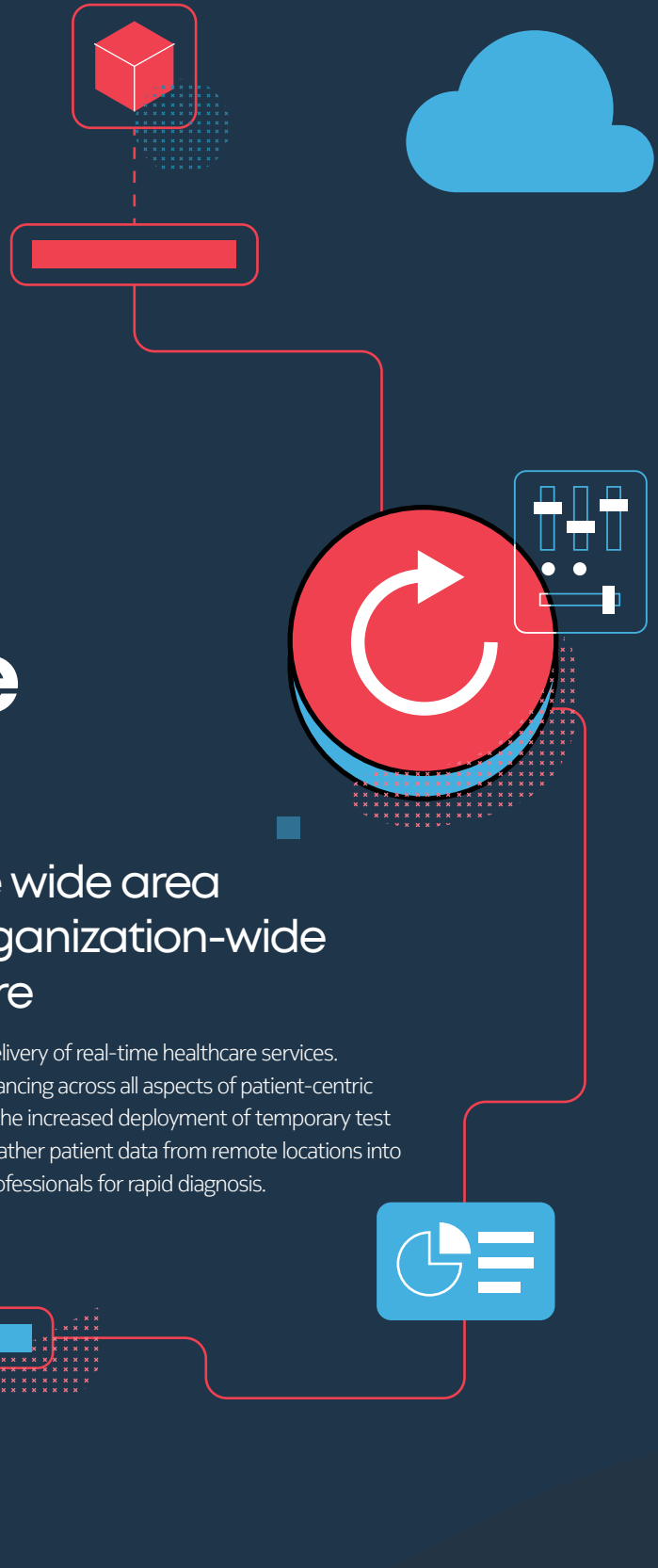![nuagenetworks From Nokia]

Setting the network foundation for real-time healthcare
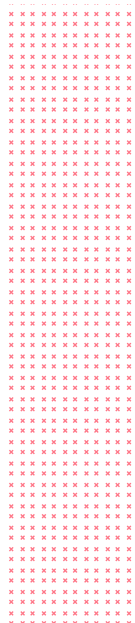
Deploy an agile and secure wide area network fabric to deliver organization-wide benefits of digital healthcare

The effect of today's global pandemic has put a strain on the delivery of real-time healthcare services. The new normal includes an increased awareness for social distancing across all aspects of patient-centric care, be that in the traditional medical center locations, or with the increased deployment of temporary test centers. There has never been a more critical time to securely gather patient data from remote locations into core healthcare applications and make it available to medical professionals for rapid diagnosis.

