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A Frost & Sullivan White Paper

Digital Infrastructure: The Key to Success in Modern Healthcare Delivery

Healthcare Innovation Powered by Evolving Infrastructure, Personalised Digital Engagement and Ecosystem Data Exchange

FROST & SULLIVAN

Contents

Introduction and Objective

The healthcare industry is in the midst of a transformative shift, and the COVID-19 pandemic has only accelerated it from clinical and operational standpoints as systems around the world continue to struggle with rising costs, aging populations, the prevalence of chronic diseases, and shortages of skilled professionals.

Digital health solutions and enhanced digital infrastructure will enable new care delivery models, expand access, and improve patient outcomes and clinician efficiency.

Digital health[1] connects and empowers people and populations to manage health and wellness, augmented by accessible and supportive provider teams working within flexible, integrated, interoperable, and digitally enabled care environments that strategically leverage digital tools, technologies, and services to transform care.

About 99%[2] of healthcare organisations are in various stages of digital transformation. The volume of health data created annually continues to increase: estimates put new data generated in 2020 at 2,314 exabytes[3]. Aggregating and analysing this data is the needed step to derive actionable insights for patient-centric and evidence-based healthcare delivery. Robust data sets generated across the care continuum can be brought together to develop insights that can improve the quality and efficiency of healthcare, optimise costs, and engage consumers. This requires collaboration among stakeholders across the value chain; with secure connectivity, access, management, and analysis of data at optimum cost, the quadruple aim of healthcare can be achieved.

Healthcare providers are not focused on digital transformation efforts purely to stay ahead of the innovation curve; they also see it as an effective way to ensure that their facilities can offer superior patient experiences across the continuum of care, securely engage staff and clinicians, and have the ability for localised analytics as they aggregate data for both research and health outcomes. To achieve these outcomes, several questions must be considered:

- What factors are driving digital transformation in healthcare?
- What challenges will healthcare providers face while embarking on digital transformation?
- How can healthcare providers ensure a superior digital experience while transforming legacy infrastructure and onboarding new solutions, especially to cater to local experience and interaction?
- Does establishing a core digital infrastructure (with access to a broader and expanding partner ecosystem) enable healthcare providers to accelerate healthcare innovation?

Digital infrastructure includes assets and resources that enable organisations to support the use of data using information technology capabilities, such as digital communication, computing, or data storage.

This white paper elucidates the need for robust digital infrastructure to help healthcare providers adopt cutting-edge technologies that contribute to improved outcomes.

1. Introduction: Healthcare Market Challenges

- Healthcare providers, in their quest to ensure the efficiency of care while optimising costs and resources, are faced with challenges in terms of data management and managing multiple workflows.
- The transition to patient-centric care requires predictive insights to enable clinicians at the point of care.
- The expansion of hospital provider networks requires a core digital infrastructure, edge computing capabilities, and access to a broader partner ecosystem.

Digital Transformation of the Care Continuum to Address Healthcare Challenges

The healthcare industry is going through a transformative phase, addressing the challenges posed by evolving patient demographics, rising healthcare expenditure, expanding roles of stakeholders, and the increasing collaboration between clinical and non-clinical functions within and outside of hospital provider networks. With a more decentralised, patient-centric model driven by multi-disciplinary approaches to care delivery, improved care coordination, and increasing healthcare consumerisation, digitalisation of the healthcare value chain will be critical.

Healthcare data as the key enabler for digital transformation

For healthcare providers to harness the immense potential of patient data and use it to support clinical decisions, they need to aggregate, store, analyse, and share information from multiple sources. In 2020, hospitals had to readjust their workflows in response to the COVID-19 pandemic as they limited inpatient care to emergencies, established temporary facilities, and used telehealth to manage outpatient consultations, collaborate with employees, and ensure business continuity.

This was easier said than done, considering the need for interoperable IT infrastructure to integrate various workflows and care pathways within and outside of the hospital network, further complicated by gaps in the complex value chain.

