


LIVE KUBERNETES DEBUGGING

WITH THE  elastic stack

Philipp Krenn

@xeraa

KUBERNETES IS THE ANSWER. WHAT WAS THE QUESTION?

— <https://twitter.com/charlesfitz/status/1068203930683752448>



elastic

DEVELOPER



Spring Boot Petclinic on Kubernetes

Find Owners

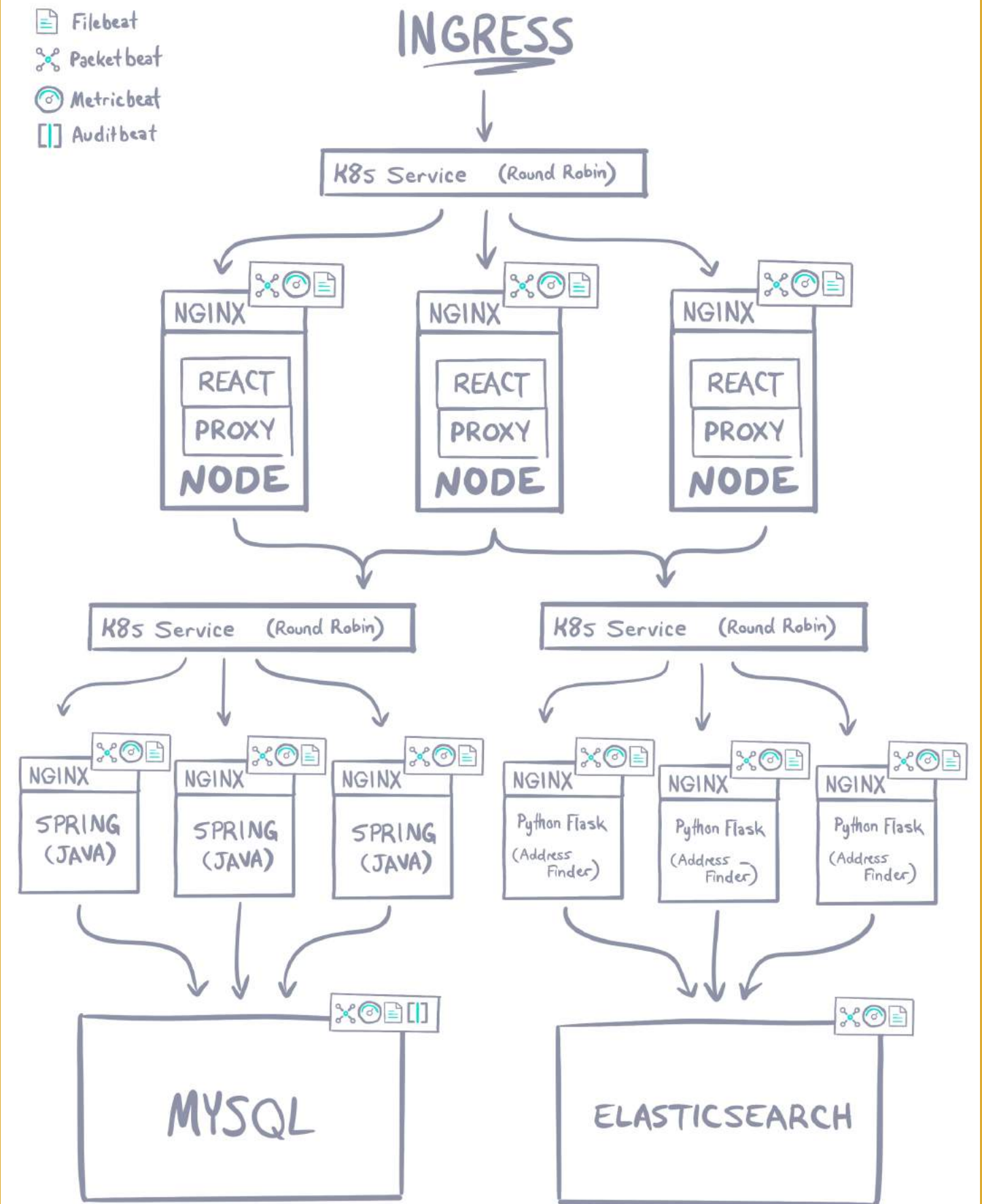
Last name

Find Owner

10 Owners found

Name	Address	City	Telephone	Pets
George Franklin	1167, gate rd, castlewood, virginia	castlewood	6085551023	Leo
Betty Davis	1365, trane rd, el monte, arizona	el monte	6085551749	Basil
Eduardo Rodriquez	2615, brodnax rd, brodnax, brunswick county, virginia	brodnax	6085558763	Jewel, Rosy
Harold Davis	1607, edgecliff rd, edgecliff village, texas	edgecliff village	6085553198	Iggy
Peter McTavish	13252, s yale av e, indianapolis, oklahoma	indianapolis	6085552765	George
Jean Coleman	73, jacob dr, crosby township ham oh, ohio	crosby township ham oh	6085552654	Max, Samantha
Jeff1 Black	1, ocala intl com park phase 2, ocala, marion, florida	ocala	6085555387	Lucky
Maria Escobito	e hls, wellsburg, west virginia	wellsburg	6085557683	Mulligan
David Schroeder	1260, e mohawk dr, buellton, arizona	buellton	6085559435	Freddy
Carlos Estaban	4054, n cove rd, la mesa, arizona	la mesa	6085555487	Lucky, Sly

Architecture



Discover: Filebeat

```
kubernetes.labels.app : "infra-petclinic-server"
```


D

Discover

e

Filters

kubernetes.labels.app : "infra-petclinic-server"

KQL

Nov 26, 2018 @ 18:01:23.1 → Nov 27, 2018 @ 16:47:56.9

Refresh

+ Add filter

filebeat-*

Selected fields

? _source

Available fields

Popular

t log.file.path

t message

@timestamp

t _id

t _index

_score

t _type

t agent.hostname

t agent.version

t cloud.availability_zone

t cloud.instance.id

t cloud.instance.name

Nov 26, 2018 @ 18:01:23.160 - Nov 27, 2018 @ 16:47:56.923 — Auto

Count

10,000

8,000

6,000

4,000

2,000

0

21:00

00:00

03:00

06:00

09:00

12:00

15:00

@timestamp per 30 minutes

Time

_source

Nov 27, 2018 @ 16:47:56.000

kubernetes.labels.app: infra-petclinic-server

container.image.name: openresty/openresty@sha256:99896cbb05a7b4fe14bd036495bbe86d17007835f620b71f3124d5a35ec0e36a

container.name: k8s_infra-demo-petclinic-nginx_infra-petclinic-server-5fff5b6b-gx6x5_default_5f62c511-f1ae-11e8-a17d-42010a80006d_0

container.id: f04900a8d3cb7974ee97ff3aa855273dda63f0c84f21744f0f71bda3df8c3076

Expanded document

View surrounding documents

View single document

Table

JSON

@timestamp

Nov 27, 2018 @ 16:47:56.000

t _id

HX3bVWcBJxh0DmSjC-Pj

Metadata

cloud.* container.* kubernetes.*
and where they are coming from

Filebeat Configuration

Daemonset, ConfigMap, and especially
`filebeat.autodiscover`

<https://github.com/elastic/beats/tree/master/deploy/kubernetes>

Drill Down the Logs

`event.module is not one of nginx mysql`

Optionally add a `loglevel`



Discover



677 hits



New Save Open Share Inspect



Filters

2

kubernetes.labels.app : "infra-petclinic-server"



NOT event.module is one of nginx, mysql ×

loglevel: ERROR ×

+ Add filter



filebeat-*



Selected fields

? _source



Available fields



Nov 26, 2018 @

ount

20
15
10



Log UI

Java application with tags : "petclinic-server"

Configured with logback.xml and petclinic-server.json (ingest pipeline)

D

Logs

e

tags : "petclinic-server"

Configuration

Customize

Highlights

Streaming new entries...

|| Stop streaming

Timestamp	Message	
	erFilter@102a11bb, org.springframework.security.web.header.HeaderWriterFilter@2517cc38, org.springgframework.security.web.authentication.logout.LogoutFilter@5feb82b3, org.springframework.securit y.web.authentication.www.BasicAuthenticationFilter@7462ba4b, org.springframework.security.web.sa vedrequest.RequestCacheAwareFilter@77cd235b, org.springframework.security.web.servletapi.Securit yContextHolderAwareRequestFilter@173b1af1, org.springframework.security.web.authentication.Anon ymousAuthenticationFilter@62de73eb, org.springframework.security.web.session.SessionManagementFil ter@2e1ba142, org.springframework.security.web.access.ExceptionTranslationFilter@7e1a9173, org.s pringframework.security.web.access.intercept.FilterSecurityInterceptor@5b1ff8cd]	03 AM
Sep 27, 2019 @ 12:19:56.176	[INFO] INFO AnnotationMBeanExporter - Registering beans for JMX exposure on startup	09 AM
Sep 27, 2019 @ 12:19:56.188	[INFO] INFO DefaultLifecycleProcessor - Starting beans in phase 2147483647	
Sep 27, 2019 @ 12:19:56.188	[INFO] INFO DocumentationPluginsBootstrapper - Context refreshed	
Sep 27, 2019 @ 12:19:56.349	[INFO] INFO DocumentationPluginsBootstrapper - Found 1 custom documentation plugin(s)	12 PM
Sep 27, 2019 @ 12:19:56.371	[INFO] INFO ApiListingReferenceScanner - Scanning for api listing references	
Sep 27, 2019 @ 12:19:57.764	[INFO] INFO CachingOperationNameGenerator - Generating unique operation named: addOwnerUsingPOS T_1	
Sep 27, 2019 @ 12:19:58.076	[INFO] INFO Http11NioProtocol - Starting ProtocolHandler ["http-nio-0.0.0.0-8000"]	03 PM
Sep 27, 2019 @ 12:19:58.207	[INFO] INFO NioSelectorPool - Using a shared selector for servlet write/read	
Sep 27, 2019 @ 12:19:58.273	[INFO] INFO TomcatEmbeddedServletContainer - Tomcat started on port(s): 8000 (http)	
Sep 27, 2019 @ 12:19:58.285	[INFO] INFO PetClinicApplication - Started PetClinicApplication in 35.617 seconds (JVM running for 48.897)	06 PM
Sep 27, 2019 @ 12:20:11.767	INFO [/petclinic] - Initializing Spring FrameworkServlet 'dispatcherServlet'	
Sep 27, 2019 @ 12:20:11.767	[INFO] INFO DispatcherServlet - FrameworkServlet 'dispatcherServlet': initialization started	09 PM
Sep 27, 2019 @ 12:20:11.867	[INFO] INFO DispatcherServlet - FrameworkServlet 'dispatcherServlet': initialization completed in 89 ms	

