



# SPACE2CONNECT CONFERENCE

SHAPING THE FUTURE  
TOGETHER



# ENABLERS

## SESSION 5

**How can we embrace  
Disruptive Innovation  
and Standardization?**

DAY 2

THURSDAY 8th JUNE 2023

# ENABLERS

## SESSION 5

### DIGITAL TRANSFORMATION IN SATCOM



#### Disruptive business models



SPEAKER

**Guido Baraglia**

Head of EMEA Aerospace,  
Amazon Web Services (AWS)

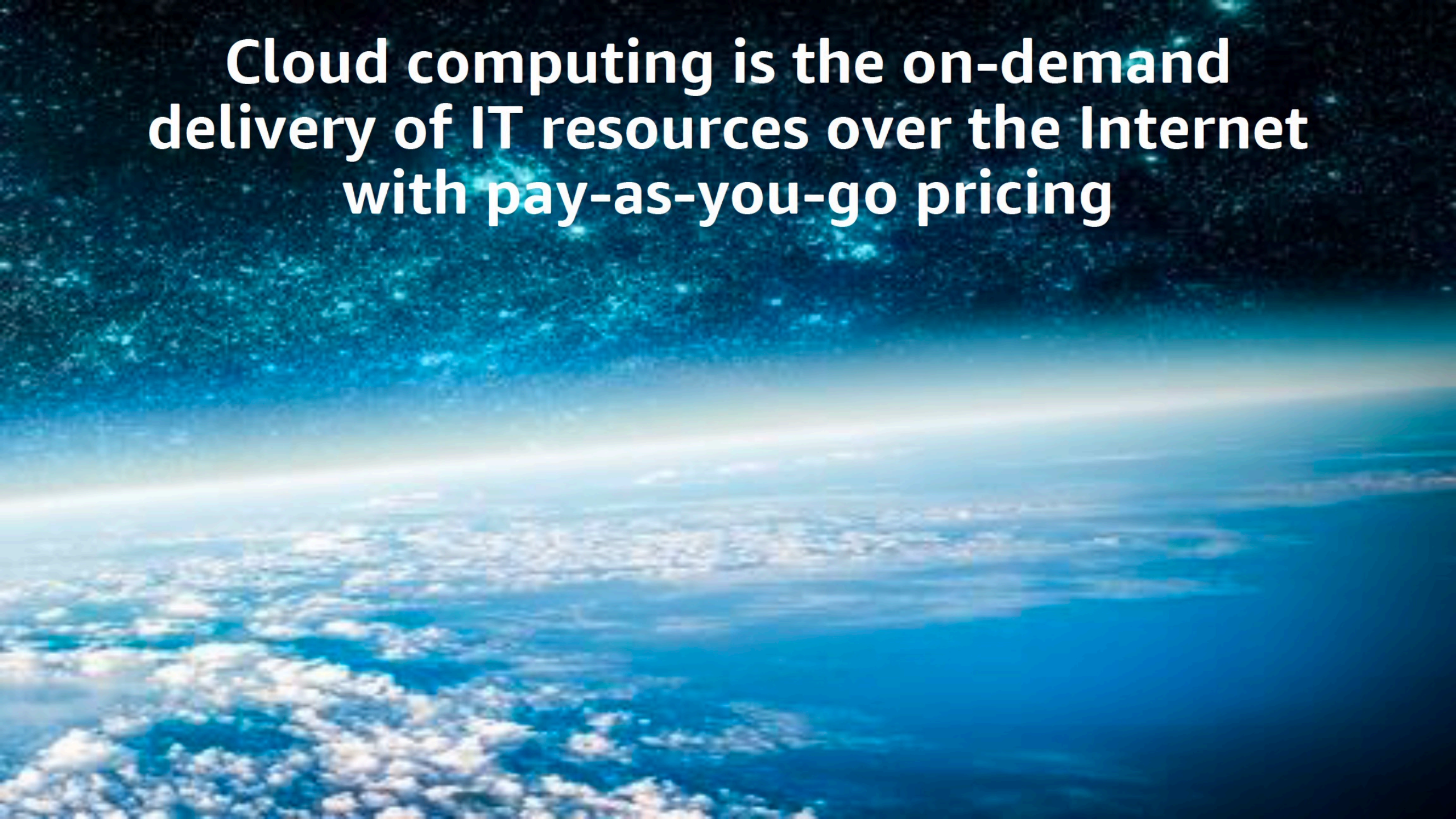


# AWS Aerospace & Satellite

## Reimagining missions through cloud computing

Guido Baraglia  
Space2Connect – Matera – June 8<sup>th</sup>, 2023  
Session 5: Digital Transformation in SatCom

