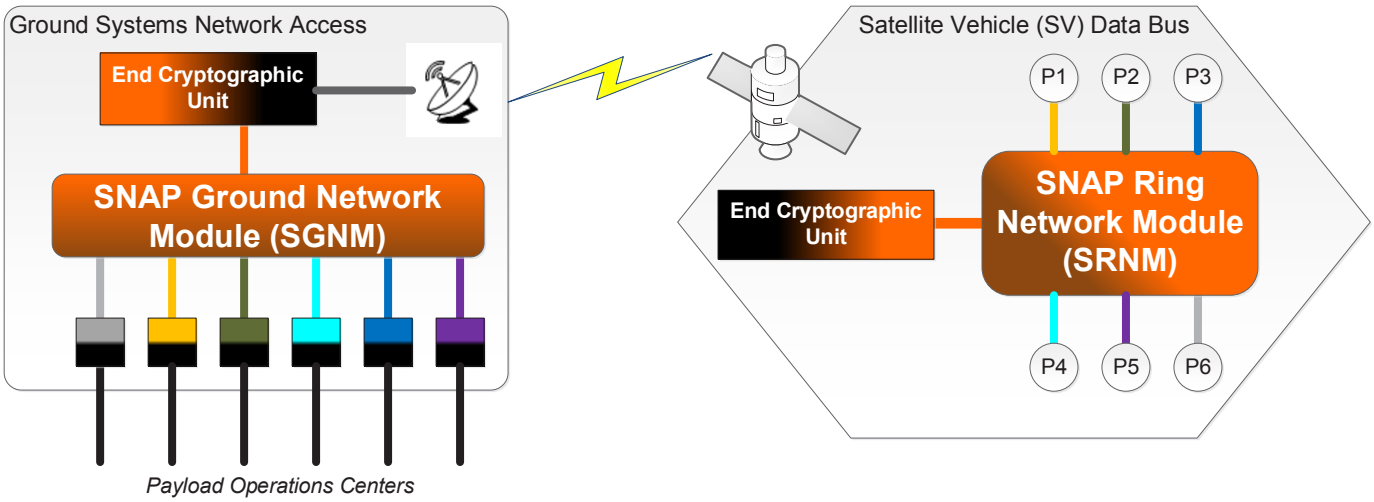
GENERAL DYNAMICS
Mission Systems

Ring of Fire: Multi-Level Switching Security Solution

Digital infrastructure/satellite bus securely enabling transparent access to data with different security categories/levels



Purpose-built software/firmware for a controlled, data-separation bus

Enables a means for designing a low SWaP-C data-separation solution

Foundation of Policy-Driven Controls

Allows for layering of cryptographic mechanisms with data-separation

Coupled with mechanisms in Ground Systems and Mission Operations

Leverages concepts of NCDSMO Raise-the-Bar Multi-Level Switch and Network Interface Card

Overview

Ring of Fire is designed for satellite buses hosting diverse payloads (e.g., ESPA rings, rideshare platforms, multi-manifest payload hosts, etc.) with different security levels/categories that need simpler solutions for integration, as well as those who need methods to reduce the SWaP-C associated with carrying multiple independent data-buses to address data segregation. In short, Ring of Fire allows your platform to carry all the necessary data appropriately, securely, and simply on one data bus. We bring proven GDMS cybersecurity technology already accomplishing this data management function from our land and airborne division into the space domain.

Data-Separation Solution for Hosting Multiple Payloads with Different Security Categories

Our proposed solution is to reuse, or re-factor, a digital bus that is based on the GDMS SNAP technology complying to the "Cross Domain Solution (CDS) Design and Implementation Requirements: 2021 Raise the Bar (RTB) Baseline Release," Version 4.1, NCDSMO-R-00008-004_01. Application into space-based networking can start with balancing data-separation requirements across, or within, Security Levels – providing options to develop a specific solution that separates and isolates mission data running between payloads and Ground Operations.

