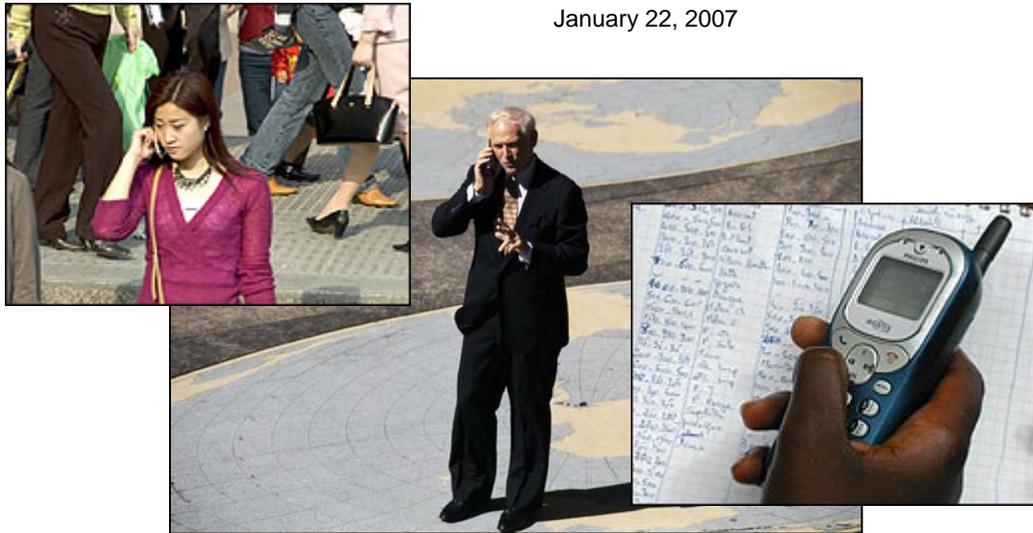


# The Satellite Roadmap for Expanding Mobile Communications Capabilities

Using satellite to build revenues,  
supplement coverage and  
ensure business continuity.

January 22, 2007



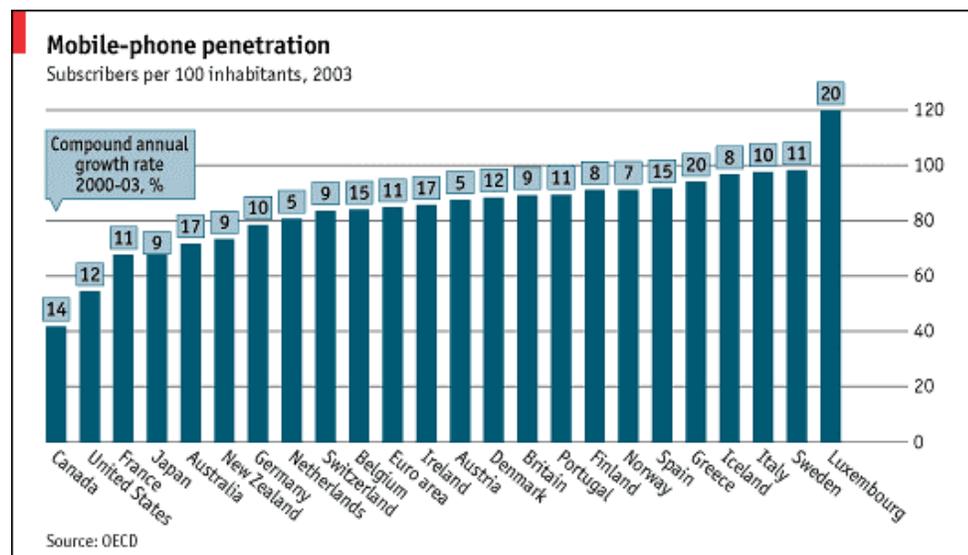
**A little bit of satellite goes a long way®**

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## How to Think 35,800 Kilometers Out of the Box

According to a September 2005 report from the Organization for Economic Cooperation and Development, mobile phones have become one of the most successful communications products in history. In Luxembourg, mobile phones outnumber people, and penetration throughout the industrialized world is nearly as high, though the US and Canada continue to lag behind.

