



# CONNECTIVITY IN HEALTHCARE

The Rise of the Network as a Strategic Imperative



The communication network is the lifeline for today's collaborative, real-time healthcare delivery model. Medical staff need to connect to patient data and digital applications from anywhere – on any device and at any time – to successfully deliver care in virtual, physical or hybrid settings.

Today's healthcare networks must be agile, secure and adaptive to support the increasingly complex demands of the rapidly evolving digital healthcare landscape. Healthcare systems are prioritizing connectivity because advancing to a fully connected care delivery model with a legacy network architecture is just not feasible.

In this guide, we will share how applications are shaping network decisions and learn what new network requirements are needed to deliver performance at scale.



# **SECTION 1:** A Call to Action

*Expediting Digital Transformation in Healthcare*

The background is a solid purple color with faint, light-colored illustrations of medical equipment and data. A stethoscope is positioned at the top, with its chest piece resting on a tablet. The tablet screen displays various medical data visualizations, including a heart rate icon, a circular diagram, and a waveform. A pen is visible in the bottom right corner. The overall theme is healthcare and digital technology.

**Seventy-five percent** of U.S. healthcare systems think **investing in digital transformation initiatives is crucial** right now, according to the 2022 HIMSS State of Healthcare report.

# What's Driving Change

Although there are many initiatives driving the need for healthcare systems and providers to transform digitally, these five trends are leading the pack.

## Rapid, Innovative Advancements in HealthTech

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Today's healthcare providers leverage streaming video and online collaboration tools to work in partnership with different medical teams outside their ecosystem. This real-time clinical collaboration comes in many forms.

It can be as simple as doctors and nurses sending secure text messages to communicate next steps for patient care or as complex as launching tele-ICUs – where remote clinicians consult with bedside staff to deliver optimal patient care.

## Healthcare Data Security Challenges

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For years, healthcare systems, hospitals, and providers' offices have been a breeding ground for cyber thieves looking to hack in and exploit sensitive data. The rise of connected medical devices combined with more healthcare providers needing access to Electronic Health Records (EHRs) to deliver care has made the endeavor that much more enticing.

In just over a year, the average cost of a data breach in the healthcare industry climbed from \$7.13 million to \$9.23, according to a recent Ponemon Institute report – and that number keeps rising.<sup>3</sup>

## Fast-Emerging Consumer Trends in Healthcare

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Today's consumers crave constant and convenient connectivity to their banks, favorite stores and friends and family through digital applications. Now more than ever patients expect healthcare teams to meet those same needs.

Healthcare providers must leverage digital medical applications to attract patients to their facilities and empower them to stay healthy after they leave.

## Mergers & Acquisitions

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Many health systems are growing through acquisition, particularly in the ambulatory space. With continued consolidation, health IT leaders are working to avoid patchwork infrastructure and onboard new facilities efficiently.

Additional facilities come with a bevy of new devices, services, equipment and complexity. By streamlining network architecture and deploying a repeatable, modular set-up, health systems can greatly reduce the implementation time/burden and get new offices up and running.

## Threat of New Entrants

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Today's healthcare consumers don't go to a traditional doctor's office when they're sick. Instead of scheduling an appointment, they head to the minute clinic in their local grocery store because they can be seen immediately. And they pick up their prescriptions at the big-name retailer down the street when they stopped in to grab a gourmet cup of coffee.

Unconventional new market entrants are popping up everywhere, adding a completely new layer of competition. Healthcare systems willing to embrace retail healthcare are discovering bold new ways provide better patient care.



# Exponential Growth in Healthcare Data

IT leaders are often called on to educate non-technical leaders, and the data speaks volumes on the rate of change in healthcare.

