ContainerSolutions

Monitor My Socks

Using Prometheus in a polyglot open source microservices reference architecture

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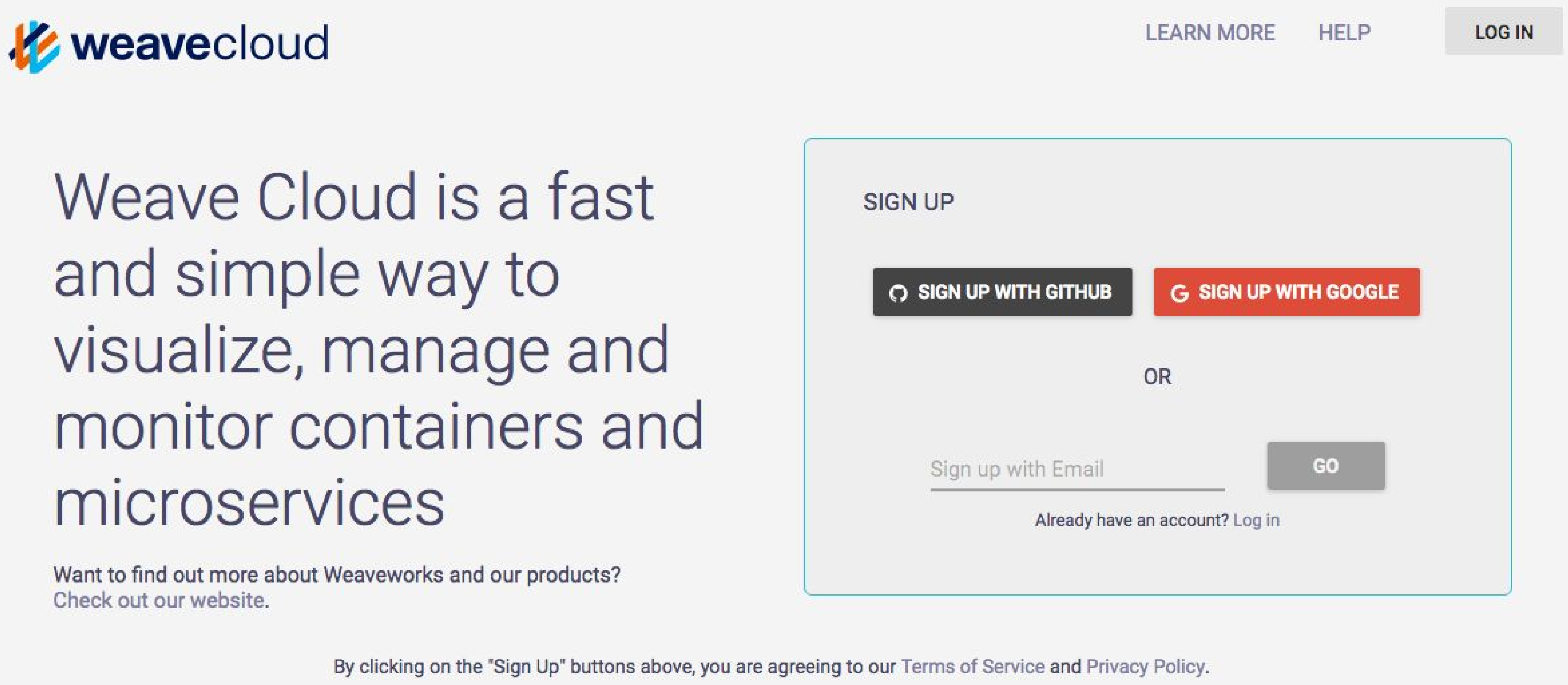
Winder Research

ContainerSolutions

weave~~works~~ socks

How did it come to this?



Weave Cloud is a fast and simple way to visualize, manage and monitor containers and microservices

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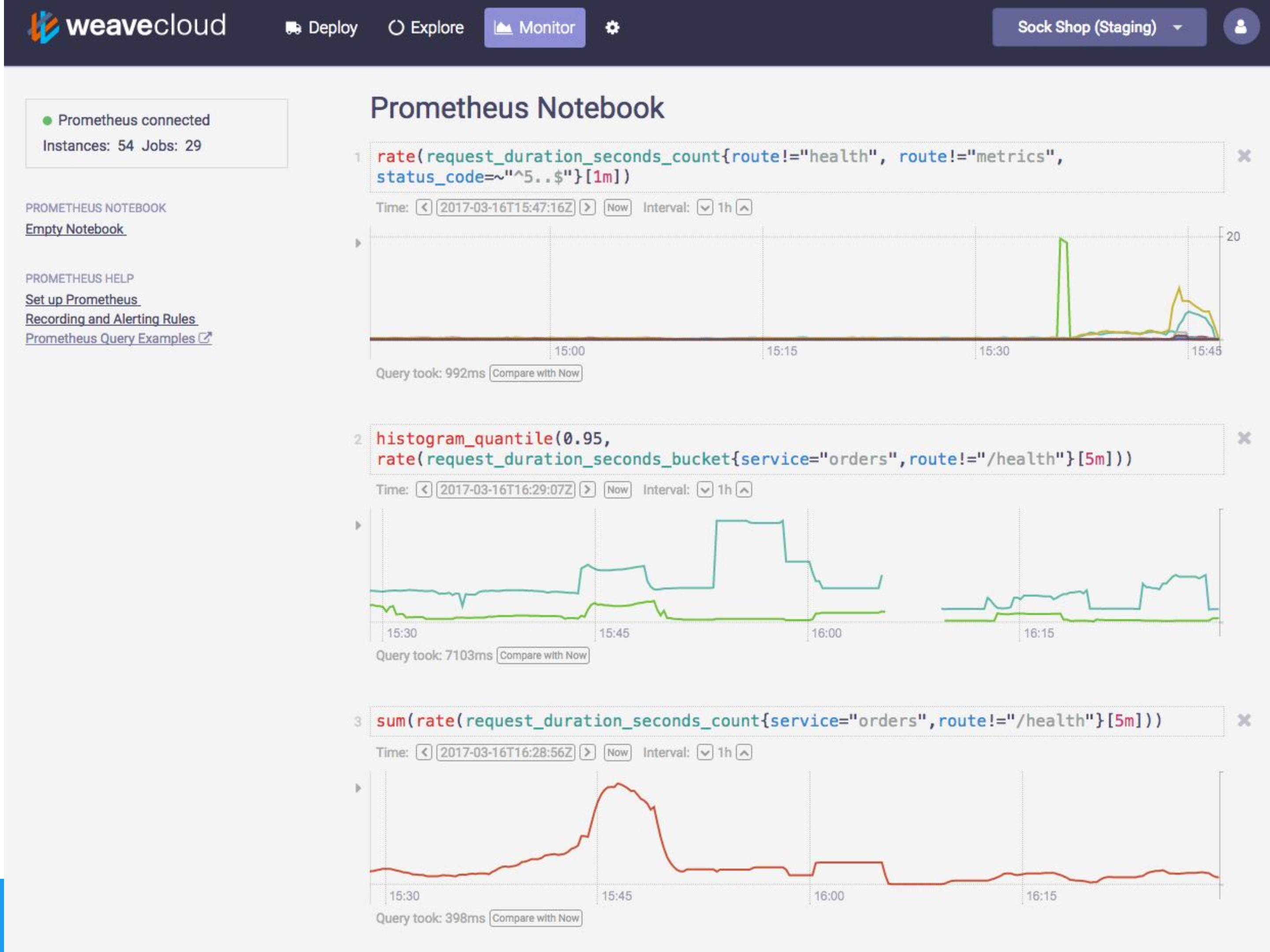
Cortex

- Managed
- Multi-tenant
- Unlimited data retention
- WIP



● Prometheus connected

Instances: 54 Jobs: 29

PROMETHEUS NOTEBOOK

Empty Notebook

PROMETHEUS HELP

Set up Prometheus

Recording and Alerting Rules

Prometheus Query Examples

Prometheus Notebook

```
rate(request_duration_seconds_count{route!="health", route!="metrics",
status_code=~"^5..$"}[1m])
```

Time: 2017-03-16T15:47:16Z Now Interval: 1h

Query took: 992ms Compare with Now

```
histogram_quantile(0.95,
rate(request_duration_seconds_bucket{service="orders",route!="/health"}[5m]))
```

Time: 2017-03-16T16:29:07Z Now Interval: 1h

Query took: 7103ms Compare with Now

```
sum(rate(request_duration_seconds_count{service="orders",route!="/health"}[5m]))
```

Time: 2017-03-16T16:28:56Z Now Interval: 1h

Query took: 398ms Compare with Now

How do you do monitoring?

How do you do microservices?

Where are the examples?

What can I use to test this out?

How can I try against different orchestrators?

How do I do this in <insert language here>?

Etc.

Etc.

