Live Kubernetes Debugging
with the elastic stack

Philipp Krenn @xeraa
Kubernetes is the answer. What was the question?

— https://twitter.com/charlesfitz/status/1068203930683752448
Developer
Spring Boot Petclinic on Kubernetes
### Find Owners

**Last name**

- George Franklin
- Betty Davis
- Eduardo Rodriguez
- Harold Davis
- Peter McTavish
- Jean Coleman
- Jeff Black
- Maria Escobito
- David Schroeder
- Carlos Estaban

---

### 10 Owners found

<table>
<thead>
<tr>
<th>Name</th>
<th>Address</th>
<th>City</th>
<th>Telephone</th>
<th>Pets</th>
</tr>
</thead>
<tbody>
<tr>
<td>George Franklin</td>
<td>1167, gate rd, castlewood, virginia</td>
<td>castlewood</td>
<td>6085551023</td>
<td>Leo</td>
</tr>
<tr>
<td>Betty Davis</td>
<td>1365, trane rd, el monte, arizona</td>
<td>el monte</td>
<td>6085551749</td>
<td>Basil</td>
</tr>
<tr>
<td>Eduardo Rodriguez</td>
<td>2615, brodnax rd, brodnax, brunswick county, virginia</td>
<td>brodnax</td>
<td>6085558763</td>
<td>Jewel, Rosy</td>
</tr>
<tr>
<td>Harold Davis</td>
<td>1607, edgecliff rd, edgecliff village, texas</td>
<td>edgecliff village</td>
<td>6085553198</td>
<td>Iggy</td>
</tr>
<tr>
<td>Peter McTavish</td>
<td>13252, s yale av e, indianapolis, oklahoma</td>
<td>indianapolis</td>
<td>6085552765</td>
<td>George</td>
</tr>
<tr>
<td>Jean Coleman</td>
<td>73, jacob dr, crosby township ham oh, ohio</td>
<td>crosby township ham oh</td>
<td>6085552654</td>
<td>Max, Samantha</td>
</tr>
<tr>
<td>Jeff Black</td>
<td>1, ocala intl com park phase 2, ocala, marion, florida</td>
<td>ocala</td>
<td>608555387</td>
<td>Lucky</td>
</tr>
<tr>
<td>Maria Escobito</td>
<td>e hls, wellsburg, west virginia</td>
<td>wellsburg</td>
<td>6085557683</td>
<td>Mulligan</td>
</tr>
<tr>
<td>David Schroeder</td>
<td>1260, e mohawk dr, buellton, arizona</td>
<td>buellton</td>
<td>6085559435</td>
<td>Freddy</td>
</tr>
<tr>
<td>Carlos Estaban</td>
<td>4054, n cove rd, la mesa, arizona</td>
<td>la mesa</td>
<td>6085555487</td>
<td>Lucky, Sly</td>
</tr>
</tbody>
</table>
Architecture
Discover: Filebeat

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

Filters

- kubernetes.labels.app: "infra-petclinic-server"
- NOT event.module is one of nginx, mysql
- loglevel: ERROR

filebeat-*

Selected fields

? _source

Available fields

Nov 26, 2018 @
Log UI

Java application with tags : "petclinic-server"

Configured with logback.xml and petclinic-server.json (ingest pipeline)
<table>
<thead>
<tr>
<th>Timestamp</th>
<th>Message</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sep 27, 2019 @ 12:19:56.176</td>
<td>[INFO] INFO AnnotationMBeanExporter - Registering beans for JMX exposure on startup</td>
</tr>
<tr>
<td>Sep 27, 2019 @ 12:19:56.188</td>
<td>[INFO] INFO DefaultLifecycleProcessor - Starting beans in phase 2147483647</td>
</tr>
<tr>
<td>Sep 27, 2019 @ 12:19:56.349</td>
<td>[INFO] INFO DocumentationPluginsBootstrapper - Found 1 custom documentation plugin(s)</td>
</tr>
<tr>
<td>Sep 27, 2019 @ 12:19:56.371</td>
<td>[INFO] INFO ApiListingReferenceScanner - Scanning for api listing references</td>
</tr>
<tr>
<td>Sep 27, 2019 @ 12:19:57.764</td>
<td>[INFO] INFO CachingOperationNameGenerator - Generating unique operation named: addOwnerUsingPOST_1</td>
</tr>
<tr>
<td>Sep 27, 2019 @ 12:19:58.076</td>
<td>[INFO] INFO Http1NioProtocol - Starting ProtocolHandler [&quot;http-nio-0.0.0.0-8000&quot;]</td>
</tr>
<tr>
<td>Sep 27, 2019 @ 12:19:58.207</td>
<td>[INFO] INFO NioSelectorPool - Using a shared selector for servlet write/read</td>
</tr>
<tr>
<td>Sep 27, 2019 @ 12:19:58.237</td>
<td>[INFO] INFO TomcatEmbeddedServletContainer - Tomcat started on port(s): 8000 (http)</td>
</tr>
<tr>
<td>Sep 27, 2019 @ 12:19:58.285</td>
<td>[INFO] INFO PetClinicApplication - Started PetClinicApplication in 35.617 seconds (JVM running for 48.897)</td>
</tr>
<tr>
<td>Sep 27, 2019 @ 12:20:11.767</td>
<td>INFO [/petclinic] - Initializing Spring FrameworkServlet 'dispatcherServlet'</td>
</tr>
<tr>
<td>Sep 27, 2019 @ 12:20:11.767</td>
<td>[INFO] INFO DispatcherServlet - FrameworkServlet 'dispatcherServlet': initialization started</td>
</tr>
<tr>
<td>Sep 27, 2019 @ 12:20:11.867</td>
<td>[INFO] INFO DispatcherServlet - FrameworkServlet 'dispatcherServlet': initialization completed in 89 ms</td>
</tr>
</tbody>
</table>
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
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
### Transactions

