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**Large Enterprises Encouraged to Adopt  
'As-a-Service' Operations**

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**Automating OTA Software Updates for IoT**

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A central graphic featuring a burst of colorful lines radiating from a central point, with several colored spheres (blue, green, orange, red) scattered around. The text 'New ICT' is in a large, white, outlined font, and 'Drives Innovation' is in a large, bold, black font with a white outline, both centered over the graphic.

# 'New ICT' Drives Innovation

Customer-centric, business-driven, and developer-defined ecosystems enable innovative modes of collaboration.

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Vertical Solutions Roundup

IoT Drives Digital Transformation

Last Word: 5G for IoT and Mobile



# New ICT Era Creates a Win-Win Ecosystem

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

**T**he new ICT era requires more than just new technologies and architectures — it calls for a new ecosystem.

As the digital economy transforms our personal and professional lives, new ICT technologies are fundamentally changing existing business models. Companies engaged in finance can obtain insights into users' consumption habits from personal data generated by various types of terminals that can be used to form the basis for credit ratings and lending decisions. City administrators can improve public safety by creating protection functionality through the use of the Internet of Things (IoT) and Big Data analytics that enhance dispatch utilization for police officers and related civil services. Intelligent metering enables electric power enterprises to optimize the efficiency of electricity supplies by quickly identifying problems over the transmission grid. These are examples of demands that must be enabled, and more are emerging in other industries at an accelerated rate. Against this backdrop, cloud computing and ICT technologies are providing scalable applications that rely on our new era of enterprise digitalization.

Generally, enterprise ICT infrastructures consist of business systems that generate mass data in real time and platform systems that are based on cloud computing and Big Data analytics to support business operations and decision making. The combined power of these systems allows enterprises to reach new levels of agility and automation. Huawei believes that the digital transformation of enterprises requires ICT infrastructures that provide centralized cloud computing.

These new infrastructures will reshape existing ecosystems. By 2025, global applications of ICT technologies are projected to result in 100 billion connections, with vertical industries running hundreds of millions of applications. While continuously providing new offerings that meet users' needs, ICT enterprises must adopt new and open architectures and interfaces that combine cloud computing, networking, and devices; amass countless developers to help them integrate ICT solutions across growing industries; and promote 'ecologically coordinated' innovations that harness the power of the upgraded infrastructures.

New ICT technologies, architectures, and ecosystems will breed new rules of engagement. Huawei is committed to providing cloud-pipe-terminal solutions that maximize clouds, networks, and devices. Huawei is also committed to working with developers and partners to create customer-driven ecosystems that take advantage of its open ICT platforms that enable a path of innovation for every industry. This win-win ecological environment will unleash unlimited business opportunities for all. ▲





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# Technology News

| Source: PR Newswire

## MEMS Revolutionized with Picosun's Batch ALD Cluster Tools

**ESPOO, Finland, Jan. 25, 2016** — Picosun Oy, the leading supplier of high quality Atomic Layer Deposition (ALD) thin film coating solutions for industrial production, has revolutionized cost-effective MEMS manufacturing with high throughput PICOPLATFORM™ batch ALD cluster technology.

MEMS (MicroElectroMechanical Systems; Microsystems) are micrometer-scale, semiconductor-based components that combine electrical, mechanical, and optical functions. They are present in our everyday products such as hard disk read heads, inkjet printer nozzles, microphone and projector chips, airbag controls, tire pressure monitoring, and driving stability systems in cars.

## Huawei's Next-Generation Firewall Solutions Receive Common Criteria EAL4+ Certification

**BEIJING, China, Jan. 26, 2016** — Huawei today announced that its Unified Security Gateway (USG) and Eudemon series next-generation firewall solutions have been awarded Common Criteria (CC) certification at Evaluation Assurance Level 4+ (EAL4+). It demonstrates the security and reliability of Huawei's next-generation firewall products.

The evaluation was conducted by Epoche and Espri, an independent European security evaluation organization, which provides security evaluation and testing services to industry-leading international companies. EAL4+ is the highest assurance level that is recognized globally for network products.

## Prodapt and Sprint Partner to Power the Global IoT Ecosystem

**DALLAS, Texas, U.S.A., Jan. 26, 2016** — Prodapt and Sprint have entered into a strategic partnership to deliver industry specific IoT solutions. The partnership enables Sprint to leverage software products, platforms, and integration expertise from Synapt (Prodapt's IoT division) to deliver solutions for Sprint's enterprise



customer base. Internet of Things (IoT) refers to the intelligent network of things that communicate directly or indirectly with each other.

The IoT market is expected to grow to USD 1.7 trillion by 2020, and the need for ready-to-use product platforms, rapid prototyping, and faster time-to-market are key elements for successful IoT deployments in the enterprise market.

## China Smartphone Shipments Hit a Record 438 Million Units in 2015

**BOSTON, Mass., U.S.A., Jan. 28, 2016** — According to the latest research from Strategy Analytics, China smartphone shipments grew 3 percent annually to hit a record 438 million units in 2015. Xiaomi maintained first position and captured a 15 percent smartphone market share in China last year.

Linda Sui, Director at Strategy Analytics, said, "China smartphone shipments declined 4 percent annually from 123.0 million units in Q4, 2014 to 117.9 million in Q4, 2015. China smartphone growth is slowing due to market saturation, inventory build, and economic headwinds. However, for the full year, China smartphone shipments grew 3 percent annually from 423.6 million units in 2014 to a record 437.8 million in 2015."

## Huawei Releases Any Media Giga Access Platform to Deliver Gigaband Enablement

**LONDON, England, Jan. 28, 2016** — Huawei launched its Any Media Giga Access Platform that allows operators to make full use of the various access media on their existing networks to quickly deploy gigabit-capable ultra-broadband (Gigaband) networks with unified architectures, software, and management. The Gigaband Era is truly upon us now!

Broadband networks are moving from the 100M-level to giga-level access at the home as 4K TV, virtual reality, holographic imaging, and other new bandwidth-hungry services emerge. All-optical networks are the optimal medium for Gigaband. However, in some regions, exclusive use of optical fiber to build gigabit

networks requires huge investment and ROW acquisition, and the time needed for the rollout tends to be long. This trade-off means the time it takes to pay for this infrastructure investment is often protracted. Enter the Huawei Any Media Giga Access Platform, which is able to support fiber, copper, coax, and combined fixed and mobile access methods. The innovative new tech going into the platform provides the way to the Gigaband era with ultra-broadband network enablement.

## E2open Announces Latest Product Release to Empower Flexible, Scalable, and Adaptive Supply Chain Operations

**AUSTIN, Texas, U.S.A., Feb. 1, 2016** — E2open demonstrates the result of its significant and ongoing investment in supply chain management technology with its latest product release announced today. The improved intercompany connectivity, new shipment and material tracking and traceability, deeper control of manufacturing processes, and better planning capabilities — all within a more secure cloud-based operations environment — provide enriched visibility and control while leveraging E2open's powerful business network.

## EXFO Introduces the World's First G.fast Handheld Test Set

**QUEBEC CITY, Canada, Feb. 1, 2016 /CNW Telbec/** — EXFO Inc. (NASDAQ: EXFO), (TSX: EXF) today announced the introduction of its MaxTester 635G (MAX-635G) test set, a handheld G.fast CPE emulation solution that supports ITU-T G.9700 and G.9701 recommendations, as well as current VDSL2 and ADSL2+ technologies. The MAX-635G is a must for operators rolling out ultra-broadband to subscribers in today's highly competitive broadband residential services market.

EXFO's new MaxTester 635G test set provides technicians with a handheld solution to confidently install, turn up, and maintain G.fast, VDSL2, and ADSL2+ deployments with a single test tool, enabling the verification of subscriber data rates of up to 1 Gbit/s.

## Omnitracs Launches Intelligent Vehicle Gateway

**DALLAS, Texas, U.S.A., Feb. 1, 2016** — Omnitrac, LLC, a global pioneer of fleet management solutions to transportation and logistics companies, today announced the introduction of Intelligent Vehicle Gateway (IVG)

— brand new, cutting-edge technology designed to spearhead the next generation in commercial vehicle telematics. A highly powerful, integrated application delivery system, IVG offers advanced features such as a larger display, superior wireless connectivity, and hands-free voice commands designed to improve safety, efficiency, and productivity. IVG represents a breakthrough in mobile fleet management technology.

## Sagemcom Will Supply Enexis with the First Large-Scale, Smart-Meter Rollout

**RUEIL-MALMAISON, France, Feb. 2, 2016** — Enexis selects Sagemcom as one of the suppliers for LTE smart meters for the large-scale rollout in the Netherlands.

Sagemcom has been selected for the development and supply of the ESMR5.0 smart electricity meters in the Netherlands, which will contribute to the smart metering program of Enexis for the period Q4 2016 to 2021 (with optional extensions to 2026).

Based on the Dutch DSMR4.2 specifications, these LTE-adapted ESMR5.0 smart electricity meters will provide new features to enhance the communication interface with consumer gas meters and aim to improve security for customer privacy concerns. This new solution, which complements the Enexis-installed base of smart electricity meters with GPRS, offers real-time information on energy consumption in order to reduce energy usage and significantly decrease energy costs for customers.

## Synopsys Redefines Circuit Simulation with Native Environment

**MOUNTAIN VIEW, California, U.S.A., Feb. 3, 2016** — Synopsys, Inc. (Nasdaq: SNPS) today announced that its circuit simulators will include a native environment for simulation management and analysis. The included solution provides designers with full access to the advanced features available in Synopsys SPICE and FastSPICE simulators and eliminates the need for third-party environments. As an early collaboration customer, Samsung Electronics' System LSI Business evaluated the new environment with FineSim SPICE and has deployed it to their analog design community. ▲

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David Gould

# Industries Go to the Cloud

| By David Gould, Bloomberg News

**Innovative ICT is impacting businesses, productivity, and lifestyles. >>**

**D**igital technology is shaping the future. The dramatic convergence of the cloud, mobile, networks, and Big Data is a catalyst that's empowering business owners, consumers, and creative partners to drive a new connectivity that can enrich all humanity.

Right now, the world is seeing how a new style of elastically scalable computing — the cloud — is impacting business, productivity, and lifestyles. Cloud platforms are already vital to enterprise application strategies, with Forrester Research, an independent technology and market research firm, estimating that one-quarter of developers globally are using cloud services.

“Over the next four to five years, we expect a ten-fold increase in the number of new cloud-based solutions,” says Frank Gens, Senior Vice President and Chief Analyst at the global market intelligence firm IDC. “Many of these solutions will become more strategic than traditional IT has ever been. At the same time, there will be unprecedented competition and consolidation among the leading cloud providers. This combination of explosive innovation and intense competition will make the next several years a pivotal period for current and aspiring IT market leaders.”

As this technology continues to evolve, the connectivity it enables will drive economic transformation worldwide, as well as cause even more massive changes for individuals, businesses, and governments. In short, the cloud revolution will not tolerate standing still.

## Quantifying the Cloud

Cloud computing has become the platform of choice to power the applications necessary to manage national economies, industrial infrastructure, and consumer services. And, since it offers utility-scale computational power to support the burgeoning Internet of Things (IoT) and Big Data applications, the cloud's continued growth is a foregone conclusion.

According to the research firm Saugatuck Technology, more than 60 percent of enterprises will have at least half of their infrastructure on cloud-

based platforms by 2018. IDC forecasts, in that same timeframe, public cloud spending will more than double to USD 127.5 billion. According to a Goldman Sachs study, spending on cloud computing infrastructure and platforms will grow at a compound annual growth rate of 30 percent through 2018 — much higher than the five percent of growth forecast for overall enterprise IT.

“Cloud users are realizing benefits that impact business directly via agility, simplicity, collaboration, and innovation,” says Robert Mahowald, Program Vice President at IDC, and leader of IDC's SaaS & Cloud Services practice.

However, fully embracing digitalization and transforming into a digital enterprise that doesn't only use the cloud in an ad hoc way — a trend known as ‘shadow IT’ — is an effort that's beyond the capabilities of many organizations' IT departments. For that reason, while some companies are on the way to becoming adept at leveraging the cloud, many have been slow to move ahead — even if they understand that being inactive risks a competitive disadvantage.

## The Power of Partnership

CIOs, technology vendors, and consultants all agree that a serious shortage of cloud computing skills and a lack of understanding of cloud-centric business processes across the IT industry threaten to impede adoption and deployments.

An IDC survey shows just how naïve many IT departments are about their level of cloud adoption: They typically believe themselves to be one to two stages beyond where they actually are. “For these companies, it's a wakeup call that they need partners with skills to route them to the destination,” notes IDC's Mahowald.

In the future, businesses seem likely to bypass their in-house IT and look to experienced Information and



Communications Providers (ICPs) to handle the end-to-end workflows of mission-critical applications. Doing so will allow them to more readily take advantage of the new digital world.

“It will be the experienced cloud providers who can offer innovative cloud solutions to their customers, whether they're in the financial, urban government, media production, enterprise campus, or software development markets,” adds Yan Lida, President of the Enterprise Business Group at Huawei Technologies, Inc., a leading global Information and Communications Technology (ICT) solutions provider. However, as they enable digital transformation for their partners, ICT providers will also face challenges.

## Building a Better Connected World

In a world that, by 2025, may have 100 billion digital devices connected to the IoT — an estimated USD 2 trillion global market — ICT providers will need to engineer a digital ecosystem with a connected infrastructure and mobile broadband technology to the highest standard, faster than ever, for everyone, everywhere.

Given how vast this ecosystem needs to be, it's clear that no single company can serve every customer across the entire industry. Instead, enterprises will need to maintain close collaborations with hundreds of technology partners in order to build a solid cloud ecosystem — one that's based on cooperation, openness, and mutual benefit.

To deliver the best user experience, organizations not only need to construct future-oriented infrastructure that ensures agile innovation but also need to focus on the creation of a healthy and open industry ecosystem where all players along the value chain collaborate and contribute.

In the digital economy, no one company can serve all customers, making it that much more important to create new solutions with the help of a

partner. For that reason, leading global companies have chosen Huawei to help them offer innovative cloud solutions. This has happened across all sectors.

In finance, adopting a cloud solution means satisfying an Internet generation that demands promptness, reliability, and precision, as well as building IT systems able to dynamically allocate resources to keep pace with real-time changes in business volume. In the Smart City of the future, keeping pace with digitalization means supporting a culture of innovation that allows government agencies to collect and share information that will achieve greater convenience and security for its citizens by simplifying complicated bureaucracies.

Likewise, virtually every other industry has been touched by these advances, from healthcare (where a patient's information can be stored in the cloud so they can receive expert service even at distant facilities) and manufacturing (reducing the production cycle of cars to six hours) to education (where more students can share high-quality educational resources) and media (allowing reporters to share breaking news in real time with audiences using their laptop or mobile device).

“There's a need to develop ICT infrastructure with an open structure through joint innovation that provides enterprises with more cutting-edge products to drive business transformations and add value,” Lida concludes. “We believe that the impact of ICT should be measured by how many people can benefit from it. Our aim is to act as a responsible corporate citizen, an innovative enabler for the information society, and a collaborative contributor to the industry.”

As long as companies and governments continue to adopt this outlook and recognize the power of technology to create new opportunities, the cloud holds unrivaled potential to enrich lives and improve efficiency through a better connected world. ▲



*It will be the experienced cloud providers who can offer innovative solutions to their customers, whether they are in the financial, urban government, media production, enterprise campus, or software development markets. >>*



David He

# 'New ICT' Drives Innovation

| By David He, President, Marketing and Solution Sales Department, Enterprise Business Group, Huawei Technologies Co., Ltd.

Customer-centric, business-driven, and developer-defined ecosystems enable innovative modes of collaboration. >>



**W**e have entered a new era of Information and Communications Technology (ICT) in which business and technology are experiencing a 'survival-of-the-most-agile' evolution.

Today, we have the technology to query electricity consumption, account balances, and pay the bill from our mobile phones. Video-on-Demand (VoD) services enable television viewers to share their favorite programs via the WeChat 'Shake' function that is designed to find new friends in your immediate vicinity. Smart home functionality allows remote control of televisions, air conditioners, and water heaters through mobile Apps that accept inputs from 'speech-to-text' servers.

### May the 'Active Force' Be with You

New ICT is an open, customer-driven ecosystem in which developers are redefining expectations for agile infrastructures centered on cloud-pipe-device collaborations designed to quickly adapt to change.

Over the next five to ten years, industry will enter a critical period of digital transformation. A report released by the International Data Corporation (IDC)

shows that by the end of 2017, CEOs from 67 percent of 2,000 global enterprises will regard digital transformation as their strategic core.

The *Transformation and Reconstruction of Banks in the Digital Era*, a Deloitte white paper, describes a new expectation for banking customers: anytime, anywhere connectivity with access to tailor-made services based on predictive analytics. And, because

new competitors are entering the market, legacy banks are being forced to implement fresh products, services, and customer support programs with unprecedented speed.

The Bank of Beijing has built a digital platform that leverages the advantages of omni-channel collaboration that not only emphasizes 'online' services but also supports its 'offline' physical outlets by meeting their requirements for customer registration and risk assessment monitoring.

Changes in the banking industry are only the beginning. Industries across all market verticals are experiencing digital transformations enabled by the new ICT. History shows that only 10 percent of enterprise service departments participated in ICT construction in 1970. Recent surveys show that participation in 2014 was at 53 percent and project an increase to 80 percent by 2020. A 2014 IDC survey of 2,492 global enterprises indicated that CIOs were most concerned with how to upgrade their ICT infrastructures to meet changing business requirements.