SOCK SHOP

An open source reference microservices architecture

Icon by http://www.flaticon.com/authors/freepik

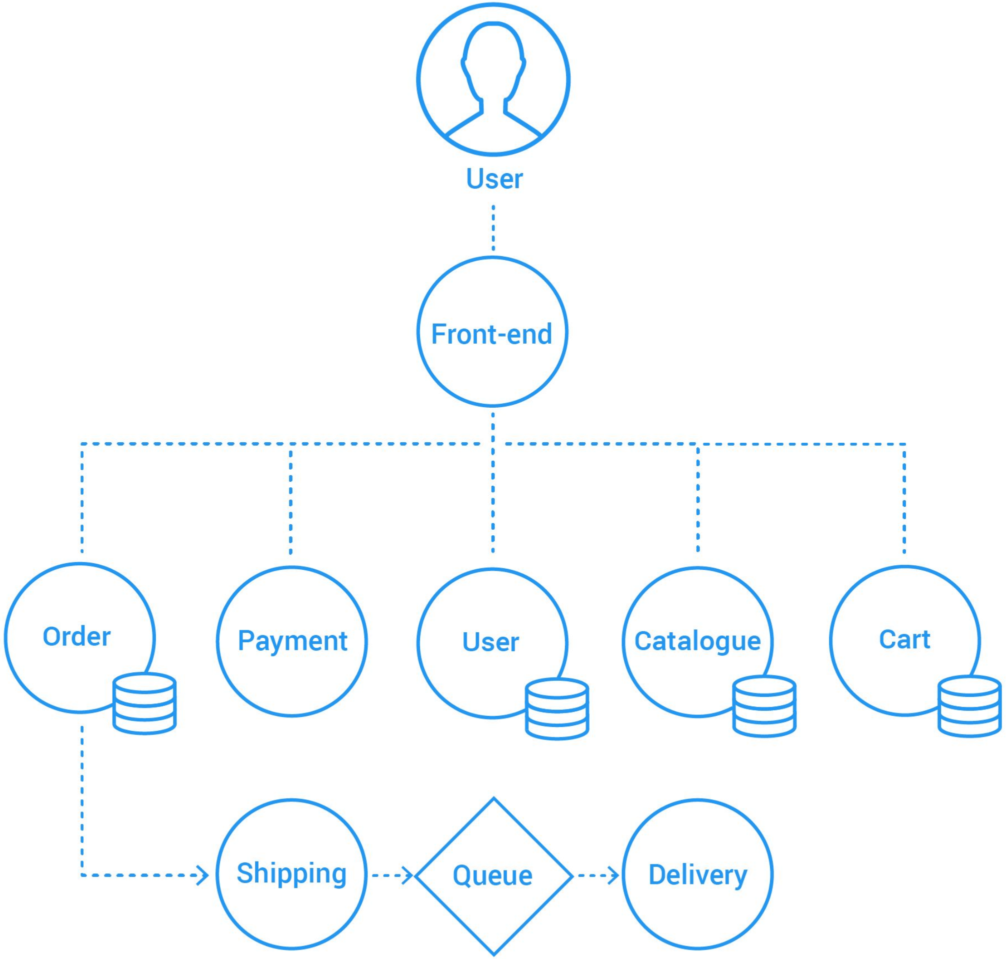
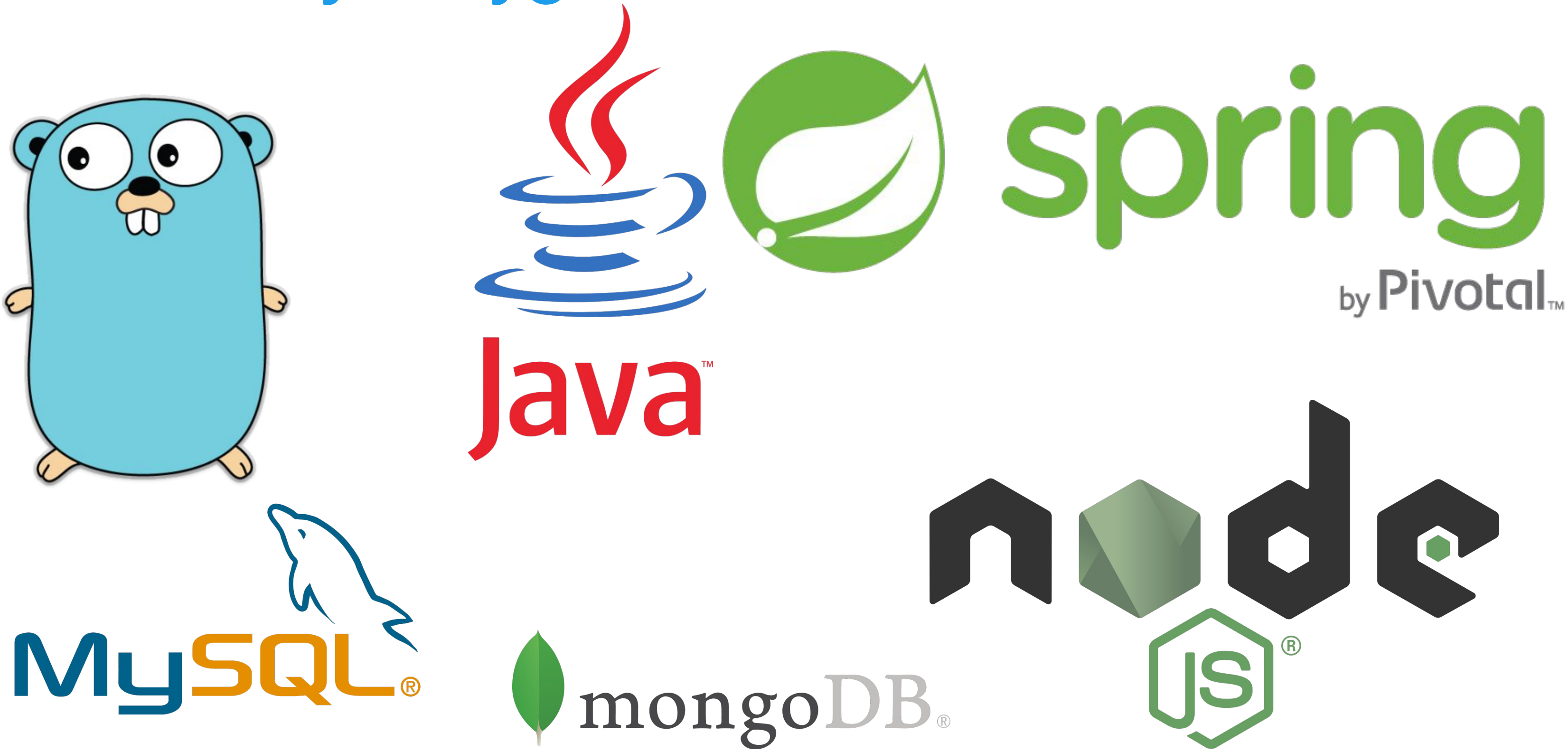
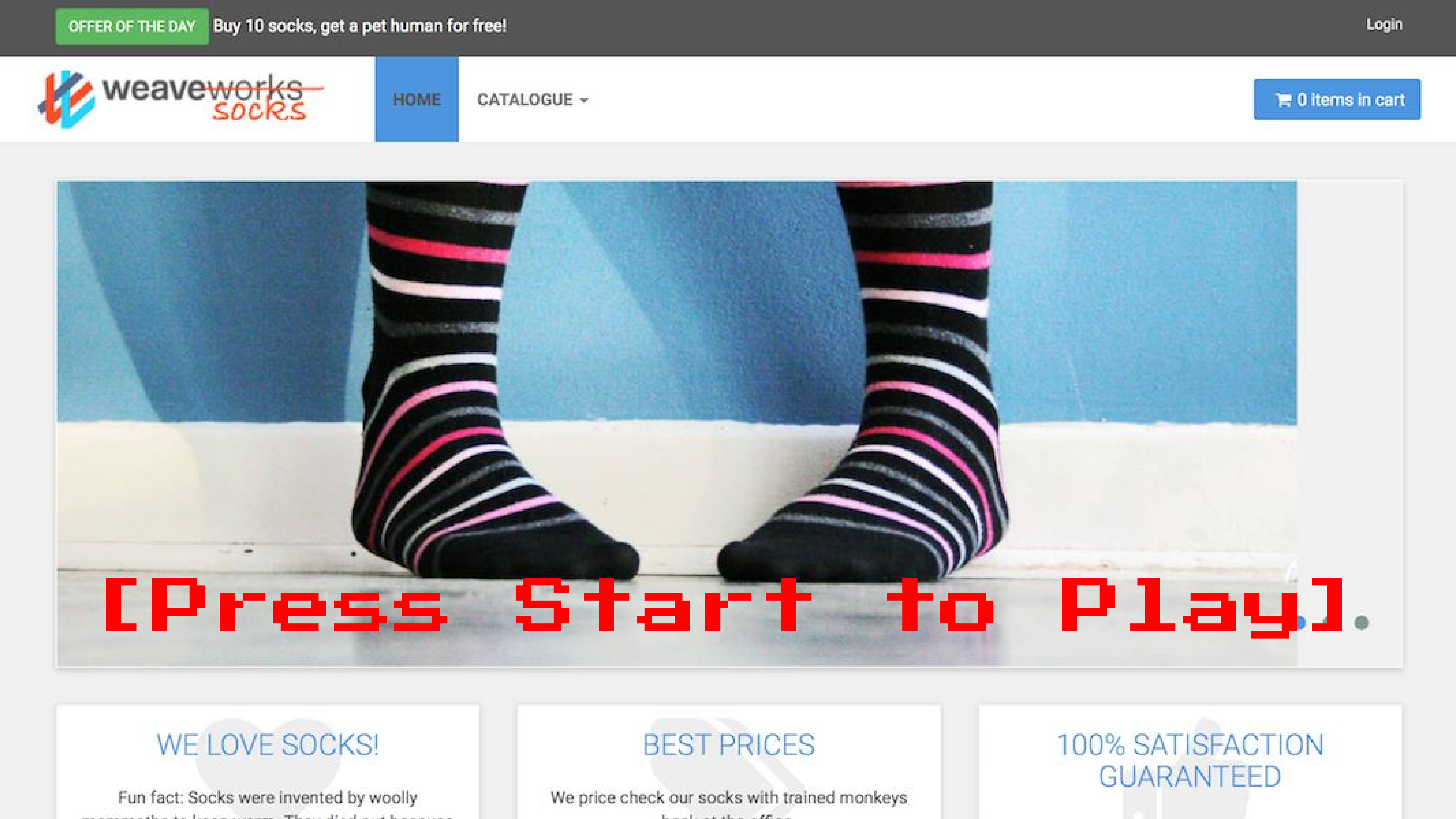


Image by Remember To Play

Obnoxiously Polyglot





Buy 10 socks, get a pet human for free!

[Press Start to Play]

WE LOVE SOCKS!

