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LEADING NEW ICT

GIV 2025: Unfolding the Industry Blueprint of an Intelligent World [Page 6 >>](#)

Huawei Infuses Intelligence into Enterprise 'Neurons' Through Digital Platforms [Page 70 >>](#)



A Digital Symphony Composed of Technology & Ecosystem

Page 16 ▶



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Avoid These Three Misconceptions During Digital Transformation
Purpose-Built Silicon for All-Flash Storage
Bringing the Digital World to Cape Verde Archipelago, North Atlantic



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Expand Digital Transformation and Bring Digital to Every Organization

By Yan Lida, President, Enterprise Business Group, Huawei Technologies Co., Ltd.

The past 120 years have been marked by three important breakthroughs in human civilization: the industrial, electrical, and Information Technology revolutions. These three revolutions unleashed gigantic productivity gains that exceeded the cumulative output for thousands of years past. Now, we stand at a new turning point. Based on Information Communication Technology and driven by Artificial Intelligence, the fourth revolution of science and technology is leading human society into a new era where all things will be sensed, connected, and intelligent. Against this backdrop, Huawei sets a new vision: We will bring digital to every person, home, and organization for a fully connected, intelligent world.

Huawei Enterprise Business Group is committed to bringing digital transformation to every organization, including governments and public utilities, across the world, as well as to enterprises in the finance, energy, transportation, manufacturing, and all other industries. Huawei helps customers implement digital platforms to accelerate the convergence of information and operational technologies, integrate new service technologies into their business, and become the customer's best partner in digital transformation.

Digital transformation is just the first step. Our ultimate goal is to build an intelligent world. Every industry and enterprise is facing both challenges and opportunities on their path to intelligence. They must seize opportunities and complete digital transformation if they are to take advantages of the trend.

How do we help enterprises grasp digital opportunities? Huawei is thinking and exploring. According to our experience, digital transformation will include two phases. In the past decade, the born-in-the-cloud Internet companies took the initiative and led the first wave of digital transformation. Now, we are entering the Cloud 2.0 era, when enterprises grow with the cloud. In this phase, industry-leading enterprises explore innovative approaches to digital transformation. Their actions inspire all industry players to practice and expand digital transformation.

In the Cloud 2.0 era, traditional industries need a reliable partner for digital transformation. Huawei actively responded to them by releasing and implementing the 'Platform + Ecosystem' strategy. Many leading enterprises are converging digital technologies with the experience and expertise they have accrued to build industry service platforms. On these platforms, they share resources with their partners and customers. Huawei aims to build a digital foundation for these enterprise platforms. Based on our core abilities in cloud infrastructures and smart terminals, Huawei works with partners to develop five ability modules: video cloud, Big Data, the Internet of Things, Geographic Information Systems, and Integrated Communication Platforms. These modules uplink to applications and downlink to data to bring digital transformation within our customers' reach.

As digital transformation expands, opportunities and challenges are emerging at an unprecedented rate of speed. I believe that digital transformation is a journey that will never end. Huawei will work with customers and partners along the industry chain to expand digital transformation and bring digital to every organization. Together, we are achieving win-win outcomes worldwide. ▲



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Inside

Comment

P1

Expand Digital Transformation and Bring Digital to Every Organization

Technology News

P4

Technology News

Features

P6

GIV 2025: Unfolding the Industry Blueprint of an Intelligent World

The ICT industry is creating +Intelligence, and ushering in an intelligent world. The industry will kick-start a new wave of economic development, change the way people live and work, and ultimately reshape society as a whole. >>

P10

Avoid These Three Misconceptions During Digital Transformation

For traditional enterprises, digital transformation is believed to be a 'second startup' riddled with overwhelming difficulties that can be further complicated by vague strategies, unclear business models, and incompetent organizations. >>

P12

Sinopec: ProMACE Builds a New Smart Factory

Sinopec cooperates with Huawei for the R&D and applications design of the ProMACE Smart Cloud. ProMACE is revolutionizing how Sinopec does business by helping to build the brand-new Smart Factory 2.0. >>

Digital Symphony

P16

A Digital Symphony Composed of Technology & Ecosystem

Digital transformation is the theme of the digital world; the art of cooperation and innovation, and a tune in which all notes harmonize to create a splendid experience. Huawei will attend CEBIT in Germany, the home of classical music, and compose a digital symphony with our partners and customers. >>

Technology Sonata

P22

Purpose-Built Silicon for All-Flash Storage

P25

Intelligent Servers: Huawei Servers Live Up to the Name



P28

Intent-Driven Networking: Transforming the Network to Maximize Business Value

P30

The Digital Workspace and Intelligent Working Modes

To be an informative and inspiring magazine, *ICT Insights* needs your continual contributions and feedback. Please feel free to submit articles for publication. The editors greatly value your input.

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Industry Variations

P34 The Future of Public Safety and Emergency Control Rooms

P39 'All-Cloud Huawei' Implements Multi-cloud Management

P42 Spain's Rivas-Vaciamadrid Enhances Smart City 'Nervous System' Functions with Huawei eLTE Broadband Solution

P46 Albania's Power Transmission Network Upgrade Lights up Electric Power Industry Transformation in the Balkans



P49 ICBC (Asia) Leverages Cutting-edge Technology to Drive Cross-border Financial Upgrades and Development

P52 CMB Creates Values that Internet Financial Enterprises Cannot Match

P56 Bringing the Digital World to Cape Verde Archipelago, North Atlantic

P60 Qatar's Hamad International Airport: Managing large quantities of HD video surveillance data with ease

Ecosystem Minuet

P62 A Digital Transformation Heart-to-Heart with Huawei

P66 Edge Computing Unleashes the Potential of the Physical World

Analyst Corner

P69 Q&A with Vernon Turner, Principal and Chief Strategist, Causeway Connections

Last Word

P70 Huawei Infuses Intelligence into Enterprise 'Neurons' Through Digital Platforms
There are three key factors to infusing intelligence into enterprises' digital 'neurons' — having a digital platform for cloud-device synergy, understanding the industry, and practice.>>

Technology News

| Source: PR Newswire

Linguamatics Introduces Breakthrough Scientific Search Solution

BOSTON, May 9, 2018 — Linguamatics, the leading NLP-based text analytics provider for biomedical applications, today announced the launch of Linguamatics iScite, a breakthrough innovation in scientific search that puts the precision and power of Linguamatics Artificial Intelligence (AI) technology directly into the hands of scientists, researchers, and other knowledge workers. iScite offers a modern, easy-to-use scientific search engine that provides intuitive access to AI-powered searches across key biomedical data sources and delivers insightful answers to search questions.

Next-Generation Monet Undersea Cable Now Fully Operational

CHICAGO, May 8, 2018 — Algar Telecom (Brazil), Angola Cables (Angola), Antel (Uruguay), and Alphabet Inc. (Google) have announced that the 10,556 km Monet Cable System connecting Boca Raton, Florida to both Fortaleza and Santos, Brazil is complete, establishing an advanced digital gateway between the U.S. and Brazil, able to deliver more than 64 Tbit/s of capacity.

SUSE OpenStack Cloud 8 to Accelerate Customer Software-Defined Infrastructure Deployments

NUREMBERG, Germany, May 3, 2018 — SUSE® today unveiled SUSE OpenStack Cloud 8, its latest enterprise-ready OpenStack Cloud platform. Based on OpenStack Pike, SUSE OpenStack Cloud 8 is the first release to integrate the best of SUSE OpenStack Cloud and HPE OpenStack technology, which was acquired by SUSE last year. In addition to accelerating the deployment of software-defined infrastructure, it delivers better interoperability, scalability, and flexibility to enable the IT transformation enterprise customers need to conquer today's competitive market and business challenges.

MayaData Releases Litmus — Open Source Chaos Engineering for Kubernetes & Free Tier of MayaOnline

COPENHAGEN, Denmark, May 2, 2018 — This week at KubeCon, the leading conference discussing cloud native and microservice technologies, MayaData, the sponsor of the OpenEBS project and



MayaOnline, released a new open source project called Litmus.

Litmus is a set of testing workloads and automations to enable end-to-end testing of stateful workloads on Kubernetes, including the use of chaos engineering to inject system failures. The Litmus project is described at <https://www.openebs.io/litmus> and is available at <https://github.com/openebs/litmus>. Litmus includes both Ansible and Go based automation engines as well as a wide variety of synthetic workloads. Additionally, using the GoDog interpreter, users can specify scenarios using plain English.

Mentor Enhances Tool Portfolio for TSMC 5-nm FinFET and 7-nm FinFET Plus Processes and Wafer-on-Wafer Stacking Technology

WILSONVILLE, Ore., May 1, 2018 — Mentor, a Siemens business, has announced that several tools in its Calibre® nmPlatform and Analog FastSPICE (AFS™) Platform have been certified by TSMC for the latest versions of TSMC's 5-nm FinFET and 7-nm FinFET Plus processes. Mentor also announced it has updated its Calibre nmPlatform tools in support of TSMC's Wafer-on-Wafer (WoW) stacking technology. These Mentor tools and TSMC's new processes will enable mutual customers to more quickly deliver silicon innovations in high-growth markets.

Open Source Network Functions Virtualization Project Brings NFV Closer to Cloud Native with Sixth Platform Release, OPNFV 'Fraser'

SAN FRANCISCO, May 1, 2018 — The OPNFV Project, an open source project within The Linux Foundation that facilitates the development and evolution of Network Functions Virtualization (NFV) components across various open source ecosystems through reference platform development, integration, deployment, and testing, today announced the availability of the sixth OPNFV platform release, OPNFV Fraser. Making the mission of OPNFV more operationally relevant, Fraser advances the state of NFV around cloud native applications and new upstream project integration while continuing end-user support as they deploy and test virtualized networks.

Portworx Advances Cloud Native Storage for Kubernetes

LOS ALTOS, Calif., April 30, 2018 — Portworx, the best cloud



native storage solution for Kubernetes, today announced the availability of PX-Enterprise 1.4, the most significant new release to-date of its comprehensive solution for running stateful containers in production. Updates in 1.4 include 3DSnap™, the container industry's first application consistent snapshot solution for complex Kubernetes applications, as well as a brand new Graphical User Interface (GUI) for PX-Enterprise optimized for multi-cloud environments. These new capabilities enable customers to store and protect containerized applications, including their mission-critical data from a single platform, and were developed in collaboration with Portworx's large and growing customer base, including 15 of the *Fortune Global 1000*.

Thermo Scientific Explorer 4 Additive Scanning Electron Microscope Delivers First Dedicated Solution for 3D Printing Process Control

FORT WORTH, Texas, April 26, 2018 — Rapid + TCT 2018 — Manufacturers using Additive Manufacturing (AM) processes can now easily use the high-resolution imaging and elemental analysis capabilities of Scanning Electron Microscopy (SEM) to characterize powders that are the raw materials for many of their processes. The new Thermo Scientific Explorer 4 Additive is the first commercially-released SEM specifically designed to measure particle size, shape, and composition in AM metal powders, and to inspect finished parts to assure quality. The new Explorer 4 Additive solution was demonstrated at Rapid + TCT 2018 in Fort Worth, Texas, April 24 to 26, 2018.

Huawei and Telefónica Germany Join Hands to Launch NB-IoT Smart Meter POC in Munich Airport

HANNOVER, Germany, April 25, 2018 — At the world's largest industrial fair, Hannover Messe 2018, Huawei, Telefónica Germany, and IoT provider Q-loud jointly launched a smart meter Proof of Concept (PoC) based on NarrowBand Internet of Things (NB-IoT) for Munich Airport. Insufficient wireless signals in buildings and underground have limited the application of sensors in various fields across the airport, making it challenging to replace analog and manual readings of electricity, water, or gas meters. However, the trial-based introduction of NB-IoT potentially opens up completely new fields for the application of sensors at Munich Airport.

Canberra Drivers Invited to Take Part in World-leading Automated Vehicle Trial

CANBERRA, Australia, April 24, 2018 — Seeing Machines, an industry leader in computer vision technologies that enable machines to see, understand, and assist people, launched phase one of its world-leading automated vehicle trial, CAN Drive, supported by the Rachel Stephe-Smith MLA and the ACT Government, which has committed AUD 1.35 million to the project.

Accedian Unifies Network and Application Performance Analytics into a Single, Virtual Platform

MONTREAL, April 24, 2018 — Accedian, a leading provider of end-to-end network performance, today announced the launch of its SkyLIGHT PVX solution, a unified network and application performance management solution which aims to bring advanced digital experience monitoring capabilities to Accedian's enterprise and telecom customers. SkyLIGHT PVX is a unique combination of Accedian's Big Data analytics technology with the network and application performance management portfolio it acquired from Performance Vision.

SAP Introduces SAP Digital Manufacturing Cloud

HANNOVER, Germany, April 23, 2018 — SAP SE (NYSE: SAP) today introduced the release of SAP Digital Manufacturing Cloud, a new solution to help companies optimize performance, elevate production quality and efficiency, and ensure worker safety. Drawing on SAP's expertise in the Industrial Internet of Things (IIoT), predictive analytics and supply networks, the solution enables manufacturers to deploy Industry 4.0 technologies in the cloud. The announcement was made at Hannover Messe 2018, held April 23 to 27 in Hannover, Germany.

The new cloud solution extends and complements the digital manufacturing portfolio of on-premise solutions from SAP and is available in different bundles to serve manufacturers of varying sizes in both discrete and process industries and roles within their respective organizations.

MapD Announces MapD Cloud: First SaaS Analytics Platform to Harness Extreme GPU-processing Power

SAN JOSE, Calif., April 3, 2018 — MapD Technologies, the extreme analytics™ platform provider, today announced the launch of MapD Cloud, the first ever Software-as-a-Service (SaaS) offering of GPU-accelerated analytics. Now, analysts and data scientists everywhere have one-click access to the world's fastest open source SQL engine and visual analytics platform. ▲

GIV 2025: Unfolding the Industry Blueprint of an Intelligent World

Recently, Huawei announced a new vision and mission: bringing digital connectedness to every person, home, and organization for a fully connected, intelligent world. To further explain its thoughts on the ICT industry's role in the intelligent world, Huawei released Global Industry Vision (GIV) 2025, the industry blueprint for the intelligent world.

GIV 2025: An Intelligent World that Exceeds Our Expectations

Modern ICT has ushered us into a fourth industrial revolution. Where the first three corresponded to the rise of steam power, electrical power, and digital technologies, respectively, the fourth industrial revolution is founded on ICT networks and driven by Artificial Intelligence (AI). It is leading us into an intelligent world where all things will have sensory capabilities, become connected, and grow intelligent.

On the path toward an intelligent world, ubiquitous sensing, high-speed connections, and the sharing of knowledge will lead to unprecedented growth and value creation. Data will become an inexhaustible resource. Intelligence will determine how the value of data is transformed and delivered. Connections will carry massive quantities of data, and enable the exchange of data and the creation of smart value. The digital world is gradually being delivered to every person, home, and organization, and this is having an unprecedented impact on life, business, and society. These changes will lead to a digital economy valued at USD 23 trillion (CNY 146 trillion).

An intelligent world that exceeds our expectations will be made possible when all things can sense, all things are connected, and all things are intelligent. GIV forecasts that by 2025, there will be 40 billion AI-enabled personal smart devices, 90 percent of which will have an intelligent personal assistant. Twelve percent of homes will host some kind of robot, and will be more capable of unleashing individuals' enormous potential as they become supported by sensors, two-way human-machine communication, and proactive information services. At the business and societal levels, GIV 2025 predicts that there will be 100 billion connections by 2025, helping to drive digital transformation in domains including public utilities, transportation, manufacturing, healthcare, agriculture, and finance. By that time, 85 percent of enterprise applications will be on the cloud, 86 percent of global companies will adopt AI, and data utilization rates will skyrocket to 80 percent. This means we will see 180 billion TB of data generated every year, which in turn will act as a constant source of innovative intelligence and value creation.

Amidst this momentous transformation, the ICT industry assumes the responsibility of creating +Intelligence. +Intelligence is the



The ICT industry is creating +Intelligence, and ushering in an intelligent world. The industry will kick-start a new wave of economic development, change the way people live and work, and ultimately reshape society as a whole.

application of cloud computing, Big Data, and AI to every industry, object, and person. It is the backbone that will support the coming intelligent world. The ICT industry must first intelligently transform itself, and then move to help all other industries go intelligent.

The data provided in GIV 2025 pertains to more than 170 countries and regions, and came from Huawei as well as from international organizations, consulting companies, and industry manufacturers. GIV 2025 breaks down the quantitative data based on the three major enabling forces of the intelligent world: ubiquitous sensing, more and better connections, and the emergence of intelligence in data usage. GIV 2025 contains three core findings.

Ubiquitous Sensing and Universal Connection Bring Everything into the Intelligent World

The start of the intelligent world will be marked by the ability of all things to sense and by the creation of 100 billion new connections. As the ability of people and things to sense and connect improves across-the-board, entirely new points of interaction will be created in the intelligent environment built by data.

GIV 2025 provides multiple key quantifiable metrics relating to the number of smart devices, the penetration rate of various sensory methods, the number of connections, bandwidth, and communications traffic. Additional descriptions and analysis of how these metrics enable the development of the intelligent world are provided.

GIV 2025 predicts that by 2025:

- There will be more than 40 billion smart devices around

the world. The role of these devices will evolve from being mere tools to being active assistants, and 90 percent of smart devices will have smart assistant functions.

- Wearables will see rapid growth. More than 440 million applications utilizing AR/VR will create new ways of absorbing and processing information.
- Mobile communications network coverage will reach 6.5 billion people. Gigabit access coverage will exceed 30 percent. Ubiquitous connectivity will gradually even out the unbalanced development between individuals and between regions.

In light of this, data will become the productive force in an intelligent environment, and will provide people with an intelligent experience across all scenarios as the integration of the digital and physical worlds deepen. As a result, the average person will experience enormous expansion of their senses and other capabilities, and the disabled will regain prior abilities. In the coming era, people will be able to do more than they ever imagined, and people with disabilities will live normal lives.

‘Things’ will be able to sense and connect in ways never seen or imagined before. By 2025, there will be more than 100 billion connected things around the world. Connected people, things, and devices will all be able to interact and exchange information. As this happens, information silos will virtually melt away and connections will be faster, more secure, and smarter than they are today. The ultra-fast network formed by 100 billion connections will expand into every corner of the physical world. The efficiency gains unleashed by this network will result in unprecedented levels of productivity. The network will drive increasing returns in all industries, and open



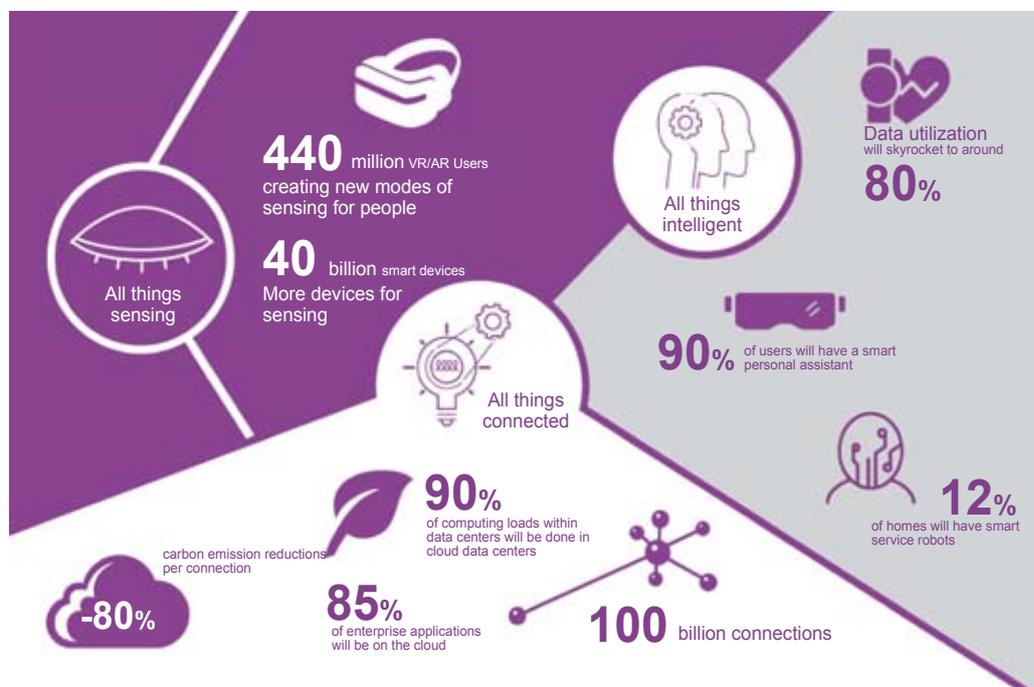
+Intelligence platforms and AI will become the springboards upon which enterprises improve themselves throughout their lifecycles. >>

the door to achieving new scaled growth through the full digitization of assets.

+Intelligence: Leapfrogging Development for Industries

The ubiquity of intelligence will generate massive amounts of data. AI will serve society as a general-purpose technology. The massive quantities of data linked to the cloud will drive the rapid evolution of smart algorithms which will, in turn, provide intelligent foundational resources that can be shared by all. +Intelligence platforms and AI will become the springboards upon which enterprises improve themselves throughout their lifecycles. Every enterprise will have to move data streams to +Intelligence platforms in order to survive and thrive. In this way, GIV 2025 traces out a roadmap for how +Intelligence platforms can enable industry development, which can act as a reference for industries as they hammer out their strategic direction.

This means that enterprises lacking cloud capabilities will disappear as we enter the intelligent world. Conversely, enterprises that take early steps to differentiate themselves by using +Intelligence will gain competitive advantages and reap significant dividends. More accurate decision-making, more efficient operations, and more specialized and innovative products will give enterprises that take this path a first-mover advantage in the intelligent world. Enormous dividends can be reaped by improving the ability to sense, collect, and use data, and by incorporating AI to improve productivity. This process can turn traditional industry resources into high-value knowledge resources. In fact, some farsighted traditional enterprises and cities with underdeveloped infrastructure are currently working to ride the wave of +Intelligence platforms. These frontrunners are aiming to accelerate the iterative development of technology and drive demand.



Mass Innovation: Tapping into the Opportunities Created by a USD 23 Trillion (CNY 146 Trillion) Digital Economy

In the intelligent world, data is what balances out supply and demand; it is the leverage used to optimize the structure. Every connection that can sense is like an oil well. Cloud and AI are the refining plants, which collect, transmit, and refine data, and then send it to the source of demand for further ‘purification’ and re-utilization. This cycle is the foundational phenomenon of an intelligent world.

Research shows that many cities and organizations are already working quickly to seize the first-mover advantage in the deployment of intelligent innovation platforms, aiming to lead in the intelligent world. These cities and organizations are all increasing the scope of their data collection, improving connection transmission efficiency, and strengthening their smart algorithm capabilities. GIV 2025 outlines an industry roadmap for all of society to do the same and make the most of what this new world presents.

Towards the Intelligent World: ICT Assumes the Important Role of Creating +Intelligence

Sensing enables intelligence. Intelligence improves perception. And perception reinforces sensing. This is a cycle of ever increasing intelligence. The evolution of intelligence, a process that has been taking place in humans over many millennia, is now playing out amongst tens of millions of ‘things’ in the world. The power of data will drive this evolution from three perspectives: sensing, connectedness, and intelligence, accelerating the evolution of intelligence millions of times over.

More importantly, the revolution in intelligence will bring new intelligent capabilities to every person, home, and organization. We are on the cusp of a new era. Three forces — universal sensing, more and better connections, and the emergence of intelligence in data usage — will combine to make the intelligent world a reality and drive society to grow and develop in entirely new ways.

The ICT industry will assume the important role of creating



+Intelligence, which when paired with 5G, cloud, video, the IoT, AI, blockchain, and other technologies will integrate the ICT industry, unleashing enormous industrial potential and kick-starting a new wave of economic development. They will further change the way people live and work, and ultimately reshape society as a whole. ▲

For more information about Huawei GIV 2025, visit: <http://www.huawei.com/minisite/giv/en>



Scan the QR code for more details of GIV 2025

Avoid These Three Misconceptions During Digital Transformation

By *Zhu Wei, Chairman, Accenture Greater China*

In recent years, China's business environment has changed at an unprecedented speed, and many traditional enterprises seem to be at a loss. Just like what companies in the United States experienced during the 1990s: Technological innovation is driving industries to switch from a pure product economy to a service economy. In a more open market, risks, uncertainties, and transformations become the new norm. Many enterprises have embarked on digital transformation to follow the digital economy trend — but only a few have succeeded.

A recent study by Accenture provided proof of this situation. At present, more than 80 percent of Chinese enterprises cannot figure out how to harness digital technologies for efficiency, more revenue sources, and business growth. At the same time, only 4 percent of Chinese manufacturers have unleashed the potential of digitalization through investment in technology.

Digital transformation of traditional enterprises is similar to a 'second-time startup.' Compared with smaller scale start-ups, digital transformation is more difficult for traditional enterprises that worry business failure will follow any attempt to start their transformation. We understand this anxiety, however, the following misconceptions can prevent enterprises from choosing the right time for transformation or adopting the proper approach, incurring even more difficulties for enterprises.

Misconception 1: Digital Applications Bring Quick Results

Chinese companies are generally enthusiastic about technology investment, and many believe that deploying new systems will bring immediate benefits. However, we find that operational improvements are not occurring in most enterprises. The causes are as follows: 1) Real transformation cannot be implemented overnight; 2) Many enterprises explore digitalization without a complete strategy. In most cases, they are making piecemeal attempts.

Based on a customer survey, Accenture found that Chinese enterprises attach great importance to digital construction on the production line but ignore planning and management. For example, regarding design, enterprises are not making the best use of digital technologies when launching new products or services. Only 8 percent of enterprises can deliver innovative services based on intelligent product terminals that collect user behavior data and feed Big Data analysis.

Enterprise leaders must understand that digital technologies are

only an enabler. Digital transformation is not just 'icing on the cake' and each department should not pursue their goals independently. Instead, digital transformation needs to be promoted by the top decision-makers in the enterprise to make it a development consensus for the entire company. Digital transformation needs to be implemented by all organization units in an End-to-End (E2E) manner from strategies to the organizational structure to operations.

In my opinion, enterprises can conduct complete digitalization in three steps. First, digitizing channels to drive revenue growth; second, digitizing operations and processes to grow margins and net profit; and third, to digitize business models to increase revenue.

