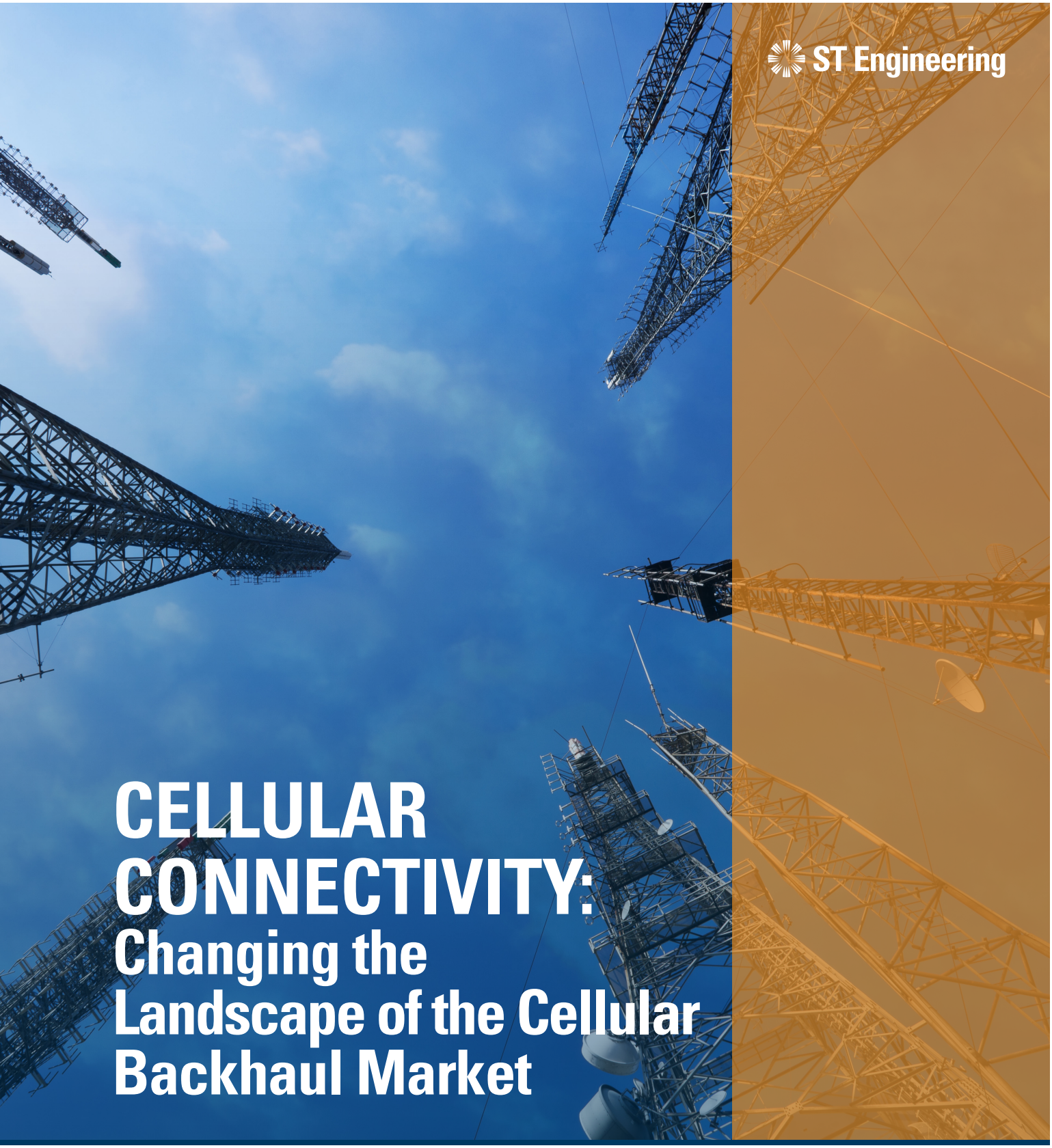

ST Engineering

# CELLULAR CONNECTIVITY:
## Changing the Landscape of the Cellular Backhaul Market

powered by Newtec iDirect

**The demand for connectivity is surging worldwide. Today more than ever, more people in more places are connecting for work, entertainment, social communications, and education. Increasingly, they're using smartphones, tablets, and other easy-to-carry devices. And in many underdeveloped parts of the world, smartphones are often the only Internet access technology that's both affordable and available.**

**As a result, mobile networks are poised to become the primary way in which we connect. According to the 2018 Ericsson Mobility Report, there will be 7.2 billion smartphone subscriptions by 2023. Total data traffic has surged by 400% from 2013 to today and is projected to explode another 500% by 2023.**

