

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

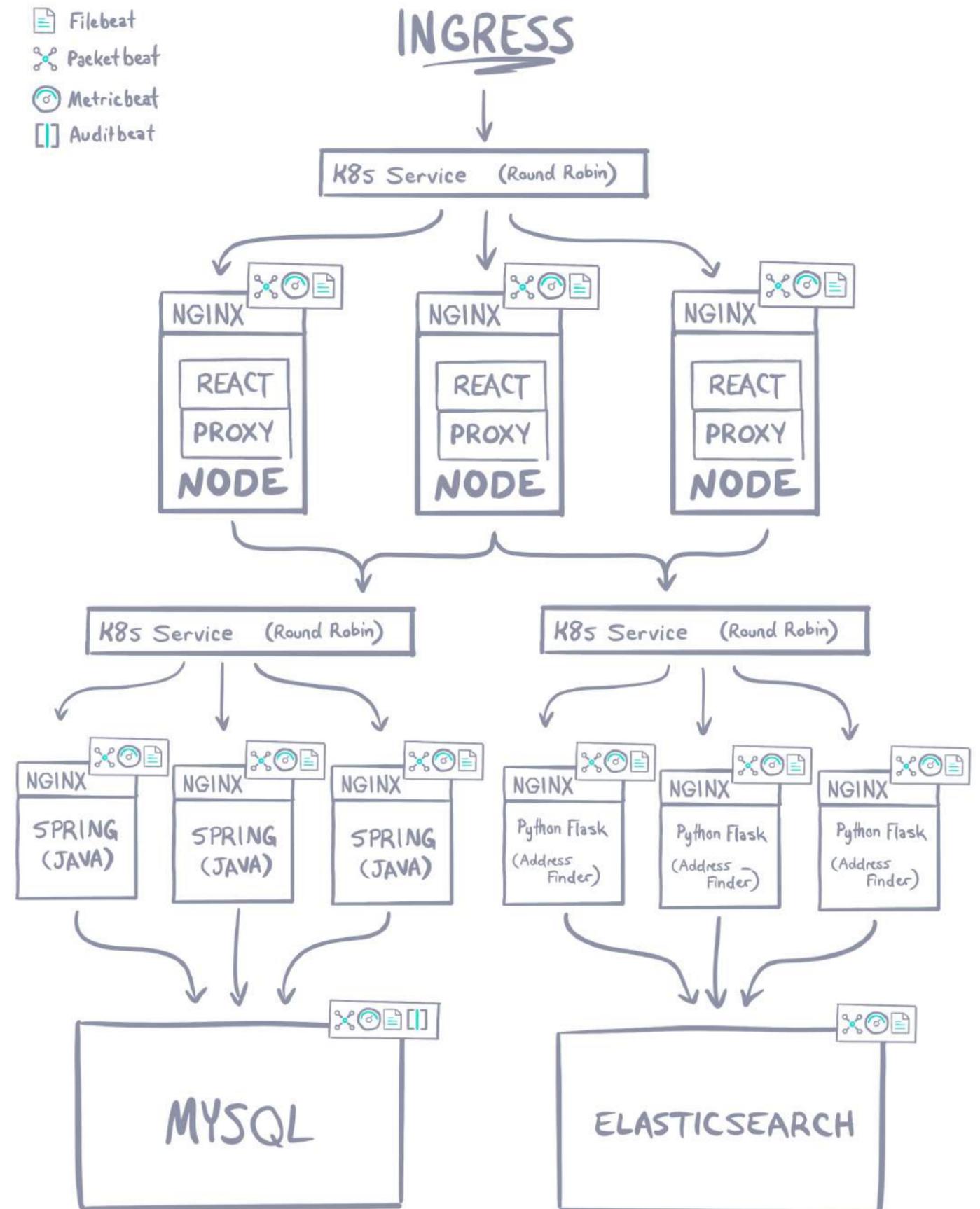
Last name

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

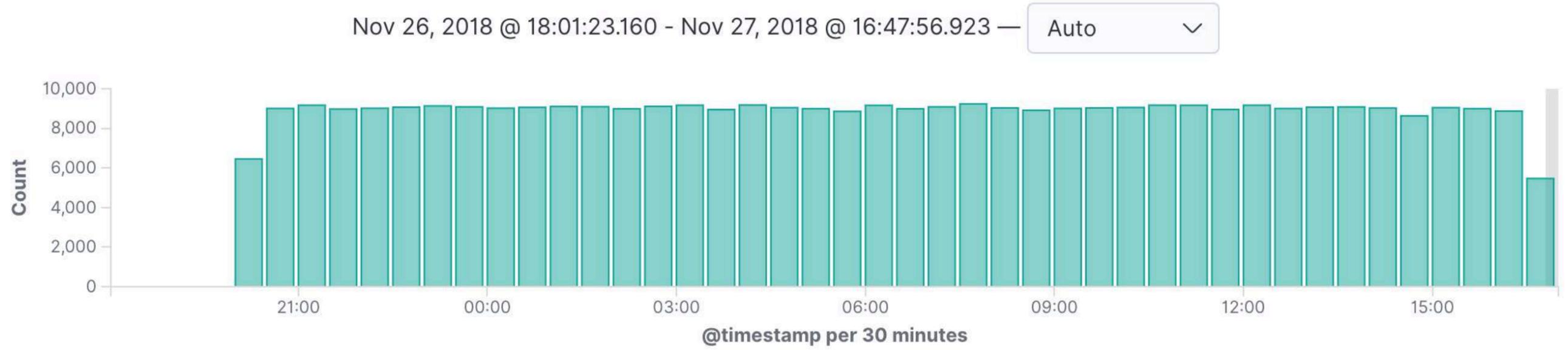
```
kubernetes.labels.app : "infra-petclinic-server"
```



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`

Time	_source
Nov 27, 2018 @ 16:47:56.000	<pre>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</pre>

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`



D

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)

tags : "petclinic-server"

[Configuration](#) [Customize](#) [Highlights](#) [Streaming new entries...](#) [|| Stop streaming](#)

Timestamp	Message	
	<code>erFilter@102a11bb, org.springframework.security.web.header.HeaderWriterFilter@2517cc38, org.springframework.security.web.authentication.logout.LogoutFilter@5feb82b3, org.springframework.security.web.authentication.www.BasicAuthenticationFilter@7462ba4b, org.springframework.security.web.savedrequest.RequestCacheAwareFilter@77cd235b, org.springframework.security.web.servletapi.SecurityContextHolderAwareRequestFilter@173b1af1, org.springframework.security.web.authentication.AnonymousAuthenticationFilter@62de73eb, org.springframework.security.web.session.SessionManagementFilter@2e1ba142, org.springframework.security.web.access.ExceptionTranslationFilter@7e1a9173, org.springframework.security.web.access.intercept.FilterSecurityInterceptor@5b1ff8cd]</code>	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)	
Sep 27, 2019 @ 12:19:56.371	[INFO] INFO ApiListingReferenceScanner - Scanning for api listing references	12 PM
Sep 27, 2019 @ 12:19:57.764	[INFO] INFO CachingOperationNameGenerator - Generating unique operation named: addOwnerUsingPOST_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	