To become a digital enterprise, we need to pay attention to both external and internal dimensions. At present, many Chinese companies are seeking only one dimension for short-term benefits, which essentially misses the forest for the trees.

Misconception 2: Imitating Internet Companies Opens Up a New World

In the new economic environment, the Internet success favored by the capital market is spotlighted, and many enterprises are rushing to abandon their original industries to approach online or emerging business. However, using the Internet strategy as a 'one for all' solution instead of reflecting on the fundamental pain points of the business will be counterproductive. Moreover, haphazard investments will result in low returns and affect the R&D investments into the main business.

Let's consider the example of a sports company in China that invested heavily in developing an eCommerce platform and multiple online channels. However, it failed to recognize problems in its core business, such as vague brand positioning, outdated offerings, backward inventory management, and inconsistencies between



For traditional enterprises, digital transformation is believed to be a 'second startup' riddled with overwhelming difficulties that can be further complicated by vague strategies, unclear business models, and incompetent organizations.

production and sales. As a result, the company's normal operations fell into disarray and a large number of distributors were lost.

Traditional enterprises are not advised to explore new opportunities without a clear purpose. Exploring new driving forces does not mean abandoning the main business to build a new platform. Enterprises should implement transformation by using digital technologies to increase the profits of existing services and pursue growth by enhancing investment capabilities to achieve sustainable development.

Traditional heavy-asset companies should make themselves 'light' by investing in software and services that contain more value. Enterprises can harness new technologies such as cloud computing, data analysis, and artificial intelligence to improve production and operational efficiencies, or seek professional services to create opportunities for business monetization.

For example, Schneider Electric has launched interconnection services based on real-time analysis and IoT platform solutions. In addition to improving existing productivity and saving costs, Schneider Electric can now respond better to the requirements from customers in the medical and dairy industries, and further explore potential value in predictive maintenance, asset monitoring, and energy optimization.

Misconception 3: Transforming Too Fast Will Lose Core Competitiveness

Many people believe that transformation is always chaotic, that enterprise performance will decline and basic businesses will be hindered. Therefore, many traditional enterprises are hesitant to make transformation decisions and respond slowly.

The facts are just the opposite. Accenture has analyzed 250 major transformation initiatives in more than 150 enterprises. The results reveal that high-performance enterprises benefited from better

cost management, customer service, and greater profits during the transformation. Comparatively, excellent enterprises have adopted three to five times more transformation measures at a faster speed.

This is consistent with my observations over the years. Long-standing problems of poor management, inconsistent processes, and siloed operations are not caused by transformation. In fact, embracing digitalization has become a compulsory task for traditional enterprises and ignorance or piecemeal measures cannot work.

To improve the probability that an enterprise will be a transformation success, executives need to focus on strong leadership, powerful systems, streamlined processes, and clear vision with passion and motivation. Only with a clear top-down policy direction can enterprises motivate all employees toward digital transformation.

Moreover, in the transformation process, enterprises can make full use of digital technologies to optimize internal processes, improve employee skills, and implement decentralized decision-making and flexible grass-roots autonomy during broader and deeper organizational transformations.

During this time of disruptive change, traditional enterprises should be neither arrogant nor underestimate their capabilities. First, enterprises need to identify the three major problems that hinder success: Vague strategies, unclear models, and incompetent organizations. Then, enterprises should conceptualize a strategic vision and continuously innovate. Digitalization brings traditional enterprises new opportunities for growth. As a partner for enterprises undergoing digital transformation, Accenture encourages more Chinese enterprises to seize the opportunities provided by digital transformation and unleash more potential into the market. ▲

Source: Harvard Business Review China



Sinopec: ProMACE Builds a New Smart Factory

By Li Defang, Director, Information Management Department, Sinopec & President, PCITC

After decades of development, China's petrochemical industry now ranks first in the world in oil refining capability, reaching 770 million tons in 2017. China also owns six fundamental oil-refining technologies, such as catalytic cracking and hydrocracking, and five major technology suites for refining oil at the level of tens of millions of tons, and ethylene and aromatic production at the millions of tons level. The industrialization of China's petrochemical industry ranks among the top-tier in the world in terms of scale.

However, China's petrochemical industry has many aspects that still need modernization despite its large scale. For example, the physical plant layout is not optimal because it is spread out; refining equipment is operating at 72 percent of capacity; meaning that production capacity is excessive. General products account for a large proportion of current production and there is a low degree of self-sufficiency for high-end products. The industry also has problems with high energy and material consumption, strict requirements for safety and environmental protection, and high production costs.

The new wave of ICT, energy efficiency technologies, and Electric Vehicles (EV) pose severe challenges to the continued development

of China's petrochemical industry. The development of EVs is noteworthy, as the EV ownership in China is increasing. Faced with the emergence of new energy efficient vehicles, do traditional petrochemical enterprises face a development crisis? In addition, the petrochemical industry urgently needs to improve its safety and environmental protection standards. These changes are a reminder to the petrochemical industry — and the vast majority of traditional enterprises in the energy industry — that they must formulate an advanced strategic plan for the future.

China Petrochemical Corporation (Sinopec Group) is the largest petroleum and petrochemical enterprise group in Asia, and in



2017 was ranked third in revenue in the Fortune Global 500. As a traditional enterprise, Sinopec faces the above-mentioned challenges in its transformation and development, and must carefully consider how to respond.

Sinopec's Road of Smart Manufacturing

Sinopec believes that smart manufacturing is the only way to promote the efficient and ecologically friendly development of China's petrochemical industry. The company's goal is to grow from being merely big to being robust. Petrochemicals is a process-dominated industry with the following characteristics: Strongly coupled physical and chemical processes make it difficult to build digitalized mathematical models; raw materials are complex; and production conditions highly variable. Because of these factors, process-dominated industries face many challenges to the adoption of smart manufacturing protocols. Smart manufacturing for discrete industries, as embodied by Germany's Industry 4.0 program, is not fully applicable to process-dominated industries. To realize an efficient and ecologically friendly process-dominated petrochemical industry for China, Sinopec must innovate independently. To this end, Sinopec has chosen a subsidiary company, Petro-CyberWorks Information Technology Co., Ltd. (PCITC), to work with selected Chinese universities and the world's leading ICT enterprises, such as Huawei and Accenture, to build an industrial IoT and smart manufacturing platform for Sinopec.

Sinopec has a long history of activity in the field of smart manufacturing. This work can be divided into three phases:

- **2003 – 2011:** Construction and promotion of a Manufacturing Execution System (MES). The MES developed in-house was applied to all refinery enterprises under Sinopec and promoted to other large domestic energy suppliers such as China Shenhua Energy Company and ChinaCoal. The successful application of the MES helped these traditional enterprises improve production management and control,

and have laid a solid foundation for a digital-network-based and intelligent petrochemical industry.

- **2012 – 2015:** Sinopec completed the overall planning and design of Smart Factory 1.0, including pilot applications deployed across Sinopec's four subsidiaries: Sinopec Beijing Yanshan Company, Sinopec Zhenhai Refining & Chemical Company, Sinopec Maoming Company, and Sinopec Jiujiang Company. Sinopec 'Smart Factory 1.0' tested theories, solutions, and core software products, and in 2015, Sinopec Jiujiang Company was recognized by the Chinese government as a model for smart factory pilots.

- **2016 – Now:** Sinopec initiated the construction of 'Smart Factory 2.0' and collaborated with Huawei to build ProMACE 2.0. The Smart Factory program was upgraded and ProMACE added a smart cloud component. In 2016 and 2017 respectively, Sinopec Zhenhai Refining & Chemical Company and Sinopec Maoming Company were also recognized by the Chinese government as models for further Smart Factory development. Also in 2016 and 2017, Sinopec was recognized for defining the China's Smart Factory standards, and in 2017, PCITC was listed in a national catalog for being a part of 'the first generation of recommended smart manufacturing system solutions providers.'

The Smart Factory construction program has enabled Sinopec to benefit from increased digitalized, network-based intelligent operations that promote its digital transformation and improve its product quality and production efficiency. The practice has proved extremely fruitful: Sinopec's average labor productivity has increased by over 10 percent. The automatic collection rate for production data now exceeds 95 percent. 100 percent of the Sinopec production system is now monitored in real-time, with analysis and warning alerts implemented for all key emission points. The performance of Sinopec Zhenhai Refining & Chemical Company's ethylene plant is among the best in the world, with a profit of more than USD 1.5 billion (CNY 10 billion) for three consecutive years



(2015 to 2017). The labor productivity for the Sinopec Maoming Company has nearly doubled between 2013 and 2016, and its 2017 profit exceeded USD 1.5 billion (CNY 10 billion) for the first time. Sinopec Jiujiang Company started making a profit in 2015 and its profit in 2017 exceeded USD 252 million (CNY 1.6 billion), ranking at the top among the enterprises of the same scale.

During the process of building ‘Smart Factory 1.0’ and again during the process of upgrading to ‘Smart Factory 2.0’, the application of the ProMACE Smart Factory Solution brought significant changes to Sinopec:

- **Collaboration between production operations:** Sinopec was the first to build an industrial 4G wireless network among all refinery enterprises. This network helps implement intelligent inspection and collaboration between internal and external operations, improve the on-site handling efficiency, increase the operations stability rate by 5.3 percent, and improve the operations qualification rate from 90.7 percent to 99 percent.
- **Risk notification based on Big Data:** Based on historical data analysis of catalytic devices and the alarm rules for digging equipment, a knowledge base has been formed and an updated warning model established. Critical alarms can be reported up to 1 to 2 minutes prior to an error to help operating engineers to take measures to avoid production risks in a timely manner.
- **Coordinated optimization for planning and dispatch:** Mechanism-modeling algorithms are leveraged to optimize planning, dispatch, and operations to help maximize economic benefits throughout the production process. The comprehensive economic benefit of pilot enterprises has increased by more than USD 157 million (CNY 1 billion).
- **Daily benefit analysis:** A deep learning algorithm implements intelligent scheduling and dynamic production optimization to allow daily benefit analysis instead of the monthly analysis as done previously.
- **Digital material warehouse:** IoT technology is used to implement real-time inventory tracking and intelligent distribution of materials to help pilot enterprises improve their material handling efficiency and reduce annual inventory costs by more than USD 7.8 million (CNY 50 million).
- **Automatic stereoscopic warehouse:** Sinopec Zhenhai Refining

Sinopec’s average labor productivity has increased by over 10 percent. The automatic collection rate for production data now exceeds 95 percent. 100 percent of the Sinopec production system is now monitored in real-time, with analysis and warning alerts implemented for all key emission points. >>

& Chemical Company adopted Chinese technology to build a large, unmanned polypropylene stereoscopic warehouse, a first in China’s petrochemical industry. This warehouse enables automatic management of solid product packaging and warehouse operations, as well as unmanned loading and shipment.

- **3D digital chemical plant:** A 3D digital chemical plant is built to enable training, equipment hoisting simulation, engineering workload estimation, equipment fault location, emergency drilling scenarios, and other applications.
- **Device health and reliability management:** Big Data technologies are leveraged to evaluate the running status of devices and perform intelligent diagnosis for predictive device maintenance and reducing unplanned downtime.
- **Energy management throughout the entire process:** The energy management center supports supply, production, transfer, transmission, and consumption.
- **Online optimization of energy flows:** An optimization model of plant-wide steam power production and output has been built to improve the operations of devices such as boilers, steam turbines, and heat exchangers. The model promotes energy savings, emission reductions, cost reductions, and efficiency improvements; and helps the enterprise save more than USD 1 million (CNY 7 million) in energy costs.
- **Emergency command coordination:** Incident reporting, incident reception, and incident handling are systemically linked to ensure quick response. The impact scope of incident diffusion is calculated based on models such as explosions, leakage, and fire to help provide guidance for on-site rescue operations.
- **Online management and control for environmental protection:** Pollution emissions (chemical oxygen demand, ammonia, sulfur dioxide, and volatile organic compounds) are monitored in real



time in accordance with the environmental protection map, and all abnormalities pushed to the appropriate party.

Building a Brand-New Smart Factory

If ‘Smart Factory 1.0’ is completed and operating successfully, why is Sinopec so focused on the development ProMACE? The pilot construction of Smart Factory 1.0 started in 2012 using a traditional information system architecture. Because the Smart Factory 2.0 program began in 2016, Sinopec chose to adjust the entire approach to system construction to accommodate newer technologies that are better positioned to meet the changing business requirements.

According to the ‘Made in China 2025’ strategy, PCITC’s goal is to build a network-based and intelligent modern factory. To achieve this outcome Sinopec has proposed a ‘Platform + Data + Service’ construction model for building a new type of Smart Factory. Sinopec and Huawei launched ProMACE jointly in 2016.

The ProMACE cloud project is not to develop Sinopec’s smart manufacturing capability, but also to support the entire process-dominated industry. Revolving around Smart Factory and capitalizing on smart logistics and services, ProMACE will integrate with Smart Campus and Smart City platforms to form new development modes and new business models that integrate traditional industries and with IT to lead the way for future industrial development.

As the primary support platform for Sinopec’s smart manufacturing developments, ProMACE has the following five core elements:

- **Secure and controllable industrial IoT:** Comprehensive sensing and interconnection form a ubiquitous industrial IoT environment to implement identification and management of materials, products, equipment, environment, and personnel.

- **Open and intelligent process-dominated industry cloud platform (Industrial PaaS):** The cloud platform is an industrial operating system for smart manufacturing. The platform provides five core capabilities: centralized integration, real-time computing, intelligent analysis, IoT access, and 2D/3D visualization.

- **Industrial Apps that incorporate best practices:** Industry-level core applications integrate the best practices of production control, safety, and environmental protection for process-dominated industries.

- **Expert services based on industry experience:** Expert resources

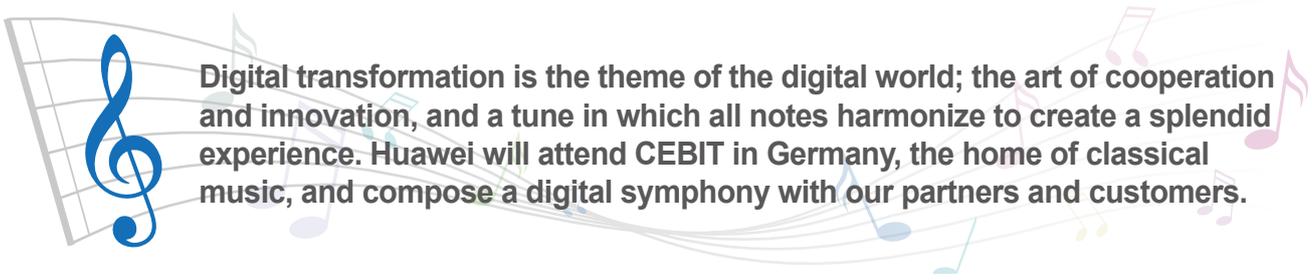
(such as academic design experts, equipment experts, and process experts) provide customers with special services such as remote device diagnosis, refining process guidance, and safety and environmental protection consulting.

- **Standards and safety systems:** Redundant systems and standardization ensure the continuous operation of ProMACE.

ProMACE is part of the effort to maximize leverage and unleash the full potential of Cyber-Physical Systems (CPS) in the Smart Factory environment for the petrochemical and other process-dominated industries. ProMACE realizes our vision to transform fixed, physical factories into easily rearranged, modular ones. The first dimension for process-dominated industries is the visual representation of factory assets using a 3D model. The second is process representation using a mechanical model. The third is the formation of a Big Data model with self-learning capabilities. ProMACE data models are combined with optimization and control techniques to implement interactions between computed and physical processes to incorporate CPS capabilities. In addition, ProMACE supports three primary business activities: production control, supply-chain management, and asset-lifecycle management to form the next-generation production operations paradigm.

The Huawei win-win ‘ecosystem’ program cooperates with partners to bring historic development opportunities across different industries, though for the manufacturing sector. Using the same concept, ProMACE is committed to a similar ecosystem for process-dominated industries over the next three years. By aggregating over 1,000 expert services and providing access to over 100 devices, ProMACE will provide professional services for more than one million users and over 100 large enterprises. ProMACE will launch over 1,000 core industrial Apps, develop more than 300 mechanical models, and build 10 demonstration sites for smart manufacturing. At the same time, over 100 partners will be involved to extend the scale of the developer community.

We sincerely hope to cooperate with experts, enterprises, and partners both in and outside the petrochemical industry to become pioneers in the digital transformation of manufacturing. We hope to contribute our strengths to China’s national project to improve manufacturing power and promote the deep integration of the Internet and AI with the real economy. ▲



Digital transformation is the theme of the digital world; the art of cooperation and innovation, and a tune in which all notes harmonize to create a splendid experience. Huawei will attend CEBIT in Germany, the home of classical music, and compose a digital symphony with our partners and customers.

A Digital Symphony Composed of Technology & Ecosystem

By Lu Qi, President, Marketing and Solution Sales Department, Enterprise Business Group, Huawei Technologies Co., Ltd.

Technology Orchestrates a Digital Symphony in the Home of Classical Music

Germany is a manufacturing leader and a digital transformation pioneer. Hannover will hold the annual Information and Communications Technologies (ICT) summit, CEBIT, in June 2018 at which new thoughts on the digital future will be presented. During the event, Huawei's exhibition will consist of four sections: Digital economy (d!conomy), digital technology (d!tec), digital discussion (d!talk), and digital campus (d!campus).

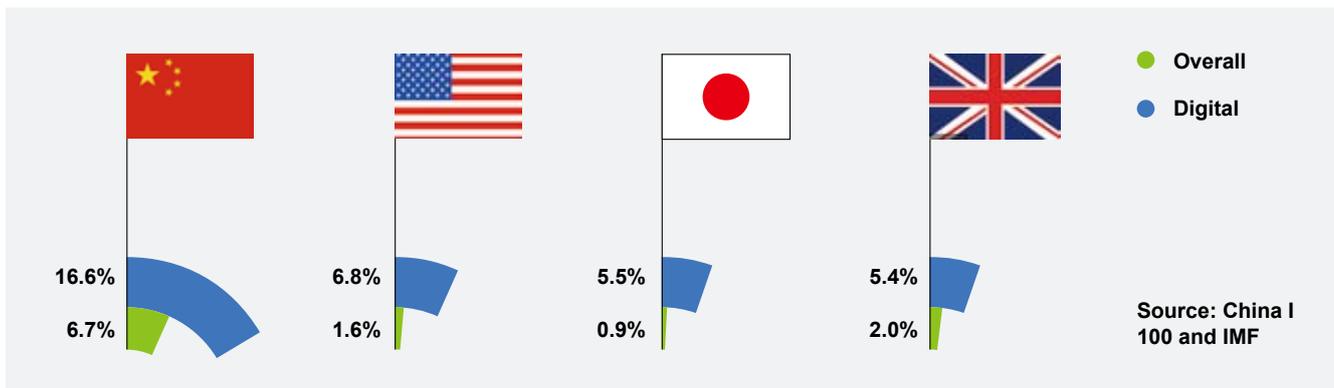
As a shining pearl in the gallery of European music, Germany has given us many renowned composers like Johann Sebastian Bach, Ludwig van Beethoven, Franz Schubert, Robert Schumann, and Johannes Brahms. From June 11 to June 15, 2018, Huawei will collaborate with more than one hundred partners to host our global customers at CEBIT, the grand international ICT exhibition. Together, we will compose a digital transformation symphony. Our exhibition resonates with three themes: Business, Technology, and Ecosystem. As an ensemble, we will demonstrate our innovative ICT and solutions in cloud computing, Artificial Intelligence (AI), Big Data, the Internet of Things (IoT), and Software-Defined Networking (SDN), as well as share our best practices for digital transformation.

Digital Technology Drives National Development, Industry Transformation, and Upgrades

Countries throughout the world are actively using new ICT like cloud computing and Big Data to promote social development, industry transformation, and innovation. These technologies infuse new momentum into economic development.

The digital economy is playing an increasingly important role in national economic development. Statistics show that the digital economy is growing much faster than other industries in China, the United States, Japan, and the United Kingdom. Take Japan as an example; Japan's digital economy exceeds its traditional economy by 6 times in growth rate. Digital transformation has become a new force driving national development, industry transformation, and innovation.

In 2017, Huawei and Oxford Economics released *Digital Spillover*, a jointly published report on the impact of the digital economy. Our analysis suggests that over the past three decades, a USD 1 investment in digital technologies has led to a USD 20 rise in Gross Domestic Product (GDP) on average. This Return On Investment (ROI) dwarfs the 3:1 return for non-technology investments in the same period. This result shows that for every USD 1 investment, the average return to GDP is 6.7 times higher



Overall versus digital economic growth

for digital investments than for non-digital investments. The global digital economy is growing rapidly and evolving constantly, in fact, over the past 15 years it has grown 2.5 times faster than the global GDP. IDC forecasts that by 2020, global digital transformation will underlie a USD 18 trillion (CNY 114.8 trillion) market. For now, 46 percent of the world's enterprises have listed increasing digital service business as their first priority over the next year. The same number is 69 percent in China.

We believe that in the next three decades, the traditional economy will experience extensive digitalization. Digital technology will reshape every industry. AI will affect every enterprise. Industry players must efficiently respond to market changes, and use new technologies and business models to explore the latest paths to innovation. To do so, enterprises need world-class digital partners to offer them reliable, easy-to-use digital platforms. Huawei is actively exploring this field and striving to become our customers' best partner for digital transformation.

• **New Cities Pay More Attention to Intelligence**

Statistics from the World Bank, World Economic Forum, and other organizations show that new smarter cities pay more attention to their intelligence levels.

Huawei leverages new ICT to build 'nervous system' functionalities for cities. With our comprehensive ecosystem in place, Huawei offers holistic Smart City solutions that cover everything from top-level architecture to service applications. In Yanbu, an emerging city in Saudi Arabia, Huawei works with industry partners to develop a series of smart applications on a unified platform. The Intelligent Operation Center and Big Data applications have improved the efficiency of Yanbu's overall administration, increased local investment by 18 percent, and created 18,000 new jobs.

Smart City development focuses on visualized, intelligent awareness. In 2017, Huawei released the industry's first video

cloud solution that supports on-cloud operations and distributed network-wide intelligence. The solution perfectly meets customer requirements for collaborative security protection that not only changes the ways in which video is watched, but also how it is used. Taking Shenzhen, China as an example. Huawei's video cloud solution, deployed in 2017, has helped the city solve more than 60 percent of its criminal cases and reduce its annual caseload by 25 percent.

• **Innovation and Digital Technology Development Upgrade Traditional Manufacturing**

Many countries have planned their national strategies to promote the upgrade and development of their manufacturing industries, such as Germany's Industry 4.0, Made in China 2025, and Made in India. These strategies are all based on innovation and development of digital technologies. Industrial statistics show that the rate of digitalization is growing explosively in a number of industries, such as manufacturing, oil and gas, transportation, and smart buildings. Innovative digital technologies are affecting traditional industry transformation like never before.

Huawei also provides basic communications abilities and advanced AI technologies to help traditional automakers leverage digitalization opportunities and gain the competitive edge created by digital transformation. In communications, Huawei has been serving the telecommunications industry for decades and has accrued rich experience. With regard to AI, Huawei provides proprietary AI chips that can effectively promote connected and intelligent car development. Furthermore, the European automobile giant, Groupe PSA, chose Huawei as its partner to build the Connected Vehicle Modular Platform (CVMP). To date, this connected car platform has covered 89 countries around the world. PSA plans to connect 8 million cars to the platform by 2025 and offer online car-scheduling, onboard entertainment, driving behavior analysis, emergency rescue,



fleet management, car resales, and many other services. Additionally, Huawei helped Dongfeng Motor Group develop a private cloud to connect Dongfeng's 15 subsidiaries to its cloud data center. This drastically accelerates Dongfeng's business transformation and has reduced the group's IT costs by 30 percent.

- **ICT Drives Financial Innovation: Digital Technology Provides Banks with New Competitive Advantages**

During this period of digital transition, the banking and insurance industries are impacted by economic globalization in addition to new rules, technologies, and customer behaviors. In fact, McKinsey has forecast that banks must master digital technologies in three to five years if they are to survive incoming market competition.

Huawei offers top financial customers a series of innovative solutions that cover campus networks, video surveillance, data centers, financial cloud, and Big Data analytics. China Merchants Bank (CMB) is raising customer satisfaction to a whole new level by using Huawei's Big Data Cloud Platform customized with a number of innovative, real-time services for targeted customer groups. Huawei and China Pacific Insurance (CPI) built the Basic Big Data Application Platform to help CPI crack down on fraud, settle claims, prevent risks, and conduct direct marketing.

- **Bits Drive Watts: ICT Brings a Brighter Future to the Electric Power Industry**

The electric power industry has already started its digital transformation. In the next decade, ICT and smart grids will converge with each other more extensively to achieve faster development, creating more opportunities throughout the value chain, and bringing a better future to the industry.

Huawei offers solutions such as the Electric Power Cloud, Electric Power Communications Network, Electric Power IoT, and other technologies to help

If the future digital world is a grand symphony, then digital transformation shall be its theme. The ICT industry must build a solid stage and provide harmonious support to orchestrate this concert. >>

world-leading power companies develop diverse automatic and intelligent services. These solutions not only help power companies improve energy management efficiency, but also offer security protection to ensure stable power grid operations. Huawei's Passive Optical LAN (POL) or Agile POL Solution helps Italian electricity company Enel complete their digital transformation and build a more reliable, efficient, and energy-saving communications network. Enel's new network has lowered power consumption by more than 60 percent, reduced their equipment foot print by 80 percent, increased deployment efficiency by 50 percent, cut down Operational Expenditure (OPEX) by more than 50 percent, dramatically improved Enel's cloud and mobile service experiences, and has boosted office efficiency.

Technology Sonata: Three Core Abilities Secure Huawei's Leadership in the Future Digital World

In April 2018, Huawei released the *Global Industry Vision 2025*. In this report, Huawei forecasts that the world will have 40 billion personal smart devices and 1 trillion connections by 2025, creating a USD 23 trillion (CNY 146.7 trillion) market. By then everything will be perceptive, connected, and intelligent.

ICT will undoubtedly play a key role in this groundbreaking transformation. The ICT industry is shouldering the responsibility to construct the digital infrastructure for intelligent industrial applications. ICT companies must pioneer intelligent transformation internally before they are able to help transform enterprises in other areas. If the future digital world is a grand symphony, then digital transformation shall be its theme. The ICT industry must build a solid stage and provide harmonious support to orchestrate this concert.



