Tiny Transmitters Could Help Avert Data Throttling

 Major carriers, arguing that their networks are clogged with smart-phone and tablet traffic, are increasingly implementing data throttling, the practice of targeting heavy users by slowing down data-transfer speeds. Now a gadget invented at Bell Labs—a programmable, pint-sized transmitter that requires no new traditional cell towers—could rapidly add capacity and thus help avoid data bottlenecks.

The gadgets are known as light radio cubes. Measuring just six centimeters on each side, they are miniature transmitters and receivers that can be programmed to work flexibly in different contexts to add capacity.

Two devices together can serve a compact area such as a stadium or train station—handling just as much traffic, in that compact area, as a whole cell tower can serve a wider area. A cluster of 10 to 20 of them can form an array that replaces the transmitters atop a typical cell tower. They can boost capacity in part by collectively reshaping the radio beam in real-time toward the incoming signals to optimize performance.

The demands on mobile networks are expected to explode over the next four years. Bell Labs has estimated that traffic will grow by a factor of 25, while Cisco says it will grow 18-fold by 2016. Either way, the system will have to be remade to accommodate the traffic.

“I think we are really at the cusp of a major transformation of what a wireless network is and does, and its value to everybody,” says Mike Schabel, a vice president at Alcatel-Lucent, which is commercializing the technology.

Light radio cubes could add efficiencies in other ways, too. In a traditional cell

tower, as much as 50 percent of power is lost just in moving a signal from the amplifiers and other components in a base station up to the transmitter at the top of the mast. But in the cubes, these components are miniaturized and distributed onboard each unit, reducing losses. Overall, Schabel says, the units can reduce costs by 40 percent compared to adding network capacity via more macro cells.

But first, real-world tests must be completed. So far, the technology—which can work with 2G, 3G, and 4G networks—is being put through trials by Telefonica, the Spanish carrier, Etisalat, in the United Arab Emirates, and China Mobile, which has 650 million subscribers.

Alcatel-Lucent is hardly the only player working on the concept; other companies, including Ericsson, Huawei, Cisco, Samsung, NEC, and Nokia-Siemens, are also developing versions of the technology, known generally as small cells. A market research firm, Visiongain, predicts that more than one-third of the world's mobile network operators may deploy small cells this year.

Carriers have already been rapidly installing a related indoor technology, called femtocells, to serve dead spots or crowded areas inside buildings. AT&T alone has several hundred thousand Cisco-made femtocells around the United States. (The amalgamation of all these networking technologies—traditional towers serving what are known as macro cells, femtocells, small cells, and Wi-Fi networks—are known as heterogeneous networks.)

"These smaller cells could possibly meet the data demands that we are facing with smart-phone applications," says Narayan Mandayam, an electrical engineering professor at the Winlab, the wireless research lab at Rutgers University. "We have to do something other than what we are doing now. The carriers are already operating at a point where they are not able to meet their demands."

The small-cell technology also answers practical problems. The traditional way of adding cellular network capacity is to do so-called cell-splitting. For example, if a given region is covered by 10 macro cells, carriers might aim to erect 10 more towers and then divide the area into 20 macro cells. But this can require costly real-estate investments and zoning battles. And from a technical perspective, it creates more radio interference at cell boundaries. By contrast, Alcatel-Lucent has engineered the light radio cube to coexist with the macro cell without interference.

The proliferation of smart phones has rapidly put the industry on crisis footing. Lately, the carriers have begun implementing data throttling. AT&T has just instituted a change to its throttling policies, now saying customers with unlimited data plans in its 3G network will face throttling only if they download three gigabytes in one month.

Part of the answer to congestion will come from new TV spectrum that is expected to be auctioned in two years under a recent deal in Washington, D.C. But adding smaller cells, and managing them smartly, will be another key solution.

"The light radio cube should help in reducing congestion," says Yingying Chen, a

computer scientist who specializes in wireless networking at the Stevens Institute of Technology in Hoboken, New Jersey. “You need something that is being deployed other than new cell towers.”

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