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HUAWEI

Increased Network Agility for Better Business Performance

| By *William Xu, CEO, Huawei Enterprise Business Group*

Software-Defined Networking (SDN) is sweeping the information and communications industry. At the center of this far-reaching network transformation we find intelligence, automation, programmability, and an open system architecture.

As companies continue IT capacity expansion, traditional networks present troublesome problems, including inflexible applications deployment, low resource utilization, and high operating costs. The surging popularity of cloud services and applications further aggravates the situation. The central premises of cloud computing are scalability, multi-tenant resource sharing, and automated control. Underpinned by data center networks, cloud computing companies must resolve the problems of virtualizing networks and automatic orchestration of network and IT resources.

SDN-powered networks provide a new approach to meeting these challenges. SDN architectures provide a centralized control function for delivering novel end-to-end capabilities. We anticipate ground-breaking business solutions by offering highly flexible and controllable solutions that add functionality and simplify network operation and maintenance. Ideally suited to cloud data center scenarios, SDN is a paradigm shift towards intelligent operation of enterprise networks.

Emerging from the backdrop of ICT convergence, SDN will cover all aspects of IT, IP, unified communications, and mobility. With Huawei's long-term leadership in technology R&D, and rich experience in ICT and network build-outs, we are ideally positioned to build future-focused solutions for our customers.

Huawei is sparing no effort to establish a presence through SDN products, standards, and joint innovations with customers by leveraging integrated data centers, campus networks, and end-to-end wide area networks. We control and manage physical and virtual networks in a unified manner, to bring intelligent and agile data centers into reality.

Huawei is enabling network openness and programmability at all layers in our effort to develop the most user-friendly network architectures. We are providing a full range of SDN products and solutions, to help our enterprise customers gain first-mover advantage in the age of ICT convergence.

Amid the evolution of network towards an SDN architecture, we are capitalizing on our carrier-level success and ICT product innovations to assist customers in the deployment of reliable, robust, and intelligent networks. We are committed to helping customers become the big winners in the SDN revolution! ▲

Comment

News

Features

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Focus

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- SDN is Redefining Our Networks
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- SDN: The Best Answer to Campus Network Challenges
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Ecosystem

The ultimate goal of holography is to make very rich communication systems. If we do it well, the human/computer interface disappears; this will change the mode of how we get the information, how we use the information, and how we share the information.>>

Successful ICT integrations require three things: A well designed solution, the appropriate equipment on which to operate the solution, and perhaps the most challenging, proper training to keep everything up and running.>>

Success

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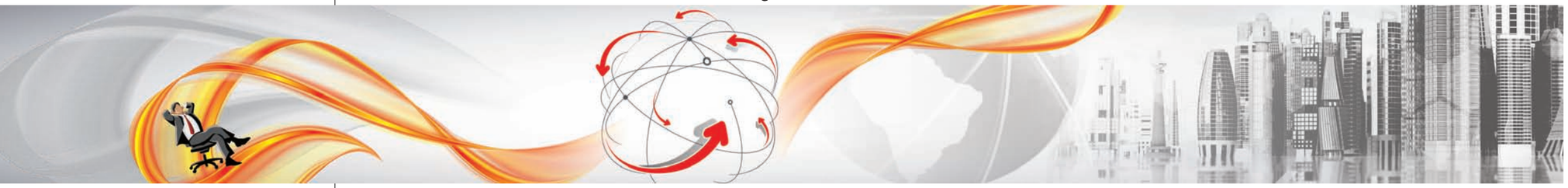
Enterprise News and Announcements in Q2, 2013



2013 June 20

Huawei has announced a strategic partnership with Nissho Electronics. Both parties will cooperate on the introduction, sales, and post-sales support of enterprise ICT products and solutions, as well as jointly plan and develop a diverse range of products, solutions, and services to meet Japanese demand. Initially, both parties will begin to sell the Huawei FusionCube Converged Infrastructure solution in the Japanese market.

2013 June 20

Huawei and IDC hosted a webinar in Beijing to jointly release a white paper detailing how enterprises can take advantage of the current trend in BYOD mobile office to create more business opportunities.

2013 June 19

Huawei kicked off its Latin America tour in Mexico with the theme of "A Futuristic Revolution of Information and Communications." Huawei also showcased its IDS2000S small data center, which has attracted widespread industry attention.

2013 June 5

In collaboration with emergency communications system manufacturers Rohill and Selex ES, Huawei launched innovative mobile broadband eLTE + TETRA solutions that target demand in the public security, transportation, oil and gas, and large enterprise markets.

2013 June 1

According to Gartner's Q1, 2013 worldwide server market report, Huawei shipped 51,643 servers in Q1, surpassing HP, and for the first time has become one of the top 3 server vendors in the Chinese market. Huawei also has become the only Chinese vendor to appear in Gartner's Magic Quadrant. Currently, Huawei offers three main series of servers: RH Series Rack Servers, E Series Blade Servers, and X Series High-Density Servers. Huawei also provides value-added component-based reference architecture and solutions for application acceleration.

2013 May 26-28

Huawei showcased its intelligent transportation solution at the 2013 4th China Intelligent Transportation Conference and 2nd International Intelligent Transportation and GPS Service Exhibition in Shenzhen. Huawei also shared best practices with highway management authorities and enterprises, as well as introducing an integrated, open ICT solution and service for customers, including the promotion of IT enablement for intelligent transportation in China.

