Five Requirements for Building a State-of-the-Art Healthcare Network from the Ground Up

Table of Contents

Executive Summary

As healthcare providers around the world grapple with the pressures to reduce patient costs, improve patient outcomes, and increase access to care, the resulting evolution of healthcare delivery is beginning to take shape. Many providers are expanding or building entirely new facilities to deliver these updated care models, and among the many resulting benefits is a fresh look at how to architect a modern health IT system.

Healthcare is leveraging current IT trends such as virtualization, cloud, mobility, big data, and unified communications to provide a foundation for its next-generation facilities. The most savvy of these providers are giving careful consideration to how data communications—specifically the network—will enable caregiver mobility, connect the ecosystem of clinicians, patients, and medical devices, provide a scalable platform for new care models, and ultimately safeguard patient data.

When faced with a new build or expansion, there are five essential networking requirements to address that will enable a hospital to deliver on the promise of a new facility and provide the latest advances in patient care delivery. In this paper, we address these requirements and discuss an example of how one recent organization leveraged them to build a state-of-the-art children's hospital from the ground up.

Introduction

Several key IT trends are emerging in the modern healthcare provider environment that are largely driven by the notion that IT can be better leveraged to reduce costs, improve outcomes, and increase access. Mobility, big data, collaboration, and communication, improved patient services, and security and compliance are all forcing IT teams to reconsider how to deliver these new services. Among the considerations must be a flexible yet solid foundation that is provided by the hospital's data communications network.

The related trends of clinical mobility and bring your own device (BYOD) are placing difficult demands on the overall IT system and the staff that supports it. As patient records become digitized, clinicians realize the benefits of enhanced data exchange through mobile platforms, and they demand access to dozens or even hundreds of applications anytime, anywhere, and from any device.

Medical device manufacturers are also realizing the benefits of delivering new, wirelessly capable devices such as monitors and pumps. While wireless—and eventually remote access—will supersede onsite wired access as the connectivity method of choice, both wireless and wired access to network and communication resources remains a major consideration in architecting the provider IT system.

Critical Importance of the Network

When it comes to healthcare and the large ecosystem of stakeholders who are involved, network availability and performance are critical. The network must be available at least 99.999 percent of the time, while also delivering data quickly and efficiently between clinical devices and caregivers. Additionally, the provisioning, management, and security of both personal and hospital-owned mobile devices must be a consideration. Developing and adopting both comprehensive mobility and security policies will ensure that provider IT teams have addressed the availability, performance, and security requirements to deliver next-generation mobility and patient services.

Big Data

In addition to mobility and BYOD, providers must also consider the impact that big data will have on the IT system, as well as how updated collaboration, communication, and data analytic applications will be delivered and managed. Improved picture archiving and communications systems (PACS), imaging and analytics applications, and telemedicine and remote communication platforms will drive the movement of large amounts of data, typically between end users and data center storage and server environments.

Data Transit and Delivery

While evolved storage and compute platforms are already being addressed, the network architecture can drastically enable—or severely impact—data transit and delivery. How the network is architected plays a critical role in a hospital's ability to serve data to applications and clinicians where and when they need it. The architecture must not only be flexible and scalable to grow as data communication demands grow, but also cost-effective to provide a return on the investment over time. With a conscientious approach to network architecture, IT teams can build a network today with the ability to evolve as well as deliver on the total cost of ownership, making the investment worthwhile.

Challenge and Opportunity

Such architecture requirements—performance, availability, flexibility, and cost of ownership—are desirable for most providers, but can be very difficult to implement in practical terms. In an existing hospital environment, IT teams are plagued by tremendous complexity within legacy systems, often supporting multiple disparate networks, each with its own requirements, devices, and applications. Additionally, making any changes requires downtime, and provider IT teams often have extremely limited maintenance windows, if any at all. While the goal is to become proactive and visionary, many IT teams remain reactive in nature and mired in operational inefficiencies. Therefore, operational simplicity must also be a consideration when designing and building a healthcare communications infrastructure.

A new facility build represents a unique opportunity to design and implement an infrastructure free from the constraints of existing systems. What considerations must be given to the network infrastructure requirements during a new build project? How can IT architect the network to provide the performance, flexibility, and simplicity required to support the next wave of health IT innovations at a cost of ownership that provides a return on the investment?