**Cloud computing is the on-demand  
delivery of IT resources over the Internet  
with pay-as-you-go pricing**



# An inspiring New Space age



Satellites launched into orbit will quintuple over the next decade



The New Space economy model requires a new infrastructure approach



Ground virtualization is key to the economic viability of space operations

# Cloud is enabling space industry success

## Edge Compute in Space

Analyze data  
in-orbit to  
save time and  
money

## Faster Time to Insights and More Value for Data

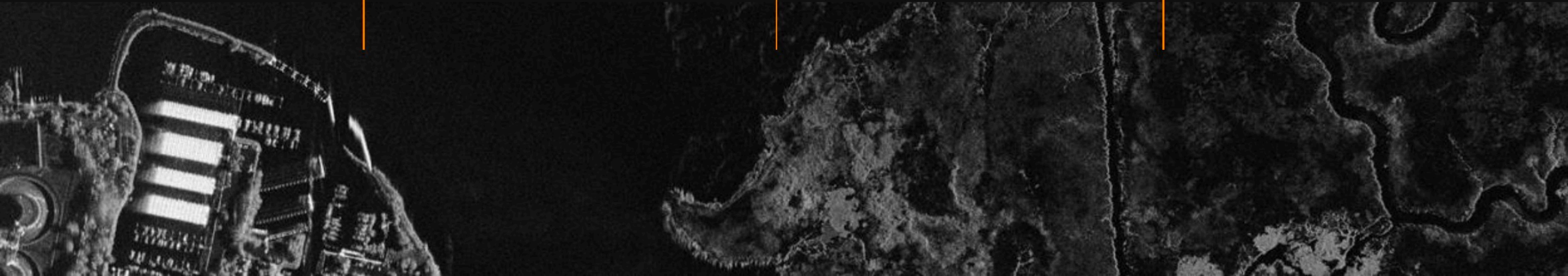
Easy access to  
high  
performance  
compute

## Managing and transforming data on earth and in space

Low-latency access  
to global cloud  
infrastructure

## Automating and Optimizing Space Systems

Virtualization and  
digital  
engineering



# Advantages of cloud computing

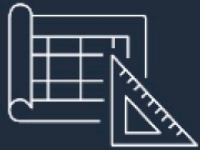
Cloud



Agility



Cost savings



Elasticity



Innovate faster



Deploy globally in  
minutes





# Thank you

**Guido Baraglia**

**Amazon Web Services**

Head of Space & Satellite EMEA

[gbaragli@amazon.it](mailto:gbaragli@amazon.it)



DAY 2

THURSDAY 8th JUNE 2023

# ENABLERS

## SESSION 5

### DIGITAL TRANSFORMATION IN SATCOM



#### Artificial Intelligence for Satcom



SPEAKER

**Alfonso Nunes**

Technology Business Development, CGI

# Space2Connect

Session 5 - Digital Transformation in Satcom

Afonso Nunes

June 2023

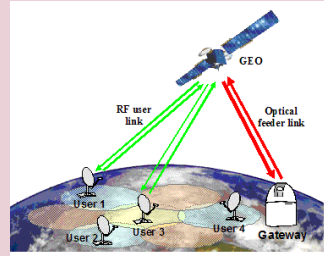


# Data, data and more data

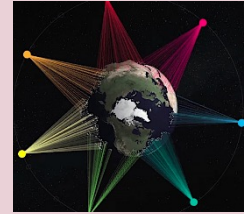
	Early Telecomms	Mobile Telephony	Internet and broadband	Mobile Data and Smartphones	Internet of Things (IoT)	5G and Advanced Technologies
Service	Voice services	Wireless cellular communications	Web browsing, emails, and file downloads.	Mobile apps, video streaming, social media usage	Sensors, wearables, smart home appliances	Improved speed, latency, and capacity
Technology	Circuit switching	GSM, SMS	3G / Packet switched networks	Higher capacity networks	M2M efficient protocols	Virtualization, SDN, NFV
Satcoms	Satphones	Satphones	DVB-RCS based offering	Maybe in the future	Wide offering and linked to vertical markets	NTN standardisation
Data per user per month	Kilobytes to Megabytes (just control data)	Megabytes to Gigabytes	Gigabytes to a few Gigabytes	Several Gigabytes to Tens of Gigabytes	Additional Megabytes to Gigabytes	Tens of Gigabytes to Hundreds of Gigabytes

# Satcom evolutions

**Softwarisation /  
Regeneration**



Bent pipe GEO satellite constellations



Software Defined Satellites

**New space  
technology**



Mega constellations



Intersatellite links

**Services  
offering**

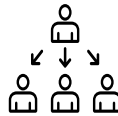
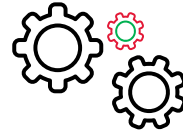


**Spacecrafts shorter life expectancy / shorter commercial cycles**

# The three main pillars for AI

## Data

- Quality
- Quantity
- Signature



## Subject matter expertise

- Domain knowledge
- Business processes (modelling and development)
- Software engineering
- Data science

## Product

- Host existing function
- Components that can be replaced or enhanced with ML designs

