Not So Fast: Analyzing the Performance of WebAssembly vs. Native Code

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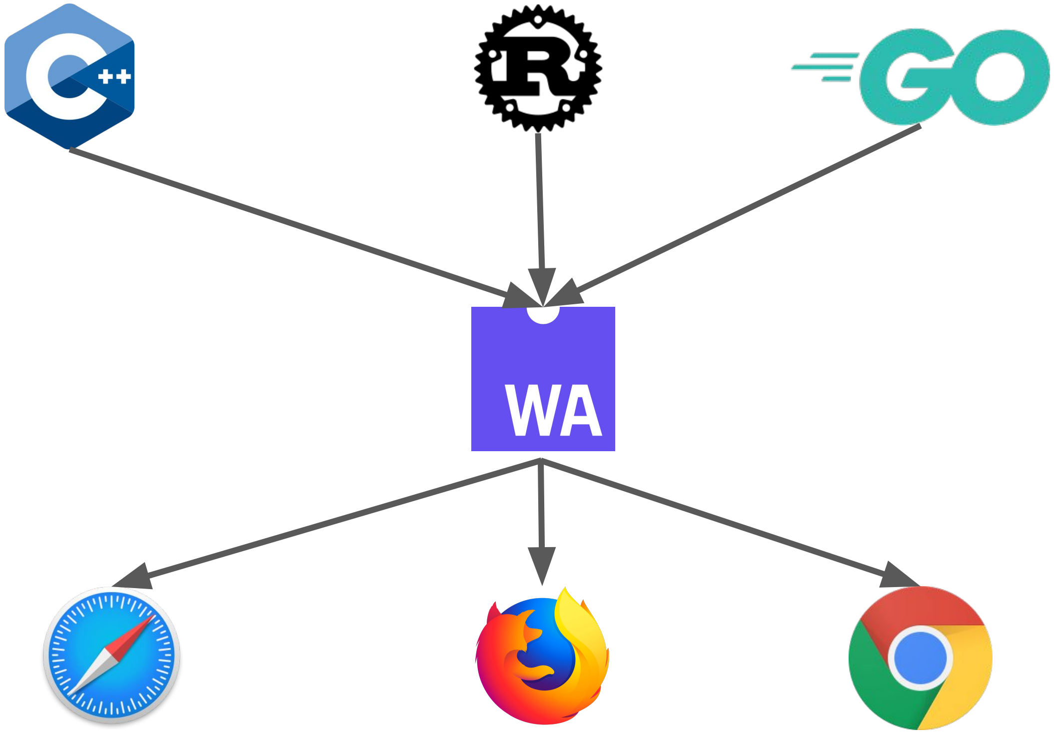
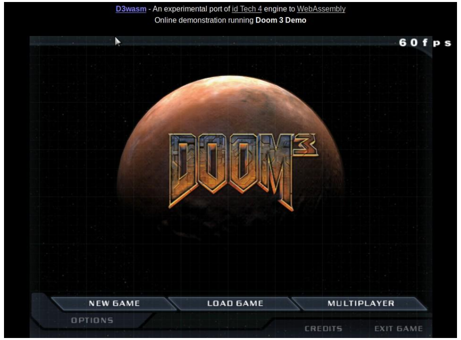
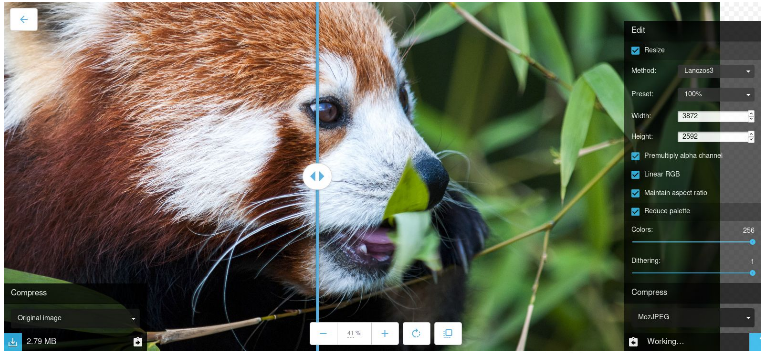
WebAssembly

