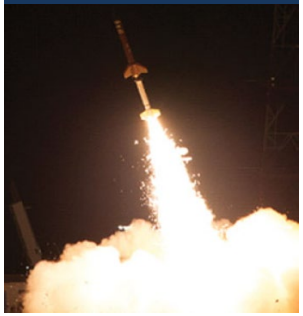
A More Orchestrated Ground

Experience in Enabling Mission Operations in the Cloud

Technology Leader in Aerospace and Defense

Unmanned Systems	Space, Training & Cyber Security	Microwave Electronics	Defense & Rocket Support Services	Turbine Technologies	C5ISR Systems
					

- Over 3,500 Employees
- Over $900M Revenue
- NASDAQ: KTOS

- 60/40% Products/Services
- 70/30% USG/Commercial
- Austin, Tx. Headquarters

Addressing the Digital/Cloud Transformation

Many Macro Factors are Driving the Digital/Cloud Transformation –
Commercial industry is adopting these technologies today

5G

- MEF Orchestration standards
- Multi-layer connectivity

Cloud Computing

- Enterprise Ground Services
- AFSCN Augmentation
- DevSecOps CI/CD
- Cybersecurity

Software Defined Networking

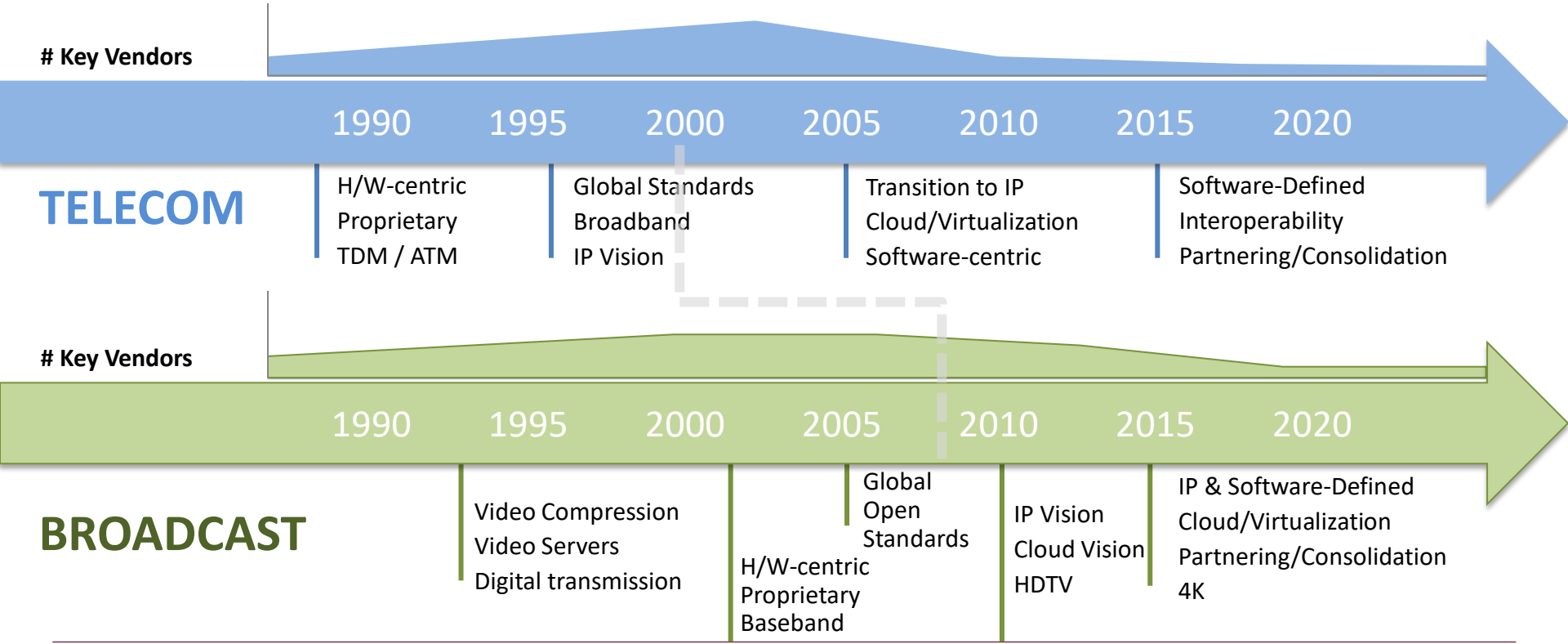
- Enterprise Mgmt & Control
- AFSCN Augmentation
- Resilient satellite C2

