



E-BOOK

An infrastructure prescription for accelerated healthcare transformation

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Healthcare digital transformation and innovation have become essential in providing patients with convenient access to timely medical care.

More than ever, hospitals and other organizations in the healthcare ecosystem depend on network infrastructure to ensure that information flows freely, accurately and reliably. While the bulk of healthcare data traffic generated by IT devices flows through the cloud, confidential patient data must be properly handled and secured in compliance with regulatory requirements. Data security and privacy is a critical challenge.

Additionally, the value of the internet of medical things market globally is set to hit **US\$158 billion in 2022**. The growth of health-focused [internet of things](#) (IoT) devices and wearables, the increasing healthcare data breaches,

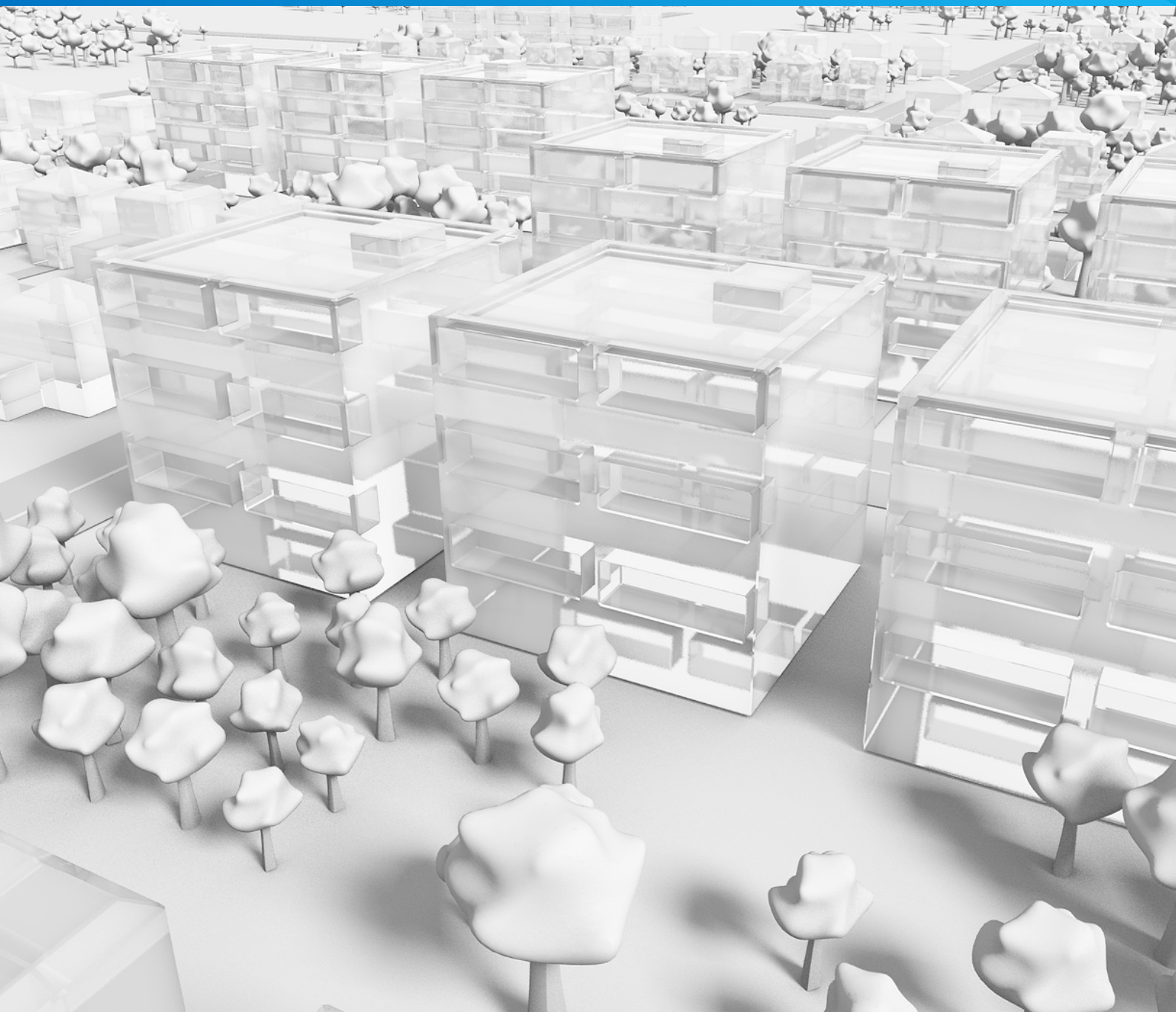
and the adoption of telemedicine, clinical informatics and mobile initiatives have led healthcare institutions to invest in modernizing infrastructure.

As digitalization accelerates in the healthcare sector, this e-book looks at the impact of network infrastructure on ensuring patient safety as well as data security. How do the right infrastructure upgrades help foster IT-operations technology synergies and operational efficiencies? How can your healthcare infrastructure enable effective digital transformation that boosts patient experience?



Chapter 1

Patient safety, data security in digitalized healthcare



Chapter 1

Modern healthcare networks are under growing pressure to meet increasing demand for telemedicine. Accelerating healthcare digitalization has placed the spotlight on patient safety, staff security as well as data security and privacy.