2013 May 20

Huawei's 10 Gbit/s NIP5500 Intrusion Detection and Prevention System successfully passed comprehensive tests conducted by SKD Labs (part of West Coast Labs of Irvine, California), and was awarded the Starcheck evaluation certificate of approval. Test results showed that the NIP5500 application-layer detection capability, success rate, and error rate are substantially ahead of similar products in the market.

2013 May 15

Huawei introduced its leading eLTE broadband clustering technology as well as transportation solutions and success stories at the Huawei eLTE Transportation Industry Solutions Media Salon in Beijing. The Huawei eLTE solution provides voice clustering, video scheduling, video surveillance, positioning, and broadband data access applications. It is the world's first LTE-based, 100 Mbit/s specialized clustering system, and the first to transition from voice clustering to multimedia clustering in private networks.

2013 May 14

Huawei announced that a new generation of S2750-EI series intelligent access switches (S2750-20TP-PWR-EI-AC, S2750-28TP-EI-AC, S2750-28TP-PWR-EI-AC, and S2751-28TP-PWR-EI-AC) would hit markets worldwide. The launch of these four new switches will enrich the enterprise access switch market, as well as help SMEs to build IT networks that are future-oriented, highly reliable, and easy to use.

2013 May 10

Huawei launched the S5710-HI, the industry's first ultra-high-density, box switch. The S5710-HI supports 4 x 40 Gbit/s uplink interfaces and can provide up to 108 physical ports. With a port density twice that of competitive products, the S5710-HI is an excellent choice to provide access for medium and large high-end campus networks, convergence for small campus networks, and access for data centers.

Photo News

From May 7 to 9, 2013, Huawei attended Interop 2013 in Las Vegas to showcase its latest innovations in ICT solutions, including the BYOD mobile office, cloud data centers, eLTE broadband access, and SDN solutions. These solutions aim to turn ICT systems into an engine for growth by harnessing the convergence of information and communications, helping enterprises to tackle challenges, and take advantage of opportunities in big data. During the exhibition, Huawei unveiled the OceanStor N9000 Big Data Storage System, which allows customers to confidently address many challenges in big data. The OceanStor N9000 uses an innovative Three-in-One concept to combine storage, analysis, and archiving, as well as adopting a new generation of scale-out architecture to manage data throughout its lifecycle.

2013 May 6

Huawei's container-based data center was awarded the world's first Tier III Design Certification by Uptime Institute (a global organization that provides data center tier certification). The certification shows that Uptime Institute recognizes the security and reliability of Huawei's award-winning desktop cloud container data center, as well as its performance and value for applications.

2013 April 23

During the 2013 ICT China Tour – which showcased Huawei enterprise ICT solutions – Huawei launched the NE20E-S Series Multi-Service Router, the AR530 Industrial Switching Router, and the AR G3 Router 40 G dual-controller SRU400 series of new products aimed at global customers and channel partners.

2013 April 17

Huawei and Intel jointly announced the release of the Trustable Cloud Platform Solution. Fully compatible with OpenStack, the Trustable solution provides protection for the hardware platform, cloud operating system, and service access. These three layers of protection eliminate fundamental cloud system security issues, and allow enterprises to utilize cloud computing securely.

2013 April 8

Huawei attracted widespread attention with its release of the Distributed Cloud Data Center (DC^2), a new-generation data center infrastructure system for the cloud era. Huawei was the first company to propose the concept and architecture of the DC^2 technology. ▲

Huawei Enterprise Business: Four-Dimensional SDN Deployment

By *Li Zhipeng, ICT Insights Reporter*

SDN is the new focus of the network industry. What is the Huawei Enterprise strategy for SDN? What is the market for SDN technology? How will SDNs be deployed? SDN expert David Zheng has the answers.

David Zheng
SDN Specialist for Huawei Enterprise Business Product and Solutions Management Department

Huawei is working proactively on SDN product, solution, and standards deployments, as well as joint innovation with customers. By combining virtualization and cloud-computing, Huawei SDN focuses on the open programmability of each network layer, and aims for the gradual evolution of integrated networks.>>

Essence of SDN

ICT Insights: Having generated much heated discussion, do you think the industry has an agreed definition of SDN? What is the essence of SDN?

David Zheng: The industry consensus is that SDN consists of the forwarding plane, control plane, and applications. The essence of SDN lies in programmable network control and management, with resulting improvements in network operating efficiency and simplification of network management and operation.

ICT Insights: Do you think the many SDN-related organizations represent divergent development trends that will lead to separate camps? How should vendors choose?

David Zheng: SDN-related organizations include the ONF, Internet Engineering Task Force (IETF), Network Functions Virtualization (NFV), OpenDaylight, and OpenStack. The business focus of each organization is as follows:

- ONF: Founded in March 2011. Focused on OpenFlow forwarding, control, and orchestration. IT vendors and emerging vendors play important roles in ONF.
- IETF: Backed mainly by traditional network vendors, IETF is devoted to the formulation of interfaces and standards above the network layer.
- NFV: Founded in late 2012, NFV is concerned with virtualizing carrier network devices.
- OpenDaylight: A Linux open source organization, OpenDaylight founded by enterprise IT vendors in April 2013 is focused on the open source interface to the SDN controller.
- OpenStack: OpenStack specializes in cloud data center applications.

With a wide-ranging product portfolio and willingness to collaborate, Huawei has joined many organizations and continues to contribute research results.

Huawei SDN Strategies

ICT Insights: What is the overall SDN strategy of Huawei Enterprise? What has Huawei deployed in SDN?

