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chapter 6 Wireless Users

Cellular

The MTN Group continues to develop digital solutions and form strategic partnerships as part of its efforts to offer customers and communities pragmatic solutions that directly address their socio-economic needs.

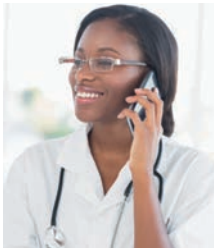
To this end, the operator is investing in the introduction of sustainable mobile health solutions to help improve access to healthcare in Africa. These have been developed in response to the various constraints in the public healthcare sector on the continent, including the impact of increasing populations on limited services, and the lack of easily available and reliable information.

As an African company, MTN says it strives to find locally relevant solutions to strengthen the use of ICT in health development. For example in Cameroon, it is providing health advice related to infant mortality rates and the diseases that are most prevalent in the region. A similar partnership in Ghana ensures access to information on maternal health, reproductive and family planning advice, nutrition health tips and interaction with health professionals in one of six major languages spoken regionally.

In addition, MTN's innovation in making healthcare accessible in Africa through technology includes the use of text-messaging platforms to access healthcare services.

For instance, it has successfully piloted a service in Uganda in partnership with Google and Technology Centre. This offers a free interactive text-messaging platform which enables mobile users to send questions on reproductive health and to receive answers from a database prepared by reputable healthcare professionals.

Meanwhile in South Africa, customers can access *MTN Care Connect*, a 24-hour nurse advisory helpline service that facilitates access to healthcare information and medical education on mobile devices.



Among its various mHealth initiatives, MTN offers its 24-hour nurse advisory *Care Connect* helpline service in South Africa.

In 2014, MTN launched the *Hello Doctor App* which provides free access to medical information daily, and includes participation in live group chat forums, confidential advice and interactions with a doctor, and the option to receive a call back from a doctor within an hour. The service is now available in South Africa, Swaziland, Zambia, Ghana, Uganda, Cameroon and Rwanda, and was accessed by more than 220,000 people in 2015.

In Nigeria, the *Business Home Healthcare* application enables healthcare professionals to receive a continuous stream of data on their mobiles, allowing them to remote monitor patient health issues such as blood pressure, weight, etc., while they are at home.

By offering affordable and easily accessible digital solutions specifically developed for the needs of its markets, MTN believes it is helping to reduce and mitigate some of the systemic challenges in public health, education, and other sectors which provide social dividends.

Cataleya modernises legacy infrastructure in Liberia

Working with Singapore-based IP networking specialist Catelya, Liberia Telecommunication Corporation (Libtelco) has modernised the national communications infrastructure and ushered in what's claimed to be a new era of IP networking in the country. The operator transformed its network in order to deliver advanced communications services and applications to local service providers, businesses and communities.

Libtelco serves local consumers and businesses with fixed-line services, as well as leasing network capacity to Liberia's four mobile operators – Cellcom (Orange), LoneStar (MTN), Novafone, as well as its own mobile operation which has more than 2.4 million subscribers.

For many years, Libtelco had been reliant on legacy TDM infrastructure. But as business has grown it recognised the need to migrate to IP and modernise its network infrastructure. The company had limited experience in IP services, and its subscribers did not have access to VoIP calling or international dialling from fixed-line phones, so the company knew there was plenty of scope for it to expand its service offering and offer greater choice for customers.

The challenge for Libtelco was to migrate to IP with QoS and QoE that matched or exceeded TDM while building its IP services capabilities. The operator wanted to move quickly to realise the advantages of the technology without needing to manage multiple vendor relationships or go through a long procurement process with different suppliers.

Cataleya was chosen to help make the transition. It was commissioned to create and deliver a fully integrated turnkey solution for IP networking that included interconnection, billing, and session and application management. The vendor took 'best of breed' interconnection and billing solutions and matched them with *Orchid One*, its session and application manager. It claims the result was a seamless roll out of IP infrastructure with Libtelco fully equipped with the tools it takes to monetise IP services.

As the foundation of the solution *Orchid One* has been used to ensure that the telco's customers receive guaranteed QoS and QoE and are able to enjoy IP services with the highest possible performance. Cataleya says

Cataleya says its *Orchid One* appliance provided Libtelco with full end-to-end visibility into network performance. As a result, it can troubleshoot issues as they happen and ensure call quality.

Orchid One gives Libtelco full end-to-end visibility into network performance with near real-time analytics related to session, service, application, MOS/R-factor scores, and end-to-end SLAs. These are used to troubleshoot issues as they happen and ensure call and session quality.

To create a complete solution, Cataleya says it used its experience in integrating multiple components of an overall solution, including switching, media gateways and BSS elements, to bring interconnection and billing together in a bespoke turnkey solution. It was therefore able to create a full IP ecosystem to accelerate Libtelco's adoption of IP.

The first phase of the network modernisation process has enabled the delivery of both domestic and international VoIP services to local enterprises and government, allowing international calling from fixed lines for the first time in Liberia. Libtelco will also use its IP infrastructure to offer triple play services on its fibre network. A second phase will support the delivery of cloud services and Unified Communications as a Service (UCaaS) to the country's growing SMBs.

AdaptiveMobile turns "grey to gold"

An application-to-person (A2P) 'grey route' is a network that sends commercial SMS data in violation of the carrier's terms and conditions regarding commercial messaging. It is SMS traffic that enters mobile networks through unauthorised and unbillable channels, transmitting alerts, notifications and marketing messages.

Globally, mobile operators are losing revenue through such unauthorised grey routes. Despite increasingly generous consumer packages for high volume messages, person-to-person (P2P) SMS is steadily falling. Enterprises are communicating more with their customers via text, and it is here where most major brands have their commercial messages funnelled at the lowest cost. If left unchecked, this will lead to the widespread use of SMS grey routes at the carriers' expense.

