HTS Revolution is Here

Are you maximizing the HTS Opportunity?

Gilat Satellite Networks Webinar | November 24th 2015

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Agenda

- GEO-HTS landscape

- GEO-HTS supply and demand

- What ground-segment architecture is required to maximize the HTS opportunity?

- The HTS challenge in a nutshell

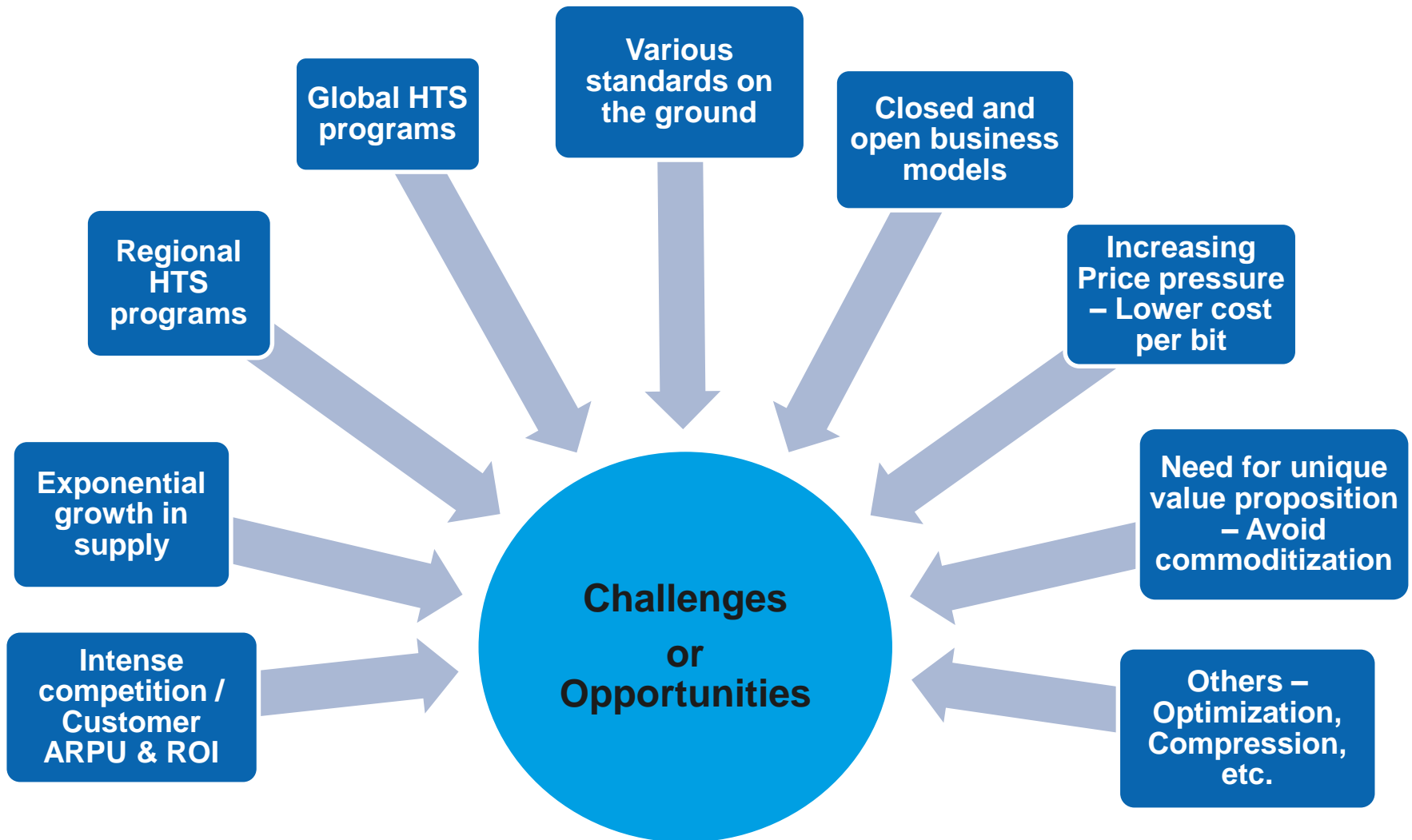- Five key points to meet the challenge

- Q&A

- Summary

Maximizing HTS Opportunities

The GEO-HTS Landscape

Challenges, Opportunities and Trends

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The HTS Game Change: Challenges or Opportunities

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Global HTS programs

Various standards on the ground

Closed and open business models

Regional HTS programs

Increasing Price pressure – Lower cost per bit

Exponential growth in supply

Need for unique value proposition – Avoid commoditization

Challenges or Opportunities

Intense competition / Customer ARPU & ROI

Others – Optimization, Compression, etc.

Market Targets

Opportunity Mix by Segment

Varied Opportunities = Varied Solutions? Or is simplicity the key?
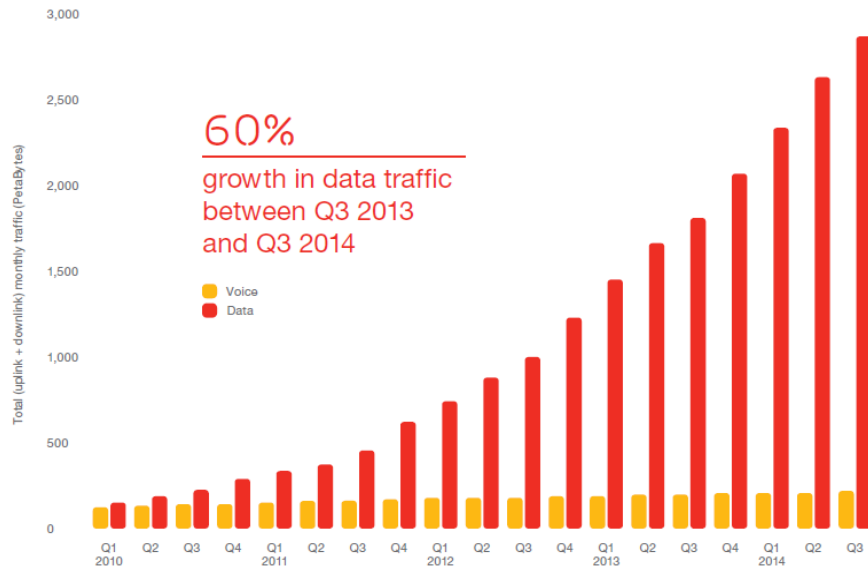
Broadband Access is the most cost-driven segment.

Enterprise VSAT require high SLA.

Wireless Backhaul on Land-based Towers need better cost structures to justify ROI.
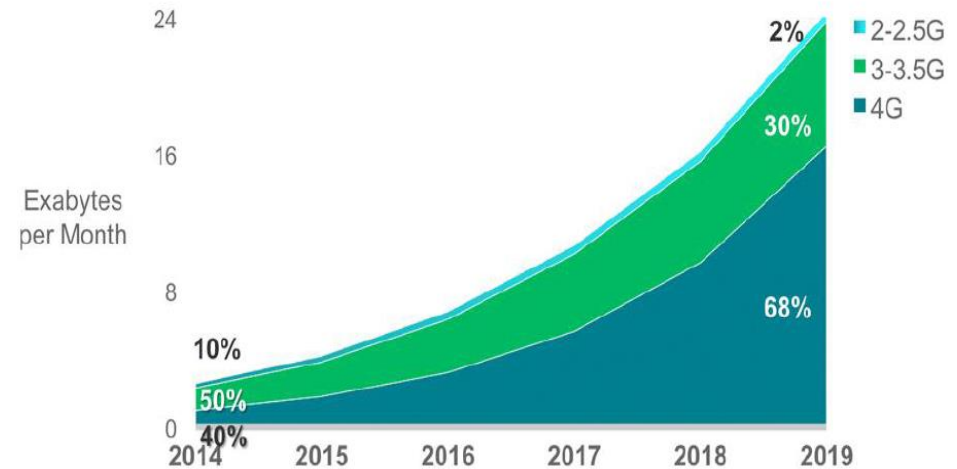
Mobility provides high growth opportunities – a "real" market opportunity.

In all these segments, the key to market success is lower cost structures for CAPEX and OPEX or TCO.

Market Trends – Wireless Industry

60% growth in data traffic between Q3 2013 and Q3 2014

Voice
Data

Source: Ericsson

Exabytes per Month

2-2.5G
3-3.5G
4G

2%
30%
68%
10%
50%
40%
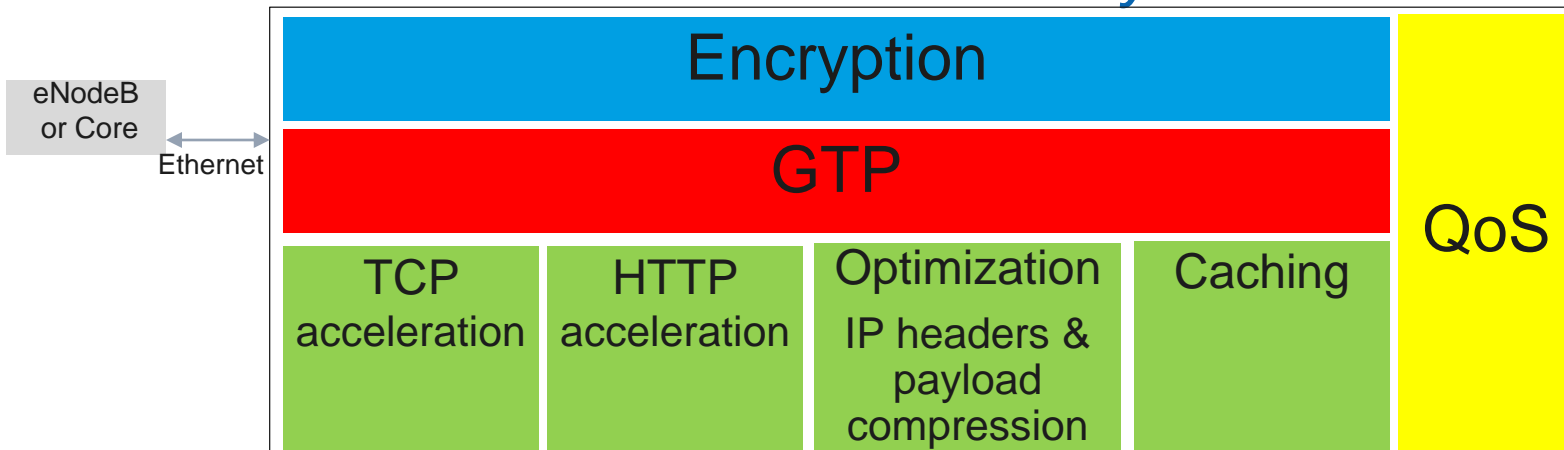
Source: Cisco VNI Mobile, 2015

Source: Cisco

- Ericsson tracked historical traffic and found that data traffic grew at explosive levels from 2010 to 2014.
- Cisco forecasts continued growth from 2014-2019 where 30% of traffic will be 3G and close to 70% of traffic will be 4G.
- Only 2% will be on 2G networks, and this is **NOT** where the satellite industry needs to be.

