SOFTWARE ARCHITECTURE

Escuela de Ingeniería Informática

Universidad de Oviedo

Lab 11

Monitoring and profiling: observability

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Monitoring and profiling

Quality attribute: Observability

Monitoring: Observe the behaviour at runtime while software is running

- Dashboards
- Usually in production (after deployment)

Profiling: Measure performance of a software while it is running

- Identify parts of a system that contribute to performance problems
- Find where to focus the efforts to improve performance
- Usually when developing/testing (before deployment)

Profiling

Monitors an application while it is running

Records performance (CPU & memory usage)

JavaScript:

- Chrome (Timeline), Firefox Developer Edition (Performance tool)

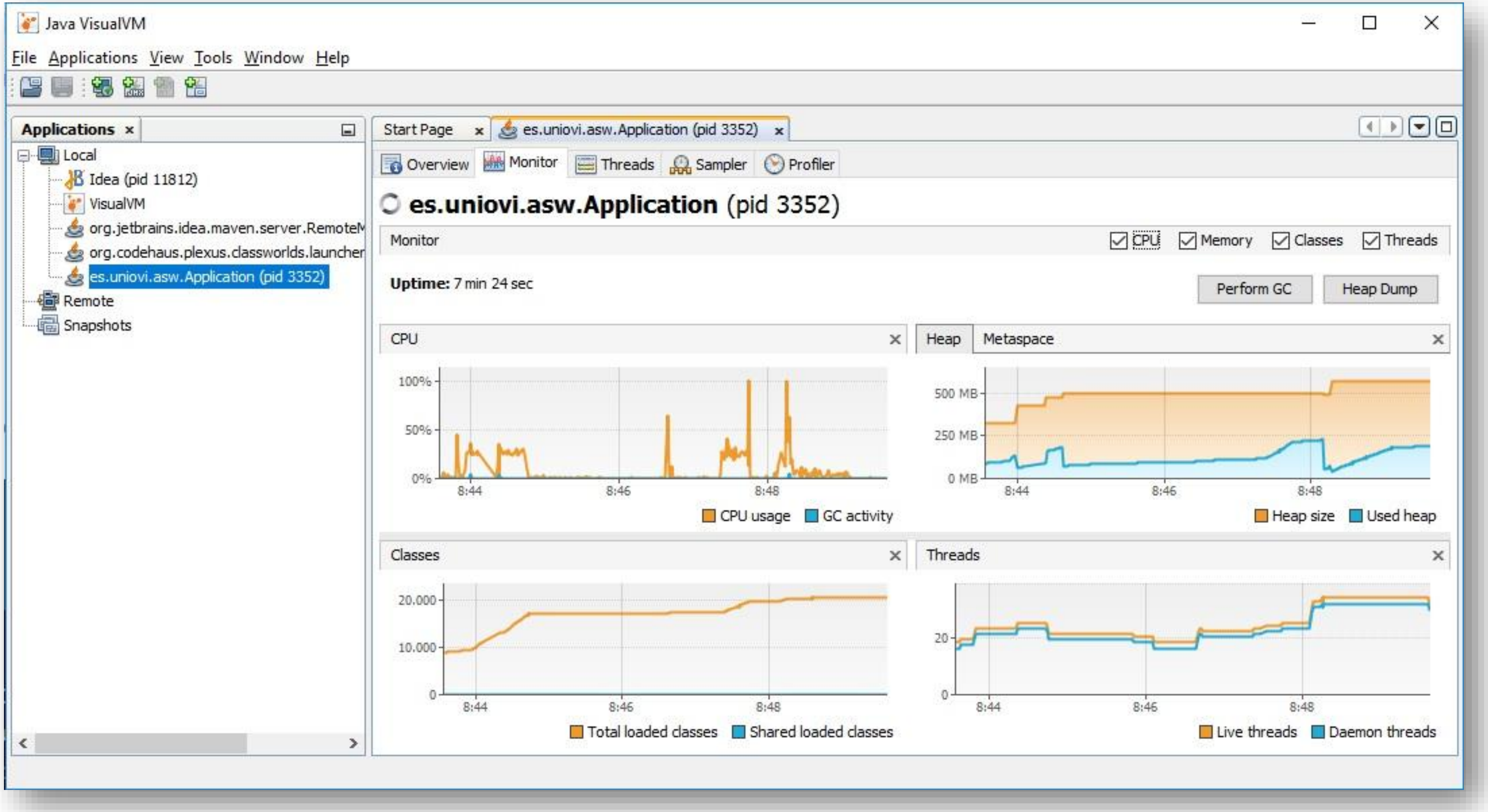
Server-side:

