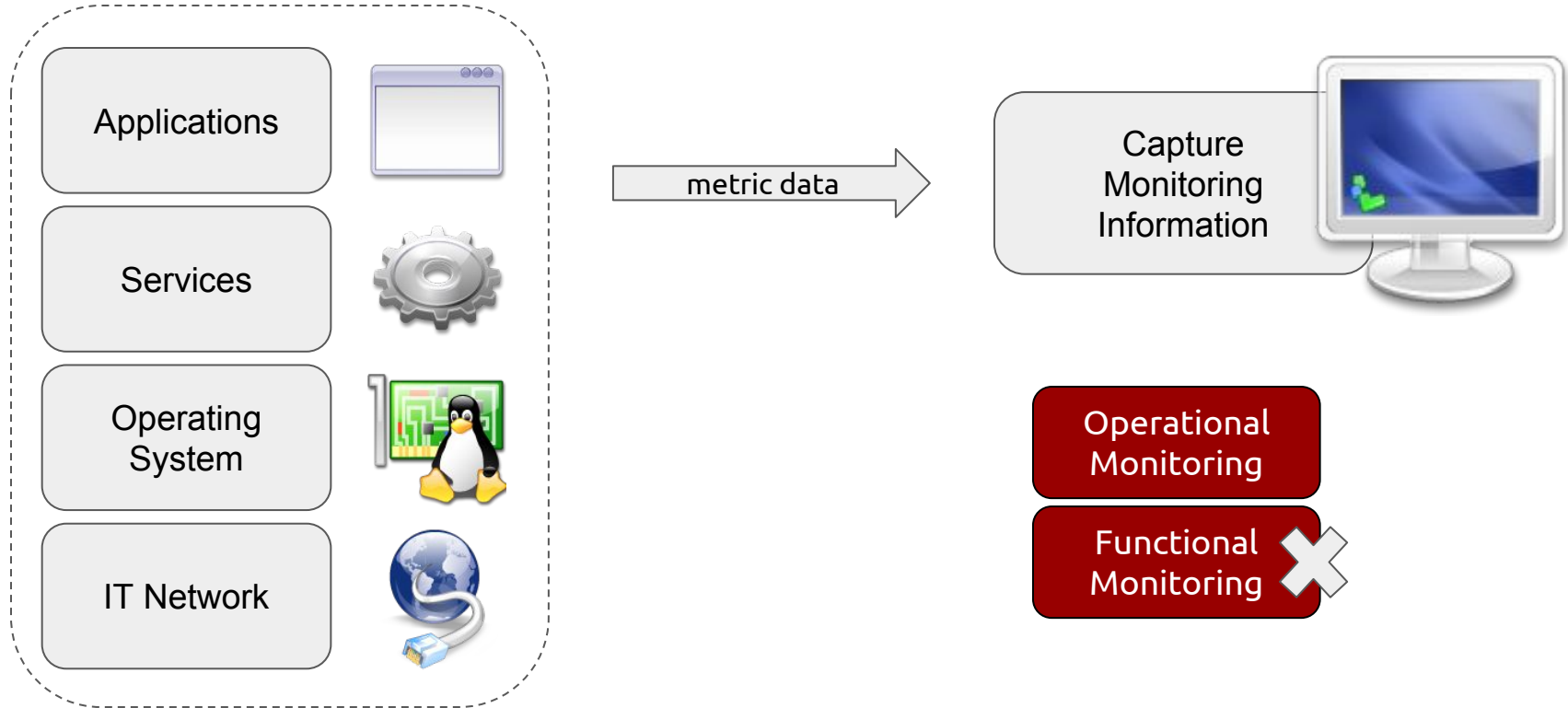
suff: 0

Why Monitoring?

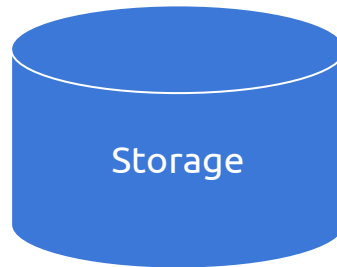
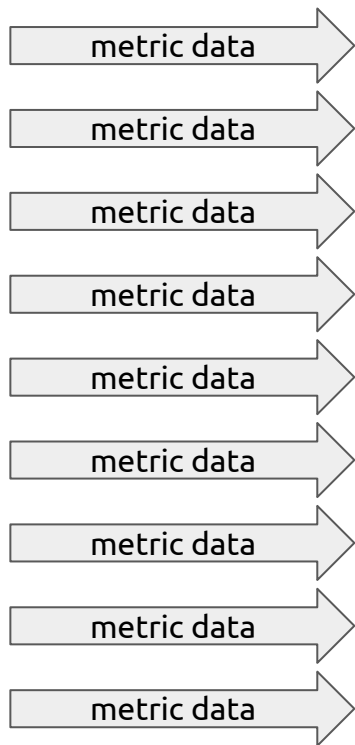
- Know when things go wrong
 - Detection & Alerting
- Be able to debug and gain insight
- Detect changes over time and drive technical/business decisions
- Feed into other systems/processes (e.g. security, automation)



What to monitor?



Houston we have Storage problem!



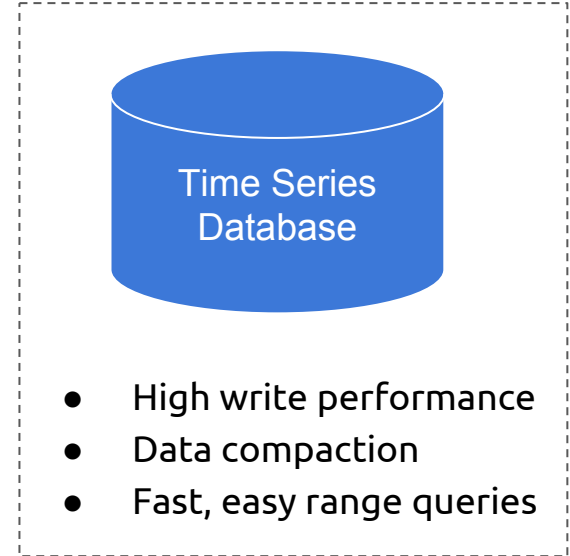
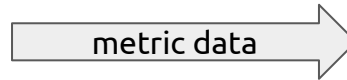
How to store the mass amount of metrics and also making them easy to query?

