



5G & Net5.5G Regional Best Practices for ASEAN



February 2025

Table of Contents

1.0	Executive Summary	2-5
2.0	Introduction	
2.1	Current State of 5G Adoption in ASEAN	6-7
2.2	Examples of Net5.5G Adoption in ASEAN	7-9
2.3	ASEAN's Role in Facilitating Inter-Governmental Collaboration	9-10
2.4	Malaysia's Role as ASEAN Chair	10-11
2.5	Opportunities and Challenges	12-14
3.0	Industry Use Cases & Best Practices Adopted for 5G & Net5.5G	
3.1	Manufacturing	15-20
3.2	Healthcare	21-25
3.3	Education	26-29
3.4	Agriculture	30-33
4.0	Conclusion	
4.1	Key Takeaways from 5G & Net5.5G Adoption in ASEAN	34-35
4.2	The Role of Malaysia in Leading ASEAN's 5G & Net5.5G Future	36
4.3	The Path Forward for ASEAN	37-39
4.4	Key Technical Recommendations and Performance Indicators	39-41

1.0 Executive Summary

The **Association of Southeast Asian Nations (ASEAN)** is undergoing a transformative digital evolution with the rapid deployment of **5G** and the emergence of **Net5.5G technology**. This report explores the current state of adoption, ASEAN's role in fostering regional collaboration, and the opportunities and challenges associated with these advanced network technologies. As **Malaysia assumes the ASEAN Chairmanship in 2025**, it is strategically positioned to lead regional efforts in digital infrastructure development, regulatory coordination, and technological innovation.

5G adoption across ASEAN is progressing at varying rates. **Singapore** leads the region with comprehensive coverage integrated into key industries such as finance, healthcare, and transportation. **Thailand** has rapidly expanded its networks to support digital economy initiatives, while **Malaysia**, with an 81.8% 5G coverage as of December 2024, is advancing quickly. Similarly, **Brunei** has achieved 90% 5G coverage. **Vietnam, Indonesia**, and the **Philippines** are making significant strides through government-backed initiatives, while **Myanmar, Cambodia**, and **Laos** face challenges due to infrastructure limitations and investment constraints. At the same time, **Net5.5G is gaining traction as the next phase of connectivity**, delivering faster speeds, lower latency, and enhanced intelligent network automation. Several ASEAN countries have already begun early deployments of Net5.5G solutions, with **Indonesia, Malaysia, and Thailand at the forefront**. Key innovations include the use of 400GE ultra-broadband networks, SRv6-based intelligent traffic management, AI-driven automation, and network slicing, all of which are improving network efficiency, supporting industrial automation, and enabling seamless digital experiences for businesses and consumers.

ASEAN plays a crucial role in accelerating the adoption of both 5G and Net5.5G through coordinated policies and inter-governmental collaboration. The **ASEAN Digital Masterplan 2025** provides a framework for harmonizing spectrum allocation, aligning regulatory policies, and establishing best practices for network security and deployment. This regional approach ensures a more unified digital ecosystem that enhances cross-border connectivity and strengthens ASEAN's position as a globally

competitive digital economy. Malaysia, as ASEAN Chair in 2025, is well-positioned to drive these efforts forward. The country's introduction of a **second 5G network** aims to enhance industry adoption and attract investment, while its **15 Priority Economic Deliverables (PEDs)** emphasize digital transformation, addressing key challenges such as cybersecurity, regulatory inconsistencies, and equitable access to next-generation connectivity.

The deployment of **Net5.5G presents numerous opportunities** for ASEAN. The acceleration of digital economies and smart city initiatives is one of the most significant benefits, as **Net5.5G** enables AI-driven automation in urban infrastructure, optimizing traffic management, public safety, and environmental sustainability. **Net5.5G** technology also enhances industrial automation, particularly in manufacturing, healthcare, and education, where predictive maintenance, remote surgeries, and immersive digital learning experiences are becoming more prevalent. Additionally, **Net5.5G** plays a critical role in expanding connectivity to underserved and rural areas by leveraging small-cell networks, satellite-backed 5G, and edge computing solutions, allowing for greater access to telemedicine, e-learning, and digital commerce.

However, several challenges must be addressed to ensure the successful deployment of 5G and Net5.5G across ASEAN. High infrastructure costs remain a significant barrier, as the rollout of fibre-optic networks, small cells, and ultra-broadband solutions requires substantial investment. Public-private partnerships (PPPs) and innovative funding mechanisms will be necessary to offset these costs and ensure widespread deployment. Regulatory fragmentation is another major challenge, with variations in spectrum allocation, cybersecurity policies, and cross-border data governance slowing regional integration. ASEAN must work toward standardized policies that facilitate seamless interoperability across member states. Additionally, cybersecurity and data privacy concerns must be prioritized, as the expansion of Net5.5G networks increases the risk of cyber threats, including data breaches and network vulnerabilities. Governments must implement stringent security frameworks and collaborate on threat intelligence to mitigate these risks effectively.

Various industries in ASEAN are already experiencing the **transformative effects of 5G and Net5.5G**. In **manufacturing**, smart factories utilizing private 5G and Net5.5G networks are optimizing real-time automation, AI-driven predictive maintenance, and digital twin simulations, improving efficiency and reducing costs. The **healthcare** sector is benefiting from 5G-powered telemedicine, remote diagnostics, and AI-driven medical data analysis, while Net5.5G's high-bandwidth Wi-Fi 7 and intelligent network slicing ensure seamless connectivity for hospitals and healthcare facilities. The **education** sector is also witnessing significant advancements through 5G and Net5.5G-enabled digital learning platforms, AR/VR simulations, and AI-powered campus networks, which are enhancing student engagement and research capabilities. In **agriculture**, the adoption of IoT-driven precision farming, drone-assisted crop monitoring, and AI-powered automation is increasing productivity and promoting sustainable farming practices.

To fully capitalize on the potential of 5G and Net5.5G, ASEAN must adopt a unified vision for digital transformation. Accelerating network deployment, particularly in rural areas, while standardizing regulatory frameworks will help streamline implementation and ensure consistency across the region. **Investing in workforce development and digital literacy programs** will also be essential, as ASEAN must equip its professionals with the necessary **skills to manage and innovate with 5G and Net5.5G technology**. Governments should also prioritize **targeted policies that incentivize investment** in remote areas, leveraging satellite-backed solutions, infrastructure-sharing models, and digital inclusion initiatives. Additionally, fostering a robust innovation ecosystem will be key to driving long-term economic growth, as 5G will serve as the foundation for new industries and business models. Encouraging research and development in **AI, IoT, and other emerging technologies** will enable ASEAN to remain competitive in the global digital landscape.

Malaysia's leadership in ASEAN's 5G and Net5.5G future is already evident through its strategic investments and policy initiatives. The country has secured **over USD 10 billion in technology investments from global firms such as Google, Microsoft, NVIDIA, and AWS**, solidifying its position as a hub for AI and cloud innovation.

Additionally, the **establishment of the National AI Office** and **MRANTI's 5G Experience Centre** highlights Malaysia's commitment to fostering research, regulatory development, and commercialization of next-generation technologies. Through its leadership in 2025, Malaysia can drive the adoption of data governance frameworks, promote interoperability standards, and encourage cross-border collaborations that will accelerate ASEAN's transition to a fully digital economy.

