Fiber for Cell-Phone Distributed Antenna Systems

Lessons for WiFi: Preconnectorized outside plant solutions have changed the cost dynamics of DAS deployments

Allen Dixon ■ *Corning Cable Systems*

Uses for cellular wireless technology have expanded from comparatively simple voice services to encompass Internet access and video, while providing something wired phone networks cannot: Mobility.

Evolution or revolution? The difference may be the speed of change. Evolution carries the context of gradual change over a long uninterrupted period of time. It is a natural progression with no definitive end and without urgency. Revolution, on the other hand, connotes a rapid break with the status quo. In revolution, the future starts now, and with a bang. Evolution (slow erosion by the Colorado River) created the Grand Canyon; revolution (a meteor strike) created Crater Lake.

As wireless becomes more ubiquitous, its physical infrastructure is struggling to keep up. The growth in users and the trend toward 3G network services is forcing carriers to increase the number of cell sites to maintain both coverage and service quality (Figure 1).

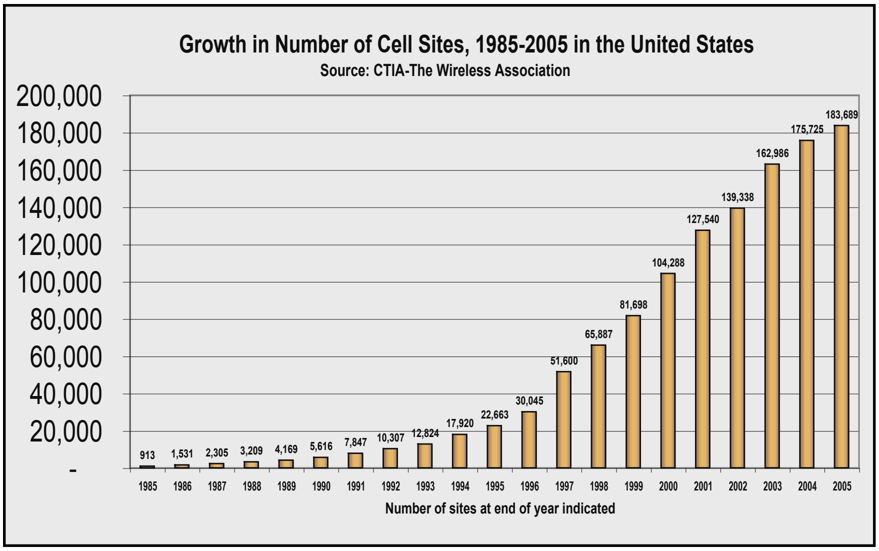

Figure 1: CTIA-The Wireless Association reports that the number of cell sites continues to increase 4.5 percent a year, even after 20 years of growth.

In dense urban and suburban areas, locating new sites is becoming difficult and expensive. This is forcing carriers to consider alternatives. One evolving solution to conventional tower sites is the installation of a distributed antenna system (DAS).

In a DAS installation, conventional tower sites are augmented by a series of smaller, lower-powered remote antenna nodes (RANs), which are placed on existing infrastructure. These smaller nodes provide a targeted cost-effective method to extend coverage in underserved areas. Potential sites for DAS nodes include light poles, utility poles, and billboards (Figure 2).

The remote antenna nodes are backhauled over optical fiber to what we call a "Base Station Hotel" (BSH). The BSH is the interface between the "dumb" RANs, which only convert the incoming RF into an optical signal, and the "smart" equipment that handles all call processing. Consolidating the RANs' backhaul in the BSH allows more efficient port utilization, simplifies troubleshooting and repair, and streamlines system upgrades. The smaller service area of the nodes enables greater use of available spectrum by allowing greater frequency reuse and more consistent service for users in the cells. These advantages provide significant benefit to the wireless network operator.

The municipality receives benefits, too. DAS nodes are not nearly as visible as a conventional cell tower. This allows the city to facilitate highly-desired wireless service to its citizens without the need for significant land usage or the always hotly contested zoning hearing involving tower placement. If city-owned infrastructure is used for the deployment, lease agreements may be signed with the network operator to create a symbiotic arrangement.

The Need to Evolve

It is difficult to understand why, with all the benefits it has to offer, DAS hasn't already sparked a revolution in building and designing wireless networks. For all its benefits, it may not be, in the words of one consultant,

In a DAS installation, conventional tower sites are augmented by a series of smaller, lower-powered remote antenna nodes (RANs), which are placed on existing infrastructure. These smaller nodes provide a targeted cost-effective method to extend coverage in underserved areas.

Figure 2: The new look of cell sites – telephone and utility poles.

"friendly enough." A DAS proponent, he thinks that for DAS to be more broadly accepted it must evolve technically, economically, and politically.

The political implications of DAS fall outside the scope of this article. There are, however, revolutionary technological innovations in network installation on the near horizon that offer help with the financial evolution of the DAS model.

In current DAS deployment scenarios, once node placements are determined, trunk cables are run and drop cables are placed. In conventional installations, this entails placing the trunk cable then placing the drops to the RAN. The drop cable is terminated at the RAN end by splicing on pigtails. At the other end, the drop cable is spliced into the trunk cable. The cable installation and the splicing are both labor-intensive processes requiring trained technicians with expensive equipment.

