



Session 5: Benefits of Satellite Services Delivering to Rural Areas

**Spacecraft
Innovation**

**Constellation
Innovation**

**Ecosystem
Innovation**

**Service Model
Innovation**

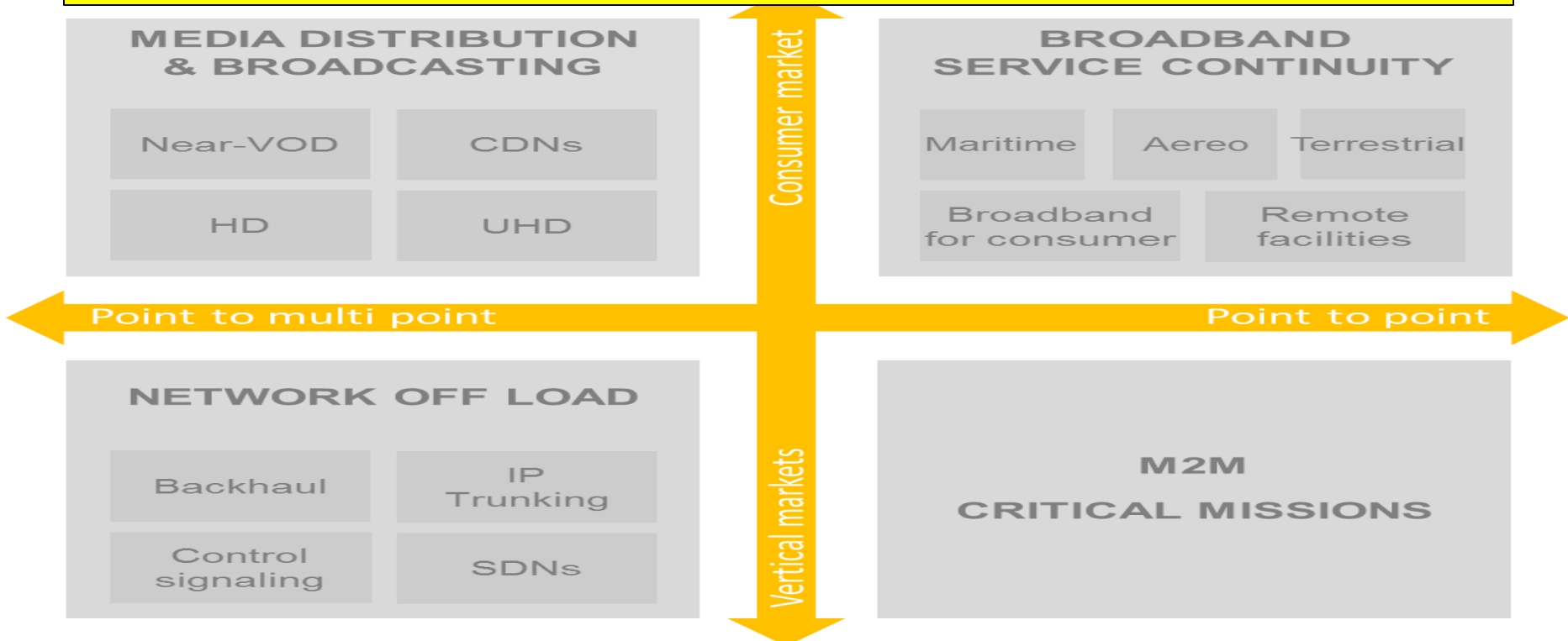
Satellite networks are a critical component of communications infrastructure. Satellites provide ubiquitous, anytime coverage, cost-effectively to many areas of the globe, which might otherwise go unserved.

Satellite communications are the only means to provide truly global coverage and mobility.