Fun fact: Socks were invented by woolly mammoths to keep warm. They died out because

BEST PRICES

We price check our socks with trained monkeys back at the office

100% SATISFACTION GUARANTEED

git.io/sock-shop

github.com/microservices-demo/**microservices-demo**

ContainerSolutions

How to do Prometheus

Prometheus Libraries

https://prometheus.io/docs/instrumenting/clientlibs/

Officially accepted as proper languages:

Go, Java/Scala, Python, Ruby

Unofficial libraries:

Bash, C++, Common Lisp, Elixir, Erlang, Haskell, Lua, .NET / C#, Node.js, PHP, Rust

Helper libraries for frameworks

https://github.com/prometheus/client_java

HIBERNATE

spring
by Pivotal™

jetty://

Apache LOG4J ™

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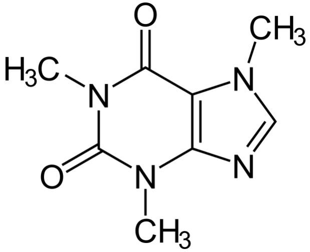
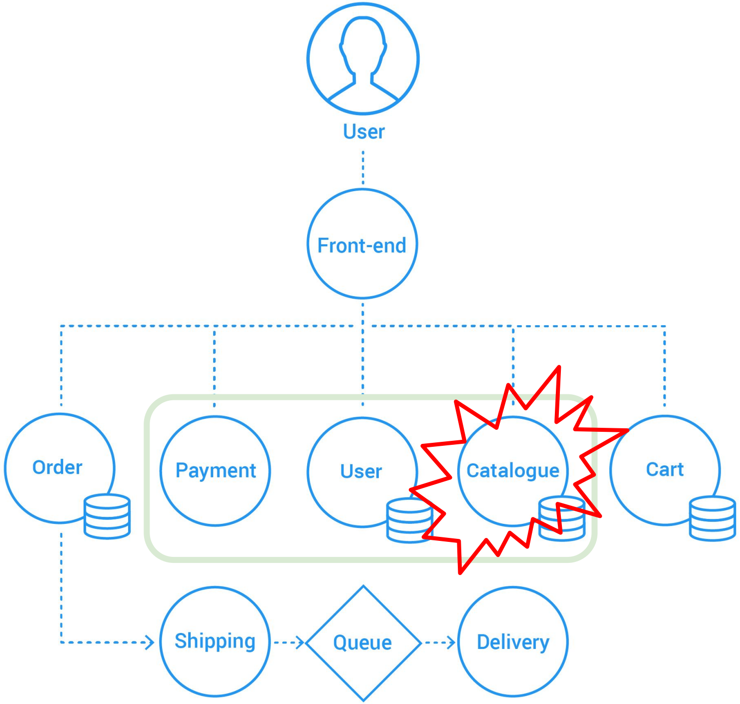
The Generic, Reliable Fast & Flexible Logging Framework



go Go GO!


User
Front-end
Order
Payment
User
Catalogue
Cart
Shipping
Queue
Delivery

Metric definition

https://github.com/microservices-demo/catalogue/blob/master/cmd/cataloguesvc/main.go

```
var (
    HTTPLatency = prometheus.NewHistogramVec(prometheus.HistogramOpts{
        Name:    "request_duration_seconds",
        Help:    "Time (in seconds) spent serving HTTP requests.",
        Buckets: prometheus.DefBuckets,
    }, []string{"method", "route", "status_code", "isWS"})
)


func init() {
    prometheus.MustRegister(HTTPLatency)
}
```

Metric definition

https://github.com/microservices-demo/catalogue/blob/master/cmd/cataloguesvc/main.go

```
var (
    HTTPLatency = prometheus.NewHistogramVec(prometheus.HistogramOpts{
        Name:    "request_duration_seconds",
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        Buckets: prometheus.DefBuckets,
    }, []string{"method", "route", "status_code", "isWS"})
)


func init() {
    prometheus.MustRegister(HTTPLatency)
}
```

Request rate (count)
Error rate (count)
Duration (buckets)
@tom_wilkie

Middleware definition

https://github.com/weaveworks/common/blob/master/middleware/middleware.go

```
// Interface is the shared contract for all middlesware, and allows middlesware
// to wrap handlers.
type Interface interface {
    Wrap(http.Handler) http.Handler
}
```

Instrumentation definition

https://github.com/weaveworks/common/blob/master/middleware/instrument.go

```
// RouteMatcher matches routes
type RouteMatcher interface {
     Match(*http.Request, *mux.RouteMatch) bool
}

// Instrument is a Middleware which records timings for every HTTP request
type Instrument struct {
     RouteMatcher RouteMatcher
     Duration     *prometheus.HistogramVec
}
```

Instrumentation

https://github.com/weaveworks/common/blob/master/middleware/instrument.go

```
// Wrap implements middleware.Interface
func (i Instrument) Wrap(next http.Handler) http.Handler {
    return http.HandlerFunc(func(w http.ResponseWriter, r *http.Request) {
        begin := time.Now()
        isWS := strconv.FormatBool(IsWSHandshakeRequest(r))
        interceptor := &interceptor{ResponseWriter: w, statusCode: http.StatusOK}
        route := i.getRouteName(r)
        next.ServeHTTP(interceptor, r)
        var (
            status = strconv.Itoa(interceptor.statusCode)
            took   = time.Since(begin)
        )
        i.Duration.WithLabelValues(r.Method, route, status,
isWS).Observe(took.Seconds())
    })
```

Main Wiring

https://github.com/microservices-demo/catalogue/blob/master/cmd/cataloguesvc/main.go

```
// Service
var service catalogue.Service
…

// Endpoint
endpoints := catalogue.MakeEndpoints(service, tracer)

// HTTP router
// Prom handler in here
router := catalogue.MakeHTTPHandler(ctx, endpoints, *images, logger, tracer)
```

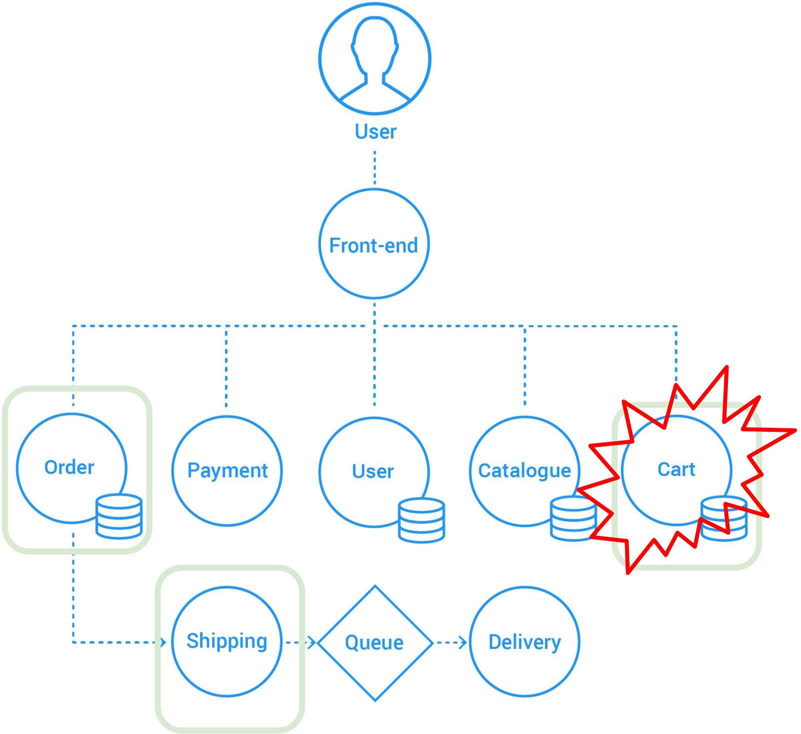
Main Middleware

https://github.com/microservices-demo/catalogue/blob/master/cmd/cataloguesvc/main.go

```go
// Middleware
httpMiddleware := []middleware.Interface{
    middleware.Instrument{
        Duration:     middleware.HTTPLatency,
        RouteMatcher: router,
    },
}
// Handler
handler := middleware.Merge(httpMiddleware...).Wrap(router)

…
// Standard server stuff
    errc <- http.ListenAndServe(":"+*port, handler)
```

j for Java


User
Front-end
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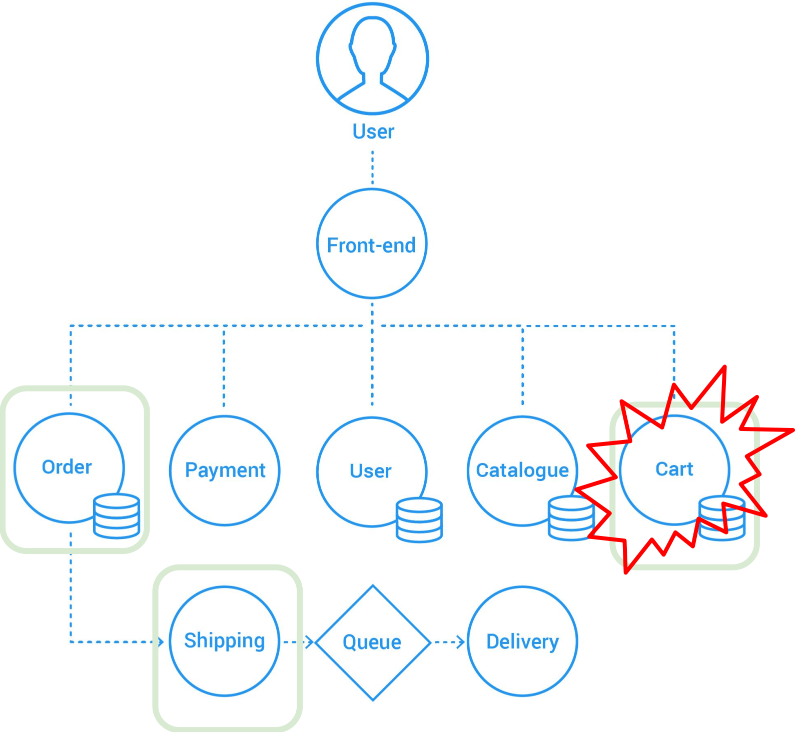
j for Java


User
Front-end
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j
Java™

First - the easy bit

https://github.com/microservices-demo/carts/blob/master/src/main/java/works/weave/socks/cart/CartApplication.java

```
@SpringBootApplication
@EnablePrometheusEndpoint
public class CartApplication {
   public static void main(String[] args) {
       SpringApplication.run(CartApplication.class, args);
   }
}
```

…

```
# In applications.properties
# Disable actuator metrics endpoints
endpoints.metrics.enabled=false
endpoints.prometheus.id=metrics
```

Timing - Easy option

```
@PrometheusTimeMethod(name = "my_method_seconds", help = "The number of seconds taken by the main handler")
public Object handleRequest {
     // Do stuff, this will be timed.
}
```

Timing - Easy option

```
@PrometheusTimeMethod(name = "my_method_seconds", help = "The number of seconds taken by the main handler")
public Object handleRequest {
     // Do stuff, this will be timed.
}
```

Uh oh. Timed methods are recorded as a Summary type, with no quantile information. Quite possible that this isn’t right for you application.