# Satcom Use Cases and Applications are still limited today



## Research

**Beam hopping optimization**  
**Anti-jamming**  
**Network Traffic Forecasting**  
**Channel Modeling**



**Most simulation based**

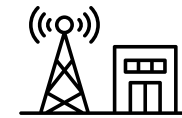


## ESA Experimentation

**MLSat**  
**SatAI**



**Use cases using ML, some with real operational data**



## Operation

**Support NMS real-time decision making**



**Based on a COTS product**

# AI will more likely succeed in Network and Operations





**Thank you!**

DAY 2

THURSDAY 8th JUNE 2023

# ENABLERS

## SESSION 5

### DIGITAL TRANSFORMATION IN SATCOM



**Automation & orchestration of megaconstellations**



SPEAKER

**Enrique Fraga Moreira**

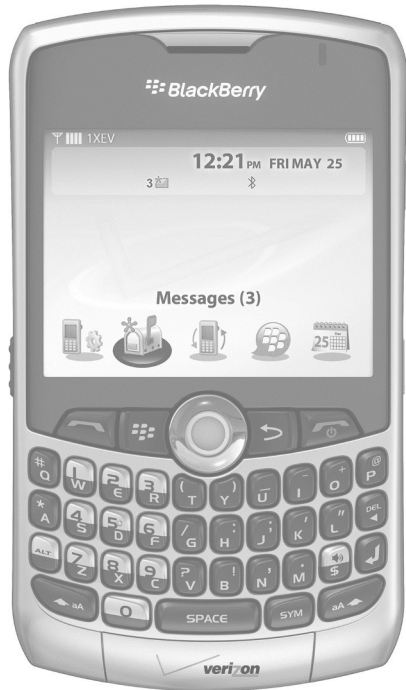
Director of Space, GMV

# Digital transformation in Satcom

Automation & orchestration  
of megaconstellations



# Transformation



Yesterday

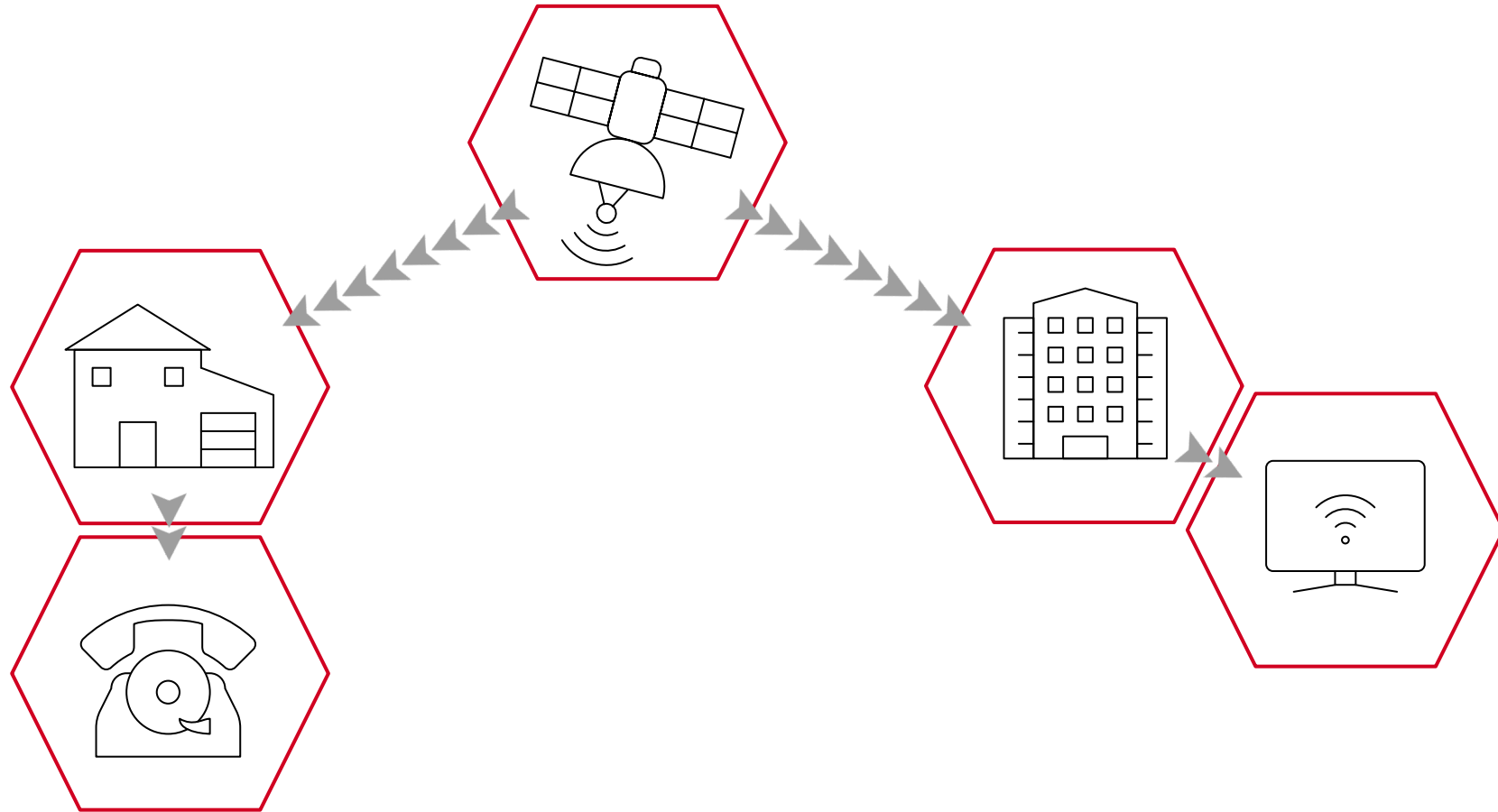


Today



Tomorrow

# Yesterday



Basic connectivity

# Yesterday

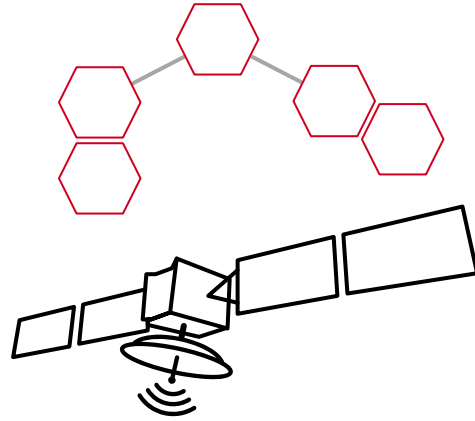


Needs: Basic connectivity

Satellites: Few, large

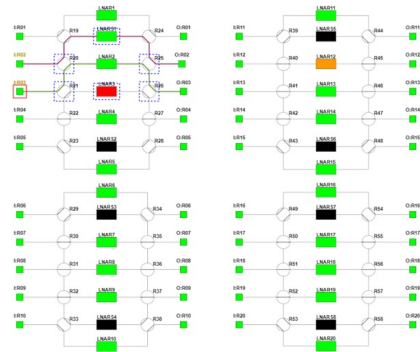
Satcom: Fixed services

Challenges: “Easy”

