Leading New ICT Building a Better Connected World

ICT INSIGHTS

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LEADING NEW ICT

Digital Transformation Enables Industry Insights

Throughout the past year, the intersection of the global digital economy with disruptive ICT solutions has become a vital starting point for enterprise transformation.

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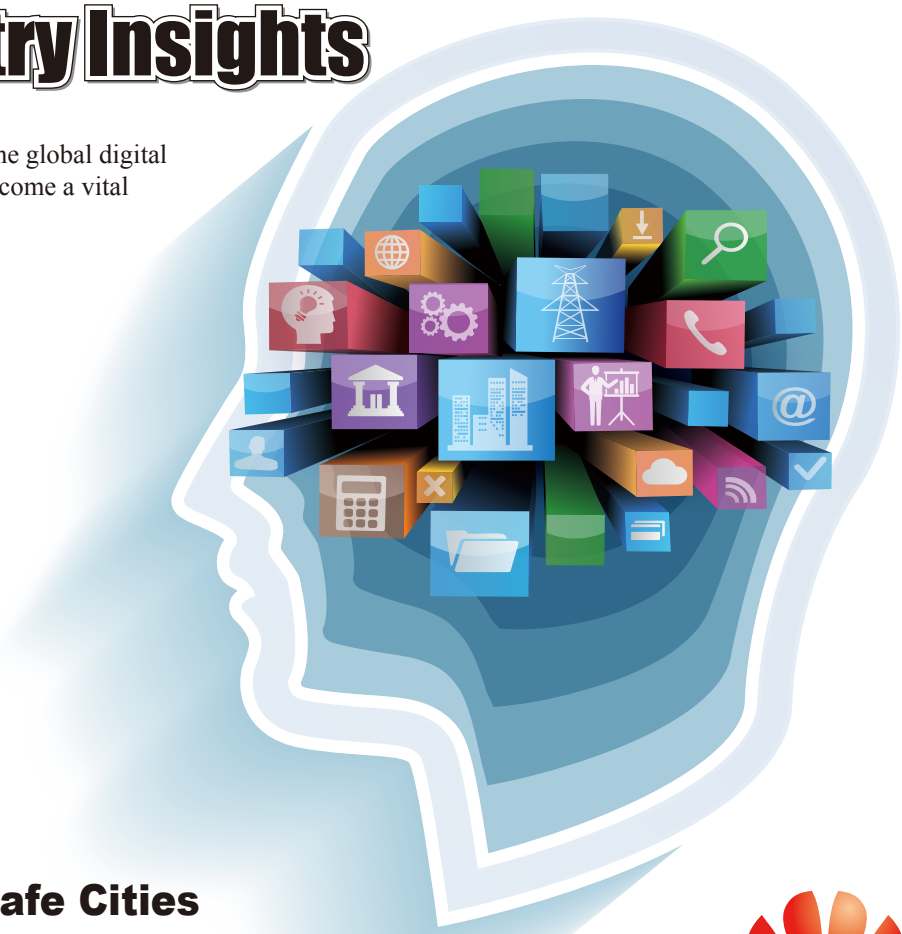

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HUAWEI

Five Years of *ICT Insights*

| By *Diana Yuan, President of Marketing & Solution Sales, Enterprise Business Group, Huawei Technologies, Co., Ltd.*

A lot can be accomplished in five years. It's long enough to graduate from college, develop technical expertise, or expand the size of your company from dozens of people to thousands. In just a few short years, Huawei Enterprise Business Group (EBG) has witnessed dramatic expansion, a wide variety of strategic developments, and continuous transformation.

When Huawei started its enterprise business activities in 2011, the global Information and Communications Technology (ICT) solutions provider realized immediately that it needed a systematic and authoritative publication that provided insights into enterprise business — from theoretical discussions and overviews of technology trends to practical business information. We founded *ICT Insights* to meet these needs and serve as a platform that showcases Huawei's business and ecosystem strategies. The magazine also set out to provide our customers and partners with the latest updates and news of best practices covering the development trends, technologies, platforms, and ecosystem of the ICT industry.

The ICT landscape has undergone unprecedented development. The following brief list presents interesting technology events that have made news in recent years:

- Kickstarter, launched in 2009, is the world's largest crowdfunding platform for creative projects.
- Intelligent devices and sensors interconnect, giving rise to the IoT.
- Google Glass encouraged a wave of development for head-mounted display devices beginning in 2013.
- Germany and China released initiatives for future-oriented industrial technologies: Industry 4.0 in 2011 and Made in China 2025 in 2015.
- Cloud computing, Big Data, the IoT, and SDN came into widespread use.
- AlphaGo beat Lee Sedol, a top professional Go player from South Korea, in a landmark victory of Artificial Intelligence (AI) over humans in 2016.

At Huawei Connect 2016, Huawei pointed out that Cloud 1.0 had come to an end. Emerging Internet enterprises are using cloud technologies to implement better user interaction and resource sharing, moving to business models that feature agile innovations, optimal experiences, and low costs.

As a result, we have now entered Cloud 2.0, which is marked by the emergence of various industry clouds that have become the engines of a new industrial revolution. Rather than being a simple combination of industries and the cloud, the 'industry cloud' is a deep convergence of businesses and technologies and a process of service-driven digital restructuring.

In recent years, Huawei's enterprise business has reached a Compound Annual Growth Rate (CAGR) of more industry customers realizing added business value with Huawei products and solutions. By teaming up with partners, Huawei EBG has made significant contributions to customers worldwide. Examples include security assurance during the Pope's visit to Kenya, construction of a smart meter reading system for Nigeria's largest power distribution company, high-performance storage systems that helped the European Organization for Nuclear Research (CERN) cope with data floods in the 'God particle' discovery, and network restructuring for Italy's Banca Monte dei Paschi di Siena (BMPS), the world's oldest surviving bank.

Huawei EBG has served governments and utilities in more than 140 countries and regions. Its enterprise products and solutions have been deployed by more than 300 financial institutions, 170+ power companies, 600+ colleges and universities, 400+ Internet companies, and multiple transport enterprises responsible for 220,000 kilometers of railways and express highways.

The rapid ICT transformation that started at the beginning of this decade is also reflected in the topics covered by *ICT Insights*, which expanded from technology innovation to business and ecosystem innovation. Authors who contribute to *ICT Insights* are a diverse group. They include Huawei EBG executives and technical experts, ecosystem partners, executives of other companies, scientists, and well-known analysts.

Since 2012, a number of special issues have been published on popular topics such as health, Internet Service Providers, Energy Internet, and Safe Cities. These extra issues have provided a platform for exchanges between Huawei, partners, and customers. For example, an electric power company was inspired by an *ICT Insights* special report on the Energy Internet to obtain much-needed help and service from Huawei and partners.

ICT Insights takes full advantage of leveraging the strengths of Huawei's latest ICT activities, including EBG's official website (e.huawei.com), enterprise business Apps, social media, Email Direct Marketing (EDM), and multimedia programs. Huawei EBG will continue to provide information on innovative ICT hardware and software infrastructures, nurture a collaborative technology ecosystem, and help readers address the challenges posed by ICT transformation.

The editorial board of *ICT Insights* will persistently endeavor to build the publication into a platform that connects Huawei EBG's ecosystem and the entire ICT industry, facilitating business exchanges and strategic collaboration between all ICT players. ▲

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Technology News

| Source: *PR Newswire*

Shannon Launches World's First 12.8 TB PCIe SSD

SHANGHAI, China Dec. 8, 2016 — Shannon Systems, a leading manufacturer of SSDs, has continued its growth in the 3D NAND-based flash market by launching several new products including the world's first 12.8 TB PCIe SSD drive, Direct-IO G4i. The Shanghai-based flash storage giant is geared up to provide a wider range of services for its enterprise customers.

"3D NAND technology heralds a new era of flash storage with high performance, high capacity, and low cost being available at the same time for users," remarked Shannon CEO Yang Xueshi. "Shannon has always been a frontrunner for research in this area. By utilizing 3D NAND, we provide a staggering capacity of 12.8 TB on a single SSD drive. This is a milestone for the SSD industry."

Chinese eCommerce giant Alibaba has already deployed Shannon's PCIe SSD products in large scale and seen significant performance improvements in mission-critical systems and the ability to handle more intensive and larger workloads during peak times.

Elektrobit Announces EB Assist ADTF 3 for Developing Highly Automated Driving

ERLANGEN, Germany, Dec. 7, 2016 — Elektrobit (EB), a leading developer of cutting-edge, embedded and connected technology solutions for the automotive industry, announced EB Assist Automotive Data and Time-Triggered Framework (ADTF) 3 to accelerate the software development of Highly Automated Driving (HAD) systems. This new version of an established tool gives carmakers and suppliers an edge in the race toward driverless cars by providing the foundation to quickly develop, test, and bring to market highly automated vehicles.

Supported by a customer consortium of premium German carmakers and suppliers, EB Assist ADTF is a globally established tool for the development, testing, validation, and visualization of advanced driver assistance software and HAD systems. The newest version optimizes these processes with improved data handling and usability. A new multi-process concept boosts stability in the testing phase by compensating for increased software complexity. Overall increased performance encourages rapid fleet evolution by enhancing how carmakers can use the tool to keep up with fast-paced HAD development.

Qualcomm Begins Commercial Sampling of World's First 10 nm Server Processor

SAN DIEGO, USA, Dec. 7, 2016 — Qualcomm Incorporated (NASDAQ: QCOM) through its subsidiary, Qualcomm Datacenter Technologies, Inc., today announced commercial sampling and conducted a live demonstration of the world's first 10 nm server processor. As the first in the Qualcomm Centriq™ product family, the Qualcomm Centriq 2400 series has up to 48 cores and is built on the most advanced 10 nm FinFET process technology. The Qualcomm Centriq 2400 series features the Qualcomm® Falkor™ CPU, Qualcomm Datacenter Technologies' custom ARMv8-compliant core, which is highly optimized to deliver both high performance and power efficiency, and designed to tackle the most common data center workloads.

Leading the industry to the next-generation node, today's announcement underscores a monumental achievement in delivering leading-edge, high performance ARM-based server processors to the data center. Qualcomm Datacenter Technologies is now uniquely positioned to address the needs of cloud customers seeking new server solutions optimized for total cost of ownership, while meeting performance, efficiency, and power demands.

Criteo Introduces New Creative Technology to Deliver Optimal Ad Personalization and Consistent Branding

NEW YORK CITY, USA, Dec. 7, 2016 — Criteo S.A. (NASDAQ: CRTO), the performance marketing technology company, today announced Kinetic Design, its patent-pending ad creation technology that delivers visually stunning, on-brand ads that are contextually optimized for every consumer and rendered in real time without the need to define ad sizes or layouts upfront. Each client's brand identity and ad requirements are translated into a comprehensive, machine-based framework that specifies the visual presentation, allowing marketers to drive greater customer engagement, improve reach, and achieve unmatched ad performance while maintaining brand aesthetics across campaigns.

Kinetic Design offers a virtually unlimited range of personalization with the ability to generate over 17 trillion visual design variations. This enhanced creative capability is offered in addition to Criteo's robust product recommendation feature, which ensures ad content is also tailored to each consumer's real-time shopping interest. Marketers are now able to manage their message and brand experience across the entire digital experience.

Enhanced Linguamatics NLP Text Mining Platform Offers New Power to Extract Actionable Insights from Big Data

CAMBRIDGE, England, and BOSTON, USA, Nov. 30, 2016 — Text analytics provider Linguamatics today released the latest version of their award-winning Natural Language Processing (NLP) text-mining platform, I2E 5.0.

Game-changing capabilities in I2E 5.0 include normalization of concepts like dates, measurements, and gene mutations within unstructured text, advanced range search, and a new query language, EASL. These capabilities tackle the variety in Big Data and accelerate insights from unstructured, semi-structured, and structured data sources.

Edge Computing Consortium Established to Deepen Digital Transformation

BEIJING, China, Nov. 30, 2016 — Today, the Edge Computing Consortium (ECC) was officially established in Beijing. This initiative was jointly created by Huawei Technologies Co., Ltd., Shenyang Institute of Automation of Chinese Academy of Sciences, China Academy of Information and Communications Technology (CAICT), Intel Corporation, ARM, and iSoftStone.

The ECC aims to build a cooperative platform for the edge computing industry that will give impetus to openness and collaboration in the Operational Technology (OT) and Information and Communications Technology (ICT) industries, nurture industrial best practices, and stimulate the healthy and sustainable development of edge computing.

Spidey Tek, LLC Creates the Strongest Material Known to Man

LOS ANGELES, USA, Nov. 29, 2016 — Spidey Tek of Los Angeles, California, announces its path to mass production of real spider silk. Spidey Tek is a biotech company dedicated to the mass production of the strongest material known to man, Real Spider Silk, and its utilization in producing superior products for the 21st Century.

Spider silk is a biomaterial that has been recognized as the strongest material on earth for many decades. The question has always been, 'How do you harvest enough of the silk to make it commercially viable?' Spidey Tek has discovered the answers to producing large quantities of spider silk by the rapid growth of specialized spider-cloned microorganisms in customized bioreactors.

Manifold Opens Up High-Performance Enterprise Blockchain Platform

SUNNYVALE, USA, Nov. 29, 2016 — Blockchain startup Manifold Technology announced today the wide release of the Manifold Platform at the Blockchain for Wall Street conference in New York City. The company's patented distributed ledger platform is now publicly available to provide a foundation on which anyone — freelance developer to financial institution — can rapidly build enterprise-ready, blockchain-enabled applications. With Manifold's easy-to-use platform, you don't need to be a blockchain expert to build and deploy production-quality applications. The platform has already been used to transform the Royal Bank of Canada's rewards program, as well as to enable member banks of the R3CEV consortium to demonstrate instantaneous trading of fixed income assets.

Huawei Launches New-Generation HPC Platform FusionServer X6000 at SC16

SALT LAKE CITY, USA, Nov. 18, 2016 — Huawei launched a new-generation High-Performance Computing (HPC) platform, the FusionServer X6000, at the Supercomputing Conference 2016 (SC16).

This FusionServer X6000 will aid computing-intensive workloads and provide enterprise customers with an ideal choice for an HPC platform that has higher efficiency and greater flexibility. "Faced with the challenges of digital transformation, enterprises are eager for service reconstruction, which drives the convergence of traditional HPC and cutting-edge technologies, such as cloud computing and Big Data," said William Dong, Vice President of Data Center Solution Sales, Huawei Enterprise Business Group.▲

Mei Hong

Cloud Computing: Ten Years and Beyond

| By *Mei Hong, Member of the Chinese Academy of Sciences and Professor of Computer Science and Technology, Peking University*

This review is based on Professor Mei Hong's keynote speech at the 2016 China Cloud Computing Conference in Beijing in which he examined cloud computing technologies to date and invites us to take a look into the future. >>

The year 2006 is regarded as 'year one' for cloud computing. Using virtualization technology, Amazon pioneered the cloud-based Hardware-as-a-Service (HaaS) model, which was designed to deliver computing resources to the public similarly to the way utilities distribute water and electricity.

Since then, cloud computing has become the primary infrastructure for Internet innovations and ubiquitous computing — converging society, information, and the real world. Along the way, this trend has demanded new computing models and platforms. To put this in perspective, we will look at the three phases of cloud development.

Phase 1 (2006 to 2010): The Basics

As companies competed to offer public cloud products, the HaaS model was widely recognized but not necessarily well understood. Unfortunately, HaaS did not come with a clear definition of cloud computing. Industry giants and researchers provided their own explanations, but all fell short. Hindsight reveals that the virtualization of large-scale computing resources and service-oriented software stacks were the key enabling technologies for what cloud computing has become.

Hardware resource virtualization and management technologies boomed and deepened our collective understanding of the cloud. Other major technical developments for cloud computing have included the following innovations:

- 2007: Kernel-based Virtual Machine (KVM) merged with Linux kernel mainline
- 2008: Linux Containers (LXC) released
- 2009: VMware vSphere launched
- 2010: CloudStack open-source released

In 2010, NASA and Rackspace jointly launched the OpenStack project, which has become important for the development of private cloud infrastructures. Innovative service models have emerged and, in turn, have bred numerous concepts featuring X-as-a-Service (XaaS). The release of important cloud computing technologies, such as open-source software, has become a defining characteristic of the cloud-computing infrastructure.

Phase 2 (2010 to 2015): Getting on Board

Cloud service providers captured market share and fought for competitive advantage. Rapid adoption produced a global market worth about USD 100 billion. In September 2011, the United States National Institute of Standards and Technology (NIST) released a white paper, which provided an authoritative definition of cloud computing that has since been widely accepted. XaaS was primarily available in three forms:

- Infrastructure-as-a-Service (IaaS)
- Software-as-a-Service (SaaS)
- Platform-as-a-Service (PaaS)

Despite starting later, the market for private clouds developed at a faster pace than the public market. Private-public hybrid clouds also emerged, which served to increase mobility and terminal connectivity to further shape the deployment of cloud computing services.

As key technologies and systems for cloud services and management matured, open-source computing platforms, such as OpenStack and CloudStack, gained wide deployment. Software-Defined Networking (SDN), represented by OpenFlow, also became an important enabler. Industries reached a consensus on the application of software-defined hardware resources, including computing, storage, and networking, to meet the growing demand for deploying large numbers of Virtual Machines (VMs) with increased flexibility. Software-defined management platforms began to allow for efficient control over the now massive scale of cloud computing resources.

Phase 3.0 (2015 to 2020): In Full Swing

Today, the maturity of cloud platforms and the emergence of a suitably large number of terminals have created a 'prosperous development' phase for cloud computing. Importantly, cloud-computing service providers have shifted their focus from cloud facilities to applications. Providers' current concerns are to meet the growing diversity of user-application requirements that have given rise to a marketplace for Application Programming Interfaces (APIs).

Big Data is an important feature of cloud computing, with spending on cloud-based Big Data and Analytics (BDA) expected to grow faster than that for on-premises solutions. An increasing number of cloud-based, device-oriented applications are expected to meet the requirements of professional users. Based on software-defined platforms that deliver greater flexibility and support, cloud-device convergence will become the new model for cloud computing.