Alternative: Structured Logs

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

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

APM

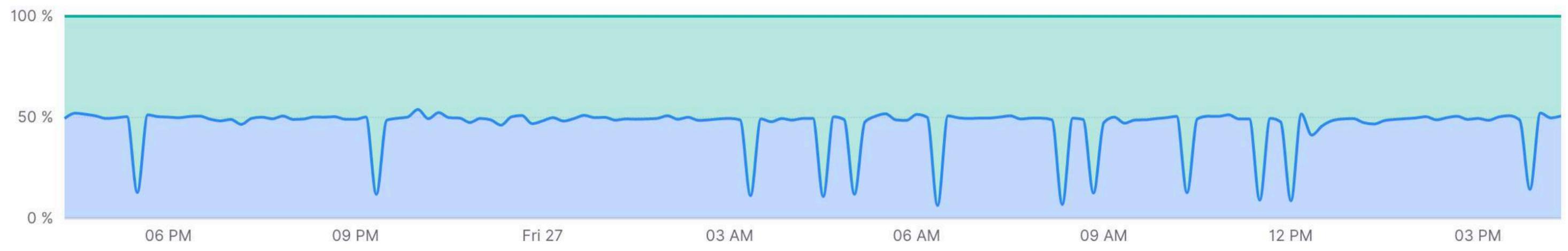
How to instrument a Java application

Time spent by span type

BETA

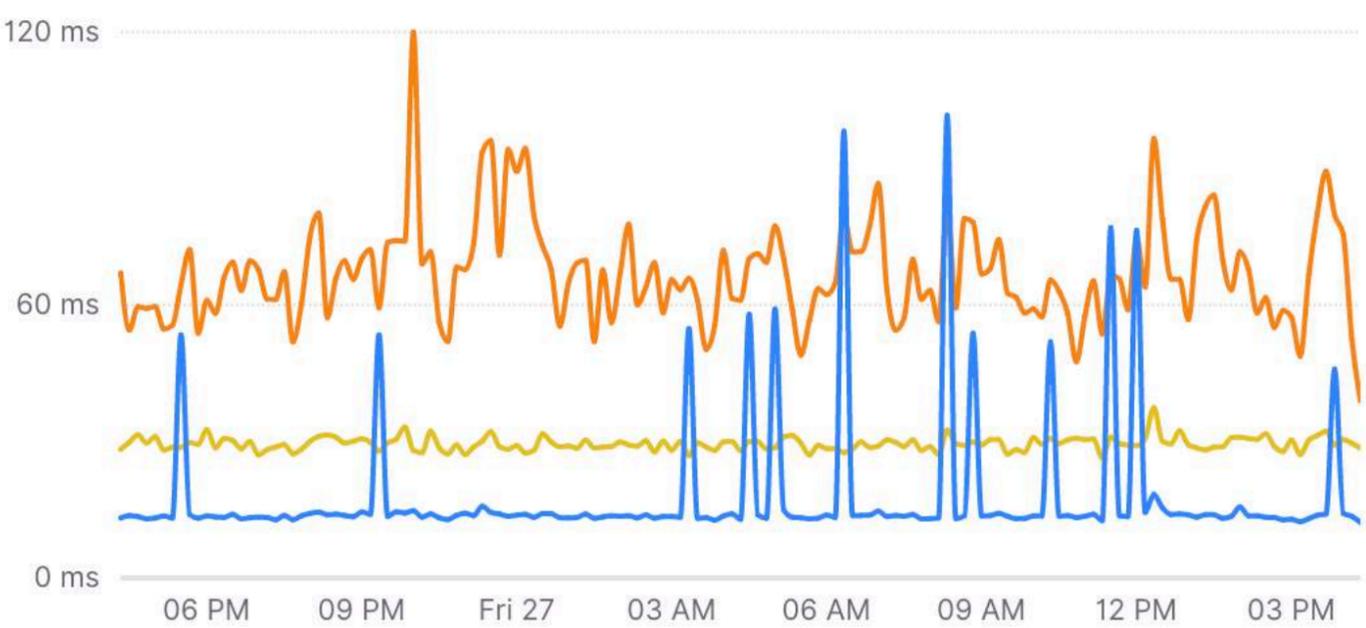
Hide chart

● app 62.5%
● mysql 37.5%



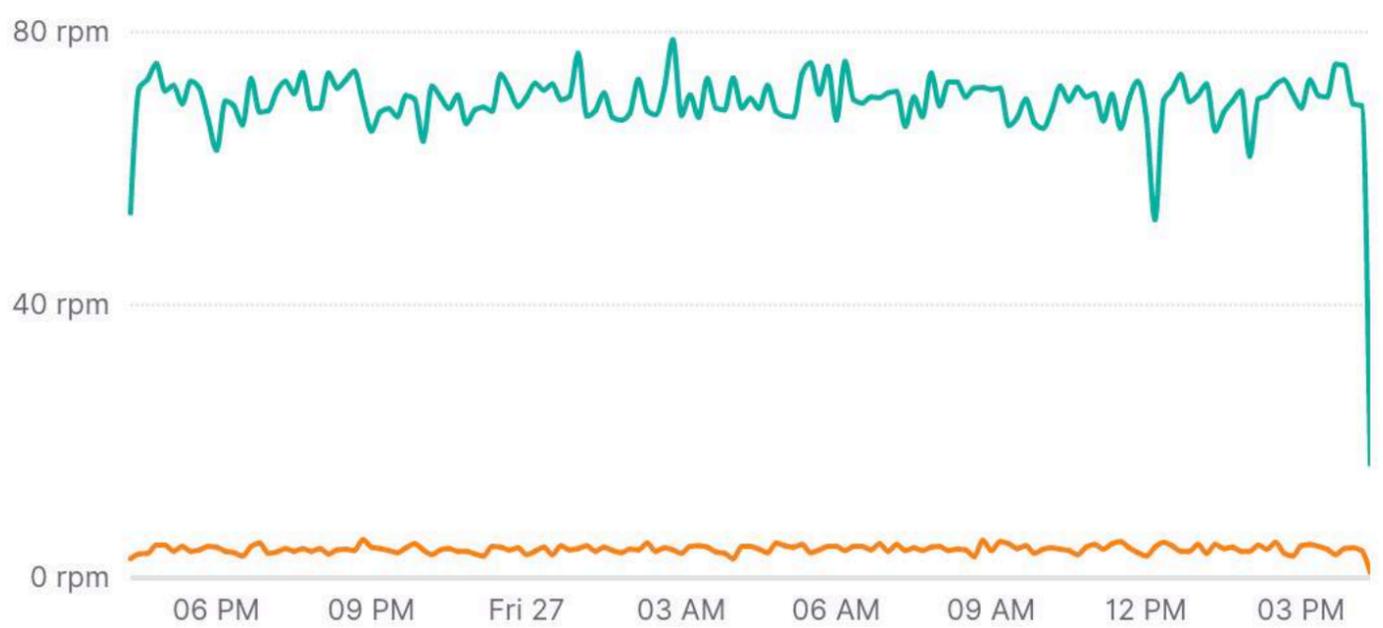
Transaction duration

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?