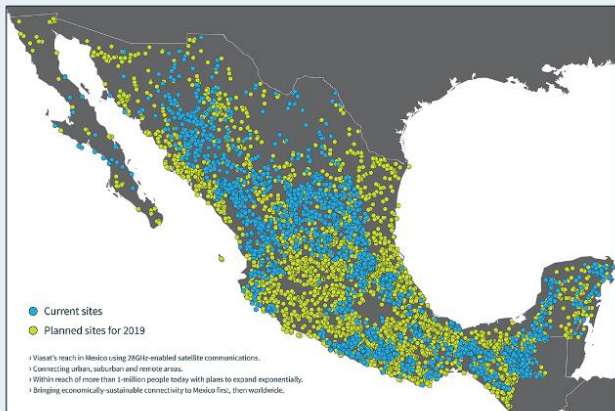
- Providing wide coverage to complement and extend dense terrestrial networks
- Complementing connectivity for mobile nodes (ships, airplanes and trains)
- Offloading a temporarily congested terrestrial network
- Providing backhauling services to fixed or moving base stations
- Providing emergency/disaster communications
- Provide broadcast or multicast one-to-many transmission links
- Satellites can deliver very high data rate services in 'broadcast / multi-cast' mode and uni-cast mode

This is of course even more relevant in view of the fact that future 5G infrastructure is expected to cope with 30-50 Mbit/s for a single video transmission.

Areas where satellites will contribute to augment 5G service capability, whilst optimising the value for money to the end-users and the business models of the telecom operators serving end-users, are :



Mexico Community Wi-Fi sites



- Internet is a basic human right yet 3.5 billion people unconnected globally
- Smart phone ownership now ubiquitous, yet most solutions are too expensive to serve unconnected markets
- Internet connectivity can bring additional services to the unconnected

Urban Cell Tower - \$\$\$

Expensive, but covers thousands of customers who can offset cost



Rural Cell Tower - \$\$\$\$

Expensive and does not cover enough population to recover cost



Community WiFi - \$

Flexible, low cost solution that can serve the uncovered around the world



Community Based WiFi Network

28GHz-Enabled Community Wi-Fi Installation



- The economics of WiFi make it a better option for rural communities
 - Low up-front investment
- Cellular is too expensive to be deployed outside of cities
 - High up-front investment results in negative project ROI
- **Cellular doesn't make economic sense for the rural market**

Reducing Child Mortality

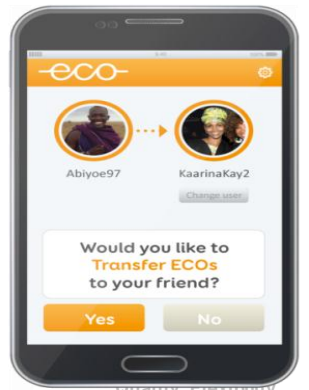
More than 2 million women, families + caregivers across low & middle-income countries treated since 2015



Mobile clinics in remote areas used portable satellite-Wi-Fi hubs to access online health info to improve mother + child health

- Maternal care services + advice
- Collecting data to enable improvements in maternal, newborn + child health

HOW IT WORKS



Voter's voices heard

- 368 electoral offices connected by satellite -
- Votes from >18000 polling offices collected + transmitted to Ouagadougou -



- Thanks to satellite, public TV live broadcasted evolution of election results in near real-time
- IP connectivity + Voice over IP (VoIP) service allowed each site to have voice calls with HQ in Ouagadougou

Commercial Air

- Video streaming available at every seat
- Significant operational savings
- Airlines and passengers expect gate-to-gate service
- Asia is the fastest growing airline market

