

SIDDHARTH Jayashankar

Research Fellow at Microsoft Research

B.Tech, Computer Science & Engineering, IIT Kanpur 2021

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EDUCATION

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 - Present

Research Fellow | Mentors: Dr. Kapil Vaswani, Dr. Akash Lal & Dr. Pantazis Deligianis


- ▶ I work on designing systems and protocols that use trusted execution environments to technologically enforce privacy compliance & guarantees.
- ▶ I am currently researching on extending the TLS protocol with hardware attestation reports to identify and establish 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 - July 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 replacement 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](#)

Sudoku Solver using SAT Solvers

Oct 2018

- ▶ Python program to encode a sudoku puzzle in the DIMACS format and solve it using minisat. | [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)

SKILLS

[†] Course done at EPFL

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
- ▶ Perfect GPA (10/10) in five semesters
- ▶ Selected for the uArch Workshop at Micro 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