This exponential growth in demand is arriving with some significant challenges for mobile network operators:

- As smartphones continue to spread throughout underdeveloped parts of the world, mobile operators will need to supply remote coverage that can handle not only traditional voice but new data-heavy applications as well.
- In urban areas, mobile network operators will need to find a way to deal with the congestion that results when crowds swarm and jam a network. Offloading traffic in these situations will be necessary to preserve network availability.
- Mobile operators will be called upon to power over-the-top (OTT) content distribution; this is becoming the preferred way to consume video content over traditional television and broadcasting methods.
- They will need a backup to supply critical communications when natural disasters wipe away existing infrastructure.

**To keep pace with growing demand and handle the massive amount of traffic coming their way, mobile network operators must look outside of their own networks. This is where satellite connectivity's inherent capabilities, strengthened by recent innovations, can help mobile operators address key challenges posed by growing demand.**

## Using Satellite To Expand Mobile Networks In Remote Areas

Many mobile network operators are already familiar with satellite connectivity, having relied on satellite service providers for years to help them backhaul traffic and extend network coverage in underserved areas. Satellite connectivity added distinct value given its imperviousness to terrain and line-of-sight restrictions as well as its quick and easy deployment and ability to directly interface with all IP technology.

As new populations come online, they will expect the same connectivity that the rest of the world has. Whereas 2G and 3G placed a high demand on voice, more 4G/LTE networks are being rolled out to handle the prevailing data and video traffic that make up the majority of today's traffic profiles.

Considering that 4 billion people remained offline in 2017, there's an incredible amount of room for mobile demand to multiply from 2G to 4G and feed the growth of traditional backhaul. In fact, according to Northern Sky Research (NSR), satellite backhaul is still in its infancy, with satellite backhaul sites projected to grow by 60% by 2027.

These growth projections stem from advances in ground segment satellite technology and lower-cost access networks. Satellite networks have made significant gains in performance and efficiency through DVB-S2X and HTS. There are new methods to compress, optimize, and manage video and heavy data seamlessly over satellite networks. Sophisticated bandwidth management capabilities improve the end-user experience and satisfy demanding applications. Furthermore, satellite connectivity can ensure mobile networks handle the IP traffic protocols in 4G/LTE networks and meet security standards in the most efficient and seamless way, often relying on Layer 2 over Satellite (L2oS) architectures.

### Extracting More Value From Satellite Connectivity

Beyond traditional backhaul to remote areas, a continued partnership between satellite and mobile operators can create opportunity for both and change the landscape of the cellular connectivity market for the better. Hybrid networking presents new use cases for satellite service providers to expand their offerings and help mobile network operators handle the demands of the connected world.

## Using Satellite for Traffic Offload

A large event that brings thousands of people to the city center might traditionally put a strain on terrestrial networks. However, with hybrid networking, satellite connectivity can help relieve congestion in densely-populated urban areas where demand during peak hours is too high for terrestrial networks alone. Mobile satellite terminals can help relieve traffic congestion by offering a hybrid connectivity solution, integrating with the latest 3rd Generation Partnership Project (3GPP) architectures, and offloading certain traffic onto satellite networks.

## Satellite for OTT Content Distribution

The demand for OTT content puts pressure on terrestrial networks in rural and urban geographies. When satellite multicasting is paired with edge computing and local content storage for on-demand and bandwidth-heavy content, it can free up terrestrial networks for other traffic and save time and Money over traditional unicast. Already, exploding IP video and data consumption saw hybrid networks capture over a half a million sites by the end of 2018, according to NSR. Recent advances in 3GPP networks and content distribution management will make OTT over satellite an even more attractive solution. Cisco predicts more than one third of capacity will bypass the core completely by 2022.

This strategy can also enhance the streaming experience for users around the globe while reducing network operational costs. In this scenario, the satellite-forward link can be used for multicast, transporting very large data or video files to thousands of locations simultaneously and achieving significant time and cost savings compared to traditional unicast.

## Satellite for OTT Content Distribution

Many severe weather incidents cause extensive damage that knocks out existing cellular networks. However, mobile operators need their networks to remain up and running for critical disaster response and recovery efforts. With satellite connectivity, mobile operators can offer first responders and government agencies critical communications immediately following a disaster for first response efforts, ensuring relief teams can connect residents, coordinate aid, and maintain the continuity of government as communities recover.