SOLUTION BRIEF

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Introduction

To absorb the increased patient requirements of the COVID-19 pandemic, preserve the high level of patient care of non-pandemic patients and maintain strong protection for both patient and clinicians requires a universal network fabric. This network needs to deliver consistent service levels across both traditional healthcare sites and any temporary or telemedicine locations.

Our managed SD-WAN service provides an agile, provides an agile, efficient, and cost-effective way for Managed Service Provider (MSP) and System Integrator (SI) partners to meet these emerging healthcare needs.

With Nuage Networks, you can build a multi-tenant accelerated network service fabric for your Healthcare Delivery Organization (HDO) customers that delivers universally available secure and high-performance access to their most critical healthcare applications regardless of their hosted location, be that in the private data center or in the public cloud.

Acceleration of spend on healthcare applications

Gartner highlighted in their 2020 Outlook Presentation on Enterprise IT Spending forecast for the healthcare provider market[1] report that the majority of spend will be concentrated on Software (CAGR 9.1%) and IT services (CAGR 5.9%) for the period 2019 through to 2023.

This increase is driven by five key market shifts that Gartner identified in their 2020 Healthcare insight report on technology investment.

This move to modernize the healthcare software and IT delivery environments had been underway over the last few years, with many HDOs replacing legacy IT hosts and relocating core applications to the cloud.

For most, the speed of change was dictated by the annual budget and the availability of skilled IT resources to securely, and reliably modernize the IT stack around the Gartner identified key changes.

In some instances, significant changes in the diagnosis and delivery of real-time healthcare had already taken place. Examples of this include disease research and remote telemedicine.

Major healthcare market shifts driving healthcare technology investment

Before	Now
Volume-based	Value-based care
Fragmented with 'IT' data silos	Integrated with "Digital" facilitating real-time insights
Healthcare provider-centric	Patient "healthcare-consumer"-centric
IT-role-driven tech buying	Clinical and business roles supported by IT roles
Care in healthcare provider setting	Borderless care delivery (virtual care, telemedicine etc)

Source: Gartner 2020

Compute Intensive Research

Traditionally compute-intensive research was limited by the compute power available within the HDO IT environment. To compensate, some HDOs formed partnerships to utilize partner compute resources in a time-share arrangement. But in both cases, there were still limitations in securing the valuable compute cycles for the research computations and securely moving vast amounts of research data to and from the processing sites.

Today this same compute-intensive research can be conducted more cost-effectively through the public cloud with leading cloud providers, including Amazon, Microsoft, and Google offering cloud computing tailored for intensive research such as Human Genome processing.

Telemedicine

Another trend that emerged recently but is accelerating due to the pandemic is the uptake in telemedicine and remote diagnosis of patient studies in real time. An excellent example of this has been undertaken by US based HDO, UPMC[2].

The UPMC IT and network teams worked alongside their radiology colleagues to deploy a secure SD-WAN based network that linked over 200 of their radiologists' homes to the core IT and radiology devices (MRI, X-Ray, CT scanners etc.) so that real-time diagnosis of the patient studies could be conducted. This delivered three key benefits:

- Convenience for the radiologists, with the removal of the requirement to be onsite within the hospital to perform their role. With this SD-WAN based deployment the radiologist can securely work at home, thus reducing traveling time and improving their work/life balance.

- Real-time access to the patient study while it's taking place. As the radiology study is undertaken the remote radiologist can review the images, make interpretations and direct the operator on the diagnostic study across any of the emergency facilities and hospitals within the UPMC healthcare network. This resulted in enhancing patient-centric care.

- 24x7 remote access at all UPMC sites (central, suburban and regional locations) to specialist radiologists including neuro and muscular-skeletal radiologists which removed the need for the patient to travel long distance for expert diagnosis.