Streaming new entries

last updated 4 seconds ago

Sat 28

Alternative: Structured Logs

<https://github.com/elastic/java-ecs-logging> (version 0.1.1)

Or <https://github.com/logstash/logstash-logback-encoder>

APM

How to instrument a Java application



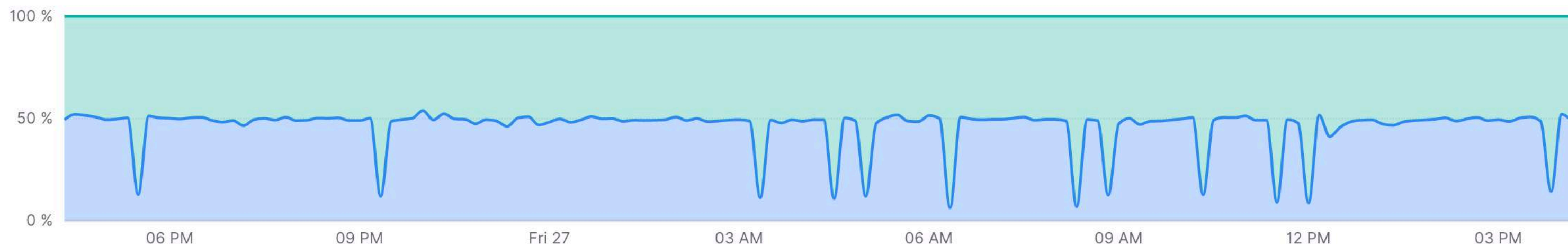
Time spent by span type

BETA

Hide chart

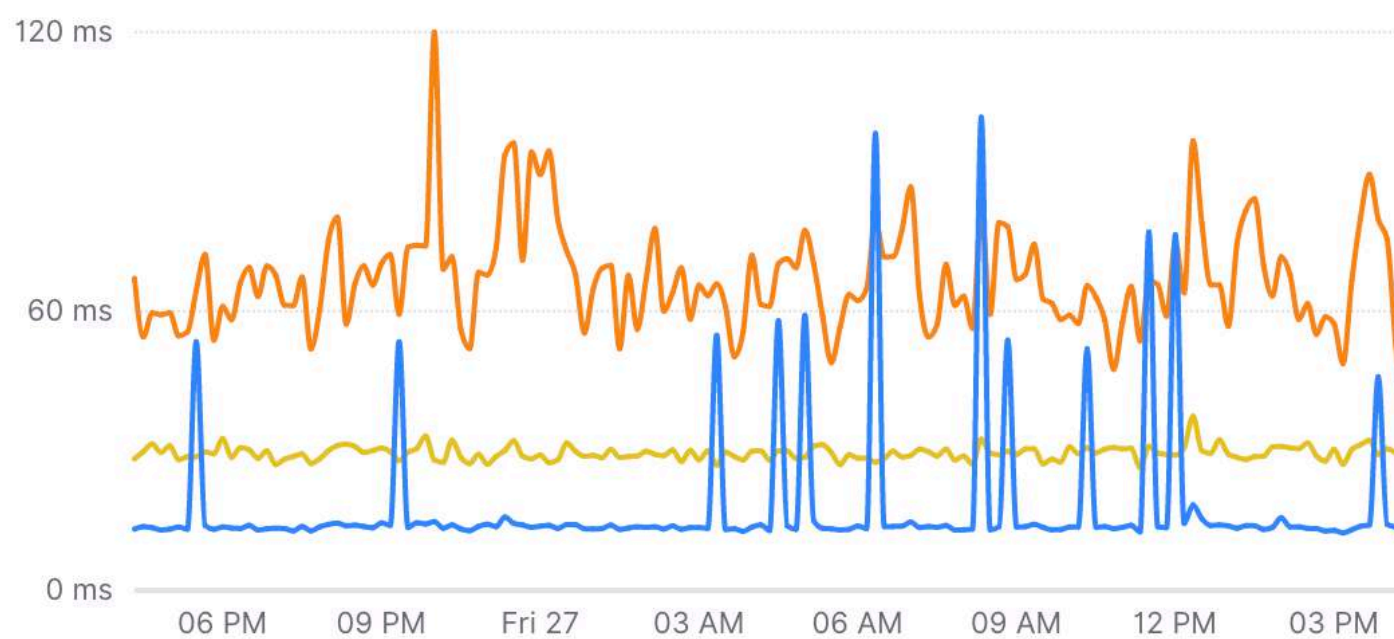
app mysql

62.5% 37.5%



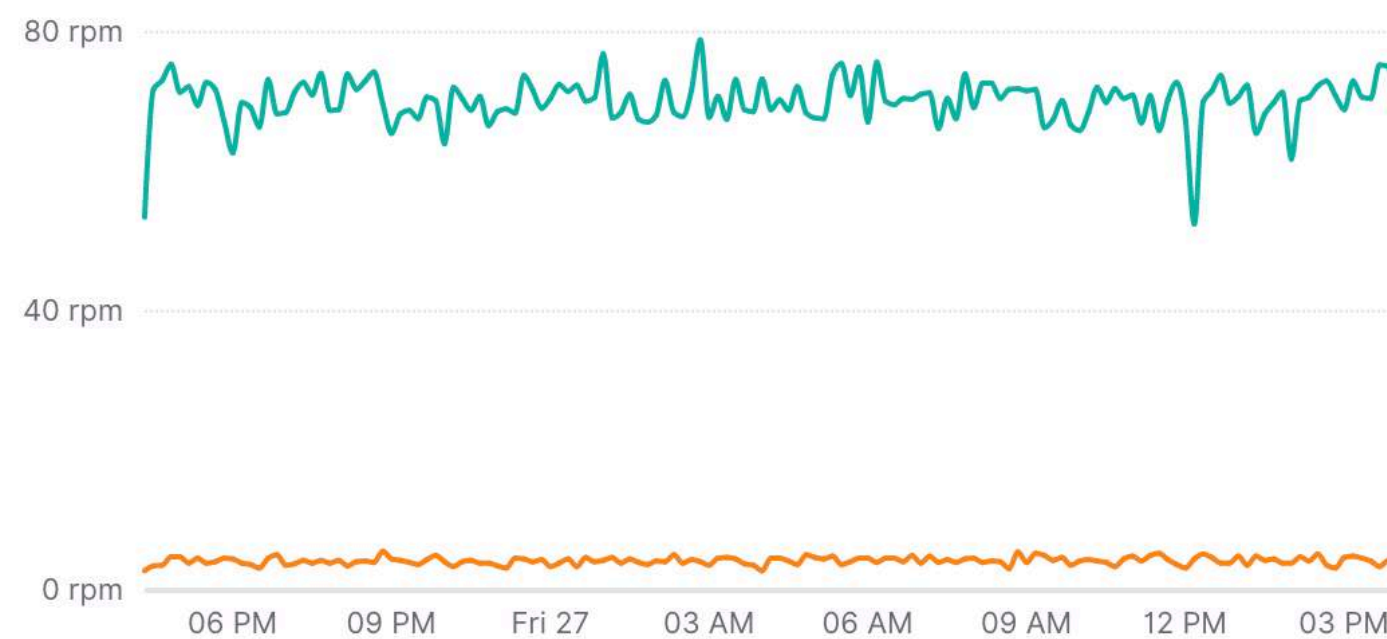
Transaction duration

Machine learning: [View Job](#)



Avg. 18 ms 95th percentile 99th percentile

Requests per minute



HTTP 2xx 69.7 rpm HTTP 4xx 4.2 rpm

petclinic-spring

Clear spikes but even traffic — what's up?

