

# UNIVERSAL HARDWARE PLATFORM

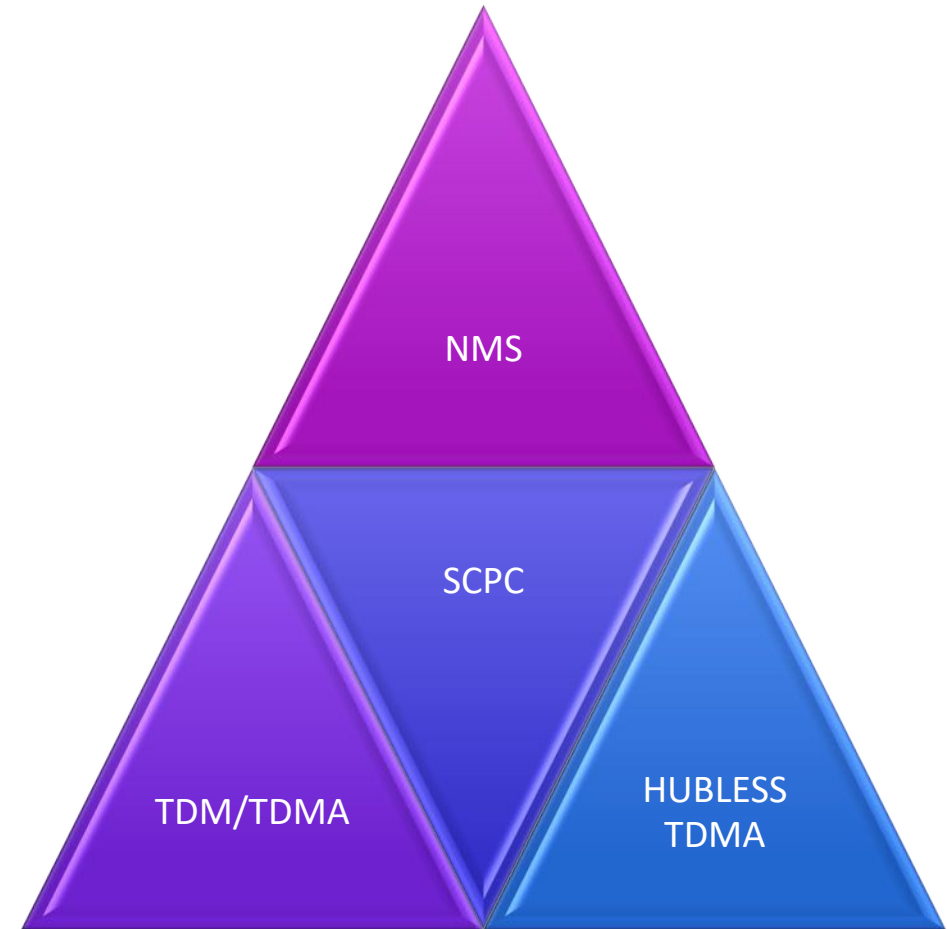
PRODUCTS OVERVIEW

AUGUST 2020



# PRODUCT PORTFOLIO

- Universal carrier-grade VSAT ground segment technology for GSO and NGSO satellites
- All network components, including Terminals, Hubs and Network Management System
- Universal topologies (P2P, star, tree, mesh, full mesh) and waveforms (SCPC, SCPC-DAMA, TDM, TDMA)
- Compatibility with any standard L-band RF equipment and C, X, Ku, Ka band satellites

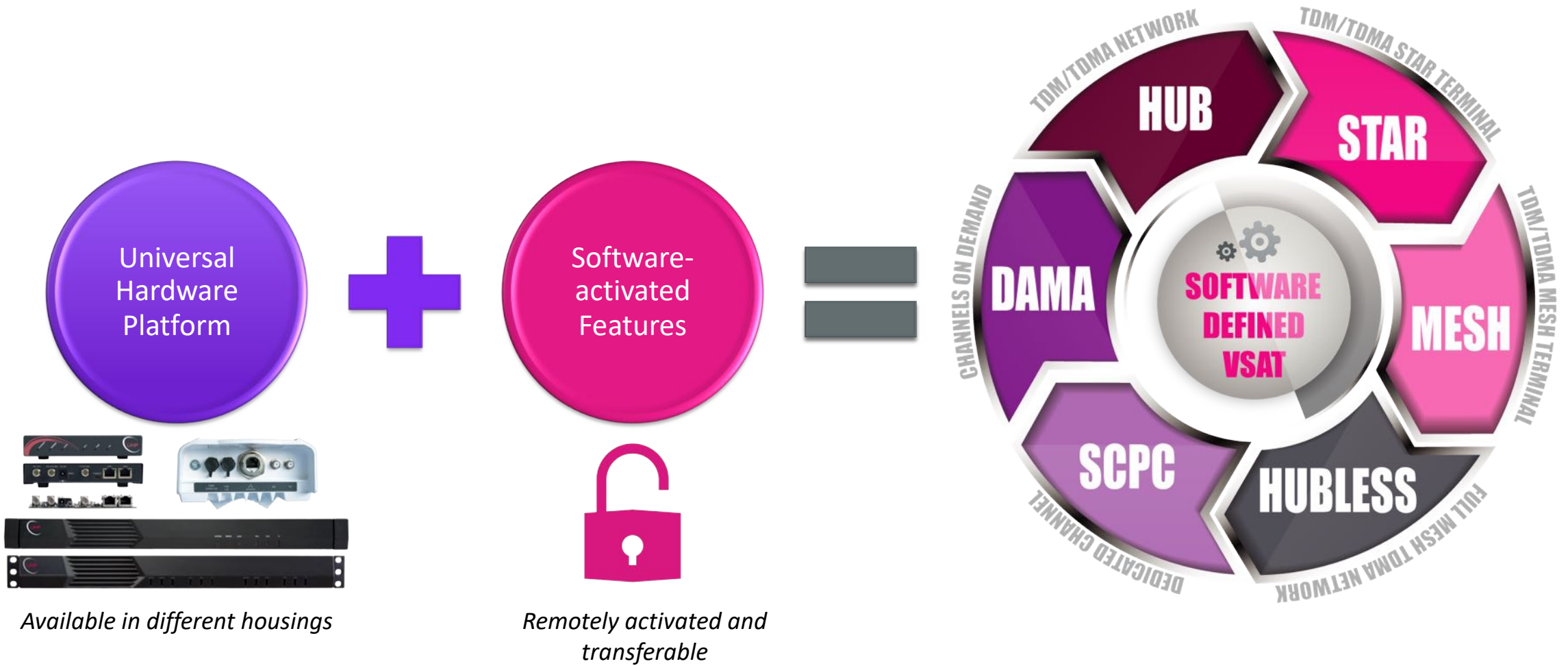


# UNIVERSAL HARDWARE PLATFORM

- **One-for-all** technology: Software-Defined Functionality
- **Made for HTS** VSAT with support of multiple beams and frequency bands
- Efficient **DVB-S2X** MODCODs and highest **TDMA efficiency: 96%** vs SCPC
- **Mesh** capability: eliminate double bandwidth allocation due to double hop
- Layer 3 routing architecture and **Layer 2** bridging mode
- Superior IP router **productivity** and rich set of supported protocols with QoS
- NMS with support of **VNO** and **API** for interfacing with OSS/BSS, etc.
- Smallest, lowest power consumption, most **reliable** IDU
- The most versatile and lowest-cost hub with **M:N local/geo-redundancy**



# SOFTWARE DEFINED VSAT



# SCALABLE HUBS

Mini Hub

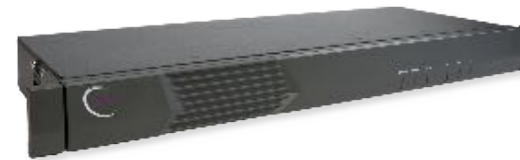
- Up to 30 MspS Outbound (OC)
- Up to 2000 terminals
- 4 channel MF-TDMA max



DVB-S2X<sup>®</sup>

Standard Hub

- Up to 64 MspS Outbound
- Up to 500k Terminals
- Up to 250 MF-TDMA Inbounds



HTS Hub

- Multi-spot Hub
- Universal Controllers & Dynamic Licenses
- Local/Geo Redundancy

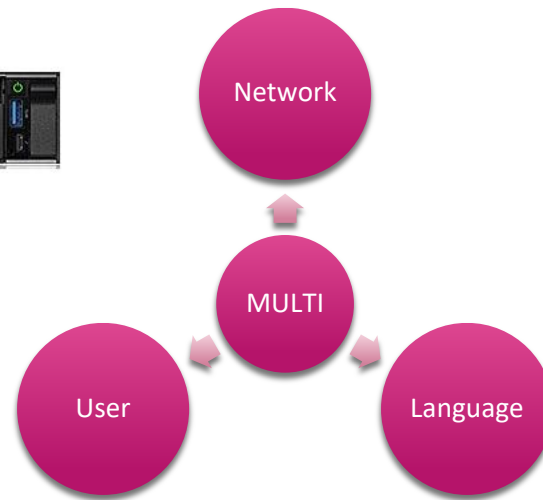
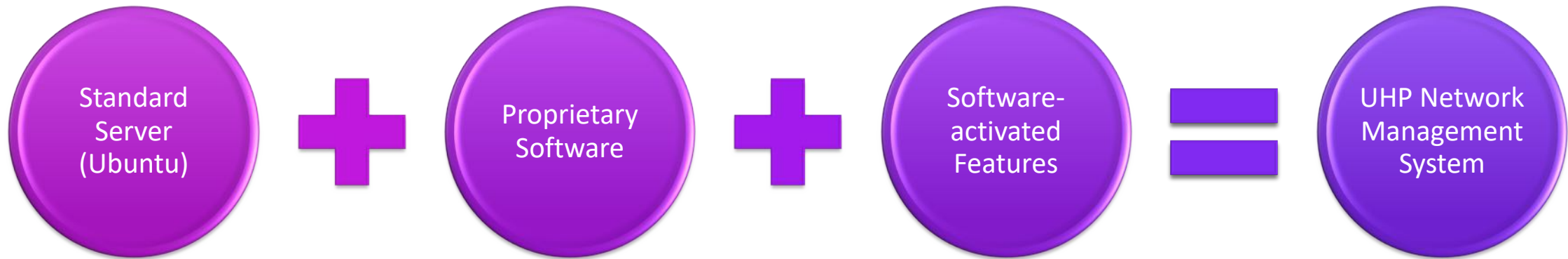
Wideband Hub

