

# SATHAUL-XE™ SOLUTION OVERVIEW

The growth and popularity of mobile voice and data services are causing mobile network operators around the globe to evaluate different backhaul technologies to meet the rapidly increasing demand for their 4G/LTE network deployments. From a satellite network perspective the ground segment will need to adapt to the new HTS ecosystem, along with terrestrial operators requirements for throughput consistency beyond 100 Mbps for LTE.

In addition to meeting sheer throughput requirements along with the best possible efficiencies using DVB-S2/ DVB-S2X and Adaptive TDMA, dynamic bandwidth allocation is critical to satisfying new traffic patterns, as well as bandwidth savings such as data compression and traffic optimization through QoS and local caching — all attributes of newer generations of terminals, minimizing actual traffic that needs to go through the satellite link. Other important factors for mobile network operators are bandwidth efficiencies on the satellite link and protocol optimization. Optimizing mobile protocols to work over satellite and seemingly integrate with the MNO's opera-

tion is essential: traffic acceleration and synchronization of OSS/BSS platforms provides meaningful advantages.

As a global leader of IP based satellite communications our platform is designed to deliver the highest performance, greatest efficiency and maximum opportunity for ST Engineering iDirect partners. Key differentiators when using a solution for 2G/3G/4G/LTE connectivity is our SatHaul-XE™ Optimization Suite which integrates Cellular Backhaul optimization with features that include TCP Acceleration features with GTP optimization, IPSec specifically for mobile networks, and Compression.

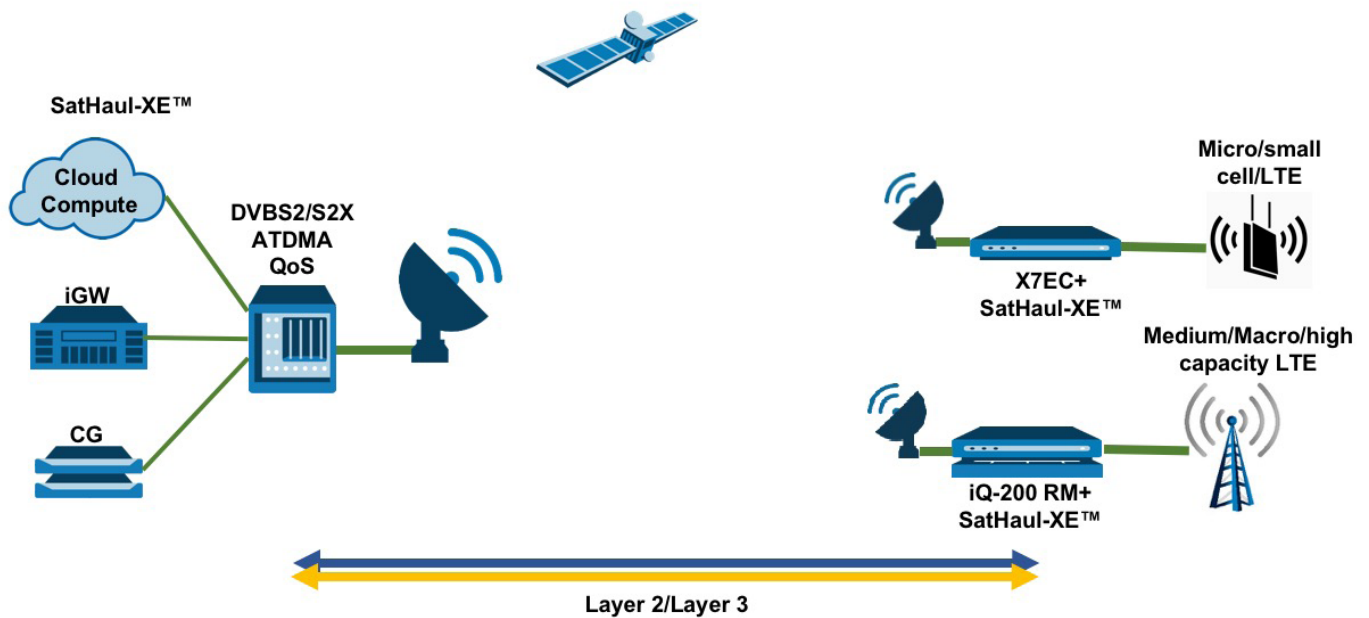
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The SatHaul Optimization Suite Focuses on Three Key Aspects for Network Efficiency:



Acceleration



Security



Compression

## Key 4G/LTE features of the SatHaul-XE Optimization Suite



### TCP Acceleration

Subscribers with a 4G device expect a high quality connection with multi-megabit throughput capabilities to deliver the latest in Internet connectivity, including streaming audio and video. One of the challenges using satellite to backhaul TCP/IP traffic is the approximately 600ms delay that is introduced through the roundtrip time sending a signal to and from the satellite.

