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MGI

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HUAWEI CONNECT 2018

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Let's Activate Intelligence

At the end of 2017, Huawei redefined its vision and mission as "Bring digital to every person, home and organization for a fully connected, intelligent world". The industry interprets Huawei's new vision as a call for an intelligent world powered by artificial intelligence (AI).

Founded on ICT networks and driven by AI, the Fourth Industrial Revolution is leading us into an intelligent world where all things will sense, all things will be connected, and all things will be intelligent. In this intelligent world, all industries will be driven by data and shared intelligence.

By 2025, there will be 40 billion smart devices globally. A total of 86 percent of global companies will adopt AI, and data utilization rates will skyrocket to 80 percent. Intelligence will become as ubiquitous as air, creating enormous opportunities. Looking back from 2025, we will see 2018 as the infancy of the intelligent world.

Currently, governments and enterprises vary greatly in IT infrastructure. Many remain in the stage of traditional operations and services, with less than 10 percent of enterprise applications deployed on the cloud. Data utilization by global companies is as low as 13 percent. And only 5 percent of companies have experimented with AI, with less than 1 percent having adopted AI.

Huawei will continue to invest in key enabling technologies, such as AI, cloud, big data, IoT, and 5G, and work with global customers and partners to connect the unconnected, bridge the digital divide, and integrate the physical world and digital world.

Themed "Activate Intelligence", Huawei Connect 2018 will gather the leading minds in ICT to chart the way forward into the fully connected, intelligent world. Huawei will announce its AI strategy and full-stack solutions for all scenarios. And together with our partners, we will present the innovations and best practices of a number of domains, including AI, cloud, big data, 5G, IoT, and video. Nearly 1,000 summits and forums and a massive 30,000 m² showroom will ensure an unparalleled range of content, insights, and game-changing technologies.

See you this October in Shanghai!

Sally Gao, Editor-in-Chief



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WHAT'S INSIDE

CON

Voices from Industry

01 iFlytek: The voice of AI



iFlytek believes that natural language processing and cognitive intelligence are the keys to AI reaching human-levels of intelligence. What are the strategies, partnerships, and solutions that are helping the company take AI tech to the next level?

06 MGI: The power of AI and genetic sequencing



MGI's Chief Operating Officer Dr. Jiang Hui explains how technologies such as 5G, cloud computing, artificial intelligence, and genetic sequencing will revolutionize healthcare and solve practical issues in precision medicine, bringing huge benefits to society.

11 Dunhuang: On the Silk Road with smart tourism and big data



Unlike other smart cities that focus on urban governance and services, smart tourism lies at the heart of Dunhuang's smart city model. The local authority has deployed ICT to boost income from tourists, manage crowds, and protect the areas historical sites, some of which are 2,000 years old.

TENTS

17 A slice of the 5G action with GSA



Joe Barrett, President of the Global mobile Suppliers Association (GSA), sat down with us to discuss the technical side of 5G, the latest industry trends, and some of the benefits we can expect to see. Find out what he had to say.

32 AI and the new wave of Enterprise Intelligence



Zheng Yelai, President of Huawei Cloud BU, describes the role AI is playing in the wave of digitalization that's redefining every industry vertical and outlines Huawei's vision of Enterprise Intelligence.

Perspectives

19 Building a Fully Connected, Intelligent World



In his keynote speech at Huawei Global Analyst Summit 2018, Rotating Chairman Eric Xu described Huawei's performance in 2017, expanded on Huawei's new vision and mission, and summarized Huawei's strategies.

26 Rising High from Cloud to AI



Huawei Rotating Chairman Ken Hu discusses how cloud and AI are reshaping the world. He touches on a diverse range of topics, including agriculture, traffic congestion, and copyright piracy, to show that, "At Huawei, we believe that the true value of AI lies in its practical application."

Tao of Business

35 How ICT can empower people and reduce inequality

41 How 3 stars are making life better around the world

Winners

45 Swisscom: Quick off the blocks with 5G

49 Cape Verde: Fixed on success with wireless

49 CMB creates value that Internet finance companies cannot match

61 ICBC (Asia) makes cross-border banking easy



“ The biggest difference between human intelligence and animal or machine intelligence is cognitive intelligence. It comes from our mastery of language and how we express knowledge.

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— Hu Yu, Executive President and Consumer BG President of iFlytek

iFlytek: The voice of AI

AI is on a clear upward trajectory and is reshaping all aspects of life. According to Hu Yu, Executive President and Consumer BG President of iFlytek, AI is starting to approach human intelligence. Serving hundreds of millions of users with its world-leading technologies, iFlytek started off as a pioneer in China's voice recognition industry and has now evolved into a global leader in AI. But it all started with a little twist of fate.

By Xu Shenglan, Xue Hua

From intelligent voice to Super Brain

Founded in 1999, iFlytek's primary goal was to make machines talk, something that even today is reflected in the company's mission: "We want the world to hear our voice." And that's starting to happen – the company is now at the forefront of the AI phenomenon.

Hu smiles as he recalls, "We had no idea at the

time that we were working on AI. At least we weren't sure what AI really was. We also weren't aware that 1999 was a bad year for AI, as the second wave of AI innovation had just peaked." Slightly tongue-in-cheek, he says, "If we'd known that AI was going to be such a tough business, we might never have started the company. I guess it was just fate."

Around 2004, AI wasn't the hot tech it is today, says Hu, but his team had come to realize that they were holding a key piece of AI. "The biggest difference





The cognitive revolution around voice and language is the peak of human intelligence and the biggest challenge for AI today.



between human intelligence and animal or machine intelligence is cognitive intelligence. It comes from our mastery of language and how we express knowledge, which allows us to do logical reasoning and complex decision-making,” he says. The cognitive revolution around voice and language, Hu believes, is the peak of human intelligence and the biggest challenge for AI today.

Hu is the leader of the iFlytek Super Brain Project, which was launched in 2014, “It’s much more than just a fancy name. We announced our definition of AI as computational intelligence.” He asserts that machines were much more powerful than humans since the day they were invented, citing AIs that play the board game Go as an example of computational intelligence. “Humanoid machines possess both perceptual intelligence and motion intelligence. That means they can see, hear, and feel the surrounding world. Today there are some impressive humanoid and animal-like machines,” he says. “However, the reason we’re at the top of the planet’s food chain is language, or ‘cognitive intelligence.’” According to Hu, one of the goals of the Super Brain Project is to evolve machines from the level of perceptual intelligence, where they can hear, talk, see, and recognize, to the level of cognitive intelligence, where they can understand and think.

Currently, Super Brain is using big data to train and

optimize its algorithms. They’re not trained by simply cramming all kinds of data into the system; instead, the system actively processes data from interactions in real-world scenarios, and uses that data to update itself. Hu believes this style of self-enhancement is like the ripple effect, where the volume of data grows exponentially as the product reaches more people, enabling his team to more rapidly iterate and optimize the product experience.

No shortage of awards

iFlytek boasts leading tech in areas like speech synthesis, voice recognition, voice assessment, and translation. From 2005 to now, the company has racked up 13 consecutive wins at the Blizzard Challenge, the world’s leading speech synthesis contest. It’s also won various machine translation championships, including the IWSLT 2014 and NIST 2015. Over the past six years, iFlytek’s voice recognition accuracy has improved from 60.2 percent to over 98 percent. The company’s strengths in voice tech became a natural bridge into the world of AI and its industrial application.

iFlytek is also researching the dynamic of AI and neurology. Through computing based on the human brain, iFlytek is trying to unlock the mystery of our intelligence. If they succeed, it may pave the way towards Artificial General Intelligence, meaning human levels of intelligence, one of AI’s holy grails.



Offering real-time interpretation between Mandarin and 33 other languages and Chinese dialects, iFlytek Translator also translates text in photographs and can be used on 4G or Wi-Fi networks or offline.



Translation on the fly

iFlytek started applying AI to the real world in the shape of natural language processing (NLP) back in 2010, when it developed China's first voice input product and the second of its kind in the world, after Google. iFlytek's system has an accuracy of more than 98 percent and supports 22 different Chinese dialects.

In 2016, iFlytek released its first smart device, the iFlytek Translator, which it followed up in April 2018 with the 2.0 incarnation. Offering real-time interpretation between Mandarin and 33 other languages and Chinese dialects, it also translates text in photographs and can be used on 4G or Wi-Fi networks or offline. Most of its users – 86 percent – use it on vacation. Translator 2.0 has also mastered the accents of four major dialects in China's complex and voluminous linguistic web: Cantonese, Sichuanese, Northeastern Mandarin, and Henan dialect, with support for more expected in the future. In an advance for NLP, the product can recognize different situations and adapt to its users' language tics.

"There are some who say that there's no need to build a translator device because the translation function can be integrated into a smartphone. But we made a deliberate decision to sell our translator as a hardware device," says Hu. First, he explains, we tend to hold our phones close to our faces, which might

not always be possible depending on the scenario. Second, phones are affected by ambient noise. Third, Hu believes that intelligent hardware must be easy to use. The best experience is something that works with a single click, but using an app on a smartphone isn't always easy or intuitive. Fourth, the translation process should allow for natural and intuitive interaction, and sticking your smartphone in someone's face isn't always socially acceptable.

In 2012, iFlytek launched its voice cloud platform as part of its efforts to build an ecosystem for the AI industry. Since then, more than 860,000 developers have worked on the platform, which connects 1.9 billion devices and provides nearly 4.6 billion interactive services each day.

In 2015, iFlytek launched the human-machine interaction interface AIUI, hitting a milestone in the AI industry. AIUI redefined the standards for human-machine interaction in the connected era. Hu adds, "In 2017, iFlytek was announced as one of China's first open innovation platforms for next-generation AI and our platform will focus on intelligent voice technology. The government clearly recognizes the importance of the ecosystem built on our company's AI."

AI: An industry enabler

iFlytek is also applying intelligent voice and AI technology

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In the intelligence era, all AI applications will run on the cloud. As cloud computing consumes a lot of resources, device computing and edge computing will better support AI.

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to different sectors, including the judiciary and education.

In the justice system, iFlytek is working with China's Supreme People's Court and Supreme People's Procuratorate (public prosecutors). In 2016, a test in Anhui Province showed that an AI system could identify phone scams with a very high level of accuracy. Moreover, a pilot study found that trials were 30 percent shorter when intelligent voice recognition was used instead of a human reporter.

In education, AI has outperformed all expectations in scoring test papers. In a test in Jiangsu Province, two different AIs scored a series of college entrance test papers. For Chinese essay questions, the two AIs differed by an average of less than seven points per paper. They were 92.82 percent consistent – more than 5 percent higher than the average consistency of two human teachers. A trial in Hunan showed similar scores.

iFlytek is currently working with China's National Education Examinations Authority to build an AI lab to jointly develop more advanced technologies for education.

A partnership covering multiple markets

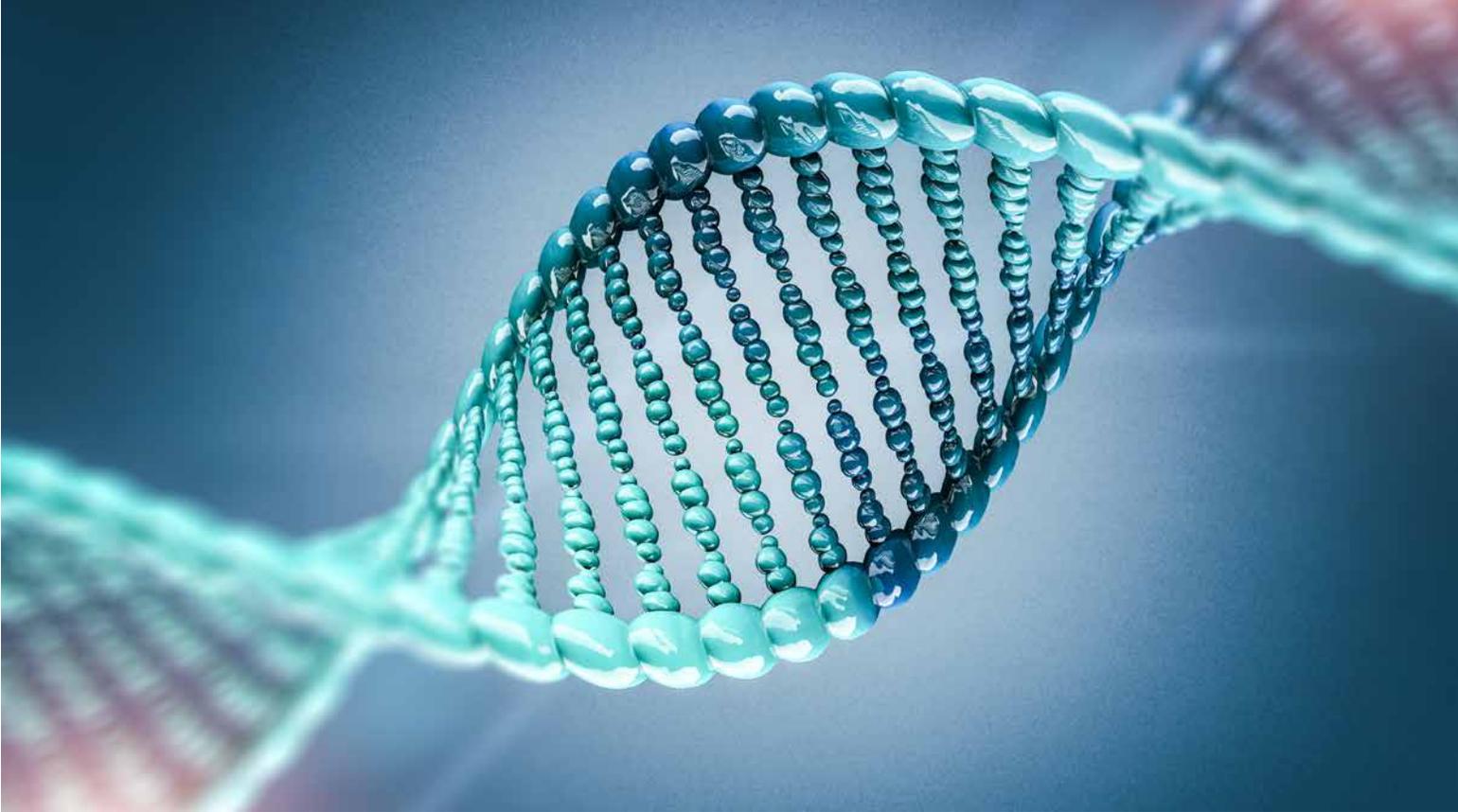
iFlytek and Huawei have formed a strategic partnership to develop practical applications for voice and AI

technology in the areas of telecoms and smart devices, building on nearly a decade of collaboration. In 2010, the two companies deployed the world's first open cloud platform for Chinese voice recognition.