- JVisualVM, JProfiler, YourKit, JConsole
- Monitoring: Graphite, Datadog, Prometheus, Graphana

VisualVM

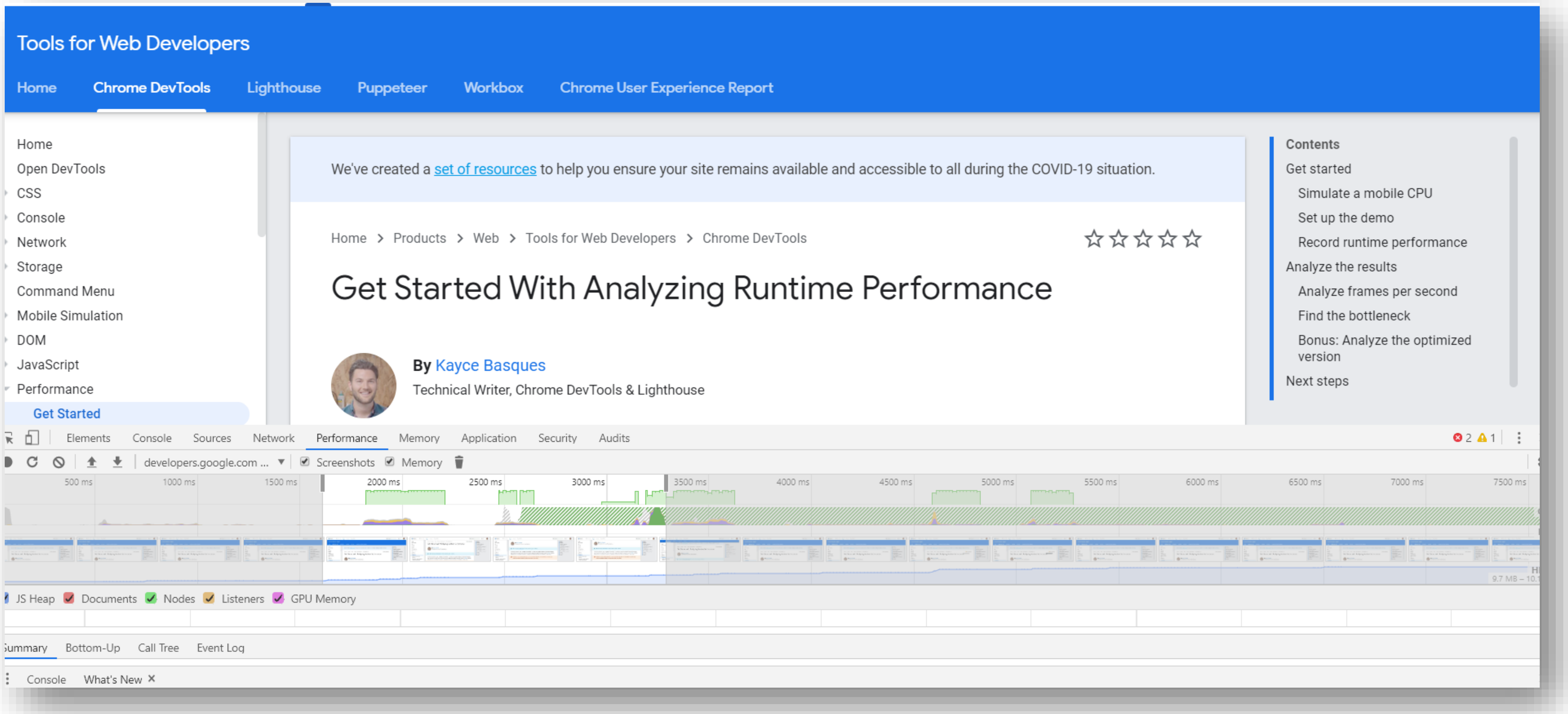
- https://visualvm.github.io/
- `jvisualvm`

Java/server JVisualVM



Browser: developer tools

Profiling/check performance



We've created a set of resources to help you ensure your site remains available and accessible to all during the COVID-19 situation.