The most startling statistic in the report, however, is that in much of the developed world, there is almost one mobile phone for every person. Unlike the wireless system that preceded it, mobile telephony is spreading fast to people once considered too poor to afford instant communications. With markets in the industrialized world reaching saturation, in fact, developing nations are forecast to provide all foreseeable subscriber growth in the future. The fastest growing region in the world is currently Africa, with double the growth rate of Southeast Asia, a red-hot market in itself.



Mobile telephony may even find new worlds to conquer. In June 2006, Microsoft unveiled a prototype system that allows people to plug a keyboard and an ordinary television into a mobile phone, which enables it to function like a simple PC.

Then there is satellite communications. As a means for people to make mobile telephone calls, it has a challenged history, from the \$10 billion bankruptcy of Iridium to the still-high cost of satphones and per-minute charges.

But on another front, satellite is opening up remarkable new opportunities in mobile. Satellite may be a challenging method for carrying individual phone calls, but it can offer startling cost, investment and network continuity advantages in the backhaul of mobile traffic. This white paper outlines technology advances in backhaul, switching and roaming powered by satellite, and pro-

vides a roadmap for the continued integration of satellite into the world's mobile networks.

## Services From the Sky

Aside from the fact that both systems are a form of wireless that uses radio waves, what does satellite have to do with terrestrial mobile telephony? Plenty, as it turns out.

Satellite circuits are being used to backhaul mobile traffic from base stations located in low-density areas where it is impossible to cost-justify installing fiber or microwave links. Satellite-equipped base stations are providing overlay networks for business continuity and the deployment of new revenue-generating services. The satellite circuits may terminate at the carrier's own switch, or may interface with a hosted switching service that eliminates the need for investment in additional switches and delivers billing data directly to the carrier's operations support system.

In all of these applications, satellite is delivering a startling low cost due to its inherent efficiency and flexibility as a one-to-many medium. That cost savings is unleashing service expansion and revenue growth for carriers around the world. Specifically, it is creating opportunities to:

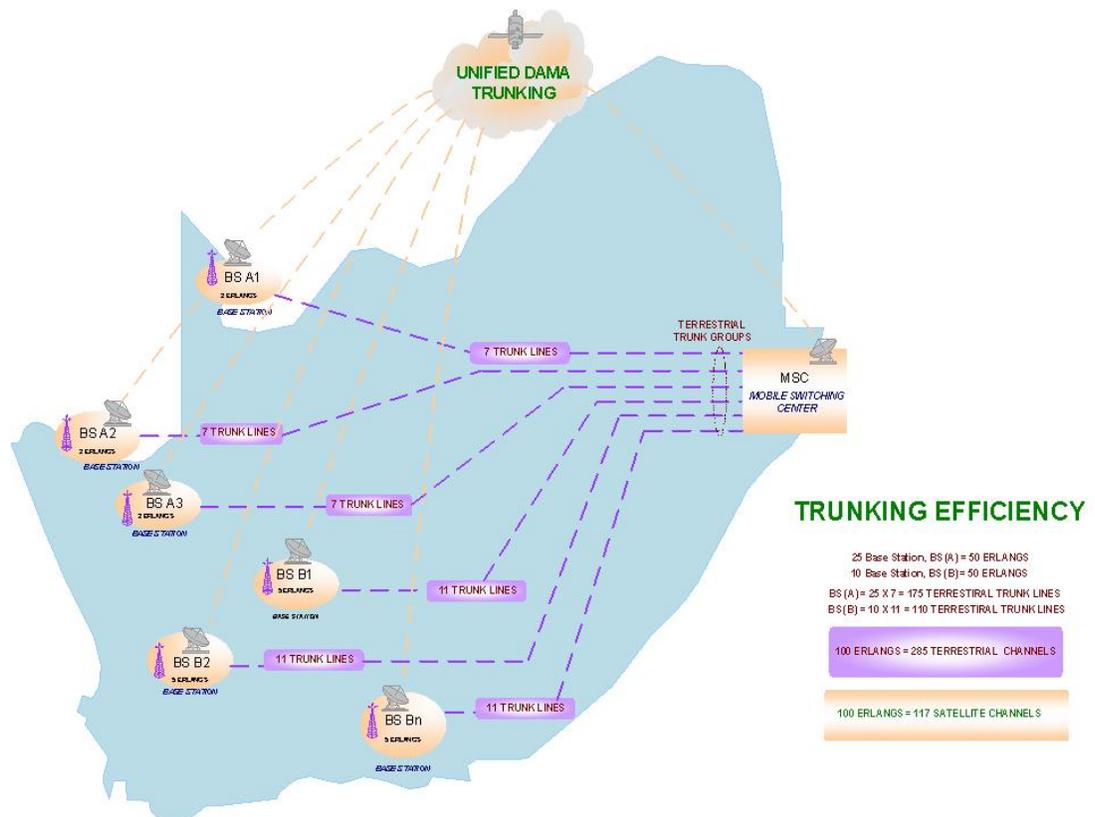
- Launch a new network or extend an existing one in low-density markets quickly and inexpensively, deferring the capital cost of fiber backhaul and carrier-class switches until traffic volume justifies them.
- Connect isolated "telecom islands" into a regional or national network when terrestrial backhaul is too expensive or too difficult.
- Quickly expand coverage at the site of special events that attract thousands or millions of attendees, or provide replacement coverage in the wake of a natural disaster, without building permanent infrastructure.
- Supplement an existing network's coverage to make possible new services or expanded roaming capabilities, as well as offering business continuity protection.