In May 2018, Huawei and iFlytek signed a strategic agreement covering four areas: public cloud services, ICT infrastructure, smart devices, and office IT systems. Huawei also integrated iFlytek's AI technology into its smartphones to gain an edge over its competitors. Huawei and iFlytek are working on smart devices and device cloud services based on iFlytek's voice AI technologies and capabilities, including voice recognition, speech synthesis, iFlyrec, and iFlytek translation.

In the enterprise space, Huawei uses iFlytek's technology and products in its infrastructure and its own office applications. The iFlytek speech engine will form a key component of Huawei's Enterprise Intelligence cloud platform. Hu believes that in the intelligence era, all AI applications will run on the cloud. As cloud computing consumes a lot of resources, device computing and edge computing will better support AI.

Each with its own strengths and ecosystems, we're certain that Huawei and iFlytek will help build a strong AI ecosystem and make AI a valuable asset to life, business, and society. [www](#)



MGI: The power of AI and genetic sequencing

The illnesses a person experiences in their lifetime are to a large extent determined by genetics. But today, the predictive power of gene sequencing technology is becoming invaluable in preempting disease. MGI Tech's mission is to benefit mankind through genomic technologies. The BGI subsidiary focuses on developing instruments and equipment for the medical and health sectors, providing a range of real-time, full-scenario, and full-life-cycle digital devices. However, the resulting rise in data requires the right digital infrastructure to make these services a reality.

By Xu Shenglan, Xue Hua

Dr. Jiang Hui is Chief Operating Officer of MGI and vice president of BGI Research. She explained to us that gene sequencing technology can help solve practical issues in precision medicine, describing how innovations in digital technology – such as AI, 5G, and cloud computing – can help transform the medical

industry.

Genome sequencing is within reach

The human genome defines most characteristics of the human body, including the risk of suffering from



Everyone will be able to have a record of their own genetic data in full. 'All-in-one-day' is within reach – acquisition, analysis, and interpretation of genetic data completed in one day.



certain diseases. Knowing our genomes' features – or the flaws in our genes – can let us understand these traits and the odds of getting a given disease. Gene sequencing and data analysis can aid research on the relationship between diseases and specific gene forms and enable early detection and treatment.

Even in cases where certain gene-related diseases have already developed, gene sequencing can help find the genes that correspond to mutations, which can aid targeted therapy. In fact, this is an area of research in precision medicine.

“The concept of ‘precision medical treatment’ first appeared in the medical community in the US in 2011. The focus of precision medicine is not ‘medicine’ but ‘accuracy’,” says Jiang Hui. “Gene sequencing technology can be used to predict what diseases might develop in the future and thus better prevent them. We can carry out early diagnosis after a disease develops so diagnostic drugs can be used in a more targeted way.” As a result, she says, doctors can provide patients with the most appropriate treatment and drugs at optimal doses and times with minimal side effects, which in turn can help with post-treatment care.

In January 2015, US President Barack Obama

announced the Precision Medical Initiative in his State of the Union Address, increasing its profile and prompting projects to start popping up, including in China. In 2016, precision medicine was included in China's 13th Five-Year Plan on Scientific and Technological Innovation, sparking the rapid development of gene technology in the country. The main areas of focus are cohort studies of diseases, molecular classification and staging of diseases, personalized treatments, and big data collection and mining. In October 2017, MGI Tech launched two new high-throughput genetic sequencers, MGISEQ-2000 and MGISEQ-200, at the 12th International Conference on Genomics (ICG-12) in Shenzhen. At the same time, BGI launched the Genome Decode Program (GDP) and the Chinese Millionome Database (CMDB).

Jiang Hui says, “With these magical tools and the help of scientific research, next-gen gene sequencing technology has revolutionized cost. In the near future we'll be able to complete rapid testing on 24 tumor samples per day. In three years, we'll have 100 yuan (US\$15.6) genome sequencing. Everyone will be able to have a record of their own genetic data in full. 'All-in-one-day' is within reach – acquisition, analysis, and interpretation of genetic data completed in one day.”

After costs fall, ordinary people will be able to enjoy the benefits of genome sequencing. According to Jiang Hui, “China has a relatively high birth defect rate at around 5.6 percent. People can carry out various genetic tests before and during pregnancy and after birth to reduce and prevent birth defects. High-throughput sequencers can be used to perform embryo detection and post-pregnancy neonatal testing.” She believes that in the future, genome sequencing will offer infinite possibilities in both scientific research and clinical medicine, and even in fields such as agriculture, forestry, animal husbandry, and fishing.

Harnessing AI

The closer integration of AI and gene sequencing will help develop the industry. Many Internet giants have been crossing sectors to enter the genetics market. Google, in collaboration with DNAnexus, has set up a vast open genome database that is free to access. And AWS’s Cloud Database also provides similar open databases on its public data platform. Going forward, we will see more algorithms that can be used in genomic data analysis.

The global gene sequencing market is projected to reach US\$13.8 billion by 2020 at a compound annual growth rate of 18.7 percent. MGI has been successfully exploring gene sequencing and AI, with achievements in big data deep mining and applications. Jiang points out that, “With AI, we can develop more accurate disease and phenotype prediction models through the in-depth analysis of desensitized gene data.” This, she says, will help us build a more detailed genetic structure of the population and hopefully find new drug targets. For example, non-invasive prenatal genetic testing was originally used for screening fetal chromosomal disorders such as Down’s syndrome. Although it was not designed for detecting cancer, MGI’s big data and AI makes it possible to identify tumor signals in non-



“ With AI, we can develop more accurate disease and phenotype prediction models through the in-depth analysis of desensitized gene data.

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— Dr. Jiang Hui, Chief Operating Officer of MGI and vice president of BGI Research



The rapid rise in demand for healthcare and serious shortages on the supply side have driven the integration of technologies such as AI in the healthcare industry.



invasive gene detection data by analyzing millions of samples and genetic characteristics of tumors. “There have been more than 40 cases of gestational cancers discovered early through non-invasive prenatal genetic testing data, and dozens of families have benefited from early detection of the disease,” Jiang says.

By the end of 2017, BGI had run genetic tests for pregnancy on almost 5 million women, including more than 2.8 million non-invasive prenatal genetic tests, resulting in a detection and specificity rate of over 99 percent, including more than 38,000 fetuses with abnormal chromosomes. More than 1.53 million newborns and pregnant women have received genetic screening for deafness, which has prevented approximately 80,000 carriers from developing hearing losses.

Jiang Hui also points out that, aside from gene sequencing, huge potential exists for AI in other applications in the healthcare industry. She says, “China has 22 percent of the world’s population but only 2 percent of the world’s healthcare resources – a serious shortage. Statistics show that 80 percent of healthcare institutions in China are located in urban areas, with just 20 percent in rural and remote areas.” Most of the new, high-tech equipment and best medical professionals are found in big cities and large hospitals. There isn’t enough equipment and

staff to meet the healthcare needs of everyone, so resources are strained in large hospitals. The rapid rise in demand for healthcare and serious shortages on the supply side have driven the integration of technologies such as AI in the healthcare industry.

“In terms of the collection and analysis of objective data, AI is much faster and more capable than humans,” says Jiang, which is especially the case in medical imaging. “Because medical image data is relatively standardized, this lends itself very well to machine recognition and deep learning. Intelligent auxiliary diagnosis systems can slash the time physicians spend looking at panels by an average of 4.25 hours and increase accuracy to over 90 percent,” Jiang says. This not only gives doctors more time to enhance service levels but also “returns” them to patients, giving doctors more time to spend on treating patients. In addition, AI can integrate different data, such as genetics and imaging, which, she says, allows doctors to more comprehensively analyze correlations in different stages of diseases.

5G and cloud computing

in 2017, Shenzhen’s Luohu Hospital Group began trialing MGI’s remote ultrasound diagnostic system MGIUS-R3. The device expands the range of

application scenarios for ultrasound equipment. It can play a crucial role in remote or extreme environments or in community centers. This device overcomes the limitations of traditional ultrasound diagnosis and treatment methods, and is a potential way to even out the distribution of medical resources. Integrating genetic data and imaging data will provide equal access to high-quality precision medical services for all.

The bandwidth and latency demands of real-time remote-control applications, such as remote ultrasonic inspection and remote surgery, are extremely high. Surgeons' hand movements, image transmission, and force feedback require high levels of synchronization. This is difficult to achieve using current networks. To solve this problem, Huawei Wireless X Labs and MGI have jointly looked at using 4.5G/5G networks to provide signal and data connections for remote ultrasound robots to help doctors remotely control patient-end ultrasound probes for diagnosis.

4.5G/5G networks can provide several megabits of transmission bandwidth for the real-time transmission of audio and video and b-scan ultrasonography imaging. 4.5G/5G networks also support low latency, allowing force feedback signals of a patient's body surface to be sent back to a physician's haptic device in just a few milliseconds. 4.5G/5G networks can also send ultrasound images to the cloud to provide real-time analysis and multi-level assistance to doctors.

According to Jiang Hui, "With a remote ultrasonic diagnosis system supported by 4.5G/5G networks, a high-sensitivity force feedback system and scan diameters of 850 mm are possible. This meets requirements for scanning the whole body including heart, neck, chest, and abdomen." Moreover, the system's HD video and voice system enables specialists to communicate with patients unimpeded.

Ultrasound image parameters can be adjusted without any latency, supporting rapid, real-time diagnosis and making diagnosis and treatment more efficient.

Gene sequencing is moving from individuals to larger populations and from research to broad commercial application. Moreover, computational analysis models are also starting to be used online in the cloud, whereas before they were restricted to local, offline use.

"The cost of gene sequencing is falling, while data is being produced at a greater and greater speed. We can't build a large-scale data center capable of keeping up with the massive amounts of data being produced on our own," says Jiang Hui. "We produce 300 TB of data every month and we now have a total of 22 PB of data. How can we deal with this explosive data growth?"

She also states that the hospital needs to enable data sharing of "our national gene bank with our partners."

"Cloud computing meets these needs well," she says. "We've improved our storage performance by 25 to 30 percent through long-term testing and using the Huawei OceanStor 9000 cloud storage system. The time it takes to deliver reports to users has dropped from 15 to 7 days."

OceanStor 9000's unified file system and hierarchical storage management are also of great help to MGI's data lifecycle management and support non-invasive prenatal genetic testing services. "In the era of integration of IT and biotechnology, we want to join forces with Huawei to tap into more opportunities to benefit humanity using genomic technology," Jiang says. 



Dunhuang: On the Silk Road with smart tourism and big data

As an ancient hub along the Silk Road, China's Dunhuang started life as a meeting point for different people and cultures. Today, it's a popular tourist destination that blends a rich history with natural beauty for more than 9 million tourists a year – dozens of times the city's population of 200,000 and an impressive ratio even alongside China's main tourist cities.

By Xu Shenglan, Xue Hua

The service sector, in particular tourism, accounts for nearly 60 percent of Dunhuang's economy. Unlike other smart cities that focus on urban governance and services, smart tourism lies at the heart of Dunhuang's smart city model. "To build a smart

city, you need to find a focus," says Sun Xiaoqiang, Chairman of Dunhuang Smart Travel Company (DSTC). "And Dunhuang found its focus. We've used smart tourism as a lever to build a smart city." Founded in 2014, DSTC is responsible for executing and running the pioneering Dunhuang Smart City project.



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Smart tourism should be the engine that propels all of Dunhuang’s ICT infrastructure, marketing systems, urban management, public safety, and transportation planning.

– Sun Xiaoqiang, Chairman of Dunhuang Smart Travel Company (DSTC)

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Doing more with less

To build a sustainable smart city, DSTC moved away from “the old way of thinking of relying on government and finance,” states Sun. Instead, he says, the company explored a new corporate and social model that combines social capital and city resources. Sun believes that a focus on economic development and top-level planning makes it possible to unify, integrate, aggregate, and share all industry resources. “Under this concept, we’ve achieved a great deal with relatively few resources,” he says.

Today, visitors to Dunhuang enjoy a smooth tourist experience and convenient services that lets them experience the scenery rather than large crowds, even during peak season. Yet city leaders still face challenges. During the high season, masses of tourists are a threat to historical sites and visitor safety, while in the off season resources for tourism are woefully underused.

According to Sun, “Smart tourism should be the engine that propels all of Dunhuang’s ICT infrastructure, marketing systems, urban management, public safety, and transportation planning. Our goal is to provide smart tourism services, enable the smart management of scenic areas, and fully market tourist destinations.” Sun believes that this will provide the springboard for sharing resources along the Silk Road, which will in turn boost the regional economy and extend smart city infrastructure so it covers all public services.

Smooth and smart

Under Dunhuang’s new smart tourism model, tourists can book tickets for major scenic spots online and enjoy fast entry using QR codes. At the Mingsha Hill and Crescent Spring scenic areas, for example, online sales account for 35 percent of total ticket sales. A cloud terminal access management system allows visitors to enter and leave the area using a variety

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Fingerprint recognition technology has also been applied to electronic ticketing and multiple-entry tickets...the two sites clocked up more than 2 million visits in 2017 and tourist satisfaction levels exceeded 96.5 percent.

