Nathan Taylor

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Experience

2021-curr. **The University of Texas** — Austin, TX
Graduate Research Assistant

Researched lightweight formal methods, which trade off certain completeness guarantees for more practical applicability, to validate the correctness of concurrent and low-level systems software. Applied such techniques in the contexts of verifying the crash consistency of a persistent memory filesystem in the Linux kernel, and mechanized the checking of a modern optimized Paxos variant's implementation against its hand-written specification and proof of correctness.

2020-2020 **Microsoft Research** — Edmonton, AB, Canada (remote)
Short-term Contract Software Developer

Contributed to *Shapeshifter* with the AI for Systems lab, which uses machine learning and dynamic analysis to optimize datastore index structure. Through careful design and profiling, reduced the critical-path policy engine's latency by nearly 40%. Built the interactive state visualizer and observability frontend for MSR's TechFest. Mentored incoming PhD interns to the project.

2018-2019 **Apple** — Cupertino, CA
Systems Software Engineer

Developed a high-performance GPU emulator modelling then-unreleased System-on-a-Chips designed for power-constrained phones, tablets, and wearables. Trading cycle-accuracy for usability, it reproduced functional behaviour with high fidelity and at interactive framerates, allowing teams to start programming against the hardware before tapeout. Revived the dormant company-wide OS research paper reading discussion group.

2017-2018 **Fauna** — San Francisco, CA
Senior Software Engineer

Developed Fauna's core product, its strongly consistent, distributed document store. Designed and implemented a greybox fault injection framework and associated DSL to state database correctness conditions, catch consistency volation bugs early, and keep development velocity high. Mentored engineers new to Scala, JVM concurrency, and the strongly-typed functional programming style.

2014-2017 **Fastly** — San Francisco, CA
Senior Software Engineer

Maintained Fastly's core product, an HTTP reverse proxy and cache, during which network throughput increased sixfold to 4.5 million RPS. Extended Fastly's edge-compute programming language. Designed and led the implementation of a sandboxing dynamic analysis and system introspection runtime for the Fastly software stack, atop which the compiler, API, and security teams built custom tooling.

2012-2014 **Twitter** — San Francisco, CA
Software Engineer II

Extended Twitter's Ruby and Java runtimes on the Runtime Systems team, improving garbage collection, JIT compilation, and runtime tooling and infrastructure. Rebuilt HotSpot's GC logging subsystem to be asynchronous and lock-free, to minimise tail latencies exacerbated by blocking writes. Collaborated with external teams to diagnose service-level performance issues; in one case, careful analysis uncovered a regression throttling throughput by two orders of magnitude. Revamped legacy systems on the Antispam and Trust and Safety Engineering Teams, reducing end-to-end latency by ~10x in one key service, and built new services for spam classification and actioning.

Teaching Experience

For further details about my teaching experience and philosophy, please see my homepage.

2020-2021 **MacEwan University** — Edmonton, AB, Canada

2020-2020 **The University of Toronto** Toronto, ON, Canada (remote)

Education

2021-2024 **The University of Texas** Austin, TX
PhD, Computer Science (incomplete) | Supervisor: James Bornholt

Organized the Systems+PL reading group and mentored students attending the undergraduate systems directed reading program.

2009-2012 **The University of British Columbia** Vancouver, BC, Canada
M.Sc., Computer Science | Supervisor: Andy Warfield

As President of the Computer Science Graduate Students' Association, I liased between grad students and the department, led TA training sessions, organized social activities such as Tuesday Tea and the Undistingushed Lecture Series, and served on the UBC Graduate Council. Organized the systems and security reading seminars for the NSS research lab. Received a TA award for my work supporting CPSC 110.

2005-2009 **The University of Alberta** Edmonton, AB, Canada
B.Sc. Specialization, Computing Science

As a Undergraduate Association of Computing Science executive, I interfaced with groups outside the department and advocated for students' issues within. As a member of the department's Cluster Challenge Team, I configured, benchmarked, and tuned the GAMESS quantum chemistry package, and was the team's physical chemistry domain expert.

Publications and Presentations

07.2024 **SquirrelFS: Using the Rust Compiler to Check Filesystem Crash Consistency** | OSDI '24 | PDF | Source

04.2022 **Proving the Coding Interview** | Dafny verified programming tutorial series | Part 1 | Part 2 | Part 3

01.2020 **ELF off the Shelf** | Guest lecture in MacEwan University's OS class | Slides

05.2018 **The Life of a FaunaDB Query** | Guest Post on the Fauna Corporate Blog | Post

11.2017 **Cache Ruins Everything Around Me!** | Guest lecture in Macewan University's OS class | Slides

07.2017 **Let's Build A HyperCard RPG!** | Coding Livestream | Videos

11.2016 **Hands-on HTTP/2, a Fresh Start to The Web** | QCon SF 2016 | Event Page

06.2016 **Beyond Breakpoints: A Tour Of Dynamic Analysis** | QCon NYC 2016 | Video | Materials

12.2015 **Two Approaches towards OS Scalability** | Papers We Love SF 12/2015 | Video | Event Page

09.2015 **Racing to Win: Correct Concurrency with Race Conditions** | Surge 2015 | Video | Materials

04.2015 **Your Computer Is Already A Distributed System; Why Isn't Your OS?** | Papers We Love SF 04/2015 | Video | Event Page

06.2014 **Your Heap And You: Garbage Collector Tuning for Twitter Services**

05.2013 **Cachekata: Memory Hierarchy Optimization via Dynamic Binary Translation** | Msc. Thesis | PDF

04.2013 **Whose Cacheline is it Anyway: Operating System Support for Live Detection & Repair of False Sharing** | Eurosys '13 | PDF

03.2012 **Debugging Through Time with the Tralfamadore Debugger** | RESolVE '12 | PDF

08.2011 **Herbert West: Deanonymizer** | HotSec'11 | PDF

10.2010 **Iodine: Interactive Program Partitioning** | OSDI '10 Poster Session