AVANTI WHITE PAPER

SATELLITE BACKHAUL

FUTUREPROOFING THE CUSTOMER EXPERIENCE

Contents

Executive Summary

- With mobile internet users expected to reach a milestone of 5 billion in 2025, mobile data is a major growth opportunity for Mobile Network Operators[1]. Total mobile data traffic will increase by nearly eight times by 2023. However, the biggest growth is expected in the Middle East and Africa, where data traffic will increase by 11 times, driven by an increase in smartphone penetration and investments in network performance.

- As the demand for data grows, Mobile Network Operators (MNOs) with a strategy focusing on Quality of Service (QoS) will gain the competitive advantage, as this will include extending the networks reach, especially to rural and remote areas. In order to deliver the best QoS, MNOs will improve existing cell site capability and densify their networks through the addition of microcells and/or small cells. This QoS improvement will result in increased demand for backhaul and this requires a rethinking of the strategy and technologies used. To deliver a superior service experience, even in the most remote and rural locations, the blend of backhaul technologies should be flexible, highly scalable, cost-effective and most importantly, future proof.

- A key challenge for MNOs is how to identify a backhaul strategy to accommodate both traditional and new technologies. MNOs that utilise a full range of backhaul technologies, including Ka-band satellite, will be at an advantage as they will deliver high quality mobile broadband services through ubiquitous 4G coverage. The advantage of better coverage and network user experience, in turn, drives customer satisfaction, a decrease in churn and increase in revenues (through increased usage and customer acquisition).

- Getting the backhaul strategy right requires overcoming both commercial and practical challenges. Commercial challenges include securing highly reliable, flexible, scalable backhaul at commercially viable rates. Practical challenges concern the seamless integration of backhaul services into increasingly complex network management systems.

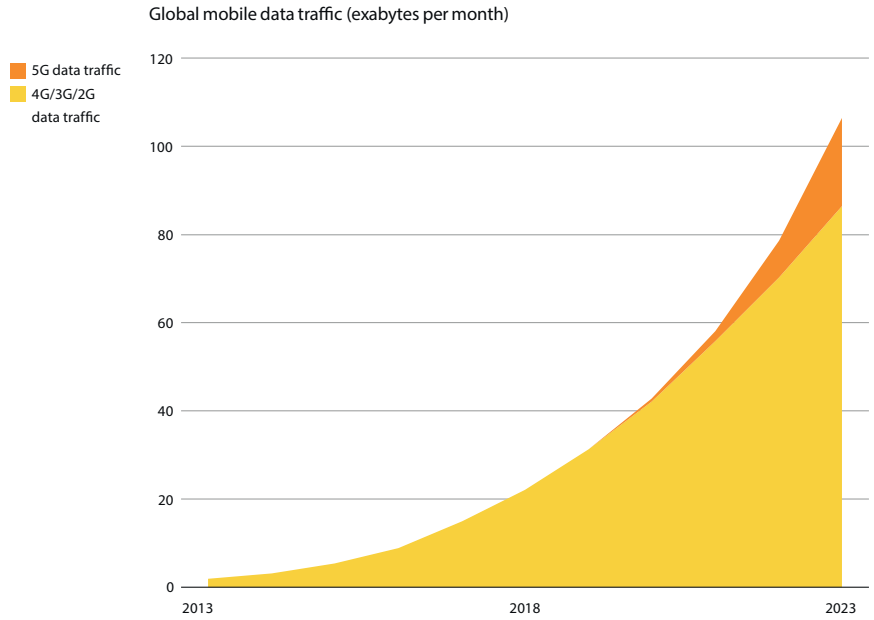
- Ka-band satellite backhaul technology is vital for MNOs looking to provide the coverage, capacity and resilience required to guarantee 4G service ubiquity. Avanti Communications not only provides ultra-fast speeds and the resiliency MNOs require, but also provides end-to-end network integration for 3G and 4G. In addition, our world leading High Throughput Satellite technology also ensures the MNO's network is future proofed, as we are 5G ready.