Satellite is even creating opportunities to expand beyond voice and data into video. As the satellite industry deploys a packaged IPTV solution, carriers gain the chance to leverage their investment in satellite-based expansion to reduce the cost of entry into triple-play services.

## Underlying Technology

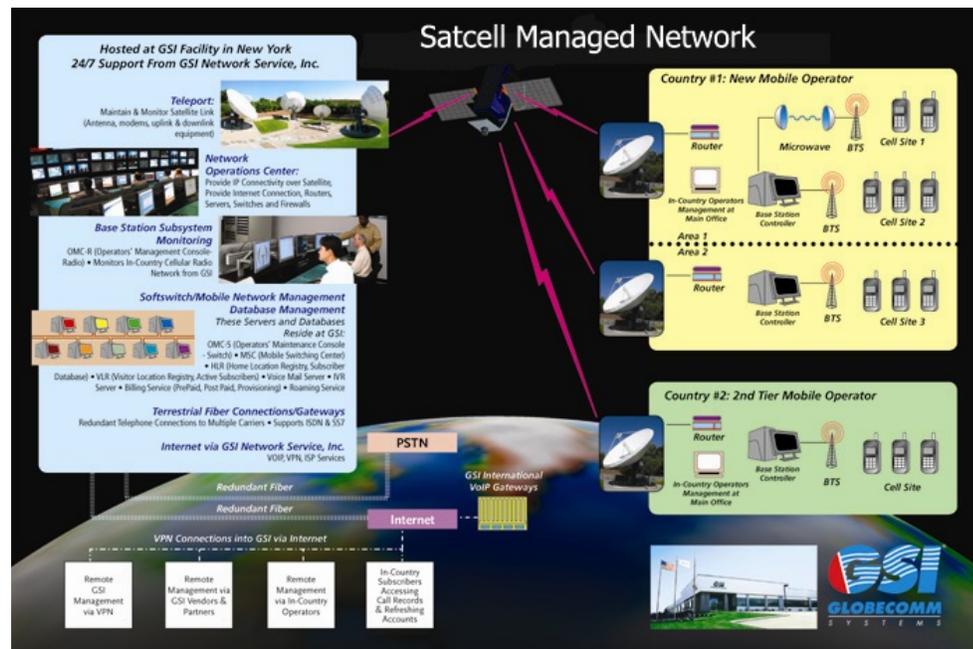
Globecomm has developed a powerful technology called SatCell<sup>®</sup> that optimizes mobile backhaul - whether GSM or CDMA - for transmission over IP using best-of-breed technology. Based on years of experience helping mobile operators, Globecomm has created a platform that drastically reduces transponder capacity needs by sharing a single IP stream between multiple links. The SatCell solution exploits the strengths of Demand Assigned Multiple Access (DAMA) Unified Trunking technology to assign access to base stations instantly on demand. With SatCell, E1s are no longer dedicated to individual base stations.

