Building Digital Resilience
to Thrive in the New Normal

NEW VALUE TOGETHER

TOGET**HER**

253
**FORTUNE GLOBAL
500 COMPANIES
DIGITALLY TRANSFORM
WITH HUAWEI.**

Building a Fully Connected, Intelligent World

Building Digital Resilience to Thrive in the New Normal

The APAC economy is on its way to recovery, underpinned by the acceleration of digital transformation. As local industries begin their journey, Huawei is committed to becoming a preferred partner.

By Jeffery Liu, President of Huawei Asia Pacific

In 2020 the world faced an unprecedented crisis, which drove digital transformation and the development of the digital economy as hot topics. Now, well into 2021, the world is familiarizing itself with a "new normal," driven by online, automated, and intelligent trends and sparking a fast track to build digital competitiveness and resilience.

According to Gartner's annual global survey of Chief Information Officers (CIOs), top performing enterprises are accelerating digital innovation and leveraging emerging technologies to come out stronger on the other side of the COVID-19 pandemic, and "2021 will be a race to digital, with the spoils going to those organizations that can maintain the momentum built up during their response to the pandemic."

Forrester also predicts that Asia-Pacific will emerge from the crisis first in 2021, before the US and Europe, due in part to the region's strengths in digital and mobile technologies. In fact, the recovery in Asia-Pacific is already underway, with 30% of enterprises adapting and 26% returning to growth: but not all are adapting at the same rate. The success of organizations will depend on how quickly and how well they harness technology.

Developing Policies for Digital Transformation Is a Priority

There is clear evidence that industries that change from reactive responses to proactive planning will benefit from the creation of new value and the improvement in enterprise competitiveness in the future.

Organizations need to reprioritize digital investments to increase business resilience and prepare for digital transformation.

Committed leadership from policy makers and industry leaders should strengthen digital commitments and capabilities, with an escalation of digital agendas to the top of socio-economic recovery plans.

Governments should adopt a similar approach to fully utilize Information and Communications Technologies (ICT) to develop the digital economy and promote digital transformation, driving the recovery process and ultimately determining the speed of economic recovery.

ICT and Industry Applications Lie at the Heart of Digital Transformation

With ICT, enterprises can not only maintain and even increase productivity, but also expand their existing businesses into new markets and opportunities.

According to Huawei's Global Connectivity Index 2020, digital infrastructure — including ultra-broadband, cloud services, and the Internet of Things (IoT) — allows people and enterprises to adapt more readily to remote work and distance learning. Countries with well-developed ICT infrastructure are better positioned to embrace the new normal and leverage their digital foothold to promote economic recovery and a more

resilient digital future.

High-speed connectivity is enabling reliable teleworking and education. More than 100 million primary and secondary school students worldwide benefited from online education in 2020, according to the Boston Consulting Group (BCG).

Flexible cloud computing is providing scalable infrastructure for storing, processing, and delivering information and services. In some industries in China (including online education, healthcare, and retail), up to 85% of enterprises have already started to use cloud services.

In addition, technologies such as big data and IoT are driving the automation of business processes and services at low cost, increasing supply chain resilience and improving decision-making processes. Many workplaces have shifted to contactless operations, leveraging automation technology in factories and unmanned vehicle logistics services in business parks.

Along with the rapid development of the digital world, ICT technology plays a dual role in reducing carbon emissions. On the one hand, it can continuously reduce its own carbon dioxide emissions and provide efficient networks while achieving green energy conservation. On the other, as an innovative technology, it can enable thousands of industries to save energy and reduce emissions, ultimately achieving symbiosis between science and nature.

As a leading global provider of ICT infrastructure and smart devices and based on best practices and joint innovation, Huawei has unique abilities to integrate ubiquitous high-speed connectivity, cloud computing, big data, IoT, and industry applications. Huawei has worked with 253 Fortune 500 enterprises in over 700 cities to help them meet their digital transformation

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goals and achieve real efficiency improvements, improve their new ICT professionalism, and build true scenario-based solutions.

Addressing the ICT Talent Shortage for Digital Transformation

Along with ICT, talent and skills are essential to building a long-lasting digital future. The lack of digital skills and an inability to develop and train local ICT talent in accordance with local conditions is one of the biggest challenges facing many countries and organizations undergoing digital transformation.

Unique conditions in each Asia-Pacific country means that, to be successful in each, a proper model for developing talent resources matching the local situation needs to be established.

Huawei's partner ecosystem includes more than 22,000 channel partners, 1200 solution partners, and 3900 service partners globally. An additional 900 talent alliance partners round out our talent ecosystem with a focus on building new ICT talent to address the

shortfall of skilled resources.

Huawei ASEAN Academy started operations in 2019, mainly using a multi-party joint operation with local governments, enterprises, universities, operators, and industry organizations to train digital talents, enable the digital transformation of the local ICT industry, promote innovations within start-ups and Small- and Medium-sized Enterprises (SMEs), and facilitate the creation of a 5G-based innovation ecosystem. The program has already covered four countries — Malaysia, Thailand, Cambodia, and Indonesia — and has trained a total of 23,465 ICT talents for the local community, with plans to benefit many more Asia-Pacific countries in the future.

2021 will be a year of economic recovery, navigated by policy, technology, and talent. Huawei is fully committed to being the preferred ICT partner in the region and to share experiences and contribute however possible to regional success. Countries in Asia-Pacific may come in all shapes and sizes, but the universal truth is that our future is digital, and embracing it better positions everyone for success in this new frontier. ▲

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Seize New Digitalization Opportunities to Create New Value for Industries

In 2020, one of the most serious pandemics in history swept across the world — the impact was profound, as we know all too well. COVID-19 has dramatically changed how people live, work, and create value. As such, it has driven the increasing convergence of the digital and physical worlds. It has also supercharged the digital transformation of industries and thousands of industries are being reshaped, marking an epochal shift.

By Nicholas Ma, President of the Huawei Asia Pacific Enterprise Business Group

A Once-in-a-Century Pandemic Has Supercharged the Digital Transformation of Industries

Digital transformation has entered a new stage of development, as it offers much-needed certainty in the climate of extreme uncertainty resulting from the resurgence of COVID-19 and a sluggish economic recovery. This new stage is defined by four trends.

First, digitalization is picking up pace and expanding into more industries. The first stage of digitalization was dominated by Internet enterprises. Today, traditional industries — such as manufacturing, education, healthcare, finance, transportation, and energy — are now also adopting 5G, Artificial Intelligence (AI), the cloud, the Internet of Things (IoT), and other new digital technologies, as well

as developing new business models. According to the leading global provider of market intelligence, International Data Corporation (IDC), by 2022, 70% of organizations will be using digital technologies to change their business processes and improve the customer experience, productivity, and resilience, to foster sustainable development.

Second, as new technologies like AI continue to mature, the application of digital technologies in enterprises is expanding beyond the office and into production systems — this brings industries into a new phase of intelligent upgrade. Huawei's Global Industry Vision (GIV) 2025 predicts that, by 2025, 97% of large enterprises will use AI and 77% of all cloud applications will be powered by AI.

Third, all cloud is also an inevitable trend. Due to the pandemic, enterprises will move to the cloud one to three years earlier than previously expected. We estimate that, by 2025, all enterprises worldwide will use cloud technologies. Cloud will greatly reduce the barriers for all types of enterprises to adopt advanced digital technologies, laying a solid foundation for enterprises to go digital.

Finally, digitalization is an all-encompassing transformation across multiple domains and levels. It is no less challenging than starting an entirely new business. When an enterprise makes the shift from informatization to digitalization, it has to make fundamental changes to its development model, with the core of digitalization lying in business transformation.

In this process, Information and Communications Technology (ICT) serves as a cornerstone and a main driving force. More and more enterprise managers want to use new digital technologies to drive the transformation and upgrade of their production and decision-making systems. We believe that technological innovation will be the main driving force for industry development over the next 10 years.

Enterprises have accelerated their digitalization and cloud adoption due to the pandemic

Digital transformation investment

86%+ managers expect investment increase

1/4 expect increase **>20%**

Full cloud adoption

1-3 yrs earlier than expected

AI adoption by 2025

97% of large enterprises

Sources: IDC, Gartner, and Huawei MI

Enterprises are entering more advanced phases of digital transformation

Digitally restructured value chain

Advanced
Core production systems

Intermediate
Support systems

Preliminary
Marketing

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Developing Innovative Scenario-Specific Solutions to Help Customers Succeed

Huawei's Enterprise business team puts customers at the center of everything they do. Together, with industry partners, we apply innovative ICT to satisfy customer needs in key business scenarios. We continue to develop scenario-specific solutions to help a range of industry customers in the Asia-Pacific (APAC) region accelerate digital transformation and cope with the challenges brought by the new environment.

For government customers, we have worked with partners to provide e-government cloud, smart government, and other solutions and services powered by 5G and cloud computing technologies. We help customers build service-oriented digital systems, and enhance the digital ecosystem for innovative services. This will boost the development of Smart Cities and drive the digital economy.

In the financial industry, we have offered multiple

HUAWEI CLOUD-based ICT product portfolios and worked with domestic and international partners to accelerate the intelligent upgrade of financial institutions. Specifically in the APAC region, we focus on six scenario-specific solutions: financial cloud, digital banking, data center construction, data center integration, financial services, and smart bank branches. In 2020, Huawei stood out from 64 technology companies to win the Most Valued Technology Partner of the Year 2020 award from the Development Bank of Singapore (DBS).

In the energy industry, Huawei has worked with its partners to develop intelligent power plants, smart grids, intelligent oil and gas fields, and many other scenario-specific solutions. These efforts are helping the energy sector transform toward green, low-carbon, secure, and efficient development. We have also helped a number of electric power companies in Thailand, Malaysia, and Indonesia build next generation power communications networks, providing customers with secure, reliable, compatible, cost-effective, and efficient, modern smart grid systems with simplified

> **APAC has an incredibly robust and dynamic economy. Accelerating the digital economy has, by and large, become a consensus among all countries in the region. Huawei will work with partners to better understand the business needs of the region's industry customers, integrate innovative ICT with their business strategies, and help these customers cope with the challenges of digital transformation.**

Operations and Maintenance (O&M).

In the transportation industry, we have provided smart construction site and smart O&M solutions for Singapore's Land Transport Authority (LTA): these have effectively supported the customer's ongoing construction work and improved security control and efficiency for its operational lines. Our solutions have also supported LTA's smooth business development despite the challenges of the COVID-19 pandemic.

In the education industry, we have provided a number of joint solutions — such as smart campus, smart classroom, and online education solutions — for educational institutions and universities across APAC, including Singapore, Hong Kong SAR, Thailand, and Malaysia. These solutions have ensured that learning never ceases, even during the pandemic. Huawei's education solutions have also helped Thailand's King Mongkut's University of Technology Thonburi (KMUTT) go digital, making "Connected KMUTT" a reality.

And in the Internet industry, Huawei has provided its customers with Internet connectivity, data center infrastructure, and HUAWEI CLOUD solutions, helping them address the challenges brought by surging network traffic and higher demands for computing power during the COVID-19 pandemic. Huawei's efforts have also helped the Internet industry go optical and intelligent.

With the rapid development of cloud computing and AI, Internet data center infrastructure faces unprecedented challenges, with new needs for ultra-large scale, fast rollout, high density, and ultra-low power consumption solutions. Huawei FusionDC 2.0, a prefabricated modular data center infrastructure solution, integrates prefabricated modular technologies to support modular designs. Each module is prefabricated and commissioned before delivery, which shortens the Go-To-Market (GTM) time by 50%. The solution also improves Power Usage Effectiveness (PUE) by 8–15% and maximizes a data center's Total Value of Ownership (TVO) by integrating advanced power electronics and temperature control and heat management technologies.

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By the end of 2020, over 700 cities and 253 Fortune Global 500 companies worldwide had chosen Huawei as their partner for digital transformation.

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Huawei has secured the largest share in the prefabricated modular data center market for five consecutive years. Huawei's prefabricated modular data center solutions have been deployed, among others, by Dubai International Airport, Nepali carrier Ncell, and the HUAWEI CLOUD bases in Dongguan and Ulanqab. Elsewhere, our intelligent data center solution has helped 1-Net Singapore build intelligent, green data centers. This solution reduces energy consumption by more than 10% compared to legacy solutions, contributing to the digital, low-carbon economy.

In terms of services, as more advanced technologies are being widely used in enterprise production systems, these systems are becoming more complex and more critical. As a result, operational and maintenance processes now need to be highly automated, to facilitate fault prediction and proactive prevention. Huawei works with its partners to closely align service capabilities and solutions with industry scenario requirements, through five capabilities: consulting and planning, industry solution services, operations, maintenance, and talent development. Through these efforts, we aim to deliver a consistent and high-quality service experience to our customers.

As of December 2020, 253 Fortune 500 companies had selected Huawei as their digital transformation partner. Huawei's products and solutions have been deployed in more than 700 cities and are used by over 2000 financial institutions and manufacturing enterprises and more than 190 electric power companies worldwide.

Our products and solutions — such as HUAWEI CLOUD, intelligent Internet Protocol (IP) networks, intelligent OptiX networks, computing, data centers, data storage, and 5GtoB — have become increasingly competitive within the market. By combining a number of our cutting-edge products, we are working to meet customers' diverse needs, drive enterprise transformation and upgrade, and create new value for industries.

Create a Thriving Partner Ecosystem for Shared Success in the Digital Era

In 2020, revenue from our enterprise business was CNY100.3 billion, a year-on-year increase of 23.0%. This would have been impossible without the strong support of our partners.

By the end of 2020, over 30,000 partners were working with us worldwide to serve the enterprise market. In the APAC region, we had established relationships with over 7900 partners in the enterprise market.

In addition, by the end of 2020, more than 19,000 partners had joined the HUAWEI CLOUD Partner Network (HCPN) and over 4000 applications had been launched on the HUAWEI CLOUD Marketplace. In total, we have brought together 1.6 million developers, creating a thriving partner ecosystem.

Huawei continues to enhance enablement and support for its partners in the APAC region. In 2020, Huawei held more than 200 training activities for partners and invested more than US$3 million into the market fund for partners, which is mainly used to support joint market development with strategic and core partners. Thanks to these measures, core partners generated 30% more revenue from their collaboration with Huawei compared with the previous year.

In addition, Huawei attaches great importance to creating a talent ecosystem for the ICT industry. In 2020, Huawei worked with more than 180 universities and colleges in APAC, offering numerous training courses. In total, we trained over 2000 ICT students.

In the future, Huawei will increase investment in partner incentives, and strive to build a diverse ecosystem that is open, collaborative, and thrives on shared success.

APAC has an incredibly robust and dynamic economy. Accelerating the digital economy has, by and large, become a consensus among all countries in the region. Huawei will work with partners to better understand the business needs of the region's industry customers, integrate innovative ICT with their business strategies, and help these customers cope with the challenges of digital transformation. Together, we will create new value for diverse industries, and light up the future with digitalization. ▲
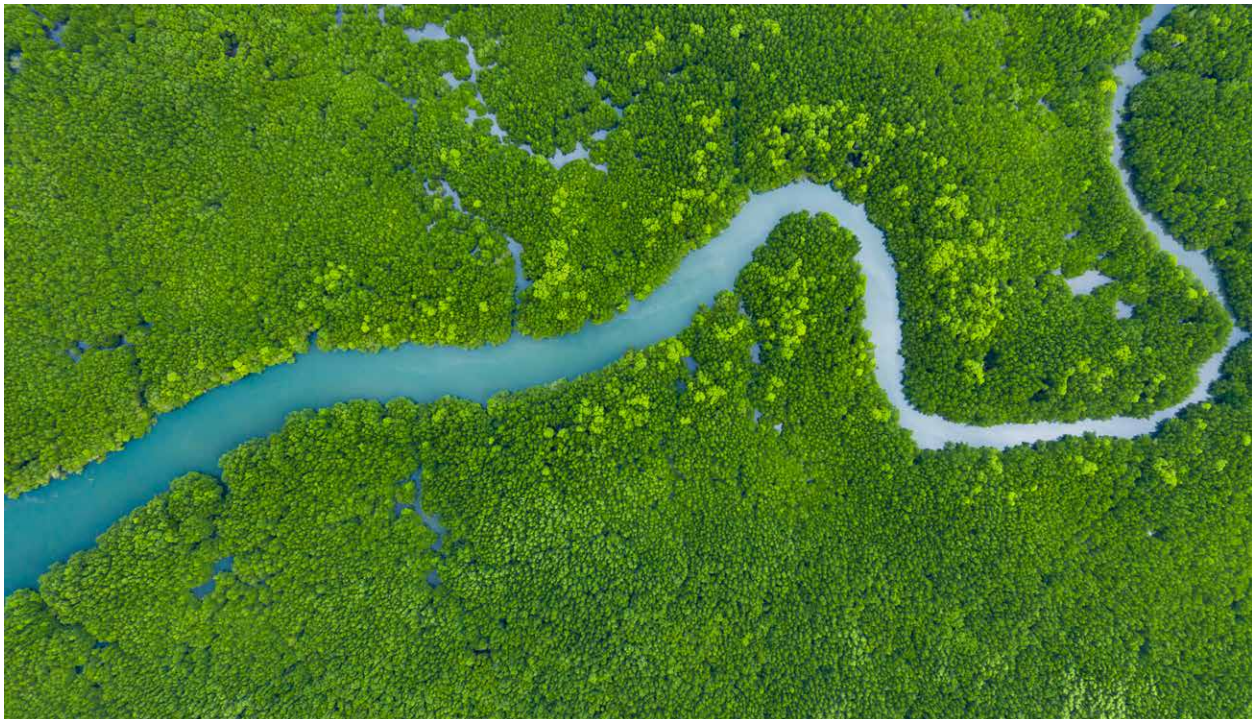
> " I am looking forward to witnessing the rising prosperity brought about by connectivity and digital technologies in the future. And this must be achieved through cooperation between the public and private sector, from the domestic to the international level. Together, let's overcome the challenges and build a better future. "

National Policy Drives Digital Technology and Sustainable Development: Building the Digital Hub of ASEAN

By Mrs. Vunnaporn Devahastin, Secretary-General of the Office of the National Digital Economy and Society Commission

The challenges brought on by the pandemic are faced by humanity as a whole, from the consequent economic downturn to increasing inequalities. We believe digital technologies are essential to achieve a better, green recovery and bring us a step closer to our ultimate goal of sustainable development.

On behalf of the Ministry of Digital Economy and Society, I am delighted to have this opportunity to share with you Thailand's national strategies for the digital economy. We are building the country into a digital hub among the Association of Southeast Asian Nations (ASEAN), with a vision to boost the economy, improve social well-being, and achieve sustainable development.

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> The digital economy promises new ways for businesses to grow and brings with it improved social well-being; at the same time, it aligns with our sustainable development goals. Thailand will seize this opportunity to strengthen its digital leadership for a better future.
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To achieve these ambitions, we have developed the Thailand Digital Economy and Society Development Plan at a national level.

This plan acts as a blueprint for revolutionizing government operations, business practices, and people's lifestyles. It proposes six strategies that will together build an equitable and inclusive society as well as increase the digital skills of the workforce, equipping them for this, our digital era.

Among these strategies, digital infrastructure sits at the foundation, fostering digital services, platforms, and businesses. Indeed, Thailand is building country-wide, high-capacity digital infrastructure in order to provide accessible and affordable Internet access for all individuals and small businesses.

Building upon this foundation, we encourage digital transformation through initiatives such as digital Small-and Medium-sized Enterprises (SMEs), digital agriculture, and digital industry, to catalyze new business models and create economic value.

This transformation also extends into the public sector.

It will create an open government and help people and businesses with an integrated "one government" approach.

To ensure inclusive and equal access to digital technologies, we are actively implementing a range of programs promoting digital community, digital learning and knowledge, and digital health. This is key to ensuring that citizens can take full advantage of digital transformation.

Meanwhile, the government is working to improve digital skills and literacy across sectors: people will only be able to derive benefits from a digital society if they are equipped with the necessary skills.

As we have all recognized, digital technologies have positively impacted society, especially during the pandemic. They promise to do the same when the world enters the post-pandemic era. The digital economy promises new ways for businesses to grow and brings with it improved social well-being; at the same time, it aligns with our sustainable development goals. Thailand will seize this opportunity to strengthen its digital leadership for a better future.

Last year, based on the Speedtest Global Index, Thailand ranked first among 176 countries in terms of fixed broadband Internet speeds. This leap to the top represents Thailand's ongoing efforts to advance digital infrastructure, to boost the economy. Within ASEAN, we were the first to launch commercial 5G services. A 5G committee has been formed to ensure the necessary support from the government for 5G development at a national level. We aim to provide extensive, equitable, and efficient 5G access across sectors, helping both individuals and businesses. General Prayut Chan-o-cha, Prime Minister of the Kingdom of Thailand, is the chairman of the National 5G Committee, which consists of 26 members from

Ministries and industry associations.This body makes it possible for Ministries, industry associations, and academic institutions to coordinate on 5G development and align with the overall digital economy roadmap. We have implemented further initiatives including boosting 5G adoption, promoting a telecom infrastructure sharing system, and improving related regulations.

