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Greg Johnson
CTO and Director of Technology and Engineering Services
VCUHS

Implementing a Comprehensive Wireless Strategy: Revolutionizing the Delivery of Acute Patient Care

By Greg Johnson, CTO and Director of Technology and Engineering Services
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Imagine implementing an in-building wireless strategy for your hospital with guaranteed coverage in every corner—and the capacity to support smartphones, mobile computers, Wi-Fi handsets, telemetry systems, and more—all with one platform. At Virginia Commonwealth University Health System (VCUHS) in Richmond, Virginia, we've done just that, transforming our IT infrastructure with a wireless and mobility solution that provides ubiquitous wireless access for our entire state-of-the-art Critical Care Hospital (CCH).

Our CCH facility is a one-of-a-kind hospital that has been setting the standard for innovative patient care in Virginia since it opened in 2008. An all-private-bed facility, VCUHS had a goal of providing the most restorative setting possible for patient recovery by providing a private room for every critically ill or injured patient. VCUHS planned to maintain current staffing ratios, but the size and layout of the new facility posed unique challenges. With a total of 232 private beds, CCH encompasses 15 floors and 368,000 square feet—tripling the patient care space our caregivers needed to cover. With each patient behind a door, it was critical that we equip our CCH staff of 5,500 with wireless devices and applications that would maximize staff efficiency while ensuring patient safety.

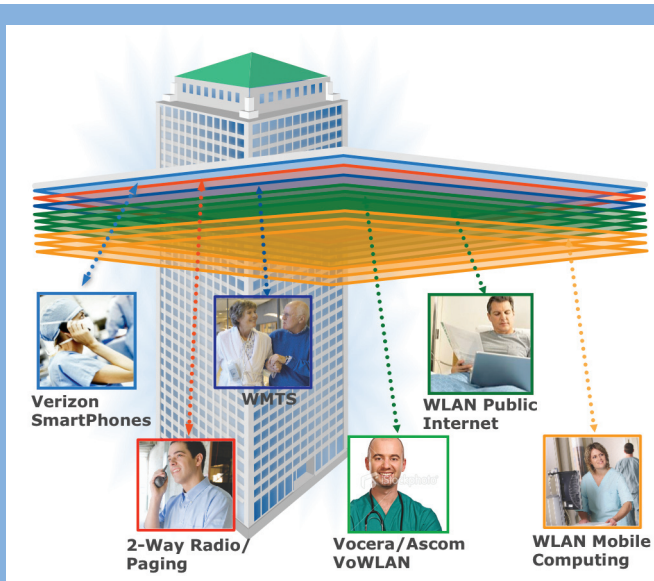
Horizon™ from InnerWireless®—The enterprise wireless solution

In order to realize our ambitious care model, the CCH required wall-to-wall 3G wireless, 2.4 GHz and 5 GHz Wi-Fi, and 1.4 GHz medical telemetry coverage. VCUHS installed Horizon by InnerWireless—a single broadband, in-building, converged wireless distributed antenna platform. This platform supports a very dense deployment of wireless devices and applications—including 100 Verizon Wireless™ smartphones, 125 two-way radios, 100,000 square feet of Philips® IntelliVue™ wireless medical telemetry, 365 wireless clocks, paging, and a dense set of Wi-Fi applications, including 600 Ascom VoWLAN phones for nurses and respiratory therapists, 240 Vocera® communications badges, 300 mobile computers for clinical data, and public Internet deployed throughout the entire hospital. And since Horizon supports the entire wireless frequency range from 400 MHz to 6 GHz, we are ready for new wireless technologies operating at different frequencies—such as a public safety frequency operating in the 700 MHz band, or 4G wide-area wireless capability.

An enterprise wireless solution provides clinicians throughout the entire Critical Care Hospital with instant access to point-of-care information, enhancing patient safety and maximizing staff efficiency.

When Horizon was installed in the CCH, it was designed to provide guaranteed coverage and signal strength for each and every wireless service, allowing us to extend wireless coverage to every part of the facility and ensure RF requirements were met for every wireless frequency—virtually eliminating the potential for dead zones. Plus, the solution delivers this functionality at a total cost of ownership that is substantially lower than other comparable solutions. When VCUHS first looked into the installation of multiple discrete wireless systems, we estimated the cost to be around $2 million. By comparison, this multi-service system cost less than 50 percent of our budget, including hardware, design, installation, provisioning, and project management.