The diagram below shows a GSM backhaul network that would normally require 35 terrestrial E1s to support 35 base transceiver stations. The satellite DAMA network, however, creates the equivalent capacity with only 100 GSM channels. If any BTS experiences peak traffic, it can instantly access up to a full E1 of capacity from the pool of available satellite GSM channels.



Globecomm's SatCell technology has produced remarkable cost savings compared with both standard Single Channel Per Carrier (SCPC) satellite extension and terrestrial network extension. The cost of bandwidth is the single big-

gest factor in the recurring cost of carrying voice traffic by satellite. SatCell technology can achieve as much as a 48x reduction in the bandwidth needs for mobile backhaul. With satellite bandwidth costing an average of \$3,000 per MHz per month, SatCell technology can carry a single erlang of traffic for less than \$50 per month. Initially, each additional erlang adds \$50 to the monthly cost, but as volume rises, changes in the network architecture can achieve costs of less than \$25 per additional erlang of traffic. As 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 the cost per erlang served.



## Mobile Deployments

This kind of efficiency puts satellite into the mobile backhaul game, but it takes clever integration and sophisticated engineering to put winning scores up on the board. The following are three scenarios in which Globecomm has engineered a solution that delivered strong payback with high quality of service.

All the scenarios have two elements in common:

- On the ground, a mobile base transceiver station (BTS) is equipped with an integrated satellite antenna. These robust, pre-engineered systems have demonstrated high reliability and exceptional voice quality under challenging conditions. They

- require only a power supply and line-of-sight to an appropriate satellite to become fully operational.
- In the sky, active management of the satellite link takes place as traffic volumes and patterns change. Optimization is critical to achieving high efficiency. In a typical application, Globecomms remotely analyzes utilization of the satellite circuits and keeps the network tuned for maximum performance through changes to protocols, dynamic bandwidth sharing and higher-order modulation schemes.

### **BTS Extension**

BTS extension is a familiar idea in the mobile world. Through BTS extension via satellite, mobile carriers can place base stations in any location with electric power in order to extend an existing network into new geographic areas or connect isolated "telecom islands." The SatCell link provides an IP-based extension to the carrier's own base station controller (BSC). This requires a satellite antenna at the BSC as well as systems to integrate the incoming IP traffic to the BSC's protocols. The cost-effectiveness of the SatCell technology for low-density areas permits carriers to meet their obligations to provide universal coverage and build incremental revenues with very low capital cost.

### **Hosted Switching**

Hosted switching is a newer concept that is rapidly catching on. It allows carriers to launch completely new networks quickly and inexpensively, deferring the capital cost of fiber backhaul and carrier-class switches until traffic volume justifies them.

In a typical hosted-switch application, call routing software in each BTS/BSC connects voice calls within the cell locally and routes all in-network calls directly to other base stations. Switching is controlled, using small increments of bandwidth, by the vendor's remote mobile switch, which provides all service provisioning, billing, roaming and termination, as well as such advanced services as voicemail, SMS and data. Out-of-network calls are backhauled to a gateway managed by the hosted switch for least-cost long-distance routing. Billing data is provided in an appropriate data format to the carrier's billing system.

### **Network Overlay**

The newest development in satellite backhaul involves the creation of an overlay for an existing network. This makes sense when the overlay allows the carrier to expand services or introduce new features at a fraction of the cost of retro-



fitting existing facilities. Once installed, the overlay also optimizes the flexibility of the network, making it possible to quickly expand coverage at the site of special events that attract thousands or millions of attendees, or provide business continuity protection against natural disasters.

The network overlay is both similar to and different from hosted switching. Once the satellite-enabled base stations are in place, it uses the same call routing software to connect calls locally. Non-local calls may be routed either terrestrially over the carrier's existing network or by satellite. In either case, the satellite network - configured in either mesh or star topology - carries the call control data to a dedicated overlay switch located at either the carrier's or vendor's premises. This switch provides the roaming and advanced services for the network that the legacy equipment on the ground is not able to offer.

Wherever it resides, the overlay switch is integrated into the carrier's own OSS to provide a transparent experience to both the carrier and its customers. And in the event that terrestrial backhaul or base stations go down, the overlay network can immediately pick up the slack, providing 24x365 protection against disaster.

