

MANAGED MOBILE BACKHAUL

A Signature Telecom Solution

Solution Brief

The logo for SES, featuring the letters "SES" in a bold, white, sans-serif font, with a small white triangle pointing upwards positioned above the letter "S".

UNDER-SERVED MARKETS NEED PROFITABLE MOBILE SERVICES

The way we communicate, conduct business, and consume information is changing. As business and residential mobile users adopt bandwidth-intensive applications, analysts predict that there will be approximately 5 billion mobile Internet users by 2025, representing a 4.8% compound annual growth rate (CAGR) from 2018.¹

By 2022, nearly 75% of mobile devices connected to the network will be smart devices that drive data growth. The fastest mobile data growth will be in developing regions with remote population centres, such as Africa and the Middle East.² Consumers in semi-rural, rural, and remote regions are quickly moving beyond voice-only mobile phone use to data-intensive, cloud-centric applications, including video streaming, telemedicine, e-agriculture, and distance learning.

Mobile Network Operators (MNOs) are expanding into these markets to capture new revenue streams. Governments of many countries now require MNOs to cover a high percentage of the nation's population, in keeping with regulated universal service obligations, and to help them live healthier, more prosperous lives.

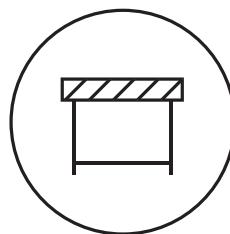
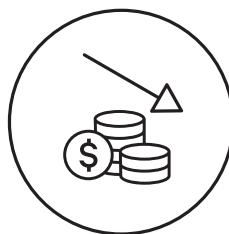
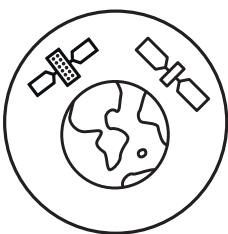


1 The Mobile Economy 2019, GSMA.

2 Cisco Visual Networking Index 2017—2022.

REACHING THE UNREACHABLE

Most under-served areas face challenges related to geography, infrastructure reliability, and low population density, making it either physically impossible or economically infeasible to provide communication services using fibre and microwave. If high-quality mobile broadband services are to reach these communities, these challenges must be solved.



Fibre and Microwave Backhaul Solutions Have Limitations

Globally, the majority of mobile base stations are connected with fibre or microwave as backhaul transmission media. In mountain regions, low-density villages, or for roadside coverage, for example, the economics of investing in fibre or microwave infrastructure make both alternatives infeasible. The builds are too costly, too complex, too time-consuming, and very difficult to maintain and operate. What is needed is a solution for which costs are not tied to distance, and capacity can be dynamically shared continuously as demand requires.

Controlling Network Operating Expenses

Once capital expenditures are made for end-to-end infrastructure, MNOs require solutions with low operating expenses to justify the network expansion. This includes hiring people in the region with the right skill sets, the cost of backhaul network capacity, power and security for the cell site, and performance monitoring and management. If capital expenditures can be reasonably controlled and depreciated over several years, operating expenses are often the greatest challenge to the business case. Added to this, low subscriber density and low average revenue per user (ARPU) are typical in emerging markets, and the standard pricing model of fixed satellite capacity may result in a large disparity between operating costs and revenue, which is driven by consumption.

