Think Small: Micro, Pico and Femto Cell Sites

BY MICHAEL HARRIS

It's not just cell phones that are getting smaller, less expensive and more capable – cell tower sites are following the same trend too. While giant macrocell sites have been the industry norm for years, carriers are increasingly turning to a range of smaller cell site options as a way to reduce costs and speed network expansion. These include microcells, picocells and femtocells.

FIGURE 1: Macrocell site tower and base station

FIGURE 2: Is that a tree or a tower?

A key catalyst for change is the surging popularity of smartphones and Internet-based mobile services. Data usage is skyrocketing on wireless networks, surpassing voice traffic. Concurrently, competition is intensifying among carriers, creating price and margin pressures. To gain an edge, carriers are pursuing strategies that boost capacity and drive down expenses. High on the list are options to shift away from "super-size" macrocell sites when possible.

Also, when adding network capacity, the use of smaller sites helps carriers avoid the increasingly common resistance to large cell towers in many communities. American consumers love mobile communications, but when it comes to towers, the sentiment is NIMBY — not in my back yard.

This is particularly true with macrocells, the largest cell towers. Looming over the landscape, these towers may climb as high as 250 feet and are installed with large climate-controlled base station equipment cabinets beneath them, as shown in Figure 1. Macrocell sites can cover a radius of up to 10 miles in diameter, depending on the terrain. However, they require large upfront capital investments, face burdensome zoning restrictions, and sizeable ongoing expenses for maintenance, site leasing, electrical power and telecom backhaul.

Zoning Out

Federal regulations prohibit local governments from prohibiting the installation of cell sites in their communities. However, they are allowed to create rules that govern where and how cell towers are installed. Strict local ordinances covering tower height, security, placement and aesthetic restrictions are common. It is not uncommon for carriers to spend years and tens of thousands of dollars sorting through the red tape of local jurisdictions. It also explains why towers increasingly resemble trees (see Figure 2) and giant cacti, or are concealed in purpose-built structures, such as church bell towers or steeples. Creating a cell tower design that blends in better with the environment is a common carrier concession.

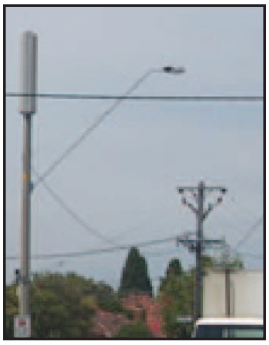

FIGURE 3: Microcell site on a light post

FIGURE 4: Picocell in an office

FIGURE 5: Sprint's Airave femtocell – a handheld cell site

It's a Small World

As carriers look to shrink cell sites, microcells provide a mid-sized option. Frequently employed in urban and suburban areas, microcells offer a coverage radius of less than a mile in diameter. They can be seen mounted on street lights (see Figure 3), traffic lights, billboards, bridges, tunnels and flag poles, to name a few. Their less obtrusive size and appearance can make compliance with local ordinances easier. Usually, the installation of three microcell sites can cover the same service area as a large macrocell, but at a lower total cost and quicker installation timeframe. The base station equipment and electrical powering costs for microcells are far less than their larger counterparts.

Picocells are even smaller than microcells. They cover areas less than 250 yards and are typically used for indoor applications, such as office buildings, airports and malls (see Figure 4). Because building walls weaken signal strength, picocells can be particularly helpful for overcoming problems with poor cell phone reception indoors.

Femtocells are the smallest of the bunch, about the size of a cordless phone base station or Wi-Fi router (see Figure 5). Each femtocell can typically support 2 to 4 simultaneous mobile phone calls. The devices use a broadband Internet connection (such as a DSL or cable modem link) to "backhaul" mobile calls and data traffic to a wireless carrier's network.

With femtocells, consumers and small businesses no longer need to wait for a carrier to install a tower to improve cell phone reception. After plugging in a femtocell, they immediately gain "five bar" signal strength inside their home or office.

Informa Telecoms & Media estimates that by October 2010, about 350,000 femtocells had been installed in the U.S., already eclipsing the number of conventional cell towers in the county, which total 256,000. The number of femtocells is expected to skyrocket in the coming years.

"There are now MORE femtocells than cell towers in the U.S."

Informa Telecoms & Media

The three largest U.S. wireless carriers are all offering femtocell products. AT&T Wireless now sells its 3G Micro Cell for $149 (despite the name, the product is a femto). Verizon Wireless offers its 3G Network Extender for $249, while Sprint charges $99 for its Airave femtocell.

Carriers are enamored with the savings that can come with femtocells. First, consumers are essentially paying the capital cost for cell site expansion. Second, each femtocell that is installed translates into fewer calls on a neighboring macrocell or microcell tower, reducing the need for carriers to add as much cell tower capacity. That may allow carriers to avoid the headache and expense of larger cell site acquisition, leasing, construction and maintenance.

"Using smaller cell sites can significantly reduce costs for carriers."

Alcatel Lucent Research

An analysis by Alcatel Lucent Research estimates that by 2014, total capital and operating expense savings (as a percentage of revenue) from using smaller cells will be 117 percent for U.S. carriers. Alcatel also projects that by 2017, 80 percent of U.S. households with mobile users will install femtocells.

Over time, it seems, the big opportunity in cell sites may be about getting small.

About the Author

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