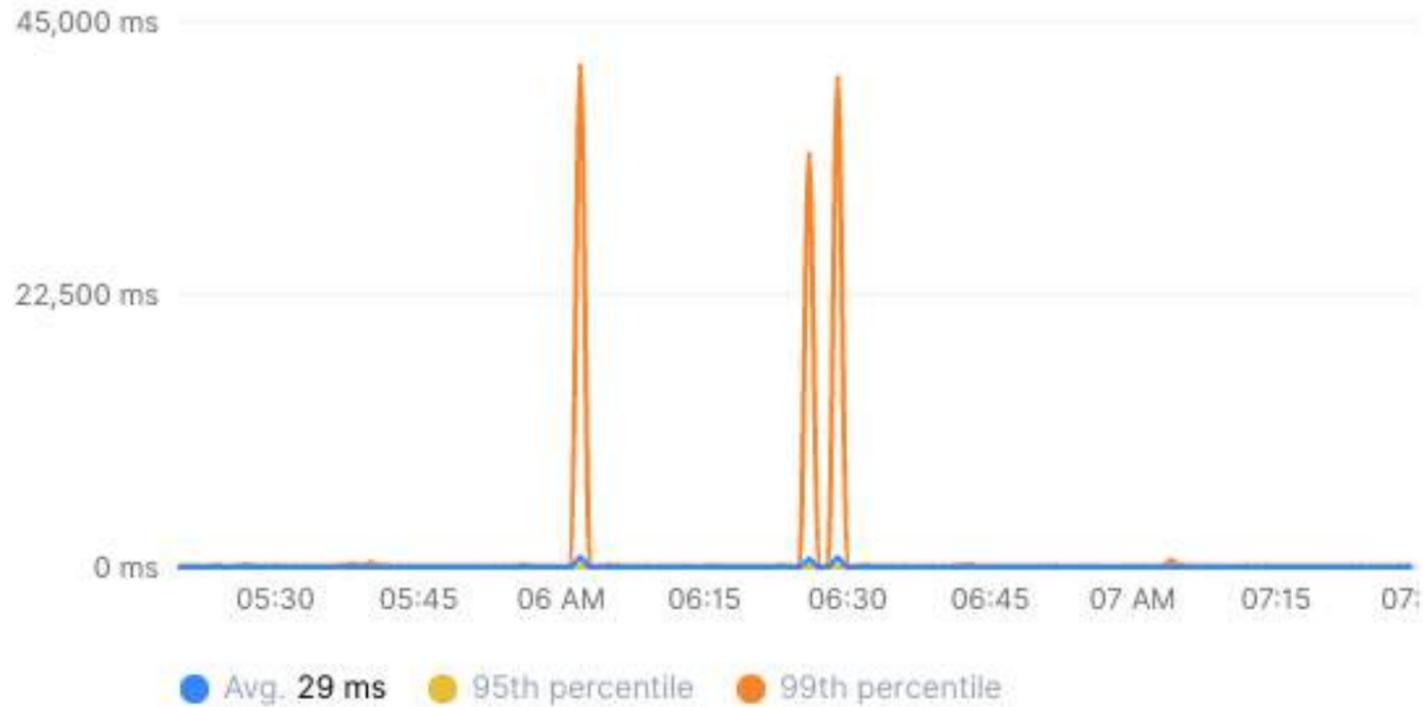
Drill Down the Traces

Times go up across all the services as you dive deeper

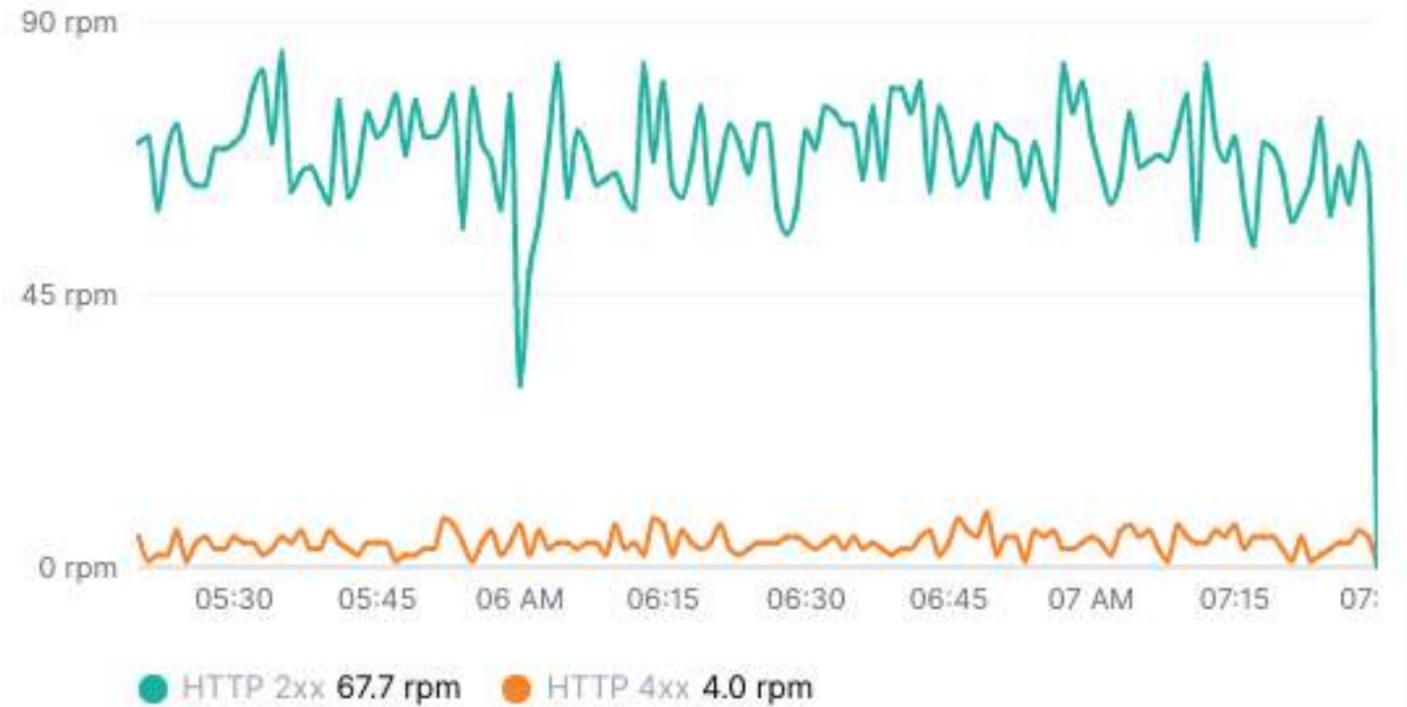


Transaction duration

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 style="width: 100%; height: 10px; background-color: #0070c0;"></div>
OwnerRestController#getOwners	25 ms	37 ms	15.4 tpm	<div style="width: 20%; height: 10px; background-color: #0070c0;"></div>
OwnerRestController#getOwner	10 ms	15 ms	19.0 tpm	<div style="width: 10%; height: 10px; background-color: #0070c0;"></div>
VetRestController#getAllVets	12 ms	19 ms	8.3 tpm	<div style="width: 5%; height: 10px; background-color: #0070c0;"></div>
PetRestController#getPets	18 ms	26 ms	3.4 tpm	<div style="width: 2%; height: 10px; background-color: #0070c0;"></div>
PetRestController#getPet	9 ms	15 ms	4.9 tpm	<div style="width: 1%; height: 10px; background-color: #0070c0;"></div>

Traces

`OwnerRestController#getOwners` has an N+1 problem

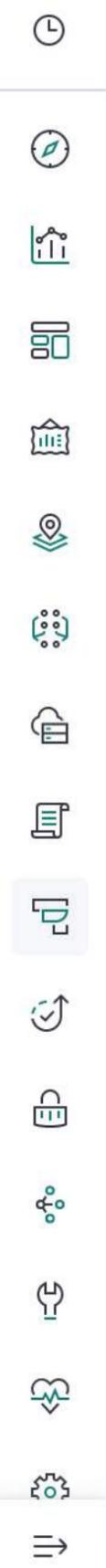
But the same for slow and fast requests, so an independent problem



D



e



Services ● petclinic-spring

0 ms 5 ms 10 ms 15 ms 20 ms 25 ms 32 ms



HTTP 2xx **OwnerRestController#getOwners** 32 ms

SELECT 364 μs

SELECT FROM owners 670 μs

SELECT FROM pets 2,552 μs

SELECT FROM visits 498 μs

SELECT FROM visits 490 μs

SELECT FROM pets 852 μs

SELECT FROM visits 5,095 μs

SELECT FROM pets 551 μs

SELECT FROM visits 2,282 μs

SELECT FROM pets 559 μs

SELECT FROM visits 434 μs

petclinic-node

Same spike for that time, so not a Java problem

"Service Analysis" Dashboard



+ Add filter

[APM] Service Stats

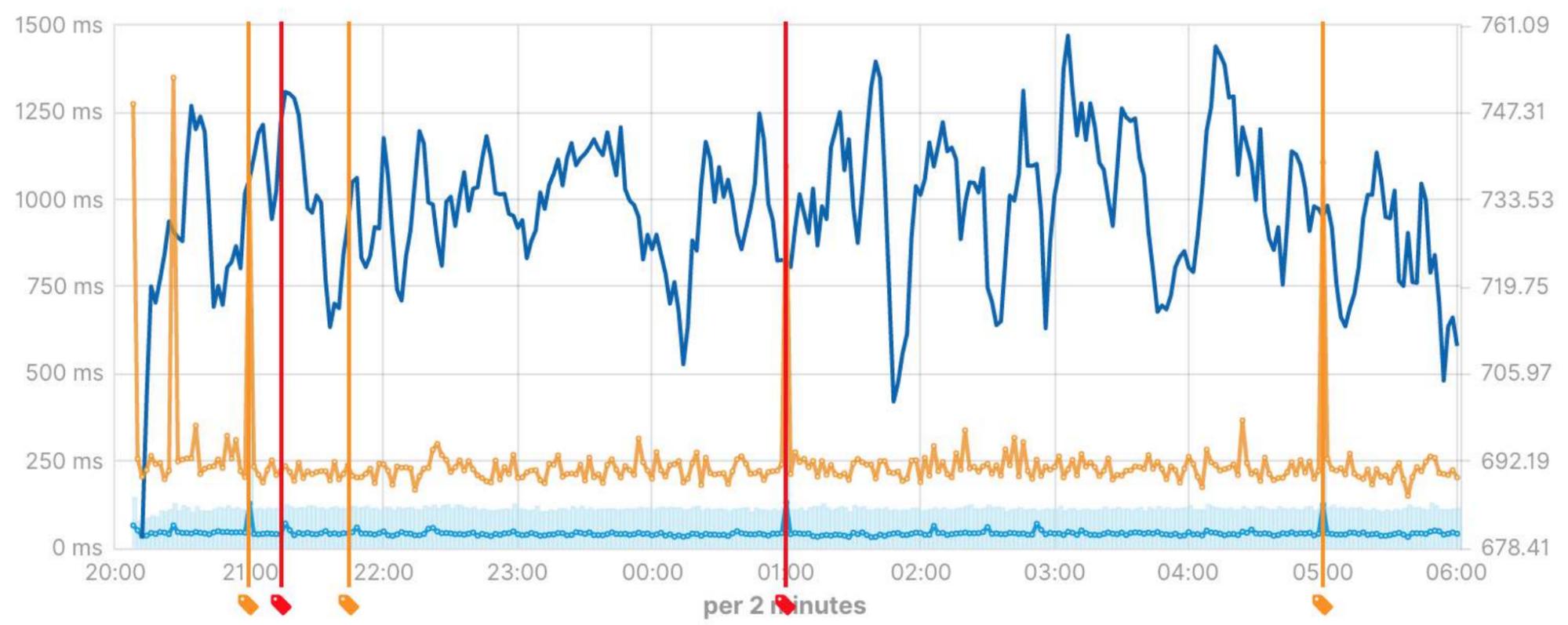
4 Service Types	15 Service Instances	1,169 Number of Users	15 50th percentile of transaction.duration.us
41 75th percentile of transaction.duration.us		113 95th percentile of transaction.duration.us	

K8 Controls - 2

⚠ Pod

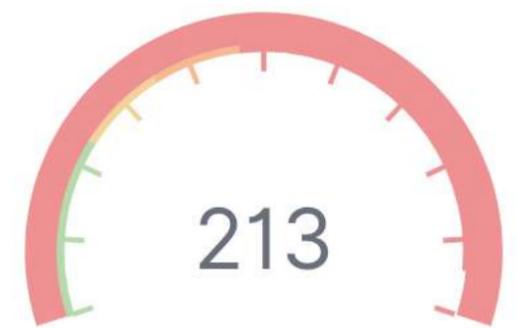
Container

[APM] System Performance



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

[APM] Service Performance ...