For the satellite industry to address these trends in 4 short years, CAPEX, OPEX and TCO need to improve dramatically in order to participate in 4G. This is where GEO-HTS' opportunity lies.

Market Trends – Application-Layer Compression and Optimization

Great opportunities to achieve higher efficiency via multi-layer optimization and compression techniques

- **Efficiencies on top of those achieved with existing satcom infrastructure**
    - Optimization and compression techniques tend to be Application-specific
- **Wireless Backhaul is an ideal application where high-ROI savings can be realized via multi-layer optimization and compression**
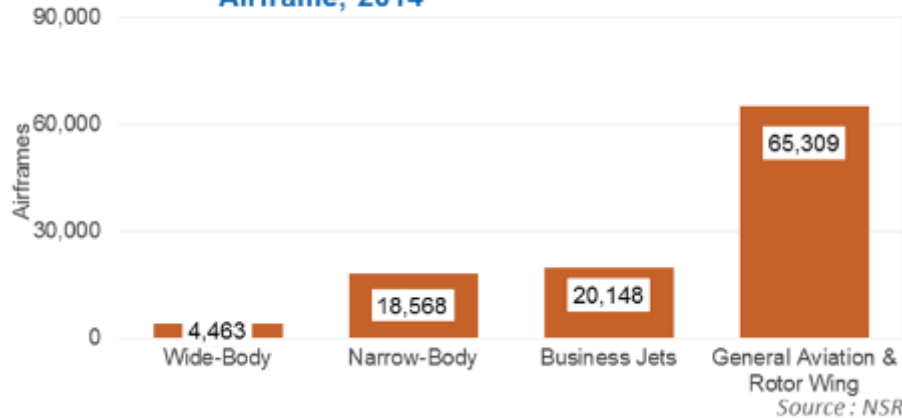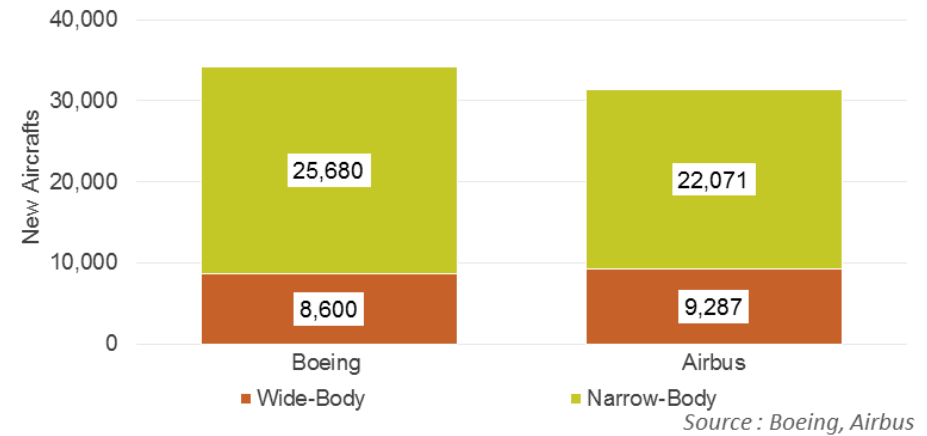
VSAT Embedded Functionality

eNodeB or Core

Ethernet

Encryption				QoS
GTP				
TCP acceleration	HTTP acceleration	Optimization IP headers & payload compression	Caching	

Source: Gilat SkyEdge II-c

3G & LTE backhaul optimization & acceleration ideally done within VSAT equipment for best QoS and cost reduction

Market Trends – Aero Mobility

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Aeronautical Satcom Addressable Market by Airframe, 2014

Source : NSR

Total New Aircraft Orders, 2013-2033

Source : Boeing, Airbus

Cockpit Communications

Cabin & Crew Communications

Internet Access

Electronic Flight Bag

Entertainment

Maintenance

Engine Monitoring

HTS value proposition based on higher throughput will play a major role in the aeronautical connectivity market.

GEO-HTS Supply and Demand

The Market Dynamics

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GEO-HTS Capacity Supply

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Global GEO-HTS C-band Bandwidth Supply

Global GEO-HTS Ku-band Bandwidth Supply

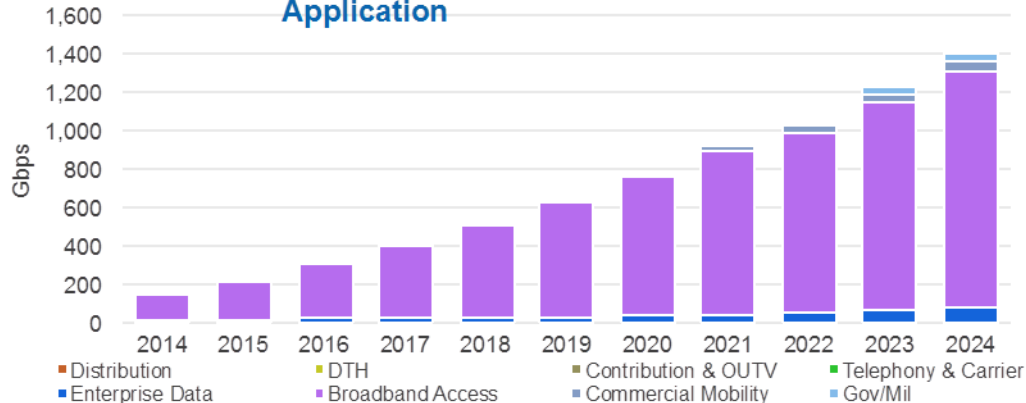### Global GEO-HTS Ka-band Bandwidth Supply

- GEO-HTS is driven by cost advantages, which is different depending on the frequency.

- Coupled with the potential over-supply of all types of GEO-HTS, declining cost structures will be a key trend affecting the solution mix.

What does this mean for ground terminal equipment?

GEO-HTS Capacity Demand & Revenues

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Global GEO-HTS Ka-band Bandwidth Demand by Application

- Distribution
- Enterprise Data
- DTH
- Broadband Access
- Contribution & OUTV
- Commercial Mobility
- Telephony & Carrier
- Gov/Mil

- GEO-HTS bandwidth demand is expected to be dominated by Broadband Access.

- All other applications require relatively low bandwidth support.

- In revenue terms, however, the market is more equalized.

- Broadband Access is a "high volume/low margin" business.

- Other applications fetch better prices and margins.

Global Revenues for Leased GEO-HTS Bandwidth by Application

- Distribution
- Enterprise Data
- DTH
- Broadband Access
- Contribution & OUTV
- Commercial Mobility
- Telephony & Carrier
- Gov/Mil

Ground equipment has to address these differences.

GEO-HTS Demand – Broadband Access
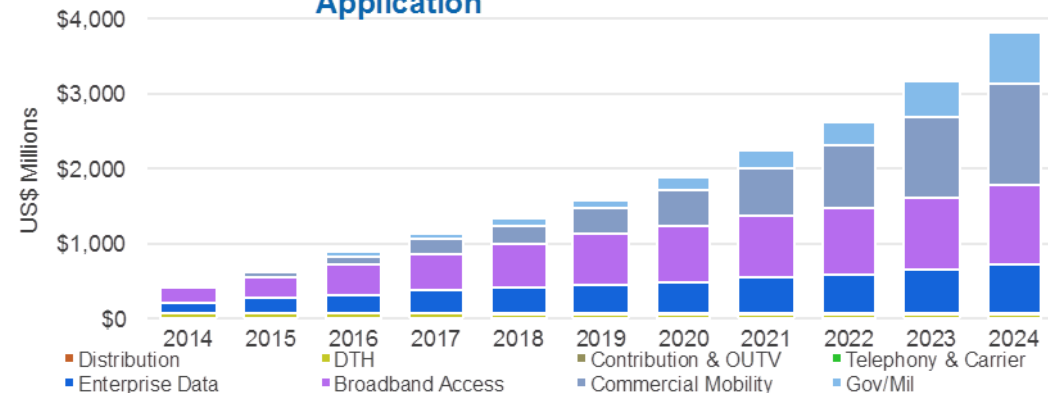
Global Broadband Access TPE & Bandwidth Demand
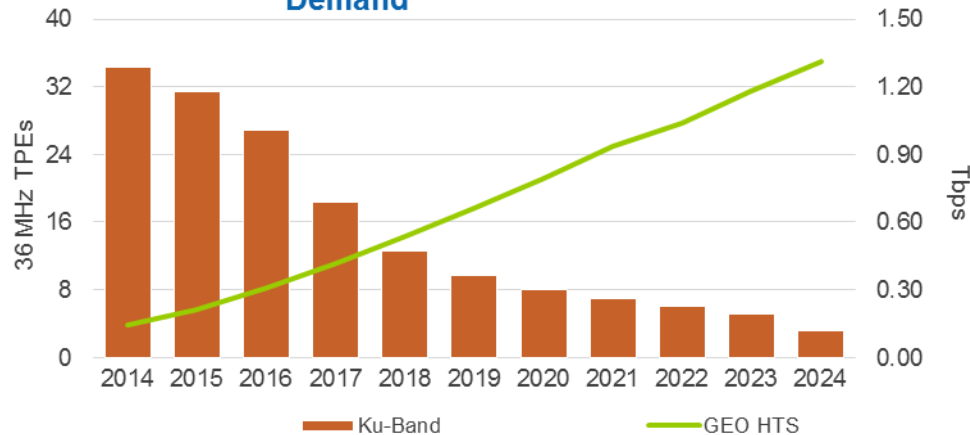
- Ku-Band
- GEO HTS