Leveraging healthcare data and ensuring data privacy and regulatory compliance are mission-critical factors in reliable healthcare delivery. Actionable insights are derived from data gathered through mobile health applications and wearables to improve patient care. They help care teams promote clinical best practices.

Apart from data centers hosting confidential patient and medical data, patient care is governed by regulations, and lives rely on the network. This makes standards-compliant connectivity—from the server room to emergency room, from nursery to the nurse’s station—critical.



DID YOU KNOW?

The global healthcare cybersecurity market will grow by



15%
YEAR-OVER-YEAR

And by 2020 to 2025 it will reach



US\$125
BILLION

Source: [Cybersecurity Ventures](#)

Warding off the enemy within

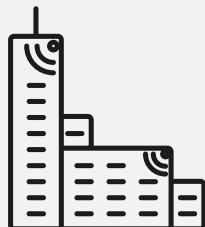
The global healthcare cybersecurity market will grow by 15 percent year-over-year and reach US\$125 billion cumulatively from 2020 to 2025, according to [Cybersecurity Ventures](#). The insider threat in particular is the number one security challenge for hospitals. More than half of insider fraud incidents within the healthcare sector involve the theft of customer data, according to the [Carnegie Mellon University Software Engineering Institute](#).

An intelligent secure infrastructure reaching every department of a healthcare facility is needed to protect data from onsite attacks, monitor safety and security measures, and manage massive file storage and transfers. This entails deployment of round-the-clock control and security monitoring systems like IP-connected cameras, occupancy sensors, card readers, automatic door locks and other connected elements of physical security.

Infrastructure security must prevent unauthorized access by an unauthorized person. It should also detect and repel unauthorized access by an authorized person by tracking all changes to the physical layer in real time.

A constant, watchful eye

At the [MacKay Memorial Hospital](#) in Taiwan, CommScope's imVision® [automated infrastructure management](#) (AIM) solution provides network administrators with real-time visibility and control of the network physical layer. Network downtime is reduced because the system monitors the entire network and documents the insertion and removal of patch cords. This is an extra layer of security against unauthorized tampering in the physical infrastructure.



Hard-wired connections complement wireless coverage wherever needed to deliver high-speed always-on connectivity for the safety of medical workers and patients. They enable patient bed alerts (panic alarms and buttons) and nursery infant protection in the wards as well as parking lot cameras and auto locking of facilities.

Tokyo's [ITO Hospital's](#) digitalization efforts, for instance, were driven by the belief that IT is essential for improving the quality and safety of healthcare services. From electronic medical records and medical accounting, to clinical examinations and radiology information management, several IT systems were introduced to help raise standards, especially in its specialty of treating thyroid disease.

Data security was a major concern. For the hospital's IT administrators, strong networks built on wired and wireless network solutions hold the key to ensuring compliance with HIPAA, GDPR, HIMSS and other data protection and privacy regulations.

Strategic elements

Vigilance at the physical layer

While wired and wireless solutions connect remote IP cameras, door access controls and other security measures in a healthcare facility, an intelligent AIM system enables a self-monitoring physical infrastructure, including unified video security systems and card access, to strengthen security processes and track safety and security measures.

Using intelligent cabling, connectors and patch panels, AIM systems monitor and map all authorized and unauthorized changes to the physical layer in real time and alert personnel to new and non-scheduled connections, such as an intruder plugging in a laptop to gain unauthorized access.

