

# Using the Firefox Profiler for performance analysis

profiler.firefox.com

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with a lot of content coming from Nazım Can Altınova

Slides: <https://share.firefox.dev/profiler-intro-fosdem-2023>

FOSDEM 2023 - February 2023



# Agenda



Key takeaways from this talk:



What is a profiler?



How do I capture and share a profile?



How do I analyze a profile?

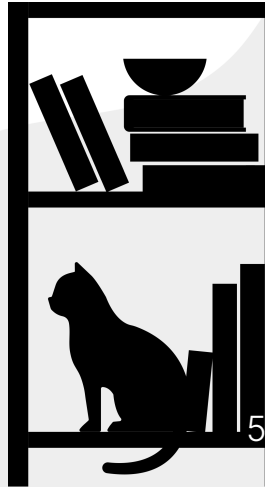
profiler.firefox.com

github.com/firefox-devtools/profiler/

# What is a profiler?

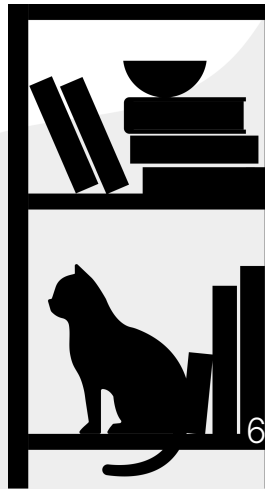
# | Where can we measure performance?

- Locally, on the developer's computer
- In CI, with automated tests
- Real User Monitor (measure on your user's computer)



# | Where is performance measured?

- Locally on the developer's computer ← Profiler
- In CI with automated tests
- Real User Monitor (aka measure on your user's computer)



Helps developers analyze  
performance issues



Gives insight and clues



this is detective work





Do not guess  
Measure

# How to capture a performance profile?

(live demo, skip 7 slides forward)

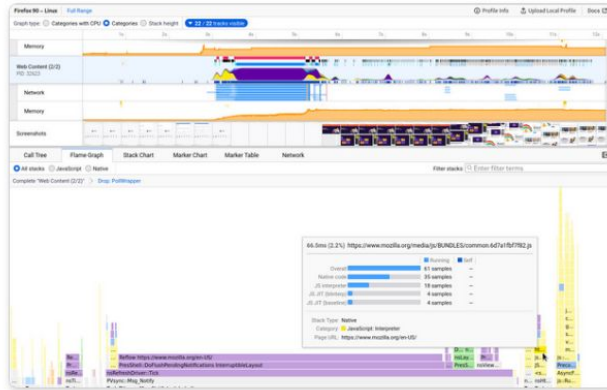
1. Go to [profiler.firefox.com](https://profiler.firefox.com)

1. Go to [profiler.firefox.com](https://profiler.firefox.com)
2. Follow the instructions

## Firefox Profiler — Web app for Firefox performance analysis



Capture a performance profile. Analyze it. Share it. Make the web faster.



[+ Enable Firefox Profiler Menu Button](#)

[? Documentation](#)

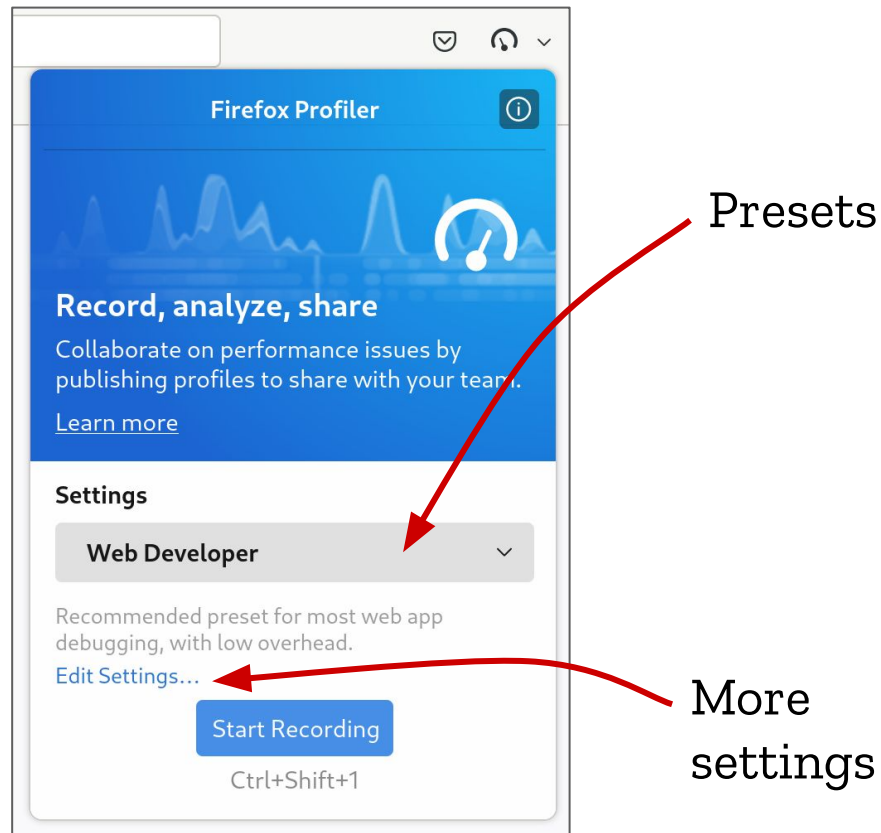
Enable the profiler menu button to start recording a performance profile in Firefox, then analyze it and share it with [profiler.firefox.com](https://profiler.firefox.com).

