SPACEBRIDGE
ALL THINGS CONNECTED

Mobile Network Operators (MNOs) around the world looking to extend new and advanced services face both challenges and opportunities.

Challenges include:

- Cost-effectively launching and delivering broadband and next-gen services, 4G/LTE/ 5G, etc.
- Extending networks to ex-urban, rural, remote, and low-density regions, delivering QoS and making business cases work for low density, low ARPU, and small-cell regions.
- Upgrading and expanding to Edge opportunities.

Satellite Solutions Built for Mobile Operators

SpaceBridge provides networking technologies that can address the spectrum of end-to-end satellite backhaul network solutions required by operators for:

- Remote, rural and ex-urban Base Station-to-Network Backhauling – from to 2G, to 3G, 4G/LTE Networks, and transition to emerging 5G/MEC requirements
- Reliable satellite Backup of terrestrial networks
- Traffic overflow capacity to supplement terrestrial backhaul
- Disaster Recovery networks via rapidly deployable satellite backhaul solutions

Intelligent Backhaul Optimization and Acceleration Solutions.

SpaceBridge offers a family of integrated Satellite modems with performance and Networking features built to meet the needs of mobile operators, from 2G systems backhauling to transitioning to 5G.

Our 2G/3G/4G/LTE Intelligent Backhaul Optimization and Acceleration solutions maximize performance of satellite links, while giving operators performance, scalability, flexibility and efficiency-savings.

ASAT™ Ultimate Series VSAT System

SpaceBridge ASAT™ VSAT Hubs and satellite terminals integrate our modems and routers to provide an end-to-end satellite networking solution that reduces the costs for deployment and operation. The SpaceBridge ASAT™ system is perfectly suited for:

- Extending Cellular and Wireless coverage into ex-urban, rural or remote areas
- Backup of terrestrial backhaul links
- Disaster Recovery and special event capacity
- Delivering extra capacity for peak-hour traffic overflow, for example, to offload overflow traffic off saturated microwave backhaul paths.

ASAT™ offers a superior satellite backhaul network solution for meeting key challenges faced by rural networks, where an affordable solution is essential due to lower ARPUs (average revenue per user).

Top-notch 2G, 3G and 4G / LTE Optimization logic is at the heart of the SpaceBridge ASAT™ cellular backhaul solution, offering MNOs the highest level of savings, scalability and flexibility.

This Optimization logic and software technology from our industry-leading partners is integrated into both our ASAT™ System VSAT HUb and Modem Routers to maximize end-to-end satellite network performance.

Maximizing Satellite Efficiency: the WaveSwitch™ Advantage

The **SpaceBridge WaveSwitch™** is designed to address the challenge of delivering end-user Quality of Service (QOS) in heavily or fully-subscribed cellular networks during peak traffic, while dramatically saving satellite costs. By dynamically switching between SCPC and MF-TDMA real time waveforms and multipleÅ access methods, SpaceBridge WaveSwitch™ optimizes satellite capacity usage – saving costs.

Powered By WaveSwitch™

By reducing the cost of ownership, SpaceBridge's WaveSwitch™ allows business cases to close at lower thresholds than ever before. With SpaceBridge solutions, Internet service providers and mobile network operators can achieve high-ROI savings in backhaul OPEX. You can do this while building a software-defined network (SDN) architecture that includes future migration to LTE backhaul services or traffic offload.

Customer-Driven Solutions

Since the introduction of our Cellular backhaul solution introduction in 2004, the customer base for Spacebridge's cellular backhaul product family has grown exponentially, and includes major customers such as: Telefonica, Claro -America Movil, Telkomsel, Entel and others.

New bandwidth efficiencies such as High Throughput Satellite (HTS) systems have recently changed the economics.Å MNOs can now leverage these improvements in order to extend network coverage further than ever before into rural and remote markets.

Optimized Cellular backhauling over Satellite Network for legacy and future cellular network generations

SpaceBridge provides networking technologies that can address the spectrum of end-to-end satellite backhaul network solutions required by MNO's.

Benefits & Features

End to end satellite bandwidth efficient, holistic support of: 3G, 4G & MEC Cellular backhauling networks.

