With the growing demand for mobile broadband services, wireless carriers across the U.S. are finding that their existing networks sometimes fall short. Wireless web, video and data applications demand more capacity than existing cell towers can provide in some areas.

Increasingly, service providers are turning to Distributed Antenna System (DAS) networks to fill in service gaps and provide a consistent blanket of RF coverage, allowing broadband speeds inside homes and offices.

DAS has proven particularly useful in densely populated areas where macro cell sites (towers and rooftop installations) cover too many users; in communities where local zoning ordinances restrict towers due to their visual impact; and in geographically challenging areas, such as canyons and remote highways.

As defined by the industry association DAS Forum, a DAS is a network of spatially separated antenna nodes connected to a common source via a transport medium that provides wireless service within a geographic area or structure. A DAS network relies on a number of low-power antennas instead of a single tower (macro site). DAS antennas are generally lower in height than macro sites and allow RF design engineers the ability to pinpoint coverage throughout a community.

DAS networks have enhanced wireless service in contained, concentrated environments for years. For example, DAS networks commonly serve airports, convention centers, stadiums and college campuses. Recently, more extensive outdoor DAS networks have sprung up to serve entire communities. In the past few years, DAS networks have been deployed in parts of New York City, San Francisco, San Diego, and New Orleans to serve highly populated neighborhoods.

A New Path for NewPath Networks

Another outdoor DAS is currently being constructed in and around Scottsdale, Ariz. by NewPath Networks, a Seattle-based wireless infrastructure company that designs, develops and operates fiber-fed wireless carrier networks. A neutral host provider, NewPath Networks owns network infrastructure in 12 states and has legal status as a competitive local exchange carrier (CLEC) in 20 states.

Once completed, the Scottsdale DAS will include 342 nodes and be among the largest multi-tenant outdoor DAS systems in North America. The Scottsdale project differs from most previous U.S. DAS networks in that it does not serve a small, densely populated area. Rather, Scottsdale and its surrounding communities cover more than 200 square miles. This case study provides an overview of the project and discusses some of the challenges NewPath Networks faced in deploying a large-scale DAS network.

History in the Making

Scottsdale is an upscale community and a tourist destination nestled in southern Arizona’s Sonoran Desert. While the permanent population of Scottsdale proper is about 245,500, according to city government estimates, the city hosts 8 million tourists a year. Golf, shopping, relaxing at the city’s many spas and hiking the nearby mountains rank among the many activities Scottsdale visitors enjoy.

The growing demand for 3G and mobile services among Scottsdale-area residents, tourists and businesses was pushing one major local wireless carrier’s existing network to the limit. The carrier needed to strengthen its signal coverage and capacity in the Scottsdale area.

Fortunately, NewPath Networks won a bid from the carrier to build a fiber-fed DAS to serve wireless customers in Scottsdale and the adjacent towns of Paradise Valley, Carefree and Cave Creek. The 4 communities combined encompass about 236 square miles.

When completed, the Scottsdale DAS will comprise 200 miles of buried fiber optic cable and 342 outdoor nodes. The network backhauls to a base transceiver station (BTS) supported by hubs throughout the area.

Figure 1: Up to 4 radios could be hidden inside streetlight poles. A single, multi-band antenna could be housed in a narrow, 4- or 5-foot-high cylinder attached near the top of the streetlight.
To maximize the network’s economic potential, NewPath Networks designed a multi-tenant network capable of accommodating multiple carriers at each node. Employing 3M™ Fiber Dome Terminal Closures, the network is designed to connect new carriers quickly and easily, enabling the addition of new carriers while keeping installation costs to a minimum.

Local Regulatory Challenges
The city of Scottsdale actively regulates development and architectural design in order to preserve the city’s ambience and to keep the tourists coming back. The city boasts some of the toughest development codes in the country and strictly enforces them.

To illustrate, the city’s general plan states: “The vision of Scottsdale’s design and character strives for quality that is higher than the average or common place. Residents, visitors and neighbors consider Scottsdale as the ‘Jewel of the Valley’ and have come to accept no less than appropriate ‘quality design’ responses as our community develops.”

Local wireless carriers stood little chance of erecting any new cell tower in Scottsdale. One major chose a DAS network primarily due to the ability to deliver enhanced services, but also because a DAS could be designed to blend in with existing infrastructure, causing minimal visual impact (and minimal controversy). Nevertheless, NewPath Networks faced many hurdles in winning city approval for installation of the DAS network.

Within Scottsdale city limits, NewPath Networks’ proposal called for the installation of 287 nodes in public right-of-ways. Each node would contain an antenna, a radio, and a hand hole containing a power supply and battery backup unit. The Scottsdale City Council approved the overall plan in June 2009. However, each node also required individual approval by the city’s Development Review Board.

NewPath Networks devised a number of strategies to minimize the nodes' visual impact. Some could be housed in new streetlights (purchased by NewPath Networks) specially designed to house the nodes. The radios (up to 4) would be hidden inside the streetlight poles. A single, 24-foot faux saguaro cactus designed to blend in with the area's natural landscape was used. The final design calls for 180 faux cacti.