UPMC delivers a consistent 24/7/365 access to radiologist professionals regardless if the patient goes to the hospital at 3am in the morning or 4pm in the afternoon, service levels remain first class.

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1   Outlook presentation based on Gartner's "Forecast: Enterprise IT Spending for the Healthcare Provider Market, Worldwide, 2017-2023, 3Q19 Update."

2   https://www.upmc.com/ and video case study of remote radiology benefits by UPMC radiologist Emanuel Kanal on YouTube at https://www.youtube.com/watch?v=5xwHDpWyYg4

In both cases there is a need for a flexible, secure and seamless network extension. For research using the cloud, this means networking that delivers timely access to the cloud with the ability to automatically adapt to the changing demands of an on-demand computing environment, including not only the connection from the HDO to the cloud but also the in-cloud networking to seamlessly connect multiple virtual machines or containers for the duration of the research project.

And with the remote telemedicine example, it's the secured extension of the healthcare network over the internet and into the radiologists' home. This is where the centralized policy management of SD-WAN comes to the fore, with its centralized policy management and hardware-based IPsec encryption technologies.

Universal Network Fabric

These two examples highlight the need for a new organizational-wide networking environment that reaches out past the traditional boundaries of the healthcare wide area network. They illustrate the cost benefits of bursting to the cloud for intensive compute and the increased patient-centric healthcare benefits of remote radiology. But the benefits of a new network architecture don't stop at the edge of the healthcare network.

Organization-wide benefits come from the deployment of a boundaryless network that enables the Gartner trend of 'Borderless Care Delivery'[3], and that's where the drivers emerge for a universally available network fabric that stretches across the traditional healthcare locations to the public cloud, and to remote telemedicine environments; be that a specialist's home or to the 'pop-up' medical testing facilities required for pandemic testing and control.

Historically, the wide-area network has been separated from any large-scale application change, mainly due to the network being in place for all applications and the separation of the IP centric network team from the IT-focused application team(s). Decisions tend to be made about the application, its choice, hosting location, where its end-users are, etc., and the network is assumed to be in place to deliver the connectivity.

This can result in project delays once the network team is engaged and told about the application needs, which has the flow-on effect of possible network upgrades, be that more bandwidth to sites, new circuits, or even equipment upgrades to the routing and security infrastructure with the latter raising the question of who pays for the network upgrade.

Gartner noted in the 2020 Outlook Presentation on Enterprise IT Spending forecast for the healthcare provider market that the network, or as they term it, Fixed Network Services tends to be sidelined into an investment bracket with little budget growth (0.2% CAGR 2019-2023), but as highlighted above, this mismatch in funding between the new application and the underlying network infrastructure can cause rollout delays or unexpected capital investments.

This historical disconnect between the worlds of IP and IT has been overcome with the emergence of Software Defined Networking (SDN) and its deployment case for the wide-area; Software-Defined Wide Area Networking (SD-WAN).

SD-WAN has emerged as the first WAN technology that is oriented top-down (IT-focused delivery) as opposed to bottom-up (IP focused) networking, and as such, it brings the potential to rearchitect the way the healthcare wide area network delivers for the applications. And this is no more evident than in the core deliverables of SD-WAN and how it delivers a universal network fabric across the whole healthcare environment versus the traditional IP-VPN (MPLS).

SD-WAN	IP/MPLS WAN
Is fully application aware (layer 2 to layer 7)	Is only aware of the network (layer 2 – layer 4)
Forwards traffic based on application flows	Forwards based on packet by packet, no context of a stream of application data (flow/session)
Has embedded security built into the core of the network service via policies including Layer 7 Access Control Lists (L7-ACLs), IDS/IPS, stateful firewall	Has basic network layer security (ACL) and relies on costly dedicated appliances for firewall, IDS/IPS and application aware (DPI) functions
Understands applications and has centrally enforced application specific policies to control application usage and access to any point of the WAN.	Lacks deep understanding of the application (limited to Layer 3 & 4) and has no concept of network wide policy so forwarding rules are individually performed by each router
Seamlessly supports multiple transport technologies (fixed, wireless, public or private) and separates the transport (underlay) from the WAN (overlay)	Is tightly integrated at the WAN service and IP transport layers which limits the flexibility to mix and match transport technology on a per site basis

3   Gartner Market Insight: 2020 Technology and Service Provider Agenda for the Healthcare Industry. Document ID G00464722

With its application led focus and ability to separate WAN service (overlay) from the transport service (underlay), SD-WAN delivers a fresh approach to building-wide area networks.