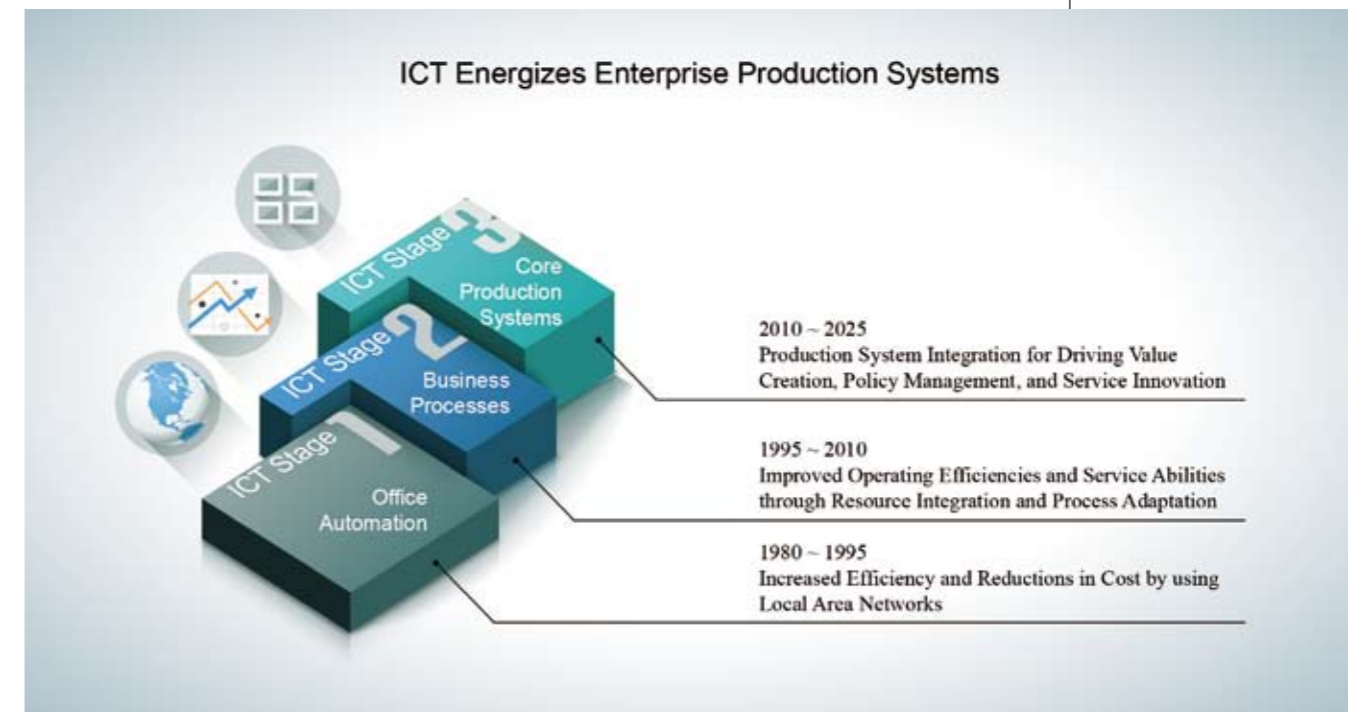
Once a support system designed for operational efficiency, ICT today is a production system for driving value creation. An example from the healthcare field is the use of cloud computing and Big Data technologies for data collection and analysis for DNA sequencing services to determine customized drug treatments.

In 2015, Huawei Enterprise launched the Business-Driven ICT Infrastructure (BDII) program to encourage close business collaboration and joint innovation efforts between Huawei and our partners.

"At Huawei Enterprise, BDII is a guiding principle for us to enable the new industrial revolution. BDII consists of three core components — to think with a business-driven mindset, facilitate joint innovation, and focus on ICT infrastructure," says Yan Lida, President, Huawei Enterprise Business Group. "As part of building BDII, Huawei will continue to focus on developing ICT infrastructures with an open structure to provide enterprises with differentiated, cutting-edge products and solutions



Over the next five to ten years, industry will enter a critical period of digital transformation. Once a support system designed for operational efficiency, ICT today is a production system for driving value creation. >>





*The new ICT industry has evolved from hardware- and software-defined to developer-defined, where customers are in their best ever position to impose an influence on the advancement of their business platforms. >>*

to drive their business transformations.”

**Developer-Defined Ecosystems**

The new ICT industry has evolved from hardware- and software-defined to developer-defined, where customers are in their best ever position to impose an influence on the advancement of their business platforms.

New modes of cooperation are reshaping a business landscape in which no single vendor can or will dominate the market. To compete effectively, Huawei must continually enhance and expand its open system capabilities and support the growth of developer-defined ecosystems that deliver commercial value for their customers, partners, and vendors. Developer-defined ecosystems create business innovations for customers and solution innovations for partners. This strategy presents a win-win scenario for all.

- Joint Exploration of Business Values  
In the traditional development channel, ‘collaboration’ is defined as partners extending vendors’

basic capabilities. In the new ecosystem, partners are better positioned to demand innovation from the vendor community based on end-user requirements in ways that optimize the joint delivery of leading-edge solutions.

ICT vendors possess the advanced technology necessary for infrastructure development but often lack domain expertise in specialized vertical markets — for instance, a vendor with mature solutions in the healthcare industry may be unfamiliar with regulations in the financial industry.

The Huawei ‘1+1>2’ partner program is designed to complement the advantages of each party to achieve winning outcomes. One such example is the SAP-Huawei joint innovation center that was established in 2015 with locations in Shenzhen, China and Walldorf, Germany to extend the SAP HANA Solution into the cloud, ‘Industry 4.0’, and IoT fields. Another important cooperation pact is with China’s Sobej Digital Technology, where Huawei is providing an IaaS-layer solution to optimize middleware and upper-

layer service software to offer an efficient, convergent, private omnimedia private cloud solution for media industry customers.

Currently, Huawei is participating in the following partnerships:

- **Strategic partners:** SAP, Accenture, VDF, and Hexagon
- **Solution partners:** 300+, including Microsoft, Alston, Siemens, and Honeywell
- **Channel partners:** 6,300+, including Synnex, Digital China, Array Network, and Indra
- **Service partners:** 1,600+, including ICT Plus and Sequence

In addition, Huawei has established the ‘Smart City Industry Alliance’ and ‘eLTE Industry Alliance’ to promote the development of industry standards and demonstrate the principles of ‘Openness’ and ‘Being Integrated.’

• **Using Open Platforms**  
Huawei leads in the exploration of new markets by providing an open ecosystem for technology and platform development. In 2015, Huawei became a Platinum member of the Linux Foundation. A longtime major contributor, Huawei won a Gold Member position from the OpenStack Board of Directors in 2016. In the Big Data field, Huawei has made significant contributions to the development of Hadoop and Spark and continues to be a major driving force for implementation of large-scale Spark deployments.

The Huawei eSDK platform provides partners with standard interfaces and pre-integrated plug-ins for developers to easily connect Huawei ICT-pipeline products with upper-level applications to efficiently meet customer service needs and gain a differentiated, innovative competitive edge. For example, GIS mapping software provider Esri uses eSDK open interfaces to accelerate project development that, in turn, allows government customers to benefit from convenient, easily maintained cloud services.

Highly flexible and collaborative, the open capabilities of Huawei’s new ICT ecosystem are devised to attract more partners and meet customers’ service requirements.

**Collaboration Drives ‘New ICT’**

Market competition motivates enterprises of all sizes to expand and advance, as delays of even a few months can mean life or death for entire product lines or online services. Enterprise ICT infrastructures must be able to support the rapid changes that come with high-stakes markets.

Safe cities, omni-channel banking, smart power grids, and the IoT are large-scale examples of the rapid digitalization of governments and enterprises alike.

In all cases, each sector needs ICT-based cloud computing to support their transformation to modern business practice.

Tencent — the host of China’s largest Internet user group — needed to add new ICT infrastructure in three short months to support peak traffic. Huawei delivered a containerized, custom Modular Data Center (MDC) solution that reduced the deployment cycle from 600 days to 60 days.

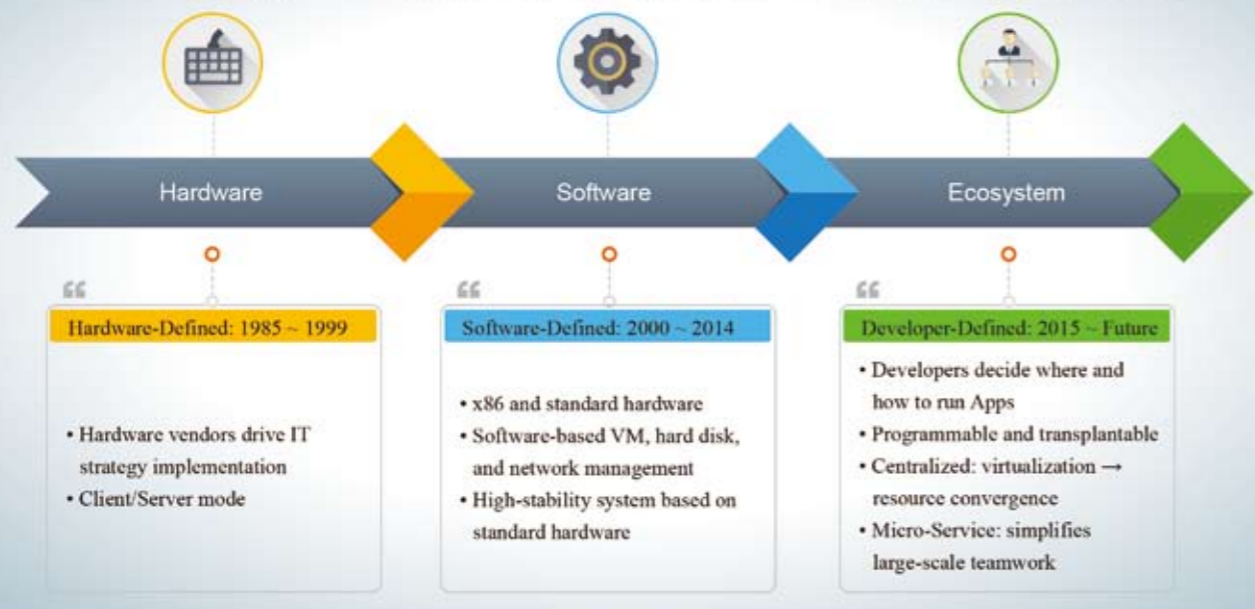
Shenzhen Media Group (SZMG) used Huawei’s Big Data solution to build a large pool of virtual computing and storage resources that reduced the time needed to migrate HD video materials by over 15 times, from 48 minutes to 5 minutes. The result of this dramatic increase in efficiency is a solid foundation for the SZMG news business to leap further into the future.

Cloud computing technologies enable enterprises to collect, store, and manage the vast amounts of interaction data used by Big Data technologies to explore and extract value from the information. The cloud-pipe-device architecture of modern ICT systems is enabling enterprises to collaborate with their integration partners to define the IoT era in which everyone and everything is connected. ▲

*Market competition motivates enterprises of all sizes to expand and advance, as delays of even a few months can mean life or death for entire product lines or online services. Enterprise ICT infrastructures must be able to support the rapid changes that come with high-stakes markets. >>*



**New ICT Industry: Evolving from Hardware- and Software-Defined to Developer-Defined**



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# Vertical Solutions Roundup

*To keep pace in a fast-paced global market, Huawei will be there to provide ICT solutions that solve the unique problems faced in specialized vertical industries. >>*

Today, we can instantly connect with people across the globe, purchase products online, or check our bank balance at the click of a button, and Huawei is responsible for the delivery of the Information and Communications Technology (ICT) solutions that are solving the many unique problems of this rapidly changing world.

Keeping people safe is a priority for those who protect and serve. Using technologies, such as Internet of Things (IoT)-based security protection, video cloud storage, and Big Data analytics, Huawei helps governments plan safer and smarter cities.

In Kenya, Huawei and the nation's leading mobile network operator deployed Long-Term Evolution (eLTE) emergency communications networks in Nairobi and surrounding suburbs to help control security threats against the nation's natural resources. Field officers can now upload on-site High-Definition (HD) videos that stream to large screens in the command center simply by pressing a button on their handheld trunking devices. The command center sends the videos to police cars with vehicle-mounted trunking terminals, implementing visual command and collaboration.

Huawei's 'better connected grid' concept helps keep Internet companies competitive with connectivity for intelligent IoT terminals and cloud-based, open architectures. The emergence of eLearning and other IT technologies and applications are redefining higher education and are bound to promote changes to teaching models, learning methods, and education management.

In Russia, Huawei's data center solution was implemented to help set up the country's payment system for processing credit card and ATM transactions across the nation. Huawei helps banks become digitalized to provide 'anytime, anywhere' financial services. Banks can offer financial products to the market quickly through data-driven requirement mining and product design, smart terminals, and remote banking.

And, ushering in the "4K" era, Huawei has partnered with Sony to build competitive TV and media industry solutions and to assist stations in their move to an all-IP environment.

Yes the world is changing, and in whichever direction it goes, Huawei will be there to meet it.







Zhang Aixue

## Protecting Enchanted Kenya

| By Zhang Aixue, Industry Marketing Execution Department, Enterprise Business Group, Huawei Technologies Co., Ltd.

**The Kenyan government is taking action to protect its natural resources. >>**

Kenya, known as the 'Cradle of Mankind,' is famous for its vast, picturesque landscapes and extraordinary animal life. Unfortunately, the beauty and vitality of Kenya are challenged by a variety of internal and external threats such as criminal incidents and terrorist attacks, as well as routine public safety matters such as the handling of traffic accidents.

### Informed Decisions Make Safer Cities

Safe City solutions that require innovative ICT for security management are part of Kenya's national strategy. Huawei partnered with Safaricom, Kenya's leading mobile network operator, and discovered the following challenges:

- **Legacy Systems:** Analog trunking systems were still being used for emergency communications; outdated devices left systems vulnerable to interference from external signals, leading to unclear communications.
- **Disparate Systems:** Kenya's police system included numerous agencies across the country, creating difficulties in planning and building subsystems into the solution for quick use across agencies and multiple locations.

- **Project Delivery:** Complexity of the project required collaboration with upstream and downstream enterprises in the industry chain.

### State-of-the-Art Solution

For visual dispatching, Huawei and Safaricom deployed eLTE emergency communications networks in Nairobi and surrounding suburbs, as well as Mombasa, the nation's second largest city. Field officers can now upload on-site HD videos that stream to large screens in the command center simply by pressing a button on their handheld trunking devices. The command center sends the videos to police cars with vehicle-mounted trunking terminals, implementing visual command and collaboration.

### Protecting Kenya's Public Safety

Huawei's Safe City solution includes interoperability among subsystems and functionalities based on a phased implementation schedule for future support products.

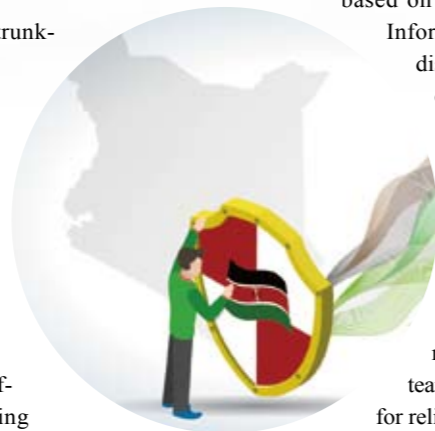
Huawei helped prioritize device configurations based on functionalities like Geographic Information System (GIS) and video distribution. The 'role – function – configuration' architecture helped users adapt easily to the new system. During project delivery, when the two companies encountered problems finding mature service resources locally, Huawei and Safaricom scheduled their own local resources by assigning dedicated teams from China and other countries for reliable project delivery.

### ICT Builds Safer Cities

Huawei believes that Kenya's new security management infrastructure opens an exciting new chapter for the country's two largest cities, where features like broadband trunking and visual command are actively protecting lives and property. The deployment of the Safe City solution has drastically improved safety conditions in the country. According to a 2015 annual report from Kenyan police, the crime rate in the coverage area decreased by 46 percent when compared to the previous year.

A longtime Kenyan journalist said, "I've heard about the African people living in misery for years. Misery is not horrible. What is horrible is if we do nothing to change it."

Huawei's commitment to improving the lives for the Kenyan people is creating that change. ▲



## Developing the Energy Internet

| By Gao Wei, Energy Sector Marketing Director, Enterprise Business Group, Huawei Technologies Co., Ltd.



Gao Wei

**Progress is making a huge impact in the energy sector in the areas of intelligent terminals, intelligent service systems, and open platforms. >>**

The China 'Internet Plus' action plan is organized to disrupt and transform businesses across multiple industries, including the plan for a new energy market valued at hundreds of billions of U.S. dollars.

### Hundreds of Billions

The Energy Internet is one of today's hot topics.

Essence Securities estimates the value of China's Energy Internet market will exceed USD 760.4 billion. In the U.S., the General Electric IoT energy management platform is projected to provide value-added service revenue of about USD 7 billion.

In Germany, more than 1,100 companies are selling electricity, and startup companies provide Photovoltaics (PV), power storage, and electric vehicle services from day one of operations.

### Energy Internet Advances

The Energy Internet is expected to affect the following areas:

- **Intelligent Terminals Connected to the IoT:** Automated power distribution and metering make the Energy Internet possible.
- **Intelligent Systems Based on Big Data Platforms:** Energy generation, storage, transmission, and consumption systems collect real-time data streams that work in conjunction with Big Data analytics.
- **Open Cloud Platforms:** Information and trading exchanges are designed to interconnect between energy sectors.

### Fully Connected Grids

In 2014, Huawei proposed an Energy Internet based on ICT technologies that we called the 'Better Connected Grid,' which includes the following features:

- **Comprehensive Data Sharing:** Allows the integration of widely scattered digital resources on cloud computing and Big Data platforms.
- **Agile Communication Networks:** Mass data collection is best connected to cloud information

processors over wideband backbone networks.