Figure 1: Opportunities for Digitalisation of Healthcare Provider Value Chain

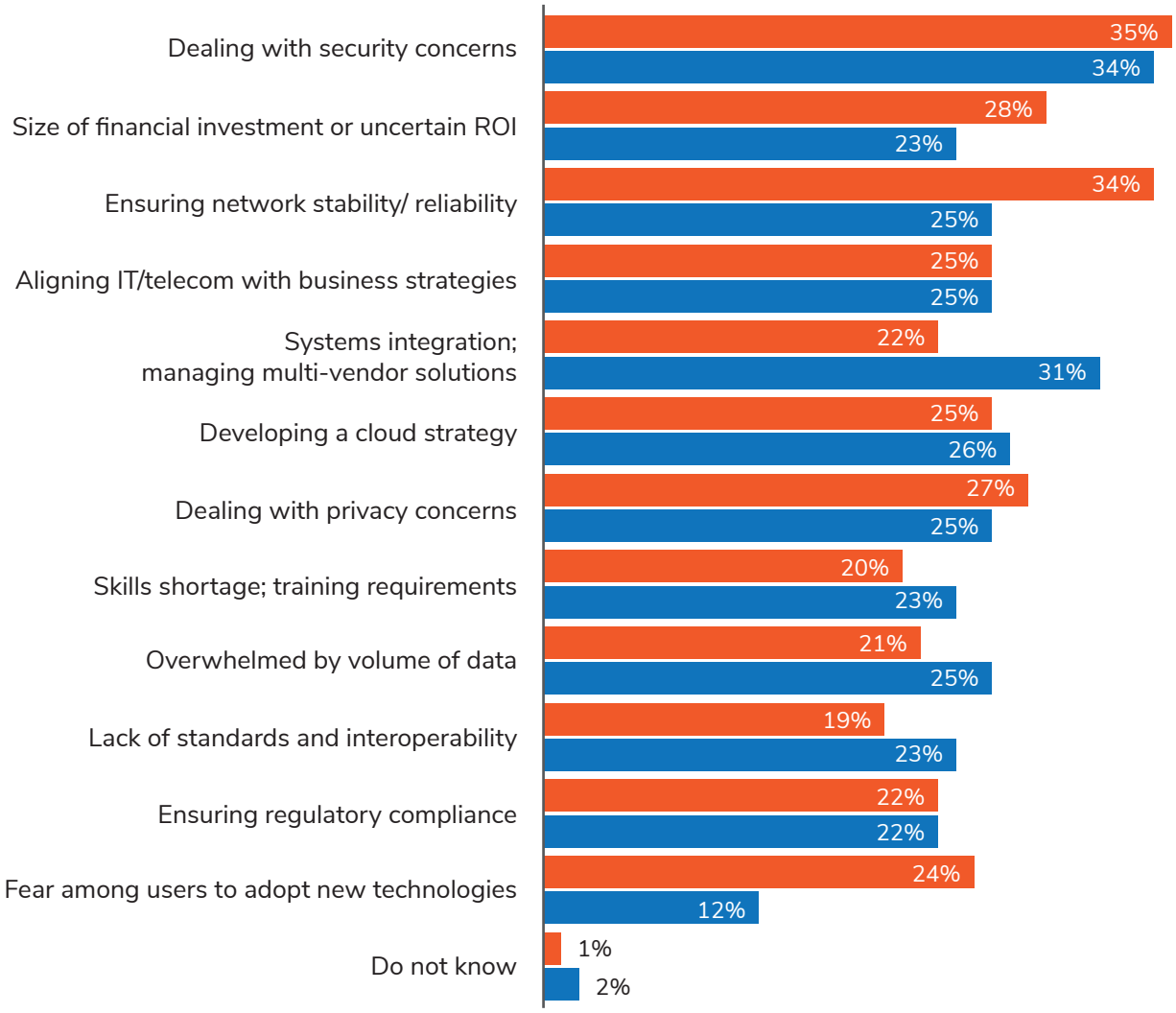
	Internal Operation Digitisation	Care Delivery Digitisation	Connected Devices	Connected Patients
Application Areas	Digital tools and approaches are making internal business functions more efficient and cost-effective.	Various facets of the care delivery process, from internal administrative tasks to clinical training and daily-use tools, can benefit from digitisation and the insights it generates.	Medical devices are becoming smarter and Internet of Things (IoT)-enabled to provide operational data for asset performance management in the hospital setting and to improve patient care.	Real-time patient data from any connected device or data recorded in an app is the backbone for personalised medicine.
Expected Outcomes	Improve operational efficiency and cost margins	Increase care access; support physicians in care delivery	Improve operational efficiency and patient outcomes	Improve patient experience and outcomes

Challenges

- Silos in data storage and management
- Ensuring access without compromising privacy or security
- Real-time data integration, connectivity, authentication, and sharing across multiple stakeholders and sources
- Analyse and predict end-user behaviour and improve engagement and outcomes

Health IT and digital health adoption increased multifold in 2020-2021. The rapid move to telehealth, virtual care coordination, and remote resource management emphasised the need for cybersecurity to ensure the safe handling of protected health information in accordance with relevant regulations, some of which are evolving. As the pandemic continues to test healthcare providers, regulations, methods of care, and technology also are adapting.

Figure 2: **Top IT Challenges of Healthcare Providers**



Frost & Sullivan Survey on Digital Trends in Healthcare, with 198 participants globally; 56% of the respondents were healthcare providers and 29% were from Asia-Pacific, July 2020

Healthcare providers are recognising that:

- Digitalisation requires scalable and agile infrastructure that brings together various components, functions, and stakeholders across the value chain while ensuring that the goals of care coordination are cost-effectively achieved through the standardisation and management of disparate sets of data from multiple sources and multiple vendor ecosystems.
- Long-term priorities will need to be evaluated, and a healthcare IT strategy will need to evolve accordingly; for instance, hybrid care through a combination of telehealth and in-person visits will resume once the surge in demand for virtual consultations in the wake of the pandemic abates. Localised deployments will improve user experience and ensure digital engagement.

