The Future is Bringing DAS to Your Building

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Overview

When you stop to think about how much workplaces have changed in the last decade, you realize how dependent we have become on mobile connectivity for nearly everything: communication, information transfer, media consumption, building control, etc.

Encouraging this change is the fact that our current workforce is made up of 56 million Millennials: digital natives who grew up with wireless connectivity and, as a result, are altering expectations for response times, communication and collaboration. This generation is made up of content creators who record and broadcast live videos, capture and share high-res photos, and post original content on social media channels and blogs. Case in point: At the 2012 Super Bowl in Indianapolis, for the first time in history, there were more data uploads than downloads (more people creating and pushing out content vs. downloading content). In fact, fans uploaded 40% more data than they downloaded at that game, posting videos and photos and sending messages.

More than 80% of today's cellular minutes are consumed inside a building, according to JMA Wireless, one of Belden's strategic alliance partners. And approximately 92% of Millennials consider the smartphone their device of choice for business communications. Wireless networks are not only connecting more people, but also connecting growing numbers of devices with unlimited data. In addition, as devices that aren't directly controlled or managed by people – like lighting systems, security systems and even parking systems – connect to the network, this number will continue to increase.

Because of how we use our devices, mobile and wireless coverage have become as vital as a utility. In fact, wireless connectivity has been dubbed the "fourth utility," meaning that it's just as expected – and as needed – as other utilities like water, electricity and gas. Buildings of all types and sizes are expected to make connectivity reliable and effortless – regardless of the number of people and devices trying to connect at once.

As our networks are expected to connect us without wires, and maintain our mobility, how can they keep up? How can we continue to support increasing numbers of devices and mobile users without interrupting the speed of the content being created and shared? A distributed antenna system (DAS) can make it happen.

There are several options for providing service to mobile-network subscribers. These radio access nodes offer network densification based on application size: femto cells, small cells, enterprise radio access networks (RAN), distributed antenna systems (DAS) and Cloud RAN (CRAN).

For the purposes of this white paper, we will use the term "distributed antenna system" (or "DAS") throughout to refer to these types of radio access nodes.

What is DAS?

Distributed antenna systems are used today in almost any type of indoor or outdoor environment: hotels, high-rise offices, sports stadiums, hospitals, manufacturing facilities, entertainment venues, parking garages, college campuses and even across cities and metropolitan areas – anywhere mobile connectivity is needed.

The reason for deploying a DAS system varies based on the building. For example, some buildings are constructed of metal, reflective glass and concrete, which block cellular signals. Even if the signals are strong outside, once you step inside, your device may lose the signal and drop the connection. In other cases, the venue experiences significant cellular data usage (think an arena or music venue), making reliable connection difficult. Cell towers can also be difficult to connect to when they're too far away from a venue. In high-rise towers, buildings in close proximity make signals more difficult to propagate due to reflections or objects in the line of sight. This can lead to a rise in RF noise levels.

When there is no DAS system in place in these situations, cellular signals are sent out from the carrier's tower (like AT&T or Verizon). Then they must permeate and travel through the building, where they're shared with everyone else utilizing those signals from that same tower. Lowered data throughput or dropped calls and poor cellular coverage often result because of signal degradation.

Distributed antenna systems can fix this problem by redistributing the signals being sent from cellular carriers either through the air or via direct line and bringing them inside a building and/or dispersing them across a vast area. Without these systems, carriers struggle to get their signals inside any building.

Upon first glance, distributed antenna systems may seem similar to WiFi technology, but these two systems operate at different signal frequencies.

WiFi works in an unlicensed band, meaning that devices connected to a network must coexist with other unlicensed, non-networked devices. Advances in WiFi technology have improved connections to devices that are essentially static at an acceptable throughput level. When there are many people connected via WiFi, or if a WiFi connection is made among a vast area, a connection to a carrier using DAS is needed. Today, venues need WiFi (for DAS offloading) *and* DAS for maximum wireless/mobile coverage and capacity.

How DAS Works

DAS hardware consists of a centralized head-end connected through fiber to the building. This head-end receives the carrier signals and distributes the signals to remote units (also called repeaters) deployed throughout a building in places like IT closets, server rooms or concourse areas. The remote units boost indoor signals and push the cellular signal out to antennas strategically placed throughout the venue – sometimes up to hundreds of feet from the remote units. Supporting this system is a mix of fiber, copper and/or coax cables and connectivity.

As with a traditional wireless system design, each DAS system and design is unique to its venue. Through engineering, locations offering the highest signal propagation and realistic spots for antenna installation are identified – and the antennas are placed there.

When a DAS system is designed and deployed correctly, cellular coverage is even extended to hard-to-reach areas like tunnels, basements, stairwells and inner rooms. DAS can support signals and bands from many carriers, as well as support two-way radio coverage for public safety initiatives.

Technology Supported by DAS

To support the increasing numbers of network-connected people and devices mentioned earlier, fifth-generation wireless (5G) is projected to be the technology of choice to address high cellular demands. With 5G, up to 1 million connected devices per 0.38 square miles can be supported. In comparison, approximately 2,000 connected devices per 0.38 square miles can be supported with 4G. 5G will increase wireless throughput at rates that are 20 to 100 times faster than today's rates and deliver connections with low latency.