## \$4.92 B

The healthcare data storage market size will reach **\$4.92 B in 2022.**<sup>1</sup>

## 1/3

The healthcare industry generates nearly **one third of the world's data volume.**<sup>2</sup>

## 36%

In the next three years, the **compound annual growth rate** of healthcare data is expected to reach **36 percent.**<sup>2</sup>

## 50 PB

50 PB: the **amount of data hospitals produce annually.**<sup>3</sup>

## 80 MB

**One patient contributes 80 MB** in imaging data and EHR data per year.<sup>4</sup>

## 10 ZB

Healthcare data will exceed the **10 ZB level by 2025.**<sup>5</sup>





# Healthcare Applications Fueling Bandwidth Demands

The single biggest contributor to healthcare's data explosion is digital healthcare applications. From individual practices and hospitals to research facilities and nursing homes, every type of healthcare organization has shifted to digital applications to optimize care delivery – and that rapid adoption is creating an unprecedented need for bandwidth.

Although different systems are pursuing varying strategies, here are the most popular technologies and digital applications being used in healthcare right now.



## Mixed Reality (MR)

Today's interactive and fully immersive technologies blur the lines between digital and physical worlds. It's helping medical students learn faster, aiding surgeons in mapping out surgery plans and educating patients about upcoming procedures on their own timeline – and from anywhere.

## Internet of Medical Things (IoMT)

### Connected Devices

**Two out of three hospitals will be 5G-enabled within the next four years.<sup>4</sup>**

Hospital beds alone now have 10-15 medical devices connected to them at any given time. If any one of these devices stops working, it causes a disruption in care. These, and other bandwidth-hungry devices, require low-latency communications to perform as expected. 5G will bring new capacity to the IoMT ecosystem.

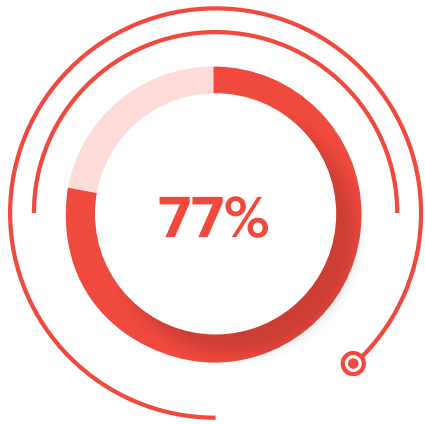
### Smart Building Technologies

According to research from IHS Markit|Technology, healthcare is outpacing all other industries in smart building technology adoption. Implementing intelligent systems that connect heating, cooling, lighting and other environmental and security services to an automated network manager is key to maximizing efficient operations and containing costs now and in the future.



## Artificial Intelligence (AI)

Using AI to perform tasks in the back office is a game changer. With rules-based logic, AI can perform repetitive tasks faster, identify errors easier, discover patterns and anomalies in Big Data, and make common, mundane workflow processes more efficient.



Seventy-seven percent of clinicians either currently use some form of AI or are interested in adopting it very soon.<sup>4</sup>





## **Live Streaming**

Live streaming video revolutionized medical visits. Patients and physicians can talk to you each other in real time without ever having to step foot in an office.

Providers can also send patients home with wearable home medical devices (e.g. smart scales, blood pressure monitors or a smartwatches) that generate data that's sent to a server to be processed – sending real-time alerts if a patient's vitals fall out of normal range.

## Natural Language Processing (NLP)

Getting information into a patient's medical record has come a long way – doctors went from scribbling after visit notes into tangible charts to dictating them into a recorder to typing them up during a visit.

Thanks to speech recognition, natural language understanding and natural language processing (NLP) technologies listening in the background can automatically add accurate medical notes into a patient's EHR, in real time based on what a provider is saying during an exam.



## **SECTION 2:**

Poor Connectivity Is Crippling the  
Healthcare System

# Poor Connectivity Is Crippling the Healthcare System

Maintaining uptime is critical to ensure high-quality patient care – especially as more medical devices and digital applications come on to the network.



**Healthcare facilities now lose an average of \$208,600 immediate lost revenue due to unplanned outages.<sup>6</sup>**

Network congestion and unplanned outages render healthcare applications useless, bring clinical operations to a halt, and negatively impact patient care.

Most healthcare networks suffer from insufficient connectivity, and even more are tied to multiple legacy management systems. There's no easy way to quickly adjust to bandwidth fluctuations – like when there's a mass casualty event and bandwidth intensive application use skyrockets, or after hours at a physician's office when those apps power down for the night.