- **Connected Intelligent Terminals:** Open Machine-to-Machine (M2M) platforms are used to implement high-speed IoT interconnections between intelligent meters, sensors, and controllers.

### Energy Internet Business Models

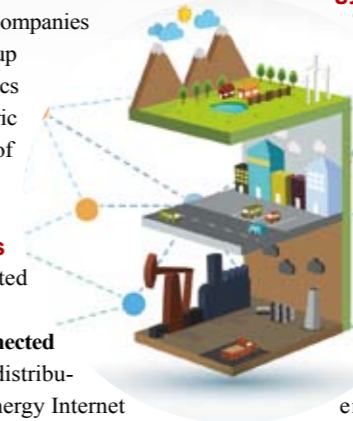
The Energy Internet is poised to disrupt traditional energy markets and bring new opportunities by adopting the following business models:

- **Transform the Ecosystem:** Energy monopolies are typically asset-heavy, vertically integrated, and highly regulated.
- **Sustainable Power:** Favored by innovation-oriented startup companies, opportunities for new forms of environmentally friendly energy utilities extend from upgraded electricity generation and transmission facilities to renewable power sources, economic models, and marketing strategies.
- **Asset-Light Cloud Architecture:** Asset-light Internet companies operate on open cloud platforms, with consumer-oriented front-end information assets that allow data-driven competitive advantages over traditional energy suppliers.

### Disruptive Innovations

Software-defined transformations in the ICT industry provide momentum to the Energy Internet market to break from siloed IT infrastructures that were built using decades-old technologies.

Adopting advanced ICT technologies is a breakthrough moment for traditional energy companies, as heavy, fixed assets are leveraged into digitalized resources at the defining edge of an evolving Energy Internet. ▲





Wang Yang

## Building a Learner-Centered Model

| By Wang Yang, Product Manager, Network Switch Solutions, Enterprise Business Group, Huawei Technologies Co., Ltd.

**eLearning platforms continue to transform higher education. >>**

Teaching and learning models that encourage learner-centered education and mass participation are redefining higher education. The mobile Internet, online learning, and other IT technologies and applications present more open, innovative approaches to higher learning.

Educators have found that learner-centered approaches to improve the efficiency of core teaching and resource-sharing services in colleges and universities are accelerated by using informatization.

Four major technology trends illustrate the benefits ICT offers to these institutions:

### Mobile Availability

As the mobile Internet grows, more curriculum services and applications will be offered through smart phones and tablet computers that have been designed to suit different learning styles and teaching approaches. To succeed, WLAN networks must implement 'seamless campuses' that are flexible, deploy quickly, maintain low failure rates, and eliminate gaps in coverage.

### Resources in the Cloud

Universities worldwide have an increasing need for new IT platforms and technologies, though high construction and O&M costs are often a constraining factor for investing in new technology, particularly in developing countries. The cost structure of cloud computing makes it possible to help every university meet new IT requirements within limited budgets.

Cloud computing provides dynamic, scalable resource allocation for IT services and is capable of charging users based on actual use. Cross-platform environments enable schools and departments to customize their information systems within a single, multi-variant framework.

### Big Data for Teaching and Management

Educational institutions are improving the effective-

ness and efficiency of the learning process by improving the accuracy of their Big Data measurement and analytics tools as related to the large amounts of data generated by Massive Open Online Courses (MOOCs), social media, and email.

Compared with traditional online courses, MOOCs provide interactive user forums to support communication between students, professors, and teaching assistants. In the U.S., a single MOOC platform includes 70 course providers. In the U.K., more than 470,000 students are registered on MOOC platforms.

Big Data analysis of data generated by MOOCs helps academic institutions direct the transformation of online teaching and learning. By analyzing course feedback, institutions can provide students with personalized and collaborative learning experiences that help reduce dropout rates and prevent students from losing money on dropped courses.

### Connected Silos

A stable, efficient network with adequate bandwidth is essential for any ICT-based education model, and reference designs are expected to include campus-wide wireless networks, cloud-based resource sharing, and cross-region eClass platforms.

The Huawei Agile Network Solution is based on Software-Defined Networking (SDN) principles that include: full programmability, quality awareness, and smooth evolution. The solution enables operators to launch services on the order of four times faster than comparable alternatives. For greater productivity and information sharing, the Huawei solution also interconnects the information silos that separate systems and departments. ▲



## Russia Commissions New Credit Card Payment System

| By Shuai Junchao, Industry Marketing Execution Department, Enterprise Business Group, Huawei Technologies Co., Ltd.



Shuai Junchao

**Using a pair of new Huawei data centers, Russia's payment system processes credit card and ATM transactions across the nation. >>**

Established and controlled by the Central Bank of Russia, a new National System of Payment Cards (NSPC) has been installed. Signed into law in May 2014, the goal of the NSPC is to handle credit card and ATM transactions throughout the country and serve as a processing center for international payment systems. The Central Bank of Russia chose Huawei to implement the NSPC infrastructure.

### NSPC: A Solid Foundation

Huawei leveraged its experience with financial institutions worldwide, including China's UnionPay payment system, to model and build the appropriate levels of processing, security, and scalability for the NSPC data centers. Huawei worked with local partners to deliver a custom solution that included two active-active data centers with high-performance computing platforms, cloud networks, and deeply integrated service systems. The result is a robust, agile, and future-proof national payment system.

Because the NSPC processes transactions from all Russian payment terminals and ATMs, the system is built to handle enormous amounts of service traffic, concurrent processing, and throughput with an average processing time per transaction of 10 ms. To meet the requirement of 10 million settlement and clearing transactions per day, the two data centers have been provisioned with more than 100 sets of x86 server clusters and a 2.8 petabyte storage capacity.

The data centers are 70 km apart. Remote replication is a crucial requirement and, for maximum availability, the two NSPC data centers back each other up. Huawei's Cloud Fabric Data Center Network solution creates an Active-Active network that employs Transparent Interconnection of Lots of Links (TRILL) and the Ethernet Virtual Network (EVN).

EVN is a Layer 2 VPN technology that is based on the Virtual eXtensible LAN (VXLAN) tunnel. This technology uses the Multiprotocol Extensions

for Border Gateway Protocol (MP-BGP) to transmit MAC addresses between Layer 2 networks and forward Layer 2 packets using the generated MAC address entries.

To the benefit of improved financial data availability and to ensure continuity, when the transaction rate reaches 3,000 Input/Output Operations Per Second (IOPS), the payment system is built to respond within 10 ms after remote replication is activated.

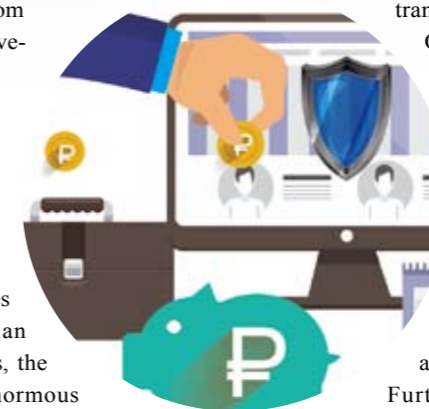
To facilitate long-term upgrades, Huawei has used an elastic architecture with Layer 2, TRILL-based networks at the core layer that enables 100 percent access to all network resources.

Further, the use of Huawei's Data Center Interconnect (DCI) streamlines the collaboration of resources between the data centers.

### System Launches

On April 1, 2015, the official launch of the NSPC was announced by the Central Bank of Russia. Over the first three months of operation, the NSPC processed the projected average of 10 million transactions per day and has remained stable as expected in the months following.

"The NSPC shoulders responsibility for maintaining a stable financial system in Russia," observed Sergey Bochkarev, Deputy CEO of the NSPC, "so the reliability and stability of the national payment system are crucially important. Huawei successfully deployed the data centers within a short delivery period and has effectively supported the rollout of the payment system as scheduled." ▲





Liu Quan

# Digitalization — Banks Transform to Outperform

| By Liu Quan, Industry Marketing Execution Department, Enterprise Business Group, Huawei Technologies Co., Ltd.

**Establishing digital banks requires the digitalization of customers, currencies, products, marketing, and services. >>**

## Banks Excel

Digitalization is sweeping the world and transforming traditional banks into digital banks that are expected to quickly launch contemporary financial products designed to leverage modern, consumer data captured via smart terminals and social media.

- **Data-driven Development:** Analysis from internal and external sources allows digital banks to grasp industry trends, identify customer pain points, and seize new business opportunities.

- **Agile Response:** In the Internet era, financial products are especially vulnerable to imitation and replication. Banks must deliver new products that 1) meet access security and data integrity standards, and 2) meet tightly budgeted R&D and go-to-market deadlines.

- **Access to Services Anytime, Anywhere:** Supporting existing customers always costs far less than acquiring new customers; therefore, the most effective means for banks to maintain loyalty is to improve the customer experience for current products and services.

## Banking 3.0

In the next era of banking, customers will live in hyper-connected information communities in which the data networks will grow more sophisticated and

valuable for the foreseeable future.

- **High-Performance Processing:** Banks accumulate more high-value data than any other sector. To maintain this lead, and the profits that come with it, their IT platforms must support the capture and processing of Big Data to find and track rules and trends, respond to customer requirements, seize market opportunities, optimize operations, and transform from experience-dependent to data-driven institutions.

- **Open Infrastructures Reduce Costs:** Distributed and high availability technologies address various resource inventory issues in cloud computing. As is occurring generally across all verticals, IT architectures for banking are evolving from closed and centralized to open, software-defined systems running on general purpose hardware. By design, open source technologies incur minimum costs relative to the high cost to build and operate a ‘traditional’ mainframe cluster.

- **Mobility and Multimedia for Omni-Channel Financial Services:** Digital banks are compelled to present online solutions to their customers to reduce the inefficiencies of operating physical branches. In the era of software-defined everything, the only available development option is to build easy-to-navigate UX/UI for both internal business systems and customer-facing applications that are accessed over smart phones. ▲



# Time to Build an All-IP TV Station

| By Deng Linwei, Industry Marketing Execution Department, Enterprise Business Group, Huawei Technologies Co., Ltd.



Deng Linwei

**The broadcasting industry is adapting IP network technologies to develop all-IP television stations. >>**

For TV stations, the era of omnimedia and Ultra-High Definition (UHD) has arrived. The emergence of 4K production and UHD display technologies has made cabling and transport bandwidths a critical issue for the production, transmission, and broadcast of digital TV signals. 4K/UHD signals are not compatible with existing technical architectures of video plants that are based on Serial Digital Interface (SDI) baseband interfaces and dedicated SDI digital video matrix switches.

## Numerous Cables — Short Transmission Distances

There are advantages to SDI, as long as Standard Definition (SD) and HD continue to dominate TV standards; however, SDI signaling in 4K/8K UHD environments present the following issues:

- **Numerous Cables Equal Difficult Maintenance:** SDI cables can number in the thousands. Migrating from HD to 4K multiplies that number by four. When including the cost of terminal equipment, the process is too complex and expensive.

- **Limited Transmission Distance:** SDI signals cannot exceed 100 meters without introducing error codes and image distortion.

- **Limited System Solutions:** Specialized, niche market SDI-based HD products, transmission cables, and backend storage products are few and expensive.

## All-IP TV Station — Disruptive but Inevitable

TV stations will launch all-IP signal transport solutions because IP platforms can provide wide coverage, mature compression and coding schemes,

simple cabling, and re-use of existing devices.

## Huawei and Sony Team Up

Huawei’s accomplishments in the field of media and television prompted Sony Television to select Huawei as a partner to develop an all-IP solution for TV stations. Sony selected Huawei server and storage components as well as its CE7850 and CE6850 series switches to meet strict delay and bandwidth requirements. Sony is providing the 4K camera sources, SDI-to-IP gateways, 4K live switchers, and LSM-100 audio/video screen management system.

Advantages of all-IP stations include the capacity of 10 Gigabit Ethernet cabling and IP interconnects that support long distance transit and local transcoding to SD-SDI, HD-SDI, and 3G-SDI signals. Simply adding IP gateways is all that is required to smoothly migrate from SD and HD to 4K/UHD.

Sony and Huawei will continue to collaborate to build competitive all-IP TV and media industry solutions as the 4K/UHD era becomes a reality. ▲





# IoT Drives Digital Transformation

| By *Tanja Rueckert, Executive Vice President, IoT & Customer Innovation Unit, SAP SE*

Tanja Rueckert leads the newly formed IoT & Customer Innovation Unit at SAP SE, which, working in close collaboration with customers and partners, focuses on developing innovative software solutions, particularly for the IoT and Industry 4.0.

**The Internet of Things (IoT) represents a tectonic change that will transform industries across all markets. >>**

## Impact on Business

The Internet of Things (IoT) has been catapulted to the peak spot of ‘inflated expectations’ in the 2015 Gartner Hype cycle.

Leading analysts and consulting firms continue to make substantial estimates about its economic impact. McKinsey & Company, for example, predicts a range between USD 3.9 to 11.1 trillion per year in 2025 and, in the past few years, venture capitalists have invested several billion dollars in the IoT, according to the Boston Consulting Group (BCG).

At the 2016 World Economic Forum in Davos, Switzerland, the IoT was predicted to be the fourth industrial revolution that, following the historical game-changers of water and steam, electricity, and electronics and IT, would lead to a new machine age. Fueled by hyperconnectivity — eventually with tens or hundreds of billions of devices plus new levels of machine intelligence — the IoT is predicted to enable complete digitalization of business processes, unparalleled operational efficiency, and disruptive business model innovation.

Technological advances play a significant part

in this vision. The following breakthroughs are the enabling levers:

- Consistent increases in computing power based on Moore’s law
- Advent of cloud technology
- (Predictive) Big Data analytics
- New machine learning capabilities
- Reduction in sensor and storage costs

This futuristic perspective carries a risk to which many businesses fall victim by presuming that the IoT will happen to them as the technology evolves and disruptive startups bring it to market. The advent of the sharing economy that has posed similar threats to traditional business models may have contributed to this passive ‘wait-and-see’ stance but fall short in comparison to the sheer complexity of an IoT-based economy.

This article explores why SAP believes many underestimate the IoT’s relevance today and its impact on the future. Waiting for the IoT to arrive tomorrow will result in missed opportunities to tap into the digital economy and gain competitive advantages now. Underpinning this argument is a case about the

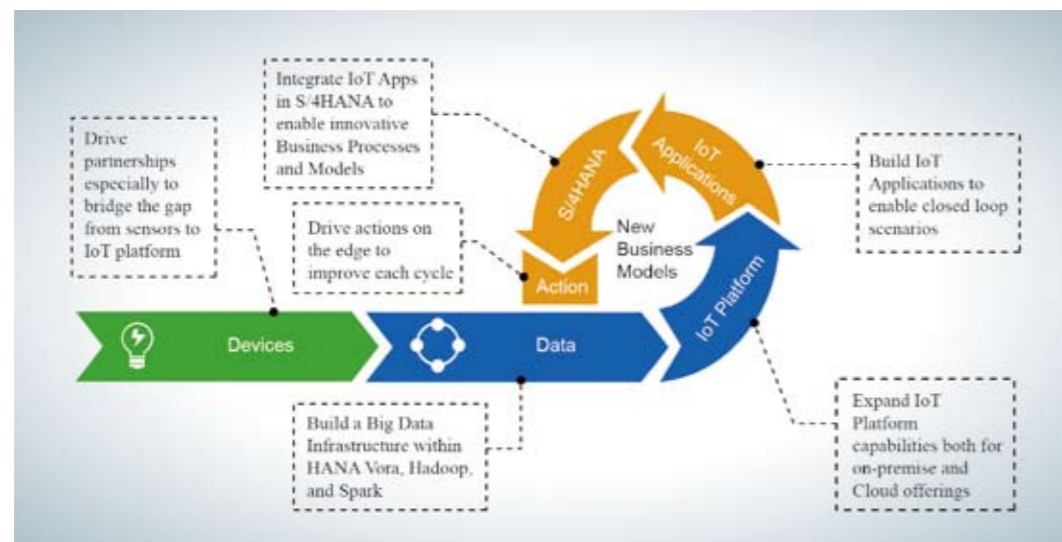


Figure 1: SAP’s Vision of the IoT for Business

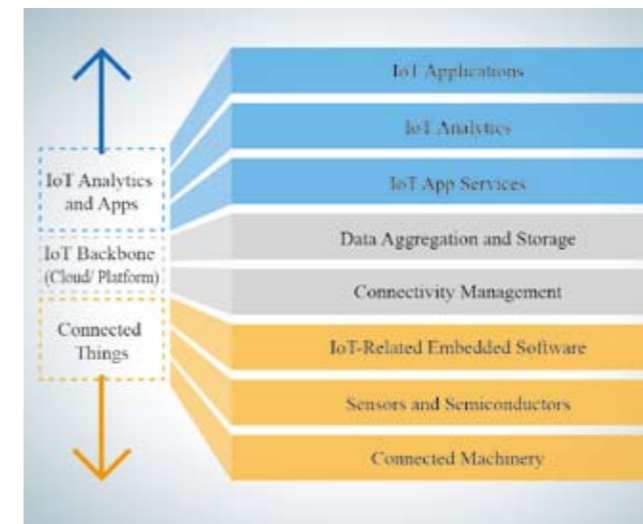


Figure 2: IoT Stack

value of an end-to-end IoT scenario and some encouragement to IT and business leaders to start small and think big — starting today.

We will also examine the critical importance of strategic partnerships. The Internet of Everything (IoE) is far too big to be led by a single company; it is dependent on an integrated ecosystem. This is why SAP is proud of its strategic partnership with Huawei and why a description of our collaboration will form the conclusion of this article.

