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01/2019

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Customer Testimony

“Through cooperation with Huawei, Ekurhuleni has deployed city-wide wired and wireless networks, powerful cloud data centers, and government applications. These are the cornerstones of a Smart City.”

Tumelo Kganane
CIO, City of Ekurhuleni

Tang Bin
General Manager,
IT Department, ICBC (Asia)

“Huawei helped ICBC (Asia) build more open and stable ICT infrastructures, it allows the Bank’s business departments to work more safely and easily. 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.”

“Since its deployment in BYD’s core service systems, including our enterprise, distributor, customer relationship, extended warehouse, and business intelligence management systems, Huawei OceanStor Dorado All-Flash Storage has proven to be stable, reliable, and robust. Over the years, these systems have seen a 5-fold boost in efficiency.”

Qiu Yan
CIO, BYD Auto

Tomohiko Sawadaishi
Chief Network Architect,
CyberAgent, Inc.

“The vision of CyberAgent is to create the 21st century’s leading company. One of the core cornerstones that support this vision is the cloud data center network with high availability, high scalability, and continuous evolution towards intelligence and automation. Based on comprehensive evaluation, Huawei Intent-Driven CloudFabric provides high-standard solutions and devices to meet requirements for constructing our next-generation cloud data center.”

“Our ETH members expect stable, high-performance Wi-Fi for mobile accessibility and connectivity. Their needs and requirements will continue to increase. With its quality products and flexible, fast processes, Huawei is a reliable partner for the future to efficiently meet these requirements.”

Dr. Armin Wittmann
Division Head, ID ICT-Networks, ETH Zurich

Giuliano Antonelli
Manager of Technology in the
Umbria Region

“Three different suppliers participated in the tender, then after making a price comparison and offering features, we chose Huawei. There was a good cost reduction. All videoconferencing that is made daily avoids the need for people to travel to Rome or elsewhere, also saving travel time. So, there is definitely an economic return.”

“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
President, NOSi



Massimiliano Belli
Head of IT Monitoring at Widiba

“Widiba’s new IT infrastructure has made a huge difference to its operation and has allowed it to accelerate significantly the introduction of new services. Moving from an infrastructure that was complex and fragile, it now has one that is more adaptable and less costly to maintain than its predecessor. With the Huawei’s powerful infrastructure, these targets are very easy to achieve. From start to finish we have been very impressed by Huawei’s approach. The company is very responsive and the support provided by its engineering team has made a big difference.”

The customer-centric concept is the first reason why CMB chose 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.

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

Ricardo Villasana
CTO, GOES Telecom

“Huawei’s eLTE is a robust and comprehensive solution that offers us an IoT platform with a high price-performance ratio. This solution has optimized the metering in aspects such as timeliness, security, and O&M expenses. Looking ahead to the future, we are expecting this solution to bring seamless coverage to Mexico City, one of the largest cities in the world.”

“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

“Huawei has been responsive in terms of support and in terms of pricing, they remain competitive, and they help us a lot with strategy planning, what to do next, and where to go — which is one key area where we feel we should continue and expand cooperation.”

Jesus Romero
COO, Converge

Dr. Henning Fehrmann
Cluster Administrator, AEI ORC

“The cluster extension with the new machines has allowed us to double the overall computing power of Atlas and has significantly improved our ability to perform follow-up analyses of gravitational wave signals. We are very happy with the way everything has worked and are impressed with the professional support we have received. The free software for CMOS and BMC management has been an added bonus.”

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ICT Insights Editorial Board,
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To subscribe to *ICT Insights*, contact the
Editorial Board.

Email: ICT@huawei.com
Address: H2, Huawei Industrial Base,
Bantian, Longgang, Shenzhen
518129, China

Tel: +86 (755) 28780808
+86 (010) 82882758

Publishers: Heng Qiu

Advisors: Jeff Peng, Alice Li, Scott Jamar

Editors in Chief: Lorra Liu, John North

Guest Editors: Jane Chen

Editors: Simon Locke, Pauline Zhang, Gary Taylor,
Tracey Hum, Colin Fuller, Michele Fowler,
Chris DeJohn, Eric Gill

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Huawei & Tianjin's Binhai New Area

AI and Smart City Create Economic Prosperity
and Better Lives

Huawei Smart City Solution has been applied in over
160 cities across more than 40 countries



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Tianjin Smart City Creates Economic Prosperity and Better Lives

By Zhang Guosheng, Deputy Head of the People's Government, Tianjin Binhai New Area, China

As one of China's first comprehensive reform and innovation districts, the Tianjin Binhai New Area has taken the lead for in-depth integration of Artificial Intelligence and Smart City technologies to set a new benchmark for Smart City solutions.

The Tianjin Economic-Technological Development Area (TEDA), established in 1984, is located in the eastern coastal region of Tianjin, at the center of the Bohai Economic Rim. TEDA is one of the earliest coastal economic and technology development areas in China.

Over its 34-year history, TEDA has focused exclusively on investment promotion and the development of enterprise services. In terms of today's industrial footprint, the area now hosts more than 37,000 international corporations, including more than 200 members of the *Fortune Global 500*, such as Motorola and Samsung. Each of these companies is an active contributor to the economic health of the TEDA region.

One example of the type of innovation emerging from Tianjin region is Motorola's concept for total customer satisfaction: Simple customer satisfaction occurs when basic expectations are met. Total satisfaction is achieved when customer expectations are exceeded. However clear the premise, absent the availability of big data or Artificial Intelligence (AI) at the time, it was impossible for the program to succeed.

One Center: AI Performs Deep Analysis, 'City Brain' Generates Value

Today, Tianjin's Binhai New Area Smart City solution provides an

accurate macro and micro understanding of the needs of its industrial and residential constituents. The Smart City solution uses cloud computing, big data, and AI to offer services that were not possible before. The '1 + 4' solution, with an AI platform at the core, was designed by TEDA and implemented with Huawei's support for processing, communication, and in-depth mining with the goal to maximally integrate information about people and things via the 'City Brain' Intelligent Operations Center (IOC). In this way, TEDA provides enterprises and residents with full-lifecycle, point-to-point smart services through the 'Serving Enterprises' and the 'Caring for Residents' platforms. TEDA's platform integration enables the analysis and prediction of the needs of each enterprise and the ability to communicate with residents and households for the delivery of services targeted to meet their specific needs.

The '1 + 4' solution refers to one center, the IOC, and four AI platforms. The IOC is the central point for recommendations and fulfillment. Data sourced from government, industry, and individual citizens through the Internet and the Internet of Things (IoT) is aggregated for processing by the TEDA AI.

The analysis performed by the IOC delivers the following three benefits. First, a real-time dashboard visualizes the moment-to-moment status of the local area for city managers. Second, decision-making tools analyze and offer optimization solutions to high-



and low-level decision makers. For example, heat maps illustrate residential activity to help officials precisely site new commercial or industrial construction. Third, the IOC hosts a suite of technical monitoring, warning, and event-linkage responses based on scientific protocols, which are especially important for complex accidents or emergencies. One such example is when the public security agencies are able to easily manage a festival or other type of celebratory activity based on input from the heat map. In the past the agencies may have been nervous or uncertain about crowd control for a daytime marathon or evening light show. With the video surveillance and cloud computing technologies available today, the agencies are far better equipped to relay dynamically changing information about all sites to the IOC.

The IOC command and control screen displays the operating status of six distinct domains in real time: A TEDA overview, economic flow, safety, transportation, public utilities, and macro quality-of-life (happiness) indices that are extracted from the data. By presenting the information visually the IOC operators are able to gain a comprehensive understanding of TEDA's overall operating status.

Four AI Platforms Support the 'City Brain'

The TEDA solution currently involves four AI platforms that interact closely with the IOC to provide smart services: Resident Voices, Resident Care, Sensing the City, and Enterprise Services.

- **Resident Voices:** Voice recognition and semantic parsing technologies enable city managers to understand the voice of each resident to gain insight into their needs. Resident voices are captured through a hotline, online messages, and in-person visits. The information and data are then analyzed in text and audio data formats.

The platform provides voice navigation for residents to improve their service experience. The smart monitoring of sensitive details enhances the quality of management by government agencies. Key information is communicated to leaders at all levels for further action.

- **Resident Care:** Deep learning and correlation analysis are used throughout the service lifecycle to generate personalized resources for residents. Beginning in utero, individual profiles are created for each person in the TEDA system, and additional information is added as residents progress through their lives. Pre-natal care and post-partum training is provided to expectant parents. Infant-nursing information is integrated with social support resources to manage the healthiest possible outcomes. As children begin school the smart education system will recognize each person's learning pattern and serve as a tutor. When the time comes for college entrance examinations, the system will recommend the most appropriate universities to best enhance each person's personality and learning style. Post-graduation the system will help with individual career planning. In summary, the platform intelligently enables a comprehensive range of services throughout the life of each resident.

- **Sensing the City:** Image recognition and correlation analysis are used to explore the relationships between people, places, and things for the purpose of fostering a harmonious order for all. Sensors collect the data required for city management, including air and water quality, street lighting, available parking spaces, and other information. The video system collects information from transportation hubs, schools, community centers, hospitals, and other locations that, when combined with sensor data, is used to build a unified view for regional health and progress. The visualization platform is used to help city managers comprehensively understand the city's status. For example, residential community surveillance can intelligently analyze the risk level posed by unknown visitors to ensure community safety. Smart surveillance throughout the transportation network is used to monitor vehicles carrying dangerous chemicals or unlicensed vehicles to ensure road and railway safety. The sensor network is also used to monitor water tanks in households and high-rise buildings to alert for water quality changes to ensure the safety of the local water supply.

- **Enterprise Services:** Multi-dimensional correlation analysis helps to clarify the internal relationships of industries in the TEDA district for the purpose of accurately matching the availability of

service resources throughout the enterprise lifecycle. A primary task for the TEDA administrators is the promotion of investments directed to local industry. The investment promotion phase relies on big data technologies to analyze the available information from government and Internet sources to better understand the market landscape in which the target enterprise is operating and evaluate its forward-looking risk. The Tianjin Binhai New Area district government pushes both targeted and general local investment information to regional enterprises in real time. Local governments follow their investments by providing targeted services during the construction and operation process. For example, if changes in the consumption data of water, electricity, gas, or heat of an enterprise are detected, this may indicate production or operational challenges that may require immediate intervention from a supervising agency.

Additional Innovations: Residential Happiness Index

Evaluation standards complement the AI platforms to help ensure that residents enjoy a better life through access to high-quality services. The success of the ‘AI + Smart City’ solution is measured by a ‘happiness index’ that has been established to build a safe living environment for all local residents. First, data is collected through sensors or surveys. Then big data analytics are performed and the grid-based city management system is used to identify risks in all regions. One example of proactive discovery is TEDA’s ability to track, capture, and analyze data on water consumption patterns for each household. Every service or utility is a candidate for this type of closed-loop management. Trends and projected outcomes are subject to further supervision by city managers who are charged with responsibility to assess and intervene with the relevant stakeholders, whether they are on the supply or consumption side of the equation. The TEDA data management tools allow public services to be provided in neighborhood convenience stores so that residents can

apply for licenses, pay bills, and engage with other public services while they are close to their homes.

The goal of the TEDA ‘AI + Smart City’ construction is to continually improve and maintain a happy, comfortable living environment for all residents. Based on the information gathered from the distribution and collection of large numbers of questionnaires we learned the issues that bring inconvenience and unhappiness to urban residents. By using the TEDA AI platform we summarized the leading factors that bring happiness to our neighbors, including peace, beauty, convenience, harmony, social order, and vitality.

In the future, we hope to develop smarter platforms using AI technologies. Our goals include building more personalized Smart City applications to continually improve the happiness indices for the residents of Tianjin Binhai New Area. We expect that the next phase of our Smart City platform will better understand the needs of people and businesses to enable a prosperous and happy modern city, and a better way of life. ▲

The Tianjin TEDA: Hosting 37,000+ international corporations, including 200+ members of the Fortune Global 500:

- **"1"** Center: Huawei's Intelligent Operations Center (IOC) displays the operating status of six distinct domains - overview, economic, safety, transportation, public utilities, and macro quality-of-life.
- **"4"** AI Platforms: Providing smart services, including resident voices, resident care, sensing the city, and enterprise services.
- **"N"** Applications: Summarizing the leading factors that bring happiness to neighbors, including peace, beauty, convenience, harmony, social order, and vitality.

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Huawei & City of Ekurhuleni

Cloud Data Center Supports Massive e-Government Applications

Huawei Smart City Solution has been applied in over 160 cities across more than 40 countries



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Huawei Helps the City of Ekurhuleni Grow into a South African Smart City Pioneer

Through cooperation with Huawei, Ekurhuleni has deployed city-wide wired and wireless networks, powerful cloud data centers, and government applications. These are the cornerstones of a Smart City.

The City of Ekurhuleni (COE) is an important industrial center in Gauteng, which is South Africa's most economically developed province. With an area of 1,975 km² and, according to Stats SA (the national statistical service of South Africa) a 2016 population of 3.37 million people, Ekurhuleni is the country's fourth largest metropolitan area behind Cape Town, Johannesburg, and eThekweni. Ekurhuleni is a modern, highly urbanized city, which has served to usher in advanced medical facilities and high levels of education. To achieve and maintain this concentration of technological advancement, COE needed to further transform its health, education, transportation, and security sectors, as well as upgrade basic services such as electricity, water, public health, and emergency medical care.

"Ekurhuleni is a vibrant and innovative city in South Africa," said Mr. Tumelo Kganane, Chief Information Officer for the city. "It is one of the largest air transportation, rail, and data hub in South Africa. We have unique advantages in terms of technology, talent, and economy so that we can build a Smart City, improve public satisfaction, and help enterprises grow. Smart City

construction is a comprehensive project. We need to select the best partner to achieve success."

Huawei's powerful and open digital platform supports cloud data center solutions and converged communications solutions. Few other industry vendors can match the capabilities and products offered by Huawei. Huawei solutions are compatible with third party developers that help customers participate in the prosperous global market of Smart City ecosystems. To date, the Huawei Smart City digital platform has been deployed in more than 160 cities across over 40 countries. In view of these advantages, the City Ekurhuleni selected Huawei to help it become a Smart City.



After studying the complexities at play in Ekurhuleni, Huawei helped the city design customized Smart City strategies, covering 'connected city,' 'efficient city,' and 'smart city.' >>

Everything Began with Connectivity

After studying the complexities at play in Ekurhuleni, Huawei helped the city design customized Smart City strategies, covering 'connected city,' 'efficient city,' and 'smart city.' Ekurhuleni planned to build a safe, green, clean, healthy, and intelligent city based on an understanding of the 30 elements that constitute a municipality.

At the same time, the following eleven IT strategies were developed:

- Deliver business solutions
- Optimize IT management and governance
- Improve IT organization and employee capabilities
 - Reduce IT costs
 - Integrate IT operation and resources
 - Expand the scope of informatisation and data analysis
- Deploy mobile solutions
- Simplify business processes
- Integrate main businesses
- Improve the relationship between business departments
 - Facilitate infrastructure development or management

In terms of strategy implementation, everything began with connectivity.

First, the City of Ekurhuleni built a fiber broadband infrastructure to provide broadband access for third parties and enable data center network access to boost the economic development of local enterprises. The customer deployed a 1,400 km fiber network infrastructure that has reduced production costs by 75 percent.

Second, Huawei enabled wireless broadband connectivity to provide free, public Wi-Fi. Government office buildings, municipal clinics, and libraries were the first to be covered, and were

soon followed with the addition of commercial and residential areas.

Third, Huawei deployed a video conferencing solution to support Ekurhuleni's 27 departments and public utilities, including access to remote branch offices. In the past, when city staff would travel through heavy traffic for frequent inter- and intra-departmental meetings, the ride to the meeting could last longer than the actual conference. Today, with the new videoconferencing system deployed in all important buildings, efficient communications among government departments and public utilities is assured. The high quality, easy-to-use videoconferencing solution has improved office efficiency by saving time and reducing costs. In addition, the videoconferencing solution integrates with office systems and business systems to better support the city's customer service business.

Cloud-based Data Center

Historically, government departments were slow to resolve problems that affected citizens and local enterprises. Coordination between departments was irregular and often difficult because department data was isolated in separate data centers. Ekurhuleni chose to build a secure, stable, and open cloud data center that could integrate diverse government applications, thereby improving government efficiency.

With more than 30 core applications and database business systems in operation, COE required the following:

- Zero data loss due to municipal system failures
- Automatic fault detection and switchover for virtual machine and database services
- Low capital investment, and quick system and service rollout

Through comprehensive innovation in chips, hardware, and software, Huawei is able to provide customers with the most complete cloud data center solutions in the industry. The Ekurhuleni solution is an end-to-end active-active data center with business migration, continuity, and disaster recovery resources that are based on server, storage, and switching products. The solution achieved the following:

- Enabled intra-city active-active capability for core systems and remote application-level Disaster Recovery (DR) for applications to ensure zero data loss and service downtime
- Improved the virtualization rate to 90 percent to boost operational efficiency and reduce power consumption
- Provided automatic switchover and visualized DR to reduce Operations and Maintenance (O&M) costs and improve management efficiency by 65 percent

The upgraded data centers ensured stable operation of Ekurhuleni's diverse smart government applications. One of those applications is the 'My Ekurhuleni' App to provide mobile access to a majority of local government services.

"Through cooperation with Huawei, Ekurhuleni has deployed city-wide wired and wireless networks, powerful cloud data centers, and

South Africa's 4th largest metropolitan area with 1,975 km² area and 3.37 million people. Huawei's Cloud Data Center helps the City of Ekurhuleni grow into a South African, Smart City pioneer:

- Designing **3** Smart City strategies and **10** IT strategies based on **30** elements that constitute a municipality.
- Deploying a **1,400** km fiber network infrastructure that has reduced production costs by **75** percent.
- Deploying a videoconferencing solution to support Ekurhuleni's **27** departments and public utilities.
- Improving the virtualization rate to **90** percent to boost operational efficiency and reduce power consumption.

government applications. These are the cornerstones of a Smart City." Said Tumelo Kganane, Chief Information Officer of the City of Ekurhuleni. "We plan to build other IoT applications, such as Smart Transportation, Smart Buildings, Smart Meter Reading, and Smart Education. We will also build a command and control system based on unified communications to further improve city operation efficiency. We are determined to be a Smart City pioneer in South Africa by staying focused on good governance, people's welfare, and economic revitalization." ▲

Customer Testimony

"Through cooperation with Huawei, Ekurhuleni has deployed city-wide wired and wireless networks, powerful cloud data centers, and government applications. These are the cornerstones of a Smart City. We plan to build other IoT applications, such as Smart Transportation, Smart Buildings, Smart Meter Reading, and Smart Education. We are determined to be a Smart City pioneer in South Africa by staying focused on good governance, people's welfare, and economic revitalization."

— Tumelo Kganane, CIO, City of Ekurhuleni

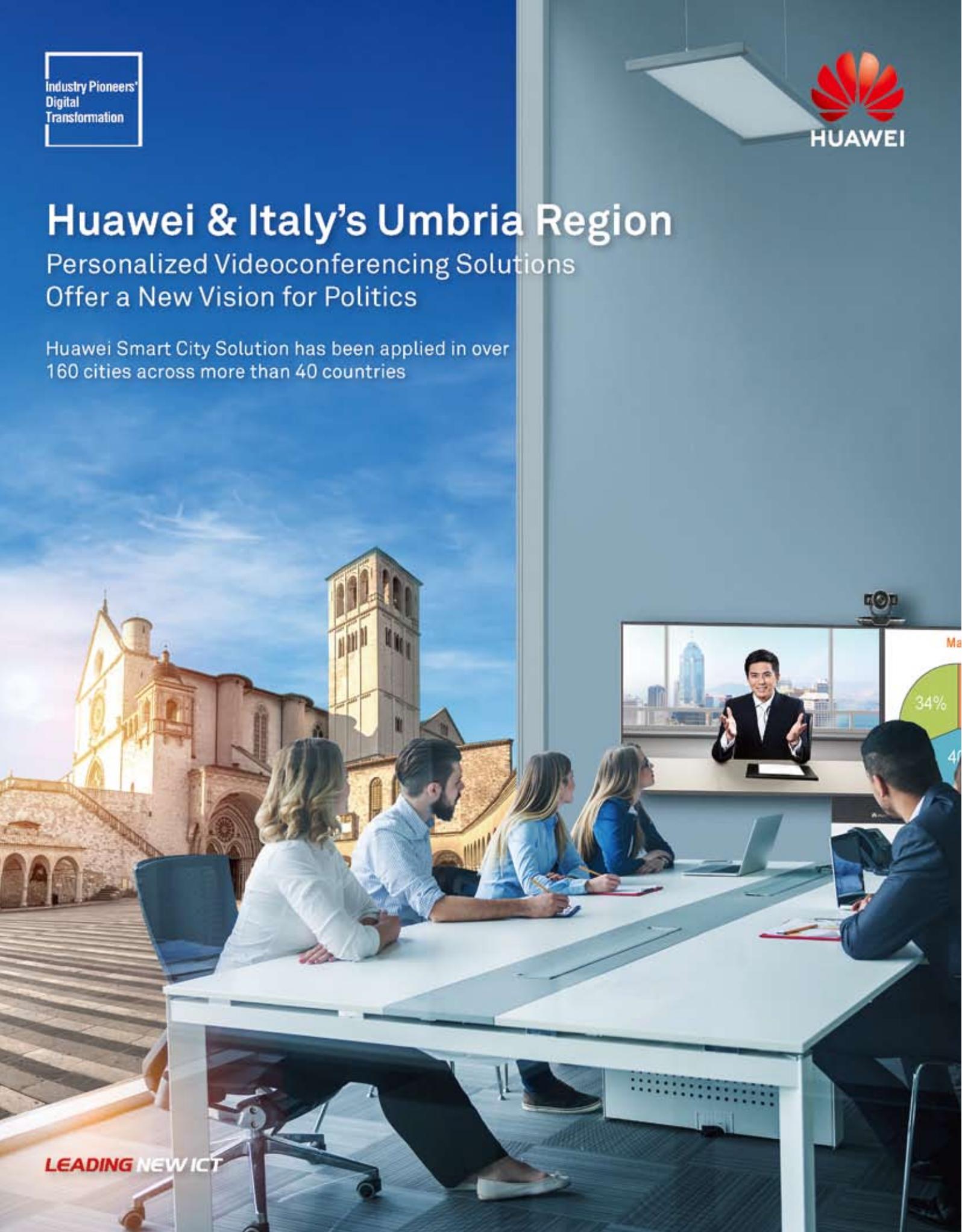
Industry Pioneers'
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Huawei & Italy's Umbria Region

Personalized Videoconferencing Solutions
Offer a New Vision for Politics

Huawei Smart City Solution has been applied in over
160 cities across more than 40 countries



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Italian Region Offers a New Vision for Politics

Huawei's personalized videoconferencing solutions and innovative technology increases efficiency, and reduces administration costs in the Umbria region in Central Italy. In short, the objectives of the region were achieved, confirming that its vision of the future, working with Huawei, could never be better.

A significant issue for the Italian government in recent years has been the efficiency of its public administration. The problem begins in the Regions, the twenty territorial entities into which Italy is historically and constitutionally divided and which include the Umbria region in Central Italy. A brilliant example of where efficiency and resource modernization has been used to address this problem is the decision by the Umbria regional government to choose Huawei to design a videoconferencing system based on the latest generation technology.

Meeting Efficiency and Resources Become Pain Points

One of the main needs of the Umbria region is to communicate daily with territorial entities such as local communities and health companies. However, it also has to liaise with other regions, up to the highest level, as well as the Italian Ministries and the European Union. Graziano Antonielli, Umbria Regional Director for Technological and Digital Infrastructures explains: "As a Region we need



to talk to each other using videoconferencing many times throughout the day, for topics that concern the institutional issues we deal with and for communication with the various regions and ministries that we need to speak with on a daily basis. However, we did not have adequate accommodation to do this in terms of either quantity or quality. Also we only had a couple of movable systems, so each time there was a need for videoconferencing, it was logistically difficult to arrange."

So, at the same time as a re-organisation of the Umbria

Personalized solutions and innovative technology, more effective communication between political parties, taxpayers' money savings and, ultimately a better image for both public administration and partner. In short, the objectives of the region were achieved, confirming that its vision of the future, working with Huawei, could never be better.
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regional building, it was decided to set up at least one fixed meeting room on each of the six floors, for a total of ten. As well as this, each room was to be integrated into a broader digital system to make it accessible to all Umbrian administrations and avoid expensive relocation costs.

To achieve this vision Umbria set about looking for a cutting-edge technology solution and, after a tender bid, it chose the Huawei solution proposed by a primary partner, In.I.T., a member of Group Partners Associates.

Huawei's RP Series Telepresence System

A Huawei Gold Partner since 2014, In.I.T. quickly identified Huawei's RP Series Telepresence system as the ideal solution. Available with one or two HD displays (RP100 or RP200), it provides high-quality videoconferencing by integrating HD video, camera, microphone, and data into one easy-to-use solution. A pedestal stand with wheels

also means it can be moved effortlessly from one room to another.

The system features full HD 1080p video at 512 Kbit/s, and AAC-LD wideband CD-quality audio supports a 20 percent packet loss resilience that enables it to deliver up to a 50 percent savings in bandwidth costs.