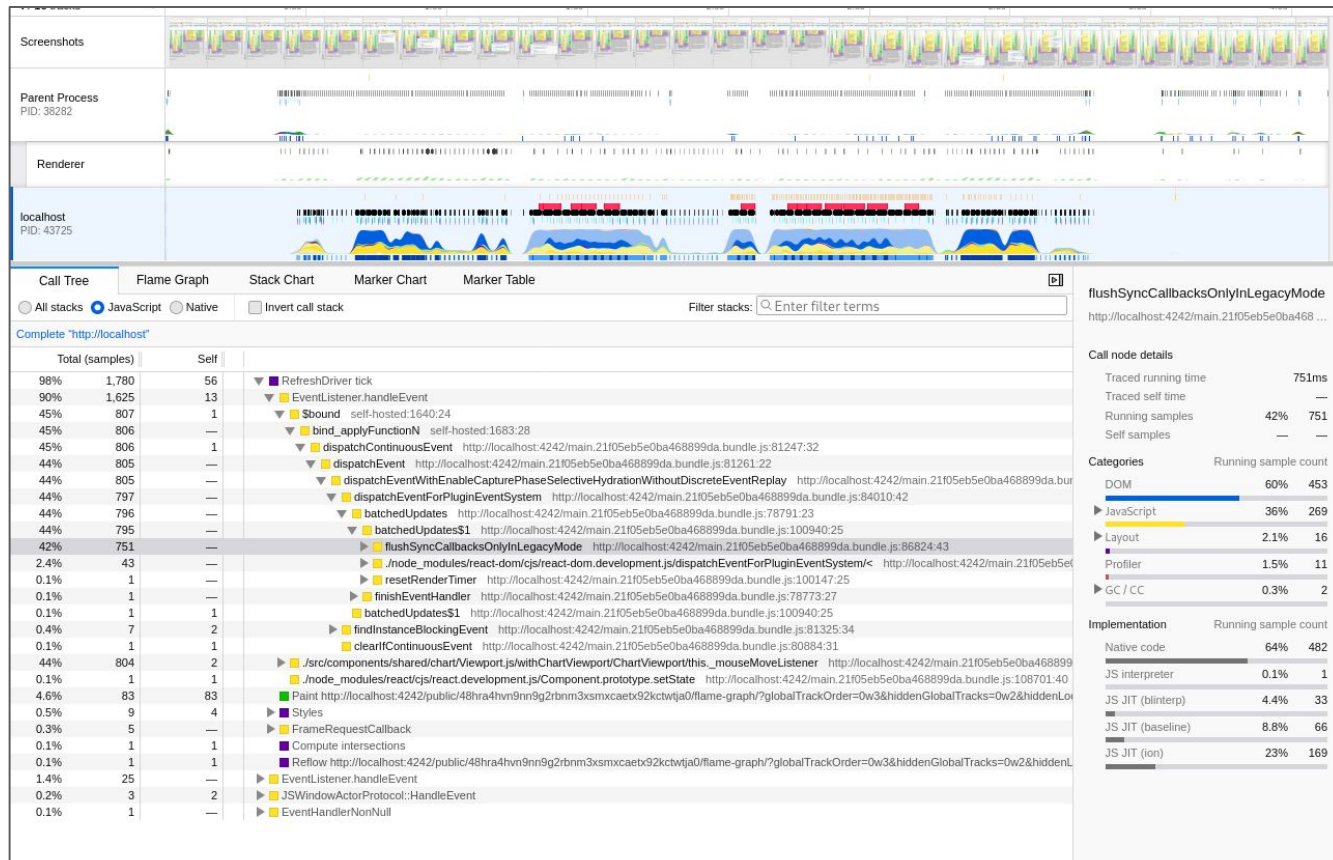
You can also profile Firefox for Android. For more information, please consult this documentation: [Profiling Firefox for Android directly on device](#).



# Recording UI

Record with: Ctrl + Shift + 1  
Capture with: Ctrl + Shift + 2






<https://share.firefox.dev/3HSmyyU>

# Share your captured profile

Full ViewLocal ProfileUploadDocs



## Share Performance Profile

Upload your profile and make it accessible to anyone with the link. This profile is from Firefox Nightly, so by default all information is included.

**Include additional data that may be identifiable**


☐ Include hidden threads


☐ Include hidden time range

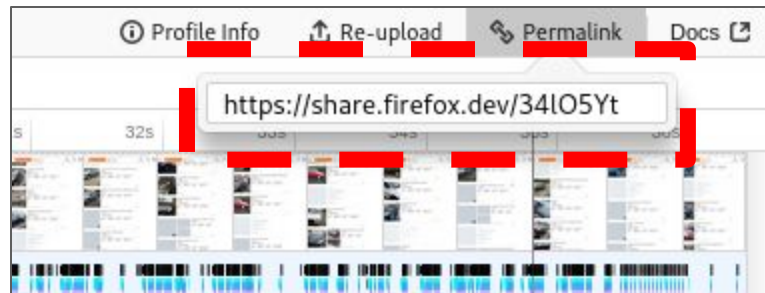
☒ Include screenshots

☐ Include resource URLs and paths

☐ Include extension information

 Download (3.79 MB)

