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THE TELECOMS INDUSTRY MEDIA PLATFORM
NOVEMBER / DECEMBER 2024
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Driving Indonesia's AI Transformation as a Digital Powerhouse

Vikram Sinha,
President Director and Chief Executive Officer,
Indosat Ooredoo Hutchison (Indosat)

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the global news agency

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Vikram Sinha,
President Director and Chief Executive Officer,
Indosat Ooredoo Hutchison (Indosat)

Driving Indonesia's AI Transformation as a Digital Powerhouse

Indonesia is leading the way in developing a digital economy, transforming the country into a digital powerhouse in Southeast Asia. The government is committed to revolutionizing the digital landscape through the 'Making Indonesia 4.0' roadmap, which focuses on innovation, infrastructure, and advanced technologies in key sectors. Initiatives like the '100 Smart Cities' program and the 'National Strategy for Artificial Intelligence (2020-2045)' demonstrate Indonesia's dedication to improving digital capabilities nationwide to facilitate inclusive economic growth.

In an exclusive interview with Telecom Review Asia, Vikram Sinha, President Director and Chief Executive Officer of Indosat Ooredoo Hutchison (Indosat), delved into Indosat's transformative journey towards becoming an AI-TechCo. As Indonesia envisions a prosperous future through its Golden Vision 2045 plan, Indosat aims to redefine connectivity, focusing on digital transformation across various sectors—from AI-driven solutions in network infrastructure to cybersecurity resilience and talent development. Through strategic partnerships, innovative services, and AI-powered initiatives, Indosat is committed to enhancing Indonesia's digital economy, supporting industry-wide innovation, and empowering communities across the nation.

In what ways does Indosat believe its AI-driven initiatives will contribute to Indonesia's Golden Vision 2045 plan?
Indosat is transforming into an AI-technology company to boost operational efficiency and drive business development. This transformation aligns with Indonesia's Golden Vision 2045 and is guided by five strategic initiatives outlined in the Empowering Indonesia 2024 report. These initiatives aim to harness AI's potential to drive the growth of secondary cities, enhance the digital economy in rural areas, empower micro, small, and medium enterprises (MSMEs), advance agricultural technology, and promote women's empowerment, all of which contribute to inclusive economic growth and digital transformation.

How are Indosat's key growth pillars redefining traditional telecom business models, and what innovative strategies are you implementing to drive this transformation forward?
The transformation strategy from a telecommunications company (telco) to an AI-TechCo emphasizes technological innovation, service

> “Indosat is transforming into an AI-technology company to boost operational efficiency and drive business development. This transformation aligns with Indonesia’s Golden Vision 2045”

diversification, and an improved customer experience. This transition involves the development and integration of advanced technologies, including artificial intelligence (AI), the Internet of Things (IoT), and other related innovations. Furthermore, the business transformation aims to expand enterprise services, particularly in B2B solutions such as cloud services, cybersecurity, and IoT-based offerings.

What are the most significant challenges Indosat faces in transitioning from a traditional telecom provider into an AI-TechCo, and how is Indosat addressing these challenges to ensure a smooth and successful transformation?

Indosat is transforming from a traditional telecom provider into an AI-TechCo, integrating AI into its core strategy and operations to boost innovation and efficiency. By reshaping its business model, Indosat is diversifying its services beyond telecommunications into sectors such as digital finance, e-commerce, and health tech.

This approach pushes the boundaries of traditional telecom, positioning Indosat at the forefront of technological advancements to maintain competitiveness in a rapidly evolving market.

Driven by ever-changing market trends, Indosat is committed to continual adaptation and sustainable innovation. Guided by the spirit of Gotong Royong, the company forges collaborations with like-minded partners to realize Indonesia's vision of becoming a leader in sovereign AI technology.

How is Indosat's AI strategy integrating with its current network infrastructure, and what innovative solutions are being used to ensure a seamless transition from telco to AI-TechCo?

> Through initiatives like the IDCamp program, Indosat is committed to nurturing digital talent in Indonesia

Indosat is expanding its network coverage to secondary and remote areas of Eastern Indonesia, thereby enhancing infrastructure efficiency. The company is also improving its network infrastructure by launching the Digital Intelligence Operations Center (DIOC), which combines the capabilities of both the Network Operations Center (NOC) and the Service Operations Center (SOC). Key strategies involve partnerships with global technology leaders such as NVIDIA, Microsoft, Google, and Huawei, alongside the launch of the AI Experience Center in Solo. The GPU Merdeka platform, which offers GPU-as-a-Service (GPUaaS), provides high-performance computing solutions for businesses, facilitating seamless AI adoption across various industries.

How is Indosat reimagining its workforce to align with its AI-native vision, and what unique training and development strategies are being implemented?

Indosat is reimagining its approach to align with its AI-native vision by creating opportunities for individuals to enhance their career prospects. Through initiatives like the IDCamp program, Indosat is committed to nurturing digital talent in Indonesia.

In 2024, IDCamp introduced a new learning path focused on AI, designed to equip participants with foundational knowledge in areas such as machine learning (ML), deep learning, and generative AI (GenAI). This initiative supports our broader mission to empower Indonesia by fostering innovative AI-based solutions applicable across various industries.

What goals has Indosat set for its AI transformation, and how are these goals pushing the boundaries of traditional telecom capabilities?

Indosat's primary focus is to deliver an exceptional experience to customers throughout Indonesia. By

> By pushing the boundaries of traditional telecommunications, Indosat is evolving into a provider of innovative solutions. The company is committed to ensuring that technological advancements positively impact social well-being and the environment

leveraging AI, Indosat can offer more personalized and responsive services. Through in-depth data analysis, the company develops AI solutions that accurately understand customer needs, enabling the provision of tailored products and services.

Artificial intelligence technology significantly enhances performance and operational efficiency, reducing task completion times from one day to just 10 minutes. This integration allows Indosat to transcend basic connectivity, offering intelligent, data-driven solutions that bridge the digital divide and ensure access to technology for all segments of society.

By pushing the boundaries of traditional telecommunications, Indosat is evolving into a provider of innovative solutions. The company is committed to ensuring that technological advancements positively impact social well-being and the environment, empowering Indonesia with advanced devices and technologies for digital progress.

AI Day and Cybersecurity

How are Indosat's AI initiatives fostering innovation and collaboration across industries, and what measurable impact have these efforts had on efficiency and customer experience?

Indosat's AI initiatives, particularly through Indonesia AI Day 2024, drive innovation and collaboration across industries by creating a platform for key stakeholders, technology experts, and business leaders to explore AI's transformative potential. The event brings together global and local leaders, including NVIDIA Founder and CEO Jensen Huang and Accenture Chair and CEO Julie Sweet, who will share insights on Indonesia's path to AI sovereignty and the expansive opportunities AI offers for the nation's digital economy. This convergence of brilliant minds aims to foster discussions and partnerships that push the boundaries of AI integration in finance, healthcare, telecommunications, and more.

By encouraging AI-driven solutions, Indosat aims to streamline operations, increase efficiency, and elevate customer experiences, strengthening Indonesia's digital economy. Indonesia AI Day emphasizes the country's AI sovereignty, offering a blueprint for sustainable AI adoption tailored to local needs and regulations. The measurable impact is evident in enhanced service delivery, operational efficiency, and greater customer satisfaction, all contributing to a more dynamic and resilient digital ecosystem in Indonesia.

What cybersecurity strategies is Indosat implementing to safeguard its digital ecosystem, and how is it ensuring data protection and resilience against emerging cyber threats?

To protect against digital threats, Indosat offers a digital security service called IMSecure. This data security solution is specifically designed to safeguard customers from various digital risks, including identity theft and cyberattacks.

In collaboration with Kominfo and Mastercard, Indosat has launched an online academy program through the Digital Talent Scholarship (DTS), with the goal of training one million individuals to enhance their practical skills in cybersecurity. This initiative focuses on building foundational knowledge and practical expertise in cybersecurity for individuals and small businesses, aiming to strengthen Indonesia's digital ecosystem. TR

> Indonesia AI Day emphasizes the country's AI sovereignty, offering a blueprint for sustainable AI adoption


Dr. Bilel Jamoussi, Deputy Director of the Telecommunication Standardization Bureau (TSB)

ITU's Strategic Focus on AI, Inclusivity, and Digital Technology Standards at WTSA-24

In an exclusive interview with Telecom Review Asia, Dr. Bilel Jamoussi, Deputy Director of the Telecommunication Standardization Bureau (TSB), outlined ITU's ambitious goals for the upcoming World Telecommunication Standardization Assembly (WTSA-24).

This assembly, the first of its kind to be held in Asia, marks a historic moment. Jamoussi highlighted the assembly's focus on inclusivity, the engagement of youth and women in standard-setting, and the introduction of new study groups aimed at shaping the future of digital infrastructure.

What specific outcomes does ITU hope to achieve at WTSA-24 regarding the integration of AI and the metaverse into global standards?

World Telecommunication Standardization Assembly (WTSA-24) marks the first time we are meeting in Asia, which is quite significant. We have organized over 20 side events and are focusing heavily on AI, which is top of mind for many.

In terms of concrete outcomes, one of our key objectives is to appoint the new leadership teams of our study groups that will develop standards for the next four years. These will cover critical areas such as AI, the metaverse, digital identity, and digital infrastructure.

We are also committed to enhancing inclusivity by engaging more youth and increasing the participation of women in standard-setting.

Additionally, we are hosting the Global Standards Symposium, which includes a high-level segment gathering ministers and CEOs and will feature 60 booths where ITU's private-sector and government members will showcase standards in action.

This event will also include the AI for Good Impact India event —our first event of the new Impact Initiative as part of the AI for Good Global Summit. This will focus on capacity building and the tangible outcomes of India's involvement in shaping international AI standards.

Throughout the event, our Digital Wave Stage will host daily panels covering a range of important topics. Overall, the assembly is set to be quite dynamic, with delegates working on international agreements known as Resolutions while also demonstrating the progress made in the field of standardization and planning for the future.

What specific obstacles do you foresee in creating standardized protocols for rapidly evolving technologies like quantum computing, particularly regarding technical complexities, differing national regulations, and industry collaboration?

One of the challenges is, of course, the inclusivity of standards development, and that's why we have a program called Bridging the Standardization Gap, where we try to make sure that experts from government, industry and academia from all countries take active participation in ITU. We're almost halfway through; we still have some work to do to be more inclusive, and that is one of our priorities: to bridge the standardization gap.

The second one is to have broader industry engagement. So far, we have around 1,000 members from the private sector. We're very proud of our members, and we are the only UN agency with member companies, and the only standard development organization that has 194 member states. But of course, we don't want to stop there.

We want to ensure that all stakeholders, big or small, especially small and medium enterprises (SMEs) from developing countries, are a focus for us. We aim to support those SMEs that are driving innovation, as seen in the digital financial services that have emerged from Africa and Asia.

India is, for example, leading the Unified Payments Interface (UPI) and the Aadhaar digital identity. Those innovations around Digital Public Infrastructure (DPI) are ones where we can, and want to, see more SMEs and industry engagement.

The third one is women. Currently, women make up 30% of participants at this assembly, and we want to raise that to at least 35% and keep growing. We also want to see more women taking leadership positions in our study groups, as chairs and vice chairs.

So, I would say our challenges encompass being more inclusive and having more participants around the world joining the effort because our standards are global; they're implemented everywhere, and we need to have everyone around the table taking part.

In what concrete ways can international standards enhance digital inclusion and build trust among diverse nations, especially in developing regions where access to technology may be limited?
First of all, we still have 2.6 billion not using the Internet. As part of our missions, we have two strategic objectives.

One is universal connectivity, and we're working very hard to connect more people. We have programs like Partner2Connect, led by our Secretary General, where we're trying to secure pledges. We have about 50 billion USD worth of pledges today, and our aim is to reach 100 billion by 2030.

We also have a program with the United Nations Children's Fund (UNICEF) called Giga, which aims to connect every school in the world to the internet. Connectivity is really the first priority because if you're not connected, you cannot benefit from any of the digital technologies.

The second strategic priority of ITU is sustainable digital transformation. COVID-19 demonstrated to us, and the world, that a lack of connectivity and digital infrastructure can paralyze economies. In response, we have been collaborating with member states and the private sector to ensure that sustainable digital transformation occurs rapidly. For developing countries, we are leading efforts in digital financial services to establish standards that enhance digital transformation in the financial sector, ensuring that the 1.4 billion adults without a bank account can use their mobile phones for transaction accounts.

We collaborated with the World Bank and the Gates Foundation to create frameworks for regulation, technology, and standards that enhance end-user trust. If users do not trust their mobile payments, they will not utilize them. To address this, we have established a digital financial services security lab at ITU, implemented in many member states, working alongside central banks and telecom regulators to ensure the security of financial services. This is one concrete example contributing to a digital-first foundation.

Another recent announcement is the OpenWallet Forum, a joint initiative by ITU and the Linux Foundation, with support from the UN International Computing Centre and the Government of Switzerland, aimed at accelerating the evolution of digital public infrastructure worldwide. This initiative focuses on digital IDs as a first step, including digital versions of driver's licenses and passports, as well as digital payments. This partnership between a standard organization and an open-source organization is unique and innovative. For instance, the CEO of the Linux Foundation will be one of our speakers at GSS.

This showcases our rapid progress, integrating standards and open-source to include more people and bridge the standards gap not only in standard development but also in implementation in developing countries.

Hosting this first WTSA in India presents an opportunity for all countries in the region to participate at the highest level and benefit from this international standards festival.

How do you believe the conversations at WTSA-24 will influence strategies for sustainable digital transformation across various sectors, and what key principles should guide these discussions to ensure long-term environmental and social benefits?
At ITU, we are committed to addressing environmental and climate change aspects of information and communication technologies. ITU-T Study Group 5 is our standardization expert group dedicated to environment and circular economy.

Many of the standards we have developed assist industries and governments in measuring the impact of ICT on the environment, while also highlighting how these technologies can mitigate greenhouse gas (GHG) emissions in other sectors. For instance, teleworking utilizes telecommunications infrastructure, reducing the need for car travel, which exemplifies how these technologies contribute to lower greenhouse gas emissions.

Recently, there has been considerable discussion around AI and its substantial energy consumption in data centers. To address this, we published a report just a couple of months ago on AI and the environment, examining both sides of the issue. While it is true that AI increases power consumption, industry players and governments can look to ITU standards for tools to measure, mitigate, and reduce electricity consumption in data centers. These standards also detail how AI can be harnessed to reduce data centres' energy consumption.

We view this equation holistically. It is in the public domain and has been quite useful in guiding discussions on AI's environmental impact over the past few months.

A closely related topic is quantum computing, which plays a role in the energy demands of AI computing platforms. While traditional computers are power-hungry, quantum computers can be more energy-efficient. At WTSA in India, we will showcase a small, portable quantum computer that could help reduce energy consumption in AI applications.

This represents advanced efforts from a standards perspective to reduce electricity use and create more environmentally friendly data centers, while also embracing emerging technologies like quantum computing to revolutionize how AI algorithms are implemented. TR

Ken Tan, Chief Technology Officer of Digital Nasional Berhad (DNB)

Malaysia's Digital Transformation: How is DNB Pioneering Connectivity?

In an exclusive interview with Telecom Review Asia Pacific at FutureNet Asia, Ken Tan, Chief Technology Officer of Digital Nasional Berhad (DNB), shared insights into the organization's vision for transforming Malaysia's telecommunications infrastructure. He discussed how DNB aims to address the pressing challenges of sustainability in 5G and beyond, while also navigating the competitive landscape shaped by recent industry mergers.

What is Digital Nasional Berhad's vision in terms of the future development of Malaysia's telecommunications infrastructure?

One of the telecommunications industry's challenges is to make sure 5G and beyond is sustainable. Globally, many telcos currently face diminishing margins. In Malaysia, there were six telcos in 2021, but two of the major ones have merged, leaving only five today.

With DNB being established to offer wholesale 5G network to operators, telcos can focus on their retail core

businesses – in essence, DNB encourages competition amongst operators, who can now focus on innovating their solutions and serving their customers better.

Additionally, with DNB offering 5G wholesale network at one of the cheapest rates in the world, telcos can not only pass the savings to their consumer end-users, but they can also encourage innovation amongst their enterprise clients, enabling them to evolve from traditional brick-and-mortar businesses into digital enterprises, with new channels to reach their customers. Enterprises of all sizes, including medium, micro, and SOHO businesses can leverage connectivity to thrive and create new opportunities, while end-customers have access to a wider choice of services, at inexpensive prices. This is DNB's ambition.

How does Digital Nasional Berhad's recent focus on 5G deployment align with its technology strategy?

When DNB started operating in 2021 as a single wholesale 5G network provider, it needed to ensure the network was world-class and always ahead of the technology curve to meet market requirements. From day one, cybersecurity was built in, and the entire organization operated based on data. This setup was designed to ensure security, allowing informed decision-making across the company.

With AI now available and data integrated from the outset, we can enable AI throughout our systems, as AI fundamentally requires data. It's similar to a car needing oil; DNB has the data, which serves as the oil. With this data in place, we can start using AI to power DNB's operations, enhancing our efficiency and competitiveness. Much of the synergies we create are passed on to our customers (the operators), enabling them to preserve their margins and avoid the capital expenditures (CapEx) typically required for operations.

How do you address the challenges of scaling technology infrastructure for nationwide coverage?

This challenge is faced not just by DNB, but by many operators around the world. From day one, we ensured we selected the best technology partners through a rigorous tender process. This process included provisions for lifecycle upgrades and aimed to incorporate network convergence from the outset.

In the telecom network space, it's crucial to avoid mistakes, as any errors that result in network outages impact customers. Therefore, careful and methodical testing cycles are essential. However, in the IT world, things move very quickly. From day one, DNB established data and digital operations, ensuring everything was digital from the onset. This brings together the best of both worlds—networks and IT—providing the agility needed to run the network effectively.

For example, cycles for software that used to take up to six months to be put into production can now be completed in about four weeks. By implementing DevOps practices, where software is delivered end-to-end through continuous integration and continuous development, we can move rapidly. This approach was integrated into DNB from the beginning, ensuring it doesn't just maintain the existing network but is also constantly upgrading itself to align with the latest 3GPP specifications.

Can you outline the key milestones in Digital Nasional Berhad's roadmap for leveraging AI and network automation in its network infrastructure?

There's no definite timeline we can commit to, but there is ambition. A lot of this involves incorporating new capabilities and technologies. When we started, many processes were manual. The fact that in three years we've achieved DNB's level-three autonomous network status, according to the TM Forum, positions us well to aim for level four in the next three-to-five years. It won't be a drastic leap; rather, it will involve many small steps to enable the entire organization to progress on this journey.

Now that DNB is more established, we need to start transforming existing processes, mindsets, and systems so we can incorporate AI. For example, in the early days when we had 500 base station sites, we had to manage over 300,000 network faults in a single day. Today, with over 7,000 base station sites, the number of faults has decreased to fewer than 1,000 per day, thanks to data and AI technologies.

