

# **Ground Stations digital transformation**

Yves Pitsch, Microsoft, Azure Space

### **Azure Space**



Microsoft innovation + a space partnership ecosystem to provide advanced, secure, and resilient capabilities

#### GLOBAL CONNECTIVITY

Enable command, control, and data downlink of satellites through Azure and connect our global data centers and edge devices via satellite and 5G.

Connect anyone's data, from anywhere in the world, at any security level, into our clouds.

#### A N A L Y T I C S M A R K E T P L A C E

Develop an ecosystem that integrates large-scale geospatial and space data, synthetics, AI/ML, and visualization to enable analytics anywhere.

Turning data into knowledge and insights.

#### AZURE IN SPACE

Run Azure analytics and hardware on satellites, space stations, and beyond.

Driving innovation and creating the ultimate cloud-enabled edge devices – on and off the planet.

#### EMULATION & SYNTHETICS

Power digital transformation and develop tools for simulating satellites in a rich synthetic environment to develop and evaluate powerful AI/ML capabilities.

#### Reliable, repeatable technologies to help the space community innovate and move faster with mission assurance.

### **Azure Orbital**



Azure Orbital is a managed service that lets you communicate to, control your satellite, process data, and scale your operations directly in Microsoft Azure

### **Azure Orbital Ground Station**

Quincy Datacenter, WA



### **Azure Orbital – Earth Observation**

Ground Station as a Service – High Level Architecture



### **Azure Orbital – Earth Observation**

Ground Station as a Service – High Level Architecture



## **Azure Orbital Virtualized Signal Processing**

Driving efficiencies and scale through virtualization and software



#### **Conventional Deployment Model** for Satellite modems

- Physical dedicated hardware-based modem
- Modem Deployed at the GS Edge

#### Challenges

- Supply Chain Management overheads
- Lack of flexibility
- Capacity Management Issues
- Maintenance & Operations overheads
- Security challenges more reliance on physical security
- Non-standards based leading to interop challenges



#### Orbital's Modern Cloud-based virtualized Modem Deployment

- Software modems running as Virtual Network Functions (VNFs) in the Cloud
- Digitizer deployed at the GS edge streaming real-time digitized RF to the Cloud

### Advantages

- **Dynamic capacity management** through software orchestration
- **Channelizer/Combiner capabilities** in software makes it easy to manage multiple RF links
- Flexibility with 0 to minimal reliance on supply chain
- Elasticity & Scale Leverage Cloud scale to process high BW missions
- Standards-based data exchange using VITA 49.2 enabling seamless interop
- Future Proof easy to upgrade / add support for modern or unique waveforms including DVBS2/X
- High Speed Digitized RF Transport enabled by Azure
- Accelerated Networking (FPGA based networking data path accelerated by DPDK)



### **Orbital's Future Deployment Model for Satellite modems**

- Digitizer deployed at the GS edge streaming real-time digitized RF to the Cloud
- Virtualized software modems orchestrated on Azure edge compute
- Modem Deployed at the GS Edge

### What next?

- High Speed Signal Processing powered by High Performance Compute (HPC) in the Cloud (using GPU or FPGAs on Azure)
- Ultra-high security by using in-memory encryption through CPU enclaves enabled by Azure Confidential Computing
- Leverage Cloud elasticity for almost infinite BW of the RF signal
- **Consistent DevOps** for customer and modem vendor regardless of modem running in edge/datacenter

### **Enabling seamless interop**

Standards-based data exchange using VITA 49.2

### **Conventional data exchange is Unique**

- Every Mission has a unique ICD
- Every Mission needs "my special modem" or "my custom waveform" support

### Challenges

- Vendor diversity not possible
- Non-recurring engineering costs for unique customizations almost a given
- Lack of flexibility not all solutions available from all vendors
- GSaaS becomes harder More customers mean more modems, more hardware and more customization

### **Azure Orbital**

- Standards based data exchange built on top of VITA-49.2 virtualized radio transport
- Working to build ecosystem of partners Kratos, Amergint and more to be added soon

### **Enabling seamless interop**

Standards-based data exchange using VITA 49.2

DEMO

VITA based interop







# Standards-based data exchange using VITA 49.2

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### Virtualized software modems at GS Edge

Running Virtualized software-based modems using Azure edge compute



# DEMO

### Virtualized software modems at GS Edge

Running Virtualized software-based modems using Azure edge compute

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Cloud integration into Ground Stations brings

- Operational Agility
- Supply chain agility
- OPEX model

Standardization is key to support interop scenarios

Performance Compute scenarios available in the datacenter and at the edge

Cloud can help increasing the security level