Huawei provides industry-leading all-stack 'cloud-pipe-device' solutions to help customers design and implement top-level ICT architectures. Adhering to the 'platform + ecosystem' strategy, Huawei works with partners to develop open solutions and a win-win strategy.
>>



The ICT industry is entering a new phase of development. During this transition, ICT and digital infrastructures will be widely implemented in all industries and sectors. Digital technology is extending from support systems to production and decision systems in almost all enterprises. To handle these various changes, ICT companies are shifting their attention and investment from vertical industries to horizontal platform industries. This is why Huawei announced a new vision at the end of 2017: Bringing digital to every person, home, and organization to create a fully connected intelligent world.

Over the last few years, Huawei has invested intensively in cloud computing, Big Data, the IoT, mobile broadband, AI, and other cutting-edge technologies that are driving digital transformation. Despite their uncertainties in future development and commercial implementation, these technologies have many common chords. They will all need chips, mathematical algorithms, and architectures.

Huawei has accumulated solid capabilities in these three aspects over several decades of ICT product development. These abilities enable Huawei to replicate its successful experience from one product to another, provide competitive products and solutions to enterprises, create a powerful foundation for innovation with our ecosystem partners, and support our customers' digital transformation across all industries.

Huawei is leading optical communications, wireless, and data center development. For example, when selecting data center products, customers want

high speed, stable operations, high energy efficiency, and small equipment footprints. Huawei gained experience in the areas of chips, algorithms, and design architecture from the optical communications and wireless domains. With these abilities in place, Huawei developed the world's fastest and most stable all-flash storage product. The OceanStor platform exceeds the industry average for Input/output Operations per Second (IOPS) by more than 250 percent. Moreover, Huawei designed the industry's first mission-critical server that supports online replacement of Central Processing Unit (CPU) and memory units. Huawei chips and architectures help customers reduce data center power consumption (by 38 percent) and space without compromising service performance and reliability. This effectively improves the energy efficiency of data centers, which further reduces the cooling and maintenance costs of these facilities.

In the area of cellular wireless communications, Huawei offers the world-leading Radio Access Network (SingleRAN) products that support multiple-bands, multi-models, and assure VIP experiences. When replicating these core technologies to the Wi-Fi domain, Huawei is capable of providing various features for the enterprise communications market, such as three-band/ultra-large capacity, multi-model convergence (Wi-Fi + e-Label + ZigBee), user-based signal beam adjustment, and intelligent antennas to ensure an optimal customer experience. These achievements contribute to Huawei taking the lead in the market for Wi-Fi technology.



AI first came into being in the 1980s, but was not commercially used on a large scale until recently. As ICT products experienced rapid growth in communications, computing, and storage abilities over the last few years, user experiences have been elevated to unprecedented levels. This places AI on a fast track to commercial use. For secure commercial utilization, AI needs lightning-fast computing and network infrastructures. Based on this, Huawei has customized a series of products and solutions for AI applications. These products are highly advanced and feature top-notch performance. For example, just seven Huawei Graphics Processing Units (GPU) servers equal 200 traditional servers in performance. Huawei's all-flash storage keeps latency permanently below 0.5 millisecond, half of the industry average. Huawei's ultra-speed AI Fabric network uses innovative algorithms that shorten AI training by 40 percent.

As we move into the future, Huawei will leverage its advantages in chips, mathematical algorithms, and architectures to ensure its leadership in the ICT industry. These three core abilities allow Huawei to continuously provide innovative products and solutions for communications, computing, and storage, and bring more benefits to customers.

Ecosystem Minuet: Huawei Creates CNY 1 billion Partner Incentive Fund

Digital transformation is the theme of our digital world — the art of cooperation and innovation, and a crescendo in which all chords harmonize to create a magnificent experience.

Huawei places great value on our ecosystem and partnership development. We need stronger and more holistic ecosystems to win in the digital future because we believe that future market competition is not between companies, but between ecosystems. Huawei provides industry-leading all-stack 'cloud-pipe-device' solutions to help customers design and

Adhering to the 'platform + ecosystem' strategy, Huawei works with partners to develop open solutions and a win-win strategy. We strive to build a platform to accommodate all systems and a resilient infrastructure for ecosystems. >>

implement top-level ICT architectures. Adhering to the 'platform + ecosystem' strategy, Huawei works with partners to develop open solutions and a win-win strategy. We strive to build a platform to accommodate all systems and a resilient infrastructure for ecosystems. Together, we create an ecosystem value chain that enterprise customers need for digital transformation. Currently, 197 of the *Fortune Global 500* companies, including 45 of the top 100, have chosen Huawei as their digital transformation partner.

Looking towards the future, Huawei will open our ICT, marketing, training, and service platforms to our partners to help them achieve comprehensive cross-border development. Over the next 3 years, we will offer effective support to help 100 partners achieve USD 15.6 million (CNY 100 million) in income, develop more than 1,200 solution partners, and establish a USD 156.7 million (CNY 1 billion) incentive fund for cloud partners.

This is a great time. The prelude of digital transformation has begun. Huawei will play the innovative, powerful sonata of technology and resonate with our global partners' minuet and industry customers' variations. Together, we will orchestrate a majestic digital symphony, in concert with the new age of digital business. ▲



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Purpose-Built Silicon for All-Flash Storage

By Wang Jiaxin, Marketing Director of Huawei All Flash Storage

Data is the core of intelligent management, and the intelligent scheduling, mining, and analysis of applications data helps companies design, produce, and organize the logistics required to precisely control the delivery of personalized experiences to end users. In addition to reducing management costs, the effective use of data unlocks the ability to define new business models and create new commercial opportunities.

Digital transformations rely on intelligent management and demand high-performance infrastructures for which all-flash storage solutions are an essential part. All-flash storage products are the new engine for mission-critical services, and the core of commercial competitiveness.

Huawei created the OceanStor Dorado all-flash storage series by vertically integrating chips, networks, and management. The Dorado platform incorporates an intelligent SSD controller chip, intelligent multi-protocol processing chip, and intelligent Baseboard Management Controller (BMC) management chip to build an end-to-end service acceleration platform. The result delivers triple the performance and maximum resource utilization.

Intelligent SSD Controller Chip: Accelerating Data Read and Write

The essential SSD components for assuring critical data performance and stability include a control unit (SSD controller + DRAM) and a NAND flash storage unit that is responsible for data read/writes. The Flash Translation Layer (FTL) stores the mapping information between the user Logical Block Addressing (LBA) and the physical

page in the SSD. In action, when the storage controller reads data from the SSD it records an LBA address. The FTL is the core of the entire SSD and it determines the response time to read and write data. The SSD flash control software finds the physical address corresponding to the LBA address, reads the data from the flash memory block, and returns the data to the host. When the control software writes data the FTL mapping table is updated.

Huawei is leveraging an innovative SSD controller chip to achieve the fastest read and write speeds. The FTL algorithm has been moved from the control software layer directly onto the SSD controller, therefore I/O latency is reduced because all FTL reads and writes are performed on-chip instead of as software interactions.

An example from history to better understand how all-flash storage affects day-to-day work: A Windows 95 computer would take two to three minutes to load a long string of boot code when powered on. A newer Windows 10-equipped machine, with a more powerful processor, is able to reach of the startup interface almost instantaneously after loading its boot code.

According to tests by Huawei's performance and interoperability lab, the read latency of Huawei SSDs is as low as 80 μ s in low-load



In the age of all-flash storage, Huawei's technology is designed to utilize all competitive advantages. To this end, Huawei chips unleash the full potential of flash storage to enable enterprise digital transformation and improve user experience.

scenarios — as little as 60 percent of the time for comparable SSDs on the market.

Huawei developed FlashLink™ technology to achieve end-to-end acceleration. By combining a proprietary SSD controller chip, SSDs, NVMe architecture, and a storage operating system designed for flash, the OceanStor Dorado series of storage platforms delivers three times higher performance. A 0.5 ms latency is maintained, even during peak hours, when value-added features such as deduplication, compression, and snapshot are enabled on Huawei all-flash storage products.

Based on the flash-oriented operating system, Huawei storage engineers have developed an innovative disk-controller-collaboration algorithm. It is well known that garbage collection is a key factor affecting SSD performance. The new algorithm enables the storage controller to recognize the data layout of SSDs in real time and adjust the layout to ensure consistency between the storage controller and SSDs.

Controller data is written into SSDs that are formatted as required at that moment, per that session, by the SSDs. Proper formatting avoids additional data migration and garbage collection cycles that ensure consistently high flash-system performance. Sequential writing of large blocks, independent partitioning of metadata, and end-to-end I/O priority adjustment all help to fulfill the basic principles of the disk-controller collaboration algorithm.

Based on the intelligent SSD controller chip and FlashLink™ technology, Huawei's lightning-fast and rock-solid OceanStor Dorado all-flash storage can deliver high performance and keep the response time to within 0.5 ms.

Intelligent Multi-protocol Interface Chip: Accelerating Data Read and Write of Front-end Network Interfaces

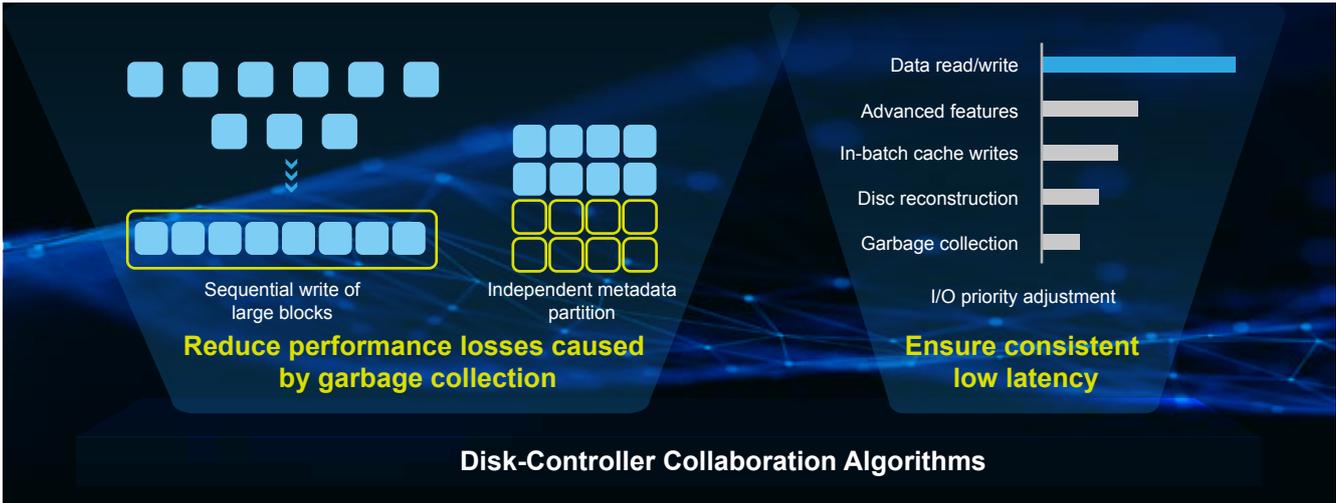
Front-end interface modules are a key subsystem because the application data is transmitted through these modules from servers

to storage arrays. Currently, mainstream front-end interface modules include 8G/16G/32G Fiber Channel (FC), 1 GE/10 GE/25 GE/40 GE/100 GE, and 10G Fiber Channel over Ethernet (FCoE). The current industry standard for each front-end interface module is to support only one of the protocols listed above, which Huawei believes is a waste of resources.

To improve upon this inefficiency, Huawei has developed a multi-protocol interface chip that integrates GE/10 GE/FC/FCoE interfaces into one device. Customers are able to use the same interface chip to transmit data for both IP and FC protocols. On a 10 GE or 8G/16G FC network, only optical module components will need to be replaced instead of the entire module. The ability to convert between protocols greatly improves network flexibility and reduces the network construction and maintenance costs for data centers.

Also important is the support for many protocol stack functions such as checksum and FC in the internal hardware logic module of the intelligent multi-protocol interface chip. The processing flow, logic, and other task-specific functions are now switched from the CPU software to the chip to ensure high I/O concurrency and low latency storage services. In other words, the interface chip offloads the checksum and FC workloads from the CPU to improve network processing performance, access, and data exchange; release x86 CPU resources; and improve overall storage performance. Huawei's performance tests show that when configured with the same front-end interface module (16G FC) and test model (7:3 read/write, 8K I/O blocks), OceanStor Dorado solutions deliver up to three times the performance of competitors' products.

Software and hardware investments are protected by the support of FCoE protocols for both FC and Ethernet-based transmission. The intelligent Huawei multi-protocol interface chip integrates the functions of the Ethernet Network Interface Card (NIC) and FC-network Host Bus Adapter (HBA) card; that is, one interface is supporting two types of network I/Os. This eliminates extra cables



and switches, and simplifies network management. Previously, the FCoE protocol would consume a significant portion of host CPU resources. And, because the CPU could not parse multiple network protocols simultaneously, the required performance levels could not be achieved. OceanStor Dorado products use the multi-protocol interface chip to process the FCoE protocol by offloading the workload from the host CPU, which improves overall network performance and server availability.

Intelligent BMC Management Chip: Accelerating Fault Management and Recovery

The quick identification and elimination of data faults is a core indicator of IT device reliability, and the intelligent BMC management chip is the ‘heart’ of the OceanStor Dorado. It has built-in fault diagnosis and pre-warning libraries to improve diagnostic accuracy, as fast diagnosis is a singular prerequisite for immediate recovery. The intelligent management chip is benchmarked at 2,000 Dhrystone Millions of Instructions Per Second (DMIPS), a figure that is five times higher than that of Huawei’s competitors. If a controller, front-end interface module, or management module fails, switchovers are performed within seconds — so fast that no data is lost, services are not interrupted, and users are completely unaware of the switchover.

The intelligent BMC management chip excels in saving energy. By monitoring the health, power consumption, and temperature of each module in detailed log files, static and dynamic power consumption control technologies are combined to adjust the heat dissipation of the system. Static power consumption is controlled by reducing the temperature of the chip. Additionally, the embedded Dynamic Energy Management Technology (DEMT) enables the chip to analyze the

status of applications on the system, disable the clock, and reduce the voltage of idle modules to reduce the chip’s dynamic power consumption. According to field tests, under the identical CPU workloads, the power efficiency ratio of Huawei’s entire flash-storage system can be improved by 16 percent.

Whether for new applications — such as artificial intelligence, Big Data, autonomous driving, or block chain — or traditional applications such as healthcare, manufacturing, or finance — innovative chip technologies are a primary force for global enterprise growth. The Huawei Storage group is committed to the continuous investment in chip innovation to help enterprises accelerate their digital transformation to better cope with today’s digital deluge.

The intelligent SSD controller chip introduces purpose-built optimizations for flash media to capitalize on the full potential to improve user experience. The multi-protocol intelligent processing chip simplifies networking, reduces management costs, and offloads network protocols to accelerate data reads and writes. The intelligent BMC management chip accelerates fault location, failover in seconds, and superior energy efficiency. Combined, the three custom all-flash storage chips help the users who lease IT devices to reduce costs and while simultaneously exploring new business opportunities.

Through technical innovation and vertical optimizations at the software, hardware, and chip levels the Huawei Storage group is committed to eliminating the performance gaps caused by the unbalanced development of CPU, media, and network technologies. In doing this, Huawei Storage is providing faster, better, and more cost-effective products and solutions. We invite you to learn more about Huawei Storage to better understand how your business can succeed with Huawei. ▲

Intelligent Servers: Huawei Servers Live Up to the Name

By Jason Ding, IT Product Line, Huawei Technologies Co., Ltd.

New Challenges in Traditional O&M Domains

With the rapid development of cloud computing, Big Data, and AI applications, increasingly higher requirements are posed on servers and computing capabilities. In turn, these factors have caused the construction of data centers around the globe to advance in both speed and scale. It is now common to see data center deployments that involve tens to hundreds of thousands of servers.

As reported by Gartner, global server revenue increased by 25.7 percent in the fourth quarter of 2017, and the server technology industry is in a prime period of rapid growth. With the blazing-fast development of services, IT infrastructures need to be quickly deployed, brought online, and conveniently managed. The management scenarios for massive numbers of servers are becoming more and more complex, and traditional Operations and Maintenance (O&M) domains face many new challenges.

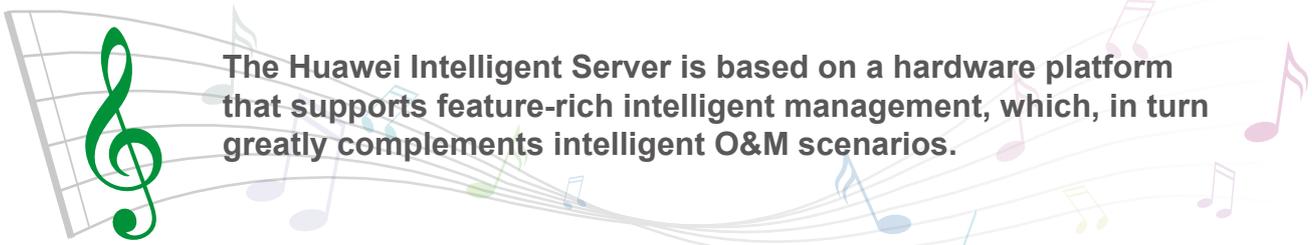
- **Challenges to Server Deployment:** In data center expansion, migration, and consolidation scenarios, newly purchased servers need to be assembled, commissioned, allocated network resources, and have had their configurations provisioned. On-site manpower

involves hardware installation and software deployment by O&M technical staff. Statistics gathered by Huawei IT service departments indicate that more than 50 percent of operating faults are caused by inefficient and error-prone manual operations that result in extra costs for labor and material.

- **Challenges to Energy Consumption Management:** According to the Climate Change News report, the total power consumption of global data centers in 2017 accounted for 3 percent of the total global power consumption, and the proportion is expected to reach 20 percent in 2025. Statistics show that energy consumption accounts for 35 percent of the data center Operating Expense (OPEX). Skyrocketing OPEX will become a global challenge. The result is that customer requirements for energy consumption management are mainly about the design of reliable power management policies to reduce energy consumption and effectively predict the cost of energy, which is critical to the precise investment of data centers.

- **Challenges to Fault Prewarning and Diagnostics:** In a traditional O&M mode, technical personnel reactively wait for faults to occur and then rectify them. In this old-school mode, the operating





The Huawei Intelligent Server is based on a hardware platform that supports feature-rich intelligent management, which, in turn greatly complements intelligent O&M scenarios.

efficiency is 50 to 100 servers per person. As the scale of data centers continues to rise, faults will occur more frequently, and the associations between faults will become more complex. This will cause a proportionally lower efficiency if the industry is not able to move beyond the traditional modes of server maintenance. Further, traditional maintenance is based on alarm reporting, which means that problems are noticed and fixed only after critical thresholds are crossed. This, in turn, leads to service interruptions. Against such a backdrop, it is difficult to deliver on Service Level Agreement (SLA) guarantees of 99.95 percent or above.

How is Huawei Tackling these Challenges?

Gartner proposed the concept of Algorithmic IT Operations (AIOps), a novel form of intelligent O&M, in 2016. The global deployment ratio of AIOps was lower than 5 percent in 2016, but will reach 25 percent in 2019. In other words, intelligent O&M will become the new normal. The AIOps platform is defined by 11 capabilities, including historical data management, stream data management, log data extraction, network data extraction, algorithm data extraction, text and Natural Language Processing (NLP) document extraction, automatic model discovery and prediction, exception detection, root cause analysis, on-demand delivery, and software service delivery capability. These capabilities enable targeted solutions to the preceding pain points, and are the main development direction of massive data center server management.

AIOps are in the process of a long-term evolution. What we see are AIOps focused on detection and prediction based on massive machine data that turns reactive O&M into a proactive method. The optimization is mainly on the software side. However, delivering a material leap forward in aspects such as deployment, energy saving, and fault management requires a vital synergy between hardware and software.

In response, Huawei has put forward the concept of Intelligent Servers that integrate intelligent management chips and intelligent algorithms to implement more efficient server deployments, fault

diagnostics and prediction, energy consumption management, mobile O&M, and version management.

The Huawei Intelligent Server is an integrated software and hardware solution that combines intelligent chips with an O&M platform and ‘integrated Baseboard Management Controller’ (iBMC) software.

So, what are the advantages of this holistic hardware and software solution?

Compared to traditional OEM servers, Huawei servers provide intelligent management functions, such as single-node-level fault prediction and analysis, and intelligent power consumption management. In addition, the Graphical User Interface (GUI) is designed to present the operating status in a user-friendly and intelligent fashion. The result is a reduction of O&M personnel costs and an improved O&M experience. What’s more, Huawei Intelligent Servers allow maintenance personnel to access server O&M systems locally via Bluetooth and Wi-Fi to dramatically facilitate server deployments and fault location.

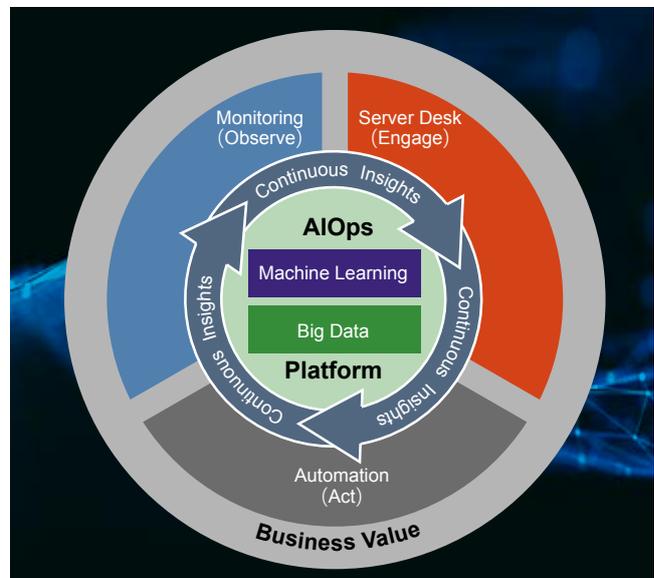


Figure 1. Algorithmic IT Operations (AIOps) overview (Gartner, 2016)

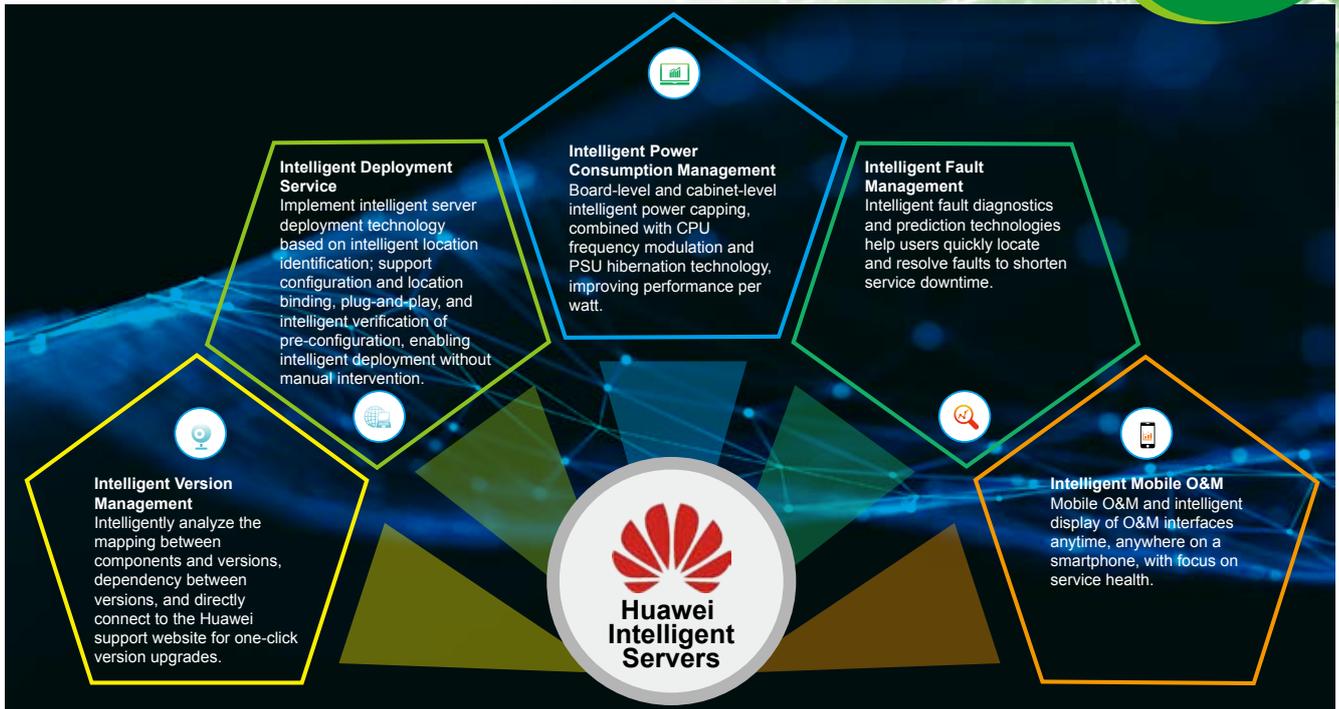


Figure 2. Five major functions of the Intelligent Server

For example, in deployment and maintenance scenarios, the Huawei Intelligent Server provides a one-click Wi-Fi hotspot button. After arriving at the site, the maintenance engineer can touch the Wi-Fi hotspot button, use the mobile App to scan the bar code on the server to access the server O&M network, and then quickly access the server enclosure information and provision configurations. The maintenance engineer can also perform assembly and maintenance according to the guidance provided by the mobile App.

The Huawei Intelligent Server is based on a hardware platform that supports feature-rich intelligent management, which, in turn, greatly complements intelligent O&M scenarios. In many scenarios, the main bottleneck in the manual operation of O&M personnel is not that the desired information is lost in an ocean of data, but that the hardware itself does not support intelligent management. Intelligent Servers bridge the gap between hardware and software to better resolve fundamental problems that cannot be addressed by solely relying on software, as occurs with other O&M scenarios. Thanks to improvements in silicon chip capabilities, the information collected by the servers is more comprehensive and provides a more reliable reference for the intelligent O&M platform to make decisions.

