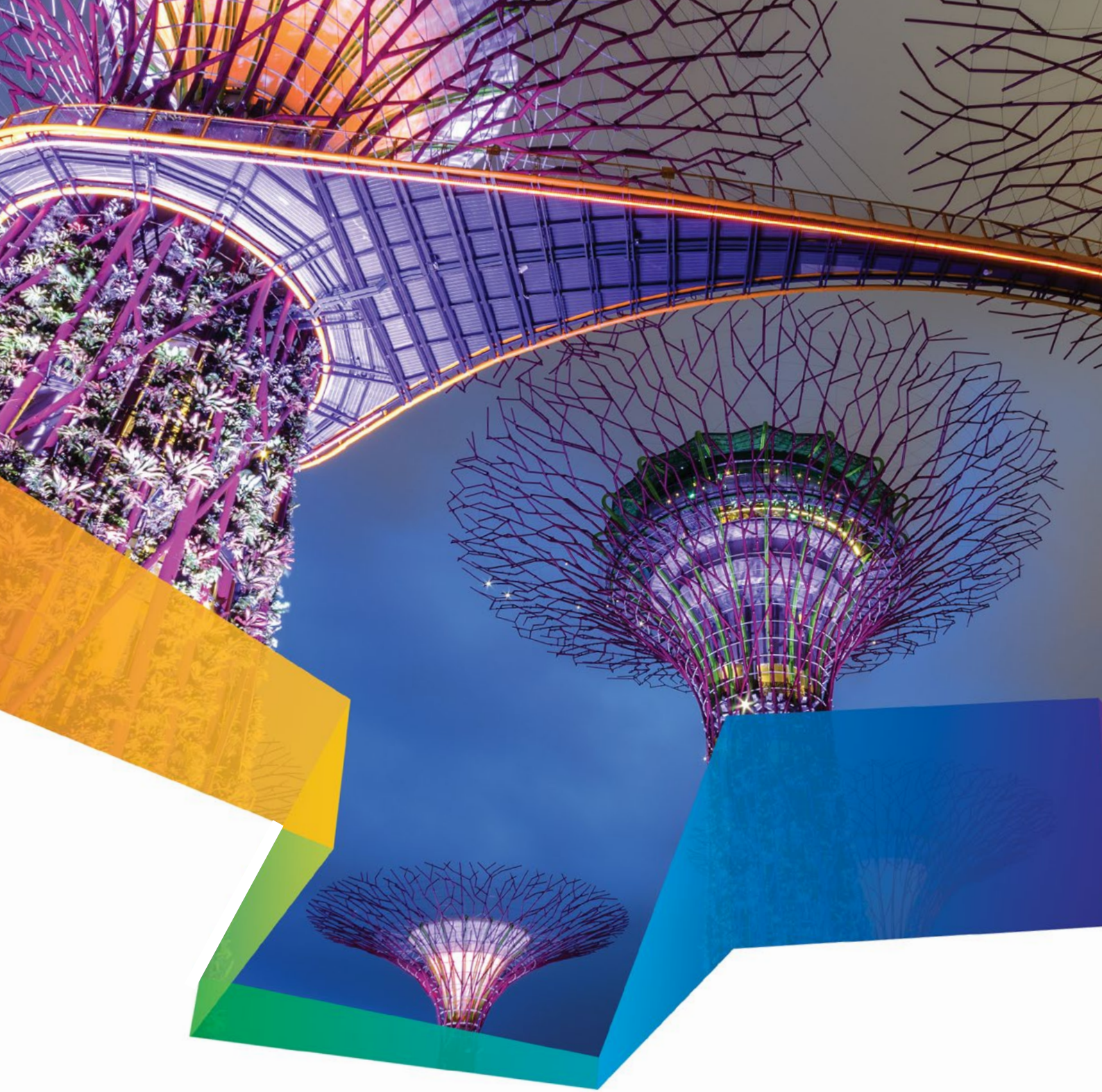




SMART FROM CORE TO EDGE:

NEXT-GEN NETWORKING FOR THE DIGITAL ENTERPRISE

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CONTENTS

Overview

- Chapter 1** Network Convergence Empowers the Internet of Things
- Chapter 2** 5G-IoT Networks Flourish on Efficient Structured Cabling
- Chapter 3** Building the Future-proofed and Efficient Data Centre
- Chapter 4** The Wi-Fi-6 Promise of Efficiency and Exceptional User Experience
- Chapter 5** Multi-gigabit Access and Switching to Make the Most Out of Wi-Fi 6
- Chapter 6** Unifying Infrastructure for 5G with Citizens Broadband Radio Service Private LTE Networks
- Chapter 7** Advanced Security for Cloud Wi-Fi and On-boarding
- Chapter 8** Physical-layer Data Security Stops Internal, External Threats

Conclusion



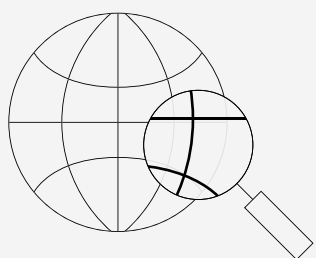
Pervasive digital transformation has turned almost every company today into a technology company. The sharing economy, for example, was made possible through platform businesses – a business model that facilitates the buying and selling, delivery, tracking, exchange and transfer of as well as payment for assets and services via apps and APIs.

These evolving digital business models and the continuing effect of consumerisation of IT on business and government organisations have fuelled demand for greater data security and privacy; safety of people and companies; data intelligence; e-commerce and cloud services; inclusive financial services; and most of all, reliable and efficient end-to-end communications networks.

This e-book presents use cases that are helping dynamic Asian enterprises seize opportunities via digital transformation to sharpen their competitive edge amid immense competition and thinning margins. A key theme is the complementary advantages presented by advances in the burgeoning Internet of Things (IoT); multi-gigabit access and switching connectivity; Citizens Broadband Radio Service; Wi-Fi 6; network convergence; and fibre and copper cabling.



As demand for broadband services and higher bandwidth surges from these transformation efforts, the cabling infrastructure that supports business operations today also holds the key to network efficiency and simplicity. This is crucial for mission-critical applications, end-to-end communications systems linking internal stakeholders and business ecosystems, as well as real-time data analytics and market intelligence.



CHAPTER 1

NETWORK CONVERGENCE
EMPOWERS THE INTERNET
OF THINGS



CHAPTER 1: NETWORK CONVERGENCE EMPOWERS THE INTERNET OF THINGS

The Asia-Pacific region accounts for [around 35.7% of global Internet of Things \(IoT\) spending in 2019](#). As countries and enterprises in Asia Pacific continue to roll out Smart City and IoT initiatives, demand for more and better connections will increase, as will im-pact on network infrastructure. Leading hubs of IoT development have sprouted in China, South Korea, Taiwan, Hong Kong and Singapore, impacting major industries such as transportation, manufacturing, agriculture, government, healthcare, and retail.

Once IoT sensors are connected to the data centre, intelligent data will be generated to drive new analytics and services. Over the next five years, the expanding edge computing environment featuring greater processing power, storage and other advanced capabilities will establish robust communications back to centralised services.

Multi-access edge computing deployments are moving processing power to the end points and users to enable lower-latency applications. Wireless networks are also experiencing the convergence of licensed (4G/5G) and unlicensed (Wi-Fi, Bluetooth, LoRa, etc.) spectrum. For example, smart buildings will be served by reliable cellular coverage along with ubiquitous Wi-Fi and support for IoT wireless networks. With Citizens Broadband Radio Service private networking added to the mix, multiple networks will be converged under one roof in the future.

These trends are intensely reliant on the convergence of broadband fibre, copper and wireless as well as powered connectivity onto a network that connects data or processing sources and consumer end-points. [The ubiquitous need for](#)

[bandwidth](#) by consumers who increasingly rely on IoT devices reinforces the need for network convergence.

THE EFFICIENCY MANDATE

Wireless network architecture is evolving and creating more capacity with 4G/LTE densification and 5G wireless. More small cells as close to each other as 250 metres means that each access point (AP) creates more bandwidth per square metre while the promise of fixed wireless 5G in the sub 6 GHz range and millimetre wave band (i.e. 28GHz) creates more bandwidth as well as additional spectrum.

In tandem with this evolution, the [converged network](#) that IoT devices rely on must be efficient because of the efficiency that consumers expect of their IoT devices.

CHAPTER 1: NETWORK CONVERGENCE EMPOWERS THE INTERNET OF THINGS

POWER

Developments in [Power over Ethernet \(PoE\)](#) technology will see a convergence between the delivery of power and bandwidth. IEEE 802.3bt – the 4-pair PoE standard also known as 4PPoE – increases the highest average power at the Power Sourcing Equipment output to about 90 W without compromising data bandwidth.

4PPoE can power more devices beyond lighting, Wi-Fi routers, IP cameras and industrial sensors, including even cellular small-cell base stations, retail point-of-sale terminals and digital signage systems. Grand View Research predicts that the global PoE market will reach [US\\$3.77 billion by 2025](#) as more applications and devices utilising 4PPoE technology, which is compatible with data rates of up to 10GBASE-T, are introduced.

BACKHAUL FOR LOW LATENCY

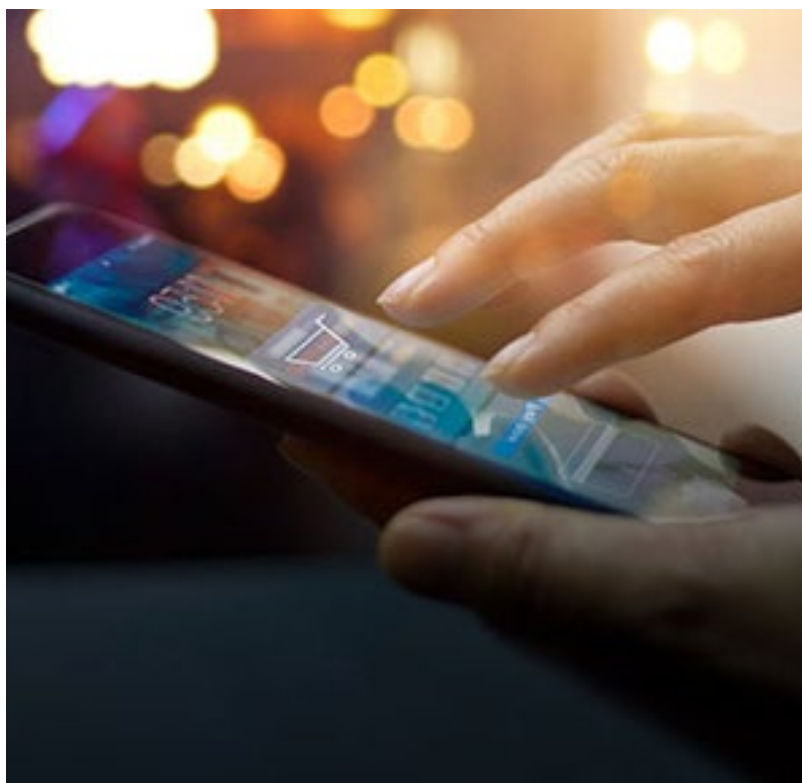
Wireless networks will ultimately need to come together with wired counterparts. A traditional cellular network typically features a network of macro cells, each independently powered and interconnected by a backhaul network of varying types, inclusive of fibre, hybrid fibre coaxial, copper and microwave.