Get Started With Analyzing Runtime Performance

By Kayce Basques
Technical Writer, Chrome DevTools & Lighthouse

Contents
Get started
Simulate a mobile CPU
Set up the demo
Record runtime performance
Analyze the results
Analyze frames per second
Find the bottleneck
Bonus: Analyze the optimized version
Next steps

https://developers.google.com/web/tools/chrome-devtools/evaluate-performance

Example with Google Chrome

Incognito mode

At the top right, click the three dots and then New Incognito Window.

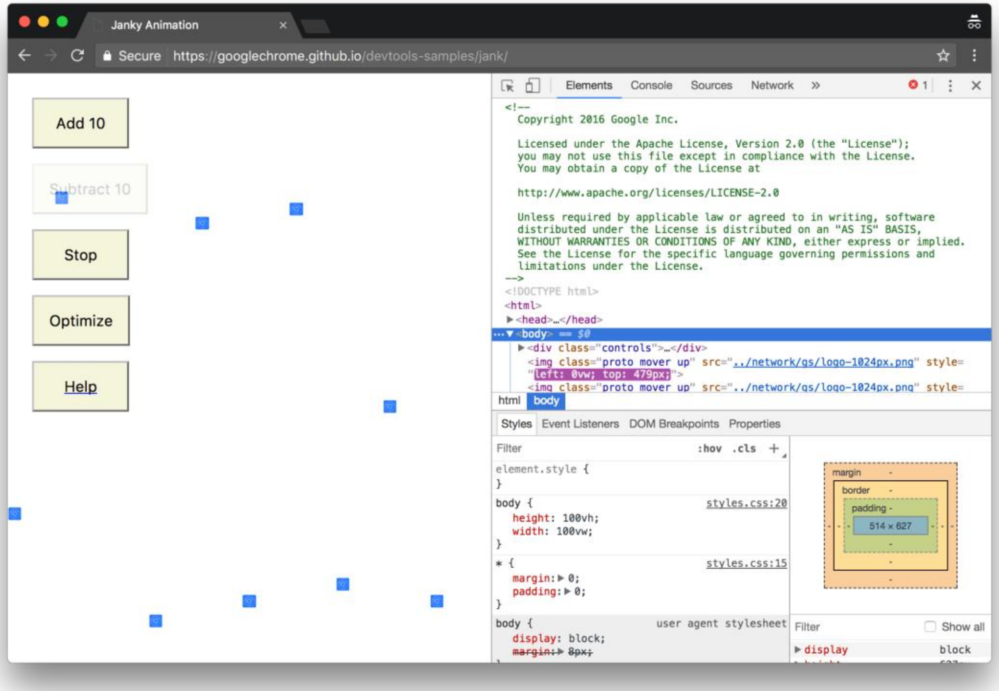
Windows, Linux, or Chrome OS: Press Ctrl + Shift + n.
Mac: Press ⌘ + Shift + n.