Case Study

Mapping Out the Requirements

If you could build a state-of-the-art hospital from the ground up, what would you do differently? One of our children's hospitals was able to do just that—and set four primary business objectives:

- **Enhance patient care** by delivering cutting-edge programs and procedures, while collaborating with the best research teams in their state.
- **Provide the latest technology features** like wireless Internet access for patients and guests; on-demand, high-definition bedside video; and improved family amenities, kitchens, and showers.
- **Entertain and delight young patients** by delivering cultural and artistic features such as a fire truck in the lobby, a healing garden, and a laser light display that the patients can control.
- **Implement a green design** with a sustainable facility, a green roof, storm water management system, and low-emission indoor products.

> **The Juniper Networks value proposition for healthcare:**
>
> *To learn how Juniper can help you build a reliable, scalable, secure, and flexible network for your healthcare organization that will result in a greater return on investment over time, visit* **www.juniper.net/healthcare**.

This particular pediatric hospital realized these goals when it opened a new facility in the summer of 2012. The new tower offers specialized care for children in a family-friendly design. The $900 million hospital was designed with private rooms and homelike amenities, with readily available access to sunlight and nature views. The hospital offers the latest innovations in medical care, expanded trauma care, enhanced clinical programs, and advanced research that affects its patients directly.

The 24-story, state-of-the-art high rise building uses the latest in electronic health records (EHR), high-definition picture archiving and communications systems (PACS), advanced nurse call systems, IP voice, IPTV in-room entertainment, and high-definition surveillance. More than 300 clinical instruments and applications are connected to the network. With so many life-critical systems in operation, the performance, availability, flexibility, and security of the network were a paramount consideration during the network design and build phase of this project.

Five Requirements for Building a State-of-the-Art Healthcare Network from the Ground Up

1. Carrier-Class Performance

The hospital achieved its IT goal of a highly available network with nearly 100 percent uptime to support life-critical medical applications, high-definition IP video, and IP voice—all in a cost-efficient manner. It opted for a virtualized data center core to support more than 200 different applications and services, each with its own performance and security requirements on a single network infrastructure. The legacy distribution layer was removed because it was no longer needed; access switches connected directly into the core. The hospital took a similar approach with virtualized, converged access switches, enabling up to 10 switches to function as a single, logical device. Members of the same virtual switch configuration are located in different wiring closets, on different floors, and even in different buildings.

> *"We wanted everything on one network. With modern healthcare systems, building automation, security, and in-patient television solutions all running and communicating, it makes sense to consolidate them over a single network."*
>
> – IT director for a prestigious children's hospital

The result has been a flattened, less hierarchical, more point-to-point network infrastructure from patient to the data center and back. This kind of design has improved the speed at which patient and application data can move about the new hospital, resulting in better access to clinical data at the point of care, and at the time it is needed. A network architecture consisting of one converged, virtualized environment drastically improves performance and uptime—both essential requirements when building a state-of-the-art medical facility.

Delivering world-class care to the sickest children can't be interrupted by network outages, slowness, or security breaches. "The network can't have sustained downtime," says the hospital's director of IT. "Our network is life-critical at times."

2. Flexibility and Scalability

While a new facility was the top priority, the hospital had envisioned a plan beyond the day the new hospital's doors opened. The IT team was tasked with planning 7to 10 years ahead in order to build an environment that could support any and all new services, both clinical and nonclinical. Understanding that the data communications network was the foundation for supporting such growth, the team chose an architecture that served the current needs, but also allowed for evolution in the years to come.

> "We need to broker the complex relationship between stability and speed. We want to be able to put new applications on the network and adjust the network to meet the need. But on the other hand, we want to retain a stable network. We need a network that has very predictable behavior."
>
> - IT director for a prestigious children's hospital

The latest in biomedical technology shares the same infrastructure with a video production studio, where children can create light shows that might be chosen to decorate the outside of the building. The new Juniper network runs everything from EHR and PACS to nurse call systems, in-room entertainment systems, and building automation. The hospital also makes extensive use of its HD videoconferencing as part of its patient care and family-centered practices.