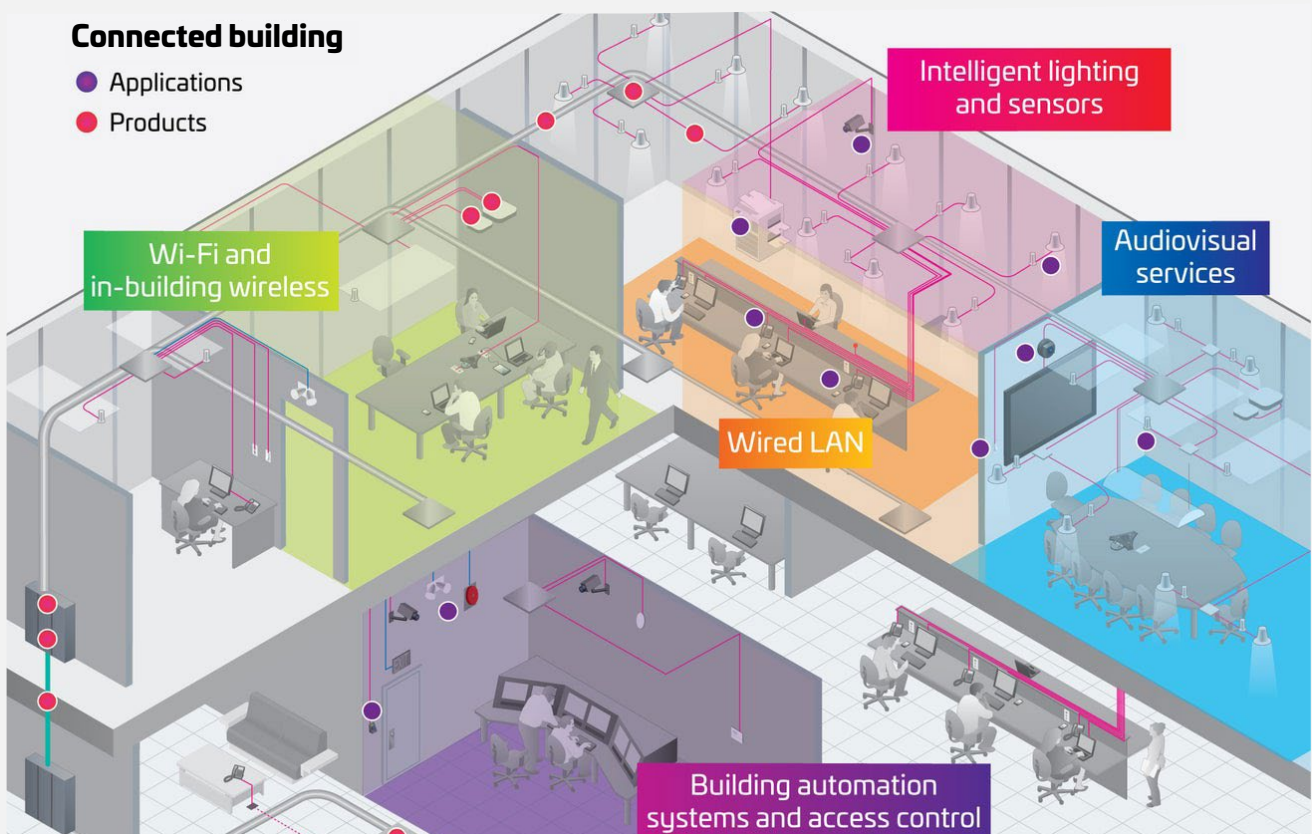
The system can be integrated with an intrusion detection system or enterprise anti-virus software to identify rogue or infected devices by physical location, including the data center. It intelligently monitors and manages large and high-speed file transfers to protect patient and medical data.

Always-on security devices and sensors

With the right cabling infrastructure, networks of [power-over-Ethernet](#) (PoE) device—such as IP security cameras, intelligent lighting, building automation and access control devices, and occupancy sensors—can help spot unauthorized intruders and play a role in protecting lives and property.

[Powered-fiber cabling](#) as well as PoE networks offer the advantage of drawing their power from switches, which are typically backed up by UPS batteries and generators. In case of a main power failure, the AIM system and all connected security devices continue to function.

The [Universal Connectivity Grid](#) (UCG) cabling design makes connectivity in healthcare facilities more efficient and flexible. UCG improves management of the physical layer infrastructure from the structured cabling network to the multiple connected systems while minimizing installation disruptions.





Standards-based cable design and construction

Within the Telecommunications Industry Association (TIA), CommScope actively participates in Engineering Committee TR-42. The committee develops standards, such as the ANSI/TIA-1179-A, that specify cabling and cabling category recommendations for healthcare facilities. In addition to IT systems, the structured cabling specified by this standard also supports clinical and non-clinical systems, including non-IP and IP-based RFID, nurse call, security, access control, and pharmaceutical inventory. ANSI/TIA-1179 recommends Category 6A cabling for all new installations in healthcare environments. Further, it is critical that infrastructure cabling meets or exceeds minimum fire safety ratings.

More capacity, control to keep patients safe

Keeping patients safe starts with a network that keeps staff connected across the hospital and healthcare facilities within the campus—the EMS en route, surgeons in need of lab results, visiting doctors needing to communicate with their offices, etc. With the advent of 5G, new digital distributed antenna system (DAS) solutions have made [indoor mobile communications infrastructure](#) cost-effective, reliable and manageable.

These solutions use Category 6A cabling and a LAN-like architecture that are much easier and safer to install, deploy and configure. They give hospitals more bandwidth capacity and more control over the capacity. For example, network managers can use software to easily reassign bandwidth from less-demanding parts of the network to the surgery suite.

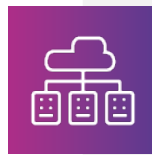
Patient safety and data security

With vital telemetry, bed alerts, nursery monitoring and more all dependent on connectivity, comprehensive healthcare-grade, standards-compliant coverage is critical.

Reliable connectivity must be extended through an entire campus—eliminating dead zones and interference across buildings, from the lowest parking level to top-floor wards.



Recommendations:



High-performance infrastructure with powered copper and fiber supports remote IP cameras, door access controls and other security applications.



The Universal Connectivity Grid, backed by CommScope's Applications Assurance warranty program, supports various applications that are required in the healthcare environment.



Standards-based cable design and construction supports IT, clinical and non-clinical systems and meets fire safety ratings.