Envisioning Future Development

The future of cloud computing will center on ubiquitous resources, platform-based systems, industry-specific applications, and improvements in service quality. As more devices are cross-connected through the Internet, society, information systems, and the physical world will increasingly converge.

Ubiquitous resources refer to various computing resources for further expansion, such as mobile Internet clouds, smart terminals, and nodes on the Internet of Things (IoT). New cloud computing architectures that feature the convergence of the cloud with devices are being developed for the on-demand allocation of client and server resources. Future clouds must not only support existing terminals, such as smartphones and tablets, but also various IoT-connected devices. A serious challenge for ubiquitous connectivity will be to manage huge amounts of cloud-device resources.

Timely utilization of massive sensor architectures is vital for cloud platform management. Public, private, and hybrid clouds of varied scales and build characteristics will emerge:

- Large-scale clouds will provide services to users worldwide.
- Small clouds will be built on existing resources.
- Physical clouds will possess their own hardware resources.
- Federated cloud alliances will be built on a foundation of physical clouds.

Today, the maturity of cloud platforms and the emergence of a suitably large number of terminals have created a 'prosperous development' phase for cloud computing. Service providers have shifted their focus from cloud facilities to applications. >>

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Demands for cross-cloud alliances are growing. For cloud service providers, serving applications across multiple clouds and realizing open collaboration and in-depth cooperation between cloud providers are important issues that must be addressed.

Platform-based systems are a sign that cloud computing support systems are evolving to cloud Operating Systems (OSs). Although much discussed, cloud OSs have yet to attain the level of architectural maturity and capability that are expected. Current systems are primarily responsible for managing cloud resources to support various applications. Future systems will also need to manage multiple tasks running on clouds, similar to standalone OSs. An ideal cloud management system should include cloud OSs, stand-alone OSs, and various application containers and middleware to support a wide variety of cloud services.

To begin, cloud OSs must seamlessly port traditional applications in order to manage massive numbers of heterogeneous resources effectively. Future OSs must support integrated interactions between dissimilar terminals connected through the Internet.

Furthermore, cloud OSs must better support uplinks to applications. Developers are encouraged to explore the construction techniques and operational impact of cloud-native applications, research and develop new programming design models and related languages, design unified scheduling and management mechanisms for cloud tasks, and implement on-demand integration of resources within and across clouds.

A critical enabler of cloud resource management, Software-Defined X (SDX), supports custom development based on user requirements. The promise of SDX is extensive management support with the ability to cover micro, mid-range, and large-scale VMs.

Industry-specific applications are geared toward the provisioning of API-integrated environments by cloud service providers to address specific solutions and connectivity domains.

Software-service awareness is an important enabler for industry-specific cloud applications. Early information systems were tightly coupled and integrated, comprising applications developed by one vendor that did not support either custom development or interoperation with third-party applications. Software-Oriented Architecture (SOA) from the 1990s gave rise to SaaS which, in turn, is able to support loosely coupled distributed applications based on coarse-grained Internet services.

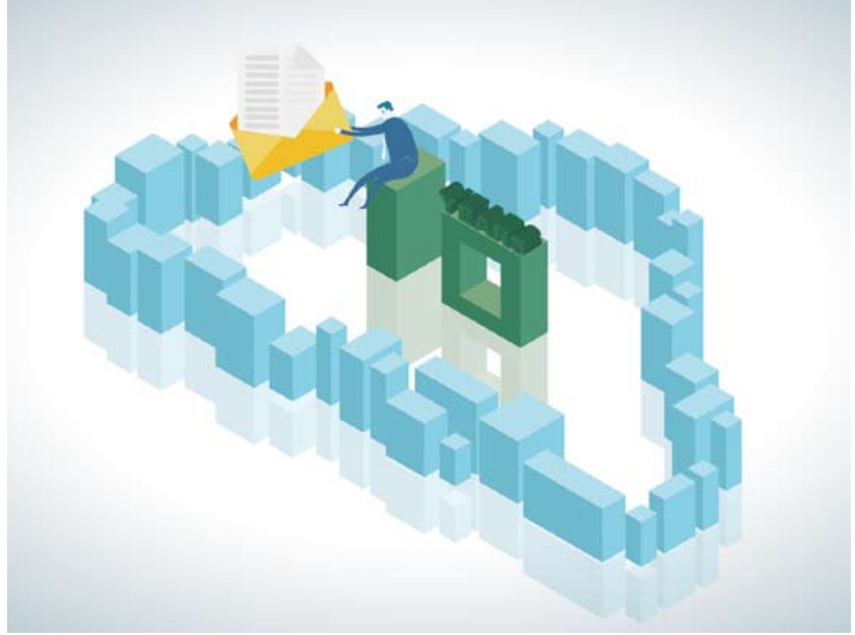
Improvements in service quality can be described in three words: higher, faster, and stronger.

Higher refers to greater throughput and the aggregation of massive numbers of support data processing with excessively high concurrent access — a common requirement of many cloud applications.

Future clouds must respond faster to improve the user experience and service quality. Amazon has found that every 100 ms of latency costs 1 percent in sales. A one-second delay in page response can significantly reduce customer conversion rates, page visits, and customer satisfaction. By comparison, Augmented Reality (AR) and Virtual Reality (VR) require 1 ms response times to satisfy customer requirements.

The key to strong, high-quality applications in the cloud is fast response to service requests. Cloud-based computing applications are subject to latencies from two main sources: the network and the cloud data center. Current statistics reveal that the network and data center each contributes about half the latency that users experience during service usage. Network latency can be reduced by higher bandwidths and better geographic distribution of data centers for user proximity. Latency caused within data centers can be reduced through better vertical integration of layered cloud-aware software stacks.

As the requirements for cloud services become more diversified and attract more organizations to switch to cloud computing platforms, researchers will continue working on initiatives in areas like VM status synchronization, parallel data and graphics calculation, large-scale nonvolatile memory, and distributed uninterruptible power supply systems.



'Internetware' for Cloud Computing

Researchers in China have proposed the term 'Internetware' to describe Internet-related software with new features that would change current software models, operating platforms, engineering, and quality.

Sponsored by *National Basic Research Program 973*, the researchers have built an open, collaborative Internetware model. The first model has been operating at Peking University for several years. There, a software team has pioneered research in hybrid cloud management, data interoperability platforms, and cloud-enabled Big Data processing. Based on the guiding principle of 'Whole Software Architecture Lifecycle,' they have further proposed a container structure and associated mechanisms to support on-demand collaboration and online evolution that will enable autonomous system management and operational support.

In the context of hybrid cloud management R&D, the team has adopted a software-defined approach that features API-based management functions and programmable management tasks in a system called YanCloud IaaS. This system supports integration and configuration management of infrastructure resources and the on-demand construction and management of public, private, and hybrid IaaS clouds. A number of Chinese IT companies have developed their own cloud management products based on YanCloud IaaS for eGovernment, transportation, telecommunications, and health. In 2015, the Internetware research program won a *Science and Technology Progress Award* from the Ministry of Education.

The software team developed the YanCloud Data-as-a-Service (DaaS) system to resolve interoperability issues that hindered data sharing over the Internet. YanCloud adopts a structure recovery technology that captures APIs and their system-facing components to enable interoperability between applications and data to form new operational management logic. The YanCloud DaaS system encapsulates data from various web systems, mobile applications, and PC software into APIs without needing the original documents or system source code. The system has enabled data sharing for over a hundred government, finance, transport, and energy application environments.

For cloud-enabled Big Data processing, the software R&D team has developed a lightweight data management and processing platform called Docklet. Docklet is a cloud OS for mini data centers where each user has a private Virtual Cluster (VCluster) of Linux container nodes mapped onto distributed physical machines. Each VCluster is separate and can be operated like a physical cluster. Docklet supports various computing frameworks, including Spark and MPI, and can run data analytics and processing programs in Python, R, and Java. Docklet offers users cloud-based workspaces with many programming frameworks preinstalled. Browsers are used to complete all data analytics operations, including editing, debugging, and programming. At the Computer Center of Peking University, Docklet provides teachers and students with a variety of cloud services for scientific computing, data analysis, visualization, and virtual experimental environments. ▲

Features

Researchers in China have proposed the term 'Internetware' to describe Internet-related software with new features that would change current software models, operating platforms, engineering, and quality. >>

Guillaume Lemoine

Leading TV News Channel Works in a Cloud

| By *Guillaume Lemoine, Broadcast Engineering Manager, TF1 Group*

France's TF1 television channel gains cost-effective performance by editing video content in a modern ICT infrastructure. >>

Moving to a cloud architecture may seem a daring choice for a news organization. After all, media companies are the second most-hacked enterprises after banks. Nonetheless, France's TF1 television channel has taken advantage of cloud technology and gained security advantages and significant cost savings.

TF1's progression to cloud technology has been a natural one given the requirements of television news and competition in the news business. To contain costs while expanding capabilities, TF1 has made technology choices that may be of interest to any media company.

TV to Multimedia

Rebranded from *Télévision Française 1* in January 1975, TF1 started as a simple channel and has evolved into a multimedia, multi-channel, and multi-platform TV network. TF1 has always led French TV in audience share and intends to maintain that leadership. However, we all know that traditional TV channels face strong competition from digital services, particularly among younger viewers. TF1 thus placed strong emphasis on diversifying activities to improve content creation and monetize capabilities. While enhancing its position as a producer of original content for news, TF1 is also selling content to other TV channels.

How can cloud technology help? The answer comes out of the long-term trends in TV operations. Like any other TV news group, TF1 sends crews into the field with more than 40 kilograms of equipment to gather content for news stories. In the not-too-distant future, we could shoot the same kind of video with a pocket-size smartphone that can transmit content across the planet thanks to the 3G and 4G networks. There is only one condition — you must shoot in landscape mode because TV screens are horizontal.

Software is replacing a great deal of hardware. The processing applied by the smartphone to improve picture quality replaces the big lenses and big image sensors used in broadcast cameras. What's more, stabilization algorithms are replacing the strength of the cameraman's weary shoulder.

Another trend has affected video editing equipment. In the 1990s and early 2000s, an entire bank of equipment was required. Today, PC-based systems are easily powerful enough to handle HD video editing. Consequently, videotape has become obsolete. Giving up workflows based on tape and tape recorders was the biggest transformation for TF1. Digital media and servers have dramatically improved the ability to work in groups and collaborate in content sharing.

Now, with software-based solutions, all the elements are in place for an even greater transformation: the adoption of cloud technology in broadcasting infrastructures.

Secure Way to the Cloud

Security presents a serious cloud infrastructure challenge for the media and broadcasting industry. Having safe infrastructure is an absolute necessity for the second most-frequently attacked industry. It is difficult to make a safer infrastructure than the closed system used years ago.

Other cloud challenges are not so much barriers to use as they are issues of scaling resources to meet TF1's requirements. For example, TF1 typically stores approximately 200,000 hours of content — in the range of a few petabytes. The company has to manage a reasonable number of files, but each file is huge. And remember — these figures are for HD resolution. 4K video quadruples the number of pixels and increases the number of frames per second, making it necessary to quadruple the number of pixels again because Japanese broadcasters intend to launch 8K technology for the 2020 Olympics in Tokyo.

Another important specification for TF1's media cloud is compute resources, which are needed for audio and video processing as well as running the databases used to manage the company's media. TF1 therefore needs solid general-purpose computing capability as well as graphics capabilities. Some of the company's video editors have been using high-end laptop computers for this task, which is a cost concern for TF1.

Now, with software-based solutions, all the elements are in place for an even greater transformation: the adoption of cloud technology in broadcasting infrastructures. >>

Additionally, the company has rolled out a major upgrade of the technical and editorial system for the 24/7 LCI news channel. LCI (*La Chaîne Info*) was previously a pay TV channel but earlier this year went free to air and is now facing new competition in the free-to-air market. The technical upgrade will make the channel more competitive but requires the use of high-end workstations.

LCI has a team of 150 journalists, and TF1 wanted to avoid investing in 150 high-end workstations when their utilization is not very high over a 24-hour news cycle. At any given time, around 60 journalists are simultaneously working on a video-editing task. Using standard workstations would have been costly and also would have constrained each journalist to a fixed location.

For a long time, TF1 thought that the only solution was to move to an architecture based on web clients. Unfortunately, significant features of audio/visual applications are still unavailable in such an architecture.

The Cloud Solution

Over the past couple of years, TF1 has performed numerous trials of virtualized infrastructures, which achieved higher density and ease of maintenance. Next, TF1 wanted to innovate in a different way to cost-effectively support the LCI journalists.

With the help of Huawei, TF1 set up a cloud architecture using Huawei's FusionCloud desktop, which enables end users to access 'virtual PCs' using thin clients. This solution encompasses terminals, other hardware, software, network resources, security resources, and consulting services to help adapt the solution to specific requirements.

The solution freed TF1 from depending on both a powerful client machine and a strong back-office capability with a high-performance network to bring high-resolution video streams to the client. The cloud architecture concentrates the computing power in the data center as a set of shared resources.

TF1 limited its shared-resource investment to 60 host computers that are accessible to 150 thin clients, which cost much less than high-end workstations, soft clients via Wi-Fi, and even smartphones. For performance, Huawei's Virtual Desktop Infrastructure (VDI) solution offered the best qualities for video playback and other crucial functions, including very smooth video playback and perfect picture and sound synchronization.

Finally, the cloud setup improved TF1's security. The VDI provides audio/visual tools and office tools on the same user screen that run on separate virtual machines. This setup allows TF1 to separate the office tools and broadcast video tools in the back office, which improved security.

Future plans for TF1 include partnering with Huawei, possibly in the short term, to implement a huge storage solution or extend the VDI solution into other areas of TF1. With the emergence of cloud-compatible TV applications and software-defined infrastructure, TF1 may soon be able to create a complete TV system as easily as a web system can be created today. ▲

Zhou Yongdong

Edge computing combined with Software-Defined Networking will simplify challenges that range from real-time performance issues to managing huge numbers of devices. >>

Managing the IoT: Edge Computing and SDN

| By *Zhou Yongdong, Marketing Director, Enterprise Network Marketing, Enterprise Business Group, Huawei Technologies, Co., Ltd.*

By itself, connecting a lot of 'things' to the Internet will not create a broadly useful Internet of Things (IoT) — the kind of IoT that will transform everything from factories to Smart Cities. That kind of IoT requires massive available computing power and networks with the capacity for staggering numbers of endpoint connections. Where (and at what cost) will you perform that computing? And how do you manage networks that connect hundreds of thousands of things? The answers are edge computing and Software-Defined Networking (SDN).

Understanding these two concepts requires a basic description of the four layers of the IoT:

- Sensing and control layer comprising 'things' (endpoint devices) that serve as data sources and/or perform some action such as a sensor and include SDN control logic
- Physical network layer that is used mostly for data backhaul
- Platform layer to manage connectivity and Operations and Maintenance (O&M)
- Application layer for data analysis and applications control

Edge Computing Advantages

The advent of cloud computing posits that management, analysis, control, and data processing tasks are best performed in data centers that host the platform and application layers.

Performing all computing tasks in data centers has drawbacks, especially for industrial applications that require real-time performance.

IoT architects have proposed that an open platform at the network edge will reliably perform tasks such as connection, computing, storage, and application installation. This edge-computing platform is close to the things that sense conditions and control actions. Considering the location, the edge-computing platform is generally implemented in an IoT gateway, where most IoT data will be aggregated in the foreseeable future.

Edge computing offers four primary advantages over traditional networking:

- Edge computing meets the needs of applications for real-time high performance. Delays in response time for control functions processed in the cloud will often be too long; therefore, some classes of analysis and control functions must be implemented at the network edge to meet specific, real-time service requirements. For example, in production control, the maximum delay in service control is often 10 ms or less. For automated driving, control delays must be within several milliseconds.
- Due to increases in local storage capacity, edge computing is well-suited to handle data adaptation and aggregation tasks. This approach is useful for sensing and control layers that involve the unification of complex, heterogeneous communications technologies and data protocols.

If bulk IoT data were sent from edges to data centers for processing, the cost of network operations would be unnecessarily high. For instance, temperature sensors need only report abnormal changes to the data center. Likewise, in the realm of facial recognition, rather than sending raw image data, only a few key characteristics need to be uploaded to the data center.

- Edge computing is reliable. Data center processing adds a level of complexity that inherently increases risk in many industrial applications. For maximum reliability, edge systems must maintain a certain level of autonomy; for manufacturing control systems, the collaboration between distributed intelligence and autonomous systems allows network edges to help secure the survivability of individual nodes and the entire system. Even with a basic system like connected streetlights, local controllability ensures pedestrian and traffic safety in the event that the city data center goes offline.

To help define edge computing architectures, open standards, and rapid adoption of IoT ecosystems, Huawei and partners have formed the Edge Computing Consortium. >>

- For many manufacturing systems, access network security is especially important. For the IoT, the network connecting the sensing layer with the data platform layer is usually the most vulnerable. To overcome this exposure, hardened security is best performed at the IoT gateways nearest the network edge.

Opening up Edge Computing

As IoT technology becomes more widely employed, edge computing turns out to be a prerequisite for implementing many industrial applications. To help define edge computing architectures, open standards, and rapid adoption of IoT ecosystems, Huawei has joined the China Academy of Information and Communications Technology, Shenyang Institute of Automation, Intel, ARM, and iSoftStone to form the Edge Computing Consortium. In support of this trend, Huawei has used edge computing as part of its Connected City Lighting and Connected Elevator solutions since early 2016.

IoT and Edge Computing Management Challenges

By 2025, Huawei projects that the application of ICT technologies will create 100 billion connections, 90 percent of which will come from various intelligent edge applications that connect things to things. This vast number of connections poses a great challenge to the management, maintenance, and control of the IoT.

Consider an 'Energy Internet' IoT project Huawei delivered in Nigeria that involved deploying 300,000 electric meters and communications modules, and tens of thousands of IoT gateways. Traditional network management systems were unable to handle such huge numbers of addressable components.

