Firefox

Firefox Performance Tooling

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Firefox Performance Team

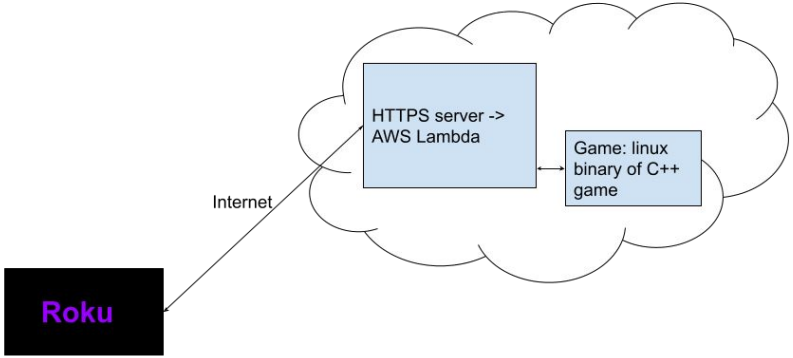
About myself

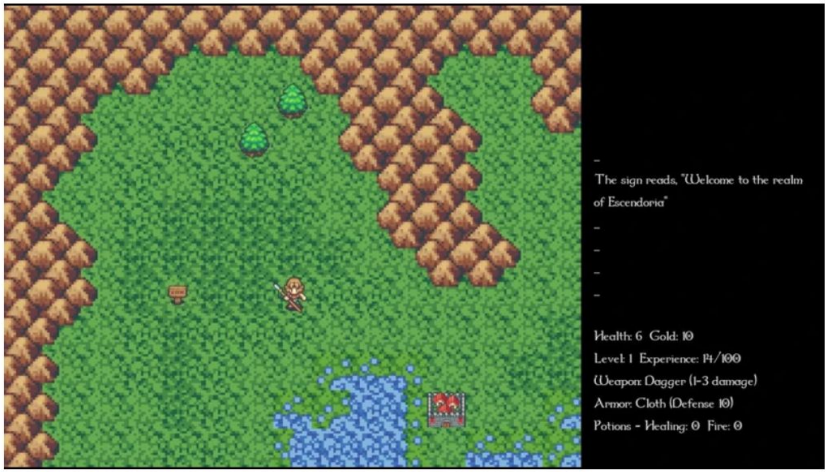
- Introduced to C++ in a second year computer science class (1998)
- Games Industry: 2002 → 2011 (Playstation 2, Xbox, Wii, Playstation 3, XBox 360, PC)
- CorelDraw Graphics Suite: 2011 → 2015
- You.i TV (now Warner Media): 2015-2018
- Mozilla, Firefox Performance: 2018 → Present

Hobby Project

C++ where you can’t use C++

Wanderer RPG on Roku





Firefox Performance Program

Make Firefox Faster, not slower

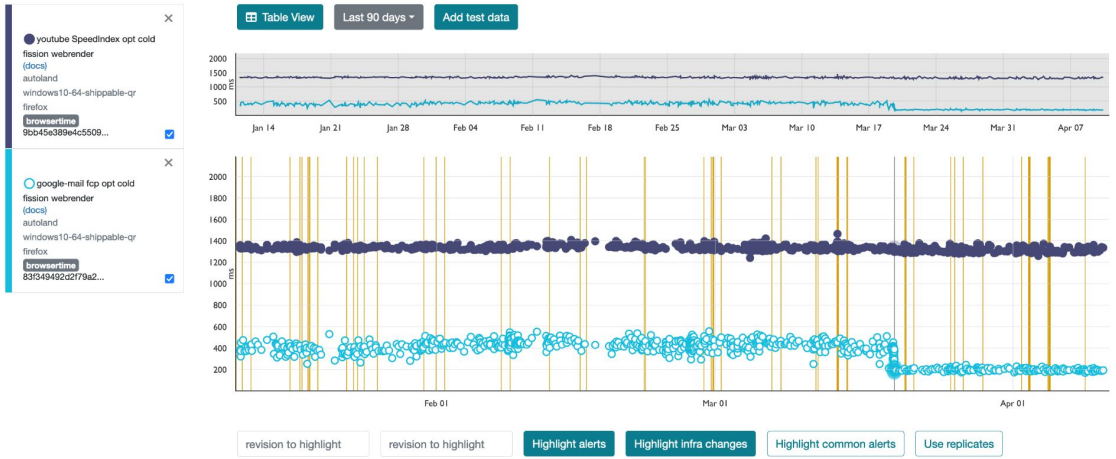
- Large runtime: C, C++, Rust, Javascript
- Windows, MacOs, Linux, Android, (iOS Firefox uses webkit)
- Prevent regressions
- Identify bottlenecks and make improvements
- Contribute to web standards (internet as a global resource)