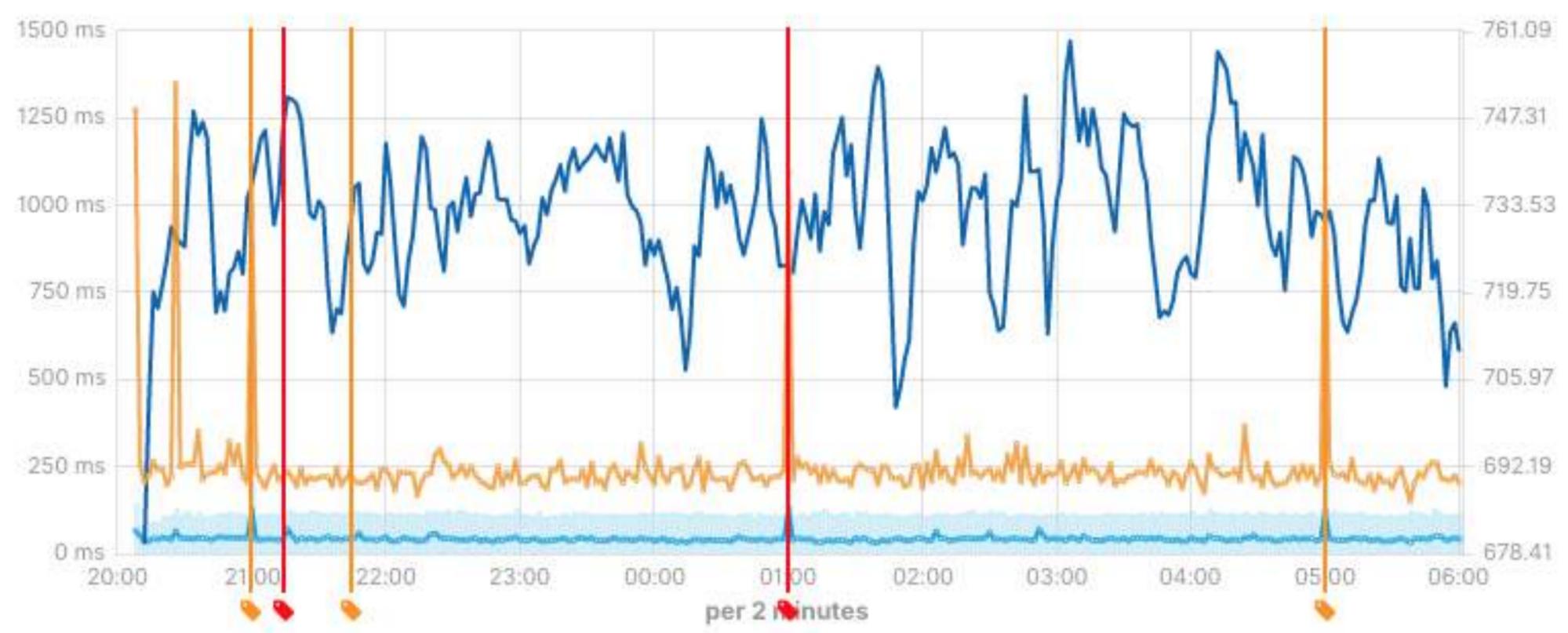
99th Percentile

Filter to the 99th percentile

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

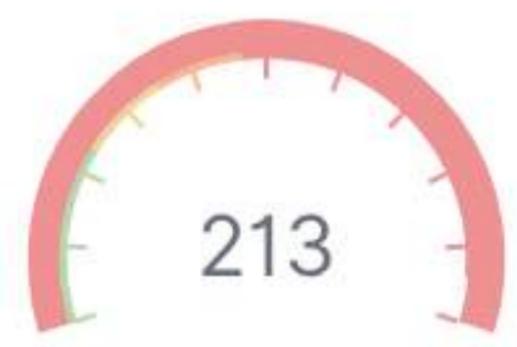


[APM] System Performance

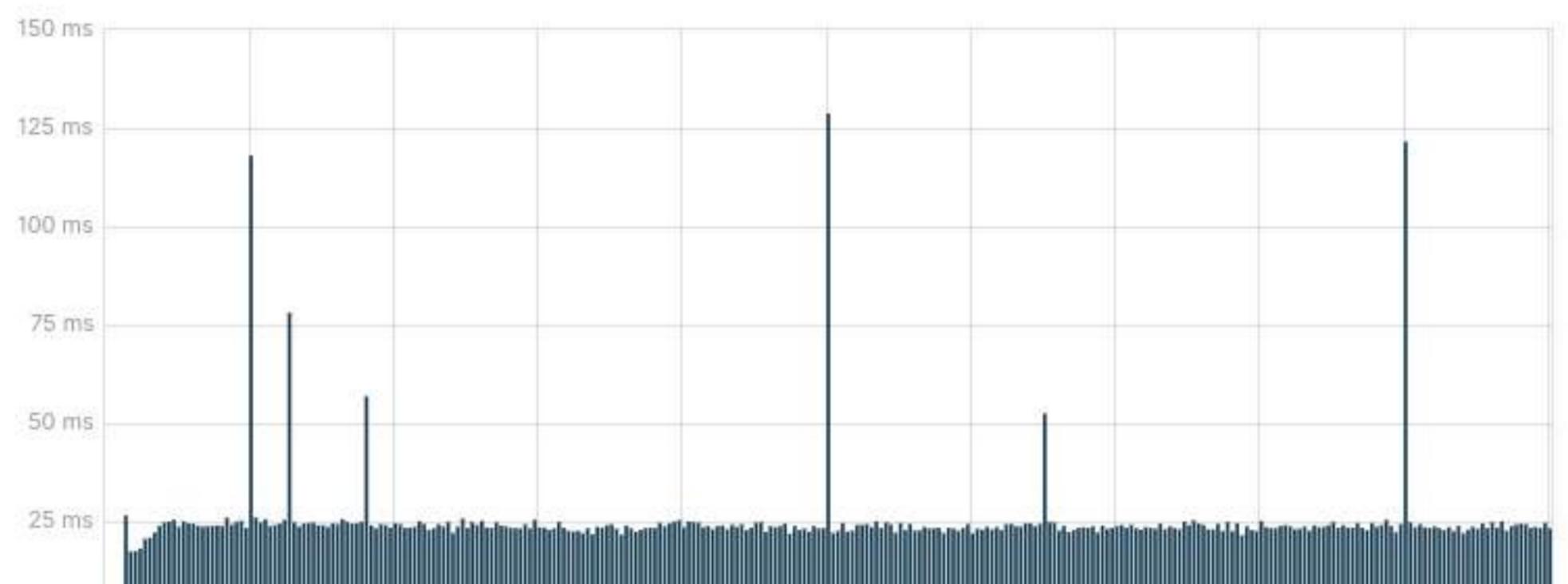


99th Percentile...	203 ms
Number of Trans...	710.4
Average	41 ms
95th Percentile ...	114 ms

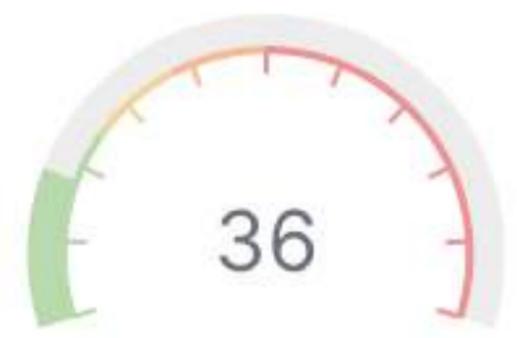
[APM] Service Performance ...