Space as a Warfighting Domain

New Satellite & Ground Architectures

- High-throughput GEO SATCOM
- MEO SATCOM
- P-LEO: Transport, Tracking, Custody

Industry Parallels



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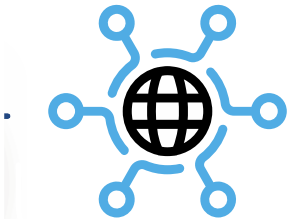
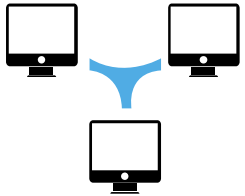
Embracing New Approaches to Modernize Ground Architectures

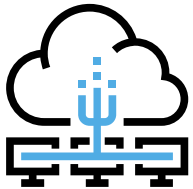
Virtualization
Increases Infrastructure scalability



Software Defined Networking
Agile and flexible ground architectures



Cloud Computing
Compute and storage on demand



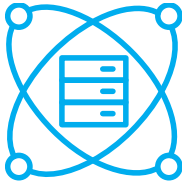
5G
Interoperability Standards across networks

Enabling more integrated satellite and ground operations to respond to changes in threat, supply and demand

Dynamic Ground Systems

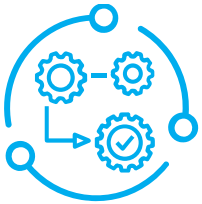
DIGITAL

Converts RF signals to IP packets to enable digital, cloud-enabled architectures



VIRTUAL

Fully virtualized, rapidly deploys and scales elastically using common compute



ORCHESTRATED

Enable automated workflows across the system to deliver services end-to-end much faster