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of methods, including QR codes, identity cards, facial recognition, and fingerprints. Fingerprint recognition technology has also been applied to electronic ticketing and multiple-entry tickets. As a result of the increased convenience, the two sites clocked up more than 2 million visits in 2017 and tourist satisfaction levels exceeded 96.5 percent.

Advanced video alarm systems and visitor flow monitoring systems are installed at tourist attractions to catch ticket evaders through electronic access

poles. At the same time, a video surveillance system helps protect the lives and safety of sightseers. For example, in summer when surface temperatures at Mingsha Hill hit 45 degrees, the system can detect people suffering from heat stroke and enable first-aid to occur in the critical 10-minute window.

DSTC ensures full Wi-Fi coverage in high tourist traffic areas, which spans 43 hotels, theaters, and other attractions across the city. As Sun explains, “We’ve distributed Wi-Fi based on tourists stopping for ten



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Big data analytics is the brain of a smart city and the key to running a smart tourism system, managing and controlling tourism resources in scenic areas in real time.

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minutes as standard. Visitors to Dunhuang only need to authenticate once and the Wi-Fi signals follow them, which greatly improves their online experience.” DSTC also launched a mobile tour guide service for visitors, complete with interactive tours and mobile phone client services. The service provides info on attractions, electronic maps, navigation, and audio guides. In a virtual panorama display system, places of interest are virtualized, digitized, and connected, letting visitors quickly understand the area before they arrive.

The big data brain

Big data analytics is the brain of a smart city and the key to running a smart tourism system. DSTC worked with Huawei to build a big data analytics platform that manages and controls tourism resources in scenic areas in real time. It can generate tourist traffic models for peak times to facilitate precision marketing. By distributing information about tourist attractions across digital channels, DSTC has increased visitor numbers in the low season, optimized visitor traffic models, and shared regional travel data with other organizations, boosting the sustainable development of the tourism sector.

In the Mingsha Hill and Crescent Spring areas, the big data analytics platform revealed that visitor numbers

exceeded the 3,000-a-day mark 34 days earlier than the previous year and that the tourist peak season was extended by 112 days. Based on this information, the big data platform could better match tourist resources in the surrounding areas to visitors. This boosted 2017 visitor numbers to scenic spots west of Dunhuang by 15.78 percent year-on-year.

Sun explains, “The platform revealed that in 2017 group tourism accounted for less than 10 percent of visitors to Dunhuang. Ninety percent were independent sightseers, of whom 60 percent come in their own cars. We’ve been able to provide customized services to meet the specific needs of tourists with cars, including vehicle hire and package tours. You can build your own sightseeing passes, on-demand arrival services, and arrange car return to different locations.”

Protecting history and sharing resources

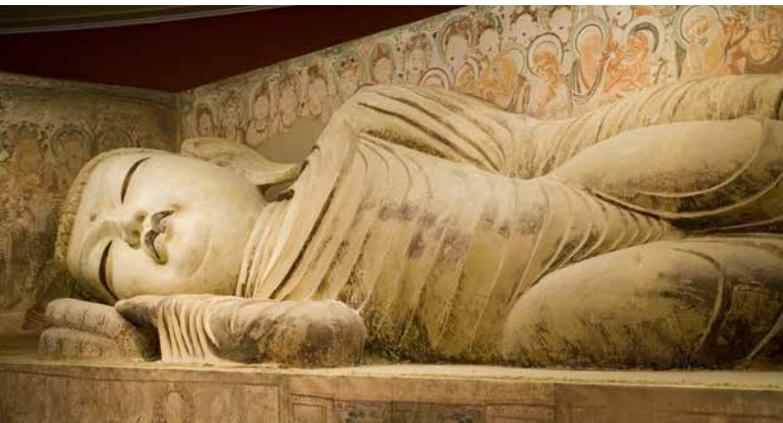
Massive tourist numbers can negatively impact historical sites and in some cases compromise tourist safety. A common solution is to restrict visitor traffic, but this negatively impacts user experience as well as the local economy.

For Dunhuang, getting smart was the answer.

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Thanks to a smart booking management system, the number of visitors to the Mogao Caves is forecast to drop from 30,000 to 6,000 a day, reducing the chance of potential damage to the site’s murals.

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Wireless sensors and other networking technologies are used for real-time monitoring, early warnings, and managing potentially damaging environmental factors such as sandstorms, floods, bad weather, and animals. And Dunhuang is home to some incredibly important sites that require protection, including the Mogao Caves, which according to UNESCO is acclaimed as “the world’s greatest discovery of ancient Oriental culture,” and the 2000-year-old Jade Gate, which served as a pass in the Han Dynasty’s Great Wall. New technologies have transformed protection efforts from salvage-based to preventative-based – a great win for cultural heritage.

DSTC has built up an extensive big data tourist resource pool that it shares with other stakeholders. It comprises

23 databases containing over 200,000 data points covering the Dunhuang manuscripts, the Mogao Caves, and research on Dunhuang. This has formed an initial, integrated system for sharing information that can help with cultural protection, research, and the promotion of Dunhuang. DSTC has also set up an intangible heritage database. This contains a digitized directory of 53 items of intangible cultural heritage, an inheritor system, and an AV manuscript information system.

Supplementing physical visits to sites like the Mogao Caves with an online experience that people can enjoy at home is an effective way to relieve pressure on sites caused by tourist surges during peak season. Thanks to a smart booking management system, the number of visitors to the Mogao Caves is forecast to drop from 30,000 to 6,000 a day, reducing the chance of potential damage to the site’s murals. “We’re able to determine opening times and maximum number of visitors for the caves by monitoring humidity and temperature, carbon dioxide concentration, visitor numbers, and the density of transport connections,” says Sun.

Tourism benefits all industries

The big data platform is the foundation of the new smart city. The time sensitivity and complexity of the smart city ecosystem places extremely high



Smart tourism has brought to life all of Dunhuang's different elements. But we must go further. We need to extend and replicate what we have done in Dunhuang to achieve smart tourism in Gansu and along the Silk Road.



requirements on the performance of big data analytics platforms. Openness and universality are also essential, explains Sun, "When selecting equipment manufacturers, we first considered unified hardware standards and high reliability. Huawei was able to meet our needs. As for software, we believe that it should be open. Smart tourism and smart cities are open, shared ecosystems."

The Feitian Cloud Data Center is Smart Dunhuang's unified foundation platform. Built using Huawei's cloud computing technology, the platform features solutions for data sharing, video sharing, geographic information, and big data analysis. It carries smart applications for travel, homes, transportation, government, management, and services, and features capabilities for personalized visitor experiences.

According to Sun, "We can promote industrial planning through the ecosystem to help the smart city become a self-developing and evolving organism." Indeed, Dunhuang's smart tourism has brought huge benefits to the region, revitalizing the car rental and hospitality sectors, and boosting local primary and secondary industries. "Smart tourism has brought to life all of Dunhuang's different elements," says Sun. "But we must go further. We need to extend and replicate what we have done in

Dunhuang to achieve smart tourism in Gansu and along the Silk Road."

Dunhuang was nominated for a Smart City Award at the 6th Smart City Expo World Congress (SCEWC) in November 2016, becoming the first Chinese city to become a nominee for this international award. Set up by the Spanish government, the World Bank, and other organizations, SCEWC is the world's leading smart city expo, and Dunhuang's nomination testifies to successes in planning, strategy, and execution.

"Smart Dunhuang 1.0 is 'an industry-focused smart city led by smart travel' and Smart Dunhuang 2.0 will have 'cultural Dunhuang' at its core," explains Sun. "After the tourists arrived, major investment projects followed and industry flourished. Dunhuang's profound cultural heritage is the next potential area of development for Smart Dunhuang. Dunhuang has a rich repository of human civilization and culture that can be digitized."

He believes that integrating, researching, mining, and processing this data will lead to the development of a new wave of industries, including innovation, incubation, trade, design, processing, logistics, finance, and settlement. "By creating a brand and standards for Smart Dunhuang, the potential for development is unlimited," he says. 

A slice of the 5G action with GSA

Joe Barrett, President of the Global mobile Suppliers Association (GSA), sat down with us to discuss the technical side of 5G, the latest industry trends, and some of the benefits we can expect to see. Here's what he had to say.

By Gary Maidment

WinWin: What disruptive changes do you expect 5G will create in different verticals?

Joe Barrett: There's going to be quite a lot of disruption because we're going to see new capabilities and new levels of service with 5G as a result of faster bandwidth, more capacity, and more granularity. And there will also be greater flexibility for enterprises and different companies to utilize just parts of the 5G system for new services. Whether its robotics or factory automation or autonomous driving, it's all going to play into new services for critical markets.

WinWin: What benefits will network slicing in 5G bring?

Barrett: Network slicing in 5G is going to create flexibility for operators to deliver unique services far more efficiently to their customers, because it means that there's no wasted spectrum. At the end of the day, that's where the limit is: spectrum. Network slicing will let operators deliver a very small slice of information, for example, through a sensor with NB-IoT in an agricultural scenario, or they'll provide a much wider slice for services like VR and AR. That flexibility in 5G is going to change the dynamics of

how operators deliver services to their customers.

What are your thoughts on the complexity of 5G networks?

Barrett: 5G should actually bring less complexity into the industry. The core network is going more software-based and therefore far more like IT infrastructure with software-defined networking (SDN) and Network Functions Virtualization (NFV) supporting the underlying physical infrastructure, cloudified access, transport, and core networks. That means the implementation and overall costs should over time fall, so we should see a cost-benefit with 5G as it rolls out over the next 5 to 10 years.

WinWin: What new infrastructure functions will 5G bring?

Barrett: There are some interesting new functions coming with 5G including MEC (mobile edge computing), which is bringing the functionality and the service closer to the end user and content closer to the point. That helps with latency in services where you need really fast control – robotics, for example, where you want to be able to have an instant decision made on an action.



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One of the things about 5G we will see is the mobilization of mobile. With drones, for example, there's no reason why you can't put a whole 5G network into a drone and deploy that in an emergency situation.

– Joe Barrett, President of the Global mobile Suppliers Association (GSA)

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One of the things about 5G we will see is the mobilization of mobile. With drones, for example, there's no reason why you can't put a whole 5G network into a drone and deploy that in an emergency situation. You can also have drones in agriculture, checking on livestock. Robotics and autonomous driving are also other examples, where you need information – you can bring a 5G network to where it needs to be. You can't do that today with the current structure.

WinWin: What spectrum challenges exist with 5G?

Barrett: One of the big advantages of 5G is the release of new spectrum: 6 GHz and above to 26, 28 and even up to 70 GHz, and that's going to give far broader bandwidth. It will enable smaller cells, more capacity, and more throughput, especially in densely populated areas where we have a need for very, very high bandwidth and multi-gigabit services. GSA is working with the GSMA on spectrum activities and we've established a global spectrum group, which includes Huawei. We're lobbying and consulting globally on new spectrum allocations, and trying to get as much harmonized spectrum globally, so it's easier for devices to work across multiple regions.

WinWin: What do you expect to see with spectral efficiency?

Barrett: 5G is also going to bring increases in data rates and we're going to see new techniques, especially massive MIMO. That's going to enable greater flexibility in delivering maximum capacity and maximum efficiency, so that you can reuse spectrum within the same cell and retarget services towards a specific spot. And there are other technologies like 256 QAM, not only on the downlink, but it's also being deployed now on the uplink in some cases. And we'll see that the new radio application within 5G will be far more efficient at managing the spectrum that's available.

What do you expect from vendors like Huawei?

Barrett: I think we've seen vendors like Huawei develop and drive the ecosystem. Not just devices, but also the whole network and expanding that out and supporting vertical markets, which is where there's a lot of need now when you think about things like robotics and factory automation. 5G is going to come into those places and companies like Huawei are really driving that capability and that niche side of the business. [www](#)



Building a Fully Connected, Intelligent World

Speech by Eric Xu at the Huawei Global Analyst Summit 2018

In 2017, our performance was in line with expectations. We achieved robust growth. Our sales revenue was 603.6 billion yuan, representing a year-on-year growth of 15.7 percent and a five-year compound annual growth rate of 26 percent. Our net profit was 47.5 billion yuan, for a five-year CAGR of 23 percent. Cash flow from operating activities rose to 96.3 billion yuan, with a five-year CAGR of 44 percent.

Revenue from our carrier business was 297.8 billion yuan, up 3 percent over 2016. Revenue from our enterprise business was 54.9 billion yuan, up 35 percent over the previous year. Our consumer business earned 237.2 billion yuan in revenue, representing year-on-year growth of 32 percent. Our consumer business and enterprise business were our two major growth engines, driving Huawei's ongoing rapid growth.

In recent years, we've emphasized the importance

of innovation in achieving future growth. Last year, we invested 89.7 billion yuan in R&D. That was 14.9 percent of our total revenue. From 2008 to 2017, our total R&D investment amounted to 394 billion yuan. We forecast that over the next decade, we will continue to invest about 15 percent of our annual revenue back into R&D every year. This will fuel ongoing innovation and, in turn, drive future growth.

The world is changing rapidly and profoundly impacting every person, home, and organization. These changes have brought new experiences, greater efficiency, and a new level of convenience in study, life, and work. However, not every individual, home, or organization around the world is enjoying the benefits that many of us do.

Individuals

Smartphones and the mobile Internet have produced a ton of value for everyone. These days we enjoy

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5 billion people still don't have smartphones and 4 billion don't have access to mobile networks. And 40 percent of people who have access to mobile networks lack access to mobile broadband.

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healthier lives and better entertainment. However, a lot of people still don't have access to these things.

Right now there are 3.8 billion smartphones in use around the world. However, 5 billion people still don't have smartphones and 4 billion don't have access to mobile networks. And 40 percent of people who have access to mobile networks lack access to mobile broadband. In many countries, mobile traffic per user per day may reach 10 to 20 gigabytes. But if we take a step back and look around the world, the global average is only 0.03 gigabytes of mobile data consumption per user per day. This is far from enough to meet everyday needs in life, work, and entertainment.

