



Deciphering the rural mobile market

The mobile market has experienced a huge surge in growth across the world. However, there are still many areas where mobile networks operators struggle to reach due to a lack of infrastructure in their region. It is also often not cost effective to meet these needs through the deployment of terrestrial infrastructure. In this article, Doreet Oren, Director of Product Marketing for Gilat Satellite Networks, takes a closer look at the rural market and how small cells and satellite technology can help mobile network operators expand their reach.



Doreet Oren, Director of Product Marketing for Gilat Satellite Networks

Anyone still need a mobile connection?

The mobile market has grown so fast that subscriptions in the developed world are actually tapering off. Mobile penetration in these areas is over 100 percent - meaning there are more subscriptions than people. But there is one demographic which remains untapped in the global market: the nearly two billion potential customers who live beyond the reach of mobile networks in rural, suburban and remote sites.

Until recently, operators would not even attempt to reach these potential users: they often could not justify the time and expense of rolling out conventional infrastructure, coupled with low ARPU. But as other markets reach

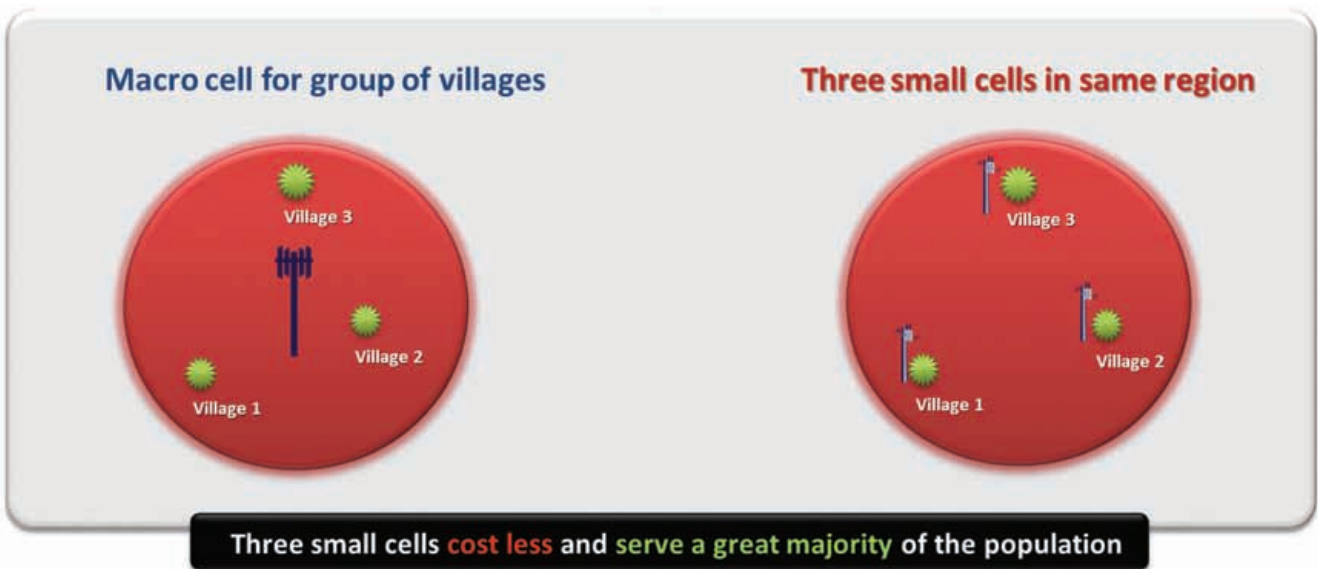
saturation, and as governmental Universal Service Obligations (USO) increasingly require mobile operators to provide rural service, these remote potential users now represent the final frontier for market growth.

Diversify your network

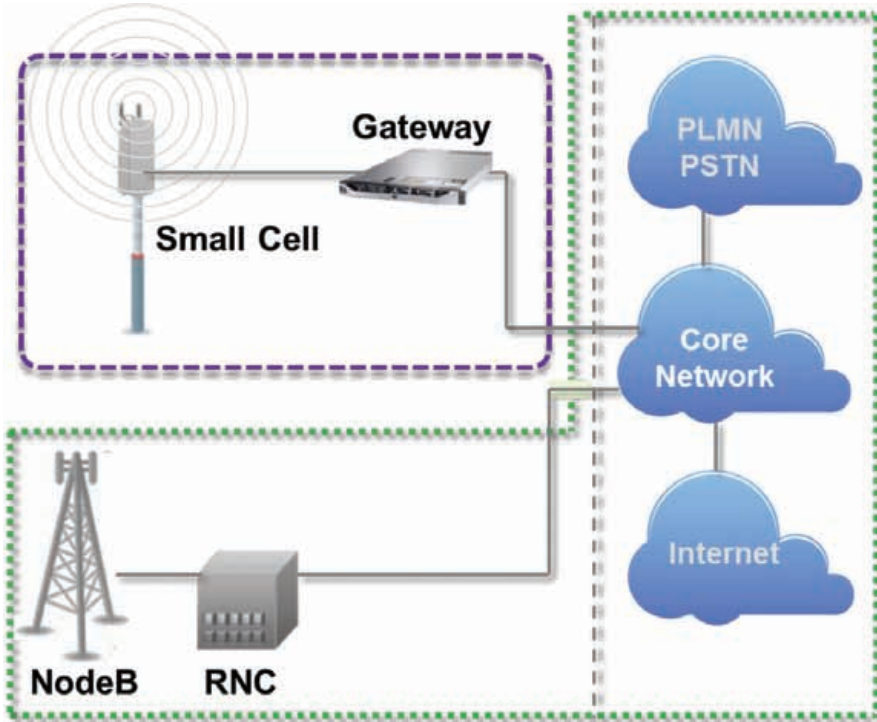
Reflexively, when the subject of network expansion arises, macro cells, with their high capacity and wide coverage, receive primary consideration. This is a natural response; most networks were built with macro cells, mobile operators understand their deployment and rely on them to do the heavy lifting when it comes to coverage. But a monolithic strategy to network expansion does not account for the nuances of data consumption patterns in rural areas.