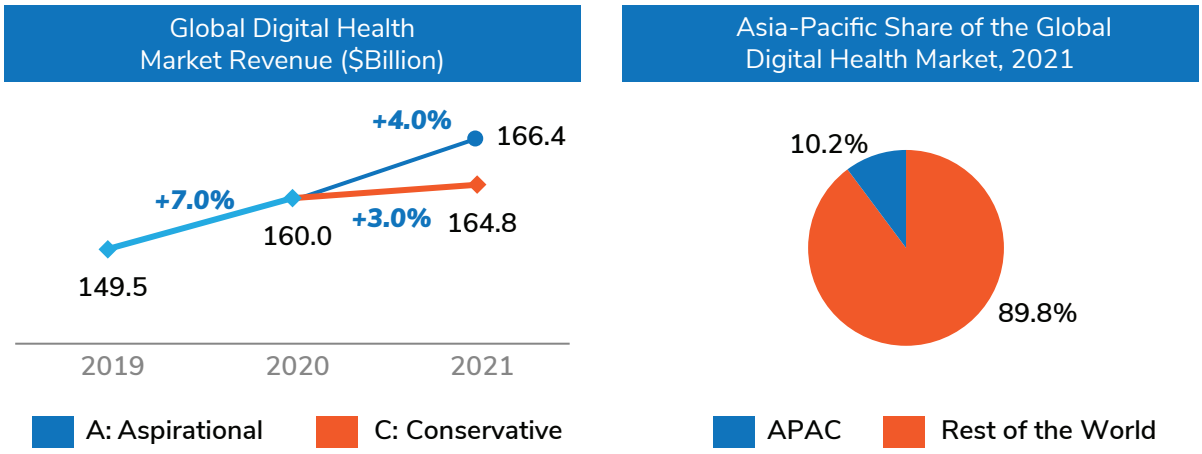
Developing and maintaining a digital ecosystem will require collaboration at the technological, system, provider, and clinician levels. It will be critical to have a core infrastructure foundation and partner network in enabling digital transformation.

2. Disruption: Impact of Digital Transformation on Healthcare Delivery

- Digital health initiatives are in various stages of implementation around the world. Variables include the amount of public and private investment, regulatory policies, and national or regional e-health strategies.
- Demand is increasing for virtual healthcare services, clinical decision support, and healthcare data analytics for a more personalised care paradigm. Advancements in artificial intelligence (AI), the IoT, and cloud computing will propel digital health tools to the next level.

Digital health enables proactive, predictive care at the individual and population levels, connecting patients and caregivers in a secure environment that protects electronic health records (EHRs).

Figure 3: **Global Digital Health Market Dashboard**[4]



Digital Health Initiatives Accelerating the Transformation of Healthcare Delivery

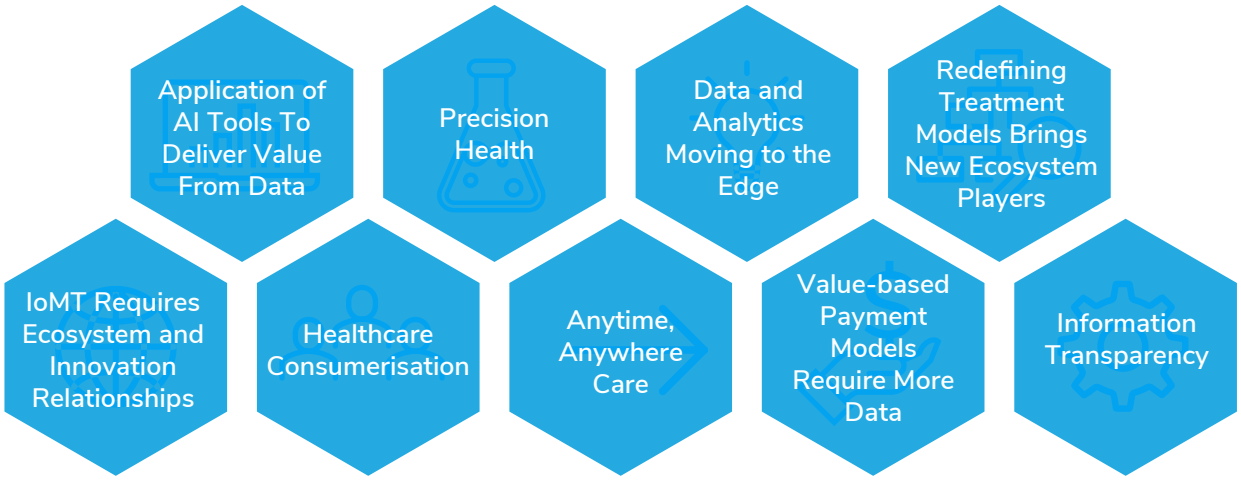
Digital health is influencing how healthcare professionals interact with patients; how patient history, documentation, and data (such as test results and imaging) are shared among providers; and how clinical decisions are made. It also moves healthcare delivery beyond the walls of a hospital or doctor's office to the remote and virtual realms for teleconsultation and patient monitoring.

Regional healthcare systems' e-health initiatives focus on establishing healthcare IT infrastructure, including EHRs and connected, interoperable devices. For instance, the EHR program of Australia, My Health Record System (previously known as Personally Controlled Electronic Health Record) was initiated in 2009; by 2019, 90% of the population has a personal health record. In 2020, in the wake of the pandemic and bush fires, the government together with public-private health partnerships made investments in telehealth and virtual health services (including for mental health and aged care), AI, interoperability, health informatics, and e-referral and booking capabilities. Telehealth became a vital part of the primary care model, with Medicare subsidising telehealth as well as electronic prescriptions and home delivery of medicines. As a result, more than 30 million healthcare services were funded under Medicare for telehealth since March 2020 as compared to 394,000[5] in March 2019.