In 2012, one of the largest operators in Africa approached AdaptiveMobile seeking assistance in dealing with this unauthorised traffic. The unnamed operator had three main areas of concern. Firstly, it was worried by in-bound marketing messages sent from one corporation to many subscribers at no additional interconnectivity cost. Traditionally, these are legitimate messages from valid organisations – for example, customer notifications from delivery firms, utility companies, financial services or retail brands. They are often requested by the subscriber and are not spam.

Secondly, there was competitor messaging. This type of message is specifically sent from a competitive network to roamers or subscribers on the operator network to try to entice them to switch to a different network – along with their valuable roaming revenue.

Thirdly, the operator was concerned about access codes – messaging that comes from companies such as banks or social networks that use SMS to send access codes and notifications about a specific account. These are not spam, as often the receiver has requested this method of communication and it's used as a security feature for any service that requires two-factor authentication.

Based on the strength of an existing relationship, the operator worked quickly with AdaptiveMobile to determine a solution. After deploying the vendor's *Grey Route Controls*, the cellco was able to identify and shut down three main classes of grey route traffic and realise in excess of UD3.7 million in revenue each month.

AdaptiveMobile monitors a network using its *Threat Intelligence Unit* and the deployment of *Grey Route Controls* in conjunction with its *Threat Intelligence Service*. The receiving operator then gets intelligence on the routes and sending organisations, ensuring maximum revenue through direct sales to enterprises and brands. While the enterprises and brands may be still paying the same price per message, AdaptiveMobile says grey routes are significantly reduced and the operator can ensure the original message is successfully distributed to its intended end-audience.

The vendor adds that once *Grey Route Controls* are implemented, most messages sent through unauthorised routes will be blocked. As a result, AdaptiveMobile points out that it would be in the best interest of the sending company to set up a direct relationship with the operator.

The company claims it is unique in providing a product that enables multiple business models to manage grey routes. It says the managed service is deployed through a "sophisticated high precision platform", allowing only illegitimate traffic to be blocked, even when coming from rapidly changing sources or compromised legitimate sources. This means that regardless of where the grey route moves to, the operator is always protected and is able to select appropriate hybrid business models – protecting business relationships with key brands.

Swaziland races ahead using Dynamic Tariffing Engine

The Kingdom of Swaziland is a landlocked country bordered to the north, south and west by South Africa, and to the east by Mozambique. MTN Swaziland is the country's only mobile operator, and out of a population of more than 1.26m people (World Bank figures), the company says around 900,000 currently subscribe to its services.

In 2007, MTN wanted to find a way of making mobile telecoms more accessible to the population, while improving network utilisation and reducing congestion, increasing ARPU, and maintaining revenue. As a result, it decided to pilot Digitata's *Dynamic Tariffing System (DTS)*, which at the time was offered by South African business intelligence specialist Rorotika (Digitata acquired a controlling interest in the company in September 2015).

Two areas representing 13 per cent of MTN Swaziland's mobile network were chosen to pilot *DTS*. Customers in the trial area were offered discounts of up to 90 per cent during periods when network capacity was under-utilised. This resulted in a more evenly distributed network traffic profile in the pilot area across the day.

According to Digitata, the peak traffic on the over-utilised cells in the area was reduced by 14 per cent, while network utilisation increased by 11 per cent. It adds that mobile originated revenues rose by nine per cent in the pilot area, while ARPU from registered customers increased by 4.8 per cent.

Only 1.3 per cent of registered customers decided to leave the *DTS* service during the five-week pilot period, but at the end of the trial, 85 per cent migrated to it. These subscribers generated 81 per cent of all mobile originated traffic. MTN Swaziland went onto launch *DTS* commercially on a partial basis in August 2007, and embarked on a full national launch in June 2008.

Satcoms

With millions of voters heading to the polls to take part in the democratic process, government elections require a high level of logistics, sharp coordination of electoral management staff, and efficient and reliable technical resources.

This is particularly the case in countries with a high proportion of rural areas, where collecting and accurately processing retuned

ballots can be a very difficult task mainly due to the scarcity and obsolescence of terrestrial infrastructures. For example, with an electorate of 5.5 million selecting a new president and parliament, the Commission Électorale Nationale Indépendante of Burkina Faso (CENI) faced the challenge of coordinating polling stations and publishing the results of the 2015 presidential elections on the day following the ballot.

CENI commissioned SES Techcom Services for the installation a high-performance, reliable and secure network infrastructure to ensure the transmission of the results in due time. This had to delivered within eight weeks from contract signature.

Using the *Astra Connect* satellite service and Newtec's *Dialog* platform, SES Techcom installed and integrated a solution connecting 368 polling stations across the country to CENI's collection centre in Ouagadougou. Local ISP Satplay and system integrator Access-sat secured the successful deployment and support of the satellite terminals across the country.

The International Foundation for Electoral Systems supported the training of the 368 technical coordinators in collaboration with local technology partner Unicom and SES Techcom. Together with the coordination of technical teams and experts, this training was key to the project's success.

Each of the 368 sites was equipped with a VSAT station allowing rapid transmission of electoral raw data to the collection server at CENI's central office. These data were then automatically dumped to a specialised server which was developed by Unicom and was capable of showing the results graphically in real-time.

The graphs were not only available on CENI's dedicated election website, but were also disseminated by national broadcaster Radio Télévision du Burkina (RTB) via an *Astra Connect* terminal at its HQ. RTB was then able to show the evolution of the results during its TV broadcasts, making the information widely available to the public in a clear and transparent way.