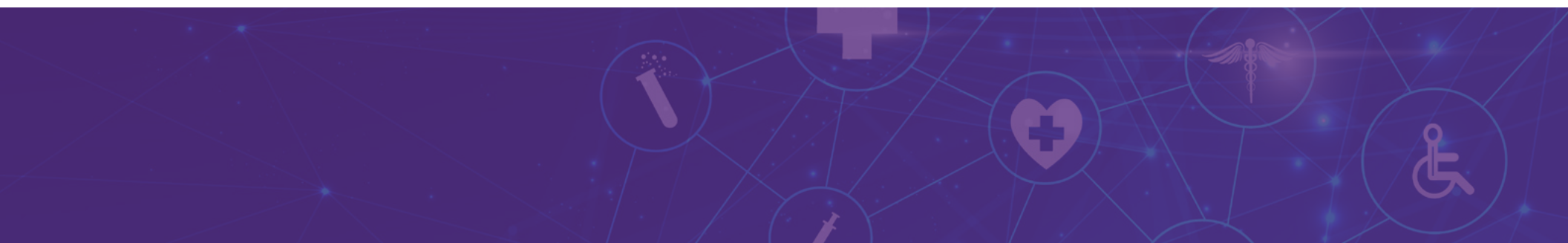
# New Requirements for Healthcare Networks

## Planning for Agility, Flexibility and Responsiveness

Today's network architects and planners must carefully consider capacity requirements, latency sensitivity, and location density. They must have a plan for "peak time" network bandwidth and predict future capacity requirements. But, most importantly, they must figure out a way to strike the balance between under-architecting and over-architecting the network.

### Network Connectivity Conundrum

Network Design Strategy	Negative Outcomes
Over-architecting	<ul style="list-style-type: none"><li>• Underutilized bandwidth</li><li>• Extended time to provision</li><li>• Expensive</li></ul>
Under-architecting	<ul style="list-style-type: none"><li>• Network congestion</li><li>• Unplanned outages</li><li>• Poor application performance</li></ul>





Over-architecting leads to underutilized bandwidth, which is wasteful and costly. And under-architecting causes network congestion and unplanned outages, causing poor application performance.

To avoid this conundrum, healthcare network architects and planners should carefully consider bandwidth demand, traffic patterns, and distribution as they design an architecture that will best meet their needs today and in the future.

Radiology departments are one of the largest consumers of bandwidth.

**40 MB - 3 GB**

average range for images<sup>5</sup>

**200 MB**

average cardiac MRI exam

**20 GB - 30 GB**

single CT scan data set<sup>5</sup>

**20 GB**

typical ViosWorks exam

# Traffic Patterns & Distribution

## Top 6 Factors Impacting Network Bandwidth

1	Distances between facilities
2	Number and type of sites
3	Fast adoption of digital, virtual collaboration, and 3D imaging
4	Prevalence of EHR platforms, IoMT, mixed-reality, and other HealthTech initiatives
5	How many patients, staff and visitors access the network at any given time
6	Anticipated user and application traffic growth





## **SECTION 3:**

Key Criteria for Choosing the  
Best Network



Because fiber provides the highest capacity, lowest latency and most reliable connectivity, it's hands down the best choice for healthcare organizations – and there are a few options.

## **Private Networks**

Depending on the amount of in-house IT expertise, budget, and desire for control, healthcare systems may choose to procure and deploy their own fiber network – either wholly owned fiber assets or dark fiber from a carrier. But the associated challenges of having enough in-house expertise to run and maintain a fiber network when it's difficult to find (and afford) individuals with such specialized skillsets, along with the high capital expense required to set up the network, make this option particularly difficult.

For wide area networks (WAN), dark fiber is an optimal choice for systems that must rapidly scale from 10 Gb/s to 100 Gb/s. Take heed – dark fiber pricing and availability varies widely across markets. While dark fiber or wholly owned fiber assets provide the optimal network paradigm, some health systems must consider alternatives given budget limitations and staff availability/expertise.