Time Series - Database

- Time series data is a sequence of data points collected at regular intervals over a period of time. (metrics)

- Examples:

- Device data
- Weather data
- Stock prices
- Tide measurements
- Solar flare tracking



- The data requires aggregation and analysis

Time Series - Data format

metric name and a set of key-value pairs, also known as labels



































`<metric name>{<label name>=<label value>, ...} value [timestamp]`



`http_requests_total{method="post",code="200"} 1027 1395066363000`

23 systems in ranking, May 2018

Rank			DBMS	Database Model	Score		
May 2018	Apr 2018	May 2017			May 2018	Apr 2018	May 2017
1.	1.	1.	InfluxDB 	Time Series DBMS	11.00	+0.24	+3.05
2.	2.	 5.	Kdb+ 	Multi-model 	3.07	-0.01	+1.50
3.	3.	 2.	RRDtool	Time Series DBMS	2.68	-0.07	-0.34
4.	4.	 3.	Graphite	Time Series DBMS	2.26	+0.07	+0.25
5.	5.	 4.	OpenTSDB	Time Series DBMS	1.62	-0.08	-0.05
6.	 7.	 8.	Prometheus	Time Series DBMS	1.12	+0.07	+0.64
7.	 6.	 6.	Druid	Time Series DBMS	1.01	-0.05	+0.07
8.	8.	 7.	KairosDB	Time Series DBMS	0.43	-0.01	-0.08
9.	9.	9.	eXtremeDB 	Multi-model 	0.31	-0.01	-0.02
10.	10.	 11.	Riak TS	Time Series DBMS	0.27	-0.00	+0.06
11.	11.	 19.	Hawkular Metrics	Time Series DBMS	0.11	+0.00	+0.11
12.	12.	 18.	Blueflood	Time Series DBMS	0.10	+0.00	+0.07
13.	 15.	 10.	Axibase	Time Series DBMS	0.05	+0.02	-0.16
14.	 18.	 12.	Warp 10	Time Series DBMS	0.04	+0.01	-0.15
15.	 16.		TimescaleDB	Time Series DBMS	0.04	+0.01	
16.	 17.	 13.	TempoIQ	Time Series DBMS	0.02	-0.00	-0.13
17.	 13.	 15.	Machbase 	Time Series DBMS	0.01	-0.07	-0.04
18.	 19.	 17.	Heroic	Time Series DBMS	0.00	±0.00	-0.03
18.	 19.		IRONdb	Time Series DBMS	0.00	±0.00	
18.	 19.	 19.	Newts	Time Series DBMS	0.00	±0.00	±0.00

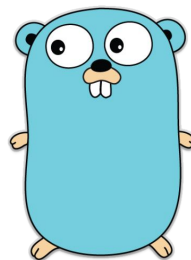
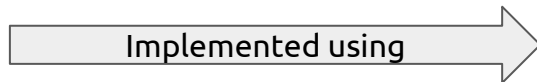
<http://db-engines.com/en/ranking/time+series+dbms>

Prometheus Overview

Prometheus

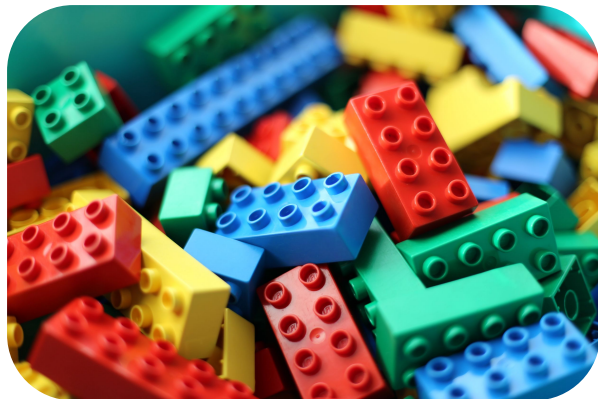
Prometheus is an open-source systems monitoring and alerting toolkit originally built at SoundCloud. It is now a standalone open source project and maintained independently of any company.

<https://prometheus.io>

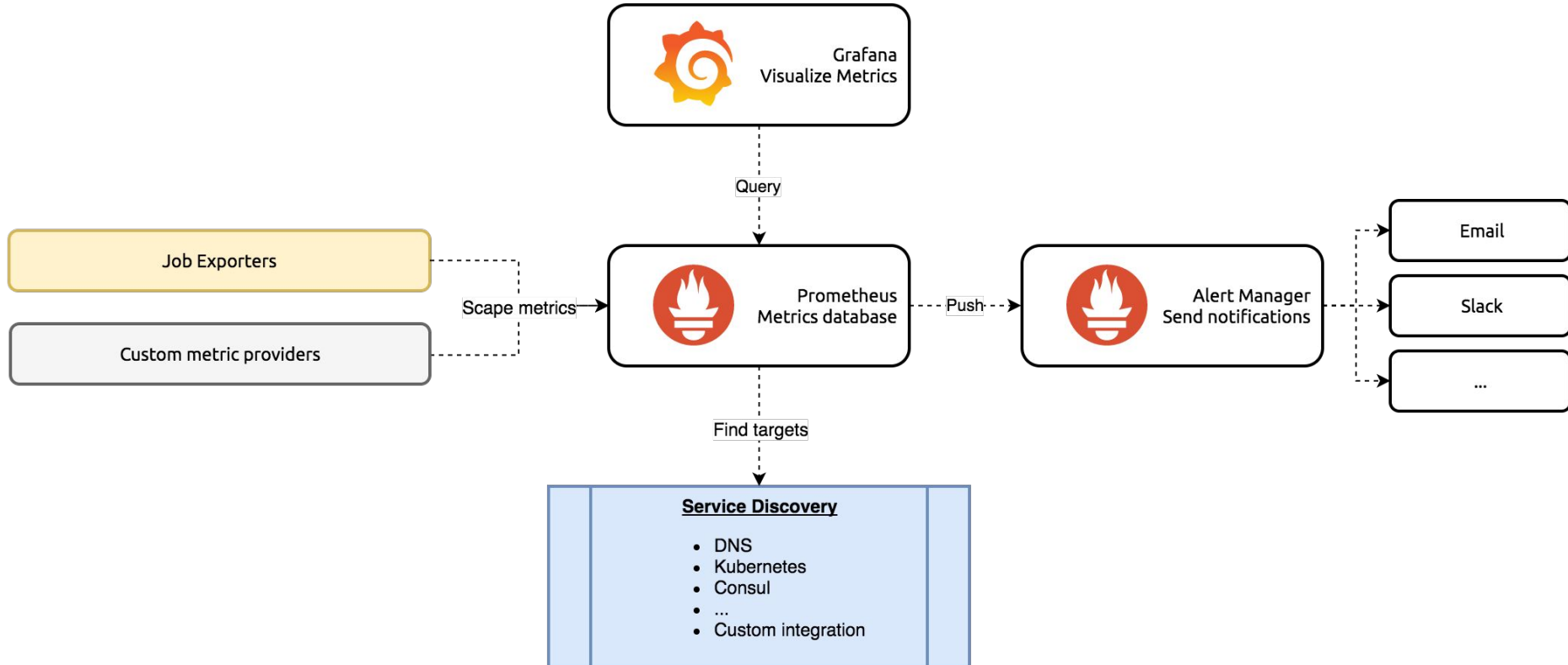


Prometheus Components

- The main [Prometheus server](#) which scrapes and stores time series data
- [Client libraries](#) for instrumenting application code
- A [push gateway](#) for supporting short-lived jobs
- Special-purpose [exporters](#) (for HAProxy, StatsD, Graphite, etc.)
- An [alertmanager](#)
- Various support tools
- WhiteBox Monitoring instead of probing [aka BlackBox Monitoring]