The associated TE Mobile Videoconferencing soft client delivers a superior audiovisual experience when installed on mobile phones and tablets, making it easy for users to make video calls, join videoconferences, and share presentations. In the words of Francesco Donadio, Chief Technology Officer of In.I.T.: "One of the main advantages of this solution — as with all Huawei solutions — is the use of standard, non-proprietary protocols. This makes it possible to build infrastructures that are understandable to those who use them and which can be easily be expanded. Each room can be equipped with

Huawei's personalized videoconferencing solutions and innovative technology increases efficiency, and reduces administration costs in Italy's Umbria region:

- Providing high-quality videoconferencing by integrating HD video, camera, microphone, and data into one easy-to-use solution.
- A pedestal stand with wheels also means it can be moved effortlessly from one room to another.
- The system features full HD 1080p video at **512** Kbit/s, and AAC-LD wideband CD-quality audio supports a **20** percent packet loss resilience that enables it to deliver up to a **50** percent savings in bandwidth costs.
- The associated TE Mobile Videoconferencing soft client delivers a superior audiovisual experience when installed on mobile phones and tablets, making it easy for users to make video calls, join videoconferences, and share presentations.

wireless microphones, and can accommodate more if needed. It is also possible to add more cameras, so that you can move the action to a wider audience.”

However, the system does more than allow sharing and participation. It offers centralised management of rooms, reservations, technical assistance (everything can be done remotely), point-to-multi-point communication to connect multiple virtual rooms with a single room, and the ability to share audio content and real-time video and compatibility with Android mobile systems/Skype calls.

A New Vision for Efficient Communication

The highly customised solution that the Umbria Region has installed has been up and running for more than a year and has allowed it to meet the needs of both its partners and customers.

In.I.T. has already received a similar request for Huawei technology from another regional entity so that, with the support of the Umbria region, the experience has become a great example of what can be achieved.

Francesco Donadio confirms: “The platform has improved the quality of the meetings, and the work of those in the Umbria region, having helped them to avoid frequent relocation. It has really proved to be an innovation in public administration.”

For the Umbria Region, efficiency is measured by a highly competitive quality/price ratio and further savings from logistics optimization. Giuliano Antonelli, Manager of Technology for the Umbria Regional Government clarifies: “Three different suppliers participated in the tender, then after making a price comparison and offering features, we chose Huawei. There was a good cost reduction. All videoconferencing that is made daily avoids the need for people to travel to Rome or elsewhere, also saving travel time. So, there is definitely an economic return.”

Personalized solutions and innovative technology,



more effective communication between political parties, taxpayers’ money savings and, ultimately a better image for both public administration and partner. In short, the objectives of the region were achieved, confirming that its vision of the future, working with Huawei, could never be better. ▲

Customer Testimony

“Three different suppliers participated in the tender, then after making a price comparison and offering features, we chose Huawei. There was a good cost reduction. All videoconferencing that is made daily avoids the need for people to travel to Rome or elsewhere, also saving travel time. So, there is definitely an economic return.”

— Giuliano Antonelli, Manager of Technology,
Umbria Regional Government

Industry Pioneers'
Digital
Transformation



Huawei & Cape Verde

Smart City Digital Platform Helps the
e-Government Cloud Shine in West Africa

Huawei Smart City Solution has been applied in over
160 cities across more than 40 countries

LEADING NEW ICT

Bringing the Digital World to Cape Verde Archipelago, North Atlantic

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.

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 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,



In the second phase of the Cape Verde's eGovernment project, Huawei performed the following:

- Cloud data center: Building **1,000** VMs and 1,656-core CPUs with **1,000** TB of storage capacity, meeting the business development requirements in the next **5** years.
- eGovernment network: Using **530** routers and **669** switches, connecting **1,142** organizations across the country through the same network.
- Smart application: Developing more than **150** websites and **77** types of eGovernment software, providing applications and services for **5** surrounding countries.

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.

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

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, and distance education and healthcare for all government departments, schools, hospitals, and state-owned enterprises in Cape Verde. >>

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 Enterprise Resource Planning (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

Industry Pioneers'
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Huawei & Serbia

Safe City Solution Safeguards Belgrade's Security

Huawei Safe City Solution has been applied in
230 cities across more than 90 countries



LEADING NEW ICT

Safeguarding Serbia's Security

The Ministry of Interior (MOI) of Serbia wants to develop a leading Safe City that covers the city of Belgrade, and eventually the entire country. Huawei proposed a comprehensive solution to meet the MOI's requirements.

In 2015, a traffic accident occurred in Belgrade, Serbia that killed a child. The perpetrator escaped and the public demanded justice. A great number of Serbian police officers spent two months searching for clues. The suspect had fled to Hong Kong and later entered Shenzhen. Based on images provided by Serbian police, the Shenzhen Public Security Bureau made an arrest within three days using video cloud, big data, and facial recognition technologies.

Serbia's public security department was inspired. While they were still using analog surveillance equipment and facilities, Shenzhen was taking advantage of the latest services available with intelligent technology.

Security at the Crossroads

Located in the southern Pannonia Plain and the central Balkans, Serbia is known as a crossroads that connects central and southeastern Europe, Asia, the Middle East, and Africa. For centuries, it has been a place where Eastern and Western civilizations meet, interact, and jointly progress human civilization. Since 2000, Serbia has sought to become a member of the European Union, with the understanding that security and stability are important prerequisites. The republic, however, still faces great challenges in the security field.

According to data from Informator on Work of the Ministry of Interior (MOI) updated on November 14, 2017, in 2017 alone, more than 49 percent of criminal cases remained unsolved, more than 20 gangs committed crimes across the country, and crimes

targeting police officers rose by more than 6.6 percent over 2014. Further, 34,000 traffic accidents were reported that same year, and the number of traffic related injuries and fatalities increased by 24 percent. In addition, 35,000 illegal immigrants, plus an onslaught of nearly 550,000 asylum applications, placed Serbia's government under intense pressure.

The MOI is responsible for most of Serbia's public safety affairs. It manages the national police forces, including the border police, counter-terrorism forces, and traffic police, as well as the nation's fire departments. With its command center and headquarters in Belgrade, the MOI employs more than 42,000 workers; intends to combat crime and traffic violations; and works to enhance public safety, law enforcement, and public satisfaction.

More Than 200 Cities across the Globe Have Chosen Huawei

To achieve its goals, the MOI needed to establish a unified service and technology platform for collaboration and information sharing that is able to leverage innovative ICT to integrate policing services, build a unified and centralized command center, and construct a video surveillance system. The result was the creation of an all-scenario ICT platform.

Huawei is the only vendor that can provide such a comprehensive Safe City solution. To date, Huawei has deployed Safe City systems in 230 cities for more than 90 national or regional governments. The Huawei Enterprise Business Group proposed a comprehensive solution to meet the MOI's requirements, which included Huawei

Huawei's Safe City Solution better analyzes suspicious vehicles and suspects, shortens investigation time, improves arrest and apprehension rates, deters organized crime, and reduces overall crime rates.

>>

Intelligent Video Surveillance (IVS) systems; Intelligent Transportation Systems (ITS); eLTE broadband trunking technology; unified data centers; and converged command centers.

For the purpose of presenting and testing most updated technical solutions including eLTE and IVS, Huawei has deployed nine cameras at five locations for functional tests and demonstrations. The locations included MOI headquarters, a sports arena, a commercial center, and a police station. The test network successfully verified multiple key functions, such as video retrieval, video compression, automatic license plate recognition, behavior analysis, facial recognition, and video quality diagnosis. Initial test results showed significant satisfaction among MOI officials and that the Republic of Serbia would choose Huawei as its solution provider to help construct Safe Cities in the country. In February 2017, MOI and Huawei signed a Strategic Partnership Agreement.

Video Surveillance in Public Security

In Phase 1, Huawei's project team deployed more than 100 High Definition (HD) cameras and intelligent Video Content Management (VCM) system at more than 60 sites in key areas, and remodeled the command and data center in Belgrade. A large number of advanced technologies and products were used, including infrared license plate recognition, 4K video solutions, H.265 HD encoding, cloud-based cluster networking, SafeVideo to ensure data security, and virtual checkpoint systems. In addition, the solution allowed interconnection with rich GIS maps on the live network for which the following benefits have been attained:

- **HD video:** The world's leading 4K ultra-HD cameras with large surveillance scope and high

image quality meet EU standards and support future evolution.

- **Intelligence:** The VCM intelligent analysis systems integrate automatic license plate recognition, tripwire detection, loitering detection, abandoned object detection, behavior analysis, video compression, and others. By working with HD cameras, VCM systems assist police forces to improve security in key areas of Belgrade.

- **Reliability:** Video data is stored using OceanStor, Huawei's industry-leading high-end storage device. Scattered video resources can be integrated, converged, and stored with other image and structured and unstructured data sources for easy query and retrieval. The solution also supports efficient video sharing, parsing, and big data analytics into the future, and VCM analysis results can be retained for one year. In the past, raw data was stored on a camera's built-in hard disk without any independent storage systems.

- **Convergence:** The GIS map system on the customer's live network was integrated to provide visualization support for multiple applications, including the ability to quickly isolate crime sites or suspicious vehicles while continuing to support access to an existing network of IP cameras.

Huawei's delivery team worked with an internal R&D team and ecosystem partners to help the MOI solve problems to ensure a smooth deployment. For example, Huawei's R&D team provided a customized infrared license plate recognition application with highlight compensation to reduce the negative impact of poor lines of sight between the cameras and vehicles — a solution that is based on an integrated infrared light compensation process

that required no additional hardware devices. This solution also complied with the regulations that forbid white light compensation for license plate recognition. In addition, the custom software delivered high recognition rates both day and night, which exceeded frontline and customer expectations.

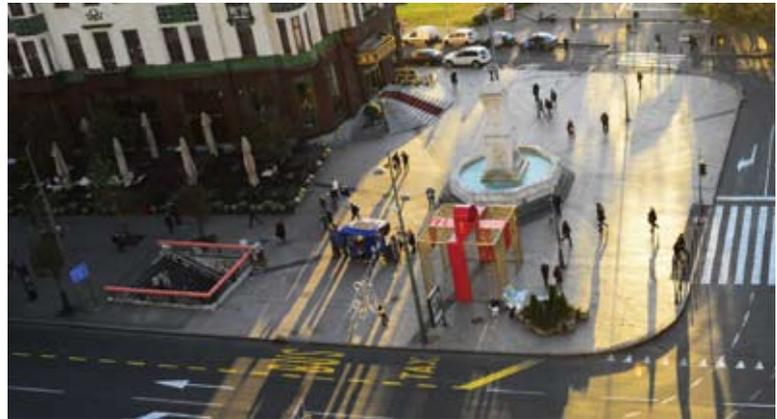
Virtual checkpoints were equipped with Huawei's 4K ultra-HD infrared video cameras and intelligent analysis platforms, that improve license plate recognition through iterative image processing routines that feature system learning, adaptive algorithms, and parameter/angle adjustments. The virtual checkpoint system was tested at the Huawei Hangzhou Research Center. The result is a license plate recognition rate that exceeds 95 percent, which is similar to the rates achieved with physical checkpoints but at a much lower cost.

Huawei's Safe City Solution better analyzes suspicious vehicles and suspects, shortens investigation time, improves arrest and apprehension rates, deters organized crime, and reduces overall crime rates. In addition, it enhances road safety and traffic governance, and reduces traffic accidents and related casualties.

Ensuring Event Security

Since the Phase 1 deployment of Serbia's first Safe City project more than five months ago, the system has helped the police solve multiple vicious criminal cases and ensured the security for many major sport events in the country.

In the past period, sports facilities in the Republic of Serbia had an analogue video surveillance system which, due to their limited technical capabilities, could be monitored only at one location — a video surveillance room that all security managers had to access. This system has shown shortcomings in the work, especially during the maintenance of high-risk sporting events. By introducing the new system, by setting up HD cameras, using analytical tools and the possibility of distributing signals and tracking it to



multiple locations, the work of police members was improved and the conditions for maintaining a safe public order and peace on such events were created.

In 2018, devices from Phase 1 were used during several high-risk events. A large number of police officers regularly monitored all activities related to these events in the command center (surrounding intersections, player hotels, and key areas) in real time.

Officers were dispatched to emergencies in a timely manner, as was demonstrated by high efficiency and strong execution. There are often increased rates of speeding and drunk driving during large sporting events, and the new automatic license plate recognition system greatly assisted police by improving the efficiency of their investigations for these cases. Thanks to Huawei's intelligent technology, police are now able to locate suspects based on stored HD video, with the results showing by improvements in safety and security, and an overall reduction in the rates of crime.

Together with Huawei, the MOI will develop a comprehensive Safe City solution that covers the city of Belgrade, and eventually the entire country, through critical communications, converged command centers, and intelligent surveillance. This project will not only deliver digital transformation to Serbia, but also bring security and happiness to every person and home — making Belgrade a leading Safe City in Europe. ▲

Industry Pioneers'
Digital
Transformation



Huawei & Mauritius

All-Cloud Safe City Solution Makes Mauritius
the Inspiration for Heaven

Huawei Safe City Solution has been applied in
230 cities across more than 90 countries



LEADING NEW ICT

Building a Safe Mauritius, the Inspiration for Heaven

Huawei's all-cloud Safe City solution will transform Mauritius into a safer country, attract more foreign investment, promote economic development, improve public safety, and maintain social stability. Huawei aims to convert Mauritius into a safer and livable country, and help the island move towards the intelligent world.

Mauritius, a volcanic island in eastern Africa, is located in the southwestern part of the Indian Ocean, 2,200 km from the African continent. It is surrounded by coral reefs and has a variety of natural wonders. Mark Twain once said, "Mauritius was made first, and then heaven; and heaven was copied after Mauritius." Now the island has become a garden paradise for people from all across the world to enjoy. In 2017, 1.35 million tourists visited Mauritius, and that number is estimated to grow by 5.1 percent in 2018, making tourism one of Mauritius's core industries.

Tourists can stroll the fine white-sand beach of Île aux Cerfs, marvel at the rare seven-colored earths of Chamarel, enjoy giant water lilies at the Sir Seewoosagur Ramgoolam Botanical Garden, or witness holy weddings in Notre Dame Auxiliatrice. But no matter the pursuit, guaranteed safety is a must for leisurely holidays and prosperous tourism.

Improving Policing and Efficiency with Science and Technology

Urbanization has generated centralized and intensive population distribution in Mauritius, which has led to the gradual deterioration of public safety. The number of criminal cases increased from 3,601 in 2012 to 5,361 in 2016, with a compound annual growth rate of 10.3 percent, increasing the crime rate from 32.68 percent to 36.66

percent over the past five years.

Mauritius's current police resources are insufficient to handle this surge in crime. The island's call-taking and dispatching system and dispatch system are independent of each other, and there is no real command center. Four analog phones receive all emergency calls from the entire nation, which still uses manual dispatching. All this leads to time-consuming call taking and dispatching, low efficiency, and a lack of collaboration — making it difficult to respond to reported incidents within 15 seconds and handle them within 15 minutes.

The island's Closed-Circuit Television (CCTV) surveillance system was installed in 2010. It features low video resolution (720P) and cannot be used with intelligent applications. As a result, videos have to be manually filtered, which reduces efficiency when compared with modern, automated systems.

In addition, the lack of surveillance facilities and converged command centers makes it difficult for Mauritius's Ministry of Public Infrastructure and Land Transport to comprehensively detect, analyze, and then disperse urban traffic in real time.

These conditions not only hinder the rapid growth of tourism, but also negatively impact the overall economic development of Mauritius and the well being of its citizens.

Born at the right time to meet one of the key goals of the government's '2030 vision,' the installation of a Safe City

infrastructure is part of the country's national strategy and aims to transform Mauritius into a safe and stable country and make it the first African nation with integrated safety and intelligence. While promoting tourism, the government hopes to attract foreign investment with safety and intelligence features that will safeguard economic prosperity and improve public happiness.

Mauritius has reached a consensus for improving policing and efficiency with science and technology. The government hopes to use new ICT technologies to better equip the Mauritius Police Force (MPF) and Ministry of Public Infrastructure and Land Transport to apply proactive monitoring, early warnings, unified communications, and crisis management. These new technologies will strengthen public safety and optimize transportation.

Safe City construction in Mauritius involves the following

Safe Mauritius: 1.35 million tourists in 2018, and will grow by 5.1 percent in 2018. Huawei's all-cloud Safe City solution will Build:

- Unified command center: a Command and Control Centre (CCC), a Traffic Monitoring Center (TMC), and 7 Sub-Command Centers (SCCs), applying unified resource scheduling and improving collaboration between departments.
- Emergency communications: 45 base stations, 4,500 mobile terminals, and 500 eLTE onboard and desktop terminals, emergency handling efficiency will be improved by 60 percent.
- Intelligent Video Surveillance: 4,000 HD cameras, 2,000 sites, video storage for 30 days.
- IT devices and data centers: Providing state of the art cloud infrastructures, saving 40 percent of equipment room space.

aspects:

- **Converged command:** Integrated video surveillance, videoconferencing, and eLTE terminal video convergence solutions; enhancing negotiation, command, and decision-making efficiency.
- **Public safety monitoring:** Support for HD cameras, video storage
- **Intelligent Traffic System (ITS):** Intelligent checkpoints supporting latest technologies for traffic surveillance.
- **Service cloudification:** All-cloud data centers simplify O&M and save space.

Building an All-Cloud Safe City

To meet the requirements of the MPF and Government of Mauritius, Huawei proposed to help Mauritius build an all-cloud Safe City based on the concept of 'one cloud and one pool' to bring the digital world to every corner of the island.

'One cloud' refers to the unified and flexible scheduling of computing and storage resources based on cloud computing, which provides efficient cloud resource services, and 'one pool' focuses on data and refers to the centralized, mixed storage and shared scheduling of multiple data sources, such as video, images, voice, and structured data.

Huawei is the only vendor in the industry that can simultaneously integrate converged command, intelligent surveillance, intelligent transportation, and cloud computing — and its Safe City solution has been deployed in 230 cities in more than 90 countries and regions.

Mauritius Telecom (MT) and Huawei enjoy a successful cooperation foundation in the telecom market, and the Mauritius government chose both Huawei and MT to jointly transform the island into a country with integrated safety and intelligence. As a state-owned telecom company, MT is responsible for popularizing telecom services and improving the level of national information access to international standards. Therefore, MT is proactively involved in the ICT infrastructure and safe country construction in Mauritius.

Huawei's comprehensive Safe City solution consists of six subsystems and adopts the design concept of 'platform + ecosystem.' It combines industry best practices with Huawei's ICT

capabilities to achieve the optimal combination of various applications.

- **Unified command center:** Consists of a Command and Control Centre (CCC), a Traffic Monitoring Center (TMC), and seven Sub-Command Centers (SCCs); integrates the Computer-aided Dispatch (CAD), Integrated Communication Platform (ICP), and Internet Protocol Contact Center (IPCC) solutions; supports various communication modes such as voice, video, and data; provides the customer with 150 IP phones. The command center displays various types of information in a visualized manner, applying unified resource scheduling and improving collaboration between departments.

- **Emergency communications:** 45 base stations, 4,500 mobile terminals, and 500 eLTE onboard and desktop terminals send on-site video and images to the command center in real time, achieving visualized dispatching and timely responses.

- **Intelligent Video Surveillance (IVS):** 4,000 HD cameras (3,000 box cameras and 1,000 dome cameras), 2,000 sites, video storage for 30 days. ISV applications can apply in-depth interconnection and optimization with Huawei's video cloud platform to enable accelerated launch and zero-risk delivery.

- **Intelligent road surveillance:** 75 intelligent checkpoints, 300 ANPR checkpoints, and 150 traffic cameras provide functions such as traffic data collection, and video recording.

- **IT devices and data centers:** Providing state of the art cloud infrastructures, including E9000 converged architecture blade servers, OceanStor 2800 video cloud converged storage systems, and Dorado V3 all-flash storage. Compared with traditional appliance solutions, Huawei's Smart City solution saves 40 percent of equipment room space. In addition, Huawei's Bare Metal Service

(BMS) provides the customer with the ultimate physical server performance as well as the same convenient experience as Virtual Machine (VM) provisioning. In this way, services can be quickly migrated to the cloud without changes. Huawei also provides the eSight Safe City and data center converged management solutions to simplify Safe City and data center O&M, help O&M personnel rectify system faults, and ensure stable Safe City monitoring.

Paving the Road to an Intelligent Mauritius

Delivery of the project's first phase is currently underway, with completion expected in 2019. Once the project is successfully delivered, the solution will provide visualized command and efficient collaboration for the MPF. Emergency response time (call taking and dispatching) will be reduced to less than 15 minutes, the emergency handling efficiency will be improved by 60 percent, and the linkage between the Safe City system and incident reporting system will effectively reduce crime rates.

Huawei's Safe City solution can prevent crimes targeted towards the normal citizen, tourists, students, elderly persons etc before they occur. There are many scenarios where this deployment will apply or enhance policing such as robbery cases, pick pocketing, reduction of crime, road traffic incidents or non-compliances to road traffic acts and last but not least drug trafficking.

Huawei and its partners believe that the all-cloud Safe City solution will transform Mauritius into a safer country, attract more foreign investment, promote economic development, improve public safety, and maintain social stability. Huawei aims to convert Mauritius into a safer and livable country, and help the island move towards the intelligent world. ▲

To meet the requirements of the MPF and Government of Mauritius, Huawei proposed to help Mauritius build an all-cloud Safe City based on the concept of 'one cloud and one pool' to bring the digital world to every corner of the island. >>

Industry Pioneers'
Digital
Transformation



Huawei & ICBC (Asia)

Cutting-Edge Technology Drives Cross-Border
Financial Upgrades and Development

A growing number of industry pioneers
choose Huawei as digital transformation partner

LEADING NEW ICT

ICBC (Asia) Leverages Cutting-Edge Technology to Drive Cross-Border Financial Upgrades and Development

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.

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) 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, IT Department, 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 more safely and easily. 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 more safely and easily. 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."

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Digital
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Huawei & China Merchants Bank

Financial Big Data Solution Makes Fintech Change for You

211 of the Fortune Global 500 companies
choose Huawei as digital transformation partner

LEADING NEW ICT

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

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.

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 2018, the bank ranked 20th in the Banker's *Top 1000 Banking Brands*, and 213th 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,

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. >>

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 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

China Merchants Bank (CMB): Building a unified risk control platform for credit cards based on Huawei's FusionInsight big data solution:

- Reducing the number of problem cases by **50** percent and saving more than CNY **100** million in six months.
- Shortening the time to issue a credit card from **15** days to **5** minutes.
- Supporting the ability to issue loans up to CNY **300,000** within **1** minutes.
- Leading the market to provide innovative services such as withdrawal authentication and flash payments.

The joint innovation between CMB and Huawei has three phases: 1) Initial phase — focus on commercial pilot projects in 2018, 2) growth phase — reach industrial scale in 2019, and 3) stable development phase — Carry out largescale promotion and replication activities in 2020. >>

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 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 was selecting a specific product. At that time, several vendors, including Huawei, offered to provide related 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.

Independent innovation will be conducted based on Huawei's years of experience in database development, 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. ▲

Customer Testimony

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Industry Pioneers'
Digital
Transformation



Huawei & Italy's Online Bank Widiba

OceanStor Converged Storage System
Helps Internet Financial Services Operate
Efficiently and Stably

211 of the Fortune Global 500 companies
choose Huawei as digital transformation partner

LEADING NEW ICT

MPS Widiba: Bridging the Past, Embracing the Future

In recent years, Widiba has intensified its technological innovation. Aiming to build a one-stop financial service platform to serve high-value customers, Widiba chose Huawei as a partner to build a future-proof IT data management platform.

Founded in 1472, Banca Monte dei Paschi di Siena S.p.A. (MPS), is the oldest bank in the world. Headquartered in Siena, Italy, MPS boasts more than 25,000 full-time employees, providing retail and commercial banking services worldwide.

Widiba is an online banking arm of MPS created in 2014, with the aim of providing customers with simple, convenient, and innovative fund management services. It prides itself on delivering high value through the use of an IT platform that can be customized by users to suit their own particular needs and a network of 600 advisors, offering a wide range of telephone-based financial advice services.

Demands: Business Agility and Resilience

The transformation of traditional financial services is being driven by fast-changing and pervasive Internet information technologies. The application of cloud computing, big data, Artificial Intelligence (AI), and mobile interconnections promotes the development of e-Commerce and mobile financing services that tend to be socialized and data-based, which requires financial enterprises to upgrade their IT infrastructure.

Aiming to build a one-stop financial service platform to serve high-value customers, Widiba is actively deploying wealth management services. It covers more customers by providing intelligent investment advisory services through an Internet-based financial platform, meeting a diverse range of financial service requirements.

“When Widiba was first set up, it was reliant on using

Montepaschi’s data center infrastructure to host its core services. Although this worked well in its initial start-up phase, it soon became a problem as its customer base started to grow,” explains Massimiliano Belli, Head of IT Monitoring at Widiba. “The fast growth we were experiencing meant we needed to improve the speed at which we could handle the increasing flows of data. We also wanted to launch new products to keep up with what our customers were asking for, but we just didn’t have the agility and resilience we needed. We soon realized that the only way forward was to build a new data center network.”

Massimiliano Belli continues, “Most banks choose solutions based on what the big vendors give them. They are often told what they want but this is not the way we work. Our requirements are driven solely by our customers. With this in mind, we wanted a system that uses open-source software that we can adapt as we need.”

In recent years, Widiba has intensified its technological innovation. It uses an interactive model similar to Google search and leverages big data engines to recommend banking services for users based on their behavior algorithms and feedback information. After several rounds of communication and repeated demonstration, Widiba chose Huawei as a partner to build a future-proof IT data management platform.

The platform is powered by Huawei’s OceanStor 5500 converged storage systems in new data centers. The OceanStor 5500 supports converged active-active (HyperMetro) for SAN and NAS. The high-performance SSD-based all-flash SAN storage bears online

Widiba has built a highperforming storage resource pool composed of SSD-based OceanStor 5500 systems to meet the performance and efficiency demands of core business systems. The pool helped increase the core service processing efficiency, and shorted the average transaction and query response time. >>

transaction records and other critical business systems, and check images are kept on the large-capacity NAS storage.

