

**Swastik Mittal** (smittal6@ncsu.edu), LinkedIn, Github, (224)-388-2914

## EDUCATION

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<b>PhD, Computer Science, North Carolina State University</b> <i>Compiler Optimization, Embedded/Real-Time Systems, Parallel Systems</i>	GPA: 3.625/4.00 <i>Aug 2020 - Present</i>
<b>MS, Computer Science, North Carolina State University</b> <i>Operating Systems, Linux Networking, Internet Protocol, Graph Theory</i>	GPA: 3.625/4.00 <i>Aug 2018 - Apr 2020</i>
<b>Btech. Computer Science, Vellore Institute of Technology</b> <i>Parallel and Concurrent Systems, Cloud Computing, Agent Based Intelligent System</i>	GPA: 8.76/10.0 <i>Jul 2014 - Apr 2018</i>

## RESEARCH EXPERIENCE

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**Graduate Research Assistant, North Carolina State University** Raleigh, NC  
*Aug 2019 - Present*

Research Advisor: Dr. Frank Mueller

### **OpenMP-Q: Quantum Task Offloading Extension for OpenMP — Publication: IWOMP-2025:**

- Developed an OpenMP extension that seamlessly integrates quantum offloading with conventional HPC workflows.
- Created a quantum-circuit library enabling users to define circuits and execute quantum tasks via POSIX pipes in Python.
- Designed the extension for broad compatibility, including support for reverse offloading and other advanced features.
- Achieved up to 2.9x speed-ups on representative quantum workloads.

### **T-TeX: Timed Security in Multi-Threaded Real-Time System (OpenMP) — Publication: ICCPS-2025:**

- Developed OpenMP code region identification technique using LLVM-Clang
- Implemented a code protection algorithm to prevent delay attacks in real-time OpenMP applications
- Designed a real-time communication interface between user code, the OpenMP runtime, and the Linux kernel to evaluate worst-case execution time
- Solved the challenge of early intrusion detection, achieving 100% attack detection for a 60 $\mu$ s delay attack

### **T-Pack: Timed Network Security for Real-Time System — Publication: ISORC-2021 :**

- Designed a packet modification technique using Linux kernel modules and network socket buffers for transmission time analysis
- Evaluated worst case transmission latency for a packet in a real-time system
- Solved early intrusion detection problem by detecting 95-100% of the attacks
- Optimized the design to incur a minimal performance overhead of  $\approx 0.012$  milliseconds
- Upgraded to support all network communication protocols and complement IPSec encryption for additional security

Research Advisor: Dr. Hung-Wei Tseng

### **In-Network Processing Analysis:**

- Developed synthetic benchmarks with Apache Spark and Hadoop workloads
- Inspected possible bottlenecks for network congestion
- Helped analyzing performance of software defined networking (edge computing for 5G networks) using identified bottlenecks

## WORK EXPERIENCE

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### **AIM Intelligent Machines** ***Performance Optimization Eng.***

Monroe, WA ,USA  
May 2024 – Aug 2024

- Implemented MPS integrated framework to improve GPU schedulability, reducing latency step time by  $\approx 9\%$
- Identified potential bottlenecks within CPU & GPU using performance tools (Perf, Nsight compute)
- Utilized performance analysis to reduce process latency by  $\geq 80\%$

### **Programming Systems, Uber** ***Compiler Optimization Eng.***

San Francisco, USA  
May 2022 – Aug 2022

- Implemented profile-guided code layout optimization in the GO linker
- Developed a cross-package weighted call graph to generate function order using the C3 heuristics algorithm
- Successfully generated an optimized function layout for best cache utilization of a large scale google benchmarks with multiple GO packages

### **Defence Research and Development Organization** ***Cloud Service Eng.***

Agra, India  
Dec 2017 – July 2018

- Designed and implemented a cost efficient infrastructure virtualization service using KVM hyper visors and cloudstack cloud orchestra-tor.

## TEACHING EXPERIENCE

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### **Graduate Teaching Assistant - Parallel Systems**

- Guided graduate students in completing projects on CUDA (NVIDIA GPU programming), MPI cluster programming, and system performance/power optimization techniques

## PROJECTS

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### **Developed a cloud provider with DNS as a Service:**

- Developed a virtual private cloud, based on user demand using Linux Lxd containers
- Provided domain name system (DNS) as a default service (hierarchical DNS look up) using Linux bind9
- Successfully allowed users to avail a cloud service with default DNS and load balancing

### **Autonomous car driving simulator on Carla:**

- Designed a PID controller and a CNN model to simulate autonomous driving car on a carla simulator.
- 100% of the vehicles were observed to successfully follow the traffic signs with 10 vehicles scheduled at any given time.

### **Peer to peer file sharing system:**

- Coded dynamic file sharing system in Transfer Control Protocol (TCP)
- Upgraded to support User Datagram Protocol (UDP) for point to multi-point file transfer secured via stop and wait technique.
- Successfully achieved 95% network efficiency.

## SKILLS

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**Programming Languages:** C, C++, Python, GO

**Parallel Programming:** OpenMP, MPI, CUDA

**Networking and Distributed Systems:** Spark, Hadoop, SDN .

**Compilers and Code Optimization:** LLVM, DynamoRIO, GO Compiler

**Systems Programming:** Kernel Module - Linux network stack, Linux signals, Process scheduling, Timers, GPU scheduling