As ASEAN moves forward, strategic collaboration and bold policy decisions will be essential to harnessing the full potential of 5G and Net5.5G. The region must focus on ensuring inclusive access to advanced connectivity. With Malaysia at the helm, ASEAN has a unique opportunity to establish itself as a global leader in **leveraging 5G and Net5.5G to drive economic growth, technological innovation, and regional competitiveness**. By addressing key challenges and capitalizing on emerging opportunities, ASEAN can build a resilient and future-ready digital economy that benefits all of its member states.

2.0 Introduction

The Association of Southeast Asian Nations (ASEAN) is experiencing a transformative phase with the rapid deployment of 5G and Net5.5G technology across its member states. This chapter delves into the current state of 5G and Net5.5G adoption within ASEAN, highlights the organization's pivotal role in fostering inter-governmental collaboration to expedite 5G implementation across various industries, and underscores Malaysia's strategic position and opportunities as the ASEAN Chair in 2025.

2.1 Current State of 5G Adoption in ASEAN

As of early 2025, ASEAN countries exhibit varying stages of 5G deployment, reflecting diverse economic landscapes, infrastructure readiness, and policy frameworks. According to an industry report, 5G subscriptions in Southeast Asia and Oceania were projected to reach nearly 30 million by the end of 2022, with an anticipated compound annual growth rate (CAGR) of 67% leading to approximately 620 million 5G subscriptions by the end of 2028¹.

Singapore stands at the forefront, boasting comprehensive 5G coverage and a robust ecosystem that integrates 5G into multiple sectors such as finance, healthcare, and transportation. Thailand has made significant strides, with major urban centres experiencing substantial 5G rollout, bolstering its digital economy initiatives. Malaysia is accelerating its 5G infrastructure development, aiming to position itself as a regional leader in digital transformation, with about 81.8% 5G coverage as of December 2024², while Brunei has also been largely successful with an estimated 90% 5G coverage³. Conversely, nations like Myanmar, Cambodia and Laos are in the nascent

¹ <https://www.ericsson.com/en/reports-and-papers/mobility-report/closer-look/south-east-asia-and-oceania>

² <https://theedgemalaysia.com/node/723474>

³ <https://www.usasean.org/article/5g-rolled-out-brunei>

stages of 5G deployment, contending with challenges related to infrastructure deficits and limited investment.

2.2 Examples of Net5.5G Adoption in ASEAN

2.2.1 Indonesia

Indonesia XL Axiata has started to practice and explore Net5.5G technology to improve user experience.⁴ It is the first IP bearer network to deploy 400GE, SRv6, and digital network map, building a foundation for ultra-broadband and high-quality digital economy.

With the popularization of FTTH, the number of 4G users, and the pilot of 5G packages, users have increasingly high requirements in terms of experience. 400GE deployment can cope with the rapid growth of traffic. Indonesia has many islands, and inter-island network link resources are very important. However, frequent fibre cuts cause traffic congestion and uneven utilization of network link resources. Traditional manual operations and management is difficult. Digital network maps and SRv6 are used to automatically optimize and adjust congested paths in a timely manner without manual intervention, maximizing network utilization.

In addition, based on the network digital map visualization, the traffic bandwidth and link delay of the live network can be easily evaluated. Based on agile service provisioning capabilities and network slicing experience assurance technologies brought by Huawei, Indonesia XL Axiata plans to expand more B2B services in the future for added revenue channels.

⁴ <https://www.163.com/dy/article/ILSA9SQK0531N0ME.html>

2.2.2 Malaysia

Malaysia's Internet Service Provider, TIME Dotcom, shared its best practices during the Asia-Pacific Net5.5G IP GALA of the Asia-Pacific ICT Summit 2024 held in Bangkok, Thailand.⁵

At the conference, TIME Dotcom introduced the practice of transforming from traditional MPLS to SRv6 networks, simplifying networks based on SRv6 and network digital maps, and providing programmable network paths to flexibly provide services.

With the generational upgrade of Net5.5G, it will help operators open up new business spaces such as mobile, home broadband, B2B, and intelligent computing. Based on key capabilities such as 400GE, SRv6, slice as a service, and network digital map, Net5.5G converged bearer target network is built to help operators achieve new growth.

2.2.3 Thailand

Through two years of self-intelligent network practice, Thailand Advanced Info Service (Thailand AIS), the largest network operator in Thailand, leads L4 evolution of Smart Networks to meet complex challenges of Future Network Technologies.

By adopting Net5.5G, Thailand AIS has successfully improved customer experience by 10%, reduced traffic loss by 80%, and improved network efficiency by over 20%.⁶

Leveraging on the new opportunities brought by 5G Advanced technologies such as high-precision positioning, improved mobility and time-critical support, enhanced Massive MIMO, enhanced support for network slicing and exposure, as well as AI-based capabilities, AIS is

⁵ <https://mp.weixin.qq.com/s/vqz9PicBtEBpxfJtznMvhw>

⁶ <https://www.news.cn/20240724/032f37c7d40148e99dd95c65817e2655/c.html>

committed to providing customers with the ultimate experience and helping vertical industry enterprises with digital transformation.

To achieve a higher level (L4) of self-intelligent networks, AIS is actively exploring the application of key technologies such as cross-domain digital twin networks and large language models to optimize fault management and complaint management processes.

AIS plans to upgrade fault management and complaint management to L3.5 level and build cross-domain digital twins to achieve the goal of zero business interruption. By predicting fault risks and proactively optimizing real-time networks, AIS will further reduce network failure rates and improve customer experience.

Looking to the future, AIS calls on the whole industry to cooperate and jointly formulate L4 industry standards and blueprints to promote the healthy development of self-intelligent networks.

2.3 ASEAN's Role in Facilitating Inter-Governmental Collaboration

ASEAN plays a crucial role in harmonizing efforts among its member states to expedite 5G adoption and establish unified implementation standards across industries. The organization's collaborative framework fosters policy alignment, resource sharing, and capacity building, ensuring that all member countries can benefit from the advancements in 5G technology.

The ASEAN Digital Masterplan 2025⁷ underscores the importance of sufficient and suitable spectrum allocation, recognizing it as key to initiatives like introducing 5G and delivering connectivity in rural areas. The masterplan advocates for harmonizing spectrum bands and adopting best practices in spectrum reallocation and award processes.

⁷ <https://asean.org/wp-content/uploads/2021/08/ASEAN-Digital-Masterplan-2025.pdf>

Furthermore, ASEAN's commitment to digital integration is evident through initiatives such as the development of best practice guides for the 5G ecosystem⁸. These guides aim to provide member states with frameworks to navigate the complexities of 5G deployment, from infrastructure development to regulatory considerations.

2.4 Malaysia's Role as ASEAN Chair

Assuming the ASEAN Chairmanship in 2025, Malaysia is uniquely positioned to spearhead initiatives that accelerate 5G adoption and digital innovation across the region. The nation has articulated a vision centred on inclusivity and sustainability, with a focus on 15 Priority Economic Deliverables (PEDs) designed to strengthen regional economic integration and promote sustainable growth⁹.

In preparation for its chairmanship, Malaysia has been proactive in enhancing its digital infrastructure¹⁰. The government has introduced a second 5G network, aiming to promote the use of 5G across various industries. This move is anticipated to position Malaysia as a 5G leader during its ASEAN Chairmanship and strengthen its influence on digital-related investments in the region.

Additionally, Malaysia's collaboration with global telecommunication partners to supercharge its 5G network with advanced capabilities, such as seen through the partnership between UMobile and Huawei, reflects its commitment to technological leadership.¹¹ This partnership will probably see Net5.5G as the main backbone, enhancing Malaysia's domestic 5G infrastructure and setting a benchmark for other ASEAN nations.

