

The Hard Part is Making it Simple

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Asia is renowned both for vast distances and vast disparities in development. From 21st Century cities like Seoul, Singapore and Hong Kong to remote island archipelagos, dense rainforests and rugged highlands, Asia presents unique challenges to modern communications. Satellite is ideally suited to meet those challenges. But making it work – simply, efficiently and cost-effectively – takes a great deal of expertise with rapidly-converging technologies.

Take something as simple as direct-to-home (DTH) television. Typically operating in the Ku-band, DTH has enjoyed explosive growth across Asia, thanks to well-proven and stable technology and the availability of low-cost receivers. But the closer one gets to the Equator, the greater the challenge to DTH from simple rainfall. Malaysia, for example, ranks sixth in the world for precipitation, receiving on average over 2,300 mm (93 inches) of rain per year, compared with 1,400 mm in Japan, 1,200 across the USA and 650 mm in France. In the Ku-band frequencies, heavy rainfall too often extinguishes the satellite signal – at least, too often for Measat Broadcast Network Systems (MBNS). This company operates Malaysia's ASTRO satellite pay TV network, which provides 74 channels of satellite TV to nearly 2 million customers in Malaysia, Brunei and Indonesia. It managed to achieve uplink availability of 99.95% (about 4.4 hours of outage per year) but wanted to drive that number up to 99.995% (less than 30 minutes per year).

The standard solution is to build a diversity uplink site far enough away to be unaffected by a thunderstorm over the main origination facility, ASTRO's All-Asia Broadcast Center (AABC) in Kuala Lumpur. Selecting the Cyperjaya technology



Globecomm's Long Island International Teleport is the hub of its managed network services

park as the site, ASTRO awarded the diversity site contract to my company, Globecom Systems in the USA.

And as usual, making it simple turned out to be hard. From 2004 to 2007, Globecom and MBNS engaged in a collaborative partnership to develop a state-of-the-art system. The diversity site idea was constantly evolving from design review through implementation. The final solution was capable of automatic switching in less than one second by measuring the satellite's beacon signal level, which gives a precise indication of attenuation due to rain or heavy clouds.

The finished system monitors the beacon signal at both locations. Based on variables set by MBNS, the system can alert the operator to prepare for a switchover. If deteriorating conditions pass through a second threshold, the system makes the switch automatically. It took many design discussions and engineering analysis to come up with the algorithms that make it all work. Today,

the sites run as mirrors of each other. Normally, each site uplinks half of the ASTRO service traffic. AABC uplinks even-numbered channels and the diversity site at Cyberjaya uplinks odd-number channels. In the event of rain fade exceeding the parameters, either site can instantly offload its traffic to the other.

Making Low-Density Markets Profitable

Of the world's top 20 "megacities" with populations of 10 million or more, nine are in Asia. Yet most Asian nations also contain vast swathes of underpopulated land. Providing anything approaching "universal service" to mobile phone customers is a tremendous challenge in simple geographic terms, even if affordability is not part of the equation. Yet access to mobile telephony is not just a convenience. It can be the difference between grinding poverty and the promise of a better life. According to a recent report on the 3GSM show in Barcelona in *The Economist* ("Bringing the Poor Online," Feb. 22, 2008)", more than 3 billion (almost half the



world's population) now have mobiles, and the price of a phone has sunk as low as \$25. There are now more mobile-phone subscribers in poor countries than rich ones. That would have been unimaginable a decade ago. Mobile phones have improved poor people's lives tremendously, from providing political news and health-care information in remote areas to fuelling commerce."

The same article, however, points out the challenge of interconnecting mobile base stations in rural markets with rugged topography and lots of bits of land separated by water. The high cost too often results in "telecom islands," where a local base station provides connections among local callers but not to the rest of the world. But increasingly, satellite is coming to the rescue.

Satellite has always been a theoretical answer to the problem of connecting inaccessible locations. The barriers have been bandwidth availability and cost. But recent advances by many innovators are changing that equation. At my company, the technology is called SatCell, and it won a GSM Association award when it was first applied to a customer project. It aims squarely at the fact that the cost of bandwidth is the single biggest factor in the recurring cost of carrying voice traffic by satellite. SatCell technology can achieve as much as a 48x reduction in the bandwidth needed for mobile backhaul. With satellite bandwidth costing \$3,000 per MHz per month, that means SatCell technology can carry a single erlang (a standard measure of voice traffic) for less than \$50 per month.

Achieving this simple and desirable result was hard. It took advances by many other innovative companies, and knowledge of how to make them work in the uniquely demanding satellite environment. SatCell creates a demand-assigned network that optimizes both mobile signaling and backhaul traffic for transmission as IP via satellite. The SatCell technology uses a hybrid architecture customized to the network's traffic volumes and patterns to prioritize traffic, dynamically share bandwidth among base stations, and deploy higher-order modulation where needed.

Initially, each additional erlang of traffic adds \$50 to the

monthly cost, but as volume rises, refinement in the network architecture can typically drive costs down to less than \$25 per additional erlang of traffic. If volume increases further, carriers can easily calculate the point at which growing revenues justify converting the cell to fiber backhaul or making other capital investments that will further reduce operating costs.

