



## How to Create an Enterprise Wireless Infrastructure

By Jeff Kunst

2008-02-03

**Providing efficient, effective wireless coverage within a major structure, whether it's a skyscraper or a sports stadium, can be more than just problematic. As MobileAccess Vice President Jeff Kunst explains, it takes careful planning and the right kind of antenna system. For another look at how this problem was solved in the real world, see eWEEK's article on [wireless networking in the Hearst Tower](#).**

Today's enterprises embrace wireless applications that depend on an array of wireless technologies and frequencies. While [IT departments](#) are most familiar with WLAN-based applications, consider the escalating indoor use of mobile phones and PDAs, the regulatory push for public safety radio coverage in large venues, and the buzz surrounding new Mobile WiMax and 4G technologies.

Unfortunately for the IT department, most large [enterprise](#) facilities are black holes from a wireless perspective—wireless coverage doesn't just happen. Most often, RF (radio frequency) signals are blocked by a building's reflective glass coating or signals are absorbed by dense structural materials so they're unable to evenly penetrate the building's core. To ensure "five-bar" wireless coverage indoors, IT managers need to deploy a "plumbing" [infrastructure](#) for wireless. Known as DAS (Distributed Antenna Systems), these infrastructure solutions overcome a building's inherent structural impediments and deliver robust wireless coverage throughout the facility.

### What Is a DAS?

At the simplest level, DAS solutions provide a wired path for delivering wireless services. They use a cabling infrastructure for RF signal transport from signal sources to a network of distributed antennas that broadcast signals throughout a facility. The DAS cabling infrastructure may employ coaxial, fiber optic, or Category 5/6 cabling in various combinations.

Of course, to function, a DAS must be connected to the RF signal sources associated with wireless services. The simplest option is to "siphon" wireless signals from a nearby cellular tower using a rooftop antenna linked to a BDA (bidirectional amplifier). While this approach is simple, it can impact a carrier's macro network. For a larger investment, a carrier can also place a wireless BTS (base transceiver station) inside the facility with a T1 backhaul connection to its macro network, thereby improving capacity of the larger network.

Once a signal source has been established inside a facility, signals are “distributed” at the building core to ensure even indoor coverage for a variety of RF services. The newest flavor of DAS on the market also supports integrated WLAN capabilities over DAS cabling, eliminating the need for separate WLAN-only wiring. This approach enables IT departments to cost-effectively piggyback their WLAN deployment over the same infrastructure used to support other wireless services.

**Checklist: When to Consider DAS Deployment**

As mobile communications in the workplace become standard, IT managers need to weigh their wireless options and assess the need for a DAS. Considerations include:

}	<b>Mobile Environment</b>	You have mobile staff, clients and visitors, and their productivity depends on wireless services from a variety of wireless operators.
}	<b>Poor Coverage</b>	Your existing coverage footprint relies on macro networks and your indoor RSSI (received signal strength indication) is well below -85dBm, typically available only around building windows.
}	<b>WLAN Expansion</b>	You're considering expanding your existing WLAN footprint beyond the boardroom or adopting voice over WLAN applications, making it a good time to evaluate a multiservice-capable DAS.
}	<b>Public Safety Needs</b>	Since Sept. 11, 2001, many jurisdictions have mandated strong indoor coverage for public safety radios. You may need to support 450MHz radios and emerging frequencies (for example, 700/800MHz radios) for <a href="#">compliance</a> .
}	<b>Future Service Requirements</b>	Supporting new multimedia applications using Mobile WiMax services (operates in the 2.5GHz band) means you'll need to ensure strong indoor coverage since these higher frequencies experience more energy loss.

If your organization meets some of the above criteria, then you’re a strong candidate for DAS deployment.

**Selecting a DAS Solution: Two Design Options**

Depending on the size of your building and wireless requirements or “service mix,” you can pursue two paths: a *narrowband* or *broadband* solution. These two DAS varieties differ on cabling media used for transporting signals and the type of equipment handling wireless signals.