⁸ https://asean.org/wp-content/uploads/2022/02/03-ASEAN-5G-Ecosystem-Best-Practices-Guide_Final-Report_SG_ASEC_TL_PH_MY.pdf

⁹ <https://fulcrum.sg/aseans-2025-chair-navigating-tricky-economic-shoals>

¹⁰ <https://www.bernama.com/en/news.php?id=2353747>

¹¹ <https://dig.watch/updates/u-mobile-and-huawei-malaysia-partner-to-enhance-5g-networks-and-drive-digital-growth>

As Chair, Malaysia has the opportunity to facilitate dialogues and partnerships that address common challenges in 5G deployment, such as cybersecurity concerns, regulatory harmonization, and equitable access. By leveraging its leadership position, Malaysia can advocate for policies that promote investment in digital infrastructure, support innovation, and ensure that the benefits of 5G are accessible to all member states.

In a nutshell, the ASEAN region is on a promising trajectory toward widespread 5G and Net5.5G adoption, with member states making significant progress in deploying this transformative technology. ASEAN's role in fostering inter-governmental collaboration is pivotal in ensuring a cohesive and inclusive approach to 5G and Net5.5G implementation. As the incoming Chair in 2025, Malaysia holds a strategic position to lead these efforts, driving initiatives that will shape the digital future of the region.

2.5 Opportunities and Challenges

2.5.1 Opportunities

- **Acceleration of Digital Economies and Smart City Initiatives**

ASEAN nations are experiencing rapid urbanization, and 5G-powered smart cities¹² that are under way as shown in Figure 2-1, offer solutions for traffic management, waste disposal, public safety, and efficient energy use. Launching of smart city initiatives utilizing 5G-enabled IoT sensors and AI-driven automation can improve urban infrastructure and service delivery.



Figure 2-1: Smart City Projects Across Southeast Asia

¹² <https://www.sourceofasia.com/unlocking-aseans-infrastructure-potential-key-investment-opportunities-in-southeast-asia/>

- **Increased Connectivity for Underserved and Rural Areas**

5G technology enables high-speed internet in remote regions where traditional broadband infrastructure is unavailable or unreliable. By deploying small cell networks, satellite-backed 5G, and edge computing solutions, ASEAN governments can bridge the digital divide and provide essential digital services such as telemedicine, online education, and e-commerce to rural populations.

- **Enhanced Automation, AI, and IoT-driven Industrial Growth**

5G allows manufacturers to implement intelligent automation, predictive maintenance, and robotic process automation. AI-powered robots, digital twins, and machine learning applications can enhance productivity and reduce operational costs.

2.5.2 Challenges

- **High Infrastructure Costs and Investment Requirements**

The deployment of 5G infrastructure, including fibre optics, small cells, and high-band spectrum towers, requires massive financial investment.¹³ Governments must explore public-private partnerships (PPPs) and international funding sources to facilitate nationwide deployment.

- **Fragmented Regulatory Policies Across ASEAN Member States**

ASEAN nations currently lack a unified approach to spectrum allocation, cybersecurity protocols, and cross-border data management.¹⁴ Without regional policy coordination, interoperability issues and investment uncertainty could hinder 5G growth.

- **Cybersecurity and Data Privacy Concerns**

The expansion of 5G networks increases the risk of cyber threats such as data breaches, espionage, and network attacks.¹⁵ Governments must implement strict security frameworks and collaborate with international cybersecurity organizations to mitigate these risks.

¹³ <https://www.linkedin.com/pulse/5g-asean-investments-challenges-growth-scenarios-naveen-menon/>

¹⁴ <https://fulcrum.sg/fragmented-digital-regulations-are-constraining-aseans-digital-economy/>

¹⁵ <https://www.gsma.com/newsroom/article/safeguarding-the-future-managing-5g-security-risks/>

3.0 Industry Use Cases & Best Practices Adopted for 5G & Net5.5G

3.1 Manufacturing

3.1.1 Use Cases

The manufacturing sector stands to gain substantially from 5G, particularly through the implementation of smart factories, where automation, real-time monitoring, and data-driven decision-making enable higher productivity and efficiency. 5G's ultra-low latency and high-speed capabilities enable seamless communication between machines, sensors, and cloud systems, leading to enhanced operations.

Smart factories utilize IoT sensors and AI-powered systems to monitor production lines, manage inventory, and optimize workflows in real time. The ability to detect anomalies instantly and respond to issues immediately reduces downtime and increases overall efficiency.

Predictive maintenance is another critical application, allowing manufacturers to anticipate equipment failures before they occur. By leveraging 5G-powered sensors that continuously monitor machinery, manufacturers can identify signs of wear and tear early, schedule maintenance accordingly, and avoid costly downtime.

5G also enables the integration of augmented reality (AR) and virtual reality (VR) tools in manufacturing, which support remote training, virtual prototyping, and even maintenance guidance. These tools enhance operational efficiency and create more flexible and adaptive manufacturing environments.

Bosch, a leader in manufacturing, implemented 5G at its plant in Stuttgart-Feuerbach, Germany, transforming it into a fully smart factory.¹⁶

By leveraging 5G's ultra-low latency and machine-to-machine (M2M) communication, Bosch introduced real-time monitoring systems, IoT sensors, and autonomous machines on the production line. This allowed for predictive maintenance, anomaly detection, and significantly reduced downtime. Bosch reported improved production efficiency and reduced operational costs through optimized workflows and inventory management.



Figure 3-1: Private 5G Network at Bosch's Stuttgart-Feuerbach Plant

¹⁶ <https://www.bosch-presse.de/pressportal/de/en/bosch-puts-first-5g-campus-network-into-operation-221632.html>

Meanwhile, for Net5.5G, an implementation example in Manufacturing can be seen through Rongjie Energy's smart factory.¹⁷ To meet the high requirements of the manufacturing site on campus networks, Rongjie Energy uses Huawei's high-quality 10GE campus solution to build a new-generation Research & Development network that features security, reliability, flexible access, and intelligent Operations & Management. This ensures high availability, scalability, and intelligence of the network, apart from providing strong network support for Rongjie Energy's smart manufacturing journey and promote it to achieve a higher level of innovation and development in the new energy industry.

The VXLAN virtualization technology is innovatively introduced to construct a virtual network on top of the physical network at the network layer. In this way, the SDN network is constructed. By using the network logical layer isolation, a dedicated high-speed channel is built for service transmission, where office and production services are transmitted.

In addition, Huawei iMaster NCE-Campus centrally manages and controls all network resources, implements automatic provisioning of network configurations throughout the base, and isolates the intelligent network and dormitory network from the office and production networks through firewalls. It builds a secure and advanced smart campus network for Rongjie's manufacturing site, greatly shortens network construction time and saves construction costs.

Huawei's iMaster NCE campus network digital map enables multi-dimensional visibility and policy configuration of network devices, production terminals, and production automation applications to be implemented on one GUI, greatly simplifying management and

¹⁷ <https://mp.weixin.qq.com/s/ShEWIVYjuMwZqqVPXg62A>

operation. In addition, end-to-end network path and quality detection is performed based on production automation applications.

The digital map of the campus network can detect network experience in real time. When a fault occurs on the network, the impact scope of the fault can be quickly determined and the fault can be located. One-click fault optimization makes network maintenance more efficient. It provides convenience for the network active support and lays a foundation for building automated production lines.