## Managed Services

Health systems have an array of options for managed or “lit” services, including managed Ethernet private line services and managed optical wavelength services. Legacy solutions such as MPLS are being reconsidered in favor of alternatives given the nature of many of the healthcare digital transformation initiatives.

### 4 Key Drivers in the Move to Ethernet

 Affordability

 Scalability

 Security

 Simplicity

A managed service offering is the simplest option for deploying and managing interconnected hospital locations, outpatient clinics, data centers, and satellite offices. It's most ideal for hospital system locations requiring 100 Mb/s to 10 Gb/s WANs.

## Data Security Best Practices

Whatever the network architecture, IT leaders must address the convergence of network and security, which includes...

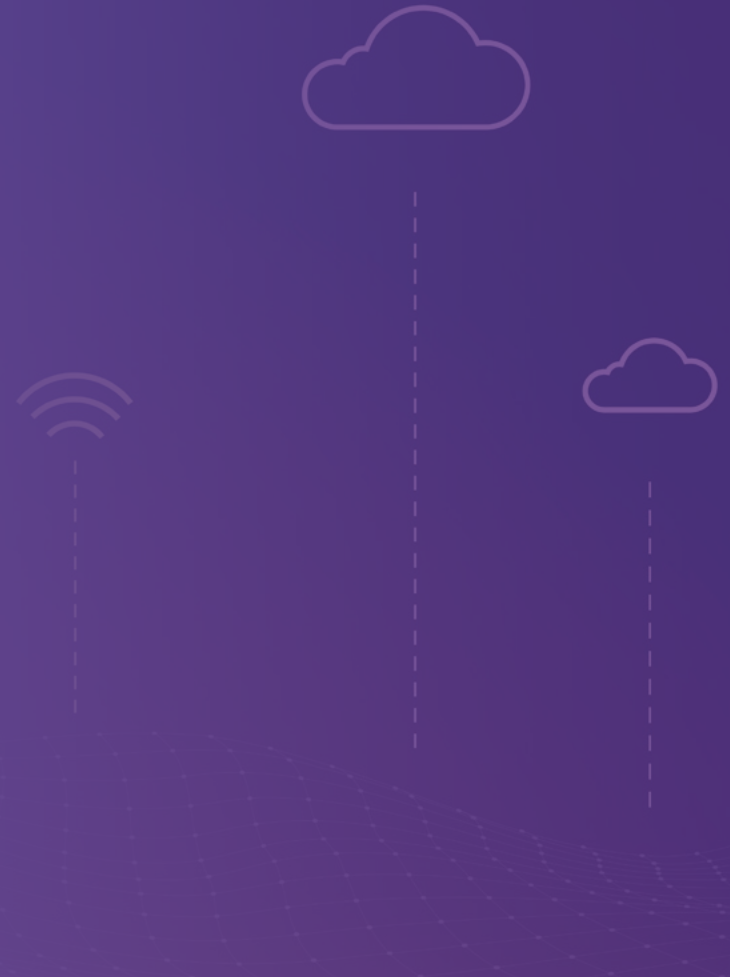
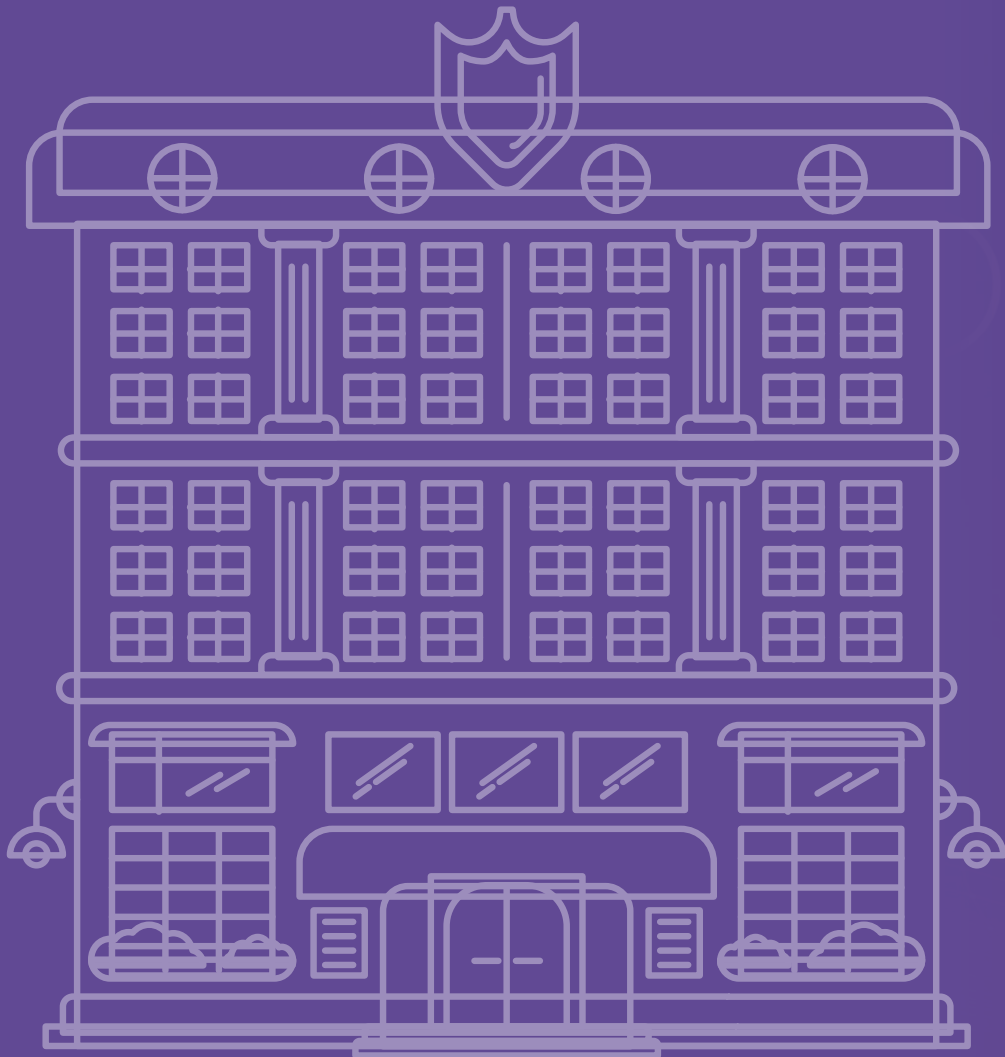
- Keeping “in-flight” data encrypted across the network
- Implementing a “zero trust network access” (ZTNA) approach
- Securing “work from anywhere” endpoints
- Deploying physical or virtual firewalls