Global Broadband Access Subscribers by Geography
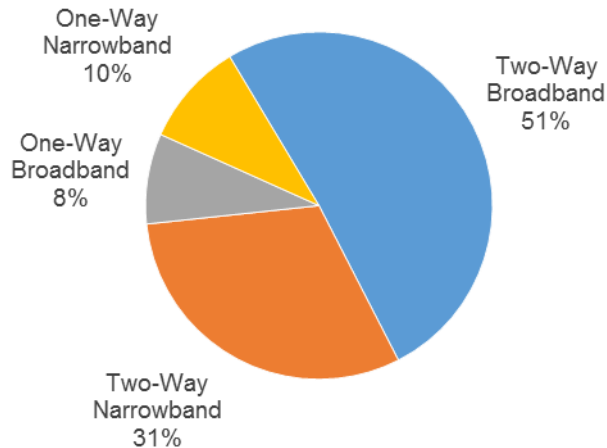

- Rural / Remote
- Sub-urban
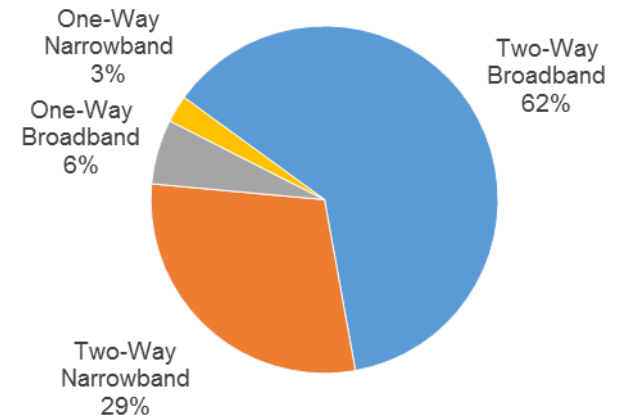- Urban
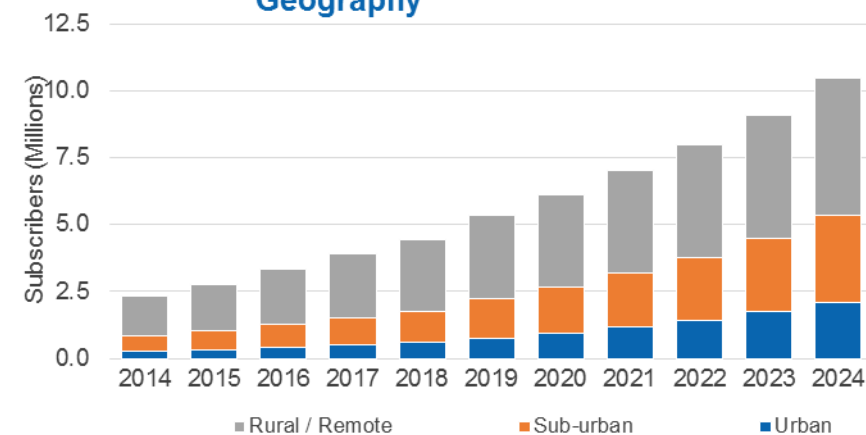
A Rapid Market shift:
- Ku-band usage to decline
- GEO-HTS to grow at robust levels
- **Equipment needs to adapt and evolve RAPIDLY as well; OR keep up with anticipated increase in bandwidth requirements**

GEO-HTS opens up opportunities in non-traditional satellite service areas – Urban markets

GEO-HTS Demand – Enterprise VSAT

Global Enterprise VSAT Networking Sites, 2014

- One-Way Narrowband 10%
- One-Way Broadband 8%
- Two-Way Broadband 51%
- Two-Way Narrowband 31%

Global Enterprise VSAT Networking Sites, 2024

- One-Way Narrowband 3%
- One-Way Broadband 6%
- Two-Way Broadband 62%
- Two-Way Narrowband 29%

Shifting Requirements and Platforms:

- Narrowband to Broadband
- One-way to Two-way
- **What is the best platform to address these market shifts?**

Opportunities abound for GEO-HTS but do not forget the challenges. Reliability, availability, high SLA will be key in GEO-HTS' success.

GEO-HTS Demand – Wireless Backhaul

Global Fixed Land Towers Wireless Backhaul HTS Capacity Demand by Frequency

Source : NSR
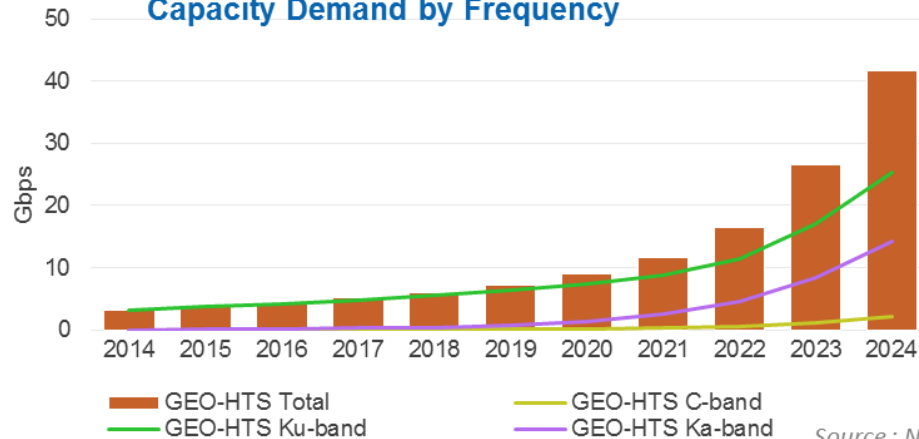
Emerging regional mix

- Asia to dominate.

- Other regions join in by 2021.

**What is the best frequency choice?**

What will be required of equipment manufacturers?

A diverse customer base

- Tier 1 telcos can better provision services in rural and underserved areas for USO.

- Tier 2 telcos can leapfrog and compete aggressively with Tier 1 service providers.

What type of equipment will be the best fit per customer?

Global GEO-HTS for Wireless Backhaul Services by Region

Source : NSR

GEO-HTS Demand – Aero Mobility
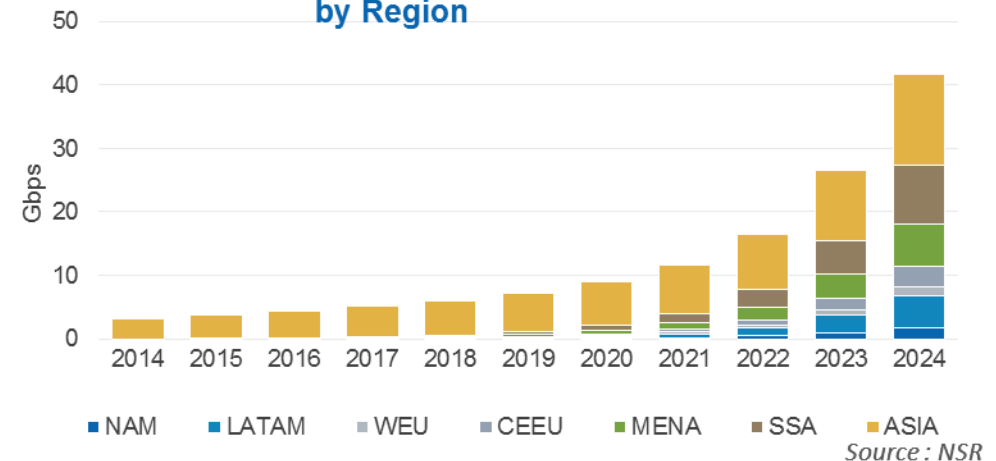
VSAT Connectivity by Airframe

- At the current rate of installs, the **wide-body market segment has the fastest market penetration.**

  - The installs on **HTS systems will help reach over 87% penetration rate by the end of 2024.**

  - More OEM deals will have a positive impact on adoption rate.

Aeronautical VSAT Penetration Rate

Legend: Wide-Body — Narrow-Body — Business Jets — Total

Source : NSR

- High throughput connectivity on long-haul flights will become a differentiating factor for many established players.

- VSAT penetration rate still low on business jets, but market is clearly growing but since it is used for shorter flights, the justification for taking up VSAT connectivity is not always present.

GEO-HTS Demand – Maritime Mobility
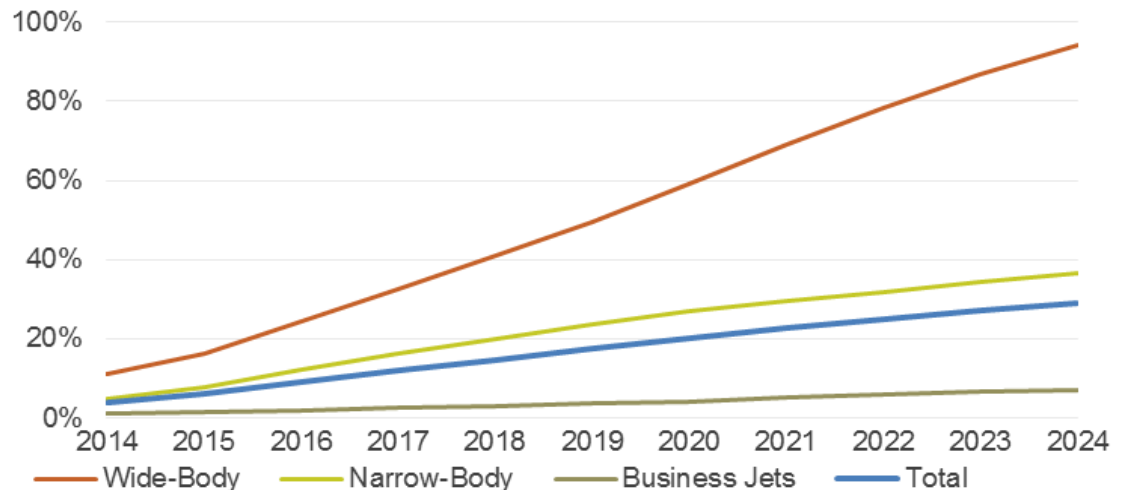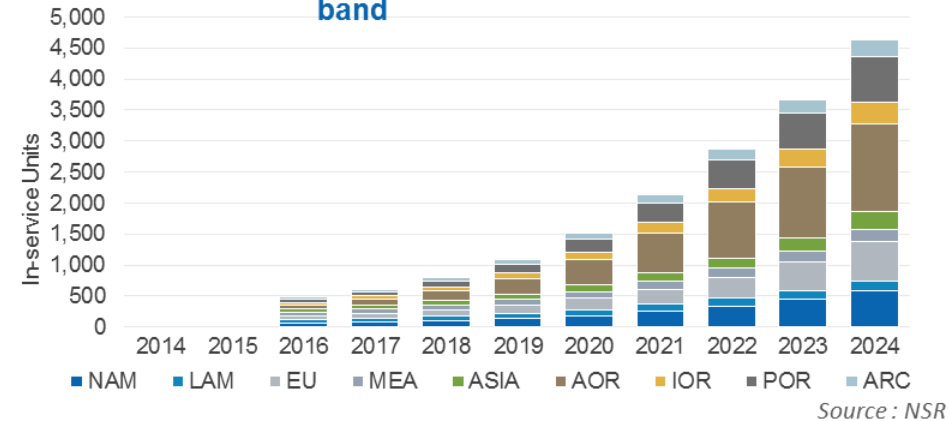
Global Maritime In-service Units GEO-HTS, C-band