3.1.2 Best Practices Adopted

- **Implementation of Private 5G Network**

Bosch's Stuttgart-Feuerbach plant leveraged a private 5G network to enable real-time automation and machine-to-machine (M2M) communication. This ensured a dedicated, low-latency, and secure network for industrial applications without relying on public infrastructure. This model allows manufacturers to have better control over their connectivity, security, and bandwidth allocation.

- **Predictive Maintenance through IoT Sensors**

Bosch adopted IoT-powered predictive maintenance to monitor equipment health in real-time. The 5G-enabled sensors continuously collected and transmitted machine performance data, allowing for early detection of potential failures. This proactive approach minimized downtime, reduced repair costs, and improved overall productivity.

- **Autonomous and AI-Driven Production Lines**

The factory incorporated AI-powered robotics and autonomous systems that adapted production processes based on real-time data. By enabling seamless machine communication over 5G, these intelligent systems optimized resource allocation, reduced errors, and enhanced production efficiency.

- **Digital Twin Technology for Workflow Optimization**

Bosch utilized digital twins (virtual models of physical assets) powered by real-time 5G connectivity to simulate production scenarios and optimize workflows. This enabled manufacturers to test changes digitally before implementing them, reducing inefficiencies and material waste.

- **Using Net5.5G High-quality 10GE Campus Solution**

Rongjie Energy uses Huawei's high-quality 10GE campus solution to build a new-generation Research & Development network that features security, reliability, flexible access, and intelligent Operations & Management. This ensures high availability, scalability, and intelligence of the network.

- **Using VXLAN virtualization technology**

Rongjie Energy constructed their SDN network by using VXLAN virtualization technology. It allows for network logical layer isolation, where a dedicated high-speed channel is built for service transmission.

- **Real-time network monitoring and fault detection**

Rongjie Energy utilizes Huawei's iMaster NCE-Campus to digitally map its network and assess network experience in real time. When a fault occurs on the network, the scope can be quickly determined and mitigated with one-click fault optimization capabilities.

3.2 Healthcare

3.2.1 Use Cases

In healthcare, 5G opens the door to telemedicine, remote diagnostics, and smart health devices that can significantly improve patient care and reduce the burden on healthcare facilities. The ability to transmit large amounts of data with minimal latency and high reliability makes 5G a game-changer in this sector.

Telemedicine benefits from 5G through high-definition video consultations that provide real-time interactions between doctors and patients, even in remote locations. The ability to conduct remote surgeries using robotic systems and haptic feedback becomes feasible with the low latency of 5G, offering specialized care without geographical limitations.

Remote diagnostics allow healthcare providers to monitor patients continuously using wearable devices that transmit health data, such as heart rate, blood pressure, or glucose levels, to clinicians in real time. These smart health devices can alert medical professionals about any abnormalities, ensuring faster intervention and personalized treatment plans.

Additionally, AI-powered diagnostics that require rapid data analysis can benefit from 5G's high-speed capabilities, allowing healthcare systems to analyse imaging results or other complex data in real time, enhancing diagnostic accuracy and efficiency.

Samsung Medical Centre in South Korea deployed a 5G network to enhance its remote cooperative surgery and real-time remote surgical training.¹⁸ The centre utilized 5G's low latency and high-speed

¹⁸ <https://www.netmanias.com/en/post/oneshot/15743/5g-kt-private-5g/case-study-on-private-5g-service-of-kt-mos-in-korea-samsung-medical-center>

connectivity for video streaming captured from high-definition immersive video such as AR glasses, an endoscope, and a 360-degree camera, and then streamed to a medical education platform through a private 5G network. In a remote office, a specialist watches the video and guides the surgeon (remote cooperative surgery). Students and junior doctors in the seminar room can observe the live surgical video while also learning from the surgeon's guidance (real-time remote surgical training).

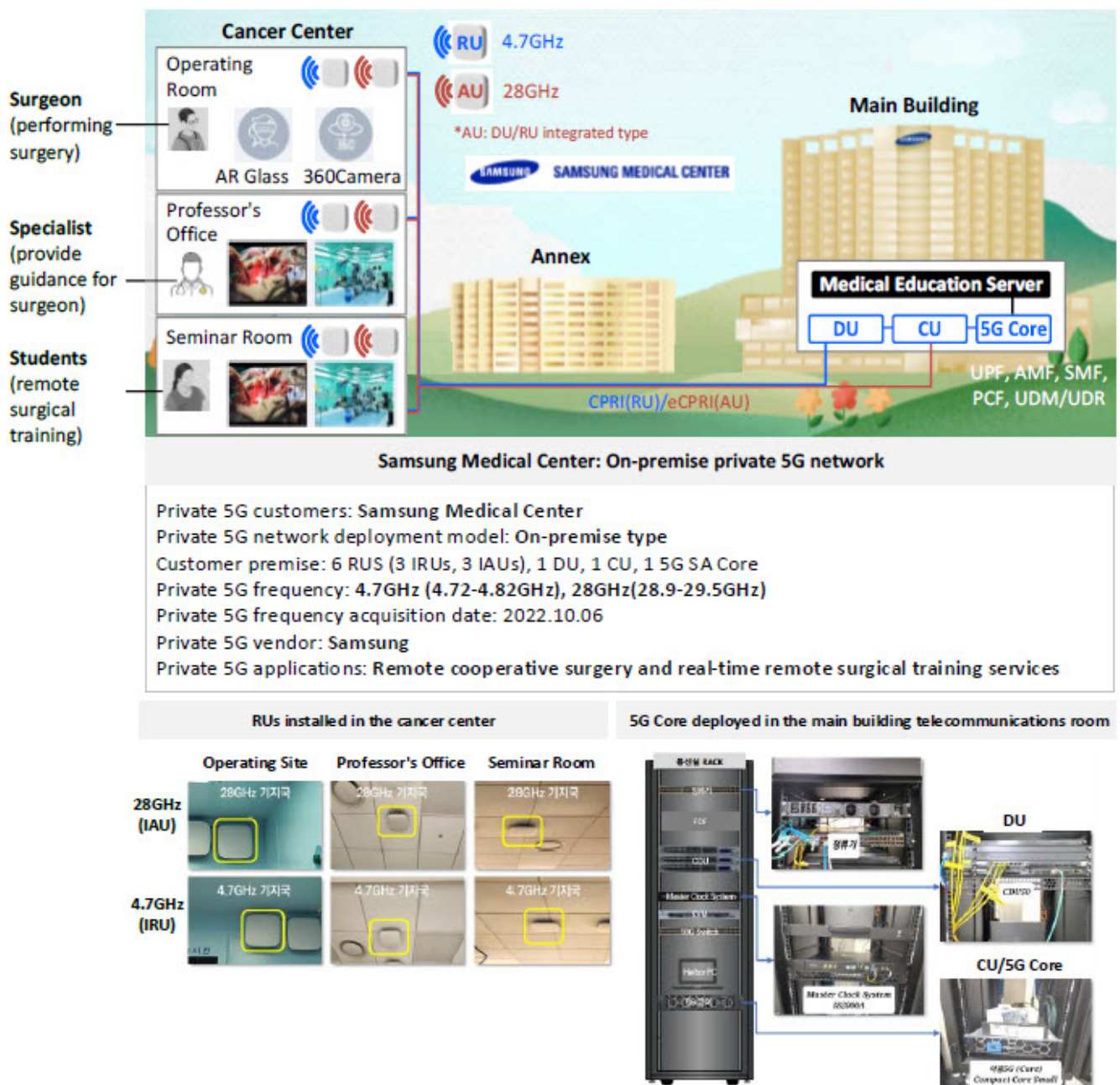


Figure 3-2: Private 5G Network at Samsung Medical Centre in Seoul, South Korea

Meanwhile, for Net5.5G, an implementation example in Healthcare can be seen through Koc Healthcare, a top medical institution in Türkiye.¹⁹