During the IT enablement process, Widiba made penetrating insights into the trends of big data and the monitoring of user experience. It believes that SSDs will be the most appropriate data storage media to meet the requirement of massive storage capacity and the high performance necessary to ensure satisfactory user experience. Therefore, Widiba has built a high-performance storage resource pool composed of SSD-based OceanStor 5500 systems to meet the performance and efficiency demands of core business systems. The pool helped increase the core service processing efficiency, and shorted the average transaction and query response time. The storage system latency was reduced from 3 to 5 ms to less than 1 ms.

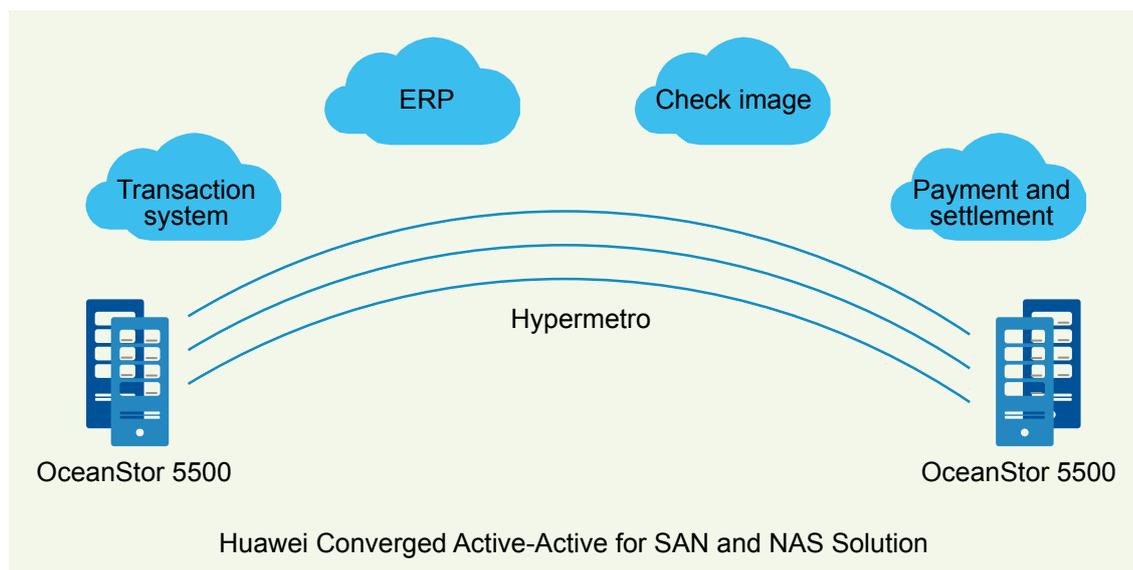
One unified converged storage system meets the varying demands of different workloads (online transactions, ERP financial services,

customer management system, and check image management system) and outperforms the legacy hosting system three-fold. The SAN-NAS convergence has delivered elastic storage, simplified service deployment, and improved storage resource utilization, reducing the Total Cost of Ownership (TCO) by 30 percent.

The Constant Pursuit of Service Stability

Data is a valuable asset for enterprises. It is a strategic asset that promotes high-quality development. Widiba realizes that the key to maximizing data value is to ensure that the data is accurate, up-to-date, consistent, and secure. However, in the mobile Internet era, which has brought a sweeping wave of big data and ever-escalating threats to data security, the reliability of data storage is confronted with unprecedented challenges. As a money-management company, Widiba cannot allow any disruption to IT systems which might result in heavy financial losses. Ensuring the stability and security of service





system operations is of paramount importance.

To address the challenges of the mobile Internet era, Widiba cooperated with Huawei to design a converged active-active (HyperMetro) SAN and NAS solution. Huawei deployed one set of OceanStor 5500 systems in Widiba's Siena Production Center and another one in its Florence Data Center, in an active-active configuration. Storage resource pools at the two sites provide backup for each other, achieving 99.9999 percent data availability. The two linked sites are 100 km away from each other. One storage system of the SSD-powered active-active SAN provides 100,000 IOPS at 1 ms latency, and one storage system at the other site offers 78,000 IOPS at 2.4 ms. This design meets the storage performance requirements of IBM MQ, VMware virtualization, and PostgreSQL databases on the live network.

“Huawei even helped us in developing our end-to-end business continuity services in both the qualification and delivery phases, to make sure we could meet the very challenging service performance requirements we had set.” adds Massimiliano Belli.

Huawei's OceanStor 5500 system adopts a scale-out architecture with a multi-layer reliability design (RAID 2.0+, full redundancy of components, and converged active-active). A storage array supports up to eight controllers and provides million-IOPS level and 1 ms latency. It offers PBs of storage capacity with the system performance and capacity linearly growing as

the number of controllers increases, allowing Widiba to configure controllers on demand without worrying about performance bottlenecks during future capacity expansion.

“Widiba's new IT infrastructure has made a huge difference to its operation and has allowed it to accelerate significantly the introduction of new services. Moving from an infrastructure that was complex and fragile, it now has one that is more adaptable and less costly to maintain than its predecessor. With the Huawei's powerful infrastructure, these targets are very easy to achieve. From start to finish we have been very impressed by Huawei's approach. The company is very responsive and the support provided by its engineering team has made a big difference,” concludes Massimiliano Belli. ▲

Customer Testimony

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Industry Pioneers'
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Huawei & Shenzhen Airport

Digital Platform and AI Build a Future-Ready Airport

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LEADING NEW ICT

Combining the Digital Platform and AI to Build a Future-Ready Airport in Shenzhen

By Zhang Huai, CIO, Shenzhen Airport Group

Shenzhen Airport's aims are to become a global leader in airport operations and support the development of the Greater Bay Area, focusing on three major aspects — security, efficiency, and passenger experience. To fulfill these goals, the airport began to work with Huawei to access new technologies and AI innovation engines to build a future-ready digital platform.

It's really amazing to stand here as a keynote speaker at *Huawei Connect 2018* and see so many people gathered here today. In fact, this scenario is similar to what happens at Shenzhen Airport occasionally — when large-scale flights are delayed due to weather or for other reasons, more than 8,000 passengers can be stuck waiting in an isolated area at the same time. So how should the airport respond to this situation? I believe that new technologies, such as Artificial Intelligence (AI), will help Shenzhen airport and other airports around the world solve this problem.

Shenzhen Airport has been developing at a rapid pace, as is the case with the city of Shenzhen as a whole. In 2016, at a time when business travelers were estimated to account for 50 percent of the total traffic, Shenzhen Airport was selected as the world's best airport by the Airports Council International (ACI). In 2017, the passenger volume reached 45 million; and for 2018, it is estimated

that the number of passengers will reach 50 million and cargo volume will exceed 1.1 million tons. Shenzhen Airport has become the core transportation hub of China's Greater Bay Area.

A Future-Ready Airport to Support the Greater Bay Area

Managing and controlling multiple runways and terminals is inherently complex and a daily challenge for Shenzhen Airport. We had long explored and tested solutions to the problem, but our information department acted in response to business demand, rather than pre-empting business needs.

In 2017, the International Civil Aviation Organization (ICAO) chose the Shenzhen Airport site to build a worldwide showcase for future-ready airports. The first reason why Shenzhen Airport was selected is that our business scenarios and operational complexity are



representative of many airports; and second, Shenzhen boasts a large number of science and technology enterprises that would be interested in contributing to the showcase.

Our aims are to become a global leader in airport operations and support the development of the Greater Bay Area. To be specific, we are focused on three major aspects:

- **First, proactive security assurance:** Over 30 percent of risks can be identified using digital platforms. By implementing digital technologies we expect to rank third in security assurance among all Chinese companies.
- **Second, efficiency within a limited space:** We expect to shorten aircraft turnaround times, reach an on-time release rate of 85 percent, and reduce the taxi time for each aircraft by one minute.
- **Third, we intend to improve the passenger experience** through the use of end-to-end services; Shenzhen Airport has plans to achieve a 15 percent decrease in time spent waiting in line, and an over 30 percent increase in the rate of self-service baggage drop-offs.

Enabling a Future-Ready Airport through Innovation

To fulfill these goals, we began to work with Huawei to

access new technologies and AI innovation engines.

Huawei and Shenzhen Airport are following the 'Platform + Ecosystem' strategy to build a future-ready digital platform. Based on Huawei's Information and Communications Technology (ICT) infrastructure, the two parties have integrated the Internet of Things (IoT), big data + AI, video cloud, Geographic Information System (GIS), and Integrated Communication Platform (ICP) resources. In partnership with other vendors, we are building a platform-based ecosystem in which AI is playing an important role. For example, AI big data is used for applications such as knowledge graphs, machine learning, and natural language processing. AI vision utilities include facial and human body recognition, vehicle identification and tracking, and panorama stitching. The ICT platform is delivering operational control, security, and passenger services to the airport.

- **Operational control:** Intelligent and efficient Aeronautical Operational Control (AOC) and intelligent resource allocation
- **Security:** Proactive, intelligent security assurance and collaborative emergency management
- **Passenger services:** End-to-end, personalized, visualized, connected, and self-service amenities

Intelligent and Visualized Flight Services

The goal of Shenzhen Airport management is to deliver intelligent, visualized flight services. Jointly with Huawei, we have spent a year on projects using technology innovations to improve the efficiency of airfield operations:

- **Intelligent stand allocation:** Based on big data and AI, the utilization of contact stands has been optimized to reduce the number of passenger shuttle buses. Today we have increased the direct boarding rate by a minimum of 10 percent, which eliminates the need for shuttle buses in 100 out of every 1,000 flights and delivers a better experience for passengers.
- **Smart airfield ground lighting:** Based on IoT and AI, individual light control, flight path planning, and conflict detection expedite taxiing before take off and after landing. For busy airports, the time between flight landing to

passenger unloading can be 20 minutes or longer. If this time can be reduced by 20 percent, three to four minutes can be saved for each flight. In scenarios of 1,000 flights per day, up to 67 hours can be saved in addition to contributions toward energy conservation and environmental protection.

- **Visualized ground operations:** Video and AI technologies enable automatic information collection from IoT-connected sensors embedded across the airfield. The system conducts comprehensive computer-vision analytics and supervisory operations. In the past, all such activities were done manually and at higher risk.

Delivering an Efficient Airport Experience

Apart from providing intelligent and visualized flight services, we have also performed joint innovation in regard to passenger trips. Future-ready airports will improve travel efficiency and provide better travel experiences with self-service check-in, self-service baggage drop-off, multi-layer security checks, smart Flight Information Display Systems (FIDSs), facial recognition identification for boarding, last calls, and VIP services. Our goal is to implement self-service resources, such as information access, that are based on AI-assisted video (i.e. facial recognition), passenger route/flow analysis, and wait time analysis resources that are enabled by digital connectivity between passengers and airport facilities, and between the airport and airlines.

Regarding security screening, we understand that most passengers are reliably nonthreatening, and heightened measures are only required for a limited number of passengers. Based on this background, we discussed the possibility of simpler security screening with the General Administration of Civil Aviation and other official institutions. A differentiated-classification security

screen is currently implemented at Shenzhen Airport — a process that we continue to refine.

Our goal is to provide facial recognition services through big data analysis for all passengers entering and leaving Shenzhen Airport. Facial-image-based access control eliminates the need for manual passenger identification and reduces the amount of time spent waiting in lines.

Innovation at this scale requires a comprehensive plan. Therefore, we have worked with ecosystem partners such as Huawei to promote the development and construction of a future-ready airport. It has taken us a year and a half to streamline business scenarios in a simplified manner and integrate the infrastructure, data architecture, and data platforms. To be specific, we implemented an overall plan — including a top-level design, architectural model, and data governance policies; performed joint innovation to manage uncertainty, iteration, and ecosystems; and drafted enterprise and industry standards for a future-ready airport showcase.

On August 28, 2018, a Beijing Capital Airlines flight to Macao made a successful emergency landing at Shenzhen Airport. The decision by the pilots to divert to Shenzhen is a testament to the industry's trust in our future-ready facilities. We believe that with further application of innovative technologies, we can do even better.

In the future, we will continue to work with ecosystem partners such as Huawei to deliver scenario-specific services, manage scenarios on the platform, and open platforms to the ecosystem. We will build a world-leading future-ready airport by focusing on security, efficiency, and the quality of the passenger experience. ▲

This essay is based on a speech given by Zhang Huai at Huawei Connect 2018

In the future, Shenzhen Airport will continue to work with ecosystem partners such as Huawei to deliver scenario-specific services, manage scenarios on the platform, and open platforms to the ecosystem. We will build a world-leading future-ready airport by focusing on security, efficiency, and the quality of the passenger experience. >>

Industry Pioneers'
Digital
Transformation



Huawei & Hamad International Airport

Distributed File Storage Manages Large Video Data with Ease

211 of the Fortune Global 500 companies
choose Huawei as digital transformation partner

LEADING NEW ICT

Qatar's Hamad International Airport: Managing Large Quantities of HD Video Surveillance Data with Ease

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.

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 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

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. >>

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.

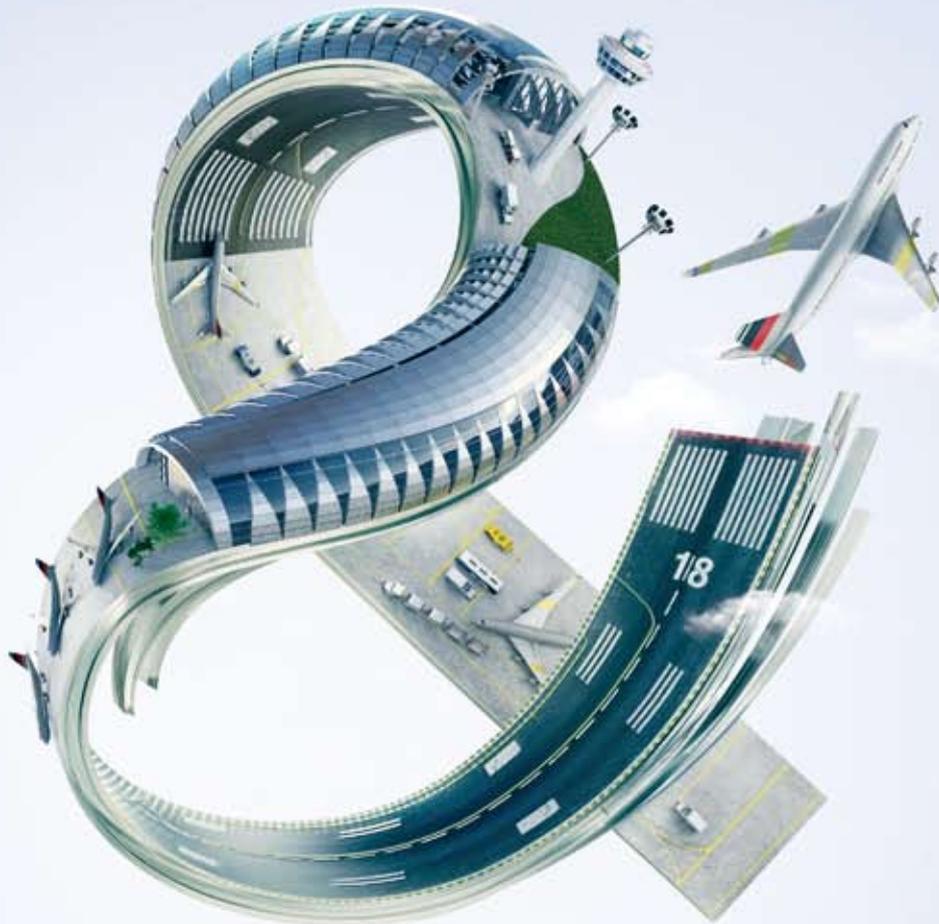
The distributed architecture of the OceanStor 9000 protects data among nodes and can withstand the failure of up to four nodes in a single storage system without disrupting business. Storage capacity and computing capability grow as more nodes are added, delivering linear increases in bandwidth and concurrency. 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. ▲

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Huawei & Austrian Federal Railways

Smart Optical Transport Platform Guarantees Punctual Travel

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LEADING NEW ICT

Huawei Constructs a Best-in-Class Optical Transport Network for ÖBB

ÖBB believes building a stable, fast, and high-quality network is the basis for railway communication development, and chooses Huawei to deploy an Optical Transport Network (OTN) at multiple sites across Austria and Germany. Now, the new OTN infrastructure has already generated immediate and considerable benefits to both ÖBB and its customers.

Huawei deployed an Optical Transport Network (OTN) using Dense Wavelength Division Multiplexing (DWDM) for Austrian Federal Railways (ÖBB). DWDM technology enables 100 Gbit/s performance and the ability to expand broadband network systems efficiently. Customized for ÖBB, Huawei's DWDM OTN products are now deployed at multiple sites across Austria and Germany.

One of the Most Reliable Railway Operators in Europe

One of Austria's leading rail transportation companies, the ÖBB group transports 459 million passengers and 115 million tons of goods per year. It is among the most reliable railway operators in Europe with a punctuality rate of 96 percent. More than 40,000 employees across the group ensure that nearly 1.3 million passengers reach their destination safely every day.

With a 10 to 15 percent annual growth rate for rail transportation, ÖBB faced increasing congestion on the backbone networks the company was using for dispatch and

ticketing traffic. Also important is the requirement that faster trains have modernized train control that is also based on ICT. With plans to extend its rail network to reach 90 percent of the country, ÖBB is preparing to build more stations and increase the available bandwidth resources on local and backbone networks. All current and future stations will be equipped with High-Definition (HD) video surveillance systems, intelligent office systems, and other digital railway information systems. A new high-speed backbone network was required to keep up with the growing demand for rail services throughout Austria.

A Best-in-class Network is the Trump Card

ÖBB's 10G legacy network suffered from inadequate device performance because more than 80 percent of its network bandwidth was already in use. New requirements for wireless train control, centralized dispatch, and automatic operations could not be met due to a lack of adequate bandwidth. Intelligent offices and modern production systems needed to be connected to a unified high-speed backbone carrier network to

ÖBB's new OTN infrastructure has generated immediate and considerable benefits; including the resolution of legacy performance issues and delivery of sufficient bandwidth for customers. >>

allow communications and dispatch. Additionally, railway service characteristics require network communication systems to be absolutely secure and reliable.

ÖBB believes building a stable, fast, and high-quality network is the basis for railway communication development. In other words, a best-in-class network is the trump card for a leading railway operator. Based on such an understanding, ÖBB sought a mature partner capable of deploying networks in industrial environments.

Huawei DWDM Technologies

Based on ÖBB's requirements, Huawei used DWDM technologies commonly applied in the telecommunications carrier market to construct optical transport networks.

The OTN tributary/line-separation architecture maximizes the utilization of line bandwidth, allows access to multiple types of services, and greatly improves the flexibility of service configuration and grooming.

The new network uses its Multi-Service OTN (MS-OTN) function to support OTNs, Virtual Circuits (VCs), and packet cross-connections,

thereby enabling end-to-end management for all types of services and resulting in a future-proof intelligent network.

In the new coherent system, the bandwidth has been increased up to 100 Gbit/s per wavelength, or up to 8 Tbit/s over each pair of fibers. Future upgrades will expand the bandwidth from 100G to 400G, 1T, and 2T channels per wavelength.

The Fiber Doctor (FD) and Optical Doctor (OD) functions apply automatic commissioning and optimization to minimize the Operations and Maintenance (O&M) costs that keep the network in an optimal state.

Protection mechanisms at the electrical and optical layers allow fast switching and eliminate service interruption. Thanks to these inherent attributes, DWDM technologies can be used to carry crucial safety-related data.

In the summer of 2016, Huawei and NIC Solutions jointly deployed a new OTN at 52 sites in Austria and Germany, including an Ethernet-based management system. Once operational, the OTN achieved positive results that have been mutually beneficial to both ÖBB and its customers.

Competitive Advantage in Operational Management

ÖBB's new OTN infrastructure has generated immediate and considerable benefits; including the resolution of legacy performance issues and delivery of sufficient bandwidth for customers. The OTN supports flexible service-access modes and facilitates high device utilization, simplified data processing, and efficient O&M management. The results give ÖBB a competitive advantage in operational management. Moreover, the new OTN will contribute to the continuous optimization of ÖBB's products and services. ▲



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Huawei & Prague Public Transport Company

Agile Campus Network Solution Helps Prague
Build a Brand-New Metro Network

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LEADING NEW ICT

Cutting-Edge Wi-Fi for Transportation in Prague: Journey to the Ancient City for a Modern Digital Symphony

Taking into account the complex requirements of metro network, DPP chose Huawei's one-stop ICT infrastructure and digital platforms to help build a brand-new metro network. With a stable and reliable network featured by efficient O&M, DPP will provide passengers with more and better services.

The annual Prague Spring International Music Festival is one of the biggest cultural events in Czech and also one of the most important music festivals worldwide. Each year, prestigious musicians, symphony orchestras, and chamber orchestras gather here to share their love of music, and their performances resonate with music lovers of all kinds across the world.

Most of the fans choose public transportation, especially metros, during their stay on this land full of cultural heritages. But here is a little-known fact: While enjoying the beautiful classical music in Prague, the fans are also experiencing a digital symphony composed by Huawei and the Prague Public Transport Company (DPP).

Burdens on Prague's Metro Network

DPP, founded on September 1, 1897, has been providing high quality services to Prague citizens and tourists since its debut.

Metros serve as the backbone of the entire public transportation system in Prague. To avoid the bustling traffic in the downtown area, more citizens choose to travel by subway. DPP has 61 stations on three lines (A, B and C) with a total length of 65.2 km. Commuters heavily rely on the Internet surfing as the best option to kill the long travel time. It has become a commonplace in the metro that people watch online entertainment videos like live concerts on their phones. However, their time-killer was faced with several challenges: lack of free Wi-Fi coverage, slow 2G EDGE network access, unstable 4G signal, and restricted data service. The entertainment experience enabled by seamless connectivity was never enjoyed. Even worse was that websites could not be accessed sometimes. A foreign tourist once complained: "I was talking to a friend on a social media App about going to a concert together. However, when I stepped into the metro, the communication got constantly interrupted. That really



spoiled our conversation.”

As part of the public infrastructure, metro network coverage should not only meet passengers’ daily needs for network, but should guarantee the metro safety, which is one of the most important considerations for DPP. Using the network to enable emergency communications and video surveillance, the company can provide online traffic information, emergency alarm, and safety guidance to passengers anytime anywhere to ensure a safe and stable operation of the metro. Therefore, the stability of the network becomes exceptionally crucial. Taking into account these complex requirements, DPP chose Huawei to help build a brand-new metro network. Huawei’s one-stop ICT infrastructure and digital platforms outperform many competitors in terms of performance, reliability, and management. For instance, Huawei’s solution enables connectivity without single points of failure at stations covered by signals. It also provides high-density coverage and unified management of wired and wireless infrastructures and firewalls. Moreover, Huawei has a good track record in metro network deployments worldwide. All these advantages make Huawei an ideal partner for DPP to reinvent its metro network system.

Securing a Stable and Smooth Network

Network reliability is fundamental to high quality ICT service experiences. The high reliability of the network core layer is especially important. In the core layer of DPP’s metro network, Huawei uses its Agile Switch S12704, which offers the CSS2 technology, a switch fabric hardware clustering system that allows 1+N backup of Main Processing Units (MPUs). With this technology, as long as one MPU in any chassis of the system functions normally, the multi-chassis service can operate stably, greatly improving the reliability of the cluster system. Huawei also provides the lowest 4μs cross-chassis delay in the industry, allowing smoother traffic forwarding across chassis and ensuring a stable, high-speed and uninterrupted network.

Providing High-density Network Coverage

To provide better network access in densely populated areas in the metro, Huawei recommends using AP6050DN/AP7050DN/AP7052DE. These APs are in compliance with the 802.11ac Wave 2 standard, support 4x4 MU-MIMO, and provide a rate of up to 2.53 Gbit/s. Of particular note is the smart antenna array technology adopted

by the AP7052DE. This technology brings more accurate user perception, automatically suppresses interference, and greatly enhances users' experience in using wireless networks. In terms of network deployment, Huawei uses the self-developed WLAN-based 3D network planning tool to cope with the 3D deployment space. Factors affecting network quality in a 3D space are considered to replicate the real world scenario, eliminating the errors made when using the traditional planning method under complex environments. Radio frequency (RF) interference between APs is avoided, ensuring a dead-zone-free coverage in the metro stations. Four high-density access technologies (low-speed terminal control, multi-user conflict control, multi-user access scheduling, and Airtime scheduling) are adopted to ensure high-speed network services in a high-density crowd scenario.

Simplifying Network O&M

An eSight platform efficiently manages the wired and wireless networks. Through the vertical virtualization technology of agile switches, Huawei virtualizes multiple devices (core, aggregation, access, and APs) into one logical device for simplified management. Access Switches (ASs) are visualized as cards of modular switches, and APs as ports, thereby unifying and simplifying the management of services, equipment, and users. In this way, the administrator's workload is reduced and O&M efficiency is greatly improved.

Huawei Wi-Fi has provided a high quality and convenient Internet access in public places, which has improved network security and user experience and delivered a new subway travel experience. According to an independent test, Metro Wi-Fi is crowned as the top transportation

network in Prague (download speed is 117 Mbit/s, and upload speed is 68.1 Mbit/s, according to idnes.cz). With a stable and reliable network featured by efficient O&M, DPP will provide passengers with more and better services.

Martin Gillar, CEO of DPP, said: "Once connected to the Wi-Fi network, passengers will be informed about Prague online traffic information using their smart devices. This will allow DPP to immediately propagate the information on metro line transfer or safety instructions to passengers in case of any emergency."