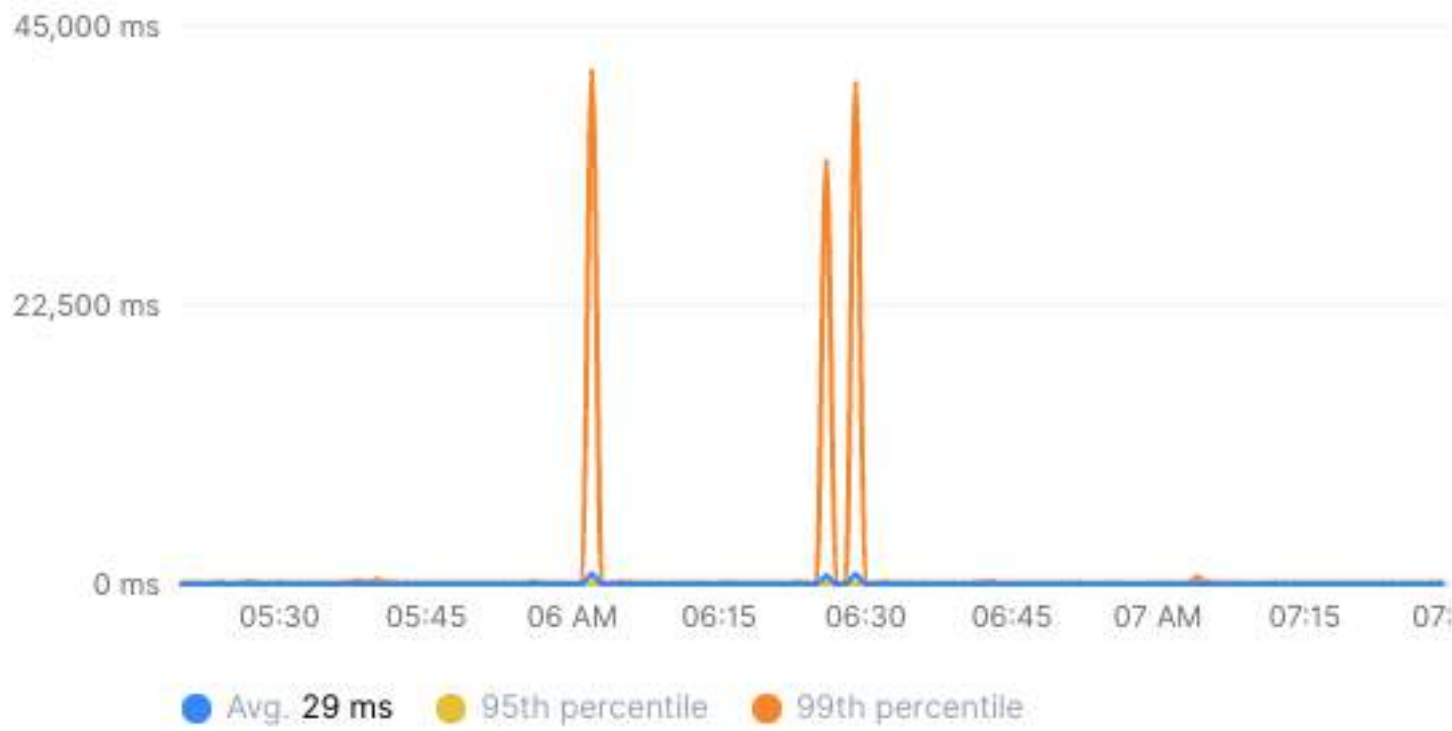
Drill Down the Traces

Times go up across all the services as you dive deeper

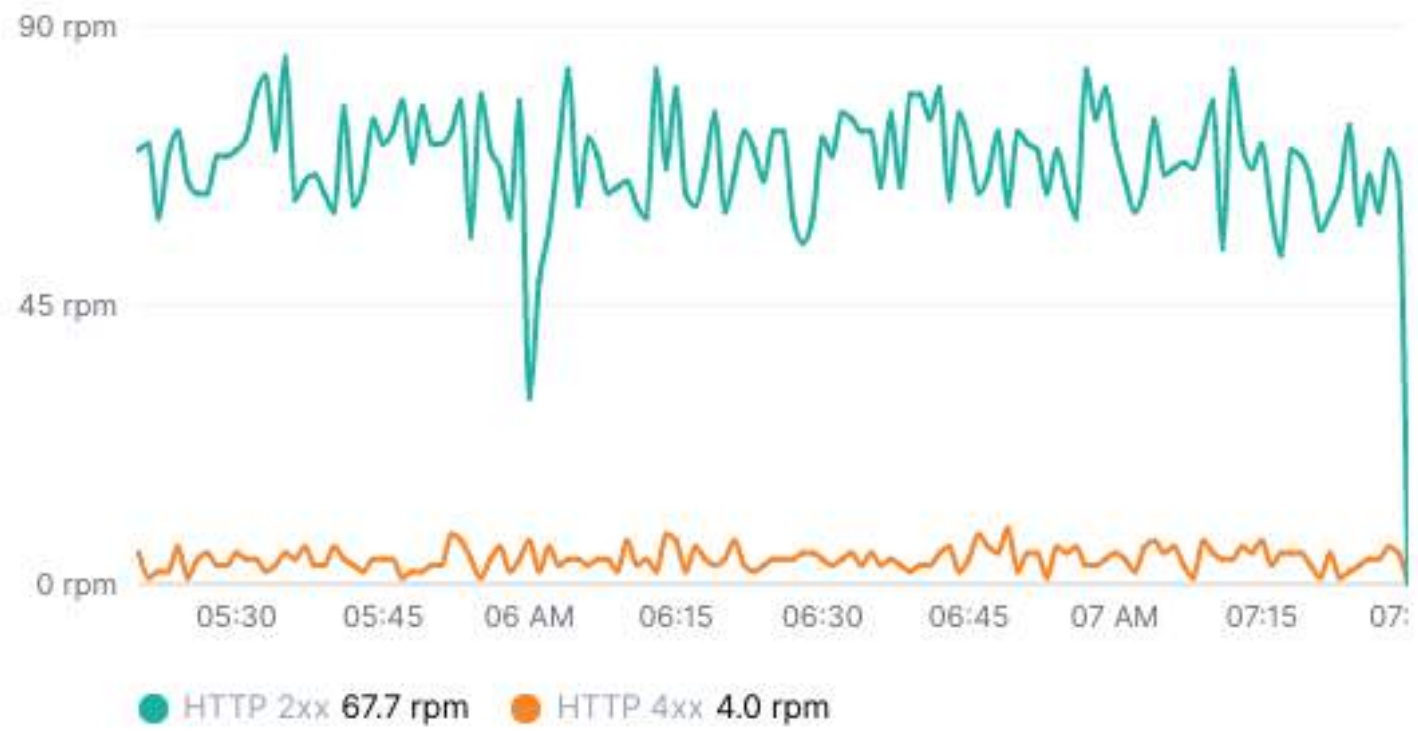


Transaction duration

Machine learning: [View Job](#)



Requests per minute



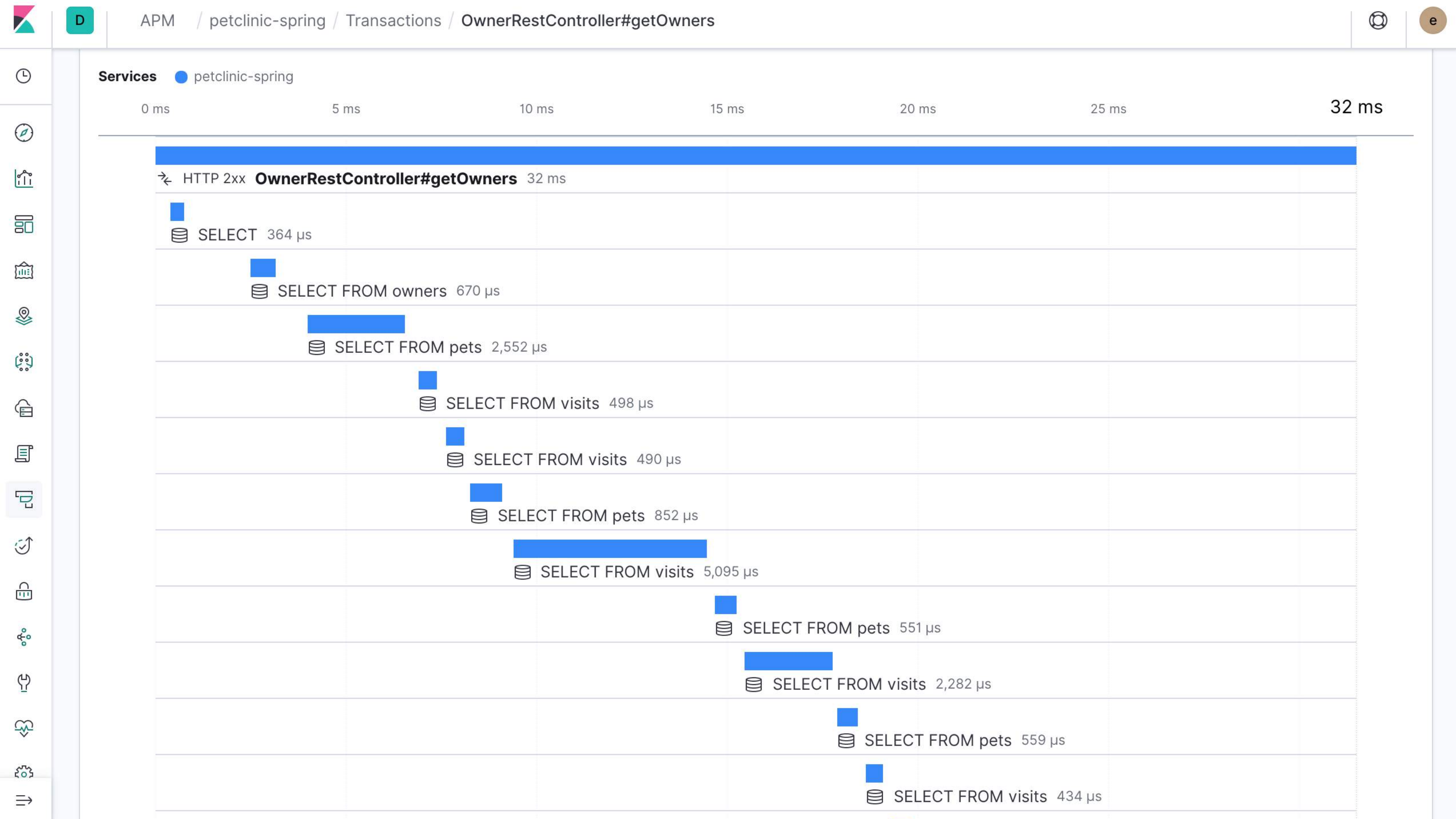
Transactions

Name	Avg. duration	95th percentile	Trans. per minute	Impact ↓
OwnerRestController#updateOwner	1,239 ms	103 ms	0.9 tpm	<div></div>
OwnerRestController#getOwners	25 ms	37 ms	15.4 tpm	<div></div>
OwnerRestController#getOwner	10 ms	15 ms	19.0 tpm	<div></div>
VetRestController#getAllVets	12 ms	19 ms	8.3 tpm	<div></div>
PetRestController#getPets	18 ms	26 ms	3.4 tpm	<div></div>
PetRestController#getPet	9 ms	15 ms	4.9 tpm	<div></div>