 Upload





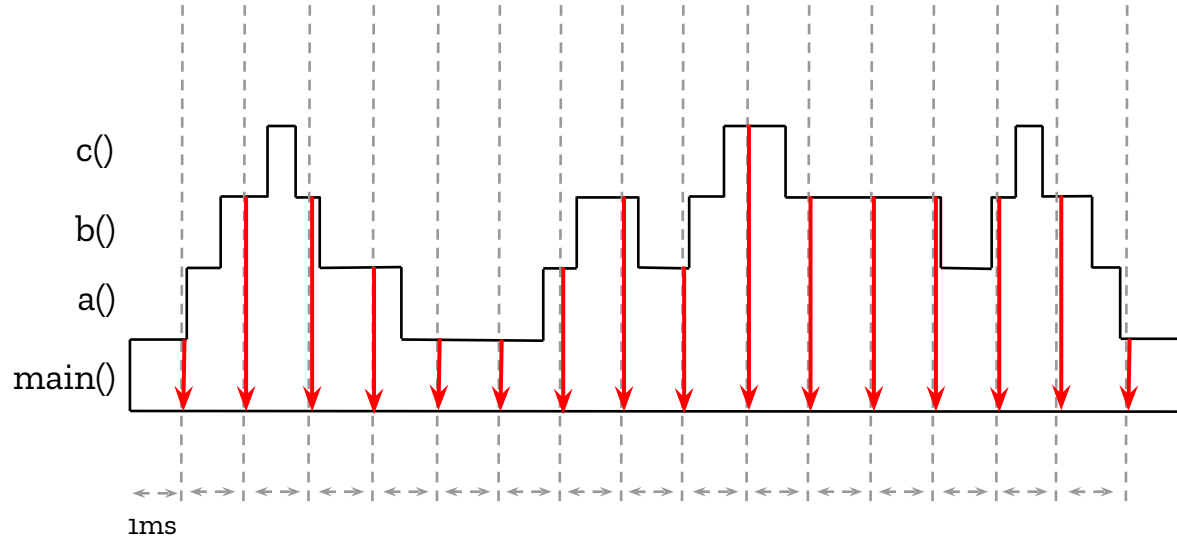
# A few rules to capture good data

- Isolate the problem as much as possible.
- Ensure you reproduced the results you want.
- Keep recording until you are happy with the captured data.



# Different types of captured data

# What is sampling?

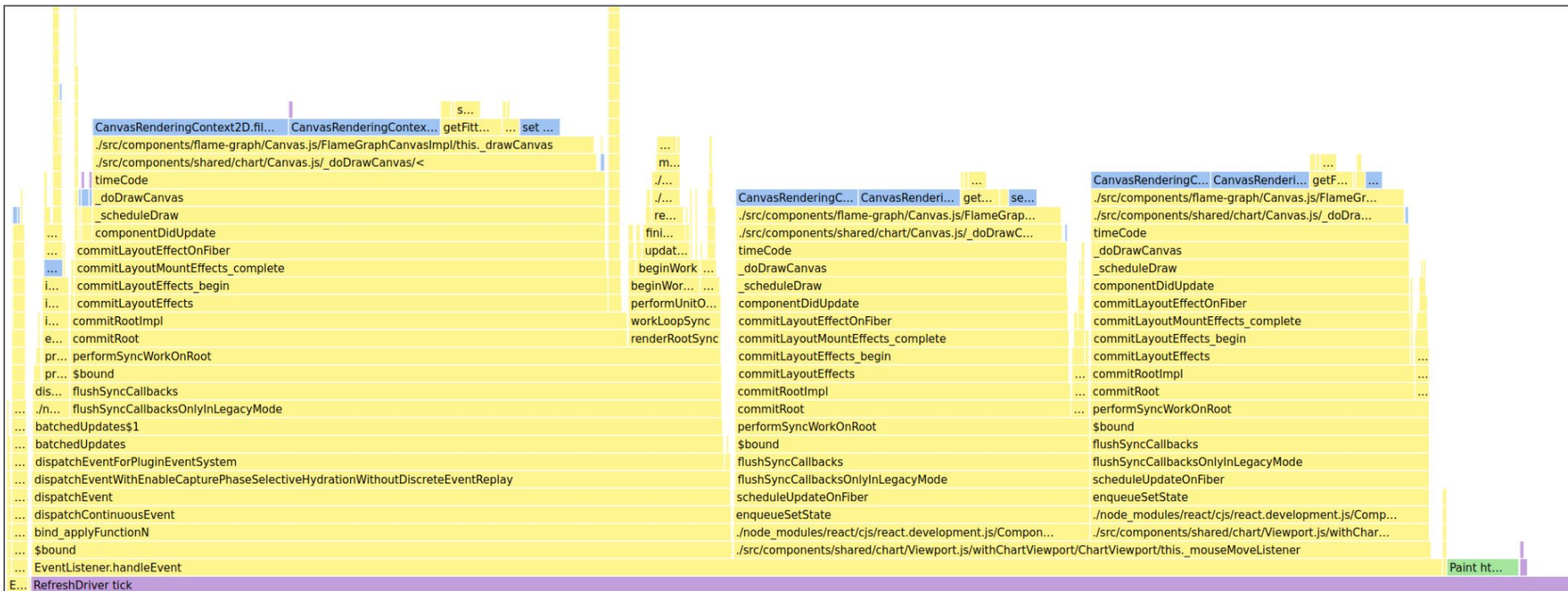


Stops the execution of the program at a fixed rate and records relevant information like the current stack.