DevTools

Windows, Linux: Control+Shift+I
Mac: Command+Option+I

Example with Google Chrome

https://googlechrome.github.io/devtools-samples/jank/



```
<!--
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  you may not use this file except in compliance with the License.
  You may obtain a copy of the License at

  http://www.apache.org/licenses/LICENSE-2.0

  Unless required by applicable law or agreed to in writing, software
  distributed under the License is distributed on an "AS IS" BASIS,
  WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
  See the License for the specific language governing permissions and
  limitations under the License.
-->
<!DOCTYPE html>
<html>
▶<head>…</head>
…▼<body> == $0
  ▶<div class="controls">…</div>
   <img class="proto mover up" src="../network/gs/logo-1024px.png" style=
   "left: 0vw; top: 479px;">
   <img class="proto mover up" src="../network/gs/logo-1024px.png" style=
```

```
element.style {
}
body {                                   styles.css:20
   height: 100vh;
   width: 100vw;
}
* {                                      styles.css:15
   margin:▶ 0;
   padding:▶ 0;
}
body {                          user agent stylesheet
   display: block;
   ~~margin:▶ 8px;~~
```

```
▶display                                       block
```

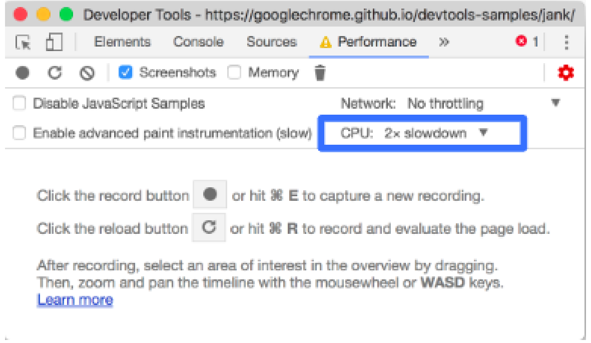
Performance>Record

click Add 10 (20 times)

try Optimize / Un-optimize

Stop

Performance>CPU>2 x Slowdown


Developer Tools - https://googlechrome.github.io/devtools-samples/jank/
Elements
Console
Sources
Performance
»
1

☑ Screenshots □ Memory

□ Disable JavaScript Samples Network: No throttling

□ Enable advanced paint instrumentation (slow) CPU: 2× slowdown

Click the record button ● or hit ⌘ E to capture a new recording.

Click the reload button ↻ or hit ⌘ R to record and evaluate the page load.

After recording, select an area of interest in the overview by dragging. Then, zoom and pan the timeline with the mousewheel or WASD keys.
Learn more

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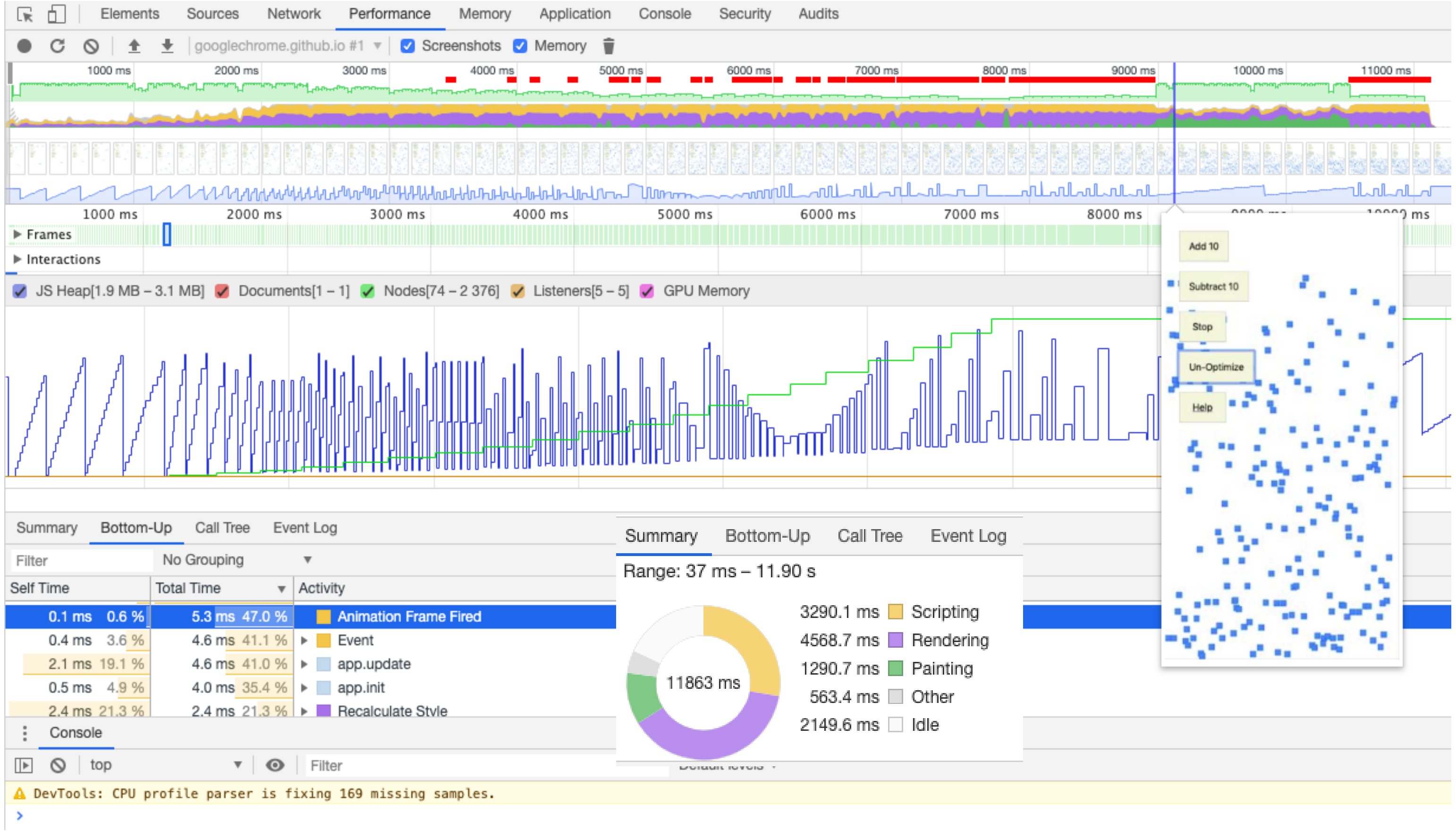
Example with Google Chrome

