Neil Rayu

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Education

University of Illinois at Urbana-Champaign **Aug. 2023 – May 2027**
Bachelor of Science in Computer Engineering GPA: **3.91/4.00**

Relevant Coursework

Systems Programming: Operating Systems (ECE 391), Digital Systems Laboratory (ECE 385), Distributed Systems (ECE 428)
Advanced Topics: IoT and Cognitive Computing (ECE 479), Data Structures (CS 225), Security Laboratory (CS 460)

Experience

Sandia National Laboratories **May 2025 – Present**
Center for Cyber Defenders (CCD) Intern Albuquerque, NM

- Developing **low-level C firmware** for a custom embedded security testbed, involving hardware interfacing, **real-time debugging**, and performance validation of system robustness.
- Designed and verified **FPGA logic in SystemVerilog** through simulation, synthesis, and timing closure, integrating hardware/software co-design principles for secure embedded systems.

Information Trust Institute **May 2024 – May 2025**
Cybersecurity Systems Engineering Intern Urbana, IL

- **Enhanced Linux kernel performance** by migrating access logging from a linked list to an RCU-based hash table, achieving a **10x speedup** in concurrent system call tracing.
- Performed **multi-threaded kernel trace analysis** to detect anomalous activity, strengthening threat detection heuristics within a **Linux kernel environment**.

NCSA – National Center for Supercomputing Applications **Sep 2024 – Jan 2025**
Cybersecurity Researcher Urbana, IL

- Explored integration of **Post-Quantum Cryptography (PQC)** into the **Linux kernel TLS subsystem**, focusing on performance tradeoffs and memory/resource management.
- Evaluated PQC in **OpenSSL networking libraries**, benchmarking throughput and latency impacts in secure communication stacks.

Projects

Operating System from Scratch | *C, RISC-V Assembly, QEMU* **Winter 2025**

- **Engineered a multi-threaded, preemptive operating system** from the ground up in C and RISC-V Assembly, implementing fundamental system software concepts including virtual memory with paging, process scheduling, and system calls and more.
- Developed a custom kernel-level File Integrity Monitoring (FIM) system to detect unauthorized file modifications from a custom syscall-based attack, earning 4th place in a competitive system design competition.

Real-Time Sign Language Translation | *Embedded FPGA, Vivado HLS, C++, Raspberry Pi* **Winter 2025**

- Co-designed a real-time embedded system for sign language translation, focusing on **latency optimization** by offloading a custom CNN from a Raspberry Pi to an FPGA accelerator.
- Achieved a **12 ms inference latency**, enabling 80 FPS processing, by optimizing HLS modules for CNN layers, minimizing DSP (15%) and LUT (33%) resource usage on the target hardware.

Leadership & Technical Achievements

Future Architecture and System Technology (FAST) Lab **August 2025 – Present**
Undergraduate Researcher Urbana-Champaign, IL

- Implementing a **translation lookaside buffer (TLB)** to support a zswap-inspired memory compression mechanism for **CXL-attached memory**, targeting reduced latency and efficient compressed page retrieval.
- Evaluating **CXL memory compression strategies** on Intel Agilex 7 FPGAs, focusing on kernel integration, dynamic page management, and performance optimization for memory-intensive workloads.

Illinois EV Concept **January 2024 – May 2025**
Dashboard Software Team Lead Urbana-Champaign, IL

- **Led real-time embedded software development** in **C/C++** on an STM32 platform using TouchGFX.
- Implemented a **CAN Bus protocol stack** for dashboard communication, enabling reliable, low-latency data transfer for speed and cruise control.

SIGPWNY (Cyber Security Organization) **August 2023 – Present**
Embedded CTF Developer Urbana-Champaign, IL

- Developing a secure, **embedded cryptographic system in Rust** for the 2025 MITRE eCTF competition, implementing AEAD encryption to secure satellite TV transmissions.

Technical Skills

Languages: C, C++, CUDA, Python, SystemVerilog, Rust, Assembly (RISC-V), Bash
Systems & Embedded: Linux Kernel Development, Operating System Design (threads, memory management, scheduling), Firmware Development, Real-Time Systems, Hardware/Software Co-Design, Concurrency Optimization
Architecture: Familiar with x86, and RISC-V; microcontrollers (STM32), FPGA development (Vivado)
Developer Tools: Git, Linux, Docker, GDB, QEMU, OpenSSL, Wireshark, Make/CMake