Horizon also offers a unique Wi-Fi topology that is tailored to our healthcare needs and requirements. Using an architecture developed and coined by InnerWireless as layered WLAN and using access points and infrastructure from Cisco Systems, multiple simultaneous channels of 802.11 b/g and multiple simultaneous channels of 802.11 a are available throughout every area of the hospital. Unlike a traditional Wi-Fi deployment with one channel of 802.11 b/g and one channel of 802.11 a in an area, we have three channels of 802.11 b/g and three channels of 802.11 a. Multiple channels, or layers, means that we can manage our traffic in a new and novel way—we can optimize the quality of service (QoS) of our numerous computing and VoWLAN devices by assigning different devices and applications to different channels. In this way, the devices don't compete for a single shared wireless resource. This yields a 2-3x improvement in network performance over our other conventional Wi-Fi installations, allows us to separate clinical data from public Internet access, and enables deployment of multiple VoWLAN devices from different vendors.



Horizon supports all of our wireless needs. For Wi-Fi, multiple channels in a layered WLAN infrastructure allow different devices and applications to be assigned to specific channels, optimizing traffic by preventing devices from competing for a single shared wireless resource.

The combination of coverage, signal strength, and capacity has provided a consistent user experience, thereby greatly improving clinician confidence and reducing calls to our IT help desk.

VCUHS employs three wireless engineers costing nearly $300,000 annually to manage a million square feet of wireless coverage throughout the entire medical VCUHS campus—these engineers spend less than five percent of their time managing the wireless infrastructure connected to Horizon in the CCH, and due to its passive nature, no time on Horizon itself. The rest of their time is spent managing conventional wireless issues in other buildings.

Horizon—Impact on care

With our new wireless infrastructure, virtually every clinical device and system can take advantage of wireless capabilities. This includes IV pumps, mobile CT scans, MRI machines, and our electronic medical record system. Plus we have flexibility when deploying wireless applications. For instance, we are using PatientKeeper on smartphones so our physicians have virtual access to the Cerner HIS. Our caregivers are utilizing Emergin middleware and VoWLAN handsets for remote viewing of bedside alerts and alarms. The flexibility to mix and match applications and devices allows us to provide the best solution possible for each user. This has also allowed us to meet our goal of providing up-to-date point-of-care information for every patient encounter.

Another example of how wireless has allowed us to transform our patient care is evident in the new NICU care area. At CCH, every infant has a private room where ambient noise and light can be controlled, families can have privacy, and the mobile communication system allows visitors to communicate with the clinical staff. One of the typical problems that we faced is that the NICU environment generates many alarm situations, and oftentimes these alerts are false, caused by artifact. Because of our hospital-wide wireless access, we're able to quietly deliver the actual patient alerts to a nurse's mobile handset so they can determine whether the alert is caused by a real issue or is the result of artifact. The nurse-specific wireless application means nurses can care for patients as well as they could when the infants were all co-located in the same room, while the infants now enjoy an environment that is more developmentally appropriate.

Because of the stress-free, all-private-room environment that our wireless solution enables, the CCH has already seen a five percent increase in the number of NICU admissions. Patient satisfaction has risen because of the noise reduction from the remote distribution of wireless alerts and alarms. Nurses have also reported a drop in pain medication requirements due to the tranquility of the care environment. And response time for patient alerts is at its fastest, enhancing patient safety because wireless telemetry now monitors patients continuously, regardless of where they or the caregivers are in the facility.

Strategy for seeking funding

Clinicians who move between the main hospital and the CCH appreciate the dramatic improvement in wireless capabilities at the new facility, noting that the level of wireless service drops off considerably when they move from the CCH to the main hospital, due to the limitations imposed by conventional wireless deployments. As a result, VCUHS is seeking funding to expand its new InnerWireless solution throughout the entire campus.

We are in the process of applying for a grant through the National Telecommunications and Information Administration's (NTIA) Broadband Technology Opportunities Program (BTOP). Congress recently appropriated nearly $5 billion for "eligible entities to expand broadband services." VCUHS is developing a grant proposal in the hope that these funds will help us to expand a revolutionary system that is improving overall patient care and satisfaction.