# Call Tree

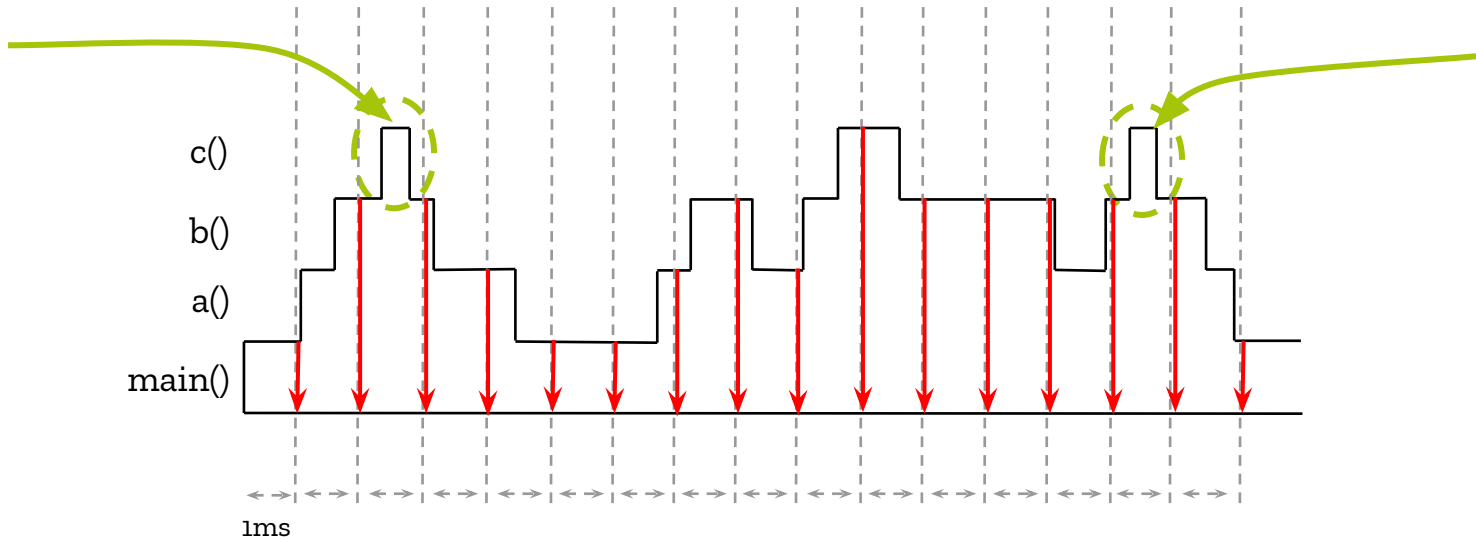
Total (samples)	Self	
98%	1,780	56 ▼ RefreshDriver tick
90%	1,625	▼ EventListener.handleEvent
45%	807	▼ \$bound self-hosted:1640:24
45%	806	▼ bind_applyFunctionN self-hosted:1683:28
45%	806	▼ dispatchContinuousEvent http://localhost:4242/main.21f05eb5e0ba468899da.bundle.js:81247:32
44%	805	▼ dispatchEvent http://localhost:4242/main.21f05eb5e0ba468899da.bundle.js:81261:22
44%	805	▼ dispatchEventWithEnableCapturePhaseSelectiveHydrationWithoutDiscreteEventReplay http://localhost:4242/main.21f05eb5e0ba468899da.bundle.js:81261:22
44%	797	▼ dispatchEventForPluginEventSystem http://localhost:4242/main.21f05eb5e0ba468899da.bundle.js:84010:42
44%	796	▼ batchedUpdates http://localhost:4242/main.21f05eb5e0ba468899da.bundle.js:78791:23
44%	795	▼ batchedUpdates\$1 http://localhost:4242/main.21f05eb5e0ba468899da.bundle.js:100940:25
42%	751	▼ flushSyncCallbacksOnlyInLegacyMode http://localhost:4242/main.21f05eb5e0ba468899da.bundle.js:86824:43
42%	751	▼ flushSyncCallbacks http://localhost:4242/main.21f05eb5e0ba468899da.bundle.js:86834:27
42%	751	▼ \$bound self-hosted:1406:24
41%	750	▼ performSyncWorkOnRoot http://localhost:4242/main.21f05eb5e0ba468899da.bundle.js:100872:30
35%	642	▼ commitRoot http://localhost:4242/main.21f05eb5e0ba468899da.bundle.js:101478:19
35%	642	▼ commitRootImpl http://localhost:4242/main.21f05eb5e0ba468899da.bundle.js:101496:23
34%	615	▼ commitLayoutEffects http://localhost:4242/main.21f05eb5e0ba468899da.bundle.js:99413:28
34%	615	▼ commitLayoutEffects_begin http://localhost:4242/main.21f05eb5e0ba468899da.bundle.js:99422:34
34%	614	▼ commitLayoutMountEffects_complete http://localhost:4242/main.21f05eb5e0ba468899da.bundle.js:99484:42
34%	612	▼ commitLayoutEffectOnFiber http://localhost:4242/main.21f05eb5e0ba468899da.bundle.js:98058:34
33%	591	▼ componentDidUpdate http://localhost:4242/main.21f05eb5e0ba468899da.bundle.js:22877:20
33%	591	▼ _scheduleDraw http://localhost:4242/main.21f05eb5e0ba468899da.bundle.js:22786:15
33%	591	▼ _doDrawCanvas http://localhost:4242/main.21f05eb5e0ba468899da.bundle.js:22852:15
33%	591	▼ timeCode http://localhost:4242/main.21f05eb5e0ba468899da.bundle.js:65943:17
32%	581	▶ ./src/components/shared/chart/Canvas.js/_doDrawCanvas/< http://localhost:4242/main.21f05eb5e0ba468899da.bundle.js:22852:15
0.3%	5	▶ console.log
0.1%	2	▶ Performance.measure
0.1%	1	▶ Performance.now
0.1%	1	▶ Performance.mark
0.7%	13	▶ componentDidUpdate http://localhost:4242/main.21f05eb5e0ba468899da.bundle.js:35795:20
0.3%	5	▶ commitHookEffectListMount http://localhost:4242/main.21f05eb5e0ba468899da.bundle.js:97928:34
0.2%	3	▶ componentDidMount http://localhost:4242/main.21f05eb5e0ba468899da.bundle.js:35792:19