- Up to 200 MspS Outbound
- Multiple OC per carrier
- Local/Geo Redundancy

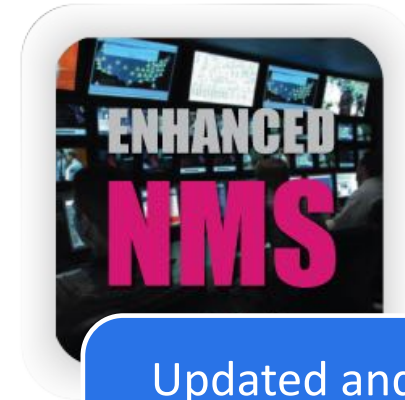
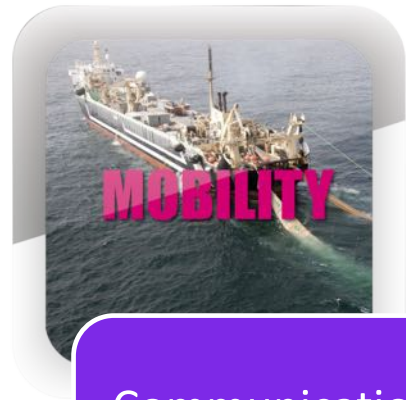


**CAPEX- FRIENDLY:**  
SCALABILITY WITHOUT  
HARDWARE REPLACEMENT

# NETWORK MANAGEMENT SYSTEM



# NEW SOFTWARE RELEASE V3.6



HTS-based networks with multiple services in one wideband carrier

Communication on the move with roaming and GXT maps support

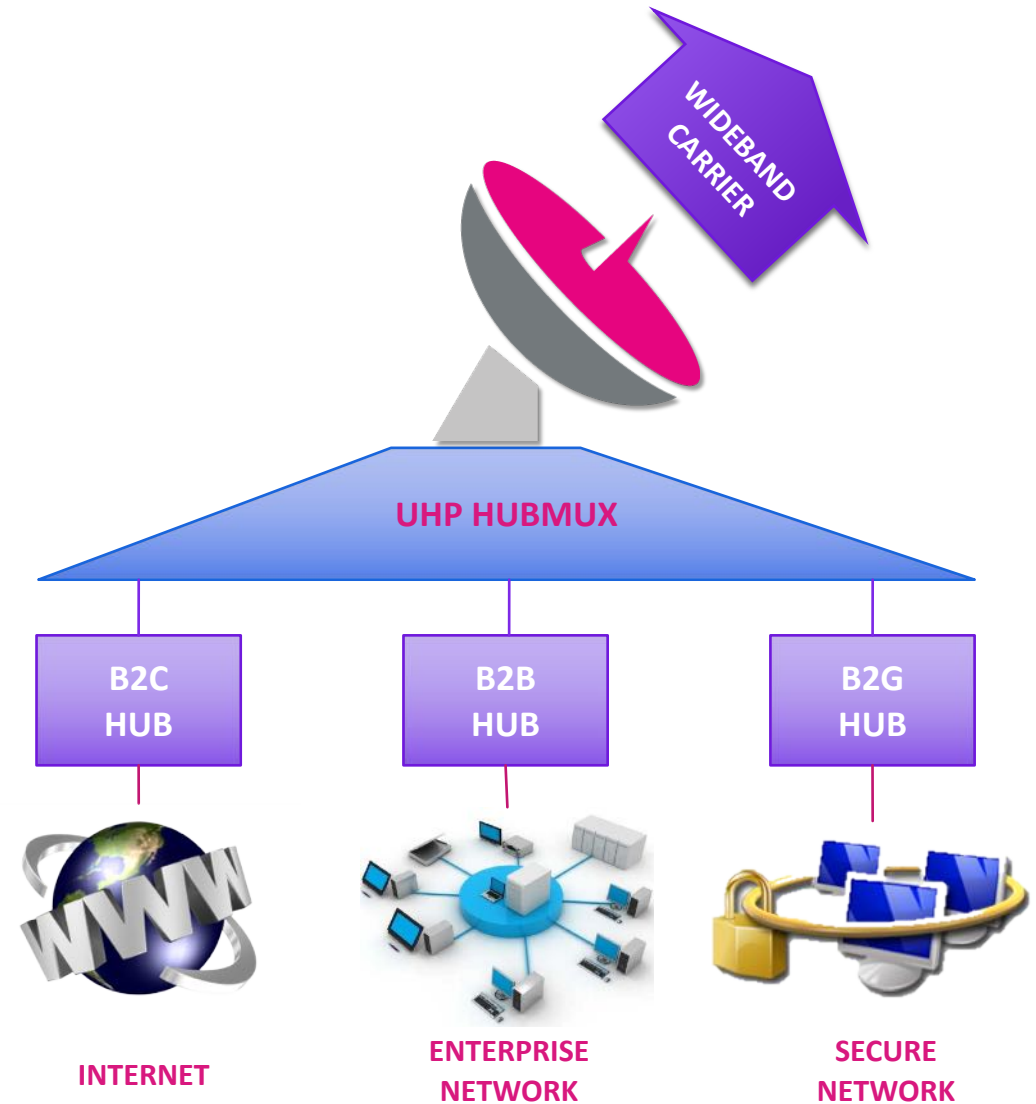
11 Msp/s TDMA, more TDM MODCODs and load balancing

Updated and accelerated NMS with footprints and tracking of mobile terminals



## HUBMUX WIDEBAND HTS NETWORK

- Aggregation of multiple TDM/TDMA and SCPC networks in a single wideband carrier
- Dedicated bandwidth and full traffic isolation of embedded networks
- Efficient multiservice use of HTS capacity and new dimension of VNO cooperation
- VSAT HUB virtualization with SW-activated pay-as-you-grow functionality







# UHP-232 WIDEBAND SATELLITE ROUTER

- 1U Rack-mountable wideband satellite router
- DVB-S2X ACM modulator with 5%-20% roll-off
- QPSK – 256APSK modulations
- Symbol rates: 300 ksps – 200 Msps
- HubMux feature with support for 4 subnetworks
- 650 Mbps aggregate throughput per carrier
- Hot-standby 1:1 redundancy option



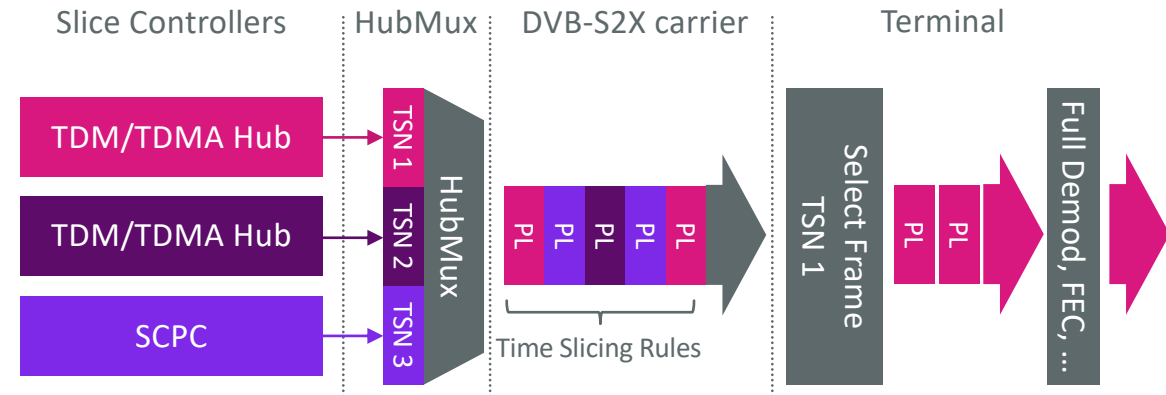
The screenshot displays the UHP-232 web interface. At the top, it shows system information: Name: UHP, Uptime: +03:23:56, Profile: 1-SCPC\_modem (High speed), State: Operation. Below this are navigation tabs: REBT, SYST, LAN, CRC, OFFS, TLC, NWRN, LWRN, NFLT, LFLT, Clear. A sidebar on the left lists menu items: Overview, Site setup, Profiles, Advanced, IP routing, IP protocols. The main content area is titled "WideBand Modulator" and contains a configuration table:

TX level (-dBm)	1.046.0
frequency (kHz)	950000-3200000
SymRate (kSps)	300-200000
SymRate (kSps)/Slice	300-64000
MODCODS	1: SF QPSK 3/5, 2: SF QPSK 5/6, 3: SF QPSK 5/6, 4: SF 8PSK 3/5, 5: SF 8PSK 5/6, 6: SF 16APSK 2/3, 7: SF 16APSK 5/6, 8: SF 32APSK 5/6
Slicing	<input checked="" type="checkbox"/>
Pilots	<input type="checkbox"/>
Roll-off	20%
VLAN (1-65535)	12

Below the configuration table is an "Apply" button. An "RF Spectrum" window is overlaid on the interface, showing a spectrum plot with a "DVB-S2X" watermark. The plot shows a signal centered at 1600 MHz with a span of 300 MHz. The plot includes a "Span" window and buttons for "Center", "Span", "Start", "Stop", "LastSpan", and "RBW".

# DVB-S2X ANNEX M TIME-SLICING

- Operation in wideband mode, without requiring a full-speed decoding of the total carrier capacity
- Suitably mapping the transmitted services in multiple time-slices (bursts)
- A time-slicing burst (identified by a TSN) corresponds to one PL-Frame
- Terminals select and decode a specific stream (time-slice) carrying one or more service(s) within its performance capabilities, while discarding the other streams and services of the wide-band carrier
- Hub's Slice Controllers (may act as SCPC or OC) prepare PL-Frames with unique TSN and deliver it to HubMux wideband modulator via GBE LAN
- HubMux modulator transmits the bursts (time-slices) within a single DVB-S2X carrier
- The return channels are associated with the respective slice controller and transmitted in a standard way via separate carriers





## HUBMUX

### MULTISERVICE PLATFORM FOR HTS

#### Advantages

- Single-signal transponder operation
- Increased Hub performance
- Multiple services in the same carrier
- Multiple networks with traffic isolation
- Diversification of applications and customers
- New VNO business model with virtual Hubs
- Pay-as-you-grow Hub infrastructure
- Multi-vendor opportunities due to open DVB-S2X Annex M standard