Cellular networks often exclude rural areas from coverage due to their low ARPU. When a network operator determines that coverage is needed in a rural area, they must still contend with high macro cell costs. Unless a subscriber population has grown dramatically, a macro cell deployment requires significant CAPEX and OPEX, and is 'overkill' for a rural market.

The TCO of a three-sector LTE macro cell over a five-year period has been approximated at \$279,000. In comparison, the TCO of a 3G small cell over a similar period is less than a sixth of this price (*Senza Fili, 2012*). Even multiple small cell deployments do not add up to the cost of a single macro cell deployment. Imagine typical rural



All images courtesy of Gilat



- **Fibre lines** – this solution is best leveraged in urban areas, where a single deployment facilitates backhaul for a large quantity of data traffic. As data traffic spreads to more geographically remote areas, the less cost-effective fibre becomes, due to the increase in deployment costs and the reduction in usage. In rural areas, the sheer distance between locations, difficult terrain, trench construction, and slow deployment makes laying fibre a highly unlikely backhaul option unless the fibre lines are already in place.
- **Microwave** – this solution supports large quantities of data transmission. But microwave deployment has limitations as well:
- **Distance between coverage areas:** When the gap between coverage areas is large and unpopulated, it is not economically feasible to add towers to bridge this distance.
- **Terrain:** Because microwave communications require line-of-sight, this solution is applicable only in certain terrain. In rural areas which feature rain forests or in mountainous regions, this solution is a non-starter.

residential patterns: a village here, a village twenty kilometres down the road, a third village thirty kilometres beyond that. Because rural residential areas are clustered around a few population centres, they are ideal candidates for a small cell solution, deployed more rapidly and with far less expense.

Macro cells are still the building blocks of most cellular networks. But a network architecture willing to incorporate a variety of methods rather than a one-size-fits-all approach is the one most likely to thrive.

Small cells are ideal for addressing the challenge of extending a 2G/3G network to outlying areas. Northern Sky Research forecasts that over the next ten years, small cells will outnumber macro cell sites in rural implementations. While small cells have their limitations, they are a useful complementary tool in the arsenal of a well-planned network. Particularly in rural markets, a small cell solution can be critical to success.

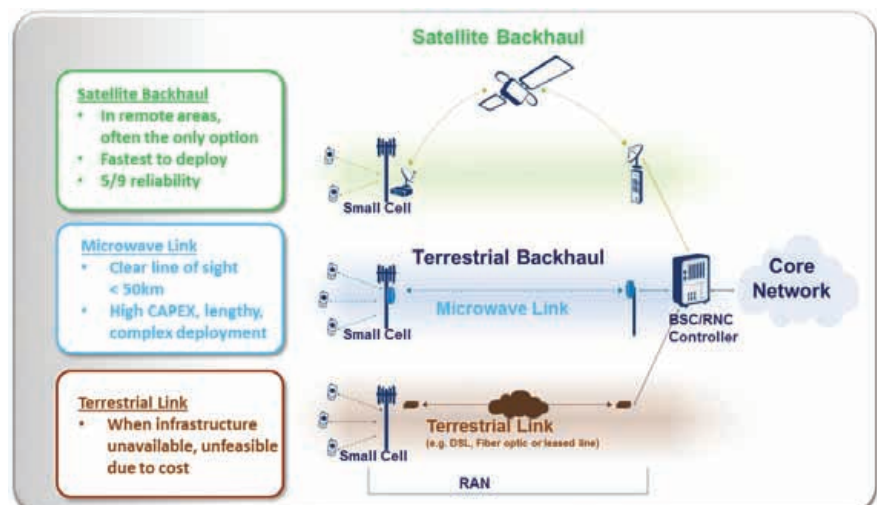
Small cells originally became known to the cellular industry as a solution for boosting coverage in urban areas, where higher frequencies assigned to 3G networks could not penetrate buildings, hampering connectivity. To solve this problem, small cells were often situated on each floor of tall buildings. Recently, small cells have come to be regarded as a solution in sparsely populated rural villages as well,

providing coverage within a three-kilometre radius. When properly integrated, they represent an easy-to-implement solution. Designed to handle data, they cost far less than macro cell deployments, and require little power to run.