The CommScope-Ruckus end-to-end connectivity portfolio allows enterprises to design and install a seamless fibre, copper and wireless infrastructure. As wireless infrastructure becomes more centralised and data traffic in mobile networks continues to grow rapidly, wireless backhaul traffic will be converged onto the same fibre used by wireline services. Solutions for converged

wireless networks include CommScope's Smart Cities portfolio and CommScope Ruckus solutions ranging from Wi-Fi 6 to Citizens Broadband Radio Service (CBRS), IoT, and LTE.

FUTURE-PROOFED

Whether it's [laying the groundwork](#) for wireless and wired infrastructure, for data analytics, or for cabling within a building, decisions are being made today for sites that are going to be around for another 20 years. Ongoing developments such as the IoT, 5G, Multi-access Edge Computing, and new standards in PoE mean that it is important that preparation provides the greatest flexibility for the technologies and applications that lie ahead.



CHAPTER 1: NETWORK CONVERGENCE EMPOWERS THE INTERNET OF THINGSSUCCESS STORY: [MILLENNIUM & COPTHORNE HOTELS](#), SINGAPORE

SMART CONVERGENCE LAYS FOUNDATION FOR FUTURE INNOVATION

Tech-savvy guests, evolving customer demands and technological innovations such as IoT are disrupting the hospitality industry. In an evolving landscape, Millennium & Copthorne (M&C) Hotels aimed to roll out services and innovations for their five hotels and corporate office in Singapore while increasing guest satisfaction regarding Wi-Fi performance and supporting multimedia content.

The global company owns and operates over 100 hotels worldwide, including the six properties in Singapore. A key concern was meeting current and future guest demands for bandwidth and seamless connectivity. It also required hotel-wide Wi-Fi coverage to support deployment of new digital services, IoT innovations, and room service robots.

Specifically, a network architecture that leverages the latest 802.11ac Wave 2 technology to provide strong and reliable Wi-Fi was needed for increased productivity and efficiency, improved collaboration amongst employees, and reduced operating costs.

SOLUTION

Over a short eight months, more than 2,900 CommScope Ruckus APs that leveraged the 802.11ac Wave 2 standard were deployed across the five hotels.



Over 135 [CommScope Ruckus ICX switches](#) were deployed to support latency-sensitive applications, such as real-time voice/video streaming, and to provide the aggregation functions. Each of the five hotels is individually managed by a 2-node SmartZone Cluster, which enhances resiliency for high availability requirements.

CHAPTER 1: NETWORK CONVERGENCE EMPOWERS THE INTERNET OF THINGS

SUCCESS STORY: [MILLENNIUM & COPTHORNE HOTELS](#), SINGAPORE

To enhance guest experience, the hotel deploys service robots. The robots need a wide Wi-Fi coverage area with stable and reliable connections, as well as travel-far signals to operate and find its own way around the hotel to deliver room amenities to guests.

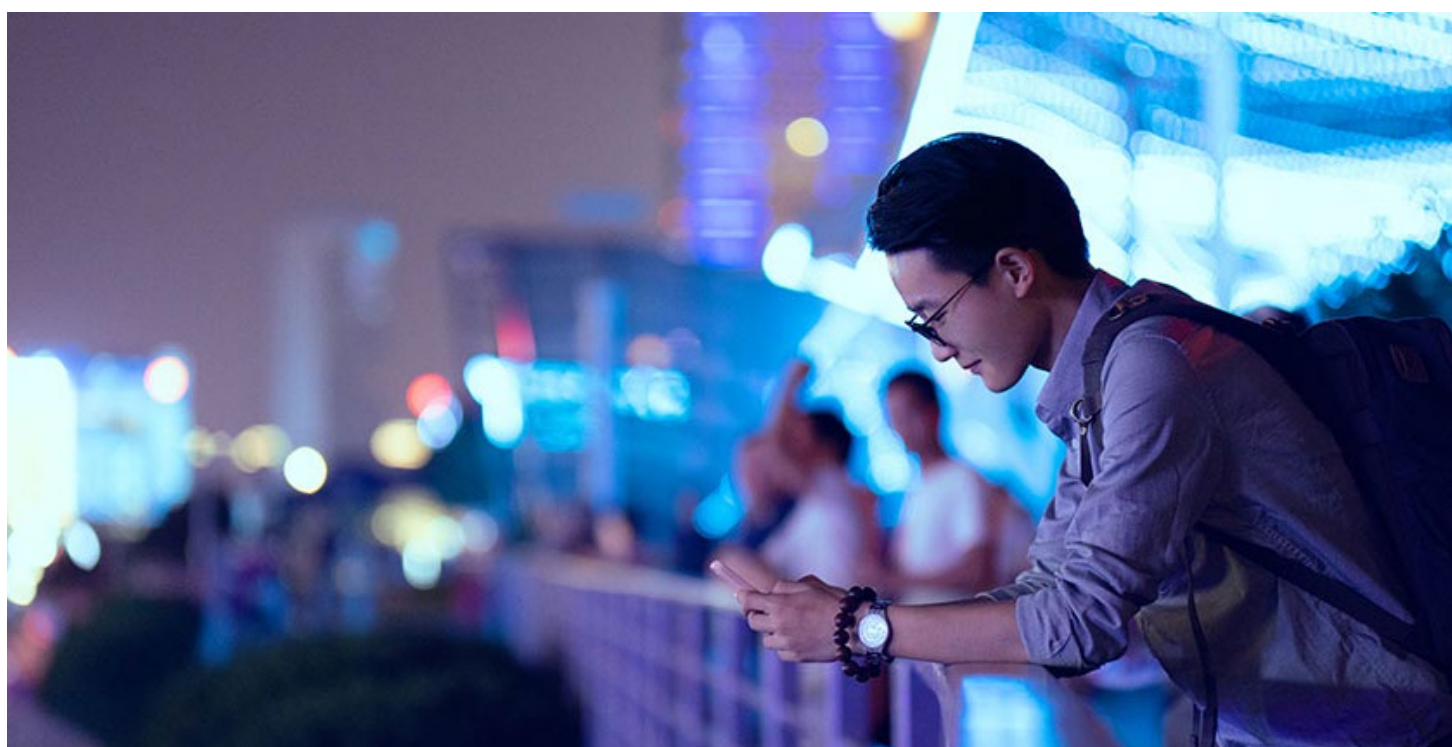
Also, CommScope has been [easing hotel fibre deployments while enabling IoT solutions](#). CommScope's structured cabling products, along with the Ruckus ICX 7150-24F fibre switch, ICX 7150-C08 compact switch and [Fiber Backpack](#), offer hospitality customers an end-to-end solution.

BENEFITS

The CommScope Ruckus range of [specialty APs](#) are geared for unique location-

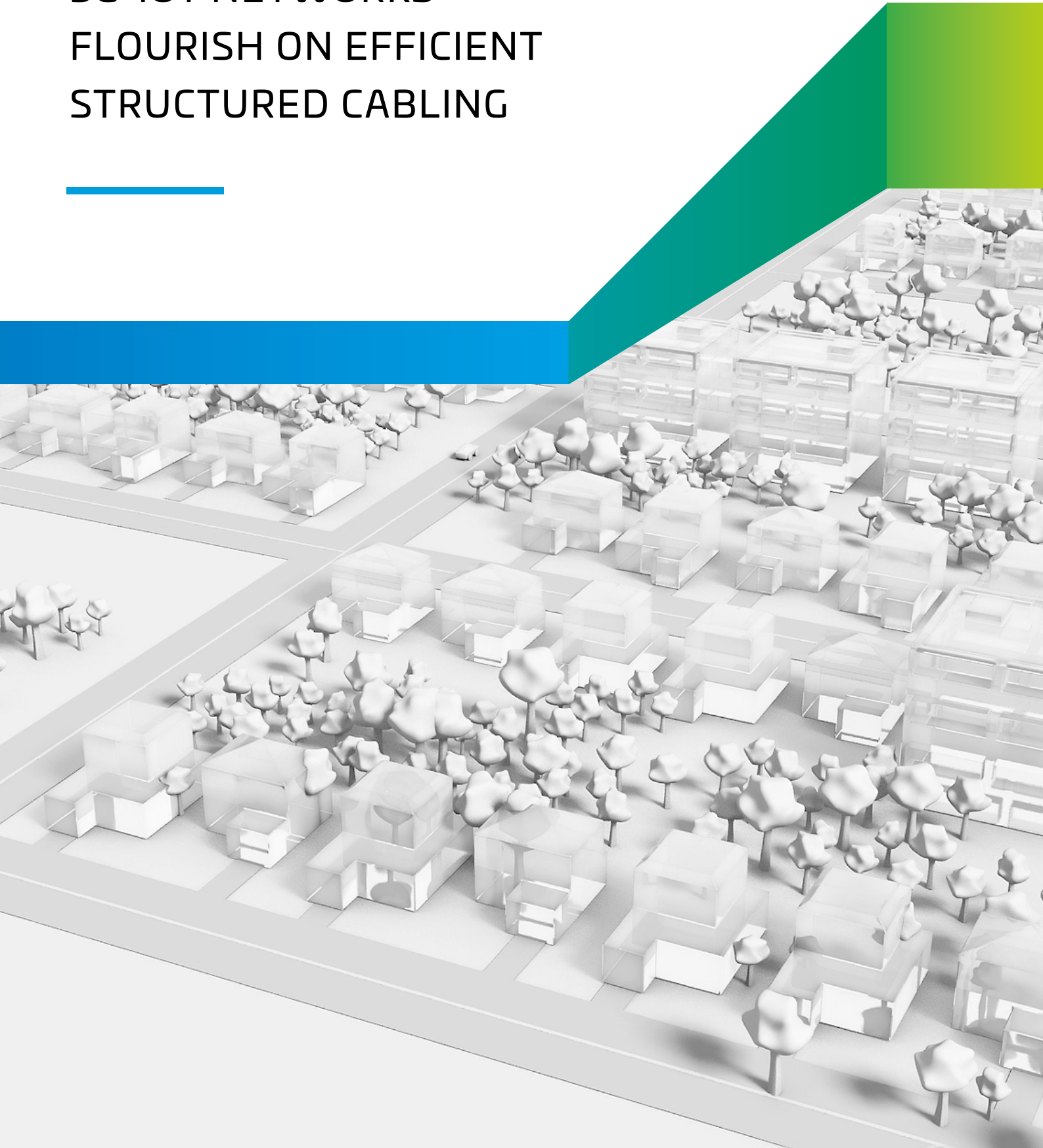
specific requirements. The H510 APs, which deliver in-room Wi-Fi, support more devices simultaneously. The R510 APs bring performance, reliability and coverage to medium-density indoor common areas. The R710 APs deliver reliable connectivity to high-density locations, such as ballrooms and pre-function areas, including the 3,800 sqm of convention space at Grand Copthorne WaterFront, and the T610 APs serve busy outdoor locations, such as swimming pools and tennis courts.

