Smart Design Strategies for the Wired and Wireless Network

Planning and designing an integrated wired/wireless network before construction begins pays big dividends later.

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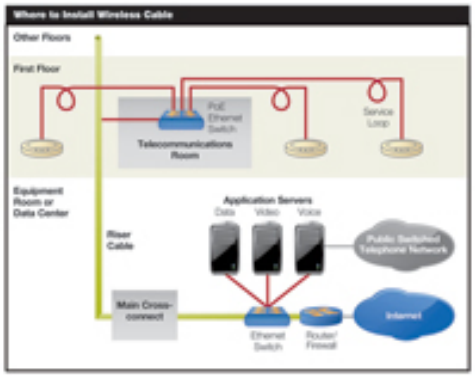

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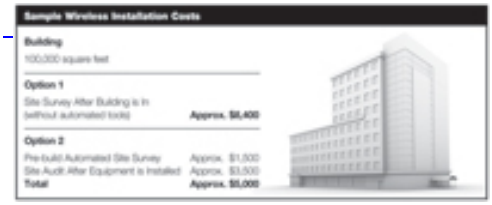
When building or upgrading a cabling infrastructure, it pays to include wireless networks in your upfront plans and budget accordingly to enable seamless integration and interoperability.

When installing or upgrading a structured cabling plant, IT departments can save time and money by determining their wireless LAN (WLAN) requirements and folding them into the project from the start. The reason is that while WLANs provide over-the-air communication in the access network in areas where mobility and portability are needed, they also create new cabling requirements at the back end, often in hard-to-reach places. It’s far less expensive and labor intensive to install all cabling at once, without ceilings, walls and other obstructions in the way, than to install WLAN cabling later as a separate project.

The most common way of deploying WLAN access points (APs) is to mount them in ceilings and cable them directly to an Ethernet switch port. Generally, a 15- to 20-foot piece of cable called a service loop is left in the ceiling (See Figure 1) in case an AP later needs to be moved slightly to tune coverage or avoid interference from other RF devices, such as wireless phones and microwave ovens. Planning for those cable runs upfront, in addition to your other network cabling needs, is financially and operationally prudent, allowing your organization to purchase all the necessary materials and labor in bulk with a corresponding volume discount.

Consider After-the-fact Costs

Installing wireless after-the-fact involves the cost of opening up ceilings and walls, as well as possible disruption of business operations. These factors can increase the overall cabling project cost by 2 to 4 times, depending on the property's size and complexity. The greater the importance of aesthetics in a building, the more difficult and expensive the after-the-fact cabling job is likely to be (See Figure 2).



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For example, there might be costs associated with patching or repairing walls and ceilings. An additional consideration is the cost of the cable itself. The cable can cost more if bought later on, rather than as part of your initial volume order.

Note, too, that the wiring closet contains most of the equipment required for the distribution network that supports the wireless APs: Ethernet switches, Power over Ethernet (PoE) switches and power injectors, phone system elements and uninterruptible power supplies, for example. These active devices require heating, ventilation and air conditioning (HVAC) and AC or DC power and can thus be more costly if installed later on.

These are among the reasons that a universal IT best practice is to evaluate all network infrastructure requirements any time a property is built or opened up for remodeling. However, since wireless is a comparatively new network type for mainstream use, it might not occur to planners to piggyback the network design and cabling aspects of a current or future wireless project onto the wired one. Viewing the wired-wireless network design and cabling infrastructure as one cohesive project makes installing wireless a smooth process with minimal associated costs and headaches.

Planning for Wi-Fi

Historically, most companies installing Wi-Fi have conducted a physical site survey by walking around to determine the number and placement of APs needed. This "best guess" process may have worked for small installations, but it becomes unwieldy as wireless networks become mainstream throughout the building. If your building is undergoing construction or remodeling, how do you know where ceilings will be for mounting APs and how can you plan around potential sources of

interference before the fact?