Source : NSR
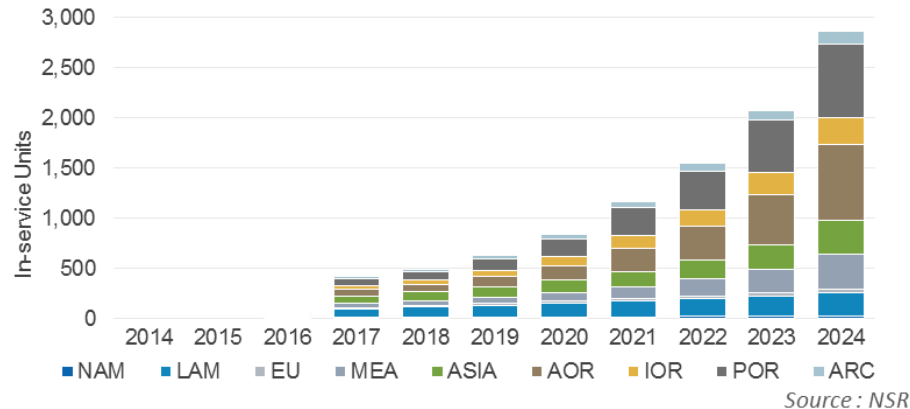
Global Maritime In-service Units GEO-HTS, Ku-band

Source : NSR

Global Maritime In-service Units GEO-HTS, Ka-band

Source : NSR
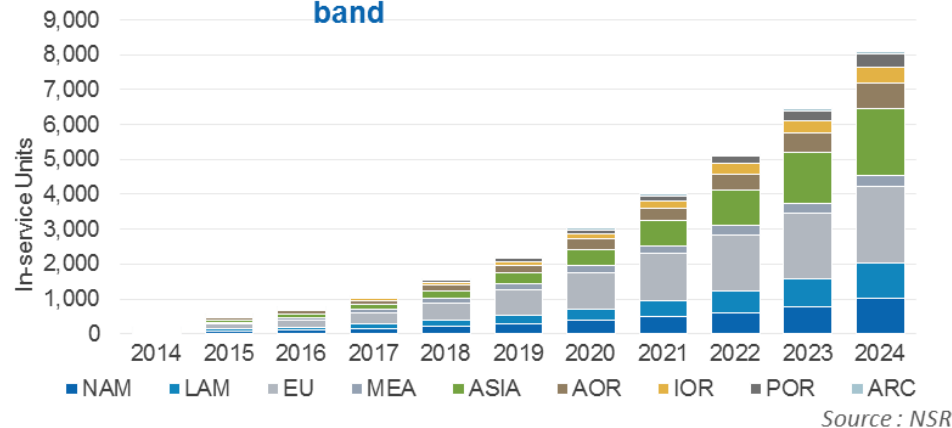
A nascent market

- GEO-HTS maritime market is just beginning to take hold.

- All HTS frequency platforms are expected to grow at high levels.

# What Ground Segment Architecture is Required to Maximize the HTS Opportunity?

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The Quick Answer Is: You Need a Ground Segment Architecture that Enables

High Flexibility

Low OPEX

Low CAPEX

High Scalability

High Availability

High Density

High Efficiency

Multiple Markets

Multiple scenarios

The HTS Challenge in a Nutshell

What is the Big Change with HTS?

- Additional capacity
- Faster data rates
- At lower prices

Ka
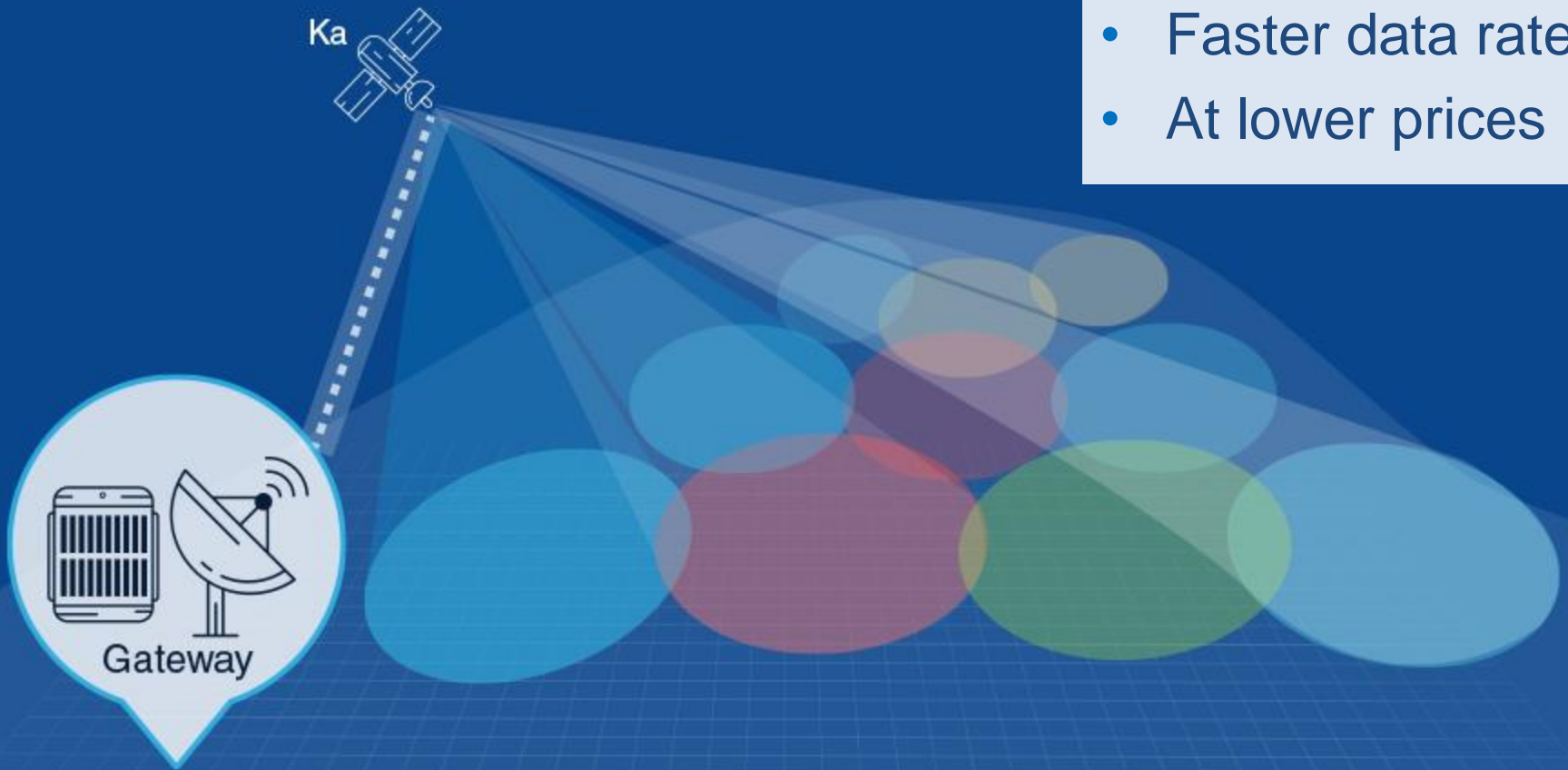
Gateway

Example: Wide Beam vs. Multi Spot Beam

Scenario A: A traditional **wide-beam** satellite with a payload of **1.1GHz**, or approximately **2Gbps,** is comprised of a *single wide beam*.