Dynamic Service Delivery

Deploy new services to customers in minutes

Scale on demand to support more services

Reconfigure on the fly as demand changes

Provision new services automatically with zero touch

OpenSpace Platform
The Dynamic Ground System

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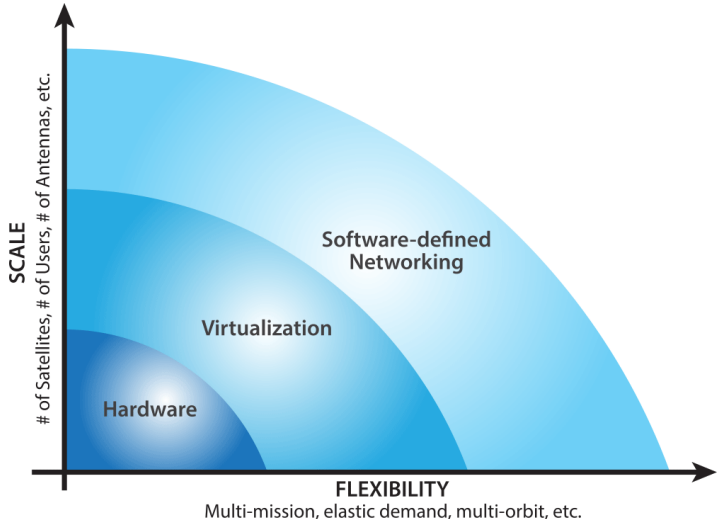
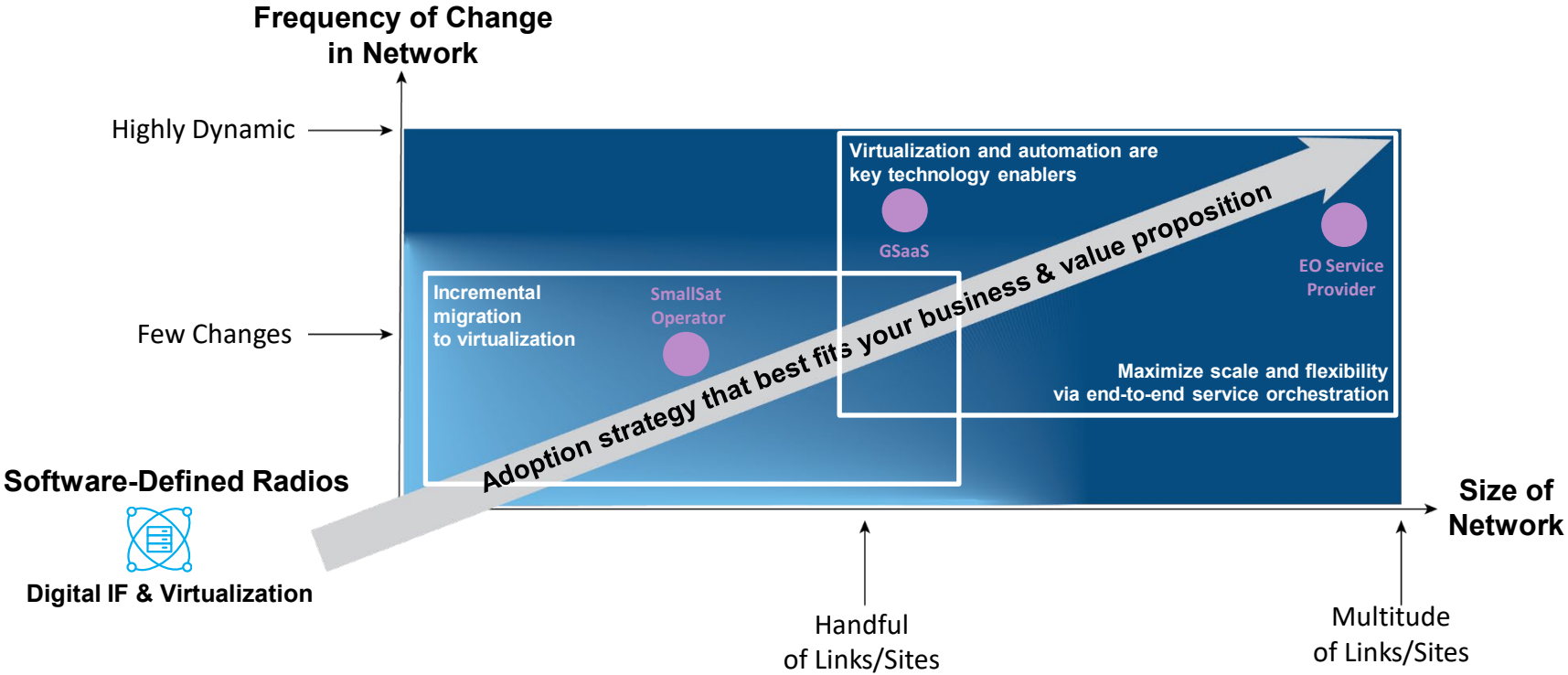
Digital/Cloud Architectures Address Scale and Flexibility Needs