Profile result:

Frames per Second ➡

CPU ➡

Bottleneck ➡



Summary | Bottom-Up | Call Tree | Event Log

Filter | No Grouping ▾

Self Time		Total Time ▾		Activity
0.1 ms	0.6 %	5.3 ms	47.0 %	🟨 Animation Frame Fired
0.4 ms	3.6 %	4.6 ms	41.1 %	▸ 🟨 Event
2.1 ms	19.1 %	4.6 ms	41.0 %	▸ app.update
0.5 ms	4.9 %	4.0 ms	35.4 %	▸ app.init
2.4 ms	21.3 %	2.4 ms	21.3 %	▸ 🟪 Recalculate Style

Summary | Bottom-Up | Call Tree | Event Log

Range: 37 ms – 11.90 s

11863 ms

3290.1 ms	🟨 Scripting
4568.7 ms	🟪 Rendering
1290.7 ms	🟩 Painting
563.4 ms	▨ Other
2149.6 ms	□ Idle

Console

top ▾ | Filter

```
⚠ DevTools: CPU profile parser is fixing 169 missing samples.
>
```

Other tools for browser

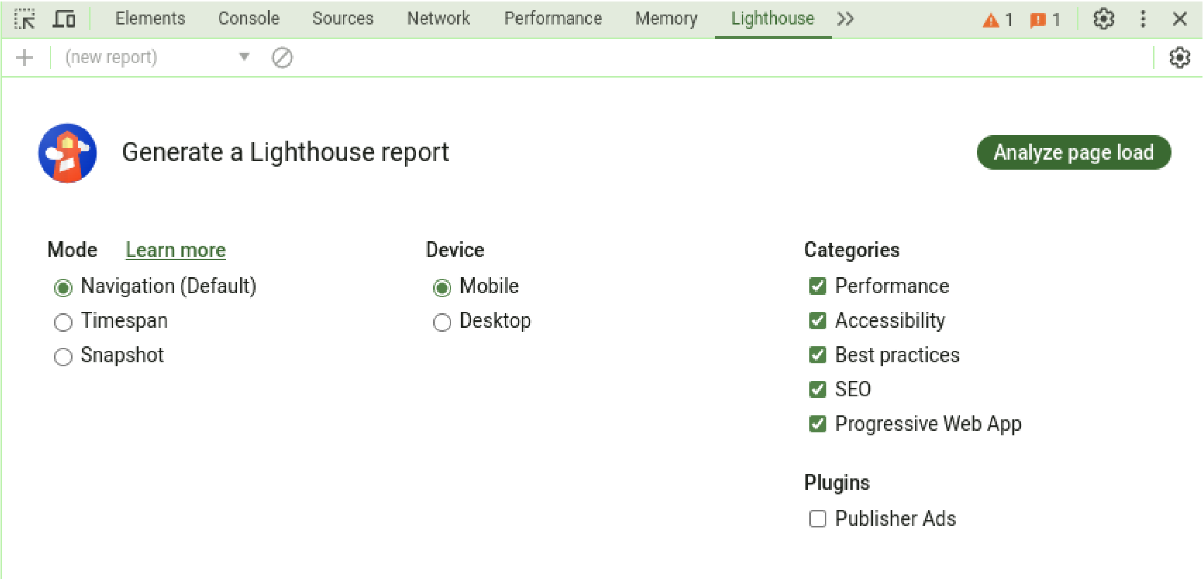
RAIL model:

Response, Animation, Idle, Load

https://developers.google.com/web/fundamentals/performance/rail

https://webpagetest.org/easy

Lighthouse (with Chrome)



Generate a Lighthouse report

Mode Learn more

● Navigation (Default)
○ Timespan
○ Snapshot

Device

● Mobile
○ Desktop

Categories

☑ Performance