An approach that has allowed HDOs to drive greater flexibility and resiliency out of their wide area network without a major increase in budget. This is achieved via three avenues:

- Right-sized IP transport on a per-location basis
- Simplification of the branch by removing dedicated network appliances
- Reduction on day-to-day operations via intuitive customer portal-based moves, adds, and changes

Being able to pick and choose from available carrier services on a per-site basis allows the HDO to select bandwidth within a competitive marketplace. Rather than increasing bandwidth to the site on expensive MPLS, the HDO could complement (or replace at their discretion) MPLS with high-speed business internet. This allows them to cap the spend on MPLS and gain a higher throughput at the site whilst taking advantage of the lower cost per bit of internet transport.

Simplification of the WAN at the healthcare location is also possible by the retirement of dedicated network appliances (firewalls, etc.) and the embedding of those functions directly into the SD-WAN service as security policies.

Lastly, with the customer-centric management portal provided by the managed SD-WAN service, the overall complexity of operating the WAN is reduced whilst the increased visibility into the application traffic traversing the WAN provides richer information on application performance.

This increases the diagnosis capabilities of the network team with intelligence into the real-time usage and performance of healthcare applications both across the whole WAN and on a location basis.

Nuage Networks Managed SD-WAN Service

The managed SD-WAN service (Nuage managed SD-WAN) is ideally is ideally suited to meet the new demands of the healthcare delivery organizations due to its ability to deliver boundaryless networking across the traditional healthcare sites, deep into the public cloud, and to any pop-up medical facilities or specialized homeworking sites.

As a managed service offering delivered to HDOs from their trusted Managed Service Provider (MSP) or System Integrator (SI), it fits with the market trend across all enterprise verticals of the preference for SD-WAN to be provided 'as a service.' This trend is acknowledged by leading analysts' companies, including IDC and Appledore, whom both see the market shifting to managed solutions. With this trend, there has

emerged a new WAN operating model that meets the needs of the HDO, and that's co-managed WAN service.

In this model, it's the responsibility of the MSP/SI to operate the platform (a task Nuage does for them), ensuring the that network service platform is maintained and hosted with capacity growth, etc. but the HDO maintains some level of control over the day to day management of their WAN. At its simplest form, just visibility into the running conditions of the WAN and the applications or more hands-on with shared responsibility for moves, adds, changes and deletions on the healthcare WAN.

This allows the HDO to set a responsibility matrix that meets their need, maybe that's having the visibility and control to affect network or application performance on a location by location basis, and to let the MSP/SI own the changes that affect overall WAN performance and/or maintenance tasks such as software upgrades.

Application-aware networking

At its core as an application-first solution the Nuage Networks managed SD-WAN service delivers full visibility and control of each of the healthcare applications traversing the WAN, such as the widely deployed VDI / thin client applications deployed for frontline healthcare staff.

With VDI, network performance is critical, so network and application policies can be created that prioritize VDI over and above general office traffic. This prioritization can be extended into groups of applications. For instance, an application policy group called 'priority healthcare' could be set up with the HDOs VDI and Electronic Health Record (EHR) applications prioritized as a group over general office traffic such as Office 365 or general internet.

This application-aware networking capability can also be extended to segment or isolate certain healthcare traffic into secured network slices.