The training of technical coordinators for the 368 VSAT-equipped polling stations was key to the success of the project in Burkina Faso.

VoIP was also provided at each site to enable constant contact and coordination with CENI's technicians and collaborators sitting in the capital.

On 29 November 2015, 3.3 million people or 60 per cent of the Burkinabé electorate turned out to vote. The e-election was able to reach a vast number of voters across vast areas. SES Techcom's satellite solution ensured that fast and secure transmission of electoral results was provided, with votes displayed to the public in real-time as they were counted.

The following day, it was announced that the country's former prime minister, Roch Marc Kabore, had won the presidential election having received 53 per cent of the votes. SES Techcom says CENI had become Africa's fastest electoral administration to deliver presidential electoral results in a transparent way.

Mercy Ships set sail with mission-critical satcoms

Mercy Ships is a global charity that has operated hospital ships in Africa and other developing regions since 1978. Currently serving needs in Madagascar via the *Africa Mercy*, the organisation brings hope and healing to individuals and communities by mobilising people and resources across the globe.

Mercy Ships' volunteers and staff have performed more than 67,000 life-changing operations that are free to patients. They have treated more than 572,000 patients in village medical and dental clinics, educated around 32,100 local health care professionals and workers (who have in turn trained multiple thousands in primary health care), and completed more than 1,100 community development projects focusing on water, sanitation, education, infrastructure development and agriculture.

Working in some of the world's most distant and isolated locations, the organisation depends on mission-critical satellite communications to keep its ships operating smoothly, and to ensure its teams of volunteers – which include surgeons, dentists, nurses, health care trainers, teachers, engineers, agriculturists and crew – remain connected with headquarters and family members back home.

"Running an organisation like this requires a lot of close collaboration between our staff on our hospital ship, our offices around the world, and our shore teams that are working off the ship," says Chris Gregg, CIO of Mercy Ships. "We are probably more integrated in terms of the involvement of the shore offices with what goes on onboard than you would probably see in a normal

Mercy Ships has operated hospital ships in Africa and other developing regions since 1978. EMC has been its exclusive provider of satellite connectivity for more than 15 years.

merchant vessel. The actual operation onboard is tied very closely with our support office, whether that be supply or hospital programmes, or even IT or finances."

EMC has been the exclusive provider of satellite connectivity for Mercy Ships for more than 15 years. Whether at sea, on land or in the air, the company says it provides "seamless and reliable" connectivity as well as access to some of the most remote locations on the planet.

In 2015, EMC signed a new agreement to expand and upgrade the satcom systems and services it is providing to the *Africa Mercy*. The ship relies heavily on satellite to support surgeries and treatments, as Michelle Bullington, programmes design director at Mercy Ships, explains: "There are two key areas, lab and radiology, that are particularly influenced by a connection with satellite. In our lab we use it to help with diagnoses from a remote location in the US. Also, all of our scans from our radiology department are read remotely. [Satcoms] is important for us to help achieve our mission in terms of treating people."

Mercy Ships is also evaluating new ways to use satellite, especially for training. Bullington says that with satellite-enabled video, the organisation could teach both staff and beneficiaries using lessons delivered from land. "As a future area of growth, we see that using video could be beneficial in terms of sharing curriculum or ideas with other groups and organisations. There are others who are interested in this type of work as well, so we can share ideas and train more people in Africa more effectively."

To support the ship's important medical training mission, EMC is deploying its new global on-demand video service for remote learning access. Based on patented technology, the company claims *HD Connect* provides broadcast-quality video anywhere in the world.

In addition, it is increasing the satellite bandwidth available to *Africa Mercy*, making it easier for the hundreds of volunteers living onboard to communicate with family

and friends during long deployments. The crew and volunteers also have access to live broadcasts from the BBC and Fox News.

EMC says the new agreement with Mercy Ships leverages its extensive VSAT coverage across the continent, as well as its wholly-owned and operated satellite-terrestrial-cellular broadband network with fully meshed MPLS interconnected teleports. The company adds that it has 52 field service offices around the globe, staffed by its own field engineers who are ready to render "prompt and efficient" service to Mercy Ships' vessels wherever they travel.

Bringing Africa closer to London

A mid-sized UK-based independent energy firm listed on London's FTSE 100 stock exchange had existing communications services in Africa, mainly from a local internet service provider. While the services were low-priced, they did not provide an SLA or connection directly to the energy firm's London-based data centre. In addition, the services were largely reliant on local infrastructure, and were delivered through numerous providers with no consistent single point of contact, either for the end users or for the firm's information services (IS) department.

As a result, the energy company (which has not been named due to confidentiality agreements) sought a new connectivity solution and got in touch with SpeedCast. After surveying the client's communications, SpeedCast began with recommendations on how the firm could take more than 20 contracts in a single country down to one with a defined SLA, service support framework, and connection direct to its UK data centre.

Due to the nature of the client's drilling campaign, sites were required at short notice and in remote locations. They needed to be installed before drilling could start, and so the IS team and SpeedCast were placed under pressure to accelerate implementations even before orders were placed. By working in partnership, SpeedCast says it rose to the challenge and delivered on time, each time.

The remote sites connect directly to the client's centralised data centre and it now has one service desk to call for all of its global remote sites. SpeedCast also advised the client on how to cut 30 per cent from its overall network communications budget by moving to a consistent footprint and platform across all of Africa.

As the relationship developed, SpeedCast contributed to and informed the IS strategy, developing standardised remote deployments to give forecasted costs and lead times. It also contributed to the client's local content strategy by opening local offices to support the services, and contracted local companies alongside its own employees to deliver support.