[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`

🔍 kubernetes.labels.k8s-app : "infra-demo" ✕

📅 10/01/2019 1:05:33 PM

▶ Auto-refresh

Hosts **Kubernetes** Docker

Metric: CPU Usage ▾

Group By: All ▾

⚙️ Configuration

🗺️ Map View **Table View**

Showing the last 1 minute of data from the time period

All 10



0%

12.5%



Metrics

Collection similar to Filebeat

No outlier for our problem though

- Pod
- Overview
- CPU Usage
- Memory Usage
- Network Traffic

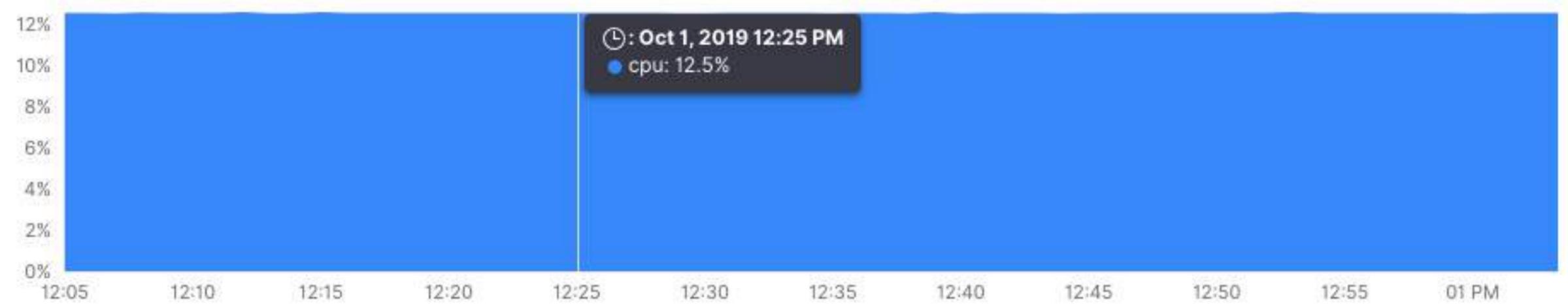
infra-petclinic-mysql-569c4cc7c8-fzzk4

~ an hour ago → ~ 9 minutes ago [Refresh](#)

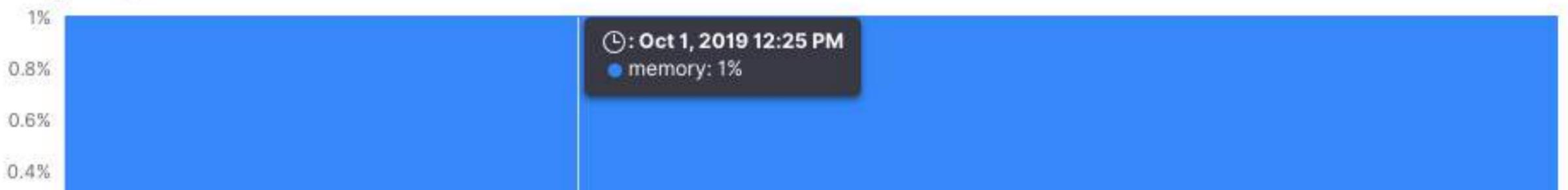
Pod Overview



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

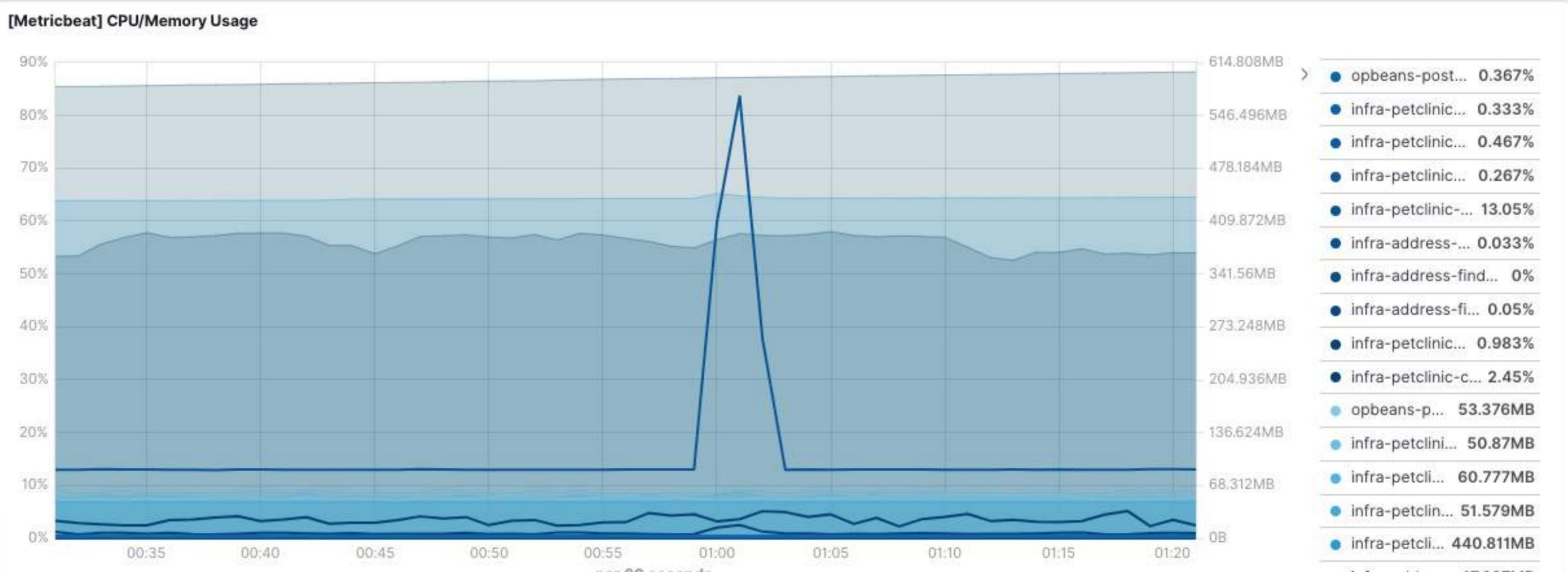
Select...

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-...`

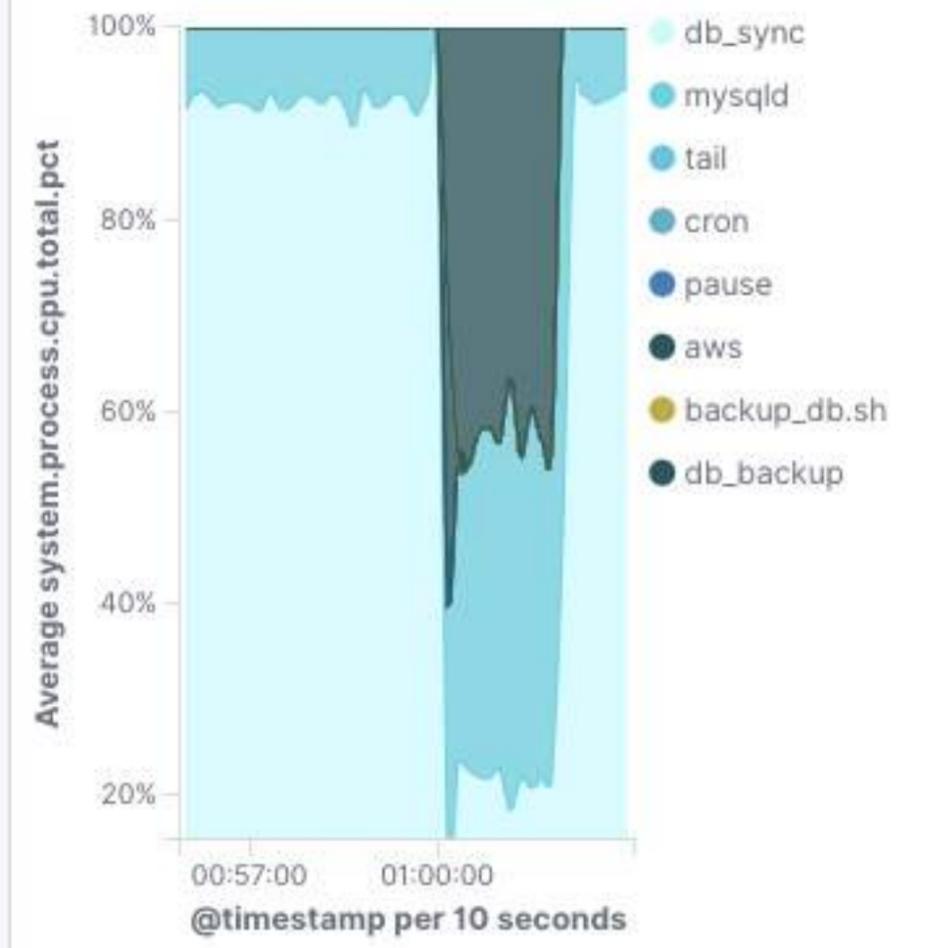
Do you see the problem?