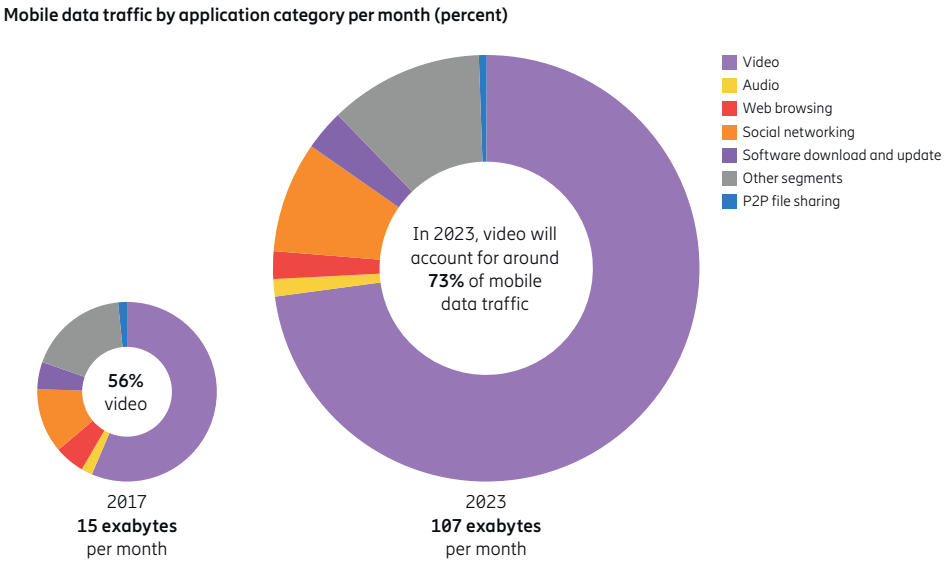
[1] GSMA, Global Mobile Economy 2018
[2] Ericsson, Mobility Report, 2018

Confronting Capacity and Network Complexity Issues

The Capacity Challenge

In 2019, 4G will become the leading mobile network technology worldwide by number of connections (more than 3 billion)[1]. The increasing availability of 4G networks and LTE enabled devices has fundamentally changed user behaviour; consumer and enterprise users expect anytime, anywhere access to mobile data for browsing, social networks and videos. Mobile video traffic is forecast to grow by around 45 percent annually through 2023 to account for 73 percent of all mobile data traffic[1]. MNOs must be prepared to meet customer expectations and improve their user experience.





Source: Ericsson Mobility Report, 2018

[1] GSMA, Global Mobile Economy 2018

Managing Network Complexity

As mobile data increases and mobile subscriptions rise, alongside the task of providing network capacity and speeds for 4G services, MNOs must contend with a further array of network complexities. Network technologies do not mature nor transition overnight. Alongside increasing speeds and capacity demands, MNOs must contend with the need to support multiple standards and legacy systems over a period of years. For example, European MNOs are considering shutting down 2G and 3G networks and reusing spectrum for 4G, whilst in Africa, the majority of network roll-outs continue to be 2G and 3G based.

The Evolution of Mobile Networks Across EMEA

	2G 2.5G	3G	4G	5G
Bandwidth	64Kbps	2Mbps	200Mbps	1Gbps
Use Case	Voice Basic Web Browsing	Voice Web Browsing Multimedia Video Social Networks	Voice Web Browsing Multimedia Video Social Networks File Sharing	Voice Ultra-fast Web Browsing Multimedia HD Video Social Networks Wireless Home broadband File Sharing IoT at scale
Region	EMEA	EMEA	EMEA	Not rolled out

5G standards are still in development, though the aim to provide speeds in excess of 1Gbps is expected to require a new air interface and a virtualisation of the 4G core. The anticipation of an explosion in device numbers, driven by new services and the IoT, adds to the need for MNOs to maintain a robust backhaul strategy.

Not only must the network deliver the capacity, coverage and speeds needed to support anytime and anywhere access to applications, but also deliver OPEX savings in customer provisioning, service activation and billing. All without causing network congestion and outages which can directly impact and damage the MNOs' reputation.

Satellite Backhaul underpins 4G Network QoS, Capacity and Flexibility

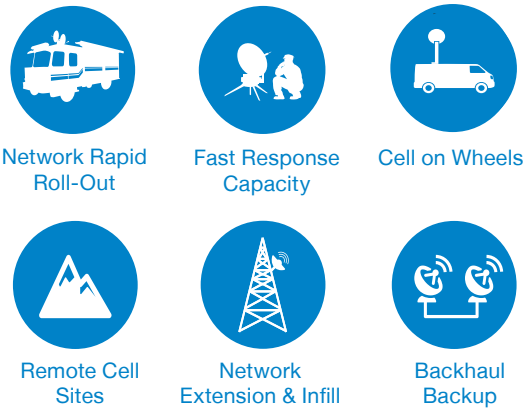
Until recently MNOs have been reluctant to use Satellite Backhaul for 3G and 4G services for perceived high costs and the availability of fibre and microwave networks in largely urban networks. MNO capital expenditure has focused on providing 4G in major urban and suburban areas, which do not require a satellite backhaul option.

For more remote and challenging locations, Satellite Backhaul becomes a more viable option. While it has in the past been perceived as an expensive and complex option, Avanti is set to change that perception.