In this project, edge computing provided the advantages described earlier but also imposed new requirements on the management system, which in the past was responsible simply for network facilities. Now, the system must also manage the computing and storage resources of IoT gateways, and open-source third-party applications running on those gateways.

While the IoT and edge computing create exciting opportunities to use real-time data in countless scenarios, manually managing the edge network will grow increasingly impractical. The numbers and types of IoT devices are proliferating, networks are exposed to security threats, and management complexity is rising. The explosion of data collected and conveyed through IoT networks frequently requires near-immediate response times for safety, security, and production continuity.

Enabling IoT Management through SDN

SDN can cost-effectively virtualize IoT networks to provide automatic device reconfiguration and bandwidth allocation to boost performance and conserve bandwidth. SDN simplifies network management for even the most complex networks by offering plug-and-play device setup and deployment. SDN ensures security by detecting and resolving threats through automated application of security policies and improved access control with the benefit of greater traffic transparency at the network's edge.

Enabled by the policy-driven management of massive numbers of data center and edge computing devices, SDN supports the unified management of all ICT resources, including the unification of lifecycle management and the control of virtual machines, containers, and their mirror files.

Southbound controller interfaces enable centralized management of sensors, terminals, communication modules, IoT gateways, and other devices. Plug-and-play technology simplifies the management of multiple devices by implementing automatic deployment, security authentication, status monitoring, and remote upgrades. In the future, SDN is expected to leverage Artificial Intelligence (AI) to implement in-depth fault analysis and automated troubleshooting.

- The Role of Data Management

SDN also helps manage applications, including the ability to handle data subscription and distribution. This is especially useful when edge computing is implemented on open platforms that support third-party applications and edge services while decoupling network and data connections. SDN supports quick and flexible interworking with multiple data platforms through unified management of the delivery, installation, operation, and deletion of third-party applications.

The need for data management is a major difference between IoT management and traditional network management. Traditional connectivity technologies lack the depth of in-service analysis that is available in the current generation of network monitoring applications. For the IoT, collecting, analyzing, and uploading data is the point — and SDN provides the network flexibility to include the widest range of scenarios.

- SDN and IoT Control

Support for data uploading is another important SDN feature. For example, agent software on IoT gateways interacts with application platforms in data centers or with IoT platforms. This approach is supported by Huawei's OceanConnect, an open ecosystem built on IoT, cloud computing, and Big Data technologies, and GE's Predix, a cloud-based industrial Internet platform. Data can be sent to controllers for simple protocol processing before being forwarded to application platforms or IoT platforms. Network and data connections are decoupled from each other, with controllers performing data distribution and subscription and unified data uploading.

SDN removes the restrictions of traditional network architectures and is proving useful in Wide-Area Networks, with the goal of adapting networks to deal with rapid changes in industry demands. >>

Integration of northbound and southbound interfaces is also helpful for IoT applications. The IoT is an ecosystem involving different applications and domains for which no single vendor can supply a complete end-to-end IoT system. By providing northbound and southbound interfaces that support unified standards for quick integration with third-party systems, SDN can simplify the configuration of IoT platforms.

- Wide-Area Network Support

SDN removes the restrictions of traditional network architectures and is proving useful in Wide-Area Networks (WANs), with the goal of adapting networks to deal with rapid changes in industry demands. WAN controllers implement unified and centralized network management and global business model abstractions. Standard northbound interfaces for upper layer applications enable fast, inter-application integrations and day-to-day adjustments for SDN-equipped business networks.

- Huawei SDN/IoT Solutions

With all these functions, the use of SDN technology, especially controllers, will resolve issues such as IoT management, control, maintenance, and interoperability. Since launching an agile IoT solution at the *2015 Huawei Network Congress*, Huawei has deployed systems in a variety of domains, including electrical power transmission, connected lighting systems, intelligent buildings, and the Internet of Vehicles in collaboration with partners and other mainstream vendors.

Open Platforms and Simplified SDN Management

IoT platforms are much more complex than the simple connection of edge devices to the network and will always involve many different business applications and technical considerations. As the number of devices continues to grow (from an increasing number of vendors), networks will become more complex, harder to manage, and more vulnerable to security threats.

Fortunately, the combination of edge computing and SDN offers a path forward through many of the issues and complexities that the IoT services industry is facing. With edge computing on open platforms and simplified SDN management, IoT implementations will feature reliable, real-time, secure operations capable of taking advantage of the growing range of connected 'things' and the valuable data they generate. ▲

Optimal 4K Video Delivery

| By *Wang Jinhui, Deputy Director, Fixed Network Transmission Marketing Support Department, Huawei Technologies Co., Ltd.*

Wang Jinhui

One-hop transport of video services using Optical Transport Networks reduces per-bit transmission costs, packet loss, and delay. >>

Telecom operators are discovering that Optical Transport Networks (OTNs) are a strategic opportunity for transformation by leveraging the value of 4K video services. With 4K terminals gaining wider penetration and more content becoming available, telecom operators see 4K paths as a way to differentiate themselves from competitors. As a result, these operators are shifting focus from simply offering network connectivity to adopting service- and experience-driven approaches to network construction that will optimize the user experience.

4K Drives Network Upgrades

The issues that had delayed the development of 4K video, such as lack of 4K programming, limited bandwidth, and high prices for 4K displays, have gradually been resolved. For example, in the U.K., British Telecom (BT) achieved 23 percent growth in video services by launching the BT Sport video service over a newly constructed Next-Generation Access (NGA) network. In China, Sichuan Telecom has more than 5 million video service subscribers, 1.2 million of whom subscribe to 4K video — and the number is growing rapidly. In South Korea, the top three operators offer 4K services and expect to achieve 100 percent coverage for 1 Gbit/s access by 2020.

Driven by the development of technologies such as 8K video, Augmented Reality (AR), Virtual Reality (VR), and holography, video will continue to be the largest and fastest growing source of network traffic.

Metro Ethernet Challenges

The traditional Metro Ethernet (ME) networks that suit voice and data services are not a good fit for streaming video data.

A key difference between voice and video services lies in the size and duration of their bandwidth use. For voice calls, average connection lengths are in minutes and dozens of kilobits per second. For video services, connections for feature films will last up to two hours and require orders of magnitude of more bandwidth.

At 30 Mbit/s per user for 4k video services, traffic carried over Metropolitan Area Networks (MANs) is expected to increase by up to seven times within three years to support the immediate growth of 4K video consumption and by at least ten times in five years.

Rising network loads are accompanied by increases in packet loss and delay and, in fact, multiple researchers have published results indicating that video streams are on the order of one hundred times more sensitive to corruption by packet loss or delay than audio streams.

As recommended by Technical Report TR-126 from the DSL Forum, a non-profit corporation organized to create guidelines for Digital Subscriber Line (DSL) network system development and deployment, the packet error and drop rate in HD video transmission should be less than 10^{-5}. When packets are forwarded hop-by-hop over the Internet, delay occurs, although this delay is generally shorter than the normal 50 μs when network devices are not congested. Even high-priority services are subject to delays that may reach the level of milliseconds or even seconds on a single device.

The major requirements of video services today are high bandwidth, low packet loss, and low delay. Traditional ME network characteristics, however, include hop-by-hop forwarding and layer-by-layer convergence, both of which lead to high packet loss and long delays. In addition, the costs of ME networks are high.

Extending the OTN to Central Office Sites

Several measures are available to provide users with optimal video experiences, minimize the number of converged layers and nodes, and reduce per-bit network costs. First, the architecture of traditional ME networks can be optimized to take on a flattened structure with three layers:

- Smart Central Office (CO)
- Broadband Network Gateway (BNG)
- Core Router (CR)

Once this structure is in place, the OTN can be extended to CO nodes. Specifically, a large number of Optical Channel Data Unit-k (ODUk) hard pipes

Users relentlessly pursue a better service experience over more diverse terminals, and more flexible viewing options ensure the continuous growth of video traffic. >>

are used to connect Optical Line Terminals (OLTs)/Hubs and core-layer devices. These connections transform the IP ring topology into a tree network that allows service traffic to be forwarded from IP edge nodes to the core nodes with a single hop. This architecture eliminates intermediate hops and packet forwarding, which reduces forwarding costs, delays, and packet loss. With this architecture, video services on Content Delivery Networks (CDNs) are becoming as close as one hop away from the requesting terminals and being transmitted with high bandwidth, low delay, and zero packet loss, thereby delivering the best 4K video experience to users.

Simplified Network Architecture

Telecom operators working with MANs have the advantage of a simplified architecture that enables them to adapt to a fast-changing service landscape. For example, Huawei uses the OTN as the transport layer, which helps operators construct simplified networks that extend the OTN to COs. In this architecture, the OTN delivers many advantages.

First of all, the OTN ensures sufficient pipe resources. Wavelength-Division Multiplexing (WDM) technology offers an extraordinary capacity. With WDM, one pair of optical fibers supports concurrent transmission of traffic over as many as 80 channels, each providing up to 200 Gbit/s bandwidth for a total bandwidth of 16 Tbit/s. With the use of flex-grid technology, the bandwidth of one pair of optical fibers can exceed 20 Tbit/s.

In addition to increased raw bandwidth, for all practical purposes, the OTN exhibits zero packet loss. Packets are lost with other transport technologies for three main reasons. First, packets may be discarded due to line-bit errors. In contrast, OTNs have forward error correction capabilities with unparalleled Bit Error Rates (BERs) up to an order of magnitude below 10^{-12}. The second reason for packet loss is device processing errors. Since the WDM uses hard pipes and the OTN mapping-based encapsulation mode to transmit services transparently without further processing, the probability of packets being dropped by devices is effectively zero. The third reason for packet loss is

protective failovers. The WDM network is capable of implementing fast protective failovers (within 50 ms). When a working path is interrupted, the WDM network can restore dropped packets from the buffer of the protection path, thereby ensuring zero packet loss.

Another advantage of the OTN is minimum delay. Congestion over forwarding nodes is the prime cause of delay in conventional networks and occurs only in locations where traffic is forwarded from a larger pipe to a smaller one. In contrast, the WDM/OTN utilizes straight-through hard pipes and is able to forward all received traffic without any congestion, which reduces delay in video services.

Additionally, OTN simplifies network Operations and Maintenance (O&M). Huawei's Smart OTN O&M solution accomplishes this simplification by providing design planning tools, automated optimization and commissioning tools, visualized dashboards, and a 4K service-experience-indicator qualitative management system. These tools enable visualized and manageable device layers, with each device layer having a clear alarm and monitoring interface that supports quick and accurate fault location. Management and maintenance are made easier and Operating Expenses (OPEX) are significantly reduced, while ensuring a smooth End-to-End (E2E) 4K O&M experience.

By leveraging E2E OTN products and services, Huawei is assisting telecom operators to restructure and simplify their transport networks.

WDM-to-OLT Architecture

Vodafone Netherlands (VDF NL) began building a new WDM network in 2009. In this project, VDF NL used Huawei OTN devices to replace aging Synchronous Digital Hierarchy (SDH) and Point-to-Point (P2P) 10G WDM devices. New equipment with 40G wavelengths has been deployed over the entire network. As the 100G technology gradually attained maturity, VDF NL also deployed 100G wavelengths on the fixed network. In planning a Fiber-To-The-Home (FTTH) transport network, VDF NL relocated WDM devices originally deployed on the backbone (involving about 70 sites) to OLT sites. The upstream traffic of OLTs was transported through WDM devices directly to switching sites, which provided the fixed network with high bandwidth for one-hop transmission of traffic.

Fire and Forget

Swisscom, a major telecommunications provider in Switzerland, used a different approach called 'fire and forget' to implement a simplified network. In this approach, traffic is forwarded by WDM directly to OLTs/base stations. Each link provides direct GE bandwidth to the core layer without convergence.

Compared with financial figures from 2010, Swisscom invested more than USD 2 billion in additional funding in recent years on network restructuring or Capital Expenses (CAPEX) but saved about USD 3.4 billion in OPEX.

Looking Ahead

Users relentlessly pursue a better service experience over more diverse terminals, and more flexible viewing options ensure the continuous growth of video traffic. Additionally, market demand for cloud storage and cloud computing will continue to rise and push telecom operators to increase investment in their Data Center (DC) infrastructures. Against this backdrop, DC-centric network architectures are earning wide acceptance by telecom operators, who are starting to migrate services, including video services, to DC-centric architectures.

Telecom operators are moving WDM devices downward to MANs and access sites, and using the OTN to construct simplified transport networks for 4K video services. The current development phase, focusing on hardware, can be dubbed 'Simplified Optical Network 1.0.'

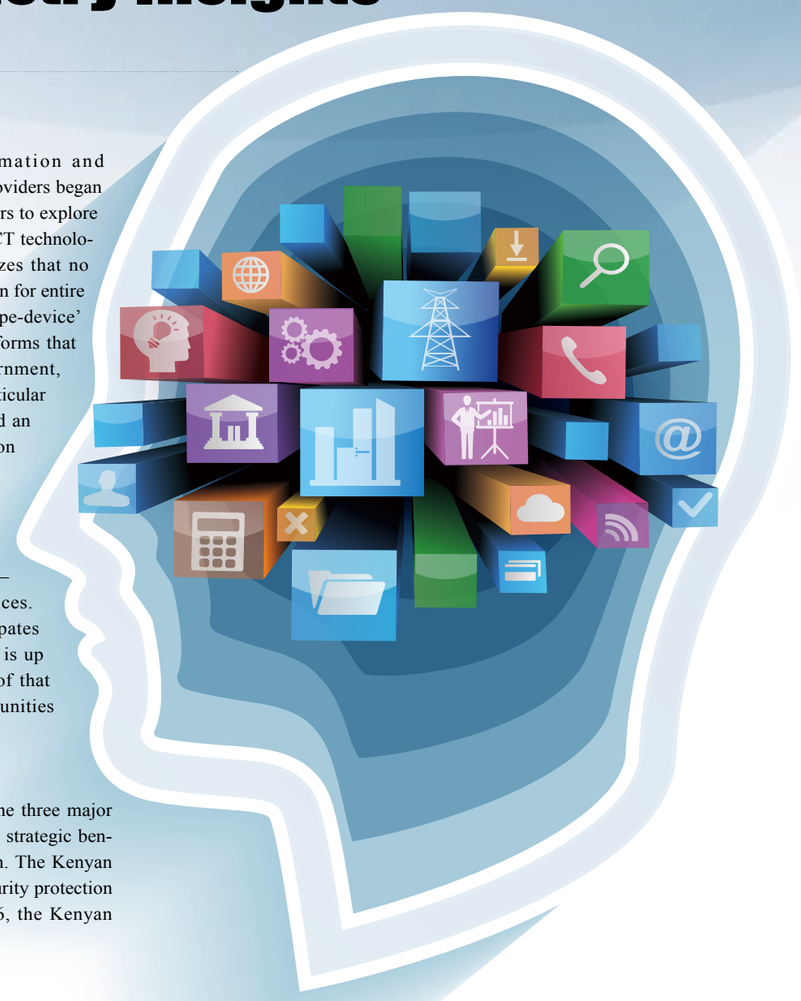
Huawei continues to invest in Software-Defined Networking (SDN) development to increase the level of network intelligence. Looking ahead to the year 2020, Huawei will develop more solutions for DC-centric services, helping construct telecom networks that have enhanced software capabilities with auto-detection, self-healing, and self-organization. We can soon expect the arrival of 'Simplified Optical Network 2.0'!▲

Market demand for cloud storage and cloud computing will continue to rise and push telecom operators to increase investment in their Data Center infrastructures. >>

Digital Transformation Enables Industry Insights

| By *the editorial board of ICT Insights*

Throughout the past year, the intersection of the global digital economy with disruptive ICT solutions has become a vital starting point for enterprise transformation. >>



Boom Year for Disruptive Technologies

Early in 2016, Huawei and other Information and Communications Technologies (ICT) solution providers began a number of joint ventures with ecosystem partners to explore how best to transition customers to innovative ICT technologies. Each of the joint venture members realizes that no single vendor can deliver the digital transformation for entire industries. Instead, solutions require a 'cloud-pipe-device' collaboration that combines open, scalable platforms that are flexible and yet highly secure. The government, finance, energy, and manufacturing sectors in particular have undertaken disruptive ICT solutions toward an end goal of operating state-of-the-art information and communication infrastructures.

Meanwhile, innovative ICT for enterprises — such as cloud computing, Big Data, Software-Defined Networking (SDN), mobile networking, and the Internet of Things (IoT) — continue to disrupt traditional business practices. For example, the retail banking market anticipates that USD 405 billion in total potential revenue is up for grabs from 2015 to 2017, and 90 percent of that projected value will be generated from opportunities empowered by an all-digital transformation.

Global ICT Voices

Kenya, which means 'God's Resting Place' in the three major indigenous languages, has embraced the national strategic benefits of the recently deployed Safe City platform. The Kenyan government sees it as a model for improving security protection for cities across the country. Throughout 2016, the Kenyan government integrated a series of solutions, including a Computer-Aided Dispatch (CAD) system, Geographic Information System (GIS), video surveillance, a communications platform for handling alarms, and videoconferencing and broadband trunking systems. The overall solution has improved the efficiency of emergency response communications between police and medical, fire, and other municipal departments.

In 2016, Ikeja Electric, Nigeria's largest power distribution company, also achieved large-scale ICT breakthroughs with its Advanced Metering Infrastructure (AMI) solution. The system resolves many problems arising from practical operations, such as high line losses, undetected power theft, long payment cycles, and slow return on investment. The company implemented a smart meter network, installed smart metering terminals, and created an IT-based application system, all to improve its operational efficiency.

The financial industry's portfolio of on-demand, mobile, and customized banking products now includes Virtual Teller Machines (VTMs), cloud computing, and Big Data analytical tools. London-based HSBC, one of the world's largest online financial institutions, is committed to creating a more personalized customer experience through digital channels. This year, HSBC successfully rolled out its VTM Remote Banking project to expand its digital offerings.

Manufacturing giant General Electric (GE) is realigning its global production by combining physical, mechanical, and analytical techniques. In 2016 alone, GE saved USD 500 million by taking advantage of initiatives that utilize smart devices; this figure is expected to double by 2020. In keeping with the company's goals, GE is committed to designing a digital operating system for the worldwide market.