Moving forward, we will focus on developing software using AI, enhancing network operations, and transforming the skill sets required to manage the network in the realms of data analytics and cybersecurity. Our goal is to deliver new capabilities that meet market requirements, as we continue our transformation journey over the next three-to-five years. TR

With DNB offering 5G wholesale network at one of the cheapest rates in the world, telcos can not only pass the savings to their consumer end-users, but they can also encourage innovation amongst their enterprise clients

Ng Hoo Ming, President, ASEAN Chief Information Officer Association, CEO BSL Technologies Pte Ltd

ASEAN Urged to Unite Against Rising Cybersecurity Threats

In today's capricious digital world, cybersecurity is more important than ever. In an exclusive interview with Telecom Review Asia, Ng Hoo Ming, President, ASEAN Chief Information Officer Association, CEO BSL Technologies Pte Ltd, highlighted the urgent cybersecurity issues facing ASEAN countries on the sidelines of GovWare 2024.

As digital transformation accelerates across the region, threats like ransomware attacks, fraud, and cloud security vulnerabilities are on the rise. Consequently, Ng Hoo Ming is encouraging ASEAN member states to work together to boost cybersecurity defenses and improve governance practices. Chief Information Officers (CIOs) can lead the way in promoting cybersecurity within their organizations through strong leadership and strategic planning.

What are the most pressing cybersecurity issues that ASEAN countries are facing today, particularly from your perspective within the Cybersecurity & Governance Chapter at ACIOA?

Digital technology adoption is a global trend, but it has been particularly accelerated in Southeast Asia due to government policies promoting digital transformation on a national scale. Additionally, businesses have had to embrace

digital technology as a strategic necessity, especially during the pandemic, when it became less of a choice and more of a survival instinct. The lockdowns and restrictions on physical movement forced companies to adopt digital technologies to maintain operations. Digital transformation has become unavoidable for enterprises to remain competitive and continue operating in the post-pandemic new normal.

Several key trends are driving this transformation, whether it is initiated internally or influenced by external factors. Firstly, there is a significant shift toward cloud computing, primarily for cost efficiency. Secondly, e-platforms are being widely adopted to reach business partners, customers, and even government agencies. Thirdly, e-payment has become the standard mode of transaction. Finally, automation through AI and other technologies is increasingly being integrated into business processes.

Southeast Asia's digital economy has already surpassed initial projections of USD 300 billion by 2025. The updated forecast now suggests that the region's digital economy could reach USD 1 trillion by 2030. This presents a massive growth opportunity, positioning ASEAN as a significant player in the global digital economy. With over 600 million young and dynamic people, ASEAN is uniquely positioned to leverage digital technology to drive economic progress and enhance the living standards of its population.

However, with digitalization comes new risks. While the region embraces digital technology, it also faces heightened cybersecurity threats. Malicious actors are constantly seeking vulnerabilities in our systems for their gain. The top four cybersecurity challenges in ASEAN include financial losses from fraud and online scams, which amount to hundreds of millions of dollars annually. Ransomware attacks also pose a significant threat to both government agencies and private institutions, regardless of their size. Deepfakes are another rising concern, undermining trust in digital platforms. Lastly, cloud security remains a major concern for enterprises as they increasingly adopt cloud-based strategies.

How can regional collaboration among ASEAN member states improve collective cybersecurity defenses?

Cybersecurity is a major focus area that the ASEAN region is seriously addressing. The ASEAN Digital Master Plan 2025 highlights several key areas for enhancing cybersecurity. Firstly, there is a focus on delivering trusted digital services and preventing consumer harm. To encourage the adoption of digital services, particularly in sectors like health and finance, consumers need to trust these services. This applies to new and emerging technologies as well. A crucial part of this is ensuring that best practices in cybersecurity and digital data governance are widely adopted to mitigate the impact of breaches on businesses and consumers, and to build trust.

Secondly, enabling trust through broader use of online security technologies is essential. ASEAN Member States (AMS) could establish a program to measure and improve the use of secure networking technologies by creating a reliable index and measurement system for critical online security technologies and ensuring their deployment across the region.

Additionally, AMS should build trust by enhancing security in key sectors like finance, healthcare, education, and government. Building on frameworks like the ASEAN Framework on Personal Data Protection (2016) and the ASEAN Framework on Digital Data Governance, AMS can develop harmonized, principle-based regulations for data protection and privacy, including data management and cross-border data flows. This will facilitate cross-border digital trade by fostering user trust in sharing personal data. ASEAN should also build on the 2021 Implementing Guidelines for the ASEAN Cross-Border Data Flows Mechanism to develop and implement a suite of data transfer mechanisms. This would improve the region's ability to ensure the interoperability of standards with frameworks like APEC CBPR and the European Union's GDPR. Moreover, ASEAN could create a framework for common policies on handling large data collections and using AI and machine learning (ML) with these datasets.

Improved coordination and cooperation among regional Computer Incident Response Teams (CIRTs) is also a priority. ASEAN should expand the coordination between individual country CIRTs and fully establish a regional CSIRT (Computer Security Incident Response Team) for better response to cybersecurity threats.

Finally, promoting consumer protection and rights in relation to e-commerce is crucial. Moving towards convergence on consumer rights and protection will facilitate cross-border trade and give consumers confidence that products are safe, and their rights are recognized across member states. Building on the progress made so far, ASEAN could strengthen collaboration with relevant sectoral bodies to create pan-ASEAN arrangements for recognizing and enforcing cross-border judgments for both private and public actions, further fostering trade and consumer trust.

What role do CISOs play in promoting cybersecurity governance within organizations, and how can they enhance their influence in this area?

CISOs ensure that organizations recognize cybersecurity as the responsibility of the entire senior executive team and the Board. A cyber incident affects the whole organization, not just the IT department. It can disrupt online sales, impact contractual relationships, or result in legal and regulatory consequences. Therefore, senior executives and the Board

must possess sufficient expertise to guide cybersecurity strategy and hold decision-makers accountable. Every leader needs to understand how cybersecurity impacts their specific areas and the organization as a whole. When cybersecurity is a priority for the Board, it will naturally trickle down through the organization. Interestingly, while two-thirds of C-suite executives view cybersecurity as a top concern, outstripping even financial risks, fewer than 20% demonstrate a high level of cybersecurity preparedness. Leaders must not be content with having just a plan on paper; they must actively work toward improving cybersecurity governance.

Cybersecurity governance should not be viewed as an obstruction to operations but as an enabler that allows businesses to continue operating despite increasing cyber threats and attacks. Every organization, whether it be individual, business, or government, shares the responsibility of enhancing cybersecurity. It should be seen as an investment, not a cost. Any company undergoing digital transformation needs to consider cybersecurity seriously to ensure its operations are faster, better, and, most importantly, secure and resilient. Cybersecure organizations not only survive but thrive, scaling up as they continue to ensure their systems remain protected. Cybersecurity must be managed at a higher level to align with business imperatives and industry best practices while adhering to national regulatory frameworks. Business leaders need to understand cybersecurity to make informed decisions on risk management because it directly impacts the bottom line.

To improve cybersecurity governance, leaders should ask themselves key questions: Is the organization investing enough in cybersecurity? Do we know the effectiveness of our security investments? Do we have the means to continuously validate the effectiveness of our defenses beyond simply passing audits? Do we have a cybersecurity governance program with actionable procedures and contingency plans? Are these plans practiced and understood by the organization?

Implementing a strong cybersecurity governance framework requires organizations to identify which systems and data are critical, who has access to them, how well they are protected, and how to enhance their protection. Most importantly, developing a Cybersecurity Readiness Maturity Index will help assess the organization's cybersecurity maturity in key areas: risk mitigation, early detection, robust response, and rapid recovery. This will guide efforts to manage cyber risks effectively and develop systematic action plans to improve governance and security protocols.

What best practices would you recommend to ASEAN organizations to effectively manage their cybersecurity risks?

In terms of technical control measures, organizations in ASEAN should adopt the mindset that a security breach is inevitable and, as such, should lock down their networks. This does not mean physically isolating the network from the rest of the world, but rather ensuring that there are no open paths for hackers to exploit internal systems. Additional security measures should also be implemented to address insider threats. Full visibility and continuous monitoring are crucial, especially in accounting for all privileged access, privilege escalation, and the creation of administrator accounts.

Application security is also of paramount importance. Weak software coding, such as embedded administrator passwords, poses significant risks. Organizations must ensure the secure storage of encryption keys and avoid the sharing of administrator accounts. It is recommended to use dedicated machines for administrative tasks and implement network segmentation to create separate network segments for administrative work. If remote access is allowed, strong two-factor authentication (2FA) and time-based access control should be applied.

Additionally, a zero-trust approach should be adopted to counter today's sophisticated cyber attacks. This approach operates on the assumption that user identities or the network itself may already be compromised and relies on AI and analytics to continuously validate connections between users, data, and resources, including devices, applications, and backend servers.

These critical defensive measures can significantly reduce an organization's cyber risk, but it is impossible to guarantee 100% cybersecurity. In the unfortunate circumstances that an attacker penetrates the defenses, strong data encryption, including post-quantum computing proof, should be deployed to protect sensitive data. Additionally, a robust data backup system should be in place to ensure that business operations can be recovered in a timely manner. TR

> Southeast Asia's digital economy has already surpassed initial projections of USD 300 billion by 2025

Keith Leong, Managing Director for Enterprise, Singtel Singapore

Singtel: Advancing Enterprises through Emerging Tech and Global Alliances

Committed to pioneering new technologies in the telecommunications sector, Singtel has launched a range of service offerings designed to empower enterprises in their digital transformation journey. Through strategic alliances with leading global telcos, Singtel is impacting the broader ecosystem, driving innovation and setting new industry standards.

In an exclusive interview with Telecom Review Asia, Keith Leong, Managing Director for Enterprise at Singtel Singapore, discussed how Singtel's initiatives are enhancing customer experiences, raising operational efficiency, and delivering customized, scalable, and secure AI-driven solutions tailored to support enterprises' digital success.

How is Singtel leveraging AI to enhance operations, particularly in network management and capacity planning?

Singtel is no stranger to adopting new technologies. For years, we have leveraged AI and machine learning (ML) to enhance network performance, streamline operations, and improve customer experience. As technology advances, we continue to embrace new innovations to drive advancements in these areas.

In the area of network management and capacity planning, AI has unique capabilities. We use it for network troubleshooting as part of automation, employing network orchestration to automate the troubleshooting of network elements. This allows us to identify issues, diagnose problems, suggest solutions, and improve overall network reliability, reducing manual intervention.

We are also auto-configuring our network devices, as AI orchestrates the configuration of new devices that come online, allowing us to consistently reduce human error and speed up deployment processes. Automated software upgrades are another area where AI-driven orchestration handles software updates seamlessly, ensuring devices receive the latest updates without disrupting network services.

Lastly, AI orchestrates the provisioning of network services, enabling us to set up virtual private networks more quickly and efficiently, optimizing resource use and service delivery. These features are integrated into our Empower portal, a self-service portal for enterprises, where they can access and manage both new and existing services in one place with a consistent UI and UX. These innovations are attracting international clients and propelling Singtel as a global telco.

What are the impacts of AI on Singtel's service offerings and customer experience?

From the perspective of customer experience, we have AI-assisted chatbots that are not just your typical chatbot; they analyze histories and various interactions to provide personalized support for the client. They also give agents case summaries, reducing human error. Helping agents be more efficient and freeing up customer service time to address complex customer issues is critical. Additionally, having larger volumes of data allows us to extract insights and trends, identifying areas for improvement. We are leveraging chatbots, especially AI turbo-charged assistance, to reduce average handling time and apply AI to business segments like our SME call desk and voice AI to handle customer requests more effectively.

For businesses and enterprises, scam prevention is crucial. We use AI to analyze and recognize patterns of scam calls and SMS messages, blocking them before they reach the customer. Every month, more than 30 million scam calls and over 20 million scam SMS messages are blocked, making AI utilization in this area vital.

How is Singtel capitalizing on the rise of 5G, particularly in terms of network slicing and monetization opportunities?

Digital transformation is increasingly taking place across the economy and various industries, with high-speed, high-bandwidth, and low-latency connectivity supporting the innovation and growth ambitions of enterprises. Our 5G journey began with nationwide coverage achieved in 2022, enabling Singapore to serve as a sandbox for innovation and successful trials in both the public and private sectors. We have conducted about 30 successful trials across industries like aviation, homeland security, and others, using 5G as a transformation engine.

Beyond industry transformation, we are unlocking more 5G network capabilities, like 'security as a slice' and network slicing, deploying not only to devices but also to specific locations, applications, and even individual levels. This development supports business-critical and mission-critical applications. With more hybrid work arrangements and a shift towards a mobile-only workforce, base network slicing is crucial for business continuity, collaboration, and communication.

We became the first in the world to offer network slicing features to enterprises commercially, through enhancements to User Equipment Route Selection Policy (URSP). This paves the way for broader adoption, with Samsung, one of the world's largest device manufacturers, as a partner.

What examples demonstrate how Singtel is using 5G technology to enhance value for enterprises?

One example is the National University Health Systems (NUHS), which utilizes multi-access network edge computing to allow doctors to use mixed reality applications for better visualization and organization in high-resolution 3D, aiding in the planning of surgical procedures.

The Hyundai Motor Group Innovation Center is another first-of-its-kind initiative, focusing on smart manufacturing. Singapore has become a flagship for Industry 4.0 and smart meta-factories, with the IONIQ 5 and IONIQ 6 electric vehicles now being assembled in Singapore—the first electric vehicle smart manufacturing facility of its kind globally. Additionally, Micron has deployed 5G millimeter wave solutions in its flash memory fabrication plant, integrating 5G to augment Industry 4.0 manufacturing applications, such as automating visual inspections and augmented reality operations and maintenance.

In the consumer space, network slicing is being deployed in high-traffic conditions such as Taylor Swift concerts, Coldplay concerts, and the recent F1 race, enabling

customers to live stream or share their favorite moments, even in congested environments.

How will Singtel's global venture with other telecom stakeholders enable enterprise clients to adopt APIs? What benefits do they bring to the wider industry ecosystem?

Increasingly, greater collaboration is needed in the telco space. In 2023, Singtel, together with 21 leading global telcos, formed the GSMA Open Gateway Framework, which initiated a federated and interoperable framework with open standard applications, or application programming interfaces. This will accelerate the development and growth of services in areas such as fintech, identity, smart mobility, gaming, and Web3. This particular framework will connect digital service providers and mobile network operators across the world to seamlessly develop open APIs for third-party developers and apps. This allows us to partner with some of the world's largest telcos, including AT&T, Deutsche Telekom, Orange, Reliance, and others.

Together with Ericsson, we have established a new venture to make network application programming interfaces available to developers on a global scale. As a team, we can enhance our offerings and leverage these APIs through the GSMA Open Gateway Framework.

In Singapore, we have developed a solution called SingVerify, a network API that authenticates digital identities registered on consumer services or platforms against telco data. Instant verification of customers' digital identities via their numbers and locations mitigates phishing and digital fraud. More authentication APIs will be added to the SingVerify suite in the future.

We also collaborated with another local telco to federate APIs at a national level in Singapore, and expanded this initiative to telcos in Thailand and Malaysia, thus widening our defense to cover more than 57 million customers. Partnering with other telcos and being part of an alliance enables us to explore greater innovation.

What other initiatives is Singtel pursuing to enhance customer service through advanced technologies?

One area we are actively exploring is advancing telco large language models (LLMs). Given the vast amounts of customer data we have amassed, and how labor- and cost-intensive it can be to build an LLM for a single company, it is more efficient to pursue LLMs development collaboratively. As such, alongside other leading telcos, we have established the Global Telco AI Alliance (GTAA) to accelerate the development of LLMs, enabling us to make a greater impact globally.

Under this joint venture, we are co-developing an LLM to help telcos improve customer interactions via digital assistants and chatbots. This will be available in Korean, English, German, Arabic, and Bahasa, serving a customer base of 1.3 billion across 50 countries, covering the respective markets of the founding parties. The GTAA plans to include more languages and cover more markets in the future.

How is Singtel's NaaS offering helping enterprises address growing demands for flexibility, scalability, and customized network solutions?

Many enterprises are undergoing rapid digitalization and are exploring and developing tailored solutions for deployment in their industries. This often involves juggling multiple tools to manage their network connectivity and cloud application lifecycle, both at the edge and in their centers. Of course, everyone is facing resource limitations and a lack of know-how, and many of them struggle to navigate this space, resulting in slow progress for their businesses.

We understand the challenges and complexities they face, especially in managing various networks, edge computing, and applications. So we've developed platforms that enable faster deployment of such services like GPU-as-a-Service (GPUaaS) and AI-driven solutions, while removing considerable operational and cost overheads.

On the other hand, CUBΣ is a similar platform for network solutions and services, providing a single touchpoint to manage and monitor network utilization, workload performance, and sustainability metrics using AI-driven and machine-learning predictive analytics. Through these solutions, we create platforms that allow our clients to have a single point of engagement with Singtel. This approach enhances the digitization efforts we are assisting our clients with, providing a unified user experience (UX) and user interface (UI) for engaging with the Singtel team.

Additionally, we prioritize cybersecurity resilience and service assurance, ensuring that everything is cost-effectively managed—that's how Paragon and CUBΣ were conceived, developed, and delivered to help enterprises meet these needs through a single platform. Paragon is the industry's first all-in-one orchestration platform for 5G, edge computing, and cloud services. It significantly reduces the complexity and time needed to adopt 5G MEC and low-latency applications and services, ultimately lowering the barriers to entry for enterprises. TR

> We became the first in the world to offer network slicing features to enterprises commercially, through enhancements to User Equipment Route Selection Policy (URSP).

APAC A2P Messaging: How e& Balances Innovation with Robust Security

In recent years, the advancement of digital technologies has completely redefined how global businesses connect with their customers, breaking down a host of barriers – even time and distance.

Different messaging platforms, for example, are paving the way for better communication and customer experiences, with application-to-person (A2P) messaging continuing to emerge as a particularly valuable channel.

Facilitating more efficient, real-time communication, A2P messaging allows companies to connect seamlessly with customers, employees, and partners while protecting sensitive data and information.

The A2P Landscape in Asia Pacific

In Asia Pacific, Business Market Insights forecasts A2P and Communication Platform as a Service (CPaaS) to become a USD 42.75 billion market by 2028, increasing at a Compound Annual Growth Rate (CAGR) of 7% - reflecting the region's growing need for innovative customer solutions and the essential role of digital communication platforms in current business strategy.

The CPaaS market is also expected to see an 8% CAGR by 2030 as the increase in new use cases generates demand for integrated communication solutions, including SMS and other channels.