## **SECTION 4:**

Three Most Common Healthcare System Architectures

# One: Headquarters Campus Network

This network configuration maintains connectivity (via fiber or 5G) between distinct functions in various buildings and the administrative headquarters/primary data center.



## Two: Core Network

In this scenario, the system headquarters and primary data center connects to one or more regional headquarters in a single state or across multiple states – and it requires healthcare systems to maintain a robust disaster recovery and business continuity (DR/BC) plan with secondary, tertiary, and public cloud-based data centers.

There are several connectivity options to keep headquarters, the primary data center, regional headquarters, secondary, tertiary, and cloud data centers in sync – 10 Gbps – 100 Gbps+ dark fiber, managed dark fiber, managed wavelength, or 100 Gbps Ethernet services. Connectivity to internet service providers and public cloud providers normally involves 10 Gb/s or 100 GB/s circuits.

# 40%

One multi-facility hospital system upgraded its core network from 1Gbps to 10 Gbps to support the bandwidth needs of a new remote emergency room patient video monitoring application, which **decreased annual emergency room mortality rates by 40 percent.**

# Three:

## Wide Area Network

With Software-Defined WAN (SD-WAN), smaller facilities can improve app performance and decrease cost by splitting network traffic between Ethernet and Internet underlay connectivity services.

More specifically, a single site can route non-mission critical network traffic over a business internet service and route more important, latency-sensitive traffic over the 1 GigE or 10 GigE Ethernet service.