To develop Thailand's digital economy, the Ministry of Digital Economy and Society, the Digital Economy Promotion Agency, and Huawei jointly opened the Thailand 5G Ecosystem Innovation Center in Bangkok. This center will serve as a sandbox for digital innovation in 5G applications and services
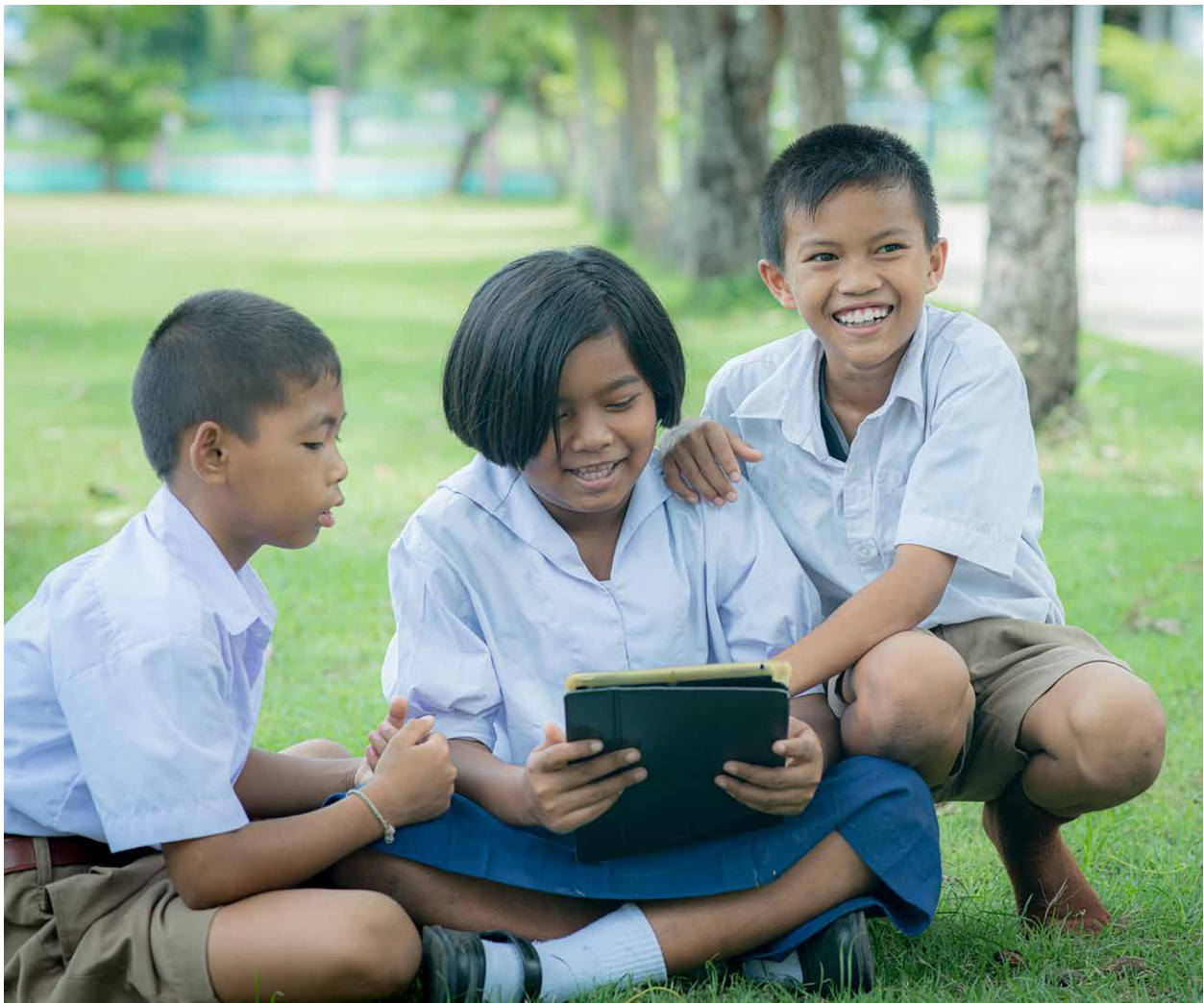
across various industries. These innovations will create new business opportunities for SMEs, startups, and educational institutions, paving the way toward achieving Thailand 4.0 [the Thai version of the Fourth Industrial Revolution, or Industry 4.0] and building a digital hub in the ASEAN region.

To strengthen the country's digital competitiveness, one crucial factor (among many) is the efficiency of public services. Currently, there are several government initiatives that aim to improve and transform public services, for example the Government Data Center and Cloud service (GDCC), which aims to be a foundational digital service that drives digital transformation in Thailand. The GDCC provides high standard and highly secure cloud services for government agencies. GDCC also supports the use of new technology to support government operations, such as big data, Artificial Intelligence (AI), and the Internet of Things (IoT). We aim to improve the efficiency of government operations, support the use of advanced technology, and decrease the government budget for digital infrastructure development.

We believe it is vital to bring the benefits of digital technology to all. In addition to providing accessible and affordable connectivity, Thailand's Village Broadband Internet Project (Net Pracharat) is laying efficient, high-speed Internet networks in villages lacking private investment, pushing forward opportunities for broadband access to people in rural areas. A total of 24,700 Internet service points have opened for public use — notably, free of charge. The project is also laying more than 80,000 km of fiber optic core network in many remote areas, which will provide crucial digital infrastructure and digital opportunities, bridging the digital gap in many areas throughout the country.

In addition, the Digital Community Center Project

is designed to help communities learn digital skills and build confidence in the use of digital services. Currently, 2277 sites have been built, covering 77 provinces, with over 2300 staff volunteering their time. All groups — including senior citizens, the disabled, children and youths, women, the disadvantaged, and residents from remote areas — can learn digital skills in these digital community centers.

The Digital Community Center Project integrates central, regional, and local government agencies to provide people with one-stop services. It not only provides Internet connectivity but also functions as a knowledge sharing platform and activity center across education, agriculture, healthcare, trade, services, tourism, and more.

The objectives set are clear: to reduce inequality by helping people of all groups get the most out of using public and private digital services. This is aligned with the sustainable development goals of the United Nations (UN): lifting people out of poverty, reducing inequality, and providing high-quality education. We always bear these goals in mind and the Digital Community Center Project will continue to strive to enable people to understand, and make use of, digital services, directly and indirectly. More importantly perhaps, the project is a platform for the government to understand the needs of the community and to build people's confidence using digital services. In the long term, the country's initiatives will help reequip Thailand's workforce and enhance employment skills in the digital society.

I am looking forward to witnessing the rising prosperity brought about by connectivity and digital technologies in the future. And this must be achieved through cooperation between the public and private sector, from the domestic to the international level. Together, let's overcome the challenges and build a better future. ▲

Embracing Cloud-Native 2.0 to Enable Digital Innovation and Entrepreneurship

Almost all enterprises in the Asia-Pacific (APAC) region are accelerating their digital transformation in 2021, driven by diverse factors, such as the pandemic and the development of the Internet and the financial industry. Indeed, we've seen many enterprises enter a new stage of digitalization, accepting the idea of cloudification and accordingly moving to the cloud. This is not limited to Internet enterprises, either. All enterprises — in all industries — can now move to the cloud to become new, cloud-native enterprises, which will only facilitate their service development.

By Zeng Xingyun, President of the Huawei Asia Pacific Cloud & AI Business Group

Enterprises Are Moving from "ON-Cloud" to "IN-Cloud"

In essence, cloud-native capabilities bring enterprises into a new stage of digital transformation. Huawei defines this as Cloud-Native 2.0, which has several important features. We believe that Cloud-Native 2.0 represents a new stage in the intelligent upgrade of enterprises, helping enterprises move from "ON-Cloud" to "IN-Cloud." As such, Cloud-Native 2.0 connects new and legacy capabilities so that they can co-exist and function together, allowing for higher resource utilization, more agile applications, and intelligent, secure, and trustworthy services.

Cloud-Native 1.0 featured the "ON-Cloud" model, where enterprises migrated their offline services to run on the cloud. This model has helped to resolve Operations and Maintenance (O&M), deployment, and capacity expansion issues. But it has proved unable to handle the range of problems caused by traditional monolithic architecture, which is siloed and inflexible. But Cloud-Native 2.0 shifts to the "IN-Cloud" model, in which enterprises develop and grow services in the cloud. They utilize cloud-native technologies, such as Artificial Intelligence (AI), big data, audio and video,

> Through Cloud-Native 2.0, HUAWEI CLOUD enables enterprises from multiple sectors, including logistics, e-commerce, and media, to explore new businesses, new ecosystems, new business models, and new technologies. HUAWEI CLOUD helps them go digital and accelerate innovation in both services and digitalization.

and edge computing, to pass through the "deep water zone" of digital transformation. However, enterprises also need to continue to build on and develop their existing capabilities, so that new and legacy capabilities co-exist and function together.

In the Cloud-Native 2.0 era, we hope to help enterprises grow these new capabilities. Moreover, many people in the industry may think that cloud-native is all about the Internet. Of course, many Internet enterprises are developed based on the cloud, and thus have full cloud-native capabilities. Yet, cloud-native is not limited to Internet enterprises. Today, many traditional enterprises also need cloud-native capabilities. And while their past development was not based on the cloud, they are still able to grow cloud-native capabilities, looking to the future. Indeed, this is the new answer that we bring to you with Cloud-Native 2.0.

Huawei's Cloud-Native Practices: Develop and Grow New Capabilities in the Cloud, Which Function Together with Legacy Capabilities

This concept of new cloud-native enterprises and

relevant practices are all derived from Huawei's own digital transformation experience. Most people see Huawei as a traditional manufacturing enterprise. However, our own Information Technology (IT) systems have gone through the digital transformation process to become cloud-based. And at the core of Huawei's cloud-native practices is the idea of developing and growing new capabilities in the cloud, where they co-exist and function together with legacy capabilities.

For example, Huawei's Research and Development (R&D) operations have been fully cloudified, and a large number of enterprise cloud-native R&D applications have been deployed. This greatly improves our efficiency, increasing the resource reuse rate by three times and improving deployment efficiency by 10 times. In this digital R&D environment, online and offline resources are integrated to implement digital twins and reconstruct R&D operations. Digital labs utilize Software-Defined Networking (SDN) and cloud computing to flexibly and quickly set up R&D testing environments, on-demand and in real-time. Now, in our labs, a testing environment can be automatically set up within minutes with no coding required, improving testing efficiency by 10%. With an R&D desktop cloud and other digital R&D tools, Huawei's 150,000 R&D personnel worldwide have all moved

their coding tasks to the cloud.

Due to the COVID-19 pandemic, telecommuting and online exhibitions have become necessities and a new normal. Throughout the pandemic, Huawei has carried out online exhibitions with cloud-native technologies, in order to maintain sound customer relationships and ensure service continuity. We have addressed uncertainties related to exhibitions through our cloud resource platform, which is based on cloud-native architecture. The platform can be flexibly used to quickly set up an exhibition on-demand, which improves the resource reuse rate and reduces costs. Over the past year, we have organized more than 1000 exhibitions. We have also responded to the demand for meetings and held an average of 107 high-level online meetings or summits per month, up from an average of 30 offline meetings before the pandemic struck. In the past, we could only hold an event in one country at a time. Now, we are able to open online exhibitions in more than 20 countries at the same time, through online and digital platforms.

Meanwhile, Huawei has built an Operation Web Services (OWS) global O&M service platform, to quickly respond to customer demands and provide personalized services. Based on cloud-native technologies, this platform adopts a unified global O&M architecture that enables easy and fast deployment, as well as convenient access to abundant resources around the world. By connecting with third-party applications, the platform provides three key capabilities: low-barrier, configuration-based development; cloud-based deployment; and an open ecosystem. These all support frontline personnel in their independent R&D and rapid deployment of online applications.

Huawei has also deployed a large number of AI applications to support automatic financial reimbursement, identification of the authenticity of contract signatures and seals, and intelligent acceptance of site delivery. These applications have improved our work efficiency, reduced labor costs, and allowed employees to focus on key and difficult tasks.

Cloud-Native 2.0 Accelerates Digital Innovation in Industries

HUAWEI CLOUD leverages Huawei's own experience in digital transformation to help more enterprises become cloud-native.

For example, the express delivery industry is growing at lightning speed and delivery service companies are struggling to keep up with all kinds of new IT requirements. Proactive action is difficult, if not impossible. Service deployment across multiple countries and regions is expensive and procurement is slow, making it difficult to aggregate and manage service data.

In response, Indonesian courier service provider J&T Express deployed their service systems on the HUAWEI CLOUD node in Singapore, allowing these systems to be accessed from anywhere in the world. In countries with heavy service loads, such as Indonesia and Thailand, our Cloud Connect services have been deployed (in China) to ensure access even in peak hours. After service deployment, elastic scalability now allows for scaling up and Cloud Connect services ensure smooth access.

Elsewhere, e-commerce giant Aladdin also struggled to deal with the massive surges in traffic seen during promotions and sales, due to the changes in customer behavior caused by COVID-19. Indeed, the company was experiencing 100-fold increases in user visits. As a result, servers were regularly overloaded, resulting in slow system responses and, at times, even causing the

entire platform to crash.

HUAWEI CLOUD features preset scaling policies to handle traffic surges during large-scale promotions, which helps maintain service stability. Computing which resources can be scaled up or down, so that services meet immediate requirements, HUAWEI CLOUD has helped Aladdin reduce server expenditure by approximately 20%, while providing shoppers with an enhanced user experience.

As Aladdin continues to expand its platform in 45 countries, the HUAWEI CLOUD e-Commerce Cross-Border Solution has enabled Aladdin to easily deploy multiple systems worldwide, ensuring accelerated service roll-out.

One final example can also be found in the innovative e-commerce live-streaming platform MeOne, which operates across Southeast Asia. It offers cost-effective supplies and novel entrepreneurial support to its users.

But despite MeOne's ability to integrate cross-border supply chains, it was still struggling to make major breakthroughs in Southeast Asia. During the ongoing pandemic, data restrictions also made it more difficult to expand its business.

HUAWEI CLOUD's high-performance, low-cost services allowed MeOne to reduce its IT expenditure by approximately 50%. With a Relational Database Service (RDS), MeOne has since established a more reliable system and its data access speeds have increased by 30%, helping the company expand its business into markets with poor Internet support, such as the Association of Southeast Asian Nations (ASEAN) market.

Through Cloud-Native 2.0, HUAWEI CLOUD enables enterprises from multiple sectors, including logistics, e-commerce, and media, to explore new businesses, new ecosystems, new business models, and new

technologies. Simply put, HUAWEI CLOUD helps enterprises go digital and accelerate innovation in both services and digitalization.

Digital Entrepreneurship Enabled by the Huawei Spark Program

All startups can make a difference. Every single one of them has the potential to reshape the world. Indeed, many of today's technology giants started as experiments in garages. But the harsh reality remains that 99% of startups ultimately fail. And a big reason for this is a lack of experienced support and guidance.

The Huawei Spark program was created to address this precise problem. It gives startups access to general technology platforms and industry capabilities, as well as to Huawei's own technical, ecosystem, and market resources. We are committed to empowering startups so that we can grow together — and grow better. Participating in the Huawei Spark program allows startups, as well as Small- and Medium-Sized Enterprises (SMEs), to get the head start they need, driving their digital transformation and supporting their spirit of entrepreneurship. Huawei's platforms and sales channels help startups and SMEs alike more easily develop in the Chinese market and go global. Meanwhile, these organizations help us to build up the Cloud-Native 2.0 ecosystem, which will in turn improve Huawei's own business environment and its social and business influence.

One of Singapore's fastest-growing online car marketplaces, UCARS, for example, is designed to make buying cars easier. The company was founded in 2019, but its user base fluctuates drastically, making the app susceptible to online attacks. In addition, UCARS needs to continue providing more and more value-added services, to make transactions easier for both sales staff and buyers.

HUAWEI CLOUD is helping UCARS develop and deploy applications faster, as well as manage and monitor applications more effectively, with an Elastic Cloud Server (ECS), load balancers, associated databases, cloud container engines, firewall tools, and application O&M services. With AI-powered image search and quick match capabilities, buyers are more efficiently matched with car dealers who are increasingly likely to offer what they're looking for. This has made UCARS a truly cloud-based business.

Another example can be found in the NextBillion.AI platform that sells map Application Programming Interfaces (APIs) and tools to enterprises. It participated in the 2020 Huawei Spark program within its specific category. A spokesperson for the company commented: "We have benefited greatly from the Spark program and have received significant support from HUAWEI CLOUD in terms of cloud architecture, talent, and business development. Especially in terms of business forms, HUAWEI CLOUD's containerized platform allows us to flexibly deploy solutions in any other HUAWEI CLOUD user environment, and with very low deployment and O&M costs. This has won us more valuable enterprise customers."

To further drive a boom in the cloud-native industry, HUAWEI CLOUD APAC has launched the Cloud-Native 2.0 Action Plan, which focuses on joint innovation, industry promotion, community contributions, and comprehensive enablement. Through this plan, we are committing ourselves to providing stable, reliable, secure, sustainable, and innovative cloud services, creating fertile soil in which the intelligent world can flourish. We want to help enterprises across all industries become truly cloud-based as they go digital, and jointly build exemplary models of Cloud-Native 2.0 enterprises. ▲

Empowering the Financial Industry in the Intelligent Mobile Era

In the intelligent mobile era, Huawei — with its vision, insights, solutions, ecosystems, and experts — is uniquely positioned to create new value. The global outbreak of COVID-19 has disrupted the lives and businesses of countless people, and the transformation to digital business models poses huge challenges to every industry.

By Cao Chong, President of the Global Financial Services Business Department, Huawei Enterprise Business Group

The global outbreak of COVID-19 has impacted the lives and businesses of countless people, and the transformation to digital business models poses huge challenges to every industry. A new era has arrived, as vertical industries accelerate digital and intelligent transformation, to adapt to new business models and respond to future uncertainties.

During the pandemic, leading digital banks have continued to provide digital and contactless services, allowing customers to access various financial services, manage their finances, and receive financial support — all from the safety of their homes. We have seen that these leading digital enterprises have excelled in terms of their risk resilience, agile collaboration, and market response efficiency. The underlying reason for their success comes from each enterprise's ability to proactively rebuild service processes and the relevant technological capabilities, to further digitalize and personalize their operation models, which in turn enables them to flexibly respond to changes in the market and provide tailored services for customers.

The Financial Industry Enters a New Era

The digital transformation of financial enterprises

starts from digital channels, such as mobile banking, and gradually expands to the digitalization of employees' work arrangements, branch resource management, data management, and risk control policies. With digitalization, managers and employees alike can re-think and redesign the overall operation of a bank, driving the financial industry into the intelligent digital era.

Accelerating the Digital Transformation of the Financial Industry

For the financial industry, certain measures will be crucial to overcoming business challenges in the long run and will help increase the industry's overall resilience:

Redesign the customer service journey: Even though online banking has been widely adopted for many years now, customers still need to frequently physically visit the bank for more advanced financial services due to regulatory requirements or complexity issues. As bank branches have closed due to the pandemic — drastically increasing the demand for contactless services — banks have begun to focus on improving their online customer service through mobile banking. Financial Technologies (FinTech) can be used to increase the number of services available online, enhance the customer experience through the overhaul of the service journey, and reconstruct the existing services of banks around people's daily online habits. Online services such as making reservations and pre-filling out forms are combined with offline QR code scanning, one-click interconnection services, and cross-selling, enhancing the customer experience while making the entire process more efficient and secure. Banks can also use these technologies to maximize their resource usage and further improve the banking experience for customers.

Business agility and mobility: The development of technologies such as 5G, Artificial Intelligence (AI), and the cloud has transformed services: They have become more mobile and personalized, and — notably — card- and cash-free. Moreover, by undergoing digital transformation and adopting a mobile first strategy, financial institutions are boosting their service agility and relationship with customers. We predict that the main challenge banks will face in the future will come from mobile applications. The core capability of bank operations will be digitalized, including customer acquisition, services, and operations. Meanwhile, the mobile first strategy that had, up until recently, remained largely theoretical, has now become the go-to strategy for the banking industry in the real world. Many leading banks in and outside of China have incorporated this strategy into their organizational principles and key targets. But mobile first isn't merely a strategy; it will fundamentally transform systems, processes, and the organizational culture, with advanced Information Technology (IT) and collaboration platforms in turn digitalizing bank operations. To realize this transformation, financial institutions need to collaborate with partners who not only have a deep understanding of technology, but are also adaptive to changes and prepared to face the future head-on.

Smart branches: Technologies such as 5G, Wi-Fi 6, Internet of Things (IoT), AI-enabled smart cameras, and Smart Teller Machines (STM) will make operations more intelligent and mobile. These smart branches will use newly acquired intelligence to identify customers, measure their temperatures (while the pandemic continues to spread), and guide service processing. With the help of smart tellers, more experts can be involved in the customer service process. New additions to branches such as smart temperature control, smart cameras, and smart experiences will make branches more secure and comfortable for customers, as well

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With decades of experience in the financial industry, Huawei has served over 1600 financial customers in more than 60 countries, including 45 of the world's top 100 banks.

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as increasing the bank's management and operation efficiency. In addition, branch distribution and resource allocation can be optimized.

Digital payment: Today, Internet giants have made mobile payment a must-have service. According to research conducted by market intelligence firm International Data Corporation (IDC), the use of mobile payment has increased by 60 percent in the first quarter of 2020 in some Asia-Pacific markets. As a result of this increase, banks have been grappling with a range of mobile payment issues and need to find ways to provide better support, improve convenience, seamlessly merge with existing banking services, and increase the accessibility for more Internet players.

Digital customer acquisition and operations: With the transformation of traditional bank branches and the surge of Internet users, the Internet has become a key channel for banks to acquire new customers. Financial institutions need to not only use the Internet to strengthen digital customer acquisition capabilities, but also the capabilities of big data, AI, and FinTech — such as Electronic Know Your Customer (eKYC) — to better understand customers' needs, mitigate risks, and improve the precision of customer services. Additionally, financial institutions need to use digital means to improve their internal operation capabilities

and efficiency.

Customer communication: Through their platforms, Internet companies can provide 24-hour support, send relevant notifications, and respond to needs quickly, increasing customer satisfaction and loyalty. Banks — with siloed multi-channel services — are facing ever bigger challenges. The best way forward is for banks to build an interactive platform that offers direct communication with customers, pushes services in real-time, and responds to customers' needs at any time. Doing so will improve customer service quality and satisfaction immensely.

Cloud architecture: Hybrid cloud isn't merely a trend for the digital transformation of banks — it has become a foundation itself. The cloud is always available and resources can be flexibly expanded, enabling financial institutions to improve their resource usage. Additionally, the cloud can provide micro-services and development tools at any time, which banks can use to quickly launch and iterate Internet-native services and products in a collaborative development mode, greatly shortening the Time To Market (TTM) of ideas. Quite simply, the connection of cloud architecture and the Internet enables banking services to be available to customers anytime and anywhere.

5G+ trend: 5G and IoT technologies can enable the connection of countless terminals, which will create massive amounts of information and even change the very way information is exchanged. Ultra-broadband — made possible by 5G — broadens the variety of applications, from text and voice services to video, Virtual Reality (VR), and Augmented Reality (AR). Moreover, 5G's low latency and high reliability enable banks to migrate even more services online and connect with a billion individual and enterprise customers. Meanwhile, working together, edge computing and AI enable banks to deploy more personalized service capabilities that are closer to customers; banks can use these technologies to quickly identify customers, improve service capabilities, and guard against risks. Although 5G hasn't yet been widely adopted in the financial industry, the impact of 5G+ applications is potentially huge.

5G+ financial scenarios will enable remote and virtual financial services, and promote the upgrade and transformation of the financial industry. Lending services as well as investment and wealth management can be conducted virtually through smart terminals. To meet enterprises' financing

requirements, banks can effectively evaluate overall risks through big data analytics (enterprise business performance), AR (onsite inspection of enterprises), and IoT technologies (mortgage information), based on 5G. Essentially, 5G+ finance can increase the efficiency of information sharing, which will greatly improve the user experience, increase the transparency of credit and loan information, improve the fund allocation efficiency of financial institutions, and reduce the costs of transaction and risk control. The application of these new cutting-edge technologies will also increase the diversity of financial services and realize more inclusive and flattened financial services.

Huawei's Vision and Solution for the Financial Industry

With decades of experience in the financial industry, Huawei has served over 1600 financial customers in more than 60 countries, including 45 of the world's top 100 banks. Huawei believes that, to successfully implement both mobile first and digital transformation strategies, the financial service industry needs to focus on three aspects: connectivity, digitalization, and business agility.

> "Huawei's vision is to help customers in the financial industry embrace the new era of mobility and intelligence, realizing full connectivity, digitalization, and business agility."