One of the key factors driving this market growth is the increased investment in digital consumer engagement. Organizations have started to realize the value of integrating SMS and other messaging channels into their apps, which not only enhances the digital customer service experience but also boosts operational efficiency.

According to e&, A2P SMS continues to be an essential channel for ensuring secure communication, especially for the transmission of One-Time Passwords (OTPs) and transaction notifications. Despite the widespread availability of many messaging platforms and communication channels, A2P SMS accounts for 60% of the total SMS business.

e&'s innovative approach to A2P Messaging

e& APAC, headquartered in Singapore, has recognized distinct market categories within the region, providing advanced, high-capacity technologies that meet the increasing need for uninterrupted connectivity and immediate communication.

According to Dino Civitarese, Vice President at e& APAC, "e& has been consistently expanding its presence in Asia and beyond, providing A2P Monetization as a service. This expansion strategy demonstrates the company's commitment to showcasing the potential of A2P communications and its dedication to providing dependable and secure solutions to businesses throughout the region."

e& APAC has anchored its growth around A2P services and Internet of Things (IoT) solutions in response to growing market demand in Asia. Since its launch, the company has experienced a remarkable increase in A2P revenue growth within the region. Voice and cloud services, introduced recently, are also on the rise, garnering major interest from OTT providers and enterprise customers.

e& APAC has also recognized a growing need for sophisticated digital infrastructure from OTT providers, hyperscalers, telecoms and content delivery networks (CDNs). As a result, there has been a significant increase in demand for e&'s data center solutions.

Additionally, Conversational AI, which has a worldwide market potential of USD 44.3 billion, can transform customer experiences by allowing businesses to engage with customers using chatbots and virtual assistants, especially in the APAC region.

Speaking recently at International Telecoms Week (ITW), e& Director for Voice & Mobility, Tushit Seth, discussed the resiliency of the A2P market, highlighting the potential for growth despite market challenges.

According to Seth, Mobile Network Operators (MNOs) and hyperscalers are cohesively working together now more than ever to reduce the impact of price elasticity, maintain higher conversion and directly deliver reliable and trusted services to customers' end users. e& is also utilizing AI to identify abnormalities in the traffic and sender ID abuse through firewalls, allowing businesses to immediately take corrective actions and rebuild customer trust.

Addressing Security Challenges

Despite the clear benefits of A2P messaging for a wide range of business sectors, such as banking, logistics, healthcare, retail and other industries, there is a rising concern about security risks. The emergence of SMS phishing and Artificial Inflated traffic, for example, poses a significant threat to the integrity of this communication channel.

e& recognizes this problem and is collaborating closely with regulatory bodies such as Singapore's Infocomm Media Development Authority (IMDA). e& has also raised this matter with global platforms such as Innovative Operators (IO) and the Global Leaders Forum (GLF), where it leads various sub-committees to develop a stronger and more comprehensive framework against these activities. The primary goal of this collaboration is to restore trust in SMS and ensure its effectiveness as a channel.

e& APAC has recently closed two A2P Monetization projects, which have provided a stronger outlook for future plans to offer similar projects as a bundled value proposition for MNOs, enabling them to generate additional secure revenue streams, highlighting the increasing need for robust business models and dependable solutions in the industry.

Forming responsible partnerships with OTTs lays the foundation for a safer and more reliable future for A2P messaging. Through ongoing innovation and collaborations, A2P will continue to be a fundamental communications channel in the years to come.

Contact our team today at cxm@eand.com to explore how we can help you unlock the full potential of A2P messaging for your business. Together, let's build a more connected and secure digital future. TR

By Dino Civitarese, Vice President at e& Carrier & Wholesale for the Asia & Pacific region (APAC and Tushit Seth, Director Voice and Mobility, e&

e& APAC has recently closed two A2P Monetization projects, which have provided a stronger outlook for future plans to offer similar projects as a bundled value proposition for MNOs

Atty. Aileen Regio, Co-Coordinator, Eastern Communications

Eastern Communications: Transforming the Future of Philippine Connectivity

In an exclusive interview with Telecom Review Asia, Atty. Aileen Regio, Co-Coordinator at Eastern Communications, discussed the company's latest technological advancements and shared insights into its forward-thinking strategies.

How has Eastern Communications contributed to the advancement of internet technology services in the Philippines?

Eastern Communications was the first telecommunications company in the Philippines, dating back to 1878. As a pioneer telco, it has been continuously expanding its network footprint across the country.

I've always said that to be able to provide internet services and quality internet services, we have to be where our customers are. So, we have embarked on a network expansion program to contribute to the development and expansion of internet services in the Philippines.

Through Eastern Communications' recent execution and partnership in the Philippine Domestic Submarine Cable Network (PDSCN)—the country's longest domestic submarine cable—the company was able to be present in top digital cities and major business districts with its fully redundant network. Aside from helping us reach enterprise customers and business owners, the expansion initiative also enables us to provide reliable connections to major telcos in their efforts to connect DC-to-DC and DC-to-Cable Landing Stations.

Once disconnected communities will now be able to connect through our recent partnerships with major satellite operators. We now cater to major C-, Ku- and Ka- band requirements using Intelsat and Kacific satellites.

Aside from internet reach, we continue to innovate connectivity so that it becomes faster, better, and more secure with the latest ICT technologies (SD-WAN, SASE, Security, locally hosted Eastern Cloud, Manila Internet Exchange).

Innovation is also very applicable to our commercial modeling, hence, we prioritize being able to offer internet and data connectivity that is acceptable in terms of ASEAN regional standards. Our innovative processes and procedures have enabled us to ensure that our services meet both global and Southeast Asian standards.

What strategies has Eastern Communications implemented to ensure inclusive connectivity?
Democratization of technologies guides our strategies and tactical programs. Complete inclusivity is only possible if we make connectivity more accessible and more affordable. We believe the keys to making internet pervasive include expanding our reach through fiber deployments, satellite communications, cooperating with other service providers, and utilizing the mobile network of local operators. It's our mission to make innovation available to both large enterprises and SMES by deploying new technologies, while creating economies of scale.

Can you discuss any recent technological innovations or upgrades that Eastern Communications has introduced to enhance its services and client relations?
Product Transformation: In a span of five years, we have engaged in agile product creation and expanded our portfolio from 'connectivity only' (prior to 2017) to a full suite of ICT solutions including cybersecurity, our Eastern Cloud and data centers, business applications and managed services; thus, future-proofing the company and increasing its market relevance.

Resilient and Future-proofed Network: Eastern Communications has been continuously implementing a technological refresh across its network, while increasing uplink connectivity to the rest of the world.

How does Eastern Communications address security concerns within the realm of cloud services, and what specific measures are in place to protect client data?
We partner with top global technology providers such as Cisco, Cato and Fortinet to provide high-tech security solutions both in our locally hosted Eastern Cloud and in our offering of other public clouds.

Not only do they have existing security solutions that are world-class, but they also continuously innovate and develop their security solutions to ensure that they are a step ahead of security risks and concerns that may happen in the future.

However, sometimes, partnering with those types of entities is not enough. You have to be able to make it affordable for your customers as not any ordinary company can afford it. Through economies of scale, which we implement by partnering with them, we make the services affordable across several other organizations. If there are several organizations using the service, then the service becomes more affordable.

Have there been any key collaborations or partnerships that have significantly influenced Eastern Communications' success?
When I started Eastern Communications in 2016, there were not many partnerships. Let's face it, we are a developing country, so we need the strength of developed countries that have mastered technological advancements.

Our key success factors include the partnerships we have fostered with leading technology providers. This holds true for both sell-to and sell-through collaborations. To date, we work with the likes of Cisco, Fortinet, Microsoft, Sophos, and Cato Networks as we continue to gain sales performance recognition from these partners. Before the end of the year, there will be two major products that Eastern Communications will launch on the market. To give you an idea, the first will establish a new internet exchange, and the second will be a first in the Philippines when it comes to internet security.

What are the company's future plans and vision for the next decade? Are there any recent technological innovations or upgrades Eastern Communications has introduced?
Our vision has always been to be the top-of-mind provider for our clients, and we are actively working towards that goal. By partnering with globally recognized software providers and developers, we enable our clients to implement their operations faster and more digitally.

In addition to our business plans for growth, Eastern Communications is committed to building on our initial successes in providing managed services—from connectivity to network deployment and security. Our aim is to simplify processes and offer comprehensive solutions to meet every client's need.

As we expand, we also seek to become the preferred choice in the industry by offering SaaS applications tailored for enterprises of all sizes. While our narrative may evolve, our dedication to customer success will remain the ultimate measure of our growth.

For instance, in response to the growing trend of remote work, we are developing software to help companies ensure their employees remain productive, regardless of location. This productivity will be monitored through our solutions, although it's still in development.

Additionally, we will soon launch a range of software solutions, reinforcing our aspiration to be the leading provider in managed services—not just in network deployment, but also in security and other critical areas. TR

“We believe the keys to making internet pervasive include expanding our reach through fiber deployments, satellite communications, cooperating with other service providers, and utilizing the mobile network of local operators”

Mr. Wasit Wattanasap, Head of Nationwide Operations & Support Business Unit, AIS

AIS: Paving the Way for a 6G-Ready Future

Thailand's digital future is rapidly evolving, driven by cutting-edge technologies like 5G, AI, and IoT, which are transforming industries and enhancing connectivity across the nation. As the government and leading telecom companies push for smart cities and connected industries, the country is on the path to becoming a major digital hub in Southeast Asia. With initiatives aimed at developing robust digital infrastructure, fostering cross-industry collaborations, and advancing sustainability, Thailand is positioning itself at the forefront of the global digital economy, ready to meet the challenges and opportunities of the next technological era.

In an exclusive interview with Telecom Review Asia at FutureNet Asia 2024, held on September 17-18 at Marina Bay Sands, Singapore, Mr. Wasit Wattanasap, Head of Nationwide Operations & Support Business Unit at AIS, shared insights into the company's 5G expansion strategies, AI integration, and its pivotal role in advancing Thailand's digital economy.

As 5G expands and the push towards autonomous networks becomes more pronounced, how is AIS preparing its infrastructure to accommodate future technologies like 6G?
The way we are working now is not just preparing for 6G infrastructure, but focusing on creating a sustainable network operation that will adapt to whatever comes next, be it 6G, 5.5G, or even beyond. At AIS, we are heavily invested in autonomous networks and intelligent IT systems, aiming to build a foundation that allows us to do more with our networks and IT backend. This not only serves end-to-end processes but also enhances the customer experience.

Autonomous networks enable us to manage costs, increase operational efficiency, and differentiate our products and services. It is all about ensuring that whatever 'G' comes next; we are ready to tackle it while maintaining a seamless experience for our customers.

What partnerships or collaborations is AIS forging to stay ahead in the rapidly evolving telecom landscape? How do these partnerships contribute to your long-term network strategy?
Partnerships are key at this stage, especially since the ultimate goals of the telecom evolution are still unfolding. Collaboration across industries and with partners helps us share successes, learn together, and scale our efforts.

For instance, AIS is actively involved in the TM Forum, and contributes to white papers, shares use cases, and helps set industry standards such as API gateways. These collaborations are crucial in enhancing our services, networks, and open platforms. By aligning with industry standards and fostering partnerships, we ensure long-term success and adaptability in an ever-changing landscape.

What role will AIS play in Thailand's evolving digital economy, particularly with the rise of smart cities and connected industries?
In Thailand's digital economy, AIS is committed to driving progress through three key pillars: digital infrastructure, cross-industry collaboration, and sustainability. As leaders in the telecom sector, we have established a strong foundation with extensive digital infrastructure, including 2G, 3G, 4G, 5G, and fiber optics across the country.

However, building smart cities and connected industries requires more than just advanced networks; cross-industry collaboration is essential. While we can manage mobile networks on our own, creating smart cities requires partnerships with other industries. No company can achieve this alone, and collaboration is crucial to success. We work closely with different sectors to understand their unique needs, identify pain points, and tailor our solutions accordingly.

The third pillar encompasses people and sustainability. AIS is part of the nation, and we are evolving with Thailand. As part of our approach, we intend to ensure that our digital transformation benefits the people, supports sustainable growth, and contributes to the development of smart cities and connected industries.

Thailand already has 140% mobile penetration, meaning most people carry more than one mobile device. The next step for growth is to expand into IoT and connected industries, enhancing every aspect of people's lifestyles through digital innovation.

What role does AI play in future-proofing AIS's network operations? How do you think AI will reshape network operations in the next five to ten years?
AI is set to become a cornerstone of our network operations. We are aiming for a cognitive takeover where real-time interactions and personalization become the norm. We are embedding AI into every process, both internally and in customer interactions.
For instance, in terms of network provisioning, we are moving towards fully autonomous operations.

By 2025, we aim to achieve level-four AI integration in selected processes, and we are already close to reaching level 3.5 in some areas. The goal is to shift from zero-touch networks to predictive networks. That means identifying and resolving potential issues before they affect customers. For example, rather than waiting for a customer to report a problem, AI will allow us to anticipate and resolve it before they even realize it occurred. This shift will significantly enhance customer satisfaction and operational efficiency, making AIS more proactive in delivering seamless experiences. TR

At AIS, we are heavily invested in autonomous networks and intelligent IT systems, aiming to build a foundation that allows us to do more with our networks and IT backend

Andreas Hipp, Executive Chairman, ConnectiviTree

Unlocking Global Connectivity: ConnectiviTree's Bold New Partnerships

In an exclusive interview with Telecom Review Asia at FutureNet Asia, ConnectiviTree Executive Chairman, Andreas Hipp, discussed the recent expansion of the company. This growth represents a strategic initiative aimed at tackling the connectivity challenges faced by operators in today's competitive industry.

ConnectiviTree has recently expanded its Global Alliance with new partners. What motivated these partnerships, and how do they align with ConnectiviTree's strategic goals?

Most of our Alliance partners are either domestic or regional operators, which means they have limited reach regarding fiber infrastructure. They typically focus on selling to enterprise customers, many of whom have an international footprint with offices or manufacturing plants. These partners often struggle to procure international connectivity easily and cost-effectively. Their interest in us lies in our ability to bring a group of network operators together under one umbrella. Being part of this Alliance allows them to achieve a global footprint. This collaborative approach has been key to our success, enabling us to attract more than 20 Alliance members to join our initiative.

What are the key solutions ConnectiviTree offers to its clients, and how do these solutions address the specific challenges faced by enterprises in today's fast-evolving digital landscape?

ConnectiviTree's connectivity enablement platform is based on three key components. The first one is the network called Ctree Rootnet, which is a brand-new, fiber-based transport network spanning Western Europe and parts of Eastern Europe in its initial phases. The interworking with our Alliance Partner's network functions somewhat like the tube in London—specifically, the Circle Line, which travels in a loop. Then we have the Alliance members, which are the other lines, and touch at different stations or networks. That's kind of how the networks link up and one can transit from one line across all others with a single ticket.

Then there is an overlay automation and orchestration software called CTree Plaza, which not only encompasses the software automation across our footprint, but also across our partners' footprint. So any Alliance member can order across our network and any other Alliance member network online in real time, and can request connectivity provisions.

The third piece is the Alliance Members themselves, each one a piece of the global network puzzle and part of the "network of networks"—ConnectiviTree.

How has ConnectiviTree adapted its solutions to meet the changing needs of enterprise clients?

Everything is about agility in today's world; the applications, the cloud instances, which are available online within minutes, and that drives the instant demand for services and connectivity. You can go to AWS, or any other cloud provider, and activate the hosting in minutes. You can spin applications instantly, however, connecting to clouds or other enterprise locations still requires a manual effort, lots of price enquiries and weeks to deliver. What we are trying to do is bring the agility the cloud and applications offer today to the network so it becomes more application-like, offering instant, flexible, seamless availability.

In terms of evolution, what role will ConnectiviTree play in the global telecommunications industry over the next five years?

As mentioned earlier, the third and very important component are the Alliance members; it's an association, and like Rome, it's not built in one day. That being said, we have 20+ members and quite a few in the pipeline set to officially become Alliance members. We still have a some way to go to truly have global coverage. So, of course, the objective is to be the 'network of the networks', provide seamless connectivity and become a hub… Similar to how booking.com serves the travel industry—We want to be that for connectivity services. TR

What we are trying to do is bring the agility the cloud and applications offer today to the network so it becomes more application-like, offering instant, flexible, seamless availability

Boon Ho, Chief Information Officer, Datastream Digital Sdn Bhd (DST)

Datastream Digital: Crafting a Digital Identity Revolution

In an exclusive interview with Telecom Review Asia, Datastream Digital Sdn Bhd (DST), Chief Information Officer, Boon Ho "Andy" Lai, discussed the various strategic and operational aspects DST is implementing as it navigates the dynamic telecommunications landscape. Lai also discussed DST's long-term vision beyond its role as a telecommunications provider, as well as its vision for the future of connectivity through digitalisation.

With the launch of DST's Bruneian-developed digital telco, CRM, how do you envision this tool redefining the traditional telco-customer relationship?

When we first built these tools, we realised that there are a lot of telcos actually focusing on product-centric customer service. During our transformation, we found that the world is coming together to implement e-identity. E-identity is customer-centric (i.e. I need to know all my customers, rather than I need to know the product and the customers).

When we introduced customer centricity, we initiated a tender process but discovered that many systems were fragmented—mobile vendors were separate from fiber vendors. This led us to develop our own solution in collaboration with MultiSys, and we're pleased with the results. Now, we can view customers' entire product portfolios seamlessly.

However, we realised that retaining customers, especially for DST as the largest telco, is the most challenging and costly aspect. One critical element for retention is creating an integrated ecosystem. By combining mobile services, digital wallets, and

government services into one super app, customers are less likely to leave, even if our pricing is slightly higher than competitors.

I think the new generation believes that value is what they pay for. This is something that we are hoping our system will help with during the transformation of big companies.

How does DST incorporate sustainability into its digital and telecommunications strategies? And how does DST balance adopting global technological trends with the specific needs and preferences of your market?

There are three forms of transformation occurring. The first layer is the network layer, and the application layer separates the IT stack. The second layer encompasses actually moving to the cloud.

Before our transformation, we always bought new hardware to accommodate the numbers. Buying new hardware is not sustainable. At that time, we had 36 or more servers, so we decided to migrate everything to the cloud. Once we migrated to the cloud and shared services, we saw proven numbers that demonstrated our commitment to sustainability on this journey.

Many companies tend to focus heavily on technology, chasing the latest trends like blockchain or other emerging innovations. However, DST's approach differs. We understand that technology alone isn't enough to retain customers. What truly drives retention is the overall customer experience throughout the entire system.

For instance, introducing a blockchain wallet and a regular wallet might just appear as two wallets to a customer. The real question is: why does the customer experience matter? This is where technology serves a purpose. Our focus isn't just on the tech itself but on how it enhances the customer experience and aligns with our business objectives. Without those key elements, technology on its own lacks impact. That's why our priority has always been creating a valuable experience for customers, rather than simply offering them a blockchain solution that doesn't truly meet their needs.