David Zheng: Huawei Enterprise is focused on data centers, Wide Area Networks (WANs), and campus networks. Based on a variety of business scenarios and requirements, Huawei SDN has combined virtualization and cloud computing technologies, with an emphasis on the openness and programmability of each network layer. Our design goals are network integration and ongoing evolution.

Having accumulated valuable experience, the Huawei SDN portfolio boasts a full range of enterprise products from networks to data center solutions. We believe this combination is rare in the industry. Our great R&D strengths have provided leading network solutions for more than 20 years, and our IP network products are spread across the globe. These advantages lay a solid foundation for Huawei's success in the SDN market.

Huawei provides end-to-end SDN solutions both horizontally, from users to data centers, and vertically, covering networks, computing, storage, and management.

ICT Insights: Can you give more details about the progress Huawei is making to deploy SDN in four dimensions?

David Zheng: In the product category, Huawei launched the industry's first hybrid SDN controller and SDN-capable router. We were also the first to pass the ONF 1.2 test.

Regarding solutions, Huawei embarked on SDN strategic research in 2010 and we have gained significant experience in providing end-to-end solutions.

In the standards arena, Huawei has joined many standards organizations, including sponsorship in Open Network Research Center (ONRC). Additionally, our NFV research results have been presented in the draft standards.

Cooperative innovation has begun with more than a dozen customers, which in turn is fueling progress in data center and data center WAN applications.

Towards Commercial Deployment in Two to Three Years

ICT Insights: What progress do you expect in the global SDN market in 2013?

David Zheng: SDN is currently used to virtualize data center networks and optimize WANs between data centers. I believe that progress will continue to be made on these fronts in 2013.

ICT Insights: When will SDN be fully implemented, and how should interested customers manage the deployment of SDN?

David Zheng: SDN is only two years old, and the supply chain is still in its infancy. However, chip, device, control, and management vendors have put forward many concepts and are launching new products. We can expect to see significant progress in SDN in the coming years. Companies such as Google, eBay, and Tencent are already using custom SDN implementations to virtualize WANs between data centers. Mature products for commercial deployment will hit the market gradually over the next two years. Enterprise customers, especially those with large data centers, must first conduct research, verification, and testing of their current virtualization and cloud deployments before final requirements can be established.

ICT Insights: What is the relationship between SDN, cloud computing, and virtualization? They always seem to appear at the same time.

David Zheng: As a core buzzword for the last few years, cloud computing changes network architectures and business models by integrating and virtualizing computing, network, and storage resources. Computing virtualization has been popularized, and storage virtualization has made progress also, but network virtualization remains unsolved because relevant products and technologies are not yet mature enough. In addition, relocation of virtual machines and security management are confronted with network restructuring problems. SDN can resolve these issues.

SDN is to cloud computing and virtualization what technology architecture is to service scenarios. SDN is an impressive technology architecture that can address existing problems in service scenarios, such as data center conversions to cloud computing and network virtualization. ▲

SDN is to cloud computing and virtualization what technology architecture is to service scenarios. SDN can address existing problems in service scenarios, such as data center conversions to cloud computing and network virtualization. >>

The SmartNet project team at Huawei's Shannon Laboratory has successfully developed advanced SDN technologies after analyzing prevalent design implementations, such as the introduction of MDA-D best practice, industry-leading SSDN, and SDN control and forwarding technologies.>>

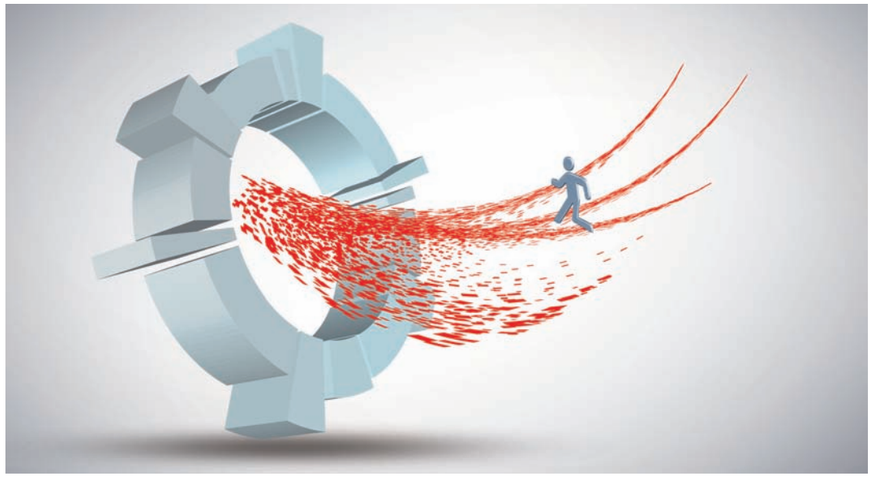
Huawei Overtaking the SDN Industry

– Huawei's Shannon Laboratory Takes the Lead in Industry Tests

By *Luo Min, Chief Architect and Future Network Research Director, Huawei Shannon Laboratory*
Wu Chou, Huawei Chief IT Scientist and Shannon Laboratory Chairman

Network transformations brought about by SDN will significantly reshape telecommunications and enterprise networks. Huawei's Shannon Laboratory started the SmartNet project in February 2012. By leveraging the profound wealth of knowledge in computer, network, and software engineering possessed by the project team, we were able to find solutions quickly to key problems in the SDN industry and make spectacular breakthroughs in SDN control and forwarding technologies. Armed with these advanced SDN technologies, we proudly aced the PlugFest test organized by the Open Networking Foundation (ONF) and the SDN interoperability test, which was primarily oriented towards carriers and organized by the European Advanced Networking Test Center (EANTC).