Lack of Turnkey Networking Solutions for Under-Served Areas

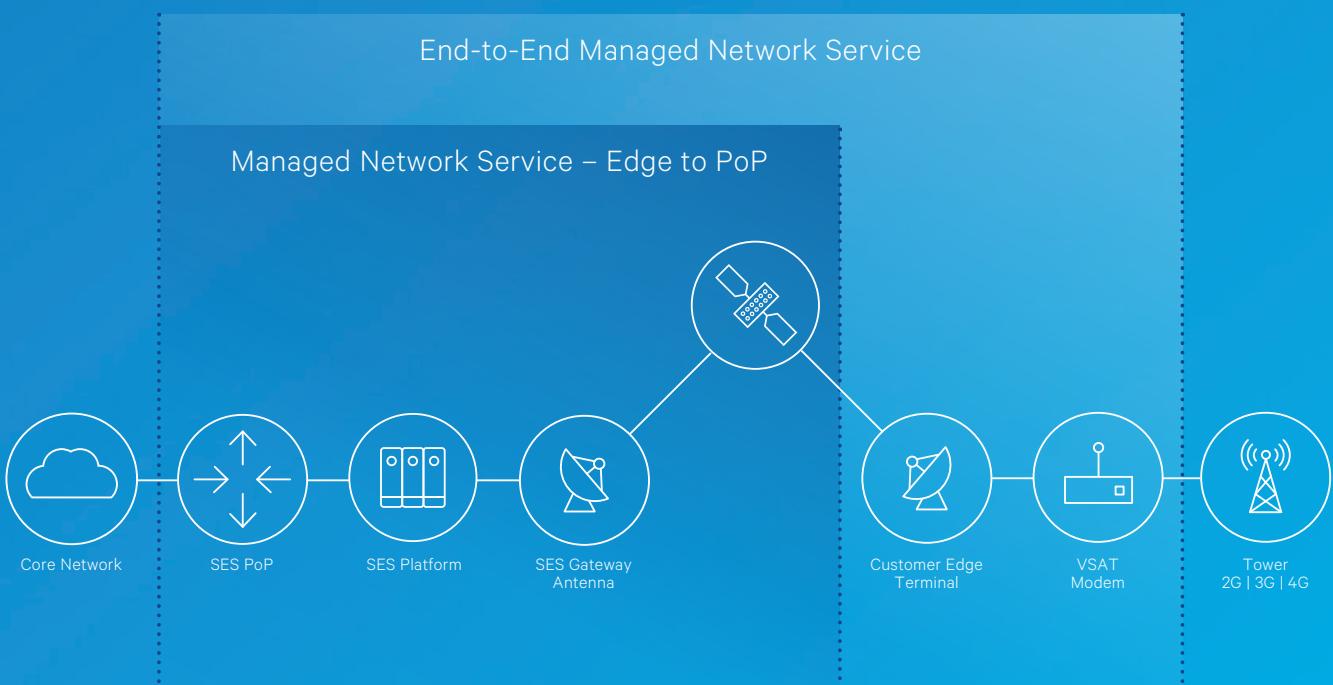
Even when the economic equation for backhaul capacity can be solved, the cost of procuring and deploying towers, cellular radios, and power is often too high for under-served areas. The largest cellular and tower manufacturers are focused on dense population centres requiring towers that support larger radios, drawing 2,000 Watts of power. This requires substantial facilities nearby for power generation and transmission. Since cellular infrastructure is costly to procure and deploy, it is not economically feasible in many hard-to-serve regions. What these areas need is low cost, power-efficient cellular infrastructure designed for lower density markets.

A NEW APPROACH TO MOBILE BACKHAUL

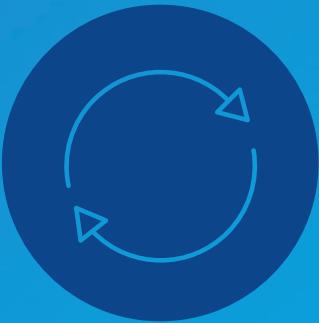
Our Signature Telecom Solutions are tailored to meet business requirements specific to MNOs, and backed by strong and comprehensive service level agreements (SLAs).

SES can address any backhaul use case via the industry's only multi-orbit satellite fleet, local expertise in lifecycle services to tackle complex technical challenges, and an expansive, next-generation network of ground systems and remote site solutions. Our end-to-end managed services offload the financial and operational risk of deploying and managing the backhaul network and its required infrastructure. A fully managed service makes the backhaul link a seamless extension of your network. It easily and

quickly integrates into the network via standards-based interconnection, all managed by our VSAT and data networking technology experts. Underpinned by a range of commercial pricing models that further mitigate business risk, our backhaul solutions make the economics of network expansion more attractive. This is particularly the case in under-served areas, where low population density and low ARPU pose a challenge to near-term profitability.



