THE FUTURE MARKET FOR CELLULAR BACKHAUL:
## How to Win the Expanding Opportunity

The Coming Mobile Surge

The demand for bandwidth is soaring worldwide. More people in more places are connecting for work, entertainment, social communication, and education, and they're increasingly using mobile phones, tablets, and other easy-to-carry devices. And in many developing parts of the world, mobile phones are often the only internet-access technology that's both affordable and available.

As a result, mobile network operators will face intensifying challenges to support surging demand for connectivity. The latest Ericsson Mobility Report projects the following trends by the end of 2025 compared to numbers in 2019:

- **Mobile subscriptions will outnumber people.** There will be 8.9 billion mobile subscriptions globally across different types of devices, higher than the world's population projection. More than 8 billion, or 90%, of the subscriptions will represent mobile broadband.
- **Total data traffic will quadruple, and smartphones will carry the load.** Mobile subscriptions will spawn a 400% growth in global mobile data, which is more than 160 exabytes per month. Further, 95% of mobile data traffic will be generated over smartphones.
- **Video will be everywhere, shaping how we work and view entertainment.** Video will account for 75% of all data traffic. This will be driven by embedded video in online applications, the proliferation of video streaming services, growing use of video collaboration, and higher screen resolutions.
- **4G/LTE networks will achieve near-global coverage.** More than 90% of the world's population will have access to 4G/LTE coverage. These networks are also scaling their throughput capabilities to support faster data speeds that mobile users expect.
- **Developing nations will come online in significant numbers.** Subscriber growth is projected across every region of the developing world, driven by younger populations, increased digitization, growing economies, and cheaper devices. For example, more than 500 million additional smartphone users are expected in India. And we will see a surge in mobile data usage, accounting for 82% of subscriptions in the Middle East and North Africa and 70% in Sub-Saharan Africa, expanding to 50% of the population in that region. Southeast Asia and Latin America are expected to follow similar trends.

- **50 billion IoT devices will be running over cellular networks, with major growth in automotive and transportation.** In the coming years, we will see rapid growth in the deployment of narrowband, broadband, and critical IoT applications worldwide. One of the main industry adopters will be automotive and transportation services, which will span logistics, telematics, fleet management, road infrastructure, infotainment, telematics, driver assistance systems, and autonomous vehicles.
- **5G will see aggressive adoption.** There will be 2.6 billion 5G subscriptions, covering 65% of the world's population and generating 45% of the world's mobile data traffic, most of which will be from video applications.
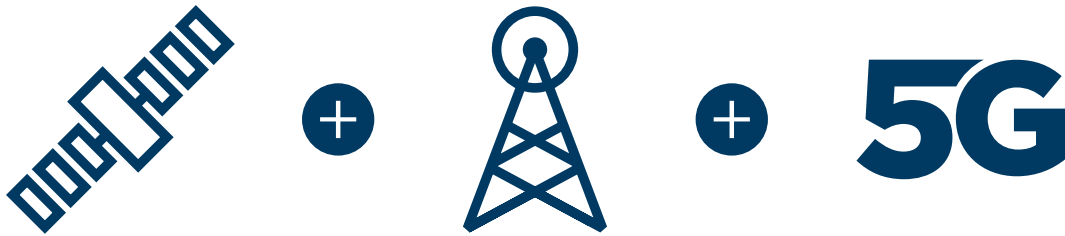
Mobile Network Operator Growth Priorities

As mobile network operators face a future of both opportunity and challenge, they need to expand and diversify their network services. Meeting customer and business demands requires smarter use of bandwidth, drawing from an expanded supply to stretch service to secure new subscribers and support new applications.

Here are the key priorities moving forward:

- **Connect the unconnected.** As mobile phones continue to spread throughout developing 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. Voice communications and the internet are not a luxury — they're a necessity for modern life. A lack of access to the internet hinders society's response to unexpected events, and it has been shown to limit social and economic growth as well.

- **Provide reliability for emergency response.** When natural disasters wipe away existing infrastructure, mobile network operators will need a backup — extra bandwidth on demand to a specific location — to supply critical communications for immediate first response and recovery efforts.

- **Manage peak traffic.** 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.

- **Distribute video efficiently.** Mobile network 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.

- **Converge networks further.** Mobile network operators will need hybrid networks that can seamlessly switch between terrestrial, cellular/LTE, and VSAT. This way, they can support the right applications with the right bandwidth levels through the lowest cost and more efficient available networks.

Remote and Rural Coverage

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

As new populations come online in massive numbers, they will expect the same connectivity as the rest of the world. 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.

There's an incredible amount of room for mobile demand to multiply from 2G to 4G and feed the growth of traditional backhaul. As noted earlier, the latest Ericsson Mobility Report projects that more than 90% of the world's population will have access to 4G/LTE coverage by 2025. Plus, Northern Sky Research (NSR) believes satellite backhaul is still in its infancy, with satellite backhaul sites projected to grow by 60% by 2027.

Growth from these projections will be supported by advances in ground segment satellite technology and lower-cost access networks. Satellite networks have made significant gains in performance, efficiency, and quality of service (QoS); 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.

How Satellite Connectivity Expands and Protects Mobile Networks

Satellite connectivity's inherent capabilities, strengthened by recent innovations, can help mobile operators address key network challenges and bridge growth gaps.

- **Remote, rural and ultra-rural connectivity:** As mobile phones continue to spread throughout developing 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.