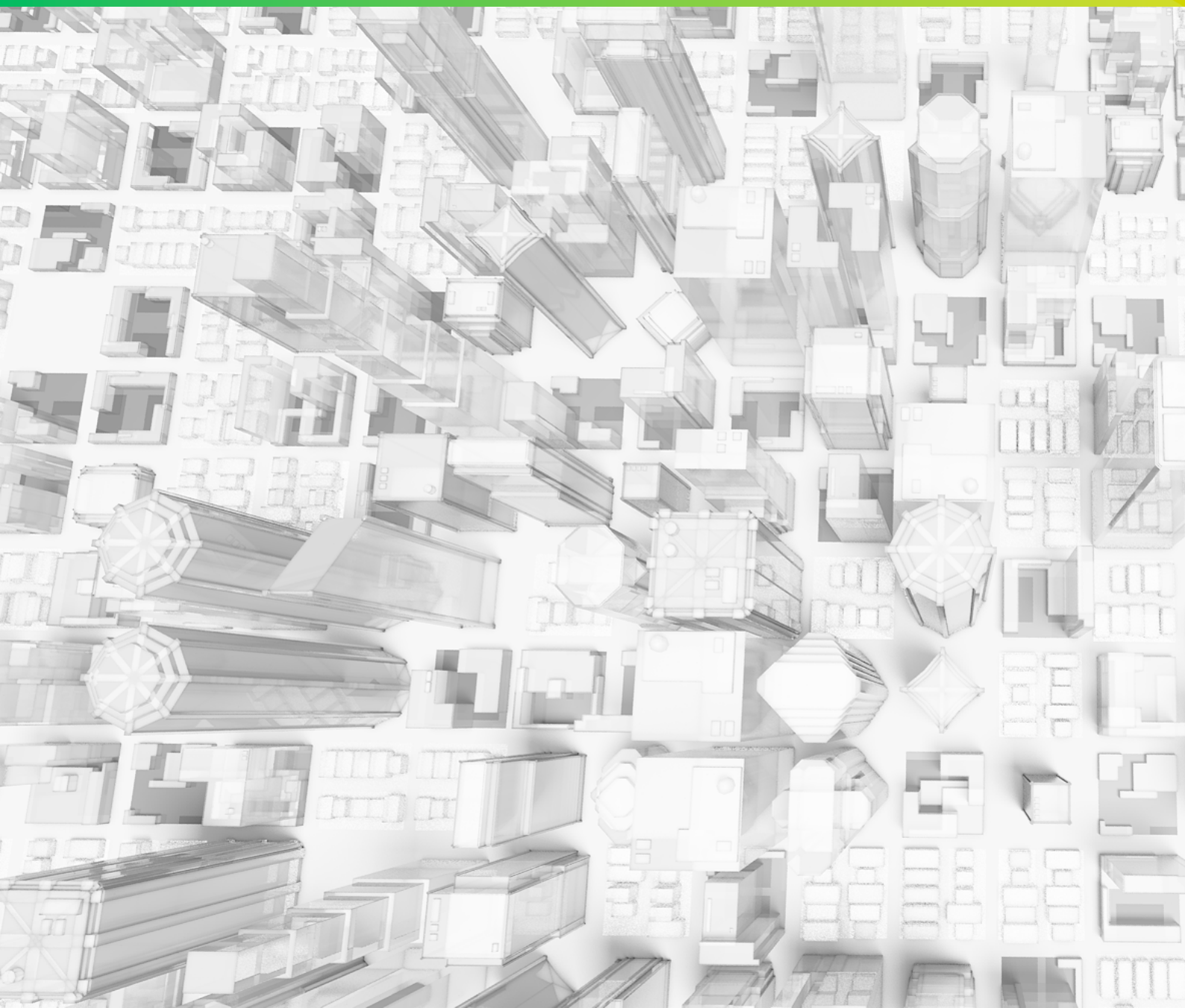
Applications can be managed by an automated infrastructure management solution. It provides a real-time, holistic view of the network and detection of any unauthorized intrusion for security-enhancing monitoring and management.



In-building wireless solutions, such as distributed antenna systems and small cells, provide required coverage, capacity and security.

Chapter 2

IT-operations technology synergies for smart, efficient healthcare



Chapter 2

Modern healthcare organizations rely on free and timely information flows for efficient operations. Faced with mounting pressure to do more with less resources, healthcare operations require solutions that help optimize operational expenditure (OpEx) as key systems become more connected and more capable.

With this aim in mind, IT and operations technology teams can develop shared avenues of efficiency to attain the industry's ultimate metric of success—improved patient outcomes and patient experience.

The healthcare industry has a continuing commitment to provide affordable high-quality care to a growing number of patients while lowering operational costs in the process.

Efficiency built on convergence

IT infrastructure plays a big role in streamlining operations. Sharing a common physical network unlocks the potential for more efficient network administration and facilities operations. Working together on a converged network, IT and operations technology teams are leveraging IoT capabilities that have led to

Many successful hospitals have taken advantage of IT solutions, such as lean principles and predictive planning, to help drive efficiency and relieve resource pressures.



exponential growth in the number of wired and wireless network devices as well as requirements for PoE.

For example, [Wi-Fi 6/6E](#) is connecting smart beds, oxygen monitoring devices, and real-time access to X-rays, among other staff alert and patient monitoring applications. IoT adoption has also gained traction in lighting, HVAC, physical security, asset tracking, smart parking, smart locks and security cameras.