Digitalization is the first step in the long journey towards the ultimate goal of intelligentization. Huawei is looking forward to playing with DPP an even more beautiful symphony about intelligent transportation. ▲

Huawei Wi-Fi has provided a high quality and convenient Internet access in public places, which has improved network security and user experience and delivered a new subway travel experience. >>

Prague's Metro Network: 61 stations on 3 lines with a total length of 65.2 kilometers. Huawei's one-stop ICT infrastructure and digital platforms help build a brand-new metro network:

- **1+N** backup of Main Processing Units: Greatly improving the reliability of the cluster system.
- Lowest **4μs** cross-chassis delay: Allowing smoother traffic forwarding across chassis and ensuring a stable, high-speed and uninterrupted network.
- **4** high-density access technologies: Ensuring high-speed network services in a high-density crowd scenario.
- Download speed is **117** Mbit/s and upload speed is **68.1** Mbit/s: Providing passengers with more and better services.

Industry Pioneers'
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Huawei & Shanghai Yangshan Port

eLTE Helps the World's Largest Container
Port Operate Automatically

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LEADING NEW ICT

The World's Largest Automated Container Port Operates Using First-of-Its-Kind 5.8 GHz LTE

The systematic trial operations of the fourth phase of Yangshan Port in Shanghai, China is largely attributed to an industrial wireless network built on Huawei's first-of-its-kind 5.8 GHz Long-Term Evolution technologies. To date, Huawei's eLTE Industry Wireless Network is becoming a key enabler for diverse industries to accelerate their digital transformation.

The fourth phase of Yangshan Port in Shanghai, China started trial operations at around 11:00 a.m. on December 10, 2017. This 'Smart Giant' seaport, which has been constructed over the past three years and now offers seven large deep-water berths, becomes the world's largest automated container terminal.

The systematic trial operations of what has been nicknamed the 'magic container terminal' is largely attributed to an industrial wireless network built on Huawei's first-of-its-kind 5.8 GHz Long-Term Evolution (LTE) technologies. To date, 4.5G LTE technology based on Third Generation Partnership Project (3GPP) standards is becoming a key enabler for diverse industries and sectors to accelerate their digital and automation transformation.

AGVs Efficiently Operate for World's Largest Automated Port

"You will not find people working in the container terminal area. Everything becomes automated. For

example, quayside container cranes are no longer driven by operators; instead, they can be operated remotely from the background system. Container trucks are not needed, either. They are replaced by Automated Guided Vehicles (AGVs) which move freely to load, unload, and transport cargos," said a worker who explains why this is referred to as the 'magic container terminal.'

The expectation is that there will be 130 AGVs, 26 bridge cranes, and 120 rail-mounted gantry cranes to automate Yangshan Port. The devices which were previously operated manually will be replaced by smart devices. These smart facilities will automatically perform production tasks as instructed by the system. Workers will remotely control bridge cranes, rail-mounted gantry cranes, and AGVs. As a result, production operations environments will be improved, and the overall operational efficiency will be greatly increased as well.

AGVs function as a horizontal transportation system which is critical for the automation services at the port.



Subsequently, AGVs have received wide attention from the industry. AGVs support unmanned driving, automatic navigation, path optimization, and proactive fault prevention; additionally, AGVs are also designed with self-fault diagnosis and self-power monitoring functionalities. Through wireless communication equipment and an automatic dispatching system, AGVs can move freely with precise positioning to accurately and systematically complete the instructions delivered from the ‘brain’ of the system.

What kind of network streamlines the ‘commanding’ of all these operations?

The Industry’s First-of-the-Kind 5.8 GHz LTE Builds a Reliable Network for AGVs

The AGV system poses the following stringent requirements on the wireless communication network:

- The driving control signals for AGVs require stable transmission. As such, the transmission latency of the entire network must not exceed 50 milliseconds; otherwise, the system considers the AGV data to be unhealthy, which results in a low vehicle operating efficiency.
- To accelerate loading and unloading of cargos, each berth allows concurrent access of a maximum of 60 AGVs.

At the very beginning, Yangshan Port implemented a traditional industrial wireless network to transmit

AGV control signals. This conventional network performed poorly, especially for network coverage, mobility, and multi-AGV access capabilities; therefore, it failed to stably transmit AGV control signals. As a result, the entire set of AGV automatic driving systems could not meet the requirements for commercial use.

The Yangshan Port management also found other traditional wireless solutions to be unfeasible. Starting from the beginning of 2017, port decision-makers were impressed by Huawei’s industry-leading 5.8 GHz LTE wireless technology, eLTE-U. Using the most-advanced 4.5G LTE technology, Huawei’s eLTE-U provides reliable LTE wireless connections on the 5.8 GHz unlicensed band. eLTE-U achieves a perfect combination of Wi-Fi liked easy deployment with additional high-performance LTE functionalities.

- **Strong security:** eLTE-U provides the most advanced anti-interference capabilities and supports Advanced Encryption Standard (AES) to ensure plaintext-free transmission. Consequently, control signals cannot be maliciously hacked, ensuring stable wireless connections for AGV driving control signals on the 5.8 GHz unlicensed band.
- **Large capacity:** eLTE-U uses multiple technologies such as advanced wireless scheduling algorithms and high-gain directional antennas. As such, eLTE-U ensures low latency for AGV control signals even

when a single berth has a high-density access of 60 AGVs.

- **Convenient deployment:** The inter-site distance of 250 meters ensures that all base stations are installed to the port lighthouse, without the need of additional infrastructure. This implementation minimizes port reconstruction costs.

After nearly one year of verification, eLTE-U is finally put into trial operations in the fourth phase of Yangshan Port. This provides the most-reliable wireless network for the port facilities to move cargo going from and to destinations worldwide.

4.5G Wireless Enables Industry Digitalization

Now, Yangshan Port efficiently operates as the world's largest automated container terminal that has the highest level of automation around the globe. Completion of the fourth phase marks a milestone for upgrading operational paradigms and technology usage in China's port sector. Yangshan Port will help consolidate Shanghai

Port's standing as the world's largest cargo-handling port and further support Shanghai's efforts to expand as the world's top best-in-class shipping center.

The 5.8 GHz LTE network technology used at Yangshan Port represents another achievement in which Huawei has partnered to contribute its advanced 4.5G wireless technology to specific industries. As network capabilities are upgraded from supporting mobile Internet to empowering the industrial Internet of Things (IoT), 4.5G LTE technology based on 3GPP standards is also gaining in popularity among diverse industries and sectors.

Looking ahead towards 5G evolution, Huawei will continue to work with more industry-leading partners specializing in port machinery, electric power automation, industrial manufacturing, warehousing and logistics, and additional sectors. Huawei's state-of-the-art 4.5G LTE is becoming a better choice for industry IoT networks to accelerate digital transformation across industries and sectors. ▲

After nearly one year of verification, eLTE-U is finally put into trial operations in the fourth phase of Yangshan Port. This provides the most-reliable wireless network for the port facilities to move cargo going from and to destinations worldwide. >>

Huawei's eLTE Industry Wireless Network provides the most-reliable wireless network for the World's Largest Automated Container Port, Yangshan Port in Shanghai, China:

- Large capacity: Connecting 130 AGVs, ensuring low latency for AGV control signals even when a single berth has a high-density access of 60 AGVs.
- Strong security: Providing the most advanced anti-interference capabilities and supporting Advanced Encryption Standard, ensuring stable wireless connections for AGV driving control signals on the 5.8 GHz unlicensed band.
- Convenient deployment: The inter-site distance of 250 meters ensures that all base stations are installed to the port lighthouse, and minimizes port reconstruction costs.

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Huawei & NetCity

eLTE-IoT Helps Build a Powerful Neural Network
for Electric Power Systems

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eLTE-IoT Network for Mexican Power Grid

Huawei's eLTE is a robust and comprehensive solution that offers Mexico City — one of the largest cities in the world — an IoT platform with a high price-performance ratio. This solution has optimized the metering in aspects such as timeliness, security, and O&M expenses, and helps the power grid company to efficiently and cost-effectively collect electricity consumption data, reduce fee collection times, and increase revenue.

With the convergence and development of Information and Communications Technology (ICT), bits do more than simply measure volumes of data. Instead, the benefits of digital transformation are generating beneficial reactions and good partnerships across industries industry. In the new era of Mexico's electric power industry, the transition means that 'bits drive watts.'

Smart meters have fundamentally changed the electric power business. In Latin America, one of the world's largest regional electric power markets, digital transformation is predicted to unleash an opportunity that will equal USD 24 billion (MXN 495.1 billion) in value.

According to the 2013 to 2017 national power system plan, Mexico's infrastructure investment will reach USD 97.1 billion (MXN 2 trillion) in the next 15 years. The largest power company of Mexico provides integrated management services for power generation, transmission, transformation, distribution, and use, wanted to upgrade power grid.

Advanced Metering Infrastructure is the Optimum Choice

Mexico implemented a new electricity law in 2014 that opened

the national power grid to investment to promote competition for the generation and sales of electrical power. The openness and competition in the electric power sales market have led to a common demand by electric power sales for neutral, third-party metering — which is used especially by large industrial and commercial users. NetCity, owned by GOES, has emerged against this backdrop to help electric power sales enterprises improve operations capabilities and solve problems such as difficult and slow fee collection, high line loss, poor management, and low customer satisfaction. The Advanced Metering Infrastructure (AMI) solution provides electric power organizations with a smart metering platform based on bi-directional high-speed communication that allows real-time transaction charges. Huawei's comprehensive user management system effectively prevents electricity theft, analyzes line-loss statistics, and streamlines operations. The end-to-end deployment of AMI solutions is the first step toward solving the many endemic problems occurring through their service lifecycle.

Because of the difficult and time-consuming of network build and capacity expansion, The power grid company facilitated additional support through a partnership with NetCity — a professional wireless Internet of Things (IoT) provider to

The Huawei OpenLab center in Mexico is a development and cooperation environment for ecosystem partners that has also played an important role in Mexican electric power project. The OpenLab facility provided a setting for the joint incubation and verification of AMI devices — with the goal to enhance product competitiveness in the Latin American market. >>

efficiently and cost-effectively collect electricity consumption data from homes and businesses, reduce line losses and fee collection times, and increase revenue.

eLTE-IoT, the Neural Network for Electric Power

The digital communications network is the nervous system for the AMI platform. Huawei will use an enterprise Long-Term Evolution-Internet of Things (eLTE-IoT) network as the backbone for the AMI system. The open system is designed for ease of integration for partners collaborating to provide secure and cost-effective End-to-End (E2E) smart grid solutions.

The eLTE-IoT network operates in the 902 MHz to 928 MHz Industrial, Scientific, and Medical (ISM) frequency band, uses 3GPP 4.5G technology, and employs new features that comply with the laws and regulations for unlicensed spectrum, enabling backhaul communication for power metering, for improved security, reliability, and network performance that exceed published IoT requirements for AMI.

- **Improved reliability:** The Huawei eLTE-IoT network has adopted a two-level, anti-interference retransmission technology that applies Forward Error Correction (FEC) and narrowband Frequency Hopping (FH) to ensure stable connections over the ISM radio spectrum.
- **Strong security protection:** Bi-directional authentication prevents abnormal intrusions and E2E encryption ensures service security for signaling data.
- **Wider coverage:** Multi-hop technology improves indoor coverage that, when combined with high terminal receiver sensitivity, ensures network access to underground layers.
- **Additional connections:** Slotted ALOHA

technology doubles spectral efficiency and improves the granularity of resource allocation for concurrent channel transmission that enables 3,000 AMI devices to be read from a single base station.

- **Reduced power consumption:** Power Saving Mode (PSM) and Extended Discontinuous Reception (eDRX) technologies are used to extend the battery life for devices in the field for up to 10 years.
- **Open system:** Huawei eLTE-IoT components share an industry chain and development ecosystem with Narrow-band-IoT (NB-IoT) products. This fact allows Huawei to develop collaborations with global partners through the OpenLabs facilities located around the world. Following a thorough and in-depth due diligence review, the Huawei eLTE-IoT solutions were selected for use by the Mexican electric power industry.

In the first quarter of 2017, the technical specifications of the Huawei's eLTE-IoT platform were written into the *Mexican National Industrial Communications Act*, and in the second quarter of 2017, eLTE-IoT-connected AMI meters passed the admission certification and earned Huawei the contract for a Phase 1 deployment.

The Huawei OpenLab center in Mexico is a development and cooperation environment for ecosystem partners that has also played an important role in Mexican electric power project. The OpenLab facility provided a setting for the joint incubation and verification of AMI devices — with the goal to enhance product competitiveness in the Latin American market. The testing completed in the OpenLab forms has helped partners to pass the admission certification requirements published by Mexico's CFE Equipment and Materials Testing Laboratory

(Laboratorio de Pruebas de Equiposy Materiales, or LAPEM).

The Huawei eLTE-IoT solution also passed the tests conducted by Mexico’s Federal Institute of Telecommunications (Instituto Federal de Telecomunicaciones, or IFT). During the IFT test regime, Huawei identified over 290 interconnection requirements in the solution development field — plus an additional 16 optimization requirements for partners — resulting in an 80 percent performance improvement for AMI meter-reading.

eLTE-IoT, Applied in Multiple Scenarios across Many Industries

The Huawei eLTE-IoT communications platform was first deployed in Mexico City in the fourth quarter of 2017. With a population of over 21 million people, and the location for nearly half of the country’s industrial, commercial service, and financial institutions, Mexico City was chosen to address the most urgent needs to for electrical power system reconstruction and AMI deployment.

Following site construction, Huawei conducted a wide range of fixed-point and mobile tests in multiple settings, including densely populated urban areas, commercial districts, highways, and outdoor open areas, to accurately evaluate the typical, real-world coverage for eLTE-IoT-connected AirNodes.

The network was deployed with AMI smart meters integrated with eLTE-IoT modules and General Packet Radio Service/IoT (GPRS/IoT) dual-mode electrical meters, which allowed the meters to access the GPRS public network, and send back data in areas without IoT coverage. After the IoT network coverage was improved, services could be smoothly migrated to the new wireless IoT private network, reducing public network leasing, hardware, and servicing costs associated with electrical meter replacement.

According to the test results, the eLTE-IoT delivered a

4 km coverage radius in densely populated urban areas, and an 8 km coverage radius in outdoor areas having no obstacles. The reported success rate for AMI smart meters integrated with eLTE-IoT communication modules exceeded 99 percent.

AMI smart meters are just the first step in Mexico’s electric power transformation, and NetCity’s wireless eLTE-IoT network is enabling local electric power companies to process AMI services and build a unified platform to that will allow an increasing number of Smart City services — such as smart water and smart street lamps — to create a powerful nervous system for Smart City solutions in Mexico.

Ricardo Villasana, CTO of GOES Telecom, said, “Huawei’s eLTE is a robust and comprehensive solution that offers us an IoT platform with a high price-performance ratio. This solution has optimized the metering in aspects such as timeliness, security, and O&M expenses. Looking ahead to the future, we are expecting this solution to bring seamless coverage to Mexico City, one of the largest cities in the world. The main advantage of deploying NetCity’s own network is to target not only the electric metering market, but also Water and Gas. Additionally, we are deploying value-added solution in other verticals, such as: Smart Parking, Street Lighting, Remote Environmental Monitoring, e-Farming, etc.” ▲

Customer Testimony

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Industry Pioneers'
Digital
Transformation



Huawei & PLN Batam

Smart Meter System Helps Indonesia's Batam Enter the Intelligent Metering Era

211 of the Fortune Global 500 companies choose Huawei as digital transformation partner



LEADING NEW ICT

Huawei Helps PLN Batam Enter the Smart Metering Era

The Batam Smart Meter system is a success for PLN in the smart grid field. After delivery of the full solution, the system has been a success in terms of business operation, cost, and Return on Investment (ROI). PLN is expected to replicate the successful experience of the Batam AMI project in Indonesia.

Batam is one of Indonesia's Riau Islands. The Free Port of Batam was built in 1978, with future plans to develop it into a diversified industrial and commercial center and tourist destination. With a total area of about 715 square kilometers, Batam is the second-largest tourist destination in Indonesia, following Bali, and is known as "little Bali island." It is the closest Indonesian island to Singapore, only 20 kilometers across the Singapore Strait.

PLN Batam Faces a Problem with Mechanical Meters and Duplicated Meter-Readings

PLN Batam is responsible for power generation, the power grid, specific planning, device procurement, and related requirements (including Advanced Metering Infrastructure — AMI — and smart grid standards) for Batam, and is also responsible for selling electricity to end users. PLN Batam serves more than 300,000 customers, of which about 30,000 use prepaid meters. These customers mainly used mechanical meters and a small number of electronic meters.

Similar to most electric power companies that use

manual meter reading, PLN Batam faced problems such as low meter reading efficiency, user arrears, and poor user-load change experience.

- Customers in Batam are scattered, so meter reading required a team of 154 people. The team spent 40 percent of its working time on site meter reading and 60 percent on site maintenance. The cost of manual meter reading was tens of thousands of dollars per year and increased by 15 percent year over year.

- The company struggled to collect fees from some customers. As of August 2018, customers in arrears (almost 3 percent of total customers) owed hundreds of thousands of dollars, and the average overdue period was about two months. To restore power after processing an overdue account, PLN Batam had to post alarm stickers on site, assign dedicated employees to handle power on-site failure, and assign dedicated employees to restore the power supply. This process was time-consuming and labor-intensive.

- Customers had a difficult time changing their service. Customers had to submit an application and pay a fee in

Before project delivery, the Huawei smart metering system passed the on-site acceptance test organized by PLN Batam, and dozens of other tests were performed. After delivery of the full solution, the system has been a success in terms of business operation, cost, and Return on Investment. >>

the PLN Batam service center. Then PLN Batam arranged engineers to perform configuration operations on site. The entire process took one to five days.

Centralized Metering Communication Solves Meter-Reading Problems

Huawei's AMI Solution provides an intelligent metering system based on bi-directional high-speed communication. Precise digital technologies collect all power consumption information.

To solve the above meter-reading and electricity-consumption management problems, PLN Batam launched an AMI pilot project in 2017 using the Huawei ICT solution, which has been used by more than 190 electric power companies in 73 countries. This centralized metering communication solution has the following features:

- Huawei's industrial router AR530 is used as the Data Concentrator Unit (DCU) to automatically collect electricity consumption and meter status data. The router supports data analysis and processing, and uploads data to a management system, which enables PLN Batam to remotely read meter data and implement functions, such as real-time charging.
- Huawei's innovative broadband Power Line Carrier for the Internet of Things (PLC-IoT) technology is used to collect all power consumption information. Communications between meters and concentrators are implemented through the PLC, and the data is then transmitted to the main control center through the local telecom carrier's public networks, ensuring 100 percent success rate for meter reading. This solution provides professional network services and supports joint efforts with local partners to build a smart meter



ecosystem, as well as compatibility with multiple vendor protocols and mainstream application vendors.

- A comprehensive user management system helps prevent electricity theft, analyze line loss statistics, and achieve efficient operation. At the application layer, the router DCU provides edge-computing capabilities such as transformer district identification, line loss analysis, and fault location. A prepayment solution for large electricity users and a load control feature resolve billing difficulties. This solution provides analysis of high-value-customer power consumption, load forecasting, group management, and VIP policies to achieve orderly power usage and management.

Integrating the PLC-IoT module into the meter partner's communications module is the last-mile key point of smart metering. Huawei PLC-IoT simplifies this integration with the following advantages:

- The IEEE P1901.1-compliant broadband PLC module provides a 2 Mbit/s application-layer rate, which is 20 times faster than that of traditional approaches.
- Orthogonal Frequency-Division Multiplexing (OFDM) technology and 2 MHz to 12 MHz operating frequencies eliminate harmonic interference from low-voltage grids.
- 512 sub-carriers provide a high-performance network with a maximum rate of 2 Mbit/s, and support meter firmware upgrades and ad-hoc networking within 2 minutes.
- 15 relay levels and a single hop range of 100 meters to 500 meters ensure efficient communications between each router DCU and meters in any scenario.

Huawei Makes Every Watt Count

Before project delivery, the Huawei smart metering system passed the on-site acceptance test organized by PLN Batam, and dozens of other tests were performed. After delivery of the full solution, the system has been a success in terms of business operation, cost, and Return on Investment (ROI):

Huawei's centralized metering communication solves meter-reading problems, collects all power consumption information for PLN Batam:

- The IEEE P1901.1-compliant broadband PLC module provides a 2 Mbit/s application-layer rate, which is **20** times faster than that of traditional approaches.
- 512 sub-carriers provide a high-performance network, and support meter firmware upgrades and ad-hoc networking within **2** minutes.
- Within three months, the smart metering system achieved **100** percent meter reading success, and the data is comprehensive and reliably accurate.
- The line loss rate has decreased up to **4.5** percent.

- **High meter-reading success rate:** Within three months, the smart metering system achieved 100 percent meter reading success, and the data is comprehensive and reliably accurate.

- **Smart operation:** PLN Batam controls the operating quality of the power grid, provides data support for reducing line loss, and finds key measures to further reduce line loss.

- **Reduced line loss rate:** The line loss rate has decreased up to 4.5 percent.

- **Reduced labor cost:** Remote operation helps reduce the arrears rate as well as the overall O&M cost to the company.

The Batam AMI system is a success for PLN in the smart grid field. PLN is expected to replicate the successful experience of the Batam AMI project in Indonesia. Huawei will do its best to contribute to building an Indonesian smart grid by making every watt count. ▲



Huawei & Albania's OST

Smart Optical Transport Platform Helps the Full Upgrade of the Power Transmission Network

211 of the Fortune Global 500 companies choose Huawei as digital transformation partner

LEADING NEW ICT

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

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.

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 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

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. >>

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 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

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— Idajet Projko, OST Telecommunication Network Manager



Huawei & Lundin Norway

Oceanstor Distributed File Storage Solutions Provide Massive Storage Capacity for Offshore Oil and Gas Exploration

211 of the Fortune Global 500 companies choose Huawei as digital transformation partner



Exploration Company Improves Storage Architecture for Success in Exploration

Lundin Norway worried its current storage architecture cannot meet its fast growing data storage requirements. The tiered-storage features of the Huawei OceanStor 9000 solution specifically addresses Lundin's requirement to manage hot and cold data separately, improve storage efficiency and data analysis, and boost processing performance.

Fabulous Success in Exploration

According to IDC research, one-fourth to one-third of the value generated by a typical oil and gas exploration and production company's annual activities is owed to data. Lundin Norway is no exception.

New Reservoir Simulations Need More Data Storage

Data is one of the most valuable resources in a smart world, and the volume of data collected in the oil and gas industry is growing exponentially. With target exploration fields shifting from conventional to unconventional areas — from land to sea, and even polar regions — the explorers are becoming increasingly dependent on IT. More data requires better data mining utilization, which results in a higher likelihood that an organization will find oil resources and control the market. In order to obtain more data and generate more profit, Lundin Norway has adopted new reservoir simulation technologies that overcome many of the technical and environmental difficulties faced by offshore exploration, which in turn improves mining efficiency.

New technologies generate high volumes of data.

Lundin worried its current storage architecture cannot meet its fast growing data storage requirements. In addition, 60 percent of Lundin's data is cold data. The scalability of earlier storage system on the live network was insufficient and did not support tiered storage; the result was that all the company's data was stored on expensive SAS disks, which resulted in high Total Cost of Ownership (TCO). Further, new reservoir simulations require high-performance computing clusters.

The scope of work was linked to the following objectives:

- Lower costs;
- Apply robust, secure, flexible, scalable, and cost-effective solutions;
- Meet future storage needs;
- Coexist with cloud services.

Fully Symmetrical, Distributed File Storage Solutions

Huawei has cooperated with industry partners to launch ICT solutions that cover upstream, midstream, and

downstream sectors for combining digital production with safety control and improved productivity. Huawei's oil and gas solutions have been applied in 45 countries and regions around the world and serve fourteen of the top 20 global oil and gas companies.

Lundin's CIO and his team came to appreciate Huawei's attention to the company's pain points with solutions for their fast-growing data storage demands. The flexible scale-out architecture of the OceanStor 9000 meets all future requirements for storage expansion, and includes the InfoTier function that separates the processing and storage for large amounts of cold data on a live network.

Located in Lysaker, near Oslo, Lundin's primary datacenter (LDC3) has the rack space available to co-locate the new Network Attached Storage (NAS) platform with the current storage solution.

The OceanStor 9000 fully symmetrical distributed file storage systems supports high-performance read/write access, smooth scale-out from three to 288 nodes, up to 100 PB of capacity in a single file system, and includes Huawei's proprietary InfoTurbo acceleration technology for up to 2.5 GB/s bandwidth over a single client. As a result, OceanStor 9000 systems support simplified management and maintenance, and eliminate data silos caused by multiple namespaces. The capacity and performance characteristics of Huawei's OceanStor 9000 are designed to alleviate all customer storage concerns.

At the same time, the OceanStor 9000 InfoReplicator system provides data protection for erasure codes that are set and controlled at the directory level. Folders or files can be replicated between multiple OceanStor 9000 storage systems through IP links over Local Area Networks (LANs) or Wide Area Networks (WANs).

The storage system supports and configures remote replication in case data cannot be recovered for any reason. Remote replication requires data consistency based on snapshots in addition to full and incremental replication that are scheduled to operate automatically. The Lundin project requires a Recovery Point Objective (RPO) time of one day,



with a minimum RPO time of 30 minutes.

Tiered Storage for Deep Exploration

The OceanStor 9000 InfoTier Dynamic Storage Tiering (DST) feature stores and migrates files between devices with different performance levels according to file properties. In this way, InfoTier enables user-specific processing speed and capacity assignments for ensuring optimal space utilization, enhanced access performance, and reduced deployment costs.

The tiered-storage features of the Huawei OceanStor 9000 solution specifically addresses Lundin's requirement to manage hot and cold data separately, improve storage efficiency and data analysis, and boost processing performance.

The migration of to the new system would be completed in three months. Not only did the OceanStor 9000 deployment succeed in avoiding daily penalties, the project was completed in only half the time.