How can DST leverage digitalisation to anticipate and shape the future of connectivity in ways that go beyond traditional telecommunication services?

In 2019, when our infrastructure was consolidated nationally, transitioning from a traditional telco to an asset-light operator, has sparked our drive to modernise our entire infrastructure. When we transitioned from a telco to a techco, our primary goal was to modernise the processes for both our employees and customers. Instead of upgrading branch by branch, we centralised our efforts, integrating systems to work cohesively. This allowed us to streamline operations and today, our processes are lean and fully automated, with systems communicating seamlessly.

A crucial insight from a report emphasised that a successful digital transformation requires distributing employee focus effectively: 50% on digital and development, 30% on business, and 20% on areas like marketing and compliance. This structure has made DST agile, enabling us to deploy new products in as little as two weeks to a month.

What is your long-term vision for DST beyond being a telecommunications provider?

We were having a debate, and asked ourselves this: 'Who are we?' Are we an MVNO (Mobile Virtual Network Operator)? Or are we an MVNE (Mobile Virtual Network Enabler). Then we realised that in Brunei, we are an MVNO, however, the new product that we developed with MultiSys is actually an MVNE, and this product can actually digitise a country.

For example, in Brunei, we have segregated the network and we have connected and made a standard layer to connect to the network element. This trend is happening around the world, and they don't really care about the network; all they care about is the customer experience and the customers' pain point.

I think that this will be the long-term vision for us. We will build our use case and our experience into this system and share it across the world, then, whenever the people who use the platform have any pain points, we'll integrate them into the system to improve it continuously.

Our approach emphasizes understanding pain points before building any system. While telecom can be a high-CapEx industry, our vision is to support businesses of all sizes. We structure our model to focus on operational expenses (OpEx) based on their revenue, rather than imposing heavy CapEx charges. This makes our platform accessible to anyone, from small startups to large enterprises, looking to enter the telecom sector today. TR

We understand that technology alone isn't enough to retain customers. What truly drives retention is the overall customer experience throughout the entire system

The Future of Data Storage Dominance: Analyzing Proposed Changes to Gartner's Magic Quadrant Criteria

In the pursuit of technological supremacy, regions around the world are racing to carve out their place as leaders of innovation. Asia, in particular, has made significant strides, leveraging its market potential and innovative capabilities. Yet, a recent discourse about possible changes to Gartner's Magic Quadrant (MQ) evaluation criteria could profoundly alter the dynamics for data storage service providers, particularly those beyond the borders of the United States.

The implications of any revisions to Gartner's MQ criteria extend beyond the immediate ranking of data storage service providers; they signal a potential transformation of the global data storage ecosystem. Industry sources suggest that Gartner is revising its evaluation criteria to emphasize connections with major hyperscalers such as AWS, Microsoft Azure, and Google Cloud. This shift highlights the growing importance of data storage services but raises concerns (proposed by some industry observers) about potential market distortions, hindered developments, higher operational costs, increased reliance on select providers, and more. The issue at hand is Gartner's requirement that data storage service vendors must incorporate with US clouds, excluding non-US cloud providers when evaluating storage vendors.

The MQ has long been a benchmark for evaluating technology providers, influencing buyer and investor decisions and shaping market perceptions in general. As data storage technology becomes increasingly critical in business operations, the criteria by which vendors are

assessed will play an important role in determining who retains a competitive edge.

Setting the Stage for Regional Tech Supremacy

The rise of Asian data storage service providers exemplifies a broader shift in the global tech landscape, where innovation is no longer confined to traditional powerhouses. Countries such as China are harnessing their vast resources and talent pools to create solutions that cater primarily to the needs of their regional markets.

Several Asia-Pacific data storage giants have made notable investments in research and development (R&D), leading to advancements in artificial intelligence (AI), big data, and the Internet of Things (IoT), which directly address local business requirements.

The next generation data storage market in the Asia-Pacific region is witnessing remarkable growth, driven by an increasing demand for high-performance and cost-effective storage solutions. According to a recent report from Credence Research, the market's value is projected to surge from USD 14, 629.13 million to USD 27, 415.47 million by 2023, with a notable compound annual growth rate (CAGR) of 8.01.

As these Asian players expand their capabilities and refine their offerings, the industry is set to witness a gradual reshaping of consumer expectations and standards globally. A competitive market pushes established players to innovate more rapidly, ensuring that the technological race does not stall but instead accelerates toward more efficient, customized data storage solutions that empower businesses in all regions.

Potential Impact on Asian Data Storage Service Providers

The alleged changes to Gartner's MQ criteria could have several potential impacts on Asian data storage service providers. Columnist Prof. Dr. Emre Alkin highlighted in his commentary titled, "Changing the rules in the middle of the game?!" that changes in the evaluation criteria mid-game can possibly raise questions about impartiality.

"This change not only demonstrates the increasing importance of cloud storage but also brings with it significant concerns about market distortion, reduced competition, oligopolization, stifling innovation, increasing operational costs, and dependence on 'selected' service providers," expounded Dr. Alkin.

Program Director for Digital Leadership at the Irish Management Institute, World Business Angels Investment Forum (WBAF) Senator for Ireland and Smart Cities Board Member, and Co-Founder, Digital Transformation Lab, Tony Moroney, suggested in a LinkedIn article that these modifications might undermine competition and disproportionately benefit large, established players. This perspective reflects a broader industry apprehension to preserve a fair and level playing field.

"This proposed shift threatens to fundamentally disrupt the primary storage MQ. Traditional storage vendors, who have long been the backbone of the industry, could find themselves at a serious disadvantage," noted Moroney.

He mentioned that by emphasizing hyperscaler integration over specialized expertise and customer-driven innovation, Gartner risks marginalizing the companies that have fundamentally shaped the primary storage market.

Examining Neutrality in Gartner's Evaluations

Concerns around potential biases in Gartner's assessment processes have grown, particularly in light of the proposed changes to its MQ criteria. Analysts and industry experts have raised questions about whether the adjustments might inadvertently favor larger, established providers due to their existing market presence and resources, thereby compromising the impartiality that is supposed to underpin Gartner's evaluations.

Additionally, the integration of regional adaptability as a criterion could introduce challenges in maintaining a standardized evaluation framework. While it is essential to recognize the unique needs of different markets, the subjectivity introduced by regional considerations might lead to inconsistencies in how data storage service providers are assessed across various geographies. This raises the potential for disparities that may skew the perception of true innovation and capability among emerging players.

Ultimately, ensuring that Gartner's evaluations remain fair and unbiased is vital for fostering a truly competitive environment where both established and local data storage service providers can thrive on equal footing. Continuous scrutiny of their methodologies and criteria adjustments will be necessary to uphold the integrity of Gartner's influential assessments in the tech terrain.

Influence on Market Perceptions

As experts repeatedly emphasize, Gartner's rankings shape market perceptions due to their status as trusted and authoritative indicators within the technology sector. A provider's position in Gartner's MQ significantly impacts its reputation, determining trust levels among enterprises considering data storage solutions. When a data storage service provider is ranked highly, it often leads to increased visibility, potential partnerships, and customer inquiries, while a lower ranking might result in diminished interest and market presence. This creates a feedback loop where perception drives market behavior; enterprises may gravitate toward higher-ranked providers, assuming they are more competent or trustworthy, despite the actual alignment with their specific needs.

Additionally, when provider rankings are perceived to be biased or influenced by factors such as size or pre-existing market presence, the resulting trust deficit could deter smaller or local providers from competing effectively. Thus, ensuring impartial evaluation processes becomes essential not only for fostering innovation but also for preserving a diverse and vibrant data storage services ecosystem. TR

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What Goes into the Meta Cloud?

Cloud adoption in Africa is set for rapid growth by the end of the decade. PMP Strategy forecasts suggest a >30% CAGR in hyperscaler demand from 2023-2030, resulting in over 1,400 MW of live capacity across the continent to serve the needs of hyperscalers alone. Driving these trends are a confluence of factors, including economic growth, the need for digital transformation, and the benefits of cloud computing seen for many years now in more mature markets.

Added to the inherent challenges faced by African enterprises, such as significant data center infrastructure investment required to meet demand, a range of differing regulatory environments, and limited end-to-end connectivity services, is the fact that cloud adoption is becoming increasingly complex due to the growing need for organizations to implement clouds from multiple providers.

The concept of the meta cloud, which integrates and manages multiple cloud services and environments, offers a promising solution. As

implementations of the meta cloud remain nascent, this article speculates on some of the key enablers and components of the meta cloud in the context of Africa.

Key Developments to Support the Meta Cloud in Africa

1. Cloud Services: Major cloud players like AWS, Microsoft Azure, and Google Cloud offer powerful and scalable services that can support African enterprises. While the only fully deployed cloud regions in Africa are located in South Africa, larger-scale deployment will likely soon take place across Nigeria, Kenya, Egypt, and Morocco, where hyperscaler local zones have already been deployed. Huawei, Oracle, Alibaba, and Akamai's initial deployments are also likely to grow across the continent, adding to the complexity of choice in public cloud solutions.

2. Connectivity Solutions: Reliable and high-speed internet connectivity is crucial for effective cloud operations. Investments in subsea cables and terrestrial networks are improving connectivity across the continent. For instance, the deployment of new submarine cables like 2Africa and Equiano has significantly increased the total rolled-out capacity, enhancing connectivity between Africa and other continents.

   Content Delivery Networks (CDNs) help reduce latency and improve the delivery of popular content, enhancing user experience and performance. Akamai and Cloudflare are examples of CDNs that have established a presence in Africa, providing faster and more reliable content delivery.

3. Data Centers: Over 700 MW of additional capacity has been announced to be live by 2030 to meet the rocketing demand from hyperscalers and enterprises—more announcements will undoubtedly be made. Establishing data centers within African countries helps reduce latency, comply with data sovereignty laws, and improve service reliability. Edge data centers bring computing resources closer to end-users. South Africa, Nigeria, and Kenya are leading the way with significant investments in data center infrastructure from the likes of Teraco, OADC, Africa Data Centers, Vantage, and MDXi.

Key Tools to Consider in the Meta Cloud in Africa

1. Orchestration and Management Tools: Kubernetes, Terraform, and Ansible are popular tools for managing and orchestrating cloud services across multiple providers. These tools enable seamless integration and management of services, reducing complexity and improving efficiency, and will be important for realizing the meta cloud in Africa.

   Multi-Cloud Management Platforms enable seamless integration and management of services from different cloud providers, simplifying operations and reducing complexity. For example, Cloudify and RightScale (now part of Flexera) offer multi-cloud management solutions that could support African enterprises in managing their cloud environments.

2. Monitoring and Analytics: Solutions like Prometheus and Grafana help monitor the performance and health of cloud services. These tools provide real-time insights into system performance, enabling proactive management and optimization.

   Analytics platforms provide real-time insights, enabling proactive management and optimization of cloud resources. For example, Google Analytics and AWS CloudWatch offer real-time data insights that help African enterprises make informed decisions.

3. Data Integration and Management: Tools like Apache Kafka and Talend facilitate data integration across different cloud environments. These tools ensure smooth data flow and integration, enabling better decision-making and operational efficiency.

   Ensuring data consistency and synchronization is vital for seamless operations and decision-making. African enterprises are increasingly adopting data synchronization solutions to ensure data integrity and reliability.

4. Cost Management: Solutions like CloudHealth and AWS Cost Explorer help track and optimize cloud spending, ensuring cost-efficiency. These tools provide detailed insights into cloud costs, enabling African enterprises to manage their budgets effectively.

5. DevOps and CI/CD Tools: Tools like Jenkins and GitLab CI/CD support continuous integration and deployment, enhancing development efficiency and agility. These tools enable African enterprises to streamline their development processes and deliver high-quality software faster.

The meta cloud presents a transformative opportunity for African enterprises, offering a way to manage multiple cloud environments effectively and efficiently, particularly as the cloud environment rapidly evolves across the continent. Developers need to familiarize themselves at an early stage with the evolving essential tools, infrastructure, and environment for the meta cloud in the near term. The meta cloud looks set to drive digital transformation, enhance operational efficiency, and unlock new growth opportunities across the continent. TR

Airtel Brings 5G to Mumbai's New Metro Line

Bharti Airtel has become the first telecom operator to deliver uninterrupted 5G connectivity at ten newly inaugurated stations along the Mumbai Metro Line-3, also referred to as the Aqua Line.

This underground infrastructure aims to enhance connectivity in the financial capital, linking the Bandra Kurla Complex (BKC) to Aarey and covering the vital Jogeshwari-Vikhroli Link Road (JVLR) section.

Mumbai's highly anticipated Aqua Line—the city's first underground metro system—is set to transform urban transportation and mark a new era of efficient, high-tech travel in the bustling metropolis.

Aditya Kankaria, CEO of Bharti Airtel in Mumbai, emphasized that the company's strategic investments in enhancing and strengthening network infrastructure along the Aqua Line reflect their dedication to ensuring customers enjoy seamless, high-speed mobile connectivity while using the city's public transit system.

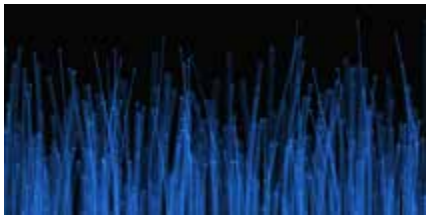
"This commitment is further underscored by our eagerness to support Mumbai's first-ever underground metro line, ensuring that customers can enjoy reliable, blazing-fast internet connectivity as an integral part of their daily commute. As Mumbai embraces this new era of efficient, technologically-advanced public transportation, Airtel stands ready to elevate the commuting experience with high-speed 5G connectivity," Kankaria added.

Stretching 33.5 kilometers, this advanced metro line will connect major transit points, including the renowned Terminal 2 (T2) airport and the lively Santacruz neighborhood.

Throughout the entire route, Airtel has significantly upgraded its 5G infrastructure, allowing passengers to access high-speed mobile internet, clear voice calls, and seamless data transmission during their travels.

Each of the ten underground stations is equipped with dedicated in-building solutions to ensure reliable, high-quality connectivity, enhancing the overall commuting experience.

PLDT Secures Social Loan for Fiber Expansion



PLDT has secured a PHP 2 billion (USD 34.4 million) social loan from HSBC Philippines. The funds will be used to finance the expansion of its fiber infrastructure in underserved and unserved communities.

Social loans are financing solutions that are implemented to generate positive social outcomes, such as improving access to affordable basic infrastructure and essential services.

In a filing with the Philippine Stock Exchange, PLDT announced that its recently secured social loan will facilitate the expansion of its fiber network infrastructure to fourth through sixth-class municipalities across the Philippines. This initiative aims to improve internet connectivity in geographically isolated and disadvantaged areas (GIDAs) that currently lack access to reliable internet services.

PLDT reported that its fiber network currently reaches 59% of the fourth through sixth-class municipalities. However, out of more than 7,000 geographically isolated and disadvantaged areas (GIDAs) in the country, only 767 have been connected to fiber.

The company has announced plans to further extend its fiber services to additional municipalities in the coming years, focusing on areas with the greatest need for improved connectivity.

Telcos to Prioritize Filipino Connectivity

President Ferdinand R. Marcos Jr. has urged the telecommunications industry to prioritize connectivity in geographically isolated and disadvantaged areas (GIDAs) as part of a comprehensive strategy to advance the government's digitalization objectives. The emphasis has largely been on improving wireless connectivity.

In April 2024, the Private Sector Advisory Council (PSAC), created by Marcos Jr. two years ago to encourage public-private collaboration, suggested that the government set aside at least PHP 240 billion to build 35,000 new tower sites for GIDAs. However, installing these towers will also need fiber infrastructure.

According to PLDT's Chief Sustainability Officer, Melissa Vergel de Dios, fiber will not only enhance wireless connectivity but also play a vital role in ensuring equitable access to education, healthcare, and economic opportunities for underserved communities.

"By expanding our presence in GIDAs and low-income municipalities, we are helping to foster inclusive growth and development in some of the most remote parts of the country," Vergel de Dios said in a statement.

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Rakuten Mobile Secures NICT Funding for Global Standardization of Advanced Edge Cloud

Rakuten Mobile has initiated a project aimed at promoting the international standardization of advanced edge cloud technologies. This project has been selected for support by Japan's National Institute of Information and Communications Technology (NICT) under its Innovative ICT Fund Projects for Beyond 5G/6G: Strategic Program for Social Implementation and Overseas Deployment.

The project, partially funded by the NICT, aims to address the limitations of current international standards for network specifications that were established before the advent of cloud-native networks. These existing standards are inadequate for the increasing user numbers and communication volumes anticipated in the era beyond 5G. Rakuten Mobile seeks to incorporate flexible, efficient and scalable cloud-native networks into these specifications.

Rakuten Mobile has already built a large-scale, fully-virtualized, cloud-native mobile network in Japan. Leveraging this expertise, the company will closely collaborate with organizations responsible for international standardization to drive the creation and adoption of unified international standards for cloud management, including edge cloud technologies essential to the era beyond 5G, thereby contributing to the widespread adoption of cloud-native networks.

Furthermore, through its subsidiary, Rakuten Symphony, Rakuten Mobile aims to ensure that global cloud solutions such as Rakuten Cloud comply with international standards, as part of the company's goal to deploy flexible and secure cloud services worldwide.

Reliance Jio Pushes for Satellite Spectrum Auction

Telecom operator, Reliance Jio, has requested Union Minister Jyotiraditya Scindia's assistance in urging the Telecom Regulatory Authority of India (TRAI) to issue a revised consultation paper regarding proposed spectrum allocation rules. The company aims to create a fair competitive environment between terrestrial and satellite service providers.

In a letter to Minister Scindia, Reliance Jio highlighted the Supreme Court's ruling in the 2G case, warning that the TRAI's omission of questions regarding a level playing field could result in potential legal disputes.

The letter from Reliance Jio was prompted by the TRAI's rejection of its request to include questions about the level playing field between terrestrial network providers, which use ground-based towers for mobile services and satellite communication service providers.

The TRAI previously reported to have initiated a consultation process that aimed to determine the methodology and pricing for assigning spectrum to satellite companies, enabling them to offer calling, messaging, broadband, and other services in India.

In its letter, Reliance Jio pointed out that several satellite communication companies, including Elon Musk's Starlink, Amazon's Kuiper, Bharti Group-backed OneWeb, Eutelsat, and the SES-Jio joint venture, have shown interest in offering their services in India. This development poses a direct challenge to land-based mobile networks. Consequently, Reliance Jio asserted that a fair and transparent auction system for satellite services is crucial to ensure equitable competition in the market.

Reliance Jio noted that while the Department of Telecommunications (DoT) acknowledged the necessity for a level playing field in its reference to the TRAI, the consultation paper released by the TRAI seemed to neglect this important concern. Reliance Jio expressed that it believes the TRAI has prematurely closed the discussion without seeking input from stakeholders.