To create improved work environments, better productivity levels and streamlined efficiency, 5G is also set to bring the concept of smart buildings to life. Its coverage and capacity will support applications like:

- Automatic temperature, AV and lighting adjustments as a conference room becomes occupied
- Control and reduction of energy consumption related to water, HVAC and lighting usage
- Automatic controls and responses to maintain building operations and high levels of safety and security
- Asset management, enabling real-time identification and location of resources throughout a building
- Smart waste and recycling receptacles that will send notifications when they need to be emptied
- Continuous equipment health monitoring to identify issues early and ensure proper function and minimal downtime

DAS systems will enable 5G technology, ensuring that facilities have the coverage and capacity levels needed for constant, reliable cellular signals.

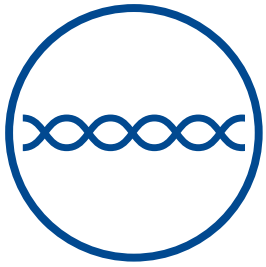
With the advent of 5G, new licensed and unlicensed spectrums will become available for smart buildings to use to support the devices and sensors that make up the Internet of Things (IoT). Today's spectrum includes licensed bands between 600 MHz and 2700 MHz. This will change, however, as mid-band spectrums, such as CBRS (Citizens Broadband Radio Service), 150 MHz (which can be shared by all operators) and mmWave spectrum become available. When these are combined with the currently available spectrum, average peak capacity can be dramatically increased to support 5G applications.

Powering in a DAS

Like almost any building system, a DAS relies on the transfer of data and power. In enterprise spaces, Power over Ethernet (PoE) has been the technology of choice to deliver data and power. But, with a DAS system, there are a few other options.

Option No. 1: Power over Ethernet (PoE)

PoE technology sends power and data through one cable. Among its many benefits, PoE reduces installation costs and provides more flexibility when it comes to locating powered devices.



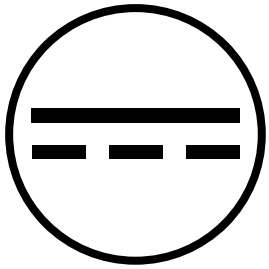
Growing power requirements of network devices are pushing the need for higher power levels delivered through network cabling – which led to the recent ratification of IEEE 802.3bt. This standard provides up to 100W of DC power to each PoE port (up to 71W of power for each device).

Powering via PoE doesn't require an electrician, which reduces project costs. But higher power levels running through a cable can cause performance issues – namely by making the cable warmer. And when the cable gets hotter, insertion loss increases. This escalates your chances of experiencing downtime and may also damage the cable itself.

To prevent cable temperature rise from impacting your network infrastructure, look for cables that offer insertion loss margin to maximize channel reach at higher temperatures (such as Category 6A cabling).

Option No. 2: DC Power Source

Another option to provide power and centralized control is through a DC power source. This type of system is in use widely in telecom systems. A centralized DC power source provides power to end devices through copper conductors varying from 12 AWG to 20 AWG. The required delivered voltage and distance of the end device from the central location will determine the number of pairs and gauge size of the copper conductors needed. For distances greater than 100 m prescribed in PoE standards, consider the use of hybrid cabling, bringing the benefits of fiber for data and copper for power together in one cable.



Option No. 3: Digital Electricity™

Digital Electricity is the safe deployment of high voltages over long distances. Packets of energy are transmitted and received similarly to how data packets travel over enterprise networks. Digital Electricity transfers high levels of power over data cabling. A complete system requires transmitters and receivers.

The transmitter (which looks like a server) takes an AC or DC power source and sends it out on individual electrical circuits. From there, specialized Digital Electricity cable can be used to distribute the power. The receiver "receives" the electricity packets sent from a transmitter and converts the energy packets into the required AC or DC form.

Whereas PoE can carry up to 100W of power over a data cable for up to 100 m, Digital Electricity can carry up to 2,000W or up to 2,000 m. In simple terms, Digital Electricity offers 20 times the power and 20 times the distance that's currently available through PoE. That's enough power to support an entire building's wireless system, including DAS, ONTs, PoE switches, IoT devices, etc.

How Belden Helps

When your DAS system components aren't located near a local power source, a remote power solution is needed. The two most common solutions - PoE and remote DC power - are limited in terms of the amount of power they can provide and the maximum distance at which the power can be provided.

In these cases, Digital Electricity is the answer, sending high levels of power over long distances. Belden Digital Electricity Cabling is designed to ensure that it can support applications like DAS when the environment doesn't easily support traditional cable lengths. The cables are available in hybrid copper/fiber to transfer power and data over long distances through a single cable run.

Belden can help you lay the groundwork for successful, reliable, high-performance delivery of data and power. Whether you choose PoE, DC power or Digital Electricity to deliver power to your DAS, we can ensure that you've got the copper, fiber or hybrid cabling infrastructure in place to support these systems. When your foundation is solid, users will experience always-on connectivity that helps them improve efficiency, productivity and safety.

To learn more, call **1.800.BELDEN.1**
(1.800.235.3361) or visit
www.belden.com