## SAP’s IoT Path

With more than 40 years of market leadership in enterprise application software, SAP has set out to realize the IoT for businesses and make it universally connected to close the ‘Thing-to-Insight-to-Action’ loop. Based on an end-to-end data and process flow, as shown in Figure 1, SAP’s solutions create intelligent insight and drive impactful action, from the devices and machines at the edge to the business processes at the digital core of an enterprise. Leveraging advanced machine-learning algorithms, these solutions become more effective over time, as data is accumulated to predict events with increasing accuracy and automate preventive action.

Real customer cases have already delivered proof that these closed loop scenarios not only drive unparalleled operational efficiency but also enable entirely new business models, such as transforming a traditional product into an innovative service with flexible pay-per-use billing options. These early adopters have found in the IoT a means to ensure their survival and gain a competitive advantage in the highly disruptive digital economy.

These end-to-end closed loop scenarios require the full IoT stack, as shown in Figure 2, which SAP enables through key partnerships.

The ‘Connected Things’ layer is where physical machines and sensors connect and generate data. The ‘IoT Backbone’ layer refers to the critical link between core business processes and Things. SAP provides a secure, open, and extensible IoT platform based on



**Waiting for the IoT to arrive tomorrow will result in missed opportunities to tap into the digital economy and gain competitive advantages now. IT and business leaders need to start small and think big — starting today. >>**

SAP’s HANA Cloud Platform (HCP). It offers common services and standardized interfaces and API, and supports ‘reconfigurable,’ closed-loop business processes by integration with the digital core. HCP also enables differentiating IoT analytics and applications at the top layer. Customers and partners build, extend, and integrate IoT Apps and benefit from reusable IoT application services.

For SAP, empowering and nurturing a rich ecosystem and offering customers an integrated and interoperable landscape are the key to IoT success.

Along with this ecosystem is the responsibility for end-to-end security across the entire stack. In particular, unprotected distributed Things can be easily compromised via the Internet or can physically expose the integrity of the network and the edge data to a wide array of cyber attacks.

Based on an end-to-end IoT security architecture, SAP is committed to keeping data secure in transit and at rest, and deploying mechanisms that ensure data integrity and appropriate access controls with the use of strong cryptography.

## Digital Transformation

Powerful technology stacks that enable end-to-end IoT scenarios are fundamentally changing traditional business models and creating unprecedented value. For example, a busy shipping port is the result of a prosperous economy and favorable location. A terminal management enterprise at a busy port requires efficiency and effectiveness and technologies that increase port throughput, reduce idle time, save energy, and increase revenue. SAP’s answer is to provide IoT technologies to connect every Thing in a port in real time.

Port business processes include waiting for ship arrivals, unloading/loading operations, delivering containers, and transferring them to and from freight forwarders. Required port information is entered into a Terminal Operation System (TOS) days in advance; then, the system schedules all required activities based on this static



**Shipping ports are at an apex of information flow and logistics in the transportation industry. The vast accumulation of past and current cargo information offers vast opportunities to find business value in patterns mined from the data. >>**

data. However, in today's world, schedules based on static data do not always meet customer needs, as customers prefer IoT-based dynamic scheduling solutions that can deal with unexpected changes.

For example, when the Automatic Identification System (AIS) discovers a delayed ship arrival, all allocated resources — cranes and vehicles — must be automatically rescheduled, rather than being held offline. If GPS data indicates vehicles are stuck in traffic, pick-up times for the gantry cranes are recalculated in real time to avoid an unnecessary container queue. Real-time Location-Based-Service (LBS) platforms auto-connect with all vehicles that are inside the port perimeter, giving vehicle drivers a full picture of traffic on the port grounds, as well as an optimal route to freight stations, parking areas, and fuel. Major ports like Hamburg, Germany have widely adopted IoT-LBS services delivered by SAP solutions, showing significant improvements in port logistics, as shown in Figure 3.

Apart from increasing the efficiency of job execution, the IoT is also helping ports digitally transform traditional business processes by creating new services.

'Track & Trace' is a most valuable service that enables the logistics life cycle to use IoT technologies, such as RFID, AIS, and GPS.

Traditionally, freight forwarders, purchasing agents, and goods owners must seek out very detailed information from multiple parties, such as which container holds a specific package, current ship locations, and estimated arrival date and time, etcetera, with limited results. Therefore, port management operators can use centralized Track & Trace services to sort all these fragments of information and provide access to the assorted stakeholders. Any port that is newly equipped with the latest in information-services support positively impacts its suppliers and customers. Once the goods are transferred to the freight-forwarding carrier, the life cycle enters into the land carriage stage.

Many larger terminal management enterprises own large vehicle fleets; therefore, the land transportation sector must focus on continuous

improvements in quality and safety as an essential component of their services. Numerous vehicle networking applications, such as SAP Connected Transportation, address this need. In the commercial market, overland transportation management tools focused on safety-best practices are readily available. Within these applications, telematics data is collected from the vehicle On-Board Diagnostics (OBD) interfaced with other types of sensor data, such as weather, noise levels, CO<sup>2</sup> concentrations, GPS signals, and even wearable devices. The telematics and sensor data is correlated by the central server for output as driver-behavior and driver-fatigue analysis, vehicle health checks, and others. Based on the results, dynamic task planning and mechanical/behavior optimizations are presented to Machine-to-Machine (M2M) or a graphical UI/UX for people and integrated with Enterprise Transportation Management and Human Capital Systems, such as employee care and training programs.

Shipping ports are at an apex of information flow and logistics in the transportation industry. The vast accumulation of past and current cargo information offers vast opportunities to find business value in patterns mined from the data. Port management enterprises can use data mining technologies to provide unique analysis of variations in supply and demand for all categories of goods by using key factors like seasonality, economics, weather, and climate. By performing risk assessment and making use of the results, they can offer business innovations, such as procurement consulting services, that include future demand forecasts based on Things like the upstream supply of raw materials, thus transforming port management enterprises into purchasing agents or even financial service providers.

IoT technologies drive the digital transformation of specialty equipment manufacturers that produce and sell equipment to ports and are anxious to find new opportunities for expanding their businesses. Predictive Maintenance is one example of an IoT-based innovation that manufacturers wish to improve upon.

The current market for maintaining port equipment is full of vendors that provide qualified maintenance services at relatively low costs, compared to the prices quoted by the Original Equipment Manufacturers (OEMs) — making it clear that the business model of providing maintenance services is more profitable and sustainable than selling equipment alone. Equipment manufacturers win back the technical services market from independent maintenance vendors with the IoT. Equipment vendors are in the best position to remotely collect operational data, such as temperature and equipment vibration, and return it to the factory. By fusing operational and IT data, the OEMs build reliability models that automatically schedule maintenance tasks, preventing large business losses.

The IoT is a key lever to realizing the smart port, and the core of the IoT is connectivity. Each asset inside and outside a port, including ships, cranes, cargo, etcetera, is well-connected through IoT-enabled smart devices.



**Figure 3: IoT-Enabled Digital Transformation for Shipping Ports**



**Together with SAP's dominant market position in high-performance, in-memory computing, Huawei will provide comprehensive end-to-end IoT solutions to drive IoT adoption to the next level. >>**

Individually connected with a powerful data analytics engine that extracts intelligence from the system, each piece of equipment is optimized for its task, with green production and improved work safety levels.

#### **SAP and Huawei Strategy**

SAP and Huawei have joined together to more closely explore IoT market opportunities and leverage their respective advantages. As a world-leading communications and network device provider, Huawei, with its IoT smart gateway, is an important edge component for remote data collection. Together with SAP's dominant market position in high-performance, in-memory computing, Huawei will provide comprehensive end-to-end IoT solutions to drive IoT adoption to the next level.

Transportation is a remarkable example. The Traffic Safety Culture Index in the U.S. shows that car crashes rank among the leading causes of death. SAP is developing an IoT-based transportation solution to help guarantee driver and passenger safety by using IoT data collected from public transportation vehicles, such as school buses, coaches, and heavy vehicles.

Huawei plans to install a smart IoT gateway device inside vehicles so that, while a vehicle is on the road, different kinds of sensor data will be collected and saved into SAP SQLAnywhere, which serves as local storage on the IoT gateway. The IoT data will then be uploaded to the SAP HANA database via 3G or Wi-Fi, either in real time or as scheduled. Then, SAP HANA uses its powerful calculation capability to perform analytics, such as driver behavior and fatigue detection, enabling intelligent insights to fleet managers.

A reference case solution has already been successfully presented to large enterprises in various countries. This cooperation is only the beginning for SAP and Huawei in the IoT arena. Soon, this alliance will enable the full IoT stack in unprecedented ways for a broader ecosystem. ▲



Samantha Zhu

# Large Enterprises Encouraged to Adopt 'As-a-Service' Operations

| By Samantha Zhu, President of the Corporate Citizenship Council of Accenture Greater China

**For many large enterprises, 'being lean and responding quickly to market changes' remains the elephant in the room. >>**

Today, markets are inundated with rapidly changing customer requirements, increasingly short product life cycles, and innovative competitors. In this context, 'being lean and responding quickly to market changes' is impossible to ignore. Large enterprises respond slowly to change due to vast assets, numerous employees, and complex processes and regulations. Though most enterprises appreciate the importance of agility for survival, a report sponsored by Accenture in 2015 reveals that roughly two-thirds of businesses appear unprepared for what's coming.

For example, let's assume that you have entered a new field in which the number of customers increases rapidly. How do you scale your customer relationship management system to assure the continuous presentation of high-quality services? During an economic downturn and/or period of shrinking production, how do you reduce operating expenditures in a timely fashion? When competitors force themselves into markets where you have long-established advantages,

how do you launch a counterattack? The answer for enterprises struggling with these problems is to access the outsourcing market for As-a-Service operations.

### What Is 'As-a-Service?'

Typical examples of the As-a-Service model include Infrastructure-as-a-Service (IaaS), Platform-as-a-Service (PaaS), and Software-as-a-Service (SaaS) products, as the As-a-Service model is designed to



As-a-Service Comprises a Stack of Five Components:



Figure 1: As-a-Service Component Stack



enable the integration of enterprise-grade intelligent business solutions for companies that are more concerned with running their business than buying and maintaining an in-house IT infrastructure.

The marketplace is moving toward a new era of service delivery in which applications, infrastructure, and business processes are brought together and delivered as plug-in, scalable, consumption-based services supported by Big Data analytics, the cloud, and automation to deliver successful business outcomes at lower costs. Figure 1 shows a stack of components that comprise the As-a-Service model.

#### Plug-and-Play

Traditional service delivery structures are based on fixed infrastructure, terms of service, and Full-Time Equivalent (FTE) overhead. By comparison, the As-a-Service model is flexible, outcome-oriented, and based on a modular design that allows companies to employ plug-and-play, scalable, and consumption-based services at hourly, weekly, or monthly rates. The result is that companies can scale services up or down based on business volumes or changes in the market with a degree of freedom that would be impossible in a traditional service delivery environment.

The ultimate goal of the As-a-Service model is to provide companies with standardized, end-to-end, business-oriented solutions that enable them to focus on market development, customer engagement, and innovation. Specifically, As-a-Service offers the following major value levers:

- **Plug-in:** Access services quickly — in days or weeks, not months; modular designs that enable companies to set up and tear down services rapidly when necessary
- **Scalable:** Ramping up or down to match actual business volume needs
- **Consumption-based:** Paying for use,

*The ultimate goal of the As-a-Service model is to provide companies with standardized, end-to-end, business-oriented solutions that enable them to focus on market development, customer engagement, and innovation. >>*

rather than committing to hardware, services, or functionality that may not be needed

- **Outcome-oriented:** Working relationship in which the buyer and provider are committed to clear business outcomes
- **Standardized:** Shared services model for standardized and scalable processes for production and delivery; achieve repeatability in multi-client and multi-tenant environments
- **Vendor-agnostic:** Providing deep knowledge and experience across multiple provider offerings to assemble the right combination of solutions appropriate to the desired business and performance outcomes
- **Innovation-enabled:** Committed to ongoing innovation in business, infrastructure, and application processes
- **Future-protected:** Shielding the buyer from the potential disruption of upgrades and future changes; services that are always up-to-date and led by buyers who have continuous access to funding and expertise

As-a-Service disrupts existing business processes and supports new business models. For instance, Rio Tinto, a global diversified mining company headquartered in London, England, is moving to a new information systems and technology delivery model that will migrate their legacy enterprise information system to a cloud-based, As-a-Service solution — including pay-for-use pricing to keep costs fully flexible and services properly scaled based on business demand.

Since As-a-Service platforms provide services to multiple clients, platform operators are positioned to enable clients to obtain valuable insights into their businesses. One global food and beverage company saw an opportunity to reach aggressive cost reduction targets and transform an internal process by outsourcing parts of its procurement operations. Adopting an As-a-Service model can bring new insights via digital applications that answer questions for companies like, “Who are the best suppliers to meet our



needs,” “What is the fair market pricing for this service,” and “What terms and conditions should be in our contracts?”

#### Active Reform

Research from Accenture and HfS Research found that most large enterprises have not yet transitioned to As-a-Service infrastructures. Seven out of ten enterprises over USD 10 billion in revenues do not expect their core operations to adopt the As-a-Service model for at least another five years, even though they face pressure to double IT requirements and service resources on an annual basis against limited budgets. Forty-two percent of small and medium enterprises see As-a-Service as either necessary or absolutely critical for their organizations versus twenty-five percent of large organizations.

In China, enterprises are looking for advanced solutions to shift large capital investments into much smaller operational expenditures. To do so, enterprises must transform their management practices and take all measures to clarify new operating models from top to bottom. Executive leadership must be educated about how to purchase As-a-Service resources, as many do not yet know how to buy in this piece-by-piece method. The

financial value proposition is compelling, however, especially when it comes to technology upgrades or changes. For a significantly less total cost of ownership, buyers gain access to continuously updated software platforms rather than bear the burden of their implementation from scratch.

One of the many positive aspects of an As-a-Service model is that it allows companies to start small and scale fast in ways that other models do not. For most buyers, the As-a-Service model starts with an overall roadmap and then proceeds function-by-function to examine how the As-a-Service value proposition transforms each function to deliver specific business outcomes. Buyers can consider starting with functions that are less business critical and create the types of small successes that build commitments from both senior and middle management.

The As-a-Service model allows two collaborating parties far more flexibility than traditional outsourcing models in which the supplier must exhibit world-class capability and continuously prove its value to the buyer. The best suppliers are not simply transaction machines; rather, they are consultants to the buyers, doing whatever they can to help the buyers identify and extract more value. ▲



*One of the many positive aspects of an As-a-Service model is that it allows companies to start small and scale fast in ways that other models do not. Buyers can consider starting with functions that are less business critical and create the types of small successes that build commitments from both senior and middle management. >>*



Wang Lei

# Internet Transforms Chinese Education Industry

| By Wang Lei, Consulting Director, and Zhou Yi, Senior Consultant, Ernst & Young



Zhou Yi

**Content, platform, and technology providers are uncovering new opportunities in the Internet education industry. >>**

**T**ransformation is a familiar theme in education. In recent years, developments in various market segments that have illustrated large-scale changes include Massive Open Online Courses (MOOCs), Kindergarten through 12<sup>th</sup> Grade (K12), online education, online language training, and online vocational education.

Major players in the Internet education industry see room for more growth. Content providers deliver educational materials that meet the requirements of specific market segments. Platform providers are transforming to digitally driven enterprises that yield profits through Big Data analytics to attract users and achieve increases in their user base. And technology providers may have the greatest opportunity for market breakthroughs and business expansion due to new technologies, such as wearable devices, artificial intelligence, and the Internet of Things (IoT). These technologies will continue to change the education industry dramatically and attract institutional investors and entrepreneurs seeking opportunities in new industries.

Various market segments of the education industry must actively explore and develop models that suit their goals. Each segment has the following opportunities available to them.

## Preschool Education

Preschool Apps are thriving, and software subscription models are readily adopted in this market. Preschool educational products should be fun, easy to use, and interactive. Most importantly, the products should systematically match the preschool curriculum.

Due to concerns for the safety of preschool children, smart watches and smart bands with security functions are expected to be highly popular — and some Internet education companies have already entered this field.

## K12 Education

Many institutions are attracted by the huge potential market scale of K12 education, though some are only succeeding temporarily. A consensus has been

reached on the critical role of online-offline content integration. Institutions that produce online courses and products and take advantage of Online-to-Offline (O2O) models will have more opportunities.

The content of K12 educational products falls into two categories. First are exams, exercises, and assignments that meet public education requirements. The second category offers preschoolers additional curriculum materials whose content can be taught both online through mobile terminals as well as offline.

Driven by favorable policies on educational ICT construction, the state-run K12 education system has achieved remarkable results in the deployment of Internet education infrastructures. However, Internet-based reform still has a long way to go. Current circumstances indicate that providers will succeed in providing comprehensive solutions if they enter the education system through technical services.

## Higher Education

In the post-secondary market segment, ICT infrastructures are relatively mature. Governments and universities have formulated clear policies that encourage open learning systems. Rapid developments of MOOCs platforms are accelerating the penetration of the Internet into the higher education system. Technology and solution providers with distinctive advantages in creating digital course content are most likely to own future market share.

Policies on college entrance exams are affecting higher education markets, such as recent changes to China's college entrance exams that require more provinces to use unified national exams and allow students to take exams on certain subjects multiple times within a year. These changes offer great opportunities to online and offline training institutions. Unified national exams support Internet-based train-



ing because training products can be standardized rather than tailored for different regions, and the repeat-exam policy enables institutions to set more nodes in their training processes.

## International Education

International education is extending to more and more students — even younger ones. Customization is a growing trend in this market, with some institutions delivering value-added benefits such as free services on the Internet to attract attention and increase page views. Institutions that provide diversified services, customized requirements, or deliver one-stop services to other areas of the industry chain will seize more opportunities.