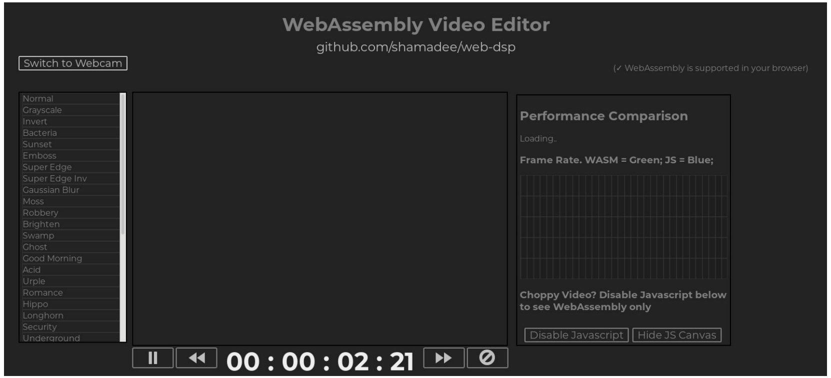


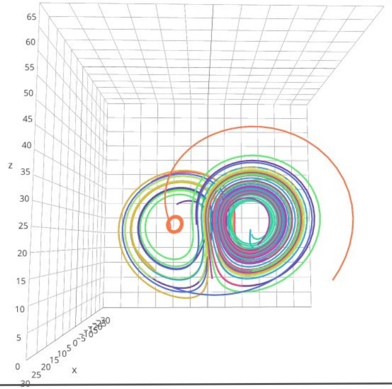
Andreas Haas, Andreas Rossberg, Derek L. Schuff, Ben L. Titzer, Michael Holman, Dan Gohman, Luke Wagner, Alon Zakai, and JF Bastien. Bringing the web up to speed with WebAssembly. In Proceedings of the 38th ACM SIGPLAN Conference on Programming Language Design and Implementation, PLDI 2017.