Timing - Intermediate option

```
// Stub. Insert new code for Histogram annotation here.
```

Timing - Current implementation

https://github.com/microservices-demo/carts/blob/master/src/main/java/works/weave/socks/cart/middleware/HTTPMonitoringInterceptor.java

```java
@Configuration
public class WebMvcConfig {
   @Bean
   HTTPMonitoringInterceptor httpMonitoringInterceptor() {
       return new HTTPMonitoringInterceptor();
   }

   @Bean
   public MappedInterceptor myMappedInterceptor(HTTPMonitoringInterceptor interceptor) {
       return new MappedInterceptor(new String[]{"/**"}, interceptor);
   }
}
```

Timing - The nasty bit

https://github.com/microservices-demo/carts/blob/master/src/main/java/works/weave/socks/cart/middleware/HTTPMonitoringInterceptor.java

```
public class HTTPMonitoringInterceptor implements HandlerInterceptor {
   static final Histogram requestLatency = Histogram.build()
           .name("request_duration_seconds")
           .help("Request duration in seconds.")
           .labelNames("service", "method", "route", "status_code")
           .register();
   @Override
   public boolean preHandle(HttpServletRequest httpServletRequest, HttpServletResponse
           httpServletResponse, Object o) throws Exception {
       httpServletRequest.setAttribute(startTimeKey, System.nanoTime());
       return true;
   }
...
```

Timing - The nasty bit

https://github.com/microservices-demo/carts/blob/master/src/main/java/works/weave/socks/cart/middleware/HTTPMonitoringInterceptor.java

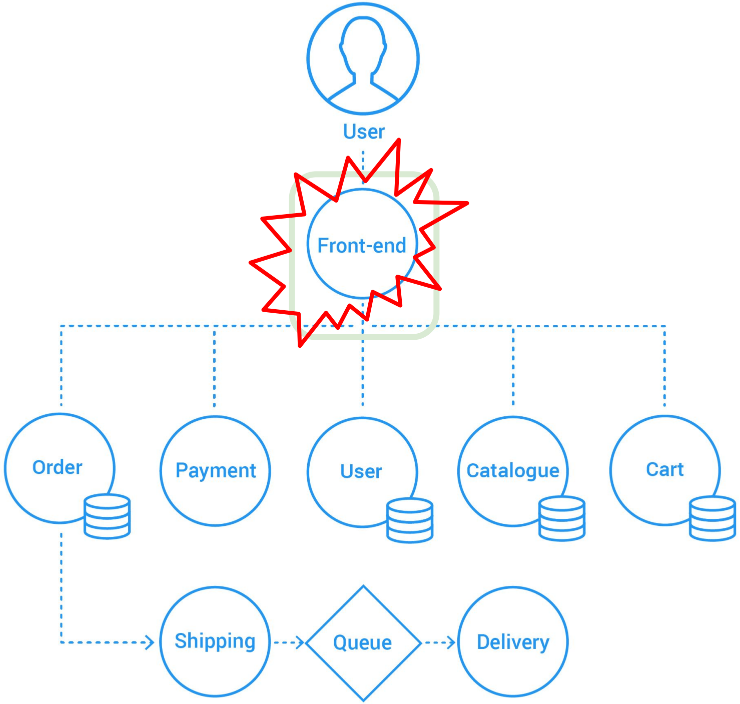
```java
@Override
public void postHandle(HttpServletRequest httpServletRequest, HttpServletResponse
        httpServletResponse, Object o, ModelAndView modelAndView) throws Exception {
    long start = (long) httpServletRequest.getAttribute(startTimeKey);
    long elapsed = System.nanoTime() - start;
    double seconds = (double) elapsed / 1000000000.0;
    String matchedUrl = getMatchingURLPattern(httpServletRequest); // ← Key part
    if (!matchedUrl.equals("")) {
        requestLatency.labels(
                serviceName,
                httpServletRequest.getMethod(),
                matchedUrl,
                Integer.toString(httpServletResponse.getStatus())
        ).observe(seconds);
    }
}
```

Recommendation?

Write your own annotation. Annotate each method you want to monitor.

Becomes tricky with spring-boot-data types, due to auto-magic.

NodeJS - Express



Declarations

https://github.com/microservices-demo/front-end/blob/master/api/metrics/index.js

```
(function (){
 'use strict';

 var express = require("express")
   , client  = require('prom-client')
   , app     = express()

 const metric = {
   http: {
     requests: {
       duration: new client.Histogram('request_duration_seconds', 'request duration in
seconds', ['service', 'method', 'route', 'status_code']),
     }
   }
 }
```

Middleware

https://github.com/microservices-demo/front-end/blob/master/api/metrics/index.js

```
 function observe(method, path, statusCode, start) {
   var route = path.toLowerCase();
   if (route !== '/metrics' && route !== '/metrics/') {
       var duration = s(start); // Helper method to calculate duration
       var method = method.toLowerCase();
       metric.http.requests.duration.labels('front-end', method, route,
statusCode).observe(duration);
   }
 };

 app.use(middleware);
 app.get("/metrics", function(req, res) {
     res.header("content-type", "text/plain");
     return res.end(client.register.metrics())
 });
```

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How to do Monitoring

MISUSE OF STUPID MEME
AS A MEANS OF SAYING "SHIP IT"
ABCMEMES.COM
CHUCK NORRIS APPROVED.
SHIP IT!
SHIP IT
T NOW!
memegenerator.net
IT COMPILES
SHIP IT
quickmeme.com
FUCK IT
BRILLIANT!
SHIP IT
IF YOU COULD GO AHEAD AND 'SHIP IT!'
THAT WOULD BE GREAT
LOOKS GOOD TO ME!
SHIP IT!

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OOKS GOOD TO ME!
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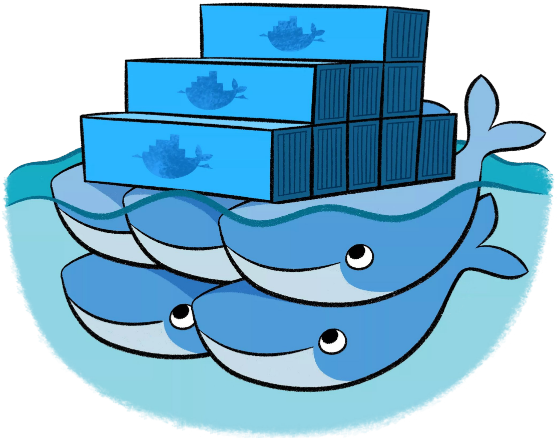
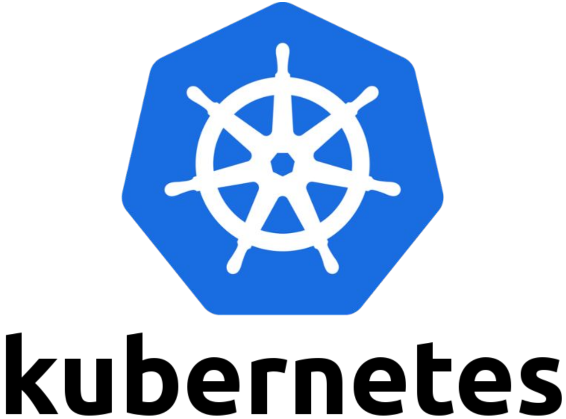
Deploying all the things





Deploying to Kubernetes

https://github.com/microservices-demo/microservices-demo/tree/master/deploy/kubernetes

```
...
   spec:
     containers:
     - name: prometheus
       image: 'prom/prometheus:v1.5.2'
       args:
         - '-storage.local.retention=360h'
         - '-storage.local.memory-chunks=1048576'
         -
'-config.file=/etc/prometheus/prometheus.yml'
         -
'-alertmanager.url=http://alertmanager:9093'
       ports:
       - name: web
         containerPort: 9090
...
```

```
...
       volumeMounts:
       - name: config-volume
         mountPath: /etc/prometheus
       - name: alertrules-volume
         mountPath: /etc/prometheus-rules
     volumes:
     - name: config-volume
       configMap:
         name: prometheus-configmap
     - name: alertrules-volume
       configMap:
         name: prometheus-alertrules
```

Deploying to Kubernetes

https://github.com/microservices-demo/microservices-demo/tree/master/deploy/kubernetes