Measuring performance

CI: Test on every commit

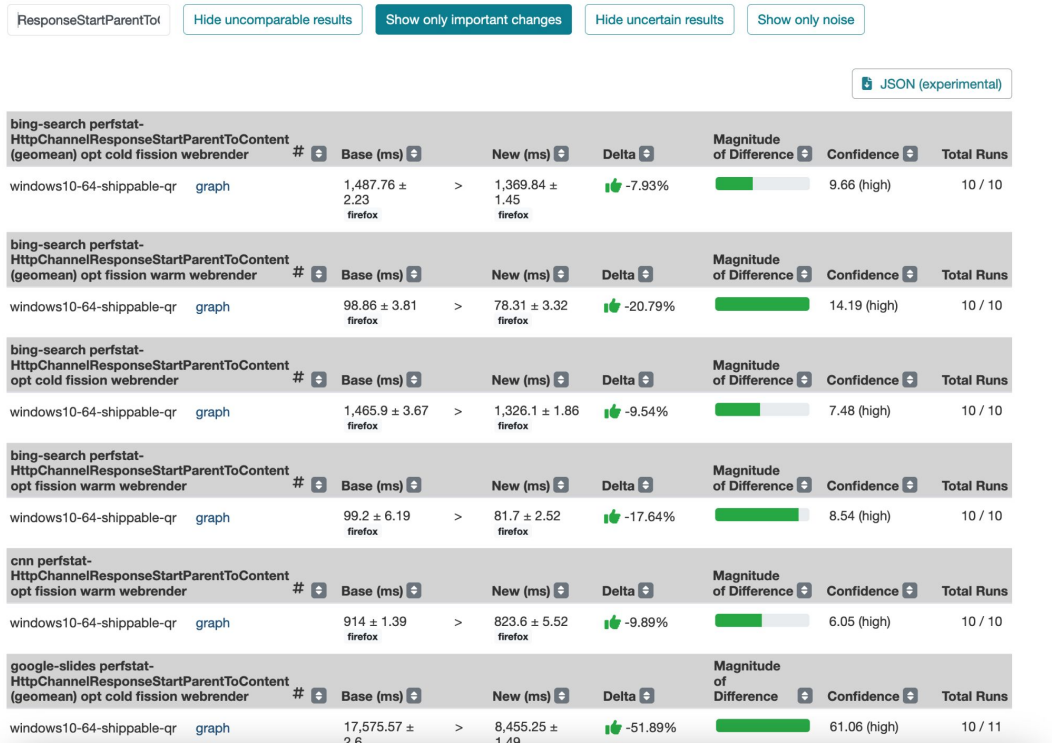
- Tests:
  - Benchmark test (like Speedometer)
  - Pageload tests
  - Video playback
  - Interaction tests
  - Micro benchmarks

- Alerts on regressions / improvements (backouts if needed)