The telecom operator further stated that the consultation paper did not pose relevant questions regarding the level playing field, preventing stakeholders from expressing their views.

"Such a consultation exercise could result in recommendations that disregard this vital issue of level playing field. Although we have raised this issue with TRAI and asked that the consultation paper be revised to address the level playing field issues between satellite and terrestrial networks, our request has not been considered favorably," Reliance Jio said.

The government, under the Telecommunications Act 2023, has chosen to allocate spectrum for specific satellite services through an administrative process instead of using an auction.

GSMA Report Highlights Barriers to Mobile Internet Adoption

The benefits of mobile connectivity have not been fully realized yet, as 43% of the global population, equivalent to 3.45 billion people, still do not use mobile internet, according to the latest GSMA 'State of Mobile Internet Connectivity 2024' report.

Although the number of people using mobile internet on their own devices is increasing every year, the rate of growth is slowing down.

Overview of the State of Mobile Internet Connectivity in 2024
Last year, 160 million people started using mobile internet, similar to the levels recorded in 2022 but lower than the years 2015-2021 when more than 200 million new users were added annually.

The new report, funded by the UK Foreign, Commonwealth and Development Office (FCDO) and the Swedish International Development Cooperation Agency (Sida) through the GSMA Mobile for Development Foundation, highlighted the obstacles preventing the increase in mobile internet services usage and emphasized the need for collaboration between governments, mobile network operators, and international organizations. The report revealed that 4.6 billion people (57% of the global population) now use mobile internet on their own devices.

However, 350 million people (4% of the global population) live in remote areas without mobile internet networks (coverage gap), and 3.1 billion people (39% of the global population) have access to mobile internet but do not use it (usage gap). The usage gap is nine times larger than the coverage gap.

Notably, the region with the lowest connectivity globally is Sub-Saharan Africa, where only 27% of the population uses mobile internet services, demonstrating a 13% coverage gap and a 60% usage gap.

Barriers to Mobile Internet Adoption
The main challenge is the usage gap, and connecting these individuals to the internet could bring an estimated USD 3.5 trillion to the global economy between 2023-2030, with 90% of this impact benefiting low- and middle-income countries (LMICs).

The coverage gap is mainly present in rural, poor, and sparsely populated areas, and requires an estimated USD 418 billion in investment to establish the necessary infrastructure for universal mobile internet access.

In LMICs, the main barriers to mobile internet adoption are device affordability and digital skills and literacy. Entry-level, internet-enabled devices cost 18% of the average monthly income in these countries. For the poorest 20% of people worldwide, this cost increases to 51% of their monthly income. In Sub-Saharan Africa, the poorest 20% would need to spend nearly all of their monthly income—99%—to afford entry-level, internet-enabled devices.

China Launches Pilot for Foreign-Owned Data Centers

The Chinese government has launched a pilot project allowing foreign investors to operate data centers within the country.

The Ministry of Industry and Information Technology's initiative will establish specific zones where foreign-owned facilities can offer digital infrastructure services to local companies.

Jin Zhuanglong, the Minister of Industry and Information Technology, noted that the pilot program represents a new phase in China's efforts to open up the telecommunications sector.

Previously, foreign investors faced restrictions on owning and operating data centers in China, with local regulations limiting ownership to domestic companies. Foreign firms were only allowed to participate through joint ventures with local partners, with ownership capped at 50% in any consortium.

The project will permit foreign investors to invest in value-added telecom services within four specified regions: Beijing, Shanghai, Hainan, and Shenzhen. Businesses in these designated areas can operate as wholly-owned ventures, providing data and transaction processing services.

Wang Zhiqin, Deputy Director of the China Academy of Information and Communications Technology, stated that the pilot program aims to enhance the integration of digital technologies across various sectors nationwide.

The project is part of China's broader efforts to open up its services sector, including establishing free trade zones like the 120-square-kilometer Lin-gang Special Area.

Chinese state media reported that 2,220 foreign-invested firms are licensed to operate telecom services within the country, as new pilot programs seek to boost foreign investment opportunities.

The Ministry of Industry and Information Technology announced plans to closely monitor the pilot initiatives and may widen their scope when the time is right.

HSBC's Chinese fintech subsidiary is already aiming to capitalize on the program, having reportedly applied for an internet content provider license.

Balancing Innovation with Privacy and Fairness in the Asia Pacific

In the Asia Pacific, privacy regulations vary widely across different countries, reflecting diverse priorities and approaches. Some nations have embraced comprehensive data privacy laws, while others are still in the process of developing their frameworks. These regulations aim to protect citizens' data and privacy while fostering innovation in emerging technologies.

For instance, Singapore and the United States have collaborated to create an interoperable AI governance framework, setting an example for other nations in the region. This framework seeks to balance the need for technological advancement with the protection of privacy, ensuring that AI is developed and deployed ethically.

Similarly, the Philippines has been proactive in seeking public consultations for draft guidelines on private identification cards and consent, highlighting the increasing importance of transparency and public participation in privacy governance.

Digital Governance and Privacy Frameworks

Countries such as Singapore and South Korea have emerged as leaders in digital governance, with their strong data protection regulations serving as a model for others in the region. Singapore's Personal Data Protection Commission (PDPC) has implemented a range of measures to safeguard personal data, while South Korea's Personal Information Protection Act (PIPA) ensures strict oversight on the collection, use, and transfer of personal data. Both countries have successfully integrated privacy protections into their digital innovation strategies.

On the other hand, China has taken a more state-controlled approach with its Personal Information Protection Law (PIPL), focusing heavily on national security and control over data flow. This regulatory framework illustrates the tension between state interests and individual privacy, particularly when considering the widespread use of surveillance technologies.

As noted by the Future of Privacy Forum (FPF), many Asia-Pacific nations are actively engaged in enhancing privacy protections while also fostering innovation in sectors such as AI, IoT, and smart cities. The key challenge here is finding a balance that does not stifle innovation but ensures fairness and transparency in data governance.

The Role of AI in Shaping Privacy and Fairness

AI is playing an increasingly central role in the Asia-Pacific's technological development. However, with its rise comes heightened concerns about privacy and fairness. AI systems often rely on vast amounts of data, raising the risk of biased algorithms and unequal treatment. If left unchecked, these issues could lead to unfair outcomes, particularly for marginalized communities.

To address these concerns, several countries in the region are focusing on building ethical AI frameworks. These frameworks emphasize fairness, transparency, and accountability in AI development. For example, ethical AI guidelines in South Korea, Singapore, and Japan are designed to prevent AI systems from reinforcing societal biases and ensure that these technologies are used to promote the common good.

Companies in the Asia Pacific are also taking steps to address these challenges. Many are developing AI systems that incorporate privacy-by-design principles, ensuring that data privacy is considered at every stage of development. This approach not only protects user data but also builds trust between companies and consumers

Tencent (China) is focusing on responsible AI use in sectors like health and education, while SoftBank (Japan) has launched a 'Happiness Empowered by AI' strategy for robotics and smart city projects. "We are heading for an AI revolution, and we will be the investment company for the AI revolution," expounded Masayoshi Son, Founder and Head of SoftBank Group.

Telstra (Australia) has aligned its transformation with national AI ethics principles to ensure ethical AI in telecommunications and healthcare, and Singtel (Singapore) has instilled transparency and privacy in its 'AI for Business' solutions.

Alibaba (China) has integrated ethical guidelines into its 'ET City Brain' project to manage smart cities with fairness and data privacy. These companies are setting a standard for ethical AI across various industries in the region.

Innovation and the Public Good

While privacy and fairness are critical, the Asia Pacific region is also keen to ensure that innovation serves the public good. The rise of smart cities, for instance, illustrates how technology can be leveraged to improve public services, enhance security, and create more efficient urban environments. However, these projects often involve the collection of large amounts of data, raising questions about how to balance the benefits of innovation with privacy protections.

One notable example is Singapore's smart nation initiative, which aims to harness data and technology to improve public services. The success of such initiatives depends on robust privacy protections and clear governance frameworks to prevent misuse of personal data.

In countries like India and Indonesia, where digital infrastructure is expanding rapidly, governments are working to implement privacy frameworks that protect citizens' rights while encouraging innovation. This includes building regulatory environments that allow for the responsible use of AI and other technologies, as well as establishing clear guidelines on data collection and usage.

The APEC Privacy Framework

The Asia-Pacific Economic Cooperation (APEC) Privacy Framework serves as a guiding document for many countries in the region, providing principles that promote both privacy protection and the free flow of information. This framework encourages member economies to develop privacy laws that are consistent with global standards while allowing for flexibility in how those laws are implemented at the national level.

The framework emphasizes the importance of individual rights, accountability, and cross-border cooperation, ensuring that privacy is respected without impeding innovation. For example, the APEC Cross-Border Privacy Rules (CBPR) system allows businesses to transfer data across borders in a way that respects privacy rights and maintains trust between different jurisdictions.

Striking a Balance

As the Asia Pacific continues to evolve technologically, the challenge of balancing innovation with privacy and fairness will only grow. Governments, businesses, and civil society organizations must work together to create environments where innovation can thrive without sacrificing individual rights.

One potential solution lies in the adoption of privacy-enhancing technologies (PETs), which enable data to be used for innovation without compromising privacy. These technologies, such as homomorphic encryption and differential privacy, allow companies to extract value from data without exposing personal information.

Furthermore, fostering a culture of transparency and accountability is essential. This includes providing clear communication regarding how data is collected and used, and also providing individuals with the tools they need to control their personal information. For instance, companies can offer opt-in or opt-out mechanisms that give users more control over their data. TR

The Future of Human-Machine Interfaces in the Asia Pacific

As the Asia Pacific region continues to advance in technology and innovation, the future of human-machine interfaces (HMIs) is set to play an essential role across industries. This evolution will profoundly impact sectors such as healthcare, manufacturing, and smart cities, where collaborative robotics, AI, and extended reality (XR) are reshaping how humans interact with machines.

Notably, the global human-machine interface market was valued at USD 5.8 billion in 2023 and is projected to reach a market size of USD 11.37 billion by the end of 2030, illustrating the increasing demand for smarter, adaptive interfaces.

Current Trends Shaping HMIs

Asia-Pacific countries are at the forefront of shaping HMIs through innovative concepts like Society 5.0 and Industry 5.0. Japan, in particular, is leading the way with Society 5.0, a vision for a super-smart society that leverages AI, IoT, and robotics to address social challenges and create human-centered solutions. Industry 5.0 builds on this by promoting enhanced collaboration between humans and machines, especially in manufacturing, where robots and humans work together efficiently. This integration capitalizes on the precision and speed of machines, complementing human creativity and problem-solving skills.

Industry 5.0 is emerging as a human-centric, sustainable, and resilient manufacturing paradigm aimed at enhancing the collaboration between humans and machines, particularly through the integration of advanced technologies like AI and robotics. It emphasizes the importance of worker welfare and adaptability in production processes, addressing the limitations of Industry 4.0, which primarily focused on efficiency and automation.

Whereas Society 5.0, proposed by the Japanese government, envisions a super-smart society that harmonizes economic growth with social problem-solving through the integration of cyberspace and physical space. While both concepts prioritize human well-being and aim to create a more sustainable future, Industry 5.0 specifically focuses on transforming industrial practices, whereas Society 5.0 encompasses broader societal challenges.

In the healthcare sector, the Asia Pacific is experiencing a major shift due to advancements in AI and robotics. Robots are assisting in surgeries, providing accuracy that minimizes human error, while telepresence robots enable remote healthcare services, making diagnostics and treatments accessible to remote and underserved populations. Countries like Japan and South Korea are particularly advanced in incorporating robotics into their healthcare systems, revolutionizing patient care and medical practices.

Personalization and customization in HMIs are also becoming crucial in the region. AI-driven algorithms allow machines to adapt to individual preferences, making interactions more intuitive and tailored to users' needs. These personalized interfaces are transforming everything from user experience in technology to the way smart cities function. In countries such as China and Singapore, where smart city initiatives are gaining momentum, this trend is expected to fuel the growth of consumer technologies and more responsive public service.

AI-driven personalization is one of the most transformative trends, enabling HMIs to adapt to user behavior, providing predictive and personalized experiences. China-based Baidu's AI-powered DuerOS platform, used in smart speakers and home devices, enables intuitive voice interactions.

Another key trend is the rise of touchless and gesture-based interfaces, spurred by the COVID-19 pandemic. These interfaces are becoming prevalent in industries like automotive, healthcare, and consumer electronics. In Japan, Fujitsu has developed gesture-controlled systems for operating rooms, allowing surgeons to interact with medical imaging without touching surfaces, reducing the risk of contamination. Additionally, voice-activated HMIs are transforming consumer electronics, with Samsung's

Bixby assistant leading voice command integration into smartphones, TVs, and home appliances across the APAC region.

Advanced technologies such as brain-computer interfaces (BCIs) and biometric emotion recognition are pushing the boundaries of human-machine interaction. BCIs, like Neuralink's neural signal technology, enable users to control machines directly with their minds, offering new possibilities for individuals with disabilities. In parallel, emotion recognition, such as Affectiva's technology in vehicles, monitors driver stress and fatigue to adjust settings and improve safety. Notably, the global biometric system market size is expected to grow from USD 42.9 billion in 2022 to USD 82.9 billion by 2027, at a CAGR of 14.1%.

Augmented reality (AR) and virtual reality (VR) are also revolutionizing HMIs by creating immersive environments for industries such as manufacturing, healthcare, and education. Boeing's AR-powered HMI, used in aircraft assembly, has reduced error rates by 50% and assembly time by 25%.

Finally, the convergence of multi-modal inputs—combining voice, touch, gesture, and visual interfaces—enhances user experience and accessibility. Xiaomi's smart home ecosystem, powered by its AIoT platform, integrates these input methods for a seamless user experience across its devices.

As these technologies advance, HMIs will continue to deliver more adaptive, context-aware, and immersive experiences across industries.

Challenges in Implementing Advanced HMIs

The development of advanced HMIs in the Asia Pacific region comes with several challenges despite its many benefits. One major concern involves ethical considerations and privacy. As machines gain more autonomy, issues of accountability and transparency become more prominent. For example, AI-powered systems, such as those in autonomous vehicles or healthcare robots, introduce difficult questions in terms of responsibility in cases of errors or malfunctions. Furthermore, the region faces rising privacy concerns as AI-driven interfaces collect vast amounts of user data. This raises significant issues regarding user consent, data security, and potential misuse, particularly in countries with expanding surveillance systems.

Another key challenge is the technological gaps and infrastructure disparities across the region. While technologically advanced countries like Japan, South Korea, and China lead in adopting robotics and AI, other developing nations lag behind due to inadequate infrastructure. A lack of access to high-speed internet and modern hardware in some areas slows the adoption of next-generation HMIs, creating a digital divide within the region.

The Role of 5G in the Future of HMI Development

The combination of AI and 5G technology is expected to serve as the backbone for the future of HMIs. The speed and low latency provided by 5G networks enable real-time interactions, making advanced applications like autonomous vehicles and remote surgery feasible.

China is leading these advancements with companies like Huawei developing 5G-powered AI applications, including remote surgery systems that allow real-time operations across distances. These initiatives are part of China's broader AI and 5G strategy, which is revolutionizing smart factories and manufacturing through enhanced robotics and automation, offering faster, more precise production capabilities.

In South Korea, SK Telecom and KT Corporation are pushing the boundaries of AI and 5G, particularly in smart cities and transportation. SK Telecom's AI-powered 5G systems for autonomous vehicles enable real-time communication between cars and their environments, enhancing safety and traffic management. On a national level, South Korea's Digital New Deal is building a comprehensive AI-based 5G infrastructure, enabling real-time HMI applications across industries like healthcare, manufacturing, and smart grids.

Singapore's Smart Nation initiative is another example of how AI and 5G are being utilized to enhance HMIs in public services and urban infrastructure. Partnering with Singtel, the government is using 5G networks to power smart traffic systems, autonomous vehicles, and AI-powered telemedicine, enabling real-time interactions that improve efficiency and safety. Across Asia, the combination of AI and 5G is laying the foundation for the future of HMIs, driving innovations that will reshape industries and improve connectivity.

Advancing HMIs in APAC

Future initiatives and research in advancing Human-Machine Interfaces (HMIs) in the Asia Pacific region are gaining momentum, as evidenced by several noteworthy studies. A research paper published in MDPI, entitled "The Role of Human–Machine Interactive Devices for Post-COVID-19 Innovative Sustainable Tourism in Ho Chi Minh City, Vietnam" examined how AI and virtual reality can enhance tourism service quality, demonstrating the potential for HMI technologies to personalize and improve user experiences.

Additionally, the "Human Machine Interface (HMI) Market Overview with Demographic Data and Industry Growth Trends 2032" report indicated that the HMI market is projected to reach approximately USD 11.88 billion by 2026, driven by the demand for industrial automation in countries like Japan, India, and China.

Lastly, a study published in the American Society of Mechanical Engineers (ASME), entitled "Human Machine Interfaces for Environmental Monitoring" explored the design and application of HMIs in environmental monitoring, highlighting their role in facilitating real-time data collection and improving decision-making processes. Together, these studies underscore the transformative efforts being made in research and development (R&D) to advance HMI integration across various sectors in the APAC region. TR

Thailand: Crafting a Secure and Inclusive Future in the Global Digital Arena

Inclusivity has emerged as a crucial pillar for progress, especially in technology and digital transactions. Thailand is at the forefront of this movement, recognizing that a truly digital future must not only connect individuals but also ensure that people of all abilities—especially those with disabilities—are empowered to participate fully in the digital economy.

Government Initiatives for Inclusivity

The Thai government has taken significant strides towards fostering an inclusive digital environment. Recent initiatives aim to bridge the digital divide, ensuring that individuals with disabilities have access to technology that enhances their quality of life. Notably, the establishment of digital applications tailored for various disabilities underscores the government's commitment to this cause. This focus was evident in a seminar led by Mr. Teerawut Thongphak, Deputy Secretary General of the National Digital Economy and Society Committee. The seminar focused on the use of digital applications for people with disabilities and attracted over 200 participants, showcasing a collective effort towards greater inclusivity.

Thongphak articulated the government's vision for leveraging technology to support national development. He emphasized the need for robust digital infrastructure that not only reduces social inequalities but also creates equal opportunities for all citizens, particularly those with disabilities. The emphasis on accessibility is pivotal in ensuring that every Thai citizen can utilize digital advancements to improve their lives and contribute to society.

Thailand 4.0 is a national strategy designed to transform the country into an innovation-driven economy. Inclusivity is a key pillar, and aims to reduce social inequality, promote equal economic opportunities, and ensure that marginalized communities, such as rural populations, benefit from digital advancements.

Thailand's National e-Payment initiative aims to promote financial inclusion by providing access to financial services through digital channels. The plan includes the development of digital payment systems to reduce cash dependence and make transactions more accessible for all, including rural and low-income populations.