Connectivity: Ubiquitous connectivity is the core of mobility and digitalization. Without high-speed, high-reliability, and high-quality network connections, mobile terminals can't provide customers with a rich interactive experience, financial services can't rapidly respond to every customer, and business will become stagnant.

Digitalization: With ubiquitous connectivity, all services can be digitalized and offered online, enabling financial institutions to adapt resources to changes in the new era. Indeed, efficiency can only be maximized when financial services and operations shift from a traditional mode to an Internet-native digital service mode.

Business agility: The COVID-19 pandemic has revealed the impact of uncertainty on society at large, for millions of people around the world. Financial institutions must respond more rapidly to changes and use digital technologies to adjust their business models, resource capabilities, and measures for risk control, to maintain their leadership and growth.

Huawei's vision is to help customers in the financial industry embrace the new era of mobility and intelligence, realizing full connectivity, digitalization, and business agility. Based on a wide range of products and solutions, and supported by a global ecosystem,

Huawei has launched "ABCDE" — a series of key enablement services and technologies for financial customers.

Finance Cloud Architecture: Financial enterprises need to use a new architecture to implement smart financial transformation. Huawei not only offers hybrid cloud, data centers, and service cloudification, but also service continuity and High Availability (HA) disaster recovery, internal networks based on Software-Defined Networking (SDN), as well as storage systems based on dual-active and all-flash technologies. Financial cloud architecture integrates the hybrid cloud with the cloud capabilities of the company's data center to ensure secure and proper use of public cloud resources.

The Bank of China (BOC) is currently collaborating with Huawei to build a hybrid cloud-based financial ecosystem to provide flexible accessibility to financial services. The new architecture supports one billion users and 100,000 transactions per second. BOC's eCommerce platform supports more than 10 million online users while the open third-party service access platform supports more than five million transactions per day. Yet the cost of the new architecture is significantly lower than that of the host architecture. The new architecture also has to provide the data infrastructure required for collecting, storing, and

processing massive data, which is integral for the new data platform. In the case of Singapore's DBS Bank, Huawei's full-lifecycle intelligent storage solution has greatly improved its service data storage and access efficiency.

Smart Branch and Services: With the continuous growth of mobile services, the role of physical bank branches is changing and needs to be redefined. We believe that the digital and intelligent transformation of branches through the application of new technologies, such as 5G, AI, and cloud, is essential for the current construction of branches: The role of future bank branches lies in the provision of a high-end, convenient, and comprehensive financial service experience for customers. Huawei provides intelligent marketing, connection, management, and security protection solutions for bank branches, and is committed to transforming branches into user-friendly, efficient, and diversified comprehensive financial service centers, with reduced operation costs.

For example, China Merchants Bank customers can reserve services ahead of time through the bank's app so that the branch can prepare the required resources in advance. The branch's smart cameras identify customers as they arrive for appointments, measure their body temperature, send reminders

to managers, guide customers into the service area, and efficiently access services through simple operations such as scanning barcodes. With edge computing and IoT technologies, operation personnel can use mobile devices to manage branch security, devices, and resources, as well as dynamically adjust branch operations. In the waiting area, targeted financial service information promotion and interactive devices can be used to improve the customer experience, which will in turn improve customer loyalty. Evidently, the intelligent transformation of branches is still the key development goal for most banks.

Digital Core: The core system is a key component of a bank. The core systems of most commercial banks still use centralized architecture. However, with low scalability, high costs, long service provisioning periods, and complex Operations and Maintenance (O&M), traditional core systems are no longer able to meet the requirements of modern banks. Despite this, banks still need to maintain the stability of basic services of the traditional core, as well as quickly build a new digital core to achieve service agility. The digital core must be built based on open and distributed technologies, to support the rapid development and rollout of new generation applications as well as speed up customer acquisition, enhance the customer experience, and

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> In the future, 5G, AI, and the cloud will impact the financial industry on a huge scale. Huawei has invested heavily in these technologies for many years and has become a global leader in related fields.
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reduce IT costs. In addition, the new digital core must be able to support the construction of a next generation data platform, so that banks can quickly reconstruct the data plane (data lake, data factory, and more).

Huawei has worked with world-leading banking partners, including Sunline Technology, Forms Syntron, and Temenos, to jointly develop a digital core solution for various scenarios. Huawei and its partners use their strengths to build a distributed architecture based on the micro-service concept at the Infrastructure-as-a-Service (IaaS), Platform-as-a-Service (PaaS), and Software-as-a-Service (SaaS) layers. The solution also supports modular deployment of the core systems of open banks and can become a new digital service platform that enables banks to develop "super apps." Over time, the traditional core of banks can be migrated to the new digital core.

At a large bank in Thailand, the traditional core system struggled to support the rapid growth of users. Huawei and its partners jointly developed a new digital core solution for the bank, which helped the bank offer benefits to tens of millions of users through a digital wallet feature. In the future, it will carry new services of various ecosystems in addition to taking over traditional services.

New Data Platform: Data is the core asset for digital transformation, but traditional databases of financial institutions can't support that digital transformation. Therefore, a new data platform is urgently needed. Huawei has been working with partners to build a new data platform solution that helps financial institutions acquire customers, control risks in real-time, and reshape operation capabilities end-to-end, in order to provide personalized products and an intelligent experience. The solution architecture consists of innovation application, convergent platform, and intelligent infrastructure layers, and provides multiple innovative service applications, such as marketing, operations, and risk control.

For example, the Industrial and Commercial Bank of China (ICBC), which has 500 million customers, has migrated and expanded more than 2 PB of data in the theme data marts, including marketing, mobile banking, financial market, and risk prevention and control over the last three years. They have also replaced their traditional data warehouse platform with a new data platform, which greatly improves platform scalability and system performance, such as query and analysis, and greatly reduces the Total Cost of Ownership (TCO) of the platform. In addition, the platform's ability to analyze customers' use of financial apps in real-time has enabled ICBC to continue to

refine the recommendation model and further improve the customer experience.

Open Ecosystem: Huawei provides industry-leading digital cloud foundations for customers in various industries and collaborates with many business partners to offer end-to-end solutions. In the finance domain, we have more than 200 solution partners worldwide, with solutions ranging from bank cores, AI chatbots, and intelligent networks to mobile office apps, business intelligence, and intelligent data pools.

Indeed, there are success cases all around the world. In China, we have worked with partners to build new distributed core systems for multiple banks as well as insurance and securities customers. In Africa, we've worked with our partners to build an inclusive financial credit platform for a leading bank in Kenya. In Southeast Asia, we've built a new digital core system for leading regional banks. Specifically, we've worked with our partners to build a payment ecosystem with banks to enable users without debit cards to enjoy financial services in Indonesia.

Huawei has become a strategic digital transformation partner for multiple global financial institutions, thanks to our technical expertise and strategic investments in the financial industry. In the future, 5G, AI, and cloud will impact the financial industry on a huge scale. Huawei has invested heavily in these technologies for many years and has become a global leader in related fields. To further drive the digital transformation of the financial industry, we will provide customers with superior options based on our open technical architecture, ongoing Research and Development (R&D) investment, and proactive cooperation model, as well as the successful transformation practices of Huawei and global leading financial institutions.

Vision, insights, solutions, partners, and industry experts — these are what Huawei can bring to the financial industry in the mobile intelligent era. We look forward to working with all our customers to help them on their unique digital transformation journey. ▲

Bridging the IT and OT Digital Divide with a New Digital Transportation Paradigm

Since the "New Infrastructure Construction" policy and the Outline for Building China's Strength in Transportation were implemented — in 2018 and 2019, respectively — the digital transformation of the nation's transportation industry has reached a critical juncture, as it has in other countries around the globe. Traditional modes can no longer meet new requirements that digital transformation brings, so a new mode is needed. And in recent years, a new digital paradigm has started to develop.

By Wang Guoyu, President of the Global Transportation Business, Huawei Enterprise Business Group

The use of new technologies — such as 5G, cloud computing, big data, Internet of Things (IoT), and Artificial Intelligence (AI) — is leading the transportation industry into the digital era.

The deep integration, bidirectional interaction, and real-time coupling of Information Technology (IT) and Operational Technology (OT) empowers the transportation industry's digital transformation and comprehensively improves the precise sensing, precise analysis, and intricate management capabilities of transportation infrastructure, as well as the modernization level of the governance of transportation.

Many countries around the world — in Europe, North America, and Asia Pacific — are planning comprehensive digital transformation solutions for transportation. For example, the European Union (EU) has devised a plan that will provide 2 trillion euros (about US$2.43 trillion) to finance a European economic recovery after the deep recession that the coronavirus pandemic is expected to cause. From that fund, 1.1 trillion euros (about US$1.33 trillion) will be used to build a 20,000-km high-speed railway network

that connects the capitals of EU countries. In 2020, the German government and Deutsche Bahn AG released a railway construction investment plan for the next decade, indicating that Germany is expected to invest 86 billion euros (about US$104 billion) to build a comprehensive pan-European transportation network by 2030.

Digital Transformation of the Transportation Industry Enters an Uncertain Period

In recent years, we've seen several disruptive events; some of them were foreseeable, while others were impossible to predict. Clearly, the future is becoming increasingly uncertain. Many innovations have been gradually integrated into the transportation industry's production process. As the digital transformation of the industry develops, determining how to radically innovate and create that much-needed new digital paradigm has become a priority.

Transportation infrastructure generally has a low level of digitization. The transportation industry is asset-heavy, and it has strict security requirements as well as high specialization and mobility levels, so it faces significant challenges as it integrates with new technologies such as 5G, cloud computing, and big data. Frankly, it lags behind the Internet, finance, and telecom industries in terms of digital transformation.

In the past 30 years, the transportation industry adopted IT technologies very early, but most transportation infrastructure has lacked digital capabilities. Many roadside, trackside, terminal, and hub devices are still 'dumb'; they're not included in traffic operations management, and they can't be used for traffic management and dispersion. This is fairly typical of the industry: Most IT applications are scattered in various information silos, and transportation is still far from being truly digitalized.

Modern transportation isn't merely the independent transportation of passengers and cargoes in vertical transportation domains, including railway transportation, highway transportation, water

transportation, and air transportation. Instead, it's integrated, comprehensive transportation based on the passenger, cargo, and vehicle flows, plus a digital, networked, and intelligent travel service system. Digital transformation is the only way to achieve comprehensive transportation, but it's very difficult because this kind of 'comprehensive' transportation is complex.

With the rapid development of urban rail transit and city cluster construction, urban rail construction has begun to evolve — from a series of separate lines to a complicated network consisting of diversified urban rail transit modes, such as metro, light rail, commuter rail, and Bus Rapid Transit (BRT). This has led to a sharp increase in the number of construction projects. For example, in recent years Shenzhen Metro's construction projects increased from 60 to 400, sometimes involving about 70,000 construction workers per month. This rapid development has also made the process management of urban rail construction much more complicated. No matter where

you look around the world, there isn't a great deal of experience in making such a large rail network digital. To explore and innovate in the field, we need to make use of next-generation IT technologies — such as 5G, cloud computing, big data, IoT, and AI.

Further complicating matters, vehicles are always evolving and constantly being upgraded. The operations and management of new vehicles — drones, unmanned vehicles, electric vehicles, and intelligent rail transit — pose challenges to the digital operations and management of China's modern transportation systems. In this context, the priority is developing a new digital transformation paradigm.

Building a New Digital Transformation Paradigm

With Information and Communications Technology (ICT) advantages accumulated over 30 years and more than 20 years of experience in transportation industry solutions, Huawei has provided transportation

> Future transportation wont be merely independent transportation of passengers and cargo in vertical transportation domains — railway, highway, water, air transportation, and so on. It will be integrated, comprehensive transportation.

solutions for 23 Fortune Global 500 customers.

The Comprehensive Transportation Solution — jointly launched by Huawei and its ecosystem partners — is one of the most popular solutions; it integrates technologies such as 5G, cloud computing, big data, and AI with business scenarios, to achieve Huawei's vision of making travel as convenient as possible for passengers and ensuring that all logistics for cargo transportation are run smoothly, improving the security, efficiency, and experiences of transportation.

Comprehensive Transportation Solution

Future transportation won't be merely independent transportation of passengers and cargoes in vertical transportation domains — railway, highway, water, and air transportation, and so on; it will be integrated, comprehensive transportation. Integrated, comprehensive transportation covers people's door-to-door journeys and end-to-end transfers of cargoes; it makes those journeys and transfers quicker, safer, and cheaper, and it guarantees better experiences.

As more industrial plans are proposed — such as the Outline for Building China's Strength in Transportation,

as well as other regional plans of the Yangtze River Delta, Guangdong-Hong Kong-Macao Greater Bay Area, Beijing-Tianjin-Hebei Region, Jiangsu province, and Guangdong — building an 'air, water, ground, and underground' integrated, comprehensive transportation system, from hubs to cities and then to metropolitan circles meets the transportation industry's development needs.

Ultimately, the aims of making transportation digital are to solve business problems, improve security, efficiency, and experiences, stimulate productivity, and ensure high-quality development of the industry by building a comprehensive transportation system that covers the entire process, architecture, and lifecycle. This digital, integrated transportation system must be implemented step by step.

The first step is to make each business scenario in vertical sub-industries — aviation, urban rail, railway, highway, logistics, and port — digital. Then, multiple digital business scenarios are connected in series to form streamlined business flows of passengers, cargoes, and vehicles. In this way, vertical sub-industries become digital.

The second step entails connecting digital vertical sub-
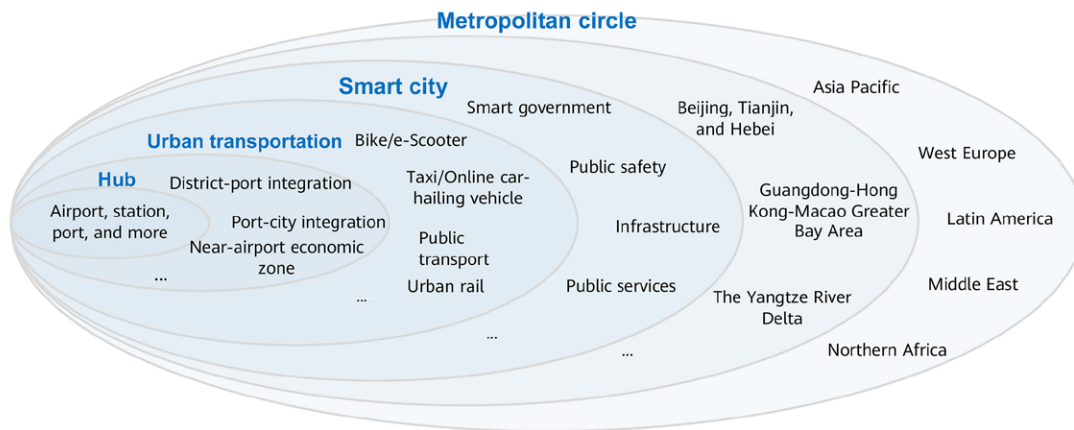
Integrated, comprehensive transportation

industries in parallel to bridge breakpoints, forming a door-to-door travel service flow and an end-to-end goods transportation flow. This way, the entire process can be sensed, predicted, coordinated, and linked — building a future-ready comprehensive transportation system.

Huawei's Comprehensive Transportation Solution includes smart airports, urban rails, highways, logistics, railways, and ports — covering major modes of transportation and logistics. Huawei is also participating in the planning, design, Research and Development (R&D), and implementation of comprehensive digital transportation construction in several Chinese cities. For example, Huawei is helping Shenzhen strengthen its urban traffic governance capacity to alleviate congestion in the city and increase its travel service level to make public travel safer and more pleasant.

As a comprehensive transportation hub that integrates sea, ground, air, and rail transportation, Shenzhen Airport prioritized the converged development of transportation modes in recent years, to build an aviation service ecosystem of combined air-ground,

air-sea, and air-rail transportation, becoming a '4-in-1' airport. This kind of convergence generates huge digital value, and it inevitably results in a vast amount of data traffic.

An important task for Shenzhen Airport is to explore how to enable 4-in-1 airports for digital transformation and build comprehensive airport hubs. To build a future-ready digital platform, Huawei and Shenzhen Airport are working together, following the 'Platform + Ecosystem' strategy, which entails the use of a digital platform and an ecosystem of partners working together. Based on Huawei's ICT infrastructure, the two parties have integrated the IoT, a combination of big data and AI, video cloud, Geographic Information System (GIS), and Integrated Communication Platform (ICP) resources.

Digitization and Digitalization

Digital transportation includes digital infrastructure (digitization) and digital business processes (digitalization). Digitization is the basis for digitalization, and digitalization is key to bridging

breakpoints and addressing difficulties and pain points.

Digital infrastructure is capable of all-round sensing and connectivity, and involves technologies such as IoT, 5G, machine vision, and radar. Digital business processes are converged, intelligent, visible, and they provide support for decision-making. These processes typically involve technologies such as cloud computing, big data, and AI.

Applying more than 20 years of experience in digital transformation of the transportation industry, Huawei has developed Traffic Intelligent Twins (TrafficGo), which integrate multiple technologies — such as connectivity, cloud, AI, computing, and application — and is an open, intelligent system that features three-dimensional sensing, multi-domain collaboration, accurate judgment, and continuous evolution — realizing cloud-network-edge-device synergy.

Taking connectivity and intelligence as an example:

Connectivity: 5G features high bandwidth and low latency, providing infinite possibilities for digital transportation.

The digitization of roadside, trackside, terminal, hub, and vehicle infrastructure is necessary for business process digitalization, and depends on sensing and connectivity technologies for data collection and transmission.

5G is one of Huawei's core technological strengths. With high bandwidth, low latency, wide connectivity, and high reliability, 5G can make a significant difference in the transportation industry. For metro facility maintenance, manual detection is inefficient and prone to false alarms and omissions.

The 5G train-to-ground wireless communications solution piloted on Shenzhen Metro's Line 11 can transmit data to stations, car depots, and monitoring stations when the train is running, so that the metro

Transportation **enables** mobility in the physical world; communications drives data interaction in the digital world.
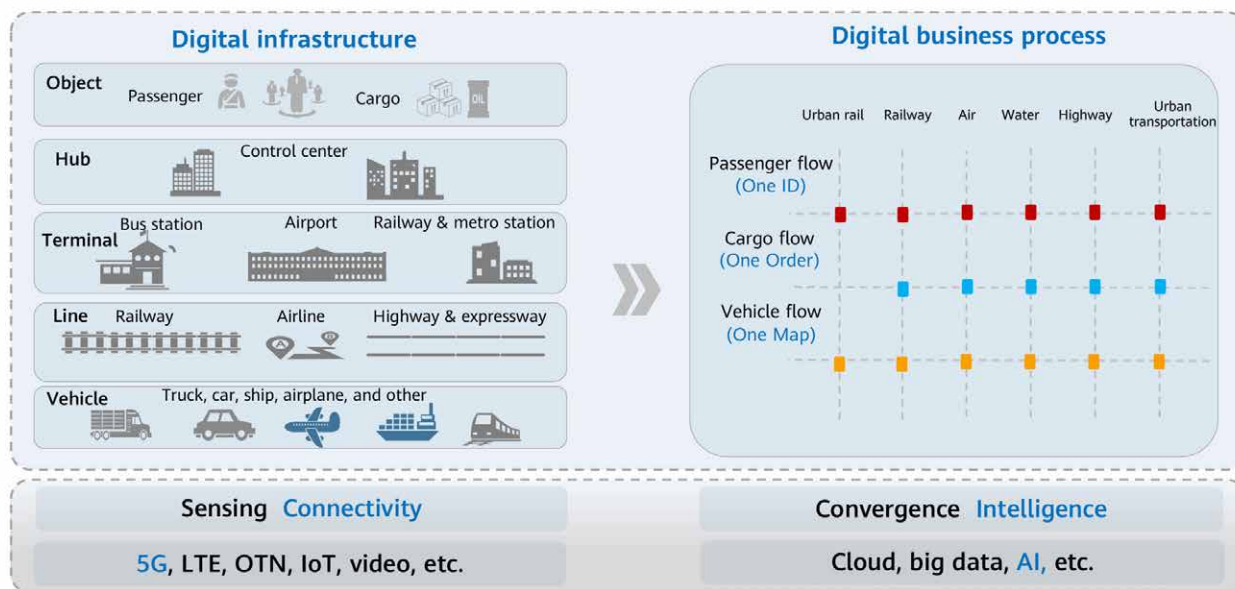
Digital transportation encompasses digital infrastructure and digital business processes.

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> It usually takes several years from preparing to build transportation infrastructure to the infrastructure being used. As technologies develop rapidly, digital enablement should cover four phases: planning, construction, maintenance, and operations.
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operation organization can monitor train facilities, train status, tunnels, and passengers. When a train runs for an hour, it generates about 25 GB of data. In the past, it took at least 120 minutes to copy that data. Now, that data can be automatically copied within 2.5 minutes. This supports prompt health management and status analysis of facilities.

Intelligence: AI reduces the amount of manual labor needed for major, frequent, and repetitive tasks.

To digitalize business processes, business experts and IT experts need to work together to select appropriate business scenarios and find the difficulties and pain points in the operations and production processes in the transportation industry. Then technologies can be used to solve the problems to improve security, efficiency, and experiences.

For example, whether the number of times passengers take shuttle bus at an airport is related to both the technology of aircraft stand allocation and the management system. An airport usually arranges for the most competent commander to allocate aircraft stands, and the commander typically spends four to five hours on this task. In the event of traffic control or

weather changes on the following day, the commander needs to quickly adjust the allocation.

AI can complete the allocation in only one minute, and makes adjustments in seconds. Shenzhen Airport's intelligent stand allocation system first introduced AI algorithms to airports in China, helping Shenzhen Airport allocate stands automatically and intelligently. By deploying this system, the airport has greatly improved its bridge-to-aircraft docking rate, as well as bridge turnover rate — enabling about 2.6 million passengers to directly board the aircraft through bridges and reducing passenger waiting time by 125 hours each year.

The convergence of connectivity and computing will change all walks of life. Metcalfe's Law states that a network's value is proportional to the square of the number of nodes in the network. This means that a network's value increases exponentially when the number of connections in the network increases, ultimately creating value for society. In the transportation industry, connectivity and computing should be integrated with business scenarios and address pain points in production systems to create value. All of these scenarios constitute a blueprint for

comprehensive transportation.

Three Business Flows

The transportation industry has three business flows: passenger, cargo, and vehicle.

Passenger flow: Providing personalized, differentiated, and more convenient travel experiences for passengers is the eternal pursuit of various transportation enterprises.

Cargo flow: Smooth circulation of cargoes can improve logistics efficiency and reduce social costs.

Vehicle flow: Resources and requirements can be better matched by linking elements such as passengers, cargoes, roads, vehicles, terminals, and stations.

We need to focus on core business flows and apply IT technologies in key business scenarios to resolve pain points — increasing production efficiency, enhancing operations management, innovating business models, and improving public service capabilities.