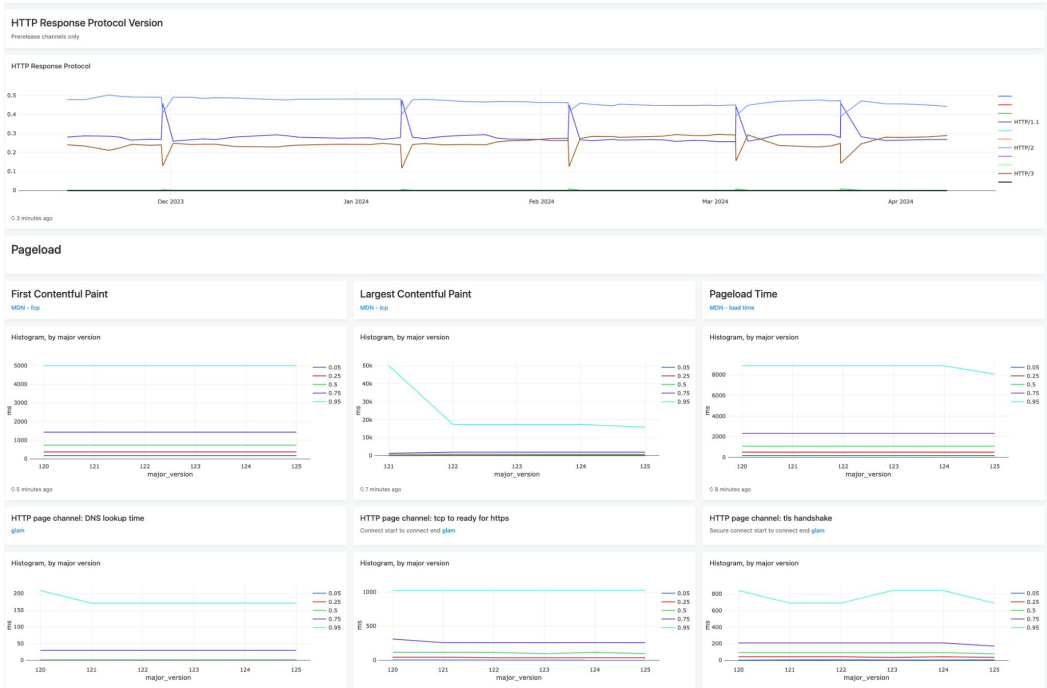
CI: Performance compare

- Evaluate the performance impact of any change _before_ commit
- PerfStats: low-level performance metrics that are granular and easy to add
  - https://firefox-source-docs.mozilla.org/performance/perfstats.html



Performance Dashboards

- Collect user-reported performance metrics in a privacy preserving manner
- Alerts on changes

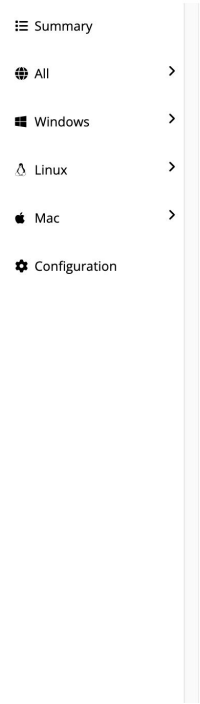


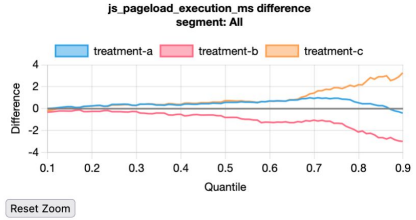
Performance Dashboards

- Internal, lower-level, metrics

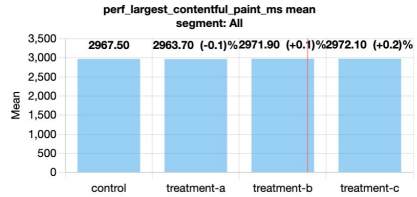
Performance Experiments

- Compare the performance impact of features and permutations via “A/B” tests
- Examples:
  - Size of DNS resolution threadpool (native DNS using blocking getaddrinfo)
  - Max connections (sockets) on a particular platform
  - Move processing of {x} off-main-thread
- Tooling to generate static html reports from sql queries:
  - https://github.com/dpalmeiro/telemetry-perf-reports