Ring of Fire: Multi-Level Switch Security Solution

Key Features

- Permits data exchanges at various sensitivity levels and classification levels
- Reduces lifecycle management challenges over SV and payload integrations, launch, LEOPs, and Mission
- Enable Multiple Independent Levels of Security (MILS) with clear evolution paths to Multi-Category Security (MCS) and Multilevel Security (MLS)
- Suitable for various orbits such as LEO, MEO, HEO, GEO, Cislunar and beyond
- Enables pairwise encryption/decryption with Payload Operation Centers (allowing various combinations across Satellite Operations, Network Operations and Mission Operations)
- Control configurations for data sharing per specific, program security-policies
- Support for bus-unique interface-technologies, such as SpaceWire, 1553, Ethernet, etc.
- Extensibility for Multi-Level Security (MLS) and "Flyaway Networking"

Enterprise Networking

Our solution provides a mechanism supporting an organization wanting to do a joint SV, P1, and P5 experiment. The SNAP Ring Network Module (SRNM) can be configured to deliver the separated traffic locally and the SNAP Ground Network Module (SGNM) will have traffic separated within the Ground Systems Network Access. Payloads on the Ring of Fire share a "Red network" with isolation and separation as multi-level switches and multi-level network interface cards. Mission data on the data bus is labeled and separated by the SRNM. The SRNM is built in a policy-driven scheme to allow for reprogrammability (even on-orbit) and reconfiguration of constraints on data sharing and data transmission in accordance with a program's requirements.

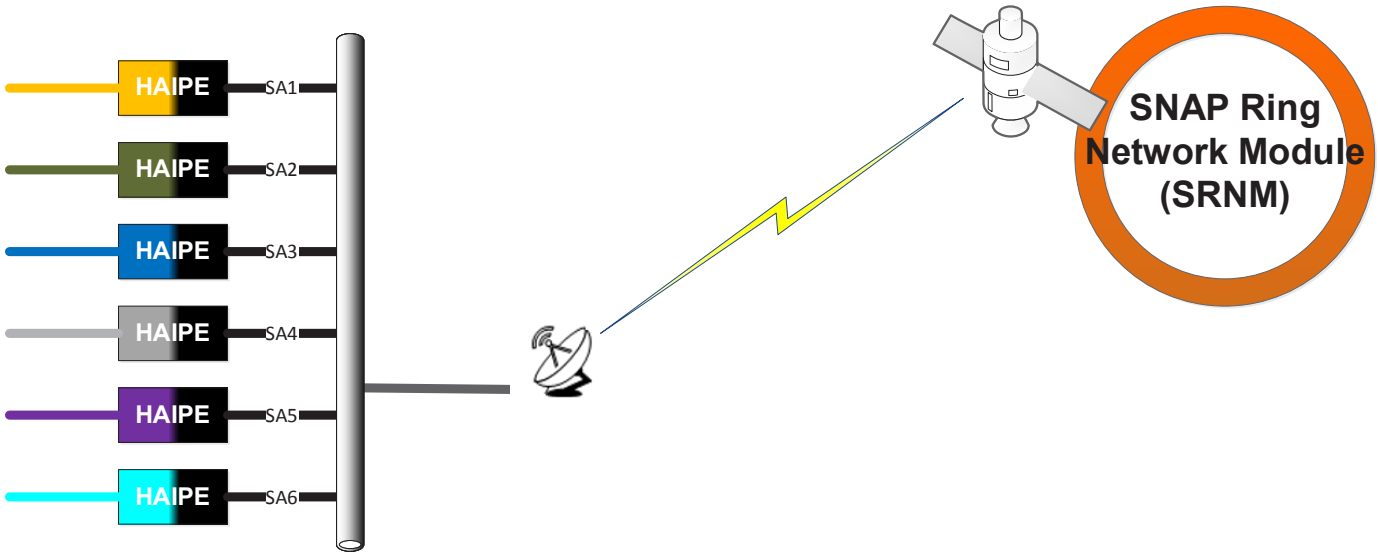
Coupling with Ground Systems

The SRNM works in concert with the SGNM to allow transmission of mission data between payloads and ground operations. The solution supports data transmission of packets of IPv4 or IPv6 while employing the CIPSO (FIPS-188), or CALISPSO (RFC 5570), Security Option and IP Authentication Header (RFC 4302). This allows for instantiation of a Trusted Security Engine (TSE) at each end of the mission communications path to verify and control transmissions/relays between the SGNM and SRNM.

Extensibility

The core capabilities of the Ring of Fire provide fundamental routing/switching techniques that can extend outward from the controlled data-bus:

- Leveraging the IP-based switching, a Secure Mesh Network (SMN) solution can be coupled with wireless transmissions off the data-bus
- MLS can be added though a Red Hat SELinux, or PitBull, network driver for each "virtual" NIC into different Security Levels
- Unique ECUs can be implemented to support programs requiring more controls on the encrypted traffic running 'over the air' between the satellite and Ground Systems



GENERAL DYNAMICS
Mission Systems

General Dynamics Mission Systems, Space and Intelligence Systems Inquiries – 1-877-449-0600
www.gdmissionsystems.com/space - www.gdmissionsystems.com/contact-us

D-Ring of Fire ROF
PRI-2304-0005