Prometheus Overview



List of Job Exporters

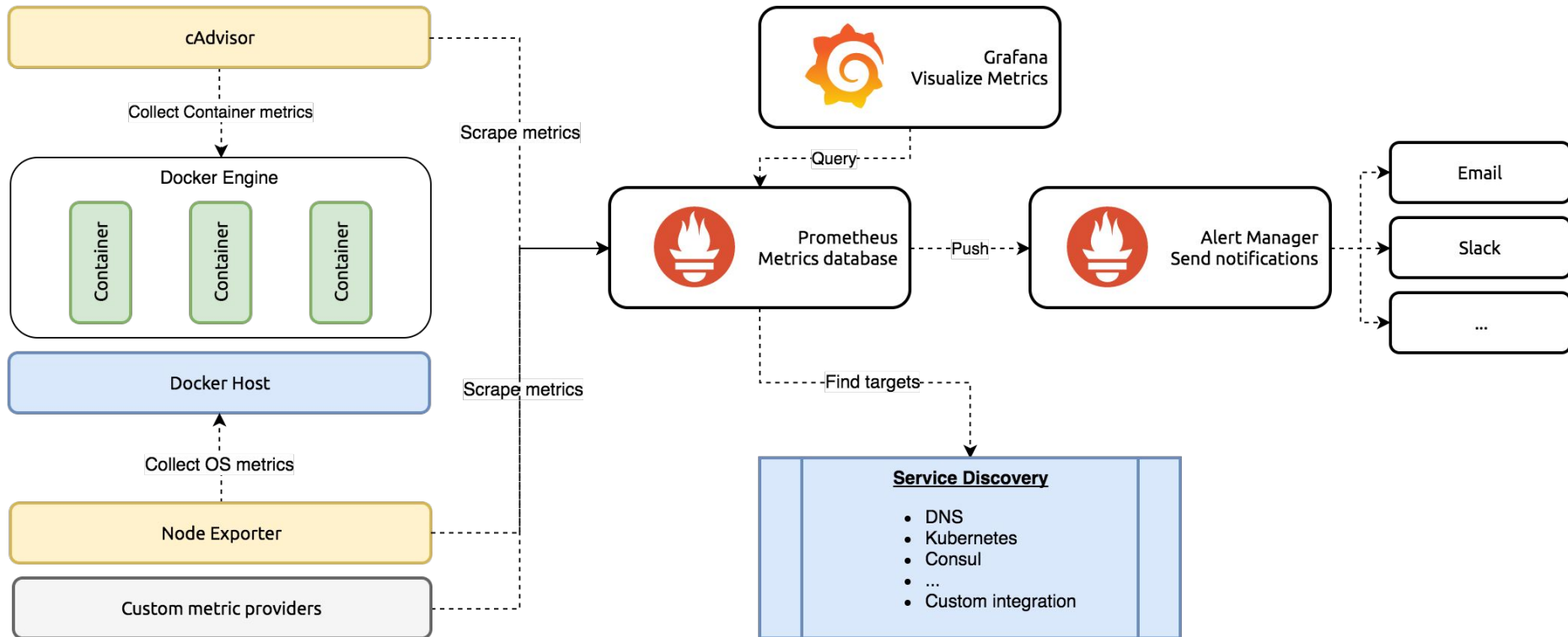
- Prometheus managed:

- JMX
- Node
- Graphite
- Blackbox
- SNMP
- HAProxy
- Consul
- Memcached
- AWS Cloudwatch
- InfluxDB
- StatsD
- ...

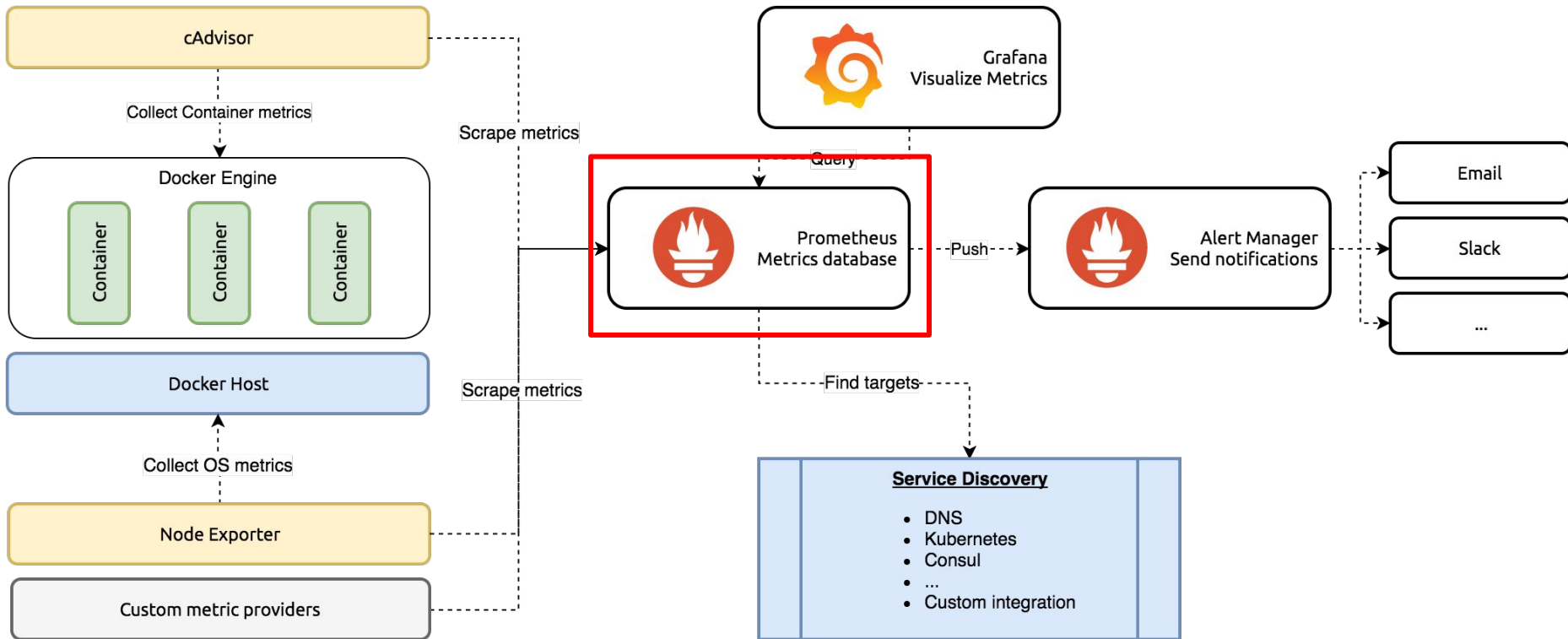
- Custom ones:

- Database
- Hardware related
- Messaging systems
- Storage
- HTTP
- APIs
- Logging
- ...