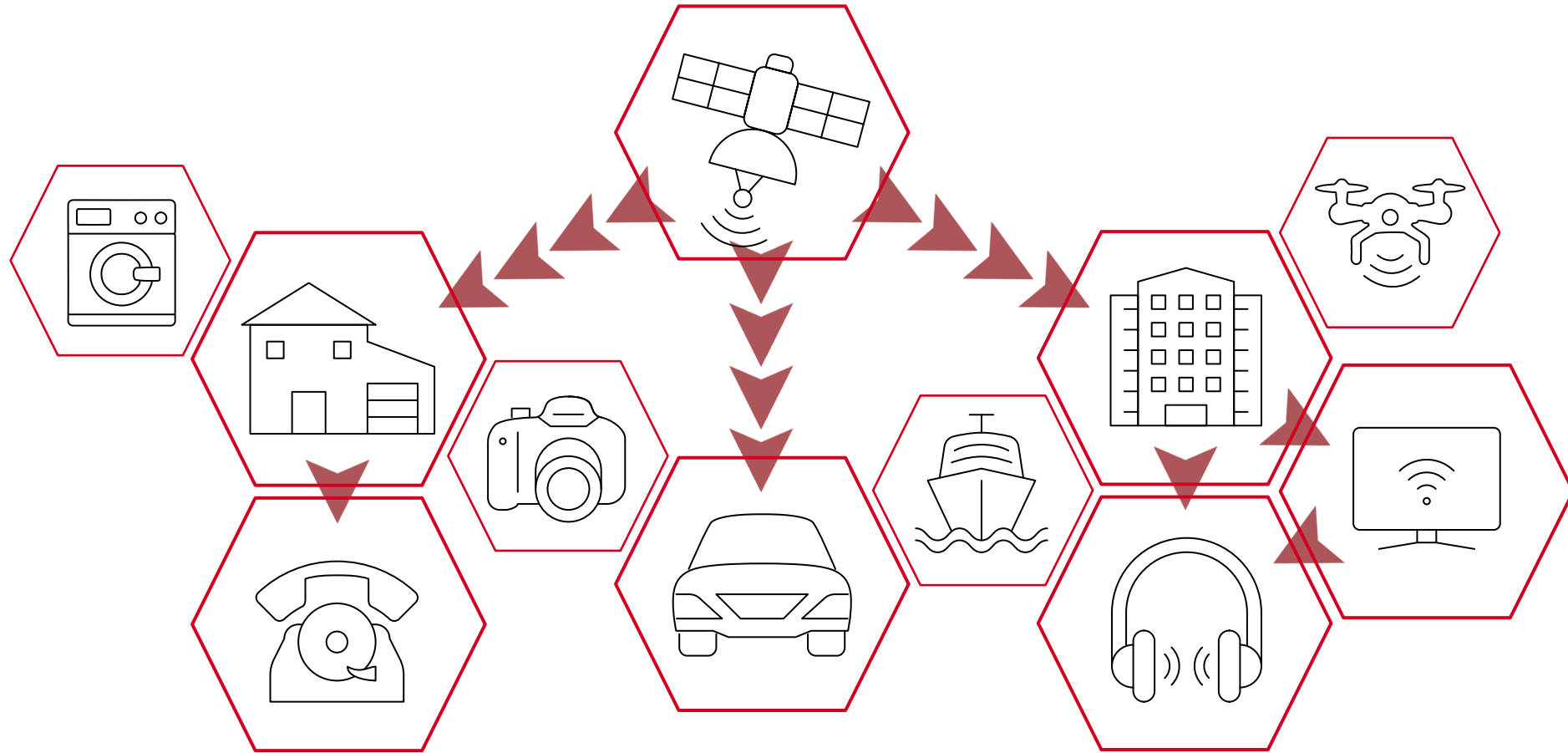


FSS  
BSS

Smartgrings



# Today



Hyperconnectivity

More bandwidth

Less latency

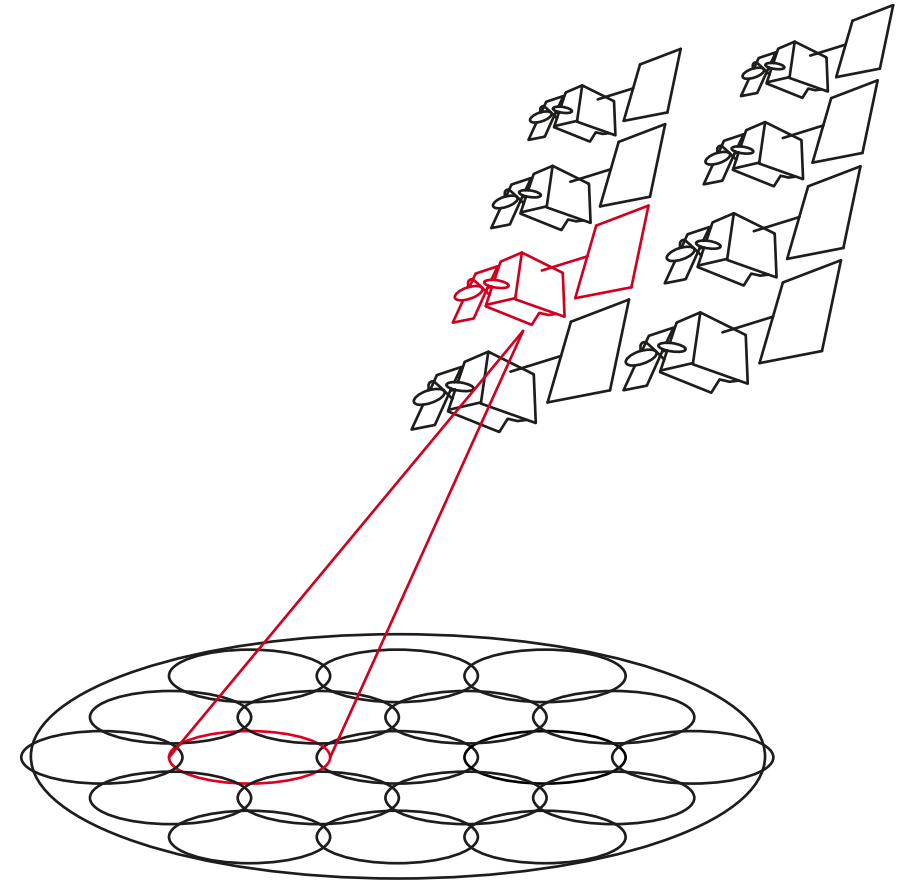
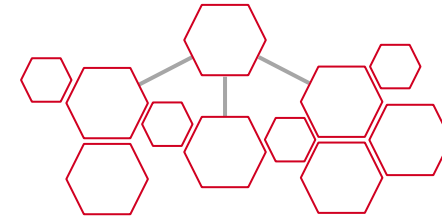
# Today