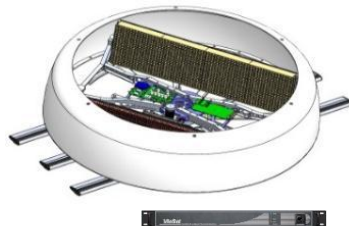


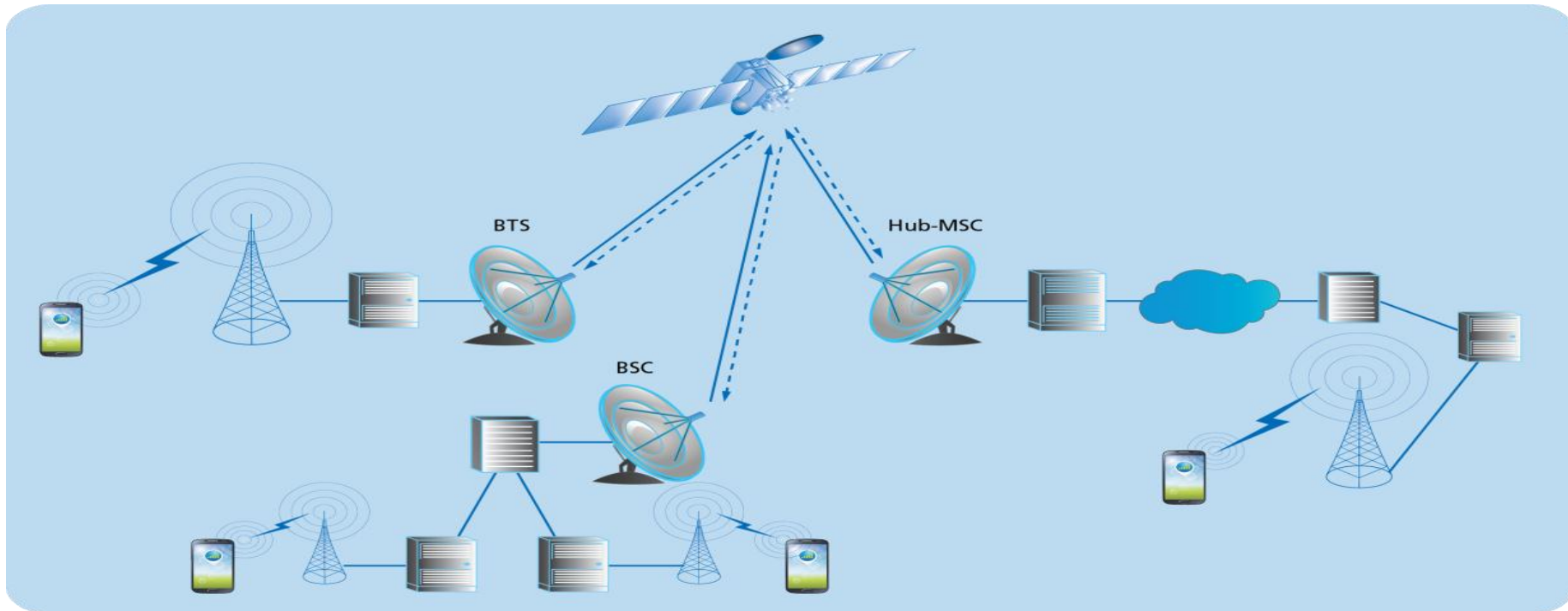
Transportable Terminals

- Man portable high throughput terminals
- Applications:
 - Mobile medicine
 - Disaster relief / Civil Emergency
 - Outside broadcast
 - Festivals, etc



- SOTM Ka-band terminal for land mobile vehicles and suitable for HTS networks
- End market segment
 - Trains, Buses, trucks (infotainment, fleet management, security)
 - Security/governmental
- Operates on vehicles on the move
- Automatic satellite acquisition and tracking
- Automatic transition between terrestrial and satellite networks
- Provides affordable broadband connectivity on commercial platforms





**GEO Ka-band HTS 'backhaul' for 2G/3G/4G base stations support 2G/3G/4G
service delivery**

Enabling Mobile Telephony

- Multiple remote villages each with <500 inhabitants
- Immediate voice + data connectivity thanks to satellite backhaul



- No GSM coverage + no electricity supply
- Population density too low to attract mobile operators
- Secured satellite installation using solar generator has immediate social impact for local population including doctors, teachers, local entrepreneurs

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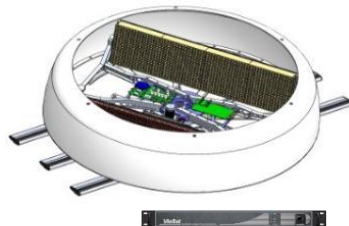