Enterprise ICT Experts

The biggest obstacle to digital transformation is not technology but, rather, lack of insight and expertise in each market. In the future, ICT enterprises will become industry experts with a deep understanding of customers' core businesses and expectations. Ultimately, these enterprises will be able to provide customers with the most valuable transformative solutions based on ICT capabilities and industry knowledge.

As we enter 2017, enterprise digital transformation will continue to gain momentum. ICT device-pipe-cloud collaboration will also help enterprises gradually evolve from support systems into core production systems. According to analysis from an international source, China's ICT market most likely will reach USD 6 trillion from 2016 to 2025, with an average annual growth rate of nearly 7 percent.

As Huawei's rotating CEO Ken Hu said: "Our forever-increasing intelligent world will bring about enormous changes to connect society. We simply have no way of knowing how deep and far-reaching these changes will be. However, we can be sure of one thing: ICT will be the cornerstone."▲

Special Report

As we enter 2017, enterprise digital transformation will continue to gain momentum. ICT device-pipe-cloud collaboration will also help enterprises gradually evolve from support systems into core production systems. >>

Special Report

The Primacy of People in a Digital Age

Frank Chen

Frank has been with Accenture for more than 21 years. He has deep industry knowledge and solid experience in conducting complex solution design and leading large-scale technology projects. He services clients across multiple industries, mainly state-owned enterprises.

| By *Frank Chen, Accenture Technology, Greater China Lead*

An agile enterprise needs an agile workforce. Traditional organizational structures can no longer keep pace with changes in the digital age. Forward-looking companies realize that they can count on a digitally savvy workforce as a key competitive advantage. An agile workforce is quickly becoming the new norm for how businesses organize.

For business owners and executives, however, there is a more practical issue to consider: Are they ready to update their technologies and organizations to build an efficient and agile workforce? Are they willing to restructure their companies to become more creative and more capable of faster and better decision making to capture new growth opportunities ahead of competitors?

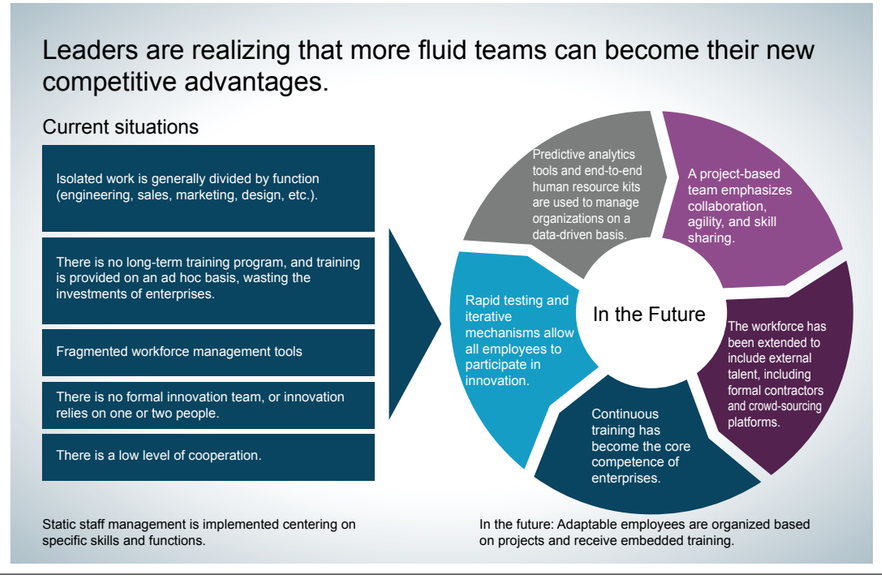
Based on the latest research and Accenture's long-term industry insight, we believe it is time that businesses take immediate actions to recruit versatile and highly skilled talent. They should carry out training to develop a motivated and technically knowledgeable workforce that is well-prepared to aggressively pursue business development.

When fast-developing technologies accelerate the pace of social and business transformation, the significance of staff tends to be ignored. >>

A Double-Role Transition

The comprehensive digitalization of business has necessitated the transformation of enterprises for both organizations and employees. This strongly suggests that isolated, static workforce and management divisions will give way to more adaptable, project-focused organizations that are self-directed and self-regulating.

'Digital aboriginals' growing up in the network era will make such combinations and adjustments possible, undoubtedly posing challenges to the current norms of internal enterprise management. For smaller, less-prepared companies, work is divided into discrete categories, such as design, engineering, marketing, and sales. Training is often delivered on an ad hoc basis due to a lack of long-term planning. Workforce management tools are rare, and so too are official innovation teams. Instead, one or two staff members with loosely coordinated responsibilities are assigned to do the innovation tasks. These negative factors hinder business innovations and slow down an enterprise's response to changes.



By comparison, an agile workforce will enjoy more freedom and flexibility in ways that encourage the enterprise to realize more of its human resources potential. Virtual Reality (VR) is one example of a trend that is poised to sweep broadly across the industrial landscape. At the *Google I/O 2014 developer conference*, Google released a VR platform called Google Cardboard, which became an instant success and attracted massive attention. Named for its fold-out cardboard viewer, a Google Cardboard headset is built from simple, low-cost components that turn a smartphone into a pair of 3D glasses. The platform was created by David Coz and Damien Henry, Google engineers at the Google Cultural Institute in Paris, as part of their 20 percent 'Innovation Time Off' project where Google engineers are encouraged to spend 20 percent of their work time on projects that interest them personally. For projects that appear feasible, Google will invest additional resources. This unsanctioned R&D model has proven its effectiveness more than once and includes products such as Google Now, Google News, and Google Maps.

Meanwhile, employees must continuously improve themselves since the freedom to innovate suggests the necessity of extending their cross-domain knowledge base and skill set. For example, it is advantageous if graphic designers also understand scripting languages such as HTML5 to successfully productize their ideas for networks and mobile devices. Similarly, outstanding sales personnel who understand data analytics are more likely to improve their sales performance. In a free working environment, employees can take a more proactive stance toward self-improvement through self-examination. By doing so, they have the potential of becoming the skilled, versatile professionals that are urgently needed by modern enterprises. In an era where a large proportion of skilled workers are freelancers, talented people are not bound to any specific position. This also allows enterprises to develop new strategies to fully utilize temporary sources of qualified talent that possess specific technical capabilities and other valuable experience at lower costs.

Of course, the blurring of industry borders and the continuous efforts of enterprises to build hybrid business ecosystems have been combined to various degrees and point to new paths for developing an agile workforce. For example, in 2015, TAG Heuer, a Swiss luxury watchmaker, released its first smart watch, engineered with Intel Inside® and powered by Android Wear. According to Bloomberg, TAG Heuer's Connected Watch (priced at USD 1,500) received more than 100,000 orders from around the world. The development of this smart watch by a traditional mechanical watchmaker and a Silicon Valley tech giant exemplifies the type of successful cross-industry collaborations that we can expect to see.

Building a Digitally Savvy Workforce

In addition to upgrading their operational strategies, enterprises must restructure their operational organizations and establish new training systems and performance evaluation criteria. This shift will call for the adjustment and transformation of supporting mechanisms for collaboration and innovation, talent recruitment, development, and incentive programs.

Enterprises must develop new workforce strategies, as follows:

- **Skill gap analysis:** Assign the HR department to review vacancies in the company and identify urgently needed talent.
- **Training ability improvement strategy:** Decide on investments in facilities, technologies, and labor required for unified and efficient employee training.
- **Innovation incentive:** Set up a mechanism to encourage employees to carry out unrestricted research in their fields of interest to encourage innovation.
- **Management:** Standardize the modes of cooperation between the company and third parties, including freelancers and contractors. Establish mechanisms for allocating work between long-

In addition to upgrading their operational strategies, enterprises must restructure their operational organizations and establish new training systems and performance evaluation criteria. >>

Special Report

Because the learning capabilities of machines are continuously improving, multiplying the value created by employees and machines has become a key objective of organizational transformation. >>

and short-term employees, and communicate the mechanisms clearly.

- **Pilot program:** Set up a project to pilot the formation of an agile workforce. Give the team sufficient autonomy and certain resources to help them achieve set objectives. After the pilot program is concluded, summarize the experience and use the project as a reference for subsequent formal implementation of the agile workforce strategy.

In the long term, an enterprise transformation plan will likely include a new training strategy, identification of urgently needed skills, and delivery of training to existing employees. Through these efforts, the enterprise will decide which training resources — training institutions, large open network courses, personalized training — are most effective for company employees. The enterprise will then make specific plans to create an agile workforce in all business areas. Based on the lessons learned in the pilot project and feedback from the parties involved, the enterprise can then take measures to improve the effectiveness of subsequent operations. In addition, the enterprise should encourage the use of data analytics by the HR department to establish a joint team of HR and data experts to further research the company's human resource requirements. The results will help optimize work related to employee evaluation, promotion, and recruitment, as well as talent acquisition and retention. Moreover, the enterprise will be applying predictive analytics in particular fields (for example, promotion or recruitment) as outlined in the employee management strategy.

Training will become a core competitive feature. Enterprises must establish digital training platforms that combine network-based teaching into single-course systems. Most Chinese enterprises have realized that employee training and the introduction of new technologies are equally important. Some enterprises now actively pursue innovative methods and technologies such as virtual worlds, adaptive learning solutions, augmentation technologies, and crowdsourcing to deliver better training to their employees. More than 70 percent of Chinese enterprises say they are considering software automation and cognitive computing solutions to improve the overall competence of their employees, which is higher than the global average of 51 percent.

Getting the Most from Manager-Machine Collaboration

Because the learning capabilities of machines are continuously improving, multiplying the value created by employees and machines has become a key objective of organizational transformation. An Accenture survey of more than 1,700 managers in 14 countries showed that 84 percent of respondents believe their effectiveness and job satisfaction will increase with the use of intelligent machines. In the future, machines with cognitive and deep-learning capabilities will take over a number of management responsibilities that now consume huge amounts of time and energy. These tasks include planning and coordination, information processing, performance tracking, routine repetitive work, and resource allocation.

Resistance to change, however, is typical among managers. Over one-third of managers fear that machines will take their jobs. Attitudes toward machines vary among industries. For example, in electronics and high-tech, 50 percent of managers strongly or partially agree that intelligent systems are a threat to their job security, compared with 25 percent in the transport industry. Managers in the high-tech industry have the highest expectations for the performance of cognitive computing platforms.

Intelligent machines could help department heads by taking over routine and time-consuming tasks such as management and financial reporting that will allow managers to spend more time on strategic planning or the development of new products and services. In manager-machine collaboration, cognitive computing applications are expected to help improve the capabilities of individual managers to leverage their unique philosophies and communication skills. The survey reveals that 42 percent of managers believe their roles will require a deeper understanding of digital technology in five years, but only about 20 percent of them believe

this about social networking, people development and coaching, and collaboration.

Enterprises with ingrained mindsets and complex organizations are often willing to adopt a new approach. One private sector example is Amazon Kindle's Mayday feature. The 'Mayday' button connects users with customer support representatives directly from their tablet. On average, an Amazon representative will respond within 10 seconds. Telstra, Australia's largest telecommunications company, announced a massive 'Digital First' initiative that automates all repetitive and administrative tasks in order to give employees the time and space for more meaningful interactions with customers.

Far from killing jobs and creating a dehumanized future, digital technology has the potential to continue becoming an important driver for more attentive services. Specifically, digital technology allows employees to take greater advantage of their unique strengths to create more value for their customers. Enterprises have come to realize that digital online interactions cannot completely replace human customer service — and that providing personalized services beyond customer expectations requires digital technologies, such as Big Data collection and analytics, to mine customer insights and apply the results by devising better services. For example, along with helping customers resolve immediate issues, banks expect customer service personnel to provide wealth management advice based on their financial conditions and even offer value-added consulting services in areas that include home buying, medical care, education, and travel.

More important than the levels of digitalization are the employees who deliver services to customers. Apple fans are not strangers to the success of the Genius Bar, and the engineers who provide customer service at the Genius Bar enjoy a sense of achievement. BMW has begun a similar program called 'BMW Genius Everywhere.'

Having intelligent machines perform specific jobs is just one example of Artificial Intelligence (AI) in business applications. Leaders and managers must consider an array of well-focused attempts to decide which functions are the most effective for discovering the opportunities with the greatest value. For CEOs, manager-machine cooperation is not merely about automated work or improvements in manager performance. Rather than expecting machines to make decisions independently, the goal of executives must be to combine the experience and intuition of their people continuously with the strengths of intelligent machines.

In this time of transformation, business leaders must remain people oriented. They need to establish cultures that feature initiative, trust, and collaboration. Only in such environments can the full potential of the entire workforce be realized. ▲

For CEOs, manager-machine cooperation is not merely about automated work or improvements in manager performance. The continuous goal of executives must be to combine the experience and intuition of their people with the strengths of intelligent machines. >>

Special Report

Bai Jianhua

ICT Builds Safe Cities

| By *Bai Jianhua, General Manager, Government Solution Department, Enterprise Business Group, Huawei Technologies Co., Ltd.*

Today's Safe City solutions need the cooperative efforts of partners in an open ecosystem to provide comprehensive, well-integrated functionality. >>

The range of Safe City technologies is continuing to expand from an original focus on public safety and transportation management, urban administration, and emergency command. Today, cities are also using the technology for the management of many other key activities, including early disaster warning and safety monitoring of industrial facilities that require coordination between law enforcement, fire, search and rescue, and infrastructure management.

In short, Safe City technology has evolved to become a platform for comprehensive public safety and security administration. Encompassing pre-event, live-event, and post-event management, the technical components include the core Information and Communications Technology (ICT) resources of servers, storage, and networks with the addition of video surveillance and Internet of Things (IoT) devices such as sensors, alarms, and actuators. Safe City solutions are more versatile than at any point in history and much less costly through the migration of Information Technology (IT) systems to the cloud and transformation toward Software-Defined Networking (SDN).

Reconstructing Safe City Solutions

The key element for the successful implementation of complex Safe City solutions is the ability to integrate the technologies into a comprehensive system. One small example for a typical Safe City security system is the association of surveillance cameras with gunshot and smoke detection systems. Multi-part subsystems are further combined to become multi-dimensional solutions.

To help expedite such development efforts, Huawei provides an enterprise Software Development Kit (eSDK) that allows integrators to add custom camera operations and test functionality without modifying the underlying application.

Big Data-based Intelligence-driven Services

Visibility into events and the ability to collaborate between government agencies — both in real time — are two of the most important benefits of Safe City installations. Visibility means more than video surveillance, as the use of Long-Term Evolution (LTE), Unified Communications (UC), and Geographic Information Systems (GISs) allows for a single display to present multiple layers of information with appropriate prioritization.

More broadly, collaboration refers to the sharing of video and data generated by Safe City systems across municipal agencies, and even beyond immediate regions to provincial and federal departments.

Whether collaboration covers multiple cities or several areas of a one large city, real-time sharing of video and data is a core issue for ensuring efficient cooperation of agencies and personnel. Therefore, Safe City implementations are definitely evolving in the direction of intelligent functionality based on Big Data analytics.

Although Big Data analytics have been applied in some ways, many more challenges and opportunities remain for the rapid processing of certain types of unstructured data.

Safe City solutions are more versatile than at any point in history and much less costly through the migration of Information Technology systems to the cloud and transformation toward Software-Defined Networking. >>

Huawei's portfolio of practical solutions includes the following:

- Multi-dimensional Safe City defenses based on IoT and agile network technologies
- LTE-based broadband trunking for visualized emergency communications
- Cross-agency command supported by converged voice, video, conferencing, and GIS
- Cross-regional intelligent analysis of leads based on a video cloud platform
- Intelligence mining and analysis system based on a Big Data platform
- Cross-regional, distributed, cloud-based data centers

Innovation Ecosystem

To meet today's Safe City needs, vendors representing different fields must collaborate. Huawei pursues joint innovation with partners to build Safe City ecosystems based on open-source software. The result leads to the integration of innovations into comprehensive solutions. One such partnership is with Hexagon-Intergraph, a leading supplier of Computer-Aided Dispatch (CAD) systems. The Intergraph suite of incident management software provides capabilities for call handling and dispatching, intelligent mapping, field communications, data reporting, and analysis to achieve a common operating picture for intelligent response. Huawei's Safe City solutions that have integrated Hexagon functionality are currently deployed in the Middle East.

Similarly, Huawei has established a growing number of partnerships throughout the world:

- Tyco (U.S.), a leading security company for IoT-enabled urban sensing
- BGS (U.S.) and Accenture (U.S.), consulting firms
- Safaricom (Kenya) and NCS Technologies (U.S.), system integrators

· Milestone Systems (Denmark), iOmniscient (Australia), SAP (Germany), Pramod Software Solution (India), and Agent Vi (Israel), application software vendors

Huawei's Safe City ecosystem includes 100+ ICT partners and almost 700 service partners. The Safe City solutions provided by Huawei now cover more than 100 cities in over 30 countries and serve more than 400 million people. Huawei also has a global network of maintenance and delivery offices, including three global and nine regional Technical Assistance Centers, as well as 45 logistics and spare parts centers. This network serves customers in more than 170 countries.

In Kenya, Huawei collaborated with Safaricom, the largest Kenyan telecom operator, to commission a number of Safe City systems, including police dispatch, enterprise LTE (eLTE) broadband trunking network, video surveillance, and intelligent vehicle analysis. More than 18,000 policemen are better connected using these systems, which provide End-to-End (E2E) visualized command. A 24/7 high-definition camera and a license plate recognition system enabled Kenyan police to catch a hit-and-run suspect within one day. In 2015, the system proved effective in securing a visit to Nairobi by Pope Francis; no major incidents occurred while managing a 300,000-person crowd. According to the annual police report of Kenya in 2014-2015, the crime rate in areas covered by the Safe City project decreased by 46 percent.

Providing Customized and Differentiated Solutions

The major regions of expansion for Safe City vendors are Africa, Latin America, the Middle East, South Pacific, and Europe. For a variety of reasons, each of these regions has a different set of requirements for their Safe City solutions.