WebAssembly is becoming *popular*



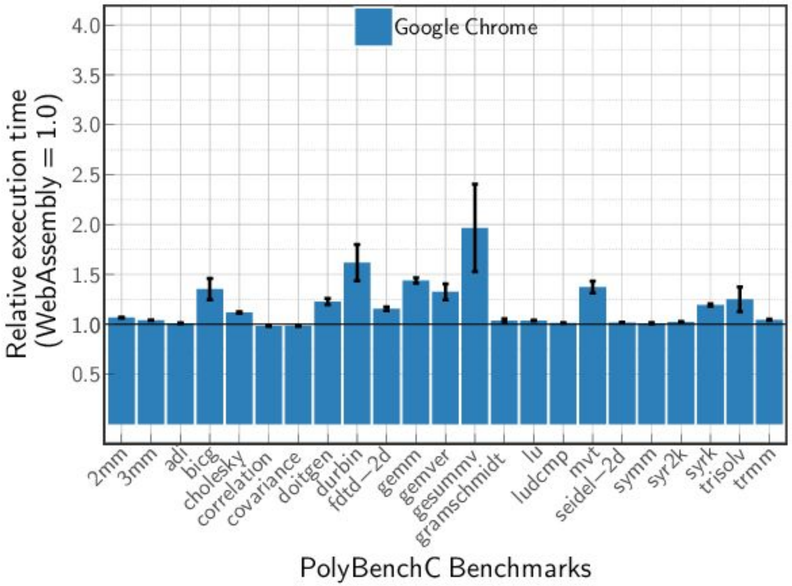


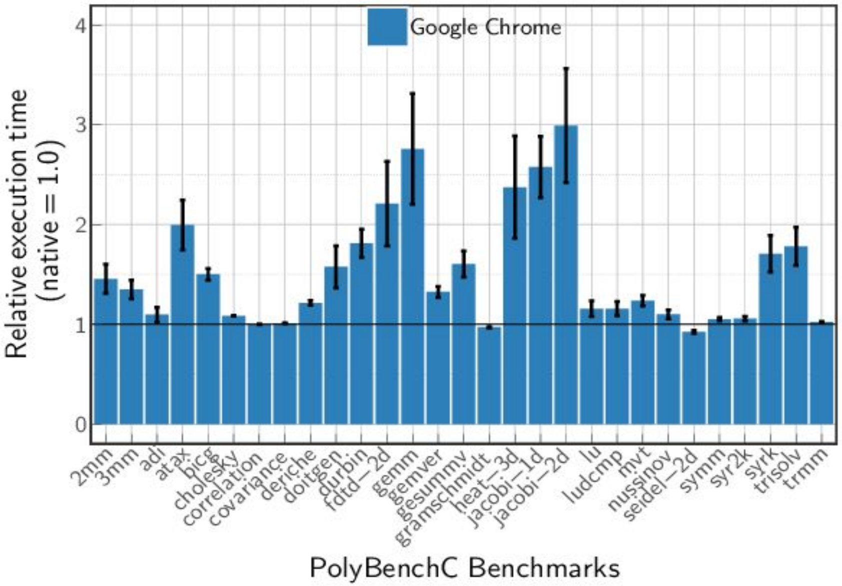




Is WebAssembly fast?

WebAssembly evaluation on PolyBenchC Benchmarks (Haas et al. PLDI 2017)

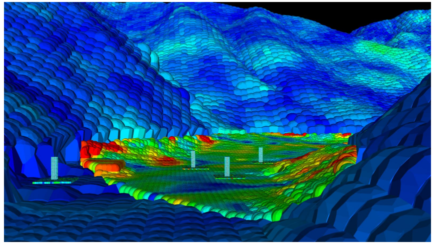




WebAssembly is 17% faster than asm.js

WebAssembly is 26% slower than native

PolyBenchC Benchmarks are **not** representative of WebAssembly use cases



Scientific Applications

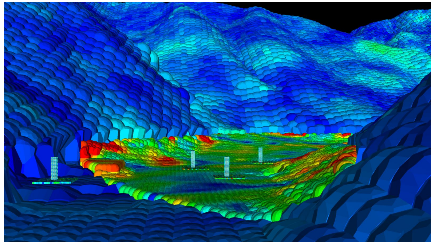
Image/Video Processing

Compilers, debuggers, interpreters, and virtual machines

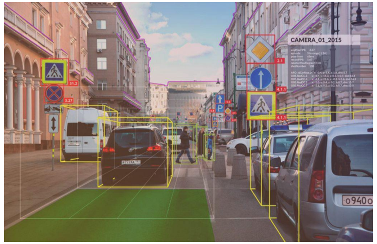
POSIX Applications

PolyBenchC benchmarks are scientific kernels

SPEC CPU benchmarks are better representative of WebAssembly use cases



1. 433.milc
2. 444.namd
3. 447.dealII
4. 450.soplex
5. 470.lbm
6. 644.nab_s
7. 429.mcf
8. 462.libquantum