Benefits

- Optimize space segment usage – a keyÅ recurring cost.
- Backup terrestrial broadband links
- Special event or "surge capacity" servingÅ COW's Cellular On Wheals
- Extra capacity for Peak hour traffic,Å alleviate and avoid temporary trafficÅ overload on microwave backhaul paths.

Features

- 3G Iub/ 4G GTP acceleration and optimizationÅ techniques maximize satellite bandwidthÅ efficiency
- WaveSwitchÄÄ technology - dynamic switchingÅmethod of allocating either SCPC or MF-TDMA or ASCPC real time waveform
- Capacity based on real application awareÅ technique.
- Multi vendors BTS, NodeB, eNodeB,Å deployment and Integration

Verticals

5G Cellular Networks
Path to 5G Broadband: Multi-Access Edge Computing (MEC)

5G network architecture pushes some decisions and applications to the "Edge" of the network, closer to subscribers, in order to provide low latency and high bandwidth access to content and services. Edge computing technologies and MEC in particular, provide a migration path towards 5G.

Open Radio Access Network (RAN) and Multi-Access Edge Computing / Mobile Edge Computing

Mobile operators can use MEC to flexibly and rapidly deploy innovative applications and services for mobile subscribers by opening their Radio Access Network (RAN) edge to authorized third-parties.

Deploying an open-RAN MEC platform will let an operator offload processing from the Core to the network Edge and drive content nearer to end users. By processing data locally, MEC applications can also significantly reduce backhaul traffic and data transfer costs. Operators can offload traffic from their own networks, while letting authorized and authenticated networks to inject content directly at the edge without consuming the MNO's core network. With MEC this can be done while maintaining full core compatibility and support.

Leveraging Satellite advantages with Mobile Edge

Inherently a wide-area, one-to-many broadcast technology, satellites are very effective for pushing the same content to many locations. This makes them very effective for:

- Instantly updating CDN endpoints and caching servers with popular content that can be locally cached; and
- Broadcasting the same live stream to a virtually unlimited number of receive points.

When combined with MEC, satellite can be used to more efficiently distribute certain types of bandwidth-intensive video and content traffic – and thereby free up terrestrial backhaul and front haul capacity for interactive services.

VSAT Router with Edge MEC Capabilities – U7780 Multi-Access Edge Computing

The SpaceBridge U7780 Mobile Edge Computing "MEC" Modem provides an ideal solution to leverage the efficiency of satellite "edge" delivery combined with the power of MEC for mobile operators.

The U7780 **Mobile Edge Computing "MEC" Modem** is equipped with internal computing power to enable smooth integration into 5G networks, and to support applications deployed over NFV (Network Function Virtualization) and SDN (Software Defined Network) infrastructure to the Edge.

More than simply an advanced satellite modem, it also hosts an Open Standards Edge Computing platform designed to help MNOs run MEC applications. With the U7780 VSAT platform, operators can run various types of satellite-enhanced edge services and applications, including:

- Content Delivery Network (CDN): a U7780 MEC can serve as a CDN end point, caching popularÅ satellite-delivered content on the MEC platform – in order to improve user latency, and reduceÅ backhaul traffic.
- Throughput Guidance: Throughput Guidance and QoS to throttle content delivery speeds andÅ maintain high quality of experience for interactive applications at sites deployed with satelliteÅ backhaul
- Multi-link / Offload: MEC local breakout capabilities can be used to set up sites with multipleÅ backhaul links, terrestrial and satellite. This can improve service resiliency and protectÅ infrastructure with MEC DDoS defenses. It can Increase the capacity of LTE sites withÅ complimentary satellite capacity.
- Traffic steering / Traffic offload: Traffic steering can be used to drive heavy/popular content suchÅs viral videos to edge hosting, while freeing terrestrial capacity for response time sensitiveÅ interactive applications.

The U7780 VSAT router provides operators the infrastructure for delivering smart and cost-effective applications and processing to the edge.

2G Cellular Networks

For mobile network operators to gain the business advantages of satellite backhaul in **2G networks**, the satellite solution needs to:

- Optimize space segment usage – a key recurring cost.
- Fully integrate with cellular Base Stations vendors to optimize Jitter, delay and Synchronization between the Base Transceiver Station (BTS) and the BSC (Base Station Controller).
- Integrate easily into complex mobile networks, with multiple standards.