One healthcare system replaced physical routers, firewalls, and other devices with virtualized network functions across all existing and new affiliated physician offices. By eliminating the need to manually replace physical devices at each location, they will **save \$3 million.**

With the latest SD-WAN service enhancements, healthcare systems have a choice between deploying an SD-WAN solution via a software-based, virtualized version uploaded onto a universal customer premises device (uCPE) or a dedicated physical device.





## **Secure Access Service Edge (SASE)**

“Working from anywhere,” virtual consultations, medical appointments and remote patient monitoring are all here to stay, though the type of connectivity healthcare providers and patients use – along with their physical locations – differ greatly.

For optimal security, healthcare IT leaders in the healthcare space should consider bundled cloud-based security services like Secure Access Service Edge (SASE) combined with a ZTNA solution. Often, a SASE architecture also includes Cloud Access Service Broker, Firewall-as-a-Service, Secure Web Gateway, Remote Browser Isolation, Data Loss Prevention, etc.

## **Edge Compute Solutions**

Today’s healthcare providers often require near real time access to large sets of structured and unstructured data to make critical clinical decisions for their patients. Many healthcare systems are deploying edge compute solutions for their low latency, mobility, and data processing capabilities.

Most edge compute solutions virtualize multiple applications onto one high-end compute device with a comprehensive software stack that supports multi-tenant workloads through application integration and service chaining.



# Beyond Connectivity and Bandwidth

## Additional Network Considerations

Capabilities on Demand	Today's network designs must remain flexible and easily adaptable to address dynamic bandwidth needs during peak and non-peak time frames.
Network Resiliency	Having "always-on" connectivity is crucial to caring for patients – network congestion and outages can literally be the difference between life and death.
Scalability	Edge compute, distributed cloud, virtual machines, and ongoing advances in HealthTech continue to push network boundaries and accelerate the healthcare industry's digital transformation.
Network Security	End-to-end encryption, physical and virtual firewalls, ZNTA, etc. help prevent data breaches and the financial and reputational repercussions of them.

# Designing Networks for Tomorrow's Innovations

## Operational Factors to Consider

Because networks mostly consist of technologies and solutions from multiple vendors, there are many instances when multiple operations teams need access to various operating and support systems to forecast, provision, and assure services. To say this makes diagnosing and resolving issues difficult is an understatement.

This is why “single-pane-of-glass” operations are so important. Today’s complex networks require an intuitive management tool that easily integrates information from varied sources across multiple applications into a centralized dashboard to manage all aspects of network and service lifecycle.

Transitioning to simplified operations can be accomplished with a single vendor across all network domains or an umbrella operations environment like an orchestra or domain controller operations across suppliers.



## Outsourcing Solutions for Network Operations

Beyond purchasing network connectivity, the administration of the network and its various elements is a consideration, e.g., managed firewall, managed security, disaster recovery, etc. Many healthcare systems possess the skills to manage the network but face competing priorities to operate with the level of proactivity the health system requires.

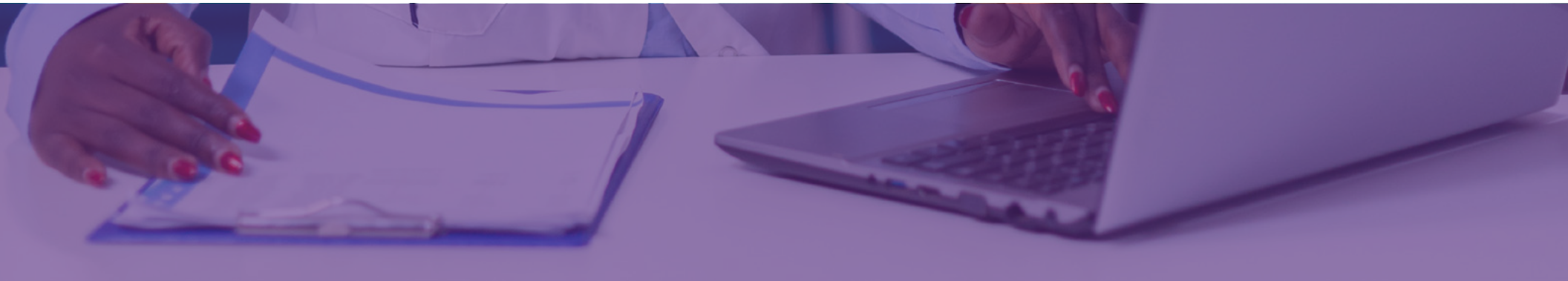
Further complicating things is the health IT staffing shortage. As healthcare organizations continue to expand their networks and adopt more digital platforms in pursuit of connected care initiatives and grapple with extreme data security risks, having access to highly skilled experts in all aspects of network management is paramount.