SDN technology has informationalized networks. This is a longstanding concept, but was seriously proposed only in recent years. SDN isolates network control management and data forwarding at the bottom layer and optimizes network resource usage by means of centralized control. This is based on network topology, status sensing, and traffic features and meets QoS requirements for various applications and flows. It also dramatically simplifies network management and reduces operating expenditures while increasing network resource utilization. The OpenFlow protocol provides interfaces (southbound APIs) for a Smart Network OpenFlow Controller (SOX) and OpenFlow switches under its management, introducing an era of SDN transformations. The challenges involved in designing and implementing the network controller and the OpenFlow switches far exceeded expectations, causing a somewhat delayed evolution of SDN technologies from OpenFlow1.0 to OpenFlow1.2/1.3. This technology evolution also involves painstaking efforts by the SDN industry as a whole.



Industry-Leading Performance in Key Technology Development

The SmartNet project team of Huawei's Shannon Laboratory has developed advanced SDN technologies after analyzing prevalent design implementations, such as the introduction of the Model Driven Architecture-Development (MDA-D) best practice, industry-leading Software Service-Defined Networking (SSDN), and Service-Oriented Architecture (SOA), as well as entire SDN architecture and SDN SOX architecture. Such breakthroughs resolved some tough problems facing SDN, like northbound interfaces and horizontal extensions.

Huawei introduced MDA-D architecture to SDN, created a highly scalable SDN controller model, and developed the first broad-based SDN SOX in the industry. SOX manages the hybrid network on which various and even incompatible OpenFlow-standard switches are deployed and resolves the network dissolution caused by OpenFlow (OpenFlow1.0 and 1.2) backward-incompatibility. The SOX architecture provides a broad control mechanism for a hybrid network where switches with varied southbound APIs are deployed. It also meets various open API requirements, boasts compatibility with switches from a variety of vendors, and supports dynamic network topology discovery, standard version discovery/negotiation, and link control. As a result, the SOX architecture offers high compatibility, flexibility, and scalability, becoming a benchmark in the SDN network controller industry.

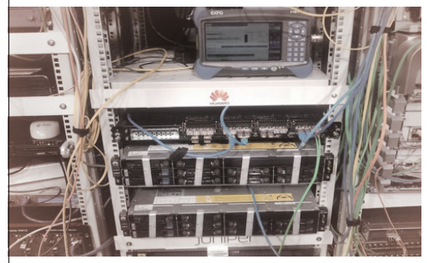
Outshining All Contenders

In early October 2012, Huawei participated in the PlugFest test organized by ONF and exhibited the industry's first broad-based SOX capable of controlling hybrid SDNs. This SOX, deployed on a hybrid network where various OpenFlow-standard switches from different vendors were deployed, successfully completed dynamic topology discovery, feature discovery, version negotiation, and three-layer network configuration management. This was the first time SDN switches of different OpenFlow versions were successfully interworked on a hybrid network.

At the end of October, the first SDN World Congress was held in Germany. There, Wu Chou, Huawei Chief IT Scientist and Shannon Laboratory Chairman, gave a speech entitled "SDN for Service Oriented Data Networking," released the white paper "SOX – A Generalized and Extensible Smart Network OpenFlow Controller," and announced an attempt to develop SDN control and management technologies based on best software engineering practices and MDA-D-capable SDN software architecture. These all drew wide attention.

At the first China SDN & Open Networking Summit held in Beijing on December 6, 2012, Huawei displayed SOX hybrid networking and some OpenFlow1.2-based functions. Luo Min, Chief Architect and Future Network Research Director at Huawei's Shannon Laboratory, gave a talk entitled "Software Engineering for Software-Defined and Future Networking."

Huawei made a stunning debut in the PlugFest test organized by ONF



Devices of various vendors in the PlugFest test

From February 4-8, 2013, Huawei SOX and OpenFlow1.2-based switches participated in the first carrier-network-oriented SDN interoperability test organized by the EANTC. Huawei provided the only solution that passed the OpenFlow1.2-based advanced test.

From March 19-21, 2013, the 2nd SDN Summit & 15th MPLS and Ethernet World Congress were held in Paris. The EANTC organized the first carrier-network-oriented SDN interoperability exhibition, which attracted major vendors. Huawei SOX and OpenFlow1.2 switches, as the core of clock synchronization, worked for the first time with the traditional IP network to control a hybrid network on which OpenFlow1.0- and OpenFlow1.2-capable switches were deployed. This system presented a striking four days of uninterrupted services at the summit.

On June 8, 2013, the Huawei SOX and OpenFlow1.3-based SDN switch SN-640 passed the PlugFest test organized by the SDN Lab at Indiana University, US, and held an increasingly distant lead over contenders in the SDN industry. The Huawei SOX's full control over the hybrid network on which OpenFlow (OpenFlow1.0 to OpenFlow1.3) standard switches were deployed impressed the ONF and all vendor participants. Huawei also identified almost all problems with the OpenFlow1.3-capable switches and provided a solid foundation for other vendors to rapidly resolve these issues. The SN-640 outshone all counterparts in terms of full support for OpenFlow1.3 and was the only switch that supported a forwarding architecture based on four or more flow tables. In this architecture, the forwarding capacity reaches up to 960 Mbit/s, and the bi-directional forwarding rate reaches up to 1.28 Tbit/s (48 x 10 GE + 4 x 40 GE). ▲

SDN Views from a Huawei Employee at ONS 2013

Chang zhi

Open Networking Summit 2013 turned out to be a great success, and its media coverage was widespread. What does the future hold for SDN? Let's take a look at the notes and insights from an attending Huawei employee.>>

ONS 2013 was held from May 7-8, 2013, and attracted participants from academic and commercial entities of all sizes from market sectors such as Information Technology, Communication Technology, Hardware, and Software. Attendance soared this year, to 1,500 people – a two-fold increase over last year. It was the first time I had ever attended such a summit, which was spectacular and informative, and I am very pleased to share my experiences.