Scenario B: A **multi-spot-beam** satellite with a payload of **10.5 GHz,** or approximately **21Gbps**, is comprised of **21 spot beams.**
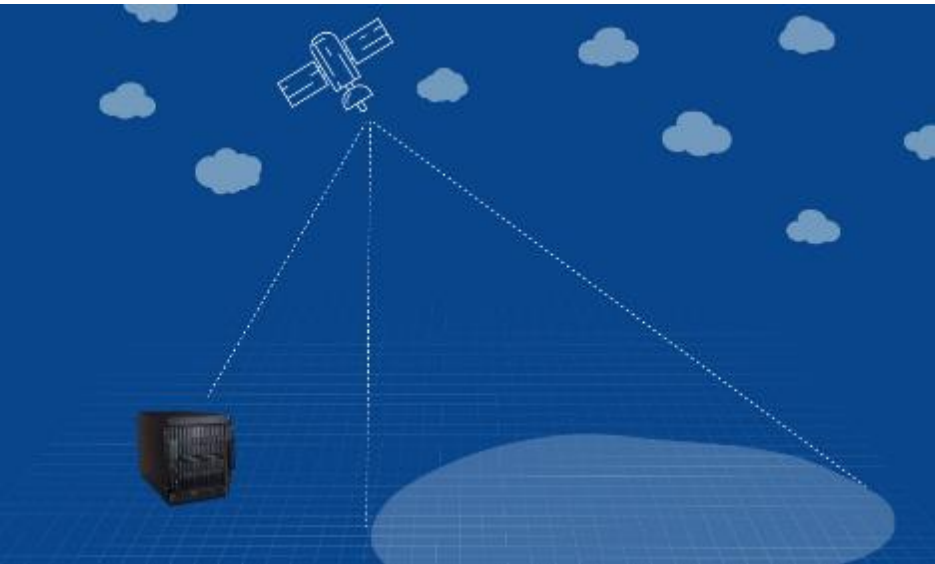
Baseband equipment in 1 gateway lights up the wide beam.
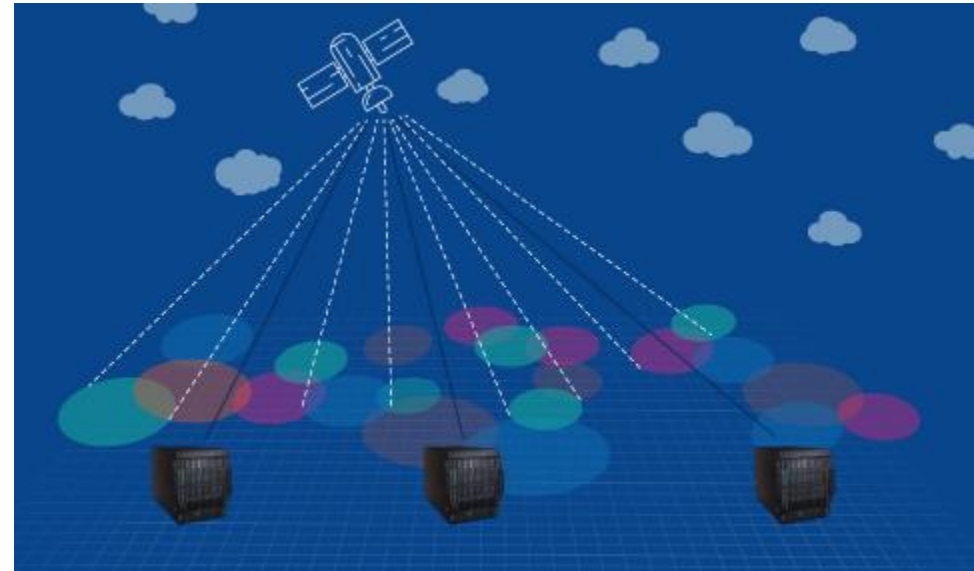
Baseband equipment is spread over 3 gateways to light up the 21 beams.
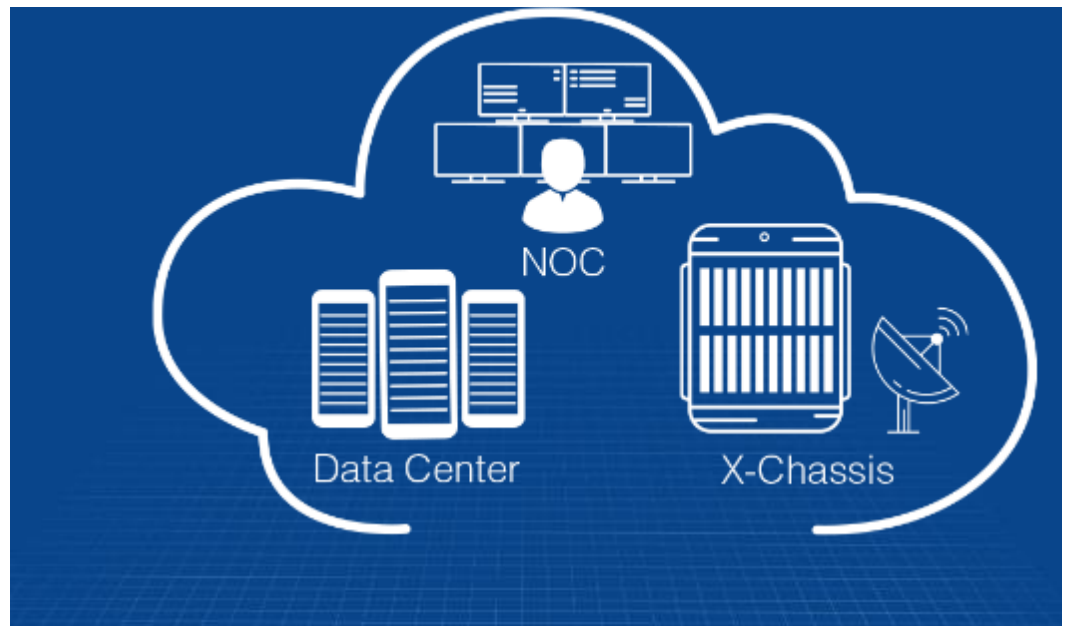
Multi Spot Beam Implications

A. Business models change

B . Ground segment change

What is Required of the Ground Segment

1 CLOUD-BASED DISTRIBUTED ARCHITECTURE

2 SUPPORT FOR MULTIPLE MARKETS

3 EFFICIENT BANDWIDTH MANAGEMENT

4 NETWORK SCALABILITY & FLEXIBILITY

5 REDUCED OPEX/CAPEX

What is Required of the Ground Segment

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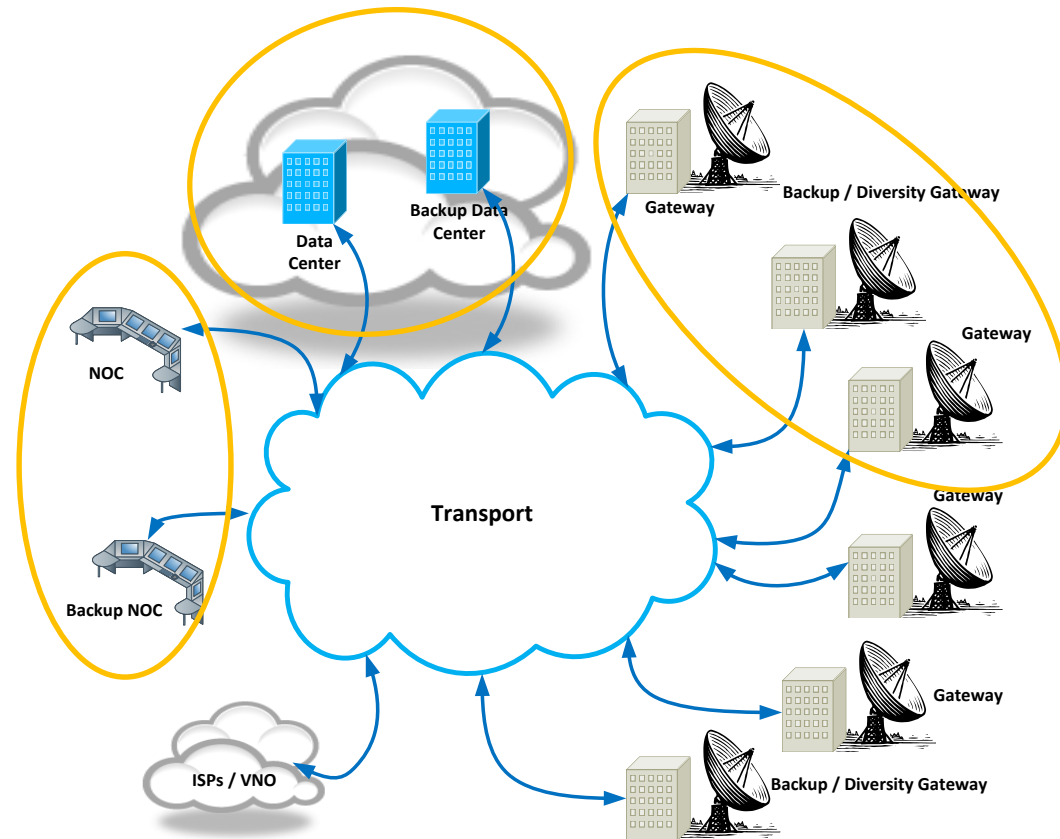
4 NETWORK SCALABILITY & FLEXIBILITY

5 REDUCED OPEX/CAPEX

Cloud Based Distributed Architecture

Maximum network flexibility with dynamic resource allocation among applications or across beams
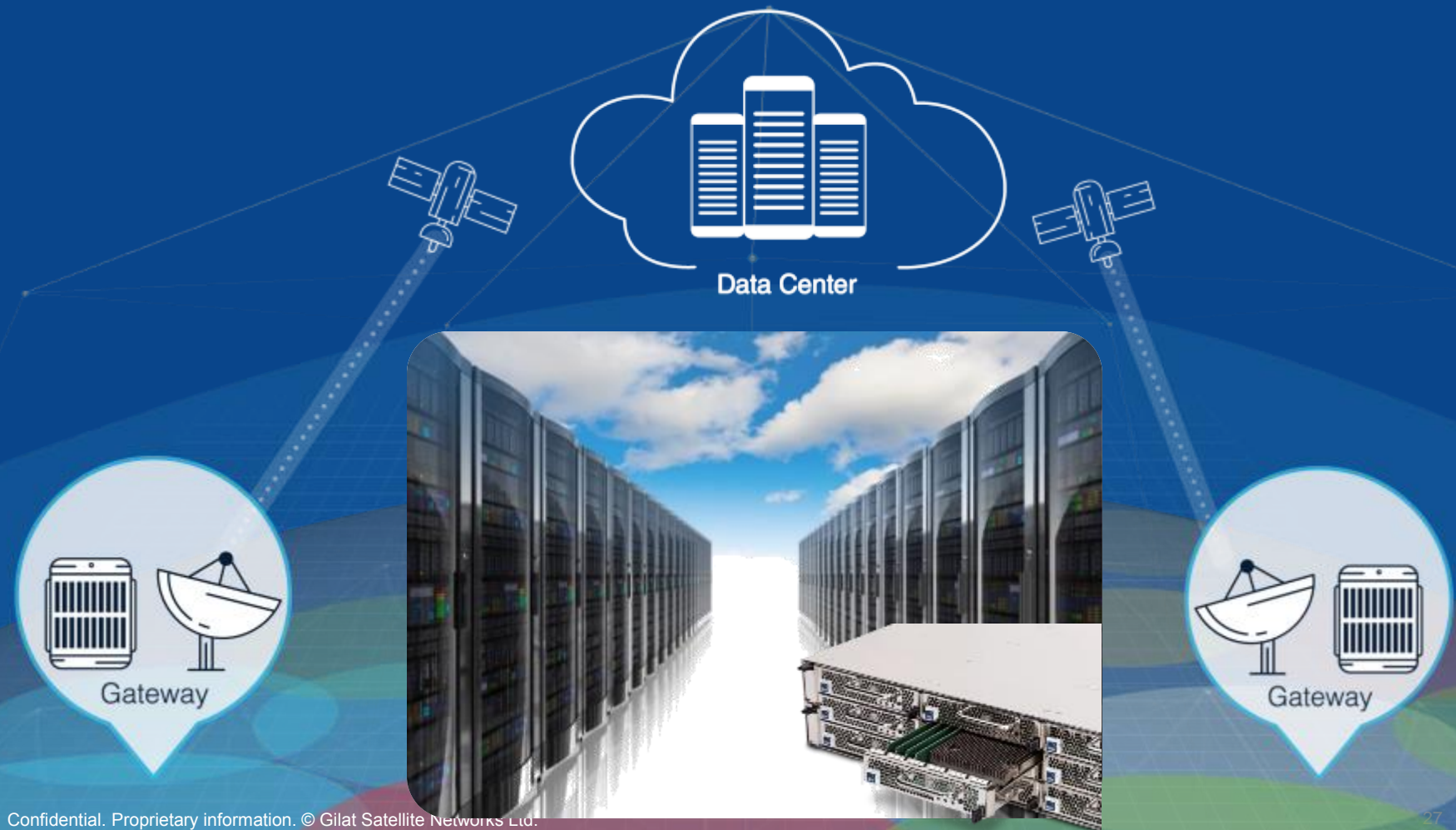
- **Baseband RX/TX**