The combined application of IT technologies — such as 5G, cloud computing, big data, and AI — can deepen the convergence of multi-source data, integrate online and offline resources, and promote the opening and sharing and converged development of information about a range of fields — such as transportation, business travel, and tourism and shopping — building Mobility as a Service (MaaS) that's centered on mobility rather than on transportation resources. Mobility requirements and transportation service resources are matched based on data, making mobility an on-demand instant service and creating a new mobility experience.

How can we apply IT to improve the passenger experience at airports and shorten the passenger processing time? The Smart Airport solution is passenger-centric, and provides precise, all-scenario, personalized, and online-offline converged services along passengers' travel routes, building an airport travel solution that creates a seamless airport travel experience for passengers, in which only one form of ID is needed. Chengdu Shuangliu International Airport is expected to provide end-to-end seamless self-help services soon — creating an efficient travel experience for passengers and reducing the risk of ID document loss. Meanwhile, the smart flight information display

Passenger flow: personalized, One ID

Cargo flow: visualized, One Order

Carrier flow: intelligent, One Map
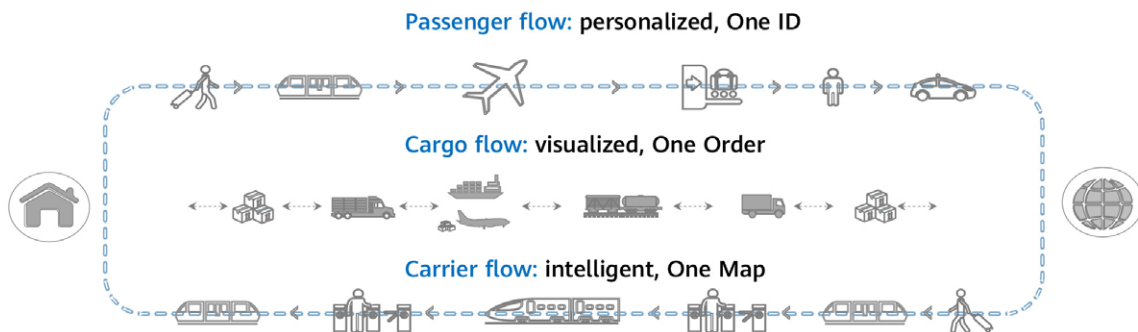
IT technologies such as 5G, IoT, video, big data, cloud, and AI are integrated to provide optimal security, efficiency, and experiences

Three business flows

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> To succeed, the entire industry needs to work together. Only when the industry uses unified standards and builds a healthy ecosystem can all parties achieve collaborative division of labor, complement each other's advantages, and flourish.
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system provides flight information and indoor navigation information for passengers. In China, all airports have equipped their boarding gates with self-service facilities, reducing the average passenger processing time by more than 15 minutes.

Lifecycle Alignment

It usually takes several years from preparing to build transportation infrastructure to the infrastructure being used. As technologies develop rapidly, digital enablement should cover four phases: planning, construction, maintenance, and operations. Coordinated deployment and iterative innovation should go throughout the lifecycle. For example, smart urban railways need to be analyzed in terms of construction, maintenance, operations, business management, and passenger travel; smart highways need to be approached comprehensively, from road network sensing and road network cognition to road network intelligence; and smart railways need to be considered from operational communications to smart train maintenance, as well as from perimeter security protection to smart freight yards and smart stations.

The business of transportation enterprises and institutions is usually divided into the aforementioned four phases. Each phase requires careful planning

and effective use of IT. The four phases should be aligned from end to end in order to obtain complete digital insights, support planning and decision-making, implement comprehensive scheduling and operations of all processes, scenarios, and elements, and verify and explore innovative business models.

Huawei's solutions and platforms are deterministic so we can decide how to deploy them to perform better services. Meanwhile, the application scenarios for those solutions and platforms are non-deterministic and constantly change, so we need to collaborate and work closely with ecosystem partners, create a unified architecture, with coordinated deployment, and efficiently iterate new technologies.

Industrial digital transformation is a systematic process. To keep this process on track, top-level design needs to be performed in the project planning phase. Under the premise of a unified architecture, decision makers need to consider the long project period and fast technology iteration, devise a plan, calculate the entire lifecycle and costs, and estimate the requirements of the maintenance and operations phases. Deterministic platforms and products should be deployed in a coordinated way. Digital platforms — as ICT infrastructure — are the foundation for the transportation industry's digital

transformation, and they should be constructed first, to improve efficiency.

In the construction and maintenance phases, we should embrace new technologies — such as 5G, cloud computing, AI, big data, and IoT — and preferentially adopt stable and open platforms, as well as technologies and solutions that can be flexibly iterated.

In the operations phase, transportation enterprises and institutions can build customer profiles based on big data analytics to explore new business models and revenue sources.

We need to collaborate with ecosystem partners, and quickly iterate technologies to cope with non-deterministic application scenarios.

The Yangchenghu Expressway Service Area in Jiangsu province is an example of successful lifecycle alignment. Up to 100,000 vehicles stop by the service area every day. Each vehicle carries at least two people, and each person spends over CNY70 (about US$11) there, creating over CNY7 million (US$10.8 million) in revenue for the service area. Yangchenghu Expressway Service Area is planned as a node on the tourism industrial chain and operated as a commercial district.

Digital transformation should run throughout the lifecycle of transportation business. In the future, this will become normal for construction of new transportation infrastructure.

Ecosystem Collaboration

The digital economy has proven a significant driver for stabilizing investment, promoting consumption, facilitating industrial upgrades, and cultivating new momentum for economic growth. To create value, the digital transformation of the transportation industry requires synergy.

Huawei applies its technological capabilities and focuses on scenario-based transportation solutions through synergy across five tech domains: 5G, cloud, AI, computing, and industry applications. To succeed, the entire industry needs to work together. Only when the industry uses unified standards and builds a healthy ecosystem can all parties achieve collaborative division of labor, complement each other's advantages, and flourish.

To help establish that healthy ecosystem, Huawei will enable partners. As well as traditional partners, Huawei will also cooperate with five types of ecosystem partners: consulting and planning partners, data governance partners, integration implementation partners, application development partners, and platform operations partners.

To aggregate the capabilities of these partners, Huawei will explore multiple cooperation modes, including device-side sensing, software development, data governance, and smart applications, for joint innovation. As the construction of new infrastructure progresses and new business models evolve, the investment in infrastructure construction increases year by year. More investment and financing partners need to join in, to dig deep into the segmented business scenarios of the transportation industry. Huawei and our partners will complement each other's advantages and jointly build a digital cube — incorporating cooperation modes, partner capabilities, and application scenarios to create value for the industry — to continuously capitalize on ecological potential.

Huawei adopts an open and cooperative attitude, and enables partners through this digital cube to promote the digital transformation of transportation. ▲

Realizing Potential: How Huawei Supports Digital Banking

It is clear that, with the rapid development and adoption of the Internet and mobile technology, customer expectations for banking services have been dramatically transformed. To cater to these new market forces, emerging digital banks are offering services to three distinct segments of traditionally overlooked customers: the unbanked, underbanked, and underserved.

By Lin Yi, Director of Digital Transformation, Huawei Asia Pacific Enterprise Finance Account Dept.

S low to match changing customer needs and demands, traditional banks now face significant challenges in terms of customer acquisition and retention, ultimately impacting their market position and profitability.

In the Asia-Pacific (APAC) region alone, by the end of 2020, eight virtual banks had launched in Hong Kong and the Monetary Authority of Singapore (MAS) had awarded four digital banking licenses. Elsewhere within the region, Bank Negara Malaysia — the Central Bank of Malaysia — is planning to release five digital banking licenses in 2021, and the Bangko Sentral ng Pilipinas (BSP), the Central Bank of the Philippines, released its "Guidelines on the Establishment of Digital Banks" in December 2020. BSP actually awarded the first full rural bank license to Tonik Digital Bank back in 2019, which finally launched on March 18, 2021.

In short, a new generation of banks is evolving across Asia. The Boston Consulting Group (BCG) confirmed this in its report "The Rise of Digital Banking in Southeast Asia," published December 2020, noting that 46 banks in digital form had already been launched by domestic and regional banks, as well as by some non-financial institution players, especially big tech companies and companies with an established ecosystem.

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> We have recognized that the key drivers to profitability are a combination of a well defined strategy, an innovative product, efficient revenue streams, and a low cost structure enabled through regulatory control, technical principles, an ecosystem, and big data analytics.
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New Digital Banks Share Three Key Characteristics

Branchless

Customers can complete everyday banking needs exclusively online, using the Internet or mobile technology, with 100% digital delivery covering all products and services. This includes electronic Know Your Customer (e-KYC) capabilities, which provide customers with a frictionless experience when joining a new service.

Customer-Centric

New digital banks also offer a superior customer experience: this is an essential part of their offering. State-of-the-art User Experience (UX) design, instant and hassle-free services, precise marketing with a hyper-personalized loyalty program, and responsive customer service are also all core to digital banks.

Tech-Driven

New players use a modular technological design, advanced analytics, and agile governance, providing services that can rapidly respond and scale as demand changes. A cloud-native focus, open architecture, and data-driven processes are the key pieces that complete the puzzle.

Although some players in China have demonstrated a very successful business model — WeBank, for example, which was the country's first digital-only bank, or Alibaba's MyBank — digital banks always face risk when it comes to profitability.

Drivers of Profitability

After interviewing and talking with multiple influencers in the Asian market, we have recognized that the key drivers to profitability are a combination of a well-defined strategy, an innovative product, efficient revenue streams, and a low cost structure enabled through regulatory control, technical principles, an ecosystem, and big data analytics.

Regulatory Control

Digital banks will be expected to comply with all banking regulatory requirements as well as the risk management principle and best practices that guide financial institutions in establishing a robust technical risk management framework. It is quite challenging for those digital banks operated by non-financial institution players — who have little regulatory knowledge nor experience — and they must partner with technology suppliers who have extensive experiences in

implementing technical solutions with a high level of compliance to standards, for customers in the financial industry.

Huawei always makes compliance and security the first priority in every aspect of service development and delivery. In addition to internal legal, compliance, and security teams, we also engage strong local compliance partners to conduct an independent assessment, to provide additional assurance and support for customers. For instance, the first digital bank to launch in Hong Kong SAR was supported by Huawei and local compliance partners, who helped to build a reliable and compliant cloud platform.

Technical Principles

In C-suite level conversations with traditional banks, focused on key topics for digital transformation, one of the most serious and frequent issues raised has been the constraints of low-level legacy systems. In short,

it has become abundantly clear that the adoption of agile and advanced technology stacks is critical for digital banks. For instance, for Singapore's DBS Bank, architectural screening checks are mandatory for new applications (through questions such as: "Can it function in the cloud?" "Can it work as a micro-service?" And, "is it Application Programming Interface [API]-ready") to ensure that the bank does not mistakenly invest in obsolete technology.

Huawei — named by DBS as its Most Valued Technology Partner of the Year 2020 — has provided full stack cloud services to DBS in Singapore, Malaysia, Hong Kong SAR, and Thailand. Alongside fully scalable, fully reliable Infrastructure as a Service (IaaS) and Platform as a Service (PaaS) solutions, we have also provided flexible opportunities for banking customers to trial new Financial Technology (FinTech) solutions published in the HUAWEI CLOUD Marketplace, requiring only minor investment, empowering DBS
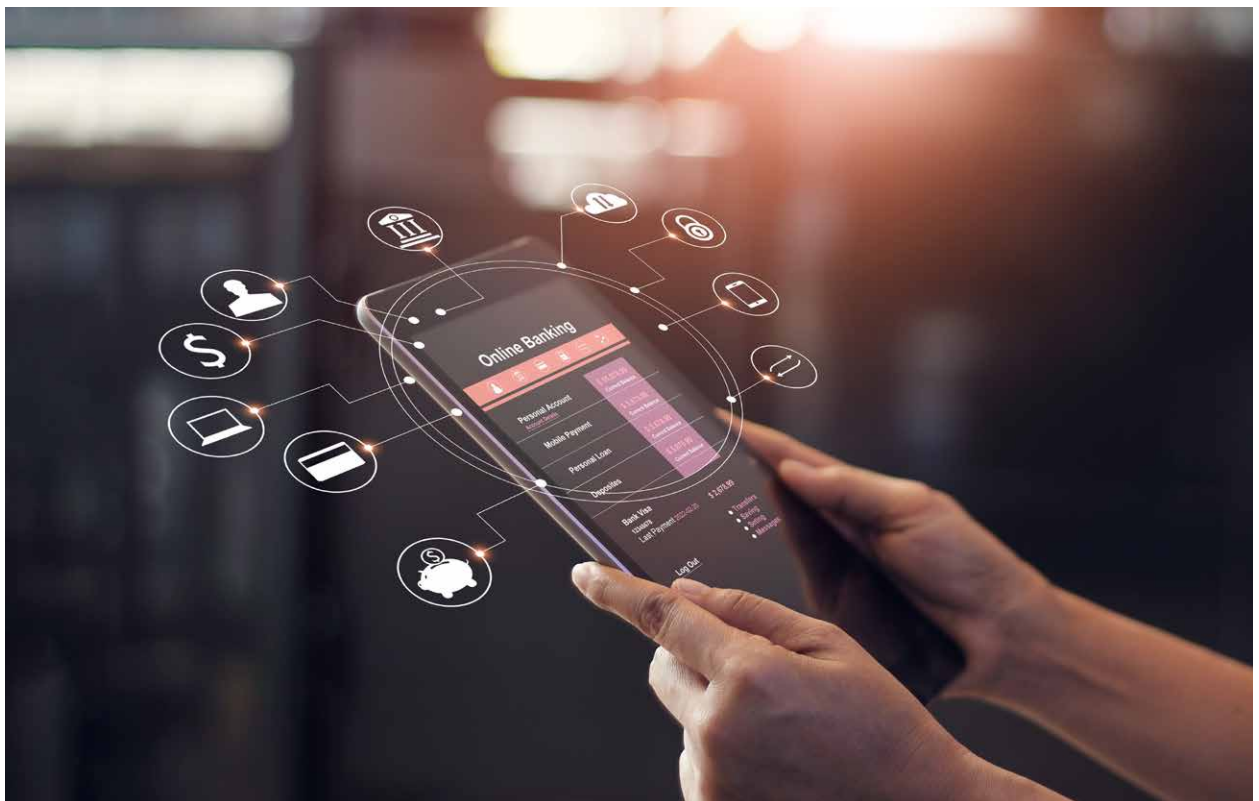
> "Digital banking allows customers to benefit from a variety of innovative financial services and offerings. In support, Huawei offers a full stack of technical solutions to help digital bank players bring a next level financial experience to life, realizing new potential for customers and banks alike."

with the capability to apply an agile operations model more productively.

Ecosystem

Digital banks must establish a strong ecosystem, pooling data from a wide range of communities to feed into an increasingly personalized product and services offering. For example, another of Huawei's customers — SEA Group in Singapore — has been able to mine information from e-commence and gaming platforms to gain insights on spending, transaction histories, demographics, ratings, and review preferences from a wide range of different customer groups. We are committed to helping our customers build their own ecosystem by bringing in a large, powerful, and diverse group of FinTech partners from both China and across the world. These partners bring a full suite of capabilities to the table, covering core banking systems, payments, digital onboarding, and conversational intelligence tools, to enable and fully support Asia's digital banking industry.

Big Data Analytics

Data is the foundation and bedrock for personalized intelligence, with advanced analytics on transactions, customers, and other data types allowing digital banks to build an understanding of customer desires and

expectations. To take just one example, Indonesia's United Overseas Bank (UOB) launched its digital bank — TMRW — operating according to a mobile-first approach. With a full set of banking solutions, TMRW recorded an astonishing 500% year-on-year growth rate in 2020. One of its most highly regarded features is the ability to analyze then predict cash flow in accounts, including patterns for upcoming payments. This allows customers to track their spending and receive personalized savings advice as and when they want it.

The big data platform that Huawei provides is a one-stop intelligent data operations platform that features a complete data governance process across the entire lifecycle, integrated with a highly customized Artificial Intelligence (AI)-driven data analytics solution. This has already been implemented for the fourth largest bank in Malaysia, giving new levels of personal financial management capability to the bank's mobile customers.

Digital banking allows customers to benefit from a variety of innovative financial services and offerings. In support, Huawei offers a full stack of technical solutions to help digital bank players bring a next level financial experience to life, realizing new potential for customers and banks alike. ▲

Building AI-boosted Intelligent IP Networks

After more than 30 years of development, IP networks have laid a solid foundation for network connectivity, and they're critical to realizing the ubiquitous connectivity that will power an intelligent world. According to Huawei GIV2025, 6.2 billion people will have access to the Internet and 100 billion connections will exist worldwide by 2025. Moreover, all enterprises will use cloud services and 85% of enterprise applications will be cloud-based. To achieve this, IP networks are required to carry more critical services, which in turn poses higher requirements on IP networks.

Kevin Hu, President of the Data Communication Product Line, Huawei

Detecting Usage Fluctuations and Diversity

A campus Wi-Fi network typically serves scenarios like office buildings, large stadiums, and large shopping malls. In these environments, the number of people in different areas fluctuates frequently and people use a variety of applications and services at the same time. O&M personnel have traditionally adjusted network resources manually. But to ensure service experience for different users, this approach is inefficient because it cannot cope with the rapid movement of people and assure user experience.

> AI-boosted campus networks can intelligently detect changes in the number of terminals, access locations, bandwidth requirements, and service experience requirements of Wi-Fi users. It can also predict trends and dynamically adjust Wi-Fi network resources to optimize network performance.

Can Wi-Fi networks become intelligent enough to detect fluctuations and multiple service types, and then automatically adjust resources to meet different service requirements? AI-boosted campus networks can intelligently detect changes in the number of terminals, access locations, bandwidth requirements, and service experience requirements of Wi-Fi users. It can also predict trends and dynamically adjust Wi-Fi network resources to optimize network performance.

Huawei has collaborated with leading customers to jointly develop Intelligent IP Networks, with test results showing that our AI-powered Wi-Fi solution can:

• Improve the throughput of wireless air interfaces by 58 percent over the industry average.

• Reduce Wi-Fi channel interference rate by 49 percent over the industry average. In addition, AI can be used for intelligent O&M on campus networks.

• Rectify about 85 percent of faults within 10 minutes.

What Will Intelligent IP Networks Look Like?

Huawei believes that Intelligent IP Networks have the following characteristics:

Super Capacity is the basis of the Intelligent IP Network architecture. At present, applications such as video, remote office, cloud computing, and AI are driving a new round of growth in network bandwidth. Campus networks are being upgraded with Wi-Fi 6 and 100GE switches, and data center networks and IP backbone networks are being upgraded to support 400GE. Advances in physical-layer performance and the emergence of network slicing networks like FlexE allow businesses to use bandwidths more flexibly and efficiently to simultaneously support multiple services, including office work, production, and computing, with a single physical network. Hard bandwidth isolation for traffic of different services enables 100 percent committed bandwidth to support verticals' key services, businesses' production networks, and operators' IP private lines. The ability to intelligently adjust the

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> Huawei's full series of network devices are embedded with AI Turbo acceleration engines, extending the AI inference capability to edge nodes and achieving real-time perception, inference, and optimization of network service quality. In addition, the AI cloud service model is used to deliver inclusive AI, enabling customers and Huawei to achieve more service innovations and speed up the advent of autonomous driving networks.
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bandwidth of different slices allows ultra-broadband networks to be flexibly adjusted for service changes, better addressing service needs.

Intelligent Experience is the ultimate goal of an intelligent IP network. Many uncertainties exist with IP networks such as inadequate or non-existent negotiation on SLA between the service layer and the network layer. As a result, the expectations (the service intent) of the service layer are unclear at the network layer, creating uncertainty on the demand side. IP networks are statistically multiplexed, meaning that the resource usage level at the network layer constantly changes with service and traffic. That creates uncertainty on the supply side.

To eliminate these uncertainties, it's necessary to accurately sense service intent. For example, the service layer could notify the network layer of service requirements, or the network layer could analyze service traffic characteristics (service models); proactively detect terminals, users, and service types; and infer the expectations of the service layer. These approaches can

help eliminate demand-side uncertainty. Furthermore, a unified platform for network management, analysis, and control can use algorithms, such as neural networks, to establish network models, detect and analyze network status in real time, and learn about network resource usage. These capabilities help eliminate uncertainty on the supply side. Intelligent experience is also a process of matching service intent with network resources to continuously provide the desired connectivity services at minimum cost, thus achieving an application-driven experience.

Autonomous driving is the key to improving user experience. Complaint-driven troubleshooting has brought significant challenges to network O&M, with the network O&M department often the last to know that a problem has occurred on the network. Proactive O&M is essential for improving user experience. First, network status should be monitored in real time to check whether an issue or potential risk exists on the network. If an issue or risk is discovered, AI can accurately identify the root cause by matching fault patterns and then automatically fix the fault before services and user experience are affected.

Three-Layer AI Architecture to Build Intelligent IP Networks

At HUAWEI CONNECT 2019, Huawei launched AI-boosted Intelligent IP Networks with three layers enhanced by AI:

AI-boosted devices: Huawei provides a comprehensive range of AI Turbo products in NetEngine routers, CloudEngine switches, AirEngine WLAN products, and HiSecEngine security gateways products. These offerings deliver edge inference and real-time decision-making, and adjust IP packet forwarding policies based on service intent to ensure optimal service experience in real time.

AI-boosted network management: Huawei iMaster NCE can identify the intent of the service layer, automatically generate and deploy network configurations, and ensure that the network meets service intent. It can also detect the health status of the physical network in real time, detect anomalies,

provide alerts, and quickly offer handling suggestions. Its built-in expert system database enables the Huawei iMaster NCE to quickly troubleshoot and optimize against network anomalies. Huawei iMaster NCE also delivers real-time visibility of SLAs and enables predictive maintenance based on AI technologies. In addition, this system provides various viewgraphs of AI-powered network capabilities, enabling partners across various industries to perform customized development.