The potential of healthcare data in enabling care outcomes

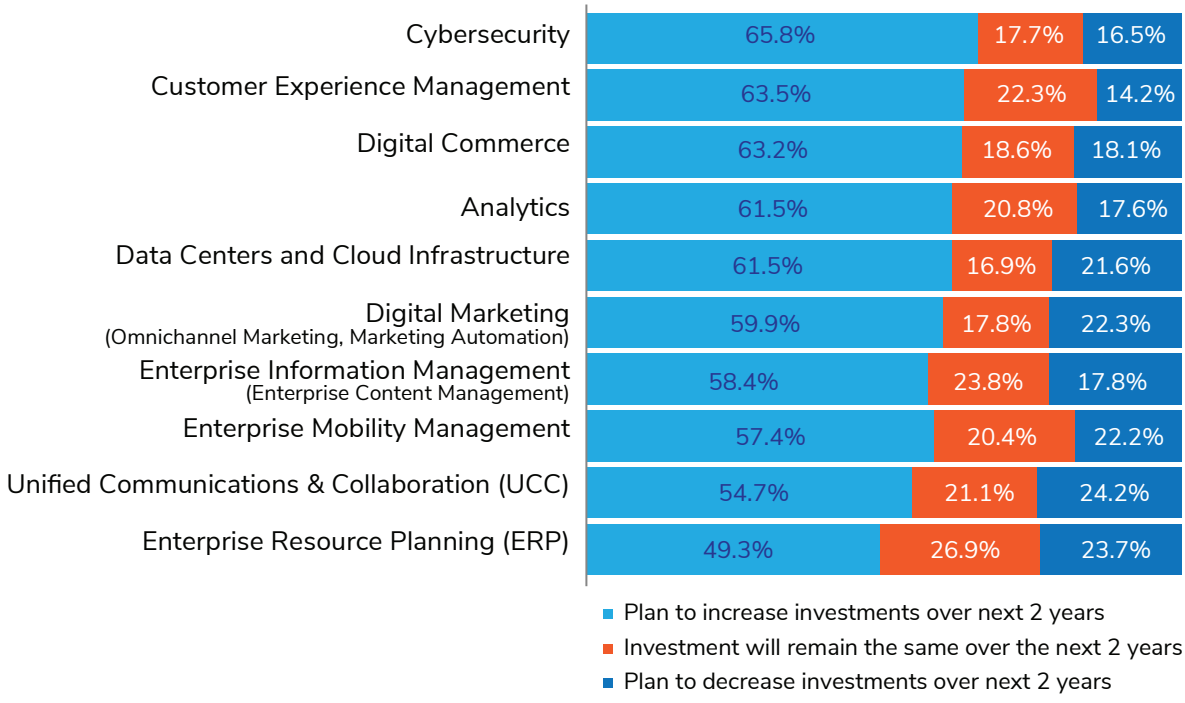
Technologies that make care more accessible and transform personal healthcare information into evidence-based, actionable insights offer myriad possibilities for new models of care in a digitally enabled environment.

Figure 4: Enablers for Data-Driven Decisions



Healthcare providers are adopting Big Data solutions to achieve the cost and outcome efficiencies promised by digital health. Big Data combines with advanced analytics to generate insights into treatment regimens and clinical workflows, but none of this is possible without robust infrastructure.

Figure 5: Investments in IT Infrastructure by Healthcare Organisations[5]



Frost & Sullivan Survey on Digital Trends in Healthcare, with 198 participants globally; 56% of the respondents were healthcare providers and 29% were from Asia-Pacific, July 2020

Technology adoption is not without challenges

With Big Data analytics, AI, and the Internet of Medical Things becoming mainstream, managing and maintaining all computing and storage facilities in-house will become cost-prohibitive.

This is where cloud infrastructure service providers can offer scalability and flexibility by converting fixed-cost infrastructure into variable-cost service offerings while supporting cutting-edge compute- and storage-intensive applications.

Cloud services support:

- The hosting of EHR, billing, and patient data
- Big Data, predictive analytics, and AI applications for clinical decision support
- Virtual healthcare services for remote monitoring and care delivery
- Business continuity and disaster recovery capabilities for critical health IT applications

For cloud-based infrastructure services to succeed, legacy infrastructure must be upgraded and mechanisms must be in place for onboarding new healthcare IT solutions and ensuring informed patient consent and compliance with data regulations and security standards.

Healthcare providers are increasingly looking to manage both on-premises and cloud capacity while ensuring localised management of assets. They also have to ensure that infrastructure partner capabilities evolve with the expanding ecosystem of applications and data sets. As a result, demand is increasing for hybrid multi-cloud deployments, which will enable healthcare providers to be agile with their digital transformation goals.

Hybrid multi-cloud deployments give healthcare providers the best of both worlds: on-premises asset management to comply with data sovereignty and privacy laws and agile public cloud capacity that can evolve as application and data set needs change or accommodate unanticipated workloads.

22% of healthcare organisations consider their digital transformation effort to be lagging compared to the others within the industry[6].

Multi-cloud adoption skyrocketed in 2020, up 54%. Hybrid cloud adoption is up 14%[7].

