Wire*less* is *More*

A comprehensive network strategy can trump wireless challenges for healthcare enterprises.

By Cathy Zatloukal

There has never been a better time to take advantage of wireless connectivity in healthcare. Technologies have matured, carriers value their highly mobile healthcare customers, and the demand to untether caregiving is high. The time is right for hospitals to forge ahead and adopt next generation wireless technology, placing mobile applications within reach.

Today, the pressure to enable mobility in healthcare is as great as the potential to improve healthcare with wireless technology. Just five years ago, hospital administrators banned the use of cell phones, fearing that Wi-Fi and cellular connections would interfere with medical equipment ranging from ventilators to pumps. Today, such a ban would be unimaginable, as wireless has become a priority for IT departments, clinicians and engineers alike.

What was once uncharted territory for hospitals has now materialized into real workflow gains. Caregiver productivity has increased and wireless access has become an indispensible tool. By deploying more wireless monitoring gear bedside, patients are more ambulatory and nurses can cover more ground, thus improving both the patient experience and optimizing care delivery. Beyond telemetry applications, untethering caregivers helps hospitals to maximize the use of limited resources while serving growing patient populations and making better use of fewer beds and staff.

Hospitals also realize that care can be delivered from anywhere when wireless access is available everywhere. Without wires, mission-critical tools are at caregivers' fingertips. The new definition of mobility has come to mean marrying a physician's location with other staff expertise, the patient's medical records, internal databases and the location of available equipment, thus transforming disparate data into a web of actionable knowledge. This high level of connectivity has resulted in customized care tailored to each patient's needs. Hospital administrators also reap the benefits of location-based wireless technologies with improved asset utilization and cost savings across the board.

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In the long-term, wireless connectivity could even improve how hospitals treat patients. When a patient isn't in the ICU or the ED, the hospital can continue to capture the patient's vital signs with wireless patient telemetry solutions throughout the care continuum — even from as far away as the patient's own home. Over time, this capture of minute-by-minute medical data can be analyzed and used to transform the very nature of care itself, changing how hospitals administer treatment. Before the vision of a completely integrated mobile experience becomes reality, hospitals will need the tools to make it happen.

Addressing Interference

As technology matured and antenna management evolved, interference fears have proven to be unfounded. Lacking vital wireless coverage indoors is actually the bigger concern for IT departments, clinicians and engineers alike. As staff complaints mount, hospitals turn their attention to the structural causes of "dead-spots" or coverage gaps inside their facilities. Dense concrete, steel and shielded glass materials absorb outside RF signals, or degrade them, creating poor or nonexistent cellular reception inside the hospital. As a result, wireless coverage is unpredictable, location-dependent and sensitive to

floor plan changes. Thus, many hospitals must add antenna systems indoors so that caregivers, patients and visitors can use their mobile devices to communicate throughout the hospital.

It actually takes a structured system of antennas and cabling to make indoor wireless work. An element of a distributed antenna solution is to prevent interference by mitigating it through proper antenna placement and design as well as filters, which clean signals from the outside. Lowering RF power indoors is another mechanism used to ensure "dirty" high power signals are not unevenly distributed inside buildings, exacerbating the interference problem. Current solutions on the market aim to create broad wireless coverage that enables multiple services without sacrificing signal quality.

In addition, with multiple radio frequencies in place, a single hospital will need to support a variety of wireless operators, devices and wireless services including cellular voice and data, Wi-Fi, public safety radio and wireless medical telemetry services. This requires a comprehensive wireless network infrastructure.

Multiple Stakeholders

Another challenge stems from the way healthcare entities are organized, as hospitals are not typical enterprise environments. While many are considered large corporations, they have become a collection of different corporate groups where physicians are employed by their practice groups; laboratories are their own entities; and, clinics operate off-campus but continue leveraging central facilities for analysis and laboratory services. This decentralized structure often complicates IT departments' plans to centralize control over wireless application, frequency or mobile device decisions. Each entity may even have its own IT budget and separate funding source for computing equipment and infrastructure investments since requests can come from any practice group or department.

Over time, separate requests for technology have meant that the average hospital has multiple mobile applications running on different floors, often unrelated to one another. For example, patient records and medication inventory management are accessed on separate systems, and physician and nurse paging applications are on another system. Some medical data is stored digitally and some still as analog copies that need to be shared among the physician's practice, the insurance carrier, and other entities — all while protecting patient privacy. It is a tall order for any integrator that must implement a new kind of network to link all of this together.