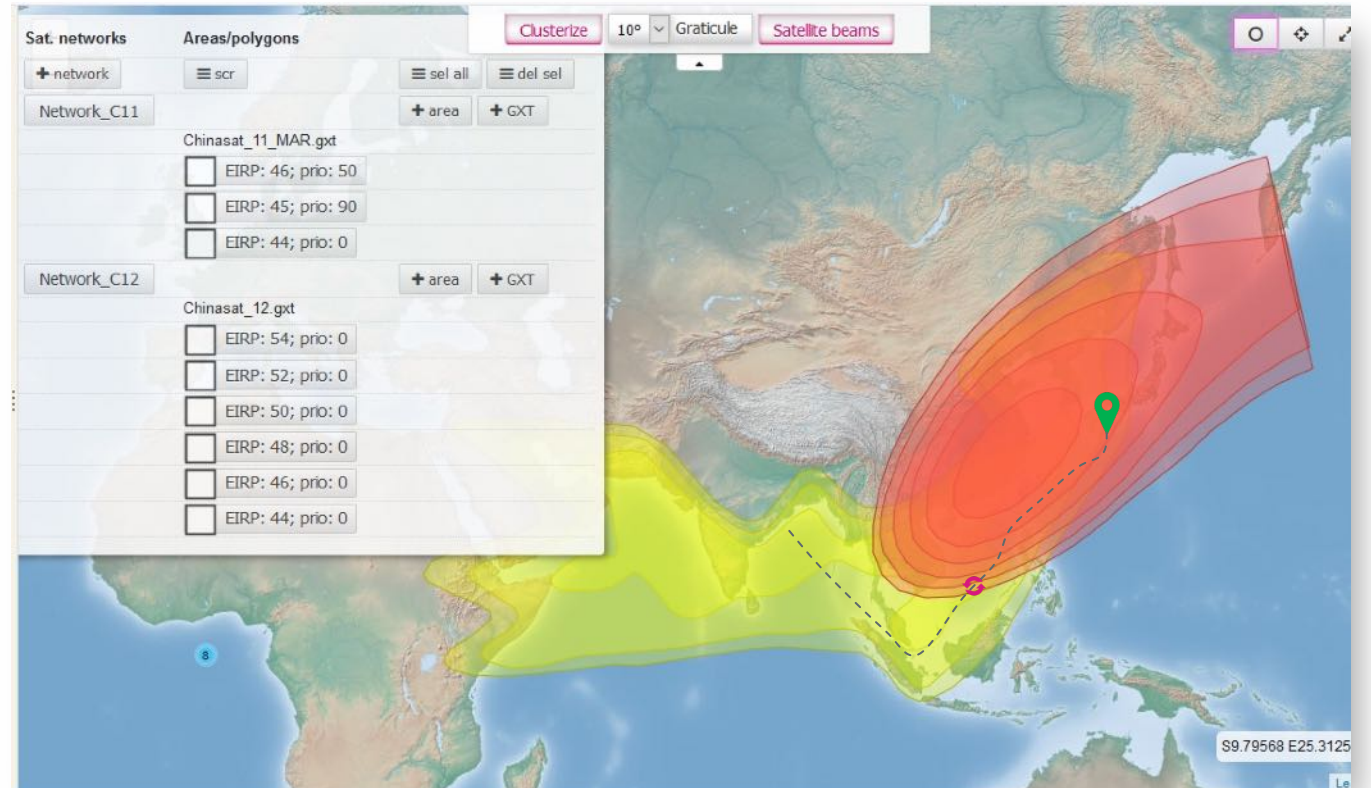
#### Applications

- High-performance TDM/TDMA networks with slicing and load balancing
- Ultra high speed SCPC channels for GSO and NGSO satellites
- Multiservice VNO networks with dedicated virtual Hubs and traffic isolation



## MOBILITY COMMUNICATIONS ON THE MOVE

- Support of GXT coverage maps
- Preloaded coverage maps in terminals
- Location-based make-before-break beam switching
- Priority of overlapped beams
- Network roaming without pre-dedicated bandwidth
- Tracking of mobile terminals





## ADVANCED WAVEFORMS AND ACCESS SCHEMES

### TDM

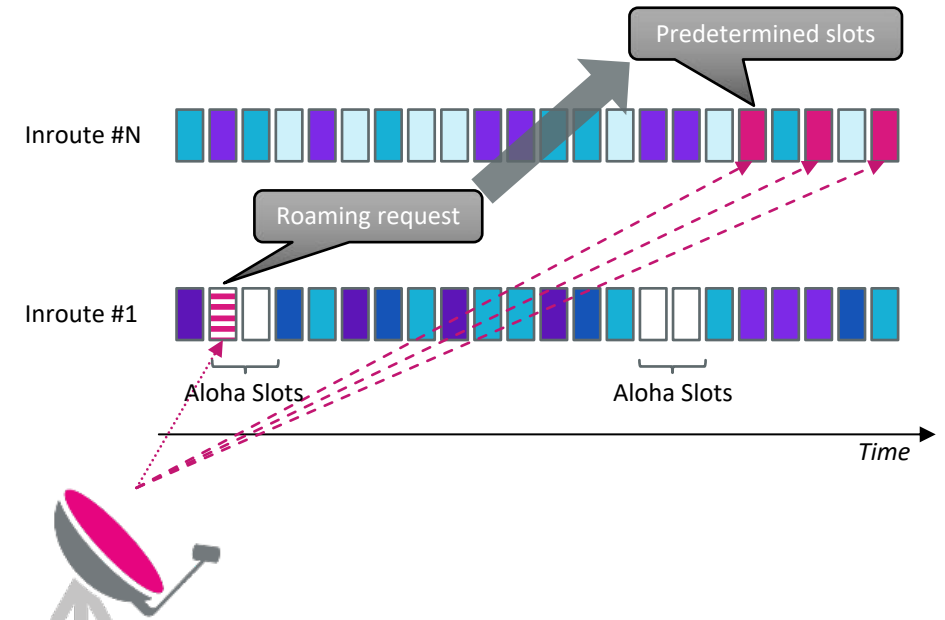
- Support of short and normal frames to optimize network efficiency
- More MODCODs for better utilization of satellite bandwidth
- 8 ACM channels for TDM carriers to increase service availability and performance
- System and user data AES-256 radio-channel protection

### TDMA

- 100 ksps – 11 Msps TDMA symbol rate for high-throughput TDM/TDMA and Hubless TDMA networks
- Slotted-Aloha network entry for roaming or long-time inactive terminals
- Dynamic load balancer for MF-TDMA groups
- System and user data AES-256 radio-channel protection

# SLOTTED-ALOHA NETWORK ENTRY

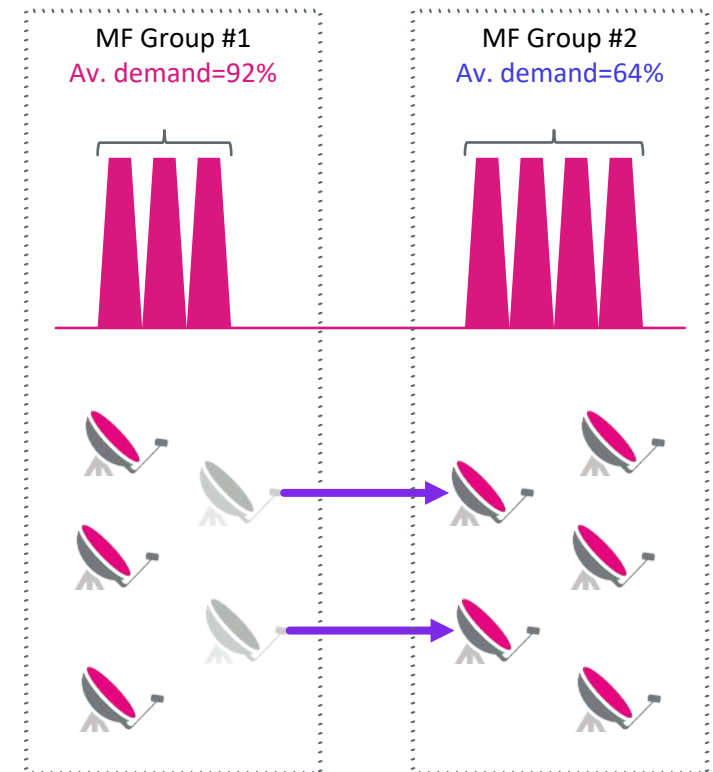
- Roaming Hub controller allows terminals to enter a new network without having the predetermined slots
- TDM/TDMA Hub allocates common Slotted Aloha bandwidth in the first TDMA carrier
- Newly arrived terminals can request roaming to this network through such common Aloha slots
- Random retransmissions in case of collisions
- If roaming is granted, terminal will start receiving standard predetermined slots as usual
- The hub will not allocate slots to terminals that have switched to another network or are inactive



**SIGNIFICANT BANDWIDTH SAVINGS FOR NETWORKS WITH LONG-TIME INACTIVE TERMINALS OR WITH ROAMING**

# TDMA LOAD BALANCING

- NMS-based controller that is distributing network terminals across multiple Inroute TDMA controllers (standalone and MF)
- This ensures no single Inroute controller bears too much average traffic demand (average demand / capability ratio)
- Configurable max demand threshold and load difference to trigger the balancing process
- Balancing is done by changing the assigned Rx controller for terminals with longest uptime or low traffic (configurable)
- One network may have a few Load Balancing controllers with different strategies