Needs: Hyperconnectivity, more bandwidth, less latency

Satellites: Many, small

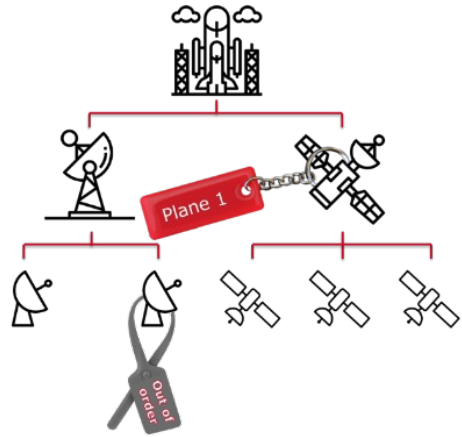
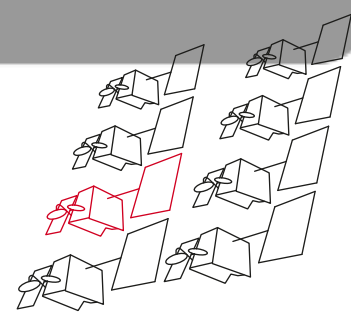
Satcom: HTS, software defined

Challenges: Dynamic constellation & dynamic service





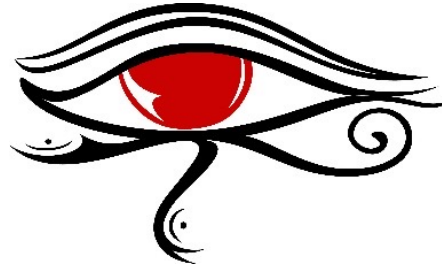
# Challenges: constellations



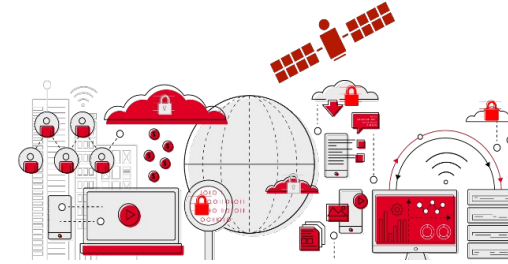
Multi-domain



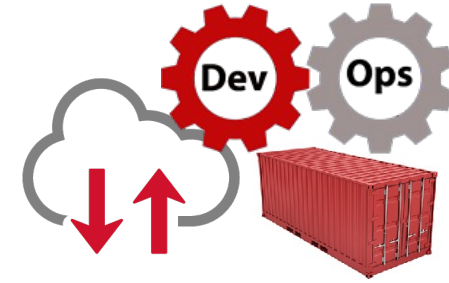
Automation



Situational awareness

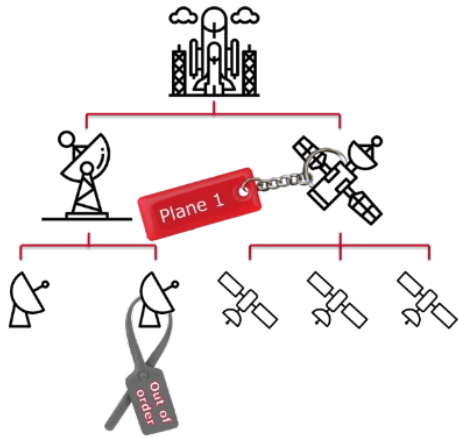
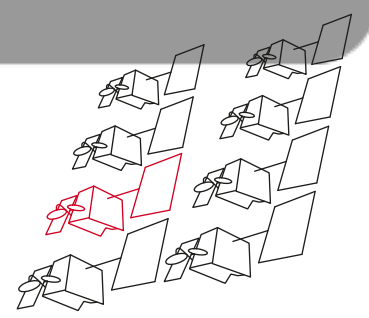