Many innovative technologies, like wearables, connected cars, augmented reality, and virtual reality, aren't been widely applied. According to our forecasts, there will be over 8 billion smartphones in use by 2025. The number of mobile users will exceed

6.5 billion, 80 percent of whom will have mobile broadband. There will be 440 million AR and VR users and 40 percent of cars will be connected.

Homes

Home broadband and home networks enable people to better interact with their families, receive better education, and enjoy more convenience in their daily lives. But many homes still don't have access to any of this. So far, only 40 percent of homes around the world have broadband access, less than 1 percent enjoy a Gbps per second broadband experience, and many home devices remain unconnected.

Smart home solutions aren't yet mature. For example, the penetration rate of smart robots is only 1.5 percent, and most robots are only able to do things like vacuum the floor. They're unable to provide at-home healthcare or satisfy the many other needs that users might have.



By 2025, it's our goal to see 75 percent of homes with broadband access, and at least 30 percent within range of a Gbps experience.



By 2025, it's our goal to see 75 percent of homes with broadband access, and at least 30 percent within range of a Gbps experience. The number of connected home devices will reach 20 billion and the penetration rate of smart robots will grow from 1.5 percent to 12 percent.

Organizations

Digital technology helps organizations work more efficiently and speed up innovation, but there are huge gaps in digital adoption between different industries.

On the whole, digital uptake is relatively low in most industries, especially traditional ones. Huawei is taking action to address this. For example, we worked with Shenzhen municipal government to roll out a safe city project that greatly enhances safety across the city. We have helped many enterprises and cities deploy intelligent innovations for preventive maintenance, flexible manufacturing, smart manufacturing, smart transportation, and smart city initiatives. These solutions are already delivering tangible benefits. And yet a huge number of organizations still aren't embracing these solutions. Why is that?

To start with, the development of network infrastructure is uneven worldwide. The private lines of 90 percent of enterprises are slower than 10 Mbps.

This type of bandwidth can't support digital or cloud services.

Second, the majority of organizations only have office networks. They haven't connected their production networks, products, and customers, let alone embraced digital production and smart manufacturing, or used digital technology for sales, service, and marketing.

IT infrastructure is also unevenly developed. Less than 10 percent of enterprise applications are in the cloud and only 13 percent of data is fully utilized. If we don't use data, it doesn't produce value. It'll just become an extra cost, not the fuel of new business opportunities in the digital age. AI is not widely used by enterprises either: only 5 percent have experimented with the technology, and less than 1 percent have used it in any meaningful capacity.

We estimate that by 2025, the majority of organizations will experience explosive growth in digital adoption. By then, 85 percent of enterprise applications will be in the cloud, 80 percent of data will be utilized, and 86 percent of enterprises will have experimented with AI.

It's clear that digital and AI technologies have created real benefits for people, for our lives at home, and



People



Homes



Organizations

2018

4 bn

people not connected to the Internet

5 bn

people without a smartphone

< 40%

homes with broadband

< 1%

homes with Gbit/s broadband

< 10 Mbit/s

90% enterprise private lines

40%

mobile users without access to mobile broadband

0.03 GB

mobile traffic per user per day

1.5%

homes with smart robots

2.6 bn

connected home devices

< 13%

data utilization

< 10%

of enterprise applications are in the cloud

< 5%

of enterprises have experimented with AI

6.5 bn

mobile users

8 bn

smartphones

75%

homes with broadband

30%

homes with Gbps broadband

80%

data utilization

85%

of enterprise applications are in the cloud

86%

of enterprises have experimented with AI

80%

with access to mobile broadband

1 GB

mobile traffic per user per day

12%

homes with smart robots

20 bn

connected home devices

40%

connected cars

440 mn

VR/AR users

2025

Source: Huawei Global Industry Vision 2025

for organizations. It's also clear that we face many challenges ahead. Despite all these gaps and challenges, our industry is in the midst of a great opportunity.

We're at the point in time where ICT and digital technology are rapidly changing every person, home, and organization, and redefining how we live, work, learn, and stay healthy. In this age of greatness, Huawei aspires to become a great company. We want to help humankind take its next step forward.

This is the basis of our new vision, our new mission: Bring digital to every person, home and organization for a fully connected, intelligent world.

Huawei is committed to making this intelligent world a reality and extending the benefits of digital technology and AI to every person, home, and organization, so its value is accessible to all, whether it's in life, work,

education, or fitness.

In this fully connected, intelligent world, all people will be empowered. For example, with connected smart helmets, the visually impaired will be able to move around with complete freedom. Smart translation services will remove language barriers. AI-powered cameras will allow unskilled photographers to create masterpieces.

In this fully connected, intelligent world, home life will be more fulfilling: A diverse array of home services such as robots for at-home healthcare and education will be available. Ultra-broadband and AR and VR technology will make holographic communications possible. Wherever you are, your family will be within reach.

In the intelligent world, organizations will become more innovative. Businesses will deliver scalable,



Our strategy is to focus on ICT infrastructure and smart devices. Imagine when everyone has a smartphone linking all of our smart devices; then, everyone will have full access to the digital world.



customizable products to meet unique user needs. Governments will have smart solutions for administration and will be able to make our cities safer.

Looking ahead, we will position ourselves as a pioneer of the intelligent world.

Our strategy is to focus on ICT infrastructure and smart devices. Imagine when everyone has a smartphone linking all of our smart devices; then, everyone will have full access to the digital world. This will bring new experiences and value in life, work, education, and fitness.

Our vision

To bring digital technology to every home, we will continue to invest in broadband and home network solutions. When you're at home, learning, playing, or just enjoying life, you'll be able to experience the entire digital world through smart devices in your home. You will have access to all the benefits it brings to healthcare, entertainment, and other areas of your life.

To bring digital technology to every organization, we will invest in networks, cloud, big data, and IoT to continue to boost the digital transformation of all industries, enabling enterprises and governments to

go digital and embrace intelligence.

We will build a fully connected, intelligent world through ongoing investment in connecting the unconnected and with AI. This will help converge the digital and physical worlds, unlock new potential, and cultivate greater intelligence for all.

These were some of our considerations throughout the process of defining our new vision and mission last year. We want to work with the entire industry to enrich these ideas so that we can continue to maximize our investment, and ultimately make our vision and mission a reality.

A look back at our strategies

I've talked about Huawei's key strategies previously, our ALL Cloud strategy for products and solutions and our services strategy. Last year, I shared Huawei's approach to AI. We consider AI to be an enabling technology, and are integrating it into our products and solutions.

Over the past year we've taken our ideas and solutions to a new level. We want to apply artificial intelligence to our smart devices, cloud offerings, and networks to make our solutions more competitive, improve customer experience, and create more



We're working to incorporate AI throughout our entire network solution portfolio. We will continue advancing towards self-driving networks and addressing industry pain points, including inefficiency and high costs.



business value.

In 2014, I spoke about carrier network architecture – the data center-centric architecture of the future. We call this architecture SoftCOM. At its core, it's about the complete cloudification of telecom networks. It was the natural evolution from ALL IP to ALL Cloud. Now, we're applying AI to our SoftCOM architecture and solutions to develop next-generation architecture. We call this SoftCOM AI.

Last year, I mentioned that the telecom industry was in an unhealthy state. By adopting AI technology, we aim to build self-driving, self-evolving networks with zero faults. We want to use architecture innovation to address the structural issues facing the telecom industry. By making telecom networks automated, autonomous, self-healing, and self-optimizing, we will significantly improve network utilization and O&M efficiency.

This new network architecture will create tremendous value for end users, carriers, and equipment vendors alike. We believe that only innovation that benefits the entire value chain can promote the healthy development of the telecom industry as a whole. Specifically, end users will enjoy a ROADS experience (Real-time, On-demand, All-online, DIY, and Social) that can be delivered in minutes. Users will receive the best connection every time, and will always be

within range of a network.

Carriers will see a huge leap in O&M efficiency, resource utilization, and energy efficiency – at least ten times higher than existing rates.

Equipment vendors will benefit from intelligent new product features. They will see a leap in service efficiency, and will be able to provide new services to tap into the value of their installed base throughout the network lifecycle.

We're working to incorporate AI throughout our entire network solution portfolio. We will continue advancing towards self-driving networks and addressing industry pain points, including inefficiency and high costs. Ultimately, we hope to help the industry extract itself from a state of ill health and get back on the path to robust growth.

We're working hard to make the leap from smart to truly intelligent devices. In December 2016, we released a phone with intelligent functions – Honor Magic. Last year, we released the Kirin 970, a mobile phone chipset with an embedded neural processing unit. We're now using that chipset in all our flagship smartphones, including the Mate 10 and P20 series. Our mobile phones can understand consumers better than ever before, with a greater capacity to see, hear,



To enable our partners and developers around the world to leverage the AI processing power of our chips and develop all kinds of new applications, we built the HiAI platform, which has opened up our AI capabilities across three layers: cloud, devices, and chipsets.



and feel. This has significantly improved experience across a number of user scenarios, including photography and voice processing.

To enable our partners and developers around the world to leverage the AI processing power of our chips and develop all kinds of new applications, we built the HiAI platform, which has opened up our AI capabilities across three layers: cloud, devices, and chipsets. This platform enables all of our industry partners to develop a limitless array of AI applications, delivering a better user experience and giving the entire industry access to the benefits of truly intelligent phones.

In the cloud domain, we officially launched Huawei Cloud in 2016. In 2017, we integrated all of our cloud resources to form a dedicated Cloud Business Unit. The mission of this BU is to provide a robust cloud platform that fosters the growth of governments and enterprises throughout the digital transformation process.

We've opened Huawei Cloud to our partners around the world so they can develop and deploy applications directly in the cloud to help organizations of all sizes resolve the issues they face as they go digital and intelligent.

We're working hard to make Huawei Cloud into a platform that's technologically strong, has a solid future, and earns the trust of our customers around the world. It will be the focal point for 30 years of Huawei's experience, technology, and services, making them all available to our customers and partners.

We've also introduced AI-enabled services to Huawei Cloud, which form the basis of our EI (Enterprise Intelligence) platform. On this platform, all types of organizations, including enterprises and governments, can use AI to develop new products and services. It's simple and convenient, and will help organizations improve efficiency and generate greater value.

Last year, we stated that our aim was to use it to improve the competitiveness of the products and solutions we provide for our customers. After another year of exploration, we've decided to integrate AI into our smart devices, networks, and cloud, to deliver a better customer experience and create greater customer value.

Alongside our full-stack AI solutions for all scenarios, we have in place a complete AI strategy, which we will officially unveil at Huawei Connect 2018 in Shanghai. [www.huawei.com](#)

Rising High from Cloud to AI

Several major provinces across China are covered in large swathes of saline-alkali soil. This is soil with salt and PH levels that are higher than normal, and therefore deadly for most plants. For this reason, about 247 million acres of land in China isn't suitable for farming – roughly 10 percent of the country's territory.

By Ken Hu, Huawei Rotating Chairman

In 2006, the National People's Congress of China set a minimum standard for arable land in the country. To strike a balance between a secure food supply for China's growing population, while still ensuring enough land for urban and

industrial development, they drew a red line at 297 million acres of farmland.

Seawater rice: Worth its salt

For the past few years, a group of outstanding scientists have been using a combination of digital and biochemical innovation to increase the country's rice provisions. They are recovering 16.5 million acres of arable land from otherwise infertile soil, which they will use to grow a new type of rice – colloquially known as “seawater rice” – that has a much higher tolerance to salt.

This project is spearheaded by a scientist named Yuan Longping. According to Yuan, these 16.5 million acres of recovered land will be able to produce 1,821 kilograms of rice per acre. That's over 30 billion kilograms of extra rice per year, more than the annual rice output of Hunan Province, the greatest rice producer in China, and enough to feed up to 80 million people.

Yuan and his team are able to reinvigorate saline-alkali soil with a four-layered approach, where they cultivate new rice varieties and regulate soil conditions based on insights they gather from an underlying IoT platform. Huawei was fortunate to have the opportunity to work with Yuan's team on this platform.



Ken Hu

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The results of the AI system plus human insights are incredible. They're able to reduce water consumption by 30 percent, cut fertilizers by 40 percent, and increase profits by 20 percent.

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Futuristic farming in Qingdao

When you look out at the rice paddies in Qingdao, a modern city along the east coast of China, you can see poles at regular intervals throughout the fields. If you look closely, you can see small weather stations and high-tech telecoms modules on each, and in the future you'll also see high-definition cameras.

Beneath these modules are a whole range of sensors, both above and below the ground. These sensors collect information about light, temperature, alkalinity, and plant growth, which is then transmitted through NB-IoT networks to a high-capacity data center – a smart agriculture cloud.

The data from these sensors is used to feed an AI system that, when combined with insight from human experts, helps farmers use fertilizers and pesticides more precisely, monitor soil quality more effectively, control pests, and automate yield forecasting.

The results are incredible. They're able to reduce water consumption by 30 percent, cut fertilizers by 40 percent, and increase profits by 20 percent. In addition, the rice they plant is greener and healthier.

Reinventing agriculture with

digital technology

When we talk IoT, sometimes the conversation can get pretty technical. But when it comes down to it, this project is all about digitizing the land. In addition to repurposing saline-alkali soil, scientists can use digital technology to upgrade existing farmland, increase productivity, and improve yield quality.

ICT is changing the way agriculture works. Throughout its long 10,000-year history, agriculture has gone through four key periods of development, from basic sedentary farming – where we largely depended on the forces of nature to grow our food – to mechanization, to automated large-scale production, and finally to intelligent operations. Right now we're in the age of Agriculture 4.0, which has created enormous room for growth in information technology.

Huawei will keep working with Yuan's Qingdao Seawater Rice R&D Center to drive ongoing innovation in IoT, big data, mobile internet, and cloud computing, which will help accelerate the development of smart agriculture around the globe.

