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Development of Intelligent Security Controls for SDN-based Space Systems

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Introduction

Space systems play a vital role in our everyday lives. Global communication, weather prediction, and Internet connectivity to rural and remote areas, are some of the services that rely on space systems. The space systems' increased importance to national security, and critical infrastructure has attracted entities who aim to compromise the services that depend on space systems. Software-Defined Networking (SDN) transforms traditional networking architectures by separating the control plane from the data plane. This separation enhances scalability and centralized management of networks. The integration of SDN in space systems can provide the benefits of managing and the ease of configuring a large-scale space system. This research integrates SDN in space systems and the development of security controls to safeguard SDN-based space systems from malicious activities.

Knowledge gap

The research project addresses three major knowledge gaps:

1. Securing space systems.
2. Integrating space systems and SDN.
3. Implement intelligent security controls for SDN-based space systems

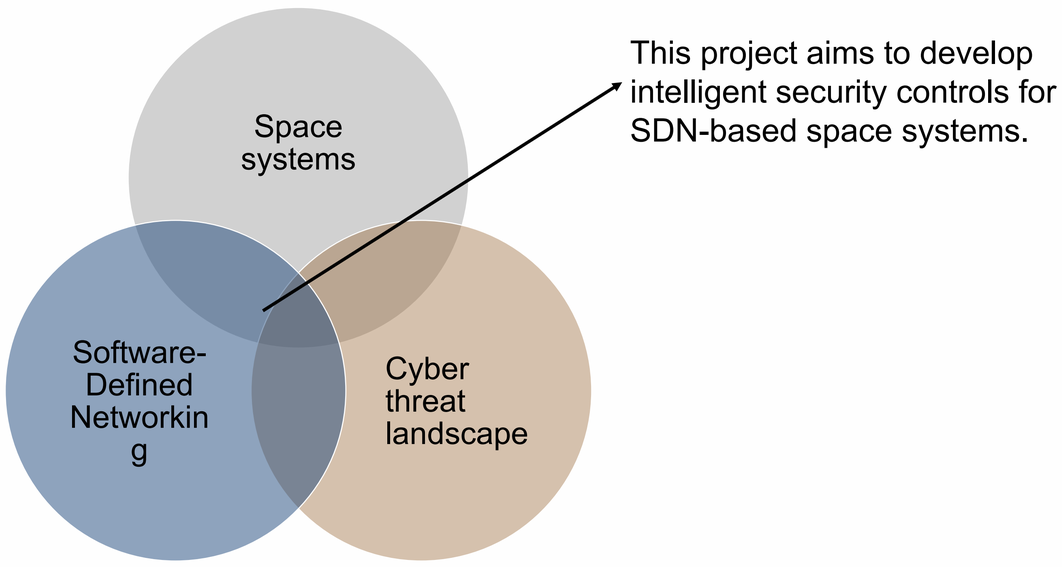


Fig. 1: Research scope

Motivation

- Space systems are vulnerable to cyber-attacks [1] [2] [3].
- Space systems are manually configured and controlled [4].
- SDN can provide automation, a centralized view, and control of a space system [4][5].
- SDN can provide ease of deploying security policy in a space system.
- Though SDN offers exceptional features for space systems, it is vulnerable mainly at its control plane.
- Security controls need to be developed to secure SDN-based space systems.

Methodology

This project applies a quantitative approach, using a deductive method (step-by-step). The research will be conducted by performing experiments and a peer-reviewed literature search.

The diagram below shows an example of SDN integration in a space system [6].

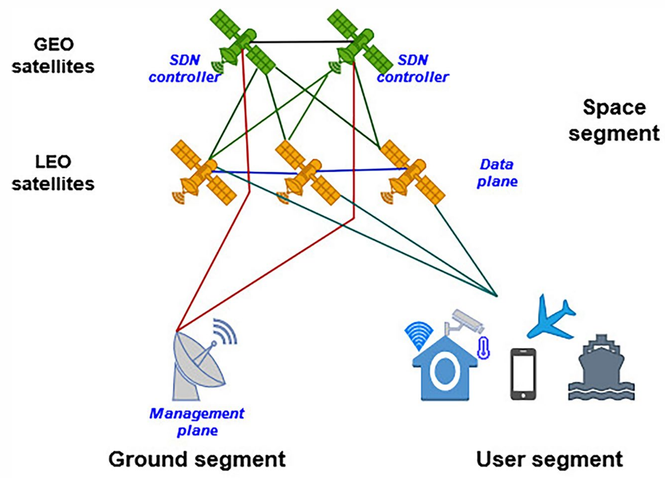
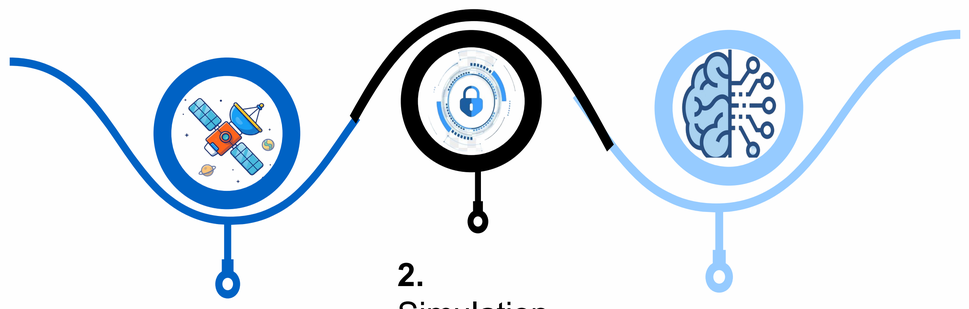


Fig. 2: SDN-based space system

To achieve the project's objective the following process illustrated in Fig 3. is followed.



1. Perform a detailed security analysis based on security frameworks, i.e., MITRE's ATT&CK, and SPARTA.

2. Simulation of SDN-based space system i.e. Mininet.

3. Investigate, develop, and application of DL-based anomaly detection.

Fig. 3: Methodology

References

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