An example could be to isolate any radiology machines from the general hospital LAN and allowing the SD-WAN service to make an application-aware traffic-steering policy that chooses the best WAN path for this with regard to the sensitivity and high-bandwidth requirement. Depending on the priority and sensitivity of this traffic (or of any other), the SD-WAN service can encrypt the application flows using IPsec and forward over the available WAN uplinks, be they private MPLS or public internet.

Reaching deep into the cloud

As per the aforementioned Gartner study, there is an investment trend on the placement of both core and periphery healthcare applications away from dedicated IT hosts to virtualized compute platforms within a public or

> Gartner predicts that by 2024, at least 40% of enterprises will have explicit strategies to adopt SASE, up from less than 1% at the end of 2018.
>
> # 40%

private cloud environment. One of the key trends in this area has been the movement of Electronic Health Record (EHR) from proprietary hosts to cloud services such as AWS and Azure, with industry-leading SaaS vendors EPIC and Cerner promoting cloud hosted options.

As with any relocation offsite, it's critical that information security is viewed holistically, and that includes the network. With Nuage Networks' managed SD-WAN service, this is inherently provided through the deployment of SASE-PoP functions.

SASE or Secure Access Service Edge[4] has been coined by Gartner as the delivery of both SD-WAN and Security functions as a managed service, and Nuage has adopted this framework for connections to the public cloud for both virtual compute and application (SaaS) use cases.

As part of the service, Nuage has invested in SASE-PoPs (Points of Presence) in key locations that facilitate the secure interworking to the cloud and SaaS applications. The feature provides flexibility to utilize either public internet or private connection services (express links) to the major cloud providers and either direct to SaaS or via Cloud Service Access Brokers (CASB) services such as Zscaler or Palo Alto Prisma.

The benefit to the HDO is that any connections to the cloud or SaaS applications inherit the same application-aware network and security policies that are implemented by the HDO on their SD-WAN service instance. So, for cloud-based deployments, the business/information security rules are identical to those implemented at the traditional healthcare sites (hospitals/medical centers) this means a single IT management domain at the HDOs physical and virtual network endpoints.

Telemedicine and temporary locations

With its ability to securely utilize any IP transport service as the underlay, the managed SD-WAN service can be extended into the homes of health professionals (like the UPMC radiologist example earlier) or to temporary medical testing facilities and third-party laboratories such as those set up for COVID-19.

In these cases, public internet and/or mobile broadband connections can be used as the underlay transport. SD-WAN supports multiple WAN uplinks with both active/standby or active/active deployment supported. When coupled with the application-aware policy features, this allows for a comprehensive use case with policies able to selectively encrypt all or some applications and select which applications go across each uplink.

For instance, if a remote testing location has fixed internet with mobile broadband as a backup, a policy could be enforced in the event of an outage of the fixed connection to block general internet browsing from using the mobile broadband so that usage was limited to encrypted healthcare applications only.

In both of these cases, the extension of healthcare WAN services to these locations is easily achieved. The MSP/SI can empower their HDO customers to enable teleworking by deploying a Nuage Networks SD-WAN gateway (7850 NSG) at the location, leveraging an easy to deploy zero-touch provisioning (ZTP) process that minimizes high-skilled IT support involvement.

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4   https://blogs.gartner.com/andrew-lerner/2019/12/23/say-hello-sase-secure-access-service-edge/

Conclusion

The Nuage Networks SD-WAN solution is recognized by industry analysts such as ACG Research as being the global leader (#1) in Managed Service Provider SD-WAN deployments[5].

With a managed service delivered on purpose built multi-tenancy SD-WAN technology, healthcare delivery organizations can seamlessly integrate all parts of their network, including their core sites, any cloud deployments, and any remote medicine locations without compromise.

By leveraging Nuage Networks' managed SD-WAN service, MSPs and SIs can remove risk and get to the market quickly with their own branded SD-WAN service.

In partnership with Nuage, the MSP/SI can offer market-leading SD-WAN powered universal network fabric services to their healthcare customers that set the foundation for real-time patient-centric healthcare delivery.

5 - ACG Research Market Release SD-WAN and VNF Report 1H2020, vendor market share from Service Provider revenue.