These real-world IoT deployments operate on a complex and costly array of network protocols, equipment and disparate management tools. Troubleshooting the network and tracking changes take significant effort. Key building systems require simpler, automated processes for efficient monitoring and control.

A common infrastructure centralizes smart hospital capabilities. [Copper and fiber cables](#) connect and power all systems, while AIM provide a holistic view of the physical network.

Structured cabling



Powered fiber cable systems



Distributed antenna systems



Automated infrastructure management



Wi-Fi access points



Sowing seeds of transformation

The [Number 4 Affiliated Hospital of China Medical University](#) laid this foundation for future expansion and greater operational efficiency. It deployed network and data center infrastructure that is based on IT requirements set by international standards organizations such as TIA and ISO.

A CommScope infrastructure solution featuring 40G/100G fiber-optic backbone cabling and pre-heading joints, which is supported by the imVision AIM system, underpins the university-affiliated teaching hospital's total transformation into a major, fully digital medical center.

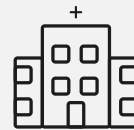
The cabling and components ensure optimal performance, while the AIM system enables breakdowns to be quickly identified and remedied and preventive measures to be taken to keep the system up and running at all times.



Strategic elements

All controls on one platform

Beyond unifying controls, a converged infrastructure paves the way for automated facility management that taps on IT and operations technology synergies. The desired outcome is reliability, minimal downtime and omnipresent connectivity through the wired and wireless networks that support patient care.



The infrastructure not only enhances the overall user experience for doctors, nurses and patients, but also enables secure, efficient and hassle-free access to confidential patient data as well as critical hospital systems via mobile terminals.

[Dezhou People's Hospital](#), in the Shandong Province of China, improved operational efficiency via a secure, reliable and high-performance network. The network improved staff effectiveness as well as efficiency in providing timely response to customer service enquiries from patients and their families.

CommScope's portfolio of wired, Wi-Fi and cellular solutions creates future-ready networks that harness the potential of IoT connectivity, smart building efficiency and healthcare-grade security.

The CommScope [RUCKUS® IoT Suite](#) enables convergence at the edge by reusing existing LAN and WLAN infrastructure and deploying a common cabling platform for the myriad applications and devices in the healthcare space. IoT data traffic are captured and backhauled over a common wireless-wired infrastructure to the IoT Suite.

Consolidating multiple radio technologies—such as Wi-Fi, BLE, LoRa and Zigbee—into a single platform helps to unify and simplify management and control of disparate systems spread across buildings and campuses for both IT and operations teams.

CommScope's powered fiber cable system simplifies the addition of new small cells, Wi-Fi access points, IP cameras, VoIP phones and other devices by distributing power and fiber through the same cable to wherever network connection and power are required.

Applicable as a PoE or PoE+ extension, the powered cable system enables smart building management and facilitates IoT through universal connectivity in every room, on every floor, and across buildings. Hence, powered fiber makes sense in outdoor links and most sites spread wide in campuses.

Less haste, more speed on efficient information flow

Again, the productivity of hospital IT staff is also dependent on the efficient flow of information they need to do their jobs and achieve positive patient outcomes.

An AIM solution monitors network security in real time and reveals opportunities for operational efficiencies

across the entire network. For example, high-speed, low-latency fiber empowers remote surgeries and other advanced medical applications, while maintaining electrical isolation in sensitive work areas like operating rooms.

CommScope's AIM system deployed in a health clinic helped to reduce operational costs by 15 percent through streamlining control of HVAC systems and improving efficiency in operations.

[Máxima Medical Center](#) (MMC), a large medical facility in The Netherlands, gained similar benefits. After implementing the AIM solution, equipment data is continuously updated and its ICT department knows exactly where each piece of equipment—from medical to ICT devices—is located.

MMC is home to tens of thousands of devices and platforms, from VoIP systems to wireless transmitters, PCs, servers, medical devices, mobile computers and portable telephones. All these devices are connected to nearly 10,000 active network ports and a multitude of active patch points.



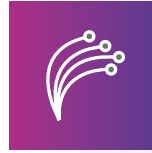
Operational efficiency

Maximizing operational efficiency for facility systems, from HVAC to video security, requires simpler, automated supervision.

The process of troubleshooting network problems, tracking hardware changes and looking for unused assets occupies resources that could be better utilized. CommScope improves efficiency with single-pane management, automation, ubiquitous monitoring and actionable insights.



Recommendations:



A converged infrastructure supported by automated infrastructure management taps on IT and operations technology synergies that increase efficiency and reduce operational costs.