## IPTV Via Satellite

Properly deployed and integrated, satellite is delivering unprecedented flexibility and cost-effectiveness to mobile carriers serving low-density and isolated markets. But thanks to new developments in the satellite industry, it is also opening opportunities for carriers to enter a completely new line of business: television.

In the US, Verizon and SBC are making multi-billion dollar annual investments in deploying high-bandwidth circuits to the home and developing a package of television, film, video-on-demand and other offerings. In so doing, they are entering into head-to-head competition with the entrenched cable TV industry, which already has a strong Internet access business and rising voice revenues.

So far, IPTV deployment has been the province of the biggest carriers serving the richest, highest-density markets. But beginning in 2007, the satellite industry is rolling out an IPTV offering aimed specifically at Tier Two and Tier Three carriers. In the US, SES AMERICOM will introduce IP-PRIME, while Intelsat will

debut Ampage. Both services use satellite to deliver a pre-packaged array of channels to a headend, which feeds the channels directly into the carrier's DSL network.



Globecom pioneered the technology for this sector by designing the Super Headend where SES AMERICOM originates the IP-PRIME service and uplinks it to satellite. Globecom has also developed its SkyBorne™ Regional Headend solution for carriers. A SkyBorne headend is composed of pre-engineered building blocks that are customized by Globecom engineers to meet the customer's exact needs. Elements include:

- Edge receivers to acquire the streaming content
- Local reception and encoding systems that allow carriers to pick up local TV signals and integrate them into the program stream
- Monitoring, conditional access and digital rights management systems
- Middleware, which is the local operating system for IPTV

In addition to customizing and installing the basic headend, Globecom can also provide the technology for revenue-generating services such as local advertising insertion and video on demand.

For carriers that operate wireline and wireless networks, there is a compelling case for using satellite for both mobile backhaul and IPTV program acquisition. It offers an opportunity to leverage core investments in satellite infrastructure and reduce the total cost of deployment.



## The Satellite Roadmap

Cities and other high-density markets have been the low-hanging fruit of the telecommunications business since the time of Samuel Morse and Alexander Graham Bell. Wherever large numbers of customers are located in close proximity, carriers have seized the opportunity to earn high revenues while keeping costs per customer relatively low.

The exact opposite has always been true of low-density markets. But by using demand-assigned mesh satellite network technology, carriers can now serve low-density and isolated markets at attractive costs. More importantly, they gain the flexibility to optimize their networks for market density. In the short term, they can profitably serve a low-density market via satellite, then deploy terrestrial backhaul when and if revenue and traffic growth justify the investment. The table below illustrates how satellite backhaul can be integrated into a carrier's planning process for network growth.

Problem		Near-Term Solutions		Long-Term Solution
Meet service obligations in low-density markets without reducing profitability	▶	Deploy satellite-equipped base stations and use satellite backhaul for cost-effective connection to the base station controller.	▶	If rising revenue and traffic volume meet your investment requirements, replace satellite backhaul with optical fiber.
Minimize the capital cost of launching a new network	▶	Deploy a satellite-based network with hosted switching, deferring the capital costs of terrestrial backhaul and carrier-class switches until justified by revenue growth	▶	As cells develop a sufficient revenue base (and higher traffic volume), invest in a switch and fiber backhaul to reduce the cost per erlang.
The high cost of replacing legacy base stations and switches blocks deployment of advanced revenue-generating services.	▶	Deploy an overlay network using satellite backhaul to a dedicated switch, integrated into your BSS and OSS, which provides the required services.	▶	Evaluate business case for replacing network elements based on actual revenue results from advanced services.

## About Globecomm

Globecomm integrates satellite into network applications in order to provide reliable, high-quality connection to the edge of the network, broadcast one-to-many, and support bandwidth-hungry applications. Globecomm is the only company in the industry that can, under one roof, design, install, integrate, support, manage and operate a customer's systems and networks, or provide turnkey services that offer the same features and functions as a customer-owned facility. Globecomm specializes in providing total solutions that free its customers to focus on their core mission, whether it is telecommunications, broadcasting, retailing, serving constituents, maintaining security or projecting force. More information is available at [www.globecommsystems.com](http://www.globecommsystems.com).

