Recommendations for Future-Ready Network Connectivity in Hospitals

Healthcare facilities all over the world are embracing the innovations of the digital age. But because of hospitals' new reliance on IP (Internet protocol) technologies, their need for faster and higher-capacity network connectivity solutions has also increased. This white paper will examine the trends and sources of healthcare data, current standards, and recommendations for building future-ready network connectivity in hospitals.

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Introduction and drivers

Healthcare facilities all over the world are embracing the innovations of the digital age. WiFi access for patients and guests is an expected feature of the hospital landscape; doctors and nurses now carry laptops and tablets instead of clipboards and file folders of medical records.

Electronic Health Records (EHRs) are essential to the modern hospital and access to these records across the health enterprise is essential for improving patient outcomes. This can be achieved through enterprise networks or through secure connections to these data centers.

But because of hospitals' adoption of IoT and growing reliance on IP (Internet protocol) technologies, their need for faster and higher-capacity network connectivity solutions has also increased.

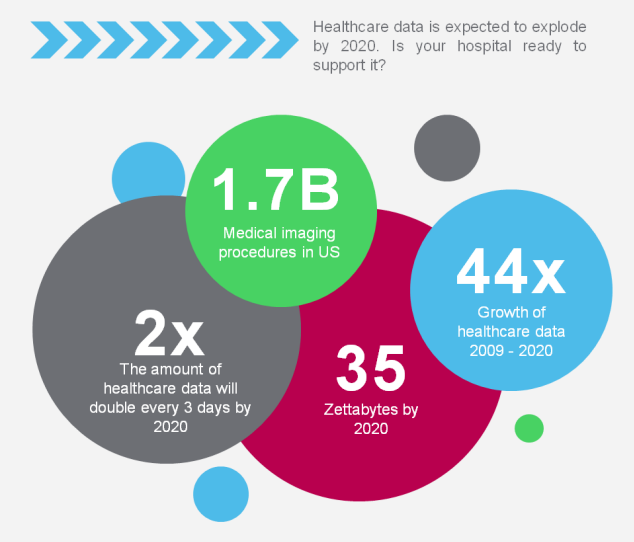
With the recent dramatic increase in digital imaging, hospitals are now starting to turn to cloud-sharing for quick image transfer and viewing capabilities, making the need for reliable, high-speed, high-capacity network connectivity essential. Hospitals are also becoming more accepting of telemedicine—a method for providing clinical advice through the Internet to patients and other physicians many miles away—especially for providing services such as diagnosis over live-feed video calls. Depending on the code used for telehealth, proper bandwidth is essential to seamless interaction through video chat and conferencing systems such as Skype for Healthcare (actual name), which requires 1.5 Mbps, and WebEx which requires 3+ for HD.

In addition, as more facilities allow patients and staff to bring their own devices, ensuring the proper bandwidth to handle the performance of these devices is critical to patient and staff satisfaction. The last generation of Wi-Fi antennas uses the 5GHz RF band. That 5GHz RF band offers up to 8 channels of 80MHz bandwidth each and each is able to support up to 866Mb/s (6.9Gb/s for 8 channels). Each antenna has to be connected with Category 6A cabling to carry such a bitrate[1].

As a recent AHA white paper states, "technology has—and will continue to have—a huge impact on the transition of care delivery…technology is the common fiber to improving the quality of care."[2] And with technology comes more and more data.

In fact, experts predict that in North America alone, healthcare data will reach 35 zettabytes by 2020, a 44-fold increase from 2009. How much is a zettabyte?[3]

"One zettabyte is equivalent to the data contained on about 250 billion DVDs. Multiply that by a factor of 35, and you'll have an approximation of the amount of healthcare data that providers will have at their disposal in 5 years."[4] Much of that is likely to stem from the growth of medical imaging. According to Frost &Sullivan, in 2006, the US performed an estimated 600,000 medical imaging procedures each year, and that number was expected to grow by up to 8% each year, which means it could potentially reach over 1.7 billion procedures by 2020.[5] By 2020, it is estimated that the amount of healthcare data will double every 3 days![6]



This is cause for concern. 2020 is only 4 years away, and in the grand scheme of things, that means the predicted explosion of healthcare data is going to happen overnight. The question is whether the hospitals are ready for it. Do they have the correct network infrastructure in place? Are they preparing for the imminent with future-ready cabling that can support the storage and transmission of all this data?

Sources of healthcare data

A hospital's network infrastructure is the web of interconnected computer and information technology (IT) systems. It enables communication between departments, clinicians, and patients, as well as larger health information networks. The following is a list of systems and applications typically seen in a hospital, which require the need for reliable bandwidth to support the storage, integration, and exchange of digital data.