Huawei and the OceanStor 9000 are benefitting the company in the following ways:

- Enable linear performance improvements by dynamically adding nodes to meet projected service growth.
- Reduced the TCO by a significant amount by 35 percent using the OceanStor 9000 tiered storage functions.
- Simplified configurations and graphical support for systems deployment.
- Increased egress bandwidth through capacity expansion to avoid bandwidth bottlenecks and meet long-term customer requirements for rapid growth. ▲



HUAWEI OceanStor Dorado

THE WORLD'S FASTEST ALL FLASH STORAGE



*According to the latest storage performance council report,
HUAWEI sets new SPC-1 performance record.

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Huawei & Australia's CP Mining

eLTE Solution Builds Efficient Scheduling Network for Smart Mining Areas

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LEADING NEW ICT

Australia's CP Mining and Huawei Build Smart Mining Areas

In response to urgent demand, CPM provides a springboard for cooperation with Huawei, and Huawei provides a large digital platform suitable to CPM's ICT explorations. Both parties will collaboratively continue to explore smart mining area development, and act as a reference for the digitalization and intelligentization of Australia's mining industry.

Imagine a large mining site with a processing plant, power station, water plant, office buildings, dormitories, dining areas, gymnasium and swimming pool, and even a seaport and airport. Such a facility is in reality a small town — fully equipped with everything the working staff might need.

Governments and leading enterprises around the world are exploring Smart City — but what if the mining areas also have requirements to adapt to the era's development for conducting digital transformation?

In Australia, CITIC Pacific Mining (CPM) and Huawei are exploring how to capitalize on digital platforms in order to affect their digital transformation strategy.

Requirements of CPM's Production and Campus Networks

Headquartered in Perth, the capital of Western Australia, CPM is a wholly owned subsidiary of CITIC Limited, a Hong Kong-based conglomerate holding company.

CPM is responsible for the management, construction, and operation of the Sino Iron project at Cape Preston, located 100 km southwest of Karratha in the Pilbara region of Western Australia. Sino Iron includes mining, processing, and port operations that provide high-quality magnetite concentrate for CITIC Pacific Special Steel and other Chinese steel plants. It is already the largest seaborne

supplier of magnetite concentrate to China. Underwritten by investments that exceed USD 12 billion (AUD 16 billion), and with six stable processing lines, Sino Iron is one of the largest magnetite mining and operation projects in the world.

Sino Iron employs many advanced technologies and facilities, including large excavation equipment, a 480-megawatt combined-cycle gas power station, a 51-billion-liter seawater desalination plant, and a port at Cape Preston, about 40 km from the mine and processing facilities.

Through investment in downstream processes, the project provides numerous job opportunities and cross-border technology transfers, adding significant economic value to Western Australia. Deloitte Access Economics estimates more than AUD 100 billion will be generated in export earnings for Australia over the life of the project, and expenditure of more than AUD 51 billion on goods and services within Western Australia alone.

By mid 2016, processing lines 3 to 6 were up and running — six months ahead of schedule and well under budget. That year about 11 million tonnes of high-grade (65 percent Fe) was shipped to China. In 2017, this figure jumped to 17 million tonnes and, in 2018, production rates will be even higher. The focus now turns to lowering operating costs and placing the project on a long-term sustainable footing.

It is for good reason that a core goal for CPM is to reduce labor

costs and improve operational efficiency, which, in turn, will lead to higher revenues.

There is no doubt that digital technologies, such as new ICT, will invigorate the company's efficient operations, including the deployment of new data centers, as well as office and production networks.

Production networks are closely related to production efficiency. CPM focused on end-to-end process control and hoped to solve communication connection problems, such as those in its truck dispatching system and remote port communication. In addition, the company's focus included implementing LTE connections for service modules in other production phases, further implementing the Internet of Things (IoT), and resolving production security issues.

The construction of campus networks in office and living areas will also be an important step toward improving efficiency. The original network devices — most having been deployed in 2008 and 2009 — needed updating because they were old with no original production service.

CPM planned to gradually upgrade its data centers and network devices to simplify network management, improve Information Technology (IT) operational efficiency, enhance network security, and improve network experiences for offices and living entertainment.

Huawei offered a family of powerful digital platforms for CPM's production and campus networks, such as the eLTE industry wireless private network, cloud data center, and smart campus. Huawei implemented direct connections to core mining services,

and IT and Operational Technology (OT) integration, making the communication among offices, living quarters, and production sites more efficient.

Finally, CPM chose Huawei, and the two signed a Memorandum of Understanding (MOU) for strategic cooperation in November 2016, to address major projects such as truck dispatching LTE, port communication LTE, and urban data center and mining-area data center upgrades.

Huawei's eLTE Solution for Efficient Scheduling

Sino Iron practices traditional open-pit mining techniques for magnetite mining that uses drilling, blasting, and some of the world's largest excavators and transportation vehicles. Unified dispatching for production vehicles in the mining area, such as dump trucks and excavators, is required to ensure efficient mineral exploration, loading, and transportation.

The traditional wireless networking had coverage limitations. Access Point (AP) locations needed to be adjusted frequently based on changing topographical levels in open-pit mining areas. This activity resulted in high Operations and Maintenance (O&M) costs. Data transmission was vulnerable to interference and unstable, affecting the efficiency of mineral exploration, loading, and transportation.

Production scheduling required effective collaboration among on-site workers and production units. Legacy narrowband voice resources had insufficient bandwidth and provided only voice-based production scheduling rather than unified voice-video scheduling. The network could not communicate with other production networks, such as truck dispatching. Multiple networks coexisted in the mining area, resulting in suboptimal construction and maintenance costs.

Port Preston is the first port built in the Pilbara region in 40 years, where CPM's magnetite concentrate is transshipped to ocean-going vessels at offshore moorings. The requirements of ports were similar to those of mining areas, including real-time performance, reliability, converged data transmission, and easy maintenance.

A primary use of the communications network is for port remote data transmission and truck dispatching systems. Additionally, the network will also carry Closed-Circuit Television (CCTV), the IoT, and Supervisory Control and Data Acquisition (SCADA) data backhaul in the future.



Huawei's eLTE solution can be used flexibly on licensed and unlicensed spectrum. The wide coverage of the eLTE platform reduces the footprints and investment costs for base station, and improves anti-interference capabilities against co-channel interference.

Handover delay is low, with zero packet loss, to ensure an always-online signal for truck dispatch. The benefits of high system throughput and low delay are realized in CPM's dense-terminal scenarios. Differentiated scheduling based on service priority safeguards the availability of key services like truck dispatching, production scheduling, and video services. Bidirectional authentication prevents network attacks and protects core data security.

Huawei's eLTE solution implements seamless Wide Area Network (WAN) coverage for truck dispatching, and eliminates the need to routinely relocate base-stations. The unified delivery of stable and reliable dispatching information improves loading efficiency of dump trucks and excavators.

For production scheduling, video, data, and voice services are also carried in a unified manner that includes rich and visualized onsite information — a combination that improves unit-collaboration efficiency.

One network carries multiple services, such as video surveillance, truck dispatching, and production scheduling, which together are expected to save 30 percent in operating costs. With further major changes expected in the mining environment, Huawei can help improve the eLTE signal strength and the coverage range to ensure operational continuity.

Data Center with Open Architectures

CPM will gradually upgrade its data centers and Wi-Fi network.

Based on innovative chips, hardware, and software, Huawei provides the most complete cloud data center solutions in the industry to meet CPM's requirements and specifications for mining areas and urban data centers. Multiple products can be provided, such as the next-generation high-performance CloudEngine 12800 series core switches for data centers and high-end campuses, the high-performance CloudEngine 6810 box switch, the OceanStor S5500T for unified storage, the FusionServer E9000 blade server with a converged architecture.



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). Huawei also developed the data center network that supports linkage with virtual platforms and evolution towards cloud-network collaboration.

These solutions are helping CPM simplify its data center infrastructure and are planned to support the expansion over 10 years. The solutions' advanced architecture, high performance, and rich functions would ensure data center reliability and increase the efficiency of problem solving. In addition, Huawei's one-stop solution reduces project risks and increases Return on Investment (ROI).

Huawei's Wi-Fi solution will enable seamless roaming throughout mining, residential, and office areas with network access anytime and anywhere. In addition to improving office efficiency, the system lets employees contact the outside world during their leisure time.

From an industry development perspective, the digitalization of intensive mechanized operations like mining is still in the early stages, but is already showing the potential to raise profits through greater efficiency.

In response to urgent demand, CPM provides a springboard for cooperation with Huawei, and Huawei provides a large digital platform suitable to CPM's ICT explorations. Both parties will collaboratively continue to explore smart mining area development, and act as a reference for the digitalization and intelligentization of Australia's mining industry. ▲

Industry Pioneers'
Digital
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Huawei & BMW Group

HPC Cluster Delivery for BMW Group in Sweden

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LEADING NEW ICT

Explore the Source of 100 Years of Driving Pleasure

Ultimately, Huawei collaborated with its partners to deliver the first BMW Group-Huawei project for ICT infrastructure, marking the successful delivery of the BMW Group's first HPC server cluster in Sweden. After going online, the system has been running stably. Huawei has demonstrated its strength through successful first project delivery.

Listen to the Voice across Time and Space

In a seemingly ordinary exhibition hall of the BMW Museum, visitors are surrounded by design walls displaying the work photos and design experience of car designers and engineers. The people and vehicle models shown may come from different centuries but their work philosophies have a lot in common, and provide us insights into the source of 100 years driving pleasure.

HPC Facilitates Vehicle Driving

In recent years, IT systems are gradually upgrading from support systems to production systems. IT departments will assume more responsibilities. They need to gain deep insights into business requirements and advanced concepts to create more value for businesses. In the automobile development field, engineers are shortening the R&D cycle, speeding up the launch of new vehicles, and enriching vehicle models through global R&D, more CAE (Computer-Aided Engineering) simulations, and higher simulation precision.

Behind the leading automobile technologies is the

CAE software that simulates and tests fluid mechanics, collision, and power assembly, and High-Performance Computing (HPC) clusters that run day and night. In this way, engineers can obtain simulation results more quickly, ensure high-quality vehicles, and make things possible. This poses multiple challenges for HPC.

The first challenge is energy consumption. The deployment of hundreds of servers on a large scale increases electricity costs, and power consumption cost accounts for a large proportion of the operations cost. Therefore, low power consumption of the server platform and makes energy saving is one of the key requirement. The second challenge is stability. Outages can result in performance deterioration or service interruption, causing direct and potential revenue loss. Therefore, server stability is of paramount importance. The platform must ensure service continuity and reliability, minimize faults that occur on large-scale servers, and ensure timely troubleshooting. Another challenge that cannot be ignored is deployment speed. The rapid expansion of automobile development services increases demands for servers every year. To meet

Urban mobility is indeed an important part of an intelligent world. Huawei is looking forward to further collaborating with automobile industry in more areas such as cloud computing, the IoV, and unmanned driving as the best partner for digital transformation. >>

service rollout requirements, but also imposes great challenges to type selection, testing, O&M management, procurement forecasts, production, and delivery.

Salute to Huawei's First Collaboration with the BMW Group

The BMW Group's IT Department required for HPC vendors for product selection. Huawei entered the final list. The BMW Group required all vendors to prove their competencies. With this particular project, besides satisfying product features, HPC suppliers must also be capable of international delivery, continuous product investments and innovation, strong technical support, and quick response to problems.

As a company that operates in more than 170 countries and regions, Huawei invests more than 10 percent of its annual sales revenue in R&D, and builds ICT solutions by innovating products, system architectures, and business models. Huawei joins together with partners to address customers' challenges in digital transformation, help customers solve problems, and achieve business success.

Huawei was awarded the lot to supply HPC infrastructure for the new DC location in Sweden.

Although this project deployed only standard servers, Huawei products offer other additional highlights. Like car tests, Huawei performed thousands of tests (including brute force insertion and removal tests and EMC tests) on each server for hundreds of hours to ensure high product quality and reliability. With efficiency design, Huawei's rack servers provide flexible and large-capacity local storage expansion capabilities, energy saving features and, at the same time, ensured excellent computing performance.

Furthermore, Huawei servers were designed using

comprehensive energy-saving technologies, such as vector airflow management technology, double-faced cellular board technology, Dynamic Energy Management Technology (DEMT), and dynamic power capping technology, greatly reducing power consumption.

Pitea — a small Swedish town near the Arctic Circle, a place 800 kilometers away from Stockholm, offers stable and abundant power resources, and 100 percent of the energy is renewable (hydropower and wind power). Extremely low carbon dioxide emissions met the industry sustainability targets. Pitea's proximity to the Arctic Circle provides a natural cooling environment for the data center. In addition, almost ubiquitous optical fibers in Sweden provided the basis for high-speed data transmission. Pitea also had high physical security. Natural disasters such as earthquakes seldom occurred in Sweden, and no war had occurred in more than 200 years. In addition, several US Internet giants had set up data centers in northern Sweden, making the region a new highland for strategic data center investments.

Fortlax, a local vendor, to provide the secure data centers and deliver data center hosting services. Fortlax built a new equipment room specifically for HPC cluster. The site was unique — a former top secure cash handling facility.

Successful Server Delivery of the BMW Group's HPC Cluster in Sweden

The project delivery started from 2016. Huawei utilized the most professional teams and high-quality resources in Germany and Sweden, and invited the most suitable channel partner Consalco to support the entire project. Huawei also signed a service agreement with Fortlax so that Fortlax IT engineers could seek technical support and



exchange the spare parts from Huawei's Global Service Center anytime, providing professional and timely maintenance services for the BMW Group's HPC cluster.

During the delivery, Huawei's project team focused on the customer and considered issues from the customer's perspective. The team fully communicated with each other, with the BMW Group and partners (Consalco and Fortlax) and made full preparations in advance. The initial configuration, cabinet dimensions, cables, equipment room space, floor, and other details were taken into consideration to minimize risks. Huawei R&D personnel effectively resolved batch faults, which greatly reduced fault rates. In addition, to support fast HPC deployment in Sweden and reduce transportation costs and time, Consalco purchased local racks and completed system pre-installation and integrated packaging locally. The cabinets were shipped and transported as integrated racks. On-site deployment personnel only needed to install servers. Services could go online as soon as the power was supplied and network cables were connected.

Ultimately, Huawei collaborated with its partners to deliver the first BMW Group-Huawei project for ICT infrastructure, marking the successful delivery of the

BMW Group's first HPC server cluster in Sweden. After going online, the system has been running stably. Huawei has demonstrated its strength through successful first project delivery.

Digital Transformation Is Vital for Next 100 Years

Over the past, designers and engineers have adhered to the unique idea of creating vehicles. In the next 100 years, urbanization, personalization, and digital transformation trends will shift the urban mobility industry.

Urban mobility is indeed an important part of an intelligent world. As a global leading ICT solutions provider, Huawei is committed to bringing digital to every person, home, and organization for a fully connected, intelligent world. To achieve this, the company offers a large number of innovative ICT technologies and a mutually beneficial ecosystem. Huawei is looking forward to further collaborating with automobile industry in more areas such as cloud computing, the IoV, and unmanned driving as the best partner for digital transformation. We hope Huawei products and solutions will bring more value to our customers by the digital transformation and open the new chapter of personal mobility. ▲

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Huawei & Audi

MDC DataCenter Solution

for the Audi Q7 Explores How AI Can Change Driving

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LEADING NEW ICT

Audi and Huawei Explore New Driving Experience

By Saad Metz, Executive Vice President R&D Audi China

On October 11, 2018, Audi and Huawei officially announced their joint innovation program for L4 highly automated driving. Together, Audi and Huawei can achieve faster and more innovative products and services to fulfill rising demands from Chinese customers.

In July 2018, Huawei and Audi signed a strategic partnership agreement as part of a meeting between Chinese Prime Minister Li Keqiang and German Chancellor Angela Merkel. The Berlin summit marked an important milestone in the cooperation between a premium car manufacturer and an exceptional information and telecommunications company.

Three Pillars of “Audi.Vorsprung.2025.” Strategy

The world is rapidly becoming more digital, mobile, and connected. Consequently, digitalization, urbanization, and sustainability are the core pillars of the “Audi.Vorsprung.2025.” strategy.

- Digitalization is a worldwide trend spawned by enormous technological progress. It is an enabler of Chinese economy, as China’s people are very open-minded about new technologies and data sharing.
- Concerning urbanization, cities are quickly reaching capacity and new solutions are required for individual and public mobility. We need to redefine mobility for urban environments.
- Regarding sustainability, we are pushing the

development of innovative technologies in order to reduce our ecological footprint.

As part of the “Audi.Vorsprung.2025.” strategy, Audi is transforming itself into a provider of digital, autonomous, and electric premium mobility.

Through our cooperation with Huawei, we combine 100 years of Audi’s competence as a premium car manufacturer with the dynamic of a top-tier information



Saad Metz, Executive Vice President R&D Audi China (left) and William Xu, President of Strategy and Marketing, Huawei Technologies (Right)



L4 highly automated driving car: Integrating Huawei's MDC into one Audi Q7 prototype vehicle

and telecommunications company. Together, Audi and Huawei can achieve faster and more innovative products and services to fulfill rising demands from our Chinese customers.

Cooperation Milestones

I want to highlight some milestones in our strategic cooperation with Huawei.

Concerning vehicle-to-infrastructure functions, our cooperation began in 2017 in Wuxi. Then we expanded our partnership to a larger scale and

achieved great success at China's 2018 World Internet of Things Expo by demonstrating even more advanced vehicle-to-infrastructure functions.

We have seen huge progress in the research of artificial intelligence technology and improved sensor fusion. Now, Huawei and Audi have achieved a major milestone by embedding Huawei's Mobile Data Center (MDC) into one Audi Q7 prototype vehicle, able to perform level 4 highly automated functions. This vehicle shows a capacity of handling complex urban traffic environments while the driver can leave the steering wheel to the car. The car is able to drive through city traffic, identify pedestrians and traffic signals, and can park itself.

Another area of cooperation is the joined training of experts in the field of Intelligent Connected Vehicle (ICV). We believe our industries need the best engineers in this complex technology field, so we are planning the establishment of an ICV training academy.

I look forward to an even closer cooperation between Huawei and Audi in the future, which will substantially benefit both companies. ▲

(This article is based on a speech given by Saad Metz at Huawei Connect 2018)

About Huawei's MDC

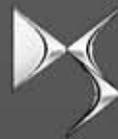
Huawei's MDC is designed to support edge computing for automated driving and other services. It features deterministic low latency, system-level energy efficiency, excellent performance, strict security, and high reliability. The MDC 600 features a computing performance of 352 Trillion Operations per Second (TOPS), and supports L4 highly automated driving calculations. It can process data from 16 cameras, six millimeter-wave radars, 16 ultrasound radars, and eight LiDAR modules. Meanwhile, end-to-end delay is less than 200 ms (60 percent lower than the industry benchmark), which meets low latency requirements for automated driving. The MDC's overall system-level energy efficiency reaches 1 TOPS/W and ranks the highest (Level D) among Automotive Safety Integrity Level (ASIL) mechanisms.

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DS AUTOMOBILES

FORGING A MOBILITY EXPERIENCE LIKE NO OTHER

HUAWEI OceanConnect IoT Platform Solution boosts Groupe PSA as
an automotive leader for mobility services.

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Huawei & BYD Auto

OceanStor Dorado V3 All-Flash Storage System
Doubles BYD's ERP Performance

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BYD Auto Becoming a Leader in New Energy with the Best Data Storage System

After Huawei OceanStor Dorado had run the ERP system continuously for more than six months on BYD's live network, there had already been noticeable improvements in service performance and reductions in maintenance costs. BYD was more than satisfied with this IT system reconstruction.

On October 11, 2017, the Low Carbon Vehicle Partnership (LowCVP) announced the 2017 Low Carbon Champions Awards. BYD UK — the London branch of BYD Auto — won the 'Low Carbon Heavy Duty Vehicle of the Year Award' and jointly won the 'Grand Prix' — the top award — with Transport for London (TfL) and Go-Ahead London for their partnership in launching London's first two all-electric bus routes (507 and 521). This award specifically noted BYD's contribution in delivering the vehicles, operational capacity, and infrastructure for the London project.

Founded in 1995, BYD engages in IT-related and automobile business for traditional fuel-powered vehicles and new energy vehicles. With 30 production centers established around the globe, BYD is the only vendor that owns both power battery and vehicle technologies in the new energy field.

Storage Becomes the Bottleneck of ERP System

BYD is experiencing a period of rapid business development and a proliferation of operational processes. This is generating a large number of concurrent data flows from product sales, spare parts inventory, and after-sales services. The data volume of most

manufacturing enterprises' online transaction management systems doubles every two years, and concurrent requests to the Enterprise Resource Planning (ERP) system grow exponentially, leading to high I/O frequencies and long user wait times.

This increase in data to be analyzed by the BI system, combined with the shorter timeframe in which data must be processed and reports generated, imposes stringent requirements on data loading and processing speed, as well as system stability. The BI system is a must-have tool for enterprises' manufacturing planning, sales analysis, market trend forecasts, and other important business decision-making.

SAP's ERP system lies at the heart of many manufacturing enterprises, and BYD is no different, relying on this system to support its three product lines. At BYD though, rapid service development, a 100 percent staffing increase, and a 10 percent quarterly order increase put a strain on the system. The ERP system simply couldn't handle the required 185,000 Input/output Operations Per Second (IOPS) and 60,000+ concurrent services during peak hours. It was so inefficient, it once took over an hour to query the monthly SAP ERP financial statements. Access performance was



Huawei OceanStor Dorado all-flash acceleration solution doubles BYD's ERP performance:

- ERP system efficiency increases **500** percent, and system latency is cut down to less than **1** ms.
- BW system data extraction time is down **66** percent, and module reporting is more than **2** times faster than before.
- Material voucher queries can now be completed in **4** minutes, instead of the previous **14** minutes.
- SSD-only configuration requires only **20** U cabinet space. It involves **50** percent less installation space.

so poor, the ERP system could not be used for service development. In one extreme case, a system breakdown even jeopardized production line operations.

As a leading global Information and Communications (ICT) solutions provider, Huawei offers end-to-end solutions covering networks, cloud computing, servers, databases, and storage. Trusting this reputation of technological expertise, BYD brought in Huawei to analyze the ERP system's server memory, Central Processing Unit (CPU) utilization, network, and disk response rate. It was from this analysis that Huawei determined that the bottleneck was occurring at the system's storage devices. The ERP production system generated more than 200 GB

of data per month, and the live network required a latency as long as 50 ms to input and output read/write data. This meant the system could only handle a few thousand IOPS, far below the 185,000 IOPS required.

The need for a system upgrade was clear. The traditional Hard Disk Drive (HDD)-based storage BYD was using simply could not meet the required level of read/write performance. On top of their current problems, BYD forecast even further service growth in the coming years, so they needed to at least double the ERP system's performance, and do so without changing the system architecture. BYD's IT O&M department also needed to be able to smoothly perform the upgrade with minimal impact on services and production operations.

Huawei OceanStor Dorado Doubles ERP Performance of BYD

Based on these requirements and the analysis results of BYD's live network, Huawei created an OceanStor Dorado all-flash acceleration solution for BYD. In this solution, HDD-based storage was replaced by all-flash storage to expedite read and write I/O and make the ERP and Business Warehouse (BW) systems more efficient. No changes were made to the live network architecture, databases, hosts, ERP software, or O&M, so as to avoid possible risks. To keep the system upgrade from affecting services, the Huawei data migration team provided a set of data mirroring workarounds using host volume management software. Legacy data was also migrated to the OceanStor Dorado All-Flash Storage without affecting ERP services. Upon Huawei's recommendation, BYD retained their development and test systems and Sandbox on the legacy storage system to protect their investment.

Since the deployment of Huawei OceanStor Dorado All-Flash Storage on BYD's ERP, system efficiency has increased 500 percent, and system latency has been cut down to less than 1 ms. With the ERP's query condition design and upper-layer platform, BW system data extraction time is down 66 percent, and Materials Management (MM),

Table 1. Performance comparison before and after the deployment of Huawei all-flash storage on BYD's service systems

Service System	Before	After
BW data extraction	4.5 hr	1.5 hr
Query of DMS one-week data	1 min (frequent errors)	6 s
Transfer time for thousands of inventory materials on EWM	1 hr	15 min
Average ERP response time	1,200 ms	600 ms
10,000 material voucher query time on ERP MM	14 min	4 min
Monthly sales report query time on ERP SD	1 hr (frequent errors)	98 s

Production Planning (PP), Sales and Distribution (SD), and Finance and Cost controlling (FICO) module reporting is more than two times faster than before. Material voucher queries can now be completed in four minutes, instead of the previous 14 minutes.

To provide BYD's required capacity and performance, a traditional HDD-based storage system would have needed to be configured with RAID 10 technology and Serial Attached Small Computer System Interface (SAS) and Solid-State Drive (SSD) disks, and would have taken up 40 U of cabinet space. Huawei OceanStor Dorado All-Flash Storage, on the other hand, uses RAID 6 and an SSD-only configuration, requiring only 20 U cabinet space. It involves 50 percent less installation space and O&M labor cost and significantly saves electricity and cooling cost. Over the next three years, Operating Expense (OPEX) will be reduced by an estimated 70 percent, which will have never been possible with traditional storage.

After Huawei OceanStor Dorado had run the ERP system continuously for more than six months on BYD's live network, there had already been noticeable improvements in service performance and reductions in maintenance costs. BYD was more than satisfied with this IT system reconstruction.

Qiu Yan, CIO of BYD, said, "Since its deployment in BYD's core service systems, including our enterprise, distributor, customer relationship, extended warehouse, and business intelligence management systems, Huawei OceanStor Dorado All-Flash Storage has proven to be stable, reliable, and robust. Over the years, these systems have seen a 5-fold boost in efficiency."