☑ Accessibility
☑ Best practices
☑ SEO
☑ Progressive Web App

Plugins

□ Publisher Ads

Server side monitoring

Cloud platforms like Azure provide monitoring solutions

- Also available in Google Cloud, Amazon AWS, Alibaba Cloud…
- In the case of Azure: Azure Monitor

We can also set up our own monitoring solution

Typical software: *Prometheus* and *Grafana*

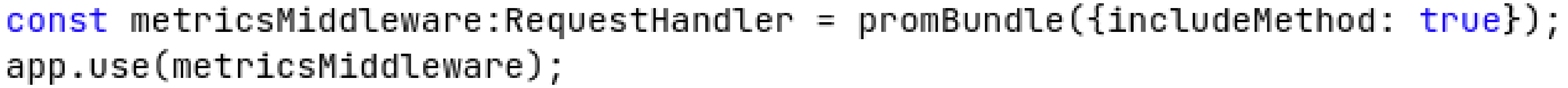
Guide:

https://github.com/Arquisoft/wichat_0/blob/master/gatewayservice/README.md

Server side monitoring

We use a library to extract metrics from gatewayservice

npm install prom-client express-prom-bundle



```
const metricsMiddleware:RequestHandler = promBundle({includeMethod: true});
app.use(metricsMiddleware);
```

If we launch the gatewayservice, in */metrics* we can see raw data can be used by Prometheus to store it and by Grafana to plot nice charts

We can choose which metrics to measure [doc]

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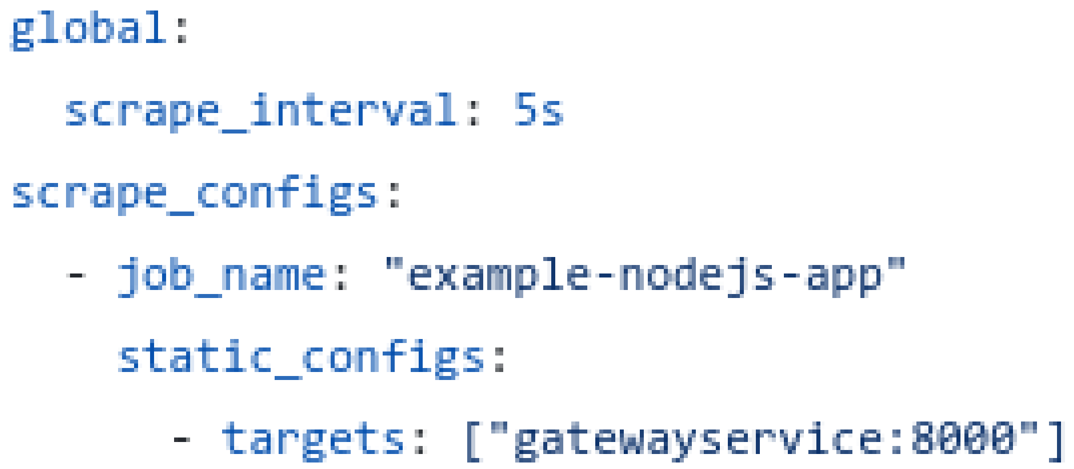
Server side monitoring