Demo Structure



Demo: Run Prometheus (native)



```
# file: prometheus.yml
```

```
global:
```

```
  scrape_interval:    15s # Set the scrape interval to every 15 seconds. Default is every 1 minute.
```

```
# some settings intentionally removed!!
```

```
# 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'
```

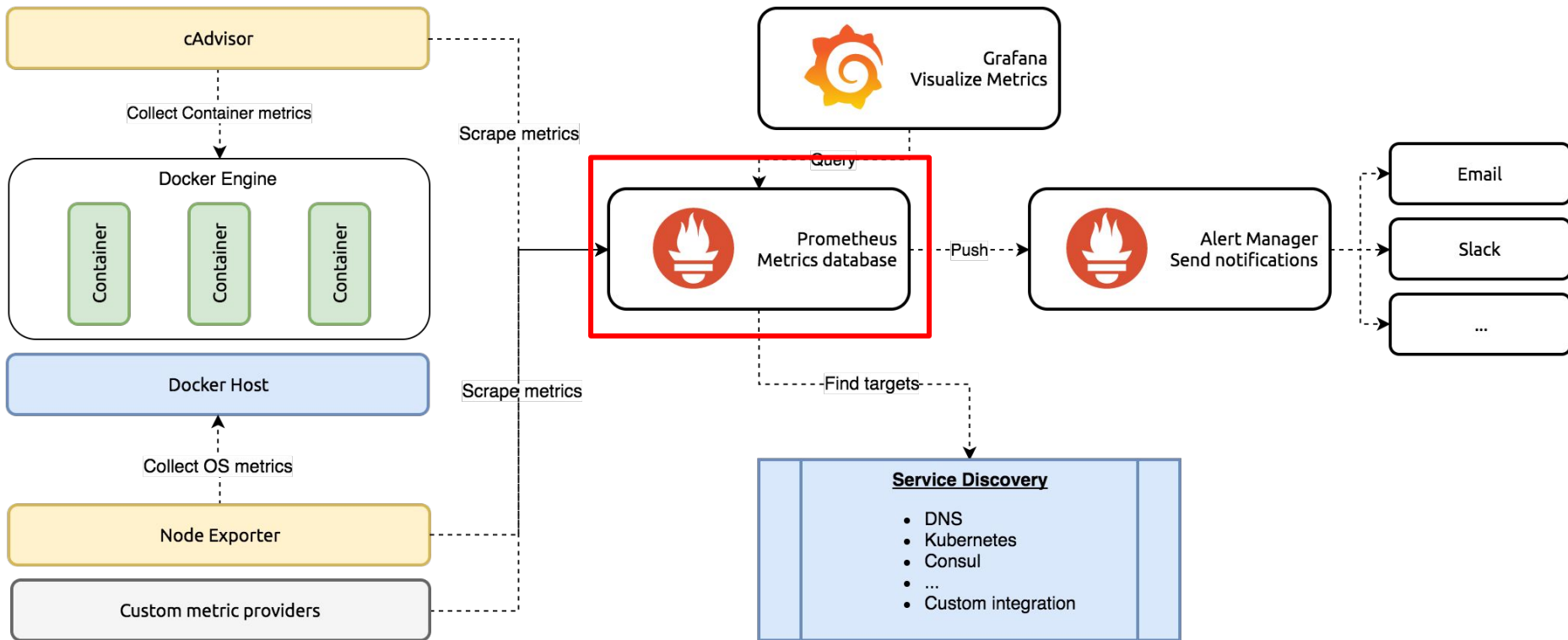
```
    static_configs:
```

```
      - targets: ['localhost:9090']
```


Code Demo

“Running Prometheus Native”

Demo: Run Prometheus using Docker



```
# file: docker-compose.yml
```

```
version: '3'
```

```
services:
```

```
  prometheus:
```

```
    image: prom/prometheus:latest
```

→ Using official prometheus container

```
    container_name: prometheus
```

→ The container name

```
    ports:
```

```
      - "9090:9090"
```

→ Port mapping used for this container host:container

```
    volumes:
```

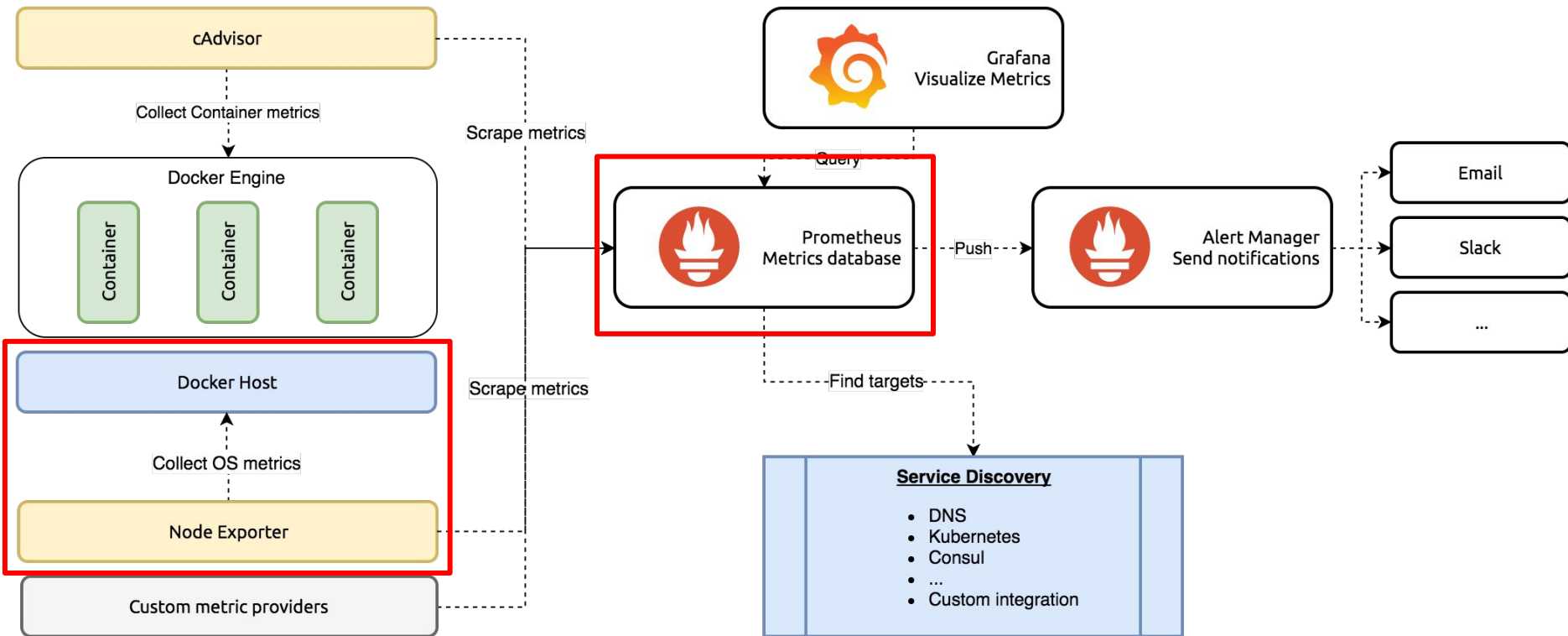
```
      - $PWD:/etc/prometheus/
```

→ Mount local directory used for config

Code Demo

“Running Prometheus Dockerized”