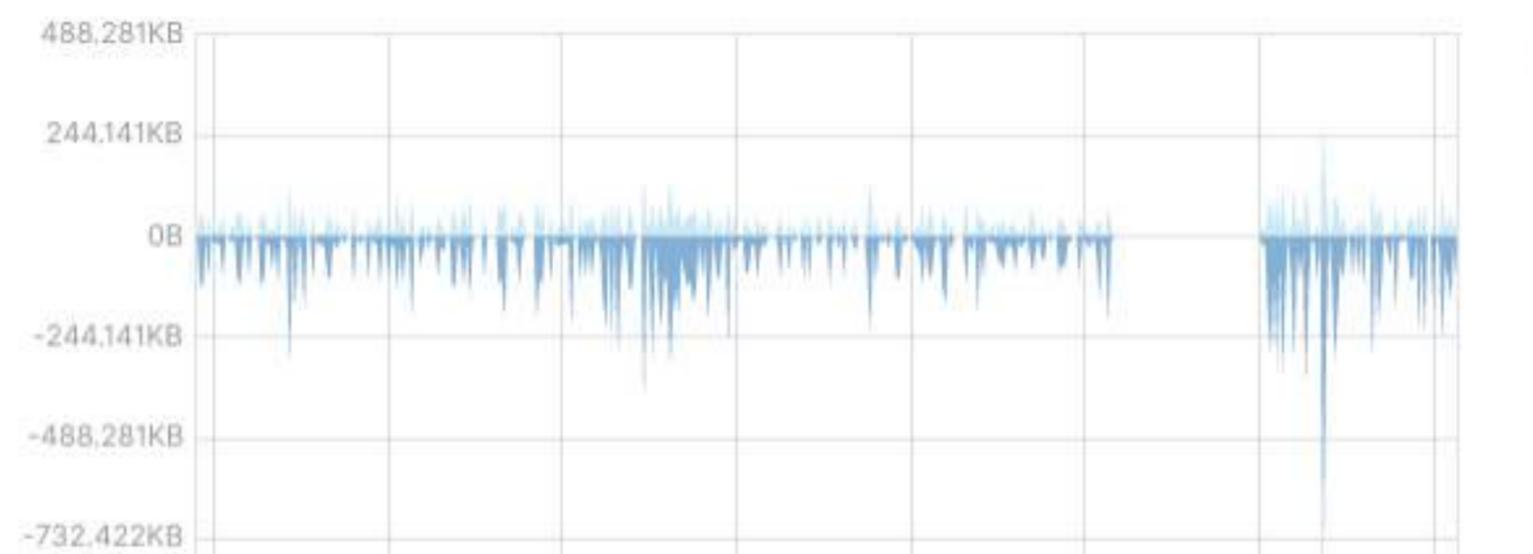
[Filebeat & Packetbeat] MySQL Performance



[Metricbeat] Top Processes by CPU



[Packetbeat] Network Traffic



[Metricbeat] Top Processes

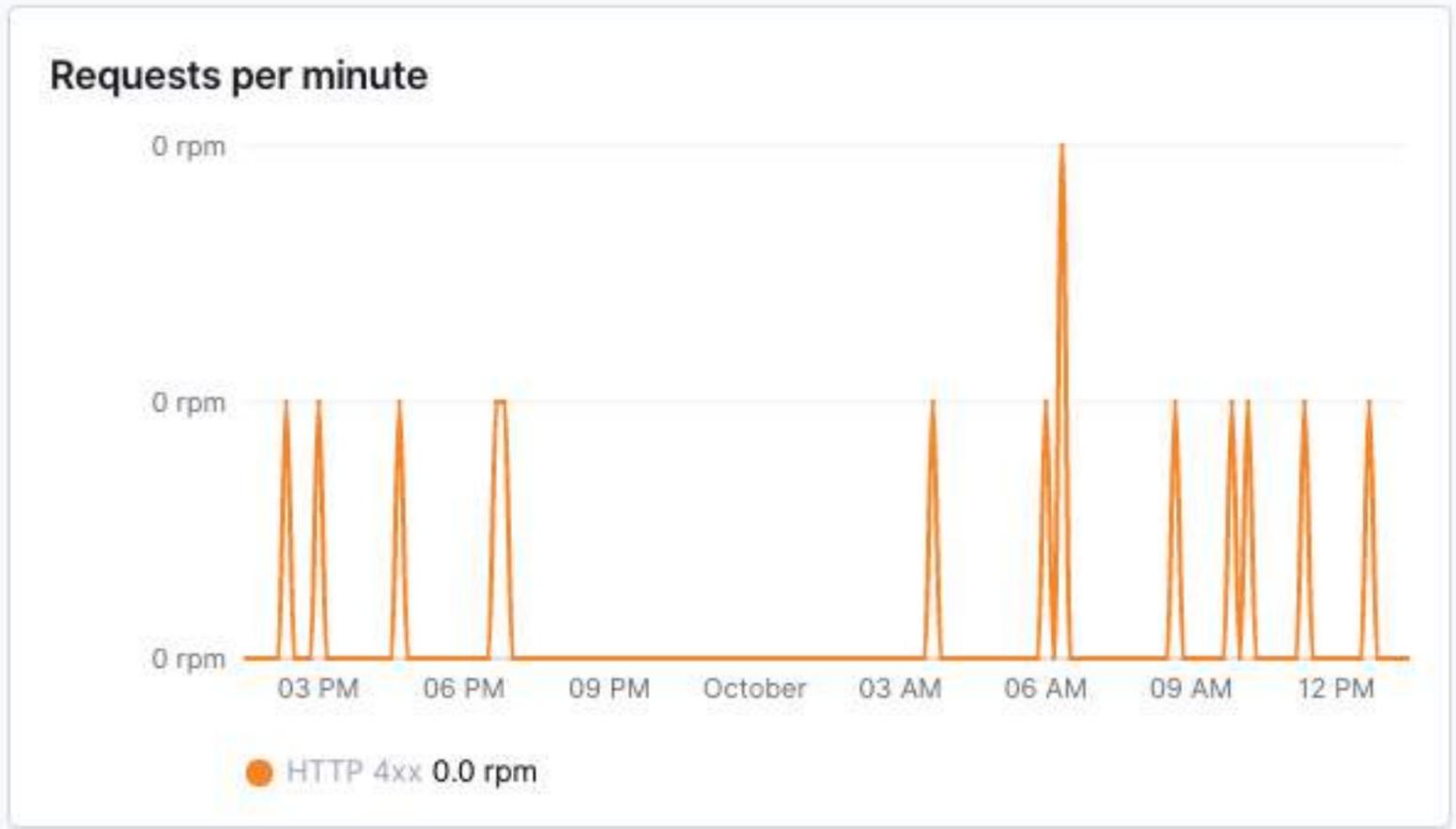
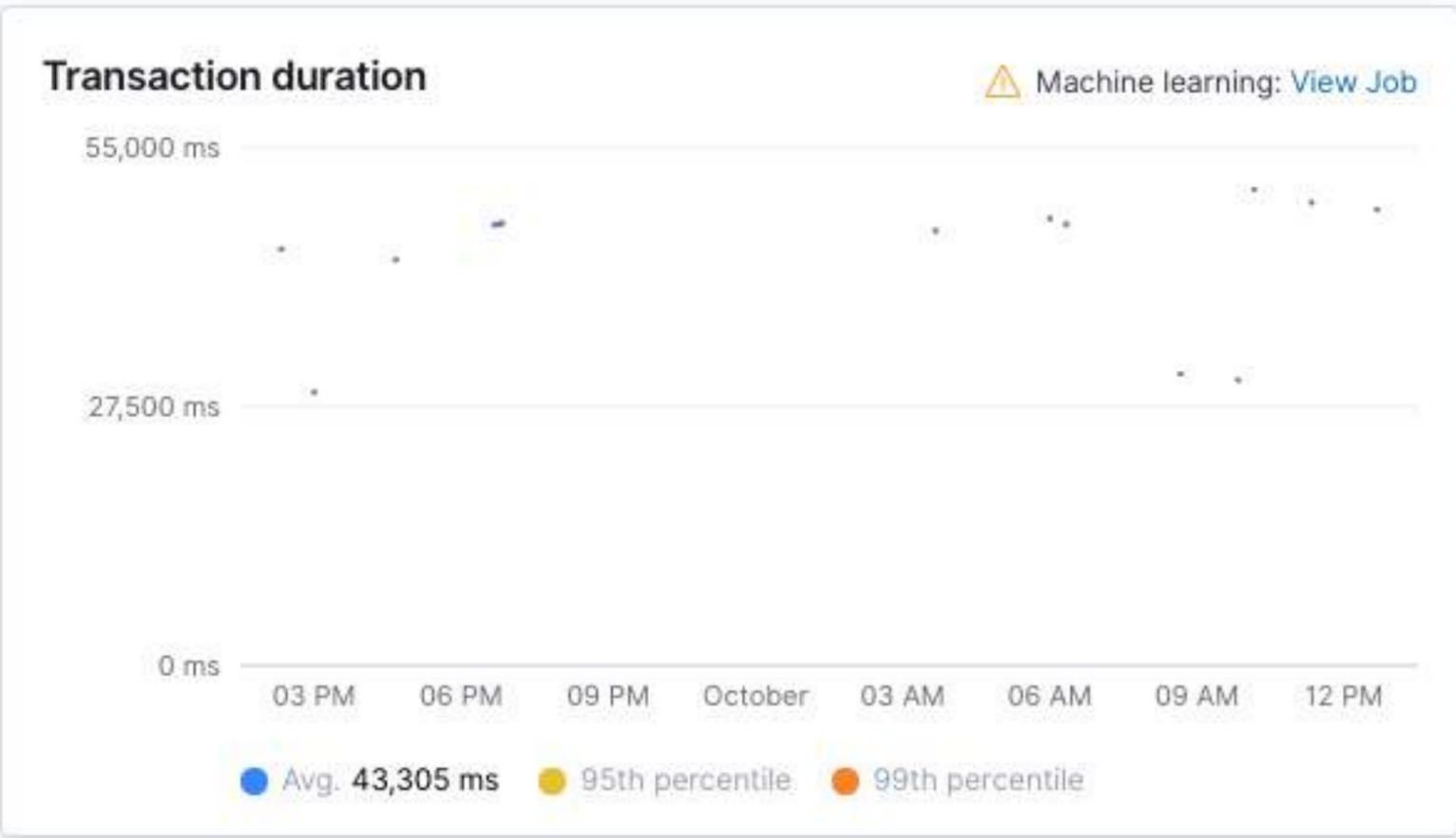


Complaint about Slow App

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

transaction.duration.us >= 2000000

Transactions Errors Metrics



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?



