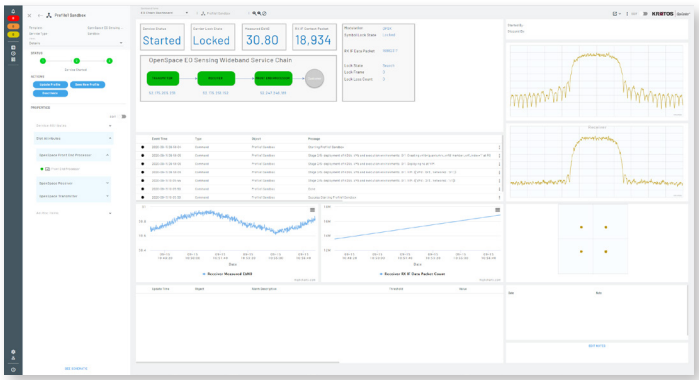
OpenSpace Platform - Enabling More Automated, Scalable and Cost-Effective Ground Operations



OpenSpace OpsCenter manages and assures performance across the platform.

New satellite architectures, cloud computing, 5G, and software-defined networking are transforming the satellite industry. These technology advancements bring new business opportunities with the capability to deliver exponentially more services, faster, with more flexibility and increased quality of service.

New Space Needs New Ground

In today's traditional ground system environment, delivering a satellite service to a customer can take weeks. With the costs in bandwidth dropping significantly due to innovations in the space layer, demand for satellite services is growing rapidly. A hardware centric, static ground configuration approach is now challenged to keep pace due to scale, cost and time constraints.

OpenSpace – A New Approach to Ground System Operations

The OpenSpace Platform is the first fully digital, virtualized, software-defined, and orchestrated Platform in the satellite industry. It is built on an innovative, open, and unified architecture that dynamically supports multi-satellite, multi-orbit, multi-payload, and multi-band operations.

OpenSpace Key Features

- *Open - leverages industry standards and open interfaces*
- *Digital – Fully digitized ground segment RF using the Digital Intermediate Frequency Interoperability (DIFI) standard*
- *Cloud Native - containerized for scale, high-availability, and redundancy*
- *Software Defined – Leverages virtualization and SDN principals for flexible service-chaining*
- *Secure – uses a Zero Trust Architecture*
- *Flexible – Match deployment sizes to service requirements*
- *Dynamic – Leverages service and resource orchestration for Platform*

Orchestrating Ground System Operations

Orchestration is what makes the OpenSpace Platform truly dynamic. The Platform enables automated workflows and logic across systems to deliver services end-to-end much faster.

The OpenSpace Platform enables the satellite and ground system to operate in tandem as a real-time integrated system, driving coordinated change that can respond and synchronize to changes in customer demand.

The OpenSpace Platform supports open, third-party service orchestration frameworks to automate an end-to-end service delivery. Satellite operators can use open service orchestration architectures to communicate directly from their business or mission planning systems to automate operations end-to-end.

OpenSpace Platform Services

The OpenSpace Platform provides scalability and automation for:

- Earth Observation (EO) and Remote Sensing (RS) missions – the capability maximizes the ability to download data on the fly when satellites are over the ground system
- Satcom services for point-to-point communications - enables highly reliable Carrier Ethernet based E-Line services to be deployed in minutes

OpenSpace Platform Architecture

The OpenSpace Platform was built from the ground up and includes three layers:

- OpenSpace Service Chains are composed of connected Virtual Network Functions (VNFs) that deliver a service. The OpenSpace Platform supports

service chains for EO/RS for mission downlink and commanding as well as E-Line applications for robust two-way communications.

- OpenSpace Controller is the brain center of the Platform that controls how satellite service chains are deployed to deliver a given service or mission against a defined SLA or Concept of Operations (ConOps). The Controller uses a standards-based Management & Orchestration (MANO) architecture to deploy service chains at scale providing abstraction from the underlying virtualized infrastructure, instantiating service-chains in a variety of private and public cloud architectures, or even across hybrid cloud environments.
- OpenSpace OpsCenter is the management interface for the Platform that enables the configuration, administration, and monitoring of the complete ground system. OpsCenter allows planning and operations personnel to design, test, and deploy service-chains across their environment to manage service chain lifecycle across the virtual and physical network functions.

  OpsCenter for OpenSpace brings together virtual service-chain management, physical network device management, and ground RF systems into single-pane of glass.

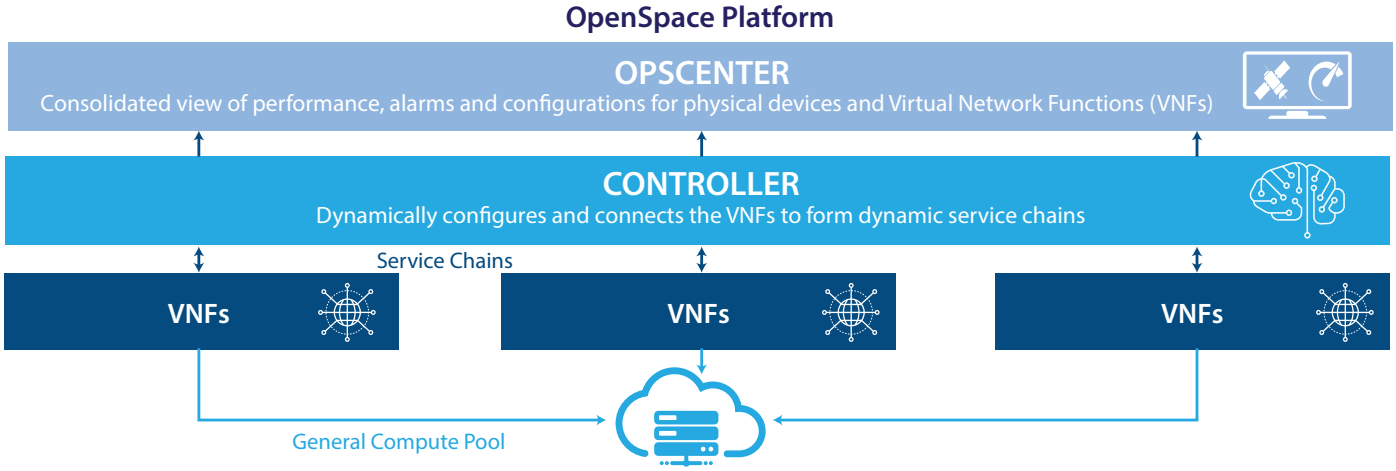
OpenSpace Family

Kratos' OpenSpace family of solutions enables the digital transformation of satellite ground systems to become a more dynamic and powerful part of the space network.

The family consists of three product lines: OpenSpace SpectralNet for converting satellite RF signals to be used in digital environments; OpenSpace quantum products, which are virtual versions of traditional hardware components; and the OpenSpace Platform, the first commercially available, fully orchestrated, software-defined ground system. These three OpenSpace lines enable satellite operators and other service providers to implement digital operations at their own pace and in ways that meet their unique mission goals and business models.

OpenSpace Platform Benefits

- *Save time - accelerate service delivery process from weeks to minutes*
- *Increase revenue – launch more services faster*
- *Optimize efficiency - maximize usage of network resources to almost 100%*
- *Automate hundreds of hours of manual tasks and maintenance*
- *Reduce costs in hardware, space, and power by virtualizing infrastructure*
- *Flexibly support multi-satellite, multi-orbit, and multi-payload*
- *Unify management across the ground system in a single view*



The OpenSpace Platform architecture includes three layers from an infrastructure, control and management standpoint that enable the orchestration of ground system operations.