Demo: Add host metrics



```
# file: docker-compose.yml
```

```
version: '3'
```

```
services:
```

```
  prometheus:
```

```
    image: prom/prometheus:latest
```

→ Using official prometheus container

```
    container_name: prometheus
```

→ The container name

```
    ports:
```

```
      - "9090:9090"
```

→ Port mapping used for this container host:container

```
    volumes:
```

```
      - $PWD:/etc/prometheus/
```

→ Mount local directory used for config

```
  node-exporter:
```

```
    image: prom/node-exporter:latest
```

→ Using node exporter as an additional container

```
    container_name: node-exporter
```

→ The container name

```
    ports:
```

```
      - '9100:9100'
```

→ Port mapping used for this container host:container

```
# file: prometheus.yml
```

```
global:
```

```
  scrape_interval:    15s # Set the scrape interval to every 15 seconds. Default is every 1 minute.
```

```
# some settings intentionally removed!!
```

```
# 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'
```

```
    static_configs:
```

```
      - targets: ['localhost:9090']
```

```
- job_name: 'node-exporter'
```

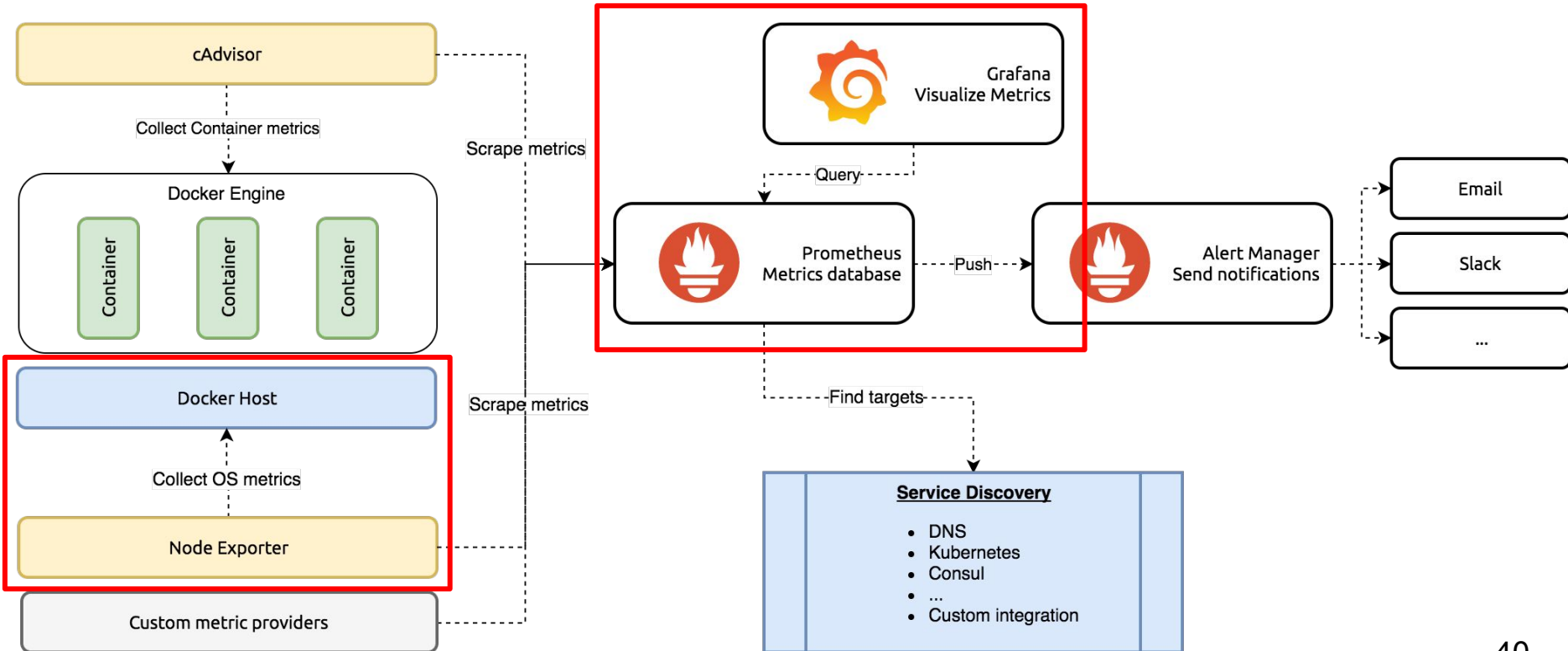
```
  static_configs:
```

```
    - targets: ['node-exporter:9100']
```

Code Demo

“Add host metrics”

Demo: Grafana



You get the idea :)

```
# file: docker-compose.yml
```

```
version: '3'
```

```
services:
```

```
# some code intentionally removed!!
```

```
grafana:
```

```
  image: grafana/grafana:latest
```

