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

Education

PhD, Computer Science, North Carolina State University GPA: 3.625/4.00
Compiler Optimization, Embedded/Real-Time Systems, Parallel Systems *Aug 2020 - Present*

MS, Computer Science, North Carolina State University GPA: 3.625/4.00
Operating Systems, Linux Networking, Internet Protocol, Graph Theory *Aug 2018 - Apr 2020*

Btech. Computer Science, Vellore Institute of Technology GPA: 8.76/10.0
Parallel and Concurrent Systems, Cloud Computing, Agent Based Intelligent System *Jul 2014 - Apr 2018*

Research Experience

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

Research Advisor: Dr. Frank Mueller

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 60µs 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 ≈ 0.012 milliseconds
- Upgraded to support all network communication protocols and compliment 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

AIM Intelligent Machines Monroe, WA ,USA
Performance Optimization Eng. *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 San Francisco, USA
Compiler Optimization Eng. *May 2022 – Aug 2022*

- Implemented profile-guided code layout optimization in the GoLang 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 GoLang packages

Defence Research and Development Organization Agra, India
Cloud Service Eng. *Dec 2017 – July 2018*

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

Teaching Experience

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

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.

Boat Localization and Automation:

- Designed and implemented an IoT-based system using Arduino and ultrasonic sensors on a custom-built boat
- Integrated the system with cloud servers to detect and log defaulters crossing international borders via water bodies
- Addressed border identification challenges between India and Sri Lanka, achieving 100% accuracy in early detection

Skills

Programming Languages: C, C++, Python, GoLang

Parllel Programming: OpenMP, MPI, Cuda

Networking and Distributed Systems: Spark, Hadoop, SDN .

Compilers and Code Optimization: LLVM, DynamoRIO, GoLang Compiler

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