Wang Hongbo, BYD's information center manager, said, "After replacing our traditional HDD-based storage with Huawei's OceanStor Dorado All-Flash Storage, our ERP BW system applications run faster and performance has more than doubled. In the first month alone, we experienced no disruption in data Extract-Transform-Load (ETL) while we saw at least one disruption every two days with our old system. Data extraction time has shortened from 4.5 hours to 1.5 hours, greatly increasing our report generation and helping our executives make more timely decisions."

The ERP system reconstruction project was so successful, BYD chose Huawei's Dorado All-Flash Storage again for its next Document Management System (DMS) and Extended Warehouse Management (EWM) system upgrade. Dorado's superb performance and robust stability again impressed BYD. BYD and Huawei also plan to further cooperate in smart manufacturing for 'Made in China 2025.' ▲

Customer Testimony

"Since its deployment in BYD's core service systems, including our enterprise, distributor, customer relationship, extended warehouse, and business intelligence management systems, Huawei OceanStor Dorado All-Flash Storage has proven to be stable, reliable, and robust. Over the years, these systems have seen a 5-fold boost in efficiency."

— Qiu Yan, CIO, BYD Auto

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Huawei & Japan's CyberAgent

CloudFabric Cloud Data Center Network Solution Maximizes
the Commercial Value of the Internet

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tapple

LEADING NEW ICT

Huawei Empowers Japan's CyberAgent to Build an IDN-Capable Cloud Data Center Network with All-Fixed Switches

With the help of Huawei's CloudFabric solution, CyberAgent successfully built a cloud data center network with Intent-Driven Network capabilities, effectively meeting the growing requirements of CyberAgent in areas such as media, Internet advertising, and gaming, and maximizing their business value.

Pioneer of Japanese Pan Entertainment

CyberAgent, Inc. is a well-known Internet company in Japan. It provides services in multiple fields, such as online communities, Video on Demand (VoD), gaming, advertising, and Internet venture capital. In 2018, revenue is expected to exceed USD 3.8 billion. Gaming is an important growth engine. CyberAgent has seven major game titles and other several tens of smartphone games. An animated version of hit titles such as 'GRANBLUE FANTASY' has been made to entertain users with the world of the game in different way. Media is a major investment area of CyberAgent, such as AbemaTV, a Internet TV station which offers about 20 channels for free, and FRESH LIVE, a live streaming service with many celebrities and popular personalities.

As cloud computing, AI, and big data go global, rapid service changes pose higher requirements on data centers. Services such as VoD, gaming, and search services often cause traffic surges. Current data center devices cannot

cope with this problem. In addition, one of the major challenges that CyberAgent, Inc. urgently needed to overcome was how to construct a data center network with high availability and high scalability while achieving smooth evolution towards Intent-Driven Network (IDN).

Tomohiko Sawadaishi, Chief Network Architect of CyberAgent, Inc., said: "The vision of CyberAgent is to create the 21st century's leading company. One of the core cornerstones that support this vision is the cloud data center network with high availability, high scalability, and continuous evolution towards intelligence and automation. Based on comprehensive evaluation, Huawei Intent-Driven CloudFabric provides high-standard solutions and devices to meet requirements for constructing our next-generation cloud data center."

Build an IDN-Capable Cloud Data Center Network with All-Fixed Switches

Huawei CloudFabric has served 2,800 enterprises in over



Tomohiko Sawadaishi talks about his experience building a cloud data center network using the Huawei CloudFabric solution

120 countries. In particular, it has been put into large-scale commercial use in industries such as finance, Internet, Media & Entertainment (M&E), cloud service provider, and telecom carrier. CloudFabric is dedicated to using the IDN architecture to drive the construction of data

center-centric next-generation network platforms for more enterprises.

Huawei CloudFabric breaks the norm to construct a network entirely out of fixed switches. The solution uses the mainstream spine-leaf architecture, supports technologies such as EVPN and VXLAN, and can be integrated with third-party automation management tools. It is the best solution for small- and medium-sized enterprises when building next-generation data center networks. The following are some of its key features:

- **High-bandwidth Interconnection and Large-buffer Access**

CE8800 series switches, used as spine nodes, provide 64 x 100 GE ports, the highest-density in the industry. CE6800 series, used as leaf nodes, provide 100 GE uplink ports, achieving 100 GE interconnection within the data center. In addition, the CE6870 series provide an ultra-large buffer of up to 4 GB, effectively coping with traffic surges on the network and providing high quality transmission of services such as VoD, gaming, and searching.

- **High Network-wide Reliability, Ensuring Zero Service Interruptions**

With the industry's most comprehensive inter-device link aggregation technology, the device networking coupling relationship evolves from stacking at the control plane to the use of M-LAG and then finally to coupling-free M-LAG Lite.

This achieves active-active server access and zero-interruption when upgrading switches, ensuring services are available 24/7.

- **Compact and Easy to Manage, Reducing CAPEX and OPEX**

The CE8860 series supports cards with four rates (10 GE, 25 GE, 40 GE, and 100 GE) while taking up just 2U of rack space, achieving high-density access of servers with different interface rates and saving equipment room space. Devices can be integrated with third-party tools such as Ansible, implementing integrated network and IT management.

Industries are now starting to enter the latter stage of their digital transformation. Enterprise data centers are no longer merely business support centers, but have also become value creation centers. Huawei will adhere to the principle of customer-centricity, respond to requirements of top global customers from industries such as finance and Internet, and improve network automation and intelligence with AI and big data technologies to continuously lead the industry development. ▲

Customer Testimony

"The vision of CyberAgent is to create the 21st century's leading company. One of the core cornerstones that support this vision is the cloud data center network with high availability, high scalability, and continuous evolution towards intelligence and automation. Based on comprehensive evaluation, Huawei Intent-Driven CloudFabric provides high-standard solutions and devices to meet requirements for constructing our next-generation cloud data center."

— Tomohiko Sawadaishi,
Chief Network Architect, CyberAgent, Inc.



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华为园区网络解决方案，提供Wi-Fi、IoT、POL等融合网络部署，构建一站式云管端协同平台，敏捷响应业务需求。胜于思，有所为。

Our **Campus Network Solution** amalgamates Wi-Fi, IoT, POL with the latest in Cloud, Big Data Analytics and AI, to truly meet your one-stop needs and more.



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Huawei & Philippines's Converge

Intent-Driven Network Enables High-Quality
Fiber Optic Internet Services

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LEADING NEW ICT

Converge ICT Builds ISP Network to Promote Philippines Digital Economy

With a full understanding of Converge's current network situation and future plans, Huawei helped Converge sort out and explore potential high-value customers, develop solutions for network construction, and outline future-oriented service plans.

The Philippines offers a wide variety of economically significant local specialties such as mangoes from Luzon Island, Barong Tagalog shirts; the wood carvings from the Banaue Rice Terraces; and a diversity of bags and carpets made from Manila hemp, just to name a few.

Local sales are limited if sold only to tourists; but with the advent of Internet 2.0, eCommerce has become the most-promising channel for boosting revenue for Philippine vendors. Having network bandwidth available is essential for enterprises and individuals engaged in eCommerce. To ensure vibrant development of eCommerce reliable, high speed and affordable network services is a must.

Of course, eCommerce is only one sector of the Internet 2.0 era. Many new economic patterns and business models are constantly emerging based on digital platforms such as online gaming, HD video, and social media. Other than goods like these, the Philippines has become the Call Center Capital of the world.

Thus, network development is vital to the advancement of the national digital economy of the Philippines.

Converge ICT (Converge) is a pure fiber Internet service provider. Converge is a leading player in the all-optical broadband

access industry with licenses for operating fixed networks, fiber optics, cable TV, enterprise private lines, fixed broadband, and wireless broadband services. Driven by a mission to fulfill the demand for high speed network services, the company is dedicated to deploying a modern and scalable network infrastructure as its contribution to the development of a modern Digital Economy in the Philippines.

Converge has deployed an extensive Fiber Optic network covering Central Luzon, the national Capital Region and South Luzon. Its objective is to be able to provide affordable, high-quality Fiber Internet services to as large an audience as possible.

Converge's Plan for New Services

Converge started as a cable TV operator. Its live network was a Hybrid Fiber-Coaxial network on which medium speed services were deployed and was the base for the growth of its Fiber-To-The-Home (FTTH) service. With continuous innovations, bandwidth-hungry services like 4K and 3D video began to proliferate, which in turn is driving exponential increases in the need for bandwidth.

In fulfillment of Converge's mission to ensure that the country is empowered to cope with the ever-changing and increasingly-

Huawei Agile WAN Solution help Converge construct an intelligent, ultra-broadband, and simplified network:

- The 2 Tbit/s large-capacity line cards support smooth capacity expansion to 2 Tbit/s per slot, which allows for large-capacity service support and the ability to meet increased bandwidth requirements in the future.
- Hierarchical Quality of Service (HQoS) provides large buffers, low latency, and high reliability to ensure superior service quality and meet individual user service experience requirements.
- Broadband remote server access in multiple scenarios and hot-standby technology ensure non-stop services, and allows rapid and covert traffic switching.

demanding digital times, the company has taken it upon itself to roll-out the Philippines' first pure end-to-end fiber network. And since their initial roll-out, Converge has been able to provide its clientele the kind of connectivity that allows them to maximize the Internet.

Today, Converge is expanding its in the Metropolitan Area Network (MAN) service market in Metro Manila by providing customers with highly reliable, high-quality, and high-speed optical network services. To this end, Converge has specified a reliable and elastic network that will deliver high input-output ratios that meet contemporary data center requirements. According to Converge's requirement, this network must also improve support for the current enterprise private line and home broadband access services, and contribute to future plans for services such as FTTH, enterprise data services, data center services, cloud services, and Smart City services throughout the country.

"Early on we felt we needed a network that was

reliable, scalable, cost-effective, and allowed us to easily implement new products and services," said Jesus Romero, Chief Operating Officer of Converge. "And we are very pleased that we were able to, in fact, get that with Huawei."

Huawei's Professional Network and Business Consulting Team

Huawei serves the top 50 network operators worldwide, and has built more than 1,500 networks, is a member of more than 360 standards-defining organizations, industry alliances, or open source communities. Huawei currently holds more than 300 leadership positions in organizations such as IEEE-SA, IIC, BBF, ETSI, TMF, and WFA. With Huawei's Innovation Research Program (HIRP), the organization is conducting cooperative innovation with over 400 research institutes and 900 enterprises in more than 30 countries or regions around the world.

After years of practical experience, Huawei has built a professional network of consulting, planning, construction, and maintenance teams. Since 2006, Huawei's global consultants have provided professional consulting services for over 120 operators in more than 70 countries or regions to help operators resolve business pain points and improve core competitiveness. With a full understanding of Converge's current network situation and future plans, Huawei helped Converge sort out and explore potential high-value customers, develop solutions for network construction, and outline future-oriented service plans.

Agile WAN Solutions Meet Large Bandwidth and Network Evolution Requirements

Huawei proposed its Agile WAN Solution to Converge, which will use NE40E universal service routers to build a Fixed-Mobile Convergence (FMC) 2.0 network. The network will help Converge construct an intelligent, ultra-broadband, and simplified network that meets their service

development and network evolution needs.

- **IP + optical synergy affords one-click service deployment.** The ‘IP + optical synergy’ solution applies cross-layer network resource integration and automatic cross-domain topology discovery, simplifies O&M, and achieves end-to-end service deployment in minutes.

- **The 2 Tbit/s large-capacity line cards to meet large bandwidth service requirements.** Built on a 2T platform, the NE40E series energy-efficient routers support smooth capacity expansion to 2 Tbit/s per slot, which allows for large-capacity service support and the ability to meet increased bandwidth requirements in the future.

- **Hierarchical Quality of Service (HQoS) meets user service experience requirements.** HQoS is applied in an end-to-end manner. It allows fine-grained service scheduling by differentiating users and services, and provides large buffers, low latency, and high reliability to ensure superior service quality and meet individual user service experience requirements.

- **Broadband remote server access in multiple scenarios and hot-standby technology ensure non-stop services.** Users can access the network in Point-to-Point Protocol over Ethernet (PPPoE), Internet Protocol over Ethernet (IPoE), dial-up, private line, wired, or wireless modes. Five authentication modes are supported, affording unified user access for the entire network. And hot-standby technology allows user information to be backed up between active and standby devices with rapid and covert traffic switching.

Assisting Converge to Become One of the Best FTTH Providers

From the Dense Wavelength Division Multiplexing (DWDM) backbone and Multiprotocol Label Switching (MPLS) core, to

the MAN, and all the way down to the access network, Converge’s network is largely built by Huawei.

The renewed Converge network is more reliable and stable, and achieves lower latency, higher rates of speed, and easier O&M — all of which help Converge to launch new products and services quickly. Most importantly, the new network will help Converge to better meet customer requirements and automatically distribute services suited for market needs. The network is beneficial for eCommerce companies that sell Philippine specialties; Internet enterprises providing online live streaming and HD video services; innovative enterprises that engage in local social media or sharing platforms; and citizens — all helping to vigorously promote a robust Digital Economy in the Philippines. In partnership with Huawei, Converge has enhanced its reputation for providing FTTH services that create superior customer experiences.

“Huawei has been responsive in terms of support,” Romero said. “In terms of pricing, they remain competitive, and they help us a lot with strategy planning, what to do next, and where to go — which is one key area where we feel we should continue and expand cooperation.” ▲

Customer Testimony

“Huawei has been responsive in terms of support and in terms of pricing, they remain competitive, and they help us a lot with strategy planning, what to do next, and where to go — which is one key area where we feel we should continue and expand cooperation.”

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Industry Pioneers'
Digital
Transformation



Huawei & Australia's PDK IT

EC6.X Full-Service Platform Provides High-Quality
Enterprise Communication Services

211 of the Fortune Global 500 companies
choose Huawei as digital transformation partner

LEADING NEW ICT

Australia's PDK IT Joins Huawei to Provide Top-Notch Cloud Enterprise Communication Services

PDK utilizes Huawei's EC6.X full-service platform to address customer's requirements and provide high-quality enterprise communication services for customers through a rental model, instead of selling a traditional solution in full.

New South Wales is Australia's most populous state, and has the highest level of industrialization and urbanization in the nation. It is one of the most active economic sectors in the Asia-Pacific region, providing more than 35 percent of the total products and services in Australia. Sydney, New South Wales' state capital, is one of the world's most livable cities.

Professional Data Kinetics Pty Ltd. (PDK IT) is a well-known local ICT equipment and information service provider in New South Wales. Since opening its doors in 2012, PDK IT has been providing exceptional service, helping its customers deploy and manage desktop cloud technology, unified communications, networks, and servers. It also provides voice, video, and conference services for enterprises. PDK IT continues to be one of the fastest growing IT companies in the Riverina region.

The economic landscape is changing rapidly. Recent digital transformation trends are ongoing, and enterprises have embarked on transformative, long-term development plans. PDK IT understands that, under the current circumstances,

equipment resale cannot boost enterprise profits; failure to quickly respond to changing business requirements will make it impossible to establish long-term relationships with customers; and market dominance is impossible without key technical advantages, all of which will eventually lead to stagnating growth. With this in mind, PDK IT has undergone a transformation to enrich its businesses and lead the shift from product resale to service sales.

Huawei EC6.X Helps PDK IT Upgrade Enterprise Communications Services

Enterprise communication infrastructure is necessary. However, it is costly for a Small- and Medium-Sized Business (SMB) to build its own data centers and purchase communications equipment, which also generate a large amount of maintenance work. In addition, as the business develops it will need to upgrade the equipment, which will undoubtedly affect internal and external communications efficiency.

Enterprise customers and stakeholders are asking the

PDK IT has successfully provided cloud enterprise communication solutions for many well-known enterprises since deploying Huawei's one-stop EC platform. The solution was designed with a deep understanding for the customer's requirements, and PDK IT is now recognized for its dependable technical capabilities and high-quality services. >>

following questions: How can we reduce costs and improve communication efficiency? How can we quickly build communication capabilities that align with business development? How can we improve employee work-flow experiences?

PDK utilizes Huawei's EC6.X full-service platform to address these issues and provide high-quality enterprise communication services for customers through a rental model, instead of selling a traditional solution in full.

- **High reliability:** Network-side, Multipoint Control Unit (MCU) resource pools implement load balancing, backup and disaster recovery, and access to nearby resources, which improves resource utilization and reliability.

- **Converged communications:** Audio/video conferencing and collaboration services can be flexibly added to the communications solution, which enables further evolution to meet future demands.

- **Multiple backup mechanisms:** The MCU

(including its control board, service board, fan, network port, and microprocessor) and video terminals support a 1+1 hot backup.

- **Network adaptability:** High-definition video is provided at a low bandwidth, with superb packet-loss-concealment capabilities (against a 20 percent packet-loss rate).

- **Unified address books:** Available hierarchical address books match an enterprise's organizational structure.

- **One-stop services:** Based on Huawei's Enterprise Communications (EC) platform, PDK IT provides all the required communication services (HD videoconferencing, voice calling, mobile office, and collaboration) for itself and SMB customers.

- **Reduced costs for customers:** PDK IT provides cloud communication services for SMB customers. Renting instead of buying eliminates the need for customers to build their own data

Huawei's EC6.X full-service platform helps Australia's PDK IT to provide high-quality enterprise communication services:

- High reliability: MCU resource pools implement load balancing, backup and disaster recovery, and access to nearby resources, which improves resource utilization and reliability.

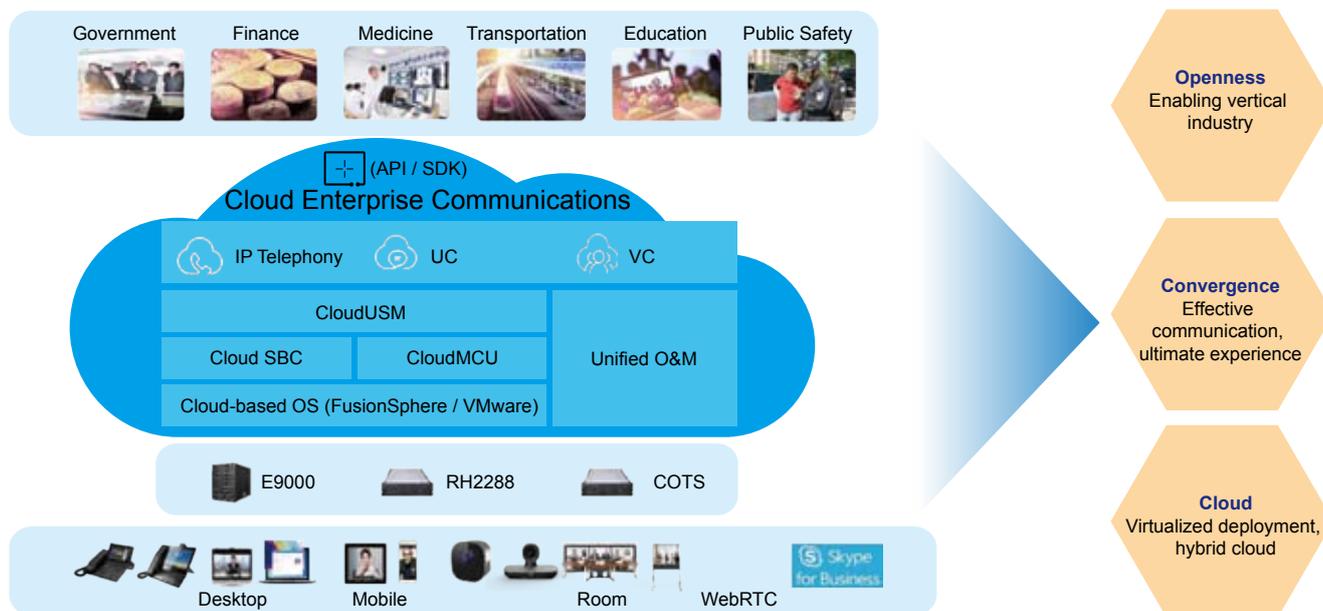
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- Reduced costs for customers: Customers only need to ensure basic network access requirements for services to be available anytime, anywhere.

One-stop Converged EC Platform, Driving Digital Transformation of Enterprises



centers, purchase communications devices, or establish large O&M teams. Instead, customers only need to ensure basic network access requirements for services to be available anytime, anywhere.

- **Flexible deployment and efficient O&M:** PDK IT bundles services by category so SMB customers can flexibly select and purchase services on demand and use the latest technologies at any time to improve communication experiences.

- **Lowered ISP business transformation investment thresholds:** Initial service deployment licenses are flexible and based on business development conditions.

Providing High-Quality Communication Services at Lower Costs for Customers

PDK IT has successfully provided cloud enterprise communication solutions for many well-known enterprises since deploying Huawei's one-stop EC platform. For example, PDK IT delivered a solution for a large headhunter in Australia within a short period to ensure continuous business without interruption. The solution was designed with a deep understanding for the

customer's requirements, and PDK IT is now recognized for its dependable technical capabilities and high-quality services.

PDK IT allows customers to enjoy high-quality communication services at lower costs, promotes economical and efficient business development, and improves efficiency and productivity by providing new voice, video, and conference systems.

PDK IT aims to supply innovative technologies and personalized solutions to enterprises, and is committed to providing high-quality cloud enterprise communication services for its customers. PDK IT has always actively responded to customer requirements during the service process to deliver better customer experiences, improve customer communications efficiency, and help customers achieve their business goals.

PDK IT and Huawei have been working together to provide high-quality products and services for customers since establishing a partnership in 2015. Huawei is now a Gold Partner with PDK IT, and the companies will continue to cooperatively provide high-quality and intelligent cloud enterprise communication services. ▲

Industry Pioneers'
Digital
Transformation



Huawei & Marina Bay Street Circuit

High-density Wi-Fi Solution Powers the Network for Formula 1 2018 Singapore Airlines Singapore Grand Prix

211 of the Fortune Global 500 companies
choose Huawei as digital transformation partner



LEADING NEW ICT

Huawei Campus Wi-Fi Solution for Singapore Formula One Event

SGP selected the Huawei Campus Wi-Fi solution to support the *Formula 1 2018 Singapore Airlines Singapore Grand Prix*. The Huawei solution helped lead the way with wide coverage, sufficient bandwidth, high-density access and fast deployment.

Accelerating Connectivity at the Singapore Night Race

The *Formula 1 2018 Singapore Airlines Singapore Grand Prix* was held from September 14 to 16, 2018, and attracted grand prix's second highest attendance to date. The more than 263,000 race fans on site created a big challenge for the venue's wireless network to meet the needs of spectators, media personnel, and on-site staff who all require fast communications and smooth connectivity.

Enhanced All-Scenario Wi-Fi Solution

The same Wi-Fi network devices had been used at the venue for 10 years. Fast forward to early 2018, race organizer Singapore GP Pte Ltd. (SGP) decided to deploy a new Wi-Fi network to meet the immediate for network bandwidth. The new network would improve connectivity in the pit building, offices, hospitality suites, and entertainment areas, as well as provide coverage in the temporary lifestyle venues built for the race. SGP

also planned to upgrade the network devices in the Media Center.

After a thorough review of the available products, SGP selected the Huawei Campus Wi-Fi solution to support the 2018 event. The Huawei solution helped lead the way with wide coverage, sufficient bandwidth, high-density access and fast deployment.

Based on the physical requirements of the street circuit, Huawei provided an all-scenario Wi-Fi solution that solved the network issues that had plagued previous races. The Huawei solution satisfied SGP's requirements for high-density, multiple-user access, reliability, security, and environmental requirements to deliver the ultimate Wi-Fi network experience for users.

Deployed outdoors, the Huawei 802.11ac Wave 2, 2 x 2 Multiple-Input and Multiple-Output (MIMO) Wi-Fi solution supports two spatial streams, and complies with both 802.11n and 802.11ac protocols. High-density Access Points (APs) provided gigabit access for wireless users and greatly improved each user's experience. The

Because Singapore's urban F1 course involves many complex structures, the location selection, deployment, and channel design for the APs was difficult. The task was simplified using Huawei's Wireless Local Area Network Planner. >>

backbone for the secure high-bandwidth wireless network was a wired network that provided continuous support and related services. Huawei Power over Ethernet (PoE) access switches simplified the deployment and connectivity of the wired devices. These PoE switches provide 10 GE uplinks that ensure access and support for seamless bandwidth upgrades in the future.

For high-density indoor scenarios, the most important planning goals were to minimize radio interference and maximize network capacity. Because Singapore's urban F1 course involves many complex structures, the location selection, deployment, and channel design for the APs was difficult. The task was simplified using Huawei's Wireless Local Area Network (WLAN) Planner. Using this tool, even inexperienced installation engineers could quickly formulate a device-installation schedule based on building diagrams. With the help of the intelligent WLAN Planner, Huawei quickly delivered a custom-fit Wi-Fi deployment solution.

Through refined network planning, the Wi-Fi network allowed race fans to smoothly access the Internet and enjoy the ultimate race experience. All network users could roam seamlessly throughout the venue. In addition, the network was further optimized to guarantee higher bandwidth assurance for hospitality suite guests, as well as media professionals at the Media Center.

Every Race Moment Counts

SGP's selection of the Huawei campus Wi-Fi network ensured wireless access for mobile phones and smart terminals.

- No matter how many users accessed the wireless network, the event staff could continue to work efficiently using the network.
- Through the wireless network, journalists filed stories and photographs in a timely manner from the Media Center.

Huawei is honored to provide enhanced high-quality support services via our wireless campus network for exciting future events. ▲





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华为园区网络解决方案，全面开放式架构，支持多云部署、跨厂商设备互联和第三方应用业务，打破封闭传统。胜于思，有所为。

Our cloud **Campus Network Solution** lets you introduce third-party services with agility and ease. Experience truly open architectures that no one else can offer.