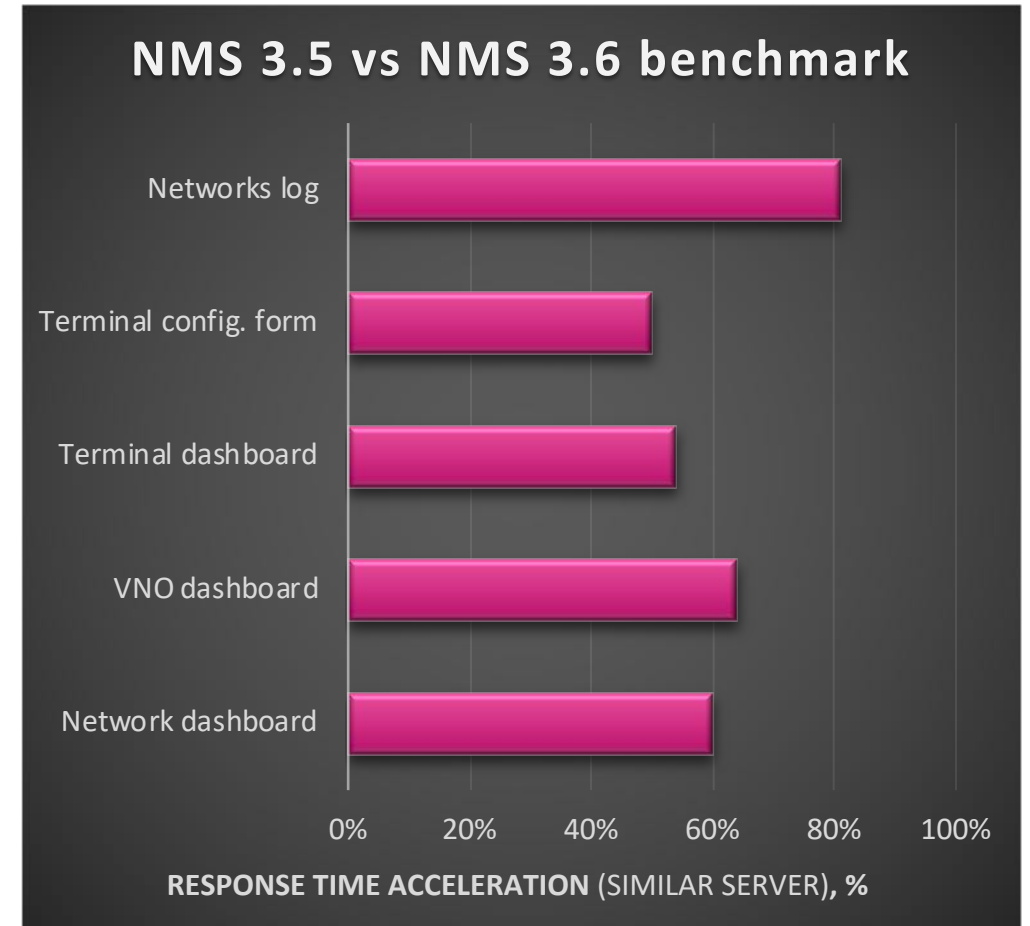


**INCREASED BANDWIDTH EFFICIENCY AND  
HIGH NETWORK PERFORMANCE**



## NETWORK MANAGEMENT SYSTEM V3.6

- Support for HubMux and Slice Controllers
- Footprints, roaming and tracking of mobile terminals
- 64-bit operating system and x64 architecture
- Improved productivity and response time
- Ability to use a separate disk for statistics
- Hot-standby 1:N NMS server redundancy
- Bug fixes and increased reliability







# KEY FEATURES

UNIVERSAL HARDWARE PLATFORM

## SOFTWARE DEFINED NETWORK

- Universal routers for all network roles
- Dynamic SW-definable mode of operation
- Quick and easy transfer/swap of the functionality SW licenses
- Reduced CAPEX for spare parts and network upgrades
- Quick and easy field replacement and change of network topology



- Powerful L3/L2 router with 190 000 pps
- Mesh: eliminate double bandwidth allocation
- Multiple configuration profiles
- Embedded Computer for advanced applications and traffic processing
- Sophisticated QoS with VLAN management and built-in 2G, 3G & LTE backhaul optimization



## BANDWIDTH EFFICIENCY

- Dual DVB-S2X 500 Msps demodulators with separate IF inputs
- QPSK - 256APSK MODCODS with ACM
- Integrated high-speed DVB-S2X modulator for SCPC return channel
- Proprietary encapsulation with 99% efficiency and advanced QoS
- Up to 20% savings on bandwidth



- Multichannel MF-TDMA LDPC demodulator
- 12 MODCODs with QPSK, 8PSK & 16APSK
- Symbol rates up to 11 Msps/terminal
- Hubless and Mesh topologies
- Highest TDMA efficiency of 96% and flexible frame structure
- Alternative Slotted Aloha network entry



## MULTI-SPOT HTS HUB

- Designed for multi-spot HTS networks
- Based on low-CAPEX universal controllers
- Required functionality is activated by SW license as network develops
- Easy SW license transfer between teleports, beams and satellites
- Cost-effective scalability up to 64 spot-beams and 500 000 remotes



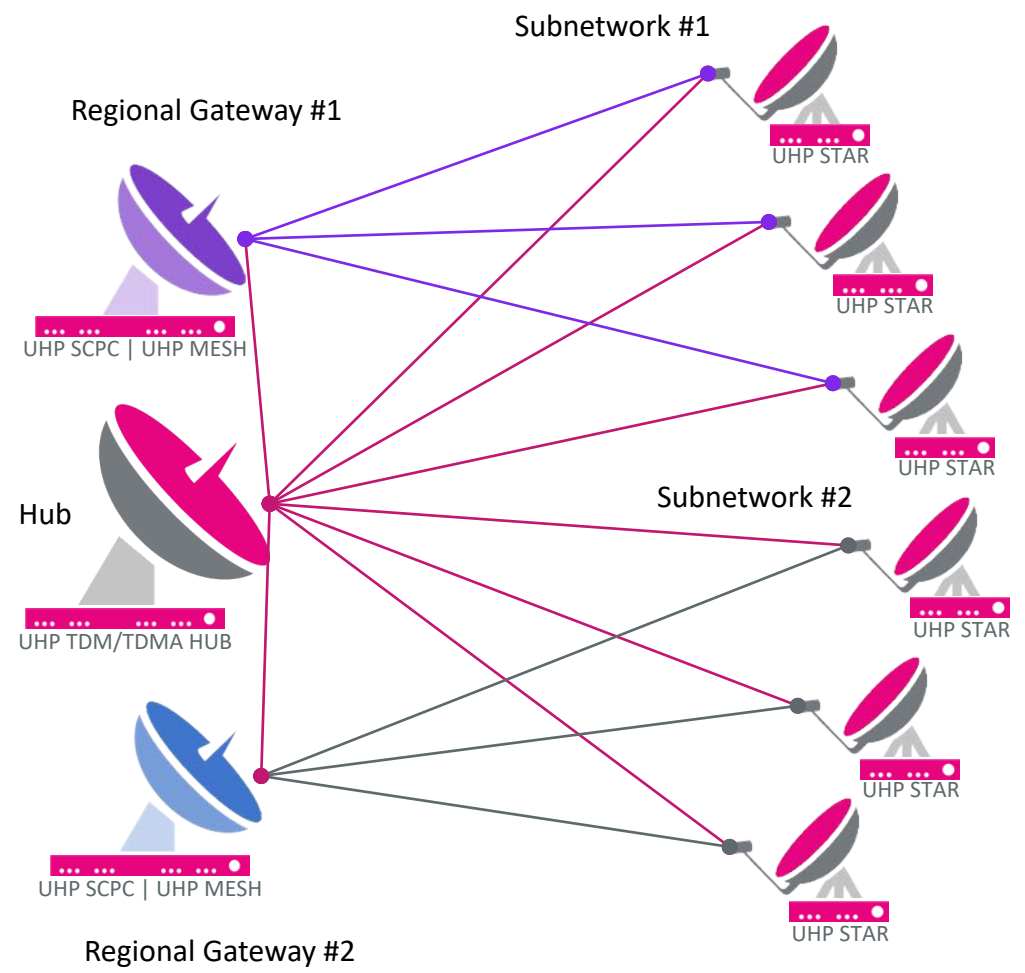
- Self-healing hub architecture
- Dynamically assigned network roles
- Automatic M:N local and geographic redundancy
- M:N site diversity with multiple teleports for increased availability
- Saves over 40% of Hub CAPEX due to functionality SW license reuse





## DUAL-GATEWAY

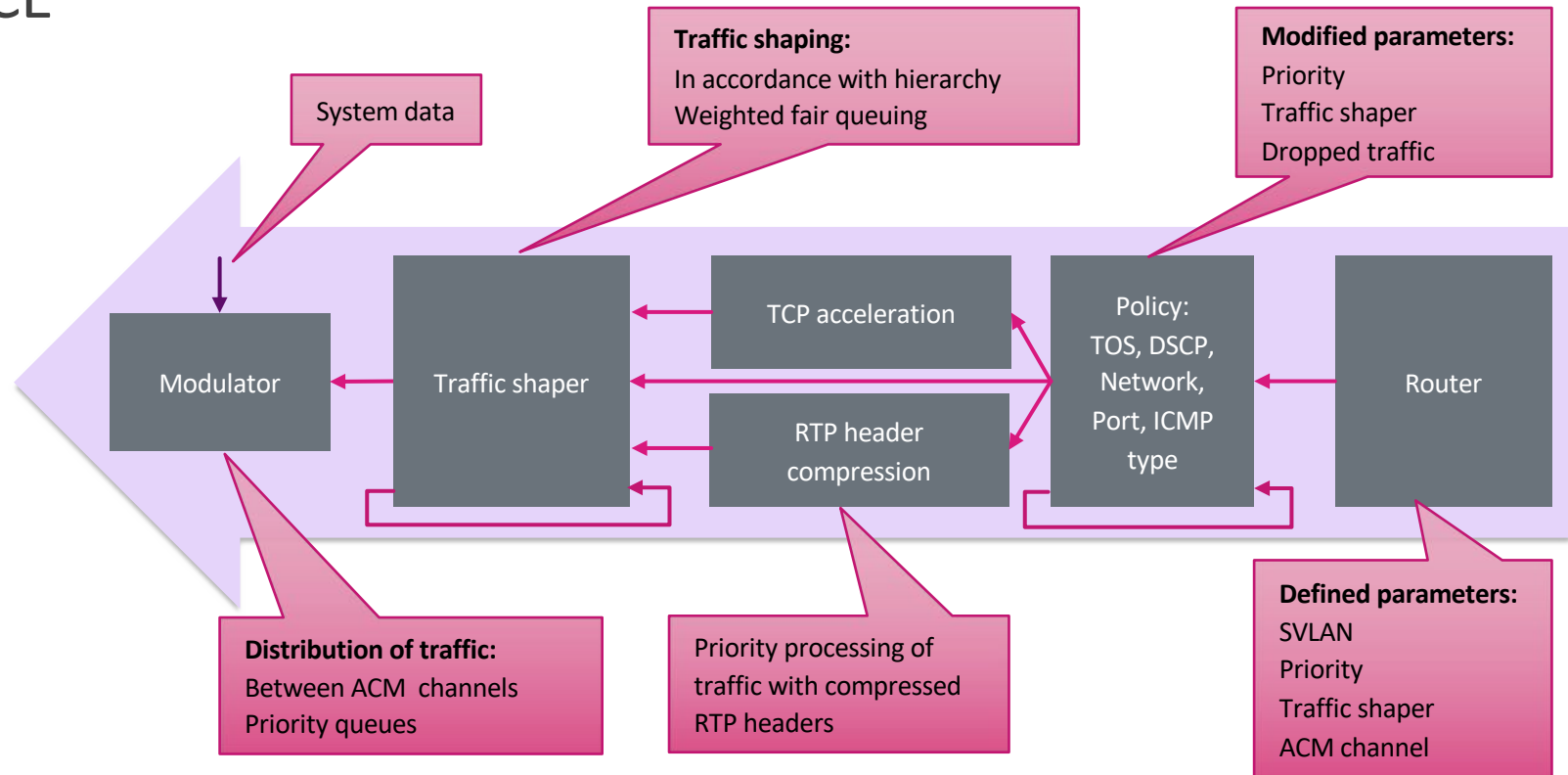
- Hierarchical topologies with basic STAR remotes
- Single-hop connectivity with Hub and Gateway
- Unlimited number of Gateways
- High spectral efficiency of all TDM channels
- Compatible with multi-spot and dual-band HTS
- >50% CAPEX savings compared to Mesh network





