EN
English

Universidad de Oviedo

School of Computer Science

SOFTWARE ARCHITECTURE

Software Architecture

Lab. 12

Monitoring & profiling

2021-22

Jose Emilio Labra Gayo
Pablo González
Irene Cid
Hugo Lebredo

Monitoring and profiling

Monitoring: Observe the behaviour at runtime while software is running

- Dashboards
- Usually, after deployment

Profiling: Measure performance of a software while it is running

- Identify parts of a system that contribute to a performance problem
- Show where to concentrate the efforts
- Usually before deployment

Monitoring & profiling

Monitors an application while it is running

Records performance (CPU & memory usage)

JavaScript:

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

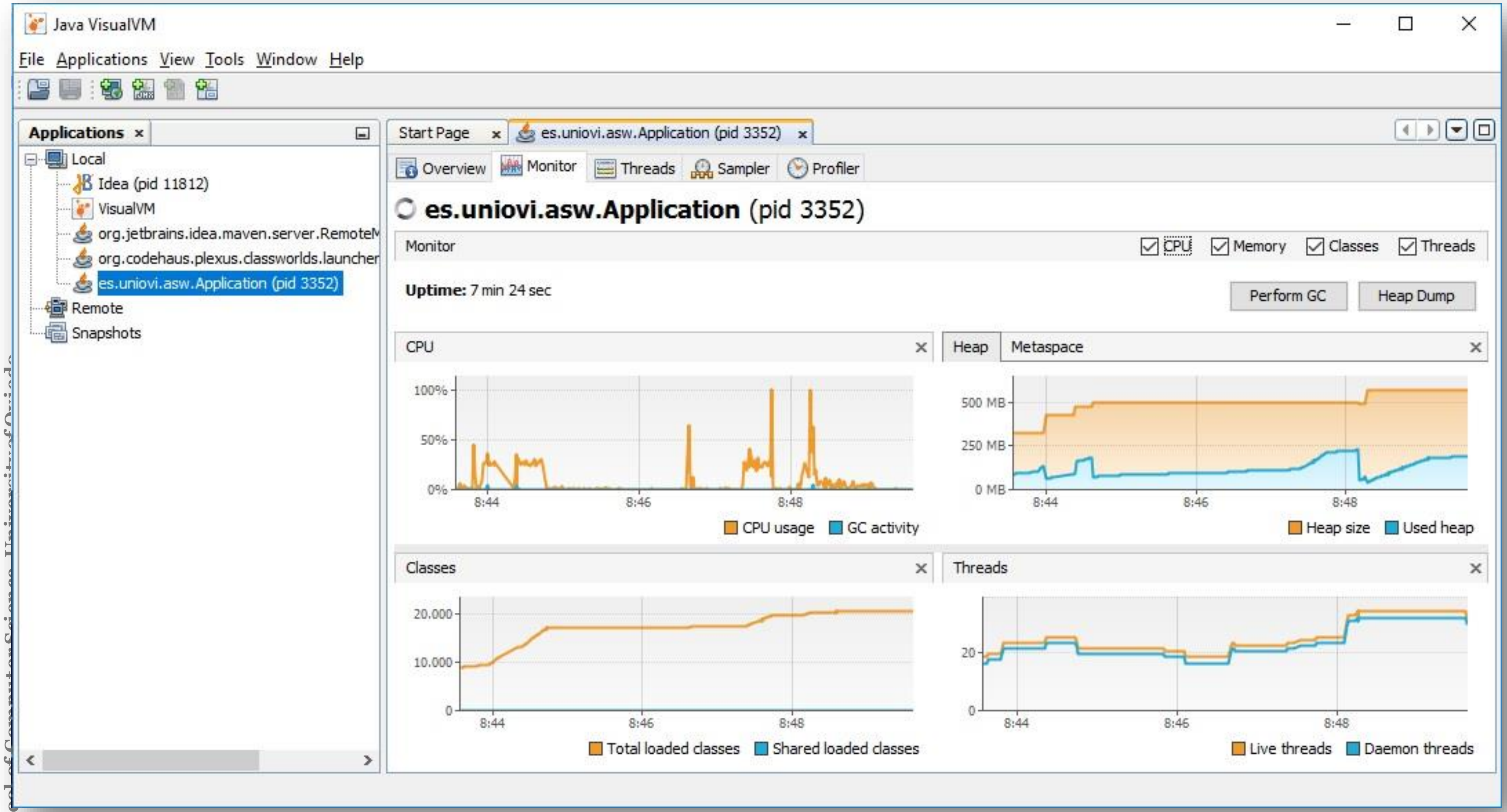
Server-side:

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

VisualVM

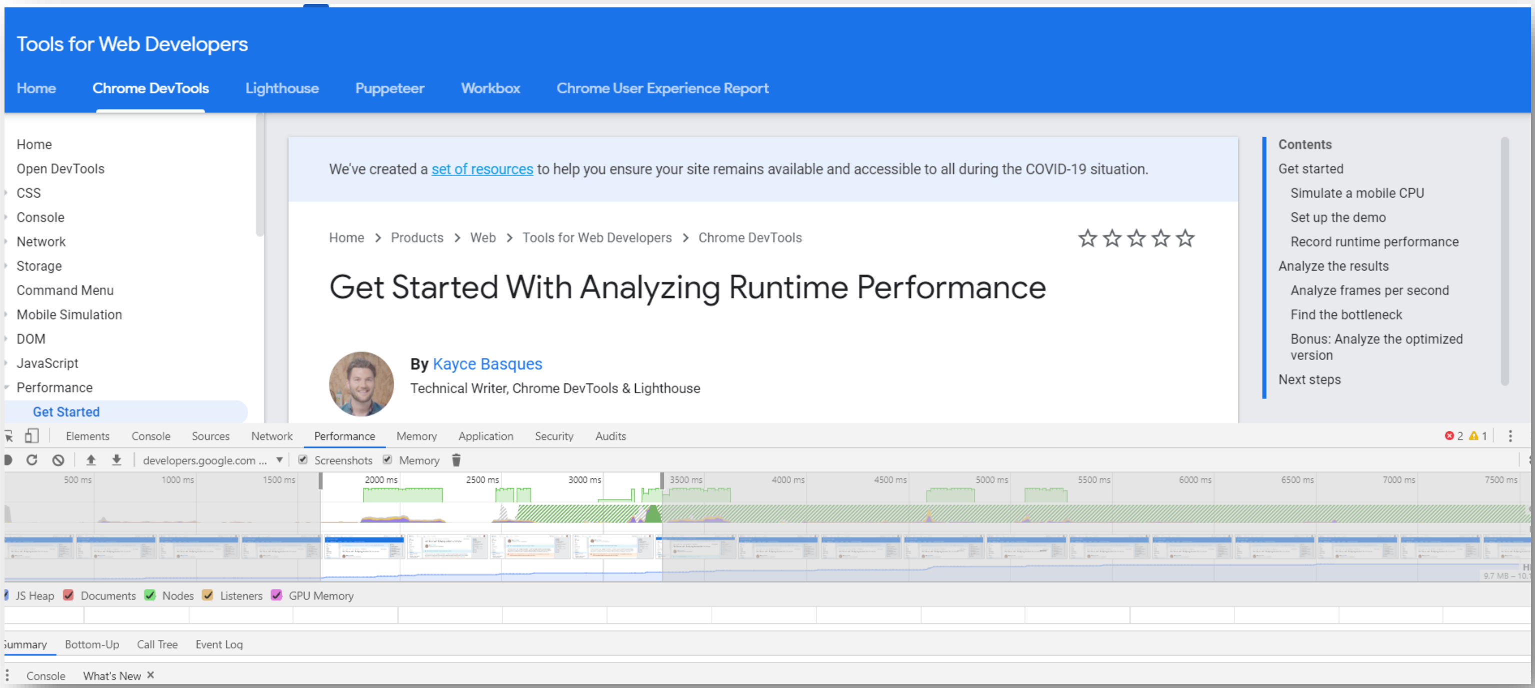
- https://visualvm.github.io/
- `jvisualvm`

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.

Home > Products > Web > Tools for Web Developers > Chrome DevTools

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.