The Fiber Backpack allows for direct integration of Ruckus H510 in-room APs onto the fibre backbone for a clean, secure installation that leverages the scale, speed and efficiency of fibre-to-the-room architecture.



CHAPTER 2

5G-IOT NETWORKS FLOURISH ON EFFICIENT STRUCTURED CABLING



CHAPTER 2: 5G-IOT NETWORKS FLOURISH ON EFFICIENT STRUCTURED CABLING

In the digitally transforming economies of Asia Pacific, enterprises have to be mindful that deploying individual networks for the myriad of Internet of Things (IoT) and cloud services not only adds both complexity and cost but also may end up impacting network performance and even precious real estate.

Faced with the impact of [emerging IoT and 5G applications](#), IT network managers must consider infrastructural efficiency seriously. Key challenges include network densification for more usable floor space; cabling system performance to meet future bandwidth demands; and important connectivity drivers such as Wi-Fi; [Power over Ethernet \(PoE\)](#)-enabled devices; and [in-building wireless](#) (IBW) systems.

UCG, CCA OPTIMIZATION ACCOMMODATES NETWORK DENSIFICATION

The relatively high cost of real estate across many of the large metro cities in Asia Pacific is driving renewed focus on [cabling for efficiency and performance](#), especially as the enterprise network supports more IoT and 5G devices as well as applications and use cases.

One space optimiser is the [Universal Connectivity Grid](#) (UCG), which divides building floor space into evenly sized areas called “cells”. By deploying consolidation points in the ceiling of each cell, connections to the core network and access to wired and wireless technologies are made easy.

Indeed, more connected devices are being deployed in the ceilings with facilities and IT networks converging onto IP/Ethernet. The [Ceiling Connector Assembly](#) (CCA) high-quality cable interconnection, which is available as a standalone unit or preterminated to an RJ45 plug, simplifies installation of these devices.

STRUCTURED CABLING PERFORMANCE FIT FOR 5G, WI-FI 6

The 5G networks of the future herald sophisticated connectivity to a myriad of smart and efficient edge IoT devices. These networks feature high-speed wired and wireless networks to meet bandwidth, efficiency and latency requirements of more machine-to-machine connections.

Category 6A cabling delivers high bandwidth and remote power to support a common



CHAPTER 2: 5G-IOT NETWORKS FLOURISH ON EFFICIENT STRUCTURED CABLING

connectivity platform for wired LAN and wireless technologies, occupancy sensors, intelligent lighting, audiovisual services, building automation, and access control to enable the IoT.

Meanwhile, early implementations of 400G fibre uplinks and backbones may happen in 2020 even as migration to 100/200G from 40G ramps up.

Building backbones have traditionally been designed to exceed the horizontal requirements by a factor of 10. With upcoming Wi-Fi 6 or 802.11ax APs offering theoretical speeds of up to 10 Gbps and working better with multiple devices, any new or retrofitted backbone infrastructure should be specified to support backhaul bandwidth of 100 Gbps.

The [fibre-optic infrastructure](#) capable of this speed is OM5 wideband multimode fibre. CommScope's SYSTIMAX structured cabling, featuring singlemode, multimode and OM5 wideband multimode fibre, is certified to meet or exceed industry standards.

As the number of switches and assets to support 5G-IoT requirements grows, CommScope's structured cabling approach ensures scalability and standardises implementations of complex networks in intelligent buildings, campuses and data centres. This approach, which adheres to established standards for deploying cabling

within a building or a group of buildings, delivers very low latencies and improves overall network efficiency to reduce CapEx and OpEx in the long run.

IOT CONNECTIVITY DRIVERS

CommScope's [structured cabling](#) is also designed to power connected IoT devices and sensor-driven technologies.

With the advent of the IoT, managing PoE-enabled links has become increasingly difficult. The latest IEEE 802.3bt [PoE standard](#), also referred to as 4PPoE, enables the remote powering of a broader range of connected devices.

To this end, CommScope is contributing to [new cabling standards](#) based on bundle size recommendations and building physical cable bundles subject to a variety of power and environmental conditions. CommScope also offers a [powered fibre cable system \(PFCS\)](#) to connect and power devices that are located more than 100 meters from the PoE switch.

To help manage CommScope's SYSTIMAX structured cabling portfolio of UCGs, fibre optic backbones and PoE solutions, the imVision [automated infrastructure management](#) system provides network administrators with a holistic view of the network from which to optimise the allocation and use of resources.



CHAPTER 2: 5G-IOT NETWORKS FLOURISH ON EFFICIENT STRUCTURED CABLINGSUCCESS STORY: [TENCENT](#), CHINA

TENCENT HQ FUTURE-PROOFED WITH SMART, STABLE CONNECTIVITY

Located in Shenzhen, the Tencent Binhai Building (TBB) covers an area of 18,650 square metres and a floor area of about 350,000 square metres. Serving as Tencent's global headquarters and R&D base for animated games and mobile internet, the TBB is a 50-storey tower in the south, a 41-storey tower in the north, and three "links" that offer indoor shared amenities between the towers. The building's structure reflects Tencent's vision of becoming a connector, as proposed by the company's CEO, Ma Huateng.

CommScope was tasked to complete the building's network and cabling while showing the "connector" concept of the design. Put simply, the TBB becomes an extension of the IoT. All wired and wireless digital devices connect to each other in the TBB. Key challenges were the development of the connectivity technology and the growth of bandwidth.

SOLUTION

CommScope's smart building solutions deliver the wireless or wired network connectivity needed in closed-circuit television, IP video surveillance, alarms and sensors, access control, HVAC, communications, energy, fire safety, elevators and lighting. For example, digital devices requiring power must use



PoE wired connectivity instead of wireless connectivity, while heat and higher levels of fire-retardant standards were considered for twisted-pair cables that transmit PoE. Further, according to TIA162-A and ISO24704 standards, the wireless connectivity coverage is within a radius of 12 to 18 metres.

Ubiquitous network connectivity consists of 2.54-million metres of category 6 copper cables, 80,000 metres of singlemode fiber-optic cables, and 35,000 information outlets.

CHAPTER 2: 5G-IOT NETWORKS FLOURISH ON EFFICIENT STRUCTURED CABLING

SUCCESS STORY: [TENCENT](#), CHINA

BENEFITS

CommScope recommended UCG best practices that facilitate simple and efficient moves, adds and changes of connection points to minimise disruption. CommScope's OFNP OS2 singlemode fibre-optic cables offer the highest fire-retardant rating in the building shaft and meet network transmission bandwidth of 10G/40G/100G. As the OFNP high-flame-retardant sheath satisfies the latest fire-retardant requirements for skyscrapers, the PoE twisted-pair cables remain safe and fire and flame-resistant even when heated.

As an interconnected and smart building, the LEED Gold-certified TBB features smart elevators that can be called out via cell phones; face recognition security system; personnel precise positioning system; smart car location and navigation system; and holographic projection guide.

Smart network cabling enables modern smart buildings like the TBB to flourish and keep pace with the times. The reason is that PoE, UCG, smart lighting, indoor wireless coverage and the like rely on high-quality wired networks to support an ultra-high density of nearly 400 wired network information outlets per floor in the TBB.

The connectivity of wired and wireless digital devices in the TBB was planned and designed with future technological development and

bandwidth growth in mind. CommScope not only met Tencent's current digital connectivity needs but also planned for seamless upgrades and expansions.



CHAPTER 3

BUILDING THE FUTURE-PROOFED AND EFFICIENT DATA CENTRE



CHAPTER 3: BUILDING THE FUTURE-PROOFED AND EFFICIENT DATA CENTRE

Faced with surging demand for cloud-based services and data storage, fuelled by the rapid pace of digitisation, rising affluence and an increasingly tech-savvy young population, big corporations are expanding their cloud infrastructure footprint.

CLOUD-DRIVEN EXPANSION

Such expansion activities, especially in Singapore, Indonesia and Malaysia, will make Southeast Asia the [fastest growing region for co-location data centres](#) (DCs) globally. Its market size is expected to grow by a compounded annual growth rate of 13% between 2019 and 2024. Overall, the market size for Asia Pacific co-location DCs is forecast to be around US\$28 billion by 2024. DC construction had kept up over the second half of 2019, in particular, over key regional data centre markets, with local cloud spend being the common theme.

[A study by IDG](#) found that about two-thirds of companies already store at least some of their data in a co-location centre. Even among organisations that rely exclusively on on-premises facilities, over 70% have made plans to migrate some data into a co-location facility. With growing server virtualization and cloud deployments, the flexibility and reliability of co-location centres enable organisations to utilise the high-performance resources of third-party facilities while also maintaining control over valuable assets as well as power and cooling requirements.

Often referred to as co-location DCs, [multi-tenant DCs](#) (MTDCs) configure and physically connect network services to a new enterprise tenant quickly and efficiently. They provide

the required cabling infrastructure to support multiple generations of equipment and speeds. Specifically, organisations have ready access to high-density, low-optical loss cables; simplified infrastructure management; and floor-mounted fibre entrance cabinets to maximise density.

5G IMPACT AT THE EDGE

The advent of 5G, the fifth-generation cellular network technology that exploits new spectrum and provides single-digit millisecond latency, will alter how DCs are designed and operated. By some estimates, DCs will be spending over half their operating budget to [support 5G](#) by 2025.

Amid rising demand for 5G-driven cloud-scale services, high-performing MTDCs may be re-located closer to the network's edge where the users, data and connected devices are. The move is to fulfil the low latency and reliability requirements of applications that 5G will enable, such as self-driving vehicles, industrial automation, machine-to-machine communications and more.

CHAPTER 3: BUILDING THE FUTURE-PROOFED AND EFFICIENT DATA CENTRE

Innovative solutions needed to support these applications include a flexible migration platform; pre-terminated fibre and copper connectivity; and an [automated infrastructure management](#) (AIM) solution.