- **Emergency response:** Mobile operators need their networks to remain online for disaster response and recovery efforts. Satellite can provide seamless and reliable failover, even transforming vehicles into mobile hotspots.

- **OTT content distribution:** Satellite can cost-effectively support OTT content distribution, especially for bandwidth-intensive video applications and software updates for connected applications.

- **5G applications:** Satellite can provide a critical support role for 5G network applications, complementing terrestrial networks to manage all connectivity seamlessly and enable the right connectivity per application and network condition.

IP Trunking

Satellite trunking networks provide local and mobile networks with access to the internet backbone or to the mobile core. Trunking refers to direct IP connection to the internet backbone or to voice over IP (VoIP) international or domestic call termination as well as an individual link from a base station to the core network or between media gateways.

Emergency Response

Mobile operators need their networks to remain up and running for critical disaster response and recovery efforts, even when terrestrial networks have been damaged or are unavailable. With satellite connectivity, mobile operators can offer first responders and government agencies critical communications immediately following a natural or manmade disaster, ensuring relief teams can connect residents, coordinate aid, maintain remote sites, and ensure the continuity of government as communities recover.

Fiber Restoration/Backup

Satellite is the ideal solution to provide backbone connectivity to regions that have no access to a fiber or undersea cable infrastructure or when the backbone link needs to cross regions that cannot be secured. It is also the fastest method to recover from a loss of connectivity due to a cable failure or natural disaster.

Hybrid Networks: Traffic Offload and OTT Content Distribution

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.

For instance, hybrid networking can help relieve congestion in densely populated urban areas where demand during peak hours is too high for terrestrial networks alone (i.e., during an event). 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.

The demand for OTT content also puts pressure on terrestrial networks in rural areas and especially 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 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 for software updates to thousands of locations simultaneously and achieving significant time and cost savings compared to traditional unicast.

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

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 ten 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 will 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. Just like with 3G and 4G networks, satellite will provide connectivity to remote and mobile sites. This includes the following:

- 5G to premises: Satellite will complement terrestrial networks such as broadband connectivity to a home or office in underserved areas 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 for sensors, surveillance systems, or 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.

The ST Engineering iDirect Solution

When it comes to advancing their networks by leveraging satellite connectivity, mobile network operators are looking for efficiency, performance, flexibility, and scalability. They want a reliable service they can use to easily extend connectivity to rural sites and integrate seamlessly within their terrestrial network. Cost efficiencies are also key to connect the lower average revenue per user (ARPU) regions that cannot afford costly build-outs. And they need to meet the scale requirements of large point-to-multipoint networks and support the throughput demands of high-speed trunking.

ST Engineering iDirect is a leader in satellite ground infrastructure and solutions for the cellular backhaul and trunking market. We have deployed 80+ mobile backhaul networks, we hold the largest network with 1,500 cellular sites, and 12 of the top 25 telcos are ST Engineering iDirect customers. We offer two distinct platforms for our service providers: Newtec Dialog and iDirect Evolution. Both are multiservice platforms for a comprehensive range of backhaul applications and network requirements across 2G, 3G, 4G/LTE and emerging 5G networks.

Dialog features award-winning Mx-DMA technology, a highly efficient, flexible, and patented waveform; SCPC for high-efficiency trunking links; and MF-TDMA for very scalable networks. Mx-DMA is a great fit for mobile backhaul traffic as it provides the highest quality of service (QoS) possible while enabling the highest spectral efficiency possible based on real-time traffic and fading conditions. We are innovating Mx-DMA even further with the introduction of Mx-DMA MRC. MRC is a new technology that combines the benefits of MF-TDMA and the spectrum efficiency of Mx-DMA into a single return technology suited to a greatly expanded set of applications, minimizing operational complexity and maximizing statistic multiplexing.

Our **Evolution platform** enables high QoS and high quality of experience (QoE) through efficient use of DVB-S2X and Adaptive TDMA waveform technologies coupled with advanced acceleration and compression technologies to maximize an operator's business profitability. Evolution's modular design and flexibility allow customers to operate a shared bandwidth platform spanning multiple satellites, bands, transponders, and topologies. With our modular hub and line card system, service providers can minimize initial capital costs, offer multiple service types from a central hub, and scale business one network at a time in a "pay as you grow" manner. Further, Evolution can operate across all business models, including VNO and managed service models, and easily add new capabilities with over-the-air software upgrades.

Both of our platforms are designed to boost performance, efficiency, scale and QoS across a full spectrum of network sizes and bandwidth requirements while minimizing capital expenditures. Dialog and Evolution both use advanced technologies to provide the highest QoS for voice and data services while managing operational expenditure. Our bandwidth-allocation algorithm enables countless possibilities of QoS levels, bandwidth management, and traffic prioritization for total flexibility. In addition, an advanced set of tools focused on compression, acceleration, and intelligent delivery of 2G, 3G, and 4G/LTE/VoLTE traffic enable traffic optimization.

Our Dialog and Evolution platforms also make it easier to integrate satellite networks with telecom core networks. The feature sets of our platforms mirror the quality and reliability of terrestrial services for an enterprise-class user experience, and both can also operate seamlessly as part of an integrated global IP network. With Layer 2 over Satellite (L2oS), our platforms can implement a variety of modern, converged network architectures; pass any Layer 3 protocols; and more easily integrate into hybrid network scenarios. No matter if they're looking for a small or large network, or prioritizing flexibility or efficiency, our portfolio of cellular backhaul solutions can help service providers address an evolving range of applications and markets.

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.