All industries are going digital



When it comes to choosing technology, organizations need to look beyond individual technologies and consider the greater overall synergy between devices, networks, and the cloud – what Huawei calls device-pipe-cloud synergy.



faster than ever

These new developments aren't limited to agriculture; smart agriculture is a microcosm of the massive changes we're seeing across all sectors. Every industry on earth – including industries like transportation, manufacturing, finance, and even public services – is picking up the pace of its digital transformation. Huawei is proud to be part of this digitalization process on an unprecedented global scale. Right now, 211 of the world's top 500 companies are working with Huawei to drive this process forward.

As more and more organizations go digital, we've noticed a few trends.

To start with, ICT has clearly become a strategic enabler, not just a tool for driving efficiency. New advances in ICT have made the impossible possible. For example, when 5G networks are the norm, it will only take six seconds to download an 8 GB high-definition video. New technology will have an indelible impact on business strategy and the way we think about user experience. Suffice to say, ICT will soon be at the forefront of corporate strategy.

Second, digital transformation is more about choosing a partner than simply choosing a supplier. At Huawei, we have established 36 joint innovation centers with

our customers and 18 OpenLabs with our partners around the world. These help us take a more focused approach to our customers' unique business needs and challenges, and speed up the overall innovation process.

Third, when it comes to choosing technology, organizations need to look beyond individual technologies and consider the greater overall synergy between devices, networks, and the cloud – what Huawei calls device-pipe-cloud synergy.

Devices are like feelers that sense the environment around them. Pipes are the neural networks that connect everything, and cloud is the foundation of ambient intelligence. How well these three elements work together will determine the success or failure of a given technological solution.

Welcome to Huawei Cloud

Two years ago at Huawei Connect I talked about how digital transformation brings greater connectivity, more sharing, and more freedom. But to make that happen we need to adopt a cloud mindset – that is, get a better view from the cloud.

Companies like Google and Uber were “born in the

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According to Huawei Global Industry Vision (GIV) forecasts, by the year 2025 over 85 percent of enterprise applications will be deployed in the cloud.

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cloud.” They were the driving force behind the Cloud 1.0 era, where they leveraged digital technology to create fresh business models and disrupt traditional industries. Now we find ourselves in the Cloud 2.0 era, where all traditional industries and enterprises will make use of the cloud to reshape their businesses and drive productivity gains.

This transformation is taking place faster than we could have ever imagined. It’s safe to say that the world as we know it is already, in effect, cloud-based. According to Huawei Global Industry Vision (GIV) forecasts, by the year 2025 over 85 percent of enterprise applications will be deployed in the cloud.

We’ve made significant progress in the cloud market since we set up our Cloud BU in 2017. Huawei Cloud now provides services to many of the world’s top-tier multinationals and large enterprises. To date, we’ve launched more than 120 cloud services with over 60 solutions for domains like manufacturing, healthcare, e-commerce, and the Internet of Vehicles.

The cloud is a runway, intelligence the engine

For us, cloud is just the beginning. We view it as a runway. To fly high, enterprises need an engine too. So after cloud, the next step is intelligence.





At Huawei, we believe that the true value of AI lies in its practical application. Wherever there is a business challenge, AI should be there to help out.



Providing enterprises with artificial intelligence is the focus of Huawei's next stage of development. AI is the latest general-purpose technology to grow out of human ingenuity, and it will soon be everywhere, just like electricity and computers are today. If we want to make the most of it, we need to pay attention to two areas.

First, we need to keep on driving innovation in the AI space, and we should focus this innovation on algorithms, computing power, and data.

Where can we get more data, and how can we use it best? How can we process it in a way that meets real and practical needs? How can we break the limits of the Moore's Law and beef up our computing power by a factor of ten, a hundred, a thousand? And how can we optimize our algorithms?

These are all questions we hope to answer through nonstop, focused innovation. In 2017, we released the Kirin 970, the world's first AI-powered chip. We'll release the next generation of AI chips soon.

Second, applications are key. At Huawei, we believe that the true value of AI lies in its practical application. Wherever there is a business challenge, AI should be there to help out. We're working hard to make AI more affordable, easier to use, and more secure.

Based on machine learning, deep learning, voice recognition, and image recognition, we're developing applications for all kinds of scenarios like city management, Internet-based innovation, financial insurance, healthcare, logistics, and commercial retail. In essence, we're transforming cloud-based AI services into Enterprise Intelligence, and meeting a broad range of needs for different organizations around the world.

As easy as looking in the mirror

We recently worked with a company called Tukuchina, a major provider of stock images in China, to help them deal more effectively with image piracy. In the past, identifying stolen images and holding people responsible was a hugely problematic. But today, Content-Based Image Retrieval (CBIR) technology has dramatically improved Tukuchina's ability to assert image copyright.

To address the eight most common methods of piracy, we used visual processing algorithms and deep learning to train a search engine with 5,000 copyrighted images. Then we used this engine to identify more than 80,000 pirated images from a set of 42 million that are published all over the web. We were able to identify pirated images with 99 percent accuracy.

This anti-piracy checking tool is now available on



In the past, drivers looked up at traffic lights to determine whether they should stop or go. Today, traffic lights are looking back at vehicles, counting them up and deciding when to give the green light.



Huawei's public cloud. With AI, finding pirated images on the Internet is as easy as finding yourself in the mirror.

AI-powered traffic lights for lighter traffic

Shenzhen has the highest vehicle density in China, with more than 510 vehicles per kilometer. In Bantian, where we have more than 60,000 employees commuting to and from our global headquarters every day, it wouldn't surprise me if the area around Huawei's campus had the highest vehicle density in the entire city.

Starting in June this year, the Shenzhen Traffic Police have been testing one of our cloud-based AI solutions on nine intersections around the city. They are using AI to adjust traffic lights based on real-time traffic flow. In the past, drivers looked up at traffic lights to determine whether they should stop or go. Today, traffic lights are looking back at vehicles, counting them up and deciding when to give the green light.

As a result, average vehicle speed has increased by 15 percent. Right now we are also using this technology in other cities like Beijing and Shanghai. We hope to give everyone a better experience on the road.

Creating an intelligent world

For the past 30 years, I think it's fair to say that Huawei has been moving in the right general direction, and we've done so while keeping our organization spry and light on its feet.

In our early days, we had no money and we were clueless when it came to strategy. Back then our goal was to become one of the top three players in the world. So we plunged ahead full throttle, fighting to take the lead and leave our competitors in the dust.

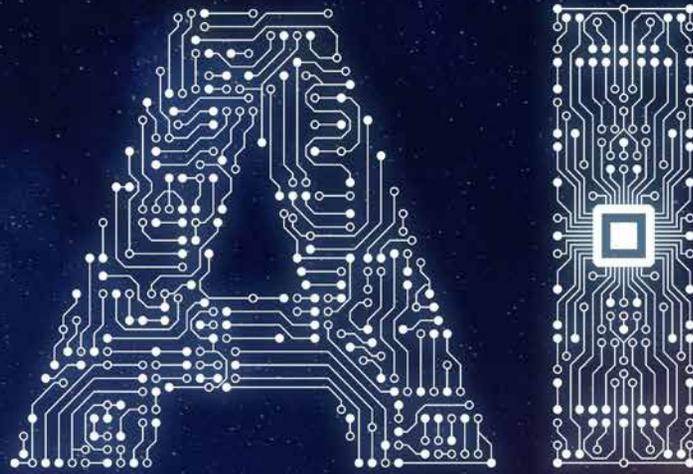
Moving forward, we want to mobilize around a vision that looks farther into the future.

In 2006, we agreed on a simple vision: to enrich life through communication. In 2014, we built on this vision, committing ourselves to building a better connected world.

At the end of 2017, after careful thought, we have yet again reorganized around a new and grander mission: To bring digital to every person, home and organization for a fully connected, intelligent world.

To get there, our goal for the time being is to build out the cloud as a runway. Then we'll equip our customers with an intelligent engine, giving them the horsepower they need to race ahead into the intelligent world.

Faster, better, and safer. 



AI and the new wave of Enterprise Intelligence

AI is poised to occupy a leading role in the new digital economy. What challenges will AI create? What is Huawei's strategy?

By Zheng Yelai, President of Huawei Cloud BU

AI will transform every industry

AI is crucial for enterprise digitalization to improve production efficiency. Since the Industrial Revolution of 1870, a major business revolution has occurred roughly every 30 to 50 years. Over the next 30 years, AI will become a basic force of production that drives the economy, rather than just a suite of

technologies geared toward testing.

AI fits most economic activities. It will pervade most production stages in enterprises and create a multiplier effect of enormous value. For example, autonomous driving and electric vehicles will transform the auto industry, which in China alone is worth 16 trillion yuan (US\$2.3 trillion). It will also transform education, health, manufacturing...and every industry.

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AI can be used to check for anomalies in customs data and discover problems at the front end, with discovery rates of up to 99 percent.

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In our own business, we deployed a machine vision system in our PCB production lines to support high-speed, automated PCB fault detection. This improved defect discovery during manufacturing and increased line production yield from 99.2 percent to 99.55 percent. Costs were lowered and manual workloads were cut by 48 percent, which is remarkable for the manufacturing industry.

Huawei operates in over 170 countries and regions worldwide, transporting a huge number of containers each year. AI helps to optimize Huawei’s supply chain process, integrating various links in the chain, from the supply side to logistics and transportation, through optimized routes and optimal algorithms, all of which have helped us to automate our internal logistics.

Specifically, we operate many warehouses and a total of 108 supply points. We design optimal packing solutions based on parameters such as the size, shape, and weight, of goods, which are shipped to more than 170 plus countries by land and sea. This helps us to increase loading rates by 15 percent. We’ve also automated customs declaration forms, significantly reducing

the manpower required and improving customs clearance efficiency tenfold.

We can also open up this capability. As customs control has set rules and regulations, AI can be used to check for anomalies in customs data and discover problems at the front end, with discovery rates of up to 99 percent. By using AI, Huawei has been able to continually improve its products, without increasing prices, and make its operations increasingly stable.

In the retail field, Huawei generates tens of millions of sales documents. We’ve used AI to achieve 99.5 percent accuracy in the document review process, integrate our sales and online risk control. Account login behavior, for example, can be used to identify intent, basically stopping unusual transactions such as surfing attacks and password sniffing.

Two major challenges

AI faces two challenges. First, the cost of legitimately obtaining data is too high, which – in China – is exacerbated by a lack of clear data sovereignty compliance standards. On May 25, the General Data



The AI era will be characterized by large amounts of data of different types, scattered data, diverse service scenarios, and complex AI application development.



Protection Regulation (GDPR) came into effect in the EU, meaning that the EU can impose penalties of €10 to €20 million, or 2 to 4 percent of a company's worldwide annual revenue, for violations. The GDPR has standardized data privacy protection, which no cloud service provider can ignore. And Huawei Cloud, China's only full-platform, full-node, full-service cloud provider, uses PCI-DSS security certification to make our AI services not only accessible and usable to customers, but also reliable.

The second challenge for AI is the lack of specialist talent. There are millions of software companies in China, but perhaps less than 10,000 experts who understand AI – the same is true all over the world. Today's mathematicians understand algorithms but they don't understand application scenarios. While experts in application scenarios understand the industry, they lack proficiency in algorithms. The whole AI system requires people who understand both algorithms and application scenarios. How can this boundary be crossed? We still have a long way to go. Huawei's main mission over the next three years is to open up its capabilities to all industries and allow AI to move beyond the current small group that use it for testing, and enable thousands of software

engineers to be able to use it and use it well.

AI is a group of technologies. When applied in business we call it "enterprise intelligence". Making AI accessible, usable, and reliable – that's our goal. The foundation of AI is data. Huawei Cloud's Intelligent Data Lake provides a foundation for smartification based on the imminent AI wave. The AI era will be characterized by large amounts of data of different types, scattered data, diverse service scenarios, and complex AI application development.

With Huawei Cloud's Intelligent Data Lake, the database supports seamless data flow in a full lifecycle and multiple analysis engine sharing, simplifying collaboration between data services. Moreover, its open format means that user data can be migrated to the cloud without the need for format conversion, making AI easier to use and extremely efficient. To give an example, it's possible to accurately find target data in seconds using multiple query criteria in a PB-level database with trillions of records.

We're committed to moving forward with all industries. I believe our future will only get better and brighter. 

How ICT can empower people and reduce poverty

On September 25, 2015, the UN ratified its hugely ambitious agenda: Transforming our world: the 2030 Agenda for Sustainable Development. Centered on the commitment to “end poverty, protect the planet, and ensure prosperity for all,” the resolution is distilled into 17 sustainable development goals (SDGs). Though disparate in aim, each has one thing in common: ICT is the fuel that can power change. But, it isn’t sweeping metaphors about tech’s benefits that will change the world; instead, it’s small steps in places where change is most needed.

By Gary Maidment

Empowering girls and women

In May 2018, Stacey Cunningham became the first female leader of the New York Stock Exchange since the institution was founded some 200 years ago. Given that the US sits at number 10 in the UN’s Gender Inequality Index of 188 countries, the fact that Cunningham’s appointment is newsworthy in 2018 is in itself newsworthy. Globally, gender inequality in the labor market extends far beyond the boardroom and any one country, hitting economies hard. A 2016 OECD report on development and gender estimates that gender-based discrimination costs the global economy a staggering US\$12 trillion per year.

Today more than ever, digital access is one of the strongest empowerment tools for girls and women. In our 2018 Huawei ICT Sustainable Development Goals Benchmark, which measures ICT development against

the attainability of SDGs, we found that SDG 5 (gender equality) shows the fourth highest correlation with ICT infrastructure. On a personal level, ICT connects women to the global community, giving them access to the educational tools and opportunities to live better, fairer lives. And for nations, enabling half of the workforce to make a meaningful contribution is simply good for their bottom line – the OECD estimates that gender parity will increase GDP the tune of 0.03 to 0.6 percent in global GDP by 2030.

Bangladesh: Training on the move

In terms of connectivity, Bangladesh doesn’t fair well, ranking 78th out of the 79 countries measured by Huawei’s 2018 Global Connectivity Index.