Broadband

Zambia Research and Education Network (ZAMREN) is a specialised ISP dedicated to supporting research and education communities in the country.

Through the Zambia Information and Communications Technology Authority (ZICTA), the Government has started an initiative to promote low-cost, quality, reliable and affordable ICT goods and services that are universally accessible. Under the programme, ZICTA has supported ZAMREN to provide last-mile connectivity between the University of Zambia, Copperbelt University and Mulungushi University to the fibre optic grid operated by state-owned power company ZESCO.

As well as last-mile connectivity, ZAMREN needed to find a broadband supplier that offered reliable, high-speed cross-border connectivity. Improving education standards is vital to the economic development of many nations, and using broadband connectivity to interlink regional education networks (RENs) is essential for success.

However, cross-border networks are still relatively rare in southern Africa. Most traffic passes onto satellite networks and is then transferred to hubs outside the continent and back again. This impacts on both price and latency.

ZAMREN decided to go with Liquid Telecom for several reasons. As well as having education sector experience and expertise, the company has built the largest single fibre network in Zambia – at more than 1,200km long it is also the country's first fully-redundant network. Liquid adds that it is able to lay new fibre to cover the last mile from its existing network to ZAMREN's establishments, and also claims to supply SLAs that are "unmatched" by any other provider in the country.

After just five weeks of testing, the organisation's network went live in July 2012. Zambia's research and educational community are now linked for the first time, and can communicate with colleagues globally via the UbuntuNet Alliance for Research and Education Networking. The UbuntuNet Alliance is an association of national RENs in Africa. It exists to provide regional and international connectivity and internet services to its members in Eastern and Southern Africa on a non-profit basis. It also provides specialised and dedicated interconnections with other RENs worldwide.

In 2013, 15 establishments were using the Zambia Research and Education Network, and a further eight were connected soon after. ZAMREN says institutions connected to its network have benefited from a five-fold reduction in the cost of dedicated bandwidth.

According to the organsation's CEO Bonny Khunga, by working with Liquid Telecom ZAMREN has been able to provide efficient, low-cost broadband to research and education institutions: "The result has been a 70 per cent reduction in the cost of internet access for ZAMREN's member institutions and now more dedicated bandwidth capacity for those institutions. This is positively impacting researchers, academic staff and students in their core business of research and education."

Managing bandwidth for corporate broadband customers

Founded in 1995, AccessKenya claims to be the country's leading corporate ISP. It was acquired by Dimension Data in 2013 and later merged with Internet Solutions Kenya, which is also owned by Dimension Data.

AccessKenya provides broadband internet connectivity and services to enterprise and high-end residential customers. Some of these services are sold directly while others are wholesaled to downstream ISPs.

In 2007, the company implemented a bandwidth management solution by installing Allot's *NetEnforcer* devices at critical links in its network. As a result, AccessKenya has been able to monitor and manage bandwidth utilisation per application and per business customer. QoS policies dynamically allocate bandwidth and ensure that SLAs are enforced at all times.

Through the Allot solution, the service provider has also created more than 40 different service plans for its customer base. As a result, its business is said to have grown dramatically both in revenues and in the number of new broadband connections.

However, as AccessKenya's corporate broadband customer-base increased, so did the demand for services within those corporations and ISPs. Enterprise users who experienced network performance problems were sure that the service provider was not meeting agreed-upon SLAs.

But thanks to the granular visibility provided by the Allot bandwidth management solution, the company knew exactly how much bandwidth each corporate customer was using. It discovered that most congestion problems were

originating on the individual corporate networks and did not point to SLA violations on the internet connection. The challenge was to make this transparent to the customer and to provide the tools to correct the situation.

Access Kenya took a two-step approach to achieving its goal. First, it needed to track the actual usage of each corporate account and present this information to the customer. In this way, they would be able to understand how their bandwidth allotment was being used as well as the causes of their congestion or performance problems.

The ISP had been using the *Cacti* open-source network graphing tool for some time to provide basic utilisation statistics to its users at no cost. This was integrated with Allot's *NetXplorer* management system so it could display its usage graphs per customer 'pipe' or 'virtual channel' as defined by the system. In this way, corporate customers can view their own utilisation graphs using a familiar interface. New customers are added automatically to the *Cacti* system and receive a user name and password via email when their pipes/virtual channels are added to the relevant service plan in the *NetXplorer* policy table.

Step two involved solving performance issues. If the problem lay with the service provider, then AccessKenya would take immediate steps to correct it by refining its QoS policies or proposing a bandwidth upgrade to the customer. If the problem was on the customer network, the service provider would offer Allot's *NetPolicy Provisioner (NPP)* to enable customers to monitor and manage their own network traffic. Through *NPP*, AccessKenya's corporate customers can see which specific applications are using the most/least bandwidth. They can assign different priorities to different applications, guarantee bandwidth to business critical apps, and limit the bandwidth available to recreational apps.

Fixed wireless access

Galela was founded as company in 2007 with the purpose of participating in various sectors of the South African economy. As well as working in the mining and energy industries, the firm also has a telecoms division as well as an investment arm for acquisitions and expansions within these sectors.

Galela Telecommunication describes itself as a "trailblazer" in deploying broadband networks, offering internet connection services in under-serviced areas such as townships and rural areas. For example, it has successfully deployed a Wi-Fi hotspot network in Dr. Kenneth Kaunda

Above left: Altai's *C1ns* is used for pico coverage, backhaul and as CPE to extend the Wi-Fi coverage. **Above right:** The vendor's *A8-Ein* base station for macro coverage and *A2-Ei* dual band AP have been deployed on the rooftops of various buildings to provide access.