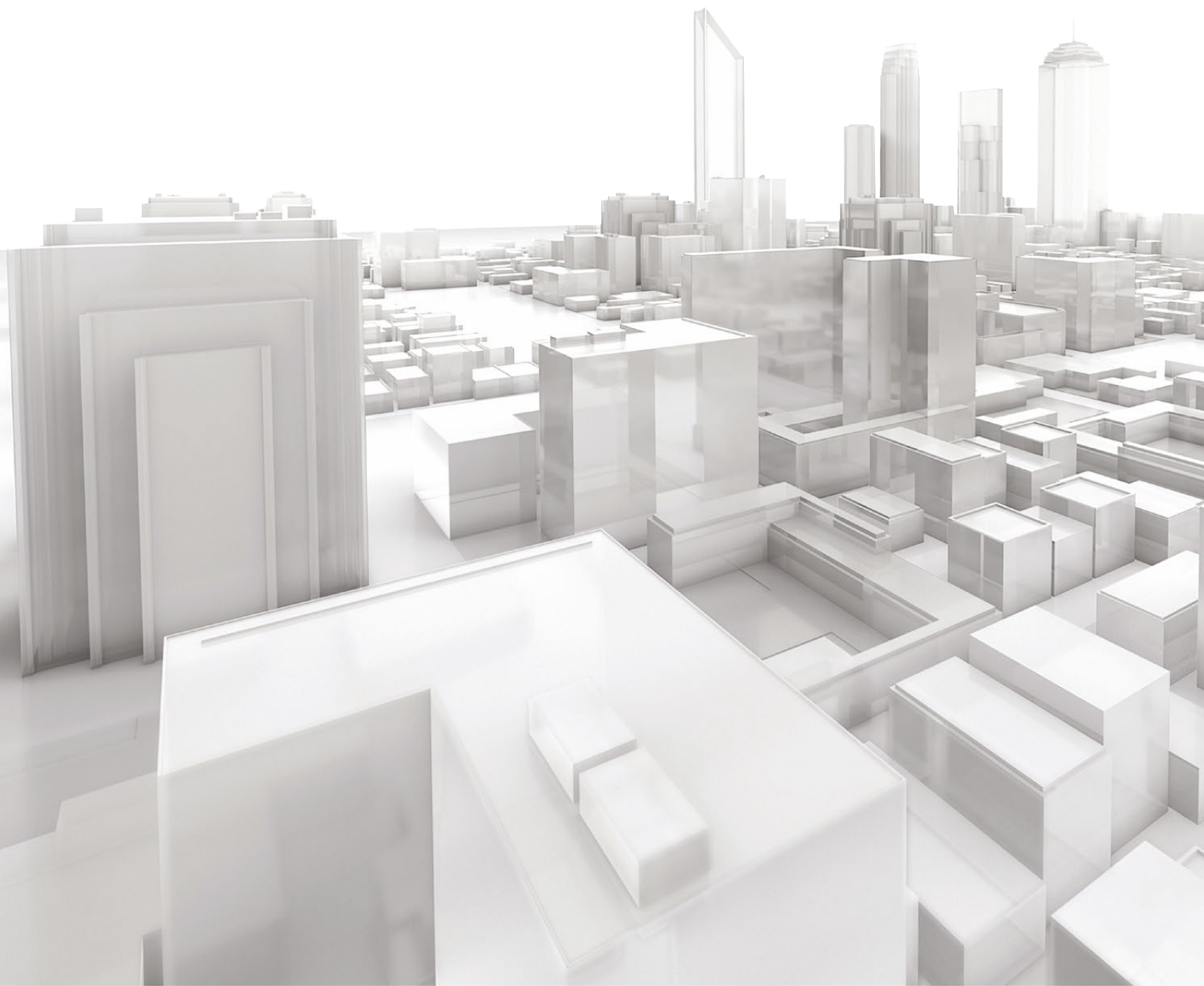
Powered cable system enables smart building management and facilitates IoT through universal connectivity in every room, on every floor, and across buildings.



CommScope RUCKUS IoT Suite brings benefits of shortened deployment duration and cost efficiency in supporting a wide array of IoT capabilities.

Chapter 3

Patient experience at heart of healthcare future



Chapter 3

Healthcare is transforming—with patient experience at the heart of everything from patient care delivery to personalized healthcare.

Adoption of digital technologies helps to improve remote patient monitoring and care delivery to achieve the best possible outcomes. Meanwhile, monitoring and control of patient experience, staff productivity, recruitment and inventory can be vastly enhanced with simpler and automated processes.

Know your patients

The bottom line is that healthcare organizations need to strike a smart balance between operational efficiency and patient experiences while supporting next-generation services like telemedicine and virtual ICU centers. The use of artificial intelligence (AI) and big data analytics provides insights that improve patient care while reducing healthcare costs.

According to an Accenture report, 84 percent of healthcare executives believe that AI will fundamentally alter how they gain information from patients and interact with consumers. For example, AI tools analyzing data from personal health devices, IoT solutions, DNA testing, genome sequencing, electronic medical records and more help clinicians to personalize treatments and experiences for the individual patient.

Yet, healthcare providers already struggle to meet operational targets without the additional handicap of disruptive infrastructure upgrades that such capabilities require. The right wired and wireless solutions pave the way for a future-ready network that is geared for the rigors of the industry.



Smooth operator

[Loma Linda University Health](#) (LLUH) teaching hospital, for example, operates some of the largest clinical programs in the U.S. and is the international leader in infant heart transplantation. To provide reliable indoor wireless coverage throughout its campus, the medical facility implemented CommScope's ERA® digital wireless infrastructure platform noted for its ease of installation and management.

Unlike traditional DAS systems, ERA runs on standard Category 6A copper and fiber-optic cable already in place in many hospitals. This lowers cost and minimizes any potential disruption of patient care. Installation can even be performed by hospital IT staff with a little training.