## Language and Vocational Training

Intense personnel recruitment and career competition have created a surge in language training and vocational education market segments. Institutions with positive brand images and expertise in particular fields are enjoying the competitive advantages that come with meeting the students' functional requirements for improved results in the form of exam performance and marketable skills.

## Interest Cultivation

Cultivating interest involves a wide range of services. Diversified institutions are competing in this market segment, but not a single one has gained prominent advantages. To overcome this concern, Business-to-Consumer (B2C) Internet institutions should promote

their service integration with offline training institutions, and Consumer-to-Consumer (C2C) platforms should enhance user participation through better community outreach to improve user loyalty and encourage enrollment.

## Financing

Another sign of opportunity is the development of multi-layer financing channels. Financial and strategic investors in the Chinese market favor enterprises in the Internet education industry. Currently, startups in many market segments are the top investment targets, including language and vocational training and K12 education. Additionally, China's new Over-The-Counter (OTC) market, which allows Small- and Medium-sized Enterprises (SMEs) to raise funds, provides a pre-IPO platform for educational institutions, allowing them to develop financing and management capabilities. Moreover, the simplified listing procedures in China's A-share market and reforms in the IPO registration system are facilitating the listing of educational institutions. This facilitation provides primary market investors with easier exit channels and has led to the current boom in educational investments. Finally, in recent years there has been a growing recognition in the U.S. of the stock markets in China and Chinese Hong Kong that are helping China's educational institutions find rich financing sources. As Internet education becomes increasingly global, there may be additional links between China's A-shares and the stock markets in the U.S. ▲



**Financial and strategic investors in the Chinese market favor enterprises in the Internet education industry. Currently, startups in many market segments are the top investment targets. >>**





Gui Lin

# The Future of Telemedicine

| By Gui Lin, Medical Industry Solutions Sales Marketing Manager, Enterprise Business Group, Huawei Technologies Co., Ltd.

Huawei has recently partnered with the First Affiliated Hospital of Zhengzhou University to develop a telemedicine system and joint innovation center. >>



Telemedicine has the potential to improve medical services for large populations in rural communities where quality care or medical services are limited. By enabling fast delivery of medical resources, telemedicine plays an important role in promoting hierarchical diagnosis and treatment, strengthening medical collaboration, and fueling new ICT technologies for services. Huawei has recently partnered with the First Affiliated Hospital of Zhengzhou University in a pilot project to develop a telemedicine system and joint innovation center in Henan Province, China.

With a population of over 94 million and a rich cultural heritage, Henan is a large province that remains economically underdeveloped. And, although the First Affiliated Hospital of Zhengzhou University provides top medical services for the region, quality resources for the province rank well below the national average. As a result, the hospital sought partners to help build a telemedicine system to distribute quality healthcare, medical treatment, disease prevention, education, research, and rehabilitation to vast regions within and outside Henan Province.

The hospital first created a regional medical collaboration alliance in 2012 and adopted ten technology support measures to member hospitals, such as 10 Mbits/s optical fiber connectivity, teleconsultation terminals, and access to other free digital resources. The hospital invested heavily to upgrade

the hardware and software platforms throughout the alliance to bring diagnosis and treatment services to more patients through telemedicine. With Huawei's advice and support, Zhengzhou University built the Telemedicine and Medical Big Data Joint Innovation Center inside the hospital.

## Telemedicine for the Public Welfare

Based on the resources of a top, large-scale, and full-service hospital, the Henan public telemedicine system has the advantage of accessing primary medical and health services that balance affordability with access to expert resources.

Today, Zhengzhou University Hospital has the largest-scale telemedicine system, the highest technical standards, and the most sought-after telemedicine capabilities in China. By the end of 2014, the

Telemedicine Center of Henan Province had deployed 128 sets of teleconsultation devices in 108 counties of Henan Province and connected to hospitals in other provinces, such as Xinjiang Uygur Autonomous Region, and Shanxi and Sichuan provinces, through cooperation with more than ten leading domestic and international medical information enterprises.

## Upgraded Telemedicine Services

In 2014, the telemedicine center conducted more than 10,000 consultations on intractable cases, gave more than 30,000 specialist diagnoses, and received more than 40,000 inquiries through the telemedicine platform. On average, there had been 70 audio and video telemedicine consultations conducted every day — up to 120 in peak periods — and more than 100 specialist diagnoses a day. During peak hours, the three specialist consultation rooms, one multidisciplinary consultation room, and the command center were overloaded.

Though impressive, this high level of activity was insufficient to meet the demand for services, so much so that the goal of extracting better information through data mining and analysis was hindered by the operational priority of scheduling and managing day-to-day telemedicine services.

## Constructing a Four-Level Telemedicine Service System

As joint partners in the development of a second-generation, ICT-based telemedicine platform, Huawei and the First Affiliated Hospital of Zhengzhou University have built a four-level (province-city-county-township) telemedicine service system that defines the future of telemedicine for the region.

The project began with an upgrade to the following telemedicine infrastructure that is now connected with more than 120

## Voice of Customer

*“By establishing a joint innovation center, the mission to facilitate the analysis and application of medical Big Data would significantly accelerate the rollout of telemedicine in Henan Province.”*

— Zhai Yunkai, Director of the Telemedicine Center of Henan Province

county-level hospitals in Henan Province and associated hospitals in other provinces: teleconsulting facilities, specialist centers (imaging, ECG, and pathology), emergency care, surgical recording and playback, intensive care, call center, data center, and medical education.

Based on these achievements and to reduce service pressures brought by growth in demand for consultation, mobile informatization, and Big Data analytics, Huawei and the hospital have launched a next-step project in the Joint Innovation Center that leverages the talent and technology advantages of both parties. The project aims to build a flattened telemedicine service system with these features:

- **Top-Level Design and Step-by-Step Implementation:** Huawei and the hospital will jointly explore future implementations of telemedicine, formulate a panoramic plan for the entire telemedicine ecosystem, and sort out implementation steps based on this top-level design.

- **Two-Level Distributed Cloud Platform for Data Sharing and Collaboration:** Large hospitals in the 18 cities across Henan Province will be tightly coupled with the Zhengzhou telemedicine system. A province-wide collaboration platform will be constructed with a two-level (province-city) distributed cloud architecture. This

platform will enable distributed data storage and service operations in both the provincial data center and municipal sub-centers to ensure the high availability and reliability of the platform.

- **Teleconsultation for Mobile, Grassroots Coverage:** A convergent teleconsultation platform will be established to upgrade the existing telemedicine platform. The platform will provide client applications through PC workstations and iOS or Android smart phones and tablets. The host platform also allows for customized terminals at grassroots medical institutions to further increase coverage.

- **Big Data Analytics:** The Huawei FusionInsight Solution — including the FusionInsight HD distributed data processing system and the FusionInsight Miner analysis platform — will be used for the hospital's new medical Big Data initiative that is designed to capitalize on the analytical strengths of third-party medical application providers.

- **Active-Active Platform Ensures Service Continuity:** The networks and services of each medical institution in the province will be connected to two data centers. During normal operation, the two centers will simultaneously provide services. If a fault occurs in one center, the other center will smoothly take over to ensure service continuity.

By collaborating in the construction of the Telemedicine and Medical Big Data Joint Innovation Center, Huawei and the First Affiliated Hospital of Zhengzhou University are expanding the quantity and quality of telemedicine services throughout Henan Province.

The hospital has optimized the provincial multi-level telemedicine service system and created a model for mobile platform solutions for the Internet+ era of China and the world at large. ▲



Jarrett Potts

# Storage is Changing, but are You?

| By Jarrett Potts, Worldwide Director of Storage Marketing, Enterprise Business Group, Huawei Technologies Co., Ltd.

*If you are looking for an infrastructure to better serve your company's vision and stimulate growth, then let's take a walk down 'memory' lane and see where it leads. >>*

It is 2016, but your storage infrastructure thinks it's 2000: Islands of storage, multiple technologies, vendors, workgroups, and project silos... your storage infrastructure is a mess. It is not difficult to understand how such fragmented environments were created. The question is how does the problem get resolved? Conventional wisdom says to know your history and learn from the past.

## Once Upon a Time

In 1928, German engineer Fritz Pfleumer started the data storage revolution when he patented magnetic tape for the purpose of recording sound. Reel-to-reel tape was followed closely by the invention of the magnetic drum in 1932 by Austrian Gustav Tauschek. In 1948, Jan A. Rajchman and his team at RCA developed the Selectron tube, a very early form of digital memory.

Jumping ahead to 1963, Dutch technology leader Philips introduced the compact audio cassette, which Sony Corporation further adapted to create Digital Audio Tape (DAT) in 1987. After numerous DAT replacements, in 1998 Linear Tape Open (LTO) and other forms of high-density, scalable data storage machines based on Pfleumer's original magnetic recording technology began to surface.

Fixed storage began its journey when IBM released the first Hard-Disk Drive (HDD) in 1956. Using rotating platters to read and write binary electrical states over flat magnetic surfaces, the '305 RAMAC' was small in storage size (5 MB) but physically imposing (1 ton) and famously unreliable.

In 1980, IBM broke the 1 GB limit with the 3380 HDD, which was the first HDD to use magneto-resistive heads.

In 1984, Fujio Masuoka invented flash memory while working for Toshiba. Capable of being erased and re-programmed multiple times, flash memory quickly gained traction in the computer memory industry.

In 1994, U.S. storage manufacturer SunDisk released CompactFlash (CF), which continues to be used in cameras and other handheld devices. According to the company's "History of Innovation" summary, in 1991, SunDisk shipped the world's first Flash-based SSD, a 20 MB 2.5-inch HDD replace-

ment, to IBM for their ThinkPad pen computer at an OEM price of USD 1,000, or USD 50 per MB. In 1995, SunDisk changed its name to SanDisk.

Magnetic tape, magnetic platters, and solid-state memory have provided the world with three primary sources of mass storage, though derivative technologies such as CD/DVD optical and DRAM have also made large contributions to the market.

## Recent History

The cost for SSD memory has been driven down well over 50,000 times and has now fallen below USD 0.0007 per MB or USD 0.70 per GB.

Smart phones are typically pre-installed with 32 GB to 64 GB of random access memory, and personal



Fritz Pfleumer Invented Magnetic Recording



## 4,096-bit Selectron Memory

computers are now routinely equipped with 500 GB to 1 TB of non-volatile storage.

The average growth rate for total data in the world is upwards of 40 percent year over year, and there are industry analysts who say that a jump to 80 percent annual growth is not out of the question if and when certain developing countries bring their populations online.

- **Big Data** is driving the creation and storage for vast quantities of data and is helping drive the fundamental changes we see today in IT environments. By 2020, upwards of 7.1 billion people will be creating data on a day-to-day basis through their personal and household electronics. With an estimated 30 billion active devices by 2020, more data will create more fragmentation. Increasingly, more and more devices will be communicating directly without human intervention — a Machine-to-Machine (M2M) network that we are coming to know as 'the Internet of Things,' or IoT. By 2020, the total digital footprint is forecast to be over 45 Zettabytes (ZB), noting that 1 ZB equals one billion terabytes.

The Internet has been organized to collect and store the data streams of people, devices, and applications, from the mundane to the important and, with conditions, to allow access to any data from any point at any time.

- **The IoT** is a relatively new name for the network of networks that is growing around us. How do we connect, 'make sense,' and 'make use' of all this data. Every last detail can now be captured; for example, the number of steps you walk daily is uploaded from your Fitbit Tracker to your phone and then sent over the Internet where it's added to your medical records so your doctors can confirm that you are following their advice.

Research shows that seven out of ten businesses have implemented data sharing significantly,

and almost three quarters expect to increase their available storage over the next two years.

We have come a long way from the earliest days of capturing electrical signals on open-reel tape and vacuum tubes.

## The Future is Now

We are at the crossroads for the next era of mass data storage. Is it possible that you continue to think: "It's just storage. How could it possibly affect sales or customer service?"

Huawei believes it is essential that every aspect of your IT infrastructure be assessed for its impact on people and operating processes.

Has an aging storage infrastructure lost the ability to serve your core business needs? True, it reads and writes bits, but is it giving your customers the level of service that keeps them coming back?

Production databases today run on industry standard 15,000 RPM HDDs. Alternately, SSD provides the same storage capacity in the same footprint, with a 30 to 40 percent increase in transfer speed and a greater than 80 percent savings in energy consumption.

And, while SSDs have typically cost many times more than traditional enterprise HDDs, Huawei's Flash Storm has altered that paradigm forever.

Selling for the same cost per TB as the 15K rotating disks, Huawei's NVMe PCIe Flash Storm SSDs are the perfect tool for future-proofing your IT environment.

Planning ahead is always a good idea, but for businesses that depend on the efficient use of IT, 2016 could well be the year for your next big step. The Huawei Flash Storm could be the perfect choice to ensure that you and your organization are not left behind the technology curve. ▲



*We are at the crossroads for the next era of mass data storage. The Huawei Flash Storm could be the perfect choice to ensure that you and your organization are not left behind the technology curve. >>*



Wang Tao

# SSD is Knocking

| By Wang Tao, Marketing Manager, IT Storage Product Line, Enterprise Business Group, Huawei Technologies Co., Ltd.

Is it time to get out in front of the crowd and move to SSD? >>

When digital cameras came onto the scene, people using film-loaded cameras were hesitant to make the switch. However, the speed, convenience, and cost advantages of digital cameras delivered benefits that ultimately led to a wholesale shift in the market for the new technology. Something similar is happening in the storage industry as Solid-State Drives (SSDs) are primed to overtake traditional Hard-Disk Drives (HDDs).

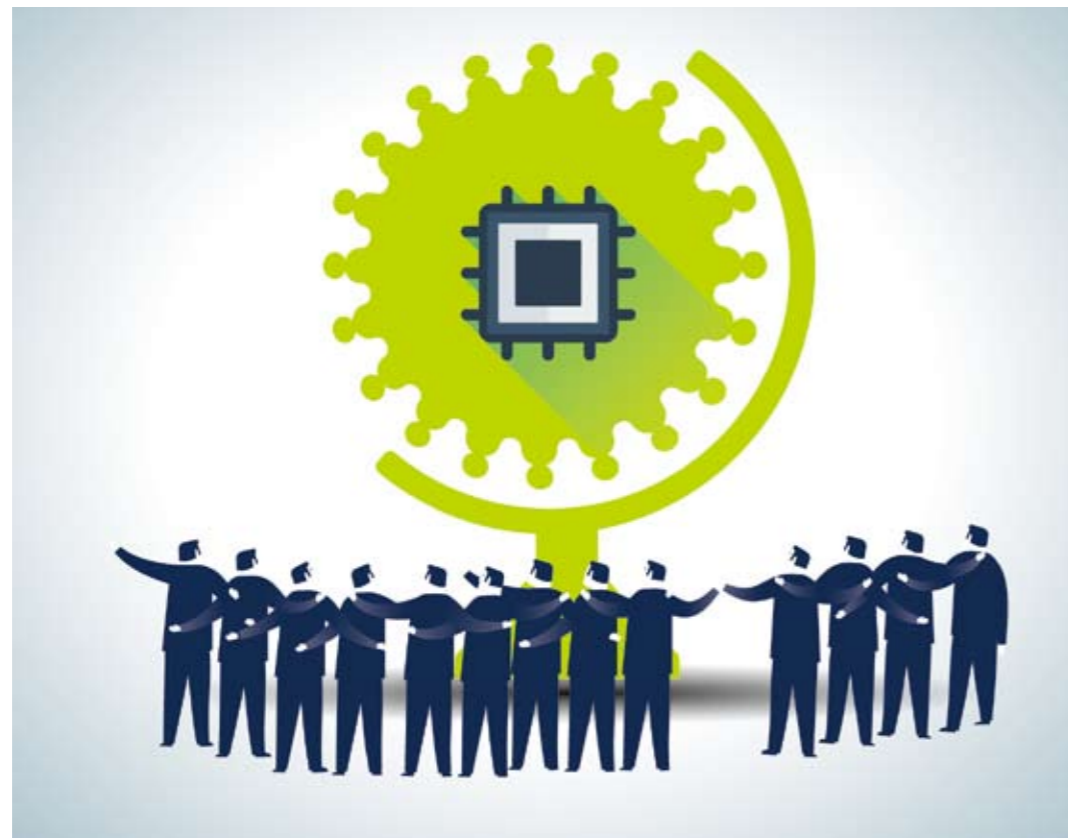
## Three Problems for SSD

How much longer will it take for SSDs to complete the move and place the technology within reach of enterprise-scale application, completing its historic mission as the baton is once again handed off in the storage arena? Before SSD can accomplish a full-scale takeover, production capacity, affordability, and impact on existing systems must be resolved.

- **Production Capacity:** HDD manufacturers have

scaled their manufacturing capacity over decades of factory upgrades. Enterprise-level SSDs require the same level of capital development to rise to a leading position in the marketplace.

- **Affordability:** An enormous price point differential puts SSD technology out of reach for all but the most demanding customers. To bring SSD to the forefront, the technology must be priced comparatively to traditional HDDs.



- **Impact on Existing Systems:** People always want new and better storage systems; however, they do not want their existing systems to be compromised.

In September 2015, Joy Huang, Vice President of the Huawei IT Product Line announced the company's ambitious SSD strategy, including the goals of matching HDD capacities and price points. Realizing that the trend would sweep the industry and knowing that none of today's big players wants to be left behind, storage manufacturers have begun to ramp up their SSD factories over recent years. Yet, many vendors continue to hesitate.

"Customers have long waited for the ability to move fully into SSD," says Fan Ruiqi, President of the Huawei Storage Product Line. "Huawei is determined to take the lead in delivering high-capacity, solid-state storage at a price point competitive with rotating media. The era of all-SSD storage will happen earlier than many in the market have anticipated."

## Huawei's Flash Decision

With research begun in 2005, and products appearing in 2010, Huawei now commands a sizable share of the enterprise SSD market.