Countries in Africa, Latin America, and Asia-Pacific regions that are focused on improving their infrastructures are especially in need of comprehensive solutions that include consultation and planning.

Statistics from the World Bank show that the ICT industry contributes 30 to 40 percent to the economic growth of developed countries. Every U.S. dollar invested in communications technology had created approximately USD 1.4 of added value per year. Safe Cities are part of this economic benefit. >>

The Middle-East and Asia-Pacific regions need to develop ICT applications that have been adapted to meet their particular conditions.

For European and North American countries with mature infrastructures, the primary task is to widen the utilization of Big Data, intelligent analytics, and other technologies.

Economic and Social Benefits

Statistics from the World Bank show that the ICT industry contributes 30 to 40 percent to the economic growth of developed countries. Every U.S. dollar invested in ICT had created approximately USD 1.4 of added value per year. Safe Cities are part of this economic benefit.

Kenya presents an interesting example. Tourism is traditionally the African nation's second largest source of foreign exchange revenue, after agriculture.

In recent years, however, safety and security concerns have seriously affected tourism. To cope with the situation, the Kenyan government chose Huawei to deliver a Safe City project in the capital, Nairobi, in collaboration with Safaricom. The two companies worked together to deploy an E2E solution consisting of dispatch, notification, and other security-related systems as well as a command center that integrates the resources of police, fire, transport, and healthcare agencies. This approach broke down information silos that had separated the agencies and, into the future, will prevent duplicate investments and reduce public resource waste. Thanks to the coordination of resources, there are significant improvements throughout Nairobi in the safe and efficient handling of major incidents. Just one example is that a six times increase in call-center capacity helped to improve the rate of success for reported alarms from 30 to 85 percent.

Huawei has built Safe City projects in Saudi Arabia, Singapore, Mexico, Germany, China, and other countries with the expectation that even more cities around the world will benefit from the transformative power of ICT. ▲

Architecture Designed for Operator Transformation

| By *Wang Jikui, ICT and Chair Professor of Aeronautics and Astronautics and CTO, Carrier Business Group, Huawei Technologies Co., Ltd.*

Wang Jikui

Operators must innovate with partners to break industry stagnation and support future business development. >>

Operating revenues throughout the telecom industry have plummeted. Internationally, Internet leaders have near monopolies in their respective markets with diversified services, profit innovation, and competitive pricing. This has eroded the traditional market share of telecom operators.

Video and the Internet of Things (IoT), however, bring important opportunities for future Information and Communications Technology (ICT) telecom development. Mobile data traffic from video streaming and communication, as well as growth in enterprise and industrial videos, has made video the second most-used medium for communication. The demand for both conventional connections and IoT-based industrial informatization is expected to increase exponentially, creating broad new opportunities for mobile operators and their industry partners.

Transformation in Waves

The information industry has experienced three periods of transformation.

The first occurred before 2000, when industry development remained entirely network-centric. During that time, network equipment vendors held some of the highest valuations in the industry. The second, between 2000 and 2015, focused on horizontal applications, enabling the emergence of the Internet giants. The third, currently underway, has industry operators contemplating how to capitalize on immediate and future opportunities.

Success hinges on whether operators collaborate with partners to achieve an all-around transformation that enables them to better forecast the future of their businesses, operations, architectures, networks, organizational potential, talent systems, and environment. During this process, the goal is for new domains, technologies, and ideas to emerge.

- National Opportunities

Economic, political, and social issues related to the Internet and Big Data are national strategy concerns of the major world powers. The U.S. Industrial Internet, German Industry 4.0, and China's Internet+ strategy, whose impact cannot be ignored, are all attracting worldwide attention.

Operator transformations must fit in the context of national strategies and develop core capabilities from the inside out. Most importantly, operators are able to position themselves to enter new high-profit areas and influence national policies.

- Region-specific Deployment

New technologies create new user requirements and new service methods that greatly impact the digital transformation of all industries. If operators ignore the timing of new developments, they cannot effectively utilize the interaction between technical innovation and digital transformation. All influences are region-specific, and there are no internationally applicable general-case solutions.

Huawei predicts that the technical development of operators will undergo five main stages between 2016 and 2020 — including aspects of Software-Defined Networking (SDN), Network Functions Virtualization (NFV), and Cloud Computing:

- 2016: Big Data
- 2017: The IoT
- 2018: 5G, Augmented Reality (AR), and Virtual Reality (VR)
- 2019: 3D printing
- 2020: Artificial Intelligence (AI) by industry

- Industrial Internet Services

For telecom operators, providing industries with digital services via the cloud is an important direction for business development. The market for cloud services is huge and multifaceted, with a multitude of varying requirements that cannot be ignored. For example, small- and medium-sized enterprises are more sensitive to price than service. They require technology services that are simple and inexpensive. Large-sized enterprises are not as price-conscious. They need End-to-End (E2E), all-in-one, high-quality cross-regional cloud services. Governments also require all-in-one cloud service platforms that support public services and eGovernment while ensuring information security to protect private data.

To increase competitiveness, operators must:

- Deliver one-stop solutions and services
- Own cross-regional cloud infrastructures
- Leverage their advantages across networks and data centers
- Provide services to multiple branches
- Satisfy the requirements of large enterprises
- Effectively integrate multiple systems, products, and solutions from different vendors
- Offer custom, localized service capabilities

The organizational structure of operators must also become agile. Basic principles include bridging the gaps between markets, separating IT systems and networks, streamlining End-to-End operational processes, and strengthening interactions between business and resource enablement capabilities. >>

Driving Digital Transformation

Digitization is an important method for operators to achieve digital transformation before 2020. To be effective, operators must implement and continuously promote top-layer designs, which include:

- Strategic Positioning

Operators typically focus on three domains: pipe strategy, construction of digital enablement platforms, and building their full capacity as digital service providers. During this process, operators must align their basic architectures as well as business, operations, and R&D models to match those of Internet companies to increase innovation.

Huawei assists operators in analyzing the potential of modern ICT solutions for developing custom plans based on business conditions.

- Business Planning

Developing a business that increases market share, adds value, and increases revenue is the most important aspect of planning.

Operators must encourage resellers to launch applications on integrated platforms and make applications available to industries, enterprises, and end users through the appropriate channels. This will enable third parties to provide more diverse services and increase profits through revenue sharing.

During service planning, operators must utilize their core advantages of network access, service quality assurance, security, and reliability to differentiate themselves from Internet companies for the purpose of adding customer value.

- Architectural Design

Operators must concentrate on the architectural design for services, applications, specific implementation methods, and the future landscape of cloud data centers.

Data centers will incorporate platforms that are completely cloud-based for internal operation. Crucial aspects of this transformation include:

- Service support
- O&M efficiency
- Internal application platforms for enterprises
- Plan and deploy data center layers
- Network technology road maps based on the evolution of SDN and NFV
- Architectural evolution of Fixed Broadband (FBB) and Mobile Broadband (MBB) platforms

For service-level cloud improvements, these upgraded cloud data centers must collaborate with subsidiaries and branches. Additionally, improved operator performance is necessary to support the growth of market share for digital services over the next five to ten years.

- Operational Management

To develop core services and innovate business models while building open, converged platforms, operators must have high-quality, well-supported operations for front-end service development, business model exploration, and flexible revenue-sharing mechanisms. This expands industrial cooperation and ensures that the criteria for Huawei's Real-time, On-demand, All-online, DIY, and Social (ROADS) experience requirements are met.

By using Big Data technologies, operators identify their most-valuable customers and push services to different user groups for additional value. To extract valuable data, operators must fully utilize Big Data technology, improve business readiness and resource usage, and improve capability development and converged platforms.

- Organizational Optimization

The organizational structure of operators must also become agile. Basic principles include bridging the gaps between markets, separating IT systems and networks, streamlining E2E operational processes, and strengthening interactions between business and resource enablement capabilities.

The traditional practice is to maintain networks by segmenting them, but future approaches will manage overall ICT capabilities at each network layer. This is not a simple task, and it cannot be accomplished overnight. There will be a transition from Computer Technology (CT) to ICT to future Digital Technology (DT). Operators must ensure that employee abilities and skills continuously adapt to new technologies and services.

Huawei and Digital Transformation

Through communications, cooperation, and joint transformation practices with operators, Huawei has helped over 400 operators in different stages of digital transformation and has gained insights into the pain points that operators encounter.

Huawei is committed to developing a customizable, realistic methodology to facilitate the digital transformation of operators. To achieve this, the Technology, Industry, Maturity, Ecosystem, and Strategy (TIMES) system has been designed to conduct full analyses and observations on each aspect of digital transformation:

- **Technology** — development of appropriate yet innovative directions for operators utilizing new technologies and response strategies
- **Industry** — exploration of the new industries where operators can optimize industrial networks
- **Maturity** — accurately estimating completion of digital transformation using a multi-dimensional analysis of business, strategies, organizations, processes, networks, and technologies
- **Ecosystem** — creation of an external environment for successful digital transformation
- **Strategy** — analysis of future positioning based on national and operator policies

Recent data collection, interpretation, and analysis suggest that the five most important elements of operator success in transformation are: Business (25 percent), Digital strategies (15 percent), Organizations (12 percent), ROADS operation (12 percent), and Networks (10 percent).

With comprehensive global solutions, Huawei collaborates with entire industries to build digital business ecosystems. Global businesses already have embarked on a path to transformation, and Huawei is excited to cooperate with operators and industrial partners for mutually beneficial results.▲

To develop core services and innovate business models while building open, converged platforms, operators must have high-quality, well-supported operations for front-end service development, business model exploration, and flexible revenue-sharing mechanisms. >>

Special Report

Cloud Computing for Railway Automation

Wang Kai

Zhi Yanli

| By *Wang Kai, General Manager, Wu Caizhong, Marketing Manager, and Yin Xiaofeng, Senior Engineer, Transportation Solutions Department, Enterprise Business Group, Huawei Technologies, Co., Ltd., and Zhi Yanli, HollySys Automated Technologies, Ltd.*

Huawei has helped create an automated control system for urban rail traffic. >>

China's first fully automated driverless metro, Beijing's Yanfang line, started testing this year and is expected to be fully operational by 2017. The technology driving the Yanfang line is Huawei's Traffic Control Integrated Automation System (TIAS), developed in cooperation with HollySys Automation Technologies, a Beijing-based provider of automation control technologies and applications.

In 1998, the world's first fully automated driverless metro line was put into operation in Paris, France. In 2008, the Copenhagen Metro in Denmark was recognized as the world's best driverless metro system. Currently, fully automated driving technology is implemented in over 50 metro lines worldwide and promises to become the future for urban metro systems. The International Union of Public Transport (UITP), a nonprofit international network of 1,400 member companies located in 96 countries that covers all modes of public transport, estimates that by 2020, 75 percent of new metro lines and 40 percent of existing lines will use automated driving technology.

TIAS Faces Many Challenges

Advances in train control systems are the cornerstone for ensuring that trains are safe and reliable. With continuous innovation, improvements in metro automation are the result of vehicle integration with signals, communications, and monitoring. Traditional metro information systems consist of multiple subsystems that include the Passenger Information System (PIS), environment and equipment monitoring system, and signal and communications systems. Typically, the control of these subsystems has not been managed centrally and has mainly used power supply/loop control for the relatively small amounts of integrated monitoring in previous technical generations.

At the core of TIAS is the controlling traffic command, which uses a uniform software and hardware network platform. TIAS is capable of intelligently monitoring every specialized subsystem to improve scheduling efficiency by automating operational processes for handling situations like disasters and failure modes. TIAS has reached a Grade of Automation 4 — the highest level for metro automation as defined by the UITP.

Pushing Upgrades

Many challenges arose from the limited availability of 'big picture' information prior to sophisticated Information and Communications Technology (ICT) architectures. With traditional metro information systems, data could only be linked through physical ports due to the independent functioning of each subsystem. Relative to contemporary standards, these older configurations were inherently less efficient and incapable of sharing data to the degree that is now expected for fully automated systems. Traditional systems waste server resources while older IT architectures are unable to support the type of integrated development necessary for today's automated urban rail traffic.

In recent years, maturing ICT platforms have added more process control technologies to address these issues. The Yanfang subway line, for example, requires over 120 PC servers and more than 150 workstations to cover about 30 kilometers. The TIAS with Automated Train Stop needs hundreds of additional on- and off-track components to be included on the data and communications network.

Fast Cloud TIAS

The disadvantages of traditional IT architectures led Huawei to its cloud computing solution for TIAS, which updates service capabilities and meets established reliability standards for metro information systems. ICT infrastructures built on open cloud platforms are designed to make planning easier for future service expansions, particularly larger scale Smart City projects.

Advances in train control systems are the cornerstone for ensuring that trains are safe and reliable. With continuous innovation, improvements in metro automation are the result of vehicle integration with signals, communications, and monitoring. >>

The cloud architecture for TIAS manages the control center-level and station-level requirements. Additionally, a cloud platform in the Operations Control Center (OCC) provides data computation and storage for various service systems of the entire line. A cloud desktop is set up at each service node to meet service processing and dispatching needs across the system. Industrial-grade Access Routers (ARs) are installed system-wide at the device layer for real-time data collection, distributed computing, and secure, reliable data transfers.

Virtualization for Automation

Huawei's solution includes a FusionCube virtualization platform deployed at the OCC. FusionCube manages multiple service application servers, deploys TIAS real-time and historical processes, allows simulation training, and simplifies many other service systems. The TIAS platform creates a logical isolation between services by using different security levels. Automatic Train Stop (ATS), Building Automation Systems (BAS), power Supervisory Control and Data Acquisition (SCADA), and other service systems are integrated and distributed among virtual data centers.

TIAS requires installation of many specialized workstations at each site with devices that are exposed to security risks. The Huawei desktop cloud technology with multiple virtual machines uses workstation software to connect with the OCC cloud platform. Line dispatchers employ cloud desktops with three-screen displays, while dispatch operators for power, loop, passenger, and train monitoring use desktops with two-screen displays. The direct connection feature for graphics processing units is especially beneficial for the graphics-heavy displays that are typical for railway line, power, and ring dispatchers.

Riding Digital Railways

Because TIAS has high data security requirements and many interconnected systems on the front-end, Huawei provides custom, x86-based AR IoT gateways to distribute computation and secure critical data at the network edge. TIAS uses Huawei's cloud architecture technology to improve hardware resource utilization. The cloud computing platform standardizes each service type to reduce costs significantly for power and facilities.

As the urban rail industry rides into a fully automated future, Huawei will continue to expand and refine the key components for cloud computing, Big Data, and other ICT technologies. The goal is to assure that global metro operators are able to procure high security, energy efficiency, and best-in-class services for the intelligent transit systems under their control.

"Today, powerful technologies are rebuilding the transport industry," said Yuan Xilin, President of the Transportation Sector of Huawei's Enterprise Business Group. "By using cloud computing, Big Data, and LTE technologies, we enable customers to achieve visualized train dispatching and the efficient management of railway assets and resources."▲

Special Report

Urban Rail Solution Speeds Up Industry Changes

| By *Wu Caizhong, Marketing Manager, Marketing and Solution Sales Department and Li Qinchao, Senior Engineer, Network Solutions Department, Enterprise Business Group, Huawei Technologies Co., Ltd.*

Wu Caizhong

Li Qinchao

Using a combination of Long-Term Evolution technologies and Network Element series industrial routers, Huawei has designed a next-generation urban rail Distributed Control System solution that incorporates current trends and future requirements. >>

"Railway operators around the world are now more concerned than ever about how to take advantage of innovative Information and Communications Technology (ICT) solutions to maximize their transport capacities and build differentiated competitive advantages based on existing railway networks and infrastructure," said Huawei's Norman Frisch, chairman of the enterprise Long-Term Evolution (eLTE) Industry Alliance, at the 2016 Asia Pacific Rail Show in Hong Kong.

One current trend — urban rail transit — is growing into an ideal mode of transportation due to its ability to transport larger numbers of passengers at faster speeds, improving punctuality and safety, and creating less environmental pollution. Simultaneously, these advantages are being influenced by disruptive communication technologies.

Ground Control

The IEEE 1474-derived Communication-Based Train Control (CBTC) railway signaling system, first developed in the 1990s, uses Automatic Train Control (ATC) functions that can include Automatic Train Operation (ATO) and Automatic Train Supervision (ATS) sub-systems. By leveraging modern wireless communications technologies, CBTC solutions have implemented moving block signaling systems that update calculated stopping distances in real time to enforce the separation between trains. Maintaining safe stopping distances between trains is a component of CBTC systems that control speed, regulate station stop duration, and monitor running times and distance-to-go data between stations. CBTC systems are essential to the safety and smooth operations of contemporary high-speed railroads.

The Data Communications System (DCS) subsystem is a bidirectional link for data exchange between CBTC modules that are both on-train and off. The DCS consists of a train-to-ground wireless communication network and a wired network. Faults within the network will delay or stop the trains from running as scheduled. Huawei CBTC systems have been developed to address a number of longstanding limits.

Challenges for Traditional DCS Systems

Recent DCS solutions have chosen to use 'Wi-Fi + industrial switch' architecture for CBTC train-to-ground communications over public frequency bands that are vulnerable to external interference. In addition to the potential for affecting safe train operations, the disadvantages of using Wi-Fi for CBTC networks include limited coverage, which multiplies the number of deployed devices and numbers of handovers to stationary base stations from passing trains. Wi-Fi networks are more maintenance intensive.

Switches based on traditional Layer 2 technology — stable, easy to maintain, and adaptable within a range of environments — have been the ideal option for DCS wired transmission networks. However, these switches can no longer accommodate the newer requirements of urban rail signaling systems.

The integration of LTE technology into the rail sector requires that the LTE frequency and phase components are synchronized with the system clock of the railway. A Global Positioning System (GPS) antenna is installed at every Base Transceiver Station (BTS) to provide the source for a synchronized time reference. Even when sufficient channels exist, the physical siting of GPS antennas to support BTS pedestals located deep inside rail tunnels is complex, and an RF signal over long cable runs is subject to great attenuation. The problem is, some sites lack channels for GPS antennas.