# QUALITY OF SERVICE

- Classification of IP packets
- Customized action rules
- Traffic policy manager
- Multichannel hierarchic traffic-shaper:
  - CIR –committed data rate
  - MIR – maximum data rate
  - MIR to CIR slope factor
  - Day/Night CIR change
- Multiple Tx priority queues with Class-Based Queueing





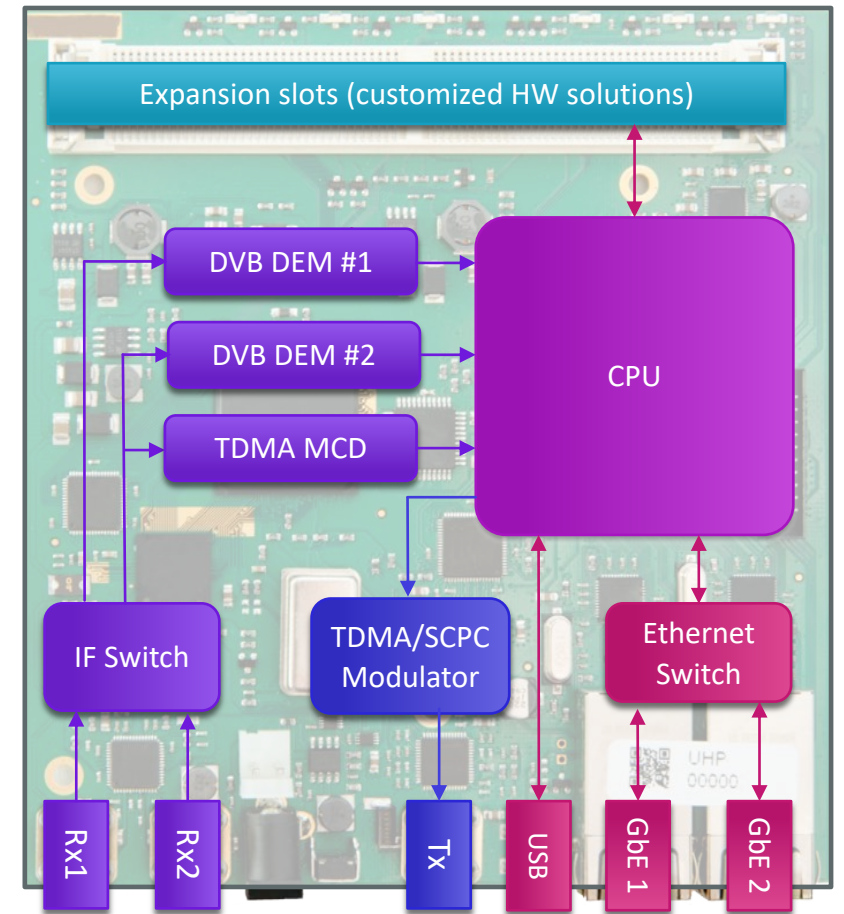
# SATELLITE ROUTERS

UNIVERSAL HARDWARE PLATFORM



# UHP-200 SERIES UNIVERSAL SATELLITE ROUTER

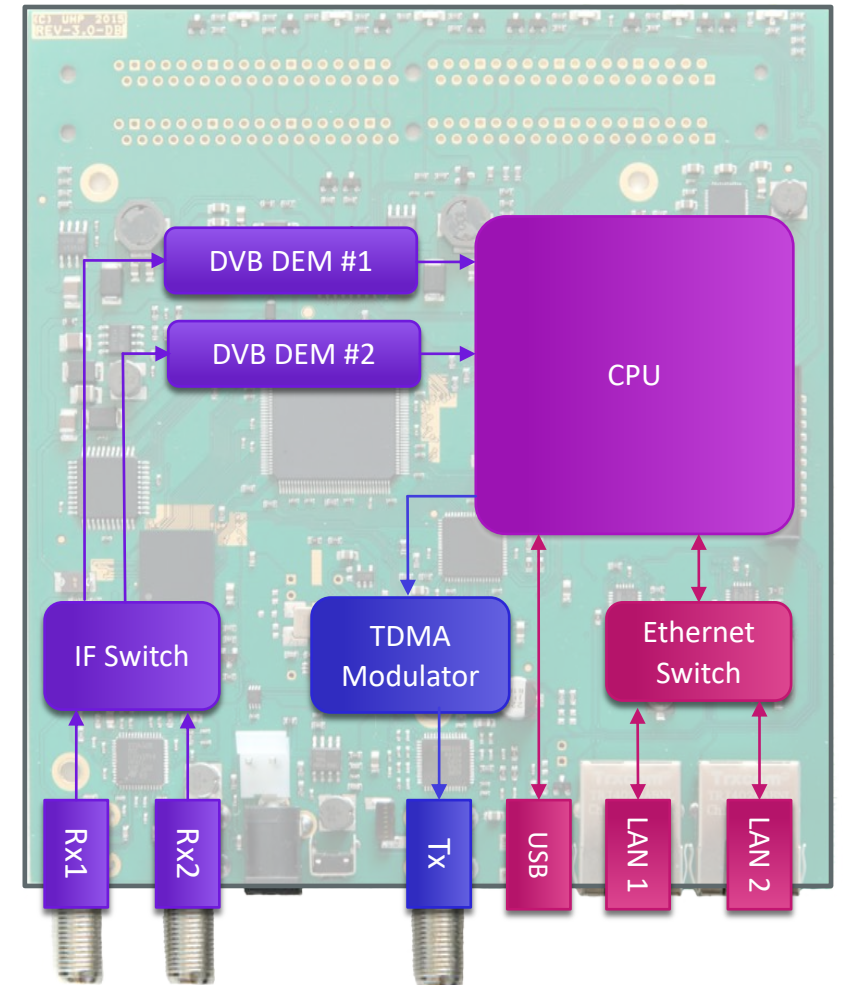
- Two DVB demodulators with separate IF inputs: up to 500 Msps DVB-S2X ACM with modulations up to 256APSK
- 4-channels TDMA demodulator: 0.1 ... 11 Msps LDPC ACM; QPSK, 8PSK, 16APSK
- Return Channels (modulator):
  - TDMA: 0.1 ... 11 Msps LDPC ACM; QPSK, 8PSK, 16APSK
  - SCPC: 0.3...64 Msps DVB-S2X ACM; QPSK - 64APSK
- Superior processing capability up to 190 kpps
- TDM/TDMA Star&Mesh&Hub, SCPC and TDMA Hubless
- Built-in adaptive hierarchic traffic shaper and QoS
- Switch with two Gigabyte Ethernet user ports
- Housings: compact [UHP-200]; board [UHP-210]; outdoor [UHP-220], rack-mountable [UHP-230]; dual rack-mountable [UHP-240]





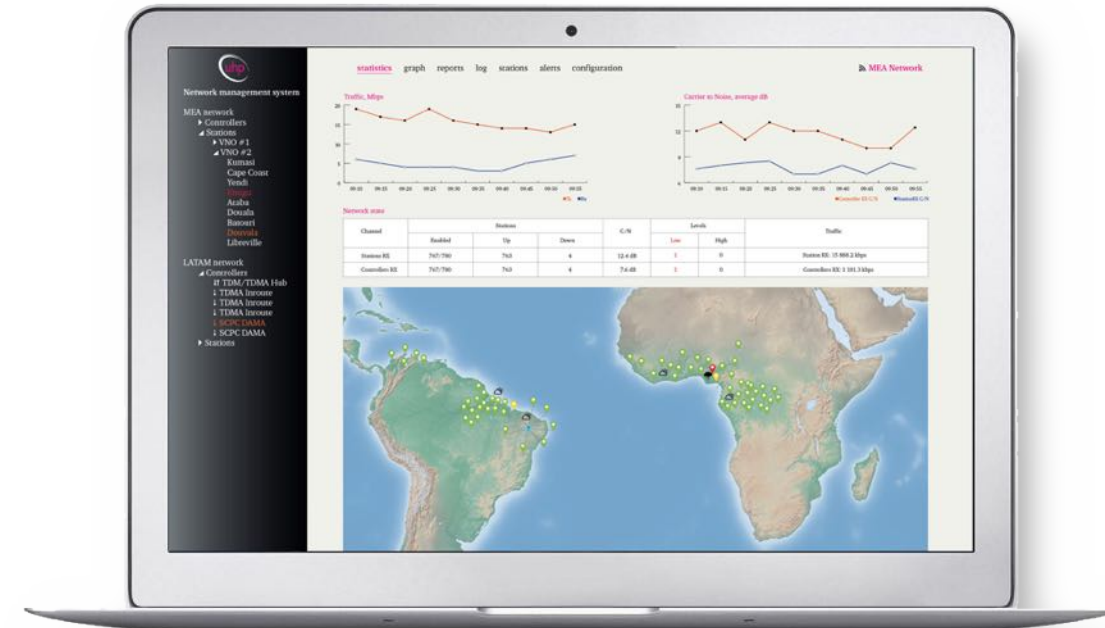
# UHP-100 SERIES BROADBAND SATELLITE ROUTER

- Two DVB demodulators with separate IF inputs: up to 500 Msps DVB-S2X ACM with modulations up to 256APSK
- TDMA Modulator: 0.1 ... 11 Msps LDPC ACM; QPSK, 8PSK, 16APSK
- Superior processing capability up to 150 kpps
- TDM/TDMA Star & Dual-Gateway
- Built-in adaptive hierarchic traffic shaper and QoS
- Switch with two Fast Ethernet user ports
- The same form factor as UHP-200
- Housings: compact [UHP-100]; board [UHP-110]; outdoor [UHP-120], rack-mountable [UHP-130]; dual rack-mountable [UHP-140]



# NETWORK MANAGEMENT SYSTEM

- Support of multiple networks with different satellites or modes of operation
- Multiuser VNO access to divide global network infrastructure
- Full details on status, alarms, levels, traffic, terminals activity, weather conditions, etc.
- API interface to external OSS/BSS systems
- Group management and scheduled firmware update of network terminals
- M:N Local- and Geo-Redundancy of Hubs
- 1:N NMS Server Redundancy