SDN is Thriving in the Data Center Industry

Google, eBay, and Microsoft explained their approach to commercial SDN applications. Specifically, Google elaborated on connectivity between its data centers, eBay explained how to shift from traditional data center network architectures to SDN, and Microsoft explained how to use SDN to speed up lease-line user deployments on its commercial cloud, Azure. With their respective strength and authority in the data center and content-provider fields, these three companies amass huge potential to influence and frame the technological choices of small rivals and equipment vendors.

In both the inter- and intra-data center fields, few participants continued to debate the advantages and disadvantages of SDN or OpenFlow. Instead, a consensus had emerged and it is understood that the deployment of SDN or OpenFlow will simplify traditional network architectures, streamline operation and maintenance, and provide the potential to speed up business development. Some vendors presented examples of their current practices. Vendors who had taken a wait-and-see approach towards SDN joined the newly founded OpenDaylight camp, trying to seize a strong position in the ICT industry. OpenDaylight is favored by key data center vendors.

My comments: SDN is an irresistible trend in the data center field. Whoever fails to embrace SDN will be left behind because SDN is the right business choice, not just a technical preference.

SDN Debuts in the Enterprise Network Industry

The president of the Intel Network Product Line invited VMware executives to his keynote speech and focused on introducing several products, successfully turning his time at the podium into an Intel product launch. Intel views SDN as a new growth point in its network product line and has stepped up SDN initiatives so extensively that it seems to be catching up with Broadcom. The upshot: competition in the chip arena will intensify.

Less developed enterprise network vendors, such as HP, Dell, and Juniper, view SDN as an opportunity to shake up the industry and have begun efforts to rapidly deploy SDN.

My comments: More time is needed to prove that SDN can replace the functions of traditional switches and routers in the enterprise network industry, and new functions and applications remain unclear. As a result, SDN is not yet as valuable to the enterprise network industry as it is to the data center industry.

SDN in the Carrier Industry: Groping in the Dark

Deutsche Telekom, NTT, and Verizon introduced their SDN pilot practices. Deutsche Telekom deployed an Operation Support System (OSS) frame for its Terastream network. NTT and Verizon ran pilot projects on their own data centers even though SDN is not closely related to their business.

On several occasions, including during panel discussions, participants agreed that four to six years would pass before carriers can deploy SDN for their services.

My comments: Carriers believe that SDN is likely to simplify network operation and maintenance and speed up service launches in the future. However, SDN still has a long way to go because the usage scenarios in the carrier industry are far more complicated than those in the data center and enterprise network markets.

Resources

Official website of ONS 2013:
http://www.opennetsummit.org/
The website is informative, including video clips of all speeches delivered at ONS 2012 and 2013.

- Opening speech by Vint Cerf
- Keynote speeches by HP and Intel
- Speech by Juniper
- Closing speech by Nick McKeown
- Final seminar

Key Takeaways

1. To compete with the successful OpenFlow and OpenStack solutions, major data center vendors established their own alliance (OpenDaylight) to provide offerings for use between northbound and southbound APIs. It is said that OpenDaylight is going to win over ONS participants and that ONS 2013 has reached its peak.

2. Bruce Davie, a Cisco, Nicira, and VMware fellow, reiterated that the key network problems lie in complicated traditional network architecture and slow innovation and that such problems can be resolved only by network virtualization, not SDN. His speech prompted both dissent and agreement.

3. The chairman of ONS made a short but interesting speech on the second day. In his view, vendors are merely re-labeling their existing technologies as SDN products by simply installing an SDN or OpenFlow interface on devices, which he called "SDN washing." He said that such attempts were dangerous, superficial, and shortsighted. These remarks, I believe, may have offended a great many vendors present.

4. OpenFlow has shifted its attention to functions beyond basic control, such as security and OAM.

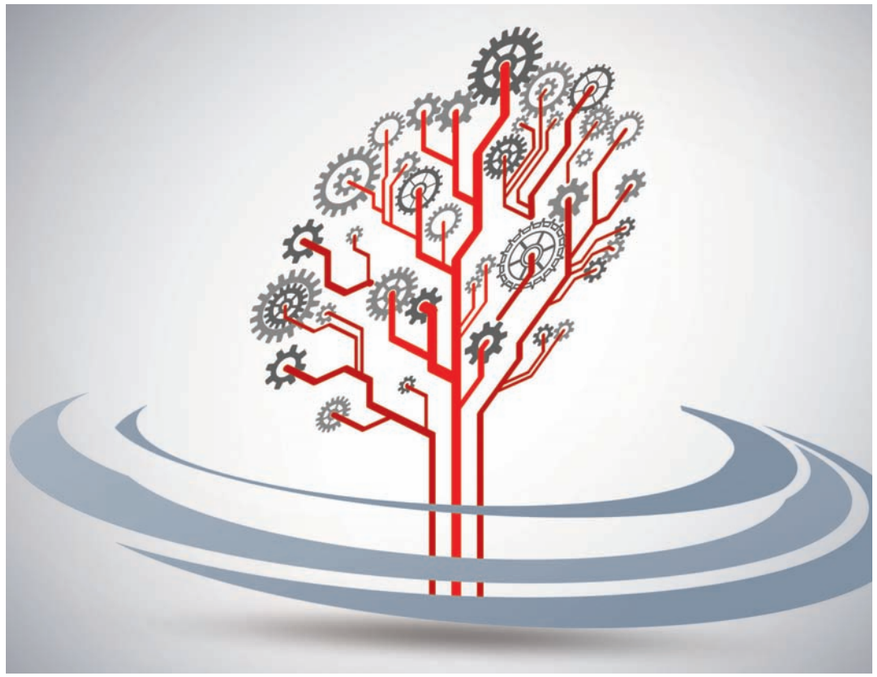
5. In terms of the development or research track, discussions focused on realities. For example, with centralized control, the algorithms for route convergence and link protection are much more complicated than those in the distributed mode.