Managed Mobile Backhaul Solutions



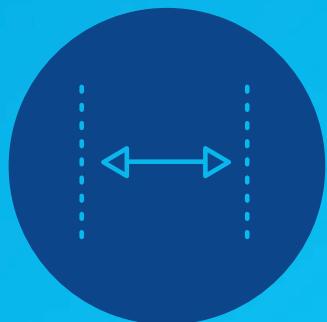
EXTENSIVE PORTFOLIO OF LIFECYCLE SERVICES

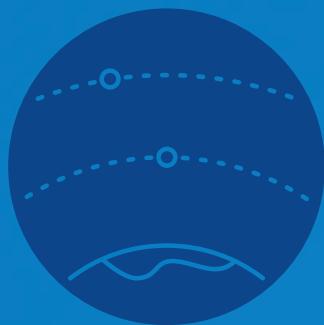
Our portfolio of Ascent Lifecycle Services includes the industry's most extensive suite of network implementation, maintenance, management, training and consulting solutions. For MNOs deploying backhaul connectivity, these services play a key role in accelerating time to revenue, removing the risk from network operations, and proactively optimising network performance. Our Ascent team serves as your local partner, helping you address critical deployment challenges, from designing in-country gateway solutions to testing and certifying remote terminal installation. Ascent Lifecycle Services are available for all of our service options, and are particularly integral to our end-to-end managed services, enabling your teams to remain focused on your core business rather than managing and operating the backhaul network.

FLEXIBLE END-TO-END MANAGED NETWORK SOLUTIONS

Our Signature Telecom Solutions include innovations in both technology and business model, and can be adapted to the specific requirements of your business.

- **End-to-End Managed Backhaul:** Based on connectivity via our Geostationary Earth Orbit (GEO) fleet or Medium Earth Orbit (MEO) satellite constellation, our comprehensive managed backhaul service enables MNOs to offset the risk of procuring, operating, and maintaining the network from the remote terminal at the cell site or aggregation point to the MNO core network handoff.
- **Managed Service from Satellite to Gateway:** With these solutions, SES manages connectivity from the satellite to our gateway and provides a standards-based handoff to the MNO core network. In this scenario, the MNO maintains control and management of the terminal equipment at the cell site.
- **Satellite Capacity:** If the MNO owns and operates its own gateway and remote terminal infrastructure, we can lease capacity on one of our GEO satellites to enable a backhaul connection.