3. Bridging the Gap: Healthcare Provider Pain Points and Barriers to Support Digital Transformation

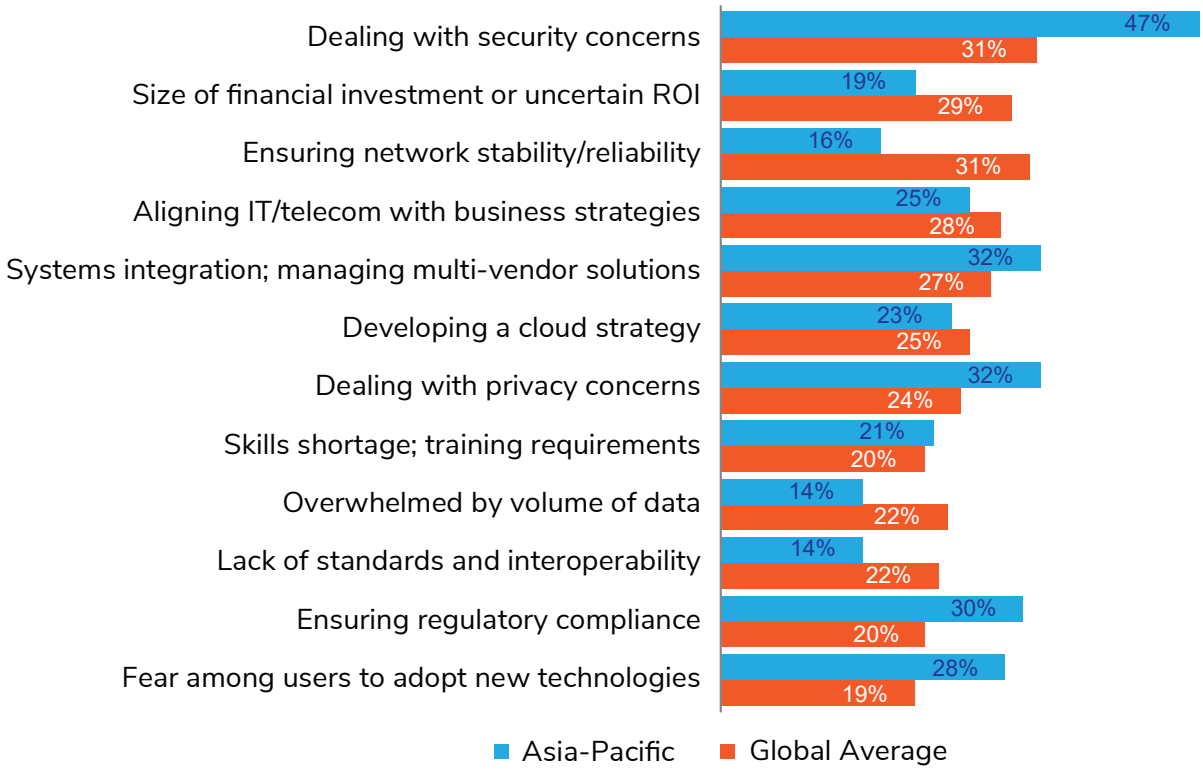
- Healthcare providers are navigating the complexity of multi-cloud environments and workflows. Growing computational needs, and security and regulatory requirements regarding protected health information, only add to the complexity.
- Collaboration among healthcare providers and vendor partners will allow for the localisation of assets and the deployment of best-of-breed digital services (e.g., telehealth) close to partners and customers.

In the Asia-Pacific region, demand for healthcare services is increasing because of a larger elderly population and a high incidence of chronic as well as communicable diseases. This further burdens healthcare systems already dealing with budgetary constraints, poor infrastructure, and staffing shortages. According to the Organisation for Economic Co-operation and Development (OECD), there are only 2.6 doctors per 1,000 people in the region, compared with the global average of 3.4 per 1,000[8]. Inequality in care distribution is high, especially in lower-middle and low-income countries, with 1 doctor and 1.5 nurses per 1,000 people. Care delivery is especially sparse in rural areas.

Digital health initiatives driven by government investments are on the rise in the region to make healthcare more accessible and affordable to a larger population. Singapore, Australia, and South Korea are leading in digital health initiatives with long-term investments in healthcare infrastructure such as electronic medical records, telehealth, and virtual healthcare services. With a strong foundation established in terms of digital health records, healthcare systems in these countries are looking at proactive and precision healthcare delivery by employing cutting-edge technology that enables tracking of health and well-being at individual and population levels. India, too, is entering the space with a $23 million program for providing digital health ID to every citizen[9].

Smart devices and the internet allow for healthcare at consumers' fingertips. During the pandemic, most Southeast Asian countries employed digital health technology including wearables, mobile apps, and telehealth for contact tracing, social distancing, and virtual care support. With revenue declining because of fewer elective procedures and less medical tourism, many leading private healthcare facilities are moving towards digital business models. For instance, 130[10] "internet" hospitals established in China since 2014[10] offer a mix of online and offline access to medical facilities using a digital platform. Telemedicine, remote monitoring, and digital therapeutics services offered in such facilities are showing an annual growth rate of 60%[10].

Figure 6: Top IT Challenges in Asia-Pacific



Frost & Sullivan Survey on Digital Trends in Healthcare, with 198 participants globally; 56% of the respondents were healthcare providers and 29% were from Asia-Pacific, July 2020

Despite countries' varying levels of digital health maturity, healthcare providers' needs in the region are common:

- Healthcare delivery is moving beyond the confines of hospitals, and providers are exploring new business models including tele-triage, virtual consultations, and remote monitoring, and surveillance.
- For a patient-centric care paradigm to be successful, healthcare data collection, management, and exchange must be efficient. A connected and interoperable healthcare ecosystem leveraging the IoT requires medical devices, equipment, and digital tools to integrate effortlessly. With an increasing number of vendor partners, scalable infrastructure is a must.
- Analytics and the sharing of sensitive individual- and population-level data require robust cybersecurity.
- Digital engagement across the care continuum, and among multiple stakeholders, requires secure multi-channel data access.

Edge deployments will enable access to the large amounts of data that connected medical devices generate for real-time decision-making.

Case in Point

Digitalisation of care pathways to ensure a multi-disciplinary approach to patient care

In a typical physician-patient encounter, the physician accesses patient history, orders tests, and uses results or collaborates with clinical specialists to make a diagnosis and prescribe a treatment regimen. Other workflows, such as documentation, billing, and revenue cycle management, require access to multiple data systems and a variety of stakeholders.