Strategic elements

Infrastructure that adapts to evolving demands

Infrastructure must be future-proofed for new connected healthcare environments. It must reduce the need to continually change hardware and be adaptable and scalable to meet demands of new applications.

Running ERA on Category 6A, hospitals like LLUH can support Wi-Fi, wireless security cameras and low-voltage lighting off the same cabling infrastructure. The ERA platform gives patients and visitors the high-speed service they expect while providing secure and reliable

communications for staff to continue improving patient care.

Strong networks improve collaboration and enable better patient experiences during telemedicine sessions and hospital visits or stays.

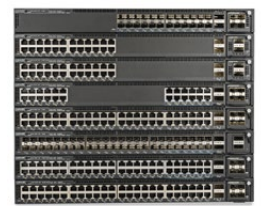
Advanced connectivity drives better audio-visual quality of in-room TV or entertainment and more reliable communications among staff, patients and visitors. Also common in hospitals is Wi-Fi connecting devices that generate medical application data or provide access to patient records and real-time data analyses. They allow doctors and nurses to receive alerts on patient's health and make informed decisions on treatment plans.



The capacity, efficiency, coverage and performance of Wi-Fi Certified 6 networks™ enable reliable connectivity in hospital environments where there are high congestion of connected devices and many latency-sensitive applications. Wi-Fi 6 networks ensure each connected device performs at an optimum level for better overall user experience.

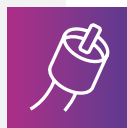
To this end, the wired network has become a critical underlay for wireless traffic. Wi-Fi 6 access points, [Ethernet switches](#) and analytics facilitate consistent, high-speed wireless access.

A fiber-enabled aggregation/core switch, such as the CommScope RUCKUS ICX® 7550, offers future-ready multi-gigabit 2.5/5/10 GbE downlink ports and 40/100 GbE uplink ports to eliminate bottlenecks between network layers and enable an uninterrupted user experience in high-density wireless environments.

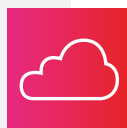


CommScope RUCKUS ICX 7550:

future-ready multi-gigabit 2.5/5/10 GbE downlink ports



40/100 GbE uplink ports to eliminate bottlenecks between network layers



enables an uninterrupted user experience in high-density wireless environments



Infrastructure that leaves room for growth

Future-ready hardware, software, and services create a foundation for long-term network evolution.

For new IT deployments or upgrades, consider structured cabling that converges wired and wireless networks onto a single infrastructure with performance that leaves room to grow as new challenges and opportunities emerge. Infrastructure that is ready for the evolving connected healthcare environment simplifies upgrades and optimizes expenditure.

[Banner Health](#), a U.S.-based healthcare provider with hospitals and clinics in six states, deployed the CommScope [ERA digital distributed antenna system](#) to deliver reliable mobile coverage throughout its facilities.

Banner Health's IT staff can deploy and maintain the all-digital ERA that runs over standard IT structured cabling infrastructure. The system can be leveraged for future 5G and IoT services.

ERA is technology and operator-agnostic, meaning it is capable of supporting 3G, 4G and 5G for multiple service providers on a common infrastructure.

ERA can also share fiber with other services to deliver major cost savings. At LLUH, multiple carriers can now connect their networks to the DAS so the hospital can scale the system effortlessly as locations or buildings are added across campus.