[1] IEEE 802.11ac standard

[2] American Hospital Association, "Connecting the dots along the care continuum", http://www.aha.org/content/15/15carecontinuum.pdf

[3] Enterprise Strategy Group, "North American Health Care Provider Information Market Size & Forecast", http://www.esg-glob-al.com/default/assets/File/ESG%20Research%20Report%20Health%20Care%20Information%20Market%20Size%20Jan%2011%20Abstract.pdf

[4] Becker's Hospital Review, "Making big data insights a reality for healthcare providers", http://www.beckershospitalreview.com/healthcare-information-technology/making-big-data-insights-a-reality-for-healthcare-providers.html

[5] Frost & Sullivan. "Prepare for Disasters & Tackle Terabytes When Evaluating Medical Image Archiving. 2008. http://www.ironmountain.com/forms/drcmi/prepare-for-disasters-tackle-terabytes-when-evaluating-medical-image-archiving.pdf

[6] IoT Now. http://www.iot-now.com/2016/02/29/43342-by-2020-global-healthcare-data-will-double-every-three-days-says-pathways-genomics-cio/

Clinical Information System (CIS): A central repository for gathering and processing clinical information, such as lab results, digital imaging, and electronic medical records.

In-room and Remote Patient Monitoring Systems: A device that monitors vitals such as heartrate, pulse, blood pressure, temperature, and more.

Interactive Patient Systems: An electronic system that allows patients to access their own health information, control entertainment, request meals, or even control their own room environment, such as with AdaptiApps for Healthcare.

Nurse Call Systems: A call system that can be used to notify nursing staff when a patient needs assistance. This could be in the form of a push button, pull alarm, or even via a mobile patient interactive system.

VoIP Systems: A Voice over Internet Protocol (VoIP) system digitizes communication and delivers it to the recipient through the hospitals network via instant messages, call forwarding to mobile devices, video, and more.

Communication Systems: A system through which communication is routed, for example cell phones, VoIP badges, and smart badges.

Security Systems: A comprehensive system to prevent and thwart violence, theft, infant abduction, patient wandering, and more. Components include video surveillance, access control, life safety, and real-time location systems, intruder detection, intercom, emergency lighting, and paging systems.

Bandwidth-Hungry Systems

Clinical Systems	Facility Systems
Telehealth Systems	Video Surveillance Systems
Medical imaging, EHRs, EMRs	Audio-Visual (AV) Systems
In-room & Remote Patient Monitoring Systems	VoIP Systems
Entertainment and Education Systems	Mobile Systems and BYOD
Nurse Call Systems	Critical Power Distribution & Monitoring Systems
Scheduling Systems	Energy Management Systems
Communication Systems	Building Management Systems

These systems and applications require high performing networks so they can send and receive data immediately, safeguarding patients.

Building Management Systems: A system to automate the control and monitoring of the hospital building's infrastructure functionality such as heating, ventilation, and air-conditioning (HVAC); lighting, and parking. This system can integrate with and control other hospital systems, such as those listed here.

Audio-Visual (AV) Systems: In addition, to the typical need for televisions, operating room monitors, and audio paging, hospitals are now starting to incorporate technology that utilize AV equipment, such as machine-assisted surgeries and telemedicine.

Real-time Location Systems (RTLS): A tagging system used to locate and track people and items, such as visitors, patients, infants, patient monitoring equipment, pharmaceuticals, hospital beds, and more.

Mobile Systems: A system or combination of systems that utilize mobile access through smartphones and tablets. For example, mobile applications can be used to allow patients to control their own room-environment for improved patient satisfaction, as well as allow hospital staff to see room status for facilities maintenance, room cleaning, food service, and patient transfer.

Critical Power Distribution and Monitoring Systems: A system that safely and reliably delivers and monitors the hospital's power sources, usually electricity, and sometimes conversion of renewable power sources. Reliable power is critical to patients' lives and must be supported with emergency power supply systems (EPSS) and regular EPSS testing in case of power failure.

Energy Management Systems: A system that enables the hospital to quickly see and map energy use and progress toward cost-reduction and sustainability goals across a single campus or an entire healthcare enterprise.

Scheduling Systems: A system, such as the hospital's admission, discharge, and transfer (ADT) system, which uses Health Level 7 (HL7) standard for the exchange and integration of electronic health information.

Are hospitals ready for the future of technology?

Though hospitals are starting to adopt the newest technologies, and have benefited immensely from the innovations mentioned above, they do not always have the infrastructure to support them. In the past, most hospital systems were installed on separate networks, but this means that as more applications and equipment are added, it became more and more difficult to manage these disparate networks. In addition, with separate networks, the hospital infrastructure lacks a common highway for quick and efficient information exchange between clinical and non-clinical applications. Patients, staff, and visitors all now expect and require immediate access to information. Without it, staff productivity slows, care is delayed, visitors become annoyed, and patients feel ignored. Improving operational efficiency, patient safety, and patient satisfaction is paramount to continued financial health in an era when costs are rising and budgets are shrinking.