→ Using official prometheus container

```
  container_name: grafana
```

→ The container name

```
  ports:
```

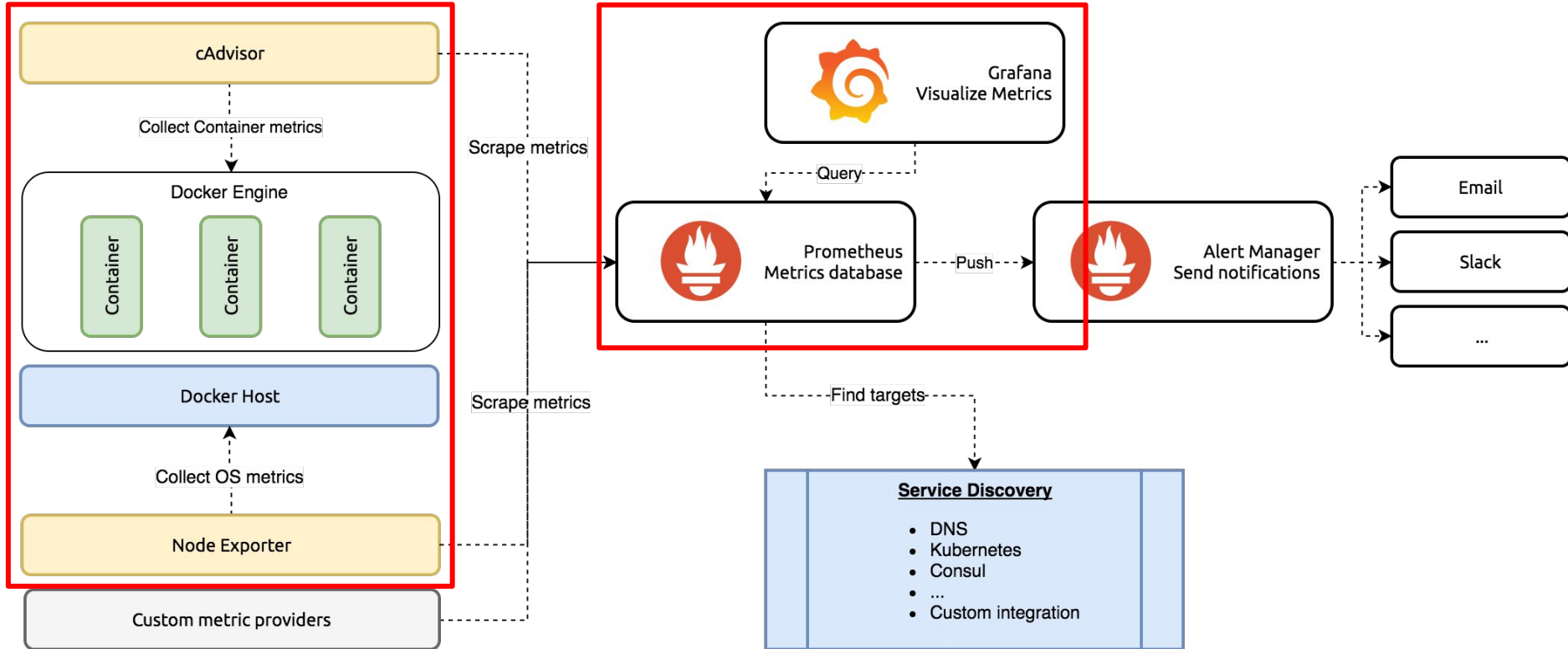
```
    - "3000:3000"
```

→ Port mapping used for this container host:container

Code Demo

“Grafana”

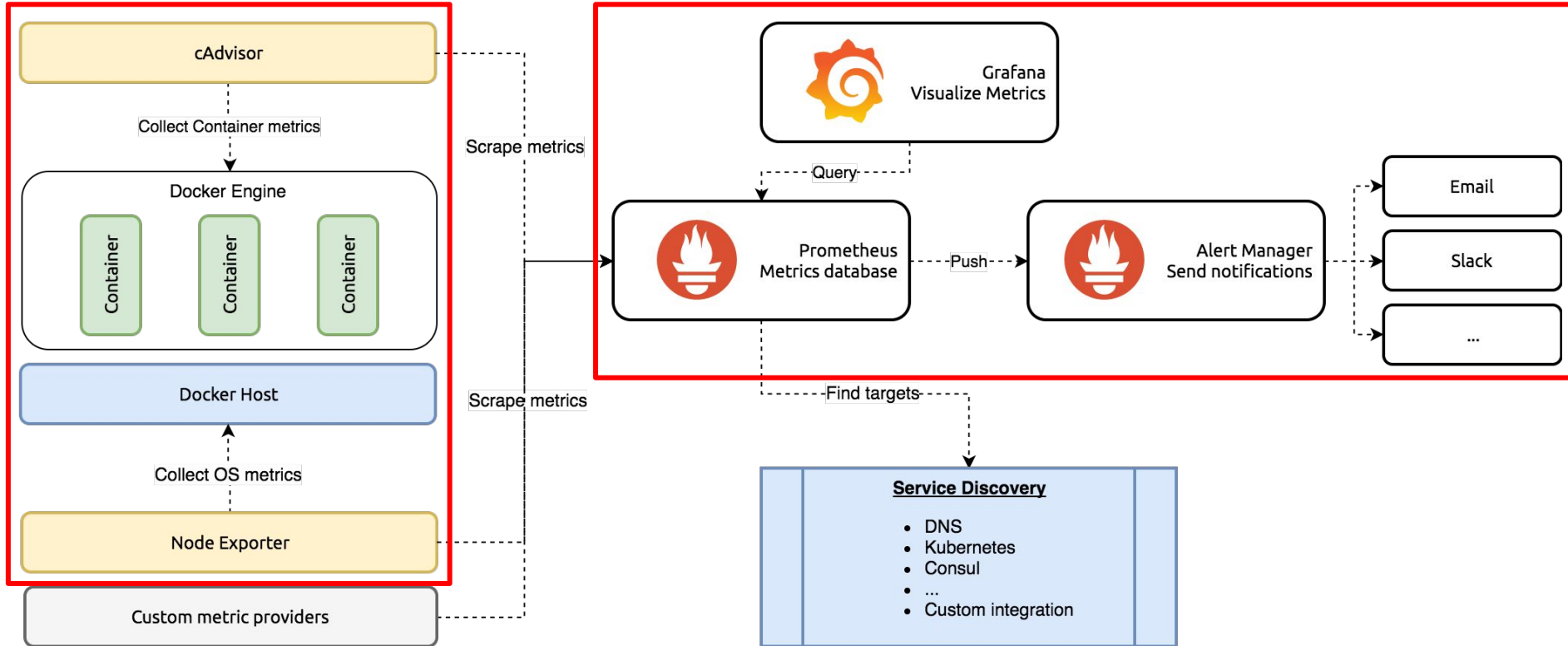
Demo: Monitor Docker containers



Code Demo

“cAdvisor”

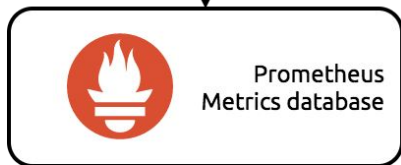
Demo: Alerting



Alerting Configuration

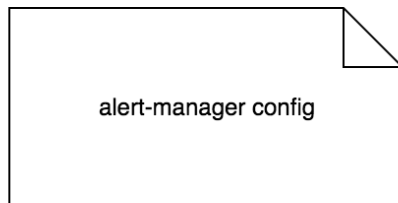
- Alert Rules

- What are the settings where we need to alert upon?

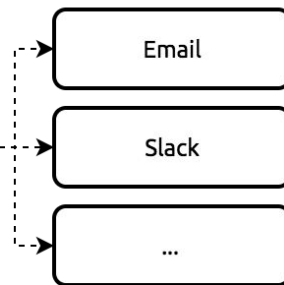


- Alert Manager

- Where do we need to send the alert to?