LTE technology also requires wired networks that support the IEEE 1588v2 Precision Time Protocol (PTP). DCS wired networks should have powerful Layer 3 routing performance and support open, standard Layer 3 interconnection protocols. If traditional industrial switches are used, broadcast storms that render the network unable to transport normal traffic may occur during Layer 2 switching. Outdated Layer 2 network management capabilities cannot support the levels of fine-grained Ethernet management specified by the PTP.

Gaining Momentum

Based on industry experience with urban rail trends and future requirements, Huawei developed a next-generation urban rail DCS solution using LTE technologies and Huawei Network Element (NE) series industrial routers. The following specifies some of the technical improvements that this solution fulfills to meet urban rail network requirements for signaling systems to transform DCS.

LTE uses dedicated frequency bands that offer excellent anti-interference capabilities and ensure the security and reliability of CBTC services. LTE supports hitless, fast, and seamless handovers that equip today's faster metro trains with the latest enhancements.

Fewer LTE base stations are required between stations because of an effective range up to 1.2 kilometers. The combination of a flattened network and fewer BTS sites inside tunnels reduces Operations and Maintenance (O&M) costs by more than 80 percent.

Huawei's innovative ATOM GPS solution transfers GPS clock signals into 1588v2 optical signals. GPS antennas and devices in equipment rooms are connected by optical fibers, so the deployment of GPS antennas is not restricted by distance. From an engineering perspective, this simplifies deployment.

Game-changing Industrial Routers

The DCS wired transmission network relies on Huawei's NE series industrial routers for comprehensive support of the IEEE 1588v2 protocol. The network simultaneously traces multiple clock sources. When an active clock source is faulty, the network immediately synchronizes with a standby clock source. These industrial routers support standard Layer 2 networking, ensuring 50 ms failover and compatibility with traditional networking modes and Internet Protocol/Multiprotocol Label Switching (IP/MPLS) data-carrying technology. This enables strong Layer 3 switching and routing functions that meet the requirements of all routing policies for diverse interconnection telecommunications networks.

MPLS Virtual Private Networks (VPNs) provide the most secure and reliable multiple-service isolation technology in the industry. The MPLS Operations, Administration, and Maintenance (OAM) enables multiple protection switchover technologies. Network switchover time is not affected by the number of nodes.

Huawei's unique, hardware-based Bidirectional Forwarding Detection (BFD) technology transmits packets to check for faults at a minimum interval of 3.3 ms, increasing fault detection accuracy. The IP Flow Performance Measurement (IPFPM) technology greatly improves the accuracy of network performance detection.

Network performance indicators such as throughput, delay, jitter, and packet loss ratio can be tested without the need for meters and instruments. The uTraffic tool monitors network-wide performance, accurately locates network problems, and produces multi-dimensional reports that reduce O&M workloads and facilitate quicker fault location.

Cutting to the Chase

Huawei's next-generation urban rail DCS solution offers cutting-edge LTE wireless networks and all-IP wired networks. The solution satisfies even the strictest requirements generated by the ever-increasing speeds of moving trains, improves the anti-interference capabilities of communications networks, and simplifies maintenance.

By embracing the digital age of disruption, Huawei is committed to building better-connected transportation by providing secure, reliable, and advanced solutions for the railway industry through continuous technological innovations and partnering with customers. ▲

By embracing the digital age of disruption, Huawei is committed to building better-connected transportation by providing secure, reliable, and advanced solutions for the railway industry through continuous technological innovations and partnering with customers. >>

Huawei Enterprise Business Group 2016 Highlights

Over the course of 2016, Huawei Enterprise Business Group (EBG) helped companies around the globe with the digital transformation of their businesses and launched a number of industry-leading products and solutions. Huawei EBG has proven to be an important partner for innovative customers who aspire to excellence across the industry landscapes of public safety, finance, transportation, energy, and manufacturing.

Remarkable Worldwide Industry Achievements Leveraging 'New ICT'

2016

Jan

- Next-generation Unified Security Gateway (USG) and Eudemon series next-generation firewall solutions awarded Common Criteria (CC) certification at Evaluation Assurance Level 4+ (EAL4+), the highest globally recognized assurance level for network products
- Launched KunLun 9032 32-socket x86 mission-critical server at CeBIT 2016, establishing new standards for Reliability, Availability, Serviceability (RAS 2.0) and CPU interconnectivity
- Collaborated with Dutch municipality of Haarlemmermeer to develop Europe's first large-scale, wired and wireless converged government campus network
- Announced 'Leading New ICT' business strategy at CeBIT in March 2016, aiming to help industry customers with their digital transformation
- Unveiled the Munich OpenLab in Germany, with over 25 partners expressing interest to participate, including T-Systems, SAP, Intel, Alstom, and Hexagon

Mar

- Earned Recommended rating from NSS Labs for the Next-Generation Firewall (NGFW) Group Test, indicating that Huawei firewalls now rank among the industry's leaders
- Signed a Memorandum of Understanding (MoU) at CeBIT 2016 with KUKA AG, a global leader in robotic technology, to develop smart manufacturing solutions for industrial markets in Europe and China
- Won April 2016 contract to build a fully integrated train-to-ground communications solution for Kenya's Mombasa-Nairobi railway line

Apr

- Launched eRadio Enterprise Microwave solution — the first end-to-end solution that targeted the vertical integration of radio transmission technologies
- FusionServer E9000 broke three world-record SPEC CPU2006 benchmarking blade-server tests
- Deutsche Telekom announced the launch of Open Telekom Cloud at CeBIT 2016, selecting Huawei as the hardware and software solution provider
- Deployed an end-to-end AMI solution for Nigeria's largest electric power company, Ikeja Electric, including the installation of over 30,000 smart electric meters — with the total number of meters expected to reach 500,000

May

- Received Best-of-Show 'Grand Prix' Awards at Interop Tokyo 2016 for KunLun 9032 mission-critical server, IP Hard Pipe Solution, and NE40E-X2-M8A Universal Service Router

Jun

- Signed MoU for Smart City development with Provence-Alpes-Côte d'Azur (PACA), France, and announced partnership for building the first 'smart technologies' region in Europe

Jul

- 2-socket FusionServer 2288H V3 set new performance benchmark by scoring an overwhelming 34.80@28 tiles in VMmark's virtualization test
- Signed MoU with ABB at Huawei Connect to integrate Huawei's LTE-based OneAir products and technologies with ABB's robots and industrial automation solutions

Aug

- Unveiled Integrated Communications Platform (ICP) that adds extensive visualization and connectivity to Huawei Safe City solutions
- Teamed with GRG Banking Equipment Company and ChinaSoft International to implement a Virtual Teller Machine (VTM) remote video banking project for HSBC
- Signed MoU with VSN at IBC 2016 to promote both companies' products, with the aim of offering a joint Media Asset Management (MAM) Solution — the core system used for digital media storage and management

Sept

- Released the Power IoT solution, which combines PLC-IoT, eLTE-IoT, and LiteOS to facilitate better-connected platforms for the global energy industry
- Announced partnership with Dubai Airports to design and build the world's first Tier 3 certified Modular Data Center Complex (MDCC) at Dubai International Airport (DXB)

Oct

- LTE-M Digital Train Solution is selected by 21 urban rail lines around the world, representing more than 60% of the market

Nov

Awards and Market Share

Leading

- Named Leader in the 2016 Gartner Magic Quadrant for 'General-Purpose Disk Arrays'
- Positioned as Visionary in the 2016 Gartner Magic Quadrant for 'Wired and Wireless LAN Access Infrastructure'
- Named Challenger in the 2016 Gartner Magic Quadrant for 'Servers'
- Included in the 2016 Gartner CIO Agenda Survey Digital Accelerator List
- Continued to rank No. 1 with a 17% market share according to the *2015 to 2016 Annual Market Report for China Modular Data Center Products*
- Ranked No. 1 in market share in China for both modular UPS (23%) and high-power UPS (20.6%) according to the *2015 to 2016 Modular UPS Chinese Market Analysis*

For 2017 and beyond, Huawei EBG will continue to provide innovative, state-of-the-industry solutions that lead the ICT industry in the area of scalable hardware and software infrastructures that use open, flexible, and secure platforms. Huawei's goals are to nurture win-win ecosystems and partner with customers to solve their digital transformation challenges while achieving the highest business success.▲

Allen Tan

New ICT Disrupts Vertical Markets

| By *Allen Tan, Content Director, Enterprise Solutions, Questex Asia Ltd.*

ICT has become the crucial enabler of transformation for business, government, and academia. New ICT contributes to an overarching enterprise-transformation effort. >>

In an increasingly digitized world, enterprises are faced with disruptions that challenge their survival. They recognize the need for a transformative platform that offers products and solutions based on industry-specific adaptations and enhancements.

Information and Communications Technology (ICT) has become the crucial enabler of transformation for business, government, and academia. Cloud computing, Big Data, the Internet of Things (IoT), Software-Defined Networking (SDN), and 4G/5G mobile broadband contribute to an overarching enterprise-transformation effort.

Huawei has adopted these disruptive technologies to propel its own ICT initiatives. Integrated mission-critical systems support efficient production, operations, and decision making. Huawei provides comprehensive vertical industry solutions for the ecosystems of technology companies, enterprise partners, system integrators, developers, and customers.

Disruption Leads to Transformation

This roundup begins with an article that focuses on how financial services are utilizing the new ICT paradigm. Banking institutions are moving away from rigid architectures that require heavy investment to an architecture that supports extending and expanding current IT infrastructure as well as providing complete mobile digital services.

The second article describes how power utilities are transforming their operations by implementing smart energy solutions that increase efficiency in generating needed power. For example, European and U.S. enterprises are using Big Data analysis and data mining to gain insights into electricity consumption that help improve responses to electricity demands.

In the third article, we finish with a look at the move towards developing safer cities to keep pace with growing urban populations. Based on a report published by the United Nations, urban centers will be home to 66 percent of the world's population by 2050. Such population shifts have raised concerns among countries like Kenya, which has adopted a Safe City solution that uses an open collaboration platform to improve efficiency and cooperation between municipal departments.

Common Solutions Bridge Vertical Sectors

Huawei recognizes the importance of a partner ecosystem that ensures openness, collaboration, and shared success through a common ICT framework. While the ICT framework provides benefits to virtually any vertical sector, the framework's transformative power can also disrupt any given sector.

One technology in particular — Big Data — is proving to have an especially large impact across many industries.

Similar to power utilities, many vertical sectors are finding disruptive power in Big Data analytics, while others rely on their ability to gather real-time data using sensors for Smart Homes, connected cars, and other intelligent devices in the environment. These capabilities are essential to the success of different enterprises in different vertical sectors. With the flexibility to respond faster to end-user needs, the open ICT platform promises to transform vertical sectors at an increasingly rapid pace.

Financial Services Cash in on Agility

Consumer financial services received shocking news last year that they were under the greatest threat of digital disruption among 15 verticals that were surveyed by Russell Reynolds Associates, a group of executive search consultants. The 2015 'Digital Pulse' survey of C-level executives analyzed the impact of digital technologies, which revealed a telling concern among business leaders regarding the threats and opportunities posed by digital disruption.

Financial technology (fintech) companies offer banking capabilities ranging from digital wallets and peer-to-peer payments to marketing services. The transformative power of these capabilities means that banks and other financial enterprises must continually rethink their ICT investments to remain profitable.

ICT Financial Blueprint

Huawei's ICT platform offers powerful solutions to the finance industry. From extending and expanding current IT infrastructure to offering complete mobile digital services, such solutions ensure that banks have an incremental roadmap to follow when upgrading their current IT infrastructure or developing disruptive new capabilities.

Legacy banking infrastructure often uses a full-stack approach, from hardware to applications.

New ICT

Huawei's comprehensive ICT platform helps banks and fintechs compete on an even playing field. A data-driven marketing platform creates agility based on evolving customer needs while strengthening the trusted relationships already established with existing bank customers. >>

ICT offers systematic solutions for smarter energy, advanced consumer services, and Smart Grid management. >>

Because these architectures represent a significant capital investment and many activities are subject to tight regulations, complete ICT replacement is not always an option.

Huawei's financial and banking ICT architecture addresses this situation using three levels:

- **Customer Data:** Huawei offers a Big Data platform that provides transformative analytics without requiring banks to change their current databases. This cost-effective approach allows a high degree of flexibility.
- **Platform:** Huawei's cloud platform is based on OpenStack, which cost-effectively enables banks to transform their old architectures to new ones without being locked into any single technology provider.
- **Service:** The aim of Huawei's approach to service is to deliver a broad range of solutions that support customer convenience while reducing reliance on expensive physical branches — one of the major cost concerns for banks.

ICT Platform in Practice

Banks easily improve business operations with comprehensive ICT solutions. For example, China Merchants Bank (CMB) built its second data plane three years ago to improve credit checking. Big Data platforms can aggregate data from multiple sources to conduct deep analytics for accurate credit scores.

Huawei's comprehensive ICT platform helps banks and fintechs compete on an even playing field. A data-driven marketing platform creates agility based on evolving customer needs while strengthening the trusted relationships already established with existing bank customers. Such ICT solutions extend banks' current IT investments, making the disruptive transition more cost effective.

Smart Energy Enables Efficient Power Generation

Comprehensive ICT solutions help coordinate every phase of electric power generation and use, from real-time analysis of grid conditions to automated customer billing. Around the world, power utilities are transforming their operations.

In Asia, for example, "The overarching reason for this interest is energy efficiency across the value chain," according to Ravi Krishnaswamy, Vice President for Energy and Environment at Frost & Sullivan. "At the moment, power utility use is very inefficient with a lot of wastage from generation to distribution. It is also very difficult to accurately measure and match demand and supply."

Powering through ICT

Companies in Europe and the U.S. have started to correlate the large quantities of data generated by smart electric meters, weather stations, and sensors providing building information. By using Big Data analysis and data mining, power companies and enterprise users obtain insights into electricity consumption to help improve responses to electricity demands.

In China, the recently released Power Distribution Network Construction & Reform Action Plan calls for a USD 314 billion upgrade of power distribution networks by 2020, as well as the construction of smart distribution networks.

Additionally, ICT supports alternative power sources. At the end of 2012, the total installed renewable-energy capacity made up 20 percent of the electricity consumed. By 2050, renewable sources will account for 80 percent of consumption. In Germany, their Renewable Energy Act requires that power generated by renewable energies should always be preferentially fed to the grid.

To help manage both traditional and renewable energy resources, Huawei offers broadband HiSilicon-enabled Power-Line Communication (Hi-PLC) products, which use electrical power lines to also carry data. Traditional PLC technology is known for a low transmission rate and poor reliability, but Hi-PLC improves reliability and supports rates higher than 2 Mbit/s — more than 20 times that of traditional PLC technology.

Super Grids Accelerate Power

Comprehensive ICT solutions will become increasingly vital as new super grids come online. For example, the European Super Grid will connect coastal wind power generators and pumped-storage power plants in the north with solar farms in the south to high-load centers in the U.K., Germany, and France. Similarly, the U.S. Grid 2030 Program aims to interconnect a variety of separate grids with Canada and Mexico.

The 36,000-kilometer Asian Super Grid aims to develop and interconnect wind and solar power in Mongolia, hydro and thermal power in Russia, wind and solar power in China, and photovoltaic and wind power in South Korea and Japan.

ICT allows super grids to function efficiently with a combination of traditional and renewable energy suppliers, including distributed power sources, bidirectional electricity flows, and smart metering. More broadly, ICT solutions for High-Performance Computing (HPC) for automated surveillance systems help protect safety and security throughout the energy sector, including oil and gas pipelines. The bottom line is that ICT powers the energy industry to better achieve the reliability, efficiency, and business goals of their customers and investors.

ICT Brings Public Safety to Smart Cities

Country populations are gravitating towards urban centers in high numbers, according to the United Nations (UN) report titled *World Urbanization Prospects (2014 Revision)*. The UN study predicts that by 2050, 66 percent of the world's population will be urban.

Despite being home to 53 percent of the world's city dwellers, Asia remains mostly rural today. By 2050, urbanization within Asia is projected to grow from 48 percent to 64 percent, including the addition of 404 million people from rural areas to cities in India and 292 million people making a similar move in China.

In 2014, there were 28 cities in the world with populations of 10 million people or more. By 2030, the number of these so-called megacities is

New ICT

Real-time voice, video, and data collaboration among agencies makes the Smart City a Safe City. >>

Strategic investment in infrastructure, smart buildings, and communication networks is understood to offer the best opportunities for delivering large-scale solutions via elastic ICT architectures. >>

projected to reach 41. Safe City projects are being developed to help each city, from the smallest to the largest, deal with its unique safety issues around two key principles: convergence and visualization.

Convergence means implementing a collaboration system across multiple city agencies. For many governments, police, firefighters, ambulance crews, and other first responders work in separate information 'silos' that make collaboration difficult. A Computer-Aided Dispatch (CAD) system allows these different units to work together to address an emergency or incident faster and more effectively.

Visualization adds another dimension to Safe City solutions, improving on technologies that are limited to voice transmission. Huawei's Safe City solution includes video and CAD to enable better real-time collaboration. Visual communications allows decision makers to see exactly what is happening in real time using enterprise Long-Term Evolution (eLTE) technology.

For example, police use real-time surveillance to identify suspects and collect evidence. At command centers, personnel rely on information to deploy emergency units based on visual evidence. The information is also quickly shared with experts to determine, for instance, whether a fire was started by a chemical or electrical source.

Kenya's Safe City

Huawei recently worked with the Kenyan government and its mobile service provider Safaricom to implement a Safe City solution that has reduced crime in Nairobi by using such an open collaboration platform. The result is a safer city that features real-time video surveillance with enhanced monitoring for anomaly detection and operational safety.

The Kenyan government specifically wanted to improve the ability of departments to share data. The Huawei Safe City solution met this requirement by providing a broadband trunking infrastructure that supports video, voice, and data for helping decision-making officials to view live video and exchange information in real time. This infrastructure has significantly reduced the number of security incidents and has shortened emergency response times.

Safe City Joins Smart City

In a recent survey among government agencies, first responders, and systems integrators, the strongest trend for the future is seen to be the continuing growth of technology integration. Strategic investments in infrastructure, smart buildings, and communication networks are understood to offer the best opportunities for delivering large-scale solutions via elastic ICT architectures.