RISK-FREE MIGRATION

The ability for DCs to support 25G/40G/100G and beyond, with up to five 9s of availability, is non-negotiable for today's hyper-connected and always-on digital businesses.

CommScope's [High Speed Migration](#) platform uses modular building blocks to support the growing speeds and densities that new applications and architectures demand. The platform is complemented by the [SYSTIMAX](#) portfolio of connectivity and structured cabling solutions to deliver agility, manageability and scalability for growth.

For example, space-saving high-density (HD) and ultra high-density (UD) panels provide up to 72 duplex Lucent Connectors (LCs) or 48 Multi-fibre Push On (MPO) ports per rack unit (RU) – singlemode or multimode – to align with the high density of fibre ports in the spine switch layer of today's leaf-and-spine networks.

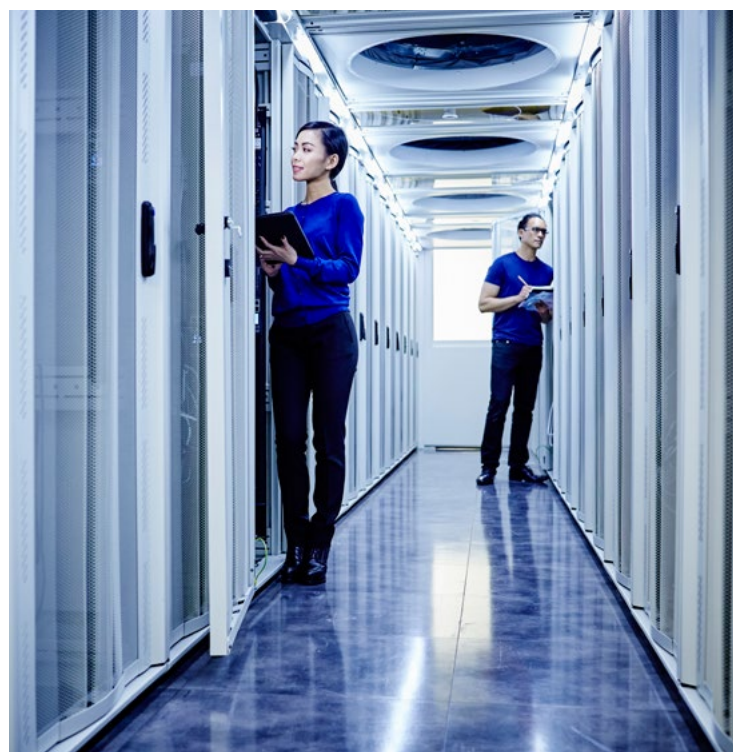
Pre-terminated and pre-tested fibre assemblies increase deployment speed and accuracy. Ultra low-loss, pre-terminated components for singlemode and multimode enable longer link spans and support for attenuation-sensitive applications.

CommScope's [imVision AIM solution](#), available with HD and UD panels, enables DCs to monitor and manage infrastructure at port level and in real time. imVision automates the planning, implementing and documenting of

moves, adds and changes; accelerates mean time to repair; and triggers alerts in real time to unplanned or unauthorised changes in the physical layer.

As enterprise and co-location facilities continue to grow in complexity, the ability to pivot quickly and easily to take advantage of new market opportunities starts with the right physical layer infrastructure and an experienced partner who can help build it.

CommScope is maximising efficiency and performance in MTDC deployments with copper and [fibre infrastructure solutions](#) as well as insightful AIM. Spaces are also enhanced through optical distribution frames and [fibre raceway solutions](#) for outside plant (OSP), entrance facilities, meet-me rooms and cages. These aside, CommScope's alliances with [top-performing MTDC providers](#) ensure that DC efforts drive business needs.



CHAPTER 3: BUILDING THE FUTURE-PROOFED AND EFFICIENT DATA CENTRESUCCESS STORY: [EQUINIX](#), GLOBAL

COMMScope AND EQUINIX DEMONSTRATE POWER OF MTDC ALLIANCE

Equinix has maintained pole position across Asia, Oceania, North America, and EMEA for seven consecutive [Cloudscene Data Centre Ecosystem Leaderboards](#) based on connectivity and density of its DCs.

After collaborating on numerous MTDC projects, Equinix became the first partner to sign on to CommScope's MTDC Alliance, a cooperative programme that now includes six of the largest MTDC providers and nearly 100 service, installation and integration partners worldwide.

Equinix provides MTDC space and interconnection services for the world's top forex service providers. In forex trading, ultra-high speed platforms move trillions in trades across the globe daily. In every network link connecting institutional traders to their markets, milliseconds mean millions.

Trading partners look to forex platform providers to provide latency equalisation for a level-playing field. CommScope helped one forex service provider to upgrade the links from its trading partners' data centres to a matching engine and ensure identical latency performance, regardless of location. The platform's matching engine was in one building; the partners were in two separate buildings.



SOLUTION

The project entailed installing an underground OSP without the ability to test before deployment. And so, CommScope had one shot to get it right and a short timeline of a few weeks to install and turn up the intra-campus links.

As CommScope engineers worked through the technical issues, Equinix focused on logistics and ensuring the service provider's team was kept up to date. The solution consisted of multiple runs of high-count ribbon fibre, rack-mounted fibre panels, and connector assemblies. In addition to the

CHAPTER 3: BUILDING THE FUTURE-PROOFED AND EFFICIENT DATA CENTRESUCCESS STORY: [EQUINIX](#), GLOBAL

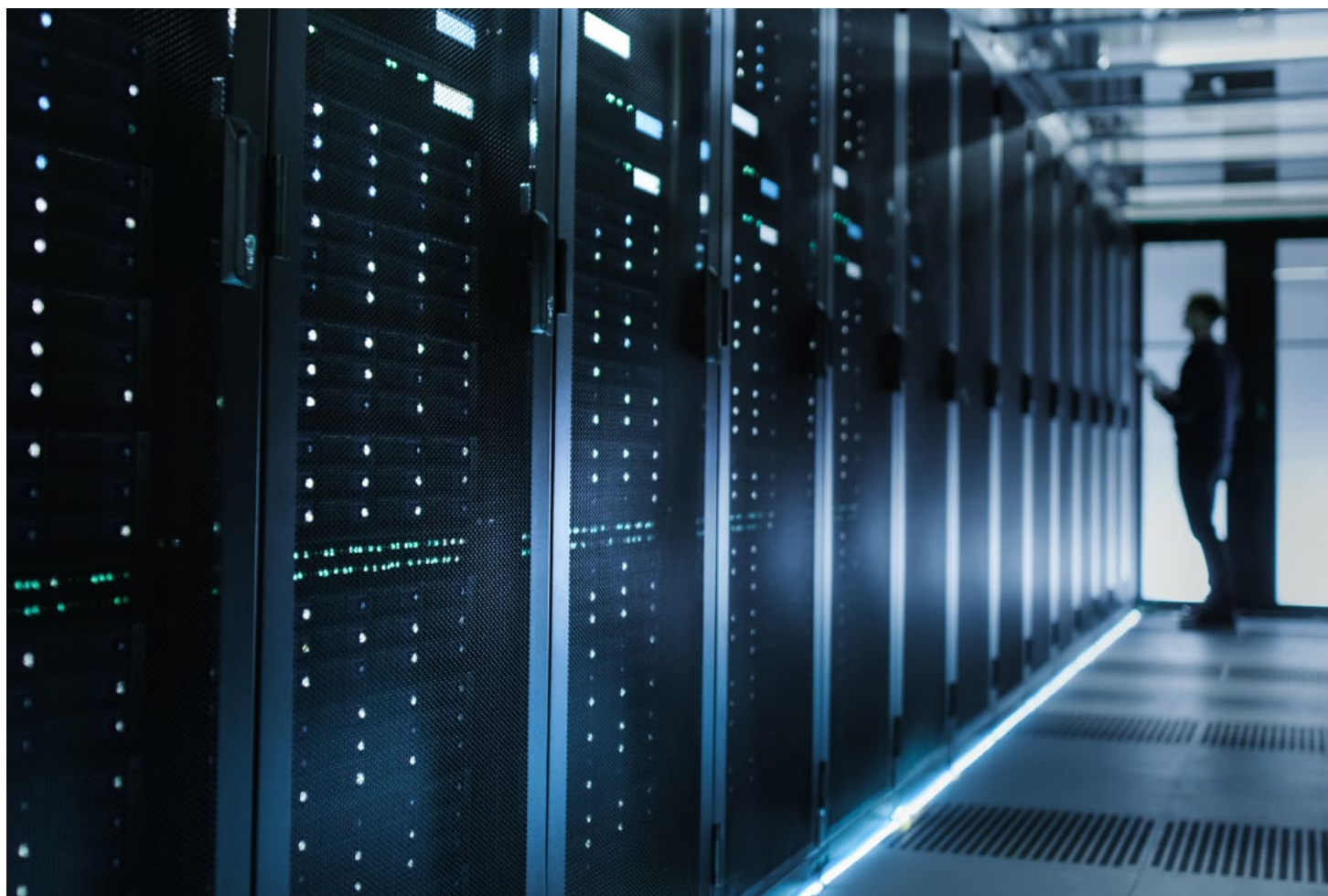
precise measurement of the spooled cabling, the end-to-end optical distance of each link had to be precise.

A highly sensitive optical backscatter reflectometer (OBR) was used for precision measuring of in-building equidistant links. One trunk cable each was terminated inside buildings A and B, and one at the customer's matching engine where both cables were terminated at the OBR.