LEADING NEW ICT



Huawei & ETH Zurich

Agile Campus Network Solution Builds a High-Quality Wireless Network

A growing number of industry pioneers choose Huawei as digital transformation partner



LEADING NEW ICT

ETH Zurich Relies on High-Performance Wi-Fi from Huawei

The Eidgenössische Technische Hochschule (ETH) members expect stable, high-performance Wi-Fi for their mobile accessibility and connectivity. These needs and requirements will continue to increase. With Huawei, ETH Zurich has a competent partner who is always ready to respond specifically to customer requirements and is supported by competent development teams.

World's Leading Technical and Natural Science University

The 'Eidgenössische Technische Hochschule' or ETH in Zurich is one of the world's leading technical and natural science universities. It is an important place of study, research, and work for around 19,800 students, including 4,000 PhD students from over 120 countries, with 510 professors and 9,100 employees. The ETH was founded in 1855 and was a driving force for the industrialization of Switzerland. In total, the ETH has produced 32 Nobel Prize winners (including Albert Einstein). At ETH, students find an environment that promotes independent thinking, and researchers enjoy a climate that inspires excellence. In the heart of Europe and with a worldwide network, ETH Zurich is developing solutions for the global challenges of today and tomorrow. ETH is regularly placed in international rankings as one of the world's best universities and the leading university in continental Europe. In 2017, ETH reached 10th place in the Times

Higher Education (THE) World University Rankings. The ETH focuses on three core tasks: excellent education and training of students and professionals in the scientific and technical fields, groundbreaking fundamental research, as well as direct transfer of new findings into practice. ETH Zurich is a university run by the Swiss Federation and the Swiss Federal Council formulates the guidelines, goals and measures of the education and science policy.

ETH Zurich offers researchers and students at sites inside and outside Switzerland an excellent infrastructure and attractive working conditions. In Zurich, besides the main city center campus, the modern campus located on the Hönggerberg is of particular importance. In total, ETH operates a data network with approximately 86,000 Ethernet ports and 70,000 different devices simultaneously on the network, distributed across 180 buildings. These buildings are currently networked with over 15 network zones divided into 2,500 Virtual Local Area Networks (VLANs).



Wi-Fi Become the Fastest Growing Part of the Network

The biggest challenge in the network area is the growing number of students, and the ensuing rapid increase in mobile clients.

Wi-Fi is the fastest growing part of the data network. In addition, ETH pursues the ‘learning at anytime and anywhere’ strategy, for which a stable and high-performance Wi-Fi network is indispensable. Another challenge is the enormous client density, e.g. in a lecture hall with up to 600 students. Almost all of these are wireless; only high-end devices such as workstations and servers are wired. At peak times, there are up to 20,000 Wi-Fi clients in the network at the same time. All of these factors are leading to an ever-increasing need for more bandwidth and full Wi-Fi coverage in all buildings.

In order to gradually renew the existing Wi-Fi network and thereby make it ready to meet the requirements of the future, ETH launched a public tender in 2016 for an initial procurement of 2,500 access points, with the option of adding 200 additional access points per year over the next five years (3,500 units in all) to keep in step with its growth. It was specified that the new access points should support the 802.11ac Wave 2 standard. The second generation of the 802.11ac Wi-Fi standard not only brings more speed, but also higher efficiency when distributing data to several devices simultaneously (multi-user MIMO).

How to Deploy a Wi-Fi Network Scientifically

After an evaluation of a total of eight manufacturers, ETH decided to launch a four-month verification phase with Huawei’s products. The deciding factor in this initial decision-making phase was, above all, the very good price/performance ratio of Huawei’s components. In the verification phase, ETH Zurich was impressed by the solid quality and, in particular, pleasantly surprised by Huawei’s comprehensive technical support.

Huawei promptly and competently responded to customization requests and suggestions, and the appropriate modifications were implemented immediately. The good cooperation with the local Huawei support teams and the support provided by project teams at the headquarters were all the more reason to choose Huawei. Huawei’s many international references in the education sector further simplified the decision.

The starting signal for the roll-out of the first access points came in January 2017. In the first two months, 700 Huawei access points were already in operation. About a year after the start of the project, the Wi-Fi network has grown further and comprises a total of 3,000 access points. Of these, about half are from Huawei. The roll-out of the new access points was much faster and more efficient than expected. Thanks to a mounting plate specially developed by ETH, mechanical migration is extremely easy. Furthermore, the commissioning of the devices could be completely automated, so that the new device can be mounted directly after unpacking (Zero Touch Provisioning, ZTP). The access points can be exchanged in a few minutes.

The AP6050DN high-speed access points support the 802.11ac Wave 2 standards, 4 x 4 MIMO, and four spatial streams. They provide data rates of up to 2.53 Gbps and are used in medium and high density scenarios. They are ideal for public spaces thanks to their high performance, even in unusual network conditions, and the energy-efficient design, as well as the innovative wireless technology, with integrated overvoltage protection and sound hardware protection.

Huawei’s central AC6605 Access Controller (AC) was designed for larger organizations. Used primarily in campus networks, this model provides support for large numbers of mobile devices, extended hotspot coverage, and video applications. Two optical SFP + 10 GE uplink ports deliver outstanding performance. A Fit AP +

AC architecture and unified routing, control and related policies simplify the network management. Up to 1,024 access points and 10,000 clients are supported.

In the future, the new generations of access points can each be connected with two cables to two different switches. This will create redundancies in the bandwidth and power supply. Up to eight access points are installed in large lecture halls in order to satisfactorily serve the high density of end devices. The 5 GHz band is generally used to ensure data rates and reliability. Only in the basements of buildings will work continue with 2.4 GHz. Since a university has to offer open access to all types of content, there are no restrictions for users in this respect. Neither content filters nor URL filters are used.

To ensure efficient network management, ETH relies on a manufacturer-neutral Configuration Management Database (CMDB). With this database, the individual access points will be managed and access will be provided to them. The individual access points are controlled via the Application Programming Interface (API). The Huawei eSight management system is used to monitor the service and the controller. eSight offers an open and flexible platform to support infrastructures and to easily develop custom administration applications.

Dr. Armin Wittmann, Division Head, ID ICT-Networks, said, “Our ETH members expect stable, high-performance Wi-Fi for mobile accessibility and connectivity. Their needs and requirements will continue to increase. With its quality products and flexible, fast processes, Huawei is a reliable partner for the future to efficiently meet these requirements.”

Learning Anytime and Anywhere

After completing the project, ETH Zurich’s campus network will be one of the largest 802.11ac Wave 2 wireless campus networks in the world in a university. The high-performance Wi-Fi network has been well received by ETH students and employees and makes an important contribution to the implementation of the ‘learning anytime and anywhere’ strategy. The new infrastructure thus helps to keep the training quality and research opportunities at the ETH at a leading level.

Dr. Armin Wittmann is highly satisfied with the new Wi-Fi infrastructure: “The new Wi-Fi components are impressive in their good quality and performance. Configuration and commissioning of the new access points was simple and efficient. And the effort required

for operation of the Wi-Fi network also meets our expectations.”

The subject of Wi-Fi will continue to occupy and challenge the ETH: In the summer of 2017, the strategic decision was made to ensure that Wi-Fi will continue to be used in all office spaces in the future. With Wi-Fi calling for in-house GSM coverage and VoWLAN (Voice over WLAN) for ETH-internal telephony, ETH Zurich wants to implement telephony over Wi-Fi. However, the Wi-Fi system has to meet some additional requirements for high-quality telephony as compared to pure data communication. For example, it must be ensured that switching of access points is possible without disconnections or other impairment of the telephone call (seamless roaming). The Wi-Fi network itself has to meet special requirements in terms of Quality of Service (QoS). Thus, certain minimum bandwidths have to be made available for telephone calls, jitter and delay values must be adhered to and defined maximum error rates must be undershot.

Another goal of the ETH is that more and more students will be able to complete their exams online, connected only via Wi-Fi. ETH is currently testing this with a pilot trial involving around 100 persons. The test group will soon be expanded to 300 participants. It should be noted that the Wi-Fi network must be particularly stable, so that all candidates have technically identical conditions.

These new projects further escalate the requirements for the Wi-Fi infrastructure. With Huawei, ETH Zurich has a competent partner who is always ready to respond specifically to customer requirements and is supported by competent development teams. Mr. Wittmann estimates that the Wi-Fi infrastructure will be steadily expanded, and around 5,500 access points will be in use in the future. ▲

Customer Testimony

“Our ETH members expect stable, high-performance Wi-Fi for mobile accessibility and connectivity. Their needs and requirements will continue to increase. With its quality products and flexible, fast processes, Huawei is a reliable partner for the future to efficiently meet these requirements.”

— Dr. Armin Wittmann, Division Head,
ID ICT-Networks, ETH Zurich

Industry Pioneers'
Digital
Transformation



Huawei & Australia's Southern Cross University

Full-Service Enterprise Communications Platform Builds
Efficient Teaching and Office Communications Systems

A growing number of industry pioneers
choose Huawei as digital transformation partner



LEADING NEW ICT

Southern Cross University Builds a New Communications System

Full and efficient connections are the first steps in the digital transformation of higher education. By deploying the Huawei Cloud Enterprise Communications platform, SCU builds a high-quality communications network, improves the teaching and living experiences for faculty and students. SCU has become the guiding star of Smart Education in the southern hemisphere.

When looking into the night sky from the Southern Hemisphere, one of the brightest and most easily distinguished constellations you see is the Southern Cross. This simple, four-star pattern has great significance to the cultures of the southern hemisphere and is used for navigation the same way that Polaris is used in the northern hemisphere. The Southern Cross is referenced in the Australian and Brazilian national anthems, and also appears on the flags and dominates the folklore of Australia and New Zealand. Australia's Southern Cross University (SCU) takes its name from the constellation that dominates the heavens above.

Efficient Collaboration Is Key

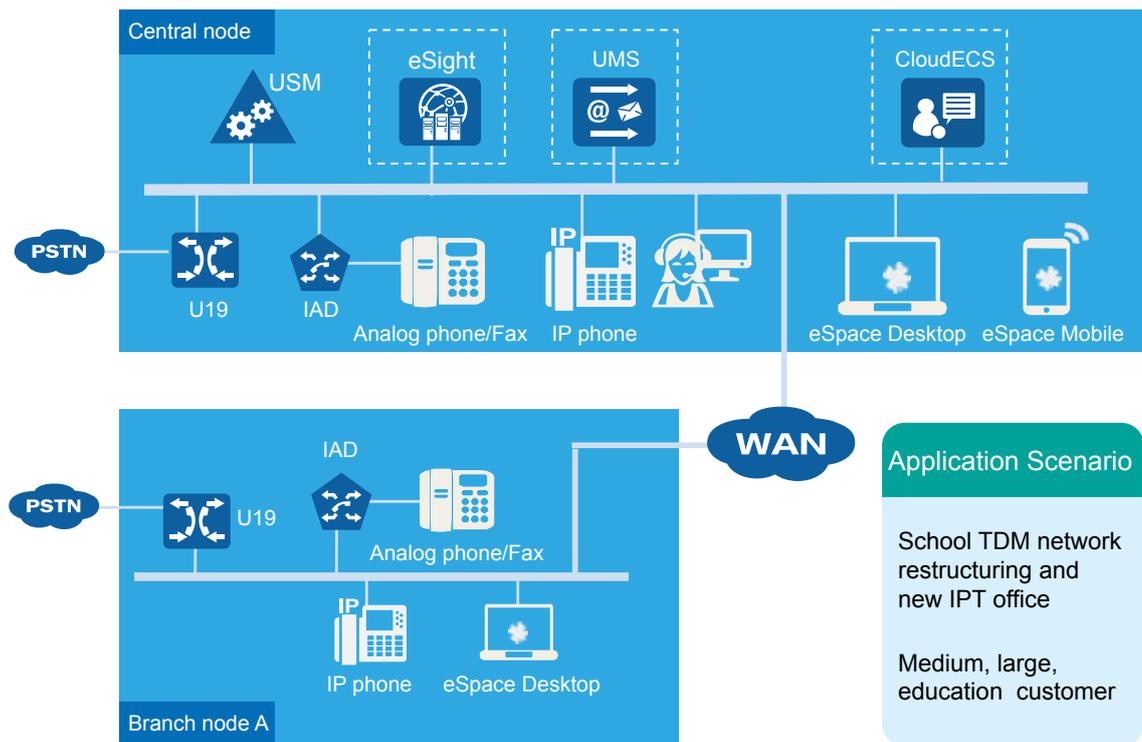
An Australian public university with 17,000 students, SCU is committed to innovative teaching and research. The university offers degrees in business, arts, social sciences, paralegal studies, environmental science, nursing, preparation courses, and more, at the bachelor's, master's,

and doctoral levels. Both on campus and by distance study, SCU emphasizes the combination of academic theory and practical experience to create good employment prospects for their graduates.

SCU has invested heavily in advanced infrastructure for students and faculty in order to improve teaching quality, and is recognized throughout Australia for the quality of its support services.

With four major campuses spread across Eastern Australia (Gold Coast, Lismore, Coffs Harbour, and Sydney) the construction of SCU's campus network was difficult due to its size and layout. SCU's goal was to achieve quick resource sharing, timely information delivery, and a balance between development, first-rank teaching, effective learning (including on-line learning), and efficiency between campus offices and administrators.

Each of the four campuses had an independent communications system that could not be easily managed in a unified manner. Routine maintenance was difficult



and costly. The use of different applications between unconnected systems made for slow resource sharing and inefficient collaboration between students and staff. The natural response was for SCU to build a state-of-the-art unified communications system.

SCU's Communications Upgrade

An up-to-date communications infrastructure is a necessity for every modern university. However, it would have been costly for each of SCU's campuses to build their own data centers and purchase communications equipment, and the institution would end up incurring an inordinate amount of maintenance work. In addition, as the campus infrastructure evolves, upgrades will be needed that will further impact internal and external efficiency.

Universities around the world are asking the following questions: How can we save costs and improve communication efficiency? How can we quickly build communication capabilities that align with our teaching requirements? How can we improve the teacher/student experience?

The answer to SCU's questions was to deploy

the Huawei Cloud Enterprise Communications (CloudEC) platform to build a high-quality teaching and office communications network.

The following features highlight the Huawei CloudEC platform:

- **High reliability:** Two CloudEC platforms working in active-standby mode are deployed on the Lismore and Gold Coast campuses to implement remote disaster recovery.
- **Efficient collaboration:** The CloudEC platform supports voice, video, and data convergence, and uses progressive communication to improve teaching and office experiences through HD videoconferencing, voice calling, and mobile office collaboration.
- **Reduced communications costs:** Local gateways are deployed at each of SCU's four campuses to local outgoing voice calling and local regeneration to reduce communications costs and ensure service continuity.
- **Maximized ROI and unified O&M:** Integrated Access Devices (IADs) are deployed to connect legacy analog phones and fax machines to the

new network, ensuring continued Return on Investment (ROI) and achieving smooth service upgrades.

- **Unified network management:** The web-based, unified eSight network management system supports centralized provisioning plus rights-based and domain-based management to simplify O&M and allow SCU's network administrators to focus on higher value assignments.

- **Automatic IP phone deployment:** IP phones affect plug-and-play convenience by automatically seeking the host server and configuring themselves accordingly.

Following the deployment of the Huawei CloudEC platform, students at the Coffs Harbour campus are now able to remotely attend courses taught by teachers located at the Sydney campus

and attend course lectures in real time. Cross-disciplinary and cross-regional research centers will collaborate more efficiently. Researchers at the Marine Research Ecology Centre and the Centre for Coastal Biogeochemistry Research will better communicate research results, share research experiences, and encourage additional research.

Full and efficient connections are only the first steps in the digital transformation of higher education. In the future, SCU will continue to innovate and use cutting-edge technologies to promote the development of teaching and scientific research to improve the teaching and living experiences for faculty and students. SCU has become the guiding star of Smart Education in the southern hemisphere. ▲

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Huawei Cloud Enterprise Communications platform helps Australia's Southern Cross University to build efficient teaching and office communications systems:

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- Reduced communications costs: Local gateways are deployed at each of SCU's four campuses to reduce communications costs and ensure service continuity.
- Maximized ROI and unified O&M: IADs are deployed to connect legacy analog phones and fax machines to the new network, ensuring continued ROI and achieving smooth service upgrades.
- Unified network management: The web-based, unified eSight network management system supports centralized provisioning plus rights-based and domain-based management to simplify O&M.
- Automatic IP phone deployment: IP phones affect plug-and-play convenience by automatically seeking the host server and configuring themselves.

Industry Pioneers'
Digital
Transformation



Huawei & Max Planck Institute

FusionServer Solution Allows AEI to Double the Overall Computing Power of Atlas

A growing number of industry pioneers choose Huawei as digital transformation partner



LEADING NEW ICT



Huawei Helps the Max Planck Institute for Gravitational Physics Enhance its Computing Resource

AEI's scientists carry out specialized, highly complex algorithms which need immense amounts of computing power to run. The Huawei FusionServer solution has allowed AEI to double the overall computing power of Atlas and has significantly improved their ability to perform follow-up analyses of gravitational wave signals.

The Max Planck Institute for Gravitational Physics, also known as the Albert Einstein Institute (AEI), was founded in 1995 for the purpose of carrying out research into the fundamental laws of gravitation. As part of this, its Observational Relativity and Cosmology (ORC) division, based in Hannover, Germany, is focused on the direct observational consequences of Einstein's General Theory of Relativity, and its relationship to astrophysics and cosmology.

This work is very compute-intensive and its success is highly dependent on the amount of computing power available to process the observational data. For this reason, one of the central activities of the ORC team is to maintain and increase the group's computing resources. Its main responsibility is to manage the Atlas computing cluster, the world's largest and most powerful resource dedicated to gravitational wave searches and data analysis.

How to Meet the Growing Demands for More Processing Power

With growing demands for more processing power, the Albert Einstein Institute needed to find a cost-effective solution to upgrade

its world-leading Atlas computing cluster.

It's vital that the power of Atlas is not only maintained, but can be easily expanded to handle the increasing requirements of the data analysts using it. Dr. Henning Fehrmann, Cluster Administrator, AEI ORC, explains: "The work our scientists carry out is very detailed and is built on highly complex special algorithms which need immense amounts of computing power to run. With the second stage of an important project about to start, we were asked to increase the capacity of Atlas so it could be completed successfully."

As with any publicly funded body, the ORC team also has to work to a very tight budget. As such, it is very aware of being accountable for what it spends and the need to demonstrate value for money in any purchase it makes. With this in mind, a public tender was issued to find a solution that would best meet its requirements in terms of both price and performance.

Huawei FusionServer Doubles the Overall Computing Power of Atlas

Several responses were received proposing solutions built on equipment from various leading vendors. Each was evaluated against



a list of pre-defined requirements with the Huawei solution, offered by IT distributor Go Virtual, standing out as the one that most closely met what it was looking for.

The Huawei FusionServer RH1288 V3 is a general-purpose rack server designed to support a range of data intensive applications. It features High-Performance Computing (HPC), large storage capacity, low power consumption, with high scalability and reliability, and is easy to manage and deploy.

Its small size means that double the computing capacity can be housed in a conventional rack, potentially saving up to 50 percent in location costs.

“We knew that the on-going running costs of the new servers were also an important factor for AEI. With a combination of very energy-efficient power supply units and simple management and maintenance, the FusionServer more than meets this need,” says Dr. Hans-Joachim Hinz of Go Virtual.

Go Virtual completed the installation of the solution in three phases and everything went to plan. A few minor problems were experienced but they were dealt with quickly. The Huawei support team provided support every step of the way, from the initial architecture design through to final commissioning.

“The cluster extension with the new machines has allowed us to double the overall computing power of Atlas and has significantly improved our ability to perform follow-up analyses of gravitational wave signals. We are very happy with the way everything has worked and are impressed with the professional support we have received. The free software for CMOS and BMC management has been an added bonus,” concludes Dr. Henning Fehrmann. ▲

(This case study first appeared in Storage Insider)

Customer Testimony

“The cluster extension with the new machines has allowed us to double the overall computing power of Atlas and has significantly improved our ability to perform follow-up analyses of gravitational wave signals. We are very happy with the way everything has worked and are impressed with the professional support we have received. The free software for CMOS and BMC management has been an added bonus.”

— Dr. Henning Fehrmann, Cluster Administrator, AEI ORC



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LEADING NEW ICT

Industry Pioneers'
Digital
Transformation



Huawei & Slovakia's CVTI

High-end Video Conferencing Terminals Start a New Chapter
in Visualized Digital Education

A growing number of industry pioneers
choose Huawei as digital transformation partner



LEADING NEW ICT

Slovakia's CVTI and Huawei Unveil a New Chapter in HD and Visualized Digital Education

The Slovak Centre of Scientific and Technical Information (CVTI) chose Huawei to help implement the Smart Education project with the hope of achieving the following goals: quality education resource sharing, excellent remote teaching experiences, and more efficient communications throughout the entire education system.

How to Digitize Tools that Cultivate Wisdom

John Amos Comenius has been hailed as the founder of modern education in Europe, and has laid out the following basic principles: universal education, unified education systems, unified teaching materials, grades, classes, and the abolition of individualized teaching. His famous words — “books are the tools for cultivating wisdom” — truly reflects the human exploration of truth and the acquisition of knowledge during the Age of Enlightenment. As the founder of modern education, the influence of Comenius’ educational philosophy and model is far-reaching, and continues to this day.

Founded in 1919 and named after Comenius, Comenius University adheres to his educational principles and is widely recognized in the international scientific community for its universally acknowledged high-quality teaching. The university is not only the longest-standing and largest

comprehensive university in Slovakia, it’s also one of the oldest universities in Europe. This shows that Slovakia has accumulated plenty of expertise in the field of education. In fact, on the whole, Slovakia’s education has grown soundly.

In addition to Comenius University, Bratislava, the capital of Slovakia, is also home to the Slovak Academy of Sciences. Those Slovakian students who have not received higher education through universities can receive education from supplementary and post-secondary education institutions to improve the knowledge and skills needed to qualify for high-value jobs.

Books remain an important cultivator of wisdom in the digital and intelligent worlds. However, books and teaching methods have entered the digital era, and education is set to undergo a transformation. Currently, many countries are promoting the process of education informatization,

Huawei's RP200 high-end video conference terminals can adapt to various remote education scenarios to successfully construct the diversified classrooms required by Slovakia's education system. >>

including teaching processes, teaching and research development, the informatization of resource construction measures, and education experiences — fully entering the digital transformation phase. The Slovak Centre of Scientific and Technical Information (CVTI) has taken the lead in enabling digital transformation in Slovakia.

CVTI is affiliated with Slovakia's Ministry of Education and is responsible for the construction of ICT infrastructure in the country's higher education field, covering the education and administrative systems of more than 40 universities. In June 2015, Slovakia's CVTI Smart Education project officially launched, and was designed to upgrade universities with functions such as remote teaching, High Definition (HD) online classes, and remote conferencing.

Huawei is committed to becoming a global ICT partner in the education industry, bridging the digital divide, enhancing teaching quality, and achieving modern ICT-based education through

an impressive array of efficient, flexible, and secure solutions.

The Smart Classroom Solution is now making contributions to basic education in numerous countries such as China, the U.S., Spain, Turkey, South Africa, and Macedonia. In light of this, CVTI chose Huawei to help implement the Smart Education project with the hope of achieving the following goals: quality education resource sharing; excellent performance, remote 1080p HD teaching experiences; and more efficient communications throughout the entire education system — covering universities, laboratories, and administrative organizations.

Huawei's HD Video Terminals Drive Comprehensive Upgrades for Slovakia's Education System

Huawei's RP series HD video terminals incorporate high-performance and cost-effective codecs, 12x optical zoom 1080p HD precision cameras, and digital microphone arrays.



Combined with full-HD displays and standalone speakers, the RP series terminals are placed on an integrated rack, which results in a single unit with a simple appearance that can be easily relocated. With a compact remote control and touch panel, users can enjoy consistent conference experiences anytime, anywhere.

Huawei's RP200 high-end video conference terminals can adapt to various remote education scenarios to successfully construct the diversified classrooms required by Slovakia's education system.

- High-end video conference terminals provide dual-screen displays. Presentation functions are added to traditional videoconferencing to improve teaching scenarios. For example, students located in Martin, Slovakia's former capital, can participate in off-site discussions and receive real-time teaching from professors in Bratislava.
- Multiple conference rooms can simultaneously connect to share high-quality educational resources and improve efficiency.
- 1080p HD cameras make interactions clearer for a more true-to-life experience. Blackboard notes and instructor facial expressions can be clearly seen by online students during remote lectures, which makes teaching livelier and helps students absorb information with more detail.
- Huawei's high-end video conference terminals are installed in administrative conference rooms and labs, which reduces travel costs and improves communication and cross-regional scientific experiment efficiency.

Education pioneer John Amos Comenius made the following point roughly 400 years ago: generally speaking, people forced into modern opportunities are busy with the new things they plan to make. However, their wisdom is increasing through various practices, and you could even



Huawei's RP series HD video terminals help Slovakia's CVTI unveil a new chapter in HD and visualized digital education:

- Adding dual-screen displays functions to traditional videoconferencing to improve teaching scenarios.
- Multiple conference rooms can simultaneously connect to share high-quality educational resources and improve efficiency.
- 1080p HD cameras make interactions clearer for a more true-to-life experience, help students absorb information with more detail.
- Reducing travel costs and improving communication and cross-regional scientific experiment efficiency.

say it is miraculously increasing day after day. Throughout history, there is not a single point in time when schools could be found in every corner of the world like they are today. Because of this, in the present, everyone is pursuing new things.