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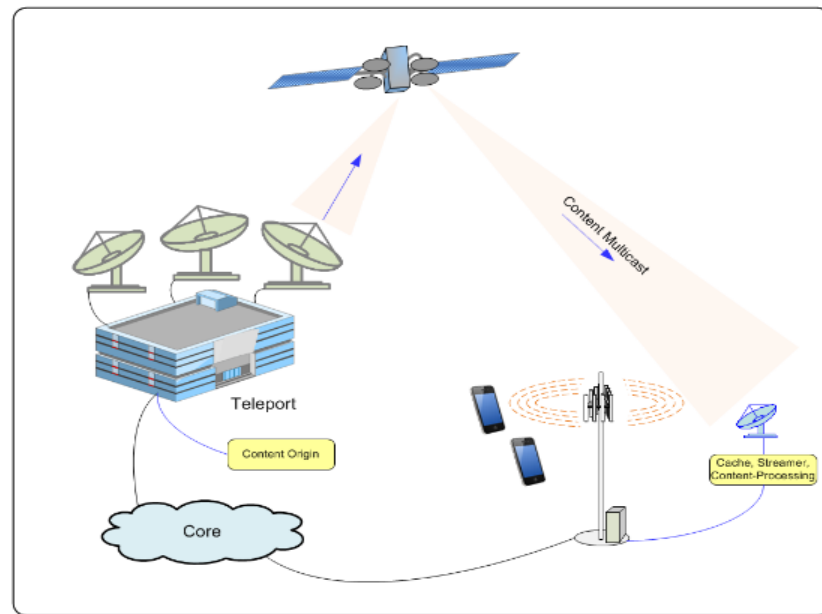
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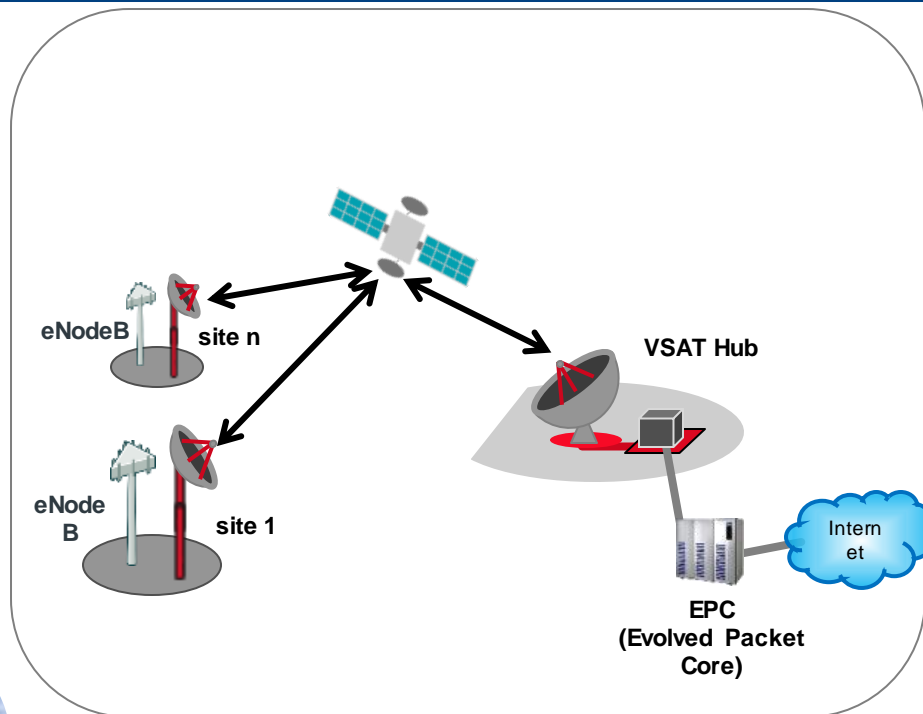
<p>Broadband access in dense areas</p> <p>PERVASIVE VIDEO</p> 	<p>Broadband access everywhere</p> <p>50+ MBPS EVERYWHERE</p> 	<p>Higher user mobility</p> <p>HIGH SPEED TRAIN</p> 	<p>Massive Internet of Things</p> <p>SENSOR NETWORKS</p> 
<p>Extreme real-time communications</p> <p>TACTILE INTERNET</p> 	<p>Lifeline communications</p> <p>NATURAL DISASTER</p> 	<p>Ultra-reliable communications</p> <p>E-HEALTH SERVICES</p> 	<p>Broadcast-like services</p> <p>BROADCAST SERVICES</p> 

✓ = Requires or benefits from Satellite

- **Problem:** A flood of requests for the same popular media content causes a surge in unicast requests that congests backhaul networks and results in a sub-optimal experience for all end-users
- **Satellite's Role:**
 - The same content can be multicast to an unlimited number of towers across a wide geographical area
 - As a result the burden of such traffic surges can be taken off of the MNO backhaul networks
 - The benefits of satellite can be further amplified by combining with caching at the edge via MEC
- **Satellite Benefits Delivered:**
 - Facilitates eMBB
 - Cost savings for MNOs while improving 5G user experience