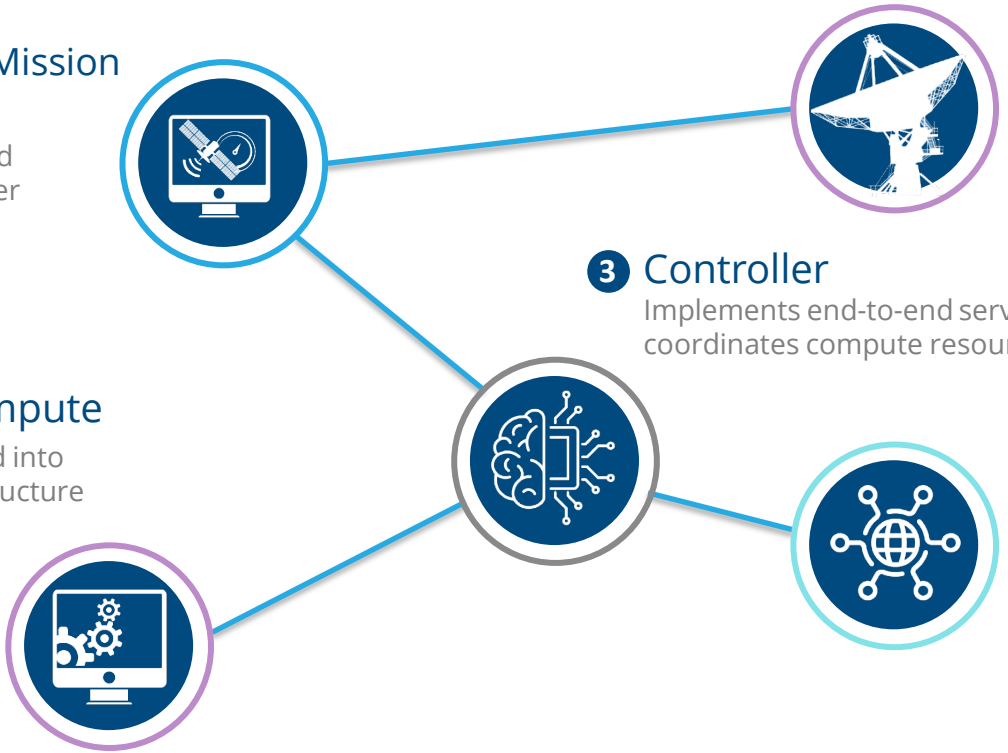
Flexible/Agile	• Multi-applications on common infrastructure • Migrate from silo'd, hardware-centric networks • Consumption-based IaaS business model
Elastic	• Dynamically react to changes in supply/demand/threat • Leverage cloud for extreme peaks
Resilient	• Distributed architecture • Standardized redundancy/diversity schemes
Secure	• TLS/ZT architecture