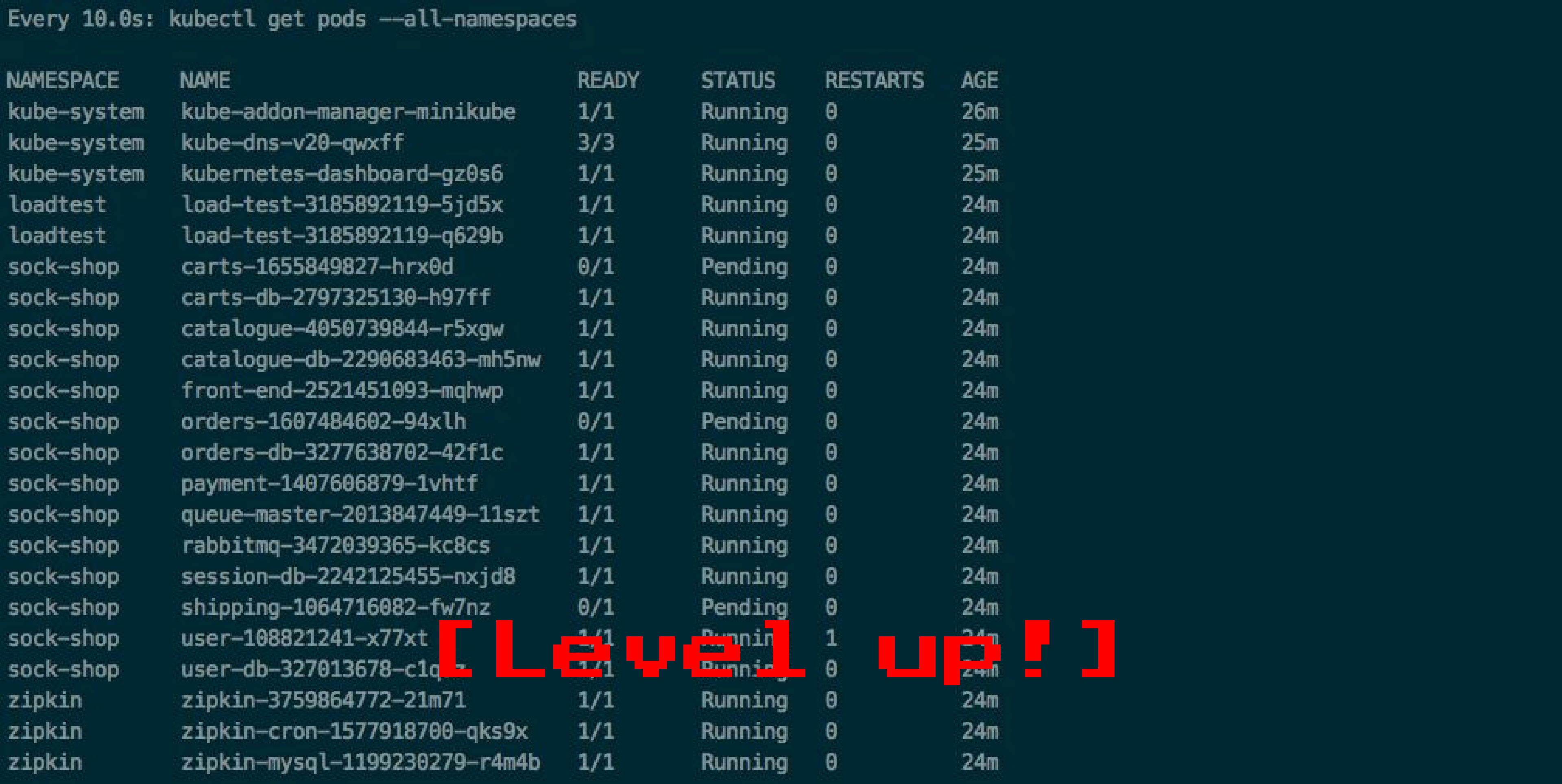
```
kind: Service
...
spec:
 selector:
   app: prometheus
 type: NodePort
 ports:
 - name: prometheus
   protocol: TCP
   port: 9090
   targetPort: 9090
   nodePort: 31090
```

```
kind: ConfigMap
metadata:
 name: prometheus-configmap
data:
 prometheus.yml: |
   global:
     scrape_interval: 15s
   scrape_configs:
     - job_name: kubernetes-service-endpoints
…
     - job_name: kubernetes-pods
…
     - job_name: kubernetes-nodes
```

Rock it with Minikube

```
$ minikube start  --memory 4096
$ git clone https://github.com/microservices-demo/microservices-demo.git
$ kubectl create -f ./deploy/kubernetes/complete-demo.yaml
$ kubectl create -f ./deploy/kubernetes/manifests-monitoring
```

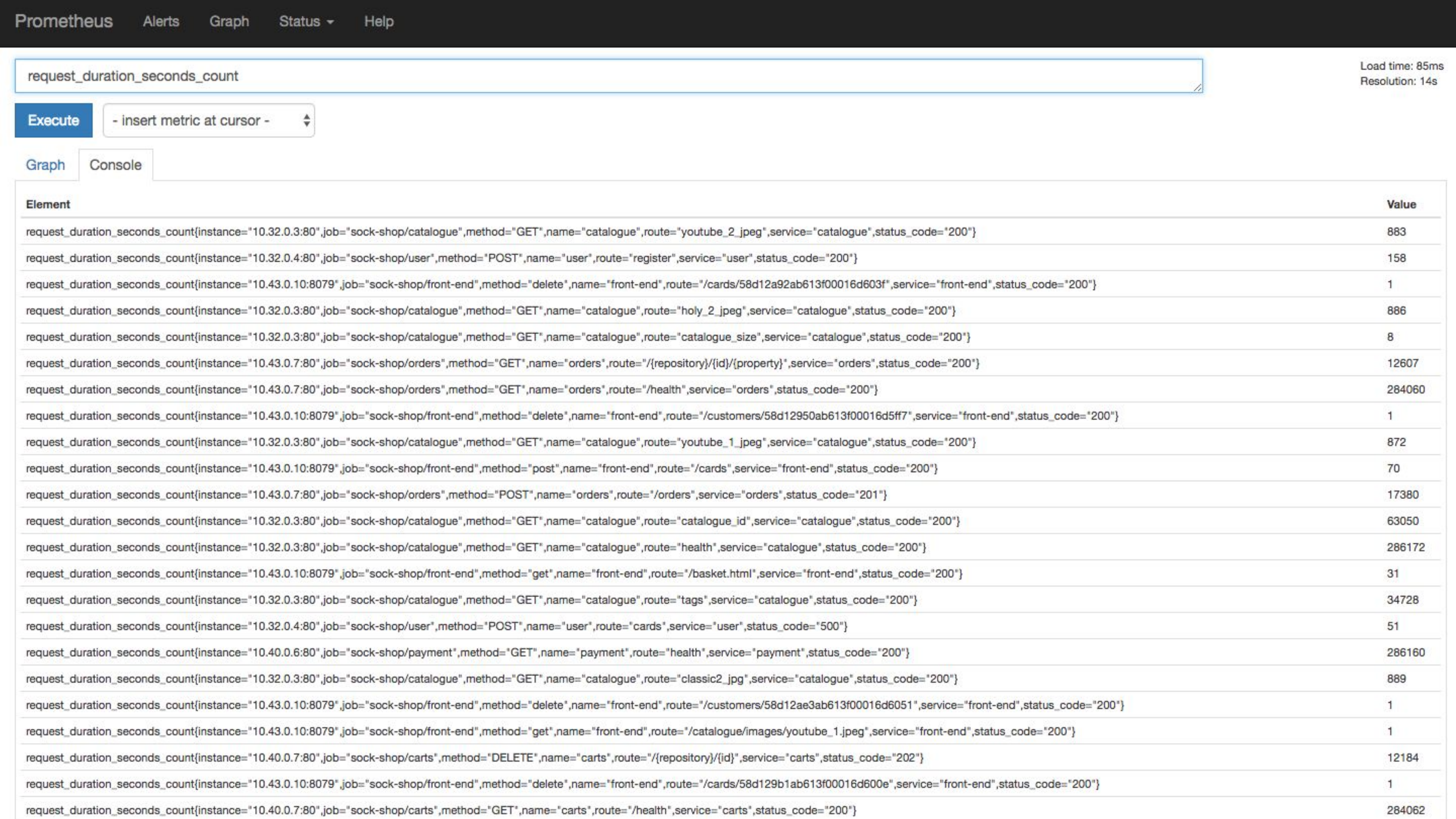
………… Then wait. (each image is approx 100MB = 20 mins to download images)



```
Every 10.0s: kubectl get pods --all-namespaces

NAMESPACE     NAME                                READY     STATUS    RESTARTS   AGE
kube-system   kube-addon-manager-minikube         1/1       Running   0          26m
kube-system   kube-dns-v20-qwxff                  3/3       Running   0          25m
kube-system   kubernetes-dashboard-gz0s6          1/1       Running   0          25m
loadtest      load-test-3185892119-5jd5x          1/1       Running   0          24m
loadtest      load-test-3185892119-q629b          1/1       Running   0          24m
sock-shop     carts-1655849827-hrx0d              0/1       Pending   0          24m
sock-shop     carts-db-2797325130-h97ff           1/1       Running   0          24m
sock-shop     catalogue-4050739844-r5xgw          1/1       Running   0          24m
sock-shop     catalogue-db-2290683463-mh5nw       1/1       Running   0          24m
sock-shop     front-end-2521451093-mqhwp          1/1       Running   0          24m
sock-shop     orders-1607484602-94xlh             0/1       Pending   0          24m
sock-shop     orders-db-3277638702-42f1c          1/1       Running   0          24m
sock-shop     payment-1407606879-1vhtf            1/1       Running   0          24m
sock-shop     queue-master-2013847449-11szt       1/1       Running   0          24m
sock-shop     rabbitmq-3472039365-kc8cs           1/1       Running   0          24m
sock-shop     session-db-2242125455-nxjd8         1/1       Running   0          24m
sock-shop     shipping-1064716082-fw7nz           0/1       Pending   0          24m
sock-shop     user-108821241-x77xt                1/1       Running   1          24m
sock-shop     user-db-327013678-c1q[illegible]    1/1       Running   0          24m
zipkin        zipkin-3759864772-21m71             1/1       Running   0          24m
zipkin        zipkin-cron-1577918700-qks9x        1/1       Running   0          24m
zipkin        zipkin-mysql-1199230279-r4m4b       1/1       Running   0          24m
```

[Level up!]