For energy consumption management, the intelligent server integrates functions such as dynamic frequency modulation for CPU cores, fan speed tuning, and power supply hibernation. When service loads are low at night, users can set the energy consumption profile to the energy-saving mode. The Intelligent Server then will adjust the CPU clock frequency to limit power consumption within a specified

range of values. The Intelligent Server can also hibernate some Power Supply Units (PSUs) to further reduce power consumption. When service loads are heavy during daytime peak hours, users can set the energy consumption profile to a high-performance mode. The Intelligent Server then will cancel all CPU frequency modulation restrictions and PSU hibernation configurations. In addition, the Intelligent Server will invoke the high-performance heat dissipation specifications for fan heat control to intelligently associate energy saving policies with real-world conditions. Combined, these features can save over 10 percent of the energy draw for a single server cabinet. The intelligent power consumption management platform also provides intelligent control of cabinet-level power consumption, where the power-capping value is recommended based on historical power records. In typical service scenarios, the density of single server cabinets can be increased by more than 10 percent.

The Intelligent Server inherits all the existing functions of the intelligent O&M platform and provides a new direction for the evolution of O&M. According to the implementation of the intelligent server solution, traditional O&M personnel will be freed from repetitive and low-value daily work. Manual operations can be optimized and the efficiency of onsite personnel boosted using automation. In addition, intelligent energy consumption and fault management capabilities can be used to enable higher fulfillment rates for SLAs to help customers save further on OPEX.

Inspired by innovations from the very core of Huawei's silicon chips, Intelligent Servers better position data center customers for excellence and success in the future. ▲

Intent-Driven Networking: Transforming the Network to Maximize Business Value

Many enterprises are prioritizing digitization to compete in today's industries. According to a recent Economist Intelligence Unit survey, 40 percent of CEOs rank digital transformation as their top priority.

Enterprises are looking to gain significant business value through their digital transformation. They are adopting digital to meet customer expectations for a Real-time, On demand, All online, DIY, and Social (ROADS) experience during every interaction with the company. They are also reinventing business processes and automating decision making to increase operational efficiency, quickly launch new services and cut costs.

In addition, enterprises are embracing digital to increase connectivity throughout their operations from production and logistics through to sales and marketing. This provides access to data and insights from across the organization to help shape business innovation. Furthermore, digitization can free up the traditional workforce to focus on the business' core competencies and innovation.

With digital transformation well underway in companies across industries, the enterprise network is key to overhauling business processes, creating digital links with customers and redefining business models to drive innovation.

However, many enterprises are struggling to maintain their edge with their current networks which are complex and not continuously aligned with today's business demands. The aging networks were designed for a physical world and require significant manual Operations and Maintenance (O&M) which stifles an enterprise's ability to meet customer demands in a dynamic digital environment.

To overcome these challenges, Huawei is introducing the concept of Intent-Driven Networking (IDN) to connect today's digital and physical worlds. IDN uses Artificial Intelligence (AI), Big Data analytics, and cloud technologies to build digital networks that automatically align with a user's 'business intent.' Huawei's IDN approach takes networking to the next level in terms of intelligence, simplicity, ultra-broadband, openness, and security.

IDN Enables User-centric Networks to Enhance the Customer Experience

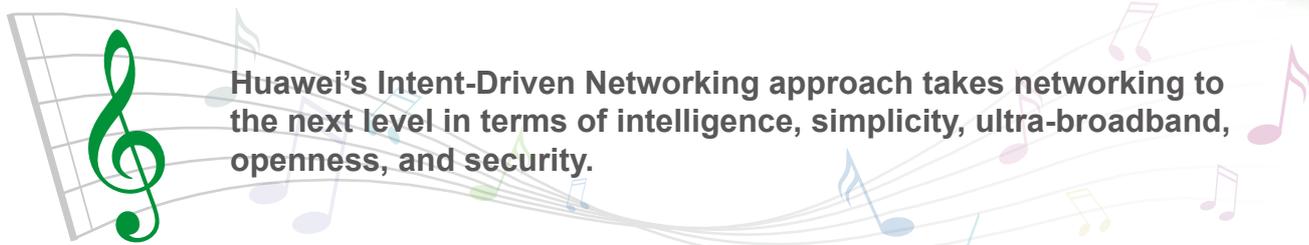
IDN enables enterprises to shift from a fragmented network to a closed-loop network that can dynamically monitor, identify, predict, and respond to a user's needs. Using AI and Big Data analytics, IDN allows enterprises to move from reactive O&M to a proactive system that optimizes network performance and availability. By transitioning from a skill-dependent network to an automated and AI-driven network, IDN eliminates time-consuming manual processes, helping enterprises increase efficiency, rapidly deliver new services, and free valuable team resources to focus on innovation.

Ultimately, IDN helps enterprises move towards a user-centric network that can keep pace with business demands for a seamless customer experience, improved operational efficiency, and accelerated business innovation.

Intelligent Predictive Maintenance Optimizes User Experience

A leading insurance company in the top 20 of *Forbes 2017 Global 2000* has over 3,000 branches which do not have full-time IT engineers on site. Using a traditional networking approach, the company's maintenance was reactive and the head office sent engineers to rectify a fault when it occurred, sometimes causing business disruption until the fault was resolved.

Leveraging AI and Big Data analytics, IDN monitors the quality of a user's experience in real-time and performs predictive analysis



Huawei's Intent-Driven Networking approach takes networking to the next level in terms of intelligence, simplicity, ultra-broadband, openness, and security.

to ensure services levels are being met. IDN's predictive intelligence rapidly identifies any anomalies and automatically reconfigures the network to maintain performance.

In the case of the multi-branch enterprise, Huawei's solution enabled IT engineers to quickly and remotely rectify faults. In fact, IDN solutions can automatically find up to 85 percent of potential issues across an enterprise campus network based on a Huawei study, meaning that the components or system can be fixed before an outage occurs to avoid impacting the user experience.

Simplicity Fuels Business Agility

In the digital era, success will be defined by an enterprise's ability to rapidly respond to changing market conditions and customer needs. In this environment, IT teams need their networks to adapt quickly to accommodate evolving business demands.

IDN provides this agility by simplifying the network in terms of architecture, protocols, sites, and O&M. By fully automating network services throughout their lifecycle and converging multiple networks into a simplified network, enterprises can rapidly provision new services while reducing Operating Expenses (OPEX) by 80 percent.

In addition, leveraging IDN means enterprises no longer need to carry out repetitive manual operational tasks and can focus on higher level strategic initiatives that drive business value.

Unleashing the Power of Ultra-broadband

The digital world will be defined by fast and easy connectivity to everything and everyone, at any time and from anywhere. IDN supports ultra-broadband to enable massive connectivity, low latency, and high bandwidth, helping enterprises deliver rich customer and employee experiences, whether it's video conferencing from mobile devices, streaming 4K videos from remote locations, or accessing AR/VR applications.

Openness Meets Vertical Industry Demands

To succeed in a fast-moving and competitive digital economy, enterprises need an open network ecosystem that enables them to

adapt their digital strategy and approach to meet the demands of their specific vertical industry. Huawei IDN's open APIs make it possible for the network to connect seamlessly to third-party Big Data analytics and cloud platforms, to enable enterprises to expand their capabilities through an ecosystem of leading-edge partners.

Proactive Security Protects Against Cyber Threats

There is no doubt that when it comes to security, enterprises cannot afford to stay still. Alongside the increased cost of cyber crime — which averages more than USD 17 million for organizations in industries like financial services, utilities, and energy — attackers are getting smarter.

Security is an integral part of IDN. The end-to-end visibility of IDN allows threats to be detected no matter where they originate from, while AI enables automated sensing and detection of any anomalies and takes proactive measures to quickly defend the network. In fact, these networks can reduce the mean-time-to-detect and mean-time-to-respond to security threats by 90 percent compared to traditional solutions, to mitigate the risk of attack.

IDN Drives Business Value in a Digital World

With a new IDN approach, forward-thinking enterprises can move towards a network that leverages cloud, AI, and Big Data technologies to monitor, identify, and respond in real-time to changing business demands, such as delivering new business services and applications, meeting security policies, and adapting operational processes.

Enterprises that adopt this approach will achieve rapid alignment of the network to business needs, resulting in a seamless customer experience. At the same time, by deploying an intelligent, simplified, ultra-broadband, open, and secure network, enterprises will improve operational efficiency and innovation to drive true business value in the connected world of the future. ▲

Originally appeared in The Wall Street Journal



The Digital Workspace and Intelligent Working Modes

By Yang Qin, Huawei Cloud Communication Marketing Director

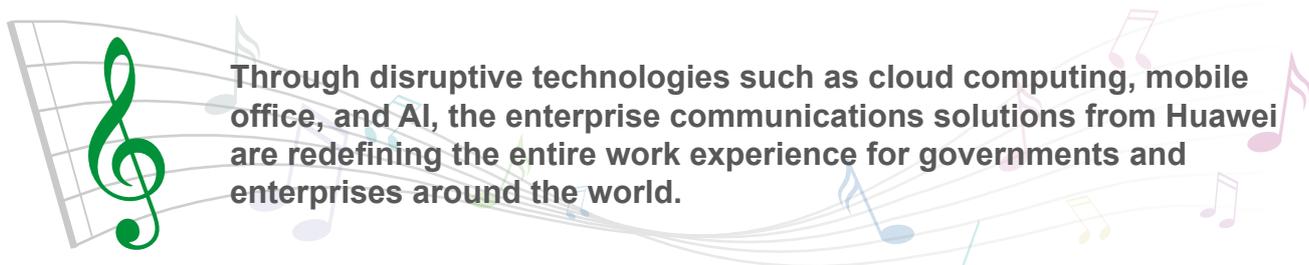
In the past 10 years a prominent feature of enterprise working environments has been wider coverage. With network and communications technologies headquarters and branch offices are communicating across vast distances using email and instant messaging as well as teleconferencing and videoconferencing products. Enterprise offices have expanded from the physical world to a broader, networked world.

What Will the Digital Office Space Bring to Enterprises?

Competitive business environments over the next five to ten years will be focused on the need to get the right people together in the right way to quickly and efficiently complete related tasks. Agile responses to customer requirements will be the most important capability for the next generation of enterprises. However, elevating productivity and performance to a new level depends on enterprises providing the hardware-based working environments that enable the 'soft power' of effective collaboration for their employees around the world. The digital revolution is taking place in, and changing, enterprise workspaces. This revolution will enable more intelligent

communication, interaction, and cooperation among employees, and ultimately promote innovation throughout the organization. Specifically, digital workspaces will bring the following significant improvements to enterprises:

- New media technologies enable all-digital communication and collaboration models that will cause exponential growth based on the connectivity index of collaboration efficiency between enterprise employees, that is, communication frequency and the amounts of information exchanged among employees. Team members will not only share electronic documents, but also digital information flows for their complex or unintuitive innovations.



Through disruptive technologies such as cloud computing, mobile office, and AI, the enterprise communications solutions from Huawei are redefining the entire work experience for governments and enterprises around the world.

- Workspace processes will perceive and learn user behaviors and intentions to dynamically coordinate the use of public resources to deliver better services.

- New natural language-based Human-Machine Interfaces (HMIs) will simplify the use of the tools that allow employees to communicate and work more efficiently.

- Mobile office capabilities enable employees to be online at any time. Because the workspace is no longer limited to a physical office employees can communicate with other team members through mobile phones to stay informed and participate with business processes in real time to ensure that all important activities will be handled in a timely and effective manner.

- The digital office can eliminate the sense of distance between employees. With no geographical limitation for staff recruitment or organizational interaction, there is no need to limit future recruitment based on work location.

Four Aspects of Enterprise Workspace Digitalization

The following four aspects are key to enterprises transforming their network-based workspaces into digital workspaces:

- **Use Cloud Computing Technologies to Build Agile ICT Infrastructure**

In the traditional closed architecture, siloed enterprise IT systems hinder communication and data sharing which make it difficult to meet the increasingly diversified requirements of business departments. Hybrid clouds are important tools because enterprise businesses benefit from the flexibility provided by cross-cloud and multi-cloud operations where core information assets are based on private clouds for the sake of security and privacy. By contrast, public cloud services are more suitable for building enterprise

communication collaboration capabilities. Public clouds, free of devices, maintenance, and private lines can use such advantages to help enterprises greatly reduce costs. On top of this, the one-point access and global coverage features of public clouds enable enterprises to build teams without regional restrictions.

- **New Communication and Collaboration Tools Will be Used to Build Activity-based Workspaces**

You will not see a mess of computers and cables in future workspaces. In fact, workspaces in the future are more likely to be divided into functional areas based on specific office activities, such as dedicated work areas, idea discussion areas, open conference areas, collaborative design areas, business meeting areas, and training areas.

When focused on a particular task, you may prefer to work in a private, quiet desktop workspace. At the same time, you will need matching communication collaboration tools to interact with other individuals. Instant communication via soft clients and lightweight integrated desktop hard terminals will enable this kind of on-demand communication and collaboration.

Small, medium, and large video conference rooms can be used for collaboration with remote teams. In particular, low-cost integrated terminals will quickly transform small conference rooms into remote collaboration spaces. Electronic whiteboards are indispensable for team brainstorming. PC or mobile device content can also be shared in wireless mode.

Team training may require the use of larger spaces that need multi-view access terminals to display the presentation and main site interactions for remote participants. Mobile access capabilities are important because team efficiency should not be limited by the presence of members located in fixed facilities.



In fact, workspaces will be divided into functional areas based on specific office activities, such as dedicated work areas, idea discussion areas, open conference areas, and training areas. >>

- **Use Smart Terminals to Build Mobile**

Workspaces

Ideal implementations of mobile office environments are not just about migrating enterprise office applications from computers to mobile devices. It is also important to think about how applications are developed to transform mobile devices into mobile workspaces with a unified user interface.

First, this requires the convergence of basic communication and collaboration capabilities, including instant messaging, voice, group conferencing, and email. The goal is the ability to contact team members in any office area, anytime, anywhere.

Second, the enterprise Information Technology (IT) and Office Automation (OA) systems must be integrated to support service processes such as daily schedules, attendance check-in and check-out, business management resources, and process approval functions across all devices, whether fixed or mobile. When based on a flexible and open integration framework it is possible for all users to add, delete, or update business processes on their local devices.

Third, self-improvement can be performed beyond fixed workspaces. Through digital workspaces, users can obtain enterprise documents, blogs, information, and training courses in a one-stop mode — including the ability to watch live videos using built-in applications.

Finally, users can connect various devices for flexible device control or business management activities by scanning a QR code to schedule or join a group conference, or share the desktop of their mobile phone.

- **Use AI Technologies to Create a Smart Collaboration Experience**

Conference rooms are strong candidates for the use of AI technology to deliver intelligent collaboration

experiences. Through voice control users can ask the virtual assistant to control and manage conferences, including conference scheduling and initiation, participant invitations, and even automatic climate control for crowded rooms. During conferences, intelligent cameras can track the speakers and display speaker close-ups with an electronic nameplate to encourage audience attentiveness and interaction. To eliminate obstacles in multi-lingual communications, intelligent conference rooms can display real-time multi-language subtitles, and following the conclusion of the conference, a record of the event can be generated automatically.

Past practices would employ full-time secretaries only for high-level leaders in order to strike a balance between efficiency and cost. Now, virtual assistants can provide similar services to improve the efficiency of all employees at a lower cost. Virtual assistants can help employees arrange personal schedules and schedule team meetings and, with the addition of self-learning capabilities, virtual assistants will communicate with other personal assistants to complete simple tasks.

Redefine Enterprise Workspaces and Employee Working Modes

Enterprises are continuously accelerating digital transformation, including production and manufacturing, sales and marketing, product delivery, and services. Against this backdrop, the work environment that supports an enterprise's production and operations also needs to be digitalized. By using disruptive technologies such as cloud computing, next-generation communication and collaboration, mobile offices, and AI, Huawei enterprise communications solutions redefine the enterprise workspace and employees working modes. These solutions are being used by governments and enterprises around the world today. ▲

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The Future of Public Safety and
Emergency Control Rooms

By Peter Goulding, Global Public Safety Expert, Huawei Technologies Co, Ltd.

Huawei's C-C4ISR Collaborative Public Safety Solutions are a suite of technology capabilities for public safety agencies. C-C4ISR stands for Collaborative — Command & Control, Communications, Cloud, Intelligence, Surveillance and Reconnaissance.

Command & Control are the means by which a public safety agency's command structure directs and coordinates activity and interoperates with other agencies to resolve events or incidents.

Communications and Cloud computing are the two enabling technologies that underpin Command & Control.

Intelligence, Surveillance, and Reconnaissance provide usable products that result from the collection, collation, analysis, and interpretation of information gathered through Information and Communications Technologies (ICT) and the Internet of Things (IoT), which includes sensors, reports, public or private CCTV cameras, plus other sources.

The collaboration provided by C-C4ISR systems enables governments and their respective response agencies to:

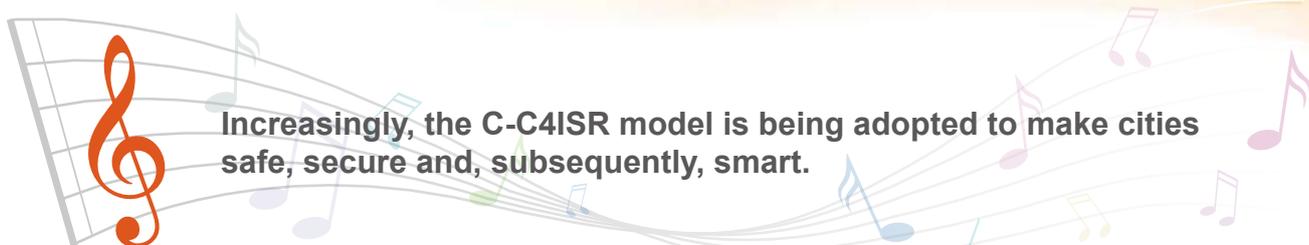
- Respond to emergencies and disasters quickly and efficiently, with appropriate and fully informed resources.
- Coordinate command & control response from multiple agencies so they can deal with diverse emergencies and disasters.

- Help responders and decision makers understand how the population might react to emergencies and disasters and provide suitable communications systems to keep citizens forewarned and informed.

- Enable Huawei's 'Leading New ICT' infrastructure resources to enhance response capabilities and improve the management of major events and incidents.

- Improve knowledge and experience to enable governments and first responders to learn from past events and enhance their responses to future incidents they may need to confront.

Governments and public safety agencies often come to the conclusion that developing a C-C4ISR capability ensures that an effective, centralized emergency response is available. Also, they believe that the solutions used should draw upon the latest and best technology and partners to build a world-class service capable of dealing with future challenges in public safety and public security. Increasingly, the C-C4ISR model is being adopted to make cities safe, secure and, subsequently, smart.



Increasingly, the C-C4ISR model is being adopted to make cities safe, secure and, subsequently, smart.

Prepare for Emergencies

One of a government's key responsibilities is to ensure its public safety agencies are prepared for emergencies.

One of the key features of any C-C4ISR command-center solution is giving the key decision makers the tools to do their jobs and to help them to be ready for whatever challenges they may face.

Achieving sound emergency preparedness may require changes to procedures and operational practices so the full capabilities of C-C4ISR can be utilized. This preparation, adoption, training, and exercising of new operational capabilities, provided through new technology, can be effective for the everyday safety and security management of cities and communities while providing the means to manage and control events and incidents that escalate and need coordination between diverse agencies. This is often managed and controlled through the adoption of a written 'Concept of Operations' that outlines the roles and responsibilities of each agency and their key personnel, which may include required technology.

Establishing an Effective Command Structure

An effective Concept of Operations protocol dictates that, when significant events occur, the responsible local agencies activate a pre-established command structure. There are different models to choose from, but they all focus on establishing a clear strategic leader. For example, 'Gold-level' leaders set the strategy for dealing with an incident or event, from initial response to resolving the issue and re-establishing normality. 'Silver-level' personnel have a command role with responsibility for coordinating the tactical responses needed to achieve the strategic aims set by Gold. A lower, but equally essential, command structure is then established with 'Bronze-level' commanders who have functional or geographical roles and responsibilities. Bronze commanders collectively act as a team to drive the tactical plan to resolve the incident or event.

The Bronze command teams activate and lead the response through the Silver-level command structure in each agency by using the C-C4ISR infrastructure and procedures. Therefore, each command team from the agencies involved needs to have visibility

of resources, equipment, demands, and tasks — so they can fully interoperate with other agencies and response organizations. This ensures effective coordinated responses to any emergency, including connected, coordinated, and evolving situational awareness as the incident or event evolves.

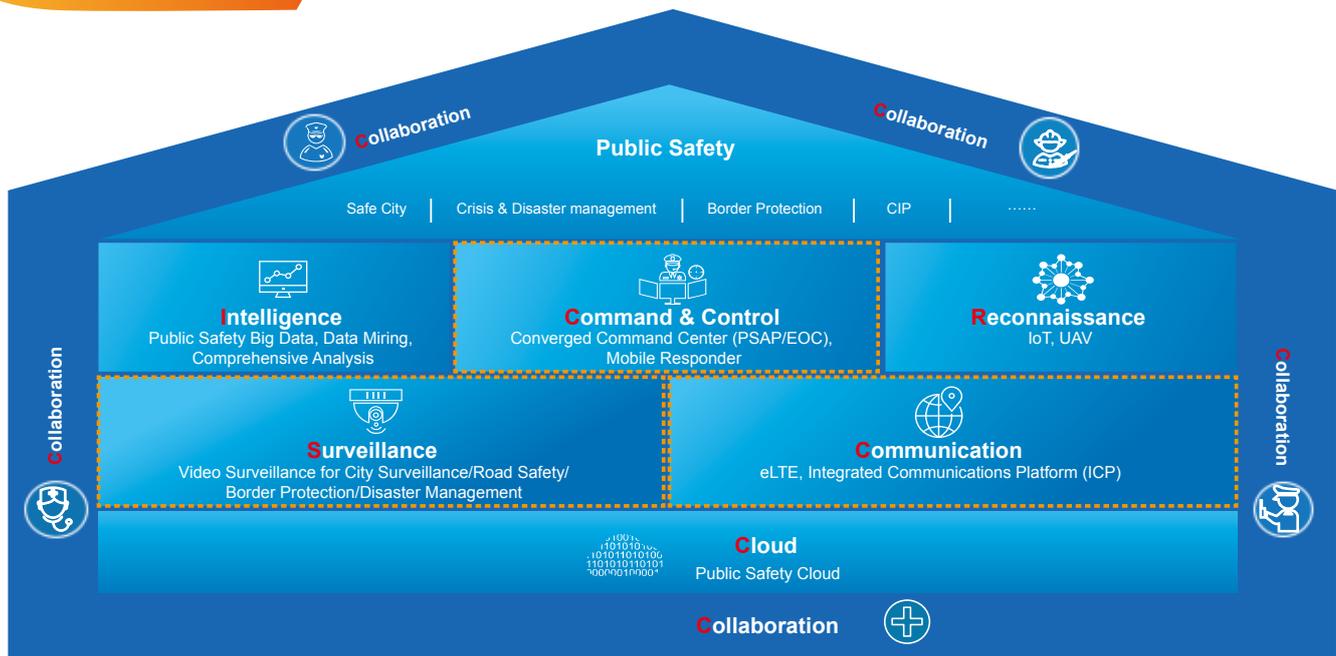
The emergency services' response teams routinely work with each other, usually based in their local control-room centers. The goal of C-C4ISR platforms is to enhance and improve primary responses and coordination. Each agency team can staff a desk in a single local center to allow on-duty personnel to actively coordinate with other agency staff to manage each emergency according to that event's needs. Emergency responses are still led by the appropriate agency; other agencies will assist and provide support as required, including municipal departments that do not have or use a control-room facility. C-C4ISR capabilities simply make this process of coordination easier.

Some agencies prefer to manage their responses and resources from their own dedicated control room, and, in those cases, do not or cannot provide dedicated resources to other agency control rooms. Historically, this has been the situation, especially if these agencies report to different government departments. As a result, control-room structures are often organized into silos that have been known to impede coordination and joint decision making.

Advanced C-C4ISR technical capabilities are built to overcome these issues by ensuring that separate control rooms are fully connected through a single network and platform, so that every control room can share and exchange voice, data, video, intelligence, and decisions. With this technology, separate control rooms can start to act as a single virtual control room that provides efficiencies and operational coordination. Whether a centralized or de-centralized system of control is preferred, technology should enable, not constrain.

Nationwide Emergencies

When there is a nationwide or regional impact because of disaster, major event, or incident — whether pre-planned, or something that happened with little or no notice — a centralized coordinating center is needed to manage the wider strategic overview. When faced with



major events, there may be the need to coordinate tasks, actions, and decisions at national and regional levels. Command positions for senior subject matter specialists are provided, when appropriate, to support the responses to these emergencies, while enabling local centers to focus on implementing the determined strategy.

National coordination centers need to be able to oversee and coordinate issues that are required beyond purely local responses, such as for national emergencies. Because of the connectivity of the C-C4ISR solution from local to national levels, personnel in these centers can observe activity and make suggestions or interventions when the center can add value. It would be a truly coordinated, interoperable response to emergencies.

By adopting full C-C4ISR capabilities at the national and local levels, the emergency management apparatus can operate and interact with non-emergency local and national government departments and non-governmental organizations. This would include establishing interoperability with coterminous states or even international organizations.

Managing Events

At every level, C-C4ISR center staff can be aware of all response vehicles, aircraft, mobile, and fixed assets. Staff can also be aware of individual team



By adopting full C-C4ISR capabilities at the national and local levels, the emergency management apparatus can operate and interact with non-emergency local and national government departments and non-governmental organizations. >>

members' locations and status by looking at a situational awareness display or Computer Aided Dispatch (CAD) system. These essential displays can show a range of information including maps, video footage, location and status reports, trends, and analysis, as well as social and media streams that can be drawn from cloud-based centralized database solutions and third-party applications. Voice and live recordings can be played in the centers live or streamed onto local displays or routed to other terminals through video conferencing solutions.

Through this C-C4ISR-connected command structure, first responders can use local and national centers as a source of knowledge and experience, from which they can seek and receive guidance support for any activity on the ground. All forms of messages can be sent and received, including video, photographs, maps, drawings, and the full range of data messages with updates that can be synchronized with the command centers using the appropriate applications. Every agency can give and receive support quickly and everyone involved can be updated with the full situational awareness of any event or incident.