"Huawei has mastered the core technologies required for scaling the manufacture of SSD components," Fan Ruiqi points out. "We build our own industry-leading controllers and own many key patents in the field. These factors together give Huawei great technical advantages."

With a partnership that began on September 19, 2015, mainstream memory supplier Micron Technology of Boise, Idaho joined with Huawei to support the application of flash memory technology. "Huawei has its own advanced production lines that are complimented by the manufacturing capabilities of our partners," Fan Ruiqi adds. "With this coupling of manufacturing capabilities between the two companies, our production costs are cut in half."



*"Huawei is determined to take the lead in delivering high-capacity, solid-state storage at a price point competitive with rotating media. The era of all-SSD storage will happen earlier than many in the market have anticipated." >>*



Huawei's 600 GB HSSD Solid-State Drive

"The move to integrate flash memory for high-capacity data storage will deliver optimal user experience and low power consumption," says Yuan Yuan, CTO of the Huawei IT Solutions Sales in Western Europe. "It is well suited to customers' business needs now and in the future and is a vital tool in addressing the challenges of Big Data. Our cooperation with Micron for flash memory is a shining example of Huawei's long-term commitment to build a sustainable ecosystem for partners within the industry chain, where we are exploring opportunities to jointly develop industry-specific product solutions."

In October 2015, Huawei launched an OceanStor Flash campaign across Europe to accelerate the process of replacing HDD-based storage systems with SSD systems and widen the adoption of flash in data centers. The core of the strategy is to help customers step into an 'all-flash' era in which high performance and excellent reliability are the norm. The goal is to integrate Huawei SSDs into the full range of storage products.

Knowing that collaboration with key industry partners is essential, Huawei seeks to combine the wisdom and knowledge of multiple parties in the supply chain to develop unique solutions. "We cannot achieve innovation by ourselves. Everything we have created, obtained, and achieved would not be possible without the joint efforts of our partners and the unflinching trust of our customers," says Yuan Yuan. "As the open source IT market continues to grow, Huawei looks forward to teaming up with additional partners to build targeted solutions, continuously improve our levels of industrial innovation, and support the company's long-term commitments."

Industries and markets across the globe pivot around access to advanced information technologies. Given the choice to act, will you answer or hesitate? The best possible decision is to get out in front and commit to moving to SSD. ▲



Eystein Stenberg

# Automating OTA Software Updates for IoT

| By Eystein Stenberg, Head of Product, Mender

**Mender Over-The-Air (OTA) services are built to support a growing ecosystem of embedded Linux devices. >>**

**F**ounded in 2015, Mender is an early-stage software company located in Palo Alto, California. The company is developing an open source, over-the-air solution for updating embedded Linux devices in the field and operates under Apache License 2.0. In addition to developing and publishing the software for enabling updatability in products, the company offers commercial support to customers.

Besides developing the embedded updater, Mender is an advocate in the Internet of Things (IoT) market that automated software updates be an integral component of open source embedded products.

Initially, Mender will support products based on Linux and the Yocto Project, which is a Linux Foundation workgroup that provides templates, tools, and methods to help users create custom software for embedded products regardless of the hardware architecture.

Software-driven transformation has been taking place in the IT infrastructure industry for decades, as servers became connected to networks, executables were abstracted through virtualization, and, finally, services were made available on demand through public clouds.

A similar software-driven transformation has taken place in the consumer electronics industry through the advent of smart devices and Apps that replace everyday physical items like Auto GPS units, newspapers, cameras, maps, alarm clocks, music players, and ATMs — to name just a few.

The IoT will bring many software innovations to embedded devices that have previously not been connected to a network. The IoT will change the business landscape in ways similar to a pattern seen in the IT infrastructure and consumer electronics industries, where companies that adopt new technologies tend to thrive, while those that pass on the opportunity expose themselves to greater risk.

## Two IoT Business Drivers

The increasing interest of business executives in the IoT is accelerating the explosive growth we are seeing in today's marketplace. When new trends arrive, discernment is required to look past the buzz and evaluate if this wave is a passing fad or if we are

witnessing a sea change with a lasting impact.

Chances are that the IoT is here to stay because the drivers behind it are fundamental for every business: improved operational efficiency plus new products and services equals new net revenue streams.

There are many examples in business today of how billions of dollars in operational efficiencies are gained through the Machine-to-Machine (M2M) connection of sensors and devices, as well as the application of analytics on the collected data. In agriculture, sensors are placed in the field to measure the moisture, fertilizer level, temperature, and other key metrics that affect crop yield. By leveraging this data, farmers know precisely when to water and fertilize their crops to maximize yield. Water schedules can be correlated with weather forecasts to determine that even though moisture levels are falling below normal, nothing need be done because rain is expected the next day.

In the U.S., the overland transportation industry in 2012 was a USD 1.33 billion business, or 8.5 percent of GDP. It is clear that improving efficiency in this sector will have a massive impact. One company discovered that trucks driving very close to one another on the highway to reduce air resistance could use up to 30 percent less fuel. The problem is that because of the time it takes a human to react when the vehicle in front applies the brakes, humans cannot safely drive at such close distances. The solution is to install a connected device in each truck to assist with emergency braking. The devices in the trucks are networked with one another. Any one device will signal the other devices that 'hard braking' is happening, which results in the other trucks quickly and automatically being slowed down safely.

There are also major innovations enabled by the IoT that facilitate the creation of entirely new categories



of products and services. A notable example is the self-driving car, which would dramatically change the way we commute. For instance, instead of parents driving their children to football practice, the car could do it alone — and more safely than is humanly possible. This innovation is only feasible because of a growing wealth of new sensors, intelligent devices, and cloud-based analytics that the IoT promises.

## Business Needs for IoT Updates

A key part of the intelligence required for IoT innovations is implemented in software running on embedded devices. It is only natural that all this new software intelligence brings with it a great deal of complexity and a constant need to improve and update it.

We can break down the types and business value of software updates into these three categories.

- **New Features:** Delivering new features to products that customers have purchased will increase the customer value of the product, thereby allowing increased revenue through higher prices and/or higher margins over extended device lifetimes.

- **Bug Fixes:** When critical problems are found with a product, the ability for quick remediation avoids negative customer impact. Industry statistics reveal that there are up to 25 bugs per 1,000 lines of software code and, as products get more intelligent and complex, there is no reason to believe that this rate of problems will drop.

- **Security Vulnerabilities:** An unfortunate reality is that software contains security vulnerabilities that put customer safety and data privacy at risk. Companies that experience devastating losses will also suffer brand damage if the weaknesses are left unaddressed. The press tends to be very unforgiving when this type of issue becomes public.

As seen in the past growth of the IT infrastructure, the updatability of embedded devices is expected to evolve over the same three phases:

- **Static Updates:** In this phase, it is not possible to deploy improvements and updates to remote devices after they have been placed in the field. After a device has left its manufacturing plant, no improvements can be made to it. Companies that don't evolve from this phase will become less competitive and are more than likely on the way to losing their business.



*It is clear that automated software updates must become standard practice for the IoT to continue growing, and those who obtain this ability first have a significant advantage over the rest of the industry. >>*



*Mender is developing a standalone open source software updater that manufacturers and embedded product companies can integrate into their products. The benefit of using the Mender solution is the ability to cost-effectively deploy automated software updates to remote devices. >>*

- **Manual Updates:** Field technicians and, in some cases, end users can apply updates to devices while they are used in the field. Typically, this is only done when a critical issue is encountered that must be fixed by installing new firmware provided by the manufacturer. For example, this is the way most car manufacturers work today. If you need to update the software in your car, you will probably take it to the dealership. The obvious disadvantage of this approach is that it is prohibitively expensive and therefore does not scale.

- **Automated Updates:** This is where the innovators of today are and the mainstream will go. Companies taking advantage of automated software updates gain significant competitive advantage by having the ability to improve their products over time without leaving their customers' hands. Automation ensures that the cost of deploying mass-scale updates is very low, which allows updates to be deployed frequently.

It is clear that automated software updates must become standard practice for the IoT to continue growing, and those who obtain this ability first have a significant advantage over the rest of the industry.

#### Designing for Automated Updates

There are clear analogies to what has happened in the IT infrastructure industry and what has begun to happen with updatability for connected devices.

However, there are also issues that make delivering updates to connected devices more challenging than in other domains.

- **Expensive to Reach Physically:** A connected device can be physically located very far away from its manufacturer. This means that a critical problem with the update could leave the device unusable and require physical access to fix — a very expensive solution whose costs may never be recovered.

- **Unreliable Power Source:** Many connected devices rely on battery power or may otherwise be disconnected from their power source at any time. This requires the software update process to have the ability to safely recover from a loss of power.

- **Unreliable and Expensive Network Traffic:** Most connected devices use wireless networks, like 3G, that have frequent and intermittent connectivity losses, such as when a mobile device is moved to an area with low cell coverage — like underground. The software update process must take such interruptions into account to ensure that update integrity is maintained in the event of lost connections. Ideally, the update process will conserve network traffic by resuming a partial update through applying intelligent compression or differential segmentation.

- **Unsecure Networks:** With updates happening over wired and wireless networks or Internet connections, the update process is exposed to threats from attackers who can intercept and manipulate network payloads. There have been several examples of lax security in update processes, allowing attackers to inject malicious software into embedded devices.

Tackling these challenges requires domain expertise and technical skills that the majority of IoT product teams do not have. With time and investment, such skills can be acquired but only at the expense of resources that can be better used to create product value.

The economics of every company investing to build a software updates solution in-house is not justified because of the significant investment required to achieve reliability. There is typically no business-specific logic in a software updates solution, which is exactly why it makes sense to find a third-party solution to leverage in the update process.

At Mender, we are developing a standalone open source software updater that manufacturers and embedded product companies can integrate into their products, independent of industry verticals. The benefit of using the Mender solution is the ability to cost-effectively deploy automated software updates to remote devices. Today, Linux is enjoying an explosive growth in embedded devices, in particular because of the Yocto Project, whose goal is the creation of custom distribution for embedded Linux products. ▲

## Easier Development for ICT Partners

| By Xia Yunqi, Senior Marketing Manager for Products & Solutions, Enterprise Business Group, Huawei Technologies Co., Ltd.

Digitalization has been penetrating enterprise and telecommunication businesses for decades. And the future looks bright across all enterprise vertical industries for every company committed to unleashing new commercial opportunities by leveraging the full gamut of advanced ICT technologies.

#### Greater Cooperation

Businesses in different industries vary greatly in their information service needs. Common ICT solutions may be inconvenient to use, have high O&M costs, or both. To realize the greatest benefit from their ICT investments, end-users often need the services of specialized integrators who have a detailed understanding of their specific industry.

Keeping up with current demands for digital transformation services has become a concern for ICT service providers. This challenge calls for large-

scale collaborative efforts across each industry chain. As an ICT infrastructure supplier, Huawei acted on the fact that increased collaboration with industry partners is a necessary function. To that end, Huawei and its partners have combined their strengths to provide a development ecosystem that facilitates open, tailored, and innovative solutions.

#### Full-Process Developer Support

Huawei's ecosystem Software Development Kit (eSDK) unlocks the capabilities of its ICT infrastruc-



Xia Yunqi

*Huawei's eSDK platform enables third-party developers to create innovative solutions that help customers accelerate their business transformation. >>*

ture products to third-party developers. By adopting standard interfaces and integrated plug-ins, the eSDK allows developers to easily create upper-layer applications that respond to customer needs quickly.

Huawei's ICT products have been deployed within customer networks in more than 170 countries for a wide range of data storage, processing, and transmission services. Although Huawei's capacity for providing customers with high-performance, high-reliability equipment and software is an advantage, the end-use customers in various industries often need custom solutions to be integrated into existing business processes. To this end, Huawei is collaborating with partners who have a deep understanding of particular vertical industries to build solutions that directly benefit enterprise end users.

Huawei incorporates Application Programming Interfaces (APIs) in almost all its product lines, including cloud computing, unified communications, enterprise mobile security, Software-Defined Networking (SDN), and the analytics applications used for Big Data. The partners who have traditionally performed secondary development for Huawei products required both domain expertise and significant time and labor investments to train on Huawei products. In 2013, this changed with the launch of the eSDK platform. This platform provides standard APIs that can be invoked by developers using a variety of common programming languages and protocols for accessing the open capabilities of Huawei products. The result is that developers are freed to focus on innovating custom solutions for their customers without having to possess an overly detailed understanding of each component. Access to the eSDK includes the usual basic toolkits and documentation and, most importantly, the types of full-process service support that are needed for after-market solutions development.



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### End-to-End Support

The eSDK provides partners with end-to-end support, from knowledge buildup to commercial launch.

- **Developer Community:** Developers obtain the required toolkits from the online Huawei developer community. This community also provides the latest updates on Huawei open product capabilities and success stories.

- **Remote Labs:** Although Huawei products are provisioned for after-market development, the cost for procurement, transport, installation, and commissioning of the hardware necessary for secondary development can require a big initial investment of time and money. If the up-front costs are too high, developers may hesitate to start. With this understanding, Huawei has built multiple laboratories populated with a full range of Huawei products that can be accessed remotely by registered developers for development and testing purposes. Huawei's developer services include shared tutorials, Beta software trials, and application authentications.

The remote lab in Suzhou, China has provided support to over 300 Independent Software Vendors (ISVs) and more than 1,000 developers. The recently completed remote lab in Munich, Germany offers an even wider range of services to developers. There are plans to build seven more remote labs worldwide to provide developers with a free, cloud-based lab environment.

- **Multi-Channel Technical Support:** Developers occasionally encounter problems that cannot be resolved using reference documentation. The goal is to train developers to understand the system logic and open capabilities of Huawei products. To achieve this result, Huawei provides one-to-one support via email, online consultation, and a telephone hotline. Additionally, Huawei conducts face-to-face training by subject-matter experts for all different levels of development.

- **Integrated Development Environment**

(**IDE**): The eSDK includes an IDE tool that can be used as a plug-in for popular development environments. The IDE tool allows developers to connect to remote labs to obtain field-proven eSDK packages, debugging resources, and application releases for the purpose of improving their development activities.

- **Marketplace:** End users, ISVs, and Huawei share the common goal of achieving success. To facilitate this goal, Huawei provides Marketplace

— a solution demonstration platform on which ISVs demonstrate their applications and end customers obtain the latest solutions.

- **Social Media:** The eSDK provides the 'Huawei Developer Community,' an official account on WeChat, and 'Huawei eSDK,' an App that allows developers to access the latest updates anytime, anywhere. Social media allows more than 4,000 developers to discuss common interests and share experiences. ▲

### Case Study

#### eGovernment Cloud Solution

*Huawei collaborated with Esri, an international supplier of Geographic Information System (GIS) software, web GIS, and geodatabase management applications, to develop an eGovernment Cloud solution for customers in the government sector. Using open interfaces provided by the eSDK, Esri delivered ArcGIS, featuring access to government cloud services, high work efficiency, and ease of maintenance.*

*The ArcGIS solution provides a GIS platform that displays and manages the correlations between geographical location information and land use, as is necessary for routine government operations. Esri adopted the cloud-based Infrastructure-as-a-Service (IaaS) approach to build its private cloud management system to allow customers to obtain resources on demand and allocate them to specific tasks at the lowest possible cost. For example, data loading consumes hard disk resources; data analysis tasks generate heavy CPU workloads; and imagery requires Graphics Processing Unit (GPU) cycles.*

*The Huawei eSDK provided the following FusionSphere APIs:*

- **Resource Invocation:** *Queries resources and assigns identifiers to create service nodes correctly. For example, a service node will be created only if the corresponding resource pool conditions exist, such as the virtual hardware configuration, network policies, mirroring policies, and traffic volume. If the required resources do not exist, they can be created using the resource invocation interface.*

- **Template-Based VM Generation Interface:** *Allows ArcGIS service nodes to be automatically created by the GISStack or manually created by users based on resource loads when map caches are being generated. This functionality improves efficiency by reducing the time needed to process individual tasks in multi-node and multi-process modes.*

- **Resource Deletion Interface:** *Recovers computing resources after the completion of a task, such as map slicing and map cache construction, to prevent resource wastage.*

*Esri used the Huawei FusionSphere Cloud Computing Solution for the underlying layer of ArcGIS. To simplify system maintenance, Esri invoked Huawei's FusionSphere APIs to develop an ArcGIS management system, GISStack, which is based on the IaaS service provided by local private clouds. The GISStack enables maintenance personnel to implement integrated and automatic delivery of all IT resources and ArcGIS software stacks that the GIS application system requires. The GISStack also helps monitor system O&M and scale resources up or down dynamically. ArcGIS end users need only focus on the construction of their own application services.*



**Using open interfaces provided by the eSDK, Esri delivered ArcGIS, featuring access to government cloud services, high work efficiency, and ease of maintenance. >>**



Neil Strother

# AMI — The Power of Dynamic Systems

| By Neil Strother, Principal Research Analyst, Navigant Research

**Electricity utility managers are exploring the potential of AMI systems for benefits beyond their energy sensing and control capabilities. >>**

**A**dvanced Metering Infrastructure (AMI) or ‘smart metering’ is an integrated system of wired and wireless technologies that supports dynamic data management for electricity utilities and their customers.

Beyond billing and managed rate structures, AMI systems provide real-time and near-real-time responses that enable new services, such as Home Area Networks (HANs), connected thermostats, in-home displays, and energy management systems. Analytics based on Meter Data Management (MDM) systems, which include Geographical Information Systems (GISs) and Volt/Volt-Ampere Reactive (Volt/VAR) control, help make utility operations more efficient and facilitate better customer engagement.

## AMI Systems

AMI systems offer many advantages for flexibility and scalability:

- **Pricing and Billing:** Smart meters enable utilities to use Time-Of-Use (TOU) rates for dynamic kilowatt rates based on daily, monthly, and seasonal fluctuations. Customers are able to easily see and

compare costs.