# Flame Graph



**Sampling provide a view into  
the profiled program**

# Short but important events can be missed



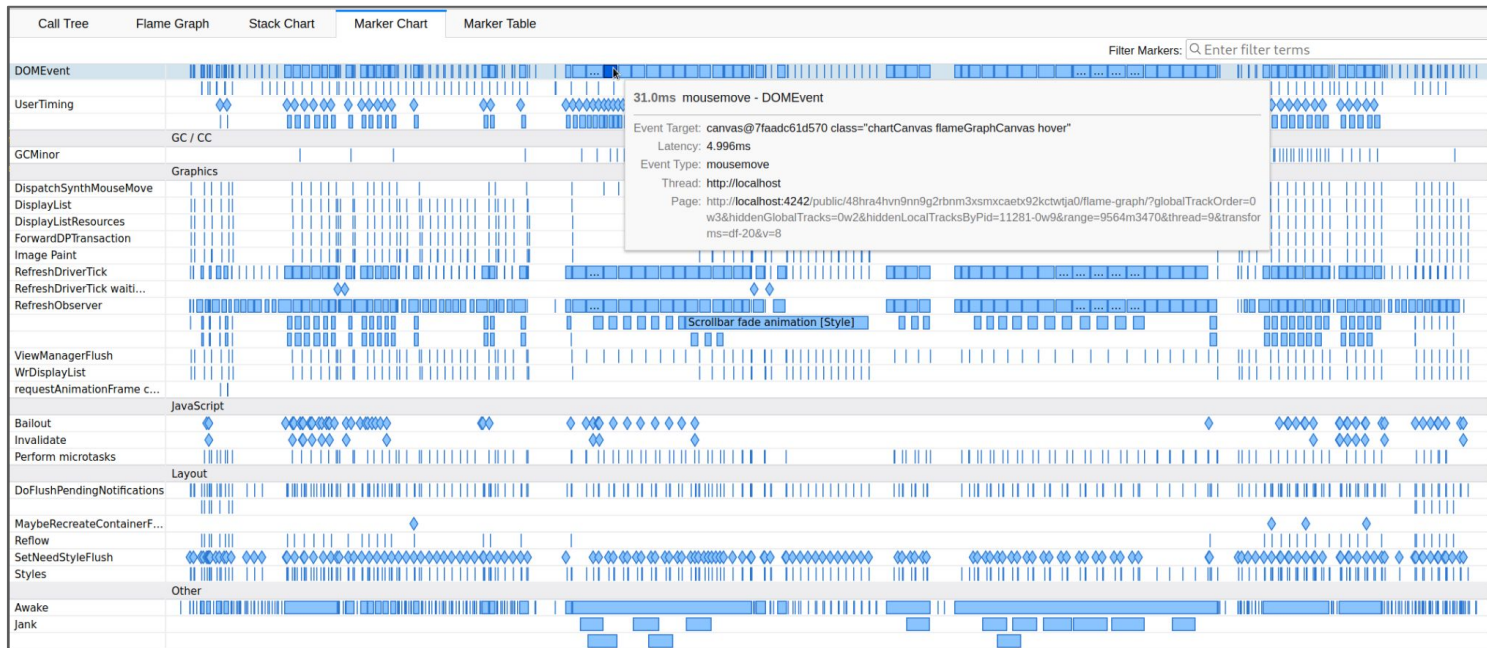
# Markers to the rescue!





# What are markers?

Markers provide a view into the executing code that does not miss anything.





# Limits



- Measuring on your computer doesn't mean it's always the same on every computer.
- The profiling itself can skew the results.