- **Problem:** Terrestrial backhaul connectivity is insufficient and/or unreliable and costly to upgrade
- **Satellite's Role:**
 - Satellites represent a pool of bandwidth that can be shared across multiple towers across a region, the pooled capacity can flexibly, cost-effectively and dynamically:
 - Provide connectivity where there is none
 - Allocate extra bandwidth to towers that need it
 - Provide DR when terrestrial networks become unusable
 - Cellular backhaul over satellite is already provided in many regions for 3G and 4G networks
- **Satellite Benefits Delivered:**
 - Facilitates eMBB and uRLLC
 - Cost savings for MNOs in deploying 5G in rural/de regions



Non-Rural + Rural

- Japan 100% coverage
- Superior performance of spot beams
- Flexibility for highly variable demand

Network Resiliency

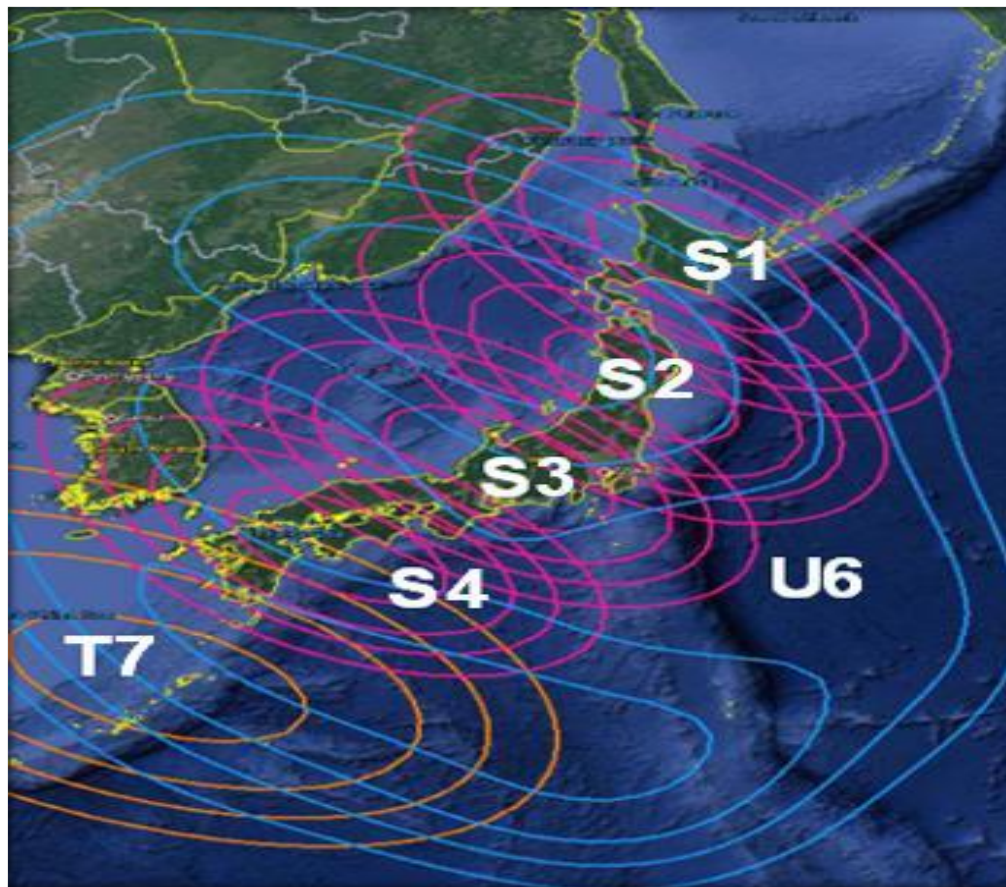
- Japan teleport infrastructure
- Fully geo redundant

