# New Developments in Ground Systems

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With High Throughput Satellite (HTS) options becoming reality, the term "future proof" is thrown around in marketing materials and presentations without much in the way of definition or clarity on what it means for a ground platform to truly be ready for tomorrow's satellite communications landscape. One thing that is clear is the fact that service providers must look into their futures and build their differentiated service offerings on a ground platform that enables them to meet the upcoming demands of their end users while unleashing the potential that HTS promises at the appropriate time. Another certainty is the fact that the performance and commercial demands of the satellite network will continue to increase significantly. Satellite networks that were rolled out in 2015 and 2016 to support a combination of voice and data are already being tested as today's end users are using a growing array of multimedia options to remain constantly connected. Looking forward, demands on satellite networks will parallel those on the telecommunications industry as a whole, which makes the selection of a satellite ground platform the single most important decision a satellite service provider can make.

*VSAT Networking for Premium Enterprise (Source: Fotolia)*

*Heights Networking Platform & NetVue Integrated Management Systems*

The first element of being future proof is the ability to support end user throughputs two or three years from now, not just today. Satellite networks designed for today's requirements very quickly become throttled as user demand increases. This results in two paths to remedy the situation, both of which are detrimental to profitability and growth, and provide the risk of lost business for the service provider. The first path is to simply throttle the remote and keep the level of throughput per site to the original design. This certainly is the low-cost solution, but it limits revenue potential while opening the door for a competing offering to replace the existing service. The second, more likely, path requires a costly site visit to upgrade the remote antenna and/or Block Up Converter (BUC ) size to support the increased throughput demand. In addition, depending on the platform selected, the remote indoor unit may also need to be upgraded if it doesn't have an ample ceiling on Mbps performance and packet processing capabilities. This increased capital expenditure teamed with travel expenses can severely reduce profitability.

The Heights Networking Platform is becoming the platform of choice for service providers looking to leverage infrastructure that allows them to succeed in the long term. The platform supports shared outbound carriers up to 150 Mbps each, capable of supporting over 700 Mbps of user LAN throughputs to a group of remote sites. Combined with return traffic of up to 64 Mbps per remote site, a single network can transport over 1 Gbps of user LAN traffic. The hub can support multiple networks and can, therefore, deliver multiple Gbps on a single platform in a fully managed environment.

Future proof also means the ability to handle the scope (number) of applications simultaneously while providing optimal Quality of Experience (QoE) to the end user. As the number of applications increases, so does the importance of traffic shaping and Quality of Service engines to properly allocate resources and ensure each application is able to run optimally (or at all). The important element here in ground platform selection is whether the modem can handle an increasing mix of applications at the high data rates mentioned before. If not, at a minimum, QoE will suffer. Or, worse, new applications may not be able to be supported at all. The Heights Networking Platform meets the demands of a scope increase in application mix. Heights remote gateways provide between 35,000 to 140,000 packets per second with all features, including three tier traffic priority and weighting, classification, optimization and prioritization, in addition to IP header compression and lossless payload compression, turned on. The platform provides embedded WAN optimization with TCP / http acceleration, persistent TCP connections, image smoothing, DNS caching and object caching, which allows optimal use of space segment resources. In addition to the traffic handling capabilities that deep packet inspection techniques provide teamed with industry-leading compression engines of the modem, the Heights solution leverages dynamic Single Channel per Carrier (dSCPC) operation, which provides the foundational media access advantages that allow the platform to minimize both latency and jitter on the links, which ensures all applications, including new ones, to work optimally.

As networks become more complex to design and operate, robust analytics tools are a must within a future-proof design. These tools must be purpose-built to provide the real-time network insight required to run an optimal network in an easily accessible format. They must allow complete network equipment monitor and control. If the network cannot learn and adapt to changing traffic conditions, portions of the network may be underutilized while other areas may experience blocking and traffic interruptions. The NetVue Integrated Management System, the brains of the Heights solution, was built for just this purpose. NetVue is a robust, comprehensive network analytics engine that allows a service provider's Network Operations Center (NOC) staff to intelligently maximize resource utilization, ensure network uptime and provide consistent service levels.

As service providers grow and modify their business approaches, a ground platform solution that is future-proof must have the flexibility to allow multiple business models to be provided. While a single managed network may be rolled out in the beginning to support private networks, many service providers see opportunity in offering Virtual Network Operator (VNO) models to smaller service providers that require quick entry into a new market or are testing new markets for potential business growth. The Heights Networking Platform enables this type of future business growth opportunity, offering a combination of shared and dedicated resources that allows a Home Network Operator (HNO) to partition off a portion of its hub and provide complete network management to a VNO within defined constraints.

Open HTS designs becoming available in 2017, offer many key advantages to the satellite operator over traditional Fixed Satellite Services (FSS) satellites. First, most designs offer significantly more bandwidth per beam into areas of high demand. Second, the implementation of smaller, geographically dispersed beams allows performance levels on both the downlink (spacecraft to earth station) and the uplink (earth station to spacecraft). These increased performance levels enable new economic models, but only to those that leverage ground equipment with these advantages.