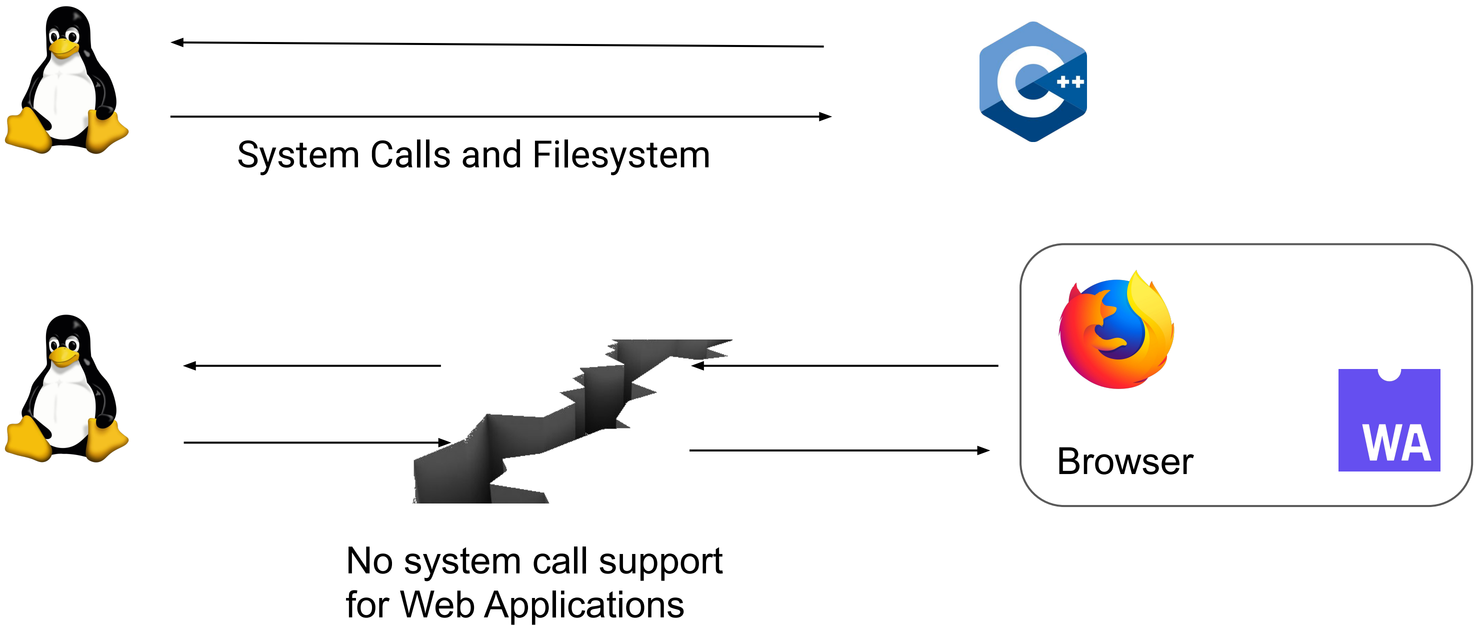


1. 464.h264ref
2. 453.povray

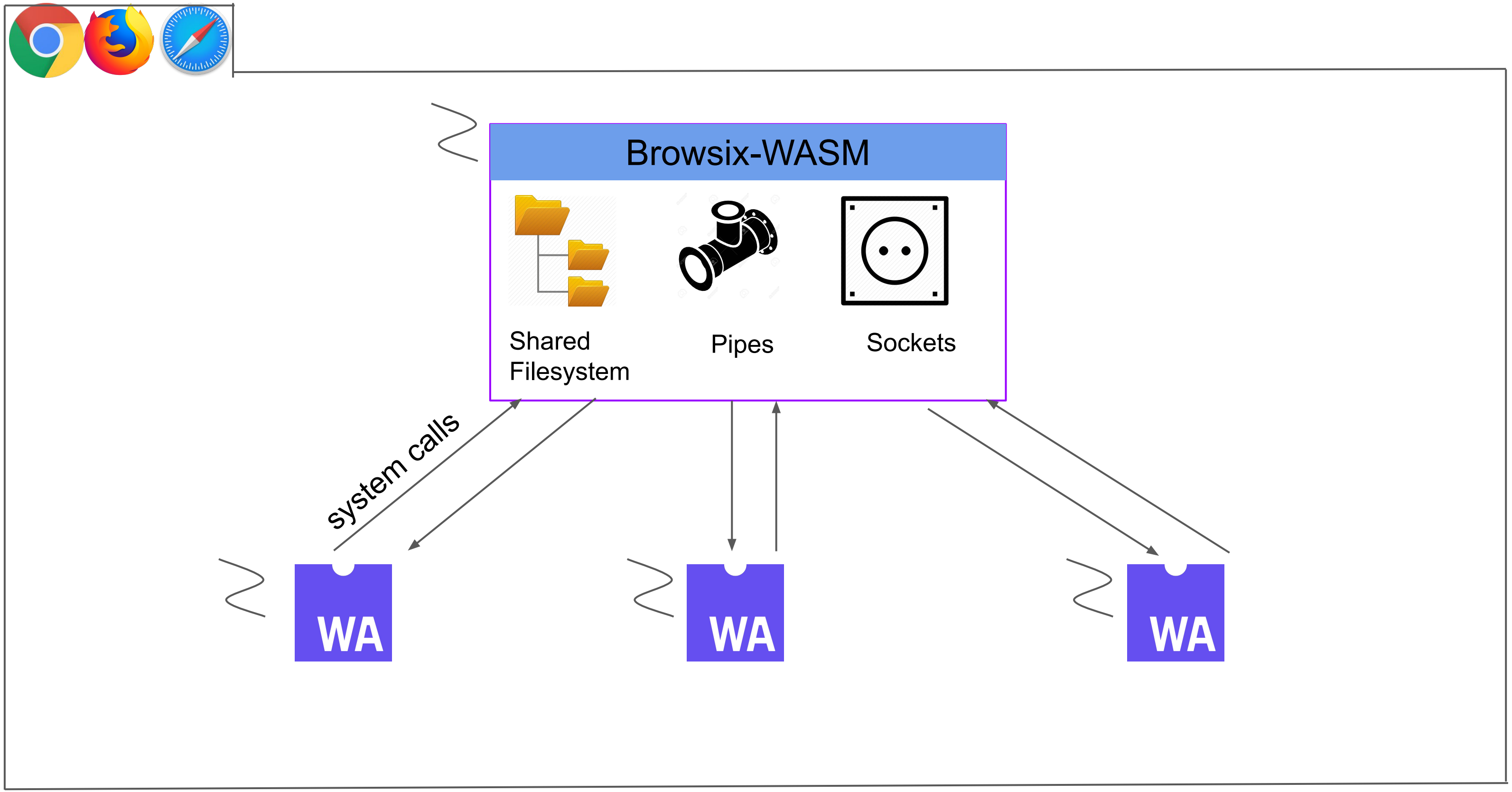
1. 400.perlbench
2. 403.gcc

1. 401.bzip2
2. 429.mcf
3. 433.milc
4. 444.namd
5. 445.gobmk
6. 450.soplex