Fully Redundant operations

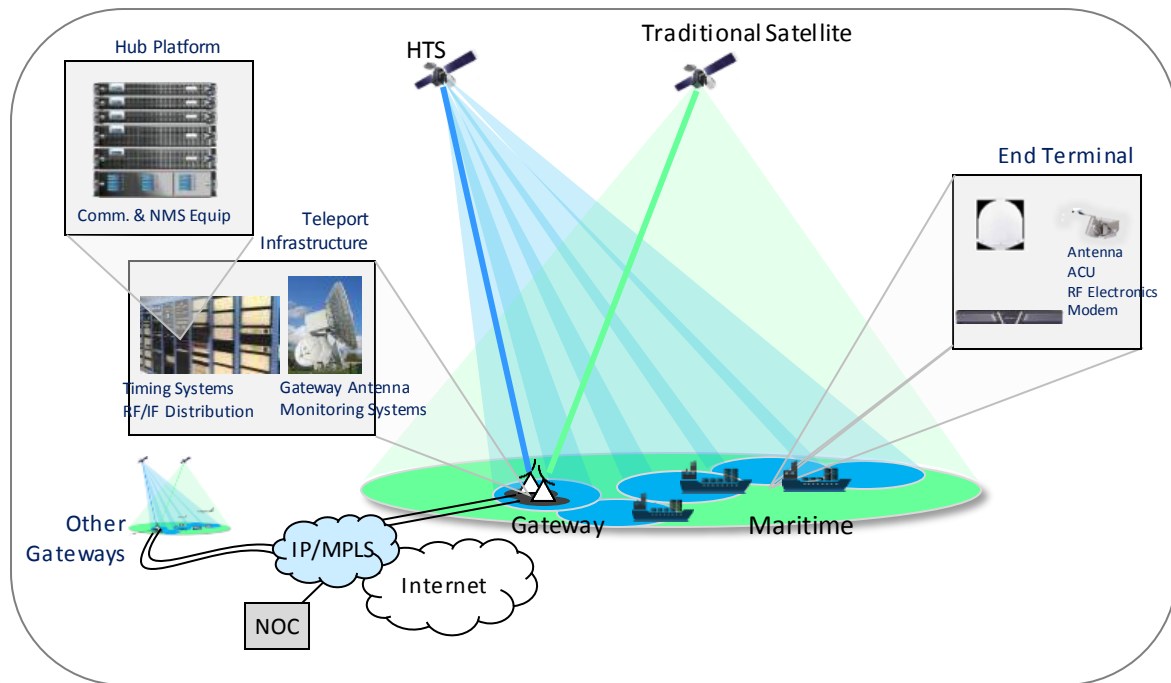
- Backup from US NOC

Customization

- HTS Digital payload for high QoS



- **Problem:** Cellular towers cannot reach ships and planes en-route
- **Satellite's Role:**
 - Satellites offer high throughput broadband connectivity globally to ships and planes while en-route
 - Supports M2M, telematics, passenger Internet access, etc.
- **Satellite Benefits Delivered:**
 - Facilitates eMBB
 - Truly ubiquitous 5G user experience



- **Problems:**

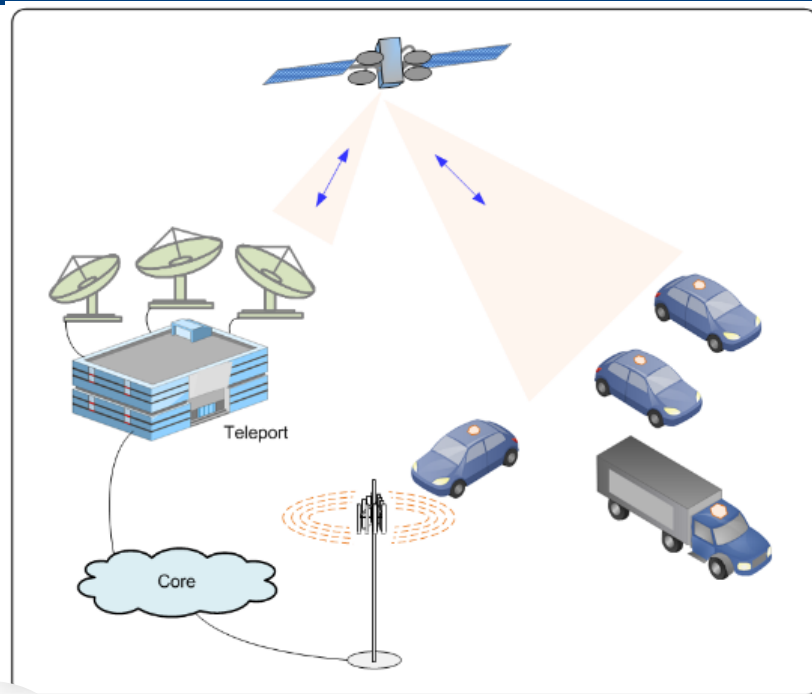
- 5G applications for connected cars become unavailable or unreliable outside of urban 5G coverage
- Same content or data being delivered to millions of vehicles simultaneously is cost prohibitive and risks congesting backhaul networks