The Village Fund is a microfinance initiative that provides small loans to rural communities to foster local development and entrepreneurship. The initiative is designed to promote inclusivity by giving low-income and rural citizens access to capital.

The Net Pracharat Project has been a cornerstone in expanding broadband access to underserved areas, with over 24,700 rural villages receiving free public Wi-Fi, thus enhancing digital access for rural communities. Complementing this, the Digital Community Center Initiative has established centers in rural areas to provide free internet, digital literacy training, and access to e-commerce and government services, ensuring that even remote communities benefit from digital opportunities.

In addition to expanding access, Thailand has prioritized digital literacy and workforce development. Programs like the Thailand Digital Workforce Development Program and the Coding Thailand Initiative aim to equip citizens, particularly in rural areas, with digital skills necessary for the modern economy. These initiatives provide free courses on coding, digital marketing, and entrepreneurship, targeting students and small businesses in underserved communities.

The Role of Telecommunications in Promoting Inclusivity

Thailand's e-government services and smart city initiatives also play a crucial role in bridging the digital divide. By

digitalizing public services and integrating digital infrastructure in smart cities like Phuket and Chiang Mai, the government is ensuring that citizens can access essential services online, regardless of their location. These efforts, supported by the Universal Service Obligation Fund, which finances telecom expansion in remote areas, are helping to reduce the digital gap, promoting inclusivity, and empowering marginalized communities to participate in the country's growing digital economy.

With Thailand experiencing rapid advancements in mobile connectivity, telcos have become key partners in ensuring that digital services reach all corners of society, including underserved and marginalized populations.

However, as Thailand undergoes a major digital transformation, senior citizens are at risk of being left behind due to a lack of digital literacy. With around 13 million people aged 60 years or older in a population of 66.05 million, the country is already grappling with the challenges of an aging society. According to the e-Conomy SEA Report 2022, Thailand's digital economy is expected to reach USD 53 billion by 2025, with a 15% compounded annual growth rate (CAGR), and is projected to double from approximately USD 100 billion to USD 165 billion by 2030.

Despite these advancements, less than 15% of people aged 75 years or older have internet access in Thailand, as reported by the International Telecommunication Union (ITU). In contrast, the internet access rate among seniors in more developed regions like Hong Kong and Japan is significantly higher. The National Statistical Office's survey indicated that while 62.1% of the elderly aged 60 years or above have internet access, 37.9% still do not.

Additionally, 84.3% of Thai seniors have access to smartphones, but those living in rural areas face greater challenges; 44.2% lack internet access, and 18% do not have access to smartphones. This digital divide underscores the need for targeted efforts to improve digital literacy among older adults, ensuring they can engage with the increasingly digital economy.

Thai telecom companies are actively bridging the digital divide by expanding network infrastructure to rural areas, ensuring underserved communities have access to digital services. AIS, Thailand's largest mobile operator, has led efforts in rural network expansion by installing mobile towers in remote areas and providing affordable data plans. These initiatives ensure that rural populations can benefit from high-speed internet, supporting online education, healthcare, and economic opportunities.

True Corporation's (True) initiatives focus on delivering affordable, high-quality internet to underprivileged schools and communities. True has donated high-speed internet to schools in remote regions, provided low-cost internet packages, and collaborated with the government to distribute digital devices.

State-owned NT and dtac have also played a key role in fostering inclusivity. NT has expanded internet access through its involvement in smart city and village connectivity projects, ensuring that even remote villages can access government digital services. Meanwhile, dtac's "Safe Internet" initiative focuses on educating young people in rural communities about responsible internet use, equipping them with essential digital skills. Together, these efforts have significantly contributed to reducing Thailand's digital divide.

Innovative Applications for People with Disabilities

At the core of Thailand's inclusivity efforts are several innovative applications developed specifically for individuals with disabilities. These applications cater to a wide range of needs, addressing visual, hearing, mobility, learning, mental, intellectual, and autism-related challenges.

Among these, the D4D APP PORTAL serves as a comprehensive application center that includes tools like InfoPage for All, which provides essential information on support centers; and My Mood for All, a mental health assessment system.

Thai developers have created apps that use AI to translate sign language into text and speech in real-time. These tools help bridge the communication gap between hearing-impaired individuals and the wider population.

Developed by the Department of Land Transport, the "Taxi OK" app includes accessibility features for passengers with disabilities. It allows users to book wheelchair-accessible taxis and provides drivers with instructions to assist passengers.

Such initiatives highlight how technology can be harnessed to foster a more inclusive society, enabling individuals with disabilities to thrive in a digital-first world.

Economic Implications of Inclusivity Initiatives

The implications of Thailand's inclusivity initiatives extend beyond individual empowerment; they have the potential to enhance the country's overall sustainability. By ensuring equal access to digital resources, Thailand is tapping into the capabilities of all its citizens, fostering an environment where diverse talents can contribute to economic growth. This proactive approach not only improves the quality of life for people with disabilities but also enriches society as a whole.

The economic empowerment of individuals with disabilities is another key benefit of these initiatives. As digital services become more accessible, people with disabilities can explore new avenues for income generation and employment. This shift is critical in reducing economic disparities and enhancing overall economic development in Thailand.

Thailand's commitment to creating an inclusive digital environment serves as a model for other nations. By demonstrating that tangible actions can lead to inclusivity, Thailand sets a precedent for global efforts aimed at creating a more equitable society. The country's experience offers valuable lessons on how to integrate technology and inclusivity, proving that when everyone has the opportunity to contribute, the entire society benefits. TR

Overview of Singapore's Model AI Governance Framework for Generative AI

The advancement of artificial intelligence (AI) , particularly generative AI (GenAI), has transformed industries and reshaped how we interact with technology. Recognizing the immense potential—and the associated risks—of this emerging field, Singapore has taken a significant step forward with the introduction of its Model AI Governance Framework for Generative AI.

The framework not only updates previous guidelines for traditional AI but also seeks to establish a comprehensive governance structure that fosters innovation while ensuring safety and trust.

Building on Existing Foundations

The Model AI Governance Framework for Generative AI, released in May 2024, expands on the original Model AI Governance Framework established in 2019, which focused on traditional AI applications. With generative AI presenting unique challenges—such as concerns over misinformation, bias, and ethical usage—the updated framework aims to address these issues holistically.

The framework draws insights from various stakeholders, including policymakers, industry leaders, and academic researchers. This collaborative approach aims to create a shared understanding and a consistent set of principles to

guide the responsible development and deployment of generative AI technologies.

Generative AI has the capability to create text, images, and other content, offering transformative potential across sectors such as telecommunication, healthcare, finance, and entertainment. However, this capability is accompanied by significant risks, including the potential for misuse, ethical dilemmas, and the propagation of misinformation. As a result, there is a growing consensus among global leaders that a structured governance framework is necessary to create a trusted environment for end-users.

The proposed framework is designed to not only mitigate risks but also promote cutting-edge innovation. By facilitating international dialogue among stakeholders, the framework aims to establish a shared understanding of best practices and ethical considerations, ultimately enhancing global cooperation in the AI landscape.

Nine Dimensions of Governance

At the core of the Model AI Governance Framework for Generative AI are nine proposed dimensions that offer a comprehensive approach to fostering a trusted AI ecosystem:

1. **Accountability:** Establishing clear responsibilities among developers, users, and stakeholders ensures that all parties are held accountable for the outcomes of AI systems.
2. **Data Quality:** Recognizing that data is foundational to AI model development, the framework emphasizes the importance of high-quality and ethically sourced data, addressing potential biases and controversies.
3. **Trusted Development and Deployment:** By enhancing transparency around safety measures and development practices, the framework encourages industry best practices in AI development.
4. **Incident Reporting:** An effective incident management system is vital for timely reporting and remediation of issues, allowing for continuous improvements in AI systems.
5. **Testing and Assurance:** External validation through third-party testing enhances trust in AI systems, fostering consistency and reliability.
6. **Security:** The framework addresses new security threats associated with generative AI, promoting proactive measures to safeguard against potential vulnerabilities.
7. **Content Provenance:** Transparency regarding the origins of AI-generated content helps users make informed decisions, enhancing trust in the outputs of generative AI systems.
8. **Safety and Alignment R&D:** Fostering research and development (R&D) collaborations globally aims to improve the alignment of AI models with human values and intentions.
9. **AI for Public Good:** The framework emphasizes the importance of harnessing AI to benefit society, promoting access, public sector adoption, and sustainable development.

The development of the Model AI Governance Framework for Generative AI reflects a proactive and collaborative approach to AI governance. By building on the successful mapping and interoperability of existing national frameworks, such as those between Singapore and the United States, the framework enhances Singapore's role as a leader in responsible AI governance.

The framework aims to serve as a foundation for international discussions, allowing diverse jurisdictions to share insights, address common challenges, and create a cohesive strategy for generative AI. This is particularly vital given the global nature of AI technologies, which often transcend national borders.

The Singapore government is committed to engaging with stakeholders to refine these guidelines and resources, ensuring they remain relevant and practical. The framework will adapt as new technologies and techniques emerge, allowing Singapore to maintain a balance between fostering innovation and ensuring the safety and trustworthiness of AI systems.

Conclusion

The Model AI Governance Framework for Generative AI represents a crucial step towards creating a trusted and innovative environment for AI technologies. By addressing the unique challenges of generative AI through a comprehensive set of guidelines, Singapore is positioning itself as a pioneer in responsible AI governance.

As global discussions around AI continue, this framework may serve as a model for other nations, promoting international collaboration and establishing principles that prioritize accountability, transparency, and ethical considerations in the rapidly evolving world of artificial intelligence.

There is a growing consensus among global leaders that a structured governance framework is necessary to create a trusted environment for end-users

Maxis and MRCA Collaborate to Boost 5G Adoption in Retail

The Malaysia Retail Chain Association (MRCA), representing 562 retailers nationwide, has entered into a Memorandum of Understanding (MoU) with Maxis.

This collaboration aims to enhance the adoption of 5G technology solutions within the domestic retail sector. The initiative focuses on improving customer experiences and increasing operational efficiency through advanced connectivity and digital solutions.

Key areas of development include retail analytics, AI-driven computer vision, managed network services, extended reality (XR) experiences, and supply chain enhancements, all underpinned by secure connectivity and cloud infrastructure.

Maxis will also conduct regular workshops for MRCA members to enhance their digital knowledge, specifically focusing on 5G solutions. This initiative aligns with MRCA's goal of fostering a continuous learning culture among its members, ensuring that retailers in the country remain competitive in the fast-evolving retail landscape.

"Our collaboration with Maxis complements our own digital transformation program and provides a platform for retail owners and stakeholders—including more than 40,000 member outlets around the country—to try out new technology and connectivity solutions. With Maxis as our trusted partner, our members can not only better adapt to the realities and demands of the digital economy, but also shape the future of retail in Malaysia," said Datuk Ken Phua, President of MRCA.

The partnership was officially inaugurated during a signing ceremony at the recent MRCA CEO Get Together, which saw attendance from over 60 founders, CEOs, and leaders from various retail organizations nationwide. The event served as a networking platform, allowing members to explore the latest technologies and trends driving retail transformation, including 5G, automation, and the Internet of Things (IoT).

Prateek Pashine, the Chief Enterprise Business Officer of Maxis, is enthused by the opportunity to engage more deeply with MRCA members to create use cases related to 5G connectivity and managed network services.

Pashine indicated that Maxis Business is prepared to assist MRCA members in accelerating their digital transformation, enabling them to concentrate on serving Malaysian consumers effectively. This aligns with Maxis's goal of connecting people and businesses to a world of possibilities.

Telkomsel Trials Facial Recognition for Prepaid SIM Registration

Telkomsel, an Indonesian operator, is testing facial recognition technology to simplify the process of registering and replacing prepaid cards.

This makes Telkomsel the second telecom company in the country to adopt this biometric technology.

Telkomsel announced that it is trialing facial recognition in its customer service portal, GraPARI Online, and the MyGraPARI app.

The facial scan compares the individual's features with government identity databases to confirm the customer's identity. Facial recognition will be used alongside current validation methods like Population Identification Numbers (NIK) and Family Card Numbers (KK).

Biometric Technology at the Forefront

Telkomsel's MyGraPARI has been indirectly using facial recognition by supporting eKTP, the digital version of Indonesia's ID card that includes biometric data. MyGraPARI also offers fingerprint scanning as an ID verification option.

Telkomsel's Sales Director, Adiwinahyu Basuki Sigit, mentioned that facial recognition will simplify and secure the process of registering and replacing prepaid cards, while also enhancing personal data protection.

He stated, "This biometric technology not only streamlines the registration process but also supports the implementation of Know Your Customer (KYC) standards to ensure the accuracy of customer data and reduce the risk of fraud and identity theft in today's digital age."

Telkomsel's announcement follows XL Axiata's launch of a new prepaid SIM card registration process using facial recognition after a successful trial last month.

These developments signify that facial recognition technology is becoming more prevalent in Indonesia, especially among government agencies and companies. There is a notable focus on immigration checkpoints.

Viasat and BSNL Showcase First Direct-to-Device Satellite Connectivity in India

Viasat, Inc. has announced its first successful demonstration of direct-to-device (D2D) satellite connectivity in India, showcasing satellite-enabled, two-way messaging services in collaboration with BSNL.

The company is actively partnering with BSNL and others to drive the global expansion of satellite services for consumer and IoT devices.

Two-Way, SOS Messaging
At the India Mobile Congress, Viasat demonstrated two-way and SOS messaging using a commercial Android smartphone designed for non-terrestrial network (NTN) connectivity. The messages were successfully transmitted across approximately 36,000 km to one of Viasat's geostationary L-band satellites, confirming the technical feasibility of satellite services for cell phone connectivity for Indian consumers and businesses utilizing Viasat's satellite network.

Phones, smartwatches, vehicles, industrial machinery, and transport operators can now seamlessly connect to both terrestrial and satellite networks. This advancement enables devices to stay connected from almost any location without the need for specialized hardware for satellite connections.

The technology adheres to the latest global mobile 3GPP Release-17 standards, which are being adopted by satellite operators, mobile network providers, and manufacturers of handsets and chipsets.

Viasat boasts a strong legacy in satellite safety services, including its role as the backbone of the Global Maritime Distress and Safety Service (GMDSS) with over 120,000 connected safety terminals. It also supports flight deck safety communications for more than 12,000 aircraft. These dependable safety communications are delivered through Viasat's licensed L-band spectrum.

Viasat is also a founding member of the Mobile Satellite Services Association (MSSA), a non-profit industry organization dedicated to advancing open interoperable architectures and standards for the integration of terrestrial and non-terrestrial network (NTN) services. This initiative enables mobile network operators to utilize existing licensed satellite spectrum, which helps to prevent the congestion of valuable cellular spectrum and streamlines the regulatory approval processes.

Singtel Launches AI Cloud Service to Democratize AI for Enterprises and Public Sectors

Singtel has officially launched RE:AI, a new AI cloud service designed to make AI more scalable, accessible and affordable to enterprises and the public sector. Through this AI-as-a-Service (AIaaS) offering, Singtel is reducing the high costs and complexity associated with AI. Leveraging Singtel's patented 5G MEC orchestration platform, RE:AI allows customers to deploy, manage, and scale AI applications with ease, further streamlining AI adoption.

At the launch event, officiated by Singapore's Deputy Prime Minister and Minister for Trade and Industry, Gan Kim Yong, Singtel signed five Memoranda of Understanding (MoUs) with strategic partners, signaling its commitment to advancing AI adoption across sectors. These partnerships focus on key areas such as research and development (R&D), advanced manufacturing, AI ecosystem development, tech incubation, and workforce training, providing GPU access and a skilled talent pipeline.

"Singtel's AI cloud service is a turnkey platform that provides access to compute infrastructure on a developmental workspace. This will, in turn, support our National AI Strategy 2.0 strategy," said Yong. "As a small resource-constrained country facing an aging population, our economic growth rests on our ability to overcome our labor and productivity challenges, and, in this regard, we believe that AI has the potential to unlock these constraints and drive the next wave of economic growth for Singapore."

Singtel's RE:AI focuses on rethinking, reimagining, and reinventing AI. It aims to empower startups, global enterprises, research agencies, governments, and AI developers to work smarter, innovate faster, and create greater impact.

"RE:AI will foster a dynamic ecosystem of partners with distinctive capabilities and platforms to accelerate AI adoption to drive innovation and growth in Singapore and the region, sustainably. As we build on this ecosystem, we will attract global AI tech companies here to expand into the region with our market access. This is key to positioning Singapore as a regional AI," said Bill Chang, CEO of Singtel's Digital InfraCo.

AIS Thailand and Huawei Propel Intelligent Wireless Innovation Forward

AIS Thailand and Huawei have teamed up to launch the RAN Intelligence Pioneers Program, a collaborative effort focused on advancing intelligent wireless innovation and creating strong, high-quality intelligent wireless networks. AIS is committed to achieving its strategic goal of attaining Autonomous Networks (AN) L4 by 2025.

Through its partnership with Huawei, AIS has made significant strides in wireless intelligence in the last two years. The entity has successfully developed applications such as base station outage detection and compensation, as well as intelligent traffic burst optimization. These innovations have not only improved network traffic and operational efficiency but have also enhanced user experience and satisfaction.

AN L3 Achieved

As a result, AIS has reached its strategic goal (AN L3) in critical wireless scenarios. The RAN Intelligence Pioneers Program brings together Huawei, telecom operators, and industry partners to create innovative intelligent wireless network applications and business models using cutting-edge intelligence technologies such as foundation models and digital twins. The aim is to discover new business opportunities and economic value in the wireless industry.

AIS plays a crucial role in this program, marking a significant step towards achieving the strategic vision of a Level 4 Autonomous Network—a level whereby the system can manage the network almost entirely on its own.

Tri-Factor Collaboration

AIS and Huawei have announced their collaboration in three key areas: leveraging decision-making intelligence to deliver a unique and reliable experience for 5G and future 5G-A users; applying digital twin technology to enhance decision-making for intelligent energy-saving features, all while maintaining optimal performance; and utilizing generative AI (GenAI) to improve network operation and maintenance, diagnose issues, provide expert advice, and forecast resolutions.

SoftBank's Large-Scale Solar "Sunglider" Achieves Stratospheric Flight in U.S. Defense Trial

SoftBank Corp. has announced the successful use of its solar-powered uncrewed aircraft system (UAS), "Sunglider," in a field trial conducted by AeroVironment Inc. and the U.S. Department of Defense in New Mexico, USA, in August 2024.

During the trial, the Sunglider achieved stratospheric flight. The Sunglider, designed for High Altitude Platform Station (HAPS) telecommunications, is larger than other publicly announced HAPS UAS, boasting a wingspan of 78 meters and the ability to carry payloads up to 75 kilograms. This enhanced version of the Sunglider demonstrated improvements in structural and functional performance, with the goal of delivering stable, high-speed, and robust mobile connectivity from the stratosphere.