6. Nick McKeown, who co-founded the ONS, discussed the next-generation SDN chip structure in his closing speech. He believes the next-generation SDN chip structure is nothing but a repackaging of the current chip, which can only deal with forwarding; far from a real Match/Action structure. He then introduced a new chip developed by TI and Stanford. ▲

IDC White Paper, Sponsored by Huawei

Driving Business Value with BYOD

By *Ian Song, Research Manager, IDC's Asia/Pacific Client Devices team*



Ian Song

Ian is responsible for the development of the region's Client Virtualization program, and is also involved in building IDC's Enterprise Mobility research. His coverage includes the next generation workspace as well as emerging technologies and trends such as the consumerization of IT.

IDC believes that BYOD platform approaches are designed to grow with the organization as needs evolve. Organizations need to consider scalability, flexibility, and multi-faceted security systems that incorporate devices, networks, content, and usage patterns.>>

IDC Opinion

The rise of Bring Your Own Device (BYOD) is a challenge for IT departments that are losing their absolute control of the enterprise. IDC believes that BYOD is the new normal, here to stay, and with the potential to truly transform the way enterprises work in the coming years.

Instead of single-point solutions for specific issues, BYOD platform approaches are designed to grow with the organization as needs evolve. Organizations need to consider scalability, flexibility, and multi-faceted security systems that incorporate devices, networks, content, and usage patterns. Open ecosystems allow end-users to fully leverage their personal devices within the enterprise.

In This White Paper

Across Asia/Pacific, the number of employees who bring their personal mobile devices to the workplace is increasing. A recent IDC survey indicates that more than 90% of respondents have heard of, or have begun to manage BYOD.

This IDC White Paper is an in-depth exploration of BYOD and enterprise mobility, in which we discuss what they mean to organizations, plus an analysis of overall mobility market trends.

Unmanaged, unsecured devices in enterprise environments leave organizations vulnerable to breaches; while, at the same time, organizations that miss the opportunity to enable efficient mobile workforces face enormous strategic risks.

Situation Overview

1. What is BYOD

BYOD is the practice of employees utilizing their own personal devices to access privileged company resources such as corporate emails, data, databases and applications, as well as personal applications and data.

2. BYOD Trends in Asia/Pacific

According to IDC's BYOD survey, 93.3% of Asia respondents use personal smartphones in their companies, but only 13.5% report a formalized BYOD policy. One reason for having no BYOD support is that heterogeneous environments are complex, and, if not properly managed, dangerously unsecure. An important factor for organizations facing the BYOD challenge is to devise a well-designed, holistic strategy.

3. Different BYOD Platforms

There are three popular device platforms users tend to use: smartphone, tablet, and notebook PC. Each of the platforms exhibits different characteristics in user adoption and utilization. Key findings are as follows:

- Smartphone: Smartphones are small enough to be with users at all times, and powerful enough for basic work functions. According to a recent IDC survey, aside from making calls and sending text messages, BYOD users check email, calendar, browse the Web, and read documents, adding up to 36.7% of all activities on consumer smartphones. For more complex tasks like creating documents, accessing corporate apps, and attending meetings, utilization drops to 13.4%.
- Tablet: Tablets are often a viable replacement for PCs, and increasingly users are bringing their tablets to work. Typical tablet users perform standard tasks (check email/calendar, read documents, browse the Web), and in BYOD environments, accessing cloud-based services, social media, and attending virtual conferences.
- Notebook PC: BYOD users of PCs tend to be heavy-content creators. It is not surprising that IDC's survey results reveal that BYOD notebook users across Asia spend more time creating content when compared with smartphone and tablet users. IDC believes that notebooks trade-off less portability for increased productivity.

4. Benefits of BYOD

The core benefit of BYOD is that it is the perfect model to complement the shifting paradigm of work. For employees and organizations, a well-secured and managed BYOD model can deliver three categories of benefits:

- Operational Benefits: The results of well-deployed and supported mobile solutions will not only improve business operations but also raise employees' job satisfaction levels. The days when people were happy to sit behind their desks from 9 to 5 are over. It is up to IT departments to provide flexible work arrangements for both company-issued and employee-owned devices.
- Financial Benefits: Companies have a difficult time assessing the returns they get from their initial mobility investments for many reasons, including the difficulty of measuring soft benefits like productivity and the allocation of cost. However, once mobility solutions move beyond mobilizing the person to mobilizing the process, it is easier to quantify and measure the business impact. (e.g., sales conversion rates).
- Organizational Benefits: Consumerization has damaged the reputation of IT in many organizations. Now, users often have more powerful devices at home than in the office, and users view the IT department as restricting their productivity. A well-defined mobility strategy will align both IT and business objectives.