With LTE there is the additional encapsulation of the traffic within the GPRS Tunneling Protocol (GTP) which requires special handling in order to get into the user's IP packet for acceleration and optimization. The SatHaul-XE protocol

processing engine handles the delay and additional GTP encapsulation by allowing acknowledgements to be sent back to the base station from the satellite terminal before being transmitted over the satellite. It enables larger amounts of data to be quickly transmitted without being impacted by the satellite delay while preserving protocol information such as IP addresses and port numbers. Ultimately this translates to delivering the end users the high-speed experience they expect transparently as they would from any alternate wireless connection. The intelligent handling for TCP acknowledgements and transmission results in a significant reduction in the bandwidth used on the return channel and adds even more value in capacity savings.



## Security

As mobile subscribers use their various devices from smart phones to tablets for surfing the Internet, shopping, banking or healthcare they are sharing user information that must be kept safe and secure.

A standard LTE implementation will use IPsec to secure all communications by authenticating and encrypting the data from the LTE eNodeB through the network to the Security Gateway within the Mobile Network Operators Core Network. In the past, it was not possible to optimize all of this information, as the traffic was encrypted.

SatHaul-XE optimization is designed to integrate into the “chain of trust” in the mobile operator’s network. This means that IPsec traffic can be decrypted, optimized, and re-encrypted inside the optimization device’s CPU. This allows the security of the traffic to be maintained throughout the entire network path, even when it is travelling over the satellite link. We use a processor with hardware encryption support to make sure that this process does not impact the performance of the satellite terminal or the throughput of the traffic.

IPsec can be supported and maintained while at the same time optimizing the traffic to significantly improve the efficiency and user experience of running over a satellite link.



## Compression

LTE networks provide the user with end-to-end IP connectivity from the handset to the end service, such as a web site or a voice server. They do this by carrying as many as five different protocols each one on top of the next. Each protocol has its own protocol header, much

of which does not change from packet to packet. Carrying all this header information is both inefficient and expensive over satellite.

Header compression works by removing the elements that are not relevant to save on bandwidth. The LTE header stack is compressed over the air interface using a standard called Robust Header Compression (RoHCv2.). SatHaul-XE uses the same standard to compress the headers over the satellite link.

This technique is especially effective when small packets are being transmitted and applies in both directions. When voice samples are only around 1/3 of the total traffic, bandwidth can potentially be reduced to more than 50% with IPsec.

With the increased amount of data traffic on 4G/LTE networks it becomes even more important to optimize the traffic before sending it over the satellite link. Aside from the header information, you have actual user traffic or payload that is being transmitted. In order to compress this traffic you must be able to see and understand what type of voice or data traffic is being transmitted.

Depending on the type of traffic there may be additional compression that can be applied that will also help save on the amount of bandwidth needed to transmit. We utilize some of the latest compression algorithms to optimize the payload traffic while maintaining a good experience at the device level. For general web browsing or text based traffic, payload compression can have a strong impact compared to traffic that has already been zipped or isn't able to be compressed. Overall this may save an additional 10-15% on the amount of traffic that is sent over satellite.

## How Do I Deploy the SatHaul-XE Optimization Suite?

SatHaul-XE Optimization Suite offers several packages to address various Cellular Backhaul requirements.

Remote terminal site options include: (1) Software embedded license on Evolution X7-EC satellite remote routers (2) An appliance to accompany an iQ 200 modem (3) Upgrade existing licenses in the field with SatHaul-XE Companion to increase throughput 50>100>200 Mbps.

On the hub side, SatHaul-XE gateway converts the traffic to standard mobile interfaces — S1 for LTE, lub/luh for 3G and Abis for 2G, where it will continue its journey back into your core network.

For deployments at the hub side SatHaul-XE is available as a software license on our Protocol Processors of up to 400Mbps and up to 1.0Gbps for our Gateway.

The same license as above can also be deployed on a cloud compute environment.

A mobile operator can choose between options depending on the market, Cellular Backhaul applications, or the existing ground equipment already in place. For connecting remote or rural locations, enabling emergency services, or providing connectivity in mobile environments the SatHaul-XE Optimization Suite can be deployed in the appropriate form factor while maximizing the capabilities of satellite for backhaul.

ST Engineering iDirect is a leader in multiple enterprise and telco markets, bringing carrier grade experience quality, layer 2 integration, high availability and security, together with unparalleled carrier efficiency and granularity with Adaptive TDMA and DVB-S2X. SatHaul-XE enhances these capabilities further to address multiple cell backhaul markets bringing a complete set of optimization techniques that can deliver satellite bandwidth savings up to 50% at a site depending on traffic profiles.

### Improving 2G and 3G networks:

Many operators are still running 2G and 3G networks and are looking to expand the reach of those services to new or under-served areas as well. Whether it's the 2G Abis or the 3G lub/luh protocols, the need to optimize these connections when using satellite can make or break the business case.

The SatHaul Solution Suite includes optimization capabilities for 2G and 3G networks as well. For 2G it is more about the intelligent handling of voice calls to make sure that you are limiting the bandwidth, without impacting the quality of the call. With 3G it is the mix of voice and basic data services, so a higher amount of IP traffic is being transported. This means that traffic must be intelligently sorted, organized and then optimized to maintain quality of service requirements for different types of traffic and to overcome the various challenges of latency and packet loss.

These various optimization techniques can deliver satellite bandwidth savings up to 50% at a site depending on the traffic profiles.