- **Satellite's Role:**

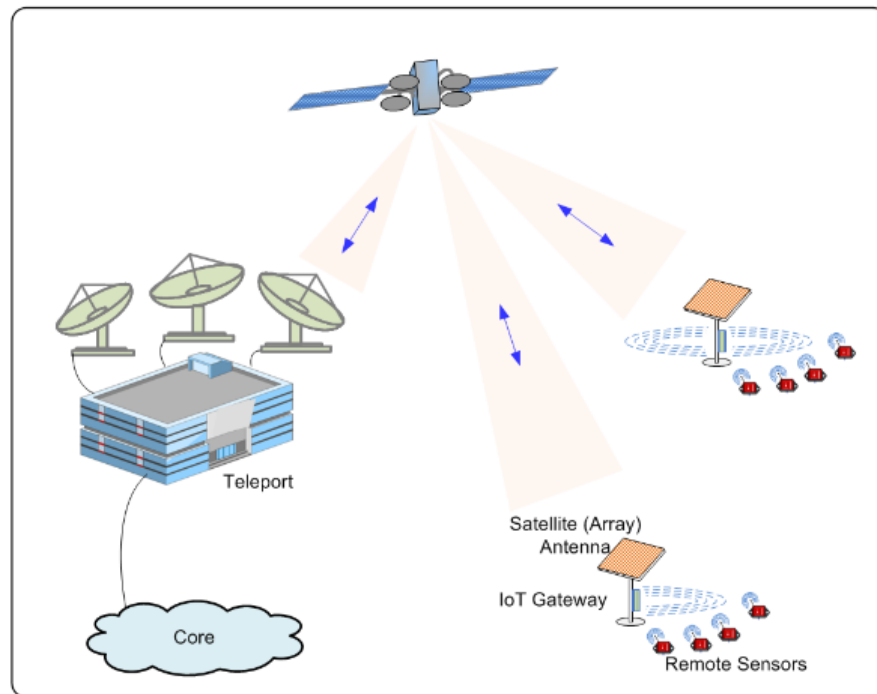
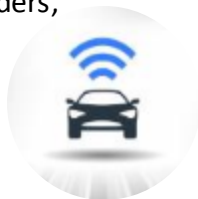
- Pick up connectivity whenever terrestrial networks are unavailable or insufficient
- Efficiently and cost-effectively multicasts popular infotainment content, or SOTA/FOTA data files

- **Satellite Benefits:**

- Facilitates eMBB, uRLLC, mMTC
- Reduces costs for MNOs, auto manufacturers etc., enhance end-user experience



- **Problem:** 5G massive IoT applications unavailable on moving vehicles and costly to implement in rural locations such as in agriculture
- **Satellite's Role:**
 - Provide extension of coverage for massive IoT for cars, trucks, buses and trains.
 - Support for 5G applications for IoT devices in rural locations without requiring costly updates to terrestrial network infrastructure
- **Satellite Benefits:**
 - Facilitates mMTC
 - Reduces costs for MNOs and IoT service providers, expands reach of 5G IoT applications



Satellite Communication networks Offer the following:

- ❑ COVERAGE EFFICIENCY – geographical coverage nationwide
- ❑ ENERGY EFFICIENCY – minimal power requirements, solar powered
- ❑ SPECTRUM RE-USE EFFICIENCY – dynamic allocation, multiple beams
- ❑ BROADCAST and MULTICAST SPECTRUM EFFICIENCY -
- ❑ GREATER FLEXIBILITY - than terrestrial towers
- ❑ LIFETIME INCREASING – with more advance technologies, TOC



Any Questions