5. Challenges of BYOD

While security is certainly the biggest issue with enterprise BYOD, it certainly is not the only challenge. The bottom line is that managing consumer mobile devices is a complex problem to tackle; and there is no one point solution that can address the issue.

6. Managing BYOD

The following eight focus areas demonstrate the growing complexity of the enterprise mobility ecosystem. Organizations looking to properly manage BYOD in their environments would require various solutions from different vendors to address the need to mobilize their users and business processes.

- Defining Users: Just because every user in an enterprise can practice BYOD does not mean everyone in the enterprise should. Classifying users is the one of the first steps organizations take to allow or disallow BYOD access.
- Mobile Device Management (MDM): MDM technology has been fundamental to managing employee-owned devices. Recently, MDM solutions have evolved to consolidate the management and

According to IDC's BYOD survey, 93.3% of Asia respondents use personal smartphones in their companies, but only 13.5% report a formalized BYOD policy.>>

The enterprise mobility ecosystem is growing more complex. Organizations looking to properly manage BYOD in their environments would require various solutions from different vendors to address the need to mobilize their users and business processes.>>

security of multiple OS environments, and customers should expect solutions to better integrate with the organization's network infrastructure.

• Additional Security: Security may be policy-driven, device-driven, or both. Policies should actively educate users on what can and cannot be done on personal devices in the corporate environment. IT can install additional tools for monitoring or limiting device functions based on location and encryption level.

• Wireless LAN Access Control: With BYOD, this may mean acquiring new networking solutions designed to integrate with MDM solutions which ensure the right level of access is granted based on device type and user credential.

• Unified Communications and Collaboration: Employee productivity can be improved by integrating existing enterprise communications and collaboration solutions onto employees' personal devices, which will allow users to participate in virtual meetings and produce inputs regardless of user location.

• Secure Remote Access: BYOD users may not have the expertise to set up solutions like secure VPN on their mobile devices. Therefore, IT should leverage capabilities from MDM solutions or other sources to remotely configure end-user devices in order to minimize end-user complexity.

• Mobile Application and Content Management: Applications designed for mobile devices can drive additional productivity. Therefore, IT must look to solutions that manage and secure content delivery to employees' personal devices, often with support from third party Software Development Kits (SDKs).

• Virtualization: Virtual Desktop Infrastructures (VDIs) host multiple and unique desktop operating systems in the data center. This enables IT to centrally manage policies for end-user access to all corporate resources and applications.

IDC recommends companies right-size their infrastructure before implementing any specific software-based solutions. Infrastructure improvements ensure the scalable capacity to anticipate peak loads and minimize downtime. Vendors who address mobility infrastructure with converged, holistic solutions help customers contain costs and speed time to market.

7. Developing an Enterprise Mobility Framework

With the influx of consumerization and BYOD, corporate IT departments are opening normally secure infrastructures to support the trend. However, few organizations have the kind of mobility strategy that establishes access profiles based on role, or applications and content protection across their network.

2012 saw an explosive proliferation of MDM solutions, and 2013 is likely the year when companies will assess their current solutions and rewrite their mobility plans. Realizing that a reactive approach to BYOD will not support long-term objectives, companies are advised to take a methodical, structured approach and engage a wider audience of stakeholders to achieve a future-proof mobility strategy.

IDC has developed a three-phase framework for enterprise mobility on which organizations looking into making a strategic approach to mobility should focus.

Phase 1: Mobilizing the Person. Lay the groundwork for scalable mobility platforms to drive value creation into other parts of the business. In this phase, the challenges are mostly technical. Capital investments are high, and the ROI is not easily measured.

Phase 2: Mobilizing the Process. Sales staff can use mobile CRM applications to log client interactions, or businesses can directly measure client interactions and observe employee productivity. The challenges are twofold: First, the stakeholders may involve every line of business within an organization, and second, mobilizing the business process is technically complex.

Phase 3: Mobilizing the Channel. Payback for properly mobilizing the channel between an organization and its partners is a streamlined value chain for quicker market access and timely resolution of issues. Very much like Phase 2, but with greater organizational and technical complexities.

Future Outlook

Enterprise customers no longer seek pure-play solutions, such as MDM, to address their mobility requirements. Rather, customers require extensible, integrated platforms. Enterprise systems vendors have responded by building or acquiring MDM solutions as part of their mobility platform offerings. Hence, IDC believes the future of pure-play MDM vendors is limited.

For customers with solid BYOD strategies in place, 2013 is the year to aggressively drive more disruptive changes in their organizations, as new business models and work styles are enabled. Innovation in today's workplace is limited only by what partners and vendors can deliver.

Vendors are creating end-to-end solutions for next-generation productivity involving desktop and mobile applications support, with content and device management spanning infrastructure, virtualization, mobility, and end-point devices. Vendors that can streamline the delivery of next-generation workspace solutions will be favorably positioned in the market.