Huawei's global perspective views its Leading New ICT campaign as an integral component of Smart City initiatives being rolled out in many countries around the world. Huawei builds Safe City solutions that assist local governments to extend their legacy architectures by integrating modern Smart City platforms. ▲

Design is Becoming a New Team Sport

| By *Bob Montgomery, Reporter, Montgomery Communications*

Bob Montgomery

A fresh perspective highlights how collaborative relationships between humans and machines positively advance the design process beyond robotics and Machine Learning. >>

Something interesting is happening in the design world. Tools — things we utilize to perform specific tasks — are increasingly developing into much more than just things. As they begin to function more like team colleagues or co-workers that collaborate with us to solve problems, tools are becoming reliable assistants.

Jeff Kowalski, CTO at Autodesk, Inc., pursues innovative ideas on the horizon rather than trends of the moment. He envisions a positive outcome for humans and Machine Learning (ML) — a transition that is already unfolding.

"We're at another major inflection point now," Kowalski explains, "focused on how one of our most powerful digital tools is expanding into the physical realm."

As the relationships between humans and machines evolve, the transition promises to turn design into a team sport where people and tools play together, side by side. This new way of working is transforming design in exciting ways, expanding the possibilities of what we can make and how we can shape the world around us.

Let's meet some of the new team players.

Player #1: Generative Design

One of the most influential tools moving the relationship between humans and machines forward in this new collaborative direction is generative design. This technology allows a designer to feed various criteria and constraints into computers in the cloud, which rapidly generate hundreds of design options that satisfy those conditions.

Do you need to manufacture a chair made only of plastic that can support up to 300 pounds? Within seconds, a generative design processor will present you with a multitude of options able to match your exact requirements.

Would you like to design a quadcopter? While we humans might have a very fixed idea in mind of what this lightweight drone should look like, generative design tools have no such preconceptions. Tools can explore a full range of possible solutions that meet your criteria and then come up with design options you may have never imagined — like a drone frame that resembles the skeleton of a flying squirrel.

The design team at Airbus employed a similar type

(Credit: Autodesk)

(Credit: MX3D)

Once you make things, why not give them a nervous system? The Internet of Things — that ubiquitous network of connected sensors — has started playing this role by gathering data about a product's surroundings and reporting it back to us. >>

of biomimicry when they used generative design to create a better partition for the galley section of their A320 planes. The resulting 'bionic partition' is 45 percent lighter than conventional partitions and equally as strong. Airbus estimates that this will save a half a million metric tons of CO_2 per year.

Player #2: Robotics

While generative design provides the tools for coming up with designs, robotics offers exciting new ways to make the designs.

Robots have been mainstays of manufacturing facilities and other industrial settings for decades, but, increasingly, we are finding ways to enhance their utility by combining robotics with other technologies like generative design and additive manufacturing.

One particularly vivid example of enhanced robotics is being demonstrated in the Netherlands, where Autodesk, headquartered in San Rafael, California, has been working with Dutch designer Joris Laarman and his team at MX3D. Six-axis pivoting industrial robots, using an algorithmic feedback system, have begun autonomously manufacturing a steel pedestrian bridge by 'printing in mid-air' — incrementally building the metal structure that will later be installed over a canal in central Amsterdam. This robotic marvel with load-bearing capabilities is already under construction with an expected completion in 2017.

"By printing with six-axis industrial robots, we are no longer limited to a square box in which everything happens," says Tim Geurtjens, CTO at MX3D. "Printing a functional, life-size bridge is, of course, the ideal way to showcase the endless possibilities of this technique."

Laarman adds: "This bridge will show how 3D printing finally enters the world of large-scale, functional objects and sustainable materials while allowing unprecedented freedom from form. The symbolism is a beautiful metaphor that connects futuristic technologies with the historical city to showcase the best of both worlds."

Equally as impressive is MX3D's suspension technique in which the robots use 3D printing to support their own weight, which is integrated into the construction process and promises to transform the building of future structures.

"Everyone who says 3D printing is just pressing a button doesn't really know how it works," Laarman points out. "It's very hands-on and very elaborate. We were all a bit bored with all the tiny, keychain-sized things people were making, so we really tried to push it to a higher level by using real materials like wood and metals."

Player #3: The Internet of Things

Once you make things, why not give them a nervous system? The Internet of Things (IoT) — that ubiquitous network of connected sensors — has started playing this role by gathering data about a product's surroundings and reporting it back to us.

As embedded sensors in products get more sophisticated, we can gain a greater understanding of how a product functions in the real world — and how we can improve its design.

For example, Autodesk worked with the Bandito Brothers, a media production team in Los Angeles, California, to outfit a racecar with dozens of sensors that could collect billions of data samples of how the car performs in race conditions. Taking this data and feeding it into a generative design tool has allowed the team to build a custom chassis that maximizes performance based on the conditions as they were captured.

Player #4: Artificial Intelligence

If generative design, robotics, and the IoT are the tools changing the way humans and machines work together on design tasks, then Artificial Intelligence (AI) is the 'rocket fuel' that accelerates their impact.

AI gives our tools a learning capability so they can continuously get better at doing their jobs. This means that generative design tools will begin to learn what types of designs we like and do not like, and take note of our preferences; robots no longer need explicit instructions in their application programs to resolve an appropriate outcome. The IoT can use AI not only to perceive but also react intelligently to the real world.

All of this added intelligence gives the tools the flexibility to be more creative in their problem solving. As a result, computers are improving upon human capabilities like trial and error, intuition, and taking creative leaps. Given the array of design challenges our world currently faces, this added source of creativity is a welcome and positive development.

Game On

In this new era of ML and advanced design tools, the relationship between humans and machines is moving exponentially in exciting and inspiring ways.

Designers and engineers should no longer view tools as machines that need detailed instructions in order to operate. Instead, they have the opportunity to embrace these tools as true collaborators capable of helping to solve big problems in ways humans alone could not nor would not resolve without them.

By viewing design as a team sport that includes both humans and machines working together for beneficial advancement, everybody (and everything) wins.

Human beings have a long record of shaping the world. Moving forward, computers will join by shaping the things that shape the world. This unprecedented blend of humanity and technology is exciting to experience, and we will be seeing many similar results in the not-so-distant future.

"Fortunately for us, computers are starting to develop human-style capabilities to augment our own," Kowalski concludes. "I think it's going to fundamentally change our relationship with tools and the design process. Humans will no longer be operators with their tools. We will be more like mentors to our tools, coaching them and providing them with guidance and experiences." ▲

Ecosystem

Human beings have a long record of shaping the world. Moving forward, computers will join by shaping the things that shape the world. This unprecedented blend of humanity and technology is exciting to experience, and we will be seeing many similar results in the not-so-distant future. >>

Link: Machine Learning & Design

Sixty years ago, a programmer taught a machine to beat humans at tic-tac-toe. Since then, we have witnessed IBM's supercomputers beating the world chess champion and contestants of the American game show Jeopardy! More recently, Google DeepMind's computer game 'AlphaGo' defeated the best human at Go, the world's most complex game. In less than a single human lifetime, the computer has gone from learning a child's game to mastering the game recognized as the pinnacle of strategic thought.
Another example is the Atari video game Breakout. By looking at only the score and controller input, DeepMind's AI learned how to play the game better than any human by playing millions of games throughout the night and automatically spread its newfound knowledge quickly to other computers. In human terms, your knowledge of Breakout doesn't necessarily help your friend become better at the game. In contrast, when one computer masters Breakout, the other machines improve as well because they are all connected.
As ML evolves, generative design will accelerate by automating designers' reactions and incorporating their unspoken preferences into the design process. ML will also give robots the ability to complete tasks without having to depend on designers for explicit instructions.

Ronald Van Loon

Data Science Predicts a Bright Future

| By *Ronald Van Loon, Director Business Development, Adversitement B.V.*

Big Data insights provide a key analytical step to recognizing customer trends and transforming businesses. >>

Today, our entire life is digital and intricately connected to a digital economy. For instance, we conduct online transactions from our mobile phones or find a ride-share from our smart watches. Even our cars tell us where we can find a filling station before the fuel runs out.

How is it that we have access to all of this information? It all starts with connectivity, followed by data collection and analysis. For businesses, the bottom line depends on monetization that uses the science of Big Data analytics.

Connectivity First

More than anything else, our world has been shaped by connectivity that enhances our lives. Thanks to Wi-Fi connections, your smart thermostat sets the temperature in your house to ensure energy efficiency when you are away, and the settings can be adjusted on a mobile App before you return home. Better yet, these intelligent products now learn your habits so that the lights will turn on when you enter the house without having to access an App.

A similar kind of data collection ensures that online advertisements and marketing efforts for your business only appear to people in your target market. Automation based on predictive analytics will remind your clients when they need to make a follow-up appointment, when they are running low on a particular product, or when it's time for more services. In other words, gathering data — when done right — makes people's lives easier while improving sales and customer loyalty.

Improved Forecasts

The benchmark for the effective use of data is to find accurate and actionable context and correlation. To do so is to gain insight into customer buying trends, marketing strategies that work and don't work, or approaches that better engage target audiences. All these advantages demonstrate why data science has an incredibly lucrative future.

Across the technology sector, companies are searching for technical staff with the talent to develop complex algorithms able to make accurate assessments. Employers need data scientists who understand how to mine Big Data in order to determine the precise recommendations that need be offered for businesses and individuals alike.

From improving recommendation algorithms for services such as Netflix and Amazon to reducing website bounces and increasing flow based on analysis of website traffic, data science is a burgeoning field. In fact, technical institutions around the world are paying more attention to Big Data every day, with academic programs in the U.K. at Lancaster University, Imperial College London, the University of Kent, and the University of Westminster, as well as in the U.S. at the University of California Berkeley, Columbia University, Georgia Institute of Technology, and Carnegie Mellon University. With the world's top educational institutions backing data science and turning out data experts, the career field for Big Data looks promising well into the next decade.

Big Vision for Data Insights

Until recently, people were talking about what the analysis of large data sets could do for businesses; however, the technology really had not reached the point where businesses could do anything but analyze historical data. The cost of processing, storage, and network transport was a big obstacle, as was the collection of data directly from customers.

Today, it is routine for businesses and their customers to store terabytes, petabytes, and exabytes of data across multiple devices all the time. The explosion in the number of devices connected to the Internet of Things will add still more orders of magnitude of information requiring pre- and post-processing to monetize the insights generated from data analytics.

Historically, Big Data was considered a solution for improving customer satisfaction. In contrast, the latest trends point to Big Data as a key tool for opening doors into entirely new solution markets. If you are not using fast data analytics and Big Data technology to stay up-to-date with your customers' needs or are not looking for other customer-centric approaches to improve customer service, then you're already behind the curve.

As this new market for solutions-driven technology and strategy continues to grow, we expect to see the majority of businesses increase their investment in analytics, data warehousing, and everything that affects data movement and insights within the next few years.

Linking Non-relational Databases to the Digital Economy

Some of the biggest challenges facing Big Data involve real-time methods for moving information. With the rise of streaming data, businesses are now obligated to implement Big Data strategies and solutions to meet the demands of an up-to-the-second market environment.

Older relational databases required structured, pre-formatted data to be stored in rows and columns which, in turn, made access to different data types effectively impossible. With unstructured, non-relational databases, data can be stored in its raw state in flat architectures until needed. Access to these 'data lakes' is easier, and data analysis is significantly faster compared with previous data management techniques.

As the vision of Big Data continues to create new marketplaces, keep an eye on technologies that provide mechanisms for storage and retrieval, such as NoSQL, Apache Hadoop, Apache Spark, and other tools, that are focused on improving the ease of access and usability of large data warehouses.

Real-world Applications

Big Data is indeed big news. It's what our governments use for surveillance; it's how social media platforms target us with advertising campaigns; and it's the next big thing for increasing your company's sales.

Depending on who's talking, Big Data is either evil or a wonderful guiding beacon for marketing and sales — or both. Big Data offers profitable uses and unparalleled transparency on a global scale.

To take best advantage of the opportunities unlocked by Big Data, you must concentrate on measurement and analysis. A logical place to begin is by looking into the details of how Big Data moves strategies forward.

- Data-driven Decision Making

Essentially, in today's business world, the guesswork has been removed regarding who your audience is, where they hang out online, and what ads they will respond to. Much of this information is freely available for building a data-driven marketing strategy. Direct marketing efforts can be organized using automated research and trends analysis mined from your customers' demographics and locations.

Do a quick Google search on the best days and times to post to Facebook, Twitter, or Instagram, and see how much information you get. That information was gleaned from Big Data sets of user frequency statistics collected at various times of the day on different days of the week. The data by itself may not appear very interesting but, with a small amount of analysis, you find that Friday is the best day of the week to post to Facebook, and weekend tweets on Twitter get 17 percent more engagement than tweets made during the week.

- Analytics Add Strategic Value

Through site analytics, opt-in surveys, and other transparent data collection means, Big Data can optimize your marketing and production strategies. Up-to-date information allows you to make adjustments that improve the quality of engagement with your online audience by recommending better targets for products and services. The best outcomes are increased incremental revenue, as well as your customers' confidence that they are seeing media that best suits their desires and preferences.

Access to Big Data alone won't do anything for your business unless the right technical talent is on board to implement analytical processes. As the tools for predictive analysis and data visualization improve, it is reasonable to expect the discovery of business values that allow you to forecast consumer trends with improved precision. Using a data-driven marketing and production strategy, you will be guided by actionable insights toward the goal of increasing the profitability of your business.▲

Big Data is indeed big news. It's what our governments use for surveillance; it's how social media platforms target us with advertising campaigns; and it's the next big thing for increasing your company's sales. >>

Walter Fang

As a key driver for industry development and the transformation of cities, urban Big Data systems help businesses improve their information processing capabilities. >>

Big Data for Smart Cities

| By *Walter Fang, Executive Vice President, iSoftStone Information Technology (Group) Co., Ltd.*

Massive amounts of data are impacting economic growth, the consolidation of industries, and patterns of urban construction. Big Data frequently plays a major role in the process of developing Safe Cities through prediction, analysis, and mining for future business development. The availability and consumption of open data is creating new opportunities for Big Data service providers poised to take the lead.

iSoftStone, a leading China-based global IT services and solutions provider, has created an architectural model for urban Big Data ecosystems that enables city management teams to change the mindset of local business leaders by pushing the revision of industry value chains and transforming organizations.

Future-proof Industry Advantage

The strategic significance of Big Data is not merely the acquisition of large amounts of data. In fact, businesses reveal the true value of Big Data by the choices they make to improve their data processing capabilities. This strategy allows them to convert massive amounts of data into useful information for industry development. The full utilization of these resources is undertaken with the goal to boost government efficiency for the implementation of social programs.

The global Big Data market value is projected to reach USD 48.3 billion in 2018 — an increase of nearly seven times compared to 2012 — with a Compound Annual Growth Rate (CAGR) of 40.5 percent. Industries that expect continued explosive growth in Big Data demand include telecommunications, finance, healthcare, retail, and education.

Given its huge potential to improve competitiveness, Big Data is considered a strategic resource by the many countries and international organizations that are incorporating it into their national and global development plans. The U.S., U.K., South Korea, Singapore, and China are among the countries that have begun to establish data analysis centers based on open data applications.

Smart City Construction

Big Data is an indispensible cornerstone for Smart City ecosystems. For instance, governments collect data from local industries to make decisions on future developments based on statistical science. This strategy enables citizen-focused services to be personalized from Big Data insights derived from critical economic development factors.

Smart City planners can focus on government data disclosure and market transactions to leverage the value of collected data to optimize city operations. Big Data platforms play a major role in integrating personal data for calculating population distribution and patterns of transportation and consumption, as well as industry data on estate, finance, manufacturing, and energy sectors.

In response to the proposal of the *Summary of China Urbanization Plan* during the 12th Five-Year Plan (2011 to 2015), iSoftStone has driven the combining of public Big Data platforms with Smart City cloud applications to construct innovative information ecosystems that cover the entire industry chain. From 2011 to 2015, Smart City deployments in China exceeded USD 102.6 billion, and by 2015, the number of cities piloting Smart City programs reached four hundred.

Given the promotion of national policies and Internet development, as well as efforts by telecom operators, Internet enterprises, and technology companies, Smart City projects are expected to climb to USD 586.82 billion during the 13th Five-Year Plan (2016 to 2020).

The Transformation

In this rapidly developing market, the most important prerequisite for having useful data is accessibility (or data openness). Government-mandated disclosure policies are changing the isolated information environments of legacy databases to a world of innovation that is being led by advanced data mining applications.

iSoftStone values common development with partners like Huawei to help governments and enterprises promote the practical applications of Big Data and provide customers with solutions based on Big Data services. >>

Open access and the exploitation of data provide continued improvements throughout the data transaction market, creating new development opportunities. City planners and administrators provision public service, public safety, smart transportation, and water resource management via Smart City operation centers. These municipal officials are applying Big Data technology for social governance, civil service, and economic development activities.

The following two factors are vital to the improvement of working conditions and quality of life for people living in Smart City-equipped municipalities:

- Social governance innovation requires a comprehensive understanding of the impact of Big Data and associated requirements. Providing accurate, timely, and comprehensive statistics are key to improving the quality, authenticity, reliability, and credibility of public information services. Based on geographic distribution, the Big Data platform plays a vital role in analyzing the local population structure, history, trends, relationships, and living habits.
- Precise plans and budgets are crucial for developing personalized and smart civil service systems. For economic development, city planners and administrators must combine the power of Big Data with local conditions to leverage their advantages in tourism, eCommerce, agriculture, energy, manufacturing, and other industries. This move will subsequently drive smart industry upgrades by applying insights revealed using data analytics.