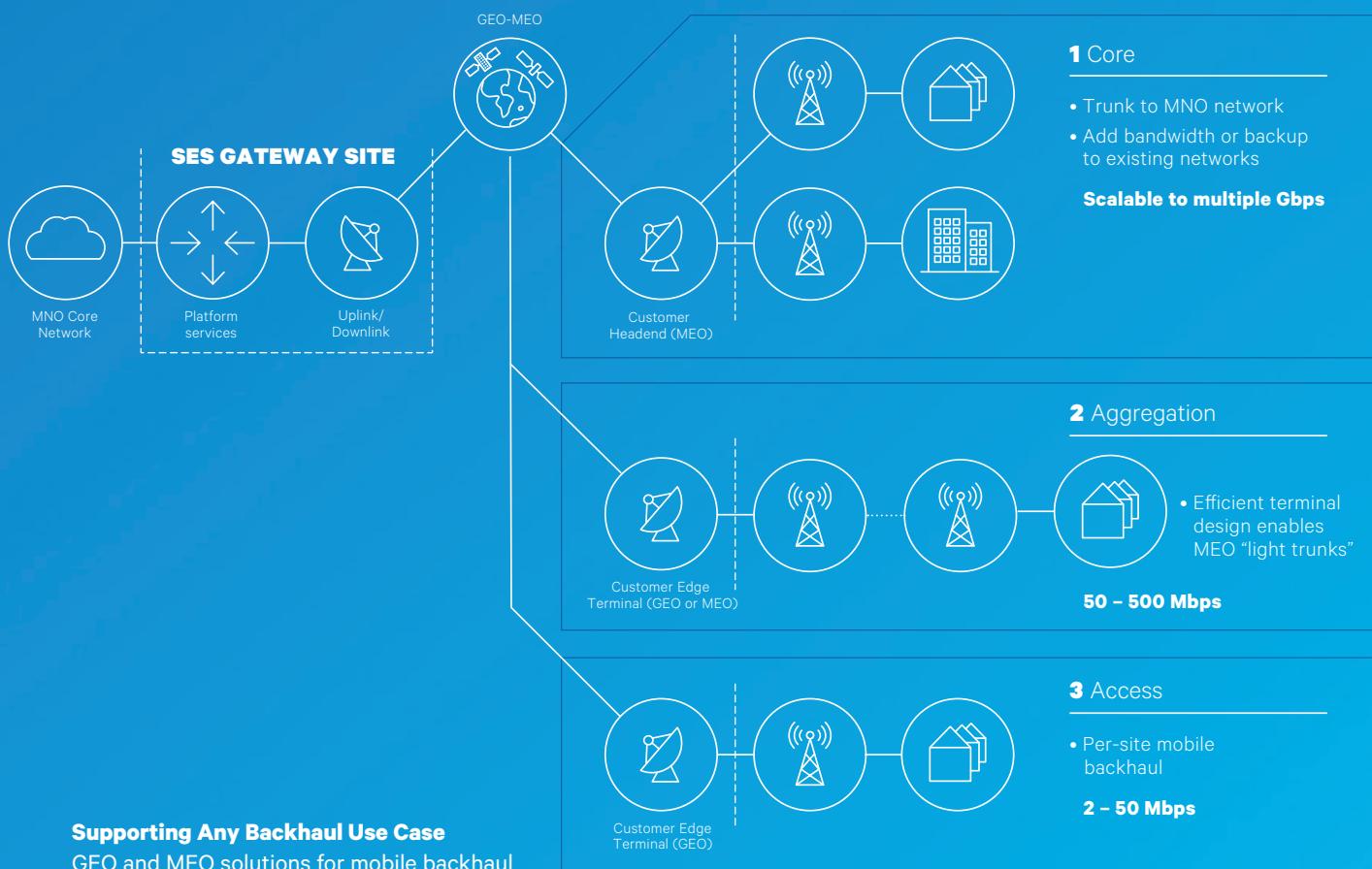
THE INDUSTRY'S ONLY MULTI-ORBIT SATELLITE NETWORK

Our Signature Telecom Solutions leverage the industry's only multi-orbit satellite fleet for optimal performance based on one or more key service attributes, such as cost, capacity, low-latency, coverage and reliability. Our multi-orbit fleet provides a more flexible range of SLAs covering committed information rate (CIR), packet loss, latency, jitter, availability, and mean time to repair (MTTR).

The industry's only commercially proven MEO satellite constellation uses spot beam technology to provide low-latency, high-throughput satellite (HTS) data rates up to 1Gbps to a single site—with multiple, steerable beams available. Since one beam can generally provide enough bandwidth for multiple towers in a region, MEO solutions are ideally suited to backhauling large capacities of traffic from a multi-tower aggregation point.

For MNOs, MEO makes low-latency backhaul a reality virtually anywhere, enabling all modern data communication protocols to work as if connected via fibre. This is why SES is the only satellite-enabled service provider to offer services certified to meet Metro Ethernet Forum's (MEF) Carrier Ethernet (CE) 2.0, so you can take advantage of a robust, standards-based Ethernet service backed by industry-standard SLAs. As MNOs migrate to 4G/LTE, and ultimately 5G, low latency is critical to supporting the growing number of applications delivered from the mobile edge or the cloud.