- **Data Processing**
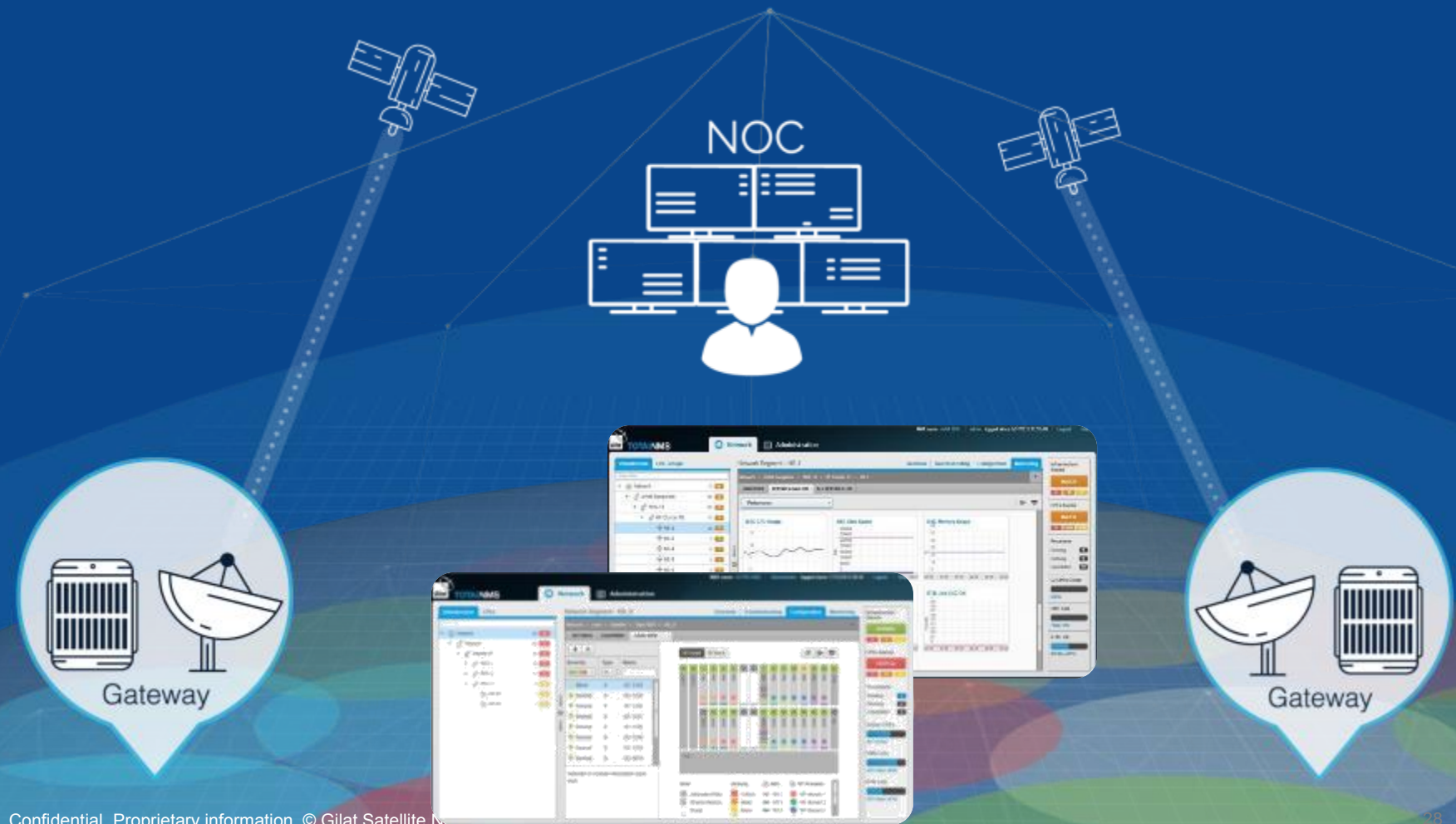
- **Network Management**

Distributed Architecture for Flexibility
High Density Data Processors

Data Center

Gateway

Gateway

Distributed Architecture for Flexibility
Global Network Management System

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One Platform – Multiple Markets

Multiple Markets Support by Multiple VSATs

ONE PLATFORM

Trains

Aviation

Broadband

Maritime

Enterprise

Cellular

What is Required of the Ground Segment

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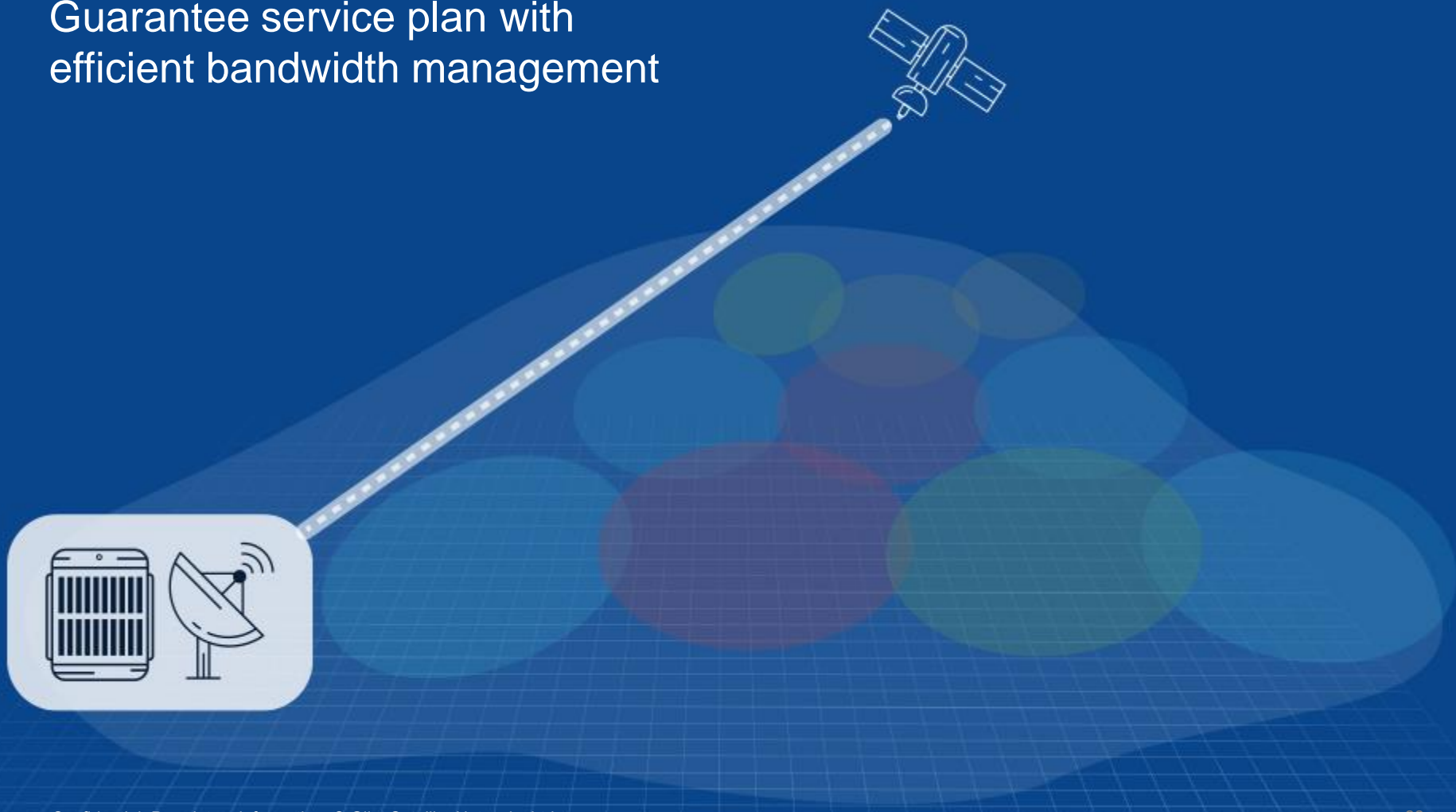
4 NETWORK SCALABILITY & FLEXIBILITY