- **Cost Control:** Because electricity cannot be stored, prices vary substantially depending on supply-demand conditions and time of day; advanced meters record usage in short time intervals that allow dynamic pricing or tariffs to be applied to residential customers; and Real-Time Pricing (RTP) passes the actual electricity cost to the customer.

- **Demand Response (DR):** DR programs help utilities operate more efficiently during peaks by providing hourly and sub-hourly responses to incoming data.

- **Consumption:** AMI deployments link smart meters with smart thermostats for residential DR. The goal is to motivate customers to better manage usage. For example, Electric Vehicle (EV) recharging and prepaid billing allow charging stations to be integrated with TOU rates to encourage off-peak

charging.

- **Data Analytics:** MDM systems provide a more complete picture of system status for helping utilities take more informed actions, make better investment decisions, and enable applications, such as outage and distribution management, DR, TOU rates, power quality monitoring, behind-the-meter Distributed Energy Resources (DER) integration, and home energy management.

## Smart Meters

Smart meters are at the core of AMI deployments and must meet certain requirements, independent of the communications network or specific local, regional, or federal regulations.

Basic requirements include:

- Capture and storage of two or more channels of usage data at programmable intervals — typically from five minutes up to one hour or more and stored for a minimum of 30 days and sometimes up to a year
- Certified to accuracy standards for measuring power consumption
- Certified to meet environmental and reliability standards for outdoor environments
- Prepared to meet or exceed standards for physical and communications security
- Secure, remote firmware upgrades without interrupting service
- Support for sub-metering to co-located gas, water, or temperature controllers

## Data Software

As new applications emerge, Meter Data Management Systems (MDMSs) are needed. MDMSs collect, process, and store meter data to help utilities improve the value and efficiency of grid operations.

Though meter data repositories have existed as part of the utility IT suite for years, the widespread introduction of AMI platforms overwhelmed legacy MDMSs with unanticipated amounts of interval data from smart meters. The updated MDMS solutions offered increased throughput capacity plus a new focus on analytics, scalability,

and flexibility. Today, MDMS vendors see more utility companies prioritizing data architectures as a critical implementation factor that must be in place before any smart meter deployment, whereas traditionally, the data management component has been treated as an afterthought.

## AMI Telecommunications

Many smart meter benefits require an AMI communications network to link the devices with the data centers to enable the real-time and near-real-time data flows that utilities and customers must rely on for making moment-to-moment decisions. Numerous wired and wireless technology choices are available to facilitate this level of Neighborhood Area Network (NAN) connectivity.

In general, Radio Frequency (RF) or wireless mesh technologies prevail in North America, while Power Line Communication (PLC) leads in Europe and is gaining in the Asia Pacific region — though there are always exceptions as market dynamics continue to shift. In other regions, the technology choices are defined by regulatory factors, the specific needs of each utility, and prevailing metering technologies.

## PLC

PLC uses existing power lines as the communications medium. Multiple types of systems are associated with many standards and PLC, including Low-Speed PLC and Narrowband PLC (N-PLC). Some systems are targeted for use on the Low Voltage (LV) portion of the grid (from the transformer to the premises) and/or the Mega-Volt (MV) portion of the grid (neighborhood regional distribution to local transformers).

Broadband-over-Power-Line (BPL) systems generally refer to PLC systems supporting data rates over 1 Mbit/s. One example is Huawei’s Broadband PLC (BPLC), which is designed to accommodate greater numbers of transformers in series, real-time monitoring, remote upgrades, and programmable measurement control. Like N-PLC, there is no shortage of BPL systems and proposals for in-home use.



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Because BPL technologies generally operate at carrier frequencies well above the CENELEC bands used in N-PLC and defined by EN 50065, they experience inconsistent and challenging spectrum characteristics. Reliable communications are difficult to achieve and often cause significant electromagnetic interference.

Business experiments in which electric utilities offer Internet services to consumers via BPL have failed, forcing utilities to refocus on their core electrical distribution businesses. In-home broadband technologies may be deployed for HAN applications and potentially could be expanded to external LV segments in the future.

Most BPL services intended for use by utilities are planned to be future-proof to supply adequate bandwidth for both current and over-the-horizon applications such as home energy control, distributed generation tools, and EV management. N-PLC systems often fail the future-proof test, as the increase in modern security controls over advanced networks requires too much bandwidth. Fatter pipes are needed to adequately secure state-of-the-art utility communication networks down to the meter level.

The Huawei HiSilicon Semiconductor Business Group developed a Hi-PLC carrier chip with a data rate of 2 Mbps/s for bi-directional, real-time, high-speed communications over power lines for improved performance over narrowband systems that, unlike wireless solutions, does not require peripheral devices or RF antennae.

#### Other Technologies

RF mesh networks form web-like topologies. When a node is not in range of its target destination, such as when a meter transmits data to a concentrator, intermediate nodes in the mesh will relay that node's data. Data packets en route between source and destination nodes in a mesh network may hop through many intervening nodes, thereby extending the effective range of the network well beyond that of any single transmitter or receiver.

RF Point-to-Multipoint (P2MP) systems use

licensed spectrum allocations at transmit power levels sufficient to communicate between centralized tower-based nodes and multiple nodes (including meters) within range. Wireless cellular phone infrastructures are public RF P2MP networks, where each cell tower has a limited range and multiple towers provide overlapping coverage. In private RF P2MP NAN implementations, tower-based gateways provide overlapping coverage to all nodes and meters within range. These are characterized as star topologies, where each node is within direct range of the center of the star — the network gateway.

Where the expense is justified, smart meters with integrated cellular modems are in widespread use for Commercial and Industrial (C&I) customers over public P2MP infrastructures. There are, however, financial obstacles for using the public cellular network for residential NAN applications, particularly in North America where wireless carriers tend to treat smart meters like consumer cell phones. The typical business model for mobile wireless subscribers yields high revenue-per-node operating costs compared to the overhead for private networks, and the wireless carriers do not see a profitable business case for smart-meter connectivity. Cellular wireless is commonly used for Wide-Area-Network (WAN) connectivity to NAN concentrators where the cost for individual nodes is amortized over hundreds or thousands of smart meters.

An emerging NAN solution promoted by GE Energy and its partner Grid Net is the combined use of Worldwide Interoperability for Microwave Access (WiMAX) and 4G/LTE solutions.

#### AMI Connectivity

The components of a typical AMI system include a HAN to connect all devices in the home, such as displays, thermostats, load-control devices, and smart appliances, to the smart metering node. NANs connect each smart meter within a neighborhood to the local utility's WAN communication infrastructure, and the WAN links the meter data concentrators to the local utility's IT system. The

HAN may also connect other meters, such as gas and water, to the NAN.

#### Business Outlook

The market for smart electric meters is very much in flux. The conditions in different countries and regions vary and are affected by local regulations, economic conditions, and technical practices that impact meter data accuracy, energy efficiency and conservation, grid modernization, and high loss rates due to theft of services. Regulatory policies are a major force driving many smart meter deployments, as policymakers believe smart metering is a key technology for helping to reach goals related to climate change, increased energy security, and greater on-premises energy efficiency by enabling better peak demand shifting.

The primary reasons for utilities to deploy smart meters are largely operational:

- Remote service connections and disconnections reduce labor and operating costs.
- Remote meter reading eliminates the cost of field personnel having to visit each and every customer site.
- Two-way meter communications enables more accurate outage detection and swifter service restoration.
- Exact billing eliminates of-use estimates.
- Active theft detection has increased total energy supply up to 20 percent in some markets.
- Demand response programs are enabled to help utilities operate more efficiently during periods of peak demand.
- Trends analysis helps utility operators better gauge loads and determine appropriate investments in new equipment.
- Timely rates-of-consumption and costs-of-service data enable better informed decisions by each utility and increased customer engagement.

There are a number of barriers that have slowed the growth of smart metering:

- A German cost-benefit analysis determined that a national rollout was unwarranted and would not be mandated; a selective approach



*AMI and IoT trends will continue to overlap and, in so doing, will bring third-party vendors to supply hardware, software, and services to support deployment opportunities. >>*



would be used instead.

- High tariffs in developing countries have inhibited the wide-scale deployment of smart meters — which, in turn, has prevented the creation of an insurmountable financial hurdle for local populations.
- A legal framework or favorable policies in support of new deployments are lacking.
- Multiple standards for meters and communications protocols produce device incompatibilities.
- Small and midsize utilities may lack the in-house competencies necessary to support AMI development, deployment, and ongoing operations.
- Customer concerns over health and privacy force regulators to mandate opt-out programs for individual customers.

#### AMI's Future

Utilities are adopting AMI systems as part of a long-term transformation to create a more intelligent grid. New AMI installations and upgrades to existing smart meter platforms offer significant growth potential. In the past, meters were replaced about every 20 years; however, North America, Europe, and China have recently been experiencing disruptive replacement cycles as large-volume smart meter deployments changed the norm. AMI and IoT trends will continue to overlap and, in so doing, will bring third-party vendors to supply hardware, software, and services to support deployment opportunities.

Although the adoption rates vary by region, advanced meters will increasingly become the standard. AMI solutions provide grid operators with highly granular data collection and control capabilities that enhance system efficiency. Smart meters are vital to a future of increasingly distributed energy resources, including rooftop solar, EV, and new energy storage options. Old-style meters were never designed for connectivity to an intelligent grid. The bottom line is that smart meters enable customers to self-monitor the efficiency their electrical energy consumption, which is an essential function for consumers and industries looking to reduce costs and regulators seeking to define equitable rates. ▲





Wu Yubin

# Big Data Refines Predictive Policing

| By Wu Yubin, Independent Economist

**Big Data technologies are driving policing management tactics towards data-enabled public safety. >>**

In recent years, Big Data has revolutionized policing and police management in the U.S. Even though violent crime rates have been falling since 1992, police departments must still cope with limited budgets. One result is that police departments are looking to Big Data to improve work efficiency and take proactive measures to anticipate and prevent crimes. Successful experiments working with Big Data in the U.S. are likely to accelerate the deployment of data analytics technologies for managing police services worldwide.

## CompStat Aids Policing Management

Officer patrols consume the largest part of police resources and are essential for maintaining high-quality interactions between police and communities. The use of Big Data technologies to manage neighborhood patrols is enabling police departments to maintain the twenty-three-year reduction in violent criminal activity. Typically, police patrols involve call-driven activities focused on rapid responses to crimes in progress. When public safety officers leave their stations on patrol, the operational details, including task and time, are directed by duty officers who remain indoors.

Beginning in 1994 with the New York City Police Department (NYPD), many police departments across the U.S. have adopted a computer-based policing management method called CompStat. Short for COMPuTer STATistics, CompStat combines a management philosophy with organizational management tools designed for accountability. The NYPD set up a data center to keep track of crime reports,

arrests, and contact information for individuals that have established a foundation for decision making. Today, CompStat includes four generally recognized components: timely intelligence, rapid response, effective tactics, and complete follow up.

With CompStat, precincts with the greatest number of incident reports are allocated the most resources. In the case of the NYPD, quantitative indicators were provided to assess the performance of each of New York City's 77 precincts. Though some argue that other economic and demographic factors are responsible for the dramatic reduction of crime through the late 1990s, others credit CompStat for making New York one of the safest cities in the U.S. In New Orleans and Minneapolis, police departments saw double-digit reductions in the rate of crime following the adoption of CompStat, and overall, the emergence of CompStat has propelled police departments across the U.S. to incorporate data- and intelligence-driven methods for managing patrol activities. Additionally, CompStat has helped police departments standardize

optimal norms for patrol behaviors and eliminate or ban ineffective tactics.

## The Santa Cruz Experiment

Despite these impressive results, CompStat may have weaknesses. In CompStat mode, police departments tend to react to the recent trends rather than taking preventive measures against emerging trends. As important as it is for police to remove criminals from the streets, some consider that the best option is to prevent crimes from ever occurring. But how?

Research scientists have determined that some types of crime can be predicted using mathematical models. For instance, burglaries are largely determined by three location-related variables: ease of access, relative affluence, and security measures. George Mohler, then a mathematician and researcher at the University of California Los Angeles (UCLA) and now Assistant Professor at Santa Clara University and Director of Data Science at Metromile in San Francisco, proposed that it was possible to predict certain crimes by modifying an algorithm used to forecast earthquake aftershocks for use in property crime prediction. The result was a far more accurate property crime map than had been produced using traditional approaches, such as CompStat. Following the implementation of Mohler's Big Data predictive policing technique, the police department in Santa Cruz, California saw a significant drop in the number of burglaries over the next six-month period.

The Santa Cruz experiment set up a benchmark for predictive policing and became a model for police departments in Los Angeles, the U.K., and the Netherlands. This experiment predicted the locations of future property crimes by analyzing 5,000 historical crime records. The prediction algorithm compared time and location

information of each old crime with real-time inputs as new crimes were reported. Other factors incorporated into the model included Automatic Teller Machine (ATM) locations, bus routes, and local weather conditions.

The predictive policing experiment in Santa Cruz demonstrated a real-world application of Big Data technologies. Initially, the crime maps produced in Santa Cruz looked similar to those generated by CompStat, but soon the maps rendered from the Big Data set identified by Mohler had a much higher level of accuracy. The Santa Cruz experiment identified the Top 10 potential crime locations at a mapping resolution of 500 square feet. Projections were generated for when and where future crimes were likely to occur within these areas and which of them presented the highest risk. By patrolling these areas more intensively, local police officers found that they were able to deter or prevent potential crimes. Over the course of the six-month experiment, property crimes in Santa Cruz decreased by eleven percent over the previous year and by four percent over the historical average for the same period.

## Policing with Big Data

Big Data technology brings advantages to other police activities as well, including:

- **Targeted Enforcement:** With Big Data analytics, specific policing targets can be set to reduce specific types of crime with breakdowns of tactical responsibilities.
- **Intelligence Collection:** Big Data technologies enable police officers to respond promptly and effectively to incident reports with the accurate collection and transmission of time and location data. When processed using Big Data pattern matching techniques, this dataset forms the basis for analysis, planning, and results assessment.
- **Effective Crime Strategies:** Predictive



*The importance of worldwide public security has never been greater, and the application of Big Data technologies brings new opportunities with the advent of predictive analytics for policing management. >>*

policing is a strategic management system that integrates the factors required to make effective decisions by police officers at all different levels. Predictive policing is not only goal-oriented but also adjustment-oriented. In other words, better decisions are possible when police departments have fast access to deep and timely insights about the quality of crime strategies and crime reduction measures, and accountability for the resulting decisions. Management personnel are charged with the duty to modify or even abandon ineffective prevention crime strategies and adopt and promote effective ones.

- **Quick Resource Deployments:** In predictive policing modes, tactical units at every level compete for limited resources. Big Data analytics can be used to support public safety strategies and deploy limited resources with maximum flexibility.

- **Effective Follow Up:** Predictive policing modes provide management with effective methods for judging if a particular crime prevention strategy has succeeded. The results are optimized policies for performing continuous follow up and accountability of public service performance at all levels.

The importance of worldwide public security has never been greater, and the application of Big Data technologies brings new opportunities with the advent of predictive analytics for policing management. ▲





Ricky Abdoelrahman

# High-Performance Cloud Computing for the Broadcasting Industry

| By *Ricky Abdoelrahman, Digital Marketing Manager, Western Europe, Enterprise Business Group, Huawei Technologies Co., Ltd.*

**Broadcasters, industry manufacturers, post-production companies, and content distribution aggregators are on the watch for next-generation technology that may change the way they work when using shared computing power and virtualization. >>**

The arrival of 4K/Ultra-High Definition (UHD) is causing a stir within the European television broadcasting industry. While UHD-ready TV sets are widely available in Europe for lower prices than six months ago, it appears that few broadcasters have in place an end-to-end system to capture, ingest, edit, playout, and archive UHD file-based content. The main reason is that the existing infrastructure dedicated to Standard-Definition (SD) and High-Definition (HD) production has not reached its technical end-of-life cycle and — more importantly — hasn't been written off financially. However, broadcasters, industry manufacturers, post-production companies, and content distribution aggregators are on the watch for next-generation technology that may change the way they work when using shared computing power and virtualization.

## UHD: Demanding a Radical Change for Industry

The media industry in Europe is a mature but constantly evolving market. As a newcomer, Huawei is focusing on broadcast offerings that can be integrated into an existing IT infrastructure. "I know broadcasters have a long relationship with their existing suppliers. So, when I speak to a production house or a playout facility, I ask them what is the next thing they want to do now, but they can't answer," says Richard Brooking, Account Manager for broadcast media at Huawei. "The natural replacement cycle of broadcasting gear is between five and seven years," Brooking adds, "but in IT there is a replacement cycle of three years. So if a post-production house just bought a very fast HD editing machine with a lot of computing power, how will they get a return on investment if a customer knocks on their door to edit UHD this year?"

Certainly, the industry is used to newer technology replacing the existing infrastructure. When HD video entered the scene, it was the final blow to traditional videotape-capturing technology. However, prior to the arrival of HD, a hybrid of digital tape and SD co-existed. The shooting was digitally captured on tape, followed by non-linear editing that was then exported to a master file for distribution from a control room. This situation created the time and space for SD and the tape-based-oriented industry to slowly migrate to the new HD universe, which made the pain to invest more bearable since the existing infrastructure could be used or upgraded. However, the advent of UHD

demands a radical change in the way the industry works. Infrastructure-as-a-Service (IaaS) is the next big wave after Software-as-a-Service (SaaS).