Traces

`OwnerRestController#getOwners` has an N+1 problem

But the same for slow and fast requests, so an independent problem



petclinic-node

Same spike for that time, so not a Java problem

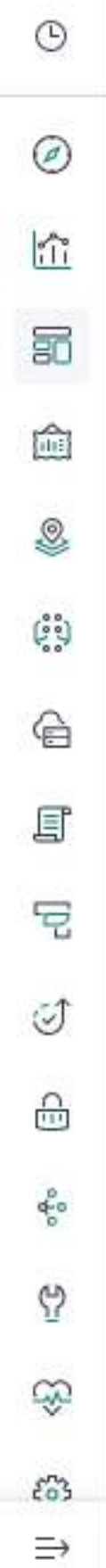
"Service Analysis" Dashboard



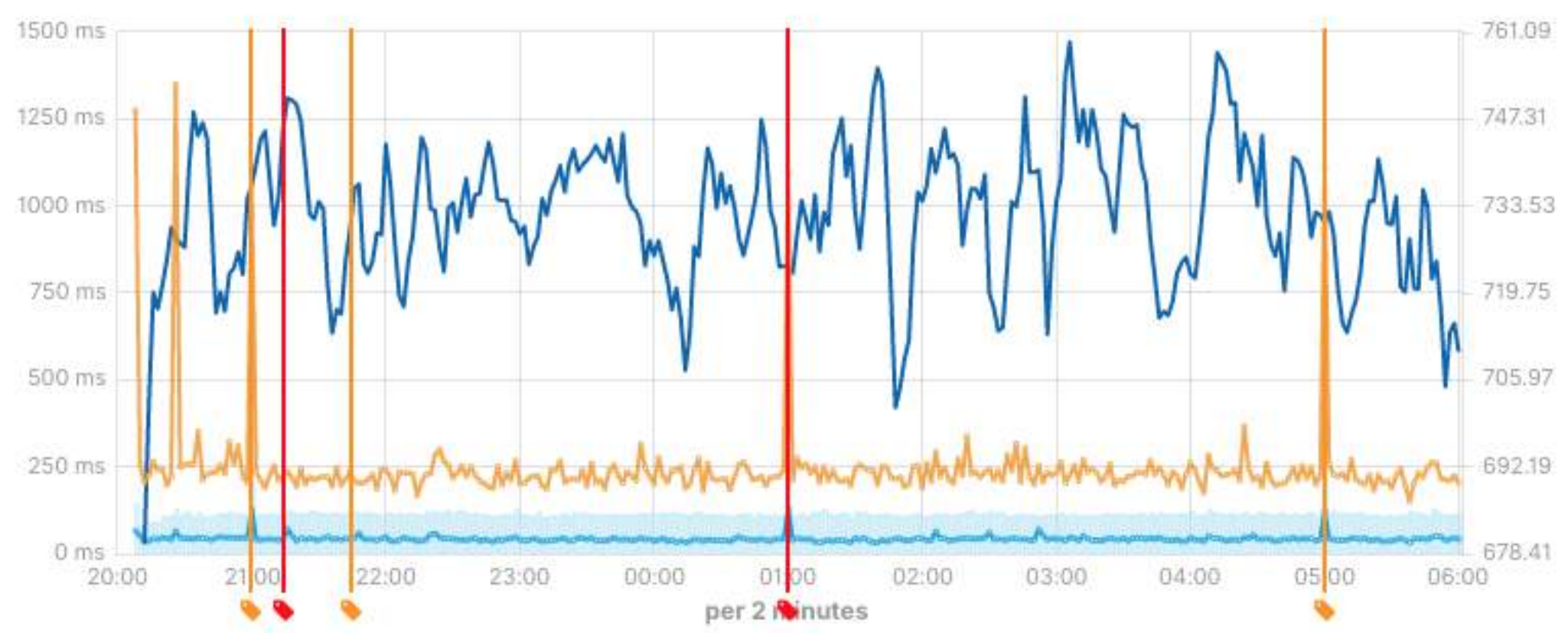
99th Percentile

Filter to the 99th percentile

`petclinic-node` and `petclinic-spring` are impacted at the same points, but not the React or Python app 🤔



[APM] System Performance

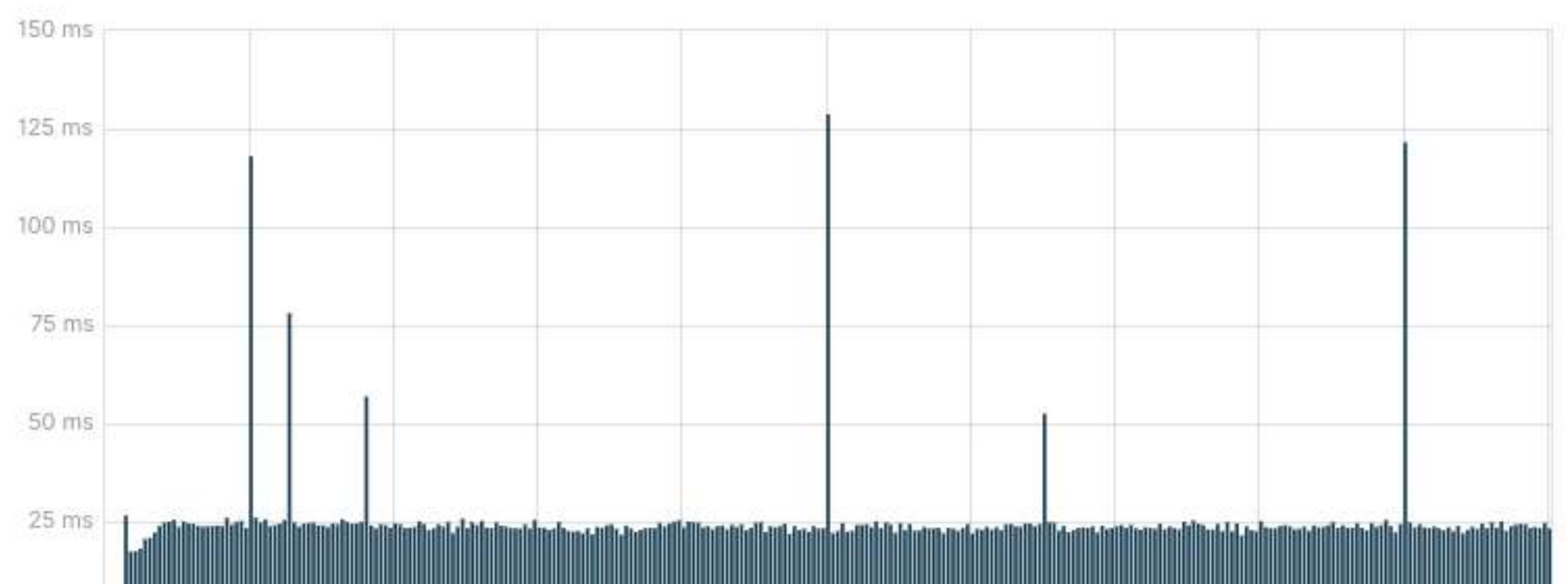


99th Percentile...	203 ms
Number of Trans...	710.4
Average	41 ms
95th Percentile ...	114 ms

[APM] Service Performance ...



[APM] Service Performance

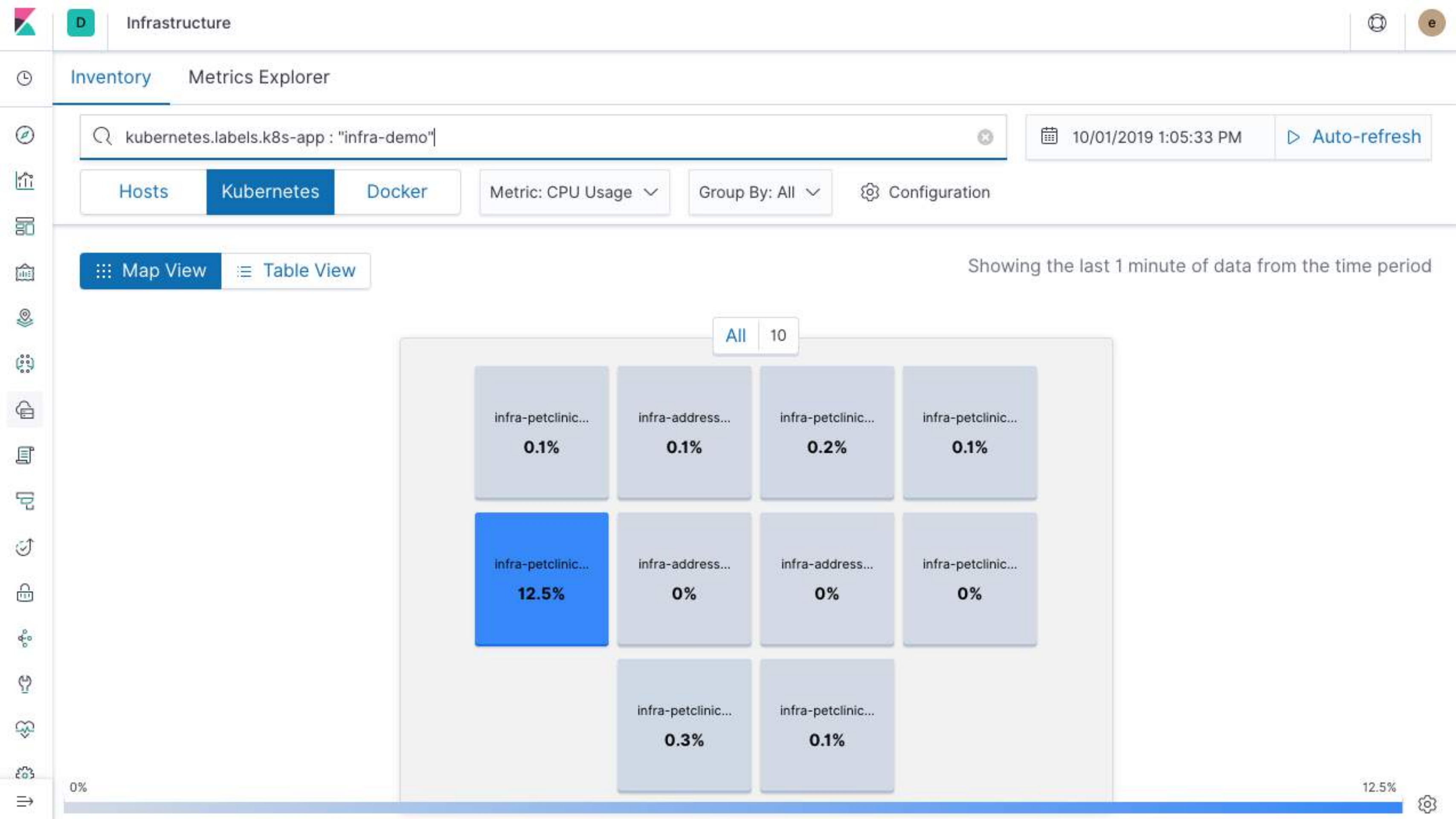


petclinic-react	224 ms
petclinic-node	34 ms
address-finder	25 ms
petclinic-spring	23 ms