request_duration_seconds_count

Load time: 85ms
Resolution: 14s

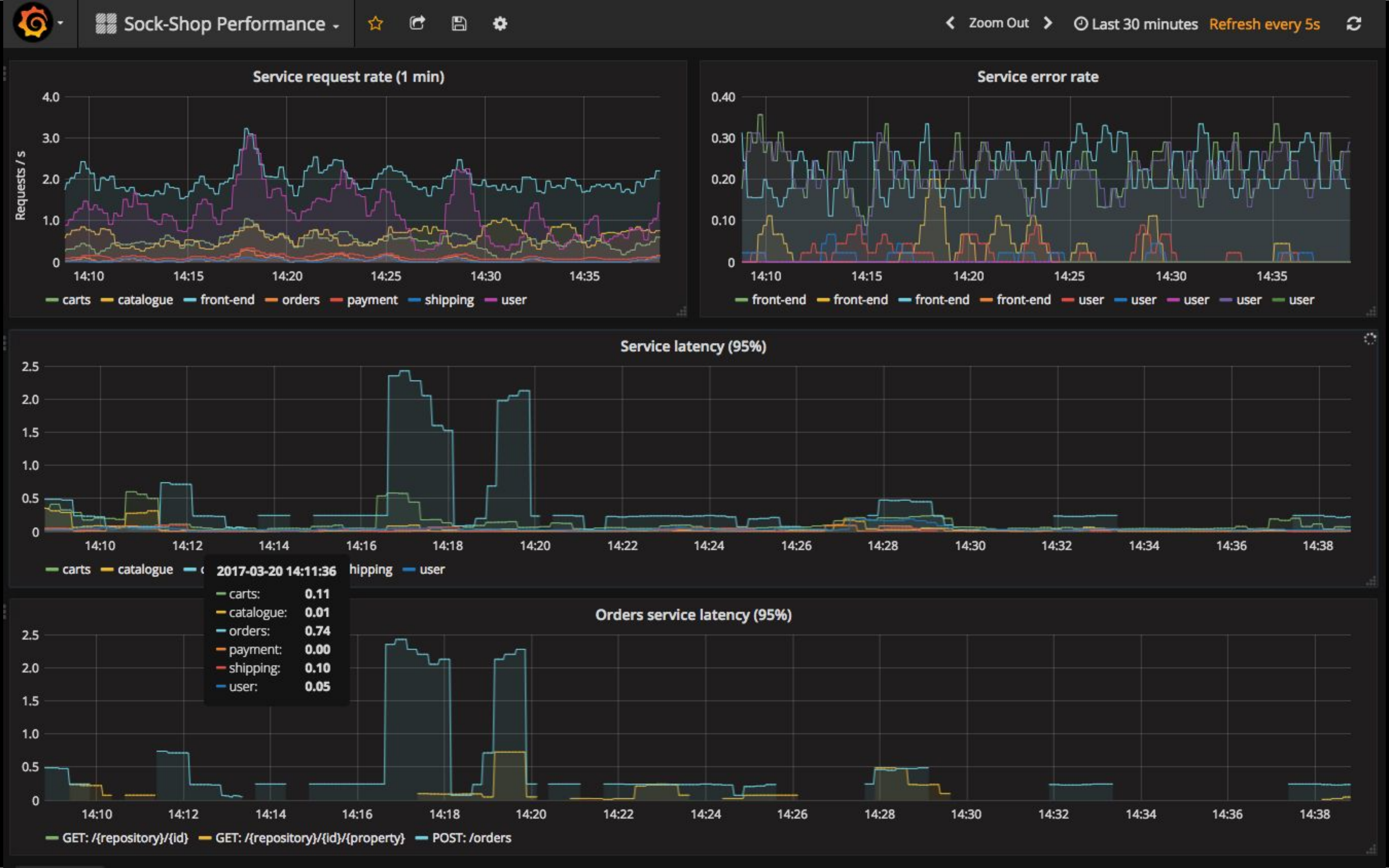
Element	Value
request_duration_seconds_count{instance="10.32.0.3:80",job="sock-shop/catalogue",method="GET",name="catalogue",route="youtube_2_jpeg",service="catalogue",status_code="200"}	883
request_duration_seconds_count{instance="10.32.0.4:80",job="sock-shop/user",method="POST",name="user",route="register",service="user",status_code="200"}	158
request_duration_seconds_count{instance="10.43.0.10:8079",job="sock-shop/front-end",method="delete",name="front-end",route="/cards/58d12a92ab613f00016d603f",service="front-end",status_code="200"}	1
request_duration_seconds_count{instance="10.32.0.3:80",job="sock-shop/catalogue",method="GET",name="catalogue",route="holy_2_jpeg",service="catalogue",status_code="200"}	886
request_duration_seconds_count{instance="10.32.0.3:80",job="sock-shop/catalogue",method="GET",name="catalogue",route="catalogue_size",service="catalogue",status_code="200"}	8
request_duration_seconds_count{instance="10.43.0.7:80",job="sock-shop/orders",method="GET",name="orders",route="/{repository}/{id}/{property}",service="orders",status_code="200"}	12607
request_duration_seconds_count{instance="10.43.0.7:80",job="sock-shop/orders",method="GET",name="orders",route="/health",service="orders",status_code="200"}	284060
request_duration_seconds_count{instance="10.43.0.10:8079",job="sock-shop/front-end",method="delete",name="front-end",route="/customers/58d12950ab613f00016d5ff7",service="front-end",status_code="200"}	1
request_duration_seconds_count{instance="10.32.0.3:80",job="sock-shop/catalogue",method="GET",name="catalogue",route="youtube_1_jpeg",service="catalogue",status_code="200"}	872
request_duration_seconds_count{instance="10.43.0.10:8079",job="sock-shop/front-end",method="post",name="front-end",route="/cards",service="front-end",status_code="200"}	70
request_duration_seconds_count{instance="10.43.0.7:80",job="sock-shop/orders",method="POST",name="orders",route="/orders",service="orders",status_code="201"}	17380
request_duration_seconds_count{instance="10.32.0.3:80",job="sock-shop/catalogue",method="GET",name="catalogue",route="catalogue_id",service="catalogue",status_code="200"}	63050
request_duration_seconds_count{instance="10.32.0.3:80",job="sock-shop/catalogue",method="GET",name="catalogue",route="health",service="catalogue",status_code="200"}	286172
request_duration_seconds_count{instance="10.43.0.10:8079",job="sock-shop/front-end",method="get",name="front-end",route="/basket.html",service="front-end",status_code="200"}	31
request_duration_seconds_count{instance="10.32.0.3:80",job="sock-shop/catalogue",method="GET",name="catalogue",route="tags",service="catalogue",status_code="200"}	34728
request_duration_seconds_count{instance="10.32.0.4:80",job="sock-shop/user",method="POST",name="user",route="cards",service="user",status_code="500"}	51
request_duration_seconds_count{instance="10.40.0.6:80",job="sock-shop/payment",method="GET",name="payment",route="health",service="payment",status_code="200"}	286160
request_duration_seconds_count{instance="10.32.0.3:80",job="sock-shop/catalogue",method="GET",name="catalogue",route="classic2_jpg",service="catalogue",status_code="200"}	889
request_duration_seconds_count{instance="10.43.0.10:8079",job="sock-shop/front-end",method="delete",name="front-end",route="/customers/58d12ae3ab613f00016d6051",service="front-end",status_code="200"}	1
request_duration_seconds_count{instance="10.43.0.10:8079",job="sock-shop/front-end",method="get",name="front-end",route="/catalogue/images/youtube_1.jpeg",service="front-end",status_code="200"}	1
request_duration_seconds_count{instance="10.40.0.7:80",job="sock-shop/carts",method="DELETE",name="carts",route="/{repository}/{id}",service="carts",status_code="202"}	12184
request_duration_seconds_count{instance="10.43.0.10:8079",job="sock-shop/front-end",method="delete",name="front-end",route="/cards/58d129b1ab613f00016d600e",service="front-end",status_code="200"}	1
request_duration_seconds_count{instance="10.40.0.7:80",job="sock-shop/carts",method="GET",name="carts",route="/health",service="carts",status_code="200"}	284062

Bonus: Grafana!

https://github.com/microservices-demo/microservices-demo/tree/master/deploy/kubernetes/manifests-monitoring

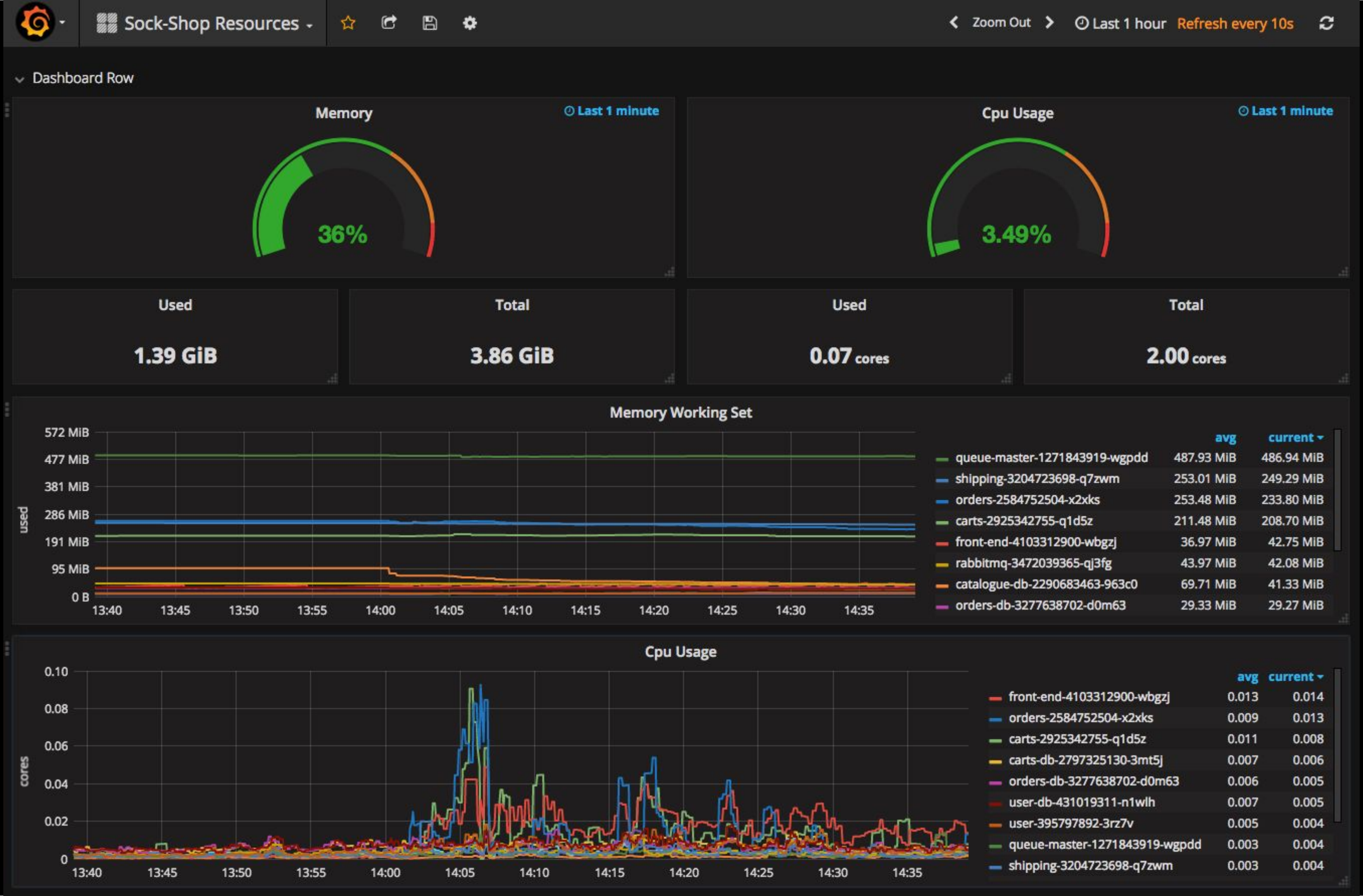
Comprises of:

- Grafana dependency & service
- ConfigMap with JSON Grafana dashboards inside
- Batch job to ingest and write the dashboards to a json file.
- Kubernetes state exporter
- Disk usage exporter



2017-03-20 14:11:36

carts:	0.11
catalogue:	0.01
orders:	0.74
payment:	0.00
shipping:	0.10
user:	0.05



Memory — Last 1 minute

36%

Cpu Usage — Last 1 minute

3.49%

Used

1.39 GiB

Total

3.86 GiB

Used

0.07 cores

Total

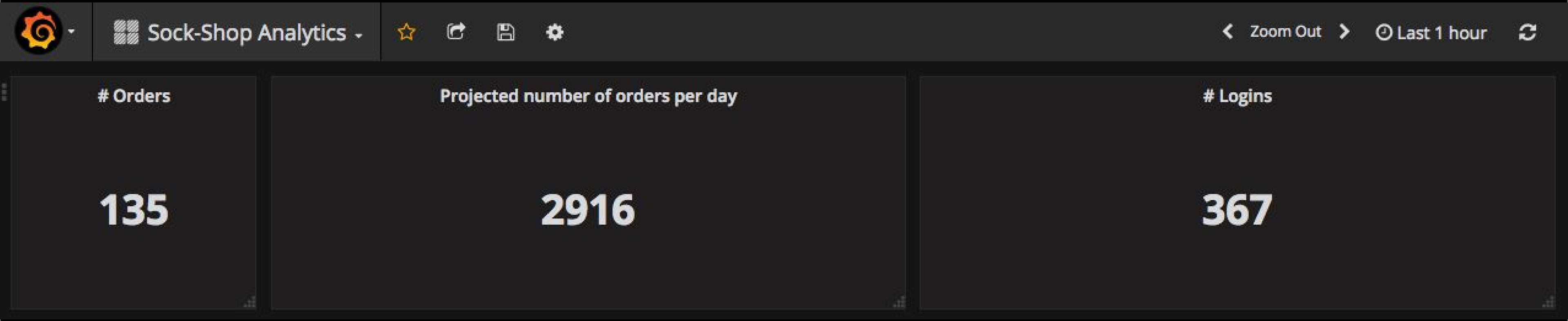
2.00 cores

Memory Working Set

	avg	current
🟩 queue-master-1271843919-wgpdd	487.93 MiB	486.94 MiB
🟦 shipping-3204723698-q7zwm	253.01 MiB	249.29 MiB
🟦 orders-2584752504-x2xks	253.48 MiB	233.80 MiB
🟩 carts-2925342755-q1d5z	211.48 MiB	208.70 MiB
🟥 front-end-4103312900-wbgzj	36.97 MiB	42.75 MiB
🟨 rabbitmq-3472039365-qj3fg	43.97 MiB	42.08 MiB
🟧 catalogue-db-2290683463-963c0	69.71 MiB	41.33 MiB
🟪 orders-db-3277638702-d0m63	29.33 MiB	29.27 MiB

Cpu Usage

	avg	current
🟥 front-end-4103312900-wbgzj	0.013	0.014
🟦 orders-2584752504-x2xks	0.009	0.013
🟩 carts-2925342755-q1d5z	0.011	0.008
🟨 carts-db-2797325130-3mt5j	0.007	0.006
🟪 orders-db-3277638702-d0m63	0.006	0.005
🟥 user-db-431019311-n1wlh	0.007	0.005
🟧 user-395797892-3rz7v	0.005	0.004
🟩 queue-master-1271843919-wgpdd	0.003	0.004
🟦 shipping-3204723698-q7zwm	0.003	0.004



Orders

135

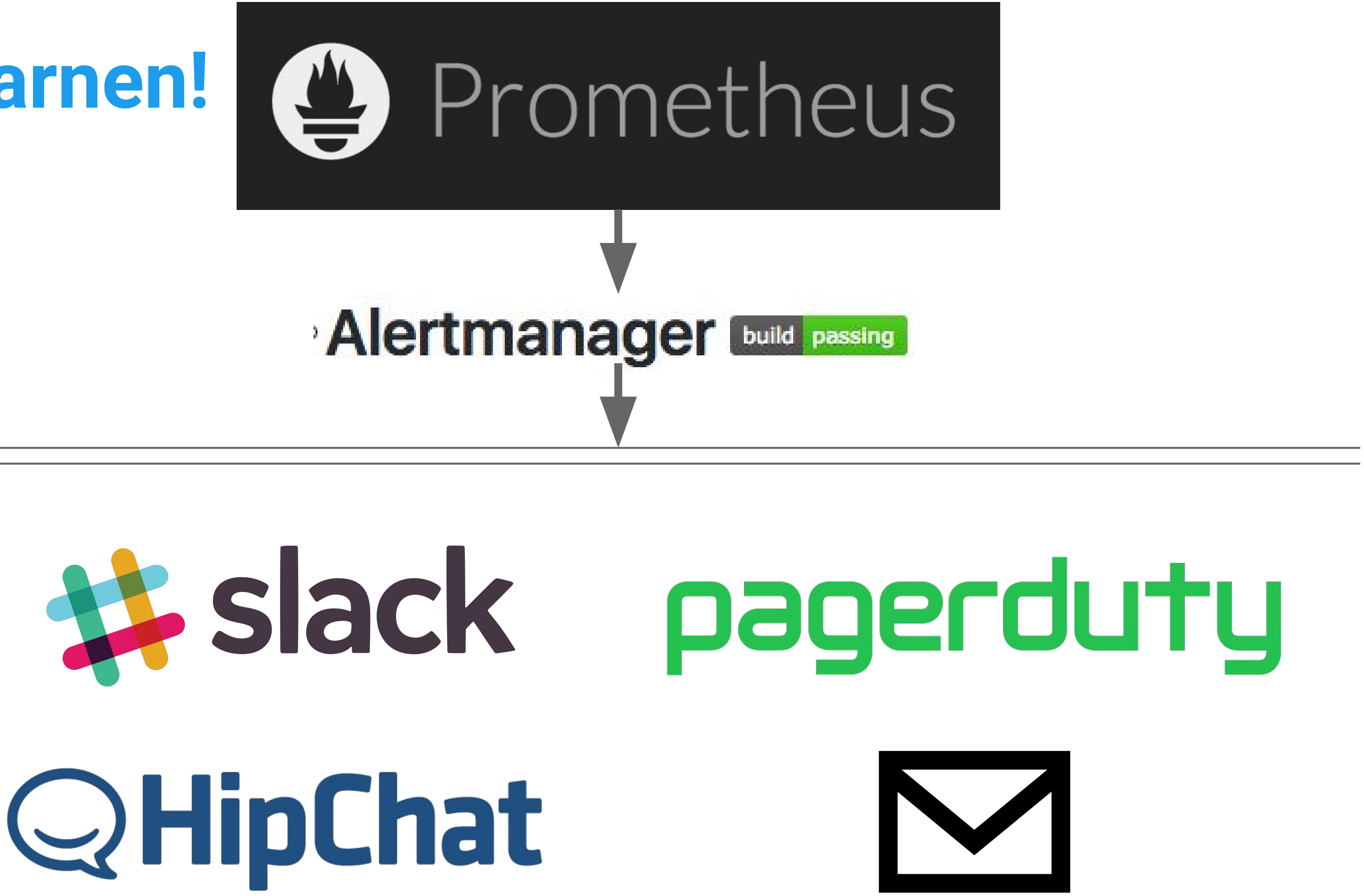
Projected number of orders per day

2916

Logins

367

Alert! Warnen!