Cloud-based AI training: The Huawei iMaster NAIE comprises a cloud platform that provides a data lake, model and training capabilities, an open ecosystem, and developer services. The solution brings the following benefits: 1) It helps businesses develop AI algorithm experts and helps developers build AI algorithm capabilities. 2) It provides training services, so that developers don't need to invest as much in computing power resources. 3) It provides a platform for sharing resource data that has undergone desensitization, which developers can use for model training. 4) It provides federated learning and transfer learning capabilities to tackle problems in model
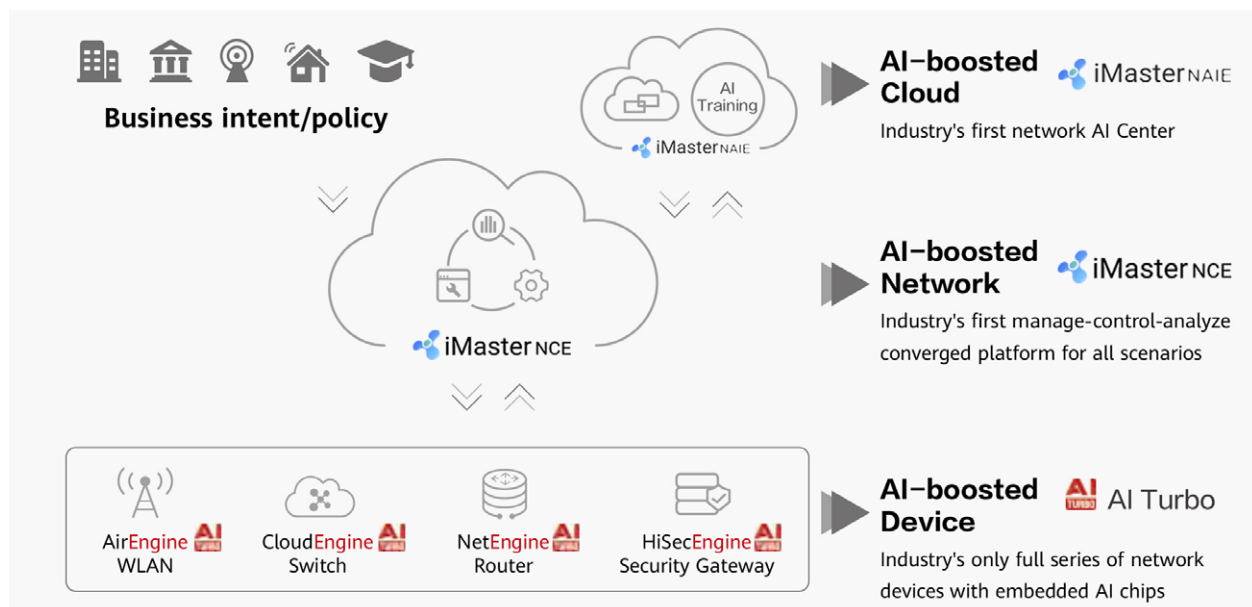
3-layer AI Architecture for Intelligent IP Networks

> " Intelligent IP Networks not only vastly improve campus networks, they also deliver breakthroughs in Data Center Network (DCN), Wide Area Networks (WAN), and security firewall fields. "

generalization and achieve model sharing.

AI training is the foundation of smart connectivity and smart O&M. In turn, building service, network, and fault models rely on training with big data and analytics. AI training can continuously evolve, enabling the entire system to become smarter, so that it adapts to rapid changes in services and networks to boost service quality and experience.

Practices and Experiences of Intelligent IP Networks

Intelligent IP networks not only vastly improve campus networks, they also deliver breakthroughs in Data Center Network (DCN), Wide Area Networks (WAN), and security firewall fields.

DCN + AI: The arrival of the AI era poses higher requirements on DCNs. According to related tests, a packet loss rate of 0.1 percent in a DCN can reduce the computing power of AI training by 50 percent. To combat this problem, Huawei launched the industry's first AI Fabric DCN solution, which achieves zero packet loss and fully unleashes the AI computing power on a DCN. This solution uses AI technologies to implement predictive traffic scheduling, achieving zero packet loss on the network and improving data computing and storage

efficiency by approximately 30 percent. In addition, Huawei and leading customers have made great progress in joint innovation by applying AI technologies to autonomous driving of DCNs. Huawei's solution can detect 75 types of frequent faults within one minute, locate them within three minutes, and rectify them within five minutes. Huawei's AI-powered DCN solution can implement intelligence in understanding service intent, selecting the optimal network path, evaluating change risks, and detecting fault and the rapid location of fault root-cause. With these achievements, Huawei has taken the lead in creating an L3 autonomous driving network in the DCN field.

WAN + AI: In today's new era, a combination of 5G, cloud, and AI is powering all industries. 5G provides unprecedented capabilities for wireless access, while cloud and AI offer almost unlimited scalability for intelligent computing (for single tenants). The bonding between 5G, cloud, and AI—the DCN and WAN networks—shouldn't be overlooked. The AI-powered DCN is the catalyst for adding AI to cloud, while the AI-powered WAN is the catalyst for joining the dots between 5G and cloud. We will use AI to advance autonomous driving networks in WAN networks and thus unleash the full potential of 5G, cloud, and AI, enabling millions of enterprises to migrate to cloud and bringing the benefits of 5G to all industries.

So, how can we make this reality?

Much like the DCN scenario, WAN networks can use AI to develop autonomous driving networks. Specifically, the AI-powered WAN can intelligently match network resources and intelligently select the optimal routes based on SLA requirements such as service latency. However, unlike the DCN scenario, WAN networks need to resolve how to quickly provision WAN networks to meet the different SLA requirements of various industries, for example, 5G telemedicine, where E2E latency must be less than 15 ms. Enabling the physical forwarding plane "body" to keep pace with the AI-powered "brain" for management, control, and analysis is a new challenge for WAN networks. Millions of enterprises are now migrating to cloud. Traditional WAN networks need to be manually provisioned hop by hop and so deployment efficiency is very poor. As virtual machines and containers can be provisioned much faster, WAN network deployment is the bottleneck. The source routing mechanism of Segment Routing IPv6 (SRv6), a next-generation routing protocol, shifts away from traditional E2E, hop-by-hop provisioning to source node provisioning only. SRv6 greatly simplifies WAN deployment and enables the body to keep up with the brain, realizing automatic and fast deployment in WAN networks.

5G-powered industries have varied SLAs, especially in terms of latency requirements. To address this, the WAN uses the SRv6 protocol to program the network forwarding route based on the optimal path calculated by the management, control, and analysis system. A route with a deterministic node, route, and latency can be quickly configured to meet the requirements of the service layer.

Therefore, SRv6 is a crucial forwarding plane capability of next-generation AI-powered WAN networks. SRv6 enables the WAN to intelligently recommend the optimal route, quickly deploy the optimal connections, and optimize service SLAs in real time. Together with 5G and cloud technologies, SRv6 can enable millions of enterprises to move to cloud.

Network security firewall + AI: Malware has many variants and is difficult to detect, especially by today's firewalls that use signature matching. Huawei confirmed its leadership in the industry by launching the industry's first T-level AI firewall series, HiSecEngine USG12000. It handles threats that traditional firewalls cannot detect and uses a unique threat detection AI Engine (AIE) to identify, for example, compromised hosts and communication with external Command and Control (C&C) servers—at network borders in real time. Achieving a detection accuracy of more than 99 percent and powered by the AI chip, HiSecEngine USG12000 improves threat detection performance five-fold. By applying intelligent security event analysis and intelligent security policy optimization technologies, HiSecEngine USG12000 achieves service rollout in minutes and implements service-driven policy deployment and change, reducing OPEX for security O&M by 80 percent. The next-generation AI firewall will provide intelligent network border protection and build impenetrable high security for enterprises.

Summary

Customer-centricity is Huawei's core philosophy. Customer needs are always the driving force behind Huawei's development. Through the NetCity joint innovation program, Huawei combines the requirements of leading customers with its own R&D capabilities to develop leading IP network solutions and shape the future of IP networks with its influence in the IP standards community. Huawei will continue to work with customers and partners worldwide to continuously incubate cutting-edge products and solutions and lead the way in intelligent IP networks. ▲

The 5G Era Is Coming — Do Enterprises Still Need Wi-Fi 6?

While wireless networks offer a great degree of business agility and technological flexibility, there remains some confusion about 5G and Wi-Fi 6. Indeed, with all the hype surrounding 5G, some have questioned if a Wi-Fi 6 network is necessary at all, given that the 5G era is already fast approaching. But Huawei expert and Chair of the IEEE802.11ax working group, Dr. Osama Aboul-Magd, has clearly stated that "5G and Wi-Fi 6 are two different things, so they don't compete, more coexist."

By Shi Ri, Solution Architect of the Huawei Asia-Pacific Enterprise Scenario Based Solution Dept.

W hile both technologies offer large bandwidth, low latency, and a massive amount of connections, their use cases differ: 5G is better suited for extensive outdoor coverage for individuals or industries, whereas Wi-Fi 6 excels in high-density indoor coverage for enterprises.

The Superior Option for Indoor Coverage

But what exactly makes Wi-Fi 6 the superior option for enterprises for indoor coverage?

Quite simply, Wi-Fi 6 allows enterprises to quickly establish their own networks, customized to their specific service needs. For example, an enterprise can tailor a network for an office environment while a school can optimize it for student access. Going beyond traditional Wi-Fi scenarios, Wi-Fi 6 can also be used for enterprise-grade Virtual Reality (VR), Augmented Reality (AR), and 4K applications, as well as for Automated Guided Vehicles (AGVs) in warehousing and logistics, and asset management for supermarkets and factories. In contrast, 5G focuses on public networks and is deployed in scenarios with high roaming and latency requirements, such as autonomous cars, drones, outdoor personal networks,

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and factories with ultra-low latency requirements (under 10 ms).

As such, there are several characteristics that make Wi-Fi 6 more suitable for indoor wireless coverage.

Operation Models

Enterprises can chose to own a Wi-Fi 6 network or simply consume it as a service. 5G, on the other hand, can only be provided as a service by a cellular service provider. As a result, Wi-Fi 6 offers far greater flexibility for customized services, from indoor navigation to user behavior analysis. Customizing carrier-provided 5G services is far more difficult.

Ecosystem

Wi-Fi provides a diverse ecosystem. A majority of devices — from laptops, mobile phones, printers, scanners, and smart whiteboards to security cameras, AGVs, and robots — are already Wi-Fi ready. In comparison, 5G devices are still by and large limited to mobile phones.

IoT Integration

Indoor Internet of Things (IoT) has become more

and more popular and it's not hard to see why. IoT has diverse use cases, playing a vital role in energy efficiency, facility management, asset management, and more. No additional construction costs are required to integrate IoT with a Wi-Fi network, making it a far more cost-effective option compared to 5G. The most common indoor IoT technologies — such as Radio Frequency Identification (RFID), Bluetooth, and ZigBee — are all supported by Huawei AirEngine Wi-Fi 6.

Cost Efficiency

In the 3G and 4G era, the cost per bit of Wi-Fi was only around 1/30 of the cellular network. This rate is little changed in the 5G era. Due to the need for licensed spectrum and a dedicated 5G core network, the cost of 5G is high compared to Wi-Fi 6, cementing the latter's position as the most cost-effective and reliable wireless solution for enterprises, big and small.

Huawei is a leader in the Wi-Fi 6 market. With AirEngine Wi-Fi 6, Huawei took the lead in deploying the industry's first enterprise-class Wi-Fi 6 network in Shanghai as early as 2018. Since then, AirEngine Wi-Fi 6

has been put into large-scale commercial use in diverse regions around the world, from Spain, Italy, Switzerland, and Belgium to South Africa, China, and India.

With unique antenna and algorithm technologies powered by Huawei 5G, AirEngine Wi-Fi 6 helps enterprises build Wi-Fi 6 networks without coverage holes, provide services with no waiting times, and achieve zero packet loss during roaming.

This allows a wide range of sectors — including digital education, digital airports, omni-channel finance, smart healthcare, smart government, and smart manufacturing — to build fully wireless campuses that are tailored to their precise needs.

Cutting-Edge Technologies of Huawei AirEngine Wi-Fi 6

Powered by an array of cutting-edge technologies,

Huawei AirEngine Wi-Fi 6 is setting the market pace.

Smart Antennas

AirEngine Wi-Fi 6 Access Points (APs) feature 16 Smart Antennas — the highest number in the industry — and a unique dual-band dual-polarized co-planar antenna design, with Artificial Magnetic Conductor (AMC) antenna materials. Performance is further enhanced by Huawei's unique four-element electronic switchgear and dynamic coverage direction adjustment algorithms, as well as beamforming technology. Together, these features enable signals from APs to move with users, doubling signal strength at the same location, and increasing coverage distance by 20%.

SmartRadio Roaming and VIP

AirEngine Wi-Fi 6 can be tailored to the service requirements of customers, using roaming processing algorithms and the practices of cellular mobile networks. Specifically, AirEngine Wi-Fi 6 APs identify

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and notify terminals of available idle channels before roaming: terminals therefore don't need to scan all channels, slashing roaming handover times.

Huawei AirEngine Wi-Fi 6 also goes beyond Orthogonal Frequency Division Multiple Access (OFDMA) technology. A hardware-based multi-queue mechanism efficiently groups users, while air-interface slicing technology slices wireless air interface resources based on service requirements. With these innovations, Hierarchical Quality of Service (HQoS) assurance for data forwarding and scheduling, as well as air interface resource scheduling, is achieved, cutting the latency for key services to as low as 10 ms — 50% lower than the time stated in the Wi-Fi 6 standards.

Intelligent Network Analysis

Intelligent analysis revolutionizes traditional resource monitoring, collecting network data in real-time using telemetry. Learning network behavior, fault patterns are identified based on big data analytics and Machine Learning (ML) algorithms, allowing Operations and Maintenance (O&M) staff to proactively discover 85% of network issues, ensuring an excellent network

experience for end-users. Real-time experience visibility and fault location within minutes further enhance Wi-Fi 6 network management.

The era of digital business has arrived and all companies must now focus on building a strategy to capitalize on the new opportunities that it brings. The first step in the evolution toward a digital business is to make an enterprise connected, with mobility sitting as the centerpiece strategy. The foundation of any connected business is a wireless network. In the past, a wireless network was treated as a tactical resource by most organizations, one to be used to incrementally improve productivity, untethering employees from their desks.

Now, however, the wireless network of a connected business is a strategic asset, used to create new business processes and change the way organizations interact with employees, customers, and each other. As such, building a robust wireless network using Wi-Fi 6 and IoT should be a key priority for business and Information Technology (IT) leaders, no matter their sector, no matter their size. ▲

CloudFabric: Leading DCNs into the Intelligence Era

Data has been becoming the core production factor in driving economic growth, and data infrastructure is the key to gain a competitive edge. As a strategic highland for the digital economy, it's a top priority to optimize data center operation efficiency to unleash the computing power and the value of data.

By Leon Wang, President of the Data Center Network Domain, Data Communication Product Line,Huawei

Having experienced the agricultural and industrial eras, the world is now entering the digital economy era, which is emerging due to the rapid development of Information and Communications Technology (ICT). According to a survey conducted by Gartner, 75 percent of large enterprises have already transferred their strategic focuses to digital transformation. While the most critical production elements were land and labor in the agricultural era and capital and technology in the industrial era, data and intelligence have taken their place in the digital economy era. A deluge of data is generated during digital transformation, which has become part of enterprises' core assets. However, data is not an end in and of itself: rather, it is knowledge and wisdom that remain our true pursuits. In this context, the focus of enterprise digital transformation is how to harness the power of Artificial Intelligence (AI) to gain genuine insight from transient data, and ultimately monetize such data. As such, AI has become the key driving force for enterprises to reshape their business models, improve their customer experience, and redefine their futures. +AI signifies a key milestone for enterprise digital transformation in the intelligence era.

> Data has been becoming the core production factor in driving economic growth, and data infrastructure is the key to gain a competitive edge. As a strategic highland for the digital economy, it's a top priority to optimize data center operation efficiency to unleash the computing power and the value of data.

AI is driving Data Center (DC) reconstruction as Data Center Networks (DCNs) face new challenges. Intelligent upgrades of enterprises drive DCs to transition from the cloud era into the AI era. Compared with traditional DCs, cloud DCs are more like service support centers, with applications at the core, and can quickly provision IT resources through a cloud platform. From this foundation, the AI DC goes further still, evolving into a business value center that focuses on how to efficiently process data using AI.

Without a doubt, running AI efficiently requires an enormous amount of computing power. For example, a common AI training for speech recognition involves 20E (1E = 1018) floating-point operations. Even if the world's most powerful supercomputer is used, it would take an extended period of time. Such stringent requirements for AI computing power are the driving force behind the evolution of DC architecture. The emerging DC architecture in the intelligence era is characterized by all-flash storage data lakes serving as the core, with GPU/AI diversified computing as the computing base. Additionally, storage and computing facilities are both undergoing drastic changes. All-
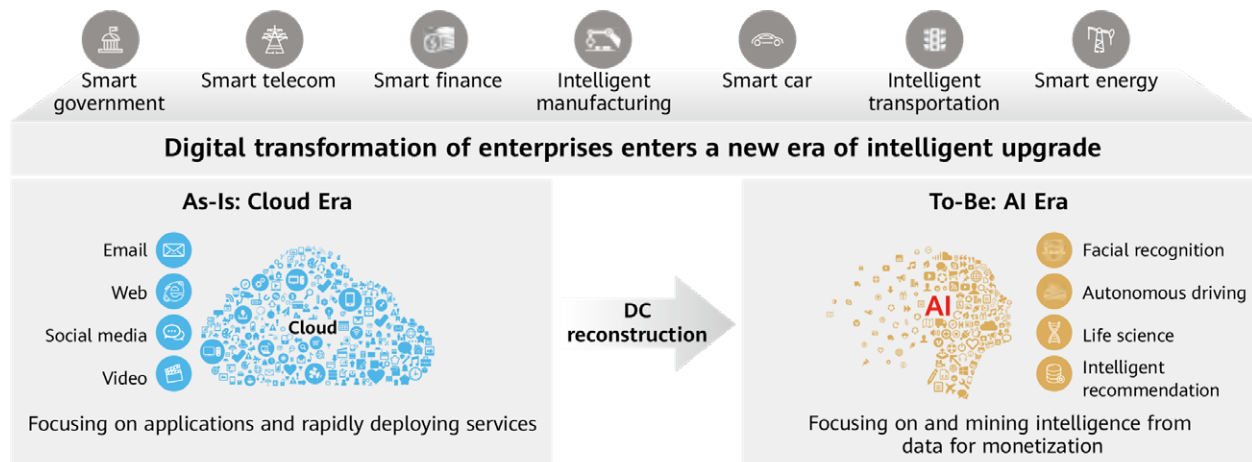

Figure 1:AI-powered Data Center Reconstruction

flash storage, for instance, has improved storage performance 100 fold while GPU/AI intelligent computing has also improved computing performance 100-fold.

If the running efficiency of a single server is accelerated by improving the performance of the processor and storage medium, the running efficiency of the entire DC can also be improved by enhancing the performance of the DCN. Indeed, DCNs have become the impetus for unleashing the DC computing power and monetizing data value in the intelligence era. As an enabling technology in the intelligence era, AI presents both new opportunities and challenges for DCNs seeking to complete intelligent upgrades and improve deployment and O&M efficiency.

CloudFabric Upgrade for the AI-Powered Intelligence Era

As the key to unlocking the gold mine that is data, AI is essential to the success of enterprises' digital transformation and intelligent upgrade. The pervasive use of AI technologies has driven disruptive changes in the mission of enterprise DCs. As AI technologies are widely used in DCs, Huawei has upgraded the CloudFabric solution to help enterprises overcome the new challenges.

World's Highest-Density 400GE DCN, Connecting Enterprises to the Intelligence Era, Enterprise digitalization has led to an exponential increase in global data volume every year. Huawei GIV predicts that the data volume will reach 180 ZB by 2025, a 20-fold increase in a span of just 10 years. Currently, 100GE DCNs cannot cope with the challenges posed by the surge in data volume expected over the next few years. In addition, from the perspective of mainstream AI service servers in the industry, 100GE NIC interfaces have become standard configurations, indicating that

the 400GE era has arrived.

In 2019, Huawei launched the industry's first DC switch, CloudEngine 16800, which is designed for the AI era. The CloudEngine 16800 has upgraded the hardware switching platform and made breakthroughs in multiple fields, achieving ultra-high-speed signal transmission, super heat dissipation, and efficient power supply based on the orthogonal architecture. It provides the industry's highestdensity 48-port 400GE line card in a single slot and the industry's largest 768-port 400GE switching capacity. With five times the industry average switching capacity,CloudEngine 16800 easily satisfies the traffic multiplication requirements in the AI era.

Industry's First Zero-Packet-Loss Ethernet, Unleashing Full Computing Power Potential in the Intelligence Era

The core of the intelligence era is to introduce AI to mine data value. AI computing, characterized by deep learning, depends on the input of massive data, and the data access speed directly affects the computing power. Improvements in both computing and storage performance, however, further deteriorate the congestion and packet loss issues on the traditional network. In the AI era, even 0.1 percent packet loss will directly cause the computing power to decrease by nearly 50 percent. Even worse, packet loss will become more serious as the service load and distributed computing traffic increase. Moreover, because computing power of AI DCs is so expensive, insufficient computing power has become a major challenge. Even when computing power is available, it cannot be fully used due to network bottlenecks. Building a lossless DCN, therefore, has become a priority for many in the AI era.

CloudEngine 16800   CloudEngine 16800

AI chip

iLossless algorithm

Compute cluster   **Storage cluster**

CloudEngine 8850   CloudEngine 6865   CloudEngine 8861

Zero packet loss   **100%** throughput   **<10**us E2E latency
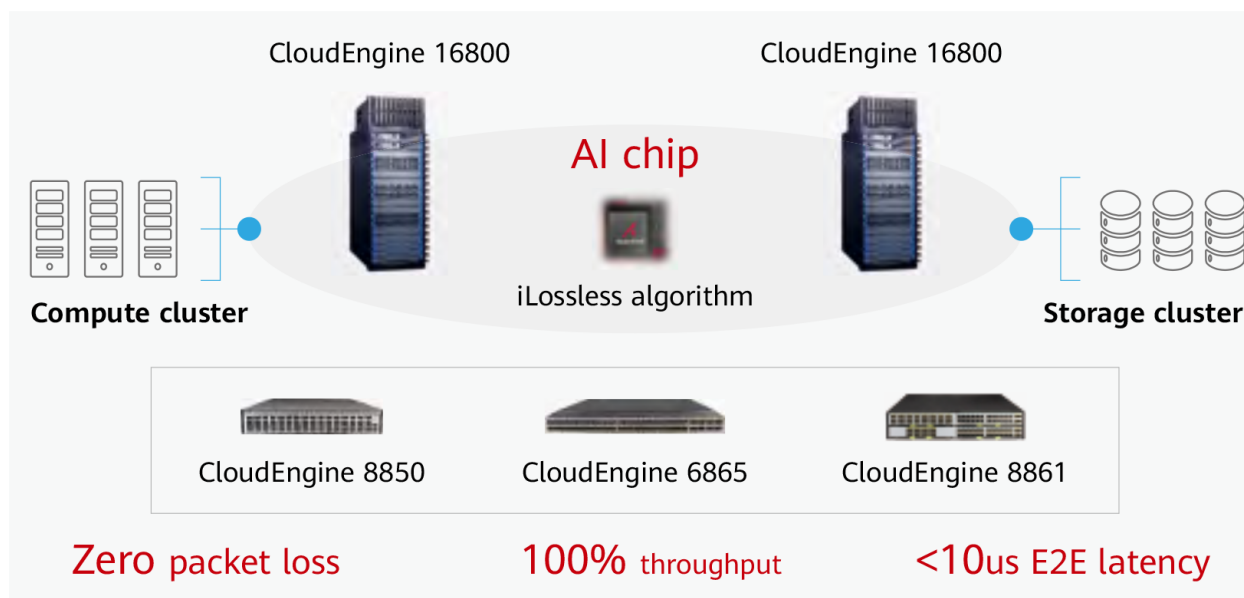
Figure 2:Huawei AI-powered CloudFabric Solution

Huawei CloudEngine 16800 is the industry's first DC switch equipped with high-performance AI chips and features an innovative iLossless algorithm that implements adaptive traffic model optimization. Intelligent and lossless DCNs built based on CloudEngine switches implement zero packet loss on the Ethernet, fully unleashing the potential of AI computing power. As verified by Tolly, Huawei's intelligent and lossless DCN achieves 27 percent higher AI training efficiency than other networks in the industry when the same GPU cluster is used.