Well-trained and tested control room staff can use information feeds from across the infrastructure to quickly assess and respond to emergencies and disasters before they become unmanageable. First responders can be directed to locations, and tasks



or incidents prioritized by the center using an ‘all informed’ mission-critical communications network so all those in the proximity of an emergency understand what is happening based on the assignment of their roles and responsibilities.

It does not matter which device or network a responder is using to maintain an all-informed communication network; an integrated solution ensures that voice, data, and video can be received, heard, viewed, and transmitted to and from whoever needs to hear, see, or use the information. This is seamless connectivity.

First responder safety can be improved as information from event locations and various sources provides better advance warnings. Suitable applications can also provide immediate and timely advice to officers prior to their arrival, or while they continue to monitor earlier events or incidents. C-C4ISR capabilities can also provide essential staff with access to notes on processes, first steps at a scene, and other standard operating procedures on any incident type the agency wishes to maintain in their records. This critical information can be transmitted onto their hand-held communications devices to guide their actions at the scene.

Crucial to any emerging incident or disaster are quick, effective warnings for personnel deployments, including the use of specialized resources, are crucial to any emerging incident or disaster. The key to C-C4ISR is ensuring the visibility of these resources and mechanisms to deploy quickly to minimize delays or inefficiencies. This is assisted by using real time information from resources that are identified by type and location, including access to useful information that may impact deployment choices, like traffic congestion. Information needed by decision makers and commanders is efficiently managed, coordinated and focused to the need.

Crucial to any emerging incident or disaster are quick and effective warnings and deployment of personnel, including the use of specialist resources. The key to C-C4ISR is ensuring the visibility of these resources and mechanisms to deploy quickly to minimize delays or inefficiencies. >>

All events or incidents evolve and the responses and demands change as it unfolds. Resources on the ground need to feed back information to the command centers to update situational awareness and assessments. This can improve information already being streamed from sensors, IoT devices, cameras, and other sources, including the media and the public. The center staff is engaged in the proactive management of information collection, analysis, and the demand to organize effective responses as events change and develop to assist the command team to maintain total control of each incident.

Managing Multiple Events

The C-C4ISR facilities must also ensure that while major events or incidents are being managed, other emergencies can also be effectively controlled. Therefore, the control room design, technology, and support capabilities need to ensure routine services will still be delivered while a major event or incident is in progress. Additionally, multiple major events or incidents also need to be handled simultaneously. Multiple simultaneous events are among the most severe challenges that control room environments will face.

The Concept of Operations needs to clarify how the command structure is organized to manage multiple events or incidents — whether the events are linked, or are independent but concurrent. In reality, different command teams may have to operate simultaneously on different events or incidents without knowing if there is a connection. Being able to process and share key information from multiple sources or intelligence is critical to making timely assessments and decisions. However, sometimes such events must be treated independently, with separate command teams, because no connection or causation is immediately evident.



Another increasing trend is the risk of terrorism and predicting the methods that may be used by an attacker or attackers. The standard procedure is now to treat many routine events as a potential terrorist attack, thus requiring the full activation of protocols. Events are downgraded if and when no link to terrorism can be established.

The C-C4ISR system needs to fully support complex multiple events from the response stage and through the following stages of incident management and longer-term investigation and analysis.

Closing Stages

As an event or incident is contained, the command team will move into a consolidation stage that works toward the return to normalcy; wherein resources are quickly reallocated, command teams stood down, and all impacted agencies return to their standard routines. Because every event or incident will generate large amounts of data, all voice recordings of transmissions, decision logs, threat and risk assessment records, video recordings, social media data, and system logs must be safeguarded, retained, and made accessible for analysis, reports, and as evidence for later prosecutions or court inquiries. Owing to the sensitive nature of these types of events and incidents, access to the data acquired throughout each operation will be strictly controlled and managed, and original data preserved in accordance with local and national regulations or guidance.

An essential stage following these types of operations is a formal, structured debriefing process to ensure all information is assessed, including negative or critical views related to operations or outcomes, so appropriate follow-up action or remediation is taken. This enables a cycle of

From natural disasters to terrorism, now is a good time for all public safety agencies to develop clear and concise Concept of Operations practices that are topical and well rehearsed to ensure they are ready to manage any and all challenges.

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continuous learning and adoption of lessons learned from complex events in order to improve protocols, procedures, and systems.

Establishing a formal debriefing process is especially important if the jurisdiction has legal rules on disclosure or if the event may be subject to judicial inquiry. Advice from an organization's legal department is always recommended prior to the debriefing process to ensure that the information collected complies with jurisdictional requirements and lessons learned memorialized for reference during future events.

Conclusion

Emergency preparedness requires that an effective command structure is established to enable strategic and tactical decision making for all stages of events or incidents. In particular, the technology capabilities provided by C-C4ISR solutions are designed to help local, regional, and national agencies respond effectively to fast-moving public safety situations.

From natural disasters to terrorism, now is a good time for all public-safety agencies to develop clear and concise Concept of Operations practices that are topical and well rehearsed to ensure they are ready to manage any and all challenges.

In addition to a high-level clarification of procedures, structured de-briefings are also a good time to conduct technical reviews of control rooms and command centers; for which the goal is to not only remain fit and ready for current purposes but to also prepare for the increasing and varied challenges for emergency communications in our modern world. The technology capabilities provided through C-C4ISR-type of solutions can provide the tools and means to respond more effectively to the changing threats we face. ▲



‘All-Cloud Huawei’ Implements Multi-cloud Management

By Su Liqing, Director of Information Technology, Huawei Technologies Co., Ltd.

Cloud-computing technology has entered the application-explosion phase. Driven by digitalization and ubiquitous connectivity, enterprises are exploring their own cloudification and digital transformation roads. At Huawei, IT is used to support both digital transformation and traditional business operations. A single Cloud Service Provider (CSP) can hardly meet all of the requirements, so it follows that a multi-cloud solution is the inevitable choice for enterprises. However, because meeting new business requirements can also pose new challenges to IT departments, how do we embark on the multi-cloud road?

Multi-cloud: The Only Road to Cloudification for Large- and Medium-sized Enterprises

At the high tide of global digital transformation, cloud computing serves as an important support technology. It features on-demand use, elastic scaling, and resource sharing. It helps simplify IT operations, shortens delivery periods, and enables more agile business operations. In addition, the technology enhances resource usage and effectively optimizes the IT cost structure. Other innovative digital applications are being developed based on cloud computing, Big Data, Artificial Intelligence (AI), and the Internet of Things (IoT);

therefore, IT application cloudification and accelerating digital transformation through cloud services are irresistible trends and a consensus decision among industries.

When using cloud services, enterprise IT departments must consider multiple factors, including time, cost, support for innovative services, risk diversification, legal compliance, and protection of key information assets. A single CSP cannot meet all enterprise requirements at the same time. The RightScale 2017 research report reveals that up to 85 percent of global large- and medium-sized enterprises have adopted a multi-cloud IT strategy.



Supporting business development through multi-cloud management is an important strategy for achieving Huawei IT cloudification. Huawei aims to integrate multi-cloud resources and services, leverage multi-cloud advantages, reduce cloudification costs, provide multi-cloud environments for seamless applications, and ensure the security of information assets.

The multi-cloud strategy brings distinct advantages to enterprises:

- Form an optimal combination of best services from various domains to meet business requirements
- Flexibly schedule global resources of multiple CSPs to facilitate the rapid development of global businesses
- Choose local compliant CSPs to effectively reduce legal compliance risks in data-sensitive areas
- Avoid vendor lock-in and retain the right to choose while enjoying the best cloud services

Multi-cloud Challenges Faced by Enterprises

The multi-cloud strategy is an inevitable trend and brings huge benefits to enterprises; however, to quote a cliché, ‘There is no such thing as a free lunch.’ What issues and challenges will enterprises face when adopting the multi-cloud strategy?

First, there are no standards for the cloud service architecture and each CSP offers exclusive APIs; therefore, CSP adaption is required for using heterogeneous cloud services. In terms of application integration, APIs need to be aggregated and converted, which raise the requirements for integration flexibility. For security, multi-cloud security governance becomes more complex due to CSP security capability differences, enterprise security requirements, and regulatory compliance in different countries.

Second, large-and medium-sized enterprises have complex IT applications that should be migrated to the cloud by module, path, and phase over a long time period. The migration may involve a great deal of effort to reconstruct or replace the application system, a process that becomes more technically difficult when implementing a multi-cloud strategy. One challenge, therefore, for large- and medium-sized enterprise IT cloudification is to minimize business impacts and risks to better enable a smooth cloud migration for enterprise applications while accelerating cloudification.

To summarize, multi-cloud service integration is an inevitable

IT trend for enterprises seeking to leverage the advantages of each vendor. The enterprises should proactively use the service advantages of CSPs for business support to achieve business cloudification and digital transformation. However, they also face new challenges in managing the multi-cloud IT environment and implementing smooth evolution.

Huawei’s Multi-cloud Practice

With 30 years of history, Huawei has increasingly diversified, globalized, and scaled businesses. With 180,000 employees around the world, Huawei conducts business activities in more than 170 countries in Business-to-Business (B2B), Business-to-Consumer (B2C), or Business-to-Person (B2P) modes. Huawei’s annual turnover now exceeds USD 80 billion. The Huawei IT organization has undertaken the important mission of digital transformation to quickly and proactively meet business requirements, adapt to technical changes, and support global business expansion. At present, Huawei has established an All-Cloud strategy. The corporate IT architecture will transform toward an open, service-oriented, multi-cloud architecture to support Huawei’s own digital transformation.

Some important strategies for Huawei IT cloudification are to provide real-time scheduling management, a consistent experience based on customer requirements, and the allocation of cloud services from multiple vendors to support businesses through multi-cloud management. This is similar to the strategies that have been adopted by today’s popular car-hailing platforms.

Huawei aims to integrate multi-cloud resources and services, leverage multi-cloud advantages, reduce cloudification costs, provide multi-cloud environments for seamless applications, and ensure the security of information assets. Different from a hybrid cloud strategy that only focuses on the integration of private and public clouds, Huawei’s multi-cloud management strategy enables a more complete coexistence between multiple private and public clouds.



Huawei IT cloudification is a complex project that will last for many years. Our goal is to ensure a smooth migration for rapidly introducing external cloud services. >>

Huawei's IT multi-cloud manager has three core capabilities:

- Multi-cloud secure access
- Multi-cloud service management and service agent
- Multi-cloud application integration

Multi-cloud management is part of the Huawei IT Cloud (HIC) capabilities and a bridge between the private HIC and external public clouds. It facilitates management, integration, and security within the multi-cloud environment. It establishes the HIC as the cloud migration entrance for internal applications and uses the HIC user interface to enable a consistent internal and external user experience. For security, the relationship between many applications and many public clouds (many-to-many) is simplified to the relationship between one HIC and many public clouds (one-to-many). Security management and protection are enhanced through federated authentication and borderless security protection. Multi-cloud management can effectively eliminate security risks when applications are directly connected to public clouds.

Multi-cloud management plays a key role in the cloudification of the multiple business domains supported by Huawei IT. WeLink is a mobile office platform available to Huawei employees worldwide for communication and collaboration, such as instant messaging, multimedia conferencing, live video, email, and document sharing. To support the varied office requirements of Huawei's global employees the platform integrates multiple public CSPs, intelligent Huawei public cloud enterprise services, and Huawei private cloud services to deliver a solution for all scenarios. By leveraging the unified service agent and integration capabilities of the multi-cloud management solution, Huawei is able to facilitate the invocation and aggregation of cross-cloud services.

The R&D business domain requires elastic scaling and on-demand delivery of development and test

resources for staff. Once completed, task resources can be released immediately. The multi-cloud management solution incorporates Huawei's public cloud into the scheduling scope to form million-level, cross-cloud shared resource pools and enable unified cross-cloud scheduling. This approach greatly enhances resource supply flexibility and improves resource utilization.

Huawei IT cloudification is a complex project that will last for many years. Our goal is to ensure a smooth migration for rapidly introducing external cloud services. As an intermediary between applications and multiple CSPs, the multi-cloud management solution avoids complex direct interconnections, ensures interconnection security, and enables applications to access both internal and external cloud services. This reduces the threshold and implementation costs for enterprises to move to the cloud.

Changing the Role of Enterprise IT

Cloud computing, the IoT, and other technologies are having a huge impact on enterprise IT. Apart from the fast rate of technical innovation, the operating modes for enterprise IT are deeply affected. In the past, the IT department invested time and capital to build and maintain hardware and software in-house; though the results did not always fulfill business requirements. As public cloud services mature we expect that the 'Build-Deliver-O&M' mode will evolve into an 'Introduce-Release-Operate' mode.

To adapt to this trend, Huawei Enterprise IT is shifting from a cloud service builder to a cloud service integrator. Through multi-cloud management, the IT department will quickly introduce excellent public cloud services into the market and combine them with its own services to satisfy business requirements. The multi-cloud management solution helps enable the smooth transition to IT cloudification and is indispensable to the evolution of IT capabilities both inside and outside of Huawei. ▲



Spain's Rivas-Vaciamadrid Enhances Smart City 'Nervous System' Functions with Huawei eLTE Broadband Solution

In front of the Jose Saramago school gate in the city of Rivas-Vaciamadrid, Spain, a father who was unable to find his child was anxiously seeking help from a police officer patrolling near the school. The police officer immediately called the Command Center for support and meanwhile used his handheld eLTE terminal to photograph the child's pictures stored in the father's mobile phone, and then transmitted the captured photo to the Command Center.

Upon receiving this incident, the Command Center for the Rivas-Vaciamadrid Police Station took immediate actions to address the situation. They quickly pinpointed the nearest patrol vehicles through their command system, dispatched them to the field for support, and sent the child's photo and child-missing notification to the handheld eLTE terminals of all the police officers in that region. At the same time, the Command Center searched for any traces of the child by isolating the real-time video feeds from the surrounding cameras. Less than a half hour later, a police officer found a likely match at a nearby basketball court and immediately used his handheld eLTE terminal to start a video call with the father. Once confirmed that this was the missing child, the father and son were reunited.

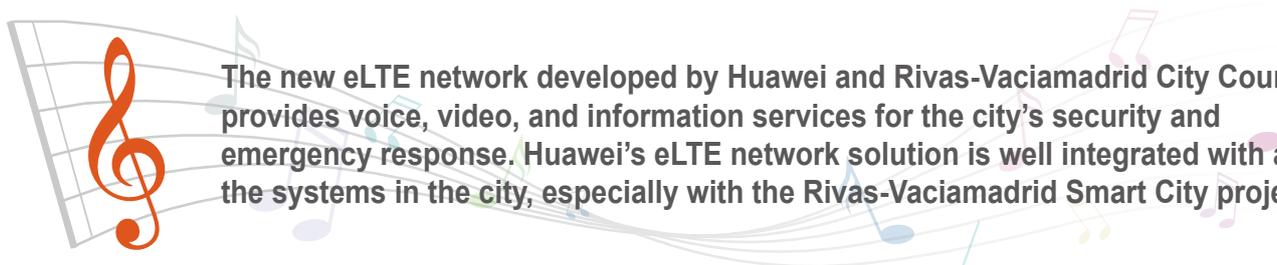
There are large numbers of children that are temporarily lost in the world every year. In the United States alone, about 800,000 children go missing annually. The first 24 hours is the golden period for finding missing children. Police officers in Rivas-Vaciamadrid could not have found the missing child or handle similar cases so quickly

if they used a Terrestrial Trunked Radio (TETRA) narrowband network. So, how did they make this possible?

The City's 'Nervous System' Urgently Receives Smart Upgrades

Rivas-Vaciamadrid is a city belonging to the autonomous community of Madrid, Spain. The city covers a land area of 67.4 square kilometers with a population of about 84,000 and is located just 15 kilometers away from the center of Madrid. This city is one of the youngest in the Madrid region, with the average age of citizens being 34. It is also one of the most environmentally friendly and sustainable cities. In 2014, Rivas-Vaciamadrid won the *European Union's Sustainable Urban Mobility Planning (SUMP) Award*.

Rivas-Vaciamadrid is a founding member of the Spanish Network of Smart Cities (RECI) and is widely recognized as a pioneering 'Smart City' in Spain. Currently, Rivas-Vaciamadrid has a network of 800 kilometers of fiber-optic cables which interconnects 86



The new eLTE network developed by Huawei and Rivas-Vaciamadrid City Council provides voice, video, and information services for the city's security and emergency response. Huawei's eLTE network solution is well integrated with all the systems in the city, especially with the Rivas-Vaciamadrid Smart City project.

municipal buildings, and provides public Wi-Fi services for the entire locality.

Pedro del Cura Sanchez, Mayor of Rivas-Vaciamadrid, said: "In 2004, the city decided to start investing in technology. There were two important factors to determine this investment. The first factor was to create a better-managed city with enough technology resources for more efficient city management and greater savings. The second factor was to better serve citizens with these technology resources."

The objectives of Rivas-Vaciamadrid coincide with Huawei's three goals of smarter city administration, more benefits to citizens, and economic revitalization when working with customers to build Smart Cities.

A Smart City is like a living organism, which is powered by a nervous system. A Smart City 'nervous system' consists of a 'brain' (the control center) and 'peripheral nerves' (the network and sensors). This system gathers real-time information about the status of the city, transmits the data, enables the 'brain' to analyze and make informed decisions, delivers feedback commands, and ultimately carries out intelligent actions.

The legacy 'nervous system' of the Rivas-Vaciamadrid government was a TETRA network they had built in 2005. This legacy network had the following problems:

- The TETRA narrowband provided voice services only and did not support multimedia data applications, such as a real-time Geographic Information System (GIS) and mobile surveillance. As a result, this network failed to meet the requirements of government and police agencies for video and large-traffic data usage. For example, the police asked that visibility capabilities be added to better learn about on-site situations through video within short periods of time. However, this network did not support such

functions, resulting in limited awareness of on-site situations and a low policing efficiency.

- The incident receiving and handling systems were not integrated with each other. In other words, the command and dispatch system was isolated from the video surveillance system. This isolation slowed down emergency response times and created difficulties in cross-department collaboration.

- The legacy network had been running for more than 10 years and was approaching end of life. The resulting maintenance costs were high.

- Due to the shrinking narrowband industry chain, narrowband network operators failed to find the right evolution direction even if they wanted to upgrade.

As such, the Rivas-Vaciamadrid government urgently needed to upgrade their existing network and decided to build new smart city 'nervous system' functions that could cover the entire city, provide more efficient commanding, and dispatch services for 330 police officers.

Improved On-Site Visibility, More Efficient Commanding

Huawei is one of a few vendors in the industry which provides a complete set of ICT solutions characterized by 'cloud-pipe-device' synergy. Huawei's eLTE Broadband Trunking Solution provides a comprehensive platform that includes video backhaul, broadband trunking, and critical communications on a single network to enable visualized dispatching. This solution is mainly intended for the public safety sector and extends to Smart Cities with integrated access network platforms to other sectors, establishing a solid foundation for more Smart City applications.

After a careful review of multiple factors, the Rivas-Vaciamadrid government selected Huawei's eLTE Broadband Trunking Solution



to upgrade their legacy network.

The Huawei eLTE Broadband Trunking Solution provides the following compelling features:

- The solution uses the most advanced LTE wireless broadband technology to enable 100 Mbit/s for downlink transmission and 50 Mbit/s for uplink transmission.
- A single network supports multimedia trunking, video dispatching, High-Definition (HD) wireless video surveillance, real-time distribution and backhaul of HD videos and pictures, ultra-long-distance data acquisition, and mobile office services.
- The Command Center can review videos sent back in real time from eLTE terminals or directly watch the live video images captured by city-wide surveillance cameras. By doing so, the Command Center remotely can accurately assess on-site conditions and effectively manage on-site incidents. Additionally, by leveraging GIS to locate people and vehicles, the Command Center can designate the most appropriate police resources and achieve visualized dispatching.
- The handheld eLTE terminals can be installed with the police station's Intranet office software, covering email, video surveillance, and police dispatching. These installations implement better-connected mobile police operations and provide enriched police dispatch information through multimedia police dispatching tickets. In the case of emergencies, nearby police officers can collaborate with each other in real time. In this way, police dispatching and incident handling are more accurate and efficient.
- The eLTE broadband trunking system can interwork with the legacy TETRA system and communicate with public-network mobile phones. High compatibility achieves the convergence of multiple network communication methods and more efficient cross-department communication and

Huawei's eLTE Broadband Trunking Solution dramatically improves the command and dispatch efficiency as well as quick response capabilities for Rivas-Vaciamadrid police officers in all cases, regardless of major activities, emergency handling, and daily police operations.
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collaboration.

- The eLTE broadband trunking network can be interconnected with the public network to implement public network coverage in areas with insufficient private network coverage. This interconnection expands the scope of applications and reduces the initial investment. In this way, investments can be gradually increased to improve coverage and data capabilities.

To address spectrum problems, Huawei collaborates with Masmovil, the fourth largest mobile carrier in Spain, to provide a 2.6 GHz frequency band; Huawei is collaborating with the live-network integrator Tecnicas Competitivas to provide eLTE broadband trunking and maintenance services; and Huawei is working with the wireless planning consulting firm Aptica to provide network planning, technical consultation, and recommendations for the project.

Huawei's eLTE Broadband Trunking Solution dramatically improves the command and dispatch efficiency as well as quick response capabilities for Rivas-Vaciamadrid police officers in all cases, regardless of whether they are major activities, emergency events, or daily police operations.

Fernando Argote Cardenosa, the Director of the Rivas-Vaciamadrid police station, stated: "The Command Center provides advantages which are clearly beneficial to Rivas-Vaciamadrid citizens. From here, we control the city traffic. For many public safety incidents, such as missing children, we find that the Huawei eLTE Broadband Trunking Solution is crucial. The most important thing for public safety is the ability of the Command Center to respond quickly."

Smart City Services Reach New Levels

Currently, 80 percent of the Rivas-Vaciamadrid area benefits from the eLTE network coverage. What



makes the Rivas-Vaciamadrid city stand out from other cities is that all city management systems are deeply converged. Almost all city facilities that can be remotely managed are networked, including video surveillance, energy management, public lighting, decorative fountains, street-side public facilities, and park irrigation facilities. The local government also provides location-based services, so that any manager can access city management applications anytime, anywhere, and from any device through Wi-Fi access via Bidi, RFID, and NFC.

Carlos Ventura, Director of the Rivas-Vaciamadrid Telecommunications Department, pointed out: “The evolution from narrowband to broadband is an inevitable trend. Huawei’s eLTE network solution is well integrated with all the systems in the city, especially with the Rivas-Vaciamadrid Smart City project. From an eLTE terminal, you can access any system in the city, such as public lighting. In the event of an emergency, police officers and other city managers may increase lighting and perform any other actions, such as opening doors or buildings via the eLTE terminal without the need for keys or other assistance.”

Ana Reboiro, a member of the Economic Development and Employment Council and Interior System and Telecommunications Council, said: “The new eLTE network developed by Huawei and our Rivas-Vaciamadrid City Council provides voice, video, and information services for all of the city’s security and emergency response needs. This new network is the foundation for addressing new challenges in urban development and will improve the daily lives of Rivas-Vaciamadrid citizens. This is the first-of-its-kind project in Spain. Once again, Rivas-Vaciamadrid leads the development of

new technologies for city services. I would like to thank Huawei for the trust that they have placed in the Rivas-Vaciamadrid City Council. I hope that we can continue to work together on developing new technologies to respond to new challenges in the future.”

By leveraging a series of new ICT technologies, such as cloud computing, the Internet of Things (IoT), and Artificial Intelligence (AI), Huawei is dedicated to expanding ‘nervous system’ functionalities that empower Smart Cities. With innovation and accrued experiences in various technologies, Huawei has developed an open platform for Smart Cities. This platform is compatible with various devices in the downstream direction and supports a wide range of applications in the upstream direction. In the future, Huawei will continue to work together with ecosystem partners to help Rivas-Vaciamadrid add visibility to daily city operations, accelerate cross-departmental emergency response and Big Data-based city management decision-making, and further enhance the operations of public services such as education, sports, energy, and public safety. All these enhancements will create a solid foundation for the ongoing Smart City journey of Rivas-Vaciamadrid. ▲

In the future, Huawei will continue to work together with ecosystem partners to help Rivas-Vaciamadrid add visibility to daily city operations, accelerate cross-departmental emergency response and Big Data-based city management decision-making. >>

Customer Testimony

“This is the first-of-its-kind project in Spain. Once again, Rivas-Vaciamadrid leads the development of new technologies for city services. I would like to thank Huawei for the trust that they have placed in the Rivas-Vaciamadrid City Council. I hope that we can continue to work together on developing new technologies to respond to new challenges in the future.”

— Ana Reboiro, a member of the Economic Development and Employment Council and Interior System and Telecommunications Council



Albania's Power Transmission Network Upgrade Lights up Electric Power Industry Transformation in the Balkans

In the western part of the Balkans in Europe, there is a 285 kilometer-long river, the Drin River, which flows westward through northern Albania and directly into the Adriatic Sea, with a catchment area of 14,173 square kilometers. Thanks to a steep riverbed slope and abundant water resources, Albania has built three cascade hydroelectric power stations on the Drin River, namely, Fierza, Koman, and Vau i Dejës. The total installed capacity of the three power stations approaches 1,400 MW, accounting for 70.6 percent of Albania's total capacity of nationwide hydroelectric power stations. They form the largest hydroelectric power station group in the entire Balkan region regarding the installed capacity and reservoir capacity.

