

**Available Position: Undergraduate Research Student**

**Topic: Multi-tier Networking with Terrestrial, Drone, Satellite Tiers**

Research overview: In an ongoing effort, we are studying the communications capabilities for the high-altitude drone/balloons and low earth orbit satellite tiers, to gauge their ability to participate in the delivery of services to users. In this project, UAV and satellite tiers are analyzed for performance and improved architectures are proposed for better quality of service, coverage, access, and security. Through modeling and analysis, some considerations are give for energy consumption, and current wireless and satellite communication standards. We propose to manage these networks using software-defined network control. SDN can provide management of routing tables, protocols, and algorithms in the path selection, for the purposes of energy preservation, quality of service, or security.

**What are Software-Defined Networks?**

Software-Defined Networking (SDN) is a networking technique that communicates with underlying hardware infrastructure and directs traffic on a network using software-based controllers or application programming interfaces (APIs). Software-defined networking (SDN) is a newer network management architecture that separates the network control plane and data plane forwarding activities. Not only does the network controller keep track of data flow, but it also sets forwarding rules. Our research focuses on developing these SDN topologies using an open-source emulation tool, Mininet, in a virtual machine (VM) Linux environment. Within our VMs, we are able to launch cyber-attacks against these networks such as Denial-of-Service (DoS), Botnet, Man-in-the-Middle (MiTM), False Data Injection (FDIA), etc. using tools such as Iperf, Hping3, dSniff, and Ettercap. Using the data collected from these attacks on our SDN frameworks, we are able to produce datasets for machine learning models that predict and classify attack types. With that information, we can levy the central control logic of SDN to mitigate attack instances quickly and efficiently.

**Undergraduate Project**

We are looking for an undergraduate student with computer communications knowledge, some coding experience, preferably with python. The project would consist of producing python scripts that use Mininet's APIs to generate custom SDN network topologies for testing different satellite, drone, or multi-tier scenarios. In this position, the student will learn about Software Defined Networking and data generation for machine learning models. They can also further their computer networks and programming experience. We are looking for someone interested in SDN, satellite dynamics and wireless standards. There is a potential opportunity to continue participating in our work beyond the initial scope of this project.

**Minimum Qualifications**

- Some experience in Python
- Basic understanding of programming and network devices
- Desire to learn more about Software-Defined Networking and Satellite networks