Which Path is Right for Your Operations?



Dynamic Workflows



1 Orchestrator/Mission Management

Defines services and integrates with other systems

2 Antenna / etc.

configures antenna, digitizers, legacy Interface(s)

3 Controller

Implements end-to-end services and coordinates compute resources

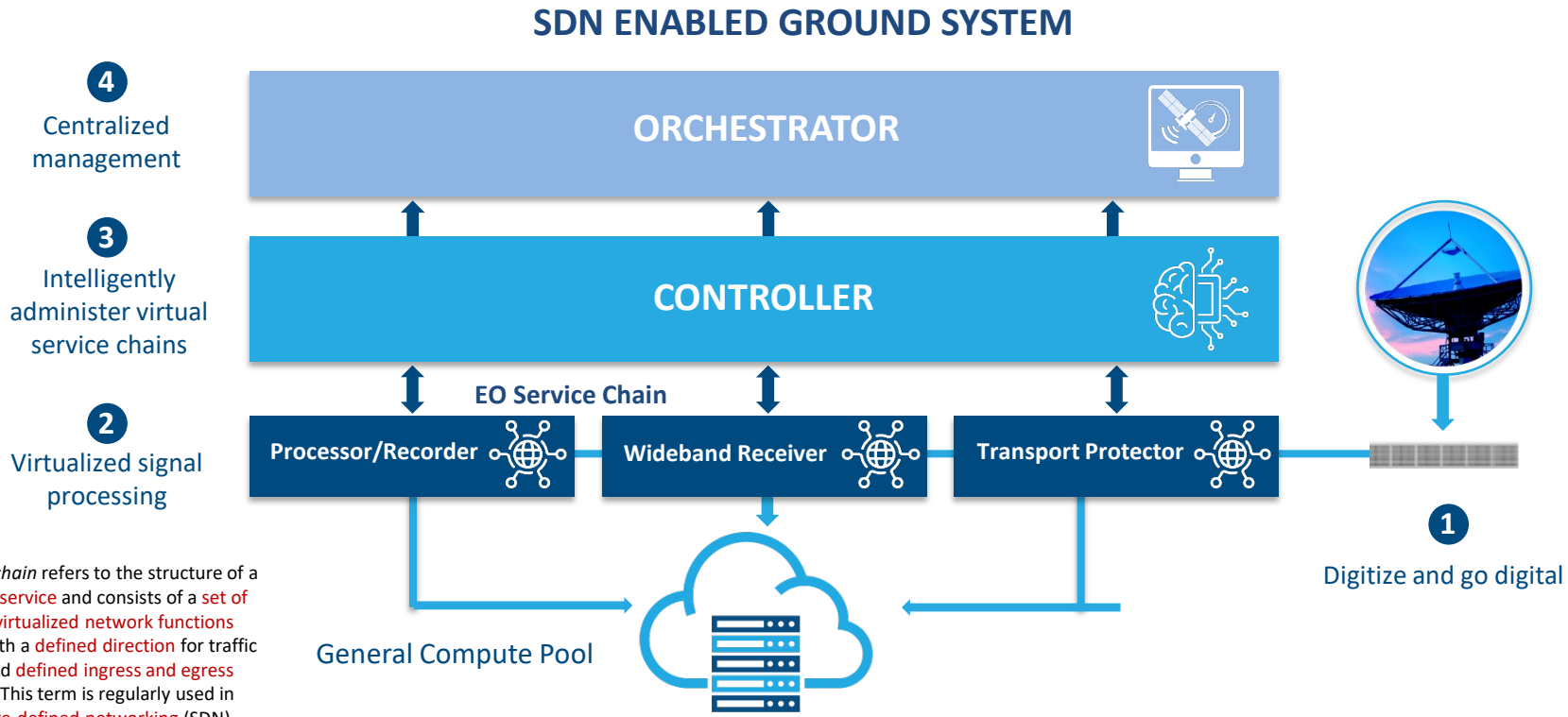
4 Generic Compute

VNFs on-boarded into compute infrastructure

5 Virtual Network Functions

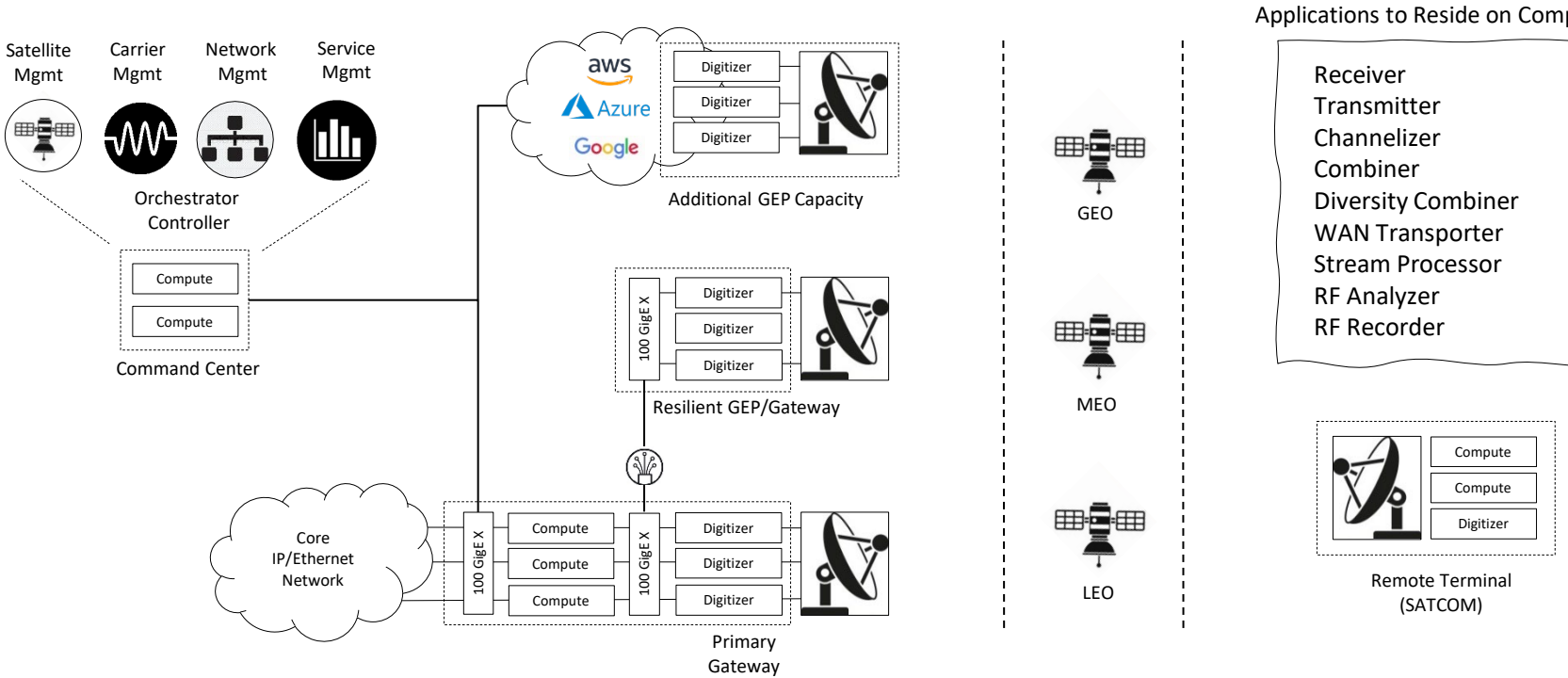
Controller instantiates and configures VNFs