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

### Transaction duration

- **Avg. 29 ms**
- **95th percentile**
- **99th percentile**

### Requests per minute

- **HTTP 2xx 67.7 rpm**
- **HTTP 4xx 4.0 rpm**
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 😐
Infrastructure UI

kubernetes.labels.k8s-app : "infra-demo" in Kubernetes
Showing the last 1 minute of data from the time period

- infra-petclinic: 0.1%
- infra-address: 0%
- infra-petclinic: 0.2%
- infra-petclinic: 0.1%
- infra-petclinic: 12.5%
- infra-petclinic: 0.3%
- infra-petclinic: 0.1%
Metrics

Collection similar to Filebeat

No outlier for our problem though
Pod Overview

CPU Usage: 12.5%
Memory Usage: 1%
Inbound (RX): 44.2kbit/s
Outbound (TX): 73.7kbit/s

CPU Usage:
- Oct 1, 2019 12:25 PM: cpu: 12.5%

Memory Usage:
- Oct 1, 2019 12:25 PM: memory: 1%
"MySQL Analysis" Dashboard
Pod Filter

infra-petclinic-mysql-...

Do you see the problem?
Complaint about Slow App

Filter to `transaction.duration.us >= 2000000` in APM
Timing of Our Code?
Transaction sample

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: ddegliabatigs

Timeline
Services: petclinic-spring

HTTP 4xx OwnerRestController#updateOwner 1 29.0 s
validateZipCode 29.0 s
updateOwner 1,782 µs
Drill Down to the Code

Plus the request and response (4xx)
## Span details

**Service**
petclinic-spring

**Transaction**
OwnerRestController#updateOwner

<table>
<thead>
<tr>
<th>Name</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>validateZipCode</td>
<td>48,373 ms</td>
</tr>
</tbody>
</table>

**% of transaction**
100.0%

**Type**
app

### Slack Trace

```
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}?\$"ала);    
}

@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
React Loading Issues 🤔

Browser correlation
Transaction sample

Timestamp: 10 months ago (November 27th 2018, 00:21:27.162)

URL: http://infra-petclinic-client:3000/owners/list

Duration: 2,317 ms % of trace 100.0%

Result: N/A

Errors: None

User ID: victor02

User agent: IE 9.0

User agent OS: Windows 7

User agent device: Other

Timeline

Services

FindOwnersPage 2,317 ms

GET /api/owners 74 ms

GET infra-petclinic-client-7b9644b6c8-8zvvdv/petclinic/api/owners 64 ms

GET infra-petclinic-client-7b9644b6c8-8zvvdv/petclinic/api/owners 64 ms

HTTP 2xx /api/owners 67 ms

HTTP 2xx OwnerRestController#getOwners 61 ms
Availability

Heartbeat — in another datacenter?
Overview

Current status
- Up: 19
- Down: 0
- Total: 19

Pings over time

Monitor status

<table>
<thead>
<tr>
<th>Status</th>
<th>Name</th>
<th>URL</th>
<th>Downtime history</th>
<th>Integrations</th>
</tr>
</thead>
<tbody>
<tr>
<td>🔴 Up 10 months ago</td>
<td>infra-petclinic-server-5fff5b6b59psl</td>
<td><a href="http://10.56.3.6:8080/server-status">http://10.56.3.6:8080/server-status</a></td>
<td>[ ]</td>
<td>***</td>
</tr>
<tr>
<td>🔴 Up 10 months ago</td>
<td>infra-address-finder-549cd468bf5mgxx</td>
<td><a href="http://10.56.1.161:80/api">http://10.56.1.161:80/api</a></td>
<td>[ ]</td>
<td>***</td>
</tr>
<tr>
<td>🔴 Up 10 months ago</td>
<td>infra-petclinic-client-7b9644b6c8-hjjsq</td>
<td><a href="http://10.56.2.88:80/status">http://10.56.2.88:80/status</a></td>
<td>[ ]</td>
<td>***</td>
</tr>
<tr>
<td>🔴 Up 10 months ago</td>
<td>Unnamed - auto-http-0X4FA94B0313EE0BC478ebd16eaca0565d</td>
<td><a href="https://www.bbc.com">https://www.bbc.com</a></td>
<td>[ ]</td>
<td>***</td>
</tr>
<tr>
<td>🔴 Up 10 months ago</td>
<td>Unnamed - auto-http-0X4FA94B0313EE0BC478ebd16eaca0565d</td>
<td>[ ]</td>
<td>***</td>
<td></td>
</tr>
</tbody>
</table>
Conclusion
FROM 🌴 TO 🌍 with Kubernetes
Try at Home

https://demo.elastic.co
Showing the last 1 minute of data from the time period
Questions & Discussion

Philipp Krenn

@xeraa