Transitions: Moving from Fiber to Faster, High-Capacity Wireless

Mon, 04/06/2015 - 1:35pm
by Anuj Srivastava, Ph.D.
Get today’s wireless headlines and news - Sign up now!

In answer to every communications officer, CTO and network administrator’s wish for “more”—more bandwidth for additional capacity, faster speeds, greater security, smaller footprint, and cost-efficacy—wireless data link technology is now eclipsing fiber as the go-to solution to meet these demands.

No longer bound by the constraints of hard-wired fiber optic links, businesses can free up space previously used to route fragile fiberglass strands along with all the hardware necessary to convert electronic streams to light pulses and then back to electronic again.

With high capacity and high speeds, wireless data communication links can leap across chasms in space to connect line-of-sight buildings at distances of several kilometers using highly directional, pencil-thin beams that prevent interference and strengthen security.

Ever evolving wireless technology

For years, wireless communications have enjoyed modest success over that of fiber-optics and coaxial cable, thanks to their untethered ability to span distances without the need for digging trenches and laying fiber or copper wire. But wireless has been traditionally limited in its capacity
to transport gigabit quantities of data due to bandwidth limitations set by the FCC.

Relatively unknown in the commercial world, the MMW spectrum has been utilized for military communications for decades. Unlike frequencies found lower in the electromagnetic spectrum, the E-Band offers tremendous, uninterrupted bandwidth to enable wireless data transmission at speeds and capacities on par with the best fiber optic communication systems. Practical data rates in the E-Band band can meet and exceed 40 Gbps.

No longer limited by ground-bound fiber—which requires the underground trenching of streets and sidewalks to establish a physical connection across city blocks—businesses can now channel vast quantities of communication data between buildings and/or campuses.

At the same time, transmission speeds via wireless prove faster than cable because of less latency. Even high quality fiber optic cable experiences significant latency issues in some applications that require precise synchronization.

Expanding upon the improved functionality of wireless is the recent development of dual-capacity MMW wireless in a single polarization that only requires one antenna.

Pioneered by the HXI subsidiary of Renaissance Electronics & Communications, LLC—a Harvard, MA-based provider of RF, microwave and MMW components and sub-systems for military and commercial applications—this technology simultaneously carries two, independent, full duplex “GigE” signals for a total throughput of 2.5 Gbps. Two dual capacity models, the HLS8454 and the HLS8654, are the latest in HXI’s Gigalink LightSpeed radio product line. The company’s earlier GigaLink Speed radios were among the first MMW radios in the 60 GHz and 70 GHz band to achieve FCC certification for unlicensed and light licensed commercial applications.

“This technology creates a value proposition by providing two high speed, high bandwidth lines for the price of one, since putting two communication links on a single antenna gives you twice the capacity with half the hardware,” says Wayne Pleasant, an independent RF consultant for HXI. “If you have multiple customers or users in a building you can sell, or dedicate, one radio link channel to one customer and the other channel to a different customer or user, without crossover.”

Previous systems required the use of two antennas to attain full duplex capability. To compensate, some systems multiplex the outgoing and incoming signal on top of each other, but that process exacts a big penalty in terms of latency, losing many nanoseconds which add up quickly. The use of a single antenna, with a single polarization, eliminates the need for multiplexing. Latency is negligible at less than 2 nanoseconds.

At the same time, using a single antenna adds to the already-increased security that MMW wireless affords.

“Channelizing two signals together on one frequency poses a greater security risk,” explains Pleasant. “But by using two independent frequencies that single polarization technology allows,
each line is kept totally separate from the other. It’s the highest security you can have for independent GigE transport.”

As if MMW radios and antennas weren’t already very small—measured in inches rather than feet—the use of a single polarization antenna further reduces the footprint of the system. This addresses the concern over potential “visual pollution” caused when mounting a large quantity of antennas to the side of a building.

Given just a single out-the-door unit consisting of both the transmitterreceiver and a single antenna on each end, dual-capacity MMW wireless saves duplication costs. When compared to the expense of laying fiber across the ground, wireless becomes extremely cost effective.

**Early adopters reap speed and capacity benefits**

Now that the E-Band spectrum has opened to the commercial world, many businesses are taking advantage of wireless communications instead of fiber.

In their quest for secure, high speed capability, stock trading firms are increasingly turning to wireless MMW transmission systems. For example, a trading company can install one of the microwave radio links on top of its data center in New Jersey and use it to create a direct connection to an exchange in Manhattan. By using microwave instead of fiber optic cables, a trading firm can establish a much shorter path to the marketplace to reduce latency and facilitate the rapid execution of millions of trades each day.

Wireless technology is also finding wide acceptance among motion picture, television, sports, and electronic news gathering (ENG) organizations for the placement of digital video cameras in remote locations up to 500 meters or more from the receiver without wires or fiber cluttering the shot or needing a grip to manage the cables.

Dual band wireless, in particular, facilitates 3D programming since it is shot utilizing two cameras that record slightly offset images to create a dimensional effect. With two channels on one antenna, two independent HD streams can be transmitted simultaneously without latency issues that could cause ghosting.

The highly directional characteristic of millimeter waves is even suited to cellular backhaul communications, particularly in crowded urban environments where the cost and challenge of implementing fiber to every site is prohibitive, particularly in urban areas where streets and sidewalks cannot easily be trenched. With typical link distances for picocell backhaul estimated at a few hundred meters between sites, and microcells almost two kilometers, millimeter wave products are ideally suited for such applications.

The technological advancements made in dual-band MMW wireless radios promises to catapult it over land-bound fiber as the communications medium of choice for many other industries in the coming years.

*Anuj Srivastava, Ph.D.is President and CEO of Renaissance Electronics & Communications, LLC and its subsidiary, HXI, LLC.*