Today, the Telecommunication Industry Association (TIA), a global network of industries which rely in part or full on Internet-based communications, recommends as a baseline that healthcare facilities adopt Category 6 cables, which can transmit up to one gigabit per second.[7] But the baseline is no longer enough. And given the heavy reliance hospitals now have on internet-based technologies, this insufficiency is not just inconvenient, but potentially dangerous to patient lives and the hospital's reputation.

[7] Enterprise Strategy Group, "North American Health Care Provider Information Market Size & Forecast", http://www.esg-global.com/default/assets/File/ESG%20Research%20Report%20Health%20Care%20Information%20Market%20Size%20Jan%2011%20Abstract.pdf

Slow network connectivity comes with some serious risks to patients. Lagging networks can increase downtime in staff communication, which in turn can delay patient treatment. In a critical situation, this could have catastrophic consequences. In a less critical situation, the delay could still worsen the patient's condition or lead to significant—and unnecessary—patient discomfort. And if a patient's EHR cannot be accessed due to connectivity issues, medical professionals run the risk of endangering patients during treatment because of their lack of access to patient data; for example, giving penicillin to a patient with a life-threatening allergy.

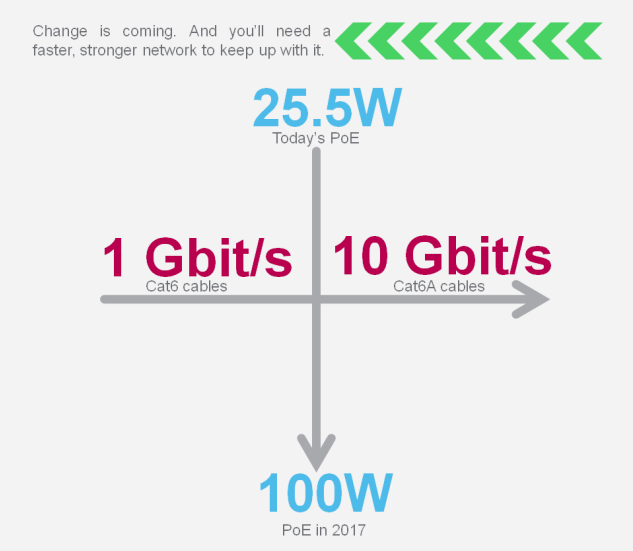
Additionally, slow connectivity comes with business risks for healthcare facilities. Poor Internet connection during a patient's stay can decrease their HCAHPs (Hospital Consumer Assessment of Healthcare Providers) satisfaction ratings, hurting the hospital's overall reputation. Inability to communicate can also frustrate hospital staff, leading to lower employee satisfaction, higher turnover, and decreased staff efficiency.

Recommendations for facility connectivity

When considering IT convergence or building a new facility from the ground up, project teams need to take into account current needs as well as the potential for future expansion.

Specifying an integrated high performance system is highly recommended by the TIA- 1179 standard to ensure the system meets current requirements, while providing headroom for future expansion.

Schneider Electric currently recommends that healthcare facilities adopt Category 6A network cables and connectors. With a transmission capacity of up to 10 gigabits per second, Category 6A cables have the capacity to keep up with the data needs of today's hospitals. A hospital which can maintain a fast and reliable network connection is a safer and more efficient one, and Category 6A cables will ensure that this is possible.



Case Study: University of Sydney, Charles Perkins Centre

In 2013, the University of Sydney constructed the Charles Perkins Centre, which was designed to foster research in obesity, diabetes, and cardiovascular disease. Schneider Electric, in conjunction with Fredon Industries, was selected to provide a comprehensive solution which included the supply of all electrical and communications products for the project; future-proof network connectivity using Cat.6A wiring; C-Bus lighting control, and accessories including power and outlets and switches. To provide some perspective of the scale of this mammoth project, there were more than 15,000 cable terminations, and more than 500 kilometres of cable in the building—enough to reach half-way between Sydney and Melbourne. The cables were supported by 3,500 metres of cable ladder and 2,500 metres of conduit. Clipsal by Schneider Electric even designed a new angled faceplate for the data outlets to compensate for limited wall cavity space. Despite the requirement of this entirely new faceplate design, Schneider Electric and Fredon delivered the project 3 months ahead of schedule.

The other major benefit to adoption of Category 6A cables is their support for a new technology known as Power over Ethernet, or PoE. This technology allows electronic devices to receive not just Internet access but also electrical power through one Ethernet plug-in. The last great innovation in network connectivity—WiFi—is over 18 years old now, and all signs point to PoE becoming the next one. Though PoE has been in the works for many years now, technologies are finally advancing to the point where mass adoption is close on the horizon. And hospitals have already begun to adopt PoE for small electronic devices such as nurse call buttons, IP phones, and computer-based technologies.