Digital infrastructure allows for secure multi-channel access and sharing of clinical data among multiple stakeholders and sites. Healthcare providers' traditional infrastructure does not always have the capabilities to meet the needs of digital healthcare.

A hybrid core infrastructure enables healthcare providers to expand access to multiple clouds securely and localise assets closer to facilities, patients, and vendor partners to reduce latency and costs.

4. Solution: Infrastructure as a Foundation to Accelerate Digitalisation

- Healthcare infrastructure is fragmented across the Asia-Pacific region, and digital health solutions offer the promise of making healthcare more accessible, affordable, and equitable.
- To elevate the quality of care, healthcare providers are looking at hybrid models of care delivery, which require digital infrastructure capabilities.
- The majority of healthcare providers do not have the in-house skills to develop and manage a core infrastructure foundation with access to networks, clouds, and a broader healthcare ecosystem.

The Asia-Pacific region accounts for 60% of the world's population[11] and more than 20% of the global disease burden[15]. The region's healthcare expenditure is growing at 7% annually[12], outperforming gross domestic product growth and signifying that the burden of rising healthcare costs is higher than the region's ability to manage it economically. The countries in the region have marked variations in terms of healthcare spending, policies, and resources, which has resulted in inequities in standards of care. Proper healthcare infrastructure can make health and wellness accessible, affordable, equitable, efficient, and high quality, but private sector resources have been largely devoted to secondary and tertiary care (especially in cities), leaving the public healthcare sector significantly underdeveloped in terms of distribution, operation, and quality.

Healthcare providers face several major infrastructure challenges:

- Integrating multiple data sources and consolidating vendor and partner footprints
- Scaling efficiently based on demand, especially the ability to upgrade legacy architecture and introduce new workflows
- Ensuring secure information exchange within and outside of the healthcare system
- Introducing viable business models for healthcare delivery that ensure accessible care (e.g., telehealth and remote monitoring)
- Shifting from data collection to actionable insights for clinical decision-making (e.g., analytics and population health management)
- Maintaining business continuity with a solid disaster recovery plan
- Managing cybersecurity and privacy in compliance with regional regulatory requirements

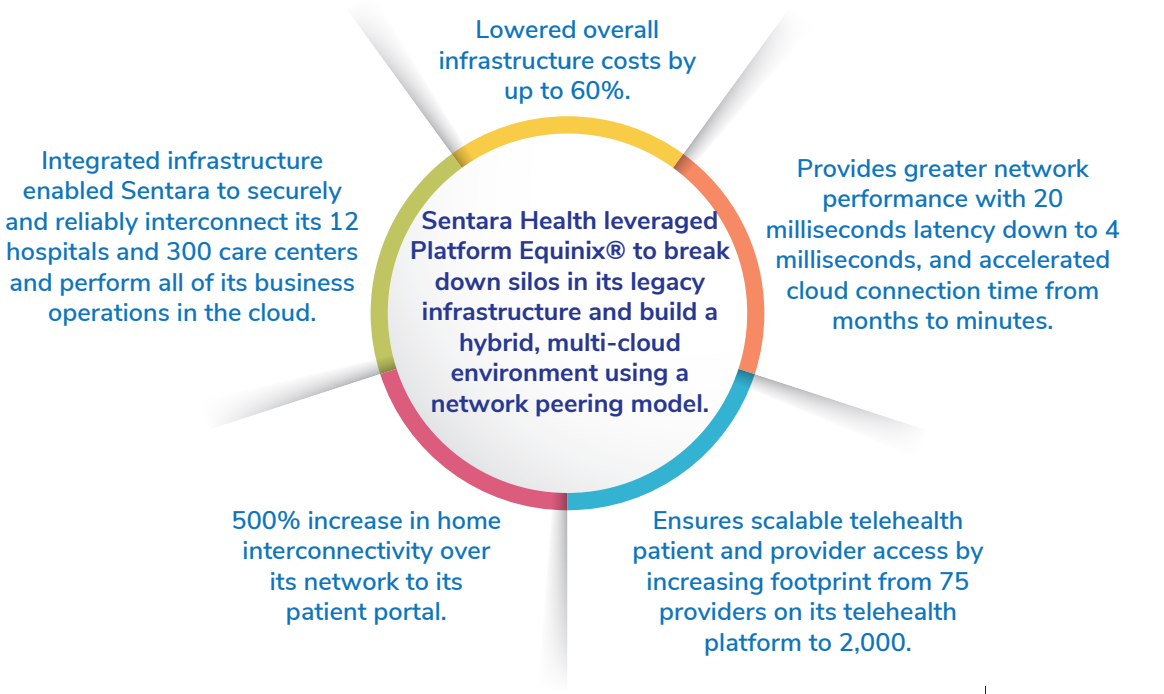
For healthcare standards to improve, basic infrastructure must be integrated with the wider ecosystem and across the value chain. The majority of healthcare providers do not have the capabilities to manage their infrastructure needs, and traditional IT cannot provide direct access to the systems, data, analytics, and ecosystems needed for smart healthcare. By re-architecting IT on a distributed, interconnected platform, providers can deliver targeted, compliant, and cost-effective healthcare.

A distributed, interconnected digital platform allows healthcare companies to access EHRs and deliver more personalised care. It also provides an agile IT infrastructure that can privately interconnect providers with patients, partners, healthcare ecosystems, and regulators, and can support real-time, omnichannel access to healthcare services for patients, making healthcare more targeted, accessible, and affordable and improving patient outcomes.