SoftBank's development partner, AeroVironment, deployed the jointly developed Sunglider in a recent field trial with the U.S. Department of Defense (DoD). The trial successfully demonstrated the Sunglider's multi-payload capability and stratospheric flight, meeting DoD requirements. It also provided SoftBank with valuable insights for future advancements in aircraft design.

Through this operation, SoftBank validated performance improvements in the latest Sunglider model and plans to use the trial data to further enhance future aircraft development.

HAPS for Society

Junichi Miyakawa, President & CEO of SoftBank Corp., said, "SoftBank began its HAPS program in 2017 as a global pioneer, and since then has been leading the industry in research and development, field trials, standardization and other activities to realize HAPS-based services. For our aircraft platform, we've been working with our partner, AeroVironment, to develop Sunglider, an industry-leading, large-scale HAPS aircraft. The HAPS service we're aiming to provide will offer high-speed, high-capacity, high-quality, and stable communications that is only possible with a large-scale aircraft."

He expressed satisfaction with the successful verification of Sunglider's performance improvements during the field trial, noting its significant potential. Looking ahead, the focus will remain on achieving further advancements, including long-duration flights and optical wireless communications. Building on the trial's success, efforts will be accelerated toward the commercialization of HAPS.

Building Brain-Inspired Networks for the Future

As artificial intelligence (AI) evolves, it is no surprise that it is drawing inspiration from one of the most sophisticated systems in existence: the human brain. Recent advances in brain-inspired networks are pushing the boundaries of how we think about computing and communication, and they could hold the key to more efficient, scalable, and adaptive systems. These networks mimic the way biological brains process information, enabling the development of machines that can learn, adapt, and perform complex tasks more effectively than traditional models.

At the core of brain-inspired networks is the concept of spiking neural networks (SNNs). Unlike traditional neural networks, which rely on continuous signals, SNNs use discrete, time-dependent spikes to transmit information, similar to how neurons in the brain communicate through electrical impulses. This method of communication is both energy-efficient and fast, making it an ideal model for developing low-power, high-speed computing systems. As explained in a recent study published in Nature Communications, SNNs operate by encoding information in the timing and frequency of spikes, which allows them to perform complex computations with a minimal energy footprint.

Additionally, researchers are exploring how to integrate synaptic plasticity—the brain's ability to strengthen or weaken synapses based on experience—into

artificial networks. This concept is vital for creating systems that can adapt and improve over time.

Brain-Inspired Design for Sustainable AI

The environmental impact of AI is becoming a growing concern, as data centers and supercomputers consume massive amounts of energy. Neuromorphic computing offers a promising solution to this challenge by significantly reducing the energy consumption of AI systems. Microsoft's research on brain-inspired AI highlights the potential for neuromorphic architectures to deliver more sustainable and energy-efficient technologies.

At Microsoft Research Asia, in collaboration with Fudan University, Shanghai Jiao Tong University, and the Okinawa Institute of Technology, three notable projects are underway. One introduces a neural network that simulates the way the brain learns and computes information (CircuitNet); another enhances the accuracy and efficiency of predictive models for future events (SNN Framework); and a third improves AI's proficiency in language processing and pattern prediction (CPG-PE).

Current AI systems are incredibly resource-intensive. Training a large AI model can require hundreds of megawatt-hours of electricity, leading to substantial carbon emissions. Neuromorphic systems, by contrast, mimic the brain's highly efficient processes, consuming only a fraction of the energy required by traditional AI models. This energy efficiency is critical not only for the sustainability of AI but also for expanding its applications in resource-constrained environments, such as mobile devices and embedded systems. These developments make brain-inspired networks a promising avenue for AI that is not only more capable but also more environmentally friendly.

One company at the forefront of neuromorphic computing is Intel, which has introduced the Loihi neuromorphic chip. Intel's Loihi chip mimics the way the human brain processes information, offering significant energy savings compared to traditional AI processors. Intel's Loihi platform focuses on advancing AI by reducing the power needed for real-time, continuous learning, which makes it an ideal solution for energy-efficient AI systems. The company is researching and developing neuromorphic systems that could drastically cut down the environmental footprint of AI technologies in fields like robotics, healthcare, and smart devices.

Applications of Brain-Inspired Networks

The potential applications of brain-inspired networks are vast, ranging from healthcare to autonomous vehicles and beyond. In healthcare, neuromorphic systems could be used to develop advanced diagnostic tools that mimic the decision-making capabilities of human doctors. By processing vast amounts of data from medical records, imaging studies, and genetic information, these systems could provide more accurate diagnoses and treatment recommendations.

Nature Machine Intelligence published a joint paper from researchers at Intel Labs and Cornell University demonstrating the ability of Intel's neuromorphic test chip, Loihi, to learn and recognize 10 hazardous chemicals, even in the presence of significant noise and occlusion. The system employs a neural network to process sensory data in real-time, much like how human olfaction works.

In the field of autonomous vehicles, brain-inspired networks could enable cars to process and respond to complex driving environments in real time, making them more reliable and safer than current models. Traditional AI models struggle with the unpredictability of real-world scenarios, but neuromorphic systems can adapt to these situations on-the-fly. This adaptability is essential for creating truly autonomous systems that can operate safely in dynamic environments.

Inspired by human vision, Prophesee's technology uses a patented sensor design and AI algorithms that mimic the eye and brain to reveal what was once invisible using standard frame-based technology. Prophesee's computer vision systems open new potential in areas such as autonomous vehicles, industrial automation, IoT, mobile and AR/VR. One early application was in medical devices that restore vision to the blind.

Moreover, SynSense, has raised double-digit millions from two Chinese venture capital firms—Maxvision and RunWoo—in a strategic investment round. The new capital will be used to further develop the DYNAP-CNN2 chip. The chip is designed to provide low-power-consumption support for complex visual applications such as autonomous flying and obstacle avoidance.

Brain-inspired networks are also making strides in the area of robotics. By mimicking the way the human brain controls the body, neuromorphic systems can enable robots to perform complex tasks with greater precision and dexterity. This capability is particularly important in fields such as manufacturing, where robots are increasingly being used to perform delicate and intricate tasks that require fine motor control.

Thanks to the world's first neuromorphic programmable robot, which SynSense unveiled together with the company, QunYu, at the 22nd China Shantou (Chenghai) International Toy Fair in April 2023, the possibilities for human-robot interaction are expanding. According to a statement, the robot can recognize, visually perceive, and imitate the human body. It is SynSense's Speck chip that makes this possible. "By waving your arms, the robot can learn your movements and wave its arms in response," explained Yannan Xing, Senior Algorithm Application Engineer at SynSense.

Innovations in Brain-Inspired Design

One of the most significant challenges in AI is balancing performance with energy efficiency. Brain-inspired systems promise to deliver the best of both worlds, drawing attention

from tech giants like Microsoft, which has made strides in integrating neuromorphic architectures into AI. Microsoft's research into brain-inspired AI emphasizes that leveraging the brain's design can create more capable and sustainable technologies. These innovations focus on creating hardware and software that work together similarly to how neurons and synapses collaborate in the brain.

A critical area of innovation in brain-inspired design is the development of hardware architectures capable of supporting neuromorphic systems. While today's AI systems rely heavily on GPUs and traditional processing units, neuromorphic computing demands specialized hardware capable of mimicking the intricate behaviors of biological neurons. As a result, companies and research institutions are working on creating neuromorphic chips, such as IBM's TrueNorth chip, which contains one million neurons and 256 million synapses, and is designed to simulate brain-like operations.

TrueNorth operates through a network of spiking neurons, allowing it to process information in a highly parallel and energy-efficient manner, much like biological neural systems. This innovation represents a significant step forward in neuromorphic computing, offering vast potential for applications requiring real-time decision-making and low-power AI solutions.

The iCub humanoid robot, developed by the Italian Institute of Technology, uses neuromorphic principles to enhance its motor skills and dexterity. The robot is designed to learn and interact with humans in a manner similar to how children learn through exploration. Its neuromorphic architecture helps it perform complex tasks like grasping objects of varying sizes, walking on uneven surfaces, and even mimicking human emotions through facial expressions. The goal of iCub is to develop human-like learning and movement, allowing robots to assist in healthcare, caregiving, or industrial tasks that require delicate handling.

Researchers at Oak Ridge National Laboratory (ORNL) developed a neuromorphic robot for environmental monitoring and exploration. The robot's brain-inspired control system allows it to process data from multiple sensors in real-time, enabling it to autonomously navigate difficult terrains and perform complex tasks, such as sampling soil or collecting environmental data in hazardous areas. The neuromorphic system enables the robot to make quick adjustments based on sensory input, allowing it to perform these tasks with higher precision and minimal power consumption, which is critical for extended field operations.

The SpiNNaker (Spiking Neural Network Architecture) project, developed at the University of Manchester, is a supercomputer designed to mimic the human brain's neural network. Unlike traditional computing systems, SpiNNaker's architecture allows it to simulate millions of neurons in real-time. The system is being used to model brain disorders like epilepsy, Parkinson's disease, and Alzheimer's, helping researchers understand the brain's functioning and simulate treatments with a focus on real-time, energy-efficient processing.

BrainChip, an AI company, developed the Akida neural processor, a neuromorphic chip designed for edge AI applications, enabling smart devices to process information locally without relying on cloud computing. Inspired by the brain's spiking neural networks, Akida is used in devices that require real-time learning and ultra-low power consumption, such as drones, security cameras, and industrial sensors. Its ability to learn on-site, in real-time, allows it to perform complex tasks like image recognition and anomaly detection with high efficiency and minimal energy use, making it ideal for edge computing applications.

Fujitsu developed the Digital Annealer, a brain-inspired computing platform designed to solve complex optimization problems that traditional computers struggle with. Although it is not a neuromorphic system in the same sense as other examples, its brain-inspired design allows it to handle combinatorial optimization tasks, such as route planning for autonomous vehicles, financial portfolio optimization, and drug discovery.

Pohoiki Springs, built by Intel, is a neuromorphic system combining 768 Loihi chips to create a large-scale, brain-inspired computing platform. It is designed for advanced research in AI, robotics, and autonomous systems. The Pohoiki Springs system can process data more efficiently than conventional supercomputers while using significantly less energy. Researchers use it to develop AI systems that can solve optimization problems, learn autonomously, and adapt in real-time, making it applicable to areas such as robotics control systems, smart cities, and AI-powered healthcare. TR

In the field of autonomous vehicles, brain-inspired networks could enable cars to process and respond to complex driving environments in real time

Cloudy with a Chance of Connectivity: APAC's Inclement Innovation

The Asia Pacific (APAC) region is characterized by its urban metropolises embedded amidst rural jungle, with climates that range from tropical to temperate. Connecting APAC's people and industries across these two varied ecosystems are intricate branches of spectrum and web-like infrastructure.

APAC's range in climate is largely due to its equatorial positioning. Positioned along the Pacific Ring of Fire and the Intertropical Convergence Zone (ITCZ), the region is susceptible to both intense tropical storms and monsoons. This heavy rainfall can severely disrupt infrastructure, particularly telecommunication networks.

According to Statista, apart from geophysical circumstances such as recurring tectonic and seismic activity in the region, climate change is the biggest reason why the Asia Pacific is the most disaster-prone territory in the world. Global warming is intensifying these weather patterns. In 2023, the total carbon dioxide (CO2) emissions in the Asia Pacific amounted to more than 21 billion metric tons.

APAC Regions with the Highest Rainfall

According to data from the World Bank, countries like India, Indonesia, Malaysia, the Philippines, and Papua New Guinea face some of the highest annual rainfall levels globally. Cherrapunji, India, for instance, averages over 11,000 millimeters of rain annually, often holding the title of the wettest place on Earth.

Indonesia, a nation comprising over 17,000 islands, experiences torrential rains due to its tropical climate and position along the equator. The Philippines, similarly situated in the Pacific typhoon belt, sees between 5,000 and 10,000 millimeters of rainfall during its wet season, with typhoons exacerbating the challenge of maintaining stable connectivity.

In Malaysia, regions like Kuching in Sarawak record an average of 4,000 millimeters of rain each year, while Papua New Guinea sees similar rainfall patterns, with its highland areas drenched with over 3,500 millimeters annually.

This high level of rainfall poses unique challenges for maintaining consistent network performance, particularly as these countries increasingly adopt digital infrastructures.

Ensuring Connectivity During Heavy Rainfall

With heavy rainfall being a common feature in many APAC regions, the risk of infrastructure damage, network outages, and reduced service quality is escalating. The key to overcoming weather-induced disruptions often lies in hardening infrastructure, developing resilient technologies, and adopting alternative means of connectivity.

Microwave and Satellite Backhaul Solutions

Traditional fiber-optic cables, while offering high-speed connectivity, are often vulnerable to flooding, landslides, and storm-related damage. In contrast, microwave and satellite backhaul solutions have emerged as reliable alternatives for areas prone to adverse weather. Microwave technology can transmit data wirelessly over long distances, providing a lifeline to regions experiencing fiber networks that have ruptured.

Companies like Hughes Network Systems have been instrumental in deploying satellite solutions across the APAC region. For instance, in the Philippines, where typhoons regularly cause fiber cuts, satellite backhaul has been implemented to maintain network resilience.

Weather-Resistant Base Stations

Base stations, which serve as the backbone of mobile networks, are especially vulnerable to high winds, rain, and flooding. In response, companies like Singtel, Ericsson and Huawei have developed weather-resistant base stations tailored for the APAC region's unique conditions.

Ericsson's 'Resilient Network' solutions, for instance, utilize waterproof enclosures and storm-proof materials that ensure functionality even during extreme weather events. Huawei has also introduced energy-efficient, waterproof base stations that are reinforced to withstand heavy rainfall and strong winds.

Dynamic Spectrum Allocation

Dynamic Spectrum Allocation (DSA) is another innovation that ensures connectivity during extreme weather conditions. By allowing network operators to automatically shift to less congested or more stable spectrum bands when one band is affected by weather interference, DSA maximizes network performance. In heavy rain regions like Malaysia and Indonesia, DSA can be pivotal, particularly for rural or coastal communities where connectivity is often compromised during storms.

In research published by the MDPI's Applied Sciences, DSA has been shown to significantly reduce signal loss due to rain attenuation, which is a major issue for wireless communications, especially in millimeter-wave bands.

Learning-Assisted Rain Attenuation (LARA) Models

Learning-Assisted Rain Attenuation (LARA) models are designed to predict and mitigate the effects of rain attenuation on wireless communication systems. By incorporating machine learning (ML) algorithms such as artificial neural networks, LARA models analyze key variables like rain rate, path length, and frequency to improve signal reliability during heavy rainfall.

Aviat Networks is pioneering advanced rain attenuation models, and is also exploring the capabilities of LARA models, to combat the adverse effects of rain on microwave signals, especially in millimeter-wave frequency bands. Insights from their research indicate that rain outage rates for millimeter-wave networks double with each increase in frequency band (e.g., from 18 GHz to 23 GHz). Additionally, rain outage is directly proportional to path length, and in tandem-connected short hops, the outage is equivalent to that of a single long hop when maintaining the same fade margin.

Importantly, multipath fading in optimally aligned millimeter-wave hops does not occur during heavy rainfall, allowing the entire path fade margin to be used to counteract rain attenuation.

Storms and Solutions

Several significant storms have impacted connectivity and infrastructure in the APAC region over the years. Typhoon Mangkhut struck the Philippines and southern China in 2018, causing extensive damage to telecommunications networks and leaving millions without service due to destroyed cell towers and lines.

Similarly, Cyclone Gita ravaged Tonga in February 2018, leading to widespread outages that hindered communication and recovery efforts. In December 2019, Typhoon Kammuri, also known as Typhoon Tisoy, made landfall in the Philippines, severely disrupting infrastructure and resulting in prolonged service interruptions.

The impact of Tropical Cyclone Idai in 2019 extended beyond Mozambique, affecting southern African countries that rely on connections from the APAC region.

Most recently, Typhoon Rai, or Odette, hit the Philippines in December 2021, causing extensive damage across several islands and resulting in outages that persisted for weeks, severely hindering communication and recovery efforts.

In the face of APAC's challenging weather conditions, several companies are implementing innovative solutions to ensure reliable connectivity.

Airtel has made strides by being the first to establish connectivity in Phobrang, navigating severe weather, rough terrain, and the region's complex political landscape.

Converge ICT Solutions is also addressing connectivity challenges, particularly through the anticipated completion of its subsea cable by 2025. CEO, Dennis Anthony H. Uy, highlighted the hurdles in obtaining permits in countries like Indonesia, while COO, Jesus Romero, pointed out that adverse weather conditions have contributed to delays in the project's progress.

AALTO's Zephyr is poised to revolutionize global connectivity by providing unmatched Earth observation and connectivity capabilities. With a coverage area equivalent to 250 ground towers, it acts as a "terrestrial tower in the sky," seamlessly integrating into mobile operators' networks. The Zephyr's direct-to-device (D2D) technology enables low-latency 5G communication without the need for costly user terminals or extensive ground infrastructure. AALTO plans to establish AALTOPORTs worldwide, starting with a launch site in Kenya, chosen for its favorable weather conditions and equatorial location, which will enhance solar charging for operations.

Ray of Light: Initiatives Focused on Ensuring Connectivity During Storms

In recent years, various government bodies, NGOs, and telecommunications companies have launched initiatives aimed at enhancing network resilience in the face of inclement weather.

The Asia Pacific Telecommunity (APT) has spearheaded efforts to develop a regional framework for resilient telecommunications, focusing on disaster-prone areas.

The International Telecommunication Union (ITU) has been instrumental in encouraging the adoption of the UN's Early Warnings for All Initiative, which encompasses the implementation of an early warning system specifically for telecommunications networks.

"Half of humanity is in the danger zone," observed United Nations Secretary General, António Guterres, at the 2022 UN Climate Conference, COP-27. "Vulnerable communities in climate hotspots are being blindsided by cascading climate disasters without any means of prior alert." He called for all stakeholders to work together to adopt the UN's newly launched Early Warnings for All (EW4A) Initiative, which stipulates that every person in the world should be protected by an early warning system by 2027.

Furthermore, the ITU is leading the 'Warning Dissemination and Communication' pillar of the EW4A initiative, with support from IFRC, REAP, UNDP and WMO. Together, the unions will explore last-mile connectivity to ensure that warnings reach the people at risk in time to take action.

Smart city initiatives across the APAC region are also helping ensure continuous connectivity, especially during inclement weather. Singapore's Smart Nation initiative, for instance, leverages Internet of Things (IoT) devices to monitor network performance during storms. Sensors deployed across the city provide real-time feedback on infrastructure stress, allowing for immediate adjustments to network capacity and performance.