Led by Avanti, the advent of Ka-band satellite technology has unlocked a powerful new capability for MNOs to transform the economics of Satellite Backhaul and to easily accommodate the complexities of overlapping network technologies. Our Satellite Backhaul solutions deliver important advantages for MNOs compared to terrestrial fibre, microwave solutions, and Ku/C-band alternatives.

Highly Scalable and Flexible

- Rapid and cost-effective expansion into rural and remote locations
- Improves and expands 4G service coverage and adds incremental revenues for enterprise and consumer applications
- Open APIs ensure our network is agnostic, allowing quick and easy integration
- Avanti's Satellite Cellular Backhaul is compatible with 4G S1 interface standard, as demonstrated through commercialised deployment by EE
- Supports multiple backhaul scenarios



Delivers 99.9% Network Availability

- Avanti's multiple data centres and Gateway Earth Stations (GES) deliver "carrier grade" redundancy and resilience
- Integrates into MNO network management systems to highlight network issues before network congestion/outage events occur
- Provides immediate and reliable backhaul solutions for 2G, 3G and 4G sites to the network core

Optimises Network Cost of Operations

- Access to the Avanti bandwidth pool allows reduction of OPEX and total flexibility for bandwidth demand
- Increased efficiency of frequencies reduces the Mbps cost
- CAPEX reduction via hub managed services and small antennas

Ways to overcome latency

Latency in satellite systems have historically been caused by three issues:

- Latency of the geostationary satellite round trip (approximately 550 milliseconds) which is an unavoidable result of the speed of RF propagation
- Latency caused on some network by inter-satellite links
- Latency caused by network congestion and poor or absent traffic management

Avanti has no inter-satellite links in its fleet, as services are transmitted directly between the remote site and the Avanti Gateway Earth Station network via Avanti's HYLAS satellite fleet.

Our Gateway Earth Station network is linked via resilient fibre network to major network peering centres globally for interconnection to the MNOs' packet core. Both the satellite transmission system and Avanti's terrestrial core network provide advanced quality of service functionality - bandwidth management and prioritisation to ensure terrestrial-grade link quality and higher reliability for voice and data services.

In addition to reducing network latency, Avanti's Satellite Cellular Backhaul mitigates remaining network latency through protocol specific acceleration and local call switching to deliver a high quality voice and data experience, supporting real world handset speeds of 130Mbps+, and compatibility with 3GPP mandated IP SEC encryption for backhaul interfaces.

As a result of this focus, our Satellite Cellular Backhaul is proven compatible with S1 3GPP standard. MNOs can be confident that latency sensitive services like push-to-talk can be delivered at a high quality. Additionally, MNOs can take advantage of the significant costs savings that come from using Ka-band Satellite Backhaul.

Resolving the 4G Backhaul Challenges

Avanti is the world's first satellite operator to deliver 3G and 4G Satellite Backhaul services using Ka-band technology. Fundamental to the success of Avanti's Satellite Backhaul is the integration of Ka-band technology into MNOs' complex networks.

EE

EE (part of the BT Group) was the first to launch 4G service in the UK in 2012. As part of its requirement to upgrade network resilience, reach and flexibility, EE has tasked Avanti to test, install and integrate a Satellite Backhaul service. This is the world's fi rst major commercial deployment of 4G Satellite Cellular Backhaul. Avanti is providing backhaul to over 1,000 fixed base stations integrated into EE's national 4G network. The Avanti backhaul solution will provide management reports to ensure 4G network congestion and outage events are identified and resolved before a loss of customer experience can occur.

Mansoor Hanif, Director of Convergent Networks and Innovation at BT stated:

"*We are delivering a highly resilient, truly nationwide 4G network and Avanti will play a key part in providing resilience and extending this network into rural areas***"**

Avanti is also working with another mobile network operator to extend 3G mobile data connectivity to base stations that experience seasonal fluctuations in traffic. We deliver ultra-fast, ubiquitous coverage and provide flexible bandwidth capacity to meet the MNO's network demand, wherever it is.

Conclusion

MNOs across EMEA have begun the transition from 2G and 3G networks to 4G networks. Furthermore, BT, Orange, Telefonica, DT and Vodafone have signed MoUs to begin 5G trials. Having a proven backhaul service to underpin 4G QoS, coverage and capacity requirements become a powerful platform for retaining the existing base and acquiring new customer revenues. Satellite Backhaul is an essential component of any backhaul service for MNOs to successfully manage the complexities of multiple existing technologies and the future transition to 5G.

Avanti is the world leader in Satellite Mobile Backhaul. With a wholly owned satellite network and commercially proven backhaul propositions, Avanti offers the latest satellite technology and expertise to integrate backhaul into the most complex mobile networks. Importantly, our High Throughput Satellite technology is reliable, flexible, scalable and readily available for 5G.

Make Avanti your partner for today and tomorrow's backhaul requirements.

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