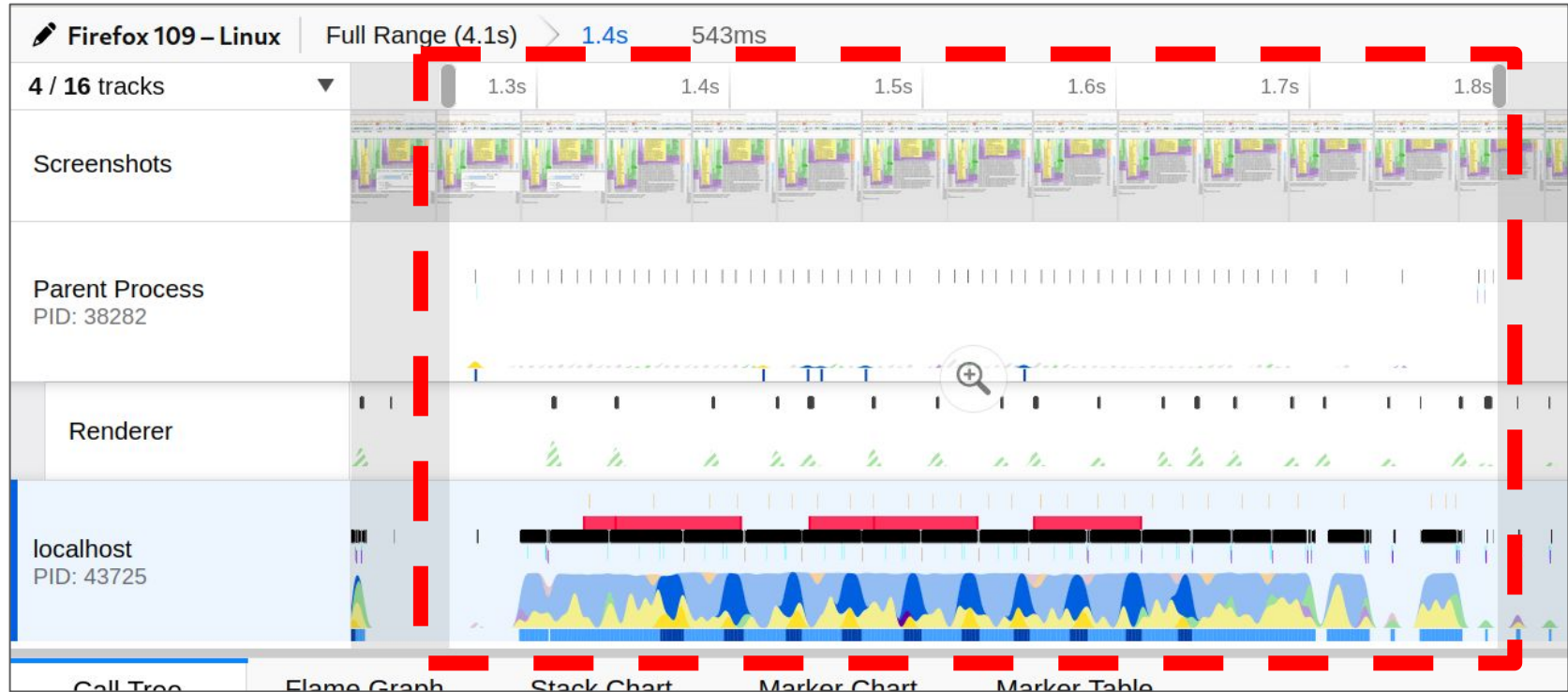
# Firefox Profiler analysis UI

(live demo, skip to "advanced topics")