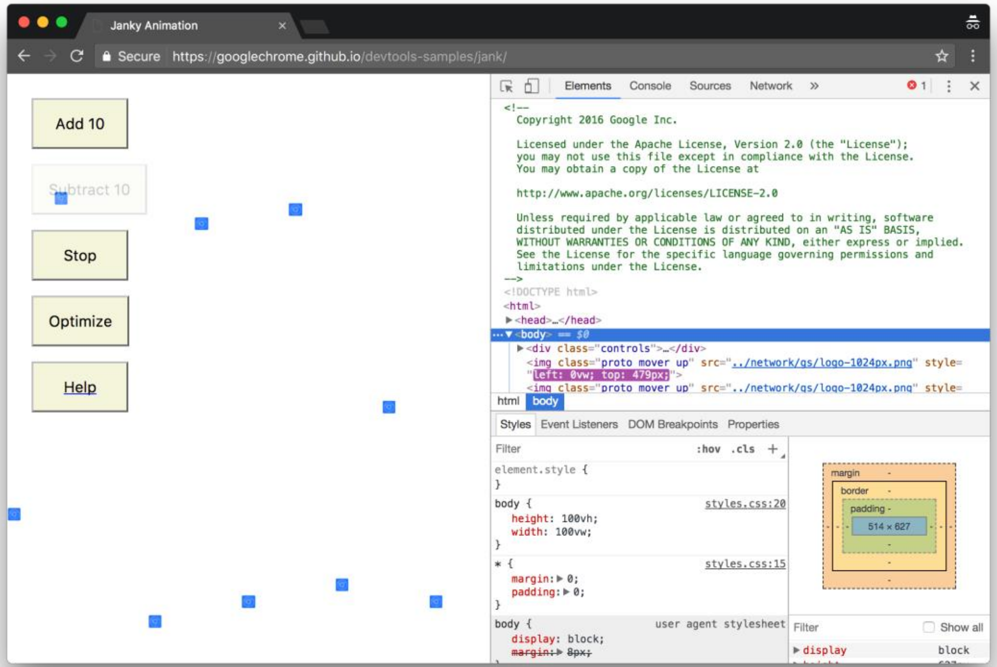
Windows, Linux, or Chrome OS: Press Ctrl + Shift + n.
Mac: Press ⌘ + Shift + n.

DevTools

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

Example with Google Chrome

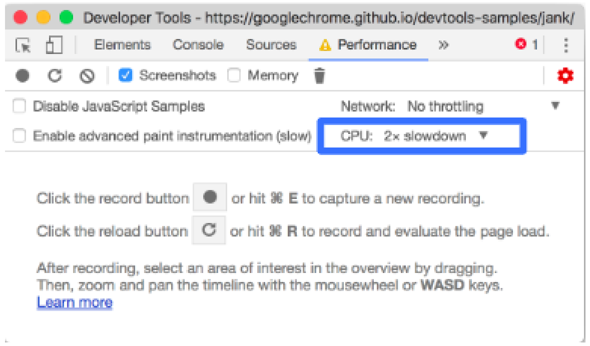
https://googlechrome.github.io/devtools-samples/jank/



```
<!--
  Copyright 2016 Google Inc.

  Licensed under the Apache License, Version 2.0 (the "License");
  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;
```

Performance>CPU>2 x Slowdown


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

Disable JavaScript Samples — Network: No throttling

Enable advanced paint instrumentation (slow) — CPU: 2x slowdown

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

Click the reload button C 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

Performance>Record

click Add 10 (20 times)