## TDM/TDMA MINI HUB

- Based on a single UHP-200 router in any housing
- Combined Outroute and Inroute controllers
- One DVB-S2X forward channel up to 30 Msps and 64APSK
- Up to four MF-TDMA channels 11 Msps aggregate
- Support for up to 2000 Star/Mesh terminals
- Hot-standby 1:1 local redundancy
- Permanent SW licenses only
- May operate without NMS
- Easily expandable to full-scale Standard and HTS Hubs



# TDM/TDMA STANDARD HUB

- Based on UHP-240 dual routers
- Separate UHP router for each OC or IC controller
- Scalable design: up to 252 RTN channels and 500k Star&Mesh terminals
- FWD: TDM up to 64 Msps DVB-S2X ACM QPSK - 64APSK
- RTN: MF-TDMA up to 11 Msps LDPC ACM with QPSK, 8PSK and 16APSK
- RTN: SCPC up to 64 Msps DVB-S2X ACM up to 64APSK
- 5% & 20% roll-off for TDM, SCPC and TDMA
- Permanent SW licenses only
- Hot-standby local redundancy (1:1 OC & 1:N IC)
- NMS is required

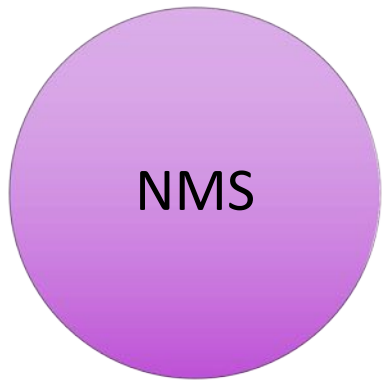


# UHP HIGH-THROUGHPUT SATELLITE HUB

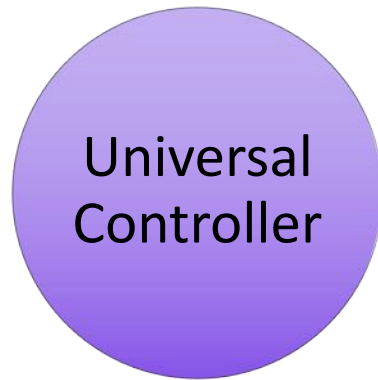
- Designed for multi-spot HTS enterprise-class networks
- Support of: TDM/TDMA Star, TDM/TDMA Mesh and SCPC terminals
- Scalable design: up to 64 forward, 16k TDMA return channels and 510k terminals
- Independent IF interface for each FWD and associated RTN links
- Scalable throughput: from 0.2/0.1 Mbps and up 14/5 Gbps per Hub
- FWD: TDM DVB-S2X ACM up to 200 Msps with QPSK, 8PSK, 16APSK, 32APSK & 64APSK
- RTN: MF-TDMA up to 11 Msps per carrier; LDPC ACM with QPSK, 8PSK and 16APSK
- RTN: SCPC DVB-S2X ACM up to 64 Msps with QPSK, 8PSK, 16APSK, 32APSK & 64APSK
- 5% or 20% roll-off and efficient TDMA protocol
- Smart load balancing in FWD and RTN channels every 30-100 ms time frame
- Rich set of supported protocols with QoS, acceleration and compression
- Hot-standby M:N local and geographical redundancy



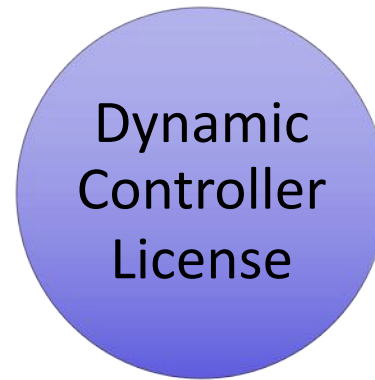
# HTS HUB WITH DYNAMIC LICENSES



- ❖ One HTS NMS per multi-sat network
- ❖ Optional 1:N redundant servers



- ❖ One router for each universal controller (UC)
- ❖ Idle UC will act as a redundancy



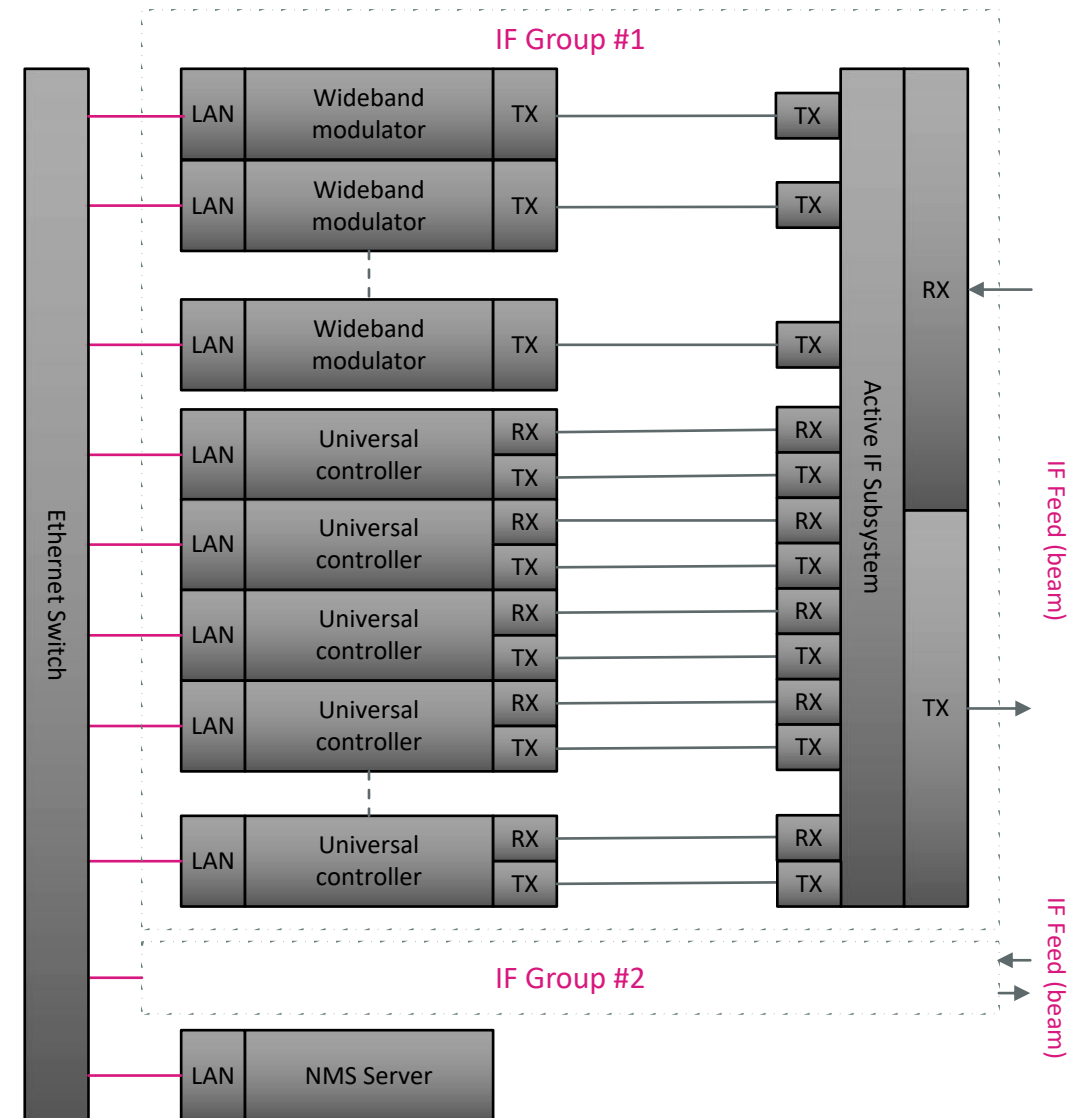
- ❖ Required number of OC and IC licenses
- ❖ Common licenses for local- or geo-redundancy



- ❖ Support for multiple beams and satellites
- ❖ Easy scalability by new UC and licenses
- ❖ Smart Local- and Geo-redundancy

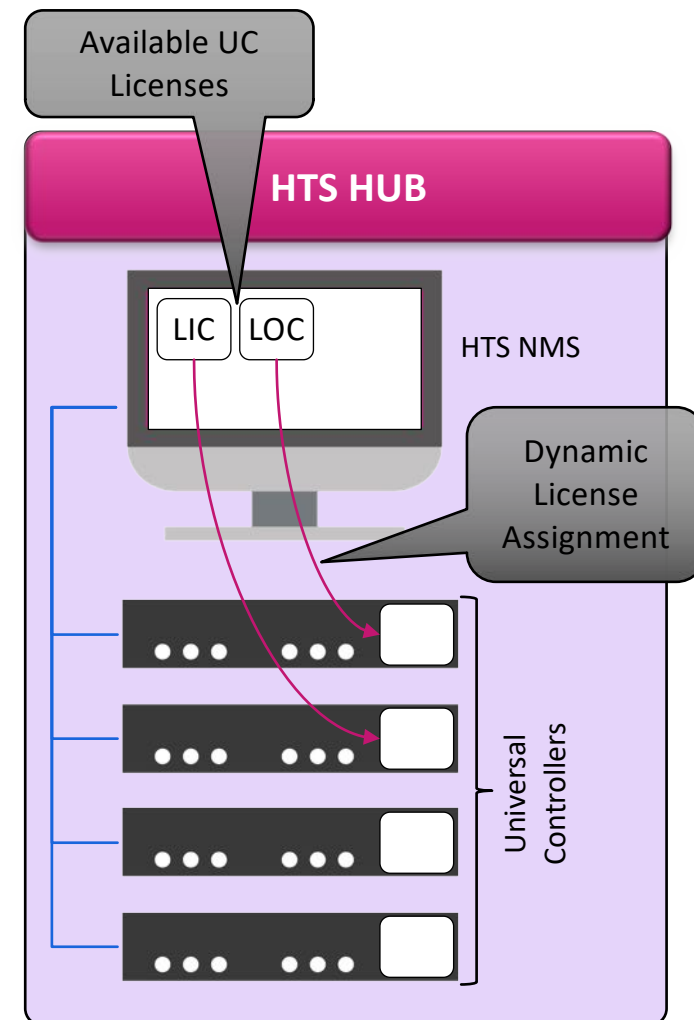
# HTS HUB ARCHITECTURE

- UHP Hub includes one or multiple IF Groups
- Each IF Group uses a common IF subsystem with aggregate Tx and Rx ports (L-band 950-2150 MHz)
- Universal Controllers are the building blocks of the hub and can perform various Hub roles
- Optional wideband modulators with HubMux feature allow combining several slice controllers within a single wideband carrier (200 Msps)
- Network Management System dynamically assigns roles to the universal controllers, configures and monitors each network component