Alertmanager manifest

https://github.com/microservices-demo/microservices-demo/tree/master/deploy/kubernetes/manifests-alerting

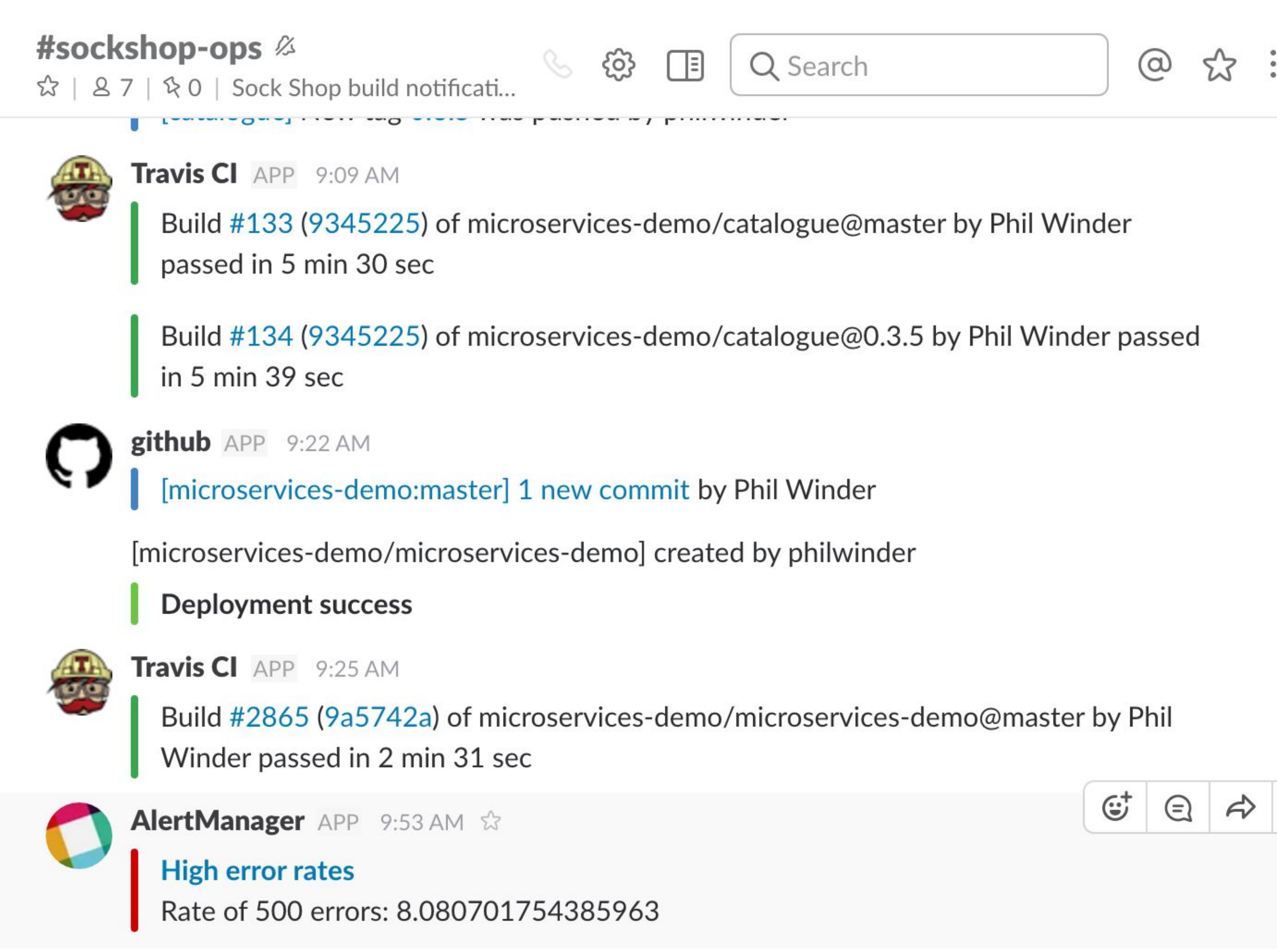
```
...
   spec:
     containers:
     - name: alertmanager
       image: prom/alertmanager:latest
       env:
         - name: SLACK_HOOK_URL
           valueFrom:
             secretKeyRef:
               name: slack-hook-url
              key: slack-hook-url
       command: ['/bin/sh',
'/etc/alertmanager/configure_secret.sh']
       args:
         -
'-config.file=/etc/alertmanager/config.yml'
         - '-storage.path=/alertmanager'
```

```
...
       ports:
       - name: alertmanager
         containerPort: 9093
       volumeMounts:
       - name: config-volume
         mountPath: /etc/alertmanager
     volumes:
     - name: config-volume
       configMap:
         name: alertmanager
```

Alert rules

https://github.com/microservices-demo/microservices-demo/blob/master/deploy/kubernetes/manifests-monitoring/prometheus-alertrules.yaml

```
apiVersion: v1
kind: ConfigMap
metadata:
 name: prometheus-alertrules
data:
 alert.rules: |
   # Alert for high error rate in the Sock Shop.
   ALERT HighErrorRate
     IF rate(request_duration_seconds_count{status_code="500"}[5m]) > 1
     FOR 5m
     LABELS { severity = "slack" }
     ANNOTATIONS {
       summary = "High HTTP 500 error rates",
       description = "Rate of HTTP 500 errors per 5 minutes: {{ $value }}",
     }
```



#sockshop-ops

☆ | 7 | 0 | Sock Shop build notificati...

[catalogue] New tag 0.3.5 was pushed by philwinder

Travis CI APP 9:09 AM

Build #133 (9345225) of microservices-demo/catalogue@master by Phil Winder passed in 5 min 30 sec

Build #134 (9345225) of microservices-demo/catalogue@0.3.5 by Phil Winder passed in 5 min 39 sec

github APP 9:22 AM

[microservices-demo:master] 1 new commit by Phil Winder

[microservices-demo/microservices-demo] created by philwinder

Deployment success

Travis CI APP 9:25 AM

Build #2865 (9a5742a) of microservices-demo/microservices-demo@master by Phil Winder passed in 2 min 31 sec

AlertManager APP 9:53 AM ☆

High error rates

Rate of 500 errors: 8.080701754385963

ContainerSolutions

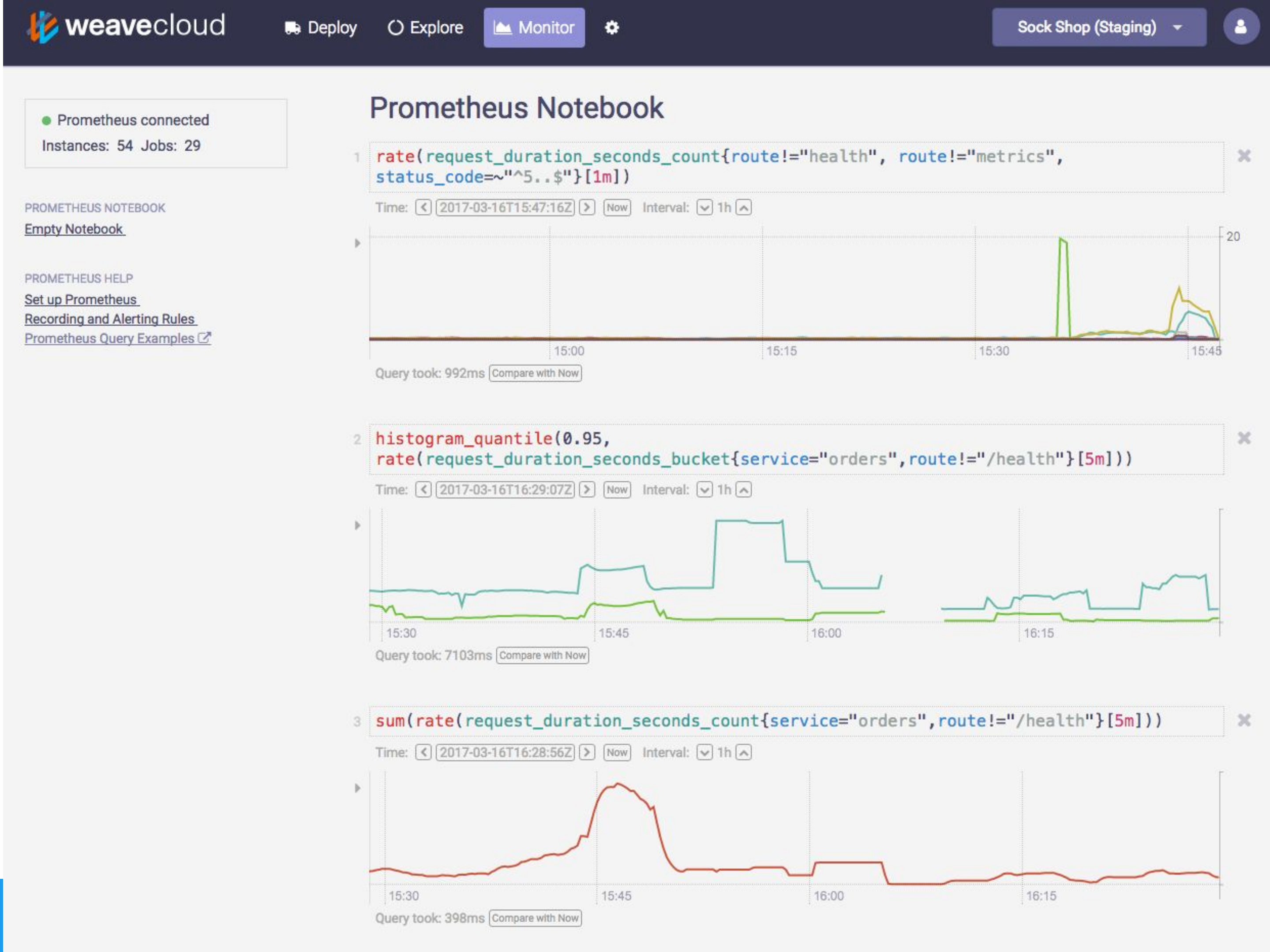
Summary

git.io/sock-shop

github.com/microservices-demo/**microservices-demo**

Weave Cloud

- Managed
- Multi-tenant
- Unlimited data retention
- WIP



● Prometheus connected

Instances: 54 Jobs: 29

PROMETHEUS NOTEBOOK

Empty Notebook

PROMETHEUS HELP

Set up Prometheus

Recording and Alerting Rules

Prometheus Query Examples

Prometheus Notebook

1

```
rate(request_duration_seconds_count{route!="health", route!="metrics",
status_code=~"^5..$"}[1m])
```

Time: 2017-03-16T15:47:16Z Now Interval: 1h

Query took: 992ms Compare with Now

2

```
histogram_quantile(0.95,
rate(request_duration_seconds_bucket{service="orders",route!="/health"}[5m]))
```

Time: 2017-03-16T16:29:07Z Now Interval: 1h

Query took: 7103ms Compare with Now

3

```
sum(rate(request_duration_seconds_count{service="orders",route!="/health"}[5m]))
```

Time: 2017-03-16T16:28:56Z Now Interval: 1h

Query took: 398ms Compare with Now

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Winder Research

Container Solutions

weave~~works~~ socks