try Optimize / Un-optimize

Stop

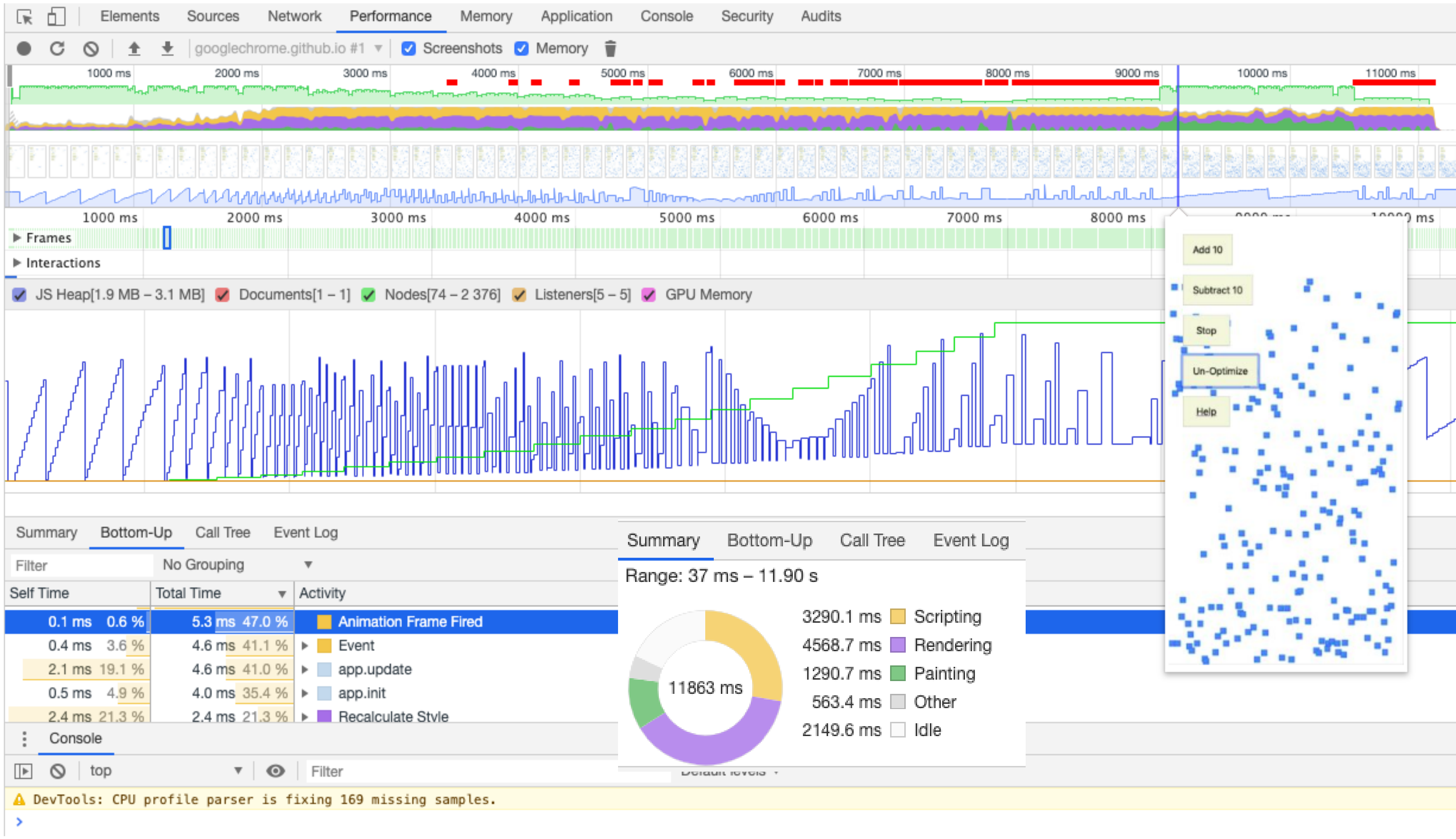
Example with Google Chrome

Profile result:

Frames per Second →

CPU →

Bottleneck →



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

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

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

Other tools for browser

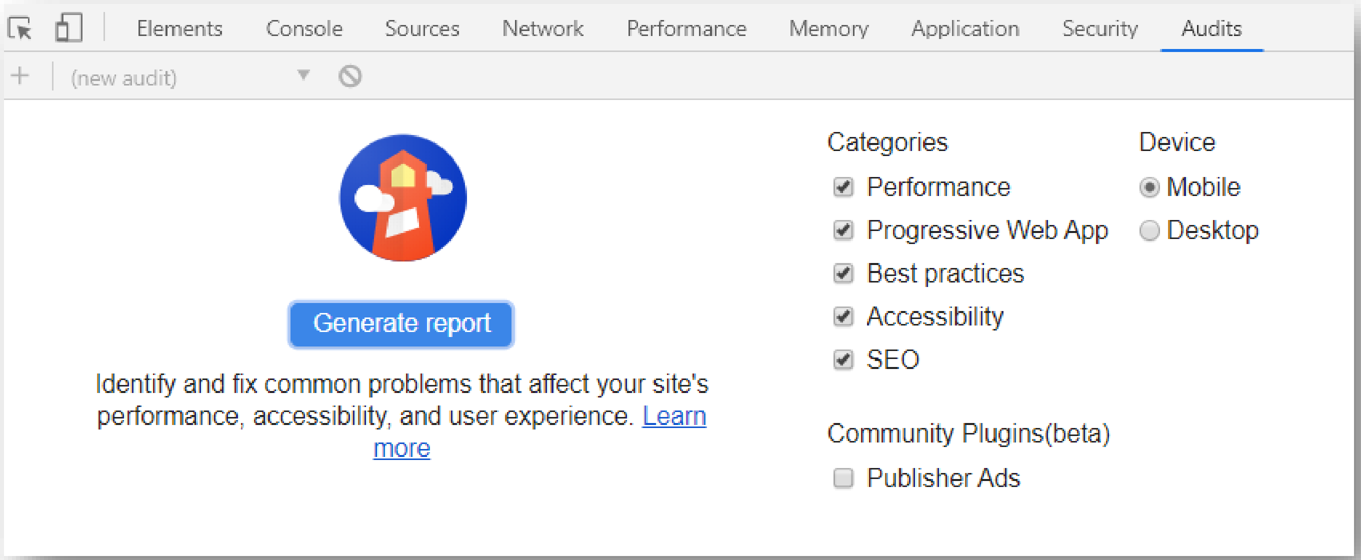
RAIL model:

Response, Animation, Idle, Load

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

https://webpagetest.org/easy

Lighthouse (with Chrome)



Identify and fix common problems that affect your site's performance, accessibility, and user experience. Learn more

Categories
- [✓] Performance
- [✓] Progressive Web App
- [✓] Best practices
- [✓] Accessibility
- [✓] SEO

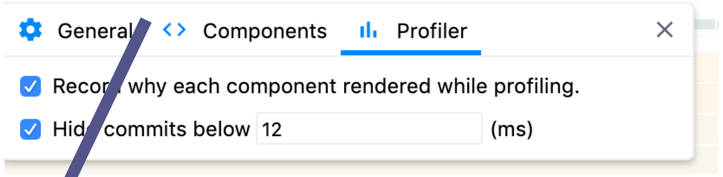
Community Plugins(beta)
- [ ] Publisher Ads

Device
- [✓ Mobile]
- Desktop

React Developer Tools

React works in two stages:

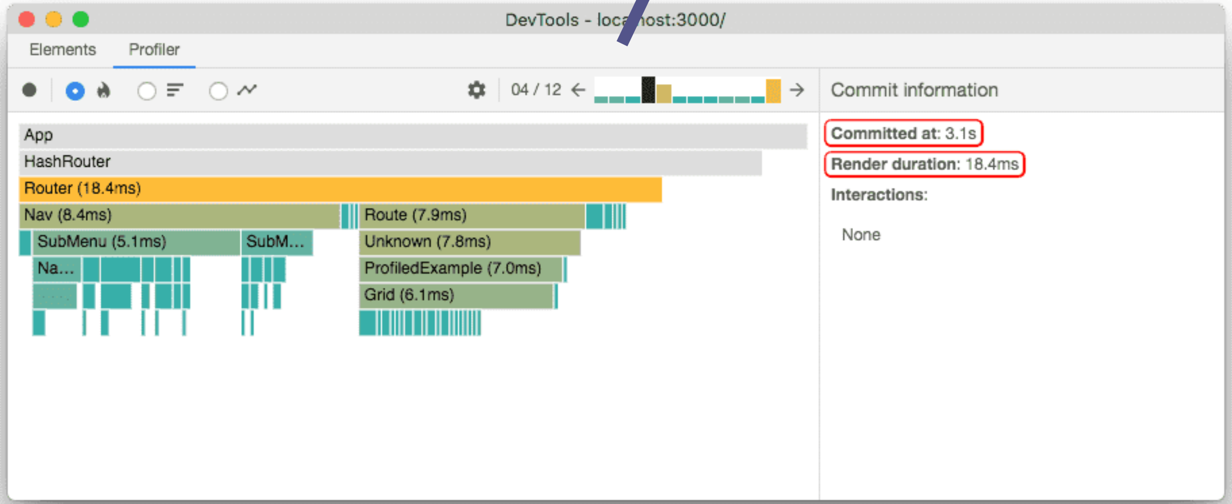
- Render
- Commit



General · Components · Profiler

☑ Record why each component rendered while profiling.

☑ Hide commits below 12 (ms)