While we developed SatCell originally for a customer in Africa, our most recent SatCell deployments have been on the Pacific Rim, where GCI of Alaska recently ordered a 200-node network to connect base stations across the country.

From Ruin to Rebuilding

Sometimes, it is changes in the project scope that create complexity and make it hard to keep things simple. As the democratically elected government of Afghanistan has struggled to rebuild following decades of civil war, communications has become a vital path for progress. The government has commissioned a series of network projects that aim to overcome geographic barriers to knit together one country many turbulent regions, using funding provided by the World Bank and the Afghan Reconstruction Trust Fund.

Globecomm has been proud to participate. We designed, built and provide international connectivity for an IP-based Government Communications Network that links 42 ministries and offices in Kabul via fiber and microwave, and extends this core network to 34 provincial capitals via satellite. While the network was in the planning stages, things took a twist. We found that the Ministry of Communications had, under a separate contract, purchased CDMA mobile switches from a Chinese company. They were providing local mobile service in "telecom islands" but had no outside connections. We were asked if we could do something about it.

We deployed our SatCell technology and a hosted switching system to connect the mobile switches and provide them with access to the rest of the world. All calls taking place within the footprint of each CDMA switch remain local, while calls between the switches or outside Afghanistan are routed through Globecomm's



The ASTRO diversity site at Cyberjaya, Malaysia

Network Operations Center in the United States. What had been originally designed as a private network unexpectedly became the backbone of a public telephone system, providing bandwidth, trunking, bringing traffic back to Kabul and providing international voice, video and Internet service.

Based on the success of that network, we eventually developed multiple projects including a District Communications Network connecting a hub in Kabul to police, fire and other services in each of Afghanistan's 337 legislative districts for voice and thin-route data as well as Internet access. We linked Army bases with a VSAT network and installed an international gateway for voice, data and broadcast video.

What made the projects remarkable are the conditions under which they took place and the transformative impact they have had. The development environment

was about as challenging as possible. Outside Kabul, there was little or no infrastructure, no roads and no electricity. Security remains a concern. Globecom employees were known to unload trucks in the middle of nowhere, hand-carry electronics across a stream, then get the truck across the stream and reload it.

To succeed in that environment required a strong local partner, Watan Telecom, which worked from the beginning to train the people needed to carry out the installation. Together, we built the capacity of the Afghan workers and transferred a great deal of technical knowledge, making it possible for them to support the programs as they moved from deployment into operations.

While all of this technology and training were going into place, we were also lucky enough to contribute to a modern telecommunications regulatory system. Each system was developed under the management of the Ministry of



The ASTRO diversity site at Cyberjaya, Malaysia

Like other nations that had been left behind by technology development in industrialized nations, Tonga chose to leapfrog legacy systems to an all-IP platform providing unprecedented flexibility and cost-effectiveness. What made it possible was low-cost, high-performance and stable IP technology, and the ability to tie it together into a working and robust system.

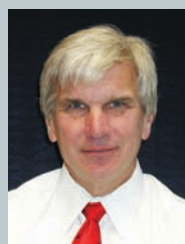
Whether in the rainforest or the highlands, the middle of the Pacific or a rugged coast, the same principle applies. For the network owner and network user, there is no substitute for robust simplicity – for systems that do what they are supposed to do, and do it in an intuitive way. As an industry, our success depends on the all-important ability to make the

Communications but then transferred to the newly created Afghan Telecom. The goal was to make the Ministry a true regulatory body while Afghan Tel becomes the operator. And with each new network, Afghan Tel gained assets and improved its ability to attract outside investment.

Mid-Pacific High Tech

The Island Kingdom of Tonga consists of 169 islands, 96 inhabited, in mid-Pacific. It should come as no surprise that satellite is the key to its communications with the rest of the world. But Tonga has taken a large step beyond conventional satellite with an all-IP network that integrates satellite, terrestrial microwave, GSM mobile, fixed wireless and digital television broadcast technologies in a single platform. Globecom designed and installed the network, which consists of three earth stations and transmission facilities ranged along the “backbone” of the archipelago’s largest island groups. These facilities, interconnected by microwave, provide mobile phone service, digital television, and wireless fax and broadband Internet service to Tonga’s population of about 112,000 people. The satellite link provides connection to the public switched global network, GSM roaming and the Internet.

complex and difficult look easy and simple. ↻



Stephen Yablonski has over 25 years of experience in satellite communications with significant concentration in video distribution and switched telephony over satellite networks. Mr. Yablonski came to Globecom Systems from Satellite Transmission Systems, Inc. where he was Vice President and General Manager of the Commercial Systems and Networks Division.

At Satellite Transmission Systems, Mr. Yablonski and his organization were responsible for the development and implementation of numerous satellite communications systems and networks while developing mass customization techniques to simplify the process of delivering one of a kind earth station. Mr. Yablonski worked very closely with his staff in the development, implementation and commissioning of the first DBS Terminals. Prior to Satellite Transmission Systems, Mr. Yablonski was the Vice President of Engineering at Argo Communications; and Manager of Advanced Technology at RCA Americom.