7. 453.povray
8. 458.sjeng
9. 462.libquantum
10. 470.lbm
11. 473.astar
12. 482.sphinx3
13. 631.leela_s
14. 641.nab_s

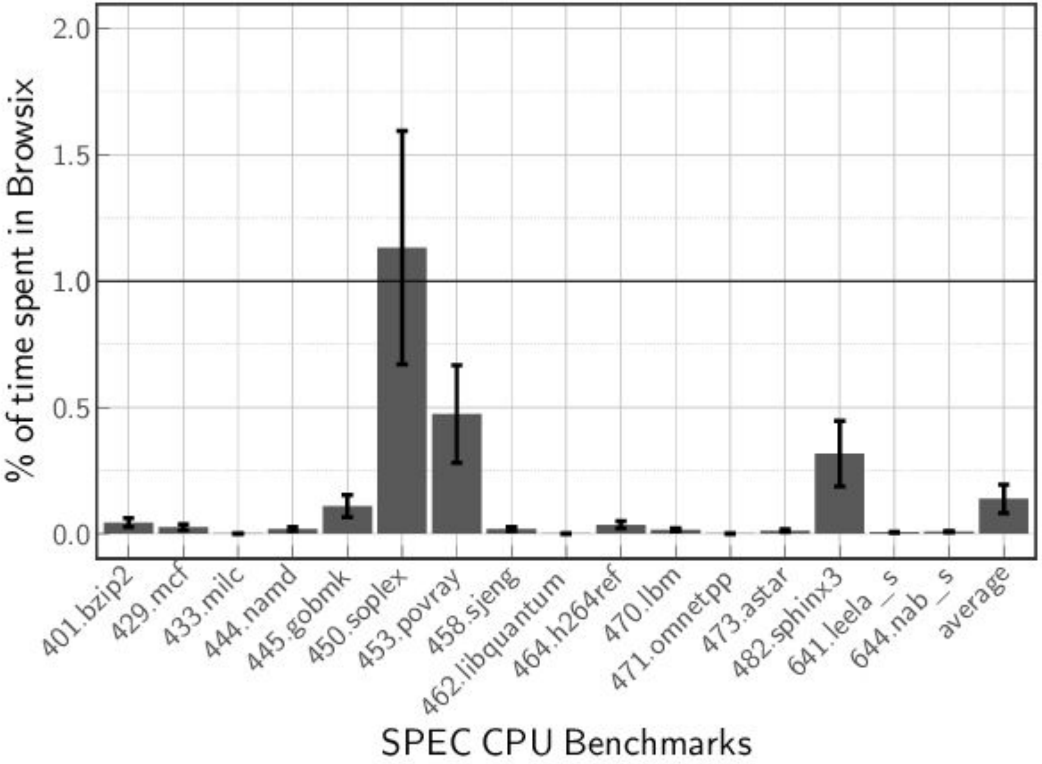
Cannot execute SPEC benchmarks in browsers