BENEFITS

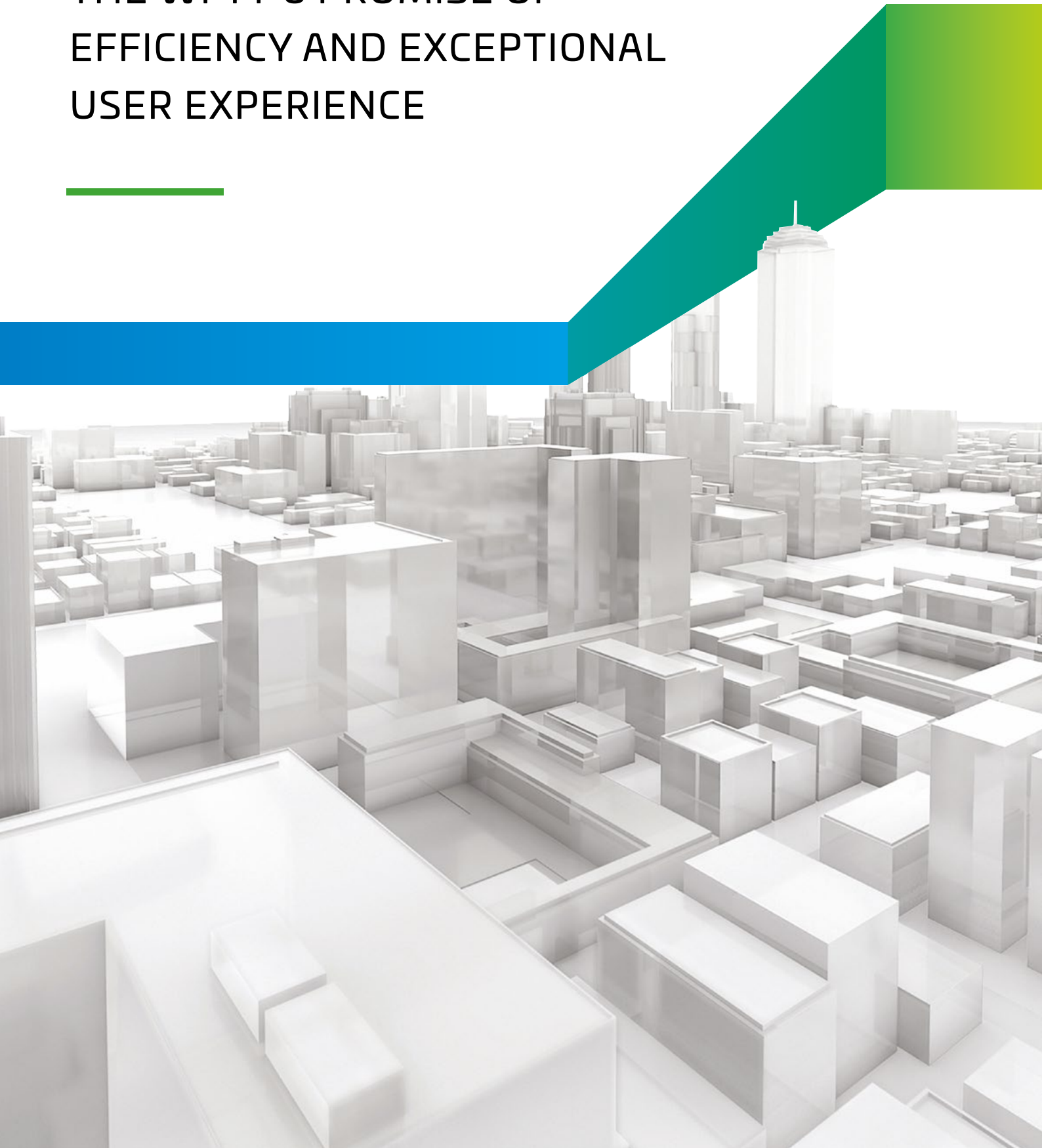
The successful project demonstrates that latency equalisation in the OSP is doable. The project reaffirmed the value of working partnerships such as those between CommScope and Equinix, and within the MTDC Alliance.

The forex service provider's infrastructure is now deployed on Platform Equinix, a co-location and interconnection platform that places strategic controls closest to users, clouds and networks. The company can connect with other trading partners for decreased latency, and scale the business up or down based on shifting market needs.



CHAPTER 4

THE WI-FI-6 PROMISE OF EFFICIENCY AND EXCEPTIONAL USER EXPERIENCE



CHAPTER 4: THE WI-FI-6 PROMISE OF EFFICIENCY AND EXCEPTIONAL USER EXPERIENCE

User experience is crucial in today's digital, hyper-connected environment. Connectivity downtime caused a total loss of US\$51 million for organisations in 2018, according to a [Ruckus Asia Pacific State of Wi-Fi Study](#). Critically, the productivity loss that wireless connectivity downtime and bottlenecks create hinder organisations from accelerating digital innovations and transforming themselves.

At the front end, all the analytics that a business embarks on to help improve online customer experience would be pointless if Wi-Fi network performance at the endpoint is poor. In such scenarios, users do not just adjust their data usage habits. They just switch Wi-Fi off altogether. In the hospitality sector, for example, studies show that nine out of 10 guests will not rebook a hotel if their Wi-Fi experience was bad. The same would likely be true for venues.

Indeed, Wi-Fi connecting to employees' and customers' devices is the foundation of Asia Pacific's burgeoning digital economy. It is not only a productivity tool that empowers employees to work and collaborate better but also a platform that enables organisations to interact directly with their customers via apps, websites and other digital services on the Internet and the Intranet.

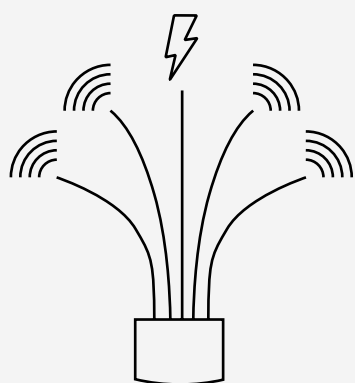
Hence, business and IT leaders of Asia Pacific enterprises – particularly hotels, healthcare facilities or hospitals, retail malls, etc. – mostly agree that a bad Wi-Fi experience will negatively affect brand reputation. This is where Wi-Fi 6 offers the critical advantage of dramatically increased wireless bandwidth and network efficiency compared to legacy Wi-Fi 4 or 5.

WI-FI 6

[Wi-Fi 6 or 802.11ax](#) made its way into new installations in 2019. It is designed to allow for wireless data rates up to 10 Gbps and to operate in today's increasingly busy and crowded environments, such as airports, stadiums, hotels, apartment and commercial buildings and entertainment venues.

With an expected four-fold capacity increase over its 802.11ac Wave 2 predecessor, Wi-Fi 6 deployed in dense device environments supports higher service-level agreements to more diverse and concurrently connected users and devices.

Wi-Fi 6 networks enable IoT devices to work better, more efficiently and make possible a new wave of IoT devices. Significantly, features such as Wi-Fi 6's Target Wake Time,



CHAPTER 4: THE WI-FI-6 PROMISE OF EFFICIENCY AND EXCEPTIONAL USER EXPERIENCE

provides the battery efficiency that allows the consolidation of services onto a single Wi-Fi or IP infrastructure and the handling of ever-increasing load being put on networks.

Wi-Fi networks have been useful in alleviating the strain on LTE/5G networks in high-density areas to enhance customer experience. Wi-Fi 6's support of multi-user, multiple-input, multiple-output (MU-MIMO) technology enables any compatible access point (AP) to handle traffic from up to eight users simultaneously at the same speed.

Still, enterprises will only realise Wi-Fi 6's true benefits with the right cabling infrastructure out to the wireless AP. The data rates of APs are increasing quickly with the Ethernet interface advancing from 1 GbE to 2.5 GbE and 5 GbE. To deliver the bandwidth needed for current and future applications, the TSB-162-A standard recommends running two Category 6A cabling to each service outlet supporting an AP.

Further, the ISO/IEC 11801-6 standard lists typical indoor ranges of an AP that should be used based on the frequency band and data rate of Wi-Fi services. The list helps to determine the coverage of an average grid and placement of cabling and service outlets.

SPECIALTY ACCESS POINTS

Every network deployment has its own unique requirements. Providing Wi-Fi in every room of a hotel or residence hall, for example, requires a different type of platform than serving an enterprise office. Deploying Wi-Fi outdoors, or in a large stadium, demands other considerations too.



CommScope, with Ruckus in its fold, offers a large portfolio of [indoor and outdoor AP options](#) to suit any type of deployment. This includes wall-mounted Wi-Fi plus Ethernet switch platforms for hospitality and multi-dwelling unit environments, as well as solutions that run over a building's existing coaxial cabling.

The [CommScope Ruckus R750 802.11ax](#) indoor Wi-Fi AP for ultra-dense client environments is one the first APs to be Wi-Fi CERTIFIED 6. This certification from the Wi-Fi Alliance validates the use of the R750 in ultra-dense client environments such as stadiums, hotels, convention centres and schools. Being Wi-Fi CERTIFIED 6, more connected R750 APs can achieve peak performance simultaneously in these environments while supporting Wi-Fi CERTIFIED WPA3 security protocol.

CHAPTER 4: THE WI-FI-6 PROMISE OF EFFICIENCY AND EXCEPTIONAL USER EXPERIENCESUCCESS STORY: [ITO HOSPITAL](#), JAPAN

RELIABLE, HIGH-PERFORMANCE WI-FI DELIVERS SEAMLESS NURSING CARE

Tokyo-based ITO Hospital specialises exclusively in the diagnosis, care and treatment of patients with thyroid disease, with the mission to provide the best care through cutting-edge medical technology. The hospital had begun upgrading its wireless network, which served as a critical support infrastructure for nursing care in the hospital wards.

IT administrators and hospital management wanted to allow connected devices to seamlessly and securely roam between different floors with minimal network interference. This was an integral part of the hospital's digital transformation efforts.

Several IT systems, ranging from electronic medical records and medical accounting, to clinical examinations and radiology information management, were introduced to help raise the quality and safety of healthcare; optimise staff productivity; and reduce patients' waiting time.

SOLUTION

The Ruckus 802.11ac indoor APs and [Ruckus Zone Director](#) controllers were deployed to establish a stable and high-performance wireless network for staff and patients even in the hospital's high-density environment where channel interference is significant.

Ruckus Zone Director controllers feature an intuitive web interface to ease configuration and administration of the entire WLAN. It includes capabilities like automatic traffic redirection, adaptive wireless meshing, rogue AP detection, advanced Wi-Fi security features, and extensive authentication support.



BENEFITS

The [high-performance CommScope Ruckus APs](#) include [Ruckus' patented Beam-Flex+](#) adaptive antenna technology that directs the antenna to point in the direction of client devices, removing interference and providing fast data transfer rates in busy environments.

CHAPTER 4: THE WI-FI-6 PROMISE OF EFFICIENCY AND EXCEPTIONAL USER EXPERIENCESUCCESS STORY: [ITO HOSPITAL](#), JAPAN

The outcome is better indoor user experience and seamless Wi-Fi connectivity even when device users move between floors.

Strikingly, the hospital not only improved wireless network security but its network infrastructure is now able to scale according to current and future needs of the hospital.

Independent assessments conducted by IT administrators of the Hospital before and after the Ruckus solution was installed showed increase in incidences of “Good” scores through signal testing from various locations inside the hospital.

Post-installation, nursing staff had no further complaints regarding the hospital’s Wi-Fi service. Overall, network service issues were reduced; staff productivity improved; and IT administrators enjoyed high availability of the hospital’s Wi-Fi network.



More importantly, with the advent of [Wi-Fi 6](#), ITO Hospital can now seamlessly upgrade to CommScope Ruckus 802.11ax APs that are geared with patented technology to fit any unique budget, performance requirement, or deployment scenario. The APs will help the hospital address challenges, such as high client density and Wi-Fi-unfriendly building materials, to deliver superior nursing care and patient experience.