Therefore, the need for flexibility and growth was essential. "We need to broker the complex relationship between stability and speed," says the IT director. "We want to be able to put new applications on the network and adjust the network to meet the need. But on the other hand, we want to retain a stable network. We need a network that has very predictable behavior." And future flexibility is key. "I see that changing," he says. "I see network technology evolving and becoming more capable of delivering the type of flexible and fast network solutions that healthcare requires."

3. End-to-End Security

Security is such a major part of the network design that it should be integrated into the network architecture. Integrated security helps maintain compliance, while also providing the latest levels of intrusion detection and prevention. To deliver on an end-to-end security strategy, the hospital used a multifaceted approach. It implemented a network access control (NAC) system to protect the network by guarding applications and data granularly, providing identity-based network security, and ensuring that only authorized users access each application. The system checks user credentials in both agent and agentless modes to assess the device security state, allowing the hospital to support BYOD and remote access as well.

In addition, the hospital uses a unified threat management solution to create secure zones that protect sensitive applications, data, and systems. The solution also provides VPN capabilities, intrusion detection and prevention (IDP), and application-layer security to protect against malicious activity targeting specific applications.

The hospital must uphold the highest levels of security and maintain strict regulatory compliance, including Health Insurance Portability and Accountability Act (HIPAA). "Using 802.1X network access control allows us to be highly assured of who's on the network, the health of their equipment, and what they can access," says the director of IT. "The network availability component that security provides is huge."

4. Operational Simplicity

The modern health IT system is a highly complex, coordinated system, particularly when leveraging a flattened, consolidated communications network platform for all services and applications. One of the most critical requirements during this build was to invest in operational simplicity, which ultimately allowed the IT team to be more proactive and engineering-focused.

The hospital achieved vastly improved operational simplicity by consolidating multiple, physically separate networks onto one converged IP infrastructure running a single Juniper Networks® Junos® operating system. The entire environment became much simpler to manage, with fewer organizational challenges and dramatic simplification of network operations. Also, a single, centralized network and security management policy engine enabled IT to manage the performance of the hospital's network, while creating and applying network and IT security policies site-wide.

The director of IT agreed. "Having one code base using Junos OS is essential to what we deliver. Our engineers learn one language and can maintain an enterprise-consistent codebase, which simplifies planning for upgrades."

5. Total Cost of Ownership

There are great cost savings involved bringing everything onto one single network, and managing that network with one operating system and automated tools. With an efficient infrastructure design, hospitals can maximize their budget spend effectively and get the best value for their long-term investment. This children's hospital was able to illustrate a capital expenditure savings over the competition upwards of 30 percent and nearly 70 percent in operating expense savings. The right architecture can also deliver a better return on the infrastructure investment over time, while also enabling key business goals and IT objectives.

"Using 802.1X network access control allows us to be highly assured of who's on the network, the health of their equipment, and what they can access. The network availability component that security provides is huge."

- IT director for a prestigious children's hospital

Conclusion

When members of a leading pediatric hospital team in the United States had a vision to build a state-of-the-art children's hospital, they knew the underlying data communications infrastructure played a critical role. When it came to architecting how all of these systems interconnected, the IT team had to architect a comprehensive solution that included everything from the yellow submarine CT scanner, to the 60 NICU private room beds, to bedside HD video to a Video Remote Interpreting (VRI) system capable of interpreting nearly 200 languages from any hospital phone. The end result was a consolidated IP infrastructure that carries all of the resulting data, interconnects a multitude of medical and nonmedical devices, and ultimately focuses on carrier-class performance, flexibility, and scalability to deliver an end-to-end security strategy, operational simplicity, and a lower total cost of ownership.

When a new build opportunity comes along, you often have one shot to make the most of it. A new network not only supports expanding hospitals and healthcare organizations looking to transform information technology systems, but also provides a transformational level of patient care. Consider the five benefits of selecting a single, high-performance network outlined in this white paper to make sure you build a highly resilient, scalable, secure, and manageable network—not only for now but also for the future of your healthcare organization.

About Juniper Networks

Juniper Networks is in the business of network innovation. From devices to data centers, from consumers to cloud providers, Juniper Networks delivers the software, silicon and systems that transform the experience and economics of networking. The company serves customers and partners worldwide. Additional information can be found at www.juniper.net.

JUNIPER
NETWORKS