Brian Richard Tauro

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My research focuses on using compiler, runtime and OS techniques to improve productivity of software developers.

EDUCATION

Illinois Institute of Technology — **Chicago, USA**
Ph.D. in Computer Science, — *August 2019 - December 2024 expected*
Advisor: Kyle C. Hale

Illinois Institute of Technology — **Chicago, USA**
Master of Science in Computer Science, GPA 3.8 — *August 2017 - May 2019*
Advisor: Kyle C. Hale

Karunya University — **Coimbatore, India**
Bachelor in Technology in Computer Science, GPA 8.4 — *July 2012 - May 2016*

PUBLICATIONS

- ASPLOS 2024
  - **B. Tauro**, Brian Suchy, Simone Campanoni, Peter Dinda, and K.C. Hale. TrackFM: Far-out Compiler Support for a Far Memory World. *Proceedings of the 29th ACM International Conference on Architectural Support for Programming Languages and Operating Systems*.
- TPDS 2021
  - **B. Tauro**, C. Liu, and K.C. Hale. Modeling Speedup in Multi-OS Environments on real world multi-kernels. *IEEE Transactions on Parallel and Distributed Systems*, September, 2021.
- MASCOTS 2019
  - **B. Tauro**, C. Liu, and K.C. Hale. Modeling Speedup in Multi-OS Environments. *Proceedings of the 27th IEEE International Symposium on the Modeling, Analysis and Simulation of Computer and Telecommunication Systems*, October, 2019.

POSTERS

- GCASR 2023
  - **B. Tauro**, Brian Suchy, Simone Campanoni, Peter Dinda, and K.C. Hale. TrackFM: Far-out Compiler Support for a Far Memory World.
- GCASR 2019
  - **B. Tauro**, C. Liu, and K.C. Hale. Modeling Speedup in Multi-OS environments. Poster at the 8th Annual Greater Chicago Area Systems Research Workshop, May, 2019.
- Chameleon User Meeting 2019
  - Infiniband HPC RDMA Aware Drivers for light-weight Kernels, Presentation at the Chameleon User Meeting at University of Texas Austin, February, 2019.

WORK EXPERIENCE

Samsung **San Jose, USA**
Operating Systems/Runtime Intern *May 2023 - August 2023*
- I worked on automatic transformation of MPI HPC code to memory disaggregated hardware using modern compiler analysis and transformation.

Intel **Oregon, USA**
Multi Kernel Intern *May 2022 - August 2022*
- Study of interference between HPC and memory dis aggregated applications, where memory dis aggregation mechanisms are implemented in the mOS kernel.

Illinois Institute of Technology **Chicago, USA**
CS450 Operating systems Teaching Assistant *Fall 2022*
- Grade OS assignments, and conduct lab sessions when needed for a class of 100 students.

Illinois Institute of Technology **Chicago, USA**
Research Assistant *August 2018 – Present*

- Mentored several graduate students for research in memory disaggregation.
- Built an InfiniBand (Mellanox ConnectX-3) device driver for Nautilus (aerokernel) in C, in order to leverage the advanced features (RDMA, SR-IOV) provided by smart NIC's to enable low latency communication between applications running in kernel space in Nautilus.
- Instrument Linux to understand floating point save/restore register overheads in the kernel.
- Implement lazy floating point usage in kernel space in Nautilus (aerokernel) as Nautilus supports floating point operations in kernel space.
- Understand OpenMP tasking overheads in order to identify time spent in context switches.
- Develop mktrace a system call delegation tool to offload selective system calls to a kernel thread to emulate multi kernel environments (system call delegation) which is very similar to a rootkit which performs system call hijacking.
- Built a memory dump tool in Linux for malware analysis using ptrace.
- Helped in building a qemu prototype device to evaluate benefits of computation offloading.

Intel **Oregon, USA**
Software Security Research Intern *May 2021 - August 2021*
- Develop supply chain post exploitation payloads (similar to SolarWinds), investigate zero day exploits, both using custom payload and metasploit framework to evaluate Intel anomaly behaviour detection model.

VMware **California, USA**
Summer Intern *May 2020 - August 2020*
- Investigate sources of Jitter in ESXi 7 hypervisor and eliminate them. To understand the sources of Jitter, a detailed analysis of the guest/host software stacks was performed with the help of VPROBES (similar to DTRACE) for collecting fine grained traces from VMM/VMK/Guest worlds and also BPFTRACE/PERF for guest OS analysis.

NexLP **Chicago, USA**
Software Intern *June 2018 – August 2018*
- Worked on multiple projects such as extending Apache Tika (content detection and analysis framework) for advanced data extraction features from documents, OCR Extraction from documents in Java, C#.

Covenant IT Solutions Private Limited **Coimbatore, India**
Software Developer *May 2016 – July 2017*
- Helped in building the vendor, payment and shipping modules for the e-commerce application.
- Played a lead role in migration of e-commerce applications to cloud, hosting and configuring continuous toolchain integration for robust web application development using DevOps framework provided by IBM Bluemix.

Covenant IT Solutions **Coimbatore, India**
Software Engineer Intern *June 2015 – July 2016*

- Integrated e-commerce application with the payment gateway API provided by PAYU for capturing customer payments.

CURRENT PROJECTS

1. Compiler Assisted Remote Memory
   - Current software based far-memory solutions, have been able to improve memory utilization in cloud data centers, by enabling applications with high memory demands to be met by utilizing memory from a remote server with fast network operations. However, the existing approaches have been unable to strike the right balance between performance and transparency provided to applications. In this project, we show how compiler aided kernel based far memory solution can strike the right balance between transparency and performance by using modern day compiler frameworks.
   - This project is part of the Interweaving Project, a collaborative effort with Northwestern University to redesign the parallel hardware/software Stack.
     - http://interweaving.org

BLOGS

- Exploring Custom InfiniBand Drivers for Specialized OS Kernels, April 2019.
  - https://www.chameleoncloud.org/blog/2019/04/19/exploring-custom-infiniband-drivers-specialized-os-kernels/

AWARDS/EXTRA-CURRICULAR

- Artifact evaluation committee EuroSys 2024
- ACM Student Travel Grant Award for ASPLOS '24
- Vice president of UPE (Upsilon Pi Epsilon) International Honors Society for Computing and Information Disciplines at IIT Chicago.
- First place in Code A-Thon (hacking competition) at Mindkraft 2016 (national event) held at Karunya University.
- Second place in Help Dexter Code (hacking competition) at Mindkraft 2015 (national event) held at Karunya University.

CERTIFICATIONS

- IBM badge for completion of cloud developer connect session on serverless computing, cloud security and performance, containers, server less programming and API connect.

- IT foundation skills assessment by Cognizant.
- Competed grade 5 in violin from Trinity College of London.

GROUP AFFILIATIONS

- HExSA Lab
- Scalable Computing Software Laboratory (SCS)
- Northwestern Parallelism Group

TECHNICAL SKILLS

Programming Languages: C, LLVM, C++, Java, C#, Assembly, Shell, Python
Parallel Programming: MPI, CUDA, OpenMP, Pthreads
Benchmarking Softwares : HPL, pmbw, IOzone, Iperf, SPEC CPU 2017, NAS
Operating Systems: Linux, Macintosh, Windows, Minix, mOS, IHK/McKernel, Nautilus
Cloud Environments: AWS, IBM BLUEMIX, Chameleon
Databases: Oracle, Dash, MySQL, Mongo
Virtual Environments: kvm, qemu, VMware, VirtualBox, ESXi
Tracing Tools: strace, systemtap, eBPF, vprobes, perf
Miscellaneous Softwares: LaTeX, Packet Tracer, Wireshark, GDB, PXE, iDRAC