---Push---



```
# file: alert.rules
```

```
# Alert for ping instance that is unreachable for 5 seconds
```

```
- alert: <service>_instance_down
```

```
expr: absent(container_memory_usage_bytes{name="<service">})
```

```
for: 5s
```

```
labels:
```

```
    severity: critical
```

```
annotations:
```

```
    summary: "Instance {{ $labels.instance }} down"
```

```
    description: "{{ $labels.instance }} of job {{ $labels.job }} has been down for more than 5 seconds."
```

```
# file: alert-manager.yml
```

```
global:
```

→ Global settings

```
smtp_smarthost: 'mailslurper:2500'
```

```
smtp_from: 'alertmanager@example.org'
```

```
smtp_require_tls: false
```

```
route:
```

→ Routing

```
receiver: mail # Fallback
```

→ Fallback is there is no match

```
routes:
```

```
- match:
```

```
  severity: critical
```

→ Match on label!

```
  continue: true
```

→ Continue with other receivers if there is a match

```
  receiver: mail
```

→ Determine the receiver

```
- match:
```

```
  severity: critical
```

```
  receiver: slack
```

```
# file: alert-manager.yml (continued)
```

```
receivers:
```

```
- name: mail → mail receiver
```

```
  email_configs:
```

```
    - send_resolved: true
```

```
      from: 'foo@bar.acme'
```

```
      to: 'please-help@bar.acme'
```

```
- name: slack → slack receiver
```

```
  slack_configs:
```

```
    - send_resolved: true
```

```
      username: 'AlertManager'
```

```
      channel: '#alert'
```

```
      api_url: 'THIS IS A VERY SECRET URL :)'
```

```
# file: prometheus.yml
```

```
global:
```

```
  scrape_interval:    15s # Set the scrape interval to every 15 seconds. Default is every 1 minute.
```

```
# Load rules once and periodically evaluate them according to the global 'evaluation_interval'.
```

```
rule_files:
```

```
  - "alert.rules"
```

```
# some settings intentionally removed!!
```

Code Demo

“Alerting -> The Alert Manager”

Instrumenting your own code!

- **Counter**
 - A cumulative metric that represents a single numerical value that only ever goes up
- **Gauge**
 - Single numerical value that can arbitrarily go up and down
- **Histogram**
 - Samples observations (usually things like request durations or response sizes) and counts them in configurable buckets. It also provides a sum of all observed values
- **Summary**
 - Histogram + total count of observations + sum of all observed values, it calculates configurable quantiles over a sliding time window

Available Languages

- Official
 - Go, Java or Scala, Python, Ruby
- Unofficial
 - Bash, C++, Common Lisp, Elixir, Erlang, Haskell, Lua for Nginx, Lua for Tarantool, .NET / C#, Node.js, PHP, Rust

```
// Spring Boot example -> file: build.gradle
```

```
dependencies {
```

```
    compile('org.springframework.boot:spring-boot-starter-web')
```

```
    testCompile('org.springframework.boot:spring-boot-starter-test')
```

```
    compile('io.prometheus:simpleclient_spring_boot:0.0.21')
```

→ Add dependency

```
}
```

Prometheus Client Libraries: SpringBoot Example

```
@EnablePrometheusEndpoint
```

```
@EnableSpringBootMetricsCollector
```

```
@RestController
```

```
@SpringBootApplication
```

```
public class DemoApplication {
```

```
    public static void main(String[] args) { SpringApplication.run(DemoApplication.class, args); }
```

```
    static final Counter requests = Counter.build()           → create metric type counter
```

```
        .name("helloworld_requests_total")                   → set metric name
```

```
        .help("HelloWorld Total requests.").register();      → register the metric
```

```
@RequestMapping("/helloworld")
```

```
String home() {
```

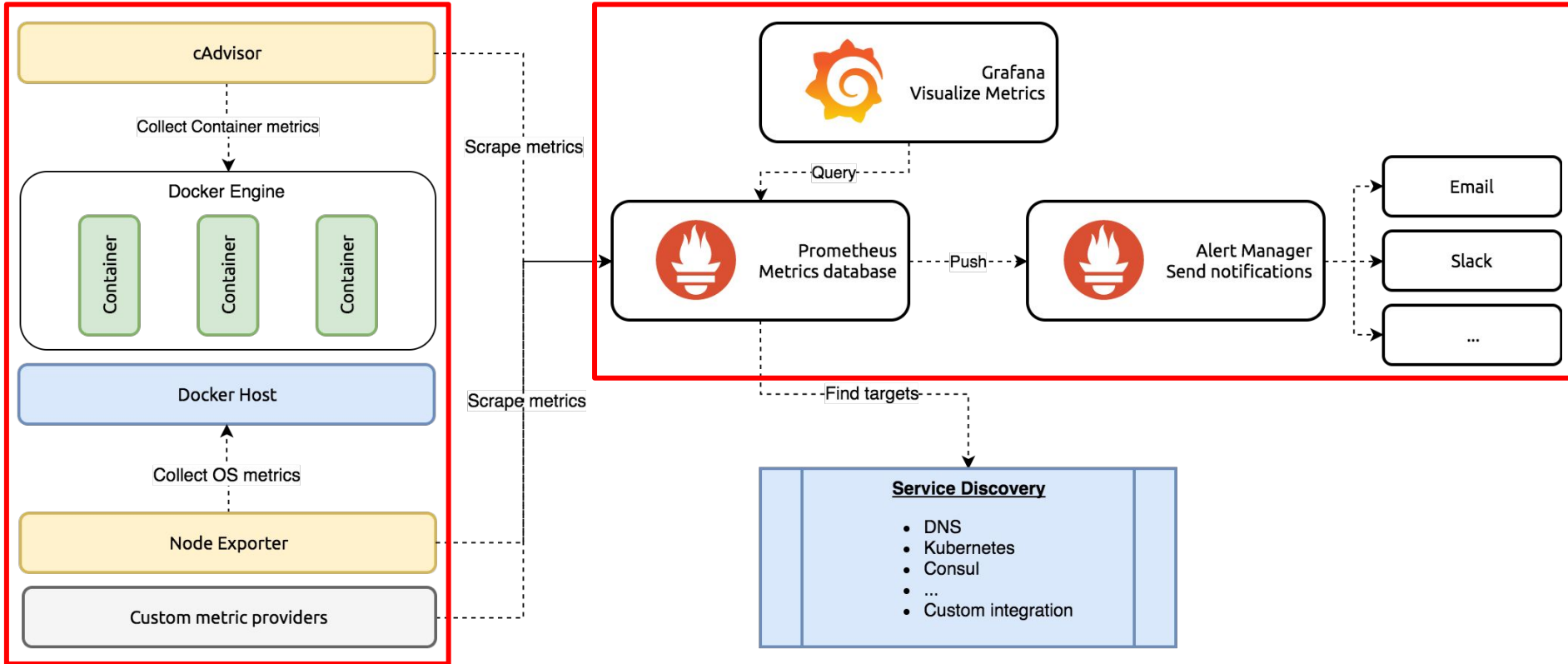
```
    requests.inc();           → increment the counter with 1 (helloworld_requests_total)
```

```
    return "Hello World!";
```

```
}
```

```
}
```