Browsix-WASM provides system calls for WebAssembly apps



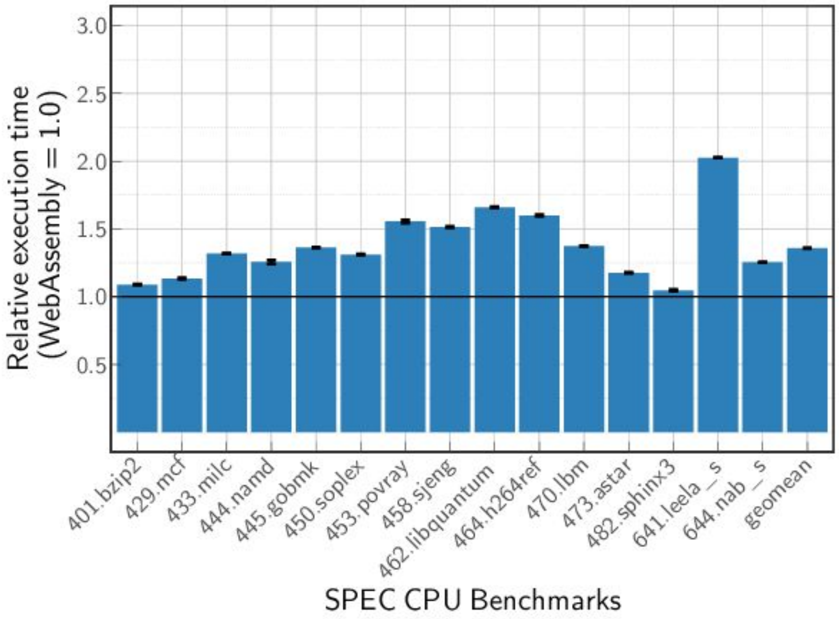
Browsix-WASM overhead is minimal

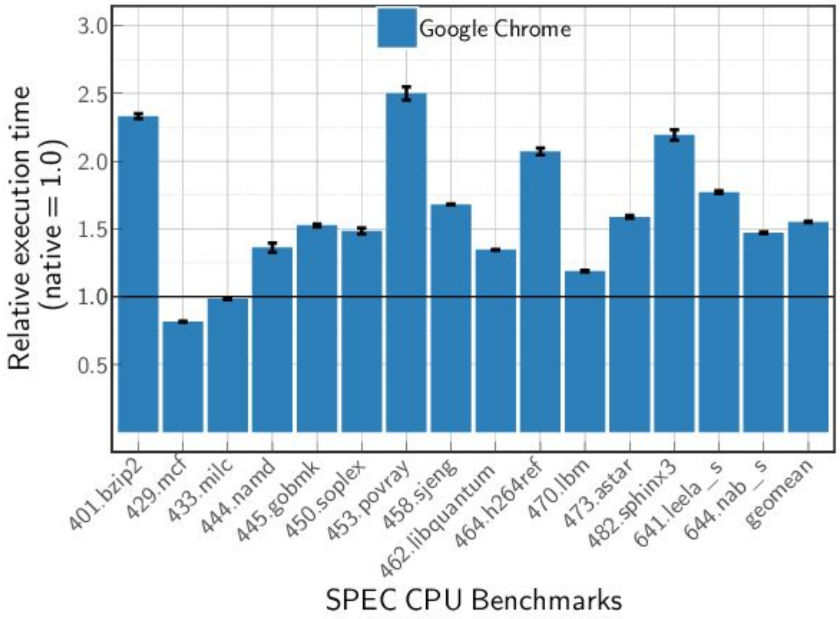


Maximum overhead is 1.1%.