GEO satellite connectivity is the predominant technology used for mobile backhaul today in remote and rural areas, providing cost-effective connectivity on a per cell site basis. Many of our GEO satellites deliver both shaped beams and spot beams in Ku- and Ka-band with HTS data rates, enabling ideal throughput levels for individual cell sites serving 2G, 3G, or 4G/LTE services.





DYNAMIC BANDWIDTH ALLOCATION AND SCALE

Our global ground network is based on carrier-grade platforms, maintained on secure premises and monitored 24/7. Each of these service platforms features redundant fibre paths to core network points of presence, with robust interconnection to peering providers and cloud operators.

Our managed network services are optimised for mobile backhaul, and designed to deliver a superior quality of experience to the end user. We can also offer backhaul to hub infrastructure co-located at the MNO's facilities, if required for regulatory or security purposes. Our service platforms are built on key capabilities:

- **Dynamic Bandwidth Allocation:** We distribute capacity when and where it's needed—to any cell site within a defined bandwidth pool—to enable operators to meet changing end-user demand in real time. CIR and Maximum Information Rate (MIR) can be tailored for each cell site, resulting in a consistently high quality of experience. We can also adjust the ratio between MIR and CIR to cope with traffic pattern dynamics and actual differences at each of your sites.
- **Low Latency and Jitter:** We employ the latest platform and modem technologies to ensure transmission that minimises latency and jitter, which adversely affect mobile network performance and the end user experience, for both voice and data traffic.
- **Advanced Traffic Optimisation:** Our ground infrastructure enables high-throughput end-to-end Layer 2 channels between designated network demarcation points. Our systems enable a granular approach to configuring multi-tier quality of service (QoS) and enforcing traffic prioritisation. With state-of-the-art WAN optimisation, acceleration, and compression techniques, we can make the most efficient use of spectrum resources to improve the end user experience, and deliver true LTE speeds.





FLEXIBLE CAPACITY POOLS AND VOLUME-BASED BILLING

Traditional satellite backhaul services based on single channel per carrier (SCPC) assign a dedicated level of bandwidth per site. In a world of predictable traffic flows, this model fits operator needs.

As data generates an increasingly larger share of total backhaul traffic, and as bandwidth usage per site becomes more and more variable, SCPC-based links sized to peak demand risk driving costs higher as you have unused backhaul capacity during off-peak times. Backhaul that takes advantage of dynamic bandwidth allocation provides a more data-centric, cost-effective business model for MNOs.

Our service models are designed to closely align backhaul costs to end-user traffic consumption. The first approach uses a flexible pool of capacity where the MNO can dynamically assign CIR and MIR on a per site basis based on subscriber patterns. The MNO is billed for the overall pool of capacity, resulting in a more cost-effective service model than one based on peak throughput per site.