('Dr. KK'), one of four large district municipalities in South Africa's North West province. The company chose to use *Super WiFi* from Hong Kong-based wireless specialist Altai. Galela says network deployments based on Altai's equipment require fewer base stations and access points per square kilometre, and significantly lower total project cost.

Altai claims its technology was designed to overcome Wi-Fi's inherent limitations and give it the ability to cover large outdoor and indoor spaces with high capacity and reliable connectivity. According to the vendor, *Super WiFi* uses proprietary smart antenna technology to give standard Wi-Fi clients much longer ranges, more uniform area coverage, and superior indoor penetration. It says in-house developed 8 x 8 MIMO technology provides five times the average throughput than standard 3 x 3 MIMO in complicated NLOS environments, and *Altai AirFi* improves Wi-Fi cell efficiency with throughput optimisation by a factor of two, even with a large number of concurrent connections.

Launched in February 2016, the Wi-Fi service in Dr. KK provides free internet connectivity to local residents. There are 225 Wi-Fi hotspots in the city of Tlokwe located in the municipality which have been installed mainly in underserved areas such as townships and settlements. Galela says that at peak hours, there are more than a thousand simultaneous users with an average speed of more than 15Mbps per user.

Because of the huge coverage area and high user capacity, Altai's *A8-Ein* base station for macro coverage and *A2-Ei* dual band AP have been deployed on the rooftops of various buildings to provide access, while *C1ns* for pico coverage and backhaul are used as CPE to extend the Wi-Fi coverage. In some areas, such as internet cafés, schools and clinics, *A2*s and *C1ns* are used to provide small area wireless networks.

The network is configured and managed using uses the *AltaiCare* cloud-based solution, which helps to enable local residents to now benefit from round the clock and seamless Wi-Fi services for free.

Galela's rollout in Dr. KK is part of the *South Africa Connect* programme which aims to provide fast, reliable and secure internet to all citizens. Phase two of the initiative will cover all the provinces in the north-western part of the country and, at the time of writing, was targeted to be completed by the second quarter of 2016.

'Digital oilfield' connectivity saves USD1m for Shell Nigeria

Nigeria has become West Africa's biggest producer of petroleum, and approximately two million barrels a day are extracted in from the country's Niger Delta region.

Shell Nigeria needed a solution that could help it automate manual processes, creating an environment that is safer and more secure for its employees and the production facility as a whole. It knew IoT technologies could help its processes become more efficient and its operations more productive, but not only were connectivity options limited, they were also expensive.

Shell Nigeria used many manual processes to monitor its oil operations in the Niger Delta, and sought a solution that not only met its requirements for providing pipeline surveillance and wellhead monitoring capabilities of remote infrastructure, but also could withstand the harsh environmental conditions across a large and remote area.

Furthermore, the company is involved in all segments of oil operations, including exploration and production, upstream and midstream, and needed a system that was scalable for future expansion as well as able to deliver different information over different communication protocols.

Additional requirements included:

- A reliable system that enabled near real-time monitoring of different processes
- Support for the end devices within the system to be able to run on battery power only, as many locations of interest for remote monitoring have no power supply
- Monitoring of operational values both in the local operations centre and at the customer's headquarters in Europe
- Two-way communication to not only improve existing monitoring capabilities, but include capabilities for remote intervention.
- Data integrity, i.e., system and communication security.

As part of its evaluation process, Shell investigated several IoT connectivity options

and technologies, including satellite, PI to SMS, and GPRS. Each required significant infrastructure investment for towers, radios, data communications equipment, battery banks, logistics and installation. The firm needed to make not only a strong technology case for implementing an IoT solution, but also a strong financial case, and these options were too expensive.

In order to fulfil all system requirements and to ensure reliability and longevity, Shell Nigeria deployed a *Random Phase Multiple Access (RPMA)* machine network from US-based Ingenu. It claims to be a pioneer in delivering connectivity exclusively to machines, and uses end devices from KONČAR, a Croatian producer of industrial electronics and power electronics devices and systems.

Ingenu's machine network is purpose-built to support M2M/IoT applications. It comprises access points that broadcast the *RPMA* wireless signal, end devices that receive the signal from the access points, and the *RPMA* signal itself.

The vendor's technology operates in unlicensed free spectrum at 2.4GHz. It says *RPMA* optimises spectrum/frequency usage, and ensures security via mutual authentication, message integrity and replay protection, message confidentiality, device anonymity, authentic firmware upgrades, and secure multicasts. Ingenu says *RPMA* also ensures the lowest possible battery consumption, yet enables wide-area coverage with almost unlimited capacity.

Upland Consulting Nigeria provided all of the necessary support and conducted all field/installation services for Shell Nigeria. It has deployed KONČAR *Remote Terminal Units* with built-in *RPMA* modules in the flow-stations, manifolds, at wellheads and other customers' facilities. Connections have been provided from the field to the office, ensuring reliable information flow of field data pertaining to pipeline pressure, temperature and flow. End devices are capable of power consumption control, OTA parameterisation and updates, scheduled and alarm reporting, and encryption of transmitted data.

As part of the IoT network for Shell Nigeria, Upland Consulting provided connections from the field to the office to transmit data about pipeline pressure, temperature and flow.

On top of the *RPMA* system, KONČAR delivered a multiple connection and data export platform with its *MGMS (Modbus Gateway and Management Studio)*, enabling MODBUS TCP/IP and OPC connectivity for Shell.

Ingenu says its low-power, *RPMA*-based WAN solution required minimal infrastructure – just four access points have been used to serve the entire oilfield. This has resulted in total project cost savings of more than USD1m over the technology alternatives Shell Nigeria evaluated.

