SIDDHARTH Jayashankar

PhD student, Computer Science, Carnegie Mellon University
B.Tech, Computer Science & Engineering, IIT Kanpur 2021

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EDUCATION

Carnegie Mellon University *2022 - Present*
PhD, Computer Science

Indian Institute of Technology, Kanpur *2017 - 2021*
Bachelor of Technology in Computer Science and Engineering | Grade: **9.8**/10

WORK EXPERIENCE

Microsoft Research India - Systems Research Group *July 2021 - July 2022*
Research Fellow | Mentors: Dr. Kapil Vaswani & Dr. Akash Lal

- I worked on designing runtime systems and protocols that use trusted execution environments to technologically enforce privacy compliance & guarantees.
- I designed the attested TLS protocol for establishing secure communication channels between microservices in TEEs

IIT Kanpur -
Computer Architecture for Reliable, Secure, and Scalable Systems (CAR3S) Research Group *Oct 2020 - May 2021*
Undergraduate Researcher | Advisor: Prof. Biswabandan Panda

- I Ported Valgrind to Android and built tracing tool- cstracer to collect program execution traces of android apks
- I used cstracer to trace mobile benchmarks - geekbench5 and Antutu and collect traces of instruction and memory accesses
- I measured the performance difference between the big and little cores in ARM's big.LITTLE architecture and investigated the potential for cache block compression on a custom modification of the champSim simulator using the traces collected
- **cstracer** | **Presentation**

EPFL - Parallel Systems Architecture Lab (PARSA) *March 2020 - Aug 2020*
External Student Researcher | Mentor: Dr. Yunho Oh

- I studied the performance of container-level horizontal and vertical scaling of Cloudsuite benchmark workloads on server CPUs.
- I analysed performance bottlenecks caused by front end pipeline stalls in server CPUs, lock contention and thread scheduling overheads.
- I performed experiments to measure the speedup caused by scale-out and scale-up workloads on CloudSuite and identify configurations for optimal resource utilisation.

Intel - Processor Architecture Research Lab (PARL) *Dec 2019 - Feb 2020*
Architecture Research Intern | Mentors: Anant V Nori, Sreenivas Subramoney

- I worked on designing a new prefetcher to mitigate the performance reduction caused by downsizing the L2 cache to extend the CATCH Microarchitecture proposed by Nori et al [ISCA'18]
- I first identified the causes for the drop in performance on benchmark workloads and used the insights to develop a new prefetcher.
- My prefetcher was able to significantly offset the performance drop caused by downsizing the L2 cache on several benchmark workloads.

IISc Bangalore - Algorithms, Complexity and Optimisations Group *May 2019 - July 2019*
Summer Research Intern | Advisor: Prof. Arindam Khan

- I worked on devising a polynomial time approximation algorithm for 2D strip packing to improve the absolute approximation ratio of Steinberg's algorithm

PROJECTS

Empirical Evaluation of State-of-the-art cache replacement policies *Nov 2021*

- A Study to compare the performance of state-of-the-art LLC replacement policies like SHiP, DIP, Hawk-Eye on SPEC CPU benchmarks using the ChampSim simulator | **Project Report**

Cache Simulator to study effects of architecture and replacement policies *Aug 2019*

- Built a cache simulator to study the effect of replacment policy, associativity and cache type (Inclusive, Exclusive, NINE) on hit and miss rates | **Repository** | **Project Report**

C to MIPS32 compiler *May 2021*

- A C source to MIPS32 target compiler written in **C++** | **Source Code**
- Compiler supports language features like **variables, control statements, recursion, custom data types, multi level pointers, multi dimensional arrays**. It can perform code optimisations like **constant folding** and **basic dead code elimination** and also provide detailed error reports.

Cache miss analysis on loop nests *Sep 2020*

- A program that takes as input loop nests and cache sizes, parses the loop nest and then reports the number of cache misses for the loop ordering | **Source Code**

Mozart Oz Interpreter *Oct 2020*

- A minimal interpreter for the Oz programming language that implements the kernel language | Source Code

Programming Operating System syscall and exception handlers *Oct 2019*

- Implemented syscalls like **mmap, munmap, mprotect, page fault exception handling, fork, copy on write fork, file and pipe reads, writes, open, close** on gemOS - a teaching OS | Source Code 1, Source Code 2

FPGA synthesis of a basic processor *Apr 2019*

- Synthesised a simple processor that can perform instructions like add, sub, compare, branch and load on an FPGA. This processor can execute simple programs like loops and report results. | Source Code

Coursework

Parallel Computer Architecture (A)	Operating Systems (A)	Compiler Design (A)
Advanced Computer Architecture† (6)	Software Security† (5)	Advanced Algorithms (A)
Machine Learning (A*)	Paralellism & Concurrency† (5.25)	Theory of Computation (A)
Formal Logic (A)	Programming for Performance (A)	Data Structures and Algorithms (A)
Database Systems† (6)	Learning Theory† (5.75)	Discrete Mathematics (A)
Principles of Programming Languages (B)	Computer Networks (A)	Multivariable Calculus (A)
Linear Algebra (A*)	Introductory Economics (A*)	Macroeconomics (A)

† Course done at EPFL

Skills

Programming & Scripting	C | C++ | Python | GoLang | Rust | Bash | PowerShell
Assembly	x86-64 | MIPS | aarch64
Operating System	Linux | Android | Windows
Containers	Docker | Kubernetes | runc | Microsoft hcsshim
Software	Envoy Proxy | Istio | Valgrind | OpenSSL
Misc	Latex | Git | Markdown | Jekyll

Awards & Achievements

- Academic Excellence Award, IIT Kanpur for the years 2020, 2019, 2018 and 2017
- A* grade for outstanding performance in 8 courses at IIT Kanpur
- Perfect GPA (10/10) in five semesters at IIT Kanpur
- Selected for the uArch Workshop at MICRO 2020
- Selected for the IITK-EPFL semester exchange program, Spring 2020
- Ranked 1348 in JEE(Advanced), 2017 and 2481 in JEE(Main), 2017
- Selected for the KVPY Fellowship Award 2016 by IISc Bangalore

Extra-Curricular Achievements

- Novice Runner Up, WBNUJS Parliamentary Debate 2019
- Novice Finalist, IIT Bombay Parliamentary Debate 2018
- Secretary, Debating Society IIT Kanpur 2017-19
- Core group member, Vox Populi, Student Journalism Body of IIT Kanpur, 2017-19
- Runner Up, NLS Debate Junior, 2015