Demo: Application metrics

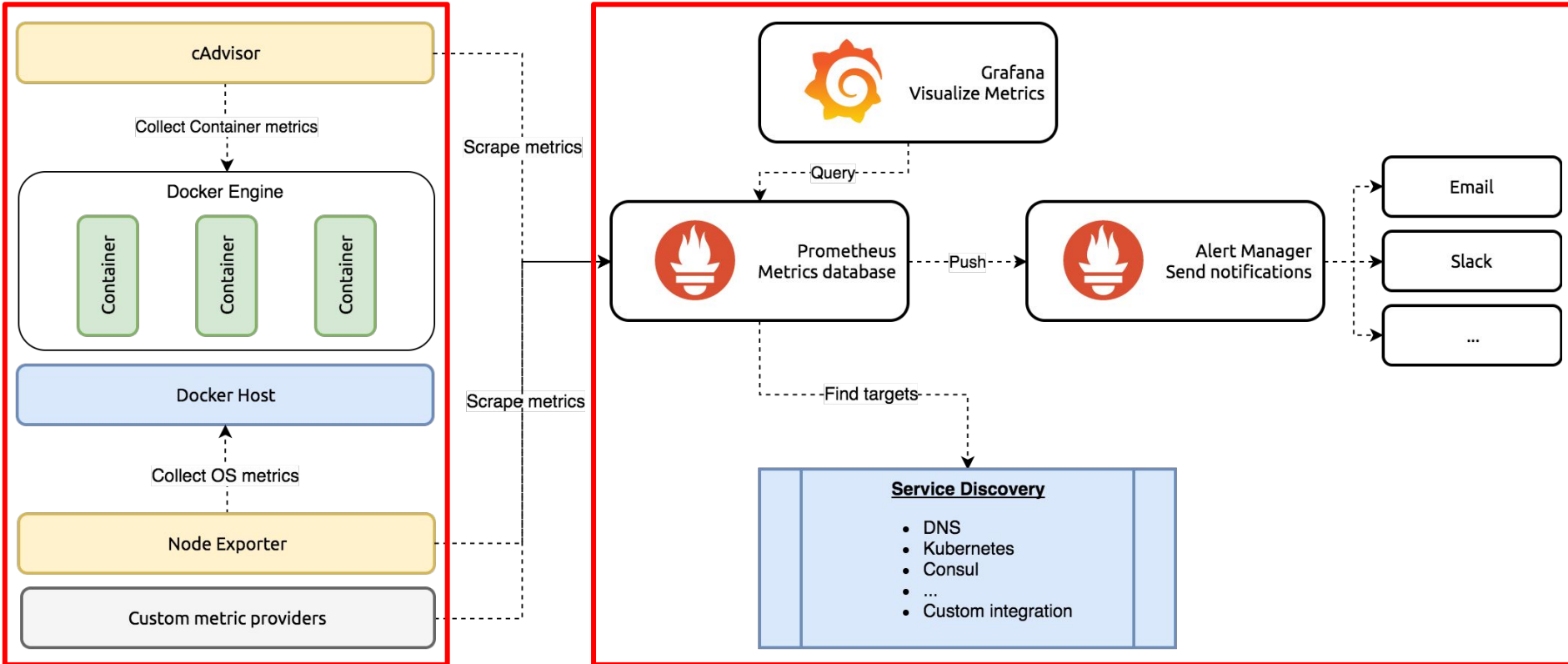


Code Demo

“Application metrics”

Service Discovery (Consul) Integration

Demo: Consul Integration



Service Discovery



SERVICES

NODES

KEY/VALUE

Filter by name

any status

EXPAND

consul

1 passing

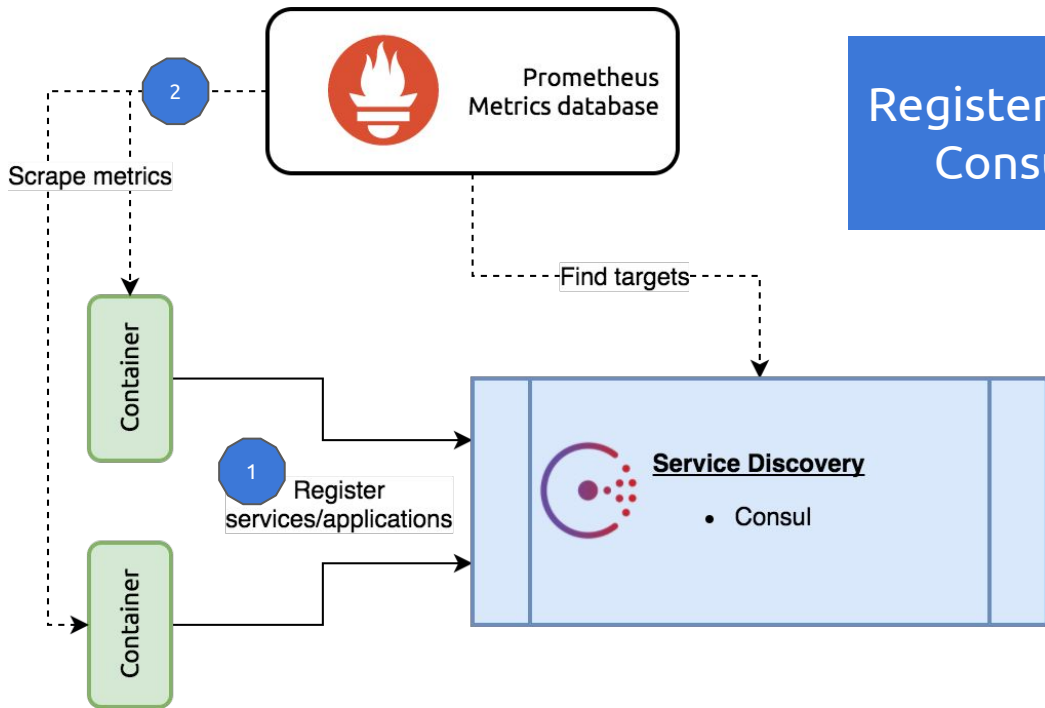
service1

1 failing

service2

1 failing

Demo: Consul integration



Register the services with
Consul and Monitor

Code Demo

“Consul to the rescue”

**I LOVE
BAD MOVIES**
"The Food Issue"
Vol. 6



You stood in line all day to get clean water. Enjoy some delicious Soylent Green with it!



Try serving tasty Soylent Green on a plate—like how food used to be!

**I LOVE
BAD MOVIES**

"The Food Issue"
Vol. 6



...open to be
...ly wealthy,
...at Green
...d soup!

*delicious blend of essays, comics &
ations made from people like you!*



That's a wrap!

Question?

Marco Pas

Philips Research

Software geek, hands on
Developer/Architect/DevOps Engineer

@marcopas