A TRUSTED PARTNER FOR THE LONG TERM

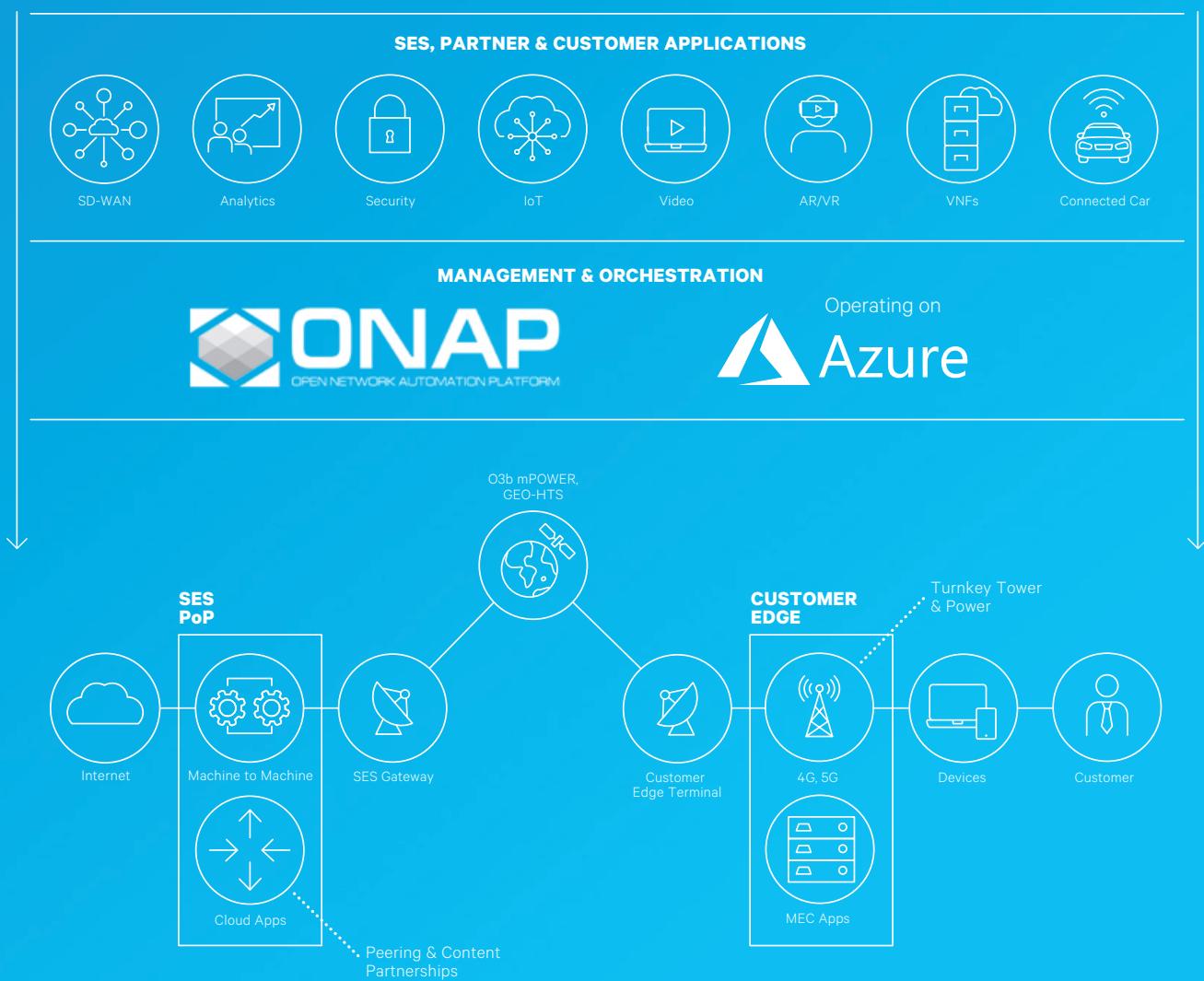
In a rapidly evolving mobile services market, it is critical for MNOs to protect their network investment with services and solutions that meet end user demand, keep costs low, and seamlessly propel the MNO from one mobile generation to the next.

Together with a growing ecosystem of partners, we are creating and delivering solutions complementary to mobile backhaul, addressing critical challenges pertaining to service quality and revenue generation. One example is our ability to help connect end users to cloud-based content and services through direct peering relationships with prominent cloud service providers, content delivery network providers, and interconnection and co-location companies. This makes it easier for MNOs to improve end users' quality of experience with cloud services and applications.

Our commitment to the future growth of MNOs is demonstrated by our ecosystem-driven approach to applications and services delivered from the mobile edge. As we expand our partner programme to manage critical network functions at the mobile edge, we can enable new revenue opportunities from edge-hosted applications, including those based on the Internet of Things (IoT) and network functions virtualisation (NFV).