Infrastructure UI

`kubernetes.labels.k8s-app : "infra-demo" in`
Kubernetes



Metrics

Collection similar to Filebeat

No outlier for our problem though

infra-petclinic-mysql-569c4cc7c8-fzzk4

Overview

CPU Usage

Memory Usage

Network Traffic



~ an hour ago → ~ 9 minutes ago

Refresh

Pod Overview

CPU Usage

12.5%

Memory Usage

1%

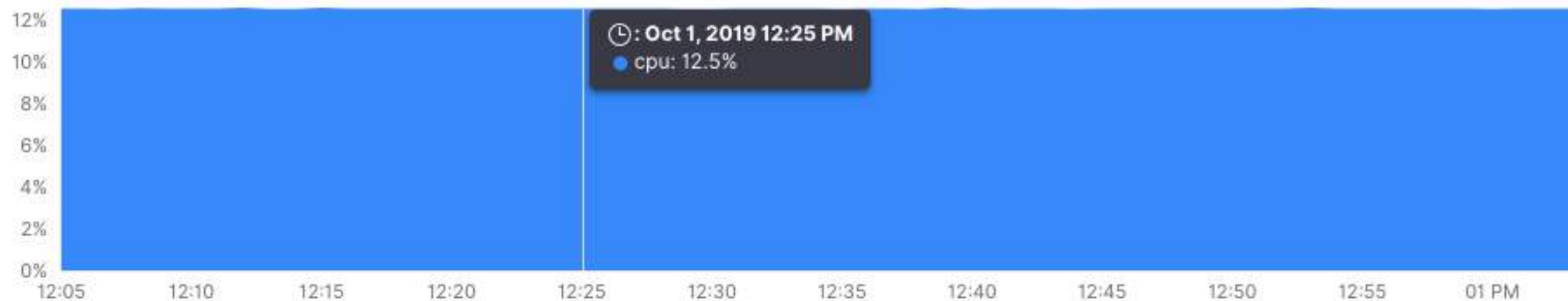
Inbound (RX)

44.2kbit/s

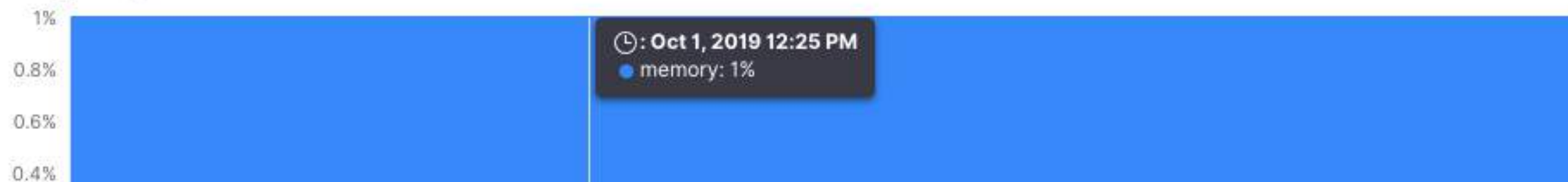
Outbound (TX)

73.7kbit/s

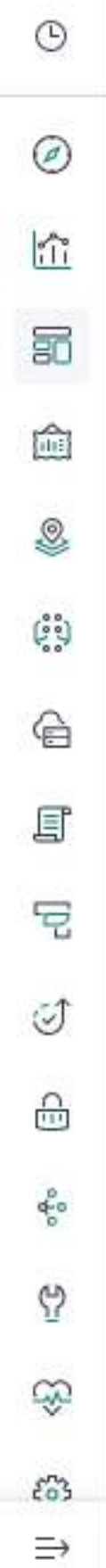
CPU Usage



Memory Usage



"MySQL Analysis" Dashboard



[Metricbeat] MySQL Metrics

195.513
Average Opened Tables

1.039
Average Threads

2,484,746
Select Commands

18,774
Delete Commands

K8 Controls - 2

⚠ Pod

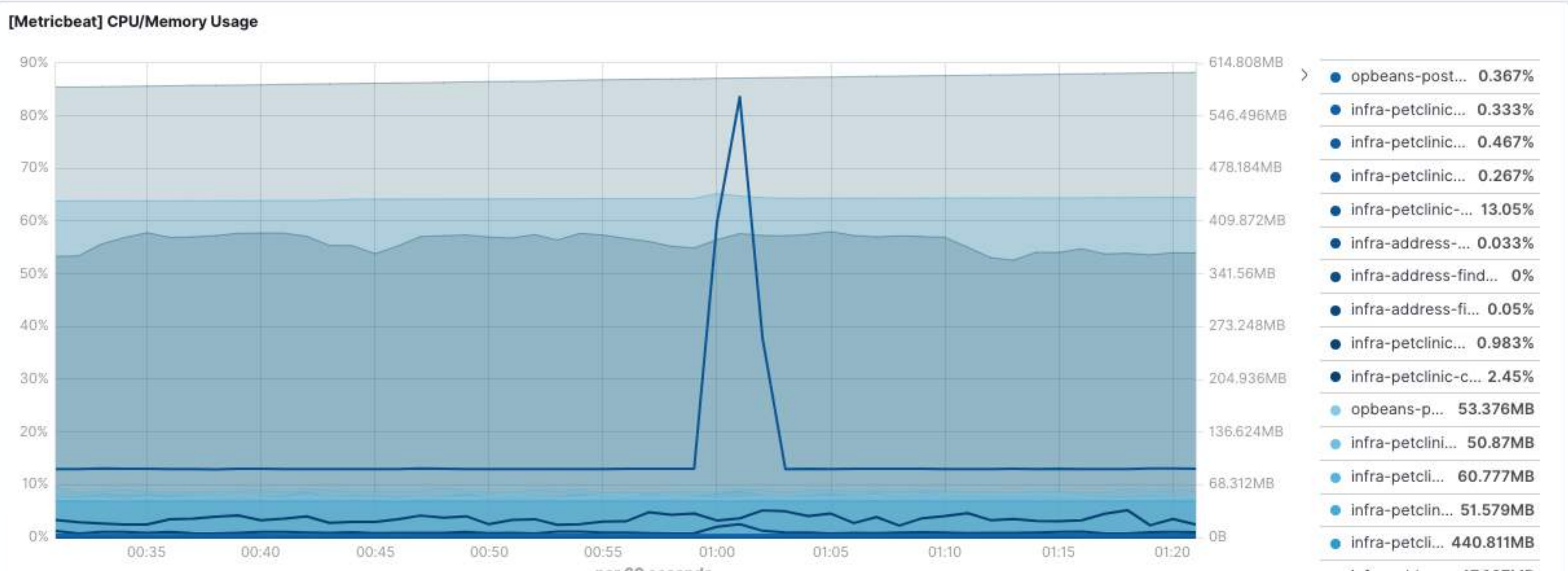
Select... ▼

Container

Select...

Nodes, Pods & Containers

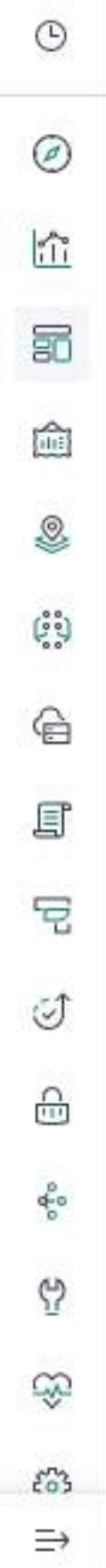
Pod Name	Container Name	Count
infra-petclinic-client-7b9644b6c8-8zvdv	infra-demo-petclinic-nginx	10,462
infra-petclinic-client-7b9644b6c8-8zvdv	infra-demo-petclinic-client	6,443
infra-petclinic-client-7b9644b6c8-8zvdv	infra-demo-petclinic-nginx	9,673