Big Data Practices

iSoftStone provides Big Data consulting, solutions, business intelligence analysis, and data integration. As a leading supplier of innovative Smart City and Industrial Internet solutions and services in China, iSoftStone is committed to a strategy of collaborative development. Their 'One Center + Four Platforms' Big Data architecture is designed to realize real-time data display for eGovernment and city management to monitor economic operations and civil services. The 'One + Four' architectural model lays the foundation for an urban Big Data ecosystem by implementing the unified processing of basic eGovernment data and including the extensive convergence of business data, deep mining of application data, and interdepartmental data sharing.

iSoftStone values common development with partners like Huawei to help governments and enterprises promote the practical applications of Big Data and provide customers with solutions based on Big Data services. By relying on their combined experience in Big Data centers, enterprise cloud services, smart communities, and other Smart City developments, the partnership with Huawei over the past decade has established a stable foundation for further collaboration. A number of programs have been implemented together, including the Smart Mall/Square joint solution and Energy Efficiency Management joint solution. iSoftStone and Huawei leverage each other's strengths to optimize a shared strategy in the areas of digital communications, Big Data, and smart industry to build Smart City ecosystems.▲

Owen Chen

Mr. Chen is a Research Director in Gartner CIO Research, based in Shanghai, China. His work focuses on IT leadership, IT strategy, and IT governance. Specifically, he provides advice and support for Gartner multinational clients on developing IT strategic plans for entering the Chinese market and for Gartner's Chinese clients on all aspects of IT management.

CIO who fixate on traditional Information Technology methods run the risk of other departments establishing their own digital teams. >>

Bimodal IT Approach to Digital Transformation

| By *Owen Chen, Research Director, Gartner, Inc.*

Enterprise Information Technology (IT) departments are beginning to recognize the importance of leadership in their digital transformation efforts. Chief Information Officers (CIOs) almost invariably find that traditional IT modes cannot cope with the challenges brought by digital transformation. They need a completely new working mode.

In 2014, Gartner proposed the bimodal IT concept with the aim of helping CIOs ensure normal operations while supporting and leading the digital transformation of their companies.

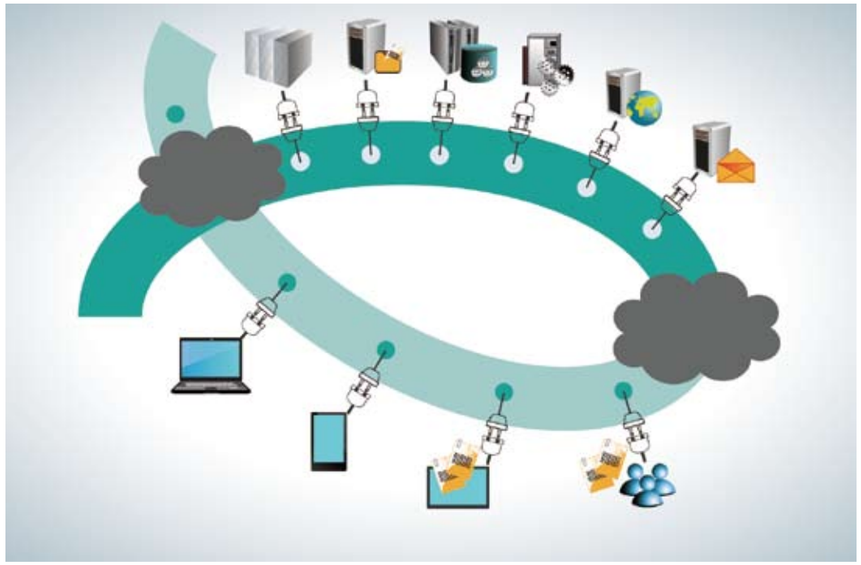
"CIOs can't transform their old IT organization into a digital startup, but they can turn it into a bimodal IT organization," said Peter Sondergaard, Senior Vice President, Gartner Research. "Forty-five percent of CIOs state they currently have a fast mode of operation, and we predict that 75 percent of IT organizations will be bimodal in some way by 2017."

Big Data, cloud computing, social media, mobile Internet, and other technologies are reaching higher levels of maturity. Meanwhile, disruptive technologies such as Machine Learning (ML), the Internet of Things (IoT), 3D printing, Augmented Reality (AR), Virtual Reality (VR), and blockchains are emerging.

These technologies are bringing profound changes to the business models of every industry, involving various aspects of enterprises that include marketing, R&D, supply chains, manufacturing, and service. To survive in today's markets, where competition is becoming increasingly fierce, enterprises must become digitized or otherwise perish.

Two-in-One

Bimodal is the practice of managing two separate but coherent delivery modes. One focuses on predictability while the other concentrates on exploration.



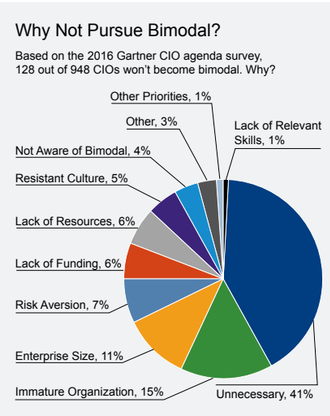
Mode 1 is optimized for reliability, availability, and low costs. A typical example of this is Enterprise Resource Planning (ERP), for which the requirements of the customer must be clarified during the requirement analysis stage.

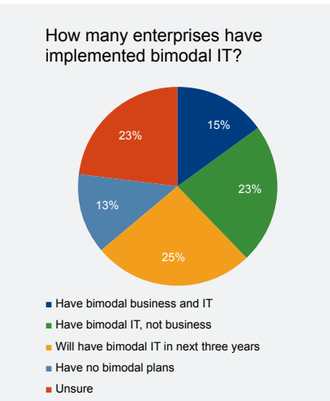
Mode 2 is exploratory, with an eye to resolving new problems. A typical example is the use of social media for marketing purposes or the use of Big Data to analyze consumer behaviors. When initiating such a project, users form theories on the expected results but have no idea about the detailed requirements for achieving those results. This is an area they must explore with the help of their IT departments.

Bimodal IT functions can be compared to the way a feudal lord in ancient Japan utilized his resources. In mode 1, the lord had an army of Samurais to fight with the Bushido spirit, which included predictable and well-regulated actions (aka Samurai mode). In mode 2, the lord relied on his Ninjas, who were exempt from virtuous Bushido restrictions, to carry out special tasks, such as sneaking into the houses of other lords at midnight to steal something or assassinate someone (aka Ninja mode). Any lord who wanted to prevail needed both Samurais and Ninjas. There was no way to win with a single mode. This also applies to contemporary enterprises, which must have bimodal IT to complete the digital transformation process.

The following is a comparison of features between the two modes:

- **Application Development:** Mode 1 is more likely to be waterfall-based (downward flow of progress); Mode 2 prefers an agile and open approach.
- **IT Governance:** Mode 1 is plan-driven and focuses on security and reliability; Mode 2 requires more agile governance.
- **Supplier Selection:** Mode 1 prefers long-term, traditional suppliers; Mode 2 requires innovative suppliers that enterprises need when exploring new business models.
- **Talent:** Mode 1 needs experts who are able to resolve complicated problems; Mode 2 requires specialists who help enterprises clear up uncertainties.
- **Culture:** Mode 1 is more concerned with economies of scale; Mode 2 focuses on discovery and exploration.
- **Team Composition:** Mode 1 needs a technology-oriented team; Mode 2 requires a team consisting of various disciplines such as software engineers, data scientists, and marketing experts.
- **Financial Decision Making:** Mode 1 makes investment decisions based on Return on Investment (ROI) figures; Mode 2, unable to produce exact ROI figures, must be supported by funds that focus on investment in innovation.





Facts and Data

Gartner's bimodal IT analysis has attracted widespread attention. Some companies also proposed similar concepts such as McKinsey's two-speed IT, Huawei's New ICT, and Lenovo's two-state IT. Accordingly, some IT consulting firms like Accenture and Deloitte have started to provide consulting services to help enterprises implement their bimodal IT initiatives.

A 2015 Gartner survey with more than 2,800 CIOs around the world shows that 38 percent of enterprises have implemented bimodal IT, with 26 percent planning to go bimodal within 3 years. Only 13 percent of enterprises say they have no plans for bimodal IT, and the remaining 23 percent are unsure.

Of those enterprises with no bimodal plans, 41 percent say it is unnecessary, whereas the others are unable to go bimodal due to various factors, including a lack of organization maturity and funding, enterprise size, and resistant cultures.

"CIOs can't transform their old IT organization into a digital startup, but they can turn it into a bimodal IT organization," said Peter Sondergaard, Senior Vice President, Gartner Research. "Forty-five percent of CIOs state they currently have a fast mode of operation, and we predict that 75 percent of IT organizations will be bimodal in some way by 2017." >>

Enterprises that claim bimodal IT is unnecessary typically fall into three categories:

- Category 1 enterprises believe that mode 1 is sufficient for them. These enterprises have yet to bear the full brunt of digitization.
- Category 2 includes enterprises that prefer mode 2 over mode 1. They are mostly Internet companies that were born with innovation in their genes and have always followed mode 2 in their business practices.
- Category 3 enterprises think bimodal IT is insufficient because they are facing complicated environments that require more modes. These enterprises may not fully understand the meaning of bimodal IT.

Gartner advises all enterprises to follow the path of bimodal IT because none of them will be immune from the impact of digitization and all must be able to deal with predicable tasks as well as carry out exploratory work.

Survey results also identified the most common barriers to enterprises when implementing bimodal IT.

The biggest barrier is a resistant culture. This occurs because mode 2 focuses on exploratory work and requires an innovation-oriented culture, which many traditional enterprises lack. The second biggest barrier is priority. Enterprise CIOs and other corporate leaders believe they have higher-priority work to do. The third biggest barrier is legacy IT environments.

Constructing Bimodal IT

Multiple approaches exist for the construction of bimodal IT, including agile development, Development & Operations (DevOps), multi-skilled teams, differentiated Key Performance Indicators (KPIs), formal innovation management, and crowdsourcing. Gartner thinks that agile development is the most appropriate starting point for bimodal IT construction and defines three application layers that are involved in its implementation:

- **Systems of Record:** Systems at this bottom layer are comparable to those of other enterprises. For example, every enterprise uses similar financial management systems they buy from other vendors.
- **Systems of Differentiation:** Applications at this middle layer are usually implemented by deploying some additional components to the systems of record or adopting some customized configurations and adjustments.
- **Systems of Innovation:** Enterprises are not always sure what systems they need at the top layer, but they do recognize the need to take exploratory innovative initiatives. The higher the layer, the more applicable mode 2 is.

Enterprises that are going bimodal can choose a project from their existing systems of differentiation or innovation to make a tentative attempt at agile development. Once the enterprise has mastered the agile development methodology, it can apply this approach to other projects.

'Flipping' to the Digital Promise

Digital transformation is a movement no one can halt. If enterprise CIOs stick to the traditional mode, other departments may have to establish their own digital teams. For example, the marketing department of an enterprise might set up a digital marketing team independent of the IT department. As a result, the CIO could be marginalized in the enterprise.

"To grasp the digital opportunity, incrementally improving IT performance isn't enough," warned Dave Aron, the former Managing Vice President and Gartner Fellow who is now Global Research Director for CSC's Leading Edge Forum.

"Digitalization is no longer a sideshow — it has moved to center stage and is changing the whole game. CIOs now have a unique opportunity, but they must 'flip' their information, technology, value, and people leadership practices to deliver on the digital promise." ▲

Darryl West

About a year ago, our CEO outlined a strategic plan for the next three years, and two of these priorities were relevant to my role in IT. One priority was to restructure the cost space of the bank by fundamentally digitizing everything in the organization. >>

Banking at the Speed of Light

| By *Darryl West, Group CIO, HSBC Holdings plc*

For 150 years, HSBC has aspired to be the world's leading international bank. We have a long track record of creating financial innovations in banking services, and today we're working to create more amazing experiences for our customers by transforming banking through digital technologies.

Digital technologies are pervasive. This is especially true in Asia where modern life is being transformed. From food to baby supplies to technology products, more than 90 percent of purchases are made online. Digital technologies represent a tectonic shift in global commerce that cannot be ignored. Significantly, 74 percent of Chinese people say they are willing to consider a purely digital bank — and that's what we are working to create.

About a year ago, our CEO outlined a strategic plan for the next three years, and two of these priorities were relevant to my role in IT. One priority was to restructure the cost space of the bank by fundamentally digitizing everything in the organization. As a result, we are on a mission to digitize every customer interaction and every banking process.

My objective is to eliminate the use of passwords forever. Remembering them is taxing, and biometrics actually makes customers more comfortable. Today, smartphones incorporate touch ID and mature voice recognition technology.

In fact, in the U.K., we are now using voice recognition in our call centers. If registered, you can speak to an operator in your natural voice and convey what you want. Our operators will know who you are and will have access to your accounts. This improves the customer experience, enhances control, and reduces costs. We have launched Apple and Android Pay services as well as China's WeChat integration in the Pearl River Delta development.

As you can tell, banks will look very different in five years. There will be no paper and no passwords, and customers will enjoy exceptional banking experiences. Value-added messaging will be delivered through mobile channels, in real time, providing timely, accurate information to customers while they are on the move, allowing them to run their lives in more efficient and interesting ways.

Getting there will require some re-engineering of older technologies. Our core systems are 40 to 50 years old. They are, however, robust, functionally rich, scalable, well supported, and do a fantastic job. As such, we can't just shut down the bank and replace those systems with new technologies; we need an integration layer that delivers data for digital customer experiences. This vision means a major architectural revolution, requiring 7,000 applications and 40,000 IT personnel spread around the world.

At the heart of this architecture is the cloud, which is fundamentally changing the banking business. We are working with various models and providers: private cloud, public cloud providers, and Software-as-a-Service (SaaS) providers. Cloud providers enable much faster delivery without the need to actually run any infrastructure or software because it is all consumed through a SaaS model. Our partners and regulators are helping to ensure that we have a secure, resilient cloud capability. Our huge organization is broken down into teams, a major shift that requires an effective infrastructure. We need high-performance collaboration tools, video and voice communications, and electronic Kanban boards — anything that helps bring the agile methodology to life.

The only way to ensure success in this journey is a strong partner ecosystem, and our partnership with Huawei has been remarkable. We must work with partners, like Huawei, who have at their core a technology heartbeat and a long-term commitment to research and development. If Huawei is successful in developing all of the exciting new technologies referred to in this article, HSBC will be an avid consumer, because technology is fundamentally transforming the global financial services industry. ▲

(Source: Huawei Connect 2016 keynote speech, Shanghai, China)

Contributions and Feedback

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

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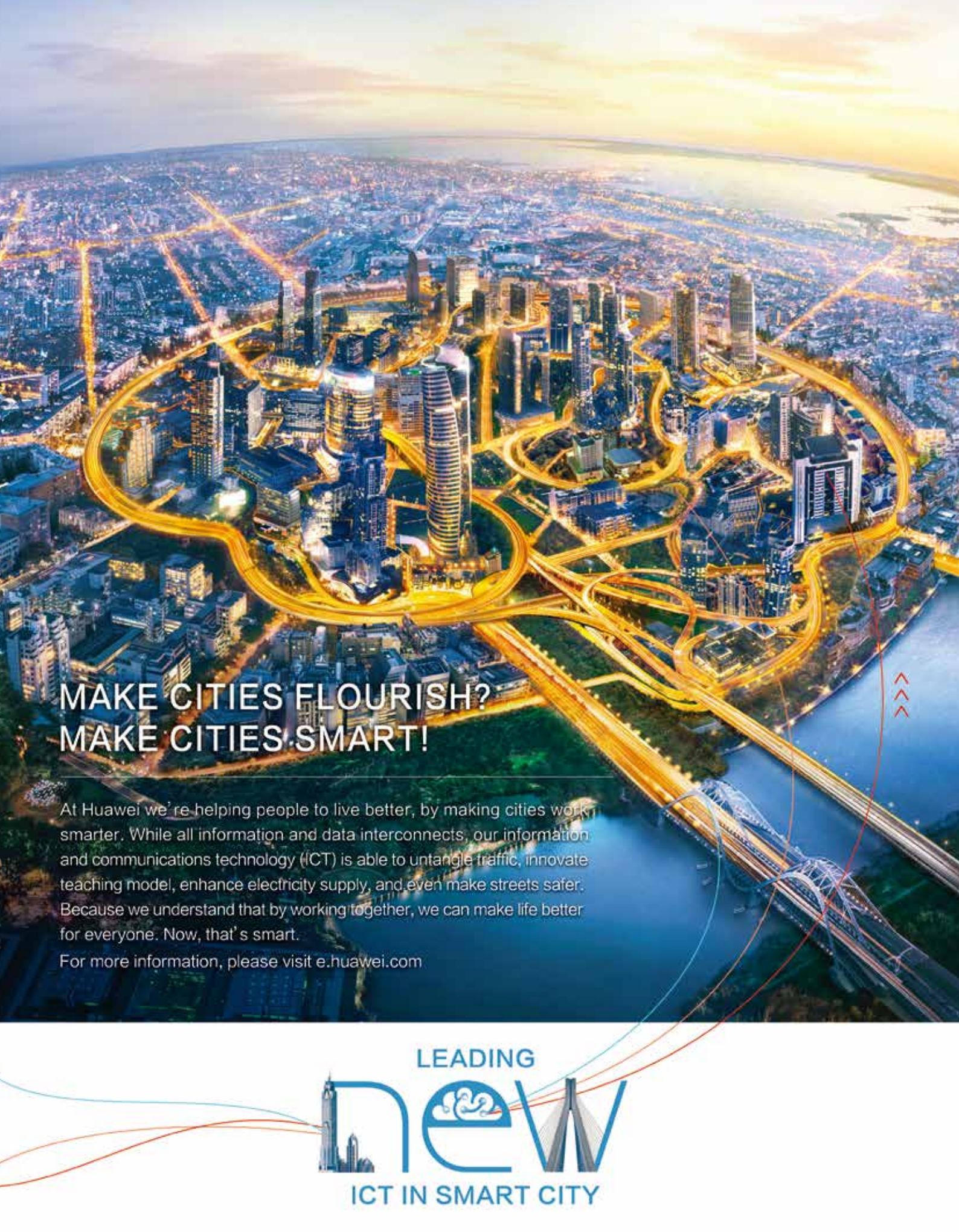
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