## The Continuing Evolution of Cellular Backhaul: Satellite's Role in 5G

The next stage of evolution for mobile network operators concerns 5G, which calls for a total integration of satellite connectivity with the 5G network model. In fact, NSR estimates that 5G-differentiated applications — such as 5G backhaul and hybrid networks — will generate close to one-third of net satellite capacity revenue growth in backhaul over the next 10 years. This is due, in part, to the fact that 5G backhaul capacity demand will consume four to five times the bandwidth of a 4G site, according to NSR.

A look at the 5G use cases identified by the International Telecommunication Union (ITU) and the 3GPP standards reveals where satellite can play an important role.

### Enhanced Mobile Broadband:

Mobile operators will rely on satellite to drive the next generation of applications that the cellular industry promises such as faster speed to handsets and opening up fixed wireless connectivity to replace last-mile fiber connections to homes and business. Just like with 3G and 4G networks, satellite will provide connectivity to remote and mobile sites.

### This includes:

- **5G to premises:** Satellite will complement terrestrial networks such as broadband connectivity to a home or office in an underserved area or to enterprise sites as a backup.
- **5G fixed backhaul:** Satellite will bring broadband connectivity where it is difficult to deploy terrestrial connections (e.g., in rural and remote areas or across a wide geographic region).
- **5G mobility backhaul:** Satellite will bring broadband connectivity to remotes or user equipment (UEs) on the move such as airplanes, trains, vehicles, and maritime vessels.

### Internet of Things (IoT) Networks:

5G will accelerate massive machine-to-machine (M2M) connectivity to support IoT, whether that comprises sensors, surveillance systems, or automated teller machines (ATMs). In this 5G use case scenario, backhauling from aggregation points is an obvious satellite use case, but the IoT opportunity will also include providing connectivity in remote places, especially with the decreasing size, weight, and power of satellite terminals and the emergence of phased-array antenna technologies.

### Ultra-Reliable and Low-Latency Communications (URLLC):

Although satellite is typically considered to be highly reliable, it will always have some latency and therefore will serve specific ultra-low latency applications (e.g., providing real-time sensor data for autonomous driving or vehicle-to-everything (v-to-x) tasks). However, satellite will be essential to complement these URLLC use cases by pushing out content via multicasting and providing non-critical connectivity to ease congestion.

For example, by multicasting content to millions of vehicles, satellite frees up valuable 5G cellular capacity needed for v-to-x connectivity. In such a case, satellite networks can distribute software and firmware via over-the-air updates as well as provide "infotainment" to passengers inside a vehicle in a cost-effective way. This use case also applies to automation equipment for construction, mining, and agriculture, where feedback and telematics from these devices are critical.

## The ST Engineering iDirect Solution

- **An Efficient, High-performance Platform:** Our bandwidth efficient satellite platform enables mobile network operators and service providers to cost-effectively manage a multitude of small, medium, or large networks, whether it's serving 2G, 3G, or 4G. For very largescale networks, service providers can take advantage of the most efficient bandwidth technology, leveraging DVB-S2X standard to drive efficiency and performance gains. The iQ modem series supports a range of features and throughput levels and can adapt to growing network requirements via software-defined capabilities.

- **Superior Quality of Service:** Our bandwidth-allocation algorithm also allows for countless possibilities of Quality of Service levels, bandwidth management, and traffic prioritization. Mobile network operators can map their core networks to satellite networks to prioritize traffic and maintain distinct Quality of Service settings by remotes, bandwidth groups, and applications to satisfy Service Level Agreements.

- **Layer 2 Over Satellite (L2oS):** Mobile network operators can run our network in a Layer 2 bridging mode with high efficiency as an alternative to traditional Layer 3 mode architecture. By doing so, they can implement a variety of modern, converged network architectures; pass any Layer 3 protocols; and more easily integrate into hybrid network scenarios.

- **SatHaul-XE™:** The SatHaul-XE™ Optimization Suite is an advanced set of tools focused on TCP Acceleration features with TP optimization, IPSec for mobile networks, and compression for intelligent and efficient delivery of 2G, 3G, and 4G/LTE traffic optimized over the links and integrated back to the core network.

- **Edge Computing:** With technologies such as OSMOSIS and multicasting that operate over satellite networks with 4G, 5G, and Multi-access Edge Computing (MEC) integration, popular video content is stored at the edge of the network, offloading traffic from the core network.

## Building Partnerships to Power the Future

In just a few years, connectivity will look drastically different than it does today. Mobile networks will be responsible for delivering huge amounts of content to remote locations, urban centers, disaster-ravaged areas, and more — seamlessly and instantly. With the aid of satellite connectivity, service providers can work with mobile network operators to power a more connected future.

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