Bringing Satellite Into A Cloud-Scale Network Ecosystem

Complementary applications via a growing ecosystem of partners



LEADERSHIP IN THE STANDARDS COMMUNITY

We have taken a leadership role in key standards organisations to help MNOs protect their network investment and migrate towards the next generation of mobile networks. Our involvement in key initiatives is repositioning the satellite industry as a mainstream, standards-based part of a global, cloud-scale network ecosystem.

MEF CE 2.0



MEF CE 2.0 and Lifecycle Services Orchestration (LSO)

SES is the first and only satellite-enabled service provider to earn MEF CE 2.0 certification, enabling MNOs to take advantage of industry-standard, end-to-end SLAs for attributes such as latency, jitter, and throughput. We are also adopting the MEF Lifecycle Services Orchestration (LSO) reference architecture, to enable fulfilment and assurance of CE 2.0 and other connectivity services in an agile, automated operational environment ideally suited to connecting cloud-based applications.

LINUX FOUNDATION



Open Network Automation Platform (ONAP)

In 2018, SES joined the newly formed Linux Foundation Networking Fund (LFNF) as a founding member, driving and collaborating on key initiatives of LFN's six founding projects, including Open Network Automation Platform (ONAP), OPNFV and OpenDaylight. In 2019, we announced partnerships with Microsoft and Amdocs to fully integrate MS Azure and ONAP within our global network. With ONAP acting as the master orchestrator in a network, MNOs have more capability to automate, virtualise, and interoperate a network built with SES. Cloud-based services and applications available via Azure can be activated and installed remotely, as well as NFVs, such as firewalls. In short, our partnerships make it simpler, faster, and more cost effective for MNOs to test new on-demand network services, on-board virtual network functions, and integrate into our operational environment.

5G INITIATIVES



SaT5G, SATis5, and 5G-VINNI

Although 5G is still in the early planning stages globally, SES is investing in a wide variety of 5G-related standards initiatives to demonstrate its viability for particular use cases in a satellite-enabled network environment. Our leadership role in these initiatives, directed by the European Union (SaT5G and 5G-VINNI) and the European Space Agency (SATis5), demonstrates our global resources and expertise in advanced network testing and integration. Adopting ONAP was also a key piece of our 5G strategy, as it represents one of the most powerful environments for delivering the control and slicing capabilities required by 5G networks in a ubiquitous and highly interoperable way.

DELIVERING MANAGED MOBILE BACKHAUL TO CHAD



With customers relying on Tigo Tchad's mobile network for their very livelihood, the company required a partner who could quickly refurbish 40 of their cell sites, and establish an in-country teleport with limited downtime. SES completed the upgrades and teleport construction in less than four months, despite the physical challenges involved.



CHALLENGES REVITALISING CHAD'S MOBILE NETWORK

As a landlocked, developing nation, Chad poses several unique challenges to deploying mobile networks. Tigo Tchad has nonetheless remained committed to connecting Chadians across the rough geography, and has identified more than 40 sites in need of updates. Several of these sites are located away from Chad's transportation and communications infrastructures, so careful planning was essential. A number of sites shared a location with a competing MNO, and required a temporary solution while the old equipment was removed since new pad construction or disruption of the competition's service were not permitted. Long outages were also not tolerable, as Tigo's customers rely on their connection to conduct business, access weather reports, and communicate with family and friends.

Tigo Tchad established the following requirements:

- Integration of satellite capacity and hardware, mobile network hardware, installation, maintenance, and logistics, covered by a single SLA
- Replacement of both satellite and mobile network components across more than 40 sites within four months
- In-region technical expertise, and readily available satellite-based network capacity and facilities
- Replacing single carrier per channel (SCPC) satellite network with a dynamic SCPC
- Migration from time-division multiplexing (TDM) to IP-based technology to upgrade sites from 2G to 3G

SOLUTION

Tigo Tchad selected SES to provide satellite capacity and orchestrate this upgrade due to our proven track record delivering highly reliable, managed satellite communications in Africa. Tigo Tchad was already using the O3b MEO network, and was familiar with our ability to provide end-to-end management.