Commit information

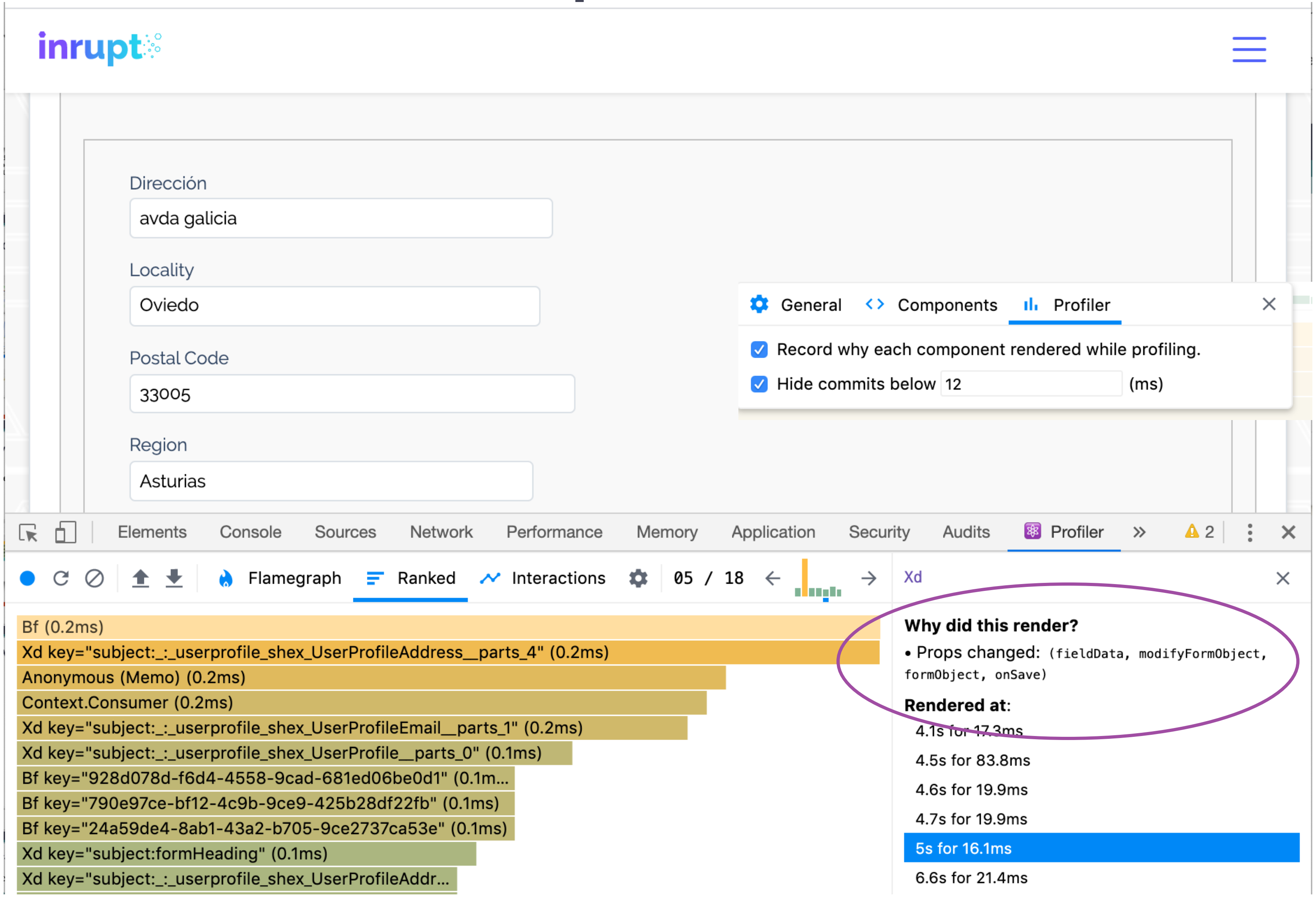
Committed at: 3.1s

Render duration: 18.4ms

Interactions:

None

React Developer Tools



Dirección
avda galicia

Locality
Oviedo

Postal Code
33005

Region
Asturias

Record why each component rendered while profiling.
Hide commits below 12 (ms)

05 / 18

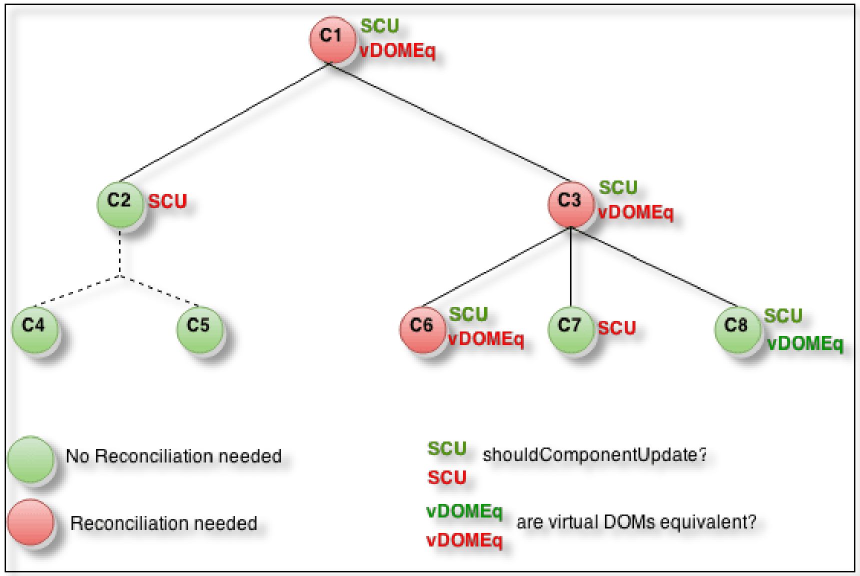
```
Bf (0.2ms)
Xd key="subject:_:_userprofile_shex_UserProfileAddress__parts_4" (0.2ms)
Anonymous (Memo) (0.2ms)
Context.Consumer (0.2ms)
Xd key="subject:_:_userprofile_shex_UserProfileEmail__parts_1" (0.2ms)
Xd key="subject:_:_userprofile_shex_UserProfile__parts_0" (0.1ms)
Bf key="928d078d-f6d4-4558-9cad-681ed06be0d1" (0.1m...
Bf key="790e97ce-bf12-4c9b-9ce9-425b28df22fb" (0.1ms)
Bf key="24a59de4-8ab1-43a2-b705-9ce2737ca53e" (0.1ms)
Xd key="subject:formHeading" (0.1ms)
Xd key="subject:_:_userprofile_shex_UserProfileAddr...
```