ASAT™ Ultimate Series VSAT System: 2G Backhaul Solutions

SpaceBridge ASAT™ VSAT Hubs and satellite terminals (U7780) integrate IP based 2G networking optimized modems to provide an end-to-end satellite networking solution that reduces the costs for deployment and operation.

- Extending Cellular and Wireless coverage into ex-urban, rural or remote areas
- Backup of terrestrial backhaul links
- Disaster Recovery and special event capacity
- Delivering extra capacity for peak-hour traffic overflow, for example, to offload overflow traffic off saturated microwave backhaul paths.

For 2G cellular network backhaul, the SpaceBridge U7780 VSAT modem, integrates optimization to maximize backhaul bandwidth in a cost-effective package. it also enables full synchronization between the BSC and the BTS.

ASAT™ offers a superior satellite backhaul network solution for meeting key challenges faced by rural networks, where an affordable solution is essential due to lower ARPUs (average revenue per user).

Maximizing Satellite Efficiency: the WaveSwitch™ Advantage

By dynamically switching between SCPC and MF-TDMA real time waveforms and multiple access methods, **SpaceBridge WaveSwitch™** optimizes satellite capacity usage – saving costs. The **SpaceBridge WaveSwitch™** is designed to address the challenge of delivering end-user Quality of Service (QoS) in heavily or fully-subscribed cellular networks during peak traffic, while dramatically saving satellite costs.

By reducing the cost of ownership, **SpaceBridge's WaveSwitch™** allows business cases to close at lower thresholds.

3G, 4G, MEC Cellular Networks

The evolution of 2.5 G and 3G mobile networks with the addition of broadband services to smart phones required tighter integration of IP networking into the backhaul link. Now carrying over 70% of total mobile traffic, fourth cellular generation 4G/LTE network deployments have brought huge increases in bandwidth and broadband speeds for subscribers. For mobile networkÅ operatorsÅ(MNOs) to gain the business advantages of satellite backhaul in 3G/4G networks, the satellite solution needs to:

- Deliver much higher bit rates, to support data traffic
- Optimize space segment usage – a key recurring cost
- Maximize data link efficiency and minimize overhead in backhaul links
- Integrate new IP-rich networking capabilities
- Integrate easily into complex mobile networks, with multiple standards.
- Add more optimization of Iub and GTP "GPRS Tunneling encrypted protocol" over the S1 interfaceÅbetween the RAN EPC and the eNodeB —to support 4G

Optimized for Satellite IP 3G/4G/LTE
The SpaceBridge U7780 is integrated VSAT modems with built-in optimization for IP 3G and 4G/ LTE satellite backhaul.   Advantages include:

Multiple Link Optimization techniques
A 3G and 4G Optimizer and built-in Acceleration Appliance Special Iub and GTP acceleration techniques maximize satellite bandwidth efficiency
Advanced satellite modulation & coding for up to 200 Mbps transmission
All of these features integrated in a single 1U enclosure.

Data Link Optimization and Acceleration Technologies
To increase bandwidth efficiency, throughput and QoS for end-users, the U7780 integrated VSAT modem employs efficient new satellite modulation and coding technologies and standards. Data optimization techniques such as header data compression, web and video acceleration, and caching combine to boost user experience.

Spacebridge ASAT™ offers a superior satellite backhaul network solution for meeting key challenges faced by 3G/4G networks in an affordable solution that reduces the overall cost of ownership. The **SpaceBridge ASAT™** system is perfectly suited for:

- Extending cellular and wireless coverage into ex-urban, rural or remote areas
- Backup of terrestrial backhaul links
- Disaster Recovery
- special event capacity
- Delivering extra backhaul capacity, for example, to carry overflow traffic diverted from saturated microwave backhaul paths during traffic peaks.

The **WaveSwitch™** system addresses the challenges of Busy-Hour Traffic and end-user Quality of Experience (QoE) in heavily to fully-subscribed cellular networks, while significantly saving costly satellite resources.