Concerning the first element, more bandwidth per beam, future-proof ground equipment must offer increasingly higher symbol rates to allow a service provider to leverage these larger transponders cost effectively.

*Network Professional (Source: Istock Photo)*

*Service Provider Utilizing Heights Networking Platform*

Ideally, ground equipment would be able to transmit, at least in the outbound direction, at symbol rates that match the capacity of the beam. Failure to do so would require multiple outbound carriers (sent by multiple modulators) to be sent, increasing capital expenditure at the hub while decreasing the bandwidth sharing possibilities required to minimize operating expenses. Care should be taken, therefore, when rolling out services that may transition onto an HTS solution in the future to ensure optimal use of space segment resources with minimal capital expenditure. A single Heights Networking Platform is capable of supporting multiple outbound carriers at up to 150 Msps each, allowing service providers to take advantage of these larger bandwidth beams. The ability to send such a large common carrier at such high speeds allows the service provider to share this bandwidth optimally, driving down costs while maximizing service levels.

The increased performance levels of smaller beams through focused transmit and receive operations on the spacecraft influence the economics equation the most for HTS designs. Smaller, focused beams allow a spacecraft to transmit a signal with much more intensity into the desired receive area on earth, offering the ability to transmit higher data rates through stronger modulation and coding techniques. The second, and much more important, advantage of smaller beam design is the significantly decreased earth noise element involved when HTS designs receive transmissions from earth on the uplink. Newer spacecraft designs available today offer from +3dB/K (twice) up to +9dB/K (four times) performance enhancements over traditional wide beam designs. Translated into signal levels, this means that a signal transmitted to a satellite can be between two to four times smaller and still receive with the same quality at the spacecraft. Looking at it another way, signals of common amplitude can transmit between two and four times as much information using the same ground equipment (antenna, BUC and indoor unit).

A future-proof design allows the service provider to leverage these new efficiencies, both in terms of Mbps/MHz and Mbps/Watt. While antenna and BUC selection are typically made independent upon the satellite platform chosen, these elements all work in tandem and care must be taken to ensure the selected ground equipment can handle double, triple or quadruple the amount of throughputs possible with the new designs. The most important factor here will not be the maximum duplex Mbps that can be supported by a remote but rather the maximum duplex packets per second the unit can support with the essential features of traffic shaping, QoS, header compression and lossless payload compression turned on. The Heights Networking Platform provides the high horsepower solution that meets these future demands, providing between 35,000 to 140,000 packets per second with all features, including three tier traffic priority and weighting, classification, optimization and prioritization, in addition to IP header compression and lossless payload compression, turned on.

Unfortunately, the advantages of transitioning to an HTS design also introduce many challenges to the service provider. The first and most obvious is scaling a hub that previously used one wide beam to cover a desired coverage area to 5, 10 or perhaps 20 beams. Hub hardware scalability is challenged in such a transition, but future-proof ground solutions provide the means to flexibly scale build outs to allow the service provider to take advantage of performance enhancements. Designed with this element in mind, the Heights solution provides the graceful scalability required to allow a service provider to grow its network intelligently, tying hub capital expenses to service revenue, which is key in a profitable endeavor.

The inherent design of an HTS solution poses another significant challenge to the service provider due to the variance in EIRP and G/T contours for a given coverage. Traditional wide beam solutions provide a very homogeneous performance environment as coverage is vast and satellite power and reception ability is spread across this large area. In the case of tens or hundreds of small beams, the performance levels of the spacecraft vary drastically from one point on earth to another. While Adaptive Coding and Modulation (ACM) techniques are available on the outbound carrier, these solutions are not prevalent in the inbound direction. In typical shared TDMA environments, remotes are bundled into pools that use modulation and coding techniques that benefit the most disadvantaged remotes. Unfortunately, this reduces overall per-site performance while driving up costs significantly to ensure all remote sites are on equal footing. The Heights platform removes this issue by leveraging the ACM protocol independently per remote site in the inbound direction. Each remote, depending upon its location, dish size and weather condition utilizes the modulation and coding pair that is most optimal to itself without being burdened by other remotes. A small advantage in traditional wide beam design, this differentiator provides significant benefit to the service provider working within an HTS environment.

This last advantage of a Heights solution in an HTS environment plays an even larger role in a mobility space. Remote vessels on the move often have different antenna types and sizes, traverse different beam contours with widely varying transmit and receive satellite performance levels and experience different, often severe, weather conditions. The bi-directional ACM capabilities of the Heights solution ensures that each vessel is able to operate at its optimal condition in times of clear sky while not falling off the network in times of difficult weather conditions. Comtech has taken this to the next step in 2016, embedding its field-proven mobility controller into the remote gateway, allowing each remote to make its own decision within the unit. The mobility controller interfaces with the Antenna Control Unit (ACU) for seamless beam switching as the terminal crosses beams.

In summary, service providers of 2016 that wish to provide profitable services into 2018, 2019 and beyond must choose a satellite networking platform that provides them the headroom for growth that is sure to come. This is where Comtech EF Data has been focused over the past year, preparing its customers for this future with a satellite networking platform that is capable of growth and truly future proof.

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