Nathan Taylor

https://www.cs.utexas.edu/~ntaylor/

nbtaylor • gmail • com

Experience

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

Researched *lightweight* formal methods, which trade completeness guarantees for 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, and in mechanizing the checking of a modern, optimized Paxos implementation against its hand-written formal specification and proof of correctness.

2020-2020 **Microsoft Research** — New York, NY (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.

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

Developed a high-performance GPU emulator modelling then-unreleased System-on-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 violation 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 routines to be asynchronous and non-blocking, to minimise tail latencies exacerbated by blocking I/O. 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

For details about my teaching philosophy, please see my homepage.

2020-2021 **MacEwan University** — Edmonton, AB, Canada (remote)
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 undergraduates attending the systems directed reading group.

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

As President of the CS Graduate Students' Association, liased with students and UBC, led TA training sessions, organized social activities such as Tuesday Tea and the Undistingushed Lecture Series, and served on the UBC Grad Council. Organized the systems and security reading seminars. 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, interfaced with groups outside the department and advocated for students' issues within. As a member of the U of A's Cluster Challenge Team, configured and managed the GAMESS quantum chemistry package, and was the team's chemistry domain expert.

Selected Publications and Presentations

09.2024 **An Invitation to Liquid Types** | Papers We Love NYC | Video
07.2024 **SquirrelFS: Using the Rust Compiler to Check Filesystem Crash Consistency** | OSDI '24 | PDF
04.2022 **Proving the Coding Interview** | Dafny tutorial series | Part 1 | Part 2 | Part 3
05.2018 **The Life of a FaunaDB Query** | Guest post on the Fauna blog
11.2016 **Hands-on HTTP/2, a Fresh Start to The Web** | QCon SF
06.2016 **Beyond Breakpoints: A Tour Of Dynamic Analysis** | QCon NYC | Materials
12.2015 **Two Approaches Towards OS Scalability** | Papers We Love SF | Video
09.2015 **Racing to Win: Correct Concurrency with Race Conditions** | Surge '15 | Video
04.2015 **Your Computer Is Already A Distributed System; Why Isn't Your OS?** | Papers We Love SF | Video
06.2014 **Your Heap And You: Garbage Collector Tuning for Twitter Services** | Internal tech talk
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