Supporting Multi…Missions, Orbits and Payloads



A *service chain* refers to the structure of a network service and consists of a set of linked virtualized network functions (VNFs), with a defined direction for traffic flow and defined ingress and egress points. This term is regularly used in software-defined networking (SDN).

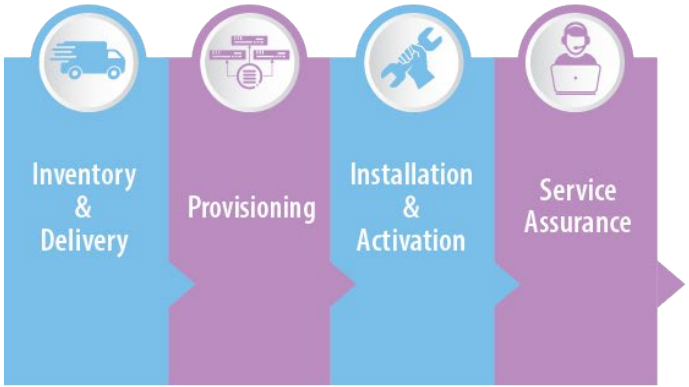
Software Defined Network Deployment Scenarios



Advantages of a New Approach to Ground Systems

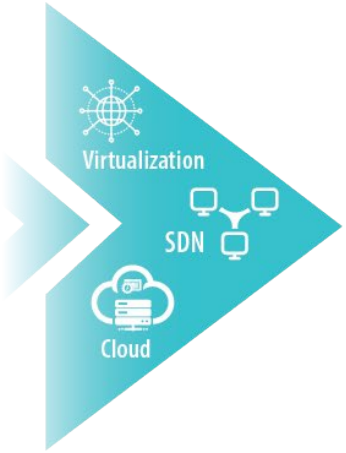
Traditional Ground System Approach
Team of engineers planning, configuring and delivering service

Deliver a service in weeks to months



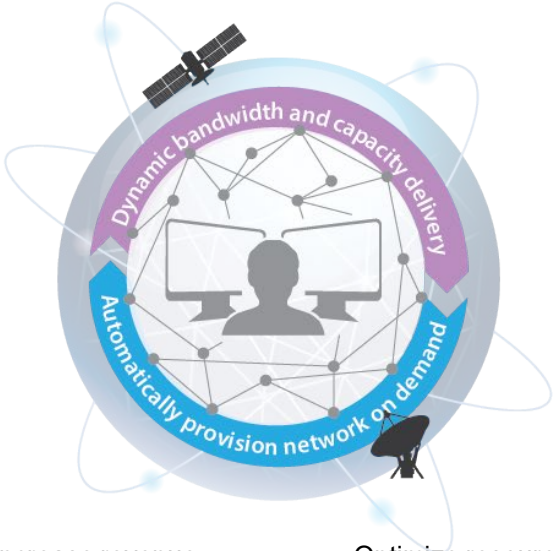
- Manual process
- Resource intensive

- Difficult to scale
- Time consuming



New Approach
Automate service provisioning end-to-end

Deliver a service in minutes



- Increase revenue
- Decrease costs

- Optimize resources
- Save time

Role of Standard Interfaces

- IEEE Digital IF Interoperability (DIFI) Consortium :
  - DIFI IEEE-ISTO Std 4900-2021 – Digital RF/IF interoperability standard for VITA-49 (data plane)
- Object Management Group (OMG) :
  - C2MS – Foundational C2 Message ICD for EGS (data plane and control planes)
  - XTCE – Common C2 database format (control plane)
  - GEMS – Ground Equipment Monitoring protocol (control plane)
- Metro Ethernet Forum (MEF) :
  - Lifecycle Service Orchestration (LSO) – Ref. architecture and APIs for ground service automation
  - LSO Presto – APIs to orchestrate SDN/NFV services and legacy infrastructure (management plane)
- ETSI NFV :
  - Open Source MANO (OSM) – ref. architecture, APIs, open source (management plane)
- Industry/Commercial – (control plane and management plane)
  - OpenAPI, REST, RESTCONF, NETCONF, HTML5, HTTPS, CSS3, JavaScript, XML, JSON, YANG
  - Zero Trust Security Standards: TLS/SSL, X509 Certs, LDAP