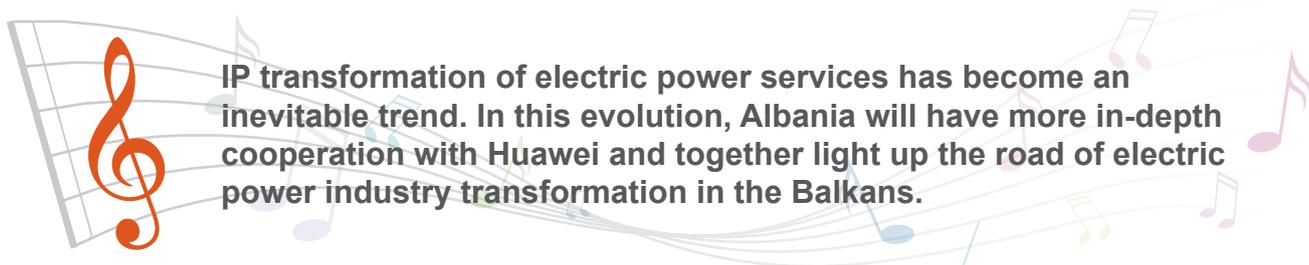
Water and Bits Together Drive Watts

Albania is one of the European countries that have the most abundant water resources. According to the data released by the Energy Regulatory Authority (ERE), in 2016, Albania generated 7.136 billion kWh of electricity and consumed 7.094 billion kWh, but power grid losses reached 1.986 billion kWh, accounting for 28 percent of the total generated capacity. The Albanian electric power system mainly consists of four parts: Power supervision, power generation, power transmission and transformation, and power distribution and sales. ERE, Albanian Power Corporation (KESH), Transmission System Operator (OST), and Electric Power Distribution Operator (OSHEE), respectively, are responsible for these four parts.

The OST is responsible for the construction, operation, and maintenance of the national transmission network. It is also responsible for promoting and coordinating interconnection with the power grids in neighboring countries. Responsibilities include:

- Transmitting teleprotection and management information
- Interconnecting all branch offices to efficiently communicate network status
- Ensuring high reliability of the communication and management system
- Providing large bandwidth for telecom and enterprise markets in Albania

Power production in Albania can meet the basic needs of the country's industrial and agricultural production. However, because



IP transformation of electric power services has become an inevitable trend. In this evolution, Albania will have more in-depth cooperation with Huawei and together light up the road of electric power industry transformation in the Balkans.

they depend entirely on hydroelectric power, climate can greatly affect power generation. During droughts, the country is more likely to suffer from power shortages and frequent power outages. Albania wants to ensure national energy security; achieve long-term, secure, and reliable supplies of electricity; and improve the country's influence in the regional energy market. As a result, the Albanian government is attempting to develop the electric power industry in four ways:

- Increase the exploitation and utilization of hydraulic energy resources
- Strengthen interconnections with power grids in neighboring countries and regions. Currently, Albania has established multiple cross-border power transmission channels with Greece, Montenegro, and Kosovo
- Diversify power generation methods
- Improve the efficiency of energy use

These four development directions have brought enormous challenges to the transmission system, not only in Albania, but also the entire Balkan region.

The original network has low capacity (only 20 Mbit/s) and urgently needs to expand. In addition, new services such as power automation, video surveillance, automatic O&M, and bandwidth leasing require high bandwidth. The operations company's utilization rate of SDH — a standard technology for transmitting data on optical media — also is low. As a result, it cannot provide external leasing services for other enterprises. In addition, it is not ready to deal with Big Data, data center interconnection, or cloudification.

Network Capacity Expansion: A Leap from 20 Mbit/s to 10 Gbit/s

The Huawei Universal Transport Solution uses innovative 'zone-specific, multi-level, and layered' concepts, and takes into consideration the power grid's structure, voltage levels, and regional interconnections. The solution helps build a converged power

communication network for power transmission and transformation that best suits power grids. A single network can carry both production dispatching and office management services and flexibly expand capacity in anticipation of future service changes.

The intelligent optical transport platform used in the Huawei Universal Transport Solution integrates Reconfigurable Optical Add/Drop Multiplexers (ROADMs), terabit electrical cross-connections, full-granularity grooming ranging from 100 Mbit/s to 100 Gbit/s, optical-electrical synergy, and 10G/40G/100G. It also provides rich management and protection functions based on large-capacity Optical Transport Network (OTN) grooming and long-haul Wavelength-Division Multiplexing (WDM). Empowered by these features, the platform provides end-to-end OTN/WDM backbone transport solutions so that customers can implement multiple-service, large-capacity, and fully transparent transmission. These feature highlights convinced OST to use Huawei's solution to help resolve issues in Albania's current transmission network, and to lay a foundation for future development.

Huawei's intelligent optical transport platform uses innovative technologies to provide the following features and benefits:

- 10 Gbit/s network capacity and support for evolution to 40G/100G. Smart 40G technology provides sufficient bandwidth for future service development over the next five to ten years.
- Large-capacity, rapid grooming, with zero waste of bandwidth resources. Any services from 100 Mbit/s to 100 Gbit/s can be encapsulated and mapped in a unified manner, meeting the customer's requirement for transmitting a variety of services over a single network.
- A highly reliable network with zero service interruption. In addition to traditional 1+1 protection, the platform supports Automatically Switched Optical Network (ASON) features at both the electrical and optical layers, offering up to 99.9999 percent reliability.
- Unified network management system and transport platform. A unified O&M team can be established, reducing customer CAPEX and OPEX.

- A series of products designed with superb spare parts that will last for 15 years.

Full Upgrade of the Power Transmission Network in Albania

- OST transmission network was nearly 2,500 km. Before 2017, the link capacity on the network was low, with each link's capacity being less than 20 Mbit/s. Huawei Dense WDM (DWDM) equipment with built-in PCM helps OST greatly improve transmission network capacity by up to 10 Gbit/s per link, meeting the bandwidth requirements of new services such as power automation and video surveillance.

- The DWDM network has powerful service grooming capabilities, allowing OST to use all types of services on the same network. Low-speed interfaces (such as STM-1, STM-4, FXSO, FE, and GE) from traditional networks and new high-speed interfaces (FE, GE, STM-16, and 10 GE) are all supported for integrating data information, allowing the interconnection with different branches and video surveillance systems.

- The new DWDM network will help OST improve business value by providing leased line services to other carriers and enterprise markets.

- Huawei provides robust networking and a powerful management system to ensure high performance and high availability, enabling OST to monitor the network from any place that can access management software through a VPN.

- A solid foundation is also laid for OST to develop Big Data services, data center interconnection, and cloudification, in order to construct a Smart Grid throughout Albania.

- Smooth evolution: After the initial phase of construction, the network supports a 40 wavelength x 10G capacity, which can be smoothly upgraded to 40 wavelength x 40G or even to 80 wavelength x 100G, delivering a bandwidth of 8 Tbit/s that completely



IP transformation of electric power services has become an inevitable trend. We believe that in this evolution, Albania will have more in-depth cooperation with Huawei and together light up the road of electric power industry transformation in the Balkans.

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meets the requirements for future Smart Grid development in Albania.

Idajet Projko, OST Telecommunication Network Manager, said, "First of all, I want to thank you, Huawei, for your commitment to the realization of this successful project. Huawei support before and during the project was determined to finalize it in the best way. OST is the National Power Transmission System Operator of the Albanian Electricity Network and the implementation of the DWDM project was very important for our network. For us it's important to have a modern network with the best technologies that provides very good performance, and at the same time a secure and reliable network. Thank you again to Huawei and we hope to continue our collaboration for future successful projects."

With the gradual development of IP services (such as integrated information platforms, telepresence conferencing, and video surveillance) and IP transformation of traditional key services (such as dispatch telephones and SCADA), IP transformation of electric power services has become an inevitable trend. We believe that in this evolution, Albania will have more in-depth cooperation with Huawei and together they will light up the road of the electric power industry transformation in the Balkans. ▲

Customer Testimony

"First of all, I want to thank you, Huawei, for your commitment to the realization of this successful project. Huawei support before and during the project was determined to finalize it in the best way. OST is the National Power Transmission System Operator of the Albanian Electricity Network and the implementation of the DWDM project was very important for our network. For us it's important to have a modern network with the best technologies that provides very good performance, and at the same time a secure and reliable network. Thank you again to Huawei and we hope to continue our collaboration for future successful projects."

— Idajet Projko, OST Telecommunication Network Manager

ICBC (Asia) Leverages Cutting-edge Technology to Drive Cross-border Financial Upgrades and Development

Cross-border Finance Has Become a New Growth Point of ICBC (Asia)

Cross-border finance is developing rapidly thanks to the opening up of China's capital market, opportunities brought by "Belt and Road Initiative," and the development of the Guangdong-Hong Kong-Macao Greater Bay Area. Take Industrial and Commercial Bank of China (Asia) as an example. ICBC (Asia) started its cross-border RMB business in 2013. By the end of 2017, the bank had established partnership with more than 500 enterprise customers, supported the settlement of near 20 currencies, processed more than CNY 36 trillion RMB settlement, had more than CNY 30 billion total deposit, and achieved double-digit growth in relevant businesses.

ICBC (Asia) is a licensed bank incorporated in Hong Kong and now has 57 retail outlets, serving as the flagship of overseas banking business of ICBC Group. The total assets of ICBC (Asia) amounted to HK\$ 898.1 billion at the end of 2017. By persisting in the business strategy of "Taking Root in Hong Kong, Connecting with Mainland China, Spanning across Asia Pacific, and Facing the World," ICBC (Asia) seizes the favorable opportunities of Hong Kong being the offshore RMB centre, and keenly exploring RMB businesses and cross-border banking services. In the future, ICBC (Asia) will provide diverse low-cost, cross-border financing (covering IPO and bond issuing), all-around cross-border RMB, and cross-border assets management services to promote the establishment of global assets management platforms in Hong Kong.

Technologies Serve Businesses and Create Value

Cross-border finance is developing rapidly, and customers' needs

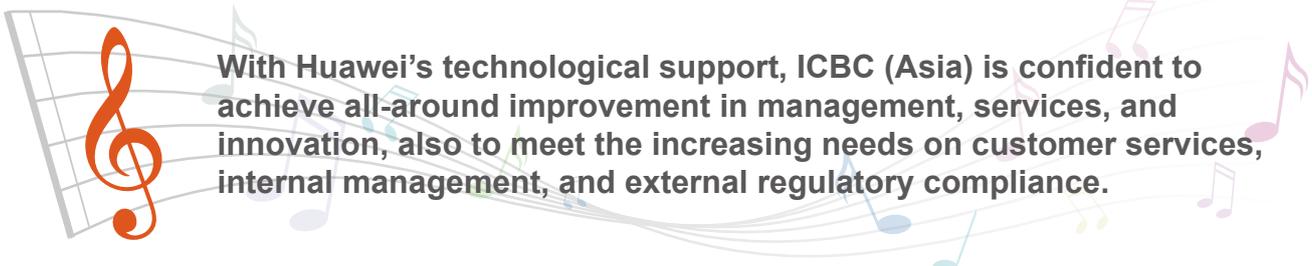
on Internet finance and new payment methods increase drastically. This brings great opportunities to ICBC (Asia)'s cross-border finance business as well as challenges to ICBC (Asia)'s business systems and its ICT infrastructures. For example, customers may require the bank to deliver high-quality cross-border services in different modes.

By adhering to the objective of "Technology Serving Business, Technology Creating Value" ICBC (Asia) gradually explores a path to develop innovative applications using biometric recognition, blockchain, Big Data, AI, and cloud computing technologies. To better serve its customers, ICBC (Asia) understands customers' need with providing VIP recognition service, precise sales and marketing strategies, customized products recommendation, and differential pricing. Smart risks prevention and control helps detecting transaction frauds, credit risks and operating risks. In addition, the "management dashboard" supports decision-making, abnormal capital flows warnings, incidents prevention and risks management.

In 2016, ICBC (Asia) started to plan and deploy innovative systems by using the latest ICT technologies like virtualization, Big Data, cloud computing, and DevOps. With the help of new architectures, ICBC (Asia) secured an advantageous position for future market competition. Based on ICBC (Asia)'s business and technology development requirements, Huawei provided a number of cutting-edge solutions, such as the Digital Multimedia Banking Solution, the Safe Financial Cloud Solution, and the CloudFabric Cloud Data Centre Network Solution.

Improving Customer Experience in Cross-border Finance

To address the cross-border service mode issue, ICBC (Asia)



With Huawei's technological support, ICBC (Asia) is confident to achieve all-around improvement in management, services, and innovation, also to meet the increasing needs on customer services, internal management, and external regulatory compliance.

developed “mVTM system” based on Huawei’s IP Contact Centre (IPCC) Solution, allowing customers to have video conferences with their financial advisors via the ICBC (Asia) Apps, and getting professional financial advice anytime and anywhere. The solution has many unique features, such as multimedia access, automated service processes, and an intelligent routing platform that can assign incoming calls to the most appropriate agents. With the above unique features, the IPCC will provide text messaging, voice call, and even video interaction services. This not only greatly improves customer experience, but also enables service back tracking to ensure the service provided fulfilled regulatory compliance.

In the future, ICBC (Asia) will develop a 24/7 omni-channel intelligent customer service system to answer customers’ enquiries. This Chatbot system will be able to process voice commands in Mandarin, Cantonese (the principal language of Hong Kong), and English, improving ICBC (Asia)’s service operating efficiency and customer service quality.

Focusing on Both Security and Agility

Banks are in constant pursuit of security and agility, while these two needs were somehow conflict in the past. Take document encryption and internet safety as examples, cyber-attacks threaten banks’ intranets and sensitive data while daily work data sharing to third party may lead to confidential information leakage that these will bring significant loss to both the bank and its customers. For this case, ICBC (Asia) worked with Huawei to improve employees’ working experience and protect internal sensitive information security at the same time. Huawei is the only vendor in the industry to provide holistic ICT solutions that cover from desktop cloud protocol software, to virtualization software, servers, storage units, firewalls and networks. Huawei deployed more than 100,000 desktop cloud accounts internally, served 180,000 of its employees, and

accrued extensive experience during the process.

With Huawei’s assistance, ICBC (Asia) achieved fine-grained security management (by user, region, and resource), security authentication and verification, as well as sliced data transmission and storage. Huawei’s comprehensive “Cloud-Pipe-Device-Control” security protection system improves service systems’ reliability in management nodes and user connections. The new O&M system features rich functions and simplified wizard operations, maximizing O&M efficiency and lowering relevant costs.

ICBC (Asia) staffs can back up important files and data to Onebox regularly for easy data protection. This is the first trial of the cloud office infrastructure transformation which dramatically improved security and efficiency of ICBC (Asia)’s office works. In the near future, Huawei will use desktop virtualization technology to help ICBC (Asia) isolate browsers from service systems and the intranet from the Internet. This will effectively protect ICBC (Asia)’s ICT systems from cyber-attacks and prevent disclosure of sensitive data (such as customer cross-border financing data and global assets data).

Building a Strong Neural Network System

The growth of cross-border finance introduced higher requirements on the data storage reliability, data centre network speed, and overall system stability. Statistics show that China’s large commercial banks and insurance companies have an average of more than 100 TB data in their databases. To address the Internet finance challenge, financial institutions are now using data to drive business innovation. Data centres, once served banks as support centres, now shoulder the responsibilities of creating value and profits.

ICBC (Asia) built its service systems based on traditional data centres and classified service sectors by business, formulated complicated security strategies. The rapid increase of service types

and capacities brings new requirements on flexible deployment, dispatching, migration, and management of service resource pools. The traditional network architecture becomes a choke point that hinders business development. ICBC (Asia) leverages standard, open network technologies, and new data centre architectures to set a solid foundation for a strong neural network system.

ICBC (Asia) breaks the constraint by replacing non-standard technologies. Its existing data centre and production backbone network used traditional solutions and closed private technologies like EIGRP and PVST+. At the network equipment aspect, Huawei provides CloudEngine, USG Next-Generation Firewall (NGFW), and other devices that feature open architectures, standard network control protocols, and standard interfaces.

At the controller aspect, Huawei deploys its Software Defined Network (SDN) controller and Agile Controller based on the open-source architectures, such as Open Network Operating System (ONOS) and OpenDayLight (ODL). ICBC (Asia) used Huawei's Agile Controller to replace its existing private network architecture and protocols. This protects ICBC (Asia) from vendor lock-in and allows more top-notch ICT companies to participate in the bank's network development. ICBC (Asia) is now able to access the OpenStack-based cloud platform, share computing resources and value-added services across data centres, enjoy multi-service convergence, and flexibly expand and upgrade its solution in the near future.

Based on existing equipment, Huawei developed the data centre network that supports linkage with virtual platforms and evolution towards cloud-network collaboration. With Huawei's solution in place, ICBC (Asia) can upgrade its network and retain many of its legacy network devices. This maximizes the return on ICBC (Asia)'s historical investment, meeting the bank's requirements on long-term development.

Huawei's solution, based on the spine-leaf architecture, uses the Agile Controller and CE Series Switches to help ICBC (Asia) smoothly complete cloud computing evolution. The project is carried out phase by phase and will not involve mass software or hardware replacement. In the future, ICBC (Asia) can choose to reshape its data centre network and build an SDN. Should this happen, service systems will be able to share network hardware resources. That is

to say, these systems will be logically isolated from each other to ensure security, and share IT resources to improve resource usage and service deployment efficiency.

Tang Bin, General Manager of IT department of ICBC (Asia), said that ICBC (Asia) recognized Huawei's technologies and product quality, and was satisfied with Huawei's support and service abilities. "Huawei helped ICBC (Asia) build more open and stable ICT infrastructures," Tang Bin said, "it allows the Bank's business departments to work safer and easier. With Huawei's solution in place, ICBC (Asia) achieved a major breakthrough in the diversity of DC network products, laying a solid foundation for private cloud transformation in the future. ICBC (Asia) looks forward to more extensive cooperation with Huawei in cloud computing, Big Data, and other sectors."

ICBC (Asia) is using scientific innovation and the latest technology to drive business upgrades and development, and promote the extensive convergence of modern information technology, and banking business operations and development. Hong Kong is now actively developing FinTech. ICBC (Asia) will seize this opportunity, work hard to build its ICT systems into its core strength and important support in offering financial services. With Huawei's technological support, ICBC (Asia) is confident to achieve all-around improvement in management, services, and innovation, also to meet the increasing needs on customer services, internal management, and external regulatory compliance. ICBC (Asia) will continue its endeavor on improvement and strives to become your preferred bank in cross-border finance. ▲

Customer Testimony

"Huawei helped ICBC (Asia) build more open and stable ICT infrastructures, it allows the Bank's business departments to work safer and easier. With Huawei's solution in place, ICBC (Asia) achieved a major breakthrough in the diversity of DC network products, laying a solid foundation for private cloud transformation in the future. ICBC (Asia) looks forward to more extensive cooperation with Huawei in cloud computing, Big Data, and other sectors."

— Tang Bin, General Manager of IT department of ICBC (Asia)



CMB Creates Values that Internet Financial Enterprises Cannot Match

By Tian Yongjiang, Manager of Application and Database Management Office, Headquarters Data Center, China Merchants Bank

In the late 1990s, something happened at a major branch of China Merchants Bank (CMB) in a provincial capital: Some banks dispatched several armored cars to this branch, telling CMB's customers they can withdraw their money if CMB can't find its way out. CMB employees called in family members to help carry the money, and the employees smiled through their tears when saying goodbye to customers. No one complained. A few weeks later, the branch was back to business as usual. Customers had brought back the money they had withdrawn from the branch along with money they had withdrawn from other banks. In a short time, deposits in this CMB branch had doubled.

This story is one small step in the development of CMB, China's first share-holding commercial bank whose shareholders include legal enterprise entities.

CMB was also the first Chinese bank to hold umbrellas for customers coming in and out of the bank on rainy days, own the auto call distributors, and provide milk to customers. These kinds of thoughtful touches have helped CMB develop rapidly over the past 30 years. In 2017, the bank ranked 23rd in the *Banker's Top 1000 Banking Brands*, and 216th in the *Fortune Global 500*.

Three Thoughts on CMB's Digital Process

Over the past 17 years since joining CMB in 2001, I have witnessed the bank's ongoing digital transformation initiatives. In recent years, technologies such as cloud computing and Big Data have developed

quickly. Keeping pace with the times, CMB introduced these innovations to achieve rapid service development and better serve customers. Several of the changes have impressed me deeply.

First is the rapid development of infrastructure. From the bank's Shekou equipment room to the data center in Nanshan and the Nanjing disaster recovery data center, or the data centers in Shanghai and Pinghu, the upgraded facilities and expanded capacity are meeting CMB's increased service requirements.

Second is the impact of the Internet. CMB's top executives believe technologies can bring disruptive changes to banks — more so than strict supervision, small loan companies, or Internet financial companies. Therefore, CMB is attaching great importance to new technologies. For example, 30 percent to 40 percent of the employees in the CMB business department spend 30 percent to 40



Through joint innovation with Huawei, China Merchants Bank aims to build cutting-edge distributed database products that give a competitive edge for banking services, drive CMB's digital transformation, and help CMB become a financial technology (FinTech) bank.

percent of their time on technology-related work and training. In addition, special funds have been established for innovative projects to support better service development.

These efforts have paid off. For example, CMB has built a unified risk control platform for credit cards based on Huawei's FusionInsight Big Data solution. The FusionInsight platform reduced the number of problem cases by 50 percent and saved more than CNY 100 million in six months. This platform also shortened the time to issue a credit card from 15 days to five minutes. CMB now supports the ability to issue loans up to CNY 300,000 within minutes. Further, the bank is leading the market to provide innovative services such as withdrawal authentication and flash payments.

The third change is what has impressed me the most: CMB's commitment to a customer-centric concept. With the slogan 'We are here just for you,' we bear in mind that providing good services for customers is our foundation. We use FinTech to facilitate our business operations and better serve our customers. We use every technology to satisfy customer needs, improve customer experience, and create larger value. Our goals are more benefits, greater convenience, faster service, and considerate services for customers.

Values Internet Financial Enterprises Cannot Match

The CMB Application and Database Management Office has been seeking answers to many questions: How do we provide better services for customers and businesses? How do we reduce costs? How should we set up our networks, and what architecture will be best?

CMB has strict architecture standards, such as read/write separation, database partitioning, active-active backup, and stateless multi-active operation. The bank has established a disciplined capability for implementation, and the gradual use of standard architectures has changed our standard for managing databases. In the past, faults had to be rectified immediately or services could not be restored. Now, with the standard architectures of today, faults have little or no effect on

services. This use of standard architectures is an evolutionary way of thinking, as well as a great improvement in reliability.

CMB's efforts in these areas differ from those of Internet financial enterprises to some degree. We implemented high-availability, high-scalability, and high-flexibility systems under strict supervision and predicated on customer security and experience. I can definitely say that CMB now bears favorable comparison to Internet companies in terms of database architecture standards and implementation capabilities.

In recent years, technology development has generated more software, including operating systems, system software, and application software. More and more types of applications are emerging, such as facial recognition, voice recognition, anti-fraud applications, and customer profile managers. These applications will evolve into public infrastructure services and will be centralized. Those who can develop the best applications will encourage the most cooperation. Banks can take advantage of these services and have no need to develop their own. Such cooperation will become typical between banks and Internet or technology companies. Banks have the final say for the problems that can be solved using facial recognition, and where and how to use this technology. This issue cannot be decided by others.

Constructing the Optimal Distributed Relational Database in the Financial Industry

Service innovations depend on IT and data. Therefore, it is critical to find a way to ensure information security and optimize the database.

If only one machine is used, its upper limit is fixed and once that limit is reached more database instances are required. This requirement leads to new problems such as higher management costs. Before database partitioning, only one or two databases would be managed, but with partitioning, 10 or more databases must be managed. In addition, the probability of faults remains as high as when only one database is used. The result is that the overall availability has not increased.



Database partitioning and horizontal expansion reduce the dependency on a single database. This approach seeks to balance the tradeoffs among resources, costs, availability, and development difficulty. The solution is to have a distributed database, which represents a trend in database development. A distributed database offers several advantages. First, it reduces cost, including hardware, labor, development, and O&M costs. Second, a distributed database simplifies development and O&M so that IT personnel have a smaller workload. Most importantly, this type of database achieves better utilization of hardware resources and provides a higher unit output rate, so the database can better support more services.

Why is the trend to use distributed relational databases so widely recognized, and why are there so many people engaged in it? First, the relational database will never be outdated. Although this type of database has been under development for over 40 years, it is still used in scenarios with strict consistency requirements. Second, single databases are encountering bottlenecks. In addition to throughput demands, the number of users and concurrent transactions have reached unprecedented levels and will continue to grow. In the future, once breakthroughs are made in technologies such as quantum computing, the transaction volume will again increase explosively. In this context, the distributed relational database is one of the best choices.

Based on experience and a commitment to go further, CMB has decided to engage in a joint innovation program with Huawei in the distributed database field. We aim to build the optimal distributed database for the financial sector that will give CMB's services a competitive edge. Both companies will rise to the challenges of 'Cloud First' by leveraging technologies such as cloud computing, Big Data, and AI, as well as leading financial

The customer-centric concept is the first reason why CMB chose Huawei. CMB is born to serve customers, and gives the highest priority to customer satisfaction. That is also true for Huawei. With a shared spirit of excellence, Huawei and CMB respect, trust, and appreciate each other. >>

business practices and high-quality resources to connect services and technologies. Further, we will jointly develop the distributed database and put the products into use, so as to migrate database applications to the cloud.

The bank's existing open-source database kernel does not have performance and function comparable to that of a proprietary Oracle database. In addition, we have issues with scaling large clusters, low cost-effectiveness, and high maintenance costs. By cooperating with Huawei, CMB hopes to build a competitive distributed database for finance with high performance, high security, high reliability, and high scalability. We will use technologies such as latch-free data structures; NUMA-aware architectures (where NUMA is Non-Uniform Memory Access); 3D-XPoint memory; high-performance distributed transaction processing, computing, and storage separation; Remote Direct Memory Access (RDMA); Group Buffer Pools (GBPs); and Z-Paxos protocol. These technologies will be used to build cloud-oriented scale-up/scale-out capabilities.

Over the years the financial industry has gradually refined the core value of the database, which is all about consistency. Databases play a critical role in data processing and solving all difficulties regarding consistency. Problems that can be solved by applications should not be handed over to the database, as databases may not be appropriate for problems better solved by applications. Moreover, coping with such problems bears a high cost and affects database capabilities, including performance and capacity. In addition, fault probabilities are higher.

Based on these concepts, CMB has a clear specification for all online transaction systems. For example, even when using an Oracle database with the capacity for 500 SQL statements, CMB may



only use 10 of them. This policy simplifies the database function requirement, which shortens the development cycle.

Mutual Trust Builds the Foundation of Cooperation

The customer-centric concept is the first reason why CMB chose Huawei. CMB is born to serve customers, and gives the highest priority to customer satisfaction. That is also true for Huawei. With a shared spirit of excellence, Huawei and CMB respect, trust, and appreciate each other. Second, we believe in the strength that Huawei has accumulated with over 10 years of experience in the database field — including both in-memory and disk-based databases. The company has many successes in multiple business domains.