(All) - perf_largest_contentful_paint_ms

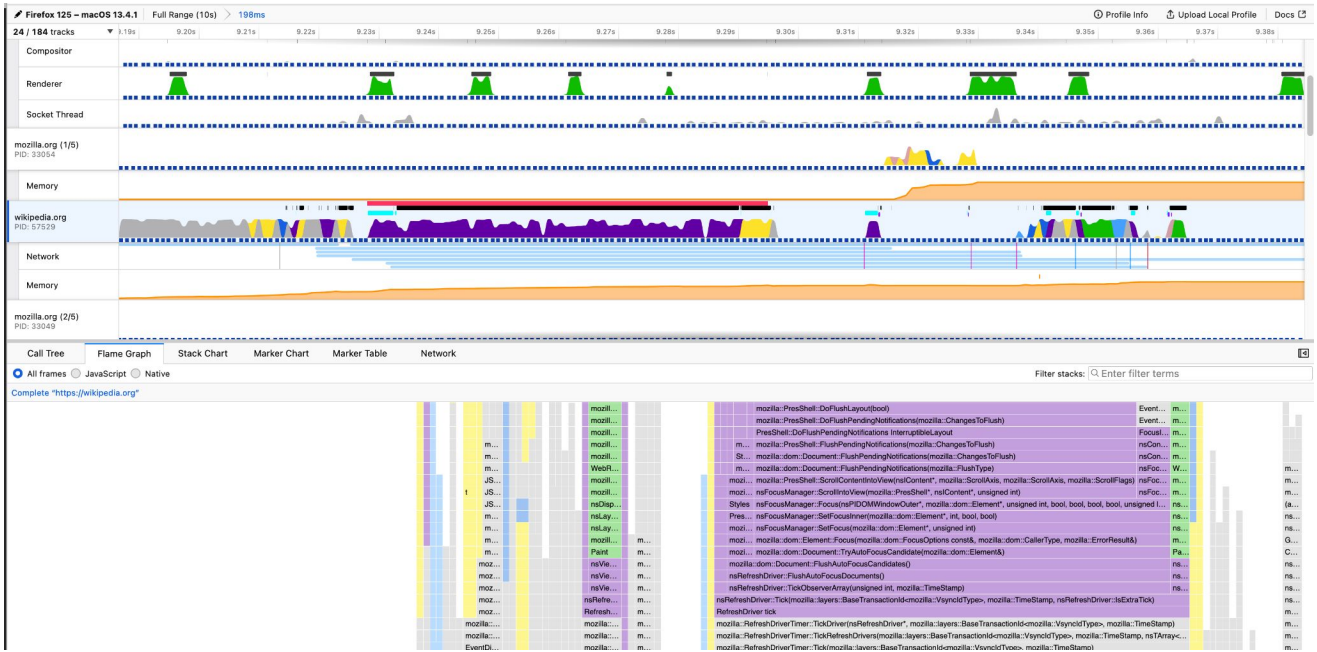


branch	n	mean	stddev	uplift(%)
control (control)	951,027,831	2967.5	8527.8	
treatment-a	952,390,384	2963.7	8518.7	-0.1
treatment-b	954,285,117	2971.9	8538.3	0.1
treatment-c	954,189,289	2972.1	8536.8	0.2

branch	t-test		mwu		ks	
	effect	p-value	effect	p-value	effect	p-value
treatment-a	0.00	0.92	-0.00	0.91	0.00	1
treatment-b	-0.00	0.89	0.00	0.85	0.00	1
treatment-c	-0.00	0.89	0.00	0.59	0.00	1

Firefox Profiler

- https://profiler.firefox.com/
- Example profile: https://share.firefox.dev/4aT3FaV



Firefox Profiler: custom formats

- https://github.com/firefox-devtools/profiler

- Import other formats
  - Linux perf
  - Android simpleperf
  - Chrome traces
  - Write your own: see https://github.com/firefox-devtools/profiler/blob/main/docs-developer/custom-importer.md

    - Talk: Power profiling your house
      - https://share.firefox.dev/49IaVeE

Performance ideas

Compile, link optimizations

- Compile options, e.g. -Oz, -Os, -O2, -O3
  - Binary size tradeoffs

- LTO
  - Thin LTO, at the module level
    - options:
      - import-instr-limit, import-hot-multiplier
  - Full LTO: application level, slower build times
  - Cross: between rust/C++

- PGO training set makes a big difference

Other ideas

- Decide what is important and measure it (as accurately as possible)
- Profile, profile, profile
- Compare to competition if possible
- Prioritize performance bugs
- Skip, cache, defer, compress, downsample anything in the critical path
- Minimize network round trips (also cross process, cross thread, etc)
- Unblock your event queues, i.e. move processing off-main-thread
- Optimize your code :)

Mozilla: careers & contributions

- Careers:
  - https://www.mozilla.org/en-US/careers/listings/
- Contribute:
  - https://firefox-source-docs.mozilla.org/contributing/contributing_to_mozilla.html
  - Good first bugs:
    - https://codetribute.mozilla.org/projects/webplatform
  - Networking team:
    - https://firefox-source-docs.mozilla.org/networking/index.html
- Say hello:
  - Andrew Creskey
    - acreskey@mozilla.com
    - linkedin.com/in/andrew-creskey-3a11231

Thank you!