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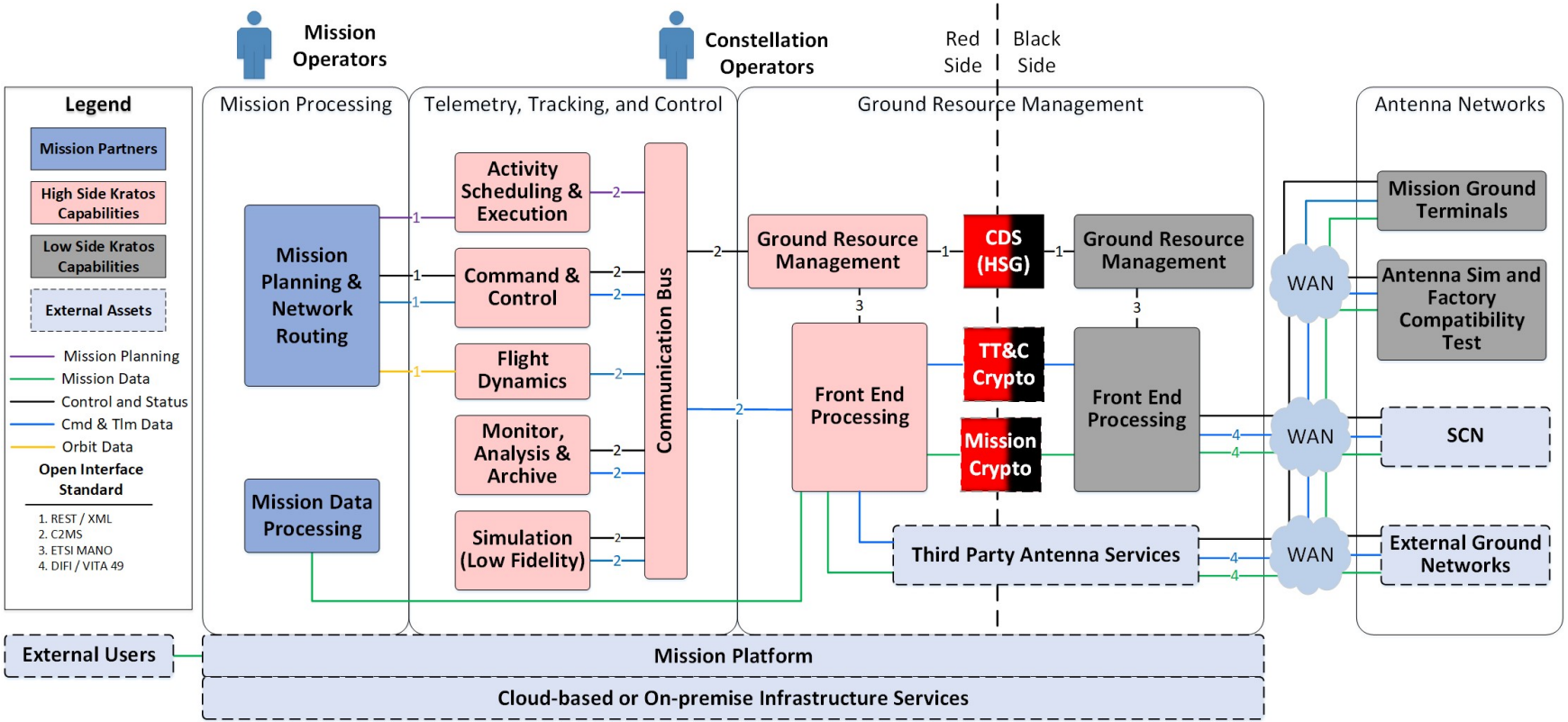
Proof Points