Koc Healthcare adopted Huawei's high-quality Wi-Fi 7 technology and iMaster NCE-Campus network digital map solution for its Izmir American Hospital. Huawei's High-Quality Wi-Fi 7 Campus Solution delivers a high-bandwidth, high-concurrency, low-latency wireless network for Izmir American Hospital in Türkiye. Huawei's high-end AirEngine 6776-57T Wi-Fi 7 AP supports a total of 8 streams and delivers a rate of up to 13.66 Gbps. Leveraging the advantages of the new Wi-Fi 7 protocol, such as multi-link operation (MLO), multiple resource unit (MRU), and 4096-quadrature amplitude modulation (QAM), the peak rate of a single terminal is multiplied compared to the Wi-Fi 6, making it perfectly suited for the high-bandwidth healthcare services of the new era and flexibly future-proof.

To fully unleash the high-bandwidth capability of Wi-Fi 7, Huawei also provides an industry-leading network solution for wired networks. Huawei CloudEngine S5732-H multi-GE access switch uniquely supports flexible downlink port rate upgrade from GE to 10GE via right-to-use (RTU) licenses on demand, and future-proofing service and bandwidth upgrade without requiring device replacement.

What's more, Huawei's intelligent O&M platform, iMaster NCE-Campus, helps Izmir American Hospital take its network O&M experience to a new level. Based on AI capabilities, the platform can automatically detect and locate faults on the network system, reducing manual intervention by O&M personnel and improving O&M efficiency. In addition, network data can be analyzed and predicted to help the hospital detect and solve potential issues in a timely manner, preventing system faults from affecting medical services. The platform

¹⁹ <https://e.huawei.com/cn/case-studies/solutions/enterprise-network/2024-izmir-american-hospital>

also provides a one-map visualized topology to help O&M personnel manage network elements (NEs) across the network, view and locate network faults at the link in minutes, improving network O&M efficiency by 80%.

3.2.2 Best Practices Adopted

- **Deployment of Private 5G Networks for Secure Medical Data Transmission**

Samsung Medical Centre established a private 5G network to support critical healthcare operations, ensuring high-speed, low-latency, and secure connectivity. This enabled seamless data transfer without reliance on external networks, reducing security vulnerabilities.

- **Remote Cooperative Surgery Using 5G-Enabled Video Streaming**

The hospital utilized 5G to facilitate real-time remote cooperative surgeries. High-resolution cameras, AR glasses, and 360-degree imaging transmitted live surgery feeds to remote specialists, allowing them to provide real-time guidance to surgeons in different locations.

- **Enhancing Medical Education with Real-Time VR Training**

The hospital introduced 5G-powered virtual reality (VR) training for medical students and junior doctors. Live surgeries were streamed using immersive VR headsets, providing hands-on experience remotely without physical presence in the operating room.

- **Optimized Data Storage & Processing Through Edge Computing**

To handle the massive data generated from high-resolution imaging and AI diagnostics, the medical centre deployed edge computing with 5G. This minimized latency by processing data closer to the source, ensuring quick access to patient records and reducing cloud storage costs.

- **Utilizing Wi-Fi 7 technology**

Izmir American Hospital in Turkiye adopted Huawei's Wi-Fi 7 technology to ensure a high-bandwidth, high-concurrency, low-latency wireless network for its healthcare premises. This guarantees that medical data is always available and mission-critical hospital operations are not impeded due to slow networks.

- **Utilizing Huawei's iMaster NCE-Campus Network Digital Map Solution with AI Capabilities**

Izmir American Hospital in Turkiye adopted Huawei's iMaster NCE-Campus Network Digital Map Solution with AI capabilities to automatically detect and locate faults on the network system within minutes, reducing the requirement of manual intervention and thus ensuring minimal downtime and disruption to its medical services.

3.3 Education

3.3.1 Use Cases

The education sector can leverage 5G to create dedicated network slices that improve the quality, security, and speed of connectivity across campus environments. The flexibility of 5G allows educational institutions to segment networks for specific use cases such as research, administration, faculty, and student needs. This ensures optimized network performance for each segment, minimizing disruptions and maximizing bandwidth where it is most needed.

Enhanced campus networks improve online learning experiences through high-speed, low-latency video conferencing, virtual classrooms, and real-time collaboration tools. 5G can also support VR/AR-enabled learning experiences, allowing students to engage in immersive educational simulations in fields such as medicine, engineering, and the sciences.

For research purposes, 5G enables faster access to large datasets and cloud-based research tools, allowing academic institutions to collaborate globally in real-time. Network slicing ensures that these high-demand, data-intensive research activities are not hampered by bandwidth limitations.

Educational institutions also benefit from the enhanced security that 5G can provide, as dedicated network slices can be secured and optimized for different stakeholders, reducing the risk of cyber-attacks or unauthorized access.

By embracing 5G, educational institutions can foster more dynamic and interactive learning environments while ensuring secure and seamless access to the resources and tools needed to thrive in an increasingly digital world.

Intel enabled the creation of a 5G Digital School Library in Penang, Malaysia that made digital learning resources accessible to thousands of Kindergarten to Year 12 students (6 to 18 years old) across the state through an AI-enabled on-premise edge solution.²⁰

This project was accomplished through an on-site edge computing solution that includes a server for content access and multiple edge devices for each school. The content access server facilitates content caching and provides uninterrupted access to teachers and students. To date, the 5G Digital School Library Program has successfully enabled 50% of Penang's rural schools with internet access. In doing so, it has enabled almost 200,000 K-12 students to access updated knowledge and expand their horizons.