Preconnectorized Fiber Changes the Economics

The promised revolutionary change comes through the use of fully preconnectorized outside plant cable so-

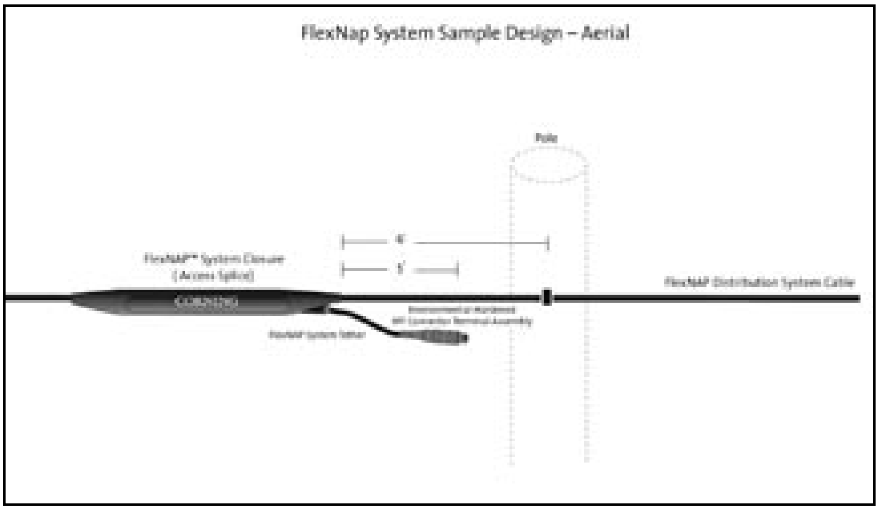

Figure 3: Example of preconnectorized assembly for aerial fiber.

Figure 4: Preconnectorized aerial fiber comes off a conventional spool.

lutions. Using standard loose tube or ribbon cables, taps (sometimes called tethers) are factory-installed at customer-specified locations (Figure 3). The cable and tap points are then tested and shipped as a complete distribution cable/terminal system, eliminating the need for splicing and closure placement at the tap point in the field.

Placement of the preconnectorized distribution assembly uses the same methods and equipment as conventional cable deployments. In aerial installations, the cable and tethers can be deployed using stationary reel or drive-off techniques using standard installation hardware (Figure 4).

In addition to using standard installation techniques, preconnectorized cable deployments offer several advantages over conventional installations. The most obvious is the elimination of splicing and the associated labor. Using the preconnectorized solution can reduce time required to complete the tap point by 50 percent or more by eliminating the splicing and closure placement.

Deploying the preconnectorized solution also provides some secondary benefits, which need to be calculated into the completed value analysis. This revolutionary product allows faster revenue velocity, reduced risk, greater capital avoidance, and higher workforce efficiencies.

Deploying networks faster means service providers can start moving traffic sooner than if conventional installation techniques are used. Factory-in-

Figure 5: Up to 12 fibers can be terminated in a rugged outside plant capable version of the MT connector.

The dielectric preconnectorized loose tube distribution cables can be packaged in lengths up to 36,000 feet. Longer lengths mean fewer setups and breakdowns as well as fewer splice points overall.

stalled and tested solutions avoid field reworks as a result of broken fibers and bad splices. Reducing the amount of splicing in the network also reduces the amount and the complexity of equipment required to complete an installation. Increasing the deployment speed and reducing complexity enables users to use their workforce more efficiently and deploy skilled workers to areas where the skills are better employed.

In addition to these important value points, this innovative solution, already extensively deployed in other trunk and tap applications, has several features which make it uniquely suitable for deployment in wireless networks:

Multifiber drop support. The DAS variant uses multiple fibers in a single connector at the tap points. Up to 12 fibers can be terminated in a rugged outside plant capable version of the MT connector (Figure 5). Using a multifiber connector on the tether, a hybrid drop cable assembly design with an MT on one end and simplex connectors on the other can support duplex based (separate send/receive fibers) RANs or multiple antennas.

System growth. At the customer's discretion, two tethers can be placed at designated access points. With an extra tether in place, additional RANs can easily be added at any time and routed to the nearest available open tether. This allows the network to evolve gracefully over time and minimizes the need for costly upgrades if additional RANs are needed to support growth, planned or unplanned.

Long length. To enable the highest possible efficiencies, the dielectric preconnectorized loose tube distribution cables can be packaged in lengths up to 36,000 feet. Longer lengths mean fewer setups and breakdowns as well as fewer splice points overall.

Conclusion

In summary, preconnectorized outside plant distribution solutions can make DAS installation more financially "friendly" by not only eliminating splicing at access points but also creating value by allowing faster revenue velocities, better capital utilization, risk avoidance, and workforce efficiencies. Optimized for DAS deployments, this new system can support continued network growth and simplify system upgrades.

Evolution or revolution? It's often difficult to tell. What seems revolutionary in the moment is often a natural next step in the evolutionary process; what seems just a natural next step often requires a revolutionary innovation. The only certainty is that network installation and design will drive toward optimization because they must in order to be economically viable. Changing to a preconnectorized distribution system positions a revolutionary product to allow installations to move to a more advanced, reliable, and cost-effective new level. **BBP**

About the Author

Allen Dixon is Market Development Manager for Wireless Networks at Corning Cable Systems. He can be reached at Allen.Dixon@corning.com.