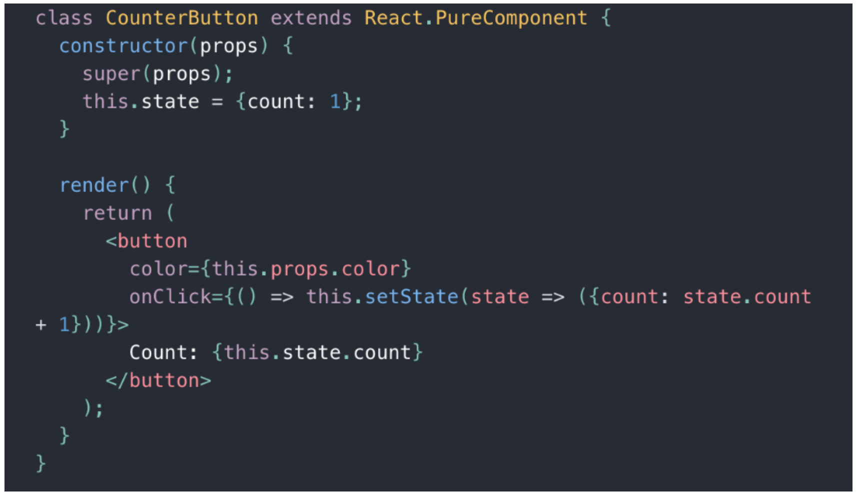
Xd

Why did this render?
• Props changed: `(fieldData, modifyFormObject, formObject, onSave)`

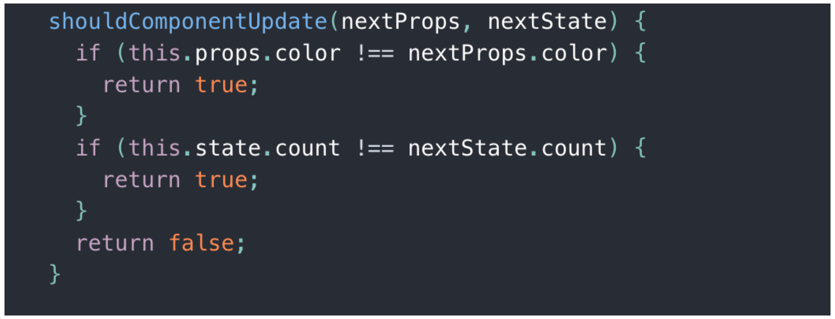
Rendered at:
4.1s for 17.3ms
4.5s for 83.8ms
4.6s for 19.9ms
4.7s for 19.9ms
5s for 16.1ms
6.6s for 21.4ms

React DOM – Virtual DOM





```
class CounterButton extends React.PureComponent {
  constructor(props) {
    super(props);
    this.state = {count: 1};
  }

  render() {
    return (
      <button
        color={this.props.color}
        onClick={() => this.setState(state => ({count: state.count
+ 1}))}>
        Count: {this.state.count}
      </button>
    );
  }
}
```



```
shouldComponentUpdate(nextProps, nextState) {
  if (this.props.color !== nextProps.color) {
    return true;
  }
  if (this.state.count !== nextState.count) {
    return true;
  }
  return false;
}
```