Data analytics



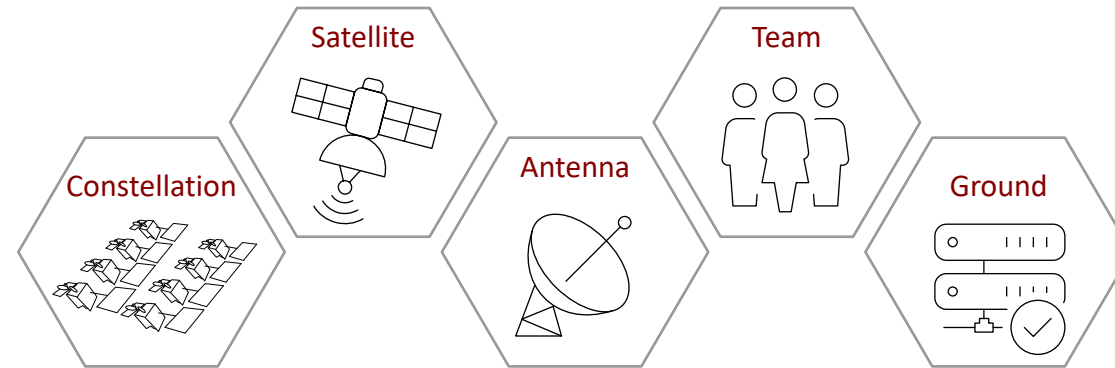
Flexibility

# Challenges: constellations



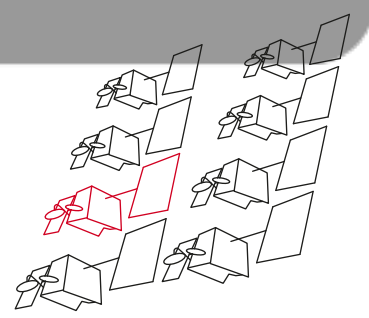
Multi-domain

Manage a **multi-domain ecosystem** in an **integrated** way



Supported by a **Constellation Data Model (ConDM)**

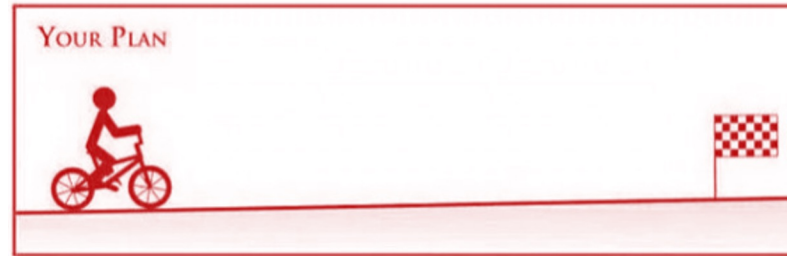
# Challenges: constellations



Automation



An automated operations orchestrator



Workflows based on rules

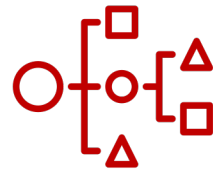
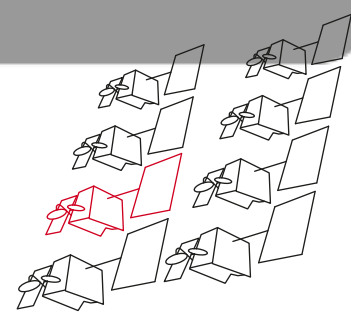
Constellation Query  
Language (ConQL)

**IF** [trigger<sub>(arg1,...,argN)</sub>] **THEN** [action<sub>(arg1,...,argN)</sub>]

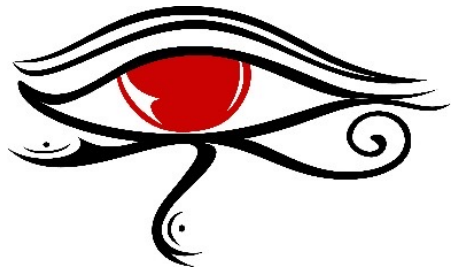
Rule

**satellite** and **tags**  
in (Launch3, FW\_VER1.3)

# Challenges: constellations



At a glance multi-domain KPIs, exploiting ConDM and ConQL



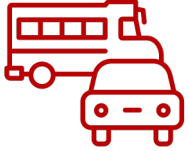
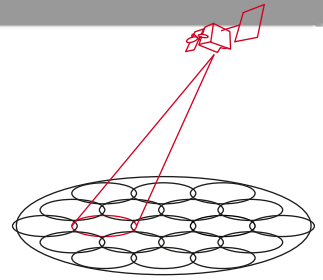
Situational awareness

*Fleetdashboard*

The screenshot displays the FleetDashboard interface with several key components:

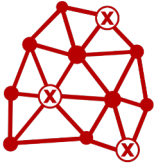
- Status Board:** A grid of 15 satellite status indicators (SL0001 to SL0015) with various colored icons representing their operational states.
- PLOTTING PLOT:** Three time-series plots showing data for parameters like AGE01\_0007, AGE01\_0004, and CCCI\_0001.
- Alerts/Events Table:** A table listing events with columns for Severity, Ack, Time, Site, Module, Domain, Type, and Description. It includes sub-tables for BATTERIES, MOVEMENT, and COMPASS CENTER.
- Right Panel:** A 'Detailed Status' section for SL0001, showing categories and a 'Fleet Watcher' section with a satellite constellation visualization.
- Bottom Right:** A video player for 'ISS HD Earth Viewing Experiment'.