Ultimately, the IT department can't prescribe a "one-size-fits-all" wireless solution or practice single device enforcement for everyone onsite. Consequently, a hospital's wireless infrastructure will need to be flexible in order to provide wireless coverage for a variety of changing mission-critical applications, an assortment of mobile devices, new and existing frequencies, multiple operators and a variety of user needs. The same system will also need to adapt as hospital floor plans change, new buildings are constructed and as progressive new applications are needed to support cutting-edge medicine.

Universal Platform

The days of a single wireless network that supports services from just one wireless operator are clearly over. There are different frequency bands for medical devices, cellular and Wi-Fi. In addition, there are different subspecies, applications and protocols within these frequency bands that make for a very convoluted collection of radios running inside a hospital. Running 10 or more different wireless applications and services is the typical scenario at many hospitals. Consequently, forcing standardization on a single application or technology is nearly impossible.

Consider the situation of providing better indoor cellular coverage for voice applications, as an example. The IT department can't choose a single cellular operator because caregivers prefer to use their own cell phones and will have a variety of providers and plans. In addition, medical technology providers have recognized that there is a growing demand to mobilize applications so that they are PDA- and phone-ready. As a result, most hospitals today support three or more of the major wireless carriers as they deploy indoor cellular coverage solutions.

The same is true for WLAN, as today's hospitals must support all varieties of Wi-Fi, now that there are wireless devices operating across the 802.11b/g and 802.11a standards. Again, this support is complex, since Wi-Fi frequency bands get used for more than just sending computer data. They're also used for voice over IP and video streaming applications.

In some cases, hospitals are finding that existing Wi-Fi applications are rapidly consuming their Wi-Fi capacity, so they're now looking to other licensed frequencies such as cellular and WiMAX to carry more of their data traffic. Wireless is no longer a single domain, a single technology or frequency or even a single protocol. Hospitals need a universal wireless platform that can handle the broad range of applications currently available with the scalability to accommodate future applications.

Wiring for Wireless

Ironically, any indoor wireless solution is going to require wiring, such as a cabling and antenna infrastructure, to distribute signals. There are really two distinct architectural approaches for delivering a mix of wireless services: 1) multiple parallel networks or 2) a universal, multi-service network.

The first approach requires a separate antenna system for each wireless service that needs to be supported in the hospital. Each wireless service has its own dedicated cabling infrastructure to bring each radio signal from its external source through to ceiling-mounted antennas distributed throughout the building, resulting in multiple separate and parallel networks. With this solution, Wi-Fi is deployed as a separate network from the cellular or any other wireless services.

The universal solution uses a single cabling and antenna system that supports multiple wireless services simultaneously. This approach relies on broadband fiber optic and coaxial cabling to deliver radio signals from multiple external sources to the multi-service antennas located in the ceilings. With this type of solution, Wi-Fi signals are supported over the same cables and antennas used to deliver all other wireless services.

With the universal approach, Wi-Fi access points are kept in secure, yet accessible wiring closets and Wi-Fi signals are combined with the other wireless services so that all signals run over a single cable to a single set of broadband antennas. This has the advantage of keeping IT infrastructure in ceilings to a minimum and in more centralized areas that can be protected and more easily maintained. This approach also removes equipment from locations in high-traffic patient areas, allowing equipment to be accessed without invoking time-consuming and expensive infection control procedures.

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In hospitals especially, one of the most significant cost components of any antenna installation is the final few yards of cabling that go from the closet to where end-users are located. In addition to the labor costs of installing cable in the ceilings, hospitals must absorb the expenses associated with the infection control procedures and regulatory compliance issues that surround installation work in sensitive hospital areas.

However, with a universal wireless solution, hospitals can keep cabling costs and operational expenses contained. A single installation can accommodate all of the hospital's current and future wireless requirements. And, by moving managed network elements to wiring closets, new services can be added at any time without the disruption and cost of penetrating the ceilings. The wireless world never sits still, so a good design means future-proofing the system, so expansion is as seamless and cost-effective as possible.

Conclusion

Today's healthcare decision makers have at their disposal, a broad range of wireless applications that promise to boost productivity, enhance the patient experience, and provide a competitive advantage. However, getting there isn't easy. To support these applications, hospitals will need to provide facilitywide coverage for an increasingly complex array of wireless services operating across multiple frequency bands.

At the same time, the wireless industry is growing exponentially, with many new technology options emerging over the next five years. To thrive in, and fully take advantage of this dynamic environment, healthcare IT organizations must develop proactive wireless strategies and invest in future-proof wireless infrastructure solutions.

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