## Stand-Alone Systems Stand Alone

While similarities exist between the migration from HD to 4K/UHD and the transition from SD to HD, the transformation to UHD is more challenging. Broadcast-related technology up to now has been dedicated to the process of editing, rendering effects, and sending programs directly to the end-user. Highly skilled creative artists and engineers have trusted their standalone systems and, while sharing cloud storage has been in place, these systems work more or less independently, only signalling to each other when a task is finished so another task can start computing the next process. However, with the enormous amounts of data that have to be rendered and shifted without a technician or TV director observing, the high specifications for such standalone systems have become too expensive to afford.

"By moving high-performance computing to the cloud and by virtualization, broadcasters and content producers will reduce their CAPEX expenditure to OPEX expenditure," says Brooking, referring to the software industry in which one can get the latest version by applying for a subscription. This model is great whenever companies are in between projects. By subscribing to flexible online plans, companies can scale down or scale out whenever there is a need.

"The advantage of high-performance cloud com-



puting is that your regular IT infrastructure can be used for up to six layers of UHD/4K video clips," says Bernard Schep, Senior Networking Solution Manager of Huawei. Thin clients at the fingertips of editors communicate with super computers that have a lot of shared computing power. Schep continues: "We will see a shift towards shared computing power as broadcasters have good experiences with shared storage."

## Huawei R&D: Tuning in to the Challenge

"In Soho, a part of London, every second building seems to be a media company with large racks for storage and computing," adds Brooking. The prices to rent or buy property in certain European cities are skyrocketing. In Amsterdam, where the International Broadcasting Convention (IBC) took place in September 2015, many video production companies have left for other cities with affordable property prices despite desperate attempts to keep to them within the borders of Amsterdam. "Together with our partners, Huawei is able to move storage and computing power to places more affordable, making room for more creative processes to take place on the same floor. And, when ingest time is reduced and media file migration time decreases, I have more time to spend on creative storytelling," continues Brooking, who previously worked as a video editor.

The question before Huawei is whether it's ready for UHD/4K shared computing

in a broadcasting environment. "Yes," says Schep, "because our 4K/UHD solutions are used with regular existing IT infrastructures."

Imagine all the rendered effects in the cloud that have to be shown on the high-resolution screens of two hundred journalists and editors. Such is the case at the Shenzhen Media Group. This broadcaster operates 12 TV channels, five radio frequencies, and has more than 20 subsidiary enterprises. "Our equipment can fully communicate with standard IP technology and can use 10G connectivity very efficiently," Schep adds: "They have extremely high buffer capacity, ultra-low latency, head-of-line blocking prevention, and embedded data management software. Data loss is no option, and data transfer speed is key. These solutions can easily work together with the IT hardware you bought earlier but have yet to depreciate."

Currently, Huawei ranks No.228 in the Fortune Global 500, reaching USD 60 billion in sales revenue in 2015. The company runs 16 R&D centres worldwide. Huawei's R&D department employs 79,000 of the company's 176,000 employees and invests more than 10 percent of its sales revenue annually in R&D, earning its standing as the world's fifth most-innovative company. "When I hear about a customer's pain, I say let me return back to you in a couple of weeks," Brooking says. "I heavily rely on our R&D department to produce a new solution which is not on the market." ▲

## Link

### Huawei Solutions at IBC 2015

*Huawei showcased its cutting-edge addition, the Huawei Media Cloud Solution, in Amsterdam at IBC 2015 (September 11 to 15). The Media Cloud Solution is the world's first media cloud solution capable of supporting concurrent editing of up to six layers of 4K/UHD video. It features smooth video editing capabilities at 25 frames per second, 120 Mbit/s code streams for programs produced within TV stations, and dedicated GPU boards for rendering. The Media Cloud delivers a service-defined hybrid cloud IT infrastructure compatible with open cloud platforms such as OpenStack.*

*OceanStor 9000 is Huawei's flagship media storage system. High-performance storage is the cornerstone of high-quality video editing. To avoid bottlenecks while keeping costs down, solutions enabling high throughput and reducing OPEX are required. Huawei's OceanStor 9000 is able to deliver 300 Mbit/s sustained throughput for a workstation, 1.6 Gbit/s throughput per node, and 400 Gbit/s per system, making it the fastest scale-out Network-Attached Storage (NAS) system in the world.*



Victor Yu

# Threat Protection through Cloud Video Storage

| By Victor Yu, Director, Industry Marketing & Solution Department and He Junhong, Principal Engineer, Government Solutions, Enterprise Business Group, Huawei Technologies Co., Ltd.



He Junhong

**Huawei's cloud-based video surveillance storage solution offers Safe Cities an alternative. >>**

**V**ideo surveillance is a city's first line of defense, as is evidenced by the wide utilization of existing surveillance systems that help and protect people from traffic tie-ups, fires, criminal activities, and terrorist threats.

The cost of this protection includes the huge amount of storage space needed to capture and sort video data. It is common that video files stored in legacy systems are separately managed and stored in decentralized systems that have been supplied by different vendors. Equally common is the absence of standardized or open interfaces for accessing or sharing these files from outside each silo, which makes effective use of them extremely difficult. Huawei's Safe City Cloud-based Video Storage solution changes all that by permitting fast sharing of videos and concurrent access across all networks.

Huawei has created a systematic engineering process that makes construction of these large-scale surveillance systems easier — systems that can involve thousands of video surveillance cameras and a thousand or more video storage devices with petabytes of capacity. Features and benefits include:

- Simplified planning, deployment, and configuration
- Concurrent access to videos by large numbers of first responders and managers
- Smooth load balancing and scalability of recording devices, even if provided by multiple vendors
- Formatting, reconfiguration, and quick restoration of faulty disks and devices
- Large-capacity storage that can be scaled elastically

## Legacy Problems

Many cities want to upgrade their legacy solutions to modern systems that support interworking and single-view monitoring across multiple software platforms.

Cities that operate legacy video networks face a variety of serious problems that Huawei has solved:

### • Faulty Disks and Devices

When more than two disks or storage devices fail, videos can no longer be stored, replayed, or for-

warded. Even if the disks or devices are immediately fixed or replaced, formatting, reconfiguration, and restoration steps must occur. The rule of thumb for the amount of time necessary to restore 3 TB of video data on a legacy storage system is 32 hours. Needless to say, operations will be dramatically slowed. Comparatively, the Huawei solution needs just one hour to restore 3 TB of video data — more than meeting the public security industry requirements of 8 hours.

### • Excessive Investment

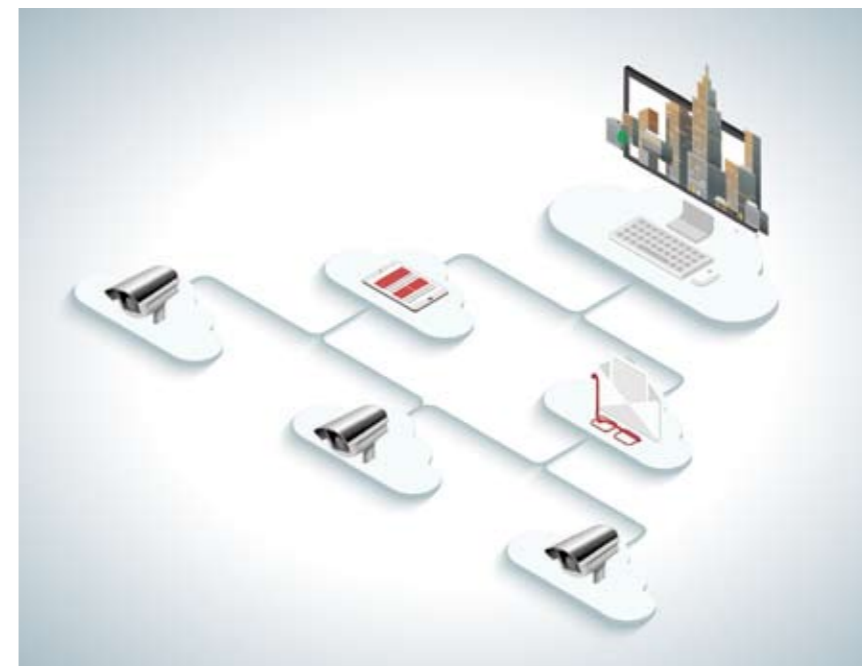
Some cities try to expand video storage by increasing the number of existing devices or purchasing a large number of devices that do not meet the actual need — and only succeed in wasting large amounts of money. For example, video surveillance storage devices configured for Standard Definition (SD) and High Definition (HD) may be used to record surveillance videos for 30, 90, or 180 days. To save money, some cities have chosen to replace all-SD storage devices with HD devices or to automatically erase files after 30 days, with the option to manually archive select videos for 90 or 180 days.

### • Heavy Workloads

In urban environments that may have thousands of deployed surveillance Peripheral Units (PUs), manual reconfigurations or upgrades are very labor intensive and carry the risk of leaving sections of the city without video protection during the service cycle.

Research and surveys show that, as Safe Cities grow, the number of surveillance cameras, especially HD cameras, will increase. The result can be an explosive growth in the amount of video data that must be captured and stored.

• The total volume of video data can quickly reach multiple petabytes, with no realistic expectation that a legacy storage solution has the capability to scale-out to that level.



**The Huawei Cloud-based Video Storage Solution is built on thorough research of actual user practices. The solution offers transparent access to devices from multiple vendors and large-capacity elastic storage. >>**

• Cities that redesign their storage architectures to up-to-date standards gain the benefits of easy deployments, simplified configurations, and fast service rollouts.

## Huawei Advantages

### • Multiple Industrial Interfaces

The Huawei solution complies with industry standards and provides easy access to a variety of cloud-based video storage systems. Industry standard interfaces include the Real-time Transport Protocol (RTP) for streaming media via the Network File System (NFS) connected through SCSI, iSCSI, and CIFS device interfaces.

### • Data Redundancy Plans

Flexible data redundancy plans are useful for reducing the cost of storage resources by enabling storage resource optimization routines for setting disk utilization rates up to 95 percent.

### • Expand Capacity

Although it is possible to expand legacy systems by adding inexpensive resources, the time and labor resources required for installation and configuration will overwhelm the savings. The Huawei solution uses a scale-out storage architecture that automatically identifies every storage node added to the system. Single nodes can be added in less than 60 seconds, and single file systems up to 40 petabytes can provide 'scalability on demand' to ensure reduced

long-term operating costs.

### • Sharing Network Videos and Providing Concurrent Access

A cache, or temporary storage block, has much faster data read-write speeds than hard disks. However, single nodes have only limited room for cache expansion. Huawei uses a global cache method that provides a pool of virtual cache resources with a maximum capacity of 55 terabytes. Any data file stored in the cache pool can be accessed by any node. The result is a reduction in the number of disk reads, writes, and access latency — and an improved overall system performance.

## Huawei Security and Reliability Features

### • Cross-device Security Assurance

Huawei's Erasure Code (EC) redundancy algorithm is a superset of RAID that improves overall system performance and resource utilization. Data written into the system is distributed among different physical nodes — an approach that prevents data loss caused by single points of failure and ensures service continuity and system availability.

### • Automated Data Recovery

The Huawei solution optimizes and simplifies hard disk management. Users need only choose the most appropriate protection models for their specific data types.

### • Data Reconstruction Accelerates Data Restoration

Data can be evenly distributed to each disk without hot spot data. This approach improves the ability to restore concurrent data, reduces time spent reconstructing data, and shortens the time needed to restore data in the event of data corruption. The result is that a terabyte of data can be restored within one hour.

### • Remote Backup for Redundancy Protection

Huawei's remote backup provides geographic redundancy. Data in one place, for example, a police station, can be backed up easily by another police station or an upper-level bureau. Remote backup features are provided for up to 300,000 directories. This huge capacity enables remote backup at all surveillance levels. If a storage system is faulty, all video surveillance users are still able to access the system from a remote disaster recovery center over a dedicated video network.

The Huawei Cloud-based Video Storage Solution is built on thorough research of actual user practices. The solution offers transparent access to devices from multiple vendors and large-capacity elastic storage; network sharing of videos and concurrent access to those streams; and zero storage downtime, including auto-recovery of services and hot backups that ensure the availability of the video surveillance system at all times. ▲



Walter Weigel

# 5G for IoT and Mobile

| By *Walter Weigel, Vice President, European Research Institute, Huawei Technologies Co., Ltd.*

**A research and technology roadmap, including real-world examples, illustrates the range and complexities of an evolving 5G/IoT ecosystem. >>**

## 5G Has Two Flavors: Mobile Broadband and IoT

The research in 5G, especially for future radio interfaces, has to be seen under two quite separate aspects:

- Use cases for mobile applications are about very high bit rates, such as future terminals with 3D-displays at 8K-resolution or holographic displays. Thinking about peak data rates as a function of millimeter waves with carrier frequencies up to 100 GHz may be necessary to provide throughputs of 10 Gbit/s or greater.

- For the Internet of Things (IoT), among the use cases under study are Industry 4.0 environments for future factory automation, Intelligent Traffic Systems (ITS) for autonomous vehicles, eHealth for smart medicines packaged with wireless modules, and smart energy with the IoT as the enabling technology for communication over complex 'Smart Grids.' In each case, the requirements look very different, though each one typically requires only a few kilobits per second but with guaranteed 10 ms latency and/or 99.999 percent reliability rates.

## IoT Will Be the Main Traffic Driver for the 'Internet of the Future'

The numbers of 'Things' predicted for the IoT are all quite large and vary by the source and year. Cisco is forecasting 50 billion connected devices while Intel is projecting 200 billion. Huawei estimates that the number will be 100 billion. In all cases, the suggestion is clear that this large number of Things will probably generate the majority of traffic in the future Internet when compared to the traffic originated by human users. We can assume that use cases will involve all manner of sensors and active tags, and that the readers for passive tags will be wireless. Such cases can include a range from cross-regional mobile devices like containers or cars to moving units with fixed locations and a constrained range like industry robots or rotating production units, or the remote devices in a smart electrical transmission grid where wireless connectivity provides the same simplicity and flexibility that are advantageous in production environments. In each of these cases, Machine-to-Machine (M2M) communication is of the highest importance.



## M2M Is Only One of Many Important Parts of the IoT

Industry is obliged to deliver an IoT wireless communication platform that fulfills all requirements.

The critical success factors include reliability in very different use cases, such as high sensor density, building coverage and penetration, guaranteed QoS and secure end-to-end communication and, not least, power sources that fit the use case. For instance, it is neither realistic nor practical to frequently change batteries for sensors or wireless modules during use in Building Technology applications or smart medicines. Research in 5G is working on the exact solutions that will offer these connectivity technologies for public and private networks to cover these and other use cases. Many such services will be carried, we expect, by telco networks and others via private solutions. Research activities concentrate on both radio interfaces and the fixed architecture that has to be kept flexible for future adoptions. Software-Defined Networks (SDN) and Network Function Virtualization (NFV) will enable these offerings by partitioning network resources into 'slices.'

Perhaps the most critical factor for determining the success of the IoT will be cost. We assume that the cost of all connected 'Things' attached to all goods in a supermarket, plus the cost of the necessary infrastructure, need all be affordable — especially as the Business-to-Business (B2B) advantages in logistics and supply-chain management will not be obvious to the consumer.

## The IoT Value Chain Includes Cloud Storage and Big Data Analytics

Another crucial point for the IoT is the 'value chain,' which, for instance, would comprise the 'Thing' with a sensor and wireless module, network connectivity over a 5G circuit, a collection of data in the cloud, and,



**Another crucial point for the IoT is the 'value chain,' which, for instance, would comprise the 'Thing' with a sensor and wireless module, network connectivity over a 5G circuit, a collection of data in the cloud, and, finally, the ability to analyze the data, which means Big Data analytics. >>**

finally, the ability to analyze the data, which means Big Data analytics. Having the value chain work end-to-end is an area of research that requires more study, as today it is a challenge to combine data from different IoT sources that populate different databases in different data formats. This is exactly the type of situation that will happen in 'Smart City' environments where different data sources have never been integrated and grown larger or separately over time. More difficult yet are the tasks involving time stamps with very different time intervals, or time stamps that are derived asynchronously. Fortunately, companies like Huawei have competencies across all parts of the IoT value chain and are well positioned to address these types of issues.

## Example Solutions for eHealth, Intelligent Traffic Systems, and Industry 4.0

It is difficult to imagine the full range of research topics without a few concrete examples. Intelligent Traffic Systems and autonomous cars are receiving a lot of attention. It is assumed that in high-speed, high-density traffic that autonomous vehicles will use three different information sources to maintain safe highway travel: First are on-vehicle cameras and sensors; second is

information from car-to-car communications; and third is information from the infrastructure — in other words, data from the cloud transmitted from base stations and roadside terminals. In combination, these three sources will optimize autonomous vehicle safety to the maximum possible extent.

In eHealth, pharmaceuticals are prescribed at specific times or intervals of time. In a diabetes case, one can imagine insulin pens equipped with sensors and wireless modules that, when connected to the IoT, have a range of possible interactions with the patient, from simple reminders to the release of a recommended dosage mechanically. Time of use, actual usage, and other data can be provided in real time to an intelligent health monitor for use in improving the treatment and drawing conclusions about future procedures.

Industry 4.0 is being organized by the German government to be the future of manufacturing production systems. Within this context, the IoT will play a crucial role alongside other key technologies like Cyber Physical Systems in which all parameters of a production line, such as sensors, actuators, tags, and readers, will be collected and uploaded to a cloud. Analysis of this data will occur in near-real-time in order to predict equipment status and operating compliance. Models and projections will trigger predictive maintenance activities. Further analysis may reveal inefficiencies that can be rectified to achieve faster throughput or cost savings.

Each of the preceding examples provides focus on the importance of our research into 5G-communications and the entire IoT value chain. It is essential that Huawei and others are committed to the necessary long-range planning and technology developments in preparation for the widest range of concrete use cases. There is really no other way that our customers and, in turn, their customers will succeed in the long run. ▲



## Contributions and Feedback

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