Despite its seemingly cloudy façade, the APAC region continues to address connectivity concerns, manage inefficiencies, implement notable solutions, and foster an environment conducive to counteracting its storm-laden positioning. TR

> ITU is leading the 'Warning Dissemination and Communication' pillar of the EW4A initiative, with support from IFRC, REAP, UNDP and WMO

The Impact of International Trade Policies on Asia-Pacific Telecom Expansion

International trade policies provide a framework for cross-border investments, intellectual property (IP) protection, and regulatory harmonization, all of which is essential for the expansion of telecommunications.

In the Asia Pacific, the interplay between local regulatory frameworks and global trade agreements determines the pace at which telecom companies can grow their networks and services. Trade agreements shape the market environment by reducing barriers, fostering competition, and promoting investment.

One notable agreement influencing telecom expansion in the region is the Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP). This agreement promotes the liberalization of trade in services, including telecommunications, by removing discriminatory barriers to foreign service providers. This results in greater access to foreign markets and increased competition, which drives innovation and network expansion in member countries.

Digital Trade Agreements and the Telecom Sector

Digital trade agreements have become increasingly relevant to the telecom sector, particularly as more services move online. The Asia Foundation's 2024 report on digital trade agreements highlighted that these agreements are crucial for establishing common rules for data flow, digital services, and electronic transactions. For telecom operators, digital trade agreements ensure that they can operate across borders with fewer restrictions, enhancing their ability to expand regionally.

These agreements also support the development of telecom infrastructure by facilitating cross-border investments and harmonizing regulations related to data privacy and security. For example, the Digital Economy Partnership Agreement (DEPA) between Singapore, New Zealand, and Chile implements provisions that enable secure cross-border data flows, a critical element for telecom companies offering cloud-based services and other digital solutions. By reducing regulatory uncertainty, digital trade agreements foster a favorable environment for telecom expansion.

Similarly, the ASEAN-Australia-New Zealand Free Trade Area (AANZFTA) and the South Korea-Australia Free Trade Agreement (KAFTA) contribute to regional integration and telecom cooperation.

Several bilateral agreements, such as the China-Australia Free Trade

Agreement (ChAFTA) and the Japan-Australia Economic Partnership Agreement (JAEPA), specifically target improvements in telecom market access and investment conditions.

Additionally, newer agreements such as the Hong Kong-United Arab Emirates Comprehensive Economic Partnership Agreement (CEPA) and the India-Mauritius Comprehensive Economic Cooperation and Partnership Agreement (CECPA) highlight the expanding focus on digital trade and telecom investment.

Regional Integration and Regulatory Cooperation

The Asia Pacific is characterized by diverse regulatory environments, which can pose challenges to telecom companies seeking to expand across borders. To mitigate these challenges, regional organizations such as the Association of Southeast Asian Nations (ASEAN) and the Asia-Pacific Economic Cooperation (APEC) have made efforts to harmonize telecom regulations. The WTO Aid for Trade Global Review 2022 pointed out that regional cooperation is essential for enabling the free flow of goods and services, including telecommunications.

One key area of cooperation addresses the standardization of telecom regulations, particularly with regards to spectrum allocation, licensing, and infrastructure development. Harmonized regulations allow telecom operators to deploy their services more easily across multiple countries, as they can adhere to a single set of standards. This is particularly important for the rollout of 5G networks, which require significant cross-border coordination due to their reliance on shared spectrum bands.

In addition to regulatory harmonization, regional trade agreements also provide a framework for resolving disputes between telecom operators and governments. The inclusion of dispute resolution mechanisms in trade agreements such as the Regional Comprehensive Economic Partnership (RCEP) ensures that telecom companies can seek redress in the event of unfair treatment or regulatory inconsistencies.

Investment Policies and Telecom Infrastructure Development

The expansion of telecom networks in the Asia Pacific requires significant investment in infrastructure, including the deployment of fiber-optic cables, satellite networks, and mobile towers. International trade policies play a key role in attracting foreign direct investment (FDI) into the telecom sector by providing investors with legal protections and ensuring a level playing field.

In many APAC countries, governments have enacted policies to encourage FDI in the telecom sector, recognizing the importance of private investment in driving network expansion. For instance, Australia's foreign investment review framework allows for greater transparency and protection for foreign telecom investors, creating a more attractive investment environment . Similarly, other APAC nations, including Japan and South Korea, have liberalized their telecom markets to facilitate greater foreign ownership of telecom assets.

However, despite these efforts, some barriers to investment remain. Protectionist policies in certain countries can prevent foreign telecom operators from entering the market. A prominent example of a protectionist policy in the Asia Pacific is the Foreign Investment Review Board (FIRB) in Australia. These regulations are part of a broader strategy to safeguard local industries, including telecommunications, from foreign dominance.

Moreover, restrictions on foreign ownership of critical infrastructure, such as undersea cables, can deter potential investors. India's National Security Directive on Telecommunication Sector (NSDTS) policy, introduced in 2020, places stringent regulations on foreign investment in telecommunications infrastructure, particularly focusing on critical areas such as undersea cables.

Trade agreements that promote the liberalization of investment rules are essential for overcoming these barriers and fostering telecom expansion in the region. Signed in December 2021 and implemented in May 2023, the Australia-United Kingdom Free Trade Agreement (A-UKFTA) aims to enhance trade and investment flows between Australia and the United Kingdom. One of its key features is the commitment to reducing barriers to investment across various sectors, including telecommunications.

The Impact of Tariffs and Non-Tariff Barriers

While trade agreements aim to reduce tariffs on telecom equipment and services, non-tariff barriers (NTBs) remain a significant obstacle to telecom expansion in the Asia Pacific. NTBs, such as complex regulatory requirements, discriminatory licensing procedures, and restrictions on cross-border data flows, can hinder the growth of the telecom industry.

The Economic and Social Commission for Asia and the Pacific (ESCAP) emphasized the importance of addressing NTBs to facilitate the development of digital economies in the region. For instance, NTBs can delay the deployment of telecom infrastructure by making it more difficult for companies to import the necessary equipment or secure the required permits to operate. Additionally, restrictions on data localization in certain countries can limit the ability of telecom operators to offer cloud-based services across borders.

To mitigate the impact of NTBs, trade agreements such as the CPTPP and RCEP include provisions that promote regulatory transparency and streamline administrative procedures. These agreements also encourage governments to adopt international standards for telecom equipment and services, reducing the regulatory burden on telecom operators and enabling them to expand more rapidly.

Furthermore, digital trade agreements can help telecom operators navigate the complex regulatory environment surrounding 5G by ensuring that they can access the necessary spectrum and infrastructure across borders. For example, the DEPA includes provisions for the mutual recognition of digital identities, which can facilitate cross-border transactions and services in the 5G era. TR

Innovations in Green Cloud Computing and Sustainable Solutions

Green cloud computing marks a major leap forward in technology, merging cutting-edge cloud technology with eco-friendly practices to foster sustainability and minimize environmental impact. As data centers account for a substantial portion of global electricity consumption and carbon emissions, transitioning to green cloud computing has become a priority for many organizations.

Green cloud computing integrates advanced cloud technologies with sustainable practices to achieve energy efficiency and reduce environmental impact. A key strategy includes server virtualization, which significantly reduces the number of physical servers needed, thus, lowering energy consumption and utility bills. Additionally, the use of renewable energy sources, such as solar and wind power, helps to further diminish the carbon footprint associated with cloud services.

One of the most significant benefits of green cloud computing is its role in promoting sustainable architecture. Data centers designed with minimal environmental impact in mind can operate more efficiently, using less power and generating less waste. This approach also supports remote work, which reduces the carbon emissions linked to commuting. Furthermore, green cloud computing encourages paperless operations, leading to decreased paper use and deforestation, and minimizing electronic waste by reducing the reliance on extensive hardware.

Green Cloud Computing Strategies

Transitioning to green cloud computing involves several strategic steps. Organizations should start with a comprehensive assessment of their current IT infrastructure to evaluate their energy consumption and carbon footprint. Setting clear, measurable goals for reducing energy use and increasing the adoption of renewable

energy is essential for successful implementation.

For example, Globe Telecom partnered with Red Hat to modernize its IT infrastructure, leveraging open-source technologies to enhance scalability, agility, and efficiency. This move comes as the Asia-Pacific cloud infrastructure market is set to soar, projected to reach USD 593.7 billion by 2032.

Selecting cloud service providers committed to sustainability is a crucial practice. Leveraging server virtualization and adopting energy-efficient computing practices can optimize resource usage. Enhancing data center efficiency and continuously monitoring performance are also vital to ensure that environmental goals are met. Engaging stakeholders and educating them about the importance of green cloud computing can drive effective implementation and foster a culture of sustainability.

Notably, Alibaba Cloud has launched its "Green Data Center" initiative, using renewable energy sources and advanced cooling technology to reduce carbon emissions. Tencent is also focused on building green data centers with AI-driven energy efficiency, particularly through its Tianjin data center, which operates utilizing natural cooling and renewable energy.

Green computing techniques are diverse and leverage energy-efficient hardware designs, renewable energy sources, and methods like data deduplication and network virtualization. These techniques are integral to enhancing sustainability and operational efficiency. For instance, energy-efficient hardware designs reduce power consumption and extend the lifecycle of equipment, while data deduplication minimizes data redundancy and storage needs.

For example, Intel's Sapphire Rapids processors focus on delivering high performance with lower power consumption, incorporating energy-saving features like dynamic power management. Additionally, AMD's EPYC processors are designed to maximize performance per watt, making them ideal for cloud and enterprise environments, significantly lowering energy costs.

Innovations in green cloud computing also focus on advanced cooling techniques, which are crucial for maintaining data center efficiency. Strategies such as hot-and-cold aisle containment and liquid cooling systems can significantly reduce the energy required for cooling data centers. Huawei's FusionServer Pro series optimizes power usage through AI-driven energy management and smart cooling systems, reducing energy consumption in data centers.

Leading Examples and Future Trends

Major cloud providers are making substantial commitments to carbon neutrality. Google aims to achieve net-zero emissions across its entire operations and value chain by 2030, targeting a 50% reduction in its Scope 1, 2, and 3 emissions from a 2019 baseline. The company plans to operate its facilities on 24/7 carbon-free energy and invest in both nature-based and technology-based carbon removal solutions. Google's approach to climate action involves a science-based strategy and ongoing transparency outlining its progress.

AWS is also dedicated to sustainability and has, thus far, achieved 100% renewable electricity usage seven years ahead of its 2030 goal. The company focuses on maximizing energy efficiency through advanced data center design, cooling innovations, and power management technologies. AWS's infrastructure is reported to be up to 4.1 times more efficient than traditional data centers, with their Graviton4 and Inferentia2 chips contributing to enhanced performance and energy efficiency.

Microsoft has set a bold goal to become carbon negative by 2030 and remove all historical emissions by 2050. Their strategy includes reducing emissions, investing in new carbon removal technologies, and supporting global carbon reduction efforts. Microsoft plans to fund carbon removal technologies, help suppliers cut their carbon footprints, and enhance transparency through annual environmental reports. The company also advocates for supportive public policies and engages employees to drive innovation in carbon reduction.

The future of green cloud computing promises further advancements, with emerging technologies like AI-driven energy management and edge computing. AI can optimize energy use by predicting and adjusting power consumption in real-time, while edge computing reduces the need for data transmission to central servers, thus, lowering energy consumption and latency.

Long-Term Sustainability

Green cloud computing represents a shift towards balancing technological innovation with environmental responsibility. Given that data centers are major consumers of global electricity and contributors to carbon emissions, adopting sustainable cloud solutions is essential. The integration of energy-efficient practices, renewable energy sources, and advanced cooling techniques can significantly reduce the environmental impact of cloud services.

As organizations and individuals increasingly prioritize environmental responsibility, green cloud computing will be at the forefront of efforts to minimize ecological impact while leveraging the benefits of modern cloud technologies. TR

The future of green cloud computing promises further advancements, with emerging technologies like AI-driven energy management and edge computing

Expanding Network Infrastructure: A Strategic Imperative for the Asia-Pacific's Digital Future

The strategic importance of network infrastructure in the Asia Pacific cannot be overstated. Economically, robust network infrastructure enhances competitiveness, enabling countries to attract foreign investment, support high-tech industries, and boost productivity. Additionally, expanding this infrastructure is crucial for bridging the digital divide, especially between urban and rural areas.

By extending high-speed internet and digital services to remote communities, governments and private entities can promote inclusive economic growth and improve the quality of life for millions. Moreover, the growth of emerging technologies such as 5G, IoT, and cloud computing depends heavily on advanced network infrastructure, which is essential for enabling innovation and driving the digital transformation of various industries.

Key Projects and Investments in the Asia Pacific

Several key projects and investments are currently driving the expansion of network infrastructure across the Asia Pacific, spearheaded by both public and private sectors. The Asian Development Bank (ADB) has played an essential role, particularly through initiatives like the "Pacific Islands Digital Connectivity Investment Project," which aims to enhance internet access and connectivity in the Pacific Islands by upgrading submarine cables, terrestrial fiber-optic networks, and satellite systems.

In the private sector, Expereo, a global provider of managed internet and cloud access services, has been actively expanding its network infrastructure across the Asia Pacific. This expansion is crucial for delivering reliable and high-performance internet and cloud services to businesses, especially multinational corporations operating in the region. Similarly, Amazon Web Services (AWS) has strengthened its presence in the Asia Pacific by launching a new infrastructure region in Taiwan. This move is expected to enhance cloud-computing capabilities and support the digital transformation of businesses across Taiwan and neighboring countries.

Another significant development is the expansion of Netmore Group's operations into the Asia Pacific, where they are delivering LoRaWAN network services. LoRaWAN, a low-power, wide-area networking protocol designed for IoT applications, is expected to facilitate the deployment of IoT solutions across various industries, including smart cities, agriculture, and manufacturing, contributing significantly to the region's digital infrastructure growth. The APNIC Foundation has also highlighted the need for increased investment in internet development across the Asia Pacific, focusing on expanding infrastructure, improving cybersecurity, and enhancing digital skills to ensure reliable and affordable internet services across the region.

APAC's Evolving Network Infrastructure

The Asia Pacific is experiencing a significant surge in network infrastructure expansion, driven by the efforts of key companies and initiatives that are shaping the digital landscape.

Globe Telecom is at the forefront of this expansion in the Philippines, actively improving its network infrastructure through extensive site builds and upgrades across the country. This initiative aims to enhance connectivity and provide better service to its growing customer base.

Meanwhile, in Pakistan, Zong 4G has rapidly expanded its network by adding 400 new sites, making it the country's second-largest data network as of July 2024. This expansion is crucial for improving data accessibility and supporting the growing demand for digital services.

EdgePoint Infrastructure is another key player extending its reach across Southeast Asia. The company's focus on developing and upgrading telecom towers is essential for supporting the region's growing mobile and data traffic.

Similarly, CDNetworks has unveiled substantial network upgrades, boasting a 10 Tbps capacity, which is critical for supporting high-speed internet services across the region.

In New Zealand, One NZ received regulatory clearance in May 2024 to expand its 5G network, ensuring broader coverage and faster speeds for its users. Additionally, Telstra International, in partnership with Trans Pacific Networks, launched the Echo subsea cable, a major infrastructure project that enhances connectivity between the Asia Pacific and other global regions.

Challenges and Opportunities in Expanding Network Infrastructure

Despite the significant progress in expanding network infrastructure, the Asia Pacific faces several challenges. The region's geographical diversity, characterized by islands, mountains, and vast rural areas, poses logistical and financial difficulties for infrastructure development. For instance, building submarine cables to connect remote islands or deploying fiber-optic networks in mountainous regions requires substantial investment and expertise. However, these challenges also present opportunities for innovation, such as leveraging satellite and wireless technologies to provide connectivity in hard-to-reach areas.

Regulatory and policy barriers further complicate infrastructure expansion. Key governing bodies like the Telecom Regulatory Authority of India (TRAI), the Australian Communications and Media Authority (ACMA), and China's Ministry of Industry and Information Technology (MIIT) enforce these regulations. Additionally, data privacy and localization laws, environmental protection acts, and land acquisition laws further complicate infrastructure development. Regional frameworks like the Asia-Pacific Telecommunity (APT) and international trade agreements under the WTO also influence the regulatory landscape, leading to high costs, legal complexities, and project delays.

Expanding on the role regulatory barriers play in network expansion, Dino Civitarese, Vice President at e& Carrier & Wholesale for the Asia & Pacific region (APAC), said, "Our growth from the Middle East and Africa market into the wider Asia region began when, in 2018, the Singaporean Government awarded us a facility-based operator license (FBO). The license allowed us to invest and build infrastructure for the domestic wholesale market and open opportunities for the international market. Through this infrastructure, we have been able to serve customers in the Asia Pacific and the Middle East, extending our reach to fast growing markets such as Indonesia, Malaysia, Thailand, Vietnam, Philippines."

Additionally, the expansion of network infrastructure heightens concerns around cybersecurity and data privacy. The rise in cyber threats across the Asia Pacific underscores the need for comprehensive strategies, including investments in cybersecurity measures, adoption of international best practices, and enhanced cross-border collaboration.

Financing remains a critical challenge in expanding network infrastructure, as these projects require significant financial resources. While public sector funding is crucial, private sector investment is equally important. Innovative financing mechanisms, such as public-private partnerships (PPPs), can help mobilize the necessary resources. International organizations like the ADB also play a vital role by providing financial support and technical expertise.

Furthermore, the expansion of network infrastructure must consider sustainability and environmental impact, with a focus on minimizing carbon footprints, reducing e-waste, and ensuring that projects do not harm ecosystems or local communities.

The Role of 5G and Emerging Technologies

One of the most significant developments in the Asia Pacific's network infrastructure expansion is the deployment of 5G networks. 5G technology promises to revolutionize connectivity by offering ultra-fast speeds, low latency, and the capacity to connect a vast number of devices simultaneously. Countries such as China, South Korea, and Japan have been leading the way in 5G deployment, investing heavily in infrastructure, including new base stations, network upgrades, and 5G-enabled devices. The widespread adoption of 5G is expected to transform industries like manufacturing, healthcare, and transportation, enabling new use cases and business models.

In Vietnam, the government's decision to discontinue 2G services by 2026 is paving the way for a significant boost in 4G and 5G networks, further supporting the country's digital transformation efforts.

The expansion of 5G infrastructure also accelerates the development of smart cities in the Asia Pacific. By leveraging IoT devices and data analytics, smart cities can improve urban services, such as traffic management, waste management, and energy efficiency. Expanding network infrastructure is essential for implementing these IoT solutions, which enhance residents' quality of life and promote sustainable urban development.

Additionally, the growth of cloud computing and the emergence of edge computing are closely linked to network infrastructure expansion. The broader APAC region is also seeing remarkable growth in cloud infrastructure, with the market expected to soar towards USD 593.7 billion by 2032. This growth is indicative of the increasing reliance on cloud services, which require robust and extensive network infrastructure. Cloud computing offers businesses scalable and flexible computing resources, while edge computing brings processing power closer to data sources, enabling real-time data processing for applications like autonomous vehicles and smart grids. TR

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