With the new network in place, the company has been able to:

- Reduce manual processes and on-site inspections, thus enabling continuous operations
- Quickly identify and resolve issues, resulting in the efficiency and safety enhancement
- Monitor equipment status in near real-time, preventing unscheduled downtime and safety risks
- Capture critical production data and utilise collected data to further enhance efficiencies
- Improve reporting

Upland Consulting Nigeria president and CEO Bola Awobamise adds: "The key criteria for selecting the solution were the technology's ability to cover difficult terrain, power performance and long-range transmission, as well as network scalability, two-way communications, and secure data transmission."

Avanti and Meso power national library digital network

The National Library of South Africa (NLSA) has an important role to play in providing universal access to information for its population. During implementation of its open source Library Information Management System (LIMS), the scale of the country's connectivity issue became apparent. Without broadband access, libraries could not make use of the new system, nor could they access central archives.

NLSA appointed Meso Systems and Avanti Communications to collaborate and deliver internet access to more than 100 South African libraries in close succession.

Phase one of the national rollout delivered the following:

- One in ten libraries were provided with services using VSAT access networks
- A state-of-the-art modem offering 15Mbps/2.5Mbps download/upload

During the first phase of the deployment, more than 2,000 connections were made at a rate of 11 new connections per day. An average of eight workstations were installed at each library.

- A cost-effective 74cm satellite antenna
- Bandwidth management using what Avanti describes as its "highly flexible" OSS

The latter enabled the NLSA to record live terminals and new installs at each step. It could monitor terminal performance and data usage, design and create its own bandwidth plans and usage policies, assist with the billing of customers, and communicate with customers.

Over a six month period, more than 2,000 connections were made at a rate of 11 new connections per day. An average of eight workstations were installed at each library.

Phase two of the project brought the total number of connections to more than 3,000. All of the sites were connected using VSAT services in partnership between Meso and Avanti.

Avanti says its satellite technology was favoured for its low cost, high quality, flexibility and rapid deployment. The company adds that not only did the technology extend the reach to rural areas where ADSL was not available, it was also chosen in many locations where ADSL exists.

"We chose Avanti because its services offer unparalleled quality at prices which radically change the economics of high-speed internet access in South Africa," said Thibedi Mogoba, chairman, Meso Group. "Now this access is supporting social transformation, and is helping deliver national objectives around knowledge- and information-sharing."

Commuter train service gets on board with wireless

Three train stations in the Gautrain commuter railway network now have wireless connectivity with the help of South African mobile operators and CommScope.

CommScope has been involved in the Gautrain project since 2007 when it was first being built. The first construction phases were all about building the railway. It wasn't until recently that it was ready for a dedicated wireless connectivity solution. Here, CommScope says it provided a

complete turnkey solution including system design, material supply, installation, project management and commissioning.

The project supports both data and voice services for Vodacom and MTN subscribers in the Gautrain underground stations at Sandton, Rosebank and Park. The solution deployed in the stations is an *ION-M* DAS (distributed antenna system) with a centralised 'base station hotel'. The master unit, which is located at Rosebank, provides the fibre distribution to all three stations which are covered by *ION-M* optical remote units.

CommScope says commuter rail projects are always challenging because work must not interrupt train services. Construction mostly happens at non-operational hours, usually in the middle of night, which makes the logistics more challenging. The company adds that it also takes skill and experience to install and optimise the network at the optimal service levels.

Like in other markets, wireless users in South Africa increasingly expect fast internet speeds and reliable voice service wherever they are. CommScope says the *ION-M* solution is a multi-operator DAS that enables Vodacom and MTN to provide such service to their customers.

The firm will also be involved in the next planned stage of the network, supplying equipment and services. It says this will bring dedicated wireless coverage and capacity to the tunnels via the leaky feeder coaxial cables.

Backhaul

Hughes has helped an MNO overcome the hurdles of jagged mountains and muddy roads to provide uninterrupted cellular overage across the DRC. It has not named the cellco but describes it as a "large African mobile operator which is working to install portable, solar-powered, towers in various parts of the country as part of its rural coverage project. These towers are connected to the mobile network core over satellite and will bring coverage to isolated locations throughout the DRC.

One such location served by this operator will be the conflict-ridden areas high in the mountains of South Kivu where building communications infrastructures can be a Herculean task. Hughes says the operator has been committed to bringing mobile technology to this and other remote areas on the continent.

In addition to boosting economic and social development, the hope is that improved communications will make the South Kivu mountain region safer. Its people will no longer be at the mercy of bandits and robbers because they will be able to connect with the government, law enforcement agencies and the outside world. Hughes is delivering the cellular backhaul services that will support the provider's efforts to enable such communications.




Clockwise from top left: With the help of Hughes, a mobile operator in DRC has provided cellular services via Ku-band satellites in Numbi; local people gather to watch as workers build the mobile tower; once completed, the 18 metre structure overlooks the town; it marks a day of great significance for local people who were able to place their first calls once the service went live. PHOTOS: SUSAN SCHULMAN

The company claims its field-proven, high-performance VSAT systems are a solution to backhaul for all generations of cellular base station technologies, including 2G, 3G and 4G/LTE. They are cost-justified in areas like Numbi, a town in South Kivu that is impossible to reach using traditional terrestrial means such as fibre, cable or microwave.

Roads do not lead past Kalunga, the small town that sits at the base of the South Kivu Mountains. To reach Numbi, workers must offload the heavy equipment and carry it up and down hillocks and berms (*as pictured below*).

In the rainy season, they must also avoid muddy and slippery dirt roads. On foot, the journey is 27km and the weight of the equipment totals 2,660kg.