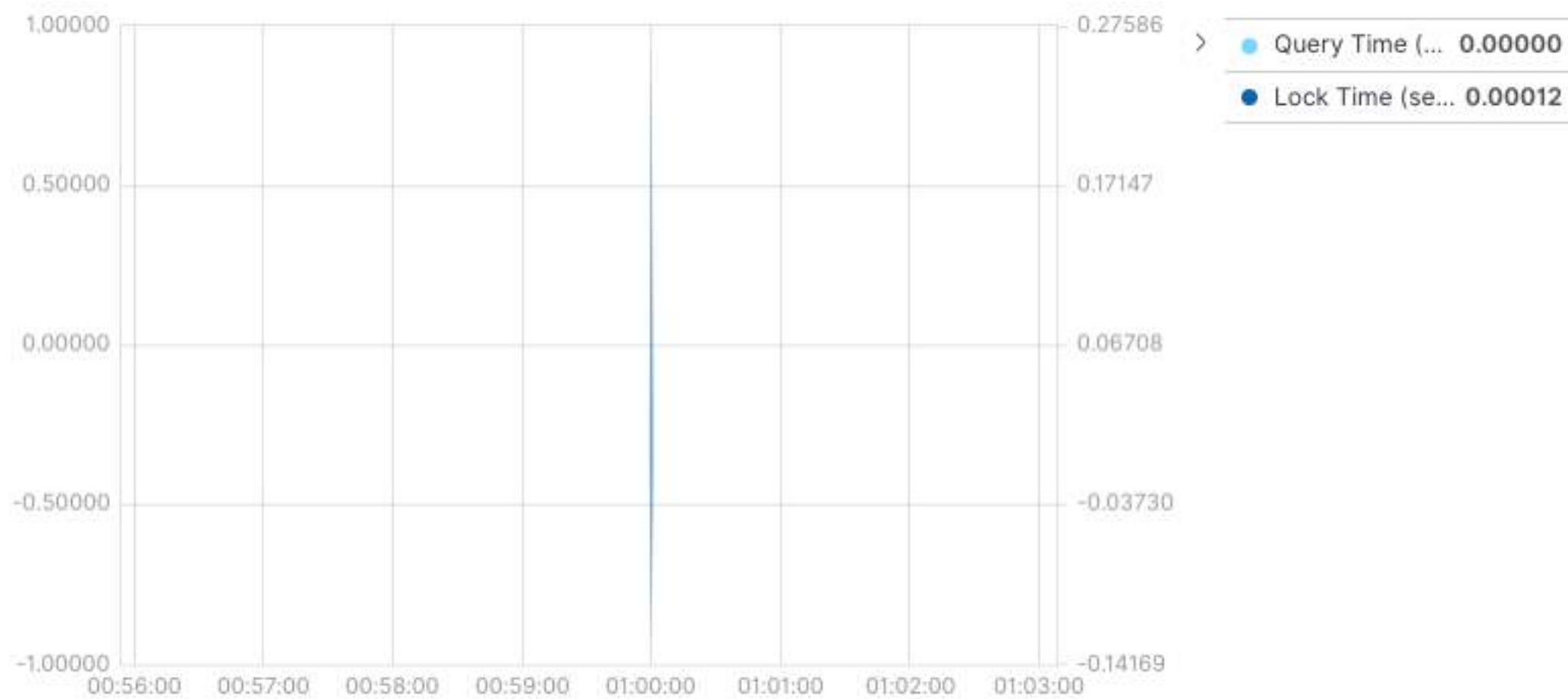
Pod Filter

`infra-petclinic-mysql-...`

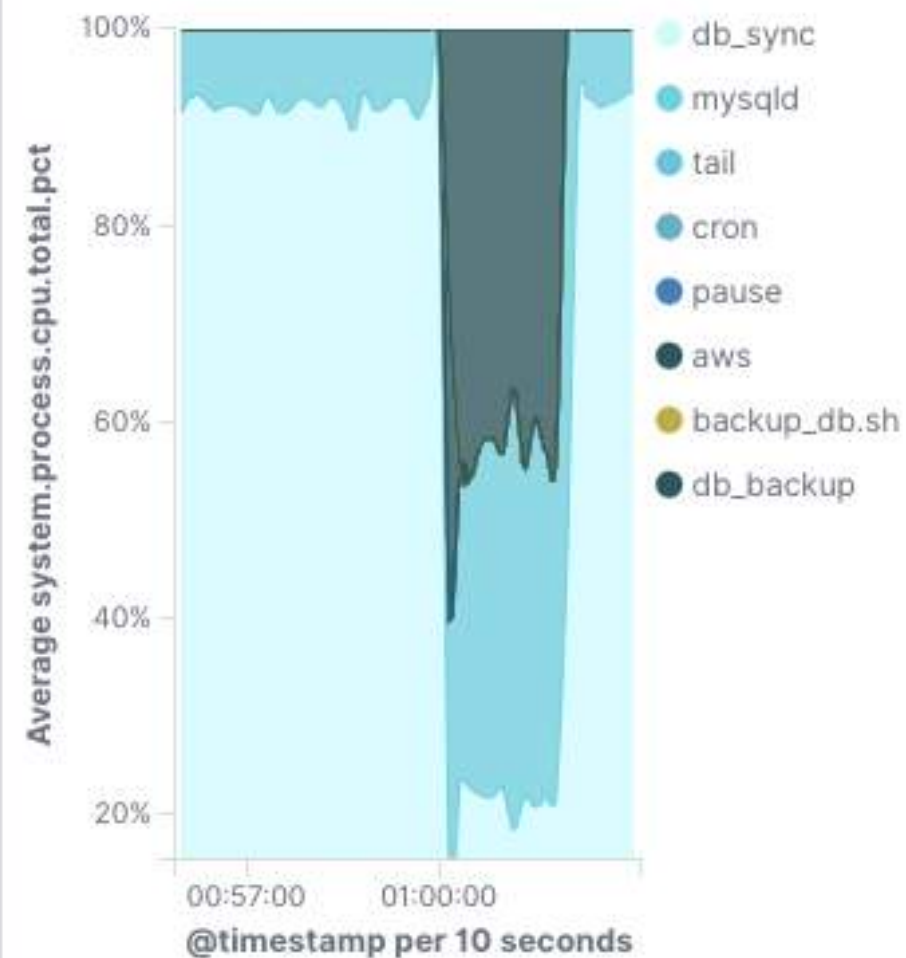
Do you see the problem?



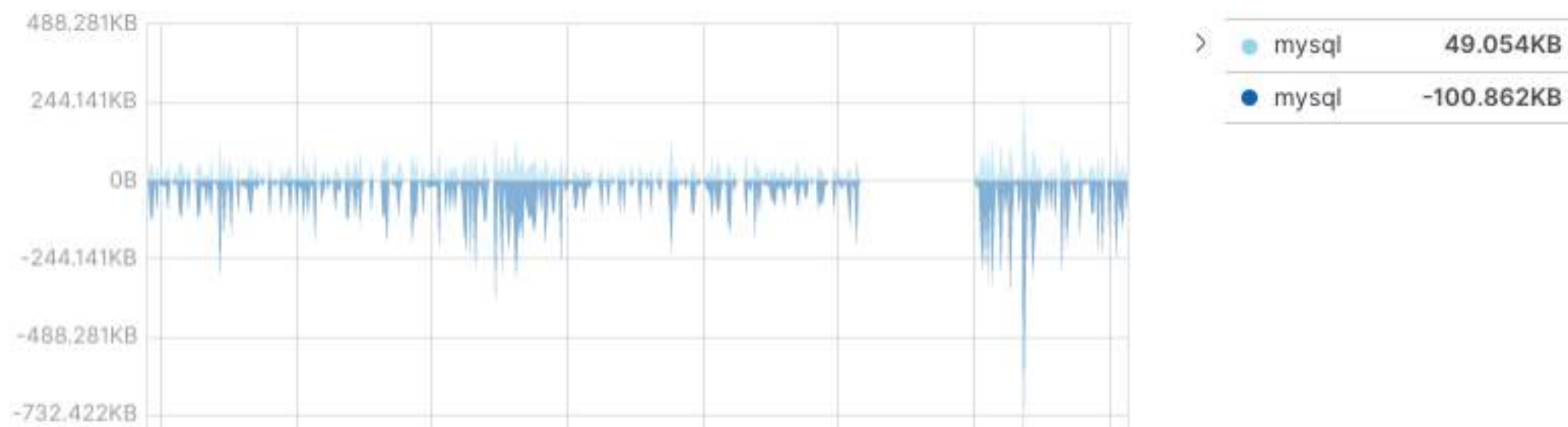
[Filebeat & Packetbeat] MySQL Performance



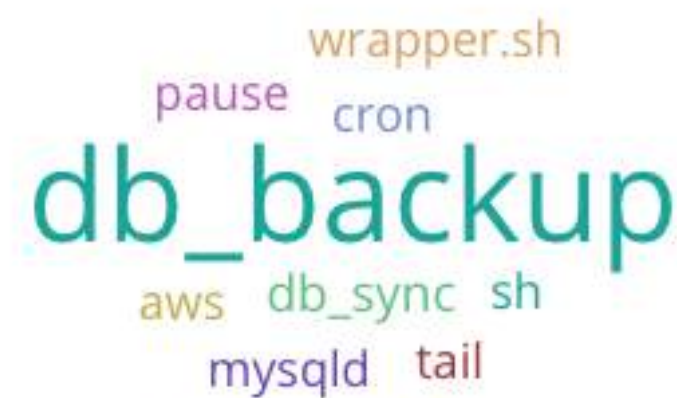
[Metricbeat] Top Processes by CPU



[Packetbeat] Network Traffic



[Metricbeat] Top Processes



Complaint about Slow App

Filter to `transaction.duration.us >= 20000000` in APM

transaction.duration.us >= 2000000

environment All

Transactions Errors Metrics

Transaction duration

Machine learning: [View Job](#)