As of 2017, only 33.04 percent of females were participating in the nation’s workforce, nearly 50 percent lower than the 80 percent of men who work.



SUSTAINABLE DEVELOPMENT GOALS



Educationally, the relative parity that Bangladeshi girls and boys enjoy in primary and secondary education drops off in higher education, with considerably more barriers existing for girls. Thus Bangladeshi women are falling behind in the digital age.

In 2017, the government's ICT Division partnered with the telco Robi Axiata and Huawei to empower the nation's women through a three-year training project: Digital Training Buses for the Sustainable Development of Women through ICT. Providing six buses fully equipped with training equipment to teach digital skills, the project aims to reach 240,000 women across 64 of the nation's districts. Each bus comes equipped with 25 work stations, a laptop per trainee, learning software, customized training modules, a standby generator, and wireless connectivity. Basic course content includes computer literacy, Internet use, and mobile banking.

Mobile banking in particular is a key skill to learn, given that 85 percent of Bangladeshi's lack bank accounts. It's also an area in which Huawei is active alongside bKash, Robi Axiata, and other local partners, and is likely to evolve as a key enabler of economic development for the nation of 165 million.

The training buses can reach women in rural communities who can't make it to centers in bigger cities, and it's far cheaper than setting up and running fixed training centers in remote locations.

In Bangladesh, a few steps in the digital direction are making a huge difference in women's lives and, in the bigger picture, to gender equality and the nation's long-term economic well-being.

Empowering unconnected communities

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For telcos, investing in sites and laying cables to connect remote communities isn't an attractive proposition because of the exorbitant cost. ROI is long and average revenue per user (ARPU) is low.

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Inequality tends to be exacerbated by the digital divide whereby some of a population lacks online access. And it's not just emerging nations that are affected: According to the Wireless Broadband Alliance, 1.75 billion citizens in the world's eight GDP-richest countries remain unconnected – with 34 percent residing in major urban centers.

People living in rural communities and those at the lower end of the income spectrum tend to bear the brunt of the digital divide. According to the FCC, the digital divide between rural and urban America “remains too large to bring rural communities fully into the digital age,” with 10 percent of Americans lacking broadband access.

Compared with an economic and digital powerhouse like the States, the urban-rural connectivity divide is much more acutely felt in developing and emerging economies, where the affordability gap between city and rural dwellers further polarizes wealth and compromises economic and development potential.

For telcos, investing in sites and laying cables to connect remote communities isn't an attractive proposition because of the exorbitant cost. ROI is long and average revenue per user (ARPU) is low.

Nigeria: Bridging the digital divide

Ranking 70th in Huawei's Global Connectivity Index 2018, Nigeria's current Internet penetration rate of 50.2 percent means that around half of the African nation's 186 million people have no way of benefiting from online opportunities. In 2018 Huawei ICT Sustainable Development Goals Benchmark, Nigeria fairs poorly out of the 49 nations studied, coming in second to last, one position below Bangladesh.

A total 51 percent of Nigerian's live outside of cities, typically around grasslands and forests in a state of digital isolation. Many villagers lack basic communications infrastructure and mobile signals are poor, forcing residents to walk several kilometers to make a call in the nearest town. Constructing traditional tower-mounted macro sites is expensive because existing infrastructure is weak, lacking both mains supply and transmission resources. Moreover, ARPU is just US\$1 to US\$1.5, lengthening the ROI period for telcos to more than 10 years.

To address these issues, Huawei teamed up with MTN to deploy Huawei's RuralStar 2.0 solution, which is designed specifically to connect the unconnected in remote areas. Solar powered by just six panels per unit, RuralStar isn't dependent on an existing power supply.

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There are still 3 billion people in the world who don't have mobile Internet, 870 million of whom lack mobile phones. Moreover, 1.1 billion households are without home broadband.

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Equipped with non-line-of-site (NLOS) LTE Relay technology, the solution can be pole-mounted at a height of just 12 meters. In contrast, line-of-site microwave signals require relay points to be in sight of each other. They have to be mounted on very high towers so that local geography or buildings don't break transmission signals. RuralStar works by

enabling relay hops of wireless signals to distances of over 40 km, overcoming both distance and – with NLOS tech – barriers like buildings, mountains, and trees.

What does RuralStar 2.0 mean for MTN? A viable connection scenario for remote communities that incurs 50 percent less TCO, a whopping 70 percent reduction in usual site construction costs, and a fast ROI of about three years. For villagers it means affordable connectivity and, according to the village chief of Tobolo in Ogun, a cause for celebration that saw much singing and dancing when the solution went live: Families in Tobolo could get back in touch with relatives who have left the village.

Connecting the unconnected in Nigeria doesn't end here. It's expected that millions of Nigerians will become connected for the first time by 2022, cutting the digital divide so that more people can enjoy the personal and economic potential brought by wireless communications and mobile Internet.

There are still 3 billion people in the world who don't have mobile Internet, 870 million of whom lack mobile phones. Moreover, 1.1 billion households are without home broadband. These are huge numbers, but change begins with small steps, or in the case of RuralStar, with small hops.



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Like broadband access, health and education are key development markers that affect developing and developed nations alike, invariably hitting the impoverished, remote, and unconnected the hardest.

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Empowering children through health and education

Like broadband access, health and education are key development markers that affect developing and developed nations alike, invariably hitting the impoverished, remote, and unconnected the hardest. The World Health Organization directly links good health to economic growth as healthy populations achieve “higher labor productivity, demographic changes, and educational attainment.” As well as creating a personal and national financial burden, another knock-on effect of poor health – educational attainment – not only affects individuals, but in turn adds to the burden of nations whose citizens are ill-prepared to enter the digital economy and benefit from the age of intelligent connectivity.

Mongolia: Connecting to a better quality of life

Vast and sparsely populated, Mongolia is the world’s 18th largest country, yet is home to just 1.9 people per square kilometer. Fifty-five percent of the nation’s 3.1 million people live outside of cities, with 40 percent of those living in yurts and working as nomadic herdsman. A study by the US National

Library of Medicine published in August 2017 noted that, “A few studies in Mongolia have focused on inequality in health. However, little attention has been paid to inequalities in health resources by geographical area.” Indeed the study found large differences in the distribution of nurses, physicians, and hospital beds based on geographical area, reducing healthcare access for children and adults in remote areas.

On the education front, a range of improvement measures have been applied to boost primary education in rural Mongolia. However, the latest figures from UNESCO show that inequalities persist in older age groups based on location, region, and wealth.

Inequality in healthcare and education feed off each other, increasing disparity within national borders, preventing participation in the national economy, and lowering productivity. However, boosting connectivity with broadband is one way to narrow the gaps caused largely by geography. Of all the SDGs, we’ve found that good health (SDG 3) and high-quality education (SDG 4) show the strongest correlation with developed ICT infrastructure.

In January 2017, Huawei and Unitel launched a plug



and play wireless home broadband Wi-Fi solution. Powered by Unitel's nationwide 4.5G LTE network, the solution includes Huawei's wireless B315s-607 router, which Unitel subsidizes or provides for free. To date, the service has connected 8 percent of the nation's unconnected, including 50,000 households, 200,000 personal users, and 1,200 businesses.

As well as providing benefits to herders and local businesses, healthcare and education have both received a shot in the arm. First, a total of 74 hospitals are upping their game with online consultations. Figures from the Communication Research Center of Mongolia predict that 560,000 Mongolians will be using online healthcare by the end of 2018. Second, Internet connectivity is enabling 35,000 rural healthcare professionals to access further education courses. And, third, 35 rural public schools can now access and download videos and educational materials.

For the 600,000 or so households that are still offline, Huawei and Unitel plan to add a further 1,200 network sites – the project will reach another 300,000 households with wireless broadband by 2020.

A spot of analysis

One common thread in each of these cases is that inequality coupled with a lack of digital infrastructure leads to one inevitable and unsustainable outcome: the Matthew effect – the rich get richer and the poor get poorer. The Matthew effect is damaging at two levels: one, inequality increases within a nation's borders, for example, between urban and rural areas, between genders, and between development markers like health and education. And two, inequality prevents nations from fully competing and collaborating in the digital economy. At the same, the leaders pull ahead, a trend that's observed in Huawei's GCI 2018.

The UN's SDGs set out the blueprint for the things that humanity really needs to care about and get right. And ICT investment is the tool to help make this happen – our research shows that ICT correlates strongly with three key markers of sustainable development: GDP, the Human Development Index, and the Environmental Protection Index.

It takes small steps to open up the vista of change, and digital infrastructure will lay the road for us to take these steps together. A single company, organization, or nation cannot go it alone. We believe that together we can walk farther and that's why Huawei places great value on SDG 17 – Partnerships. [www.huawei.com](#)



How 3 stars are making life better around the world

If you live in one of Africa's 54 countries, there's a 65 percent chance you're not online, especially if you live in a rural or remote area. If you're a business owner in Bangkok, high buildings and narrow streets might be keeping your business offline and cutting foot traffic to your store by up to 20 percent. If you're an operator for whom site acquisition and low average revenue per user (ARPU) are constant headaches, you need the right tools to make connections in tough scenarios.

By Gary Maidment

A site for sore eyes

Huawei's wireless trinity – RuralStar, PoleStar, and TubeStar – offer different mobile connectivity features and application scenarios, but have one crucial concept in common: a Site-On-Demand model that can provide communications sites where and when they're needed. In cities, PoleStar and TubeStar combat expensive and complex site

acquisition and lengthy planning processes. In rural areas, RuralStar offers an alternative to impractical fixed-line solutions that can mean decade-long ROI for operators.

Designed mainly for emerging markets, each Star is now in its 2.0 incarnation: operators are boosting bottom lines, the unconnected are getting connected, businesses are growing, and Huawei's wireless tech is proving its sustainability credentials.



Huawei's 3-Star solution can reduce TCO by approximately 30 percent in urban areas, 50 percent in suburban scenarios, and up to 70 percent in rural communities.



Applying innovations like all-in-one design, wireless backhaul, clean energy, and intelligent site planning, Huawei's 3-Star solution saves E2E TCO and opens the door to meaningful network investment for operators. The new sites integrate infrastructure and network equipment, allowing for zero-site deployment, self-backhaul, and adaptive power supply. These features can reduce TCO by approximately 30 percent in urban areas, 50 percent in suburban scenarios, and up to 70 percent in rural communities.

RuralStar 2.0: Sustainable rural coverage

Africa's average Internet penetration sits at almost 20 percent lower than the world average of 54.4 percent. Some of the continent's nations barely register in the connected context, including Eritrea at 1.4 percent, Chad at 5 percent, and Burundi at 5.5 percent. In Ghana, coverage is around average for Africa, with 34.3 percent of the nation enjoying Internet access. However, it's mainly Ghana's rural population that misses out, a common problem the world over.

Ghana: Digital Inclusivity

For local teacher Afryea, returning to a village of 2,500 after studying in one of Ghana's bigger cities was a return to a world without Instagram, Snapchat, and WhatsApp. A lack of existing infrastructure, power

supply, and transmission networks meant that villagers like school teacher Afryea had to travel several kilometers to a nearby base station to get online.

Deploying a base station in the village wasn't viable for operators: an ARPU of just US\$1 to US\$1.50 would mean an ROI of ten years due to an average installation CAPEX of US\$100,000 and OPEX at US\$9,000 per year.

In one of its first deployment cases in 2017, Huawei changed all this with RuralStar. Equipped with RRN non-line-of-site (NLOS) backhaul technology, the solution enables up to three relay hops of wireless signals to distances of up to 60 km from the donor base station. NLOS technology means that barriers like buildings, mountains, and trees no longer present an obstacle for signal transmission, which in turn eliminates the infrastructure cost of high towers. It's also much cheaper than satellite and microwave tech. Supporting remote O&M and simultaneous access to GSM, UMTS, and LTE, the solution offers a simple and versatile way out for operators.

It cuts ROI from ten years to three and, powered by six solar panels, offers a clean solution that lowers TCO.

In Ghana, RuralStar isn't just connecting Afryea and other villagers to the outside world through social

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By building more inclusive economies and improving rural access to information and services, the solar-powered RuralStar helps reduce inequalities and is good for the environment.

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apps – it helps bridge the digital divide. Connectivity enables potentially life-changing applications, including connected farming, eGovernment, eHealth and mHealth, smart energy, and mobile money.

Since its first outing in Ghana, RuralStar 2.0 has landed in more than 20 other countries, including Nigeria in partnership with MTN and Kenya in partnership with Safaricom.

Contribution to the UN’s Sustainable Development Goals

By building more inclusive economies and improving rural access to information and services, the solar-powered RuralStar helps reduce inequalities and is good for the environment. At Mobile World Congress 2018, GSMA awarded the solution **Best Mobile Innovation for Emerging Markets**.

PoleStar 2.0: Sustainable urban connectivity

We estimate that MBB will cause global site numbers to double over the next five years, exacerbating three major issues with macro base stations: difficult site acquisition, lengthy site approval processes, and high site construction costs.

Enter PoleStar 2.0, where everywhere is potentially a

site. Integrating wireless devices such as Easy Macro and Book RRU, PoleStar can reuse ubiquitous urban resources like poles and billboards. The solution supports RRN wireless backhaul, a key technology for addressing signal transmission obstruction.

PoleStar supports various types of power supply, including direct mains and blade power modules, thus minimizing power costs.

In addition to wireless signal services, the solution can provide other revenue-generating functions with hardware add-ons. These include data collection from the environment, a panel for advertising, camera surveillance, LED lights with motion-detection capabilities, emergency calls, and a charging port for electric vehicles.

Ukraine: Boosting traffic by up to 25 percent

Last year, Ukraine’s leading operator LifeCell teamed up with Huawei to overcome site acquisition issues and meet connectivity requirements in Lviv, a historical town that attracts up to 200,000 visitors per day. After partnering up with a local energy company for deployment, LifeCell selected PoleStar. The solution has boosted network coverage by 9 percent in the areas it was deployed, with voice traffic increasing by 25 percent and data traffic by 22 percent – big gains for the operator.