We also appreciate Huawei's service-minded approach and ability to tackle difficulties. About six years ago, Huawei left me with a deeply positive impression when CMB chose Hadoop products. At that time, several vendors, including Huawei, offered to provide Hadoop cluster products and services. After hearing CMB's six challenges, two of the vendors said the project was too difficult and dropped out. Only Huawei was willing to take on the challenge. Five months later, Huawei reported to CMB that five of the issues had been completely resolved and only half of the sixth issue remained. This interaction demonstrated to me that Huawei is determined to deliver on projects and deal with difficulties with service awareness and cooperation. This is the foundation of our mutual trust.

Based on this trust and cooperation, how can the two companies use online trading systems and databases in the future? What services and capabilities need further development? CMB is a typical bank. Our interaction with Huawei is to propose advanced requirements and challenging functional attributes. Huawei sees that CMB has this capability and that the database developed by the two companies applies to banks as well as to businesses in other vertical markets

supported by Huawei. I think that is why both parties choose each other to achieve win-win cooperation.

Huawei is planning to develop a database on the public cloud, and CMB can assist Huawei in developing such a database. By participating in this project, CMB will study to better understand the development trend for database technology, as well as the planning and design for core databases. This project will be highly beneficial to CMB, especially in terms of talent cultivation.

The joint innovation between CMB and Huawei has three phases:

- Initial phase: Focus on commercial pilot projects in 2018.
- Growth phase: Reach industrial scale in 2019.
- Stable development phase: Carry out large-scale promotion and replication activities in 2020.

CMB is responsible for the design of requirements and solutions, and Huawei's Online Transaction Processing (OLTP) database team is responsible for technology implementation. Independent innovation will be conducted based on Huawei's experience, and infrastructures will be integrated based on new hardware capabilities. In this way, the project will achieve the overall objective of a high availability cloud-based deployment with high security, high performance, low cost, and differentiated competitiveness.

A three-layer product architecture will be adopted. The top level is the distributed extension layer. In the middle level, the enterprise core layer will support the high performance and general database capabilities for enterprise-level services. At the bottom level is the distributed storage and cloud storage layer. This architecture supports the vertical integration of software and hardware to deliver high-performance, high-availability, and cloud-native database capabilities.

I firmly believe that the distributed financial database jointly developed by Huawei and CMB will contribute to CMB's digital transformation and help CMB become a successful FinTech bank. ▲



Bringing the Digital World to Cape Verde Archipelago, North Atlantic

Pearls of the North Atlantic

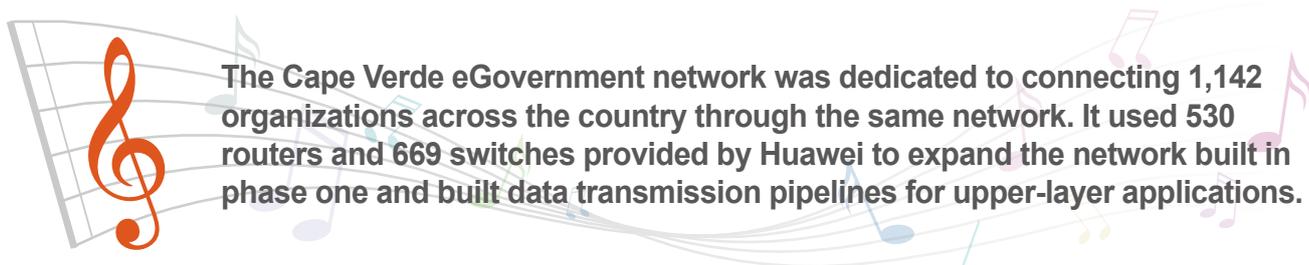
At the westernmost edge of the world map, there is a small dot — Cape Verde (Portuguese: República de Cabo Verde) in the Atlantic between the edge of the African continent and the map frame. Cape Verde, a volcano archipelago located in the mid-Atlantic Ocean, is composed of 10 volcanic islands and has a coastline of 965 kilometers. Cape Verde suffers from poor industry and agriculture due to its unique geographical location; however, the service industry is extremely robust, accounting for more than 70 percent of the country's GDP and proposing strong demands for information technology development. With informatization as a national strategy, the Cape Verde government is committed to building a more people-oriented government, creating more business opportunities to improve the competitiveness of Cape Verde, developing an open economy to promote economic development, and alleviating poverty through information communication and network technologies.

In recent years, many West African countries have built national data centers for informatization technology advances. However, due to lack of application software development capabilities, ICT talent, and an ICT ecosystem, many data centers have no load. The government of Cape Verde expects to change this situation. Through the implementation of the eGovernment project, the government of Cape Verde is attempting to build a nationwide eGovernment office

network and a national data center. The purpose is to greatly improve government office efficiency, promote the sharing of education, medical care, and other types of resources, improve Cape Verde's informatization level, and build the country into an information hub for West Africa's coastal countries, as well as a lighthouse in West Africa.

NOSi, Cape Verde's Operational Information Society Nucleus, initiated and implemented the eGovernment project and was responsible for service development and O&M after the eGovernment system was built. With 19 years of experience in eGovernment operations and development, NOSi has strong capabilities in eGovernment application software development and ICT technologies. The first phase of the eGovernment project was initiated in 2010 and delivered in 2014, which mainly included the construction of a national data center and an upgrade of the government communications network. This project phase completed the preliminary establishment of the national government network system platform and island interconnection network platform. Based on these achievements, NOSi initiated the deployment of the government informatization system.

With the gradual emergence of new eGovernment applications in Cape Verde and the rapid growth of service leasing to third parties, the national data center, with only 200 Virtual Machines (VMs) built



The Cape Verde eGovernment network was dedicated to connecting 1,142 organizations across the country through the same network. It used 530 routers and 669 switches provided by Huawei to expand the network built in phase one and built data transmission pipelines for upper-layer applications.

in the first phase, was fully loaded, leaving no available space for new applications or services. Organizations in areas that were not connected to the network were still using a paper-based working mode, leading to poor archival management, low work efficiency, and great difficulties in statistics collection and management. The education and medical care resources of the 10 islands could not be effectively shared. Remote areas suffered from sub-par teachers, poor hardware, and a low overall education level, and the government could not effectively obtain the population's health and medical information in those areas. Due to difficult inter-island transportation, government agencies faced high travel expenses each year. The average travel cost per person was about USD 340 per trip. In this way, the travel expenses of 1,000 persons would reach USD 340,000 per month. An inefficient transportation network also hindered communication between government agencies.

The preceding factors drove the initiation of the second phase of Cape Verde's eGovernment project. Through smooth cooperation with the government of Cape Verde and NOSi, one-stop innovative ICT infrastructure platform enabling cloud-pipe-device synergy, and a large number of success stories in the eGovernment cloud field, Huawei was immediately selected by NOSi.

Constructor of Cloud-Pipe-Device Infrastructure in Cape Verde

In the first phase of the eGovernment project, Huawei completed the following:

- Delivered a national data center with 54 IT standard cabinets covering 200 square meters to the government of Cape Verde, providing information services for not only the government, enterprises, and institutions of Cape Verde, but also surrounding countries.
- Built intra- and inter-island backbone networks, metropolitan

area networks, and wireless broadband access networks; constructed a fiber backbone ring using Dense Wavelength-Division Multiplexing (DWDM) technology on six major islands to upgrade Synchronous Digital Hierarchy (SDH) capacity from 622 MB to 20 GB; and provided broadband access service through the construction of Worldwide Interoperability for Microwave Access (WiMAX) to achieve the network coverage for some organizations throughout the country.

- Established 21 telepresence videoconferencing systems, giving the government the convenience of remote conferences. The phase-1 project construction effectively improved the national information and communication technology level of Cape Verde, which was a solid step towards eGovernment and social informatization.

Huawei's continuous innovation in the cloud data center domain also impressed NOSi. Huawei employed the "one cloud, one lake, and one platform" architecture to assist customers in various industries in accelerating information system integration and sharing, thereby creating business value:

- **'One cloud'**: A converged cloud resource pool, which implements unified delivery, management, and services of the infrastructure through intensive construction.
- **'One lake'**: A data lake, which aggregates a full range of data and provides the full-lifecycle processing capability of "collection, storage, calculation, management, and use" to help customers transform data resources into data assets.
- **'One platform'**: An application-enabling platform, which integrates basic data services, general middleware, and industry middleware to enable customers and industry Independent Software Vendors (ISVs) to quickly innovate services based on multiple types of middleware.

Currently, the Huawei cloud data center solution has served

projects in more than 140 countries and regions, including more than 330 eGovernment cloud projects.

Bringing the Digital World to Ten Volcanic Islands

The second phase of the eGovernment project further upgraded the ICT infrastructure based on the achievements of the first phase. To be specific, Huawei performed the following:

- Deployed new IT devices and system software and transformed the old data center into the disaster recovery center, providing secure and reliable IT leasing services for government agencies and enterprises in Cape Verde through an active-active data center.
- Deployed internal office networks and videoconferencing systems for the government, schools, and hospitals in Cape Verde to expand the office informatization coverage in those places and improve the efficiency and quality of government administration, education, and medical services.
- Jointly developed the integrated ICT training system WebLab with the Cape Verde Ministry of Education to support ICT talent cultivation in Cape Verde and promote social information sharing and development.

In terms of cloud data center capacity expansion, Huawei built 1,000 VMs for customers and upgraded the system from 480-core CPUs with 400 TB of storage capacity to 1,656-core CPUs with 1,000 TB of storage capacity. If the national data center's demands for VMs continues to grow at the same annual rate (60 percent) as that from 2011 to 2015, the capacity expansion implemented this time could meet the business development requirements in the next five years. In addition, Huawei provided 1,000 sets of FusionCloud desktop cloud systems for government agencies and national informatization training centers, solving key government administration problems such as incomplete information protection, low-efficiency maintenance, insufficient resource usage, and difficult network isolation and switchover.

Based on the 'one cloud, one lake, and one platform' architecture, the Huawei eGovernment Cloud solution provides the NOSi with shared basic resources, open data support platforms, rich smart government administration applications, comprehensive eGovernment services, strong security assurance, and efficient O&M service assurance. Those services helped remove data barriers between departments, build cloud platform-based and cross-

department data sharing and exchange platforms, and deliver ICT infrastructure to enable the proactive and efficient one-stop work mode of government agencies and enterprises in Cape Verde.

Similar to many African countries, Cape Verde suffered from unevenly distributed public resources, with one third of the country's schools in three cities (the capital Praia, the port city of Mindelo, and Santa Catarina) and 58.6 percent of the hospitals on two islands (Santiago and Santo Antão). The Cape Verde eGovernment network was dedicated to connecting 1,142 organizations across the country through the same network. It used 530 routers and 669 switches provided by Huawei to expand the network built in phase one and allowed access from schools, medical institutions, government agencies, and enterprises in small and medium-sized cities and towns, and built data transmission pipelines for upper-layer applications. The network infrastructure broke geographical separation and brought network and eGovernment benefits to people in remote areas. For example, the telemedicine application system enabled emergency patients to obtain better professional services from the capital's medical teams in a timely manner.

Confronted with insufficient teachers and low education quality, schools outside the capital of Cape Verde were eager to access the national eEducation network and acquire quality education resources of other schools in time to improve the local education quality. Teachers also expected to exchange with each other in schools in and outside Cape Verde; however, the cost of traveling between volcanic islands was extremely high. In this case, videoconferencing systems could provide great convenience. Therefore, Huawei deployed 30 videoconferencing systems in high schools and municipal governments on Cape Verde islands.

Huawei also provided WebLab, an integrated ICT training system, to help Cape Verde build a talent cultivation mechanism for educating sufficiently qualified ICT talent for its ICT industry development. ICT communications equipment, programmable enlightening robot suites, electronic maintenance tools, and furniture were deployed in containers based on NOSi's current cloud national data center to provide basic ICT training for students on other islands. Those containers could not only provide ICT training for middle school students and local people, but also serve as multi-functional classrooms to deliver other skill training and certification services.

eGovernment Cloud: Shining in West Africa

Based on Huawei's eGovernment cloud, NOSi developed more than 150 websites and 77 types of eGovernment software, covering social security, electronic elections, budget management, distance education and healthcare, and electric Effective Radiated Power (ERP) for all government departments, schools, hospitals, and state-owned enterprises in Cape Verde. NOSi also provided eGovernment applications and data center hosting services for surrounding countries, including Equatorial Guinea, Mozambique, Burkina Faso, Guinea-Bissau, São Tome, and Principe.

Major NOSi eGovernment applications and websites included the following:

- Government Resource Integration and Planning Framework (Integrated Government Resource Planning, IGRP)
- Financial Information System (SIGOF)
- Free Network Access Service (Konekta)
- Social Welfare System (SIPS)
- Medical Information System (SIS)
- Geographic Information System (GIS)
- Portal (Porton dinos ilha)
- Online Certificate System (Online-Certification)
- National System of Identity and Civil Identification (SNIAC)
- Land Registration Special Management System
- Municipal Information System (MIS)
- Student Information Management System

Take the IGRP as an example. Developers can use a variety of pre-integrated application modules and components to quickly build upper-layer application software, improve the efficiency of the government's public departments, avoid duplicate resource investment, minimize public management costs, and maximize Return On Investment (ROI). With these capabilities, the IGRP earned the title "eGov Software Maker" from NOSi's President.

Another example is the Medical Information System (SIS). It is a connection module used to manage hospitals, monitor the population status, and improve institutions' functional capabilities. The SIS manages pharmaceuticals, clinical equipment, materials, laboratory diagnosis, and reservations (analyzing a hospital's appointment information through the Internet and making schedules for doctors based on the results), and collects statistics on hospitalizations,

appointments, and deaths.

Antonio Joaquim Fernandes, NOSi's President, said, "Huawei provides valuable support for the national data center, data transmission network, and eGovernment construction in Cape Verde. It provides data, voice, and videoconferencing services for government departments and public institutions and delivers an innovative digital platform to help NOSi build an eGovernment platform. Based on the digital platform, we will develop the business center, enterprise incubation center, and training center to build a leading information service platform in Africa for Cape Verde."

According to the 2017 International Telecommunication Union (ITU) report, the ICT Development Index (IDI) of Cape Verde ranked No. 4 in Africa, far higher than that of coastal countries such as Nigeria, Angola, Gambia, and Mozambique. Under the regional ICT hub strategy of Cape Verde, NOSi has delivered eGovernment applications and services to neighboring countries in West Africa based on its ICT infrastructure and capabilities and attracted government delegations from more than 40 countries.

Currently, every organization, including each government, is in a critical period of digital transformation. Huawei is looking forward to bringing digital to every organization for a fully connected, intelligent world. It is evident that the construction of Cape Verde's eGovernment cloud is a necessary step for government, education, medical institutions, and enterprises in Cape Verde to enter a smart world. The eGovernment cloud also makes Cape Verde a pearl of digital transformation in the North Atlantic region. ▲

Customer Testimony

"Huawei provides valuable support for the national data center, data transmission network, and eGovernment construction in Cape Verde. It provides data, voice, and videoconferencing services for government departments and public institutions and delivers an innovative digital platform to help NOSi build an eGovernment platform. Based on the digital platform, we will develop the business center, enterprise incubation center, and training center to build a leading information service platform in Africa for Cape Verde."

— Antonio Joaquim Fernandes, NOSi's President

Qatar's Hamad International Airport: Managing large quantities of HD video surveillance data with ease

Safeguarding the Arabian Gulf

Hamad International Airport (HIA) has been classified as a five-star airport by Skytrax, and is one among only five other airports in the world to achieve this prestigious status. The airport is also ranked the Sixth Best Airport in the World as recognized by the 2017 Skytrax World Airport Awards. Currently, the airport has the capacity to handle 8,700 passengers per hour, more than 30 million passengers a year, and is undergoing further expansion to accommodate more than 50 million passengers. HIA is strategically located at the crossroads of the East and West halves of the globe, serving more than 150 destinations across all continents. Around 80 percent of the world's population is within a six-hour flight of HIA, positioning the airport as the gateway to Qatar, the Gulf, and to the world.

Video Cloud with Distributed Storage Gains Popularity

HIA currently has over 10,000 installed CCTV cameras, with

significant increases planned as part of the airport expansion. HIA had been using legacy Network Video Recorders (NVRs) as its main storage, which they wanted to replace with high-performing, scalable, and reliable Network Attached Storage that could manage all of its video data at a cost-efficient price point.

Globally, video surveillance systems are moving towards HD and adding intelligent utilities and analytics into the mix. Customers are paying more attention to capture quality, responsiveness, processing speed, and application overlays. Customers also require solutions that can apply scenario-specific processes to their layouts instead of just ingesting and transmitting video and images. All of these require high-performance, scalable, and distributed storage systems which are an ideal fit for centralized video cloud management.

With its distributed architecture, Huawei's OceanStor 9000 provides easy expansion and centralized management to satisfy HIA's requirements. Huawei is the first vendor to use large-capacity





Huawei's OceanStor 9000 Video Cloud Storage Solution met Hamad International Airport's performance requirements and significantly reduces both equipment room footprint and power consumption requirements.

disks (10 TB per disk) in its solutions for video surveillance. The solution leverages a high-density layout to store HD video on a single storage node. Huawei's solution met HIA's performance requirements and significantly reduced both equipment room footprint and power consumption requirements.

High Performance Puts HIA's Concerns to Rest

HIA's system performance requirements were very challenging. Individual storage nodes were required to support as many channels as possible. The airport also required POC test results and selected a vendor whose products could deliver the best performance, scalability, and capabilities.

In its minimum deployment configuration, the OceanStor 9000 uses three-node clusters and can support 1,200 video channels (at the same bit rate as the one on the live network). This means that each node supports 400 channels, without any frame loss.

OceanStor 9000 uses non-blocking check technology to support more concurrent video streams and ensure zero frame loss even with heavy usage demands. Intelligent file aggregation technology greatly enhances the efficiency of video and image storage and improves storage utilization, which meets the requirements for video recording, access, forwarding, and intelligent analysis. OceanStor 9000 also balances video access workloads evenly and manages resources dynamically, significantly improving efficiency of data handling.

Robust Security and Solid Reliability Earn HIA's Approval

Unexpected events occur frequently at airports, and security personnel must be able to pinpoint the incident location quickly and bring up surveillance videos to assist in decision-making. HIA needed its storage systems to store video data securely as per the defined, yet evolving, video retention policy.

With Huawei's solution, if an outage occurs on a node, the remaining nodes in the distributed cluster can still handle HD video from 1,600 channels without any frame loss. Test results showed that the OceanStor 9000 could provide superb performance, solid stability, and high availability even with high usage demands.

The distributed architecture of the OceanStor 9000 protects data among nodes and can withstand the failure of up to four nodes in a single storage system without disrupting business. Storage capacity and computing capability grow as more nodes are added, delivering linear increases in bandwidth and concurrency. The system uses an N + 2:1 redundancy algorithm, which can tolerate the failure of two disks in a node or one node in the system, to balance disk utilization while ensuring data reliability.

HIA ultimately chose Huawei's OceanStor 9000 Video Cloud Storage Solution because of its high-density, large capacity design, best-of-breed performance, robust scalability, and solid reliability. Solution benefits of the video cloud include:

- A distributed storage architecture that provides central storage and management for video assets, lowering total cost of ownership by 20 percent.
- Single nodes that accommodate HD video from 400 or more channels, reducing the number of nodes required and simplifying management complexity.
- Advanced data protection technologies and high-availability architecture, ensuring zero frame and data losses.

Huawei's video cloud storage places video, images, audio, and other types of data into one system for centralized management and access. The system supports a single namespace with a capacity of 100 PB, fulfilling the technical requirements for a video surveillance platform as well as its capacity expansion needs over the next five years. OceanStor 9000 delivers future-proof video analysis capabilities and a unified platform for efficient video data analysis. ▲

A Digital Transformation Heart-to-Heart with Huawei

By *Huang Changxia, Digital Enterprise Department, Digital Factory Division, Siemens Ltd., China*

In recent years, Huawei has not only achieved robust and sustainable growth in the dedicated communications field, but also expanded to other fields such as consumer electronics, smart equipment, Industrial Internet of Things (IIoT), digitalization, and intelligent manufacturing, constructing a remarkable industrial ecosystem. Further, Huawei's achievements have drawn worldwide attention.

Similar to Huawei, Siemens is a senior player among the world's top manufacturing enterprises, a global-leader in electrification, automation, and digitalization technologies and solutions, just like Huawei. And, the dialogue between Huawei and Siemens has never stopped; however, it is really difficult to promote cooperation between large multinational enterprises. Every effort needs to be made together, including top-level design and planning at the strategic management level, communication and collaboration between enterprises' multi-level functional departments, and implementation of best practices at the frontline execution level.

For example, in terms of digital transformation, intelligent manufacturing, and Industry 4.0, we have conducted multiple rounds of discussion with multi-level leaders from Huawei's different business groups and functional departments. Our topics have covered R&D, production planning, production execution management, production engineering and automation, value-added services, and other manufacturing topics. We have collaborated on industrial software and industrial automation hardware products. However, considering the scale of the two enterprises, such cooperation projects are a mere drop in the bucket. The value created by our



More than 90 percent of the manufacturing enterprises that have successfully implemented or promoted digital transformation have set up dedicated intelligent manufacturing program offices as the internal and external coordination departments needed to accelerate the overall digital transformation of enterprises.

cooperation should not only include mutual benefits, but also the acceleration of advanced manufacturing development, and could even kick off new era in global manufacturing industry.

Recently, a popular speech from Huawei titled *Planning Huawei's Big Production System Architecture from the Perspective of System Engineering to Build World's Top Advanced Production Systems has caught my eyes*. After an in-depth study, I found that Huawei had already become one of those global players with the deep insights into the manufacturing industry, which gave me confidence to promote the comprehensive cooperation between Huawei and Siemens in the digitalization and intelligent manufacturing fields.

Systematic Overall Planning

A question I often hear from customers is: "From the ERP, PLM, and MES to various integrated software platforms, we have bought almost all the software systems in the intelligent manufacturing system architecture. Why haven't we become a digital enterprise (or realized intelligent manufacturing) like we expected?"

In fact, digital transformation, intelligent manufacturing, and Industry 4.0 vision are not only a technical issue. They are complex engineering solutions that required top-down promotion. We need to conduct overall design and planning from the strategic management level of the enterprise and take every aspect into consideration, including current development status, future strategic objectives, management mode, the business model, the operation mode, characteristics of industry, the R&D system, the production mode, characteristics of process, as well as supply chain and logistics.

The result of overall design and planning is not simple paper work, but a systematic planning solution with clear scope of work,

executable tasks, and timeline. Such a solution can provide effective guidance for the implementation of digital transformation and intelligent manufacturing.

This is consistent with the statement given by Huawei's executive: "To achieve Industry 4.0 and intelligent manufacturing, we should plan and design the supply mode, manufacturing mode, and production mode for future-oriented business from the perspective of system engineering. We must better-define the architecture of the large production system because ill-defined architecture will lead us in the wrong direction."

Similarly, Siemens, with in-depth insights into the transformation of manufacturing enterprises, established a professional digital enterprise competence and solution department in 2015 to provide digital enterprise consulting and planning services for customers. In contrast to management consulting companies who provide strategic consulting services for enterprises, Siemens provides customers with digital enterprise consulting and planning services based on its own technologies, resources, and experience. Through continuous technical verification, Siemens could ensure the implementation of digital transformation and intelligent manufacturing projects.

Siemens digital enterprise team has conducted digitalization consulting and planning, overall solution design, project implementation, and engineering supervision throughout the whole process for multiple leading enterprises in various industries, such as automotives, electronics, mechanical processing, etc.

Siemens believes that promoting enterprise digital transformation and intelligent manufacturing is just like cooking: Software and hardware are the main food materials; the overall planning and solutions are the cooking methods and recipes; customized solution



is the seasoning; and system integration and engineering implementation are the act of cooking. Just as any good meal requires a well thought out recipe, system integration and implementation need to be steadily promoted based on overall systematic planning.

IT and OT Integration

System integration and interconnection are necessary conditions for successful digital transformation, as well as an important basis for achieving intelligent manufacturing and future Industry 4.0.

The 'systems' we usually talk about include not only Information Technology (IT) systems such as the Enterprise Resource Planning (ERP) and Product Lifecycle Management (PLM) systems, but also middle-layer Manufacturing Execution Systems (MES), a complete industrial automation system at the Operational Technology (OT) layer, and a full range of production equipment and terminal execution units at the execution layer. Broadly speaking, 'system integration' also includes data collection on the existing production equipment and the entire production process, and closed-loop control and continuous optimization based on data analysis.

Huawei already has in-depth understanding of both IT systems and the integration of different systems, however, OT layer (including the control layer and execution layer) also plays an important role in the large production system and even functions as its foundation.

The application of digital-twin technology in production and system operations is a typical example of IT and OT integration. Digital-twin technology focuses on implementing continuous iterative optimization of products, production, and machine operation through bi-directional information flow and continuous feedback between

System integration and interconnection are necessary conditions for successful digital transformation, as well as an important basis for achieving intelligent manufacturing and future Industry 4.0.
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the physical world and the virtual world.

In this process, 'continuous feedback and optimization' is driven by data, the 'world's fifth source of energy.' Production data can not automatically generated in the IT system. Instead, it is produced by the equipment that is continuously operating and running on the OT layer at the factory site. In order to attain the complete and efficient collection of real-time data from the production equipment, the automation systems of the production equipment require standard design, comprehensive industrial control systems, and automation integration software platforms. In other words, digitalization and intellectualization must be based on a standardized automation system. This is even more important for large enterprises. Both IT and OT are indispensable, and only through their effective integration can we promote the digital transformation of manufacturing enterprises, realize intelligent manufacturing, and move towards Industry 4.0.

Siemens' two global digital factories in Amberg, Germany and Chengdu, China rely on highly standardized, fully integrated automation systems. Those automation systems could efficiently collect data to provide power for the whole system, which provides strong support for high-quality delivery, flexible hybrid manufacturing, and continuous and efficient production and operations.