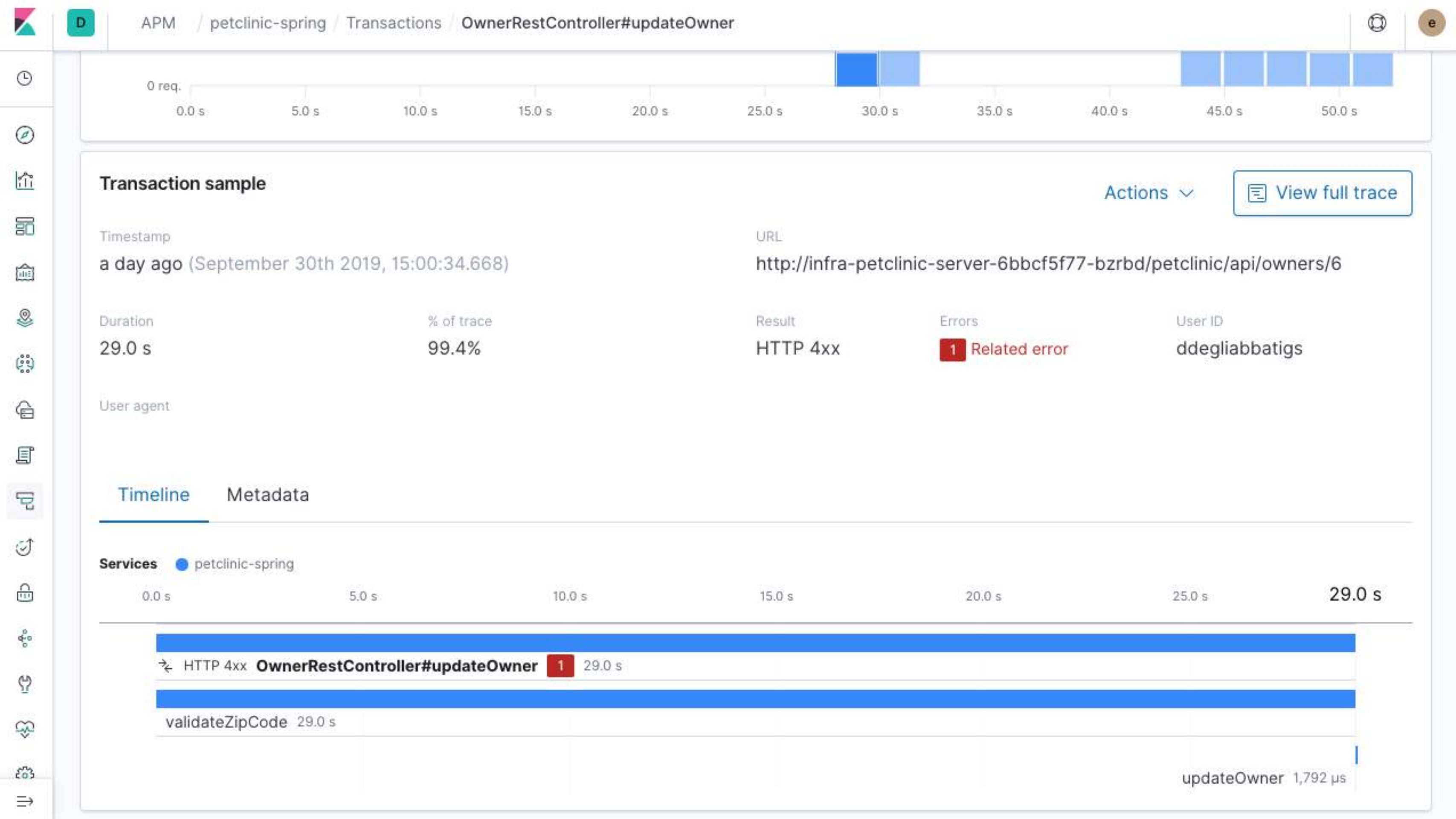
Requests per minute



Transactions

Name	Avg. duration	95th percentile	Trans. per minute	Impact ↓
OwnerRestController#updateOwner	43,305 ms	50,238 ms	0.0 tpm	

Timing of Our Code?



Drill Down to the Code

Plus the request and response (4xx)

Span details

[View span in Discover](#)

Service

petclinic-spring

Transaction

OwnerRestController#updateOwner

Name

validateZipCode

Duration

48,373 ms

% of transaction

100.0%

Type

app

[Stack Trace](#)

[Labels](#)

ZipCodeValidator.java in **isValid** at **line 33**

ZipCodeValidator.java in **isValid** at **line 12**

> [48 library frames](#)

```
private Pattern zipPattern;
@Override
public void initialize(ZipCodeConstraint constraintAnnotation) {
    this.zipPattern = Pattern.compile("^([\\d]){5}(:|-([\\d]){4})?$");
}

@CaptureSpan(value = "validateZipCode")
@Override
public boolean isValid(String value, ConstraintValidatorContext context) {
    Matcher matcher = zipPattern.matcher(value);
    boolean match = matcher.find();
    if (!match){
        Transaction transaction = ElasticApm.currentTransaction();
        if (transaction != null){
            transaction.captureException(new IllegalArgumentException(String.format("%s is invalid zip code",value)));
        }
    }
    return match;
}
```

Cloudflare Outage Caused by Bad Software Deploy

<https://blog.cloudflare.com/cloudflare-outage/> (2019/07/02)

Unfortunately, one of these rules contained a regular expression that caused CPU to spike to 100% on our machines worldwide. This 100% CPU spike caused the 502 errors that our customers saw. At its worst traffic dropped by 82%.


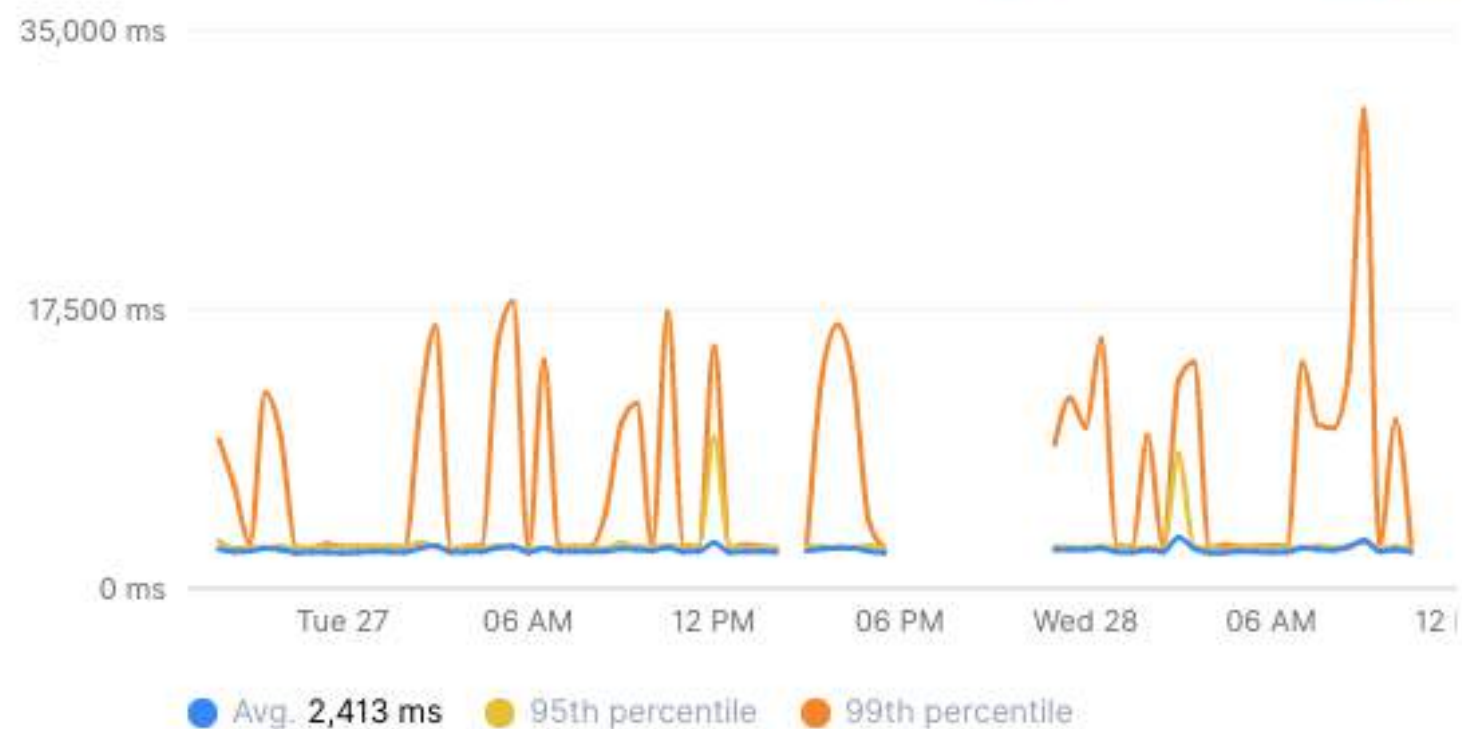
Complaint about Loading Times

React app with the same filter

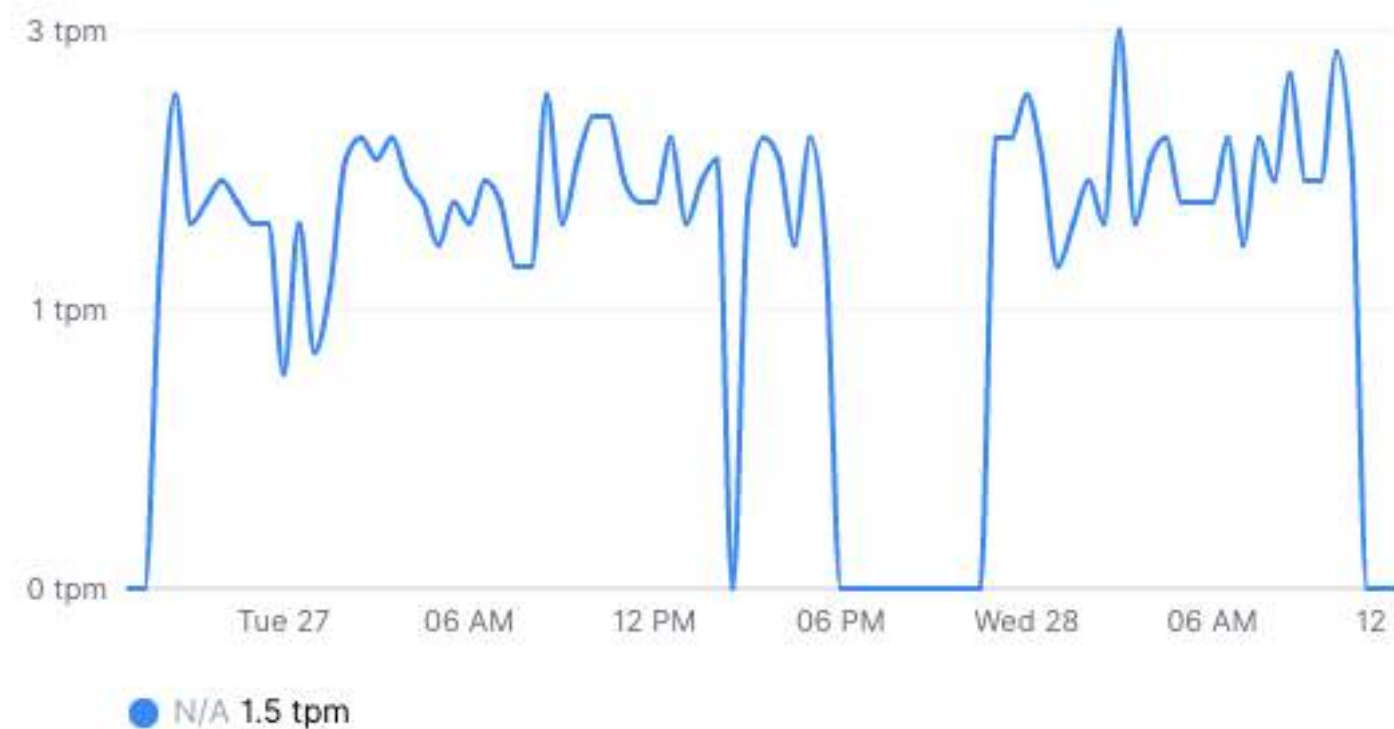
Filter by type

Events

Transaction duration

 Machine learning: [View Job](#)