Healthcare Provider Case Study: Sentara Health

Sentara is one of the major integrated healthcare systems in the United States, with 12 hospitals and 300 care centers that include outpatient care centers, imaging centers, nursing and assisted-living centers, physical therapy and rehabilitation services, a home health and hospice agency, a 3,800-provider medical staff, and four medical groups. The provider group embarked on modernising its infrastructure by deploying SD-WAN and hybrid multi-cloud to deliver critical healthcare services during the COVID-19 pandemic. Moving 100% of its business operations from on-premises to multiple clouds helped Sentara facilitate the fast and secure transfer of patient data to the cloud for data analytics and AI.

Figure 7: Key Advantages Offered by the Integrated Infrastructure Capabilities for Sentara Health



> **Without the ability to quickly scale network and cloud connections on the Equinix platform, we would not have had the ability to adapt to the sudden changes brought on by the pandemic.**
>
> *– Matt Douglas, Chief Enterprise Architect, Sentara Healthcare & Optima Health*

CollabCare®

Healthcare Service Provider Case Study: CollabCare

CollabCare is an Australia-based, global digital health company that is transforming age tech and multigenerational family interactions with digitally centered solutions that reduce pain points, increase efficiency, and expand patient access across the healthcare value chain. CollabCare platforms for telehealth, wound care, and aged care (including dementia and remote monitoring) integrate into existing workflows and software through flexible alignment mechanisms and integration points. CollabCare recognises the need for managing relationships with its customers and the end users of its virtual healthcare services, and wants to provide them with a high-quality experience. With increasing disintermediation in healthcare, efficient management of stakeholders and intermediaries within the processes is imperative, and a unified digital infrastructure approach is critical to achieving high outcomes.

CollabCare's partnership with Equinix provides a core infrastructure foundation that can scale according to demand and offers partnership networking as a key value proposition. With its global presence and ecosystem partners, Equinix gives CollabCare the opportunity to leverage its platform to connect to key industry players that are already part of its network, which enables CollabCare to explore new avenues and markets with minimum investment and at an optimised time. With a single platform approach and colocation services, the platform can evolve with market needs and enables CollabCare to meet the infrastructure requirements of geo-diverse environments by complying with regional regulations and policies around data sharing and security.

> **"Moving from on-premise to colocation requires a partner with the vision and resources to stay the distance."**

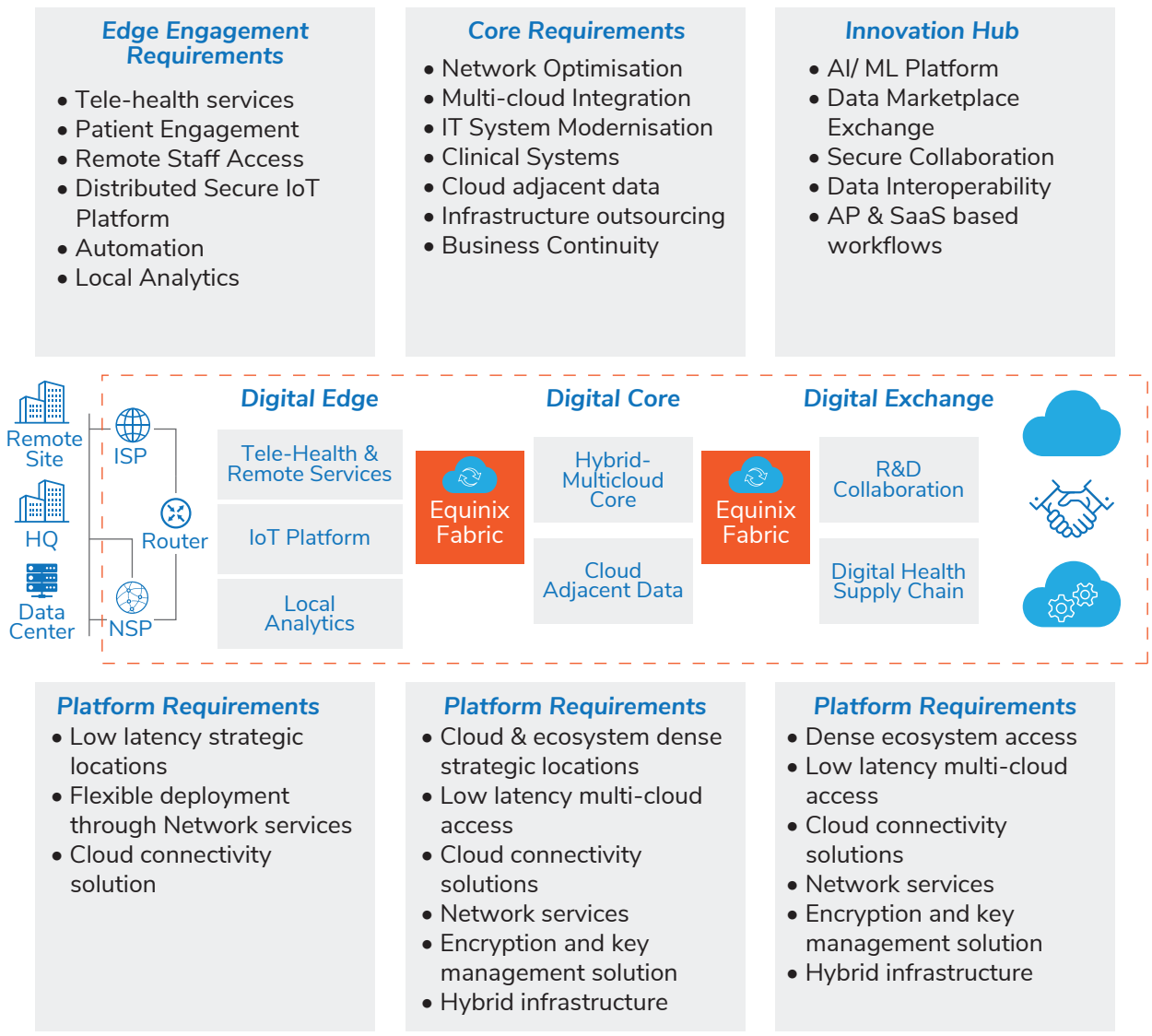
– Charles Greatrex,
Chairman of KeyTrust Group and CEO of CollabCare

EQUINIX
WHERE OPPORTUNITY CONNECTS

Equinix: Infrastructure as the key competitive advantage

Equinix is a global leader in digital infrastructure. Companies on their quest for digital transformation capabilities harness Platform Equinix® to bring together and interconnect the foundational infrastructure that powers their success.

Figure 8: Equinix Value Proposition to Healthcare and Life Sciences Industry



For a healthcare provider's digital transformation to generate optimal outcomes, a core digital foundation, an ecosystem for information exchange, and avenues for localised experience and interaction must be in place. Platform Equinix® offers three critical elements: global location coverage; private interconnection with rich digital ecosystems; and the capability to integrate, standardise, and simplify control.

Figure 9: Gaining Digital Advantage Using Platform Equinix

Platform Equinix enables customers to access all the right places, partners, and possibilities they need to accelerate their digital advantage.

- Largest global footprint of more than 220 data centers in 63 cities across 26 countries worldwide
- Most reliable platform with >99.9999% uptime and 5-layer physical security
- Industry's first commitment to supply 100% clean and renewable energy

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- Growing global ecosystem of nearly 10,000 companies; more than half of the Fortune 500 and more than one-third of the Global 2000
- Ability to connect to 1,800-plus networks and 2,900-plus cloud and IT service providers
- Serving more than 300 healthcare and life sciences customers globally, including 8 of the top 10 in the Global 2000

- Accelerate delivery and consumption of digital services at a global scale with on-demand infrastructure
- Innovate by unlocking new capabilities with software-defined connectivity to thousands of partners and providers
- Better performance at a lower total cost of ownership with 30% minimum reduction in latency and 60% reduction in network cost

Source: Equinix Blog

The Last Word

Call to Action for Healthcare Providers

Frost & Sullivan recognises the role of digital infrastructure in moving toward proactive, patient-centric, and outcomes-based care.

Healthcare providers are confronting rising costs, a shortage of staff and resources, and a surge in demand for their services. There is a need to bring together decentralised systems, solutions, and stakeholders across the value chain. Access to healthcare data from multiple sources will ensure improved clinical and financial outcomes. Digitalisation of workflows, pathways, and processes is a must, and core infrastructure capabilities that can evolve to meet the long-term goals of care coordination will be important.

Healthcare organisations will become future-ready by:

Developing a Scalable Healthcare Delivery Services Platform

New digital delivery models and hybrid cloud and edge capabilities will enable providers to serve patients anytime and anywhere. Access to multiple hybrid clouds that provide flexibility and distributing infrastructure to the edge to remove the latency between clouds, users, and applications for a localised yet secure experience will be added advantages.

Ensuring Superior Patient Experience

Seamless integration of patient records and a single view of a patient for all healthcare delivery stakeholders point to the need for secure and localised infrastructure for caregivers and patients.

Reducing Cost and Optimising Operations

Data analytics based on information from various applications can optimise workflows and reduce costs. It is imperative to have a cost-effective and scalable IT infrastructure that can keep pace with changes in technology.

Evolving the Ecosystem of Partners and Vendors

There is a need for scalable yet localised cloud infrastructure that can meet the demand from a growing ecosystem of partners and ensure collaboration between multiple stakeholders in the healthcare continuum.

> **“Healthcare organisations need to build a digital infrastructure that enables them to leverage the power of ecosystems to scale with agility, launch new digital services, and provide world-class digital experiences in order to leap ahead with confidence and gain the digital advantage they need to ensure better health outcomes.”**
>
> *– Jeremy Deutsch, President, Equinix Asia-Pacific*

Endnotes

1. HIMSS Definition of Digital Health
2. Frost & Sullivan Survey on Digital Trends in Healthcare, with 198 participants globally; 56% of the respondents were healthcare providers and 29% were from Asia-Pacific, July 2020
3. The total amount of global healthcare data, Statista
4. Frost & Sullivan Healthcare Predictions Outlook, December 2020
5. Australian Digital Health Agency
6. Frost & Sullivan Survey on Digital Trends in Healthcare, with 198 participants globally; 56% of the respondents were healthcare providers and 29% were from Asia-Pacific, July 2020
7. The 2020 Frost & Sullivan Global Cloud User Survey polled 1,621 business and IT decision-makers worldwide, representing a range of industries and company sizes.
8. Healthcare at a glance, OECD, Asia-Pacific, 2020
9. Ministry of Health and Family Welfare, National Digital Health Mission (NDHM)
10. The Internet Hospital as a Telehealth Model in China: Systematic Search and Content Analysis, JIMR, July 2020
11. Asia-Pacific population trends, The United Nations Population Fund
12. Asian Hospital and Healthcare Management

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