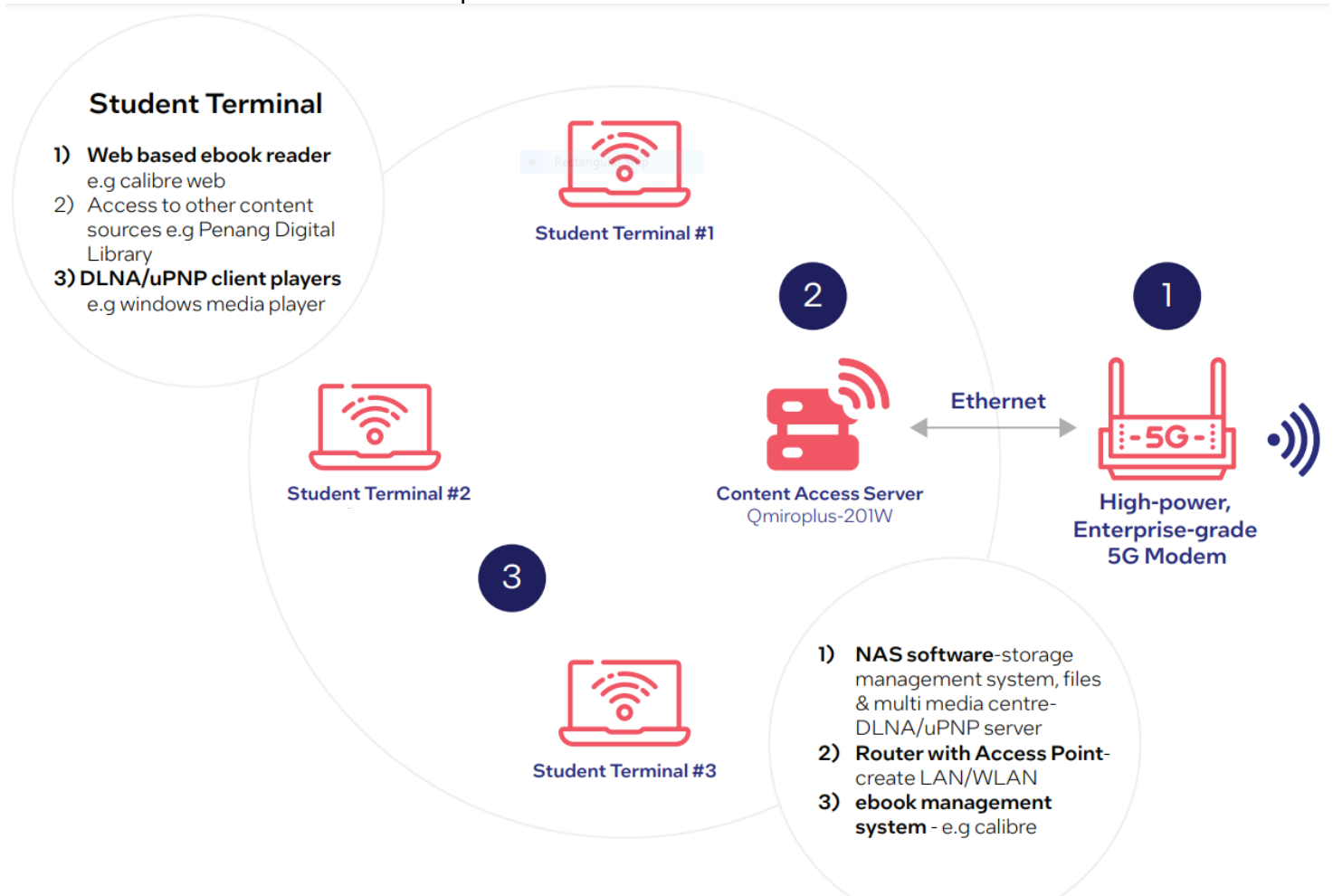


Figure 3-3: Overview of the 5G Digital School Library for Penang, Malaysia

²⁰ <https://www.intel.com/content/dam/www/central-libraries/us/en/documents/2024-07/case-study-penang-science-cluster.pdf>

Meanwhile, for Net5.5G, an implementation example in Education can be seen through the University of The Thai Chamber of Commerce.²¹

By deploying Huawei's AirEngine Wi-Fi 7 solution, they have greatly improved the learning and work experience of all teachers, students and employees.

The solution adopts the full redundancy design and AI network monitoring service to ensure network stability. It also provides application-based monitoring, hierarchical quality of service (HQoS) assurance, and AI intelligent uninterrupted roaming.

The AirEngine Wi-Fi 7 access point uses the next-generation connectivity technology to unleash high-speed wireless connectivity and support IoT capabilities to provide a seamless network experience with full wireless coverage.

In addition, the unified network management platform provides intelligent operations and management, implementing real-time wired and wireless network monitoring, and uses AI capabilities to support network analysis and fault locating in mere seconds.

3.3.2 Best Practices Adopted

- **On-Premise Edge Computing for Content Caching**

Intel's 5G Digital School Library in Penang utilized on-site edge computing, allowing educational materials to be pre-cached. This ensured uninterrupted access to digital resources for students in rural schools, even in areas with intermittent connectivity.

²¹ <https://e.huawei.com/cn/case-studies/industries/education/2024-university-of-the-thai-chamber-of-commerce>

- **Dedicated 5G Network Slices for Secure & Optimized Learning**

The 5G Digital School Library implemented network slicing to provide dedicated bandwidth for education services. This prevented congestion from non-educational applications, ensuring seamless access to digital classrooms, research tools, and cloud-based learning platforms.

- **Scalable Infrastructure for Expanding Connectivity**

The 5G Digital School Library was designed with scalability in mind, allowing additional schools to be connected with minimal infrastructure changes. This ensured that more rural students could benefit from digital education as 5G coverage expanded.

- **Public-Private Collaboration for Sustainable Implementation**

The 5G Digital School Library was a collaboration between Intel, local government, and educational institutions, demonstrating the effectiveness of public-private partnerships (PPPs) in scaling 5G-driven solutions. The model encouraged long-term sustainability through shared investment and expertise.

- **Adopting Huawei's AirEngine Wifi 7**

University of The Thai Chamber of Commerce deployed Huawei's AirEngine Wi-Fi 7 solution to improve coverage, provide hierarchical QoS and high-speed wireless connectivity to support IoT capabilities for its students and faculty's learning and research requirements.

3.4 Agriculture

3.4.1 Use Cases

5G is poised to revolutionize agriculture through the implementation of precision farming, automated machinery, and real-time monitoring of crops and livestock. With 5G's ability to support a massive number of connected devices and deliver real-time data, agricultural practices can become more data-driven, efficient, and sustainable.

Precision farming leverages 5G-powered IoT sensors to monitor soil moisture, nutrient levels, and weather conditions in real time. This data allows farmers to make informed decisions about irrigation, fertilization, and pest control, optimizing resource use and increasing crop yields while minimizing environmental impact.

Automated machinery, such as self-driving tractors, drones, and robotic harvesters, can operate more efficiently using 5G networks. These machines can receive real-time data and adapt to changing conditions on the farm, leading to more accurate planting, harvesting, and maintenance operations.

Real-time monitoring of livestock using smart sensors allows farmers to track animal health and behaviour, detecting signs of illness or distress early and ensuring timely interventions. This contributes to better animal welfare and reduces losses associated with livestock diseases.

The integration of 5G in agriculture will lead to more productive and sustainable farming practices, helping address the challenges of food security and climate change in the ASEAN region.

Agrointelli is a Danish company that develops autonomous robots for farms.²² One of the ways to use these robots is to fight volunteer potatoes that spoil sugar beet crops.

Potato leftovers grow more quickly and block the sunlight from reaching the sugar beets. This prevents sugar beets from growing normally as they can't absorb enough nutrients.

The 5G-connected robot is equipped with cameras and precision sprayers. It takes photos of plants and sends them to a cloud-based server. The ML algorithm compares these photos with over 6,000 images of weeds and potato plants. After classifying each image, the server sends them back to the robot. If the plant is a potato, the robot sprays it with glyphosate.

The full cycle takes approximately 250 milliseconds. This is possible due to the high-speed 5G connection supported on the farm.

Manually spraying volunteer potato tubers takes, on average, 20 hours per hectare and costs roughly €320–480. It takes a robot around three hours to process one hectare, with up to 95% of volunteer weeds identified.

Agrointelli's smart farming IoT solution helps farmers automate the process and reduce costs, providing 24/7 work if necessary.