Transactions per minute

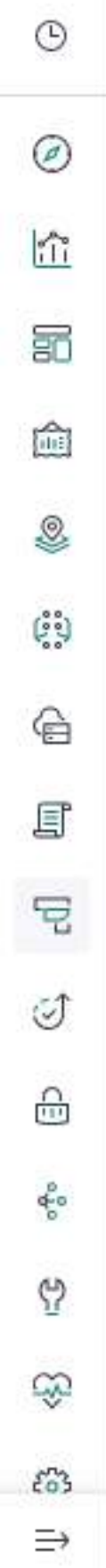


Transactions

Name	Avg. duration	95th percentile	Trans. per minute	Impact ↓
FindOwnersPage	2,329 ms	2,593 ms	0.5 tpm	<div></div>
OwnersPage	2,480 ms	2,511 ms	0.5 tpm	<div></div>
VetsPage	2,357 ms	2,534 ms	0.2 tpm	<div></div>
ErrorPage	2,361 ms	2,499 ms	0.1 tpm	<div></div>

React Loading Issues 🤔

Browser correlation



Transaction sample

Actions

View full trace

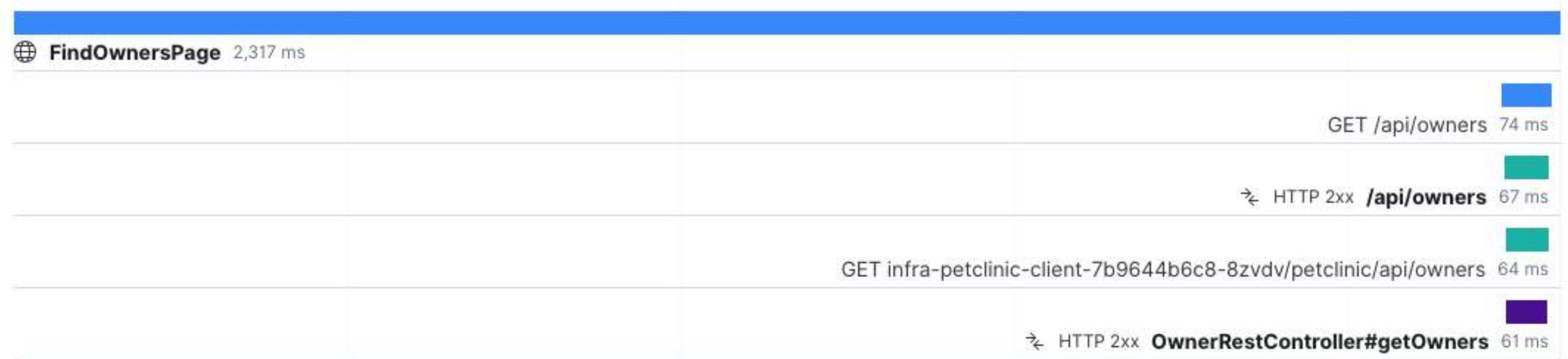
Timestamp		URL	
10 months ago (November 27th 2018, 00:21:27.162)		http://infra-petclinic-client:3000/owners/list	
Duration	% of trace	Result	Errors
2,317 ms	100.0%	N/A	None
User ID		victor02	
User agent	User agent OS	User agent device	
IE 9.0	Windows 7	Other	

Timeline

Metadata

Services petclinic-react petclinic-node petclinic-spring

0 ms 500 ms 1,000 ms 1,500 ms 2,000 ms 2,317 ms



Availability

Heartbeat — in another datacenter?

Up	Down	Location	ID	Name	URL	Port	Scheme
----	------	----------	----	------	-----	------	--------

Pings over time

The bar chart displays the number of pings received over a series of time intervals. The Y-axis, labeled 'Pings', ranges from 0 to 120,000 in increments of 20,000. The X-axis shows time intervals from 11-26 21:00 to 11-27 11:00. The chart shows a significant spike in pings at 11-26 21:00, followed by a period of high, stable ping counts around 120,000.

Time Interval	Pings (Approximate)
11-26 21:00	65,000
11-26 23:00	118,000
11-27 01:00	120,000
11-27 03:00	120,000
11-27 05:00	118,000
11-27 07:00	120,000
11-27 09:00	120,000
11-27 11:00	120,000

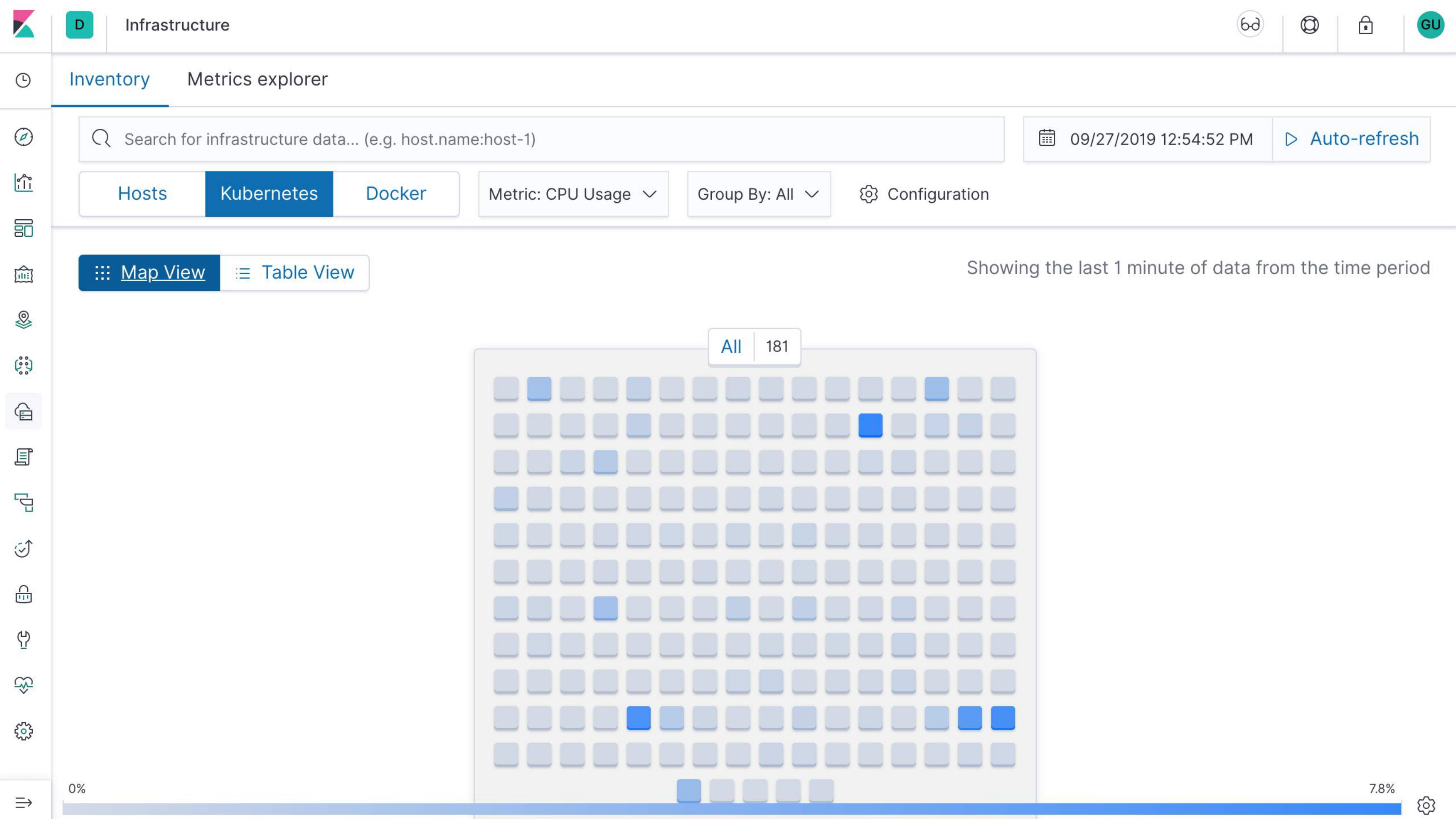
Status	Name	URL	Downtime history	Integrations
<div><div>▼</div><div><div><div></div></div>Up</div><div>10 months ago</div></div>	infra-petclinic-server-5fff5b6b-59psl	http://10.56.3.6:8080/server-status ↗	<div><div></div><div></div><div></div><div></div></div>	<div><div></div><div></div><div></div></div>
<div><div>▼</div><div><div><div></div></div>Up</div><div>10 months ago</div></div>	infra-address-finder-549cd4684f-5mgxx	http://10.56.1.161:80/api ↗	<div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div></div>	<div><div></div><div></div><div></div></div>
<div><div>▼</div><div><div><div></div></div>Up</div><div>10 months ago</div></div>	infra-petclinic-client-7b9644b6c8-hjjsq	http://10.56.2.88:80/status ↗		<div><div></div><div></div><div></div></div>
<div><div>▼</div><div><div><div></div></div>Up</div><div>10 months ago</div></div>	Unnamed - auto-http-0X4FA94B0313EE0BC4-78ebd16eaca0565d	https://www.bbc.com ↗	<div><div></div><div></div></div>	<div><div></div><div></div><div></div></div>
<div><div>▼</div><div><div><div></div></div>Up</div><div>10 months ago</div></div>	Unnamed - auto-http-0X4FA94B0313EE0BC4-78ebd16eaca0565d	https://www.bbc.com ↗	<div><div></div><div></div></div>	<div><div></div><div></div><div></div></div>

CONCLUSION

FROM TO with Kubernetes

Try at Home

<https://demo.elastic.co>



QUESTIONS & DISCUSSION

Philipp Krenn

@xeraa