Subtle shifts in backhaul routing

The vast majority of cellular backhaul is routed through fibre lines or microwaves. These technologies have their place in a network, but as discussed earlier regarding macro cells, a diverse approach is often the most cost-effective. Let's take a closer look at the main backhaul delivery methods used today:

Where does satellite fit into this picture? There is no topographic limitation to its deployment, making it the only option where distance, terrain or line-of-sight issues prevent other forms of backhaul. On one hand, it's more expensive than the other solutions, but it is also deployable – with all the attendant advantages of meeting tight deadlines for supplying coverage, scalability and high reliability.





According to an NSR study, satellite backhaul will have a four percent share of the global backhaul market by 2021, a figure that is expected to steadily grow.

An integrated small cell with satellite backhaul

We've seen that satellite backhaul is often the only feasible solution for rural connectivity, and that a small cell solution is ideal for rural network extension. To be a truly cost-effective proposition, however, small cell technology must be fine-tuned to reduce both CAPEX and OPEX and to work efficiently with satellite backhaul. Addressing these issues, Gilat has applied its extensive experience in satellite communications to design a fully integrated package, bundling a small cell with satellite backhaul from one vendor. With Gilat's CellEdge solution, a SkyEdge II-c VSAT installed in proximity to the small cell transmits data to the core network via satellite backhaul. These technologies – the satellite backhaul and the small cell – are generally sold separately. To work together seamlessly, and to provide the best user experience, consume the least power and enable cost reduction, a considerable integration and optimization effort is required.

Mixing and matching just any small cell with just any VSAT is liable to be ineffectual if not done properly. Plenty can go wrong. Integration covers:

- Efficient satellite resources allocation and reduction of protocol overhead;
- Data acceleration of cellular protocol to ensure a high-quality user experience;
- Quality of Service, including prioritizing signalling and voice over data; and
- Minimizing roundtrip delay and jitter.

Gilat's SkyEdge II-c CellEdge resolves these issues, offering a fully integrated, comprehensively tested solution with voice optimization, data compression and performance acceleration.

Low-power, low risk

CellEdge uses a fully outdoor small cell that is passively cooled – unlike a macro cell base station, it does not require shelter or air conditioning. Because the small cell is lightweight, it can be mounted on a low-cost pole or light-tower. Power transmission is high while power consumption is low. Particularly in rural areas, the advantage of a power-efficient solution is not only its lower operating cost but also its reliability. The logistics of delivering energy to a rural area can involve expensive fuel truck journeys, impassable roads, fuel theft, and all types of extreme weather conditions. This is more than an idle concern for off-the-grid villages, where power sources, if they exist at all, are often unreliable. A low-power solution bypasses these concerns. The lack of overhead associated with this solution as compared to macro cells is particularly attractive to network operators.

Optionally, in places where no grid is available, the cell can run on solar power.

Revenue sharing: win-win for satellite providers and MNOs

Another way small cell implementations are winning over customers is revenue sharing models that leverage existing infrastructure to increase profits. Satellite providers who already have a presence in rural areas deploy small cells that connect to a cellular network, providing voice/data coverage to unserved areas. In return, satellite providers receive a share of the revenue

from the resulting traffic.

From the satellite provider's perspective, they can take advantage of unused bandwidth on existing infrastructure to provide additional services and earn additional revenue. From the MNO's perspective, they are able to avoid the costs of network deployment and maintenance while attracting traffic in areas where their local presence may otherwise have been economically unfeasible.

This increasingly popular business model has been successfully implemented in places such as Indonesia and several African countries.

No more lonely road

In western Canada, the Alaska Highway stretches 1,909 kilometres from Dawson Creek until the Alaskan border. Scattered along this road are communities with hundreds of residents, often less. It is a main artery for campers looking to explore the north and a beautiful drive, but in the summer this two-lane highway becomes quite crowded.

Trucks, RVs, and construction zones can delay traffic for up to an hour. Until recently, this long, somewhat unpredictable road had no mobile coverage. But then Gilat teamed with a satellite operator and a local cellular carrier; by the end of this year a CellEdge-powered solution will bring 3G connectivity at regular intervals along the entire span, including for residents of towns along the route. Areas like these around the world are prime candidates for a small cell with satellite backhaul solution.

They are areas in which laying fibre or microwave is prohibitively expensive. The subscriber base is miniscule. Yet for the safety and communications needs of motorists and those who live in the region, reliable broadband is of paramount importance. In addition, MNOs can gain revenue by charging roaming fees to those visiting the network.

Bridging the digital divide

Whether by governmental mandate or strategic decision, expanding coverage to rural regions is an irreversible trend. Small cells are uniquely suited to meet this need, and a tightly integrated VSAT providing satellite backhaul is its required complement. For more information about CellEdge, our integrated small cell over satellite solution, visit www.gilat.com. ■