This solution uses our GEO capacity for ease of deployment and broad coverage across all locations.



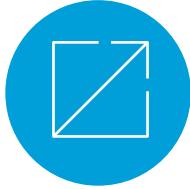
NEW TELEPORT

To supply in-country uplink and downlink services, we managed the construction of a new teleport near Tigo Tchad's headquarters in N'Djamena, and continue to operate it. The teleport was completed within three months to bring all sites on the network within the following month.



LOCAL EXPERTISE

SES and Tigo Tchad partnered with local engineers and technicians to import, warehouse, deploy, and install all sites within the deadline. Local experts were effective in navigating the difficult terrain and lack of infrastructure at the install locations.



UPGRADE-READINESS TO 3G AND 4G

By using scalable, IP-based solutions, sites could finally be upgraded to 3G, and simultaneously operated as a 2G site, depending on the current demand. The deployed RAN hardware can be switched to 2G or 3G remotely to respond to changes in user demand, as well as updated, diagnosed, and often repaired over the air.



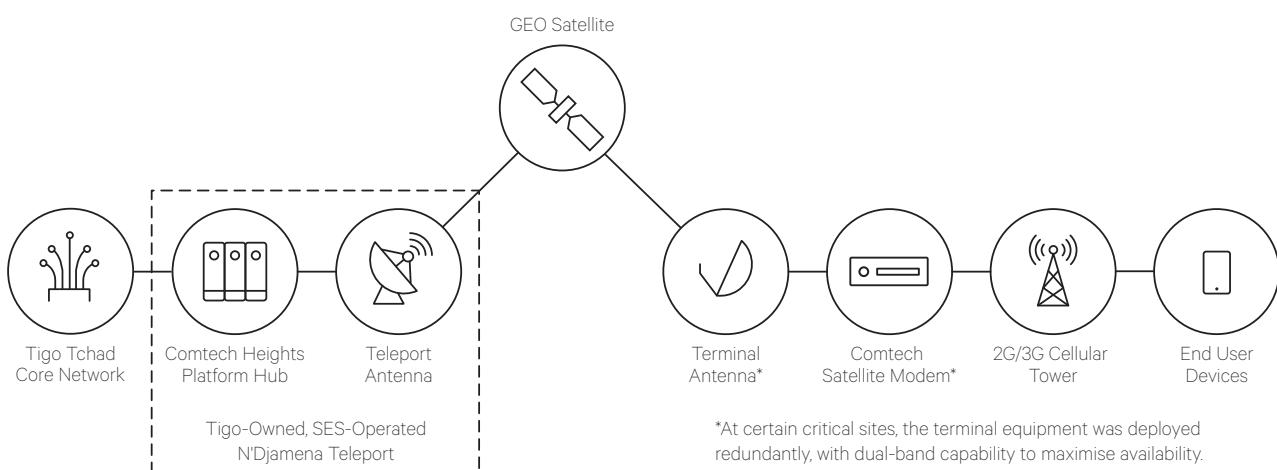
ENSURING AVAILABILITY

Our Network Operations Centre (NOC) monitors the load, traffic, and uptime of the network 24/7. The multilingual team serves as a single point of contact for any issue in the network. An automated ticket generator is included, which can discover outages even before Tigo's customers can report them.

Certain upgraded sites were designated as critical by Tigo. At these locations, we deployed parallel, redundant satellite terminal hardware in both Ku-band and C-band to ensure the highest possible availability. Developing a network of local technicians provides for rapid response if issues arise that require a physical presence.

SINGLE SLA

Together with Tigo Tchad, we agreed to a single SLA that covers all elements of the satellite and mobile network, providing 99.5% network availability. While we manage the network, Tigo Tchad has access to their network statistics via a network management system (NMS), and daily reports provided by our NOC.



Talk to us today about how our managed mobile backhaul services can help you meet universal service obligations and grow your business.

Ready to extend your service
to under-served regions?

getconnected@ses.com

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