In the intelligent era, these 'new things' are bound to relate to intelligence and should become the pursuit of education, allowing smart education to enable learning from anywhere at any time. We look forward to Huawei and Slovakia's CVTI working together to achieve this goal. ▲

Industry Pioneers'
Digital
Transformation



Those Who Produce Parachutes Should Try Them Out First

Cloud Computing and Artificial Intelligence Empower
Huawei's Digital Transformation

211 of the Fortune Global 500 companies
choose Huawei as digital transformation partner



LEADING NEW ICT

Cloud Computing and Artificial Intelligence Empower Huawei's Own Digital Transformation

“Those who produce parachutes should try them out first.” Huawei applies digital transformation internally to experience all of its risks and difficulties first hand, which, in turn, teaches the company how to provide better value services for customers. That is why 211 enterprises in the *Fortune Global 500* (with 48 in the top 100) have chosen Huawei to be their digital transformation partner.

In 2018, Huawei ranked No. 72 in the *Fortune Global 500* with its global sales revenue reaching USD 94.3 billion (CNY 603.6 billion), a year-on-year increase of 15.7 percent. Currently, Huawei has about 180,000 employees, millions of partners, and operates over 900 branch offices in more than 170 countries and regions around the world.

It is Difficult for a Large ‘Elephant’ to ‘Dance’ Flexibly

A number of challenges were overcome to achieve its current status in the industry.

- **Lower R&D efficiency:** Huawei has a large number of mobile phone models and the process of compiling their Operating Systems (OS) was isolated. In total, the Android software system for Huawei involves about 100 million lines of core code, with some code reused across phone models. The effort to isolate OS development has required an inordinate amount of Research and Development (R&D), which impacted R&D efficiency.

- **Complex process:** Huawei's team previously displayed project delivery status on a wall and checked nightly; which was very inefficient. Later, Huawei enabled online delivery services, only to encounter a new set of problems. To complete all delivery

tasks, it was necessary for operating staff to log in to more than 20 Information Technology (IT) platforms, which led to many complaints from project partners.

- **Ineffective management:** In 2014, Huawei's Consistency of Inventory Accounts and Goods (CIAG) rate was about 78 percent. Inconsistencies detected between accounts and inventory at hand were calculated to cost Huawei over USD 9.38 billion (CNY 60 billion) due to time and manpower inefficiencies of conducting logistical and supply-chain management processes manually.

Many large enterprises around the world still face these same challenges, and year after year Huawei continues to achieve new levels of innovation and operations agility through digital transformation while maintaining double-digit growth in sales revenue.

Do digital transformation.

Efficient Operations by Elite Teams

Over the past 30 years, Huawei supported business development through the continuous implementation of IT-based transformations. Given the increasingly globalized nature, greater complexity, and increased uncertainty across the company's lines of business, Huawei decision makers concluded that a centralized management system

could not effectively respond to new challenges or realize Huawei's vision of 'bringing digital to every person, home and organization for a fully connected, intelligent world.'

Huawei believes that in the future, the model of elite teams operating under full authorization of frontline offices will be adopted. Therefore, the management architectures, operation processes, and IT systems of the entire organization will be changed to reflect this philosophy.

Against this backdrop, Huawei has proposed the following digital transformation objectives: In the next three to five years, Huawei will take the lead in building a digital enterprise environment (Digital Huawei) that implements elite team-centric operations supported through big platforms.

- Externally, Huawei will align with customer business goals and digitize transaction processes to provide Real-time, On-demand, All-online, DIY, and Social (ROADS) experiences for customers, consumers, partners, suppliers, and employees.

- Internally, Huawei will make each business domain digital and service-based, remove information barriers across domains, and achieve industry-leading operational efficiency.

Huawei's Nine Business Practices Light up the Digital Path

Huawei's digital transformation equips enterprises with

efficient operations for better development. Currently, Huawei has achieved digital transformation in nine core business domains, including R&D, sales, delivery, and logistics — and we hope our experience can light the digital paths for other enterprises, including partners and customers.

- **Global Collaboration Through Cloud R&D**

R&D is a critical business activity for Huawei. In the past decade, the company has invested more than USD 61.6 billion (CNY 394 billion) in R&D alone. At present, Huawei has 14 R&D centers, 36 joint innovation centers, 1,500 labs, and more than 80,000 R&D personnel around the world.

Traditionally, product R&D covers multiple aspects such as processes, tools, data, and compilation environments. For example, if engineers from global research centers (such as the Beijing Research Center, the European Research Center, and Huawei Technologies India Private Limited) jointly develop a high-end network product, they need to perform joint commissioning, apply for equipment to be requisitioned, build IT environments, and scout locations for new facilities. The entire preparation process can take a month or even several months due to siloed lab environments. Today, with the introduction of the Huawei R&D Cloud, new lab environments are streamlined and can be raised in the matter of days.

Huawei's digital transformation equips enterprises with efficient operations for better development. Currently, Huawei has achieved digital transformation in nine core business domains, including R&D, sales, delivery, and logistics — and we hope our experience can

Light the Digital Paths for other enterprises, including partners and customers.





Hosted on the Huawei Cloud, the company's current R&D Cloud decouples engineering development phases based on services. The emulation cloud, continuous integration cloud, design cloud, desktop cloud, antivirus cloud, test cloud, and analysis cloud are provided for R&D personnel. With 100,000 desktop clouds, Huawei has laid a solid foundation for comprehensive cloud-based R&D. The R&D process has been rebuilt to improve efficiency, including the management and allocation of millions of Virtual Machines (VMs) in a centralized manner. The result achieves a minute-level preparation environment and a 2.5 times rate of improvement for resource reuse.

Huawei has achieved a 50 percent reduction of operating cycle times and accelerated product launches by using collaborative R&D cloud operations across regions and globally — and have also rebuilt the R&D security architecture by isolating work groups both on and off the cloud.

Huawei also eliminated the isolation problem when compiling mobile phone OSs. Based on the R&D Cloud, engineers can share a public platform that reduces the time to compile all instances of Huawei mobile-phone software around the globe from hours to minutes.

By leveraging Software-Defined Networking (SDN) and cloud computing, we have flexible scheduling and the ability to quickly build R&D Lab-as-a-Service (LaaS) environments.

• **Sales Operations Using Big Platform Capabilities**

Compared with other services, sales often experience greater uncertainty and more digital challenges. In the past, after detecting slow business growth, frontline directors could not quickly determine whether the lack of growth was caused by errors with lead generation, failure to

fulfill project success goals, or problems with key account projects.

Huawei now delivers different user experiences based on specific roles within a sales team with the construction of a large support platform that integrates collaborative spaces, project management services, knowledge platforms, and expert resource platforms. For example, the command system provides a visualized digital experience for managers; the operations system allows project managers to operate sales projects both online and offline; and the automation system provides online automatic and intelligent operation experiences for contract and commercial personnel — the results are improved team collaboration, greater business operations efficiency, and a higher quality frontline user experience.

At present, sales managers at all levels can view real-time operation status for more than 200 subsidiaries across all 170 countries using their mobile phones. The effect has been a gradual increase in the efficiency of a worldwide, collaborative sales operation.

• **Real-time and Visualized Integrated Service Delivery**

Huawei executives, customers, and partners agree that digital transformation has brought the biggest changes to a complex delivery services process that involves implementation, acceptance, project management, outsourcing management, and resource management.

By integrating outsourced management, site acceptance, receiving, technical support, and resource and personnel management into one operations platform, Huawei has built a one-stop delivery platform plus a series of IT equipment under a service-oriented architecture for delivery personnel. This helps apply online, real-time,

visualized, and efficient frontline service delivery. For example, Huawei's Xi'an delivery command center uses large screens to greatly improve service delivery efficiency by displaying the status of global delivery project execution at each site.

Huawei delivers to millions of sites each year and each site has hundreds of check items. Manual review would be time- and labor-consuming, so Huawei turns to intelligent machines that take less than one minute to inspect items like antennas, ground cables, and Baseband Units (BBU) — and at present, these scenario-specific intelligent machine audits have been verified and widely promoted worldwide.

Digital delivery cannot be achieved without partner and customer support. For example, in Indonesia, Huawei delivers 300 sites on average by more than 1,100 construction teams using more than 300 shipment vehicles every day, covering more than 1,000 islands.

- **Global Manufacturing Operations and Command Centers**

Production plan accuracy is often the most difficult control item for any manufacturer, including Huawei, because — as with fresh seafood, mobile phones have a short shelf life, and an incorrect manufacturing plan that produces millions of unsold phones is always a disastrous result.

In Huawei's global manufacturing Operations and Command Center, the company has integrated global supplier status information and market requirements in a service-oriented manner.

Huawei built a real-time decision-making system for each business scenario, which supports supplier material warnings, big data quality warnings, predictive maintenance, intelligent cloud diagnosis, software cloud management, and test network security monitoring.

For example, such corrective warnings can be dispatched to the manufacturing process in a timely manner if quality issues are detected during product testing. The system can manage batch replacement and the quality of materials through big data analysis.

ABB robots are successfully connected to Huawei's eLTE-U solution at the company's manufacturing base at Songshan Lake in Donguan, China, and their status and alarm data can be sent back to headquarter in real time, providing big data for preventive production-equipment maintenance.

First Pass Yield (FPY) is an indicator of a production line's product quality. Due to complex business scenarios and large data volumes (traditional business scenarios were tailored to process-level real-time calculations), the FPY calculations for Huawei device manufacturing were consuming excessive amounts of time. High-performance computing platforms enable the FPY to be calculated in real time (using data integration, cleaning, and display), and manufacturing operations monitoring can be visualized.

In the future, the manufacturing industry will embrace intelligent decision-making with the assistance of high-performance computing and Artificial Intelligence (AI).

- **Smart Logistics and Digital Warehousing**

Huawei has four supply centers to support high-value product and parts distribution to more than 170 countries — and in the past it was difficult to obtain up-to-date transfer status information. Huawei has now implemented network data access and visualized inventory management for more than 100 warehouses around the world. And at the same time, Huawei's overall CIAG rate and asset operations efficiency have been greatly improved.

Huawei's crucial digital transformation measures for key logistics nodes include:

The smart logistics and digital warehousing project at the supply chain logistics center in Songshan Lake is a good example for gradually increasing profitability. The project is a preliminary implementation for visualizing the entire logistics process, for which a series of products have been developed for sending and receiving route reservations, loading simulations, and adding Radio Frequency Identification (RFID) tagging applications that enable real-time asset tracking.



- **Supply centers:** Providing online automatic reservation platforms that enable logistics service providers to make appointments in less than a minute and visualize preparation, delivery progress, and pickup.



- **International freight:** Integrating external big data updates for maritime shipping data every four hours and air freight data every hour — which extends the number of intermediate status nodes to 10.



- **Central warehousing:** Automated, unattended warehouse operations with Closed-Circuit Television (CCTV) monitoring to provide secure and improved Operations and Maintenance (O&M) for any scenario.



- **Customer service:** Driver and customer visualization tools improve order tracking, and five tools (including verification codes, Mobile Proof of Delivery (MPOD), Quick Response (QR) code scanning, and electronic signatures) have been recently launched to improve service accuracy based on customer scenarios.



- **Site delivery:** A full range of visual tools, including collaborative algorithms and six visualized control center nodes to improve the efficiency of local deliveries.

Key warehouses use Huawei's broadband and narrowband eLTE wireless communication and IoT platforms to manage logistics automation devices such as Automated Guided Vehicles (AGVs) and automatic scanning machines. Trays, forklifts, and other assets are connected to narrowband IoT networks, and key warehouses have applied functions such as automatic inventory tracking, automatic counting, accurate asset placement and tracking, and fast digital warehousing.

Huawei has actively introduced AI into internal and external logistics activities to support the company's production base in Shenzhen to deliver large numbers of products to project sites worldwide every day.

High utilization packing-space rates can greatly reduce operating costs, and Huawei has successfully increased the packing rate by 8 percent by using an intelligent packing algorithm. The company is committed to improving volume-estimation accuracy through machine learning where models refer to overall configuration information from historical shipment data, adopt basic tally and packaging rules, and create pre-warning alerts for new codes. These efforts have increased shipment accuracy from 40 percent to 80 percent, and quotation accuracy from 30 percent to 70 percent.

Currently, Huawei has introduced Cloud Enterprise

Intelligence (EI) to logistics and warehousing operations to further improve efficiency and reduce costs. The results show that EI technologies are improving sorting and packing efficiency by 20 percent and reducing exceptional costs by 30 percent through logistics path-planning.

- **Quick Settlements and Automatic Payment**

Huawei has over 200 subsidiaries that operate in more than 130 remote offices around the world. Administratively this requires legal compliance with three different accounting standards (China, international, and local) for each office. In the past, the subsidiary accounting process was long and complex.

Huawei can now monitor global closings, including the ability to track and manage complex processes by adopting the following measures:

- Transaction accounting automation.
 - Enterprise Resource Planning (ERP) optimization, including cross-Set Of Books (SOB) closings, cross-SOB entry book generation, and fewer manual account closings.
 - Data scheduling optimization (one-day, multi-time schedules plus automatic periodic schedules).
 - Data quality monitoring (pre-transaction data quality check).
 - Improvements to data-analysis-platform performance.
- Payments are an important part of finance, and Huawei

has a wide spectrum of businesses and a large amount of data in over 70 systems that require staggered payment times and different sums. In the past, the entire payment process employed a six-layer management mechanism — including invoice receipt and scanning, bookkeeping by the accountants responsible for preparing notes, bookkeeping by the review accountants, bookkeeping by the payment accountants, audits, payments, and daily reconciliations — that was processed by manual comparison, which caused low efficiency and frequent errors.

Using a high-performance computing platform, Huawei has shifted from manual to automatic payment processing, and in so doing has improved the security and efficiency of the accounts payable department. Automatic payments have reduced the error rate to 0.0032 percent, shortened IT system convolutional calculation time, and reduced historical billing data monitoring time from nearly 3 hours to 5 minutes.

- **Fully Connected Collaborative Offices**

Currently, about 180,000 employees of Huawei are distributed among more than 1,000 offices around the world, and their daily work involves interaction with various types of application software. In the early stages of mobile offices, multiple-siloed mobile Apps were constructed to quickly meet service requirements. Incomplete applications integration resulted in an inconsistent user experience that required multiple, independent Apps for instant communication, email, information bulletins, document processing, and service approvals. Further, communication with customers and

partners had to be conducted via offline conferences, telephones, and emails. The situation was very inefficient for everybody.

To solve the many problems, Huawei built a cloud-based, mobile, and fully connected collaboration platform, WeLink, to connect people and devices with knowledge and services.

WeLink integrates advanced collaborative services and technologies like instant messaging, email, video conferencing, live video, knowledge base, task management, and intelligent devices to improve the overall efficiency of individuals, team collaborations, and cross-region collaborations.

For example, WeLink videoconferencing has been integrated into multiple scenarios such as Huawei's remote acceptance, remote customer communications, and remote interview sites to empower Huawei employees with real-time internal and external communications. This means employees take fewer business trips, which in turn reduces costs.

WeLink was designed in 2016 and released in early 2017. The system currently logs 120,000 active users in 170 countries every day, and is a great demonstration for a higher level of work collaboration among Huawei employees.

- **Huawei Smart Campus**

Huawei's campuses are located in more than 170 countries and regions.

With the need to manage more than 4 million connected objects in more than 170 countries or regions around

3 days

The draft for each monthly financial report is completed in three days

5 days

The final report is delivered on the fifth of each month

11 days

Annual reports are completed in 11 days

1.53 million

In 2017, Huawei delivered 153 million smartphones (including the flagship 'Honor' series)

1 million

Has a demonstrated capacity of processing 1 million orders an hour

10 billion

has a demonstrated capacity of processing 1 million orders an hour and has recorded sales revenues of USD 10 billion (CNY 64.4 billion) per day

the world, there was a clear need for Huawei to build a Smart Campus platform for internal use. In the past, all local security, facility management, and other campus subsystems were built independently, which caused the following problems:

- Difficult data integration and application convergence.
- Failure to cope with increasingly complex security events and inability to meet required management policies.
- Out of proportion manpower costs for analysis and processing due to limited applications intelligence.

Moving forward, Huawei is in the process of aggregating 24 separate campus subsystems to establish a global-unified digital operations center for more highly streamlined data that will improve security protection, response speed, and the quality of service experience.

Huawei has built a fully connected digital campus, which includes an ICT infrastructure, a digital enablement platform, and an Intelligent Operations Center (IOC). The digital enablement platform integrates multiple platforms: including video cloud, big data, integrated communications, IoT, and other supporting platforms such as the GIS/BIM and application engines to create a unified database. In this way, the digital enablement platform will operate on the ICT infrastructure to aggregate multi-dimensional data and provide unified interfaces for upper-layer IOC applications.

The Huawei Smart Campus has changed corporate campus service operations from plan-based control to on-demand supply. The effect brings a significant change by matching supply with demand. The goal of the Smart Campus is to fully connect people, objects,

and environments to construct secure, smart, and green campuses for different scenarios.

Taking the pilot Smart Campus at Huawei's Shenzhen HQ training center as an example: Since the project was launched, incident response times have shrunk from an average of 7.5 minutes to 2 minutes, and the incident handling efficiency has shown a 50 percent improvement; energy efficiency was increased by 10 percent; and the lifecycle of terminal devices was extended by 10 percent. Overall, the intelligently organized experiences of employees and visitors on campus have noticeably improved. Currently, this solution has been put into commercial use in Huawei's three campuses and the success has accelerated the determination of the company to deploy the internal Smart Campus solution worldwide.

• Mobile Phone eCommerce

In 2017, Huawei delivered 153 million smartphones (including the flagship 'Honor' series) in part by leveraging online channels that delivered an impressive sales performance. Huawei built an intelligent online transaction system, iDeal, that employed an IT architecture with decoupled front-end, middle-end, and back-end layers for efficient order handling. iDeal has a demonstrated capacity of processing 1 million orders an hour and has recorded sales revenues of USD 10 billion (CNY 64.4 billion) per day. To be specific:

- The front-end system provides a ROADS experience to meet different requirements for Business-to-Business (B2B) services (for carriers and large partners), Business-to-Partners (B2P) services (for distributors), and Business-to-Consumer (B2C) services (for consumers on Vmall,

third-party open-platform malls, and other websites), and supports ‘store openings’ within one to two weeks on a third-party open platform.

- iDeal leverages Huawei’s internal capabilities (such as supply and finance) and third-party ecosystem capabilities (such as logistics and payments) to implement intelligent, automatic, and end-to-end transaction processing.
- The back-end system integrates manufacturing, accounting, and auditing to support the implementation of BP/C transactions.

Transformation Instrumentation — New ICT

“Those who produce parachutes should try them out first,” said Huawei Rotating CEO Guo Ping at Huawei Connect 2017, in Shanghai.

In keeping with Mr. Guo’s truism, Huawei applies digital transformation internally to experience all of its risks and difficulties first hand, which, in turn, teaches the company how to provide better value services for customers.

Huawei’s nine core business practices have been operationalized by deploying the company’s leading ICT products and solutions — including innovative digital platforms such as cloud data centers, campus networks, network security, video cloud platforms, converged communications, Edge Computing-Internet of Things (EC-IoT), and eLTE broadband wireless access platforms.

• Cloud Data Center

Through innovations in silicon chips, packaged products, and system architectures, Huawei builds and delivers the industry’s most complete cloud data center solution — that provides supreme performance in multiple aspects, such as OceanStor Dorado V3 all-flash storage appliances with 0.5 ms latency and 99.9999 percent availability, and the CloudEngine data center switch that supports fully programmable 100 Gbit/s networks.

Using its distributed data center and network solutions, Huawei has built eight global ‘service circles’ that provide 100 millisecond access to end-users from anywhere in the world.

Following the principle of ‘one egress for one country,’ Huawei has deployed more than 400 local access lines worldwide. Greatly simplified data center networks that achieve automatic network deployment and intelligence using SDN are built using Wavelength Division Multiplexing (WDM) and passive optical components that reduce the number of deployed optical fibers to a fraction of what would have once been required — and with greatly reduced power consumption.

• Video Cloud Platform

Under the design concept of ‘one cloud, one data lake, and one platform,’ Huawei has built an open, shared, and intelligent video platform with cloud computing and a video big data ‘lake’ as the core.

Videos, images, and existing data are aggregated on one platform and shared between multiple service departments. The platform decouples data from departments and enables them to transform from passive response and hour-level innovation, to proactive prevention and real-time innovation. The Huawei Video Cloud can quickly identify an employee based on nearly 20,000 facial images and allow them to enter the campus within one second, just by scanning their faces.

Both Huawei’s core business transformation and differentiated ICT products and solutions are gradually converging cloud computing and AI technologies to make businesses and products smarter. How does Huawei apply the two technologies?

Build a ‘Multi-Cloud’ IT Platform

The diversity and complexity of Huawei’s business has required the development of a ‘multi-cloud’ enterprise IT system architecture in order for the company to thrive.

Like many government agencies or other global companies, Huawei came to the decision that building a private cloud was the key to managing growth and securing critical business data.

After more than 20 years of construction, Huawei has Enterprise Resource Planning (ERP) software packages

Finally, from an overall perspective, cloudification is only a single step. One priority of enterprise IT systems is to improve customer satisfaction, business operation efficiency, and user experiences through results-oriented improvements, and integrate internal and external capabilities to

achieve IT-as-a-Service.



and physical machines that share capabilities for the improvement of IT asset utilization — and has now moved those applications and IT infrastructures into the cloud to the benefit of company business.

First, enterprise cloudification is a gradual process. ERP in the cloud will not transform into something completely new, but will blend into the background as a backbone application. Second, Huawei has actively embraced more than 10 public cloud services and deployed either non-critical services or those that require elastic resources. For example, we have adopted Office 365 in our daily work, and Salesforce for sales services. And on November 11 each year — known in China as Singles Day — Vmall uses Huawei cloud services to meet the resource elasticity requirements for mobile phone sales.

To support digital transformation, Huawei IT systems must have multi-cloud management capabilities, and making IT systems compatible and collaborative with on-premise software package applications and innovative cloud applications has been a long-term challenge for Huawei. The company is addressing these challenges in the following ways:

- **First — Follow to the ‘On Premise + Cloud’ Strategy**

At present, we believe this strategy is a good choice for protecting investments, ensuring service stability, and completing the cloud transformation of enterprise IT applications. During application cloudification, on-premise software packages will be preserved as the IT-application backbone, play an important role while innovative cloud

applications are created and deployed, and on-premise software packages and cloud-based applications will coexist indefinitely.

- **Second — Provide Enterprise IT Systems with Multi-Cloud Management Capabilities**

Integrating and scheduling cloud services from multiple providers to support businesses through multi-cloud management is an important strategy for Huawei IT cloudification. Our goal is to integrate multi-cloud resources and services, leverage multi-cloud advantages, reduce cloudification costs, provide seamless multi-cloud environments, and ensure information asset security.

Although different from the hybrid cloud strategy that focuses only on the integration of private and public clouds, Huawei’s multi-cloud management strategy also enables connectivity between public clouds and solves problems that emerge when multiple public and private clouds coexist.

The three core capabilities of Huawei IT ‘multi-cloud management’ are: Multi-cloud secure access, multi-cloud service management and agent, and multi-cloud application development and integration. In this way, Huawei can more quickly respond to business requirements, adapt to changes, and achieve rapid business expansion around the world.

Finally, from an overall perspective, cloudification is only a single step. One priority of enterprise IT systems is to improve customer satisfaction, business operation efficiency, and user experiences through results-oriented improvements, and integrate internal and external capabilities to achieve IT-as-a-Service.

In the past, it would be enough if an 'elephant' could 'dance' while in the digital age, the 'elephant' might also need to 'do hip-hop dance'. We must actively embrace digital transformation because time and tide wait for no person. >>

Service Middle-end Based on Big Data and AI

The 'turning point' of enterprise applications has come, and in recent years we have witnessed significant breakthroughs such as AlphaGo Zero, TensorFlow, and Huawei EI in AI algorithms and computing capabilities.

Enterprises are determined to use big data and AI to solve problems, and currently, many have prioritized data collection and applications. However, large amounts of data are located in silos formed by isolated enterprise applications. Although some enterprises have achieved data interworking and sharing, because their data has not been classified it is not feasible to apply a single policy that is applicable for all of it.

Huawei prepares for the effective use of data with the following approaches: Unify databases and governance policies, build big data analytics, and AI platforms, and provide big data and AI services.

First, Huawei has formulated an overall data governance strategy: Driven by data, Huawei plans unified enterprise big data platforms that manage data on four planes to build a foundation for enterprise digitization.

- **Transaction plane:** Use relational databases to process contracts, orders, and other transactional data to maximize the advantages of relational databases in business logic and transaction processing.
- **Computing plane:** Offload high-value transaction data with complex computing logic to high-performance, in-memory computing and analysis hardware to support real-time decision making.
- **Analysis plane:** Build big data analytics platforms to support large-scale unstructured and semi-structured data processing.
- **Search plane:** Respond to large-scale

structured and unstructured hybrid data acquisitions and high-concurrent queries in a timely manner.

Second, using open-source software technologies, Huawei has built a 'service middle-end system' based on big data analytics and AI that includes AI services, AI training and reasoning models, and big data analytics services.

In addition, Huawei has built a company-level, unified database for the central management of enterprise transactions and third-party data, including access to mass ERP data from service centers through Xdata access and conversion.

On top of this, Huawei will build 'AI-Inside' full-stack products and solutions to improve competitiveness for cloud, pipe, and device platforms. Huawei's three-dimensional AI architecture includes full-stack AI deployment and applications that cover chips, algorithms, products, networks, cloud services, and O&M.

The future evolution of digital transformation remains uncertain. However, one thing is clear: Enterprises must actively embrace digital transformation to survive and thrive. According to IDC's survey on the global top 2,000 enterprises, 67 percent of CEOs worldwide made digital transformation a core strategy in 2017. As of July 2018, 211 enterprises in the *Fortune Global 500* (with 48 in the top 100) have chosen Huawei to be their digital transformation partner. We expect that more enterprises will collaborate with Huawei on the road to digital transformation and build a smarter world in the future.

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