Besides putting the preceding theories into practice at their factories in Amberg and Chengdu, Siemens has successfully assisted customers from different industries to achieve digital transformation. One of our customers, who is a world-leading electronics manufacturer in China, it was aware of the significance of automation standardization and systems synchronization in the early stage of production, and laid a more solid foundation for digital transformation and save more time than its



competitors. Nowadays, the flexible intelligent manufacturing production line of the enterprise has improved production efficiency by more than 50 percent, reduced the operations cost by more than 20 percent, and shortened the product launch time by more than 30 percent. Each of these results has exceeded the intelligent manufacturing acceptance standards of China's Ministry of Industry and Information Technology (MIIT).

Non-technical Adaptation

As mentioned above, we cannot rely on only technical integration to meet the complex system needs of digital transformation, let alone intelligent manufacturing or Industry 4.0 vision.

According to our experience, it is easy to identify and solve technology integration problems and gradually solve them through investment and renovation. By contrast, it is non-technical issues that hinder enterprises' digital transformation. Non-technical issues like the mindset and strategic vision of executives, management hierarchy and completeness, organizational structures, etc.

In terms of Huawei's quick strategic initiatives for global industries, Huawei's executives have an up-to-date mindset and a comprehensive and forward-looking strategic vision. Based on the companies' daily business communication, I believe that the management level of each Huawei business department is miles above the average level of the industry. The production capabilities of Huawei's manufacturing bases and the quality of Huawei's products for sale in the market indicate that Huawei has a deep understanding of the production processes within its industry.

Objectively speaking, most enterprises in the manufacturing industry can barely possess such comprehensive capabilities. However, since Huawei aspires to build a world-class

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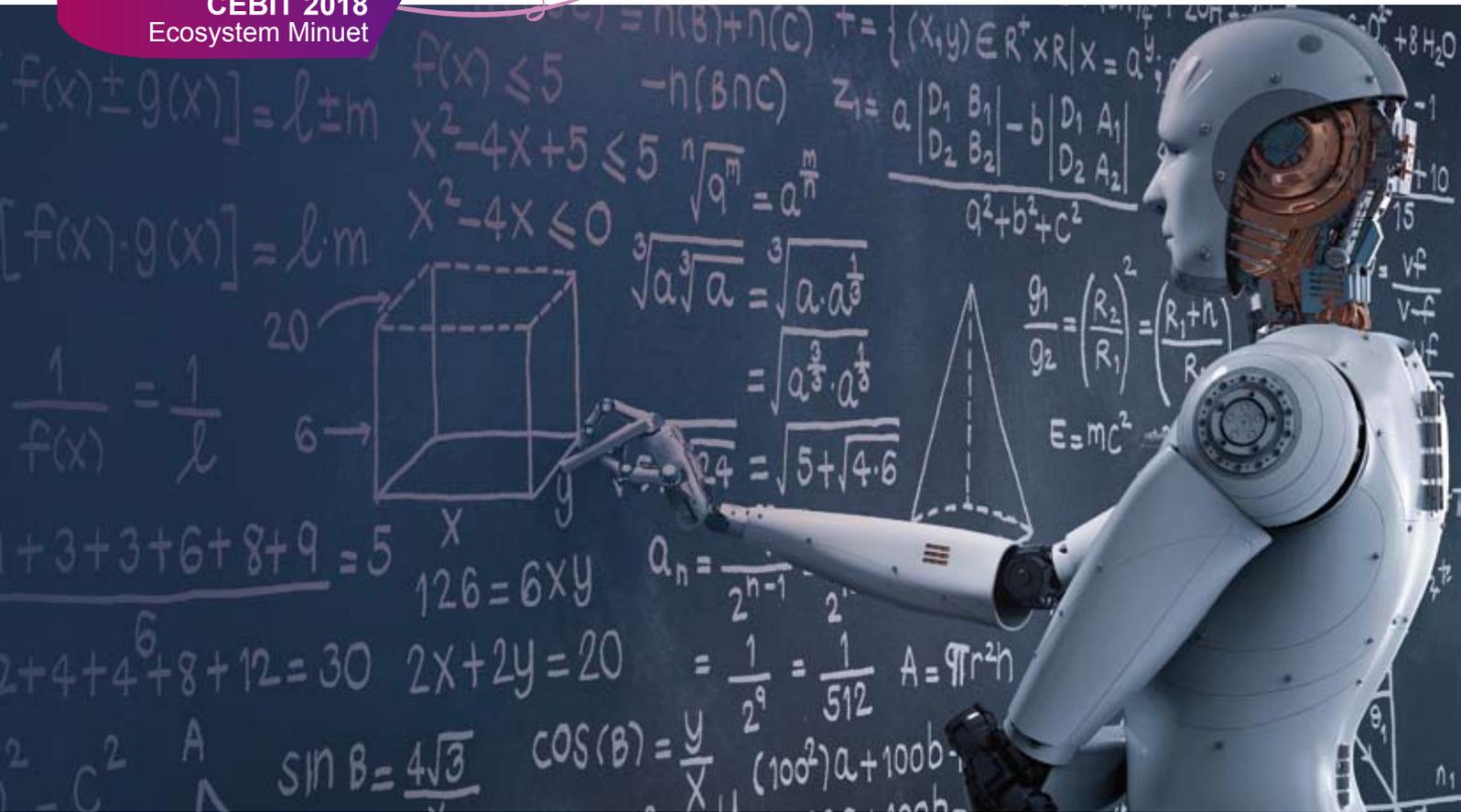
advanced production system and lead the future of digitalization, intelligent manufacturing, and Industry 4.0, I would like to put forward the following suggestions for Huawei: Set up a horizontal department with high-level management with decision-making power to promote Huawei's overall digital transformation and intelligent manufacturing. Internally, this department is responsible for coordinating and communicating with major business departments, functional departments, and subordinate units at all levels in a unified manner, and effectively integrating internal resources. Externally, this department functions as a unified interface to interconnect with external partners and ensure high efficiency of communication and collaboration.

This suggestion is not just idle theory; it is based on our experience in serving customers. At present, among all the manufacturing enterprises that have successfully implemented digital transformation or are steadily promoting digital transformation, more than 90 percent have a dedicated intelligent manufacturing department with the same or similar functions as described above. Adapting to this market change, Siemens created a horizontal digital business department that effectively serves customers with a unified interface.

A Few More Words

What is past is prologue.

Finally, I hope that Huawei can improve with each step of the digitalization journey, maintain its advantageous position, and continue its leading position worldwide. Meanwhile, we hope Siemens and Huawei will have the opportunity to continue exploring digitalization, intelligent manufacturing, and Industry 4.0 in harmony with the digital symphony! ▲



Edge Computing Unleashes the Potential of the Physical World

By Shi Yang, Industry Planning Expert, Requirement and Architecture Chairman of the Edge Computing Industry Alliance, Huawei Technologies Co., Ltd.

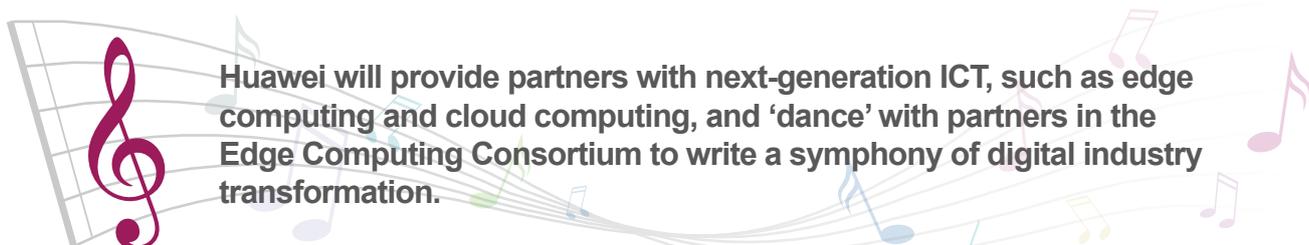
Two Themes of Hannover Messe 2018

In April, 2018, Germany held the Hannover Messe Industry Exhibition, an annual event that identifies industry trends. At Hannover Messe 2018, two Operational Technology-Information and Communications Technology (OT-ICT) convergence topics attracted the most attention:

- **Industry integration: Connection and collaboration.** Why is industry integration the main theme for today's manufacturing environment? Customers demand integrated solutions that require vendors to collaborate with each other; however, there remain a number of closed coalitions in the manufacturing industry that are not willing to collaborate with each other. Without data exchange, companies within these coalitions cannot extract more value from their service data. Today, open standards, such as the OPC Unified Architecture (OPC-UA) and Time-Sensitive Networking (TSN), are undergoing rapid development. Horizontally decoupled open platforms

are widely applied and promoted in the manufacturing industry. Vendors can connect to each other to perform cross-field collaboration. Open connections and collaboration enable players along the industry chain to flexibly select partners, focus on their core business, achieve a win-win ecosystem, and create more space for innovation. At Hannover Messe 2018, Huawei actively responded to the event's theme and the industry players' common requests, designed the TSN network and OPC UA test bed for six major application scenarios, and released the network and test bed with more than 20 international organizations and highly regarded vendors. These organizations and vendors included, but were not limited to: Alliance of Industrial Internet (AII), Avnu Alliance, Edge Computing Consortium (ECC), Fraunhofer FOKUS, National Instruments (NI), Schneider Electric, and B&R Industrial Automation.

- **Ubiquitous 'digital twin': The physical and digital worlds.** The exhibition booths for many mainstream vendors focused on 'digital



Huawei will provide partners with next-generation ICT, such as edge computing and cloud computing, and ‘dance’ with partners in the Edge Computing Consortium to write a symphony of digital industry transformation.

‘twin’ technology. Based on connections, cognition, and perception to the physical world, we can create a mirror in the digital world to enable bi-directional data and information flow. Conversely, we can leverage the innovative technology we create in the digital world to better understand and optimize our physical world. Over the last decade, network, computing, and storage — the three pillars of the ICT industry — experienced exponential growth in technical and economic feasibility. Network bandwidth increased by 1,000 times, while cost per bit decreased by 97.5 percent. The cost of computing chips fell by 98.4 percent. The capacity of a single storage disk increased 10,000 fold, while its cost decreased by 94.2 percent. Next-generation IT technologies such as Big Data and AI experienced leapfrog development and were extensively implemented, ushering in an era in which digital ICT unleashes the potential of the physical world.

Collaboration between Edge Computing and Cloud Computing

How do we connect the digital and physical worlds? Directly connecting the two worlds pose various challenges, such as high latency, high bandwidth costs, low reliability, and security and privacy issues. Many of these challenges can be addressed by migrating intelligent applications from the cloud to the network edge. We need to connect the two worlds using edge computing in a location close to the physical world. Edge computing is a distributed open platform that converges network, computing, storage, and application abilities. The platform offers local edge intelligent services to meet digital industry transformation’s requirements for agile connection, real-time service processing, data optimization, intelligent applications, and security and privacy protection. Cloud computing focuses on centrally processing and storing a massive amount of data. Real-time response is not cloud computing’s core objective. Edge computing uses distributed computing to enable the live, automatic, and collaborative operation of physical equipment.

Collaboration between edge computing and cloud computing can

improve digital industry transformation in the following aspects:

- The physical and digital worlds, once separate from each other, are now converged for more productive collaboration.
- Enterprises make business decisions based on digital models, instead of managers’ personal experience.
- All workflows are connected together, allowing data-based, end-to-end collaboration.
- Enterprises no longer toil alone; they work with ecosystem partners to achieve innovation.

Recognizing the important role that edge computing plays in digital industry transformation, Huawei started to release edge computing products and services in 2016, including Edge Computing Internet of Things (EC-IoT) gateways and open cloud-edge collaboration services.

On edge computing nodes like network edges, edge gateways, and edge servers, the local edge computing platform creates and runs the models and applications developed on the cloud to serve physical objects such as engineering machines, production lines, and transportation vehicles. The edge gateway is responsible for bus protocol conversion, and data convergence and optimization. The edge server analyzes and stores mass volumes of service data in real time. Edge computing nodes can work together based on regions and services to build an edge cloud that supports elastic horizontal expansion. The edge cloud inherits the traditional advantages of public and private clouds regarding the capability to scale easily. In addition, it provides a lightweight, intelligent, distributed architecture that features easy O&M to enable flexible deployment, intelligent distribution, and application networking. In public and private cloud data centers, the edge cloud also gives partners and end users centralized cloud computing services, such as AI, application DevOps, and Big Data services. With edge clouds in place, enterprises can centrally develop and deploy applications and models.

Huawei’s open cloud-edge collaboration services have been applied in smart manufacturing, smart water, smart building, and



many other industries. In smart manufacturing, robots are used to ensure product quality. Traditionally, enterprises would assign quality inspectors to manually check their products, which is inefficient and prone to false detection and missed faults. Edge-cloud collaboration and deep learning allow robots to perform the inspection, improving product yields and detection efficiency. In smart water scenarios, pipe pressure sensors communicate with each other to simultaneously detect pressure changes in multiple pipes. When pressure exceptions are detected, the system data exchanged between modules is used to ensure timely, accurate fault detection. Additionally, the system can also detect pipeline risks and automatically control valves to minimize risk and prevent losses.

Three Steps to Promote Industrial Implementation of Edge Computing

Huawei is also committed to promoting the healthy development and mutually beneficial cooperation of the edge computing industry. In 2016, Huawei established the Edge Computing Consortium (ECC) with the Shenyang Automation Institute of the Chinese Academy of Sciences, the China Information Communication Research Institute, Intel Corporation, ARM, and iSoftStone Information Technology (Group). Huawei is now cooperating extensively with a growing number of important industry organizations, including the Industrial Internet Consortium to jointly promote digital industry transformation.

The ECC uses a three-step strategy to continuously iterate, optimize, and promote the industrial implementation of edge computing:

- **Step 1: Define the edge-computing reference architecture.** The open edge-computing platform needs seamless collaboration along the industry chain to promote ideas and commercial implementation. The reference architecture will provide a unified top-level design to help the industry reach consensus.
- **Step 2: Build and release an open edge-computing platform.** Under the guidance of the reference architecture, enterprises along the industry chain cooperate with each other to build an open edge-computing platform, provide pre-integrated software and hardware system modules, and open interfaces to alliance members, driving the commercial use of their products and solutions.
- **Step 3: Define the reference architecture of vertical industries**

The edge computing reference architecture offers model-based open interfaces at all layers. The architecture provides intelligent services to cover the entire service process using vertical management, data lifecycle, and security services. >>

based on best practices and build industry-oriented ecosystems. Promote large-scale implementation in industries based on test bed demonstration and test certification.

Based on its industry practices, ECC released the model-driven edge-computing reference architecture 2.0 in 2017.

Based on these models, we can digitally monitor the physical and digital worlds to:

- Enable collaboration between the two worlds.
- Facilitate cross-industry collaboration.
- Reduce system heterogeneity and simplify cross-platform migration.
- Give effective lifecycle support to service systems.

The architecture has the following features:

- Intelligent services based on the unified, model-driven service framework. The software development interfaces are consistent, and deployment and operations are automatic.
- Service orchestration defines Enterprise-to-Enterprise (E2E) service flows, enabling services to drive the physical world.
- The edge cloud allows automatic visual deployment and operations of the physical world and elastic expansion of edge computing resources.
- Edge computing nodes are compatible with various heterogeneous connections, support real-time processing and response, and provide services such as integrated software and hardware security and intelligent data analysis.

The edge computing reference architecture offers model-based open interfaces at all layers. The architecture provides intelligent services to cover the entire service process using vertical management, data lifecycle, and security services.

To sum up, Huawei will provide partners with next-generation ICT, such as edge computing and cloud computing, and ‘dance’ with ECC partners to write a symphony of digital industry transformation.▲

Q&A with Vernon Turner, Principal and Chief Strategist, Causeway Connections

By Sarita Kincaid, Director, Global Analyst Relations, Enterprise Business Group, Huawei Technologies Co., Ltd.

Sarita Kincaid interviews influential industry thought leaders to learn about the latest trends, perspectives and research in the ICT market. Formerly IDC's IoT Research Fellow and Senior Vice President, Vernon Turner provides Causeway Connections customers with strategic advice and services that go beyond the initial influence of an IoT environment.

What's coming up in the IoT market? What's new or where do you see this market going?

The IoT market is fast becoming the conduit whereby all aspects of digital transformation are fueled and enabled. Data from IoT sensors used in the ICT industry accelerators such as Machine Learning, Analytics, and Blockchain are enabling innovation across every industry, both in the private and public sectors of our economies. In other words, patience is paying off as we see IoT instances become more and more embedded in our infrastructure fabric. It is because of this that I see the major cloud providers becoming very keen to be relevant across all layers of the enterprise environments.

What technologies will make this happen?

Relevant amounts of compute capabilities layered throughout the enterprise (at the core, the branch campus, the edge, and on the sensor itself) will drive the performance of industry accelerators (Machine Learning, Analytics, and Blockchain) to happen. This means that everyone from telecom, network, and IT has a chance to offer services to the major industries. It also means that the cloud providers will want to monetize their capabilities at these layers. In other words, there will be direct competition or deliberate collaboration between technology companies and cloud providers.

Why will this market be a game changer?

Currently customers are at the end of either the supply or value chain. Industries make and sell products to customers in a very linear or 'left-to-right' flow. The IoT market changes all of that. It changes the way everyone goes to market and does business. IoT

systems allow customers to be in the center of an industry ecosystem where they will have the ability to see the relevancy of everyone in the ecosystem. IoT-generated data within the ecosystem becomes available to everyone; making transparency the table stakes for every participant in this business model.

Are there early success stories that you can share?

Healthcare is a massive industry that we all know is challenged by high costs and inefficiencies. It has one of the best opportunities to be upended and modernized by the Internet of Things. Think of the patient as being the consumer or customer. Think of the doctor, the pharmacy, the insurance company, the health store or food shop, etc., as being the ecosystem for the consumer. I have worked with an IoT startup company who is enabling customers (the patients) to manage their Type II diabetes in this manner. The business outcomes have been incredible. Significant cost savings are being realized, but even more important is the improved well being of the customers.

How can your firm help enterprises move forward with their IoT initiatives?

We understand the current and future needs of enterprise data centers and networks because we have built and supported them in the past. We have been helping both vendors and customers transform the shift in business models while they retain their infrastructure resiliency and security needs. Finally, we spend time understanding companies' maturity and readiness before they dive into this journey, and advise them accordingly. ▲



Huawei Infuses Intelligence into Enterprise ‘Neurons’ Through Digital Platforms

By Heng Qiu, Chief Marketing Officer, Enterprise Business Group, Huawei Technologies Co., Ltd.

Recent data from Citi Research shows that between 2016 and 2019, the major industries that Huawei Enterprise Business Group (EBG) serves (including government and public utilities, banking, manufacturing, and transportation) will increase their Artificial Intelligence (AI) investments by two-to-five times; however, great problems persist in regards to industry-oriented AI applications for enterprises.

Based on Huawei’s observation, despite the fact that tremendous AI technical breakthroughs have been made to support a full range of AI applications, most enterprise AI applications are still siloed, mono-functional, fragmented, and general. They cannot support the intelligentization of enterprise organizational and functional modules. We have witnessed a shortage of proven industry-oriented AI applications.

To systematically support the intelligence of enterprise organizations and develop Industry-oriented AI applications, the following conditions must be met:

- Platforms that can support the systematic growth of industry-oriented AI applications
- A combination of deep industry understanding and AI technologies



There are three key factors to infusing intelligence into enterprises' digital 'neurons' — having a digital platform for cloud-device synergy, understanding the industry, and practice.

- Continuous optimization and improvement based on business practices

Each organizational or functional module is a digital neuron of an enterprise. Based on a deep industry understanding gained from enterprise businesses and our experience applying AI to Huawei's business operations, we aim to do the following:

- Build a digital platform with the device-cloud synergy to inject AI into each digital enterprise neuron.
- Systematically fuel the intelligentization of each enterprise and organization.
- Build a fully connected, intelligent world.

First, Huawei provides AI products and solutions at various layers, including the device, cloud, and AI enablement layer, to form a complete platform base for AI applications. At the same time, Huawei and its partners closely collaborate and leverage each other's strengths. Partners provide AI applications and algorithms while Huawei provides a complete digital platform that supports AI through AI chips, enhanced Information and Communications Technology (ICT) infrastructure, and AI enablement modules. Third, based on the principle that 'we should first apply AI within our own company, just like those who produce parachutes try them out first,' we adopt AI to improve our operational efficiency through the Digital Huawei project. On top of this, we work with leading industry customers to develop experience with AI industry applications. Huawei and its partners have thus far achieved several success stories.

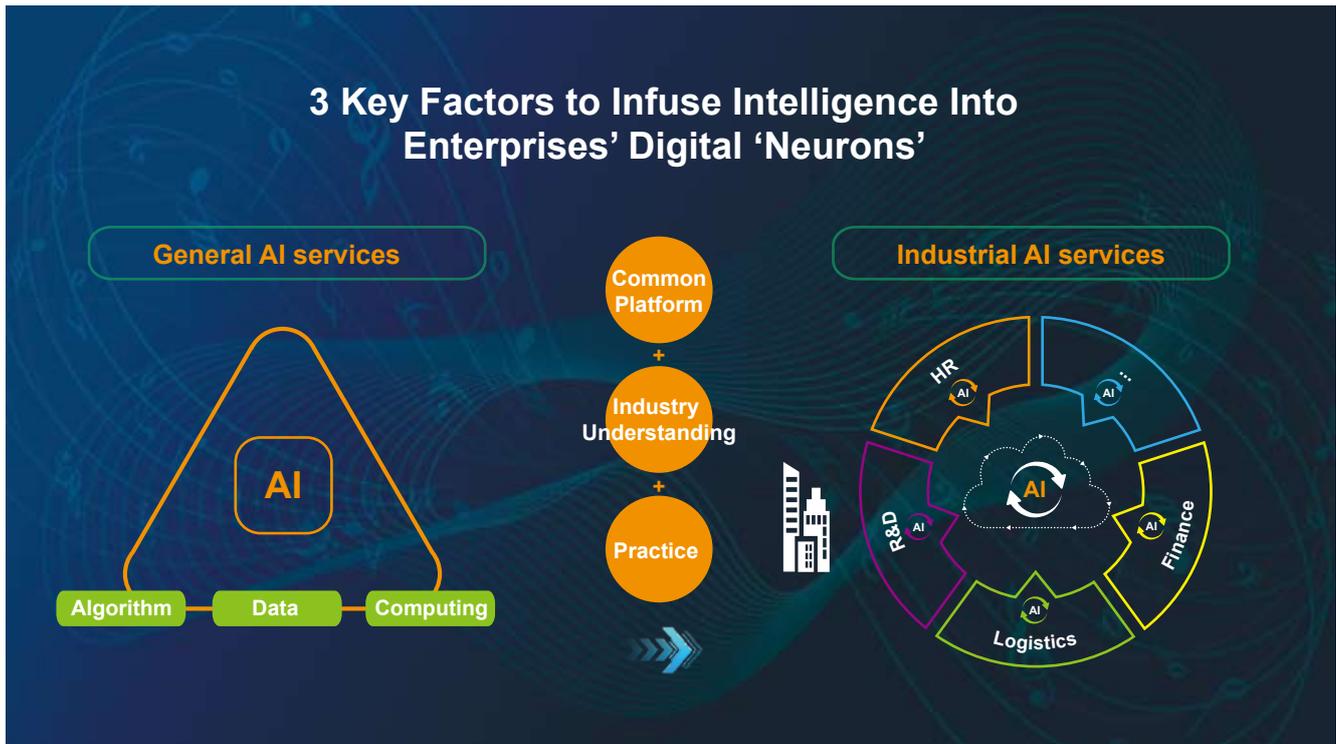
Huawei applies AI to

- Logistics and digital warehousing: increasing the estimation accuracy from **30% to 80%**
- Optimized picking routes: improving the efficiency by more than **30%**
- Optimized loading and unloading operations of trucks: increasing the number of mixed orders processed per vehicle by more than **5** times
- Shortened container detection and identification service time: improved efficiency by over **10** times

Unique Advantages of the Huawei AI Solution — ICT Digital Platform with Device-Cloud Synergy

Based on core capabilities, such as chips, algorithms, and architectural design, Huawei has built a digital platform to provide AI chips/terminals, AI-enhanced cloud infrastructure that supports computing/storage/communications, and AI enablement platforms, including the Big Data platform, video cloud Platform-as-a-Service (PaaS), and Enterprise Intelligence (EI).

The digital platform with device-cloud synergy can systematically inject the AI applications developed by our partners into the digital neurons of enterprises, such as the supply chain, delivery, Research and Development (R&D), market, finance, and governance domains, to promote enterprises' digital transformation in a comprehensive manner. With an industry-leading ICT digital platform, Huawei aims to provide the best AI application performance and experience, simplify application development, and enable quick application release.



‘Practice What One Preaches’ — Building Digital Huawei with AI

Huawei applies AI to business domains, such as supply chain management, delivery, finance, and internal audit, to improve internal operational efficiency and quality. Take the AI application in the supply chain as an example: Huawei applies AI to logistics and digital warehousing; feeds machine learning models with the historical shipment data, overall system configuration, and basic tally and packaging rules; and enables systems to generate warning information based on new protocols. In this way, the estimation accuracy has been increased from 30 percent to 80 percent. At the same time, AI can optimize picking routes to improve efficiency by more than 30 percent.

In addition, AI can also optimize the loading and unloading of trucks, increasing the number of mixed orders processed per vehicle by more than five times. AI also shortens container detection and identification service time, improving efficiency by over 10 times.

These practices accelerate the digital transformation of traditional logistics enterprises.



Huawei expects to work with partners to drive the digital transformation of each enterprise and build a fully connected, intelligent world. >>

Combining Industry Understanding with AI to Create Industry-Oriented AI Applications

Take the AI application used in Smart City construction as an example. Huawei’s AI-enabled video cloud solution has the first all-cloud architecture in the industry. It leverages hundreds of AI algorithms on hybrid clouds to provide global video sharing, remote browsing, and remote retrieval, making multiple breakthroughs in the public safety field. This solution has improved the case resolution rate by 50 percent and reduced the public traffic accident rate by 18 percent.

Huawei has applied AI to traffic management systems to assist law enforcement with Big Data-based decision-making, thereby improving law enforcement efficiency by 34 percent, decreasing the manual workload of traffic police by 47 percent, and reducing the average vehicle waiting time by 24 percent.

Huawei looks forward to working with partners to drive digital transformation of enterprises and build a fully connected, intelligent world. ▲



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