OpenSpace C2 Standardized Ground Architecture



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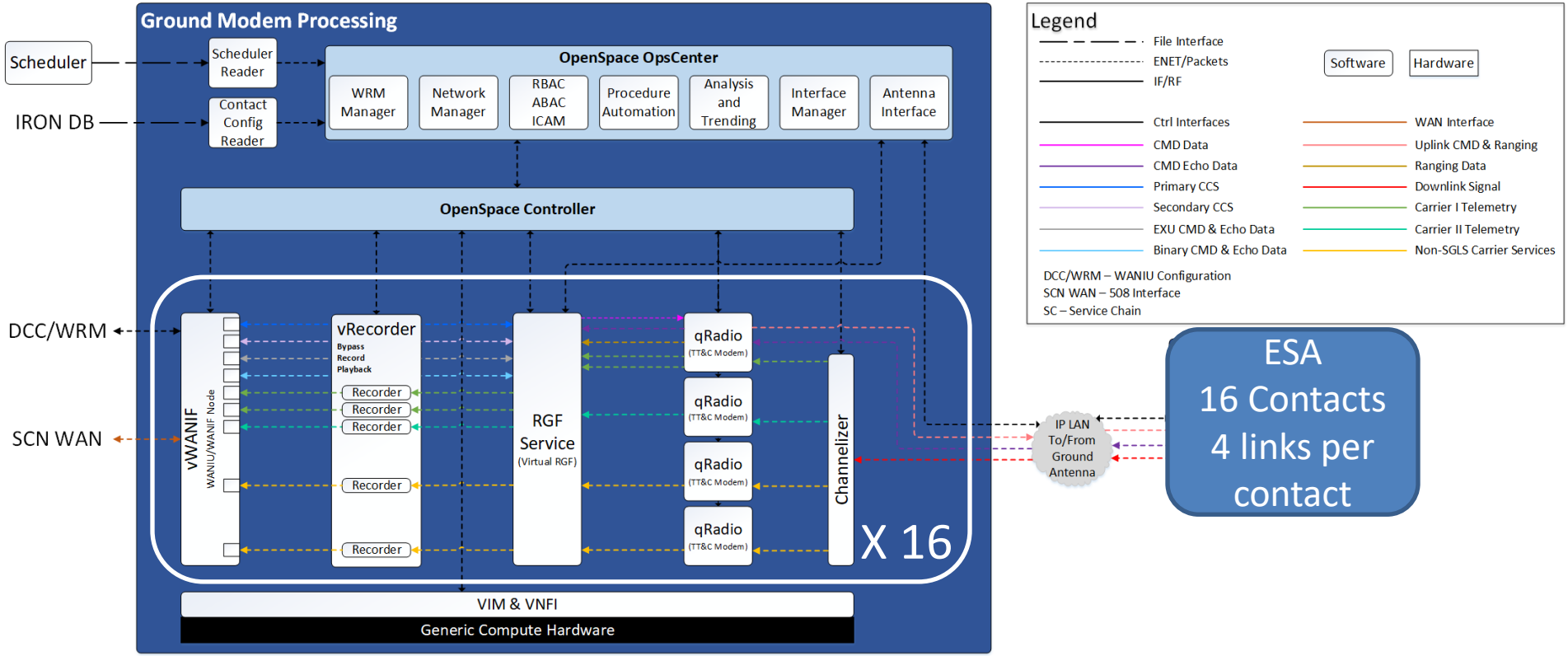
OpenSpace ESA Architecture



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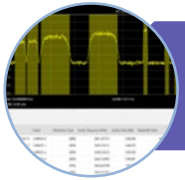
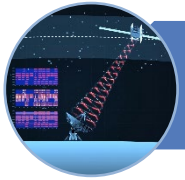
Kratos Ground Monitoring and SDA as-a-Service

Kratos RF SDA Capabilities

Passive Ranging and Maneuver Detection



Signal Survey and Characterization



Interference Detection

Signal Geolocation

The Kratos Global Sensor Network (KGSN) is a commercial deployment of over 170 RF SDA sensors located at 20 sites around the globe. Providing 24/7/365 coverage and analysis capabilities.

Supporting Customers

- Department of Defense
- Commercial
- International