The operator established a few sites such as these across DRC, bringing cellular connectivity to the lives of many. Due to low cost, ease of expansion and economies of scale, the operator decided to expand the network.

PHOTO: SUSAN SCHULMAN

The Hughes VSAT system for this network now includes three gateway stations, around 800 remote terminals, and a comprehensive network management system. They enable the operator to provide uninterrupted cellular service over Ku-band satellites. Powered by Hughes Adaptive Coding technology with support for DVB-S2 – one of the most advanced satellite air interfaces – and TDMA for efficient multi-point use, the system delivers more than 45Mbps of IP throughput. The highly scalable gateway architecture allows the operator to cost-effectively expand as needed.

The Hughes gateways are designed for 'lights-out' operation and can be fully managed from the operator's NOC. No personnel are required for daily operations at the gateways which are strategically co-located to provide coverage for the required regions, while experiencing the least amount of bad weather that could interrupt service.

Designed to scale to tens of thousands of users, the Hughes satellite VSAT system is opening new opportunities for mobile operators to extend coverage and improve mobile services for subscribers in target coverage areas with obstacles similar to those in Numbi as well as the DRC's other under-served regions.

Liquid supports nationwide coverage for Econet

Liquid Telecom has provided satellite-based backhaul for mobile base stations in rural Zimbabwe, helping its sister company Econet Wireless move closer to its goal of countrywide coverage and connecting the unconnected.

Econet is Zimbabwe's largest provider of mobile services but large areas of the country are still without cellular coverage.

Building and operating commercially sustainable networks in remote areas throws up problems including transporting kit on poor roads, generating power in areas with no electricity, and equipment maintenance.

Liquid helped Econet improve coverage by implementing a VSAT system which provides backhaul to its rural base stations in Marymount, Masase and Sango Border Post.

The satellite connection includes: a DVB-S2 shared bandwidth downstream carrier, enabling dynamic adjustment of bandwidth to suit demand; dedicated SCPC return links for an always-on connection that uses the latest modulation and coding techniques to maximise efficiency; and guaranteed service levels for specific types of traffic such as voice, SMS and internet traffic, for example.

Every BST is connected to a VSAT which then uses a dedicated IP backhaul link back to what Liquid says is a state-of-the-art VSAT hub in Harare. Both the base station as well as the VSAT run on minimal power so they can be powered by solar.

As a result Econet is now able to provide GPRS and EDGE coverage to even the most remote villages. Francis Mahofa, the operator's GM of network planning and deployment, said: "Liquid Telecom has enabled us to provide cellular services to remote areas where it has always been extremely difficult for operators to make the business model work. Liquid has built a reliable and cost-effective VSAT link and, in the process, has helped change the lives of many people in Zimbabwe for the better."

Point-to-point enables 24/7 visibility for mining company

When South African gold mining company decided to implement a new network at its site, it had very specific requirements in mind. The chosen wireless solution had to be able to:

- ❖ Transmit video in real time from cameras located at multiple locations in the mine
- ❖ Enable mining personnel to monitor activity around the clock from a command centre
- ❖ Support voice, video and data applications that are crucial to safe and effective mine operations
- ❖ Link surface infrastructure to underground systems (e.g. VoIP switches located 1,200m underground)

The company assessed equipment from different vendors before opting for *RADWIN 2000* point-to-point systems. Radwin specialises in sub-6 GHz wireless point-to-point and multipoint, wireless broadband, and small cell non-line-of-sight (NLOS) backhaul solutions. According to the vendor, its platform was chosen for a variety of reasons. Firstly, it says wireless was the only relevant option for this type of deployment as fibre optic cable was unfeasible due to reliability and maintainability concerns.

Secondly, Radwin says the mining site is a production shaft and any system placed in this type of harsh environment is subject to extreme abuse. Once again, an armoured fibre cable would have been simply too costly to install and maintain.

It claims the *2000* platform offers the highest throughput of up to 250Mbps. It supports voice, video and data services on single platform, and provides "superior" video quality transmission in challenging conditions. The system has been designed for fast and easy set-up, and also offers NLOS operation and low power consumption. Furthermore, Radwin says the ruggedised, IP67-certified *2000* is built for installation in harsh mining environments.

During the installation phase, the vendor says its system overcame challenges posed by multipath and fresnel zone limitations imposed by the moving skips and cages and the physical dimensions of the mining shaft.

The mining company now has a network that enhances the safety of its site and workers via real-time, high quality video transmission. It benefits from fast detection and response to field mining operations through round the clock visibility into activities.

In addition, the system features support for a range of applications including efficient data communications and remote monitoring, and the firm can connect surface infrastructure to the underground systems. It also has the ability to deploy and re-deploy the equipment where and whenever needed.

Critical communications

Malawi's Ministry of Health and Population extends the public health service through a number of rural clinics and health centres. However, distances from rural hospitals to the more remote health centres can be up to 80km or more, and on dirt roads often impassable in the rainy season. The use of radio communications is therefore literally a vital lifesaving tool.

The UK Department for International Development (DFID) has funded a pilot scheme to provide radiocommunication systems for remote health centres run as part of the *Safe Motherhood* project in three districts in the country's southern region. The initiative aims to improve pre-natal health care in Malawi. Its technical advisor Dr. Esther Ratsma says: "Communication is critical when dealing with health issues; when a life and death situation occurs the need to call for more professional guidance is paramount and often the life saving force."

Historically, many district hospitals and health centres throughout Malawi have used an assortment of simplex radio systems provided on an ad hoc basis from a wide variety of donor funds. After seeking advice from consultants, the *Safe Motherhood* project decided to go for an integrated and consolidated approach to each network and the needs of each district.