# Challenges: Satcom



## Heterogeneous statistical nature of the input traffic

The traffic needs to be characterized for each case



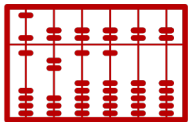
## Heterogeneous systems connections

Space and ground networks



## Dynamic

Both the input traffic and the network topology are time-varying



## Limited on-board resources (on each satellite)

Power and bandwidth mainly, but also computational capacity



## Radiofrequency resources are also limited

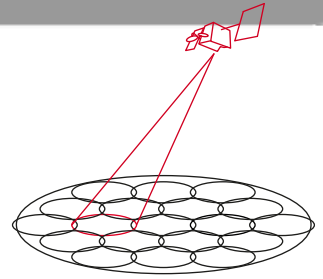
The RF spectrum is a critical and scarce natural resource



## Space segment flexibility, challenging management

Computationally intensive, even from the ground

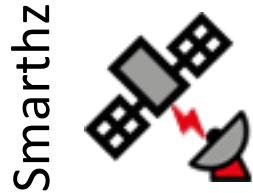
# Overcoming the challenges



## Payload Control System (PCS)



## Resource Management System (RMS)



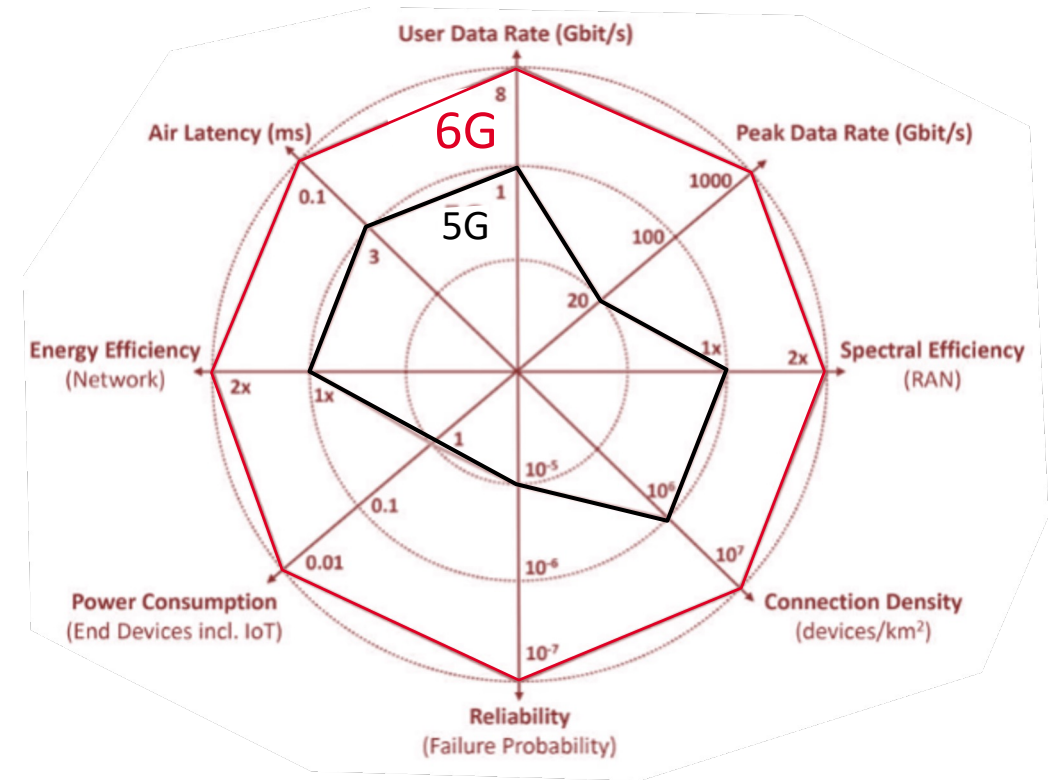
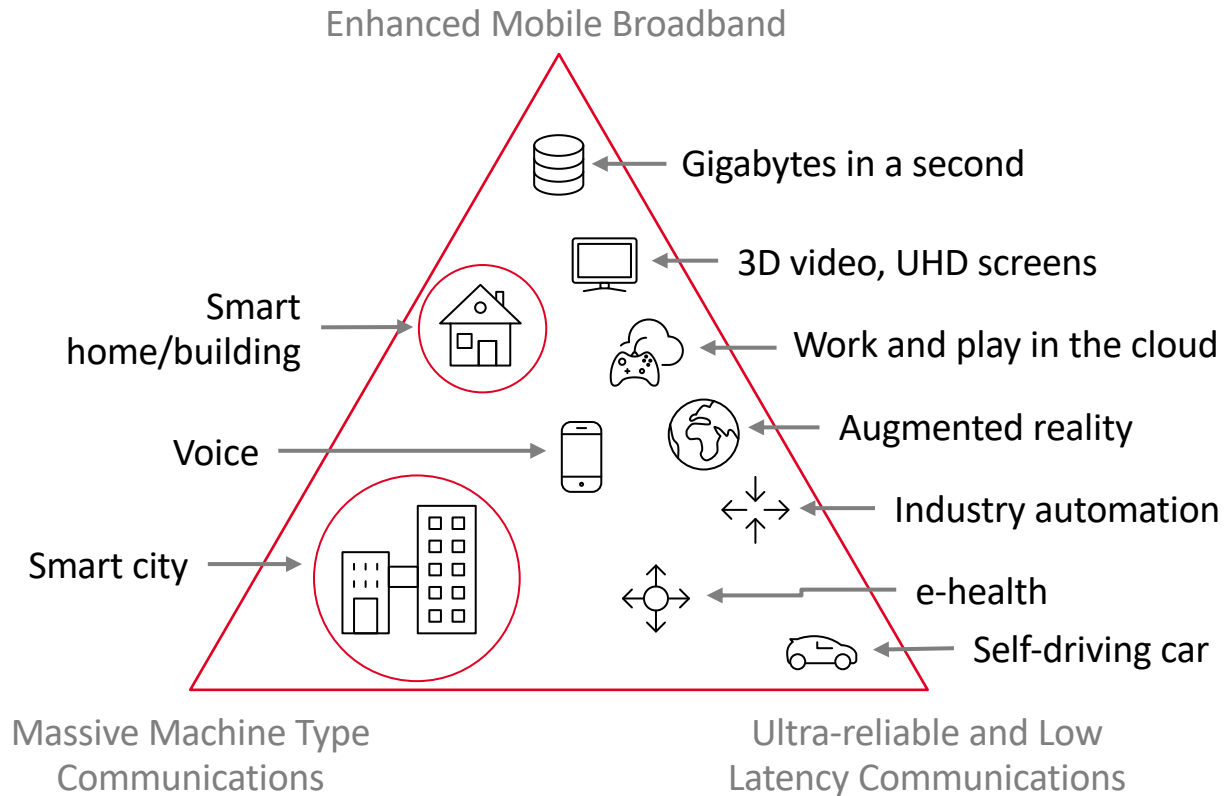
## Exploratory projects