- Grafana cannot use this data directly, we need Prometheus
  - Prometheus retrieves data exposed by a service (e.g. gateway) and stores it in a time series database so it can be consumed by Grafana
  - We configured a docker image [prom/prometheus] with a single file



```
global:
  scrape_interval: 5s
scrape_configs:
  - job_name: "example-nodejs-app"
    static_configs:
      - targets: ["gatewayservice:8000"]
```

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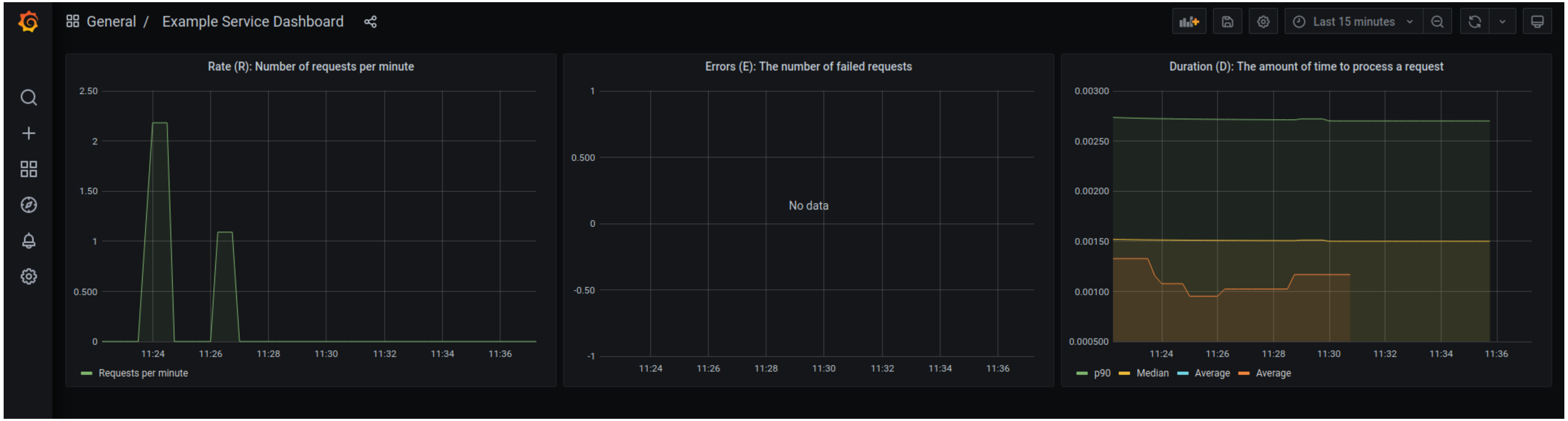
Server side monitoring

- How to configure Grafana
  - Grafana will use Prometheus as data source
  - We also have a docker image for running it [grafana/grafana]
  - We can configure datasource and dashboard (which charts to plot)



Example of Real Grafana Dashboards

https://grafana.wikimedia.org/

Links

Monitoring & Profiling

Get Started With Analyzing Runtime Performance

https://developers.google.com/web/tools/chrome-devtools/evaluate-performance/

How to Use the Timeline Tool

https://developers.google.com/web/tools/chrome-devtools/evaluate-performance timeline-tool#profile-js

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