Source: https://es.reactjs.org/docs/optimizing-performance.html

Server side monitoring

- Cloud platforms like Heroku provide monitoring solutions
  - Also available in Google Cloud, Amazon AWS.
  - In the case of Heroku, this solution is not free
- There is also the option to set up our own monitoring solution
- Which software to use: *Prometheus* and *Graphana*
- Guide: https://github.com/arquisoft/dede_0/tree/master/rest
  api#monitoring-prometheus-and-grafana

Grafana

Server side monitoring

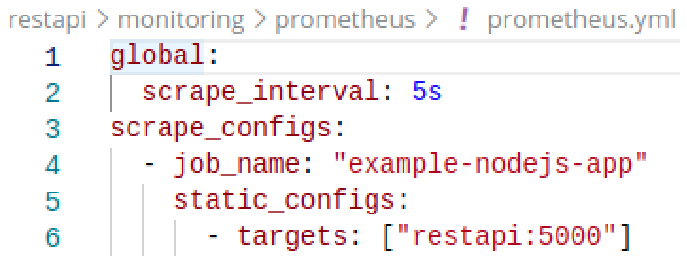
- We need a library that can extract some metrics from our restapi
  - *npm install prom-client express-prom-bundle*

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

  - If we launch the restapi, in */metrics* we will be able to see some row data that would be used by Graphana to plot nice charts
  - We can choose which metrics to measure [doc]

Server side monitoring

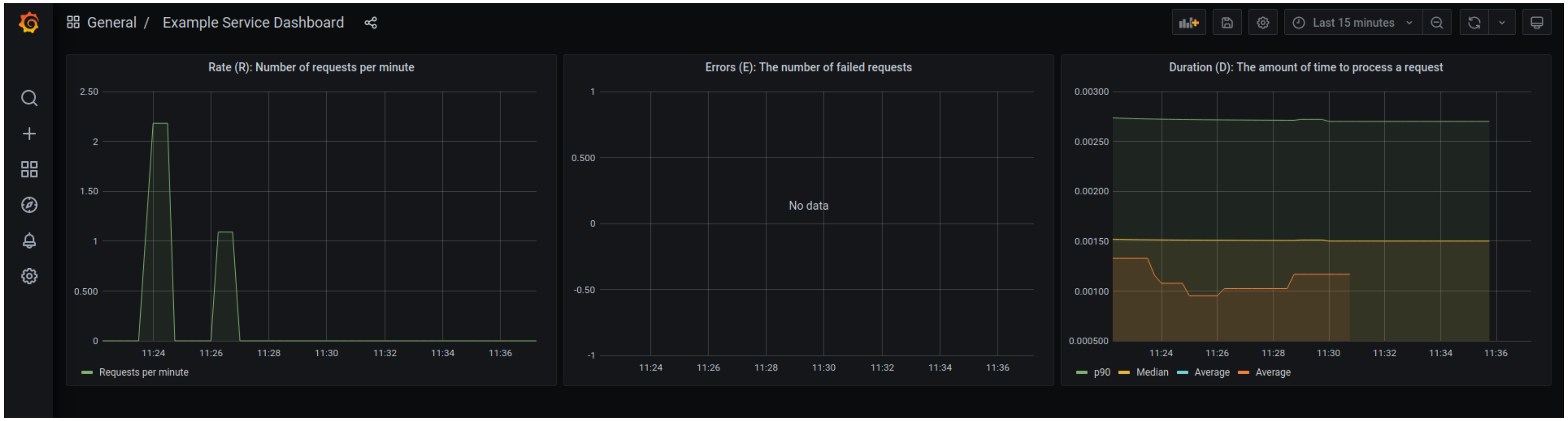
- Graphana cannot use this data directly, we need Prometheus
  - Prometheus will retrieve the data exposed by the restapi and store it so it can be consumed by Graphana
  - We will work with a docker image [prom/prometheus] that can be configured through a single file


restapi > monitoring > prometheus > ! prometheus.yml

```yaml
global:
  scrape_interval: 5s
scrape_configs:
  - job_name: "example-nodejs-app"
    static_configs:
      - targets: ["restapi:5000"]
```

Server side monitoring

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


General / Example Service Dashboard
Last 15 minutes
Rate (R): Number of requests per minute
Requests per minute
Errors (E): The number of failed requests
No data
Duration (D): The amount of time to process a request
p90
Median
Average
Average

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

Presentation

Presentation Zen Garr Reynolds
https://www.presentationzen.com/
https://www.amazon.com/gp/product/0321811984