²² <https://www.softeq.com/blog/benefits-of-5g-farming-use-cases-and-real-life-examples>

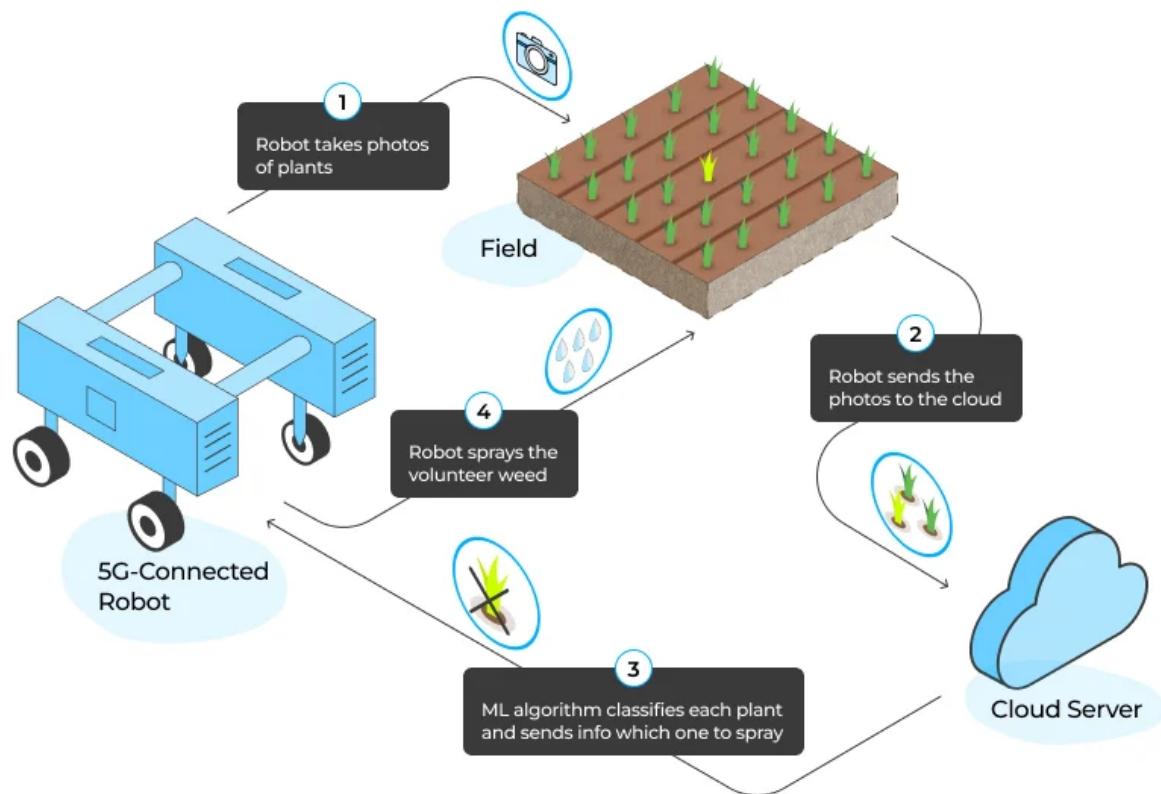


Figure 3-4: Overview of the Private 5G Network Workflow by Agointelli for Smart Agriculture



Figure 3-5: 5G-enabled Smart Agriculture Robot Conducting Weeding & Seeding Activity

3.4.2 Best Practices Adopted

- **Implementation of Robotic Farm Machinery for 24/7 Operations**

Autonomous robots connected via 5G performed weeding, seeding, and harvesting without human intervention. These robots operated continuously, optimizing resource use while reducing labour costs.

- **Cloud-Based Agricultural Data Management**

The smart farm utilized 5G to upload real-time field data to a centralized cloud system. Farmers accessed this data through mobile applications, enabling them to monitor farm conditions remotely and receive predictive analytics for better planning.

- **Precision Farming for Optimal Harvest**

The system's precise individual plant recognition allows for weeding to be carried out close to the crop, thereby reducing wastage and optimizing the harvest output.

4.0 Conclusion

The integration of 5G and Net5.5G technology within ASEAN represents a significant milestone in the region's digital evolution. As this report has outlined, the successful adoption of 5G and Net5.5G requires a multi-faceted approach, combining governmental leadership, private sector investments, and collaborative regulatory frameworks. With various ASEAN nations at different stages of 5G and Net5.5G deployment, it is imperative to align policies, share best practices, and bridge the digital divide to ensure that all member states benefit from the transformative potential of 5G and Net5.5G.

As the transition towards IPv6 and advanced networking technologies accelerates, it is essential to adopt a comprehensive approach to ensure seamless integration and optimal network performance. Section 4.4 highlights key technical recommendations and performance indicators for Wide Area Networks, Data Center Networks and Campus Networks.

4.1 Key Takeaways from 5G and Net5.5G Adoption in ASEAN

4.1.1 Enhancing Digital Infrastructure

Robust infrastructure forms the foundation of successful 5G and Net5.5G deployment. While Singapore, Brunei, Thailand, and Malaysia have made significant progress in deploying high-speed networks, other countries need greater investment in fibre-optic infrastructure, small-cell networks, and satellite-based solutions to extend coverage to rural and underserved areas. Public-private partnerships (PPPs) play a crucial role in reducing infrastructure costs and expanding network reach.

4.1.2 Regulatory Harmonization and Policy Coordination

A key barrier to 5G and Net5.5G expansion in ASEAN is the fragmentation of regulations across member states. A unified spectrum allocation strategy, cross-border data sharing agreements, and regional cybersecurity frameworks can significantly streamline deployment. Malaysia, as ASEAN Chair in 2025, has the opportunity to spearhead discussions on standardizing policies, ensuring that businesses and consumers alike benefit from a seamless 5G and Net5.5G experience across the region.

4.1.3 Industry-Specific Impact and Economic Growth

The economic benefits of 5G and Net5.5G extend across multiple industries. Smart factories leveraging 5G-driven automation will increase manufacturing output and efficiency, while AI-powered predictive maintenance will reduce downtime. In healthcare, 5G-enabled telemedicine services will enhance medical access for remote populations. Education will see revolutionary changes with immersive AR/VR learning environments, and agriculture will benefit from data-driven precision farming techniques.

4.1.4 Addressing Cybersecurity and Data Privacy Concerns

As 5G and Net5.5G networks expand, the risk of cyber threats grows. Governments must implement stringent security protocols, encourage knowledge sharing on threat mitigation, and establish regional cybersecurity task forces to safeguard data integrity. Lessons from global best practices can serve as models for ASEAN's approach to securing its digital landscape.

4.2 The Role of Malaysia in Leading ASEAN's 5G and Net5.5 Future

With Malaysia's chairmanship in 2025, the country holds the leadership position to drive ASEAN's digital transformation. Malaysia's commitment to expanding its own 5G infrastructure through initiatives like its second 5G network²³, along with its partnerships with global technology providers, places it in an ideal position to shape policies that enhance regional connectivity.

Malaysia can facilitate cross-border collaborations between ASEAN nations, encouraging investments in emerging technologies such as AI, IoT, and blockchain, which complement 5G and Net5.5G advancements. By leading discussions on data governance, interoperability standards, and investment frameworks, Malaysia can position ASEAN as a competitive force in the global digital economy.

Malaysia has shown stellar example in this regard, securing investments of USD2 Billion from Google for data centre and cloud services²⁴, USD2.2 Billion from Microsoft for AI and cloud services²⁵, another RM20 Billion from NVIDIA for special-purpose AI chips production²⁶, and USD6.2 Billion from Amazon as its latest AWS Region²⁷, all within 2024 alone.

Furthermore, Malaysia has launched the National AI Office on 12 December 2024²⁸, which carries the mandate of developing policies, overseeing regulatory frameworks, and driving strategic planning of AI in Malaysia. Among its objectives within the first year include developing an AI code of ethics, establishing an AI adoption regulatory framework, as well as drafting a five-year AI Technology Action Plan through 2030.