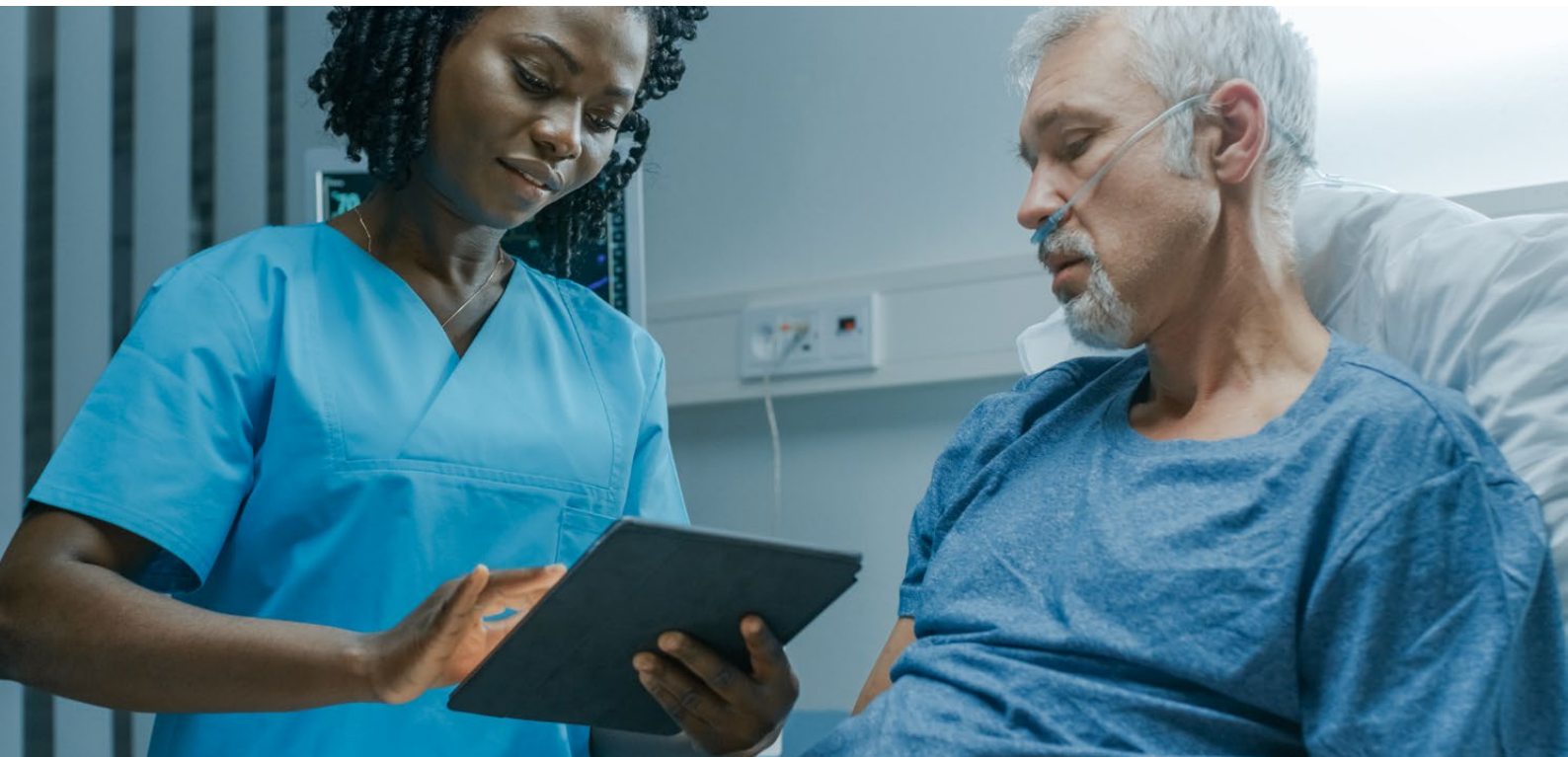
ERA's support of multiple service providers and wireless carriers provides a solid foundation to meet future mobility requirements and assures physicians, staff, patients and visitors of connectivity. By moving baseband functions across multiple buildings to a single, streamlined head-end or even to the operator's local hub, it reduces system footprint and saves valuable real estate.

Digital DAS facilitates the use of multiple-input multiple-output technology, which uses additional antennas to double the bandwidth of a network. It can be deployed to support 4G LTE wireless and then upgraded to support 5G.

Wireless connectivity that helps harness myriad devices

Indoor mobile communications has become essential in the healthcare industry for connecting people with one another and with information. Apart from deploying DAS to bring outdoor cellular signals indoors, the advent of 5G and Wi-Fi 6/6E promises greater bandwidth capacity and built-in support for onboarding telemedicine and telehealth.

The number and density of wearables and other devices used within hospitals are increasing. Wireless devices in every patient room—i.e., heart monitors, telemetry, nurse call systems and access control systems—need upgraded wireless networks. Using wireless connectivity, asset tags on equipment in many hospitals track the locations of everything from heart monitors and portable X-ray systems to wheelchairs and gurneys.



Additionally, small cells, such as CommScope's [ONECELL®](#), provide additional efficiencies for medium- and large-sized buildings and locations. Initially targeted at single-operator deployments, this solution will expand as it gains approvals from more operators.

Patient experience

Patients, caregivers and the entire business require maximum availability, ubiquitous coverage, faster speeds and higher bandwidth.

CommScope's high-performance wired and wireless networks create reliable connections—supporting critical services such as powered bed alarms and nurse call functions.



Recommendations:



Wi-Fi 6/6E's improved network efficiency and overall capacity delivers more efficient and reliable patient care in congested environments like hospitals.



CommScope's small cell and DAS solutions run on existing IT cabling so new services and upgrades can be carried out with minimal disruption. They empower LTE and 5G connectivity in every room on every floor—and even across multiple buildings—with a fraction of the head-end equipment needed for traditional DAS solutions.



CommScope [PartnerPRO®](#) Network helps healthcare IT teams navigate the challenges of network expansion and business growth.

Conclusion

From future-ready copper and fiber structured cabling to super-efficient Wi-Fi networks to 5G-ready in-building cellular platforms, the end-to-end portfolio of CommScope's solutions presented in this e-book is aimed at empowering both public and private healthcare organizations to accelerate transformation and innovation.

The healthcare industry is changing fast, driven by new technology and patient expectations. A strong wired and wireless network infrastructure will be a significant factor in enabling the changes that establish the desired data security, IT-operations technology synergies and overall patient experience. Learn more about CommScope's [healthcare network solutions](#).





CommScope pushes the boundaries of communications technology with game-changing ideas and ground-breaking discoveries that spark profound human achievement. We collaborate with our customers and partners to design, create and build the world's most advanced networks. It is our passion and commitment to identify the next opportunity and realize a better tomorrow.

Discover more at commscope.com.

Continuing to innovate to bring you the world's leading portfolio of networking solutions. Now meets next

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