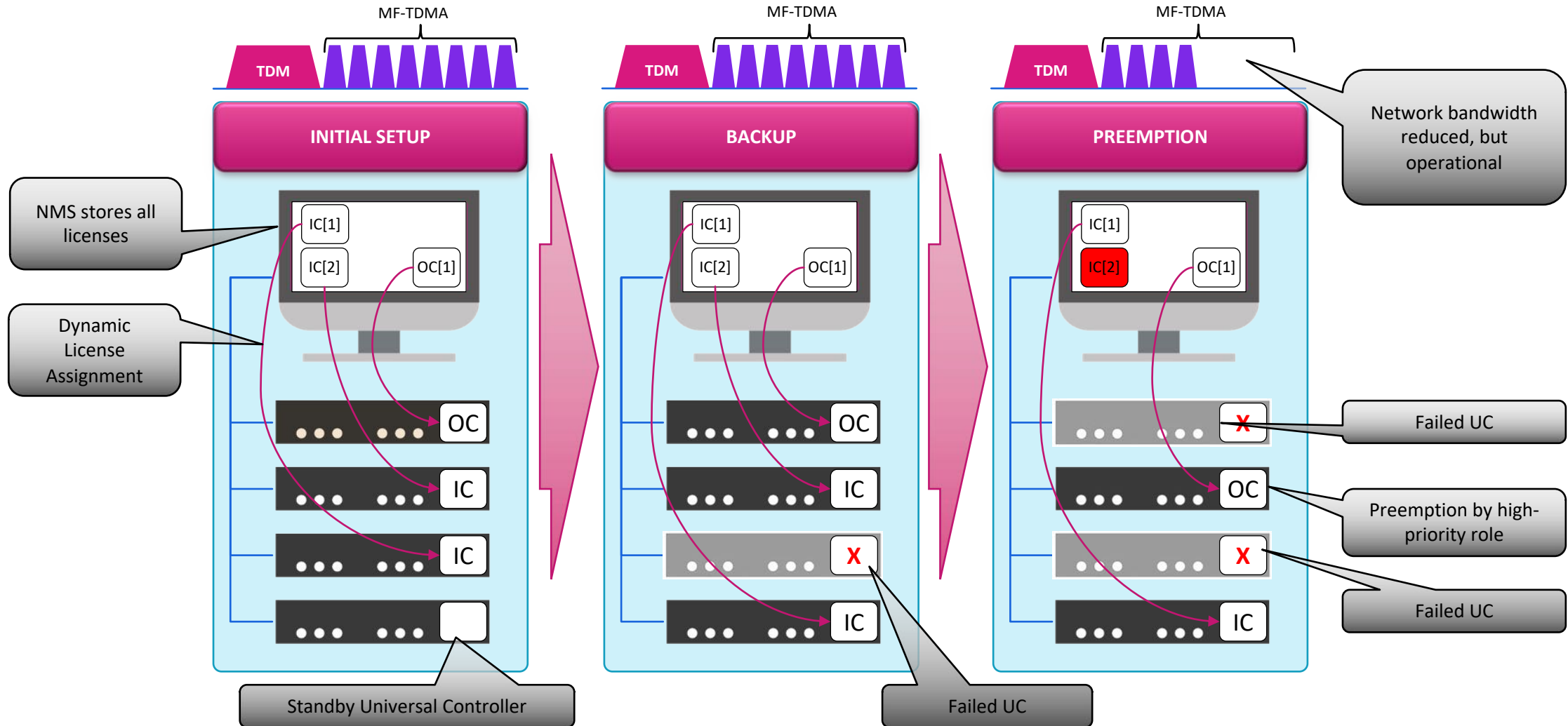
## UNIVERSAL CONTROLLERS (UHP-240)

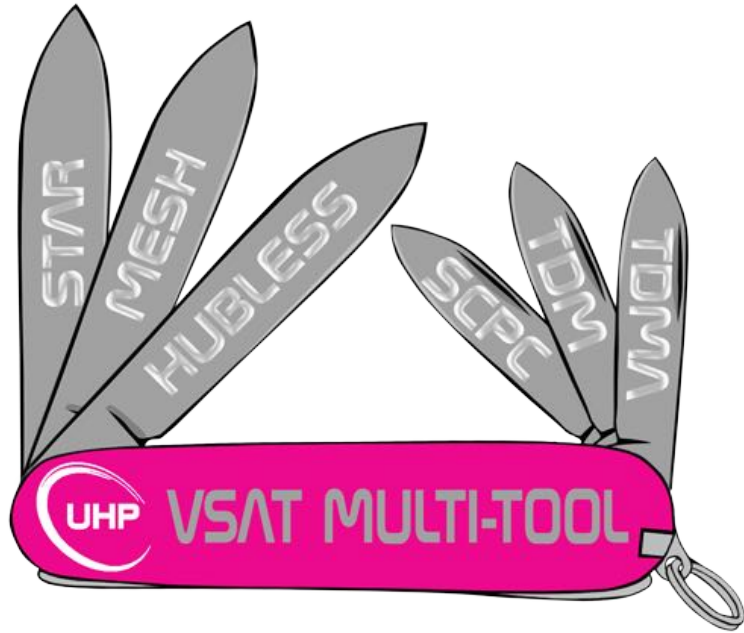
- Universal Controllers (UC) can perform one of the following roles:
  - Outroute Controller (TDM carrier up to 64 Msps)
  - Slice Controller (TDM or SCPC BBFrames for HUBMUX modulator)
  - TDMA Inroute Controller (MF-TDMA carriers, up to 11 Msps)
  - SCPC Inroute Controller (2 SCPC channels, up to 64 Msps)
- NMS manages all UCs and dynamically assigns licenses with appropriate configuration to build the defined Hub setup
- All UC without actual role are considered as redundancy units and managed by Local- / Geo- Smart Redundancy System
- Required licenses can be added as the network develops