## *Narrowband DAS*

Narrowband DAS solutions typically use Cat. 5/6 cabling that may be complemented by fiber optics to improve scalability. Narrowband architectures use electronics on either end of the Cat. 5/6 cabling to manipulate (re-band) wireless signals for transport over narrowband media. Characteristics include:

- Lower installation costs for Cat. 5/6 cabling
- Intensive equipment requirements
- Highly scalable in size when combined with fiber optic transport
- Can only handle 1-2 wireless bands simultaneously before the need for parallel networks, which affect operating expense and aesthetics

## *Broadband DAS*

Broadband DAS approaches rely on broadband media like coaxial cable and fiber optics, which enable a single cabled [infrastructure](#) to simultaneously carry multiple wireless services spanning a frequency range from 400MHz to 6GHz. These solutions come in two variations: those that use passive media exclusively (coax) and those that combine broadband media like fiber and coax complemented by active elements (hybrid).

### *Two Flavors of Broadband DAS*

#### *Passive:*

- Supports multiple frequencies and services simultaneously
- Coax losses of 3-4dB per 100 feet make rapid power loss inevitable and limit scalability (well-suited for facilities less than 250,000 square feet)
- With varied loss levels and no adjustable or “active” elements, system design is complex and inflexible to changes
- Often lacks proactive management

#### *Hybrid Broadband:*

- Supports multiple frequencies and services simultaneously
- Use of low-loss fiber makes solution expandable
- Simpler equipment but higher media costs than narrowband DAS
- Consistent design rules and adjustable power simplify deployment/design
- Proactive management helps assure maximum uptime

Since each DAS model offers unique benefits, IT managers need to consider building size, budget, service mix, staffing levels and future needs when selecting a DAS.

## **What Can I Expect?**

Once a model for DAS deployment is selected, here's what you can expect:

1. **Engage the Wireless Carriers**—Approach carriers early. Often, carriers want to proactively manage their licensed services indoors in order to avoid impacting their macro networks and many will consider paying for your BDA (\$10,000 investment) or BTS equipment (\$150,000 or more investment) based on the size of your subscriber base and service plan commitment level.
2. **Assess Topology**—Evaluate your building topology, assessing the materials that obstruct, reflect, absorb, or remain transparent to radio waves. Open buildings with few hard walls require a lower antenna density than more densely constructed facilities.
3. **Service Mix and Topology Drive Design and Costs**—Consider that RF signals in different frequency bands propagate differently through space and higher frequencies experience more loss, requiring greater allowances for fading, which impacts cable lengths and antenna placement. For example, 800MHz frequencies for public safety radios typically require antenna placement every 8 to 10,000 feet; however, 802.11a services supporting voice over WLAN require antenna placement every 1,500 square feet. All of this impacts costs. Ultimately, however, as compared to other must-have [infrastructure](#), a DAS investment is a good one; typically DAS costs range from 20 to 30 cents per square foot to \$1.50 per square foot. And you can design your DAS to meet your most challenging wireless requirements (for example, 802.11a services), which ensures that you're covered for all other less demanding services.
4. **Consider Staffing and Management Requirements**—Consider the operational expense of managing RF services. Will IT staff have the tools to detect problems quickly? For ensuring that mission-critical services work 24/7, passive DAS solutions may not be the best option.

By selecting the DAS approach that meets your organization's objectives and addresses the inherent challenges of managing RF signals indoors, you create an [enterprise mobility](#) strategy that's built right and built to last.

*Jeff Kunst brings more than 15 years of telecommunications experience to MobileAccess Networks. Mr. Kunst was vice president of marketing and product management for Lucent's metroMSX product family. The metroMSX platform was developed by Chromatis Networks, where Mr. Kunst, as director of product management, was instrumental in the acquisition of Chromatis for \$4.75 billion. He has also held senior technical and marketing positions at Newbridge Networks, Hughes Networks Systems and the U.S. Coast Guard. Jeff has a B.S. in electrical engineering from the U.S. Coast Guard Academy, in New London, Conn., and an M.S. in electrical engineering from the George Washington University, in Washington, D.C.*