# Tomorrow



Needs: Similar to today, but exacerbated



# Tomorrow



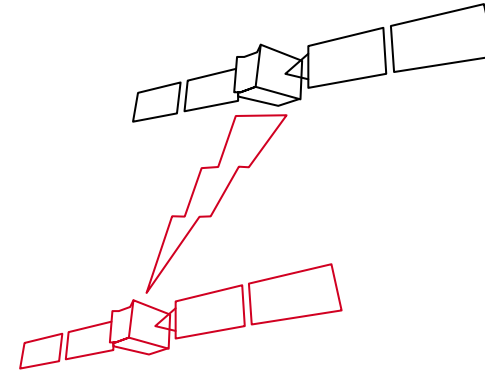
Needs:

Similar to today, but exacerbated

Satellites + **Satcom**:



Space-air-ground  
integration



Inter-satellite links

Everything **connects** to everything



# Tomorrow



Needs: Similar to today, but exacerbated

Satellites + **Satcom**: Everything **connects** to everything

Challenges:



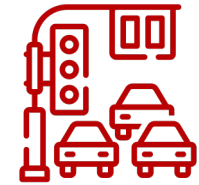
AI



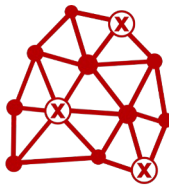
Software defined everything



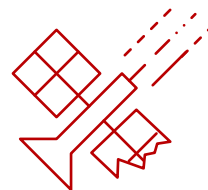
Prediction



Unattended real-time control loop



Self-organization (federation)



SSA

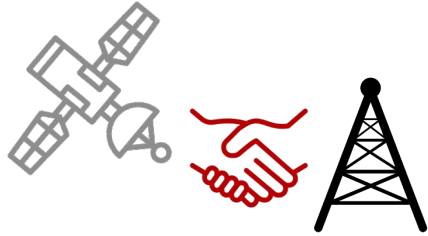


Standardization



Smart orchestration

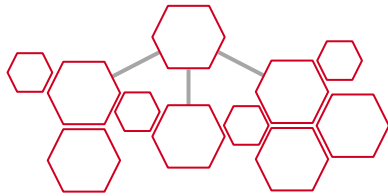
# Takeaways



Satcom hand in hand with telecom



Investment to foster innovation



Standardization for hyperconnectivity



Let's do this sustainably!

# Thank you

Enrique Fraga

DAY 2

THURSDAY 8th JUNE 2023

ENABLERS

## SESSION 5

### DIGITAL TRANSFORMATION IN SATCOM



#### Virtualisation of Satcom systems



SPEAKER

**Stuart Daughtridge**

Vice President Advance Technology,  
Kratos



# Virtualization of Satcom Systems

June 2023

# Digitalization/Virtualized Satellite Ground Systems

- A new way of thinking about satellite ground systems

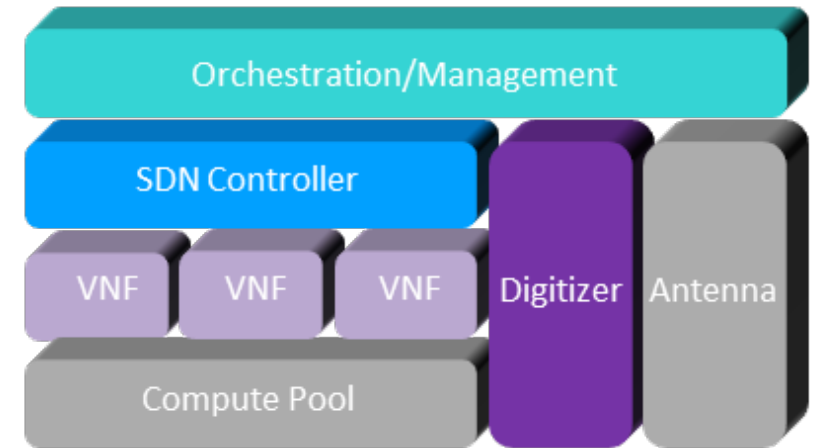
- ❑ **Digitally Transformed** infrastructure

- ❑ Hardware-centric components replaced with **Virtualized Network Functions**

- ❑ Deployable at scale within **Elastic and Cloud Agnostic** environments

- ❑ Dynamically orchestrated as **Service Chains** via industry-standard **NFVi/SDN** principles

- ❑ **Open and Secure** standards-based interfaces



A GLOBAL INITIATIVE



connecting digital ecosystems



MEF





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TOGETHER