Transaction sample

Actions ⌵ [View full trace](#)

Timestamp	a day ago (September 30th 2019, 15:00:34.668)			URL	http://infra-petclinic-server-6bbcf5f77-bzrbd/petclinic/api/owners/6				
Duration	29.0 s	% of trace	99.4%	Result	HTTP 4xx	Errors	1 Related error	User ID	ddegliabbatigs
User agent									

Timeline Metadata



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](#)

Transaction sample

Timestamp

an hour ago (October

Duration

48.4 s

User agent

Timeline

Metadata

Services

● petclinic-spring

0.0 s

5.0 s

HTTP 4xx Own

validateZipCode

```
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

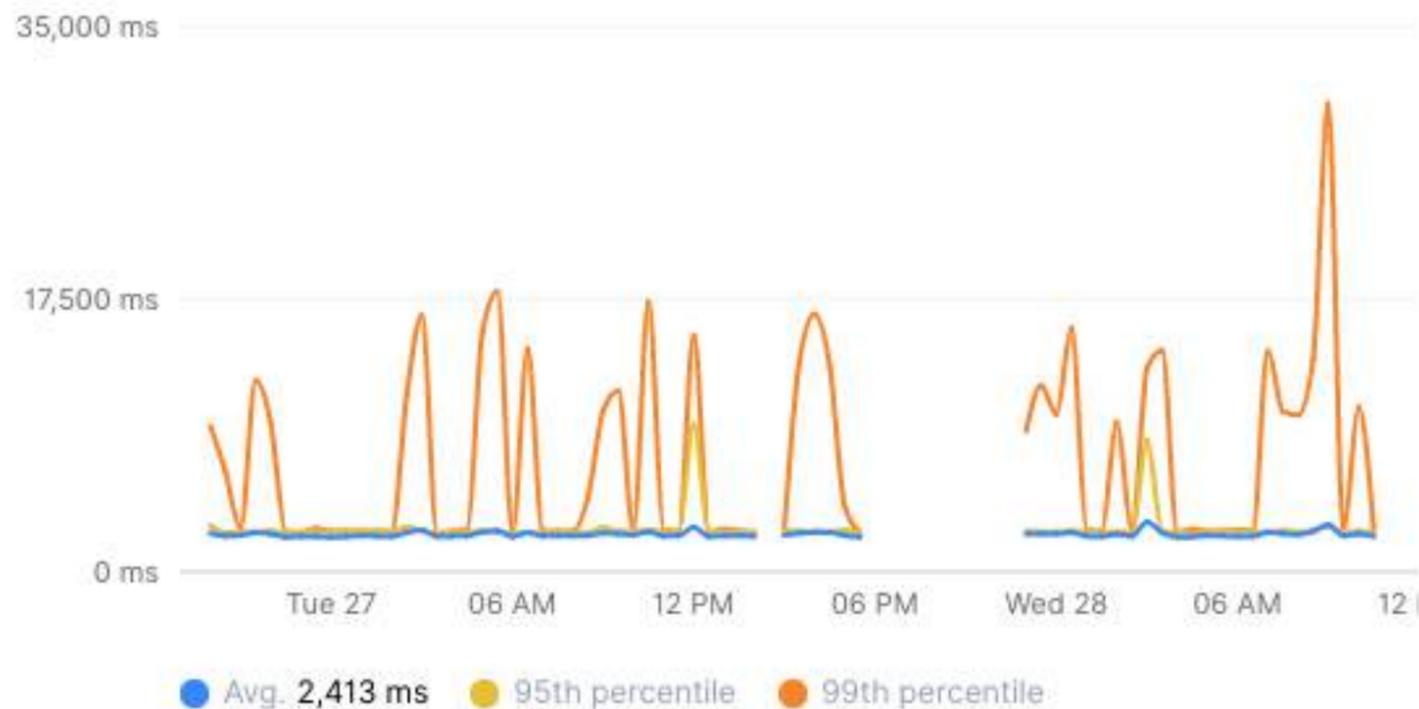
React app with the same filter

Filter by type

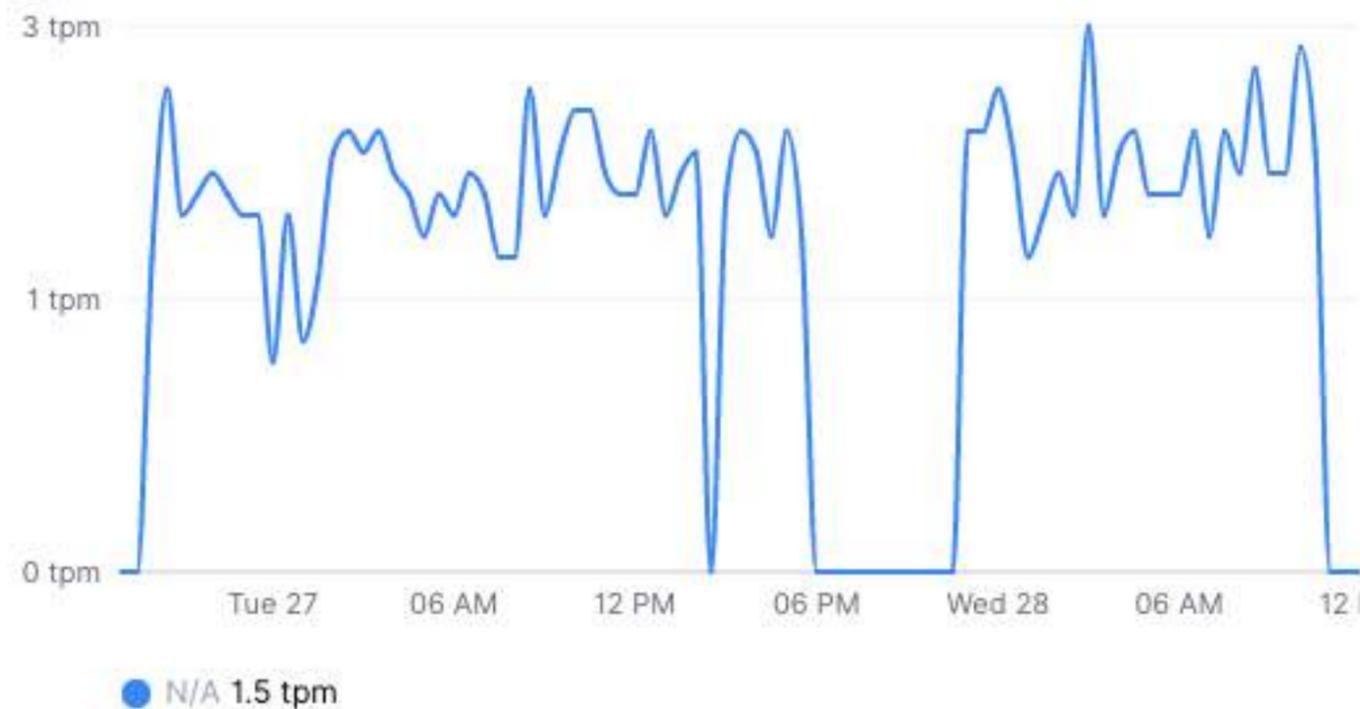
Events

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 style="width: 100%; height: 10px; background-color: #0070C0;"></div>
OwnersPage	2,480 ms	2,511 ms	0.5 tpm	<div style="width: 95%; height: 10px; background-color: #0070C0;"></div>
VetsPage	2,357 ms	2,534 ms	0.2 tpm	<div style="width: 20%; height: 10px; background-color: #0070C0;"></div>
ErrorPage	2,361 ms	2,499 ms	0.1 tpm	<div style="width: 10%; height: 10px; background-color: #0070C0;"></div>

React Loading Issues 🤔

Browser correlation

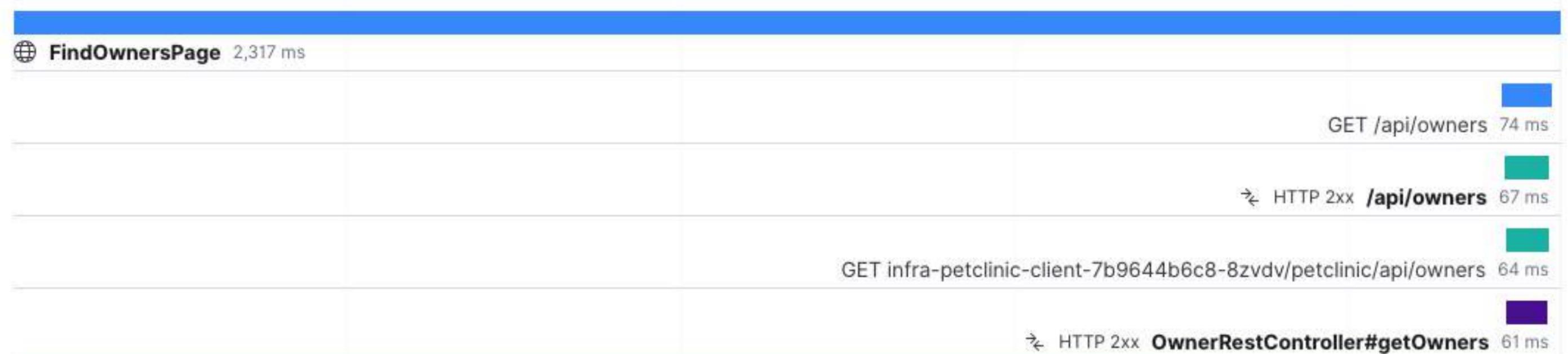
Transaction sample

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	User ID
2,317 ms	100.0%	N/A	None	victor02