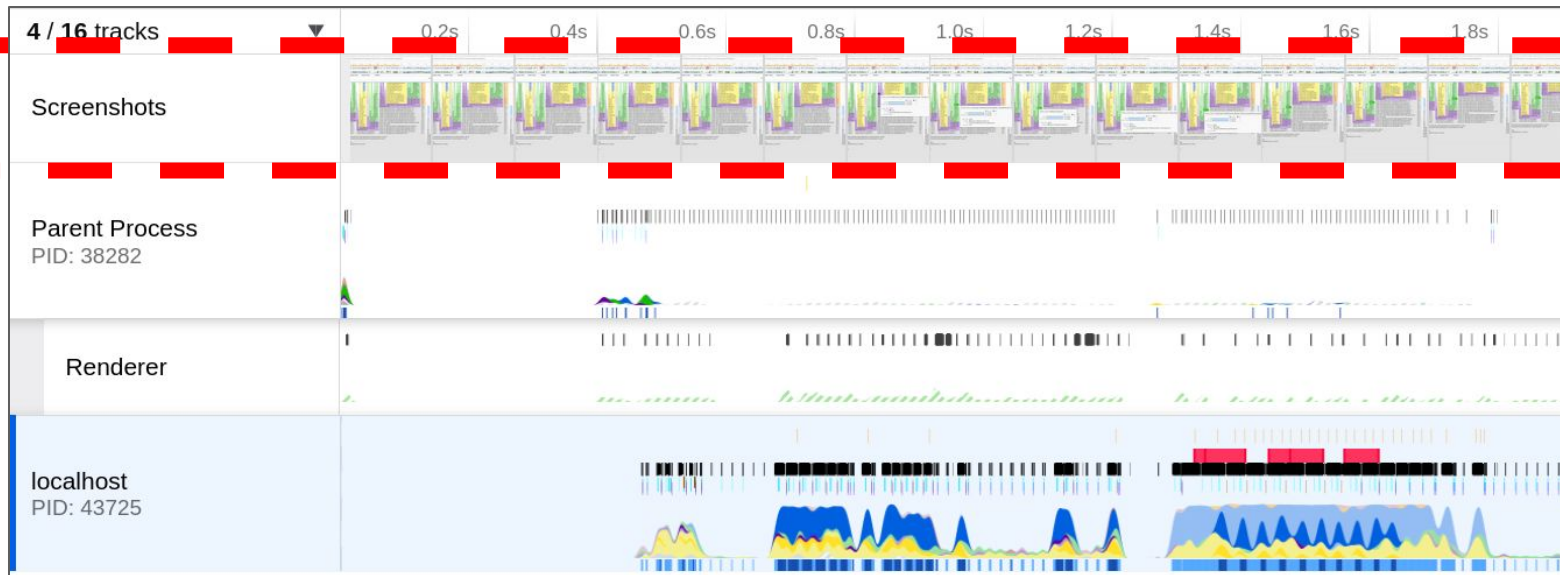
# Timeline



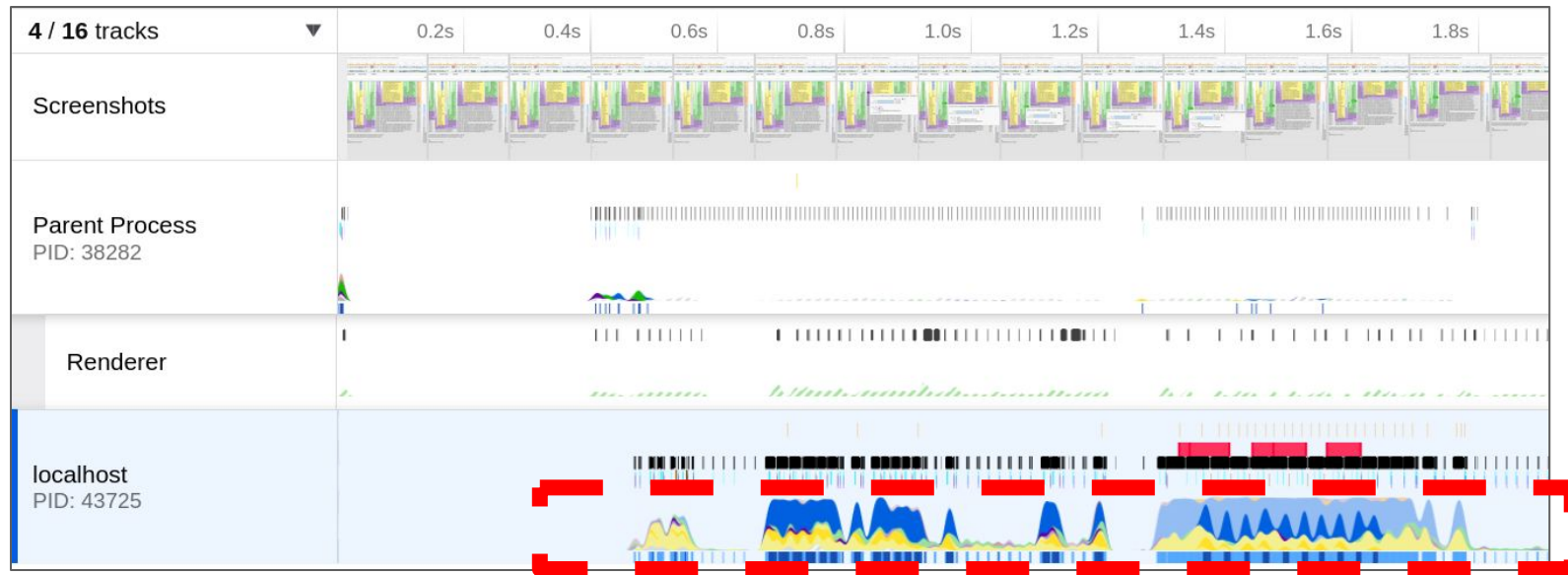
# Range selection



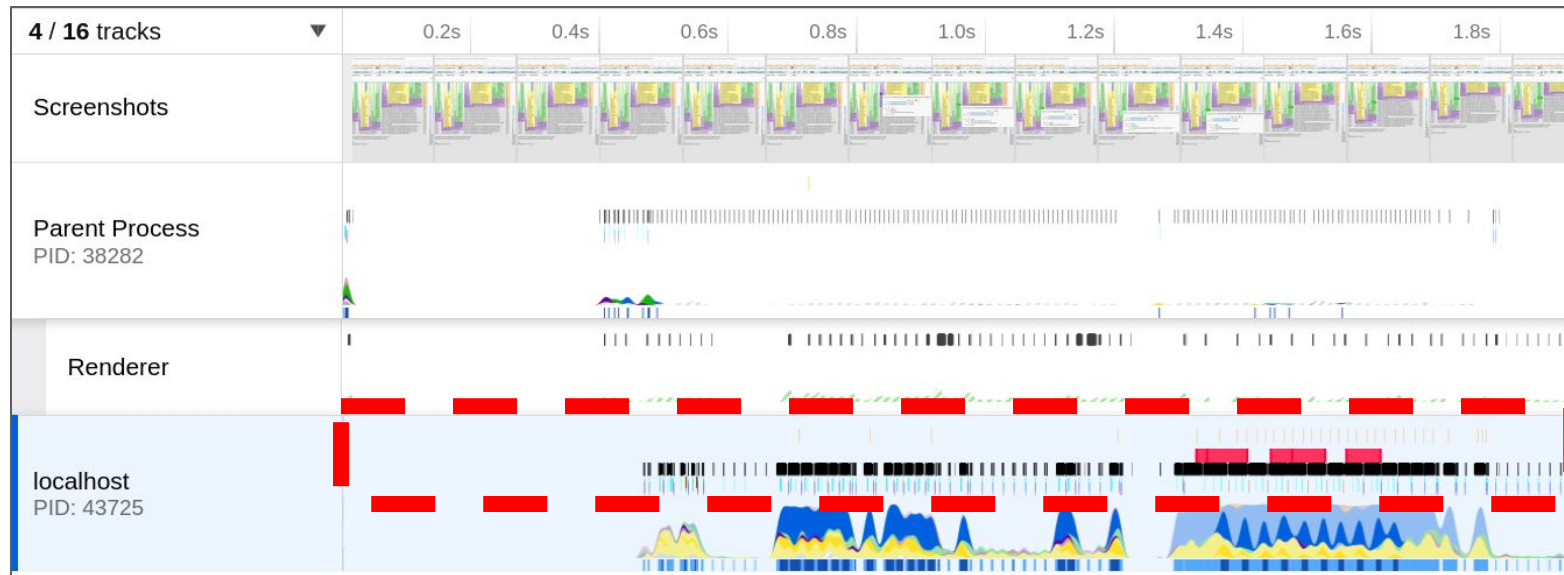
# Screenshots in the timeline



# Category graph in the timeline



# Markers in the timeline





# Marker tooltips

## 14.1ms mousemove - DOMEvent

Event Target: `canvas@7faadc61d570 class="chartCanvas flameGraphCanvas hover"`  
 Latency: 3.921ms  
 Event Type: `mousemove`  
 Thread: `http://localhost`  
 Page: `http://localhost:4242/public/48hra4hvn9nn9g2rbnm3xsmxcaetx92kctwtja0/flame-graph/?globalTrackOrder=0w3&hiddenGlobalTracks=0w2&hiddenLocalTracksByPid=11281-0w9&range=9564m3470&thread=9&transforms=df-20&v=8`

## 894ms CSS animation

Name: `tab-throbber-animation`  
 Animated Properties: `transform`  
 Can Run on Compositor: `true`  
 Target: `hbox@7f6769653a80 class="tab-throbber"`  
 Thread: `Parent Process`  
 Page: `chrome://browser/content/browser.xhtml`

## 276µs Reflow

Type: `Paint`

Thread: `http://localhost`

Page: `http://localhost:4242/public/48hra4hvn9nn9g2rbnm3xsmxcaetx92kctwtja0/flame-graph/?globalTrackOrder=0w3&hiddenGlobalTracks=0w2&hiddenLocalTracksByPid=11281-0w9&range=9564m3470&thread=9&transforms=df-20&v=8`

Stack: First invalidated 14.670ms before the flush, at:

```
Reflow http://localhost:4242/public/48hra4hvn9nn9g2rbnm3xsmxcaetx92kctwtja0/flame-graph/?globalTrackOrd...
get HTMLElement.offsetWidth
setPositioningStyle http://localhost:4242/main.21f05eb5e0ba468899da.bundle.js:35764:21
componentDidUpdate http://localhost:4242/main.21f05eb5e0ba468899da.bundle.js:35795:20
commitLayoutEffectOnFiber http://localhost:4242/main.21f05eb5e0ba468899da.bundle.js:98058:34
commitLayoutMountEffects_complete http://localhost:4242/main.21f05eb5e0ba468899da.bundle.js:99484:42
commitLayoutEffects_begin http://localhost:4242/main.21f05eb5e0ba468899da.bundle.js:99422:34