**Healthcare IT is projected to add 3.5 million jobs between from 2018 to 2028.<sup>6</sup>**

Yet the larger job market trends are seeping into the healthcare industry and creating an unforeseen staffing crisis. At the same time hospitals and health systems need more expertise to achieve their digital transformation objectives, IT specialists can (and are) changing jobs more easily. Even tenured employees have become “flight risks.”

To that end, many organizations are choosing to outsource some or all network operations to a qualified vendor that can remotely monitor and administer the network. Outsourcing partners can also help identify, isolate, and resolve issues quickly and effectively, enabling the health system’s IT team to focus on higher priority strategic initiatives.

Even though it’s impossible to predict the future of HealthTech, IT leaders and service providers must prioritize network agility and ensure they have the optimal strategy, solutions, and staff to perform securely at scale.



# **SECTION 5:** **KEY RECOMMENDATIONS FOR CIOS**

# Key Recommendations for CIOs



Focus on network security. Many are already focused on security but have yet to seize the opportunity of fully converged network and security. Make sure your network strategy encompasses traffic visibility, encryption, and policies and takes a ZTNA approach to keep patients, providers, staff and visitors safe.



Don't over-architect or under-architect your network. It should grow as demand grows to meet your "peak time" needs and stay nimble enough to scale to meet future capacity requirements.



Verify your network's operational integrity. Configure your networks with infrastructure and process reliability, backup connections, and backup sites.



Enable network traffic routing over diverse underlay connectivity services. This is key for multi-regional hospital systems moving away from hub-and-spoke models to more collaborative peer-to-peer models including SD-WAN.