Average overhead is 0.2%.

Performance of SPEC benchmarks in WebAssembly

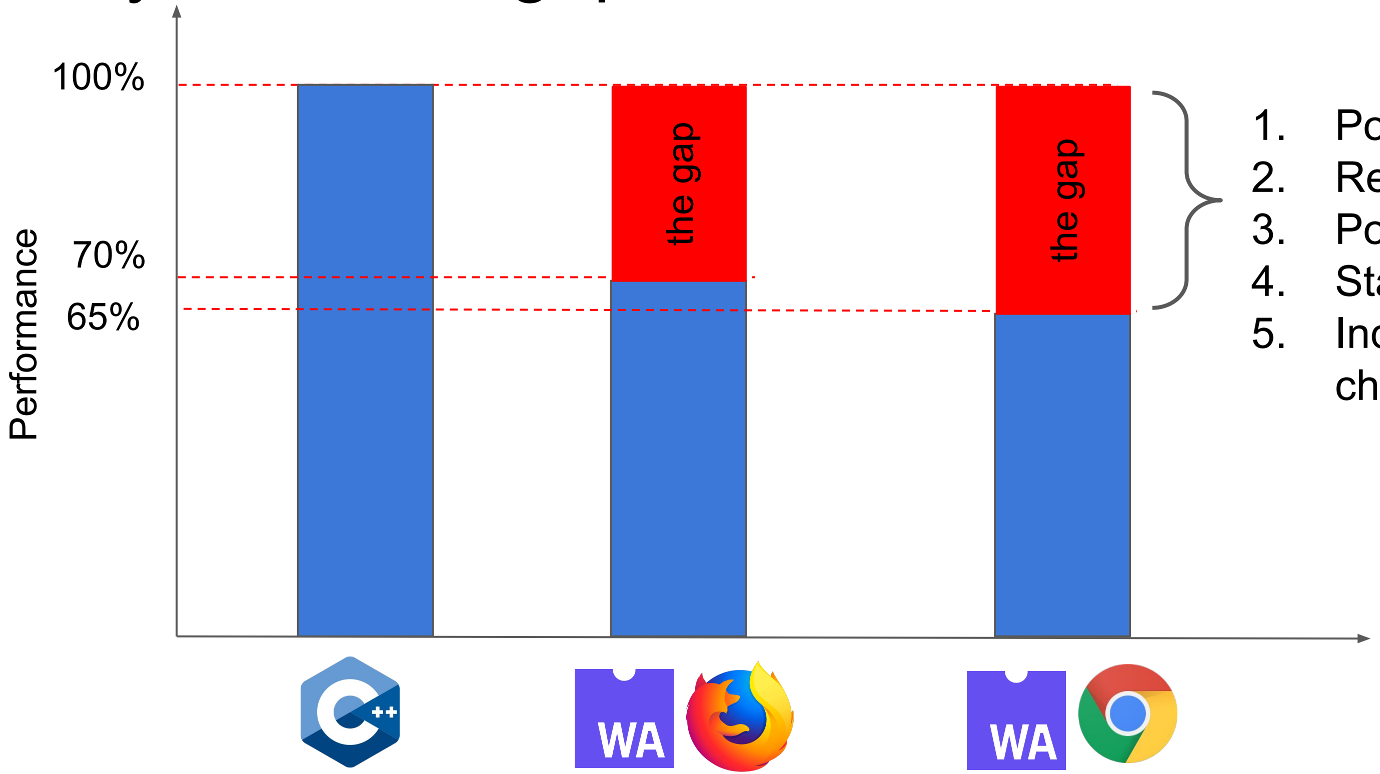




WebAssembly: 30% faster than asm.js

WebAssembly: 55% slower than native

Why is there a gap?



1. Poor register allocation
2. Reserved registers
3. Poor instruction selection
4. Stack overflow checks
5. Indirect function call checks

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ATC 2019
Wednesday, July 10
12:20 - 12:40 PM in *Runtime* Track