Essential Guidance

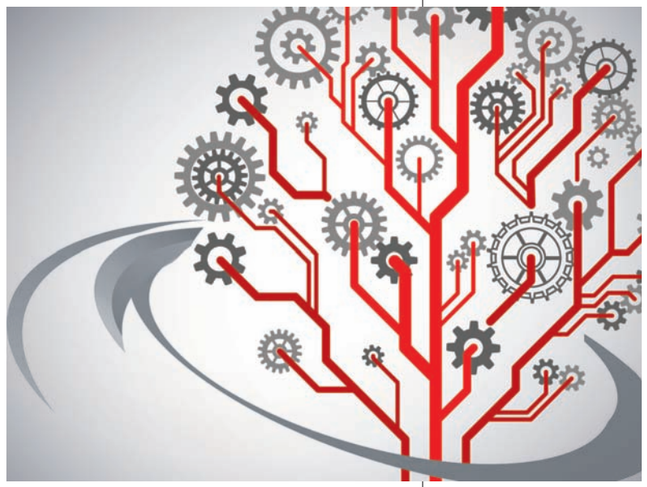
Many companies have taken the first step by launching BYOD initiatives supported by MDM, but the ongoing enterprise mobility needs are quickly outgrowing what MDM can address. IDC believes the days of the pure-play MDM solutions are at the end.

Approaching enterprise mobility requires the right mindset. IDC recommends that the following be considered by organizations:

• Be Strategic. IT must work with mobility solution stakeholders, including lines of business, security business units, and employees, to develop a thorough mobility strategy that includes detailed user profiles and solution road maps that should be aligned with both existing IT and business strategies.

• Be Secure. Extending applications and corporate data to a variety of mobile devices increases the risk of sensitive data being lost or stolen. Devices allowed onto the network must be subject to the same IT security policy requirements as connected devices to mitigate this risk.

• Be Selective. Hundreds of vendors claim to solve customer mobility challenges; however, it is vital that the vendor understand the business, integrates with existing technology, and provides a mobility platform that supports and extends future mobility deployments.



• Be Prepared. Future-proof mobility services, operating systems, and requiring an overall investment strategy to adapt and incorporate selected partners.

Ask yourself: What effect will mobility have on our business? How can mobility positively affect our organization? IDC suggests that organizations facing BYOD challenges first step back and view their mobility strategy as a value-creation challenge instead of a technical one.

Conclusion

Neither trend nor fad, BYOD decision-makers must plan for the fact that mobility and social media are driving new models of productivity. The theme for mobility today is intelligent transformation – perhaps the greatest technology transformation of our time. Rather than a threat, mobility is an opportunity to bring far-reaching improvements in the way organizations function.

For customers, the best partner on the mobility journey is one that shares a mutual vision and has the holistic hardware, software, and service capabilities to deliver a scalable and secure platform for the customers to grow with.▲

IDC suggests that organizations facing BYOD challenges first step back and view their mobility strategy as a value-creation challenge instead of a technical one.>>

Focus

Agile Network, Agile World

Huawei has launched the Agile S12700 Series, the industry's first Agile Network Architecture, SDN-ready switches.

- SDN is Redefining Our Networks
- Huawei Agile Network: A Solution for the Three Major Problems Facing Traditional Networking
- SDN Solution for Data Center Networks
- Manageable Data Center Internet on Wide Area Networks
- SDN: The Best Answer to Campus Network Challenges
- SDN: The Solution for More Intelligent Distributed Cloud Data Centers

SDN is Redefining Our Networks

By *Swift Liu, President of the Enterprise Networking Product Line,Huawei Enterprise Business Group*

Swift Liu

● *SDN – A Revolution Driven by and Responding to Customer Needs*

In data centers, SDN solves multi-tenancy problems created by frequent and rapid virtual machine migrations.

In wide area networks, SDN increases bandwidth utilization and resolves challenges that traditional routing algorithms cannot match.

In campus networks, SDN is inevitable thanks to increasing wide-area wireless coverage, mobile office, and Bring Your Own Device (BYOD). The management of security and QoS policies is expected to migrate to SDN in a similar way to how virtual machines are deployed in data centers.

● *SDN – An Opportunity to Transfer Value and Disrupt Traditional Industry Supply Chains*

SDN is turning ICT convergence into reality by further blurring the line between Communications Technology (CT) and Information Technology (IT).

It will take time to determine if SDN will extend the value of network equipment, or transfer value from network equipment to upper-layer applications. All but certain is that value will be transferred from Operating Expenditures (OPEX) to Capital Expenditures (CAPEX), and this move will drive down the Total Cost of Ownership (TCO).

SDN is creating opportunity through the supply chain of network equipment vendors, component manufacturers, and traditional IT equipment providers.

● *SDN – Changing Networks from Open Horizontally to Open Vertically, from Protocol-Driven to Programmable*

Traditional networks are open horizontally using standardized protocols, so neighboring Network Elements (NEs) connect seamlessly. Computers are open and standardized both horizontally and vertically, from bottom-level chips and components, drives, operating systems, and programming platforms, to top-level applications. These levels of horizontal and vertical integration make it easy for programmers to develop computer applications.

Compared with computers, networks are relatively closed and shapeless vertically, making it difficult to develop and deploy network-wide applications and services.

SDN makes the entire network open and programmable, both horizontally and vertically. These changes translate into higher accessibility and provide for more efficient utilization of network resources.

● *SDN – A New Challenge to Network Equipment*

The separation of forwarding from control as the defining feature of SDN networks first emerged more than a decade ago.

Today, owing to a combination of continuing technical transformations and the need to protect customer investments, programmability is necessary on both the control and forwarding planes.

Specifically on the forwarding plane of switch equipment, SDN is accelerating the replacement of traditional Application-Specific Integrated Circuits (ASICs) with fully programmable components. As SDN continues to evolve, programmable network components will continue to adapt.

With SDN, we redefine our networks! With SDN, we are building a brand new world! ▲

Huawei Agile Network: A Solution for the Three Major Problems Facing Traditional Networking

Ma Yun

By *Ma Yun, Vice President of Huawei Enterprise Networking Product Line*

Huawei Agile Network provides a highly adaