

# Anish Saxena

PHD STUDENT · GEORGIA INSTITUTE OF TECHNOLOGY

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## Education

### Georgia Institute of Technology

DOCTOR OF PHILOSOPHY, COMPUTER SCIENCE · GPA: 4.0/4.0

Atlanta, USA

2021 - present

- Advisor: Prof. Moinuddin K. Qureshi

### Indian Institute of Technology Kanpur

BACHELOR OF TECHNOLOGY, MECHANICAL ENGINEERING · CPI: 9.1/10.0

Kanpur, India

2017 - 2021

- Minor in Computer Systems

## Honors & Awards

2019 **Semiconductor Research Corporation (SRC) Member**, Indian Research Program

India

2017 **Aditya Birla Group Scholarship**, Awarded to 15 students selected from IITs and BITS

Mumbai

2017 **All India Rank 1828**, Joint Entrance Examination Advanced, 175,000 students

India

2017 **KVPY Fellowship**, Awarded by IISc Bangalore and Government of India

Bangalore

## Relevant Experience

### Memory Systems Lab, Georgia Tech

Prof. Moinuddin K. Qureshi

GRADUATE RESEARCH ASSISTANT

Aug. 2021 - present

- Designed PT-Guard, an integrity protection mechanism for Page Tables against DRAM fault injection attacks.
- Enabled detection of arbitrary bit flips through cryptographic MAC-based protection with 0 DRAM overheads.
- Implemented with < 0.2% SRAM overheads incurring < 0.2% average slowdown in gem5 evaluations.
- Devised a best-effort PTE correction scheme with 93% success rate at worst-case DDR4 bitflip probability.

### NVIDIA Corporation, India

Bharatkumar Sharma

HPC GPU ADVOCATE INTERN, HACKATHONS AND BOOT-CAMPS TEAM

May 2021 - Aug. 2021

- Created open-source tutorials and bootcamps on multi-node GPU programming for HPC applications.
- Developed lab modules on profiling, CUDA-aware MPI, NVIDIA libraries, and communication topologies.
- Published all materials online; bootcamp is accessible at [github.com/gpuhackathons-org/gpubootcamp/](https://github.com/gpuhackathons-org/gpubootcamp/).

### Intel Labs, India

Anant Nori

RESEARCH INTERN, PROCESSOR ARCHITECTURE RESEARCH LAB

May 2020 - Sep. 2020

- Improved the performance of non-inclusive cache hierarchy by extending state-of-the-art cache policies.
- Extended a cycle-accurate simulator, collected memory traces, and performed functional simulations.
- Reduced simulation time by 10× while maintaining more than 99% correlation to a full-scale simulation.
- Devised Bloom Filter-based implementation to track parameters like reuse distance efficiently in hardware.

### CAR3S Group, IIT Kanpur

Prof. Biswabandan Panda

GROUP MEMBER AND SRC STUDENT MEMBER

Apr. 2019 - Jun. 2020

- Devised DABANGG, a set of refinements that enable accurate and noise-resilient flush-based cache attacks.
- Identified that Dynamic Voltage and Frequency Scaling (DVFS) and OS scheduling affect execution latency.
- Introduced noise-aware calibration, periodic feedback, and victim profiling to optimize baseline attacks.
- Conducted key-extraction attacks on AES and RSA cryptosystems in OpenSSL and GnuPG libraries.

### New York Office, IIT Kanpur

Prof. Manindra Agrawal

COMPUTER SYSTEMS INTERN

May 2018 - Jul. 2018

- Led a team of 4 to develop the infrastructure stack of a scalable microservice-based web portal.
- Integrated Spinnaker to enable continuous and immutable delivery of Docker images on Kubernetes cluster.
- Configured pipelines, auto-triggered by Concourse Continuous Integration (CI) workflow, for Spinnaker.
- Added Canary analysis stage to the pipeline and integrated Locust load testing framework in this stage.

## Papers

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### PT-Guard: Guarding Page Tables Against DRAM Fault Injection Attacks

Anish Saxena\*, Gururaj Saileshwar\*, Jonas Juffinger, Andreas Kogler, Daniel Gruss, Moinuddin Qureshi (\* equal contribution)

Under submission at the 49<sup>th</sup> International Symposium on Computer Architecture (ISCA 2022).

### DABANGG: Time for Fearless Flush based Cache Attacks

Anish Saxena and Biswabandan Panda

Source code and paper are accessible at [car3s.github.io/dabangg/](https://car3s.github.io/dabangg/).

## Projects

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### Adaptive Rowhammer Defenses

MEMORY SYSTEMS LAB

Prof. Alexandros Daglis

Oct. 2021 - present

- Exploring the impact of Rowhammer defense guarantees on performance and hardware requirements.
- Extending the Linux OS scheduler to limit the running time of processes based on Rowhammer constraints.

### Scalable Fast Fourier Transform on GPUs

PROF. VERMA'S GROUP IN COLLABORATION WITH CDAC AND NVIDIA

Prof. Mahendra Verma

Feb. 2021 - Aug. 2021

- Extended Tarang, a parallel computational fluid dynamics simulator, to enable multi-node multi-GPU FFTs.
- Developed MPI and CuFFT-XT-based variable precision 1D and 3D scalable FFT implementations.
- Achieved upto 1650× single-node speed-up over FFTW on DGX-A100 and linear strong and weak scaling.
- Evaluated the implementation on DGX-A100 based PARAM Siddhi AI and V100-based EPCC Cirrus clusters.

### Efficient Memory Tracing for Mobile Architectures

CAR3S GROUP IN COLLABORATION WITH QUALCOMM RESEARCH

Prof. Biswabandan Panda

Jul. 2020 - Jun. 2021

- Developed a framework to collect Memory & Data Traces (MDT) natively and through emulation for Android.
- Modified QEMU, the emulator used by Android Studio, to collect MDT from Android 9.0 API with x86\_64 ABI.
- Extended Valgrind, a memory profiling framework, collected MDT natively from ARMv8-based devices.
- Extended ChampSim, a trace-driven simulator, and evaluated cache compression algorithms for LLC.

### Campus Sustainability Challenge

7<sup>TH</sup> INTER-IIT TECH MEET, IIT BOMBAY

Team Leader

Oct. 2018 - Dec. 2018

- Led a team of 6 to propose and implement solutions for waste generated on the institute campus.
- Mounted sensors in composting bins, captured Biogas, reduced PNG consumption in hostel messes by 14%.
- Configured an in-house E-Waste Management Software, analyzed disposal frequency, environmental and economic factors, and identified optimal combination of recycling techniques.

### E-Waste Management Software

COURSE PROJECT

Prof. Indranil Saha

Aug. 2017 - Nov. 2017

- Given E-waste disposal behavior and constraints on economic and environmental resources, identified the optimal path to safely and efficiently treat the E-waste.
- Modelled the path-finding algorithm from scratch, verified results for data-sets of up-to 4 million residents.

## Talks

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2021 **CUDA Programming**, guest lecture, course on High Performance Computing

IIT Kanpur

2020 **DABANGG Attack**, CAOS reading group to students and faculty

IIT Kanpur

2020 **Microarchitectural Security**, talk and demo as part of SRC Annual Design Review

Bangalore

2019 **Flush-based Attacks**, guest lecture, course on Secure Memory Systems

IIT Kanpur

2019 **ZombieLoad and CLKScrew Attacks**, CAOS reading group to students and faculty

IIT Kanpur

## Relevant Coursework

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- Secure & Reliable CompArch<sup>A</sup>
- Topics in OS (Programming NVMe)
- High Performance Computing<sup>A\*</sup>
- Computer Organization<sup>A</sup>

A\*: grade for exceptional performance

- High Performance CompArch<sup>A</sup>
- High Performance Programming<sup>A</sup>
- Modern Cryptology<sup>A</sup>
- Data Structures & Algorithms

A: grade

- Parallel CompArch<sup>A</sup>
- Computer Architecture<sup>A\*</sup>
- Operating Systems<sup>A</sup>
- Non Classical Logic

## Skills

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**Programming** C++, C, Python, Bash, Verilog

**Frameworks** Pthreads, MPI, OpenMP, CUDA, NCCL, Intel TBB, ANTLR, Valgrind

**Utilities** Git,  $\text{\LaTeX}$ , GDB, PIN, QEMU, ChampSim, gem5, Xilinx ISE, Nsight Systems, Docker, Kubernetes

## Technical Service

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2020 **Systems Reading Group**, Leader

IIT Kanpur

*Discussed topics in computer systems. Resources: <https://anish-saxena.github.io/tags/srg/>*

2019 **Programming Club**, Coordinator

IIT Kanpur

*Led a team of 24, conducted workshops, organized hackathons, and delivered lectures.*

## Miscellaneous

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- Senior Mentor to 15 students at IIT Kanpur, helped them navigate life and career choices in college. 2020
- Represented CAR3S group in departmental seminars and maintained the group's digital presence. 2019, 2020