# HTS HUB: SELF-HEALING EXAMPLE





# TOPOLOGIES

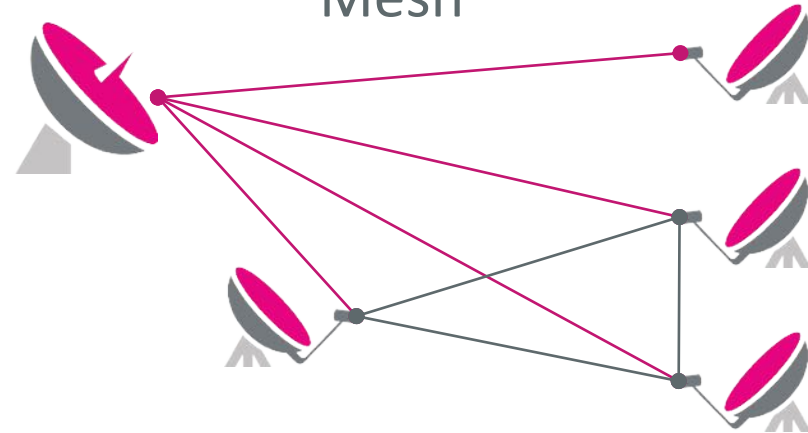
UNIVERSAL HARDWARE PLATFORM

# SOFTWARE DEFINED TOPOLOGIES

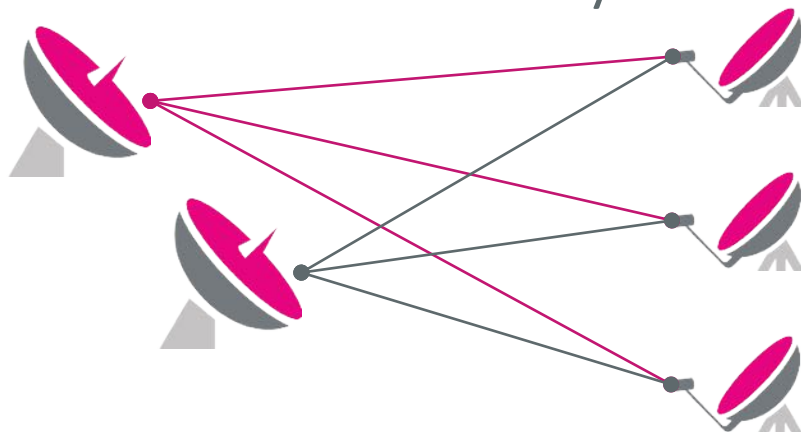
## P2P and Star



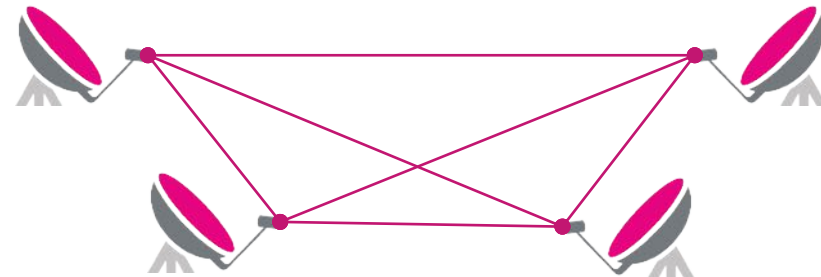
## Mesh



## Dual Gateway

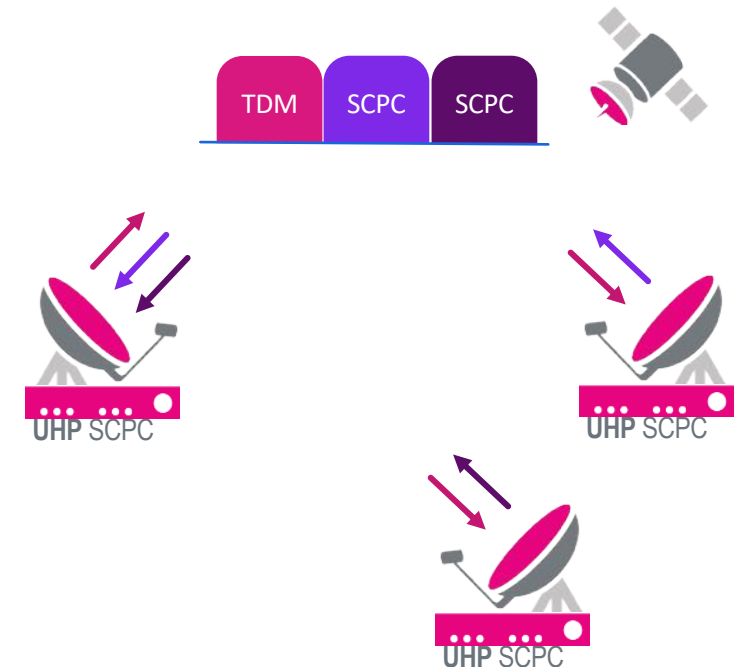


## Full Mesh



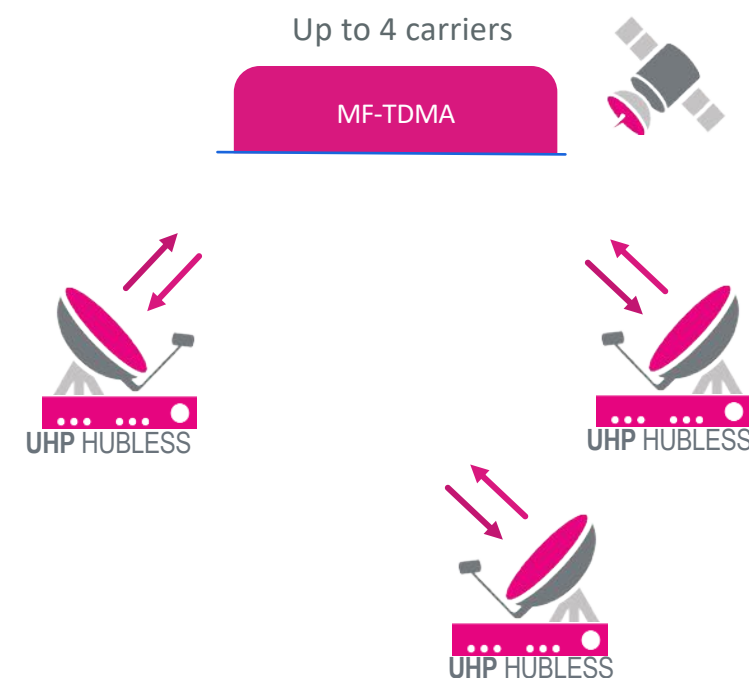
# SCPC P2P | TDM/SCPC | DAMA

- Advantages
  - Bandwidth-efficient DVB-S2X MODCODs up to 64APSK
  - L2 Bridge and advanced IP router with traffic acceleration
  - High throughput up to 225 Mbps
  - Automatic power level control and two-way ACM
  - Dual Gateway feature for hierarchical topologies
  - 1:1 automatic hot-standby redundancy
  - Ultra-compact, reliable HW platform with low power consumption
- Applications: Cellular backhaul, Network backup, IP broadcasting and data delivery, Satellite news gathering
- Topologies: Point-to-point SCPC, TDM broadcast, TDM/SCPC network , On-demand SCPC-DAMA



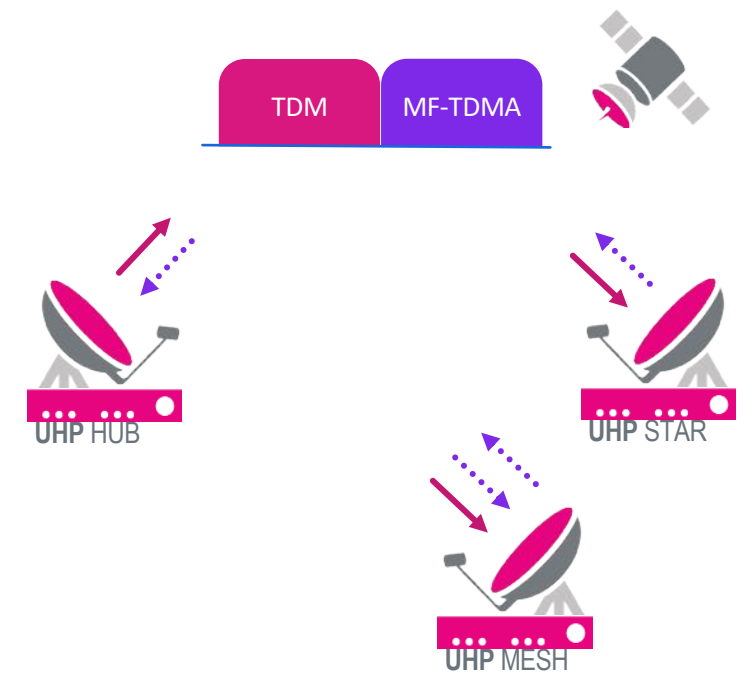
# HUBLESS TDMA MASTER | SLAVE

- Advantages
  - Full-Mesh Single- or Multi-Frequency TDMA operations
  - Innovative TDMA protocol with proven efficiency of 96% vs SCPC
  - 12 MODCODS with QPSK, 8PSK, 16APSK modulations and ACM
  - Up to four MF-TDMA carriers per channel to minimize BUC power
  - Minimal BW requirement is just 105 kHz
  - Ultra-low latency VSAT system with round-trip delay about 570 ms
  - Up to 2040 terminals per network
  - 1:1 Automatic Redundancy option
- Applications: Air Traffic Control, Governmental/Defense, Video/Voice collaboration, Network backup
- Topologies: Point-to-point, Full-Mesh, Star



# TDM/TDMA STAR & MESH

- Advantages
  - Star, Dual-Gateway and Mesh topologies
  - Highly-efficient MF-TDMA and DVB-S2X TDM with ACM
  - Bandwidth saving and latency reduction due to Mesh capability
  - Optional DVB-S2X SCPC and SCPC-DAMA return channels
  - Throughput up to 225 Mbps (190 000 PPS) per terminal
  - Layer 3 routing architecture and Layer 2 bridging mode
  - Support of VLAN, QoS, RT traffic, TCP acceleration, AES encryption
- Applications: Enterprise Networks, Broadband access, Cellular Backhaul, Satellite News Gathering, SCADA / M2M
- Topologies: Star, Dual-Gateway, Mesh





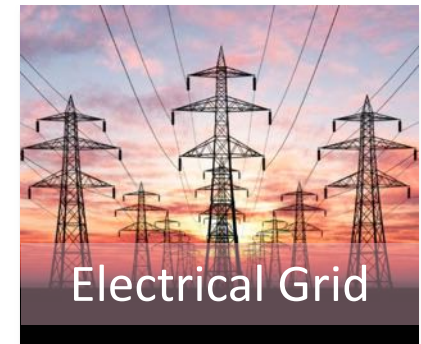
# APPLICATIONS

UNIVERSAL HARDWARE PLATFORM



## ENTERPRISE NETWORKS

- **One-for-all** technology: Software-Defined Functionality
- Highest **transmit capability** from remote : 225 Mbps
- Smallest, lowest power consumption, most **reliable** IDU
- **AES-256** encryption of user data and network management
- NMS with **API** for interfacing with OSS/BSS, etc.
- **Mesh** capability: eliminate double bandwidth allocation due to double hop
- **VNO** capability with hierarchical traffic shaper
- **QoS**: support for VoIP with cRTP header compression + Video over TDMA
- High availability: **Local-/Geo- Redundant** Teleports with Fast switchover

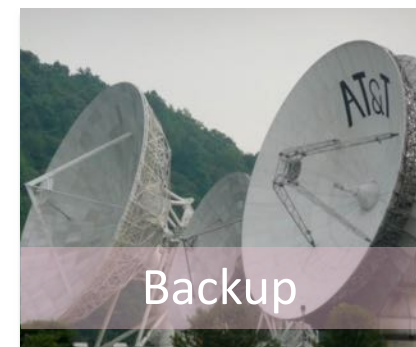






## BACKHAUL

- **DVB-S2X bandwidth-efficient** modulation and coding
- **Scalability:** start with a SCPC link and SW migrate to a TDM/TDMA network
- Highest **TDMA efficiency:** 96% and fast BW allocation
- Highest **transmit capability** : 450 Mbps aggregate
- Extremely high processing capability up to **190K PPS**
- Robust **L2** interface can carry Metro Ethernet traffic, as well as **Layer 3**
- NMS with XML-based **API** for easy integration with OSS/BSS
- Sophisticated **QoS** with built-in 2G, 3G & LTE **backhaul optimization**
- **Field proven** with major Mobile Network Operators in the USA





## BROADBAND

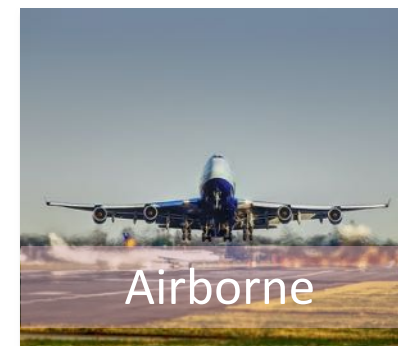
- Designed for multi-spot **High-Throughput Satellites**
- **HUBMUX** – multiservice use of wideband transponders
- High availability: **Local-/Geo- Redundant** Teleports with Fast switchover
- **DVB-S2X bandwidth-efficient** modulation and coding
- Highest **TDMA efficiency**: 96% and fast BW allocation
- **Slotted Aloha** network entry for periodically active terminals
- NMS with XML-based **API** for easy integration with OSS/BSS
- **Network-locked** terminals for aggressive subsidized business models
- Easy to use, reliable terminals with **ultra-fast start** on power on





## MOBILITY

- Efficient MODCODs with ACM and **high throughput**
- Software-defined equipment with **TDMA and SCPC return channels**
- **OpenAMIP** and other proprietary protocols to interface with antennas
- Automatic **beam switching** with network roaming
- Support for **GXT coverage maps** with prioritization of overlaps
- **Doppler effect** compensation up to 1300 km/h speeds
- **Load balancing** of channels and beams with predefined priorities
- Satellite router board for **integration into antennas**





## MEDIA

- Universal network for content **contribution and distribution**
- Effective **DVB-S2X broadcasting** up to 225 Mbps
- Powerful **IP router** with Gigabit Ethernet ports
- Dynamic **bandwidth allocation** for DSNG transmissions
- **Mesh** capability: eliminate double bandwidth allocation
- **QoS**, support for VoIP with cRTP header compression, TDMA with low jitter
- **AES-256 encryption** of transmitted content
- Best network availability: **Local-/Geo- Redundant** Teleports





## MISSION-CRITICAL

- **One-for-all** technology: Software-Definable Satellite Router
- Dynamic topologies and **M:N redundancy**
- Ready for integration with **manpack** antenna systems
- **Ultra-fast start** and extended operational temperatures
- Superior network **Reliability and Survivability**
- **Ruggedized outdoor Hub** for field-deployable networks
- Support of C-, X-, Ku- and Ka-bands, including **HTS**
- **Ultra-low latency** VSAT system with TDMA Mesh topology
- Support of **OpenAMIP** and other protocols to interface with mobile antennas