commitLayoutEffects http://localhost:4242/main.21f05eb5e0ba468899da.bundle.js:99413:28
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commitRoot http://localhost:4242/main.21f05eb5e0ba468899da.bundle.js:101478:19
performSyncWorkOnRoot http://localhost:4242/main.21f05eb5e0ba468899da.bundle.js:100872:30
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batchedUpdates$1 http://localhost:4242/main.21f05eb5e0ba468899da.bundle.js:100940:25
batchedUpdates http://localhost:4242/main.21f05eb5e0ba468899da.bundle.js:78791:23
dispatchEventForPluginEventSystem http://localhost:4242/main.21f05eb5e0ba468899da.bundle.js:84010:42
dispatchEventWithEnableCapturePhaseSelectiveHydrationWithoutDiscreteEventReplay http://localhost:4242/...
dispatchEvent http://localhost:4242/main.21f05eb5e0ba468899da.bundle.js:81261:22
dispatchContinuousEvent http://localhost:4242/main.21f05eb5e0ba468899da.bundle.js:81247:32
...
```

## moz://a



# Debugging with the profiler

- The profiler isn't only for profiling!
- Get a quick overview of the program flow for some code you don't know
  - Codepaths, file accesses, network requests, various events
- Instrument your JS code with the Performance Timing API to add more data that will show up in profilers



# Advanced topics

# Memory allocation instrumentation

<https://profiler.firefox.com/docs/#/./memory-allocations>

# Chrome (and node) profile importer

# Compare profiles

# Conclusion





**Measure, don't guess.**



**This is a tool for your toolbox.**



**Use the profiler to debug.**



**Share profiles with your team.**

# Thank you

## **Firefox Profiler**

<https://profiler.firefox.com/>

## **Firefox Profiler Documentation:**

<https://profiler.firefox.com/docs/>

## **Matrix channel:**

<https://chat.mozilla.org/#/room/#profiler:mozilla.org>

## **Slides:**

<https://share.firefox.dev/profiler-intro-fosdem-2023>