PoE is, without doubt, still a developing technology—right now, only supporting 25.5 W of electricity, which limits what appliances can be powered over Ethernet. Given these capacities, only very small appliances, such as laptop computers or similarly-sized electronics, can be powered through PoE.[8] But by 2017, it is predicted that PoE standards will provide up to 100 W of energy—increasing the variety of devices which can be powered through PoE. The higher capacities will allow PoE to also provide power to larger pieces of equipment, including building automation devices such as lighting systems, presence detection systems, and HVAC temperature controls.[9]

[8] U.S. Department of Energy, http://energy.gov/energysaver/estimating-appliance-and-home-electronic-energy-use

[9] Cisco, "Power over Ethernet Solutions", http://www.cisco.com/c/en/us/solutions/enterprise-networks/power-over-ethernet-solutions/index.html

While a large majority of the equipment in an office could be powered through PoE, hospital technology is often more complex, and consumes more energy than the average copier or desktop computer. But with the PoE capacity upgrades coming in 2017, the percentage of hospital equipment which can be powered through PoE will increase. While PoE still will not be able to support a large percentage of medical equipment, this still represents a significant increase in capacity, improving efficiency today and incentivizing facilities managers to stay on top of these technological advances by signaling the possibility of similar increases in coming years.

Why adopt 6A cables now?

Though PoE is far from a distant vision, facilities still have some time to adjust to meet the new age, as these standards will not come into effect until 2017. But outfitting facilities with Category 6A cables immediately is practical and forward-thinking for healthcare providers for a number of reasons, and benefits a number of constituent groups in the world of the hospital.

- **For patients:** An upgrade in hospital Internet connectivity will increase patient safety and satisfaction for the reasons discussed earlier in this paper.
- **For IT managers:** A LAN (local area network) infrastructure which includes PoE cables leads to easier connection of new devices. And a cable which provides both electricity and Ethernet access reduces the amount of cables a facility requires— lowering cost and increasing convenience for hospital IT departments. Additionally, because PoE does not compete with AC power, the addition of PoE-compatible cables completes rather than changes the power structure of a facility, creating a more efficient data and power infrastructure which builds a solid foundation for the addition of future innovations.
- **For facilities managers:** The installation of Category 6A cables will provide the levels of network connectivity which are required to build and support a smoothly-functioning intelligent hospital infrastructure. Facilities managers also benefit from the previously mentioned completion of a hospital's power structure and increases in efficiency of the building's data and power infrastructure.
- **For CFOs:** From a financial standpoint, outfitting a new facility with Category 6A cables is prudent and forward-thinking. It eliminates future rip-and-replace costs that the hospital would incur if they chose to install Category 5e or 6 cables initially, saving hospitals approximately $1 million per 36 beds from revenue losses.[10]
- **For CEOs:** If the healthcare organization chooses Category 5e or Category 6 cables initially, and then needs to replace with Category 6A down the line, the new cable installation will require parts of facility to be shut down temporarily for work to be done. Initial installation of Category 6A will save time, reduce headaches, ensure uninterrupted patient services, and guarantee that facilities are well-prepared in advance for larger-scale implementation of PoE when power standards increase in the coming years, establishing the facility's reputation as a groundbreaker in technology.

Conclusion

Over the past two decades, information technology has grown into an integral part of the world around us, and the healthcare industry has benefited profoundly from the fruits of the digital age. But as healthcare facilities adopt more and more Internet-based technology to streamline and smarten their building infrastructures, they increase the demand on already-insufficient bandwidth. Hospitals which upgrade their network cabling now will ensure that they are well-positioned to handle that increased demand as more and more network-based innovations become essential to the functioning of the hospitals of the future.

An upgrade in network cabling, however, comes with benefits beyond just an increase in bandwidth. It will also serve to create a more efficient and streamlined energy system in a building through the use of PoE. A facility which utilizes PoE can both increase patient safety and decrease clutter and cost in cabling infrastructure, leading to a better-ranked and more efficient hospital environment.

By adopting Category 6A network cables now, healthcare facilities not only address the issues of poor connectivity, but also ensure that they are prepared to face the changes of the future head-on. They establish themselves as authorities in utilizing cutting edge new innovations to their full potential to make a more efficient, cost-effective, and safer hospital environment. And by adopting higher-capacity cables now, facilities give themselves the security of knowing that they are prepared for more innovations in the coming years.

[10] Belden, "The Financial Case for Category 6A Cabling in Healthcare Facilities", 2012.

About the authors

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June 2016
WP-NETWORKCONNHC_A4