5 REDUCED OPEX/CAPEX

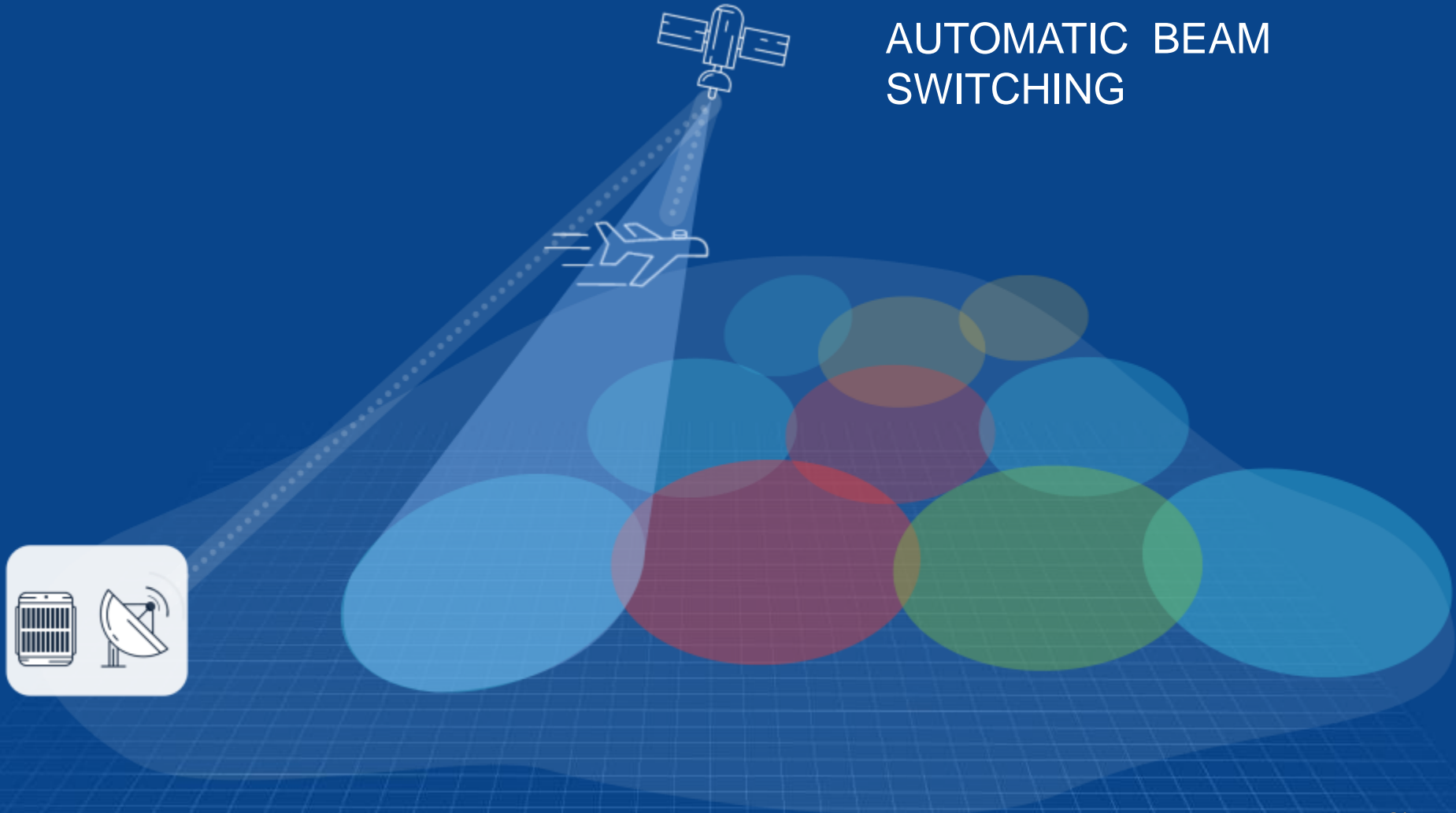# HTS Aggregate Capacity - Spread Across Multiple Carriers and Beams

Guarantee service plan with efficient bandwidth management

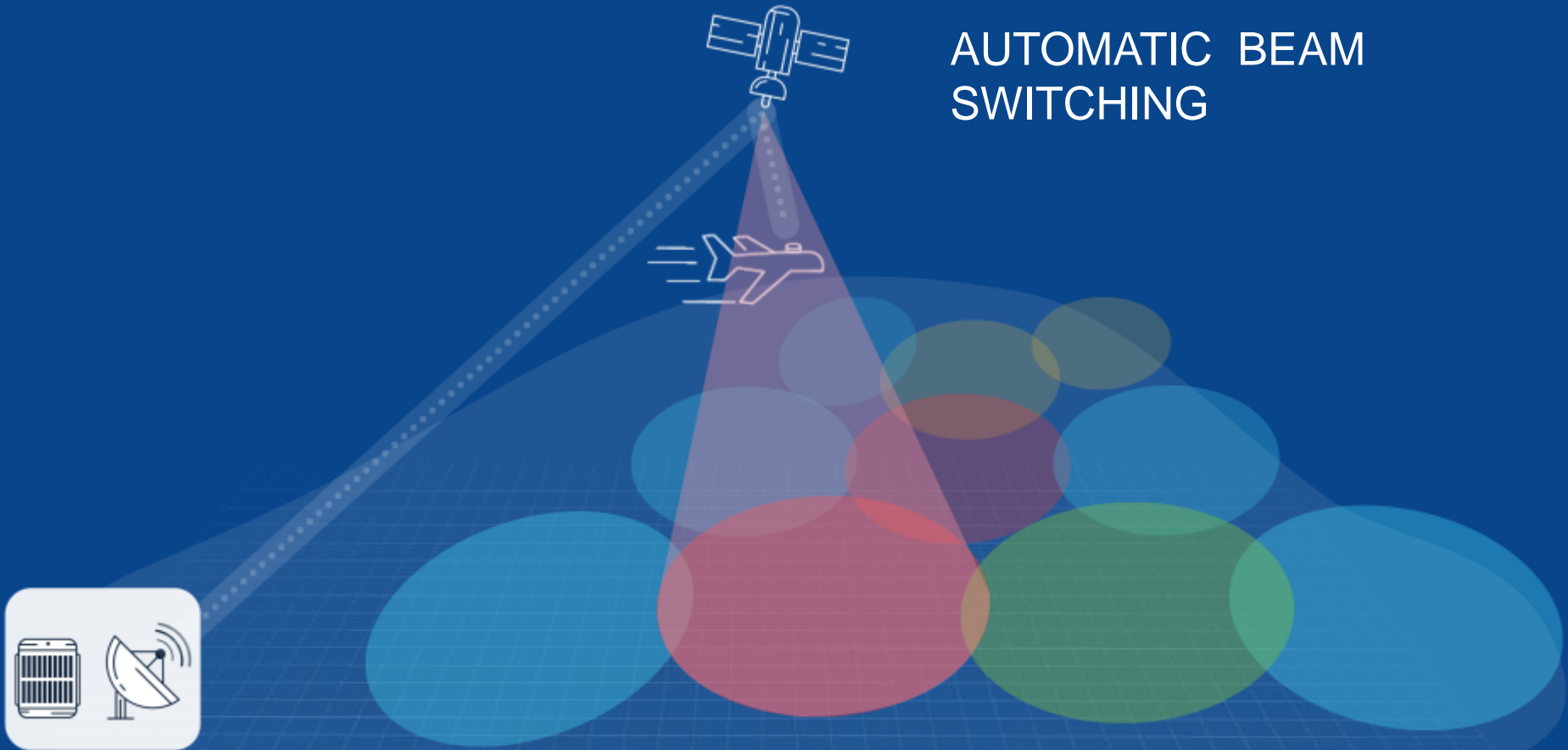# Maintain Continuous Coverage in Land Sea & Air While On-the-Move

AUTOMATIC BEAM SWITCHING

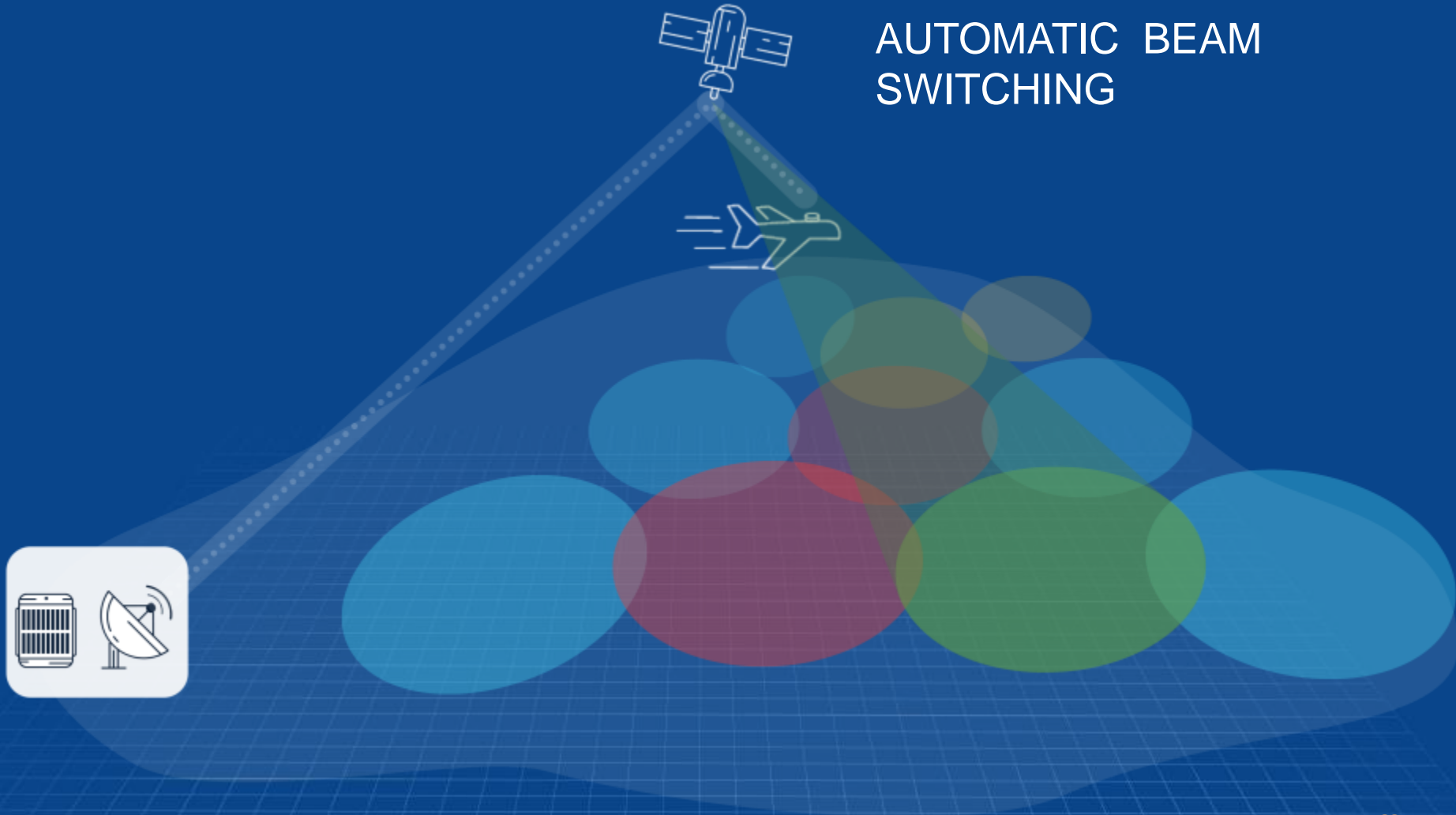# Maintain Continuous Coverage in Land Sea & Air While On-the-Move

AUTOMATIC BEAM SWITCHING

Maintain Continuous Coverage in Land Sea & Air While On-the-Move

AUTOMATIC BEAM SWITCHING

What is Required of the Ground Segment

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3 EFFICIENT BANDWIDTH MANAGEMENT