Fortunately, the latest Wi-Fi surveying and planning tools eliminate this situation by allowing you to electronically pre-design the WLAN before the work begins. Using these automated tools, you can import the blueprint into the program and it will tell you where to place APs and how many you will need, based on your wireless goals and what type of Wi-Fi equipment you intend to purchase.

One such tool is the RingMaster® management product from Trapeze Networks, a Belden brand. RingMaster works with Trapeze's Wi-Fi WLAN infrastructure equipment both to automatically create the wireless network design and to manage the wireless network post-deployment.

Determine Type and Scope of Wireless Coverage

To create an accurate Wi-Fi design, you should decide where in the building you want wireless connectivity, what applications the WLAN will support, who will have access to the network, and where they are likely to roam throughout the building. Then you need to decide whether to provide users with near-ubiquitous coverage throughout the building or whether coverage in common areas will suffice.

Another decision concerns the wireless applications to be supported. Wireless networks supporting Voice over IP (VoIP) typically require denser AP deployment than those that provide wireless data access. Data networking is far more tolerant of packet loss, delivery delays and jitter than voice, while voice requires stable, ubiquitous coverage and minimum delays when connections are handed off from AP to AP as a user roams.

For data access, installing an AP in public areas, such as meeting rooms, cafeteria and lobby, might be sufficient. However, consistent voice and location service support will require coverage nearly everywhere. That means more APs and more cabling runs to more places. The same density consideration applies to data connections in areas where large groups of people congregate to use the network simultaneously, such as a university lecture hall. **Choosing a Wi-Fi Technology**

An important early decision is to select the Wi-Fi technology that best suits your needs: 802.11n, 802.11g, 802.11a or some combination. This decision affects cabling and other downstream choices because these WLAN types run at differing throughput speeds and coverage ranges and offer differing capabilities and performance.

The newest technology (Draft 802.11n) available in WLAN equipment generally offers per-radio data-connect rates of up to 300 Mb/s, which may be the ideal choice for high-bandwidth, high-consumption applications. However, the equipment costs for 802.11n can be higher than for earlier Wi-Fi technologies. A wise strategy is to discuss this crucial decision with an experienced and knowledgeable network system provider. **Additional Factors to Consider**

Once the 802.11 technology and range of coverage issues are decided, several

other factors enter into the wired and wireless LAN design phase. Among these are: &#149

APs, Placement and Channel Planning. The WLAN site-planning tool can be used to automatically lay out the wireless network. Given the proper input, the program will calculate the number and location of APs required, and on what channels they should operate to avoid interference. The program will automatically build the layout and specify at what power levels each AP should transmit for the best overall operation, keeping in mind FCC and other regulatory power limitations. &#149

Outfitting the Telecommunications Room. Taking into account the number of APs to be installed on each floor, your network system advisor can advise on additional equipment needed for your upgraded environment, including: Ethernet switch ports, Ethernet or PoE (power over Ethernet) switches and power injectors, LAN/WLAN controllers, and other devices required for your network needs. &#149

Cable Types and Power Delivery. If you plan to deploy 802.11n now or in the future and procure gigabit-speed switch ports accordingly, it is advisable to install Category 6 copper cabling from the telecommunications room out across the floors and throughout walls and ceilings. Category 6 twisted-pair cabling provides better noise immunity and more “Signal-to-Noise” headroom for supporting gigabit-per-second speeds across Ethernet’s 100-meter standard distance.

Clearly, there are multiple efficiencies and economies that result from planning an integrated wired and wireless network. Not only will your organization significantly reduce overall cabling costs, but will also avoid future remodeling expense, aesthetic damage and potential business disruption. Simultaneously planning helps to ensure that both the wired and wireless networks will be seamlessly integrated and interoperable.

Today’s automated site survey tools make it possible to plan and design an integrated wired/wireless network even before construction or remodeling begins. Such tools not only pay off in time and costs, but also ensure your organization gains the gigabit-speed cabling and power support needed to keep the enterprise network running smoothly for many years to come.

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