Huawei's intelligent and lossless DCN has been applied to the Atlas 900 AI training cluster, which boasts the world's highest computing power. Indeed, the intelligent lossless DCN was the key to enabling Huawei to break through the performance bottleneck to set a new world record. Besides being a high-performance network oriented to AI training clusters, Huawei's intelligent and lossless DCN is also a next-generation network architecture oriented to DCs in the intelligence era.

The autonomous driving DC, which first implements

full intelligence of the network before advancing towards autonomy and selfhealing, is constantly growing in scale, and its structure is becoming increasingly complex. The Operating Expenditure (OPEX) of some DCs may even be three times higher than the Capital Expenditure (CAPEX), and the efficiency and cost of DCs face structural challenges. Even if the mainstream SDN is used to implement automatic network deployment, administrators still need to understand service intents, perform routine network inspections, and locate and rectify faults.

Huawei was the fi rst to propose the autonomous driving network concept. Based on the SDN network architecture, Huawei introduced AI technologies in the end-to-end process of planning, deployment, running, maintenance, optimization, and operation for network devices, network management and control, and upper-layer service orchestration systems. Through AI technology, networks have evolved: automated service deployment and action execution are replaced with intelligent fault self-healing, network self-optimization, network autonomy, and self-healing, free from any manual interventions.

The fully intelligent AI-powered CloudFabric solution can preliminarily implement intelligent understanding of service intents, intelligent selection of the optimal network path, intelligent evaluation of change risks, intelligent fault detection, and quick location of root causes. For 75 types of common faults, the solution can detect faults within one minute, locate them within three minutes, and rectify them within five minutes. The solution is the first to implement the industry's first L3 autonomous driving network in the DCN field as certified by Tolly.

New CloudFabric, Leading DCNs into the Intelligence Era

Around the year 2000, with the development of enterprise informatization strategies, real enterprise DCs were born.

In 2010, Huawei proposed the enterprise digitalization strategy. As cloud computing boomed, Huawei took the lead in releasing the industry's first cloud DCN, CloudFabric, leading DCs into the cloud era, realizing the elastic scaling and automatic provisioning of IT resources.

Enterprise digital transformation has entered a new phase of intelligent upgrade. As AI is widely adopted in DCs, Huawei has upgraded the CloudFabric solution. Huawei CloudFabric is the first solution to offer full intelligence for DCNs and implement the industry's first L3 autonomous driving network. In addition, Huawei CloudFabric uses the world's highestdensity 400GE CloudEngine switches with embedded AI chips and an innovative iLossless algorithm. The solution also uses the industry's only intelligent and lossless DCN with zero packet loss, which unleashes the full computing power potential for AI. It enables AI services to run more efficiently while fully monetizing the value of data, leading DCNs into the era of intelligence.

Data has become the core factor of production in driving economic growth, and whoever has the leading "data infrastructure" can gain an edge. DCs have become a strategic high ground for the digital economy.

To that end, enterprises are prioritizing the optimization of DCs to more effectively unlock the computing power potential and data value. ▲

CLOUDENGINE SERIES SWITCHES, REACHING NEW SPEEDS FOR DATA CENTER NETWORKS IN AI ERA

Ai chip and iLossless algorithm combined, attaining the first ever 100% lossless performance

- **27%** betterment in Ai training*
- **30%** faster in HPC job completion*
- **30%** improvement in distributed storage latency*

Understanding All-Flash Storage Arrays

AFAs in data centers are rapidly gaining prominence, given that their design center is optimized for the characteristics of flash, as opposed to being retrofitted from earlier generations of legacy spinning hard disk technology. With the introduction of SSDs around 2009, Huawei started offering All-Flash storage for Tier 0 and Tier 1 applications, increasing initial flash adoption rates in hybrid tiered storage for mixed workloads.

By Chris Mawer, CTO of Huawei Asia Pacific, Data Storage Dept.

As the technology developed and costs dropped, customers began to increasingly embrace All-Flash storage thanks to its consistent levels of performance and low-latency response. And even with a higher initial investment, the deduplication and compression capabilities of All-Flash storage make it more economically viable on a cost per GB basis, further encouraging customers to move away from tiered-based hybrid storage alternatives.

Understanding the AFA Design Center

All storage systems are created with a design center that serves a specific purpose, targeting a specific degree of scale, availability, performance, cost, drive type, protocol, or workload, for example. Indeed, dual-controller, multi-controller, scale-out, shared-everything, and software-defined design centers are commonly seen in the industry today.

When inherited from a legacy storage design, such as a hybrid storage array say, design centers are often laden with technical debt. This is often the case in scenarios where we see bottlenecks in maximum performance, capacity, or availability constraints.

Organizations today expect the same levels of availability from their storage systems as they get from

their virtual environments. In a virtual environment, when a physical virtualization host fails, its workload automatically migrates to other hosts within the virtual server resource pool.

The same cannot be said for most storage systems today. When a dual-controller array has a controller failure, the array's performance is suddenly halved, and should the second controller also fail, then the data becomes unavailable. This leads to Virtual Machines (VMs) being taken offline and inevitable downtime — the bane of any data center.

To address this very issue, DBS Bank in Singapore chose Huawei OceanStor Dorado All-Flash storage arrays for their virtual server environment. Inherent to OceanStor Dorado's multi-controller shared-

everything design center, the AFA can tolerate 7 out of 8 controller failures while keeping data available and virtual machines online. Today, the bank enjoys the same levels of availability they expect from their virtual server environment, from the storage that powers it.

Huawei All-Flash storage is also designed without the technical debt of past dual-controller system designs, such as Serial Attached SCSI (SAS) back-ends, dumb disk enclosures, and limited availability characteristics. This is a decisive factor for organizations seeking new storage infrastructure.

Simply put, Huawei doesn't take shortcuts, designing a solution that lasts 10 years without data migration, as opposed to a legacy design that

will need a forklift replacement and complete data migration every five years.

Why the Design Center Matters

A multi-controller shared-everything design center improves availability and scalability with a single system able to scale up to multiple petabytes and keep data available online, whilst tolerating a failure of up to 7 out of 8 controllers.

These are the same design principles behind VM resource pools, where a cluster of servers create a common resource pool that rely on each other in the case of a failure.

All-Flash Storage and AI

Huawei leverages the latest in Artificial Intelligence

(AI) technology through its own innovative HiSilicon chipsets, improving performance and system availability.

AFA Use Cases

Typical use cases for All-Flash storage arrays are constantly changing, and the lines between storage tiers are becoming blurred due to higher cost-effectiveness. Once only positioned for Tier 0 and Tier 1 workloads — for mission-critical virtualization and database services, for example — Huawei All-Flash storage is now capable of delivering a single consolidated storage array for all tiers of storage, including the consolidation of file storage for file servers and Network-Attached Storage (NAS) devices, for which hybrid storage systems were previously responsible. This has all been made possible thanks to advances made in the multi-controller shared-everything design center, deduplication, and cost economics.

1 Transmission
Network chip
3x lower network latency

2 Compute
Kunpeng 920 processor
2x higher performance

3 Intelligence
AI chip
50% better read hit ratio*

4 Management
Management chip
30% higher fault location accuracy

5 Storage
SSD controller chip
2x lower write latency

* The read hit ratio of semantic-related I/Os is improved. The data is from Huawei OpenLab tests.

> 66
>
> 1145 government customers from 114 countries rely on Huawei All-Flash storage to accelerate their digital transformation. 8 of the world's top 20 banks choose Huawei All-Flash storage for their mission-critical. applications.
>
> 99

Tier 0: The highest performance tier (with the greatest Input/Output Per Second [IOPS] to cost ratio), covering block storage solutions for financial transactions, ecommerce apps, and any applications where performance is a premium.

Tier 1: The second-highest performance tier (with a balance between the IOPS to cost ratio and capacity), covering business processing, data analysis, and data mining.

Tier 2: The lower performance tier (with a key focus on capacity), covering email, file, and print data, as well as data backups and archives.

Typically an organisation may only have a few TBs of file data, which was previously consolidated on a Tier 2 hybrid storage array, along with other workloads and a flash cache to increase performance.

With flash now becoming more economical, organizations are finding it just doesn't make sense to invest the US$50–100,000 for an independent system to store file data, when the same capacity can be consolidated in an All-Flash array at nominal extra cost.

The Future of All-Flash Storage, NVMe, and NoF

AFAs offer increased speed and performance and the latest generations — such as Huawei OceanStor Dorado — leverage Non-Volatile Memory express (NVMe) and NoF (NVMe over Fabric) to maximize data transfer speeds and minimize latency.

The future of flash storage — based on NVMe, NoF, and Storage-Class Memory (SCM) — can dramatically accelerate applications, reducing latency and increasing IOPS to meet the most demanding virtualization, database, and analytics workloads, while also providing plenty of headroom for other less critical workloads to be consolidated alongside them.

Huawei has been the first to market with NVMe and NoF support for the front- and back-ends, delivering up to 21 million IOPS at 0.05 ms latency, with high capacity 7.68 TB and 15 TB NVMe SSDs, and Smart Enclosures that offload Input/Output (I/O) handling to reduce service pressure on the controllers.

RDMA Efficiency

There are two schools of thought with regards to

handling data transfers in storage arrays, typically split between the Internet Protocol (IP) Internet Small Computer Systems Interface (iSCSI) camp and the Fibre Channel (FC) camp. Remote Direct Memory Access (RDMA) is a technology that reduces latency with data transfers and blurs the lines between iSCSI and FC.

RDMA is efficient because it addresses data transfer between two endpoints, rather than data transfer within a system. Choosing between FC and RDMA can be difficult because both have advantages and disadvantages. RDMA with flash reduces latency over the network portion of the Storage Area Network (SAN), which would otherwise be slowed down by SCSI translation layers and SAS Host Bus Adapters (HBAs).

RDMA over Fabrics is the logical evolution endpoint for existing shared storage architectures, increasing performance access to shared data. And RDMA over Converged Ethernet (RoCE) is the fastest possible network implementation of RDMA today.

RoCE is Great for the Back-End

When it comes to multi-controller scale-out SANs, such as the Huawei OceanStor Dorado AFA, a dedicated network fabric is required for the back-end SmartMatrix connectivity between controllers.

Huawei leverages RoCE for the SmartMatrix in its multi-controller shared-everything mesh architecture and Smart Disk Enclosures. As the fabric between controllers is independent of the front-end host connectivity, there is no need to retool your servers with new HBAs or switches for host connectivity, yet you can gain all the benefits of a parallel distributed network for your storage array.

FC-NVME is the Front-End Winner

With the ability to leverage existing investments in FC infrastructure without changing applications, virtual environments, or operating systems, FC-NVME is the clear winner for front-end connectivity today. The FC protocol is an established, mature standard for storage to host connectivity and FC-NVME has the highest level of ecosystem support.

RoCE is the Future of All-Flash

For new infrastructure deployments where servers can be configured with RoCE HBAs and RoCE compatible switches, moving to RoCE may be the most cost-effective choice. Consolidating separate SAN and Local Area Network (LAN) infrastructure investments with a single hybrid switching infrastructure — such as Huawei CloudEngine — while supporting NoF, iSCSI, and TCP/IP traffic on a single platform, RoCE will power the All-Flash data center of the future.

Why Choose Huawei All-Flash Storage?

Huawei has a multi-controller shared-everything architecture designed for flash with NoF and a ten year, migration-free life cycle.

Delivering the same high levels of availability that you would expect from your virtual environment Service Level Agreement (SLA), with the ability to sustain up to seven out of eight controller failures and still keep data available online.

Consolidate file and block workloads with Huawei OceanStor Dorado All-Flash storage, saving on costly separate storage silos.

All the enterprise features you expect and more: active/active, async/sync replication, snapshots, clones, thin provisioning, Continuous Data Protection (CDP), wide-stripe, enterprise application support for Microsoft, Oracle, Red Hat, SAP, and VMware. ▲
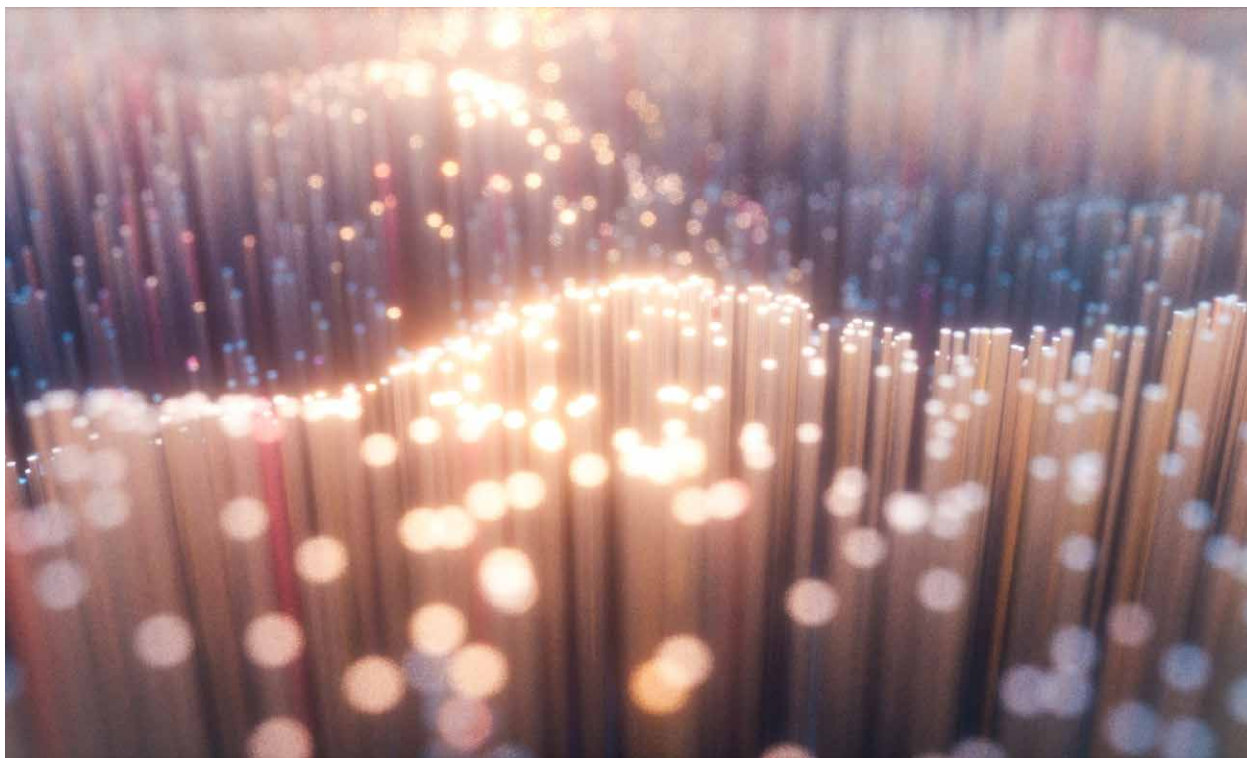
The Pressing Need to Deliver Digital Transformation Over Fiber Optical Networks

Enterprises are experiencing a historic development opportunity, with favorable policies and markets propelling the development of optical communications. Fiber optic networks, as a foundation for the new approach to technology, is providing the intelligence for digital economies, and empowering enterprises across all verticals to take advantage of the opportunity.

This article was originally posted on ZDNet and has been edited.

As noted in a McKinsey report, digital transformation has accelerated by the equivalent of three to four years in the last year alone. Meanwhile, smart technologies are rapidly transforming how cities and entire business sectors are operating. Industry 4.0 — a new industrial revolution, where digital technologies increasingly underpin every aspect of work — has been on the horizon for a few years now, but events over the past year are proving to be the big catalyst, or inflection

> Fiber optical networks are providing the platform and foundation that enable transformation solutions to deliver on their promise. By minimising latency and maximising bandwidth and scalability, enterprises can deliver the kind of real-time processing and insights that are needed for transformation activities.

point, for it. All this transformation means that enterprises are better able to serve their customers, work rapidly, and build digital services for better efficiency and productivity.

Underpinning all of this innovation is a new wave of innovation in connectivity infrastructure: fiber optical networks.

According to an Ernst & Young (EY) report, it is fiber optical networks that will provide the foundation for society to take this next step into a digitally-driven future. "The fiber-connected era can connect everything, achieving massive data transmission and breaking its own limitations," the report states, before highlighting three areas in particular that are "upgraded" when operating over fiber.

Technical upgrades: Improved bandwidth, stability, latency, and reliability allows consumers and businesses to further rely on connections.

Application upgrades: Fiber enables Ultra-High-Definition (UHD) media, Virtual Reality (VR) and Augmented Reality (AR), the Internet of Things (IoT),

and smart services that allow all parties to do more with their Internet.

Infrastructure upgrades: Fiber allows data-driven organizations the capacity and bandwidth to upgrade their network architecture and drive even deeper into data.

Meanwhile, according to the International Data Corporation (IDC), there is a long way for organizations to go before they are fully transformed: 63.2% of enterprises have only just begun their transformation journey (or have yet to start at all), and only 8.4% are fully transformed. The opportunity is there for the bulk of enterprises to gain an early mover advantage and competitive differentiation, leveraging the opportunities of fiber optical networks to accelerate their transformation now.

Everything Is Becoming Smart

Fudan University in China is one such organization that has an aggressive digital transformation strategy, built on the back of a fiber optical network. The goal

for the university is to leverage an Internet + Smart Campus strategy as its pathway to building a world-class university. Fudan University engaged with Huawei to deliver a fiber optical network solution — Huawei Campus OptiX — which has enabled a raft of digital applications across the university experience, benefiting both students and educators. These benefits include: eHall, eLearning, unified payment, smart meal ordering, self-service smart library, and simulated medical operations (for medical students) using technologies including facial recognition, VR, and AR.

This fiber optical network platform that the university rolled out is also highly upgradable, and can be seamlessly upgraded to 10G, 20G, and 50G down the track. It can also satisfy the requirements for Wi-Fi 6 connectivity and, as a final benefit, in comparison to traditional Ethernet, the fiber optic network minimizes the need for weak-current rooms, cooling devices, and cabling, resulting in a 30% fall in energy consumption.

Education is just one example of an industry vertical that benefits from fiber optic cabling. Across all sectors

this technology has relevance — it enables more efficient logistics in retail, telemedicine applications, Smart Cities, and advanced manufacturing. For example, in Germany, manufacturing — which accounts for around 20% of Gross Domestic Product (GDP) — has benefitted greatly from the Industry 4.0 innovation that fiber optical networks have unlocked. Through these networks, German manufacturers have been able to lead the world in smart manufacturing, through data collection, remote monitoring, and precise control — all of which require the kind of high bandwidth, low latency, and low jitter that fiber optical networks enable (see table below). This allows the German manufacturing industry to invest in targeted technology upgrades, adopting network slicing, edge computing, converged network architecture, industrial security systems, industrial network monitoring, and industrial network standardization as applicable to their Industry 4.0 goals.

For Chief Information Officers (CIOs), the considerations that fiber optic networks enable include:

1. Data density and modularity: CIOs can leverage larger

	Big data collection	Remote monitoring	Precise control
Characteristics	Connected devices and closed-loop from production to sales	Fiber optic network devices for real-time remote monitoring of working status and fault detection	High-frequency muitl-antenna technologry for efficient and precise industrial control.
Bandwidth	50 Mbit/s	500 Mbit/s	1 Gbit/s
Latency	100 ms	< 10 ms	1–10 ms
Jitter	—	< 1 ms	< 100 µs

> Fiber optic network, as a foundation for the new approach to technology, is providing the intelligence for digital economies, and empowering enterprises across all verticals to take advantage of the opportunity.

data pools in real-time, across the entire network.

2. Edge computing: The edge has always relied on low latency and stable connections for those processes that can't be handled on-site, across an expansive range of endpoint devices. Fiber optic networks unlock that potential.

3. Automation: The bandwidth capabilities of fiber optic networks mean that wide-scale automation can be deployed across the organization, freeing up employees to focus on higher-end tasks.

Transformation is Still a Challenge — but One That Can Be Overcome

As the IDC report shows, only 8.4% of enterprises are fully digitally transformed, and only 28.4% more consider themselves substantially down the path of transformation. For nearly two thirds of enterprises, digital transformation remains a long-term goal.

The reason for this is simple: CIOs understand that transformation is challenging, and over 70% of transformation exercises fail to deliver on their expected value. However, at the same time, there is an understanding that transformation is increasingly a do or die mission, with spending on transformation rising

10.4% to US$1.3 trillion in 2020.

Fiber optical networks are providing the platform and foundation that enable transformation solutions to deliver on their promise. By minimizing latency and maximizing bandwidth and scalability, enterprises can deliver the kind of real-time processing and insights that are needed for transformation activities.

The question that the technology then asks is: what can organizations do to deliver the best possible chance that a digital transformation activity will return value? Part of the solution is to partner with companies that have proven expertise in designing and delivering transformation, and can help their customers to break down the silos within the organization, in order to treat digital transformation as a whole-of-enterprise process. Ultimately, not following this approach is one of the main reasons that digital transformation fails.

Enterprises are experiencing a historic development opportunity, with favorable policies and markets propelling the development of optical communications. The fiber optic network, as a foundation for the new approach to technology, is providing the intelligence for digital economies, and empowering enterprises across all industry verticals to take advantage of the opportunity. ▲

Huawei's Hybrid Cloud Solution Drives

KMUTT's Digital Transformation

King Mongkut's University of Technology Thonburi (KMUTT), was established in February 1960. In March 1998, it became the first public university in Thailand to receive full autonomy in terms of financial management, human resource management and academic programs.

Based on The World University Rankings, KMUTT came 1st in Thailand three years in a row (2018, 2019 and 2020) for Engineering and Technology. With a population of over 16,000 students, it enjoys a strong reputation all over the Asia-Pacific region. Its main areas of expertise cover Architecture, Bioresources, Digital, Energy,

> With Huawei Hybrid Cloud's virtual resource pool, it is much easier to control, monitor and forecast resources, thanks to the ability to customize the number of CPUs, memory size, and networks to fit the university's needs. The Huawei Hybrid Cloud Solution safely stores data and efficiently prevents data loss, minimizing long-term CAPEX.

Engineering, Environment, Linguistics, Science and Technology.

Determined to remain a top university with a prominent role in technology and research, KMUTT aims to provide quality teaching & learning, research, and academic services that can enhance Thailand's economic development and quality of life.