Linked together and sharing resources afford the ability to communicate directly with each other. This has offered a significantly improved network performance.

Team Simoco's locally-based distributor, Pitronic Limited Malawi, entered into an agreement with the Zimbabwe distributor, Vista Communications, to submit a bid for the tender prepared by consulting engineers Scott Wilson. It's claimed Team Simoco's 33 years of expertise combined with Pitronic's local knowledge and Vista's experience (it had previously contracted a similar system in Zimbabwe during the 1990s) ensured the success of the joint venture.

The scheme called for a turnkey solution. This involved the survey, supply, installation, commissioning and maintenance of three VHF radio networks to link groups of rural health centres with district hospitals.

The primary purpose of the network was to minimise response time, both in providing professional help and, if necessary, in dispatching an ambulance to transport an expectant mother to hospital. Most rural clinics are solely dependent on good radio communications as this is frequently the only medium available outside of the major urban developments.

Team Simoco radios comprising *PRF10* repeaters and *SRM9000* transceivers were supplied throughout three of the districts. The majority of the health centres had no electricity supply, and each was therefore equipped with a solar power system as an integral part of the installation.

It's claimed the *SRM9000*'s advanced features enabled sophisticated facilities such as selective calling, ANI, missed calls, phone book, ringtones, etc., to be programmed for easy operation by unskilled staff working under difficult and isolated circumstances.

Careful planning using information gained from an initial survey determined the optimum positioning of the three *PRF10* repeaters. This ensured the best coverage over the extensive areas of operation, with topography being both relatively flat as well as very hilly.

Left: Team Simoco supplied its *SRM9000* transceivers throughout three of the districts. The majority of the health centres had no electricity supply, and each was therefore equipped with a solar power system as an integral part of the installation. **Right:** Careful planning determined the best positioning for the three *PRF10* repeaters to ensure the best coverage over extensive areas which included flat as well as very hilly terrain.

The combined resources of Pitronic and Vista proved to be extremely successful in progressing the project through all phases from initial survey, which demanded some extensive travel, to final commissioning and acceptance. With rough bush tracks providing the only access to many of the remote centres the installation teams has to use 4x4 vehicles fitted with VHF radios and GPS.

Team Simoco says its VHF equipment installed in the three districts initially selected for development is operating very successfully, with good received signal levels being achieved throughout. A few ambulances have also been fitted with *SRM9000* mobile radios, the area coverage of which is being evaluated. Improvements have been realised and the network has been expanded.

Following the success of the pilot scheme the entire team now hope to work on the extension of the project to other areas selected for development under the next phase of the DFID funded programme.

Green networks

New Sun Road (NSR) is a registered California Benefit Corporation committed to implementing solutions to climate change and global energy poverty. Its engineers have teamed-up with Ugandan green energy startup GRS Commodities to deliver reliable and clean power to the Ssese Islands in Lake Victoria. The goal of the pilot system is to provide affordable and reliable solar powered electricity to businesses on Kitobo Island.

Although no small feat, deploying the solar power grids is perhaps the simplest part of the solution. Solar was the obvious choice for the power source because it is economical and relatively simple to deploy.

The primary difficulty lies in managing the energy grid and ensuring proper maintenance without having to be on-site at every location. The capability to remotely monitor the grid will enable NSR to expand its service across the islands in a more efficient manner since each grid can be monitored from one central location. But in remote areas where communication options are limited, how could the organisation remotely monitor and manage the smart solar power grid? Without a local ISP, this can be a complex challenge, so the team decided to enable remote connectivity over the global cellular network.

In addition to communication challenges, another major difficulty NSR had to overcome was finding a device capable of withstanding the high temperatures within its network hubs. The device would be residing within a NEMA enclosure in direct sunlight, so the capability to function under extremely high temperatures was essential.

It chose Digi's *TransPort WR11 XT* industrial grade router to enable a connection to the available 3G HSPA+ network which would allow for remote monitoring of the grid. NSR says the device provides a reliable connection to the global 3G network while withstanding high operating temperatures of the network utility hub.

By using *Digi Remote Manager* the operations team can easily push out new device configurations, firmware updates, and remotely diagnose and fix any issues in the network. The cloud management platform also makes it possible to monitor device temperature and alert the team if a device is starting to reach a user-defined temperature threshold, as well as any other changes in device-state that it chooses to actively monitor.

One unique piece to the NSR solution is the custom software application it developed to provide real-time analytics and remote control for both the solar generation system and the end users' electricity usage. The analytics engine allows the team to anticipate problems before they happen, ensure correct maintenance, understand user needs, and continuously optimise the system.

In the summer of 2015, New Sun Road, GRS Commodities, and the University of California Berkeley's CAL-RAE group began providing the first ever round the clock metered electricity service, powered entirely by solar on Kitobo Island. Thirty-four businesses and residential customers are now receiving power and making regular electricity payments, saving on average 50 per cent of their energy costs by switching to the solar micro grid compared to diesel generators.

NSR says the system is generating sufficient revenue to cover maintenance costs as well as ROI, proving its sustainability. It adds that the solution also emphasises the sharing of technical knowledge with local partners and communities. Experts are available to assist young engineers who are on-site to develop skills with solar system designs and communication technology.

Following the successful pilot, New Sun Road is now committed to extending electricity service to each of the inhabited Ssese Islands over the next two years.

New Sun Road chose Digi's *TransPort WR11 XT* to enable a connection to the available 3G HSPA+ network, which would allow for remote monitoring of the grid. The vendor says its cellular router provides a reliable connection to the global 3G network while withstanding high operating temperatures of the network utility hub (pictured here).

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