CHAPTER 5

MULTI-GIGABIT ACCESS AND SWITCHING TO MAKE THE MOST OUT OF WI-FI 6



Communications networks are more complex than ever before. High-bandwidth, media-rich applications, the bring-your-own-device (BYOD) culture and the Internet of Things (IoT) have hastened businesses toward 802.11ac Wave 2 Wi-Fi implementations, even as 802.11ax (Wi-Fi 6) begins to gain awareness.

Demand for always-on internet and Wi-Fi connection is expected to surge in the next 5 years. Employees now expect use of streaming video in the workplace. And it is not just Smart City initiatives that are driving the need of access. Rural Wi-Fi connectivity projects in India, for instance, are embarking on rolling out Wi-Fi across thousands of villages.

Even as more apps now reside in the cloud, the edge has become increasingly more wireless. Wireless access points (APs) have essentially become part of a converged access platform where multiple functions – ranging from an IoT gateway to firewalling to SD-WAN, and so on – are performed. Access is established through radios operating in different licensed and unlicensed spectrum and different air interfaces from Wi-Fi to LTE to Bluetooth Low-Energy (BLE) to ZigBee.

Regardless, Wi-Fi networks in particular will have to be more efficient, flexible and intelligent than ever before. The networks will utilise sensors and machine data combined with innovations such as artificial intelligence to automatically provision for added capacity and proactively solve potential problems before it impacts the user.

Concurrently, increased dependence on data-intensive wireless and cloud-based

applications has driven demand for multi-gigabit connectivity between wireless APs and Ethernet switches at the edge.

MULTI-GIGABIT CONNECTIVITY

With the 802.11ac (Wi-Fi 5) and now 802.11ax (Wi-Fi 6) specifications, an AP has the potential of more than one-gigabit throughput. Wi-Fi 6 was built to handle more devices and bandwidth-hungry applications. But a single Wi-Fi 6 client can quickly overtax existing 1 GbE backhaul links on a typical AP. This has generated interest in multi-gigabit connections between APs and switches.

Bridging the performance gap between gigabit and multi-gigabit Wi-Fi is becoming necessary in demanding environments such as stadiums, exhibition halls, hotels and even primary and K-12 schools.

Most 802.11ac APs are equipped with two 1 GbE ports, with some featuring 2.5 GbE ports.

CHAPTER 5: MULTI-GIGABIT ACCESS AND SWITCHING TO MAKE THE MOST OUT OF WI-FI 6

The new [802.11ax \(Wi-Fi 6\) APs](#) will support up to 10 Gbps theoretically. But practical limits slow throughput so these APs will be equipped with 5 GbE ports.

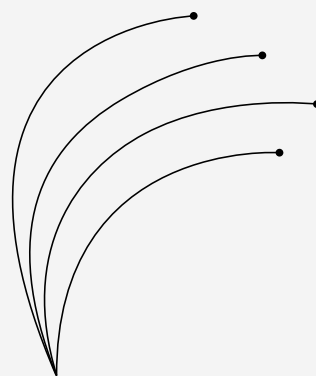
APS AND SWITCHES

Ruckus Networks, now part of CommScope, has been deploying Wi-Fi in extremely challenging venues that have incredible capacity requirements, such as stadiums and arenas. CommScope Ruckus offers [multi-gigabit options](#) that include APs and switches optimized for Wi-Fi 5 or Wi-Fi 6 with 2.5GbE connections, or Wi-Fi 6 via flagship APs or [ICX Z-Series switches](#) with 2.5/5/10 GbE ports.

These multi-gigabit solutions allow organisations to balance cost, performance and Wi-Fi client density. For example, the [CommScope Ruckus R750 802.11ax indoor AP](#) for ultra-dense client environments is Wi-Fi CERTIFIED 6 from the Wi-Fi Alliance.

Meanwhile, the [Ruckus ICX 7150-C10ZP, ICX 7150-48ZP and ICX 7650-48ZP](#) provide rich options for 2.5/5/10 GbE Ethernet switching fit for different deployment scenarios with the R750. Additionally, the [Ruckus ICX 7850](#) switch is designed to deliver 100 GbE edge-to-core connectivity for multi-gigabit enterprise and campus networks.

To maintain a consistent and richer Wi-Fi 6 user experience, the combination of CommScope Ruckus multi-gigabit switching, Wi-Fi technology and unified network controller, with CommScope's structured cabling, provides a comprehensive end-to-end network solution.



CABLING, POE TO OPTIMISE WI-FI

The cabling infrastructure needed to support the latest Wi-Fi APs must be upgraded to handle bandwidth-hungry devices and applications such as virtual reality, 4K video streaming and wearables. Critical connectivity is also needed to support operational use cases like IoT devices, video surveillance, asset tracking, climate control systems, smart locks and point-of-sale.

Generally, [multi-gigabit technology](#) leverages commonly deployed Cat 5e (for 2.5 Gbps) or Cat 6 (for 5 Gbps) cabling. Hence, enterprises can maximise the performance of their Wi-Fi networks and obtain multi-gigabit access capacity over an existing cable plant.

To ensure optimal performance of these APs, Category 6A cabling infrastructure and multi-gigabit switches that support the [802.3bt PoE standard to its full 90 W](#) should be installed. Ruckus multi-gigabit switches already offer up to 90 W per port and up to 1500 W of total PoE budget along with uplinks of up to 100 Gbps to future-proof the network.

SUCCESS STORY: [UNIVERSITY TECHNOLOGY OF SYDNEY \(UTS\) INSEARCH](#), AUSTRALIA

SEAMLESS, SCALABLE WI-FI LAYS FOUNDATION FOR LEARNING INNOVATION

UTS Insearch is the pathway provider for University Technology Sydney (UTS). It has locations across the world with a campus in Sri Lanka opened in late 2019. The UTS Insearch main Sydney campus spans five buildings and 70 classrooms. The organisation supports over 5,000 students and more than 300 staff from 75 different countries.

UTS Insearch requires a high-performance network solution in its main campus that meets current and future Wi-Fi needs with superior connectivity and coverage. Seamless Wi-Fi, coupled with high-speed wired connections, has become a core foundation on which digital curriculums and connected classrooms are built.

However, UTS InSearch's legacy APs were delivering sub-par speed and could not support a high-density of concurrent connections to support an international student base who needs seamless internet

connectivity for study and to communicate with friends and family from their home countries.

SOLUTION

UTS Insearch upgraded its legacy APs to the CommScope Ruckus 802.11ac APs, which incorporate [Ruckus' BeamFlex+](#) patented antenna technology. It also deployed the [CommScope Ruckus ICX switches](#) to enhance the wired network. The solution provides an easy upgrade path to [CommScope Ruckus Smart Positioning Technology](#) (SPoT) cloud-based location services for room utilisation monitoring.

The organisation was impressed by the Ruckus portfolio's high RF performance, seamless upgrade path and excellent customer service, with ongoing expert consultation that was tailored to the needs of the project.



CHAPTER 5: MULTI-GIGABIT ACCESS AND SWITCHING TO MAKE THE MOST OUT OF WI-FI 6

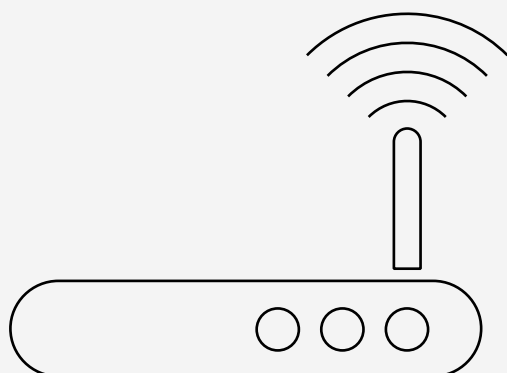
SUCCESS STORY: [UNIVERSITY TECHNOLOGY OF SYDNEY \(UTS\) INSEARCH](#), AUSTRALIA

The Ruckus APs were deployed across the campus, focusing on high-user demand areas such as lecture theatres, high thoroughfare corridors and main common areas.

A [CommScope Ruckus SmartZone network controller](#) manages not only the APs, but also the ICX switches. Implementation of [Cloudpath](#) for certificate-based BYOD management is also on the roadmap.

BENEFITS

Superior RF performance means that the team is able to use about 30-40% fewer APs compared to the previous hardware. The Ruckus ICX switches, meanwhile, provide high performance, flexible scalability and simplified management for mid-to-large scale deployments to meet current and future network demands.



Using Ruckus SPoT services to monitor room utilisation helps to minimise wasted space and energy costs. The upgraded Wi-Fi network has also enabled UTS Insearch to add new services that support learning innovation over time.

In the near future, CommScope will help UTS Insearch to manage a Campus Fabric using their Virtual SmartZone controller. The maximum number of ICX switches will also be increased from 36 to 50+ to support larger deployments.

CHAPTER 6

UNIFYING INFRASTRUCTURE FOR
5G WITH CITIZENS BROADBAND
RADIO SERVICE PRIVATE LTE
NETWORKS



CHAPTER 6: UNIFYING INFRASTRUCTURE FOR 5G WITH CITIZENS BROADBAND RADIO SERVICE PRIVATE LTE NETWORKS

Healthcare, transport and logistics, manufacturing, smart venues, smart cities, and oil and gas sectors will be major spenders in private Long-Term Evolution (LTE) from 2020 to 2025, [according to ABI Research](#). Main drivers of private LTE are a new understanding of spectrum usage spearheaded by Citizens Broadband Radio Service (CBRS) activities.

Unlike cellular spectrum, CBRS is not owned by mobile operators but it allows enterprises and [a new wave of managed service providers](#) (MSPs) to deploy in-building cellular coverage solutions at a fraction of the cost of today's alternatives. Major smartphone chip vendors already support CBRS capability and handsets are in the pipeline.

SPECTRUM

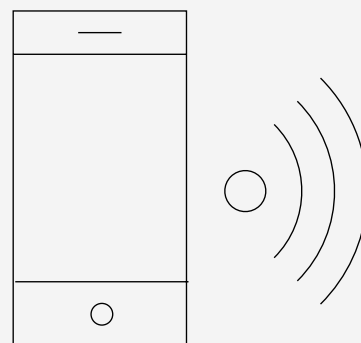
The CBRS system provides 150 MHz (3550 to 3700 MHz) of spectrum and offers the ability for companies to easily acquire spectrum in a local area at nominal cost. This has traditionally been one of the roadblocks to private LTE expansion.

With this ability, enterprises can leverage on solutions, such as the [CommScope Ruckus CBRS portfolio](#) that combines dedicated spectrum to allow enterprises to build a local private LTE network in-building or outdoors. Private LTE networks enable cellular-like reliability, mobility, security and quality of service but are managed like Wi-Fi and more cost-effective than traditional cellular/ LTE networks.