Thailand: A boon for business

As well as benefiting operators, PoleStar's coverage capabilities are also felt by businesses that suffer spotty signals due to unforgiving local geography, like narrow streets and tall buildings. For local restaurateurs, this can mean less visibility when tourists search for nearby restaurants online, fewer food snaps shared on diners' social media accounts, and zero possibility of mobile payments.

Such a situation was affecting Bangkok restaurant owner Natthapat, keeping his business behind the tech curve through no fault of his own. From the carrier point of view, however, site deployment in crowded urban areas of this type wasn't viable. There simply wasn't the space. Until early 2018, that is. Early one morning, Natthapat saw an engineering crew deploying a Huawei base station on an electric power pole.

After two days of testing, it went live. What has this meant for Natthapat? A "mobile payments accepted" sign on his door and around 20 percent more customers.

Contribution to the UN's Sustainable Development Goals

At Mobile World Congress Shanghai 2018, GSMA awarded PoleStar the prize for Outstanding Mobile Contribution to the UN SDGs in Asia. Breaking barriers for using urban public resources, PoleStar promotes equal mobile broadband in urban areas and helps achieve three SDGs.

TubeStar 2.0: Zero-footprint urban macro

TubeStar shines in what it can do for the footprint of physical macro sites, realizing a staggering 96 percent reduction. On the ground this means shrinking a typical macro site from 50 square meters, which is

equivalent to safe standing room for 12,500 people, into just 2 meters, standing room for just 20 people.

A single site supports five to seven bands for multiple RATs, including GSM, UMTS, and LTE. The tube integrates the BBU, RRU, battery, transmission equipment rooms, cabinets, and power supply module. Energy efficiency is 30 percent higher than traditional sites and air conditioners aren't required, greatly cutting the carbon – as well as physical – footprint.

Bolivia: Let the games begin

Earlier this year, Huawei completed the deployment of TubeStar for the Bolivian carrier Entel to overcome high site TCO and, in a nation where site acquisition can take six months, pressing time issues.

Because Huawei pre-installs the equipment and cables in the tube segments, Entel only had to ship the tube segments to the site, shortening deployment time from 30 days to 11 and ensuring that the operator could increase capacity in time for XI Juegos Suramericanos Cochabamba 2018 – the 11th South American Games – on 26 May 2018.

Contribution to the UN's Sustainable Development Goals

TubeStar makes ICT infrastructure more sustainable and efficient and lowers the industry's carbon footprint, mainly contributing to two SDGs. At Mobile World Congress 2018, TubeStar won the **Green Mobile Award** from GSMA.

With increasing numbers of deployment cases and proven benefits for individuals, businesses, operators, and the environment, Huawei's 3-Star Site-On-Demand model overcomes geographical, cost, and time barriers for macro sites, moving us several steps closer to bringing digital technology to every person, home, and organization for a fully connected, intelligent world. 

Swisscom

Quick off the blocks with 5G

With the highest broadband penetration in the OECD, Switzerland's telecommunications sector is mature, sophisticated, and competitive. But with agile, disruptive MVNOs and OTT companies stepping onto the ICT playing field, major players like Swisscom can't rely on yesterday's successes. And the Swiss incumbent doesn't intend to, according to CTIO Heinz Herren – his ambitions are clear when it comes to network upgrades, Swisscom's internal digital transformation, and 5G deployment.

By Gary Maidment





Fixed on 2021

Having already invested around 1.75 billion Swiss francs (US\$1.85 billion) in network expansion, Swisscom aims to continue its strong investment momentum by modernizing its fixed broadband network by the end of 2021. The scheme involves three major features, the first of which is internal transformation. “We’re starting by preparing our cloud infrastructure to be ready to take on NFV transformation,” says Herren. “This year, 20 percent of our networking functions will go into the cloud.” The software-based nature of Network Functions Virtualization (NFV) delivers a slew of advantages for carriers, including lower CAPEX and OPEX, faster TTM, better scalability, and reduced vendor lock-in – benefits that can in turn easily be passed on to customers.

The second feature involves renovating its IP transport network to prepare for the future

traffic loads that its wireline network will carry. The third and according to Herren, most important feature, is boosting the operator’s network access technologies, “By 2021, all commonalities will get ultra-broadband with at least 80 Mbps, but we’ll go up to 500 Mbps using G.Fast technology.” Offering speeds of between 150 Mbps and 1 Gbps, G.Fast overcomes the notoriously expensive last-mile transmission associated with FTTH by connecting multiple subscribers from up to 300 meters using a fiber node, which serves as a distribution point in the form of a DSLAM (DSL access multiplexer) node.

For Swiss people, these upgrades will level the playing field with the 1 Gbps FTTH speeds that one-third of Switzerland currently receives, be capable of providing more demanding services like high-res video, and meet increasing data needs because, says Herren, “in multi-user, multi-family environments at your home or business, you’ll need much, much higher Internet base speeds.”

“We’re also an ICT provider, so we offer some IT services to the Swiss market. And as part of that, digital transformation for us means being prepared to go into virtual environments of your own.”

Ears open to the customer

Swisscom is teaming up with Huawei to construct its IP transport network, continuing a decade-long partnership that began with the two companies building the operator’s optical backbone network. More recently, the partners completed a four-year G.Fast project that kicked off in 2012 and made Swisscom the first operator to deploy G.Fast in Europe. In addition to Huawei’s proven R&D and tech credentials, Herren also mentions the Chinese company’s “willingness to really listen to customer demands,” something that’s more important than ever in today’s climate of telco disruption and transformation – a climate that requires long-term strategic partners to ensure new business goals can be met.

According to Martin Creaner, Huawei consultant and author of *Delivering the Digital Economy*, digital transformation for telcos must tick three main boxes on the way to ten possible transformation destinations. “First, transformation must significantly improve the B2B and B2C customer experience if telcos wish to compete with OTT players. Second, transformation needs to meaningfully boost

a telco’s efficiency and agility. And third, it must enable them to maximize revenue from both traditional and new digital services.”

Know where you’re heading

“Our DX agenda is very intense,” says Herren on the subject. However, one advantage that the Swiss operator has is its existing forays into the IT field, “We’re also an ICT provider, so we offer some IT services to the Swiss market. And as part of that, digital transformation for us means being prepared to go into virtual environments of your own,” he states, referring to Swisscom’s NFV deployment plans. Nevertheless, that doesn’t mean neglecting your telco roots even, as Herren concedes, if your “traditional telecommunications business is stable or even shrinking...We need to make sure that we still try to grow that telco core.”

For an operator with 20,000 employees, including more than 2,500 in its other major market of Italy, a change in mindset is one of the biggest challenges required for the telco to overcome its legacy ways of working, “It’s not so much a technology challenge, honestly, you have to have the right technology in place, but

you must ensure that the style you manage the company, the way you lead the company into agile operations, into DevOps, into digital worlds can also cope with the speed of how you transform.” says Herren. “You have to adapt very quickly to the new way of working. The OTT companies show us how quickly, how strong they are in going to market.”

High five

Digital transformation and network modernization schemes are enablers for the 5G climate to flourish. “We announced last week [Feb 2018] that we’ll be launching 5G this year by Q4. We’ve done intensive proof of concept over the last two years, so I think we’re ready to launch,” says Herren. “By using a lot of virtualization techniques, by using a lot of cloud infrastructure, I’m pretty sure that we can even decrease the complexity of 5G network architecture.” He goes on to talk about the advantages of virtualization in 5G architecture, “It allows you to run multiple instances on the same infrastructures, you can easily think about much more resilience, much more redundancy, in offering 5G data services.”

In the Swiss market, he predicts that the B2B opportunities for 5G will first be seen in the banking, chemical, and manufacturing industries, the verticals he feels will realize large initial gains from low latency and higher bandwidth, especially when combined with edge computing. Herren also believes that network slicing will deliver opportunities for Swisscom, letting the operator more fully utilize its infrastructure. “By using the same network topology and infrastructure, we can have some virtual slices offering very



different network types. One network could be for an alarm company that needs to rent some alarm services, another can be for the railway companies controlling their own railway system, there could be some mobile broadband data services, there could be some services with very low latency for gamers or drone applications,” he says.

While Herren admits that the complexity of 5G architecture is still uncertain, he’s bullish about its transformative power, “If you really combine everything together, the way you manage data on the network, the way you help customers to optimize their use of service by using AI and machine-learning algorithms, the way IoT will need constant connectivity, the way you have to have security services around the millions of sensors connected to the networks, the way 5G will fundamentally transform industry, there will be a lot of opportunities for telecom operators.”

To ensure Swisscom is front and center when it comes to grasping these opportunities, the operator is proving that it’s quick off the blocks with transformation, network upgrades, and 5G. [www](#)

Cape Verde

goes digital

In the Atlantic between the edge of the African continent and the westernmost edge of the world map, a small dot marks the location Cape Verde, a volcanic archipelago. Comprising 10 volcanic islands and a coastline of 965 kilometers, Cape Verde suffered from poor industry and agriculture due to its unique geographical location and unevenly distributed healthcare and education resources.

By Chen Yingying





Pearls in the North Atlantic

However, its service industry is very strong, accounting for more than 70 percent of the country's GDP. Now, though, it needs IT to thrive.

The Cape Verde government is committed to building a more people-oriented government, creating more business opportunities to improve the nation's competitiveness, developing an open economy to promote economic development, and alleviating poverty through communications and network technologies.

In recent years, many West African countries have built national data centers to advance digitalization strategies. However, due to a lack of application software development capabilities, ICT talent, and a strong ICT ecosystem, many data centers have no loads.

The nation's eGovernment project includes a nationwide office network and national data center, designed to boost efficiency and enable resource sharing for education, healthcare, and other services. It will act as a springboard for digitalization and help transform the archipelago into an information hub for West

Africa's coastal countries.

With 19 years of experience in the field, Cape Verde's Operational Information Society Nucleus (NOSi) was responsible for service development and O&M after the eGovernment system was built. The first phase of the eGovernment project was initiated in 2010 and delivered in 2014, including the construction of a national data center and an upgrade of the government communications network. This project phase completed the national government network system platform and island interconnection network platform. NOSi then deployed the government digital transformation system.

The national data center comprised only 200 Virtual Machines (VMs) in this first phase. With the gradual emergence of new eGovernment applications and rapid growth of service leasing to third parties, the data center became fully loaded, leaving no available space for new applications or services. Organizations in areas that weren't connected to the network were still using a paper-based system, leading to poor archive management, low work efficiency, and great difficulties in statistics collection and management. The education and medical care resources of the

“Due to the difficulty of inter-island transportation, government agencies faced high travel expenses each year, averaging out at US\$340 per trip, easily totaling US\$340,000 per month.”

10 islands couldn't be shared and remote areas suffered from sub-par teachers, poor hardware, and a low overall education level. Likewise, the government couldn't obtain the population's health and medical information in those areas.

Due to the difficulty of inter-island transportation, government agencies faced high travel expenses each year, averaging out at US\$340 per trip, easily totaling US\$340,000 per month. An inefficient transportation network also hindered communication between government agencies.

These factors drove the project's second phase: a one-stop ICT infrastructure platform enabling cloud-pipe-device synergy, with NOSi selecting Huawei for implementation.

Cloud-Pipe-Device

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

- A national data center with 54 IT standard cabinets covering 200 square meters for providing information services for the government, enterprises, and institutions of Cape Verde, and also the surrounding countries.
- Intra- and inter-island backbone networks,

MANs, and wireless broadband access networks. These included constructing a fiber backbone ring using DWDM technology on six major islands to upgrade the Synchronous Digital Hierarchy (SDH) capacity from 622 MB to 20 GB, and providing broadband access through WiMAX to achieve network coverage for organizations throughout the country.

- 21 telepresence videoconferencing systems, giving the government the convenience of remote conferences.

One cloud, one lake, one platform

Huawei employed its 1 cloud, 1 lake, 1 platform architecture to help customers in various industries integrate their systems and enable information sharing for greater business value:

One cloud: A converged cloud resource pool that implements unified delivery, management, and services.

One lake: A data lake that aggregates a full range of data and provides the full-lifecycle processing capability of collection, storage, calculation, management, and use, thus helping customers transform data resources into data

assets.

One platform: An application-enabling platform, which integrates basic data services, general middleware, and industry middleware to enable customers and 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.

Phase two

In the second phase of the project, Huawei completed the following:

- Deployed new IT devices and system software and transformed the old data center into a disaster recovery center, providing secure and reliable IT leasing services for government agencies and enterprises through an active-active data center.
- Deployed internal office networks and videoconferencing systems for the government, schools, and hospitals to expand 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 and promote information sharing and development.

To expand the capacity of the solution's cloud

data centers, Huawei built 1,000 VMs 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 annual rate of 60 percent, as it did from 2011 to 2015, this round of capacity expansion could meet business development requirements for the next five years.

In addition, Huawei provided 1,000 sets of FusionCloud desktop cloud systems for government agencies and national informatization training centers, solving key admin problems such as patchy data protection, inefficient maintenance, insufficient resource usage, and difficult network isolation and switchover.

Based on the 1 cloud, 1 lake, 1 platform architecture, the Huawei eGovernment Cloud solution provides NOSi with shared basic resources, open data support platforms, rich smart government admin applications, comprehensive eGovernment services, strong security assurance, and efficient O&M service assurance. Those services helped remove data barriers between departments, build cloud platform-based and cross-departmental data sharing and exchange platforms, and deliver ICT infrastructure to enable the proactive and efficient one-stop working practice of government agencies and enterprises.

Health and education

Like many African countries, Cape Verde has suffered from unevenly distributed public resources, with one-third of the country's schools located in just three cities: the capital Praia, the port city of Mindelo, and Santa Catarina. Moreover, over half the nation's hospitals are on the two islands of Santiago and Santo Antão.

“The network infrastructure broke geographical separation and brought network and eGovernment benefits to people in remote areas.”