4 **NETWORK SCALABILITY & FLEXIBILITY**

5 REDUCED OPEX/CAPEX

Flexibility - Any Satellite in Any Frequency Band
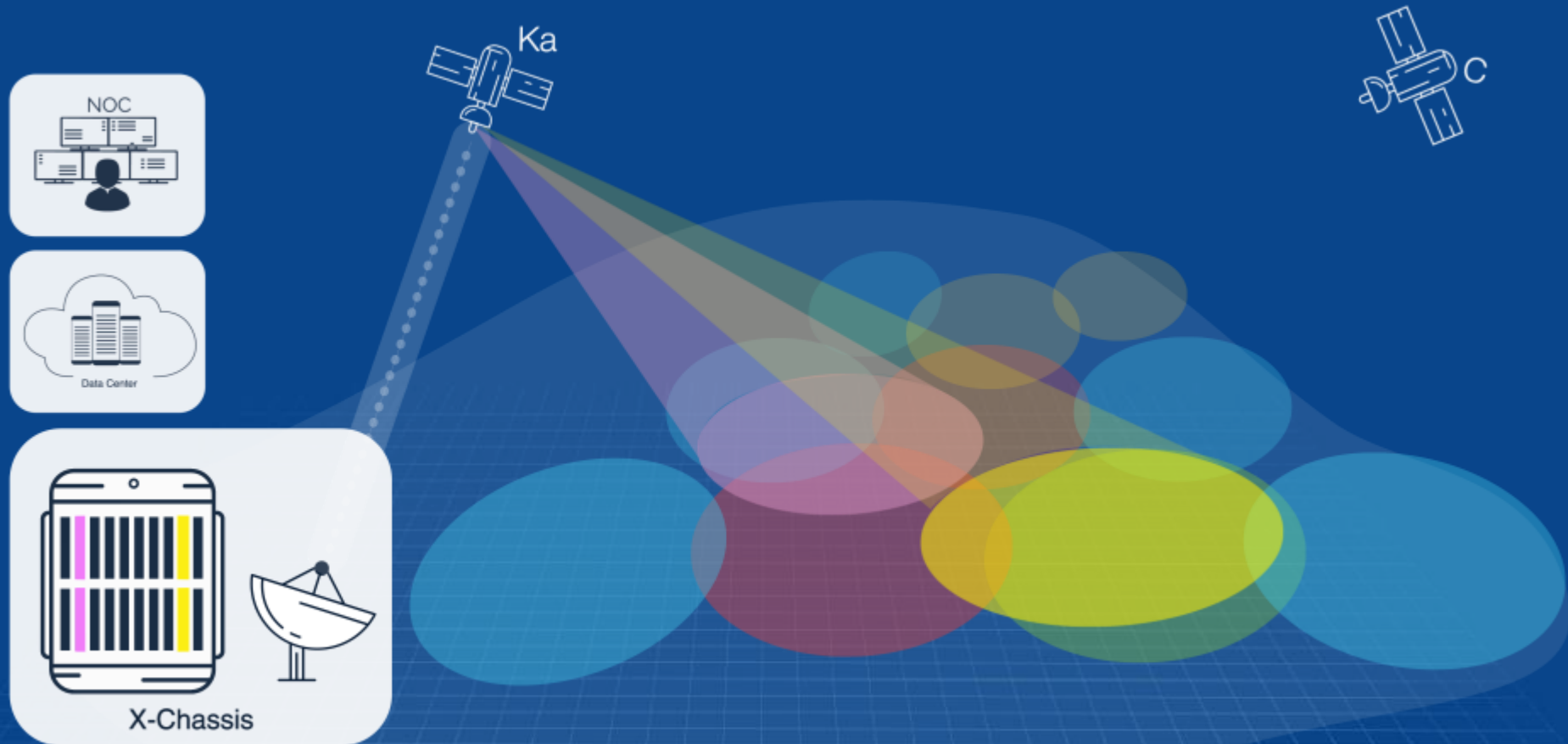
Scalability for Additional Users

Light up all beams cost-effectively with initial capacity

Scale-up capacity as needed to support additional users

Ease of Scalability

Add Transmit and Receive Cards to easily increase coverage

What is Required of the Ground Segment

1 CLOUD-BASED DISTRIBUTED ARCHITECTURE

2 SUPPORT FOR MULTIPLE MARKETS

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5 REDUCED OPEX/CAPEX

Operational Efficiency to Reduce OPEX

Software-Defined RF Matrix

X-Chassis

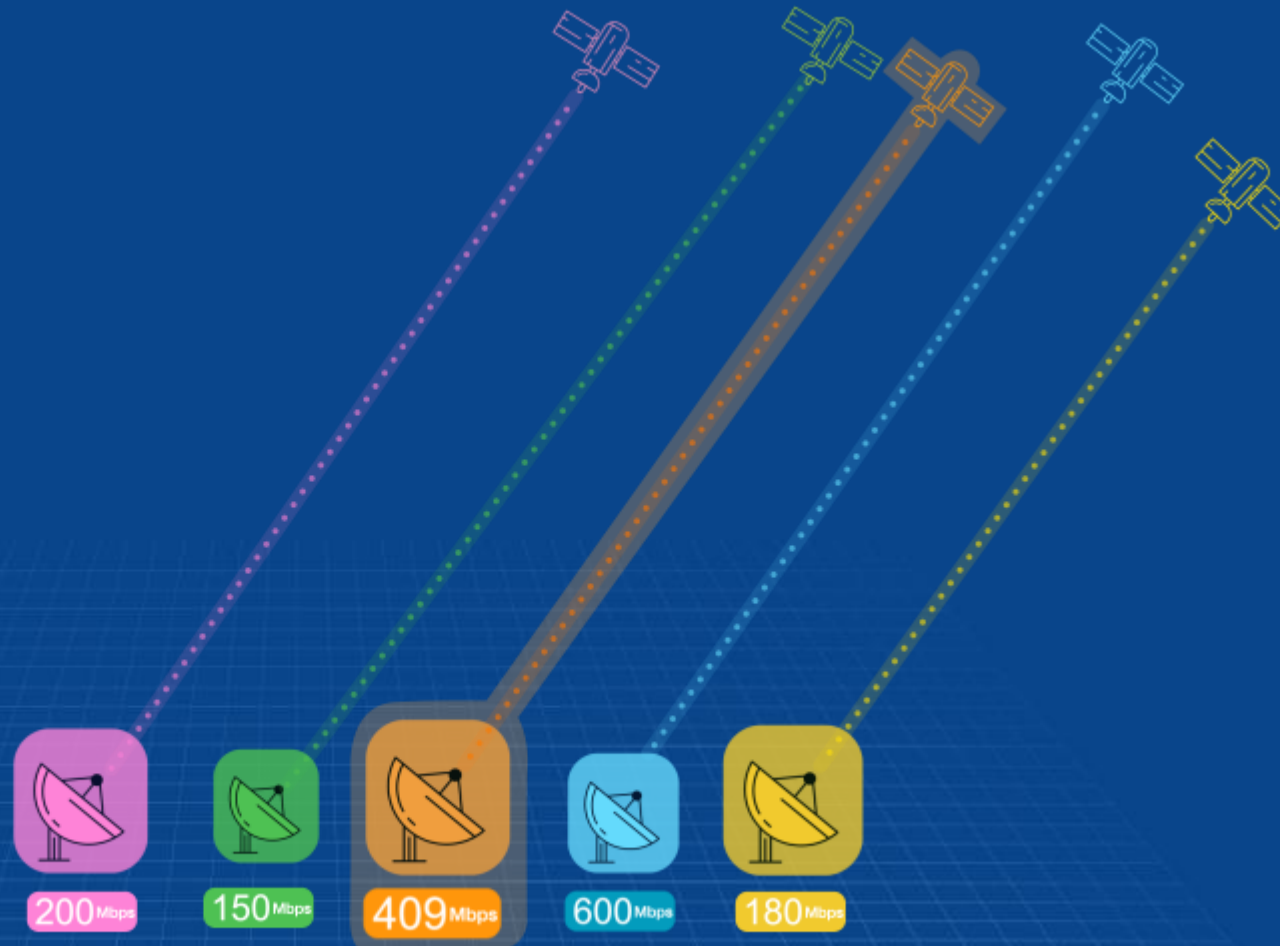200 Mbps   150 Mbps   200 Mbps   582 Mbps   180 Mbps

5 Satellite Interfaces on Single Hub

Operational Efficiency to Reduce OPEX

As your business grows you can **remotely add carriers** for increased capacity

Software-Defined
RF Matrix

X-Chassis

200 Mbps 150 Mbps 409 Mbps 600 Mbps 180 Mbps

5 Satellite Interfaces on Single Hub

Unprecedented Density

**Other baseband equipment**

?

X-Architecture equipment

- Less rackspace & power
- Four times mores dense
- One quarter of the power
- Up to 6Gbps/rack

1:n Inter-beam Redundancy for High Availability

Built-in chassis redundancy

- Redundant card can serve as backup for any malfunctioning card in the chassis

- Exceptional density achieved with redundancy for all active TX and RX cards within and across beams
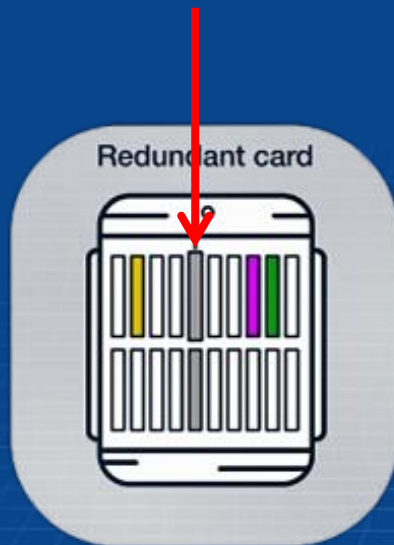
Redundant card

Failure occurred

Redundant card takes over

What is Required of the Ground Segment

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Gilat Press Announcement

Gilat Launches its Revolutionary Distributed X-Architecture to Address the Growing Demands of High-Throughput Satellites (HTS) in a Single Platform

SDN-based architecture enables satellite operators to dynamically support multiple fixed and mobility applications and business models from a single platform

Petah Tikva, Israel, October 27, 2015 -

Q&A

Summary - With X-Architecture You Can Achieve:

High Flexibility ✓

Low OPEX ✓

Low CAPEX ✓

High Scalability ✓

High Availability ✓

High Density ✓

High Efficiency ✓

Multiple Markets ✓

Multiple scenarios ✓

Thank You

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