Deploying a Centralized and Cost-Effective Cloud System

In line with the university management's vision to become a "Connected KMUTT" through digital transformation, KMUTT needed to enhance its wireless network and migrate its IT infrastructure to a unified and centralized Hybrid Cloud platform.

Previously, each faculty had separate IT services and applications, resulting in high operation expenses (OPEX) and maintenance costs. To answer these challenges, KMUTT needed to ensure:

• A more secure and reliable wireless network system, including Core Switch, Distribution Switch, Access Switch and Access Points

• The deployment of a Software Defined Network (SDN) to support the system administration

• A unified hardware and software licensing and update management

• A System Backup and Disaster Recovery (DR)

• Adequate Internet coverage in high-density areas at all times

• An Auto-Scaling (AS) computing system to adapt to diverse usage demand

Installing Huawei CloudCampus Solution

Huawei proposed its CloudCampus Solution with the objective to improve connection efficiency among all campuses and faculties. It provided KMUTT with an OpenStack-based cloud data center

network. The new wireless network encompasses a series of improvements:

• 400 Gbps connection in the data center and high-speed connection with advanced features between the Core Switches and Distribution Switches, allowing a wireless connection speed of 3.46 Gbps per Access Point.

• The new-generation Access Points can automatically track each user without the intervention of the University's IT staff

• Next Generation Firewall to enhance efficiency & security

• Centralized management and monitoring system using Huawei's Software Defined Network (SDN)

The Hybrid Cloud platform results in optimized storage and cost-effective network management for faculty members, staff and students. It means a safer and more reliable platform for all. It also enables auto-scaling capacity, resulting in cost optimization.

Customer Benefits

Huawei's CloudCampus Solution enables KMUTT to provide faster wired and wireless high-quality connection all around the campus, with increased usage security. The new IT infrastructure plays an instrumental role in supporting the university's high educational and research objectives. It also answers the demand of KMUTT's executive management in terms of speed, security and back office operations.

Thanks to Infrastructure as a Service (IaaS), most network management operations are automatically processed in the cloud portal, which helps reduce manual operations and human errors.

With Huawei Hybrid Cloud's virtual resource pool, it is much easier to control, monitor and forecast the resources, thanks to the ability to customize the number of CPUs, memory size and networks to fit the university's needs. Huawei Hybrid Cloud solution safely stores data and efficiently prevents data loss, minimizing long-term capital expenditures (CAPEX). ▲

UCARS

Helps Owners Sell Their Cars in Record Time, Building the First AI Valuation Tool in the Region

Singapore's fastest-growing online car marketplace to buy and sell new and used cars, UCARS is integrating Artificial Intelligence (AI) and cloud computing into its platform together with Huawei to provide consumers with enhanced transparency, security and satisfaction.

Singapore car owners can now expect to sell their vehicles within three days at the highest prices when they use the AI-enhanced tools provided by the UCARS

platform. This is part of the company's commitment to shifting the automotive industry towards a more modernised and customer-centric landscape.

Using AI, the company has successfully created a proprietary valuation tool on the platform that provide consumers with an estimate of their cars' resale value within seconds, making it the first instant AI Car Valuation Tool in Southeast Asia. Compared to other valuation methods that take at least a day to give an estimate, the UCARS AI Valuation Tool is the fastest valuation tool available to consumers in the region.

With the current economic lull due to COVID-19, transfer of private vehicle ownership for cars has seen an average of 15% year-on-year increase compared to September last year and reached an all-time high in September this year (source: LTA). Consumer demand for new and used cars has been seeing a steady increase in the Southeast Asia region.

"We speculate that some Singaporeans are anticipating an economic rebound in the near future, and coupled with pent-up demand for cars and reduced quotas, we are expecting to see car sales skyrocket in the coming months," said Cho Kok Yick, Chief Technology Officer at UCARS.

One seller, Gideon Lam, who has successfully sold two cars on UCARS, stated that his experience was a seamless process as UCARS "helped to coordinate all the necessary" without him needing to do extensive preparatory work. Another seller, Michael Chong, showed appreciation towards UCARS for ensuring that the entire process was "smooth and transparent" on both ends.

"We want to make the second-hand car selling process as safe and as easy as possible, this is why we continuously invest in AI technologies. This will, of course, be made possible by Huawei technologies," Cho added.

> **With the help of HUAWEI CLOUD, UCARS seeks to deepen consumer trust by integrating better infrastructure and cloud security into the platform, and embarking on several AI-related projects to improve the customer experience.**

"This is a really exciting time, where we see more companies harness the power of AI to change the way they do business. Huawei is excited to embark on this journey with UCARS to help digitalise and deepen consumer trust in the automotive industry as well as to improve the customer journey and experience,"said Daniel Zhou, President of Huawei Cloud & AI Group, Asia Pacific.

Making Better Decisions with AI

Due to the pandemic, consumers worldwide have shifted their shopping patterns, and this applies to the automotive industry that traditionally thrives on face-to-face interactions.

To help consumers make better informed decisions in a fraction of the usual time, UCARS is progressively introducing new and improved tools and services powered by AI onto the platform by partnering Huawei.

With the help of HUAWEI CLOUD, UCARS seeks to deepen consumer trust by integrating better infrastructure and cloud security into the platform, and embarking on several AI-related projects to improve customer experience. This includes a Car Image Search

Engine powered by machine vision and machine learning, as well as an improved AI Valuation Tool. All of them are developed on ModelArts, the AI platform of Huawei.

Using an improved algorithm, the accuracy of each valuation on the UCARS AI Valuation Tool improves with every use. By getting a better estimate on the value of their car, consumers can sell their car on the UCARS platform with ease of mind knowing the amount they can expect to get back, and at a fraction of the usual time it would take on other automotive platforms.

UCARS is also working on creating an AI-powered car search tool to help consumers identify the make and model of a car using only images. With machine vision, image recognition can be utilised to find a specific vehicle that consumers desire.

"We are confident that by building a strong core in the area of deep tech, we will be able to power future growth in the automotive industry in a post-COVID world," said Cho.

With the government's push for digitalisation, disruptive technology solutions like artificial

> "Launched in Singapore early last year, HUAWEI CLOUD has been investing significant resources in partnering local startups such as UCARS. They strive to optimize their backend infrastructure and AI algorithms to better meet business objectives, all while keeping Huawei's services secure and affordable.

intelligence platforms, big data platforms, startups like UCARS are stepping up to create and adapt their current technologies.

Transparent Experience on the Cloud

Notably, the automotive industry faces difficulties communicating and forging meaningful relations with its consumers in a digitising society due to obsolete and inefficient operating processes. Consumers therefore lack the trust and confidence in the products and services sold by local car dealers.

According to Cho, UCARS eliminates the need for consumers to disclose their personal contact by using the platform's built-in chat system. This allows consumers to connect seamlessly with dealers without divulging more information than they wish to.

Moreover, when dealers list on UCARS, there is no need for consumers to worry about hidden fees, undisclosed package deals, as they are provided with the latest and most accurate information on every listing.

Cho added that, after migrating its backend systems

to HUAWEI CLOUD, the UCARS platform has become more stable and is now able to handle large amounts of data much better and securely than before.

Launched in Singapore early last year, HUAWEI CLOUD has been investing copious resources in partnering local startups such as UCARS. They strive to optimise their backend infrastructure and AI algorithms to better meet business objectives, all while keeping HUAWEI's services secure and affordable. UCARS is also one of the five finalists in Huawei Spark 2020, a hybrid accelerator programme launched by Huawei for deep tech startups.

"A more robust architecture translates to enhanced user experience for both dealers and consumers. We truly appreciate the help that Huawei has been providing us throughout the integration process, and we look forward to more collaborative projects in the future," he added.

With innovation at the heart and technological know-how in mind, UCARS continues to bring consumers and dealers closer by digitising human interactions in the automotive industry, taking its place as the future of automotive retail. ▲

Huawei All-Flash Storage Sharpens
ICBC (Macau)'s Competitiveness
with Next-Generation Performance and Reliability

As a group member of the Industrial and Commercial Bank of China Limited (ICBC), the Industrial and Commercial Bank of China (Macau) Limited (ICBC [Macau]) was established in 2009 after the merger of the former Seng Heng Bank Limited and ICBC (Macau) Branch. A leading bank in Macau, the ICBC (Macau) leverages its parent company's signature strength, extensive services network, cutting-edge technology and excellent products of its foreign institutions to offer wide-ranging financial services to its clients.

ICBC (Macau) currently has 20 branches and more than 1100 staff across its three wholly-owned subsidiaries,

> **Huawei OceanStor Dorado proved to be ideal for ICBC (Macau)'s mission-critical business as it delivers the high performance, reliability, and business continuity the bank was looking for.**

namely: ICBC (Macau) Capital Limited, ICBC (Macau) Pension Fund Management Company Limited and Seng Heng Development Company Limited.

Key Challenges

Like other financial institutions, ICBC (Macau) is constantly challenged to be agile, adaptive, and innovative while ensuring 24/7 business continuity. With business transformation as its core strategy, ICBC (Macau) is always looking at new ways to ensure innovative transformation across its business, with IT-based banking as one of its key focuses.

As its online banking business grew exponentially, ICBC (Macau) knew that the legacy storage system had limited scalability to support its growth trajectory. Daily reporting took up to six hours, as latency issues with the storage system caused bottlenecks. The existing storage system also had limited capabilities to handle more than 300 Virtual Machines (VMs), causing access delays of five to ten milliseconds. In the face of sustained data growth, ICBC (Macau) wanted to overcome data surges and reduce risks of performance delays with an All Flash storage system.

Reliability was another area that needed to be enhanced, as the bank's current data redundancy was configured based on a local active/passive architecture with no geo-redundancy. Aiming for zero business disruption, ICBC (Macau) needed to revamp its storage architecture with one that offers the flexibility to scale to an active-active solution with Disaster Recovery (DR) in geo-redundant mode. In addition, the existing system's over reliance on Command Line Interface (CLI) also made it difficult to operate, causing inefficiencies in deployment, day-to-day operations, and troubleshooting.

Huawei OceanStor Dorado

ICBC (Macau) deployed three sets of Huawei's next generation OceanStor Dorado 5000 V6 All-Flash storage to modernize its storage architecture across separate systems in one data center in Macau. Two sets supported its reporting platform featuring four sets of Oracle Online Analytical Processing (OLAP) data analytics systems. The remaining set powered other hybrid requirements, including the bank's VM Farm with more than 300 VMs; five databases, a file server and its email system.

Huawei OceanStor Dorado proved to be ideal for ICBC (Macau)'s mission-critical business as it delivers the high performance, reliability, and business continuity the bank was looking for. ICBC (Macau) now enjoys

With Huawei's OceanStor Dorado All-Flash storage, ICBC (Macau) is now equipped to ensure zero data loss or application interruption with 24/7 business continuity.

ever fast performance with Huawei's intelligent chips and Artificial-Intelligence (AI)-powered architectures. Single points of failure have been eliminated with the solution's fully redundant architecture, support for dual-port Non-Volatile Memory express (NVMe) and hot swappable discs . The bank now has a future-proof storage architecture with data redundancy assurance and scalability to an active-active solution with industry-leading reliability and, most importantly, assurance of 24/7 business continuity. Total Cost of Ownership (TCO) has also been reduced across the board with the Huawei solution's small footprint, more efficient Operations and Maintenance (O&M), and other innovative capabilities.

Customer Benefits

Seamless Migration with Maximum Uptime

With meticulous planning, the Huawei team successfully migrated ICBC (Macau)'s mission-critical data from its legacy storage system to the OceanStor Dorado All-Flash storage. The seamless migration was carried out with zero downtime for 95% of the bank's mission-critical systems and with less than an hour of planned downtime for the remaining systems. In an industry where speed is everything, ICBC (Macau) is pleased with the swift deployment which took less than a month across September and October 2020.

Cut Delays by 90% with 10 Times Faster Performance

To support the exponential growth of its omni-channel online transactions, application response time is top of mind for ICBC (Macau)'s management. With the OceanStor Dorado's best-in-class performance of up to 20,000,000 IOPS at 0.1 ms latency, ICBC (Macau) now enjoys ten times faster performance, while cutting access delays by 90%. With daily reporting cut to three hours, reporting efficiency has improved by 100%, delivering quicker big data analytics for faster decision-making to increase customer satisfaction.

The OceanStor Dorado's ever fast yet stable performance is made possible with its end-to-end NVMe architecture plus FlashLink® algorithms for a smoother service experience. Elsewhere, a Flash Translation Layer (FTL) algorithm accelerates read/write response times, and Huawei-developed intelligent chips, such as the Kunpeng 20, the intelligent AI chip, and the BMC management chip, offer end-to-end acceleration.

Equipped with Gateway-Free Active-Active Solution for 24/7 Business Continuity

If ICBC (Macau) continued relying on its existing data redundancy local active/passive architecture, there would be constant worry over the potentially

devastating data loss in the event of a power outage or natural disaster. That could disrupt the business for hours — an unacceptable posture for a leading bank in today's 24/7 marketplace.

With Huawei's OceanStor Dorado All-Flash storage, ICBC (Macau) is now equipped to ensure zero data loss or application interruption with 24/7 business continuity. The scalability of Huawei's industry-leading all-flash active-active architecture stands ready to help ICBC (Macau) enable DR in geo-redundant mode, for the highest levels of data protection.

Designed from the ground-up to support demanding scenarios such as database, virtualization and big data analytics, OceanStor Dorado prevents single points of failure, with a fully-redundant architecture which supports dual-port NVMe and hot swaps.

Lower Total Cost of Ownership

ICBC (Macau) also lowered overall TCO, thanks to the revolutionary design of the OceanStor Dorado all-flash storage system. With its small footprint of 2U for 500 TB and the leveraging of inline deduplication and compression, storage utilization at the bank has been slashed by 80%, while efficiency improved by 50%.

The solution's 9.5 mm palm-sized SSDs and biplanar orthogonal backplane design also delivered further savings by cutting power consumption and cooling costs, while increasing capacity density and heat dissipation capacity.

Enhanced Operational Efficiencies

Overall, ICBC (Macau) has seen increased O&M efficiencies with the user-friendly Huawei Device Manager — a vital improvement from the previous CLI-reliant system. With no need to install client software, manageability is enhanced with intelligent AI lifecycle management capabilities ranging from resource planning and provisioning, to system tuning, risk prediction, and fault location. ▲

GO FASTER WITH
Huawei OceanStor Dorado All-flash Storage

Enjoy the ultimate performance of 20 Million IOPS* and 0.1ms ultra-low latency

Building a Fully Connected, Intelligent World

*Tested under SPC-1 model in Huawei lab environment

Huawei Provides

Macao's Municipal Affairs Bureau with a

Modern, Expandable Data Center

Macao's population amounts to approximately 679,600 people on a surface area of 32.9 km². IAM is entrusted by the Government of the Macao Special Administrative Region, hereinafter referred to as Macao SAR, to serve the population, particularly in the fields of culture, recreation and environmental sanitation, as well as to provide advisory opinions to the Macao SAR Government.

IAM needed to build a data center in its new office to support its e-Government Cloud services, such as municipal construction, public service handling, civic education and public and media relations.

> The new data center is expected to meet the mainstream requirements in terms of security, reliability, flexibility and manageability, both now and for the next five years.

The data center is expected to meet the mainstream requirements in terms of security, reliability, flexibility and manageability, both for now and the next five years.

Building a New Data Center to Accompany Macao's Development

To keep up with its rapid data growth, IAM required a new data center that would meet a series of challenges such as:

Construction time: Building a traditional IT equipment room is complex, timeconsuming and costly. A modular equipment room solution would reduce construction time and can be easily replicated whenever necessary.

O&M model: Traditionally, the equipment room O&M was performed manually, which made it difficult to locate equipment malfunction, and increased labor costs. A modular equipment room solution enables an AI-powered O&M model without manual attendance.

Energy saving: Future equipment must be energy-saving and environment friendly.

Service scaling: A modular design would enable

scalability for more value added services and facilitate future expansion.

FusionModule 2000 is Huawei's new generation of smart modular data center products. It has been awarded the world's first "Uptime Tier IV Ready" certification. The module comprises power, cooling, rack & cabling, and management. The structure can be single-row or dual-row, and supports both cold and hot aisle containment.

In addition, Huawei integrates AI technology into the data center, which significantly improves the reliability, availability and efficiency of the data center through iPower, iCooling and iManager.

Huawei provided IAM with a truly holistic solution that incorporates cabinets, power supply and distribution systems, cooling, equipment room management, lightning protection and grounding, fire extinguishing and integrated cabling systems. The advantages of this solution are its flexibility, manageability, reliability and high security.

Customer Benefits

Shorter Construction Period: Compared with a traditional IT equipment room, the modular equipment room integrates subsystems such as power supply

and distribution, cooling, cabinets, air containment, integrated cabling, and dynamic environment monitoring. It shortens the construction period by 30% and increases the number of cabinets by 30%.

Energy Saving: The modular equipment room helps save energy consumption and reduces total cost of ownership (TCO)

Intelligent Management and Refined O&M: The modular data center monitors the internal environment, powers micromodule devices in real time and ensures better coordination to implement refined O&M. This results in the reduction of O&M costs and equipment failure rates

Easy and Flexible for future expansion ▲

Smart DC
Building the Future

AI-powered and fully modular,
for a greener data center.

Building a Fully Connected, Intelligent World

From "Seemingly Impossible to Fully Feasible": Converge ICT Solutions Expands Its Data Center with Huawei SmartLi UPS

Located in Southeast Asia, the Philippines — home to a large population and a rapidly developing Internet industry — is actively seeking to transform itself into a digital powerhouse. According to data for January 2020, released by global creative agency We Are Social, in partnership with social media management platform Hootsuite, the country has 73 million Internet users,

representing a penetration rate of over 60%. And with the average time spent online every day approaching ten hours, Filipinos are, perhaps somewhat surprisingly to learn, the most active Internet users in the world.

Converge ICT Solutions Incorporated — a leading Fiber To The Home (FTTH) broadband service provider — has been active in the Philippines market since first obtaining its broadband operation license back in 2009. By focusing on providing only high-quality products and services, in 2020, Converge's FTTH market share surged to over 50%. Indeed, the company debuted on the Philippine Stock Exchange in September of that same year through an Initial Public Offering (IPO) that proved to be the country's largest since 2016.

As a company with a reputation for being highly innovative, Converge is always looking for ways to grow its business by exploring new business models. Fresh in the wake of the nascent global digital economy, new services — such as cloud computing — are emerging in the Philippines' marketplace. Jumping at the opportunity, the company decided to use its own proven advantages in networks and data centers, to provide high-quality Information Technology (IT) rack leasing services and, with that, enter the Internet Data Center (IDC) market.

Data Center Expansion

Located at the company's headquarters in the National Capital Region of Metropolitan Manila, the first phase of Converge's data center was deployed in 2016, carrying core services such as broadband operations. As services developed rapidly over the years, and with a new direction set — to enter the IDC market — existing capacity was quickly becoming unfit for purpose. The second phase of the data center,

expanding capacity, therefore needed to be brought online — fast.

The new data center's design separated the computer and power distribution rooms. To meet service requirements, Converge needed to deploy 80 IT racks in the computer room. However, the company quickly discovered that not enough space had been allocated for the power distribution room after construction had been completed, making it extremely difficult to deploy sufficient power supply devices. Compounding the problem, Converge insisted on ultra-high power supply reliability, using a 2N redundancy architecture that requires two sets of independent power supplies. This architecture doubles the number of devices needed for power supply and distribution, making power supply deployment even more challenging.

Huawei SmartLi UPS is Up to the Task

As a global Information and Communications Technology (ICT) provider with rich practical experience in the data center field, Huawei was well-positioned to provide a solution that met Converge's exacting needs. After evaluating the project and understanding its unique challenges, Huawei proposed its SmartLi Uninterruptible Power Supply (UPS) solution.

SmartLi UPS brings the twin benefits of a highly efficient modular UPS and intelligent SmartLi lithium-ion batteries. Offering an excellent user experience as well, SmartLi UPS is fast becoming a mainstream power supply solution in the data center field, since it offers multiple advantages compared to traditional solutions.

Footprint slashed: The energy density of SmartLi is three times that of traditional lead-acid batteries. And, for this project, that meant the physical footprint

required for all battery components could be slashed by 70%.

Ten year lifespan: SmartLi has a lifespan of over ten years, compared to traditional lead-acid batteries that need to be replaced every five years. In addition the lithium-ion battery cycle numbers in the thousands, with service life unaffected even when frequent power outages occur in certain geographic areas.

Simplified O&M and hot swapping: As a fully modular UPS, all functional modules can be hot-swapped, simplifying Operations and Maintenance (O&M). Indeed, O&M is so easy that basic-level engineers can quickly correct the UPS within five minutes of any fault occurring. Online capacity expansion is also supported, significantly reducing Capital Expenditure (CAPEX) and saving on initial investment required. This is flexibility with prove vital as IT development pivots toward a high density trend. Additionally, online capacity expansion can be performed without powering off, improving power distribution capability.

Given all these advantages, Converge chose Huawei's SmartLi UPS solution to power its new data center. The solution has not only helped the company achieve its initial objective — to deploy sufficient power supply in a limited space — it also meets Converge's high standards for power supply reliability, with O&M greatly simplified as well.

A Bright Future

"As the largest fiber Internet provider in the Philippines, Converge is striving to contribute more to the country's digital economy. It is our new strategic direction to build more data center infrastructure and provide reliable colocation data center services. Through this cooperation with Huawei, we have learned about Huawei's rich experience in this field. With Huawei's help, we are confident in the future. We hope that Huawei can provide more innovative solutions that make the seemingly impossible to fully feasible solutions, and help us achieve greater business success. " ---Sir Ronnie Cave, Network Support Facilities Head. ▲

Huawei SmartLi UPS
Digitizing Your Power

- Adaptive combination of old and new modules, with AI-powered predictive O&M ensuring zero down time
- Higher efficiency of 97% @100 kVA/3U

Building a Fully Connected, Intelligent World

Huawei FusionSolar Smart PV Solution Helps Infinite Green Develop

Best Performing and Highly Reliable Power Plant

Founded in 2009, Infinite Green Co., Ltd. is a leading solar power plant developer in Thailand and Southeast Asia. The company is a subsidiary of Premier Products Public Co., Ltd. (PPP), Thailand's leader in environmental products, construction materials and clean energy businesses.

Infinite Green Co., Ltd. owns three photovoltaic (PV) power plants in Saraburi province, with a combined capacity of 15 MW. It also offers a range of high-

> After installing the Huawei Smart PV Solution PR, the company saw a 4.6% increase in energy yields. The highly reliable and cost-effective solar generating solutions provided by Huawei help the firm create more electricity in less time, leading to higher sales and profits.

quality turnkey solutions and services related to the alternative energy sector for its customers across the region.

With the aim to develop photovoltaic power plants of highest efficiency and reliability, Infinite Green is dedicated to using latest innovations and eco-friendly technologies in its efforts to raise living standards in Thailand while preserving the country's natural resources.