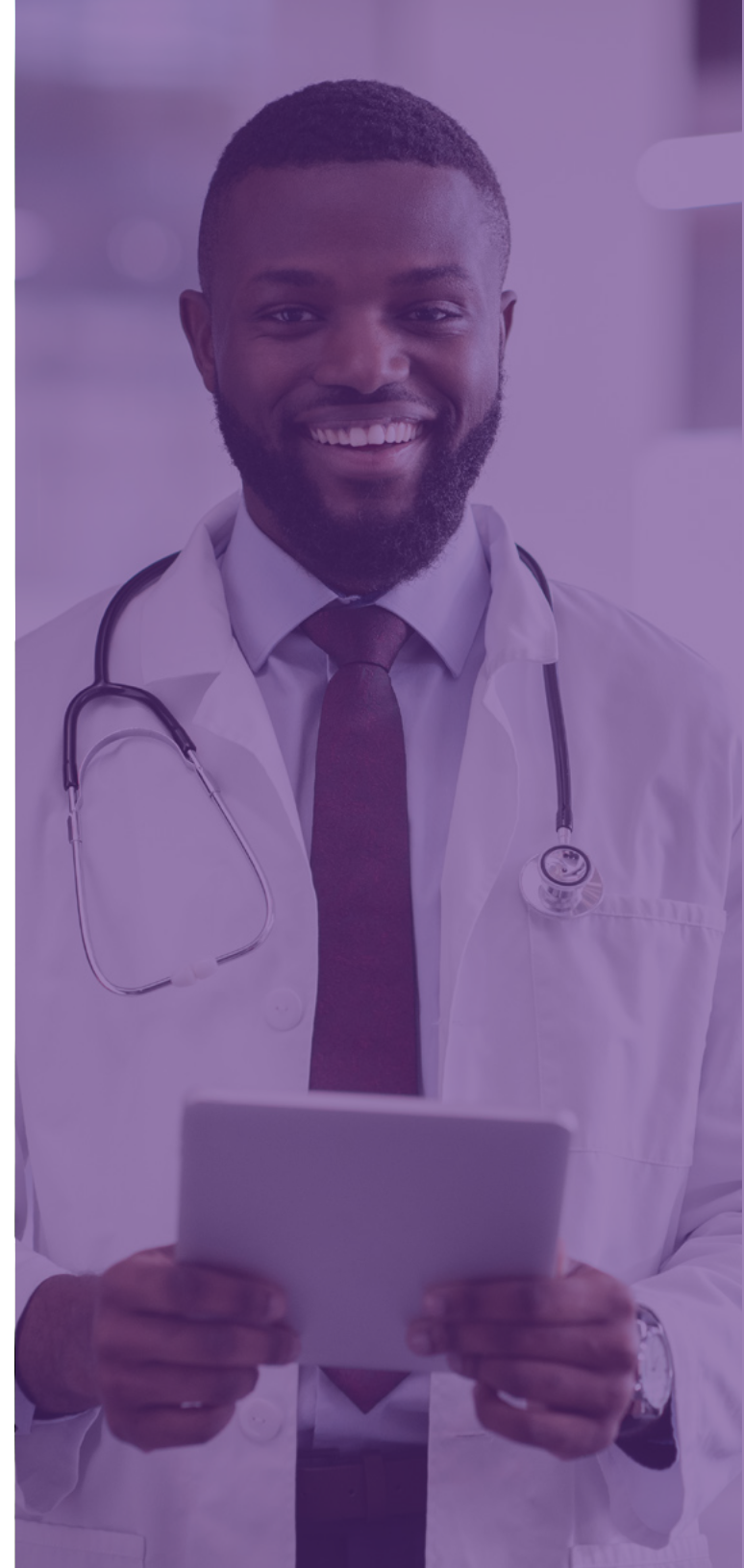


Schedule periodic reviews of the network to address shifting requirements. Make sure your network stays flexible with simple add-ons (like firewalls or VPNs services) and advance to virtualize network functions and edge compute.

# What Healthcare Leaders Must Demand From Network Service Providers

- “Bandwidth on demand” to allow for agility as their needs shift over time
- Flexibility with “service on demand” tools and be able to adjust to fast service turn up as traffic patterns change with ongoing healthcare technology adoption
- High-reliability features (dual site, dual link, operations processes) with matching Service Level Agreements (SLAs)
- Analytics tools to assist with service and network visibility
- Processes and tools for encrypted connections, core edge protection and services to assess security risk
- Aligning “on-demand” network capabilities with flexible contracting so you can grow services as needed.

Given the convergence of network and security along with the rate of application adoption and change, healthcare IT leaders must demand more from service providers – not just in the services themselves but in strategic alignment, advisement, and technical partnership.



# Partner with IRIS Networks

IRIS networks is built on wholly owned fiber assets along with industry leading Ciena technology, which provides a scalable, flexible, high-capacity transport of transit and protects traffic to support the ever-changing demands of the digital healthcare community.

To find out more about how IRIS's solutions can help you provide a higher quality experience for your healthcare system, contact us at

**865-448-4747, [connect@irisnetworksusa.com](mailto:connect@irisnetworksusa.com) or [www.irisnetworksusa.com](http://www.irisnetworksusa.com).**



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## Sources

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<sup>2</sup>IDC Future Enterprise Resilience Survey 2021; <https://www.idc.com/getdoc.jsp?containerId=US47544920>

<sup>3</sup>Cost of a Data Breach Report 2021; <https://www.ibm.com/reports/data-breach>

<sup>4</sup>HIMSS 2022 State of Healthcare Report; <https://www.himss.org/SoH-Report#:~:text=The%20pandemic%20greatly%20accelerated%20healthcare%27s,bringing%20to%20providers%20and%20patients.>

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<sup>6</sup>HelpNet Security; <https://www.helpnetsecurity.com/2021/03/23/healthcare-breaches-outages/>

<sup>7</sup>The Health IT Staffing Shortage Is a Problem Morphing Into a Crisis; <https://hitconsultant.net/2019/10/16/health-it-staffing-shortage-crisis/>