“Other nodes would be hidden within 24-foot faux saguaro cacti designed to blend in with the area’s natural landscape.”

Figure 2: To minimize the nodes’ visual impact, some would be hidden within 24-foot faux saguaro cacti designed to blend in with the area’s natural landscape. The final design calls for 180 faux cacti.

Figure 3: Other nodes are otherwise disguised as common utility poles.
multi-band antenna would be housed in a narrow, 4- or 5-foot-high cylinder attached near the top of the streetlight. (See Figure 1.) Other nodes would be hidden within 24-foot faux saguaro cacti designed to blend in with the area’s natural landscape. (See Figure 2.)

The final design calls for 180 faux cacti and 70 new streetlights. The remaining nodes are otherwise disguised as common utility poles. (See Figure 3.)

Community buy-in was also key to the project’s success. During the application process, NewPath Networks implemented a 6-month public communication plan in order to educate residents, receive their input and build consensus on the project. The plan included mailing thousands of notices to all residents living within 750 feet of a node, displaying the proposed project via open houses, installing prototypes to help residents visualize the impact, and hosting city officials on field trips to see the project. Instead of sticking to one plan, NewPath Networks provided a menu of options, allowing the community to ultimately choose the design. As of June 2010, NewPath Networks had received zoning approval on 256 node sites in Scottsdale. Of those, 153 are up and running, delivering enhanced service to thousands of area residents and visitors.

Deploying for Today and Tomorrow

In September 2009, NewPath Networks began construction on its DAS network in the Scottsdale area. Building the network required a sizeable capital outlay. For example, to deploy the fiber cable, a massive chain of underground conduits had to be bored throughout the area, often under streets or through rock. Linking the underground fiber network to the DAS nodes required digging 2,000 hand holes, about every 600 feet throughout the network.

Each hand hole contains a terminal closure connecting 6 fiber strands to the adjacent node. The fiber terminal closure chosen to support the network needed to address a number of issues. It had to be small in size in order to fit into the compact vaults. It also needed to be rugged and water-tight to protect the fiber connections from the elements. And, because long-term profitability relied on adding carriers without adding cost, plug-and-play capability was highly desirable. The terminal closure needed to easily facilitate the addition of 3 carriers to each node in the future.

NewPath Networks chose the 3M™ Fiber Dome Terminal Closure because it allows technicians to quickly and easily connect new service carriers without having to disassemble the terminal, employ specialized labor or purchase special tools. (See Figure 4.) The terminal closure requires no tools to open the terminal closure and connect a new carrier to the network node. Moreover, the terminal closure’s design allows the connection of new fiber strands to the node without disrupting existing connections. In other words, it eliminates the risk of temporarily knocking out service (and inconveniencing end users) while adding a new carrier.

Most other fiber terminal closures require partial disassembly in order to splice the fiber strands. The process is time consuming and requires skilled technicians and special tools. With the fiber dome terminal closure, fiber strands leading to the underground network are pre-terminated. To connect a new carrier to a radio node, a technician runs a 3M External Cable Assembly Module (ECAM) between the radio node and the hand hole, removes the dome cover of the terminal closure, and simply plugs it into the ECAM port. The speed and simplicity of adding new carriers to the network made 3M the terminal closure of choice for the Scottsdale deployment.

The Future of Outdoor DAS

Since 2005, the outdoor DAS market has grown from practically zero to about 20,000 nodes worldwide.3 NewPath Networks expects that outdoor, multi-tenant DAS networks will continue to spread across the U.S and the globe as demand for wireless 3G and 4G service increases.

Recent industry analyses confirm that expectation. For instance, a January 2010 report from wireless market analyst Mobile Experts (http://mobile-experts.net) predicts a whopping 29 percent growth in the outdoor DAS equipment market in 2010.4 And, ABI Research (www.abiresearch.com) reports that DAS networks will grow about 25 percent annually over the next 5 years, with the world market expanding from $2.5 billion in 2009 to more than $9 billion in 2014.5

That’s good news for everyone. A robust demand for DAS offers new opportunities for network operators, wireless carriers, network equipment suppliers and the wireless customers themselves.

ENDNOTES:
1. thedasforum.org
2. www.scottsdaleaz.gov/economics/growthprofiles/4th_Qtr.asp
3. Scottsdale Convention and Visitors Bureau
4. City of Scottsdale website
6. Mobile Experts (http://mobile-experts.net/)

Stephen C. King brings more than 28 years of industry experience to his role as applications engineer for the wireless business in the 3M Communication Markets Division. For more information email: scking@mms.com or visit: http://www.3mtelecommunications.com.

Jason Sears has been involved in the telecom industry for more than 20 years. Jason joined NewPath in 2007 and has been involved in all aspects of deployment from design, permitting, construction and testing and turn-up. For more information email: jason.sears@crowncastle.com or visit: http://www.crowncastle.com.