User agent	User agent OS	User agent device		
IE 9.0	Windows 7	Other		

Timeline Metadata

Services ● petclinic-react ● petclinic-node ● petclinic-spring



Availability

Heartbeat — in another datacenter?



Overview

Nov 26, 2018 @ 20:30:00. → Nov 27, 2018 @ 12:29:58.

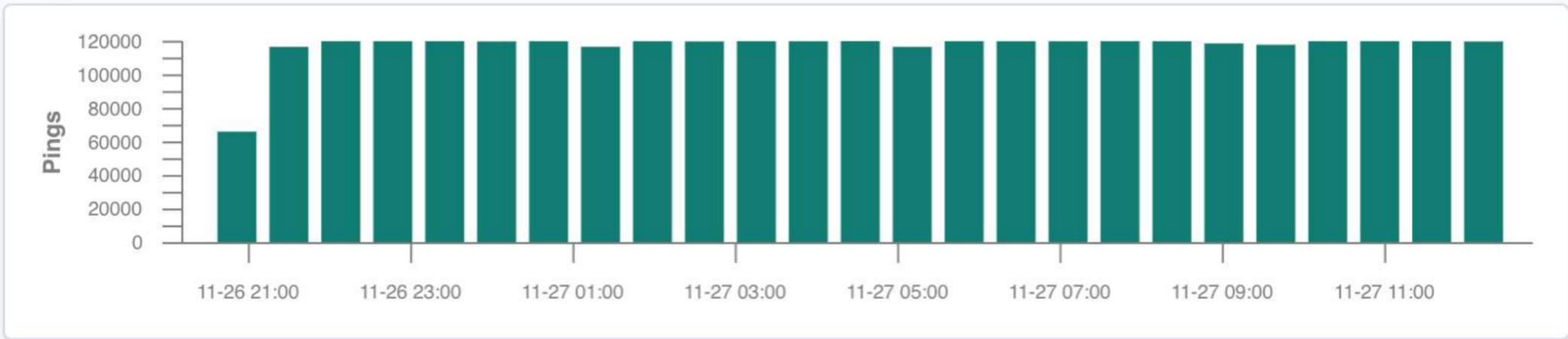
Refresh

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

Current status

Up **19** Down **0** Total **19**

Pings over time



Monitor status

Status	Name	URL	Downtime history	Integrations
Up 10 months ago	infra-petclinic-server-5fff5b6b-59psl	http://10.56.3.6:8080/server-status		...
Up 10 months ago	infra-address-finder-549cd4684f-5mgxx	http://10.56.1.161:80/api		...
Up 10 months ago	infra-petclinic-client-7b9644b6c8-hjjsq	http://10.56.2.88:80/status		...
Up 10 months ago	Unnamed - auto-http-0X4FA94B0313EE0BC4-78ebd16eaca0565d	https://www.bbc.com		...
Up	Unnamed - auto-http-0X15A04B0010550204	https://github.com		...

CONCLUSION

FROM  TO 

with Kubernetes

Try at Home

<https://demo.elastic.co>



Search for infrastructure data... (e.g. host.name:host-1)

09/27/2019 12:54:52 PM

Auto-refresh



Hosts

Kubernetes

Docker

Metric: CPU Usage

Group By: All

Configuration

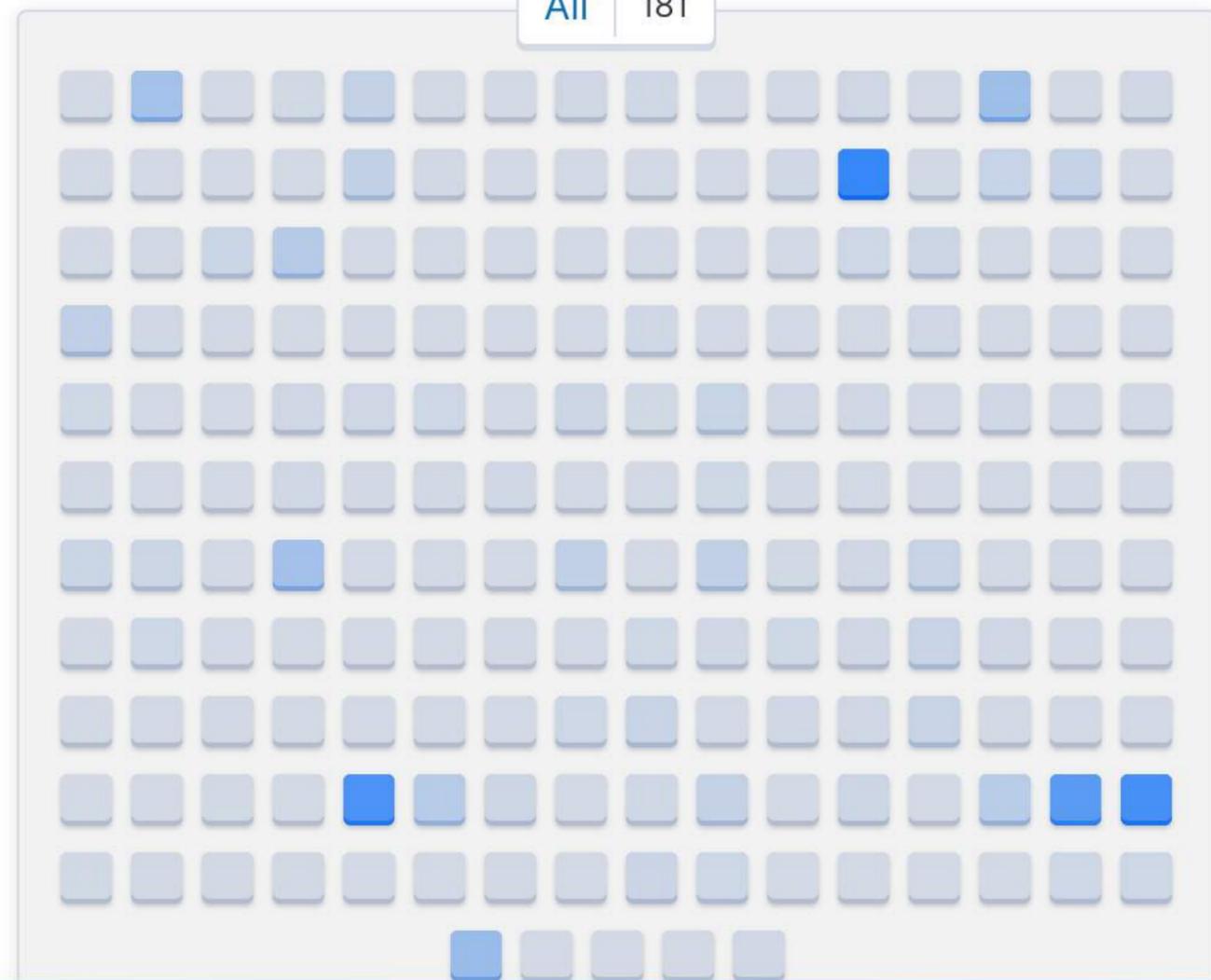


Map View

Table View

Showing the last 1 minute of data from the time period

All 181



QUESTIONS & DISCUSSION

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