Nathan Taylor

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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, optimised Paxos implementation against its hand-written formal specification and proof of correctness.

2019-2021 **Independent Consultant** — Edmonton, AB, Canada (remote)
Took a break from the corporate world to teach undergraduate computer science, read research papers, and consult on interesting and impactful problems for a variety of organizations:

- At *Microsoft Research NYC*, co-developed ShapeshifterDB, which uses machine learning and dynamic analysis to optimise datastore index structures. Reduced critical-path policy engine's inference latency by 40%.
- At *RLCore Technologies*, built reliable and safe systems for reinforcement learning-driven industrial control systems. Implemented property-based testing and record/replay debugging infrastructure for RL agents.
- At *The Department of Linguistics, University of Alberta*, collated First Nations language corpora into a unified open-access database and web frontend. Instructed non-technologists how to maintain and extend the software.

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

Developed a high-performance GPU emulator modelling then-unreleased SoCs for power-constrained phones, tablets, and wearables. Trading cycle-accuracy for usability, it reproduced functional behaviour with high fidelity and at interactive framerates, allowing software teams to start programming 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. Built 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 FP style.

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

Maintained Fastly's core product, an HTTP reverse proxy and cache. 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 analysis tooling. Rebuilt HotSpot's GC logging system 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, 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

Organised 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, organised social activities such as Tuesday Tea and the Undistingushed Lecture Series, and served on the UBC Grad Council. Ran 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