Customer Requirements and Challenges

IGC Saraburi II Solar Plant is one of Infinite Green's solar electric generating facilities in Kaeng Khoi district in Petchburi province. The 5 MW plant started its Commercial Operation Date (COD) in 2013. Using the traditional electric power generation technologies and outdated 4kw single-phase inverters, the plant's system was difficult to manage and maintain.

Various parts of its legacy solar solutions, installed over 10 years ago, required a lot of attention and care from its O&M staff, leading to high maintenance costs. Using worn-out inverters also compromised efficiency and reliability of the plant's solar energy

generating system, resulting in reduced Performance Ratio. Realizing the need for a new set of PV inverters, the company sought a smart system that could help optimize the Levelized Cost of Energy (LCOE) in the long term.

Huawei FusionSolar Smart PV Solution

Fully implemented in December 2020, Huawei collaborated with Premier Products Public Co., Ltd. to provide Huawei Smart PV solutions for Infinite Green's solar plant consist of two products:

Huawei Smart PV Controller (SUN2000-100KTL-M1)

This smart PV inverter is equipped with industry-leading technologies that are unique to Huawei. The equipment provides customers with a straight-forward O&M system and a centralized control that ensures safety and reliability at all times. The inverter's highlighted features include:

The fuse-free design provides a "No-touch" maintenance

Maximum efficiency of 98.8% at 480V guarantees

always-on availability, ensuring low failure rate

A string-level management means each string can achieve its best performance independently for higher yields

IP66-rated protection standard guarantees that the equipment can withstand harsh weather conditions

Smart I-V Curve Diagnosis

Huawei Smart PV Solution features AI Boost Smart I-V Curve Diagnosis. Equipped with FusionSolar Smart PV Management System, the solution provides system analysis using advanced diagnosis algorithm. The online scanning and analysis can help detect faults, irregularities and abnormal decrease in all system operations, achieving higher O&M efficiency, proactive maintenance and lower operation costs. The smart system's key features include:

The PV string I-V curve analysis helps identify faults with automatic report generation

One-click scanning allows on-the-go monitoring without the need of manual checks by the onsite experts

Customer Benefits

Huawei's easy-to-manage centralized system operations allow the company to see all the system information and identify potential issues at once. This helps save manpower and man hours for Infinite Green, significantly reducing operations costs.

After installing Huawei Smart PV Solution PR, the company saw 4.6% increase in energy yields.

The highly reliable and cost-effective solar generating solutions provided by Huawei help the firm create more electricity in less time, leading to higher sales and profit.

The renovation allows the plant to reach a positive Return of Investment. ▲

Digital PV Solution for Optimal LCOE

Higher Yields
>2% More Energy

Smart O&M
Lower OPEX

Safe & Reliable
25-year's Reliability

Huawei SD-WAN Solution Supports
GSB's Smart Branch Mission in the Digital Age

Established in 1913 by HM King Vajiravudh (King Rama VI), Government Savings Bank (GSB), formerly known as the Savings Office, was initially created to become a safe place for asset storage and to help Thai people save

money properly. For over a century, GSB has been fully committed to providing reliable financial services with the aim to ensure quality and safety for its 25 million customers. The social bank strives to offer Thai people innovative products that promote saving and financial

sustainability across generations.

Realizing the need for digital transformation and ever-changing demands from its clients in the past decade, GSB worked closely with its partners from both the public and private sectors to continuously develop new services for its staff and customers, in order to guarantee frictionless operations across systems. Aiming to become "more than just a bank" for all Thais, the century-old bank vows to help drive the digital economy while contributing to a better society for generations to come.

Customer's requirements and Challenges

Under its long-term mission to become a fully digital social bank, GSB focuses on enabling smart, efficient and safe operations at over 1000 branches. Many solutions and products used in the bank's legacy IT system was no longer available in the market, making updates installation difficult, leading to high maintenance costs. The previous system did not facilitate GSB's cloud data transfer, jeopardizing future network expansion.

The bank was seeking the right network infrastructure to ensure smooth operations and an identical level of services everywhere, both at small and big branches alike. A new infrastructure was needed to improve GSB's efficiency across all banking services, reduce operation and maintenance (O&M) costs, as well as enhance user experience in both online banking situations and traditional branches.

SD-WAN

Taking GSB's requirements into consideration, Huawei proposed its SD-WAN solution to help create a strong cloud-based network to accommodate new demands and future business expansion. The integrated solution

is an ideal choice for large financial institutions, thanks to its capability to interconnect headquarters, remote branches and multiple clouds. The synchronized system ensures service continuity, efficiency and stability at all branches, without compromising data security. Huawei SD-WAN's key features include:

Intelligent Ultra-Broadband and On-Demand Interconnection enable reliable and scalable interconnection between branches, headquarters and clouds.

Zero-touch configuration provides simple and reliable service roll-out and maintenance without the need for on-site staff.

Smart O&M with Unified Management allows cloud-based management of Local Area Networks (LANs) and Wide Area Networks (WANs), simplifying system deployment and reducing O&M costs.

Excellent full-service experience supports emerging technologies such as 5G, Artificial Intelligence (AI), the Internet of Things (IoT) and Cloud, driving branches towards digital transformation, while paving the way for flexible yet secure business and network expansion.

Customer Benefits

The powerful Huawei network solution met all GSB requirements, in line with the bank's digital strategy. Featuring over 6,000 applications, the intelligent platform helps the bank realize its Smart Branch mission. Huawei SD-WAN Solution accelerates service rollouts, reduces O&M costs, and ensures smooth service operations. These benefits are enjoyed by both GSB staff and customers. The future-proof solution can accommodate new demands and support the fifth-generation network, ensuring sustainable business growth for GSB. ▲

Huawei Boosts the Role of Impact Business Solutions in the Digital Transformation of East Malaysia's Energy Sector

With a proven track record and tried-and-tested technologies for ensuring security and reliability, Huawei is fast becoming the preferred partner for digital transformation, as energy companies worldwide, are introducing digital technology into every aspect of their businesses, to achieve sustainable development.

A Key Enabler of IT and Business Efficiency

Established in 2005, Impact Business Solutions

(IBS) Sdn Bhd is a Value-Added Distributor (VAD) specializing in data networking, system security, storage, and backup strategy. With offices in East and West Malaysia, IBS helps customers deploy new Information and Communications Technology (ICT) infrastructure or upgrade existing systems. IBS analyses current challenges and assesses technical feasibilities before advising and offering functional solutions with the highest adaptive capacity, ensuring customers receive the most suitable solutions.

With a full understanding of their customers' challenges, IBS explores how to best support existing

> " The partnership between IBS and Huawei has been highly fruitful, as both parties continue to deliver greater value to their joint customers in the energy sector. Strong IT solutions have been developed, opening up more avenues for IBS's digital transformation roadmap. "

ecosystems, to help businesses grow and remain competitive and profitable. In short, IBS provides consultative and customized services, bringing real value to customers.

Partnership Journey

IBS and Huawei started their partnership in 2018, following the visit of IBS executives to Huawei's Customer Solution Integration and Innovation Experience Centre (CSIC) in Kuala Lumpur, Malaysia. A strategic alliance paved the way for collaboration on a digital transformation project for an IBS customer working in the energy sector, located in East Malaysia.

IBS developed their cooperation with Huawei centering on three core aspects.

Educate: Raising the awareness of niche Information Technology (IT) solutions is a big part of IBS's role. With vast capabilities and resources, Huawei has set up technical training and workshops for IBS teams to strengthen their understanding of customized IT solutions.

Consult: By conveying comprehensive information at every step of each process, IBS ensures that customers are prepared for the future. With Huawei's support, IBS has been able to continually assess current capabilities

and anticipate opportunities, in line with evolving needs and requirements in this fast-moving era.

Support: When gaps and needs are identified, a dedicated team of IT experts is mobilized to enhance customer engagement and provide the best digital solutions, relevant tools, and insights. The objective is to increase agility to meet sudden market changes and ever evolving demands.

Empowering Customers to Realize Their Core Values

The partnership between IBS and Huawei has been highly fruitful, as both parties continue to deliver greater value to their joint customers in the energy sector. Strong IT solutions have been developed, opening up more avenues for IBS's digital transformation roadmap.

Indeed, as IBS's name suggests, Impact Business Solutions delivers real results for its customers. The team-up of IBS and Huawei for the East Malaysian energy project has undeniably produced positive effects for stakeholders, who can rely on dedicated support and uninterrupted services 24/7.

Indeed, Impact is not simply a company name — it

> With more organizations and enterprises undergoing digital transformation, IBS is looking forward to continuing to work closely with Huawei, to help customers embark on digital transformation journeys, create new business opportunities, and accelerate future growth for all.

reflects core values and a mission, too.

I — Innovation, through Huawei, has opened up new business and technology opportunities for IBS. Together, the two partners are now able to modernize customer IT infrastructure, by taking a holistic approach to digital transformation. Innovation has been key to determining and ensuring the feasibility of the pioneering changes.

M — Making a Difference is at the core of both Huawei's and IBS's business values. Strategic benchmarks are set to improve multiple aspects of the business, including customer satisfaction. The aim is to create mutually beneficial outcomes, by offering innovative value-added tools and services that will make a difference.

P — Profitability has improved for IBS. Huawei has helped grow IBS's business and expand its product portfolio, ensuring a significant Return On Investment (ROI) and increasing the bottom line.

A — Accountability is ensured by developing an in-depth relationship with business partners for each project. Through the assignment of a dedicated team by IBS and Huawei, goals are achieved in an environment that breeds trust and enhances productivity.

C — Collaboration and teamwork between IBS and Huawei have led to remarkable business growth in 2019 and 2020. As a preferred partner for the digital transformation of industries, Huawei encourages an agile relationship that is mutually beneficial and open to exploring the best practices, in order to achieve business success.

T — Trust is the key principle behind the successful working relationship between the two companies. This trust-based alliance is focused, goal-oriented, and profitable, resulting in a long-lasting and multi-dimensional partnership.

Banking on Each Other's Strengths

The mutually beneficial partnership with Huawei has enabled IBS to expand its expertise, from traditional ICT infrastructure to new areas such as data storage and network enhancement with Wi-Fi 6 technologies.

With more organizations and enterprises undergoing digital transformation, IBS is looking forward to continuing to work closely with Huawei, to help customers embark on digital transformation journeys, create new business opportunities, and accelerate future growth for all. ▲

ASL Collaborates with Huawei to Facilitate Industry Digital Transformation

Automated Systems Holdings Limited (ASL) has been established for over 40 years in Hong Kong SAR, and has been listed on the Main Board of the Hong Kong Stock Exchange for more than two decades. ASL mainly provides industry solutions, intelligent cybersecurity services, and one-stop IT integrated managed services. ASL has been cooperating with Huawei since 2011. The partnership started off with two parties implementing projects for the education sector. The nine-year partnership has been going strong since then; their current strategic projects span multiple industries, with sales revenue increasing year on year.

Cooperation Successfully Expands the Hong Kong Market

Huawei is determined to increase its market penetration rate and provide both innovative ICT technologies and comprehensive resources. Meanwhile, with the capabilities in technology, integration, and
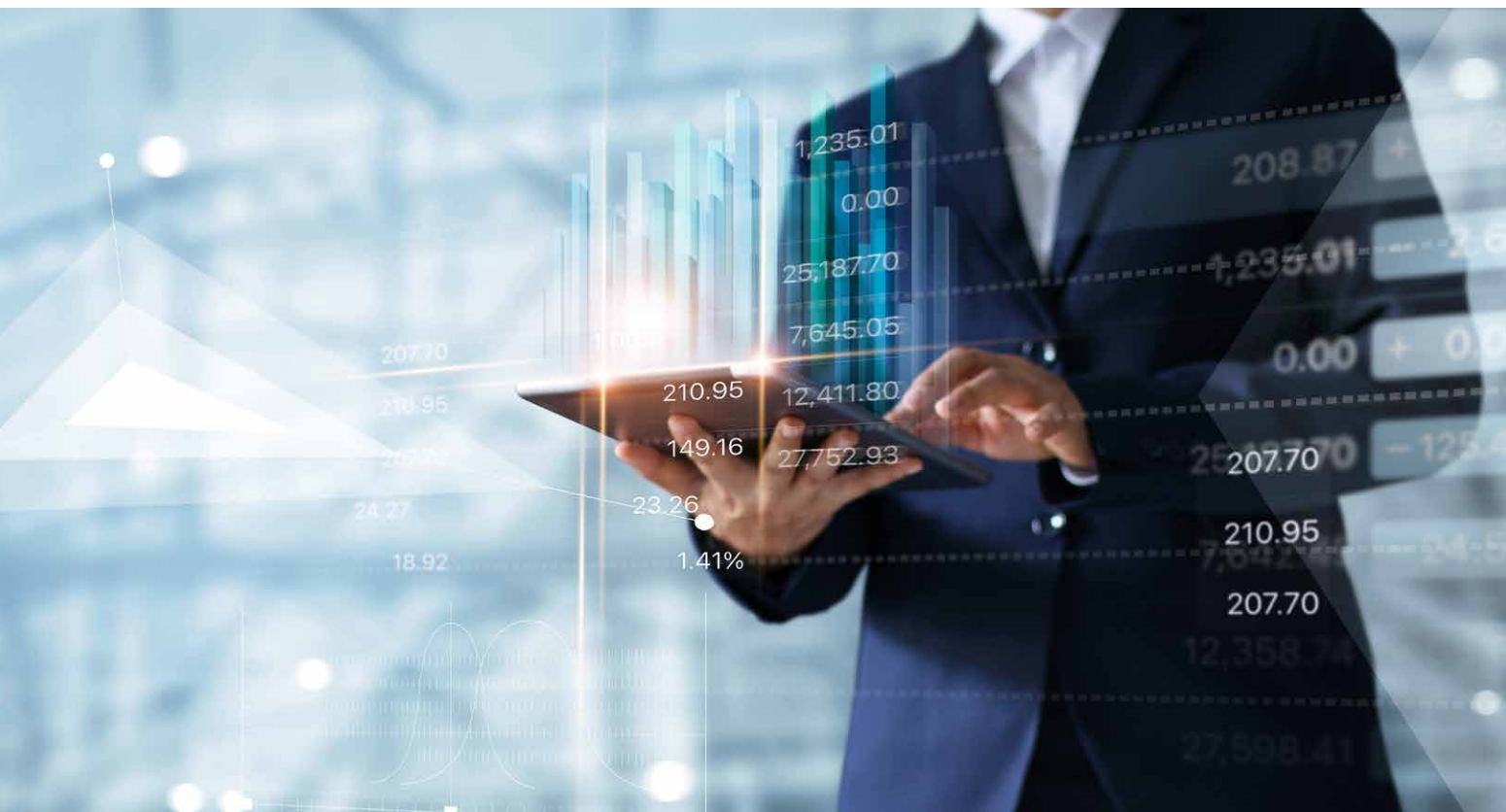
services, ASL offers services ranging from pre-sales to post-sales, through utilizing its seven R&D centers, 1,000+ high-quality professionals, and over 40 years of industry experience. Together with Huawei, ASL provides customers with innovative, industry-specific, one-stop ICT solutions, and thus achieve synergy and win-win outcomes.

Enabling Medical and Healthcare Organizations to Provide Next Generation Non-Invasive Services

Medical institutions have been increasing their demands for modern medical technologies, which raises the requirements for next-generation information systems. However, most of the ICT systems purchased usually fall short of the customers' expectations. As data grows, the gap between ICT product performance and service requirements widens. In addition, medical institutions often could not comprehensively deploy ICT systems, due to the limitations brought by technological capabilities, like the difficulties faced when carrying out Proof of Concept (PoC).

ASL and Huawei have gained trust from customers among the Hong Kong medical sector. For example, one of the Hong Kong medical institutions wanted to develop a highly accurate, low-risk and non-invasive prenatal DNA test, which has demanding server and storage requirements. By leveraging its strong systems integration capabilities and Huawei's advanced storage technologies, ASL provided this customer with a one-stop High Performance Computing (HPC) solution.

In order to enable the customer to conduct some tests that are closer to actual applicable scenarios through the R&D center, Huawei assigned onsite engineers to provide prompt and professional suggestions based on their extensive experience. Huawei's R&D center in Hangzhou also provided immense support for the project, which has greatly increased customer confidence in the implementation of the new system.

After many stringent pre-sales technical performance tests, Huawei's technologies have been proven to have a significant advantage over other competitors in terms of speed during massive storage operations. The medical institution therefore chose ASL and Huawei as its suppliers.

Finally, the Huawei HPC solution helped the customer overcome the technical limitations that they had faced for several years. After one year of operation, the system has proven that Huawei's HPC solution not only met the customer's expectation in terms of service quality, but also helped the customer continuously develop its business and improve their prenatal service quality.

Facilitating Digital Transformation in Educational Institutions

Hong Kong's higher educational institutions are taking the lead across Asia. These schools require digital transformation driven by the latest ICT to improve educational quality and address the increasing pressure stemmed from the large amounts of teaching contents.

However, a university campus is usually large in area, creating obstacles for the technological implementations. This is made more challenging by the widespread use of mobile devices, such as cellphones and laptops, in university students' lives and learning activities. Many universities have to first solve technical problems such as slow network speed and poor signal reception, under which teaching optimization is impossible.

A university with long-standing history in Hong Kong faced similar problems, after which ASL and Huawei upgraded the entire campus network to provide a

highly scalable, 100 GB high-speed backbone network. Over 1,000 access points were installed.

The next-generation wireless network technology now covers the whole campus, enabling the university to provide a convenient and fast online platform that greatly improves students' digital experience accelerating the campus' digital transformation.

Outstanding Strengths Recognized by Huawei

ASL is not only one of Huawei's highest-level partners, but also one of the few highest-level service providers recognized by Huawei. Since cooperation, Huawei has presented various awards to ASL, including The Outstanding Contribution Partner award, The Best Service award, and The Best Seller award.

Moreover, the ASL technical support team participated in the fourth Huawei Southern-East Asia Partner Skills Competition, which was held in Thailand. Because of their excellent storage solution design and implementation capabilities, the team won first place, demonstrating their outstanding delivery and professional service capabilities in the Asia-Pacific region.

Integrating New Technologies to Explore More Possibilities in the Future

More and more enterprises are undergoing digital transformation. Acting as a bridge between customers and vendors, ASL will work more closely with Huawei to jointly seize the business opportunities arising from

> "As an industry application provider, we have to think about how to interconnect Huawei's leading ICT and products with our customers application scenarios to form a closed ecosystem. This might be the biggest growth and momentum for our future partnership with Huawei. We hope to create more industry applications by utilizing Huawei's advanced products and technologies, bringing higher business value to customers."
>
> — Leon Wang, CEO of ASL

the Belt and Road Initiative and the development of the Greater Bay Area.

Meanwhile, ASL and Huawei will also develop industrial and sectoral markets, such as government and public affairs, finance, transportation, medical and healthcare, and education. Both parties will develop annual goals and promotion plans to enhance their market advantages in different industries.

As well as expanding the scope of cooperation, promoting the successful implementation of Huawei's star products and new technologies is also an important strategy for ASL to expand the market.

Similar successful cases are increasing in numbers, for example: The successful design and application of Wi-Fi 6 used in educational and government organizations, the successful deployment of Huawei's All-Flash Storage solution in the financial industry, and

the support to operators for their implementation of Huawei's FusionCloud cloud computing solution.

"Huawei has recently released a powerful chip. They are adapting their business development strategy to the cloud and AI era. In terms of ecosystem strategy, they also launched more novel incentive policies for partners. We are impressed by Huawei's strategies," said ASL CEO Leon Wang. "As an industry application provider, ASL's cooperation scope with Huawei has expanded from hardware products to cloud computing and AI products. We have to think about how to interconnect Huawei's leading ICT technologies and products with our customers' application scenarios to form a closed ecosystem. This might be the biggest growth and momentum for our future partnership with Huawei. We hope to create more industry applications by utilizing Huawei's advanced products and technologies, resulting in bringing higher business value to customers." ▲

Microgenesis's Journey with Huawei

The Road to Business Growth and Becoming a Digital Transformation Partner

Founded in 1988 as a software reseller, Microgenesis Business Systems has grown to become one of the leading Information Technology (IT) solution providers in the Philippines. Currently, Microgenesis employs 300 people across five domestic offices, with clients drawn from the top 5000 corporations in the country.

Business Challenges

The company name is a portmanteau of "micro," which means small and "genesis," which means the beginning. Microgenesis started as a small software company at a time when people didn't value software. Low profitability was a major challenge for the

business with suppliers regularly hiking prices. To remain competitive, the company therefore had to sacrifice its margins.

In addition, the competitive landscape in the Philippines was also fierce, with IT companies slashing prices to try to outbid one another to win projects.

Another major challenge was the lack of access to technical resources. As an IT company, it has always been imperative for Microgenesis to pursue the latest technological innovations, to keep up with the competition. However, access to training was too costly and there were only a limited number of local experts. Most of the training offered by IT vendors was very expensive, limiting the potential of the company's technical teams.

In the face of such challenges, Microgenesis looked for partners that had reliable technologies and could provide opportunities for growth and profitability. They were searching for new players with a relatively low market penetration but were interested in co-developing the market.

After engaging with several vendors, Jeffrey Choa — Executive Director of Microgenesis — felt that Huawei was the right fit. With reliable technologies and generous partner programs, combined with a will to succeed, Mr. Choa believed that Huawei perfectly matched their business strategy and needs.

Partnership Journey

With the formation of the partnership in 2014, Microgenesis became a Huawei Tier 2 partner. In just one short year, the partnership landed its first project with one of the largest conglomerates in the country. Then, Microgenesis won an additional infrastructure project supporting the National Elections in the Philippines that very same year. This streak of project achievements saw the company appointed a Huawei Value Added Partner — a Tier 1 partner — in the Philippines in 2016.

For a variety of reasons, the partnership went through a period of volatility from 2016 to 2019. In spite of this, the partnership survived thanks to Executive Coverage, a Joint Business Plan, a Joint Account Plan, Comprehensive Enablement, and the close collaboration between the channel team and the partner.

After this tumultuous period, the two parties have gained greater mutual trust. Indeed, revenue has surged and Huawei has become the preferred partner for strategic cooperation for Microgenesis.

Business Growth and Vision

The strategic partnerships of Microgenesis with aspiring players like Huawei has yielded dramatic improvements in the business. The company has rapidly evolved from a software developer into a system solutions provider, solidifying its position as a leading IT provider in the local market. With more than 30 years of history, Microgenesis's market share in the Philippines and profitability have continued to grow.

Microgenesis's vision is "to see a vibrant and productive society where people and businesses contribute positively to its development through the use of technology." To help the company realize their vision, Huawei will help Microgenesis offer the most advanced technology in the market to its customers. Working together, digital transformation initiatives offer benefits to customers in the short, medium, and long term. Cutting-edge technology enables customers to thrive in the new digital era by enhancing work efficiency while cutting costs. ▲

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