²³ <https://www.thestar.com.my/business/business-news/2024/11/06/u-mobile-chosen-as-malaysia039s-second-5g-provider-based-on-multiple-factors---mcmc>

²⁴ <https://www.reuters.com/technology/google-invest-2-bln-data-centre-cloud-services-malaysia-2024-05-30/>

²⁵ <https://www.reuters.com/technology/microsoft-invest-22-bln-malaysias-digital-transformation-2024-05-02/>

²⁶ <https://www.nst.com.my/business/corporate/2025/01/1158925/nvidias-investment-ytl-strengthens-malaysias-position-global-chip>

²⁷ <https://fintechnews.my/45909/cloud/aws-region-live-in-malaysia/>

²⁸ <https://fintechnews.my/47294/ai/national-ai-office/>

4.3 The Path Forward for ASEAN

To fully capitalize on 5G and Net5.5G, ASEAN must adopt a unified vision. This includes:

4.3.1 Strengthening Public-Private Collaborations

A coordinated effort between governments, telecom operators, technology firms, and industry stakeholders is essential for successful 5G deployment. Public-private partnerships (PPPs) can play a crucial role in financing infrastructure projects, accelerating innovation, and ensuring that 5G networks are deployed efficiently. Governments should foster investment-friendly policies, such as tax incentives and regulatory support, to encourage telecom operators and private enterprises to participate in the expansion of 5G networks. Additionally, ASEAN can establish regional innovation hubs where public institutions and private sector leaders collaborate on 5G research, smart city initiatives, and digital transformation projects.

4.3.2 Standardizing Regulatory Frameworks

Regulatory fragmentation across ASEAN nations presents a challenge for seamless 5G deployment. A standardized regional framework for spectrum allocation, cross-border data governance, and cybersecurity policies would promote interoperability and reduce investment uncertainty. ASEAN member states should work toward harmonizing spectrum bands to ensure efficient utilization and minimize interference. Furthermore, developing a unified cybersecurity strategy, including common standards for data protection and network security, will be critical to addressing cyber threats and ensuring the safety of 5G-enabled services across the region.

4.3.3 Investing in Capacity Building

To maximize the potential of 5G, ASEAN must focus on workforce development and digital literacy programs. Governments should invest in training initiatives to equip professionals with the skills needed to manage, operate, and innovate with 5G technology. This includes technical training for engineers, cybersecurity professionals, and software developers, as well as broader digital education for entrepreneurs and SMEs. Universities and technical institutes should collaborate with telecom companies to develop specialized curricula focused on 5G applications, AI integration, and IoT technologies, ensuring that ASEAN's workforce remains competitive in the digital economy.

4.3.4 Expanding Rural 5G Access

While urban centres in ASEAN are rapidly adopting 5G, rural and underserved regions still face connectivity challenges. Governments should prioritize rural 5G expansion through policies that incentivize network deployment in remote areas, such as subsidies for telecom operators or infrastructure-sharing initiatives. Innovative solutions like satellite-based 5G, community-driven broadband projects, and alternative network architectures (e.g., small cell networks) can bridge the digital divide. By ensuring equitable access to 5G, ASEAN can unlock opportunities for rural populations in areas such as telemedicine, e-learning, and precision agriculture.

4.3.5 Promoting Innovation Ecosystems

5G will serve as a foundation for new industries and business models and ASEAN must actively foster an environment that encourages innovation. Governments should support startups and enterprises developing 5G-enabled applications, such as AI-driven logistics, smart

city technologies, and immersive digital experiences. Policies that provide funding, research grants, and tax incentives for 5G-driven projects will accelerate digital transformation. Additionally, establishing regional innovation hubs and regulatory sandboxes will allow companies to experiment with emerging technologies in a controlled environment, positioning ASEAN as a leader in the global digital economy.

In Malaysia, the government has established the Malaysian Research Accelerator for Technology & Innovation (MRANTI), a central research & innovation commercialisation agency²⁹. It provides programs and a streamlined ecosystem for innovators to bring their products and ideas to market.

The MRANTI Ecosystem and Park is built with IR4.0 integrated infrastructure facilities, from living labs and development centre to prototype facilities, small and hyper-scale data centres for creators, innovators, researchers as well as the civil society. It encompasses the BioScience Tech Living Lab, Autonomous Vehicles Experimental Lab (AVXL), the IR4.0 Smart Manufacturing Living Lab (SMLL), DroneTech Living Lab and 5G Experience Centre (5GXC), among others.

4.4 Key Technical Recommendations and Performance Indicators

4.4.1 Wide Area Network (WAN)

Organizations should prioritize the adoption of IPv6. IPv6 and IPv6 Enhanced Technologies, as promoted by the IPv6 Forum, validate compliance with industry standards and ensure interoperability across next-generation networks. The IPv6 and SRv6 Ready Logo Programs promoted by IPv6 Forum is a globally recognized certification that

²⁹ https://themalaysianreserve.com/2024/04/26/mranti-addresses-malaysias-shift-to-become-technology-producer/#google_vignette

validates products for conformance and interoperability with IPv6-related standards. By obtaining this logo, manufacturers demonstrate their commitment to quality, ensuring seamless integration into next-generation networks. The operators and enterprises are recommended to adopt the products with the IPv6 and SRv6 Ready Logos.

Operators and enterprises are strongly encouraged to integrate IPv6 and advanced IPv6 Enhanced technologies such as SRv6-ready technology to enhance network reliability and performance.

IPv6 together with 5G and Net 5.5G can also be used to implement specific Key Performances Measurement Indicators such as:

- 1) Mobile Network IPv6 Traffic Ratio
- 2) Fixed Network Net5.5G IPv6 Traffic Ratio
- 3) 5G and SRv6 Node Deployment Ratio
- 4) Network Slicing Node Deployment Ratio
- 5) Number of 5G with IPv6 Enhanced Innovation Projects
- 6) 400GE and above Backbone Port Deployment Ratio

4.4.2 Data Center Networks (DCN)

To enhance computing efficiency, data centers should deploy minimum 400GE networks. For example, using 400GE/800GE Ethernet technologies (AI fabric+), enabling network computing collaboration and global path computation scheduling.

Specific Key Performance Indicators for DCN enhancement include:

- 1) HPC/AI Data Center with minimum 400GE Port Ratio

4.4.3 Campus Networks

The deployment of high-quality 5G and Net5.5G campus networks should be the standard best practice to ensure robust and high-speed connectivity.

Wi-Fi 7 access points (APs) should be implemented in campus networks to provide superior wireless performance and enhanced user experiences.

Next, intelligent control and operations & maintenance (O&M) capabilities should be considered for campus network optimization.

Lastly, security enhancements and application experience assurance mechanisms must be integrated to protect data and improve overall reliability of campus networks.

Specific Key Performance Indicators for campus networks include:

- 1) Campus Wi-Fi 7 Deployment Ratio
- 2) Campus 5G and Net 5.5G Interfaces Ratio

In conclusion, undertaking these steps will ensure that ASEAN not only keeps pace with global advancements in 5G and Net5.5G, but also leverage the technological innovations pertaining to Wide Area Networks, Data Center Networks and Campus Networks to drive long-term socio-economic growth across the region. Through strategic technical leadership, collaborative governance, and continued innovation, the region can harness 5G and Net5.5G to drive socio-economic development and position itself as a global leader in digital transformation for the next decade and beyond.