Telemedicine application system

The Cape Verde eGovernment network connects 1,142 organizations across the country through the same network, with 530 routers and 669 switches provided by Huawei expanding the network built in phase one to cover schools, health clinics, government departments, and enterprises in small and medium-sized cities and towns. The solution also includes 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 faster and more precise services from the capital's medical teams.

With insufficient teachers and low education quality, schools outside the capital of Cape Verde

were eager to access the national eEducation network to improve materials. Teachers were also expected to network with each other in schools in and outside of Cape Verde. This was enabled by 30 Huawei videoconferencing systems, installed in high schools and municipal governments across the archipelago.

Huawei also provided WebLab, an integrated ICT training system for cultivating local ICT talent, including communications equipment, programmable robot suites, electronic maintenance tools, and furniture, which were deployed in containers based on NOSi's current cloud national data center to provide basic ICT training for students on other islands. These containers can provide ICT training for middle school students and local people, and also serve as multi-functional classrooms to deliver other courses.

eGovernment cloud: Shining in West Africa

Based on Huawei's eGovernment cloud, NOSi developed more than 150 websites and 77 types of eGovernment software, covering social security, electronic elections, budget management, distance education and healthcare, and electric Effective Radiated Power (ERP) for all government departments, schools, hospitals,

and state-owned enterprises in Cape Verde. NOSi also provided eGovernment applications and data center hosting services for surrounding countries, including Equatorial Guinea, Mozambique, Burkina Faso, Guinea-Bissau, São Tome, and Principe.

The major NOSi eGovernment applications and websites are as follows:

- 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

With IGRP, for 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 duplicated resource investment, minimize public management costs, and maximize ROI.

Another example is the Medical Information System (SIS), which is a connection module used to manage hospitals, monitor 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. It also collects statistics on hospitalizations, appointments, and deaths.

Antonio Joaquim Fernandes, NOSi's President, said, "Huawei provided valuable support for the national data center, data transmission network, and eGovernment construction in Cape Verde. It provided 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 it fourth in Africa, far higher than other 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 and government is in a critical period of digital transformation. Huawei is committed to bringing digital technology to every organization for a fully connected, intelligent world. Cape Verde's eGovernment cloud is a necessary step for government, education, healthcare, and enterprises in Cape Verde to enter smart society, making cloud Cape Verde a pearl of digital transformation in the North Atlantic region. 

CMB creates value that Internet finance companies cannot match

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 fintech enterprise.

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





In the late 1990s, an incident occurred at a major branch of China Merchants Bank (CMB) in a provincial capital: Some banks dispatched several armored cars to the branch, telling CMB's customers they could withdraw their money if CMB couldn't find a way out. CMB employees called in family members to help carry their 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 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 auto call distributors, and provide milk for customers. These kinds of thoughtful touches have helped CMB develop rapidly over the past 30 years. In 2017, the bank

ranked 23rd in the Banker's Top 1000 Banking Brands and 216th in the Fortune Global 500.

Three thoughts on CMB's digital processes

Over the past 17 years since joining CMB in 2001, I've 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. Our upgraded facilities and expanded capacity meet CMB's increased service requirements, from the bank's equipment room and data center in Shenzhen, our Nanjing disaster recovery data center, and our data centers in Shanghai and Pinghu.

Second is the impact of the Internet. CMB's top executives believe that technology can bring disruptive changes to banks – more so

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.

than strict supervision, small loan companies, or Internet financial companies. Therefore, CMB prioritizes new tech. For example, up to 40 percent of employees in the CMB business department spend 30 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 100 million yuan (US\$15.6 million) in six months. This platform also shortened the time for issuing a credit card from 15 days to five minutes. CMB now supports the ability to issue loans up to 300,000 yuan within minutes. Furthermore, the bank leads 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 customer-centricity. With the slogan "We're here just for you," providing great 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 increase value. Our goals are more benefits, greater convenience, faster services, and considerate services for customers.

Internet financial enterprises cannot match us

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 operations. 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 predicated on customer security and experience. CMB now compares favorably 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 types of applications are emerging, including facial recognition, voice recognition, anti-fraud applications, and customer profile managers. These applications will evolve into public infrastructure services and 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.

Constructing a leading Distributed Relational Database (RDB)

Service innovations depend on IT and data. Therefore, it's 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. With partitioning, 10 or more databases need to be managed. In

addition, the probability of faults remains as high as when only one database is used. The result is that overall availability hasn't 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 offers several advantages. First, it reduces cost, including hardware, labor, development, and O&M costs. Second, it simplifies development and O&M so that IT personnel have smaller workloads. Most importantly, this type of database better utilizes hardware resources and provides a higher unit output rate, so the database can support more services.

Distributed RDBs will never be outdated. Although this type of database has been under development for over 40 years, it's still used in scenarios with strict consistency requirements.

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 RDB 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.”

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 an 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. We will jointly develop the distributed database and put the products into use, migrating database applications to the cloud.

The performance and functions of the bank's existing open-source database kernel aren't comparable to 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 characterized by high performance, security, reliability, and scalability. We will use technologies such as latch-free data structures; NUMA (Non-Uniform Memory Access)-aware architectures; 3D-XPoint memory; high-performance distributed transaction processing, computing, and storage separation; Remote Direct Memory Access (RDMA); Group Buffer Pools (GBPs); and the Z-Paxos protocol. These technologies can build

cloud-oriented scale-up/scale-out capabilities.

Over the years, the financial industry has gradually increased the value of the database, which is all about consistency. Databases play a critical role in data processing and solving consistency issues. 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 is costly and affects database capabilities, including performance and capacity. In addition, fault probabilities are higher.

Based on these issues, CMB has clear specifications for online transaction systems. For example, even when using an Oracle database with a capacity for 500 SQL statements, CMB can only use 10 of them. This policy simplifies database function requirements, which shortens the development cycle.

Mutual trust builds cooperation

The customer-centric concept is the first reason why CMB chose Huawei. CMB exists to serve customers, and customer satisfaction is its highest priority. 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 from 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 face difficulties. About six years ago, Huawei left me with a deeply positive impression when CMB chose Hadoop products. At that time, several vendors, including Huawei, offered to provide Hadoop cluster products and services. After hearing CMB's six challenges, two of the vendors said the project was too difficult and dropped out. Only Huawei was willing to take on the challenge. Five months later, Huawei reported to CMB that five of the issues had been completely resolved and only half of the sixth issue remained. This 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.

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.

Huawei is planning to develop a database on the public cloud, and CMB can assist with development. CMB will research the development trends of database technology and how to plan and design core databases.

This project will be highly beneficial to CMB, especially in terms of talent cultivation.

The joint innovation between CMB and Huawei has three phases:

- Initial phase: focus on commercial pilot projects in 2018.
- Growth phase: reach industrial scale in 2019.
- Stable development phase: carry out large-scale promotion and replication in 2020.

CMB is responsible for the design of requirements and solutions, and Huawei's Online Transaction Processing (OLTP) database team is responsible for technology implementation. Independent innovation will be conducted based on Huawei's experience, and infrastructures will be integrated based on new hardware capabilities. In this way, the project will achieve the overall objectives of 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 layer is the distributed extension layer. The middle enterprise core layer will support the high performance and general database capabilities for enterprise-level services. The bottom layer 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 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. 

ICBC (Asia)

makes cross-border banking easy

Cross-border finance is developing rapidly thanks to the opening up of China's capital market and the development of the greater bay area that links Guangdong, Hong Kong, and Macao. The Industrial and Commercial Bank of China (Asia) started its cross-border renminbi business in 2013 and has since achieved double-digit growth in its business. How has it made such impressive progress?

By Chen Yingying





By the end of 2017, the bank had established partnership with more than 500 enterprise customers, supported the settlement of nearly 20 currencies, processed more than 36 trillion yuan (US\$5.53 trillion) of settlements, and received more than US\$4.6 billion in total deposits.

ICBC (Asia) has 57 retail outlets and serves as the flagship of the overseas banking business of ICBC Group. At year-end 2017, ICBC (Asia)'s total assets amounted to US\$114.47 billion. Headquartered in Hong Kong, ICBC (Asia) benefits from the city's position as an offshore center for renminbi and cross-border banking services. In the future, the bank plans to provide diverse low-cost, cross-border financing services, including IPOs and issuing bonds, cross-border renminbi services, and cross-border asset management services.

Technology creates value

Cross-border finance is developing rapidly and, at the same time, customer needs for Internet finance and new payment methods have increased drastically. This brings great opportunities to ICBC (Asia)'s cross-border

finance business as well as challenges to its business systems and ICT infrastructure.

ICBC (Asia) is exploring innovative applications using biometric recognition, blockchain, big data, AI, and cloud computing technologies. To better serve its customers, the bank provides a VIP recognition service, precise sales and marketing strategies, product recommendations, and differential pricing. Smart risk prevention and control helps detect fraud, credit risks and operating risks, while the management dashboard supports decision-making, abnormal capital flow warnings, incident prevention, and risk management.

In 2016, ICBC (Asia) started to plan and deploy innovative systems 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 its Digital Multimedia Banking Solution, Safe Financial Cloud Solution,

“ICBC (Asia) achieved fine-grained security management based on user, region, and resource; security authentication and verification; and sliced data transmission and storage.”

and CloudFabric Cloud Data Center Network Solution.

Improving customer experience in cross-border finance

To provide cross-border services, the bank developed an mVTM system based on Huawei's IP Contact Center (IPCC) Solution, allowing customers to video conference with their financial advisors via the ICBC (Asia) app and receive professional financial advice anytime, 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 agent. With these unique features, IPCC will provide text messaging, voice calls, and video interaction services. This not only boosts customer experience, but also enables service back tracking to ensure the service provided fulfills regulatory compliance.

In the future, ICBC (Asia) will develop a 24/7 omni-

channel intelligent customer service system to answer customer enquiries. This chatbot system will process voice commands in Mandarin, Cantonese, and English, improving ICBC (Asia)'s operating efficiency and service quality.

Focusing on both security and agility

Cyber attacks threaten banks' intranet systems. Additionally, sharing sensitive data with third parties can lead to confidential information leaks, causing great losses to both customers and the bank. ICBC (Asia) worked with Huawei to improve employees' capabilities in protecting sensitive internal information. Huawei is the only vendor to provide holistic ICT solutions that span desktop cloud protocol software, virtualization software, servers, storage units, firewalls, and networks, which it has also applied internally.

With Huawei's assistance, ICBC (Asia) achieved fine-grained security management based on user, region, and resource; security authentication and verification; and sliced data transmission and storage. Huawei's comprehensive cloud-



pipe-device-control system for security improves service systems' reliability in management nodes and user connections. The new O&M system has rich functions and simplified wizard operations, maximizing O&M efficiency and lowering costs.

ICBC (Asia) staff can back up important files and data to the Onebox application for easy data protection. In the near future, Huawei will use desktop virtualization technology to help ICBC (Asia) isolate browsers from service systems and also the intranet from the Internet to protect ICBC (Asia)'s ICT systems from cyber attacks, and prevent the disclosure of sensitive data, including assets and cross-border transactions.

Building a strong neural network system

The growth of cross-border finance poses higher requirements on data storage reliability, data center network speeds, and overall system stability. Statistics show that China's large commercial banks and insurance companies have an average of more than 100 TB of data in their databases. To address the Internet finance

challenge, financial institutions are now using data to drive business innovation. Data centers, which once served banks as support centers, now shoulder the responsibilities of creating value and profits.

ICBC (Asia) built its service systems based on traditional data centers, classified service sectors by business, and formulated complicated security strategies. The rapid increase in service types and capacities requires flexible deployment, dispatching, migration, and the management of service resource pools. Traditional network architecture became a choke point that hindered business development. Now, ICBC (Asia) adopts standard, open network technologies and new data center architectures to set a solid foundation for a strong neural network system.

ICBC (Asia) breaks through constraints by replacing non-standard technologies. Its existing data center and production backbone network used traditional solutions and closed private technologies like EIGRP and PVST+. For network equipment, Huawei provides

“With Huawei’s solution in place, we’ve achieved a major breakthrough in the diversity of DC network products, laying a solid foundation for private cloud transformation in the future.”

CloudEngine, USG Next-Generation Firewall (NGFW), and other devices that feature open architectures, standard network control protocols, and standard interfaces.

Huawei deployed its Software Defined Network (SDN) controller and Agile Controller based on open-source architectures like Open Network Operating System (ONOS) and OpenDaylight (ODL). ICBC (Asia) used Huawei’s Agile Controller to replace its existing private network architecture and protocols, protecting the bank from vendor lock-in. ICBC (Asia) can now access the OpenStack-based cloud platform, share computing resources and value-added services across data centers, enjoy multi-service convergence, and flexibly expand and upgrade its solution.

Based on existing equipment, Huawei built a data center network that links with virtual platforms and can evolve into cloud-network collaboration. With Huawei’s solution in place, ICBC (Asia) can upgrade its network and retain many of its legacy network devices. Doing so maximizes the return on ICBC (Asia)’s historical investment, meeting the bank’s requirements on long-term development.

Based on spine-leaf architecture, Huawei’s solution uses the Agile Controller and CE Series Switches to

help ICBC (Asia) smoothly evolve cloud computing capabilities. The project is being carried out in phases, and will not involve mass software or hardware replacement. In the future, ICBC (Asia) can choose to reshape its data center network and build an SDN, enabling service systems to share network hardware resources. These will be logically isolated from each other to ensure security and share IT resources to improve resource usage and service deployment efficiency.

Commenting on the project, Tang Bin, General Manager of the bank’s IT department, said, “Huawei helped ICBC ((Asia)) build more open and stable ICT infrastructures, allowing business departments to operate more securely and easily. With Huawei’s solution in place, we’ve 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 cooperating further with Huawei in cloud computing, big data, and other sectors.”

With Huawei’s technological support, ICBC (Asia) is confident that it can optimize its management, services, and innovation capabilities and meet the increasing needs of customer services, internal management, and external regulatory compliance. [www](#)



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