CBRS AND 5G

With CBRS, enterprises now have access to secure, cost-effective LTE coverage as well as support for IoT connectivity. This brings both commercial mobile operator services and emerging CBRS private LTE networks into an efficient, unified infrastructure that paves the way for 5G in the building.

CBRS creates a framework for 4G and 5G deployments in the 3.5 GHz band. In many countries, the 3.5 GHz band is reserved for 5G deployments. The technology allows building owners and property managers to run in-building networks using standard 4G LTE cellular technology. Even as mobile operators across Asia-Pacific gear up to roll out 5G networks, 4G availability in the region has reached near ubiquity, particularly in South Korea, Japan, Hong Kong, Taiwan, Singapore and India.



CHAPTER 6: UNIFYING INFRASTRUCTURE FOR 5G WITH CITIZENS BROADBAND RADIO SERVICE PRIVATE LTE NETWORKS

Private LTE networks bring maximum mobile coverage and ubiquitous connectivity inside buildings, in high-traffic venues (i.e., [stadiums](#), theatres) and in high radio frequency environments, such as hospitals and corporate and educational campus facilities. Asia-Pacific is expected to be the fastest-growing private LTE market over the coming years due to government initiatives to boost Smart City programmes and rapid investments from domestic vendors to integrate 5G with private LTE networks.

Successful private LTE deployments will show the reliability of cellular technology and its ecosystem. These networks enable enterprises to enhance operational efficiency and provide innovative network solutions to the end user while paving the way for 5G in industrial markets.

CBRS COMMERCIAL DEPLOYMENTS AND PORTFOLIO

In 2019, the US Federal Communication Commission [certified CommScope's spectrum access system](#) (SAS) to support CBRS for initial commercial deployment. CommScope's Environmental Sensing Capability (ESC) sensor also passed the Institute for Telecommunication Sciences' testing.

While the CBRS opens the coveted 3.5 GHz band to wireless networks, neutral hosts, broadband providers and other networks, all operators need to access an SAS to tap into this new spectrum. SAS allows efficient frequency sharing, interference reduction and the prioritization of the traffic from incumbent users, such as government radar installations.

At CommScope's manufacturing facility in the US, CBRS devices managed by the CommScope SAS provide high-bandwidth, low-latency connections to remote video equipment monitoring the facility while select IoT devices are also connected to the CommScope private LTE CBRS network.

With the addition of [CommScope Ruckus CBRS-band LTE access points \(APs\) and associated cloud services](#), CommScope's end-to-end solution consisting of SAS and ESC gives organisations the ability to deploy LTE-based wireless solutions quickly and confidently. A Ruckus private LTE network can be deployed as easily as Wi-Fi in a matter of hours or days and managed from the cloud.

Ruckus is a founding member of the CBRS Alliance and Ruckus has offered the industry's [first FCC-certified CBRS-band LTE APs](#). Ruckus equipment has been deployed in nearly 50 trials across a wide variety of enterprise verticals as well as with network operators.

With CBRS alleviating dead spots in wireless connectivity, enterprises minimise dropped connections, outages or gaps in service. Ultimately, the CBRS-driven private LTE networks will facilitate higher customer satisfaction and streamlined facilities management.

CHAPTER 6: UNIFYING INFRASTRUCTURE FOR 5G WITH CITIZENS BROADBAND RADIO SERVICE PRIVATE LTE NETWORKS

SIGNATURE SHOWCASE:

COMMScope/RUCKUS DEMONSTRATES CBRS FOR PRIVATE LTE

In 2019, CommScope [demonstrated the Ruckus Citizens Broadband Radio Service \(CBRS\) portfolio](#) and Attabotics' 3D robotic supply chain automation system as part of Microsoft Azure capabilities for private LTE networks. The demo also highlighted how IoT applications can take advantage of the security, latency and bitrates provided.

Integration of CommScope-Ruckus portfolio with Microsoft Azure's networking and edge connectivity solutions paves the way for dedicated, secure, ultra-high-quality private LTE networks that feature end-to-end encryption.

Ruckus also showcased a CBRS-based private LTE network in partnership with Amazon Web Services, Athonet, and Federated Wireless in late 2018. The CBRS networks enabled the rapid deployment of industrial IoT applications, such as real-time surveillance devices, smart meters, and worker safety monitoring.

More than 120 programmable Amazon DeepLens video cameras were configured and set up in a matter of hours. Previously, LTE networks would have taken weeks – or even months – to plan and deploy. DeepLens runs deep learning analyses locally on the camera to take action on what it sees.

The FCC-certified Ruckus Q710 3.5 GHz indoor APs and the Federated Wireless Spectrum Controller enabled access to CBRS shared spectrum for private 4G and 5G applications with Athonet BubbleCloud as a mobile core. The network delivered a plug-and-play experience that made it easy to connect, monitor and manage IoT assets at scale.

Typically, network congestion can be an issue with many devices trying to share the wireless bandwidth simultaneously. However, the LTE network was able to do this seamlessly with no impact on performance to the user.



CHAPTER 6: UNIFYING INFRASTRUCTURE FOR 5G WITH CITIZENS BROADBAND RADIO SERVICE PRIVATE LTE NETWORKS

SIGNATURE SHOWCASE:

Such demos inspire possibilities of other applications using DeepLens and similar devices leveraging AWS applications running locally and in the cloud.

REAL-WORLD IMPACT

CBRS capabilities are poised to allow office and industrial building owners to improve cellular signal strength at dramatically lower costs. This advantage alone addresses deployment challenges related to distributed antenna systems.

Similarly, hotels seeking to solve indoor cellular coverage issues can leverage technologies, such as OnGo, to provide interference-free spectrum. OnGo is a brand of the CBRS Alliance, which promises high-quality wireless connectivity enabled by spectrum sharing in the 3.5 GHz band.

Not all organisations have to design, install or manage their own LTE networks. Managed Service Providers provide networks for private LTE and as a neutral host network. As a neutral host, organisations enter a business agreement with mobile operators to provide service to mobile customers while they are on the OnGo network on premises.



CHAPTER 7

ADVANCED SECURITY FOR CLOUD WI-FI AND ON-BOARDING



CHAPTER 7: ADVANCED SECURITY FOR CLOUD WI-FI AND ON-BOARDING

Enterprises are developing intuitive self-service workflows with streamlined network onboarding so bring-your-own-device (BYOD) users, guests and IT-issued devices can gain network access simply and securely without IT intervention.

The [global BYOD market](#) is expected to register a compound annual growth rate of over 15% between 2019 and 2024 with Asia-Pacific witnessing the highest growth rate. BYOD adoption is being driven by increasing adoption of mobile devices in everyday life to access information anywhere and everywhere, be it work related or personal information; rising IT expenditure across diverse sectors; work-from-home culture; and government Smart City initiatives.

Moreover, failure to secure network access is a risk that many organisations cannot ignore. Aligned with [simple ways to improve security related to wired and wireless access](#), the CommScope-Ruckus portfolio of solutions bolsters data security with increased visibility and control over devices and users allowed on the network.

SECURE ON-BOARDING

Expectations of enterprise end-users, especially for self-service, have been shaped by their experience as consumers. Users are familiar with the common set-it-and-forget-it experience of activating a new cell phone at the carrier retail outlet or connecting to a home Wi-Fi source.

But in the enterprise environment, IT organisations typically rely on cumbersome methods for [network on-boarding and authentication](#), like MAC authentication and conventional pre-shared keys (PSKs) that are built into their networking infrastructure.

A better fit for network on-boarding is self-service with the right mechanism in place so that it is easy and intuitive for users. This calls for a purpose-built system for [secure network on-boarding](#) where users only have to go through the on-boarding process once without IT intervention.

CLOUDPATH ENROLMENT SYSTEM

The [CommScope Ruckus Cloudpath Enrollment System](#) software or software-as-a-service platform streamlines network on-boarding for BYOD users, guests and IT-owned devices. It enables IT teams to define and manage policies for role-based access; delivers visibility and granular control over what devices users can access on the network; and dramatically reduces help desk tickets related to network access.

Cloudpath secures every connection with WPA2-Enterprise, protecting data in transit between the device and the access point (AP) with powerful encryption. Internal users can self-provision any device for network access using their existing login credentials. A digital certificate for network authentication ensures that after the initial connection, users do not need to hassle with Wi-Fi passwords.

CHAPTER 7: ADVANCED SECURITY FOR CLOUD WI-FI AND ON-BOARDING

Guest users access a self-service login portal and receive credentials for internet access via email or SMS. Be it cloud-based or virtualized on-premises deployment, the solution supports any user, any device, and any network infrastructure.

IOT ENDPOINT ON-BOARDING

Secure device on-boarding is also a challenge for organisations seeking to deploy IoT solutions in the face of a fragmented ecosystem of standards, devices and services. Common IoT access addresses these issues by consolidating multiple physical-layer networks into a single converged network.

This common network establishes uniform security protocols and converges IoT endpoint management and policy setting. The [CommScope Ruckus IoT Suite](#) simplifies the creation of such an access network through the reuse of LAN and WLAN infrastructure, thus shortening deployment duration and reducing cost to support multiple IoT solutions.

This concept is applied across various verticals such as manufacturing, hospitality, healthcare and education. In hotels, an increasing number of wireless devices and systems for both guests and staff connect to Wi-Fi as well as other forms of wireless protocols such as Zigbee, LoRa or Bluetooth Low-Energy (BLE). Unifying these wireless protocols within a single AP enables hotels to save physical space and streamline secure device on-boarding.

Additionally, a converged AP, such as the CommScope Ruckus R730 Access Point, allows IT staff to easily view, manage and secure an entire wireless infrastructure. This facilitates network automation, generation of actionable analytics, and creation of custom dashboards with open APIs.

In addition, a converged AP can support Citizens Broadband Radio Service (CBRS), which enables hotels to create their own private LTE networks and provide reliable mobile coverage in support of guest experience.

CLOUD WI-FI

The [CommScope Ruckus Cloud Wi-Fi](#) wireless LAN management-as-a-service, coupled with Cloudpath subscription, takes complexity out of the secure on-boarding of new users and guests in Wi-Fi-enabled buildings and campuses.

With Cloudpath software's 802.1X certificate management and Ruckus cloud-managed Wi-Fi, even small IT departments can remotely and easily add new users and wireless APs; administer guest networks; and manage entire Wi-Fi-enabled buildings and campuses or any multi-site deployments.

Ruckus Cloud Wi-Fi enables IT departments to provision, monitor, optimise and troubleshoot an enterprise-grade Wi-Fi network with intuitive simplicity via a single web dashboard or mobile app. This has helped retailers easily capture detailed analytics; hotels enhance the overall guest experience; and retirement and nursing homes monitor health data in real time, among other use cases.

SUCCESS STORY: [ASIA PACIFIC UNIVERSITY OF TECHNOLOGY & INNOVATION](#), MALAYSIA

FAST, SECURE CAMPUS WI-FI ELEVATES LEARNING EXPERIENCE

The Asia Pacific University of Technology & Innovation (APU) aims to provide access to the best learning and teaching experience. To this end, the institute wanted a high-performing Wi-Fi network that is easy to deploy and maintain.

With smart devices already widely used on campus, enabling secure and simple on-boarding for faculty, staff and students was a critical requirement.

Students need to reliably and securely access all the server-side applications needed for their lessons and tutorials, whether from campus or off-campus. The network also supports a wireless environment across multiple platforms including computers, telephones and projectors in lecture halls and university labs.

SOLUTION

With [CommScope Ruckus APs](#) providing seamless wireless network roaming across the campus, [a virtual SmartZone \(vSZ\) controller](#), which can scale up to 300,000 devices, enabled administrators to expand and adapt the network to the changing needs of the university.

Additionally, the [CommScope Ruckus ICX switches](#) simplified network set-up, management and upgrades; enhanced

security; and minimised troubleshooting. The ICX switching architecture ensured excellent throughput for the most demanding video, unified communications, VDI and mobile applications.

BENEFITS

The CommScope Ruckus solutions have allowed APU to deploy an affordable and highly resilient wired and wireless network to support BYOD, media-rich applications, and the Internet of Things (IoT). Its network now easily handles approximately 7,000 connected



CHAPTER 7: ADVANCED SECURITY FOR CLOUD WI-FI AND ON-BOARDINGSUCCESS STORY: [ASIA PACIFIC UNIVERSITY OF TECHNOLOGY & INNOVATION](#), MALAYSIA

devices at any one time, and with capacity to spare.

The solutions also feature the Dynamic Pre-Shared Key (DPSK) and Ruckus Zero-IT Activation. The DPSK distinguishes lecturers' and students' networks, which makes Wi-Fi usage more secure. The Zero-IT feature, on the other hand, allows lecturers and students to directly conduct authentication using their user ID without IT intervention.

Granular role-based policies for wireless clients enable the creation of policy groups segmented by user role, domain, location, and OS type, among many other factors. Roles are assigned during the authentication phase

of new user on-boarding, along with other policies as desired.

APU plans to apply analytics and insight into functions such as indoor location tracking to help administrators track student movements within campus buildings in case of emergencies, or to enable lecturers to track attendance without requiring students to manually tap in using their student IDs.

APU is planning ahead for future technological and infrastructural needs. Moving forward, [Wi-Fi 6](#) is well poised to support the capacity and reliable connections required by future digital learning tools as well as emerging IoT applications.



CHAPTER 8

PHYSICAL-LAYER DATA
SECURITY STOPS INTERNAL,
EXTERNAL THREATS



CHAPTER 8: PHYSICAL-LAYER DATA SECURITY STOPS INTERNAL, EXTERNAL THREATS

In today's hyper-connected smart buildings, every network connection is a path into a corporate or mission-critical network. At the same time, the size of the attack surface when it comes to insider threats varies directly with the number of people who have access to the data being protected.

Asia-Pacific, in particular, is an ideal environment for cyber criminals to thrive in due to high digital connectivity, contrasted with low cybersecurity awareness, growing cross-border data transfers and weak regulations. In Southeast Asia, for example, digital transformation is pervading across all economic sectors and internet access has become affordable for large segments of the population.

In the same way that insider threats are an underestimated cause of data compromise, network access security is an underestimated layer of defence. A system for secure onboarding and authentication like the [CommScope Ruckus Cloudpath Enrollment System](#) makes it easy to define and manage role-based policies for network access. It gives IT teams the power to cut off network access if any inappropriate activity is detected.

Apart from secure on-boarding, which dramatically reduces helpdesk tickets related to network access, enterprises have to avoid unauthorised access at every layer and secure every point of entry – from encryption at the application level, to authentication, virtual private networks, firewalls and physical-layer security.

PHYSICAL-LAYER SECURITY

The cost of a data breach in the enterprise network goes beyond financial damage; it can take years for a business to regain trust and rebuild its reputation. It is estimated that 60% of data security breaches were carried out by insiders with either malicious or inadvertent intent. The physical layer infrastructure is clearly a critical part of any [data security](#) plan against internal and external threats.

In industries such as healthcare and finance, the issue of network security has spawned regulations and compliance requirements regarding data storage. Network infrastructure security concerns generally fall into two categories:

- Unauthorised access by an unauthorised person can be reduced or prevented through the deployment of IP-connected cameras, occupancy sensors, access controls and other connected elements of physical security. Physical cabling security such as keyed connectors, secure patch cords and port blockers can be deployed to reduce the threat of unauthorised access. Similarly, [automated infrastructure management \(AIM\) solutions](#) can record and report any unauthorised activity on the physical layer.

CHAPTER 8: PHYSICAL-LAYER DATA SECURITY STOPS INTERNAL, EXTERNAL THREATS

- Unauthorised access by an authorised person can be more difficult to detect and repel. Given the depth and complexity of the enterprise network, an AIM system enables network managers to monitor and manage network connections from the inside. Using intelligent cabling, connectors and patch panels, it automatically detects and maps all physical layer activity at the port and device level, in real time. If an authorised user connects or disconnects a device, [an AIM solution like CommScope's imVision](#) automatically alerts IT personnel.

IN-BUILDING WIRELESS

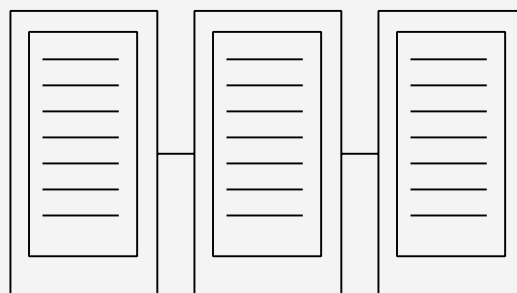
Given that the bulk of mobile traffic originates or terminates within a building, [in-building wireless networks](#) have become as vital to an enterprise as water or electricity. A worrying trend is that hackers have found ways to exploit weakness in the WPA2 security protocol used by most corporate Wi-Fi systems.

The latest iteration of the protocol – WPA3 for Enterprise – offers the equivalent of 192-bit cryptographic strength. Alternatively, a cellular or mobile network powered by a dedicated distributed antenna system (DAS) with security administered and managed centrally by service providers may be more robust and responsive than legacy Wi-Fi.

SECURITY MONITORING AND POWERED FIBRE/ POE CABLING

Networks of IP security cameras and occupancy sensors commonly installed in intelligent buildings are helping to spot unauthorised intruders. With the right cabling infrastructure, these [Power over Ethernet \(PoE\)](#) internal security monitors can be distributed throughout the building or campus.

While an AIM system can only locate a would-be hacker, cameras provide corroborating visual proof. Low-voltage powered-fibre or PoE network supports these connected sensors, cameras and controllers. If the main power fails, the AIM system and all connected security devices continue to function because they draw their power from the switches, which are typically backed up by UPS batteries and generators. This power structure is inherently more resilient and secure.



CHAPTER 8: PHYSICAL-LAYER DATA SECURITY STOPS INTERNAL, EXTERNAL THREATS

SUCCESS STORIES: [HANOI STOCK EXCHANGE](#), VIETNAM AND [SOUTH AUSTRALIAN HEALTH MEDICAL RESEARCH INSTITUTE](#), AUSTRALIA

CONSTANT MONITORING AND ALERTS MAKE A TRULY SECURE NETWORK

Establishing a secure network infrastructure where connectivity performance is critical had been a key concern for both Hanoi Stock Exchange and the South Australian Health Medical Research Institute (SAHMRI).

Intelligent infrastructure management was needed to provide system managers a real-time view of the network physical layer, speed up troubleshooting, and improve security while reducing network downtime and making maintenance more cost effective.

SOLUTION

Both organisations turned to CommScope, a leading supplier of structured cabling, and deployed the SYSTIMAX iPatch system consisting of the System Manager soft-ware, iPatch Manager, and iPatch intelligent copper and fibre panels that met all their infrastructure requirements.

CommScope's installations are backed by a global support network and industry-leading 20-year guarantees. At the Hanoi Stock Exchange, the finished infrastructure connects CCTV and access control systems. Within its data centre, SYSTIMAX cabling connects servers with a storage area network.



Meanwhile, SYSTIMAX 360 solutions-based network infrastructure connects SAHMRI's data systems and supports extra-low-voltage systems, including building management, security, voice-over-IP and lighting control. These critical applications depend on copper and fibre cabling with high performance and reliability.

BENEFITS

IT administrators at both organisations gain real-time visibility and control of the physical layer. Copper and fibre connections in the installations are managed using iPatch panels

CHAPTER 8: PHYSICAL-LAYER DATA SECURITY STOPS INTERNAL, EXTERNAL THREATS

SUCCESS STORIES: [HANOI STOCK EXCHANGE](#), VIETNAM AND [SOUTH AUSTRALIAN HEALTH MEDICAL RESEARCH INSTITUTE](#), AUSTRALIA

that allow monitoring of network connections and attached devices.

The iPatch software also alerts administrators immediately of any changes by detecting and locating unauthorised access points. The System Manager software helps to document and monitor the infrastructure through a standard web browser.

IMVISION AIM PLATFORM

Building on the iPatch System, CommScope offers its imVision AIM solution, which drives actionable insights as well as a new level of real-time intelligence and visibility into events that impact the network's physical layer and the devices connected to it.

An AIM solution uses intelligent cabling, connectors and patch panels to monitor the connected environment in real time. Should it detect an unauthorised or authorised device attempting to access unauthorised information, the system issues an immediate alert.

The System Manager tracks all devices, even those operating wirelessly, as they move about a network. The software also integrates with PoE devices, verifying that power is available to a connection. Further, the iPatch intelligent panels initiate real-time alerts whenever they detect unexpected changes to the network.

Deploying PoE and powered-fibre technology using Category 6A cabling also increases the resilience in security systems such as IP security cameras and AIM-based intelligence.

8 - 2



CONCLUSION

Communications networks are more complex than ever before. CommScope, combining the Ruckus and ARRIS portfolio, is well positioned to help digitally transformed Asian organisations seize opportunities and take advantage of long-term growth trends, including network convergence, fibre and mobility everywhere, 5G, Internet of Things and rapidly changing network and technology architectures.

The technology breakthroughs and customer stories presented in this e-book has highlighted how new customer initiatives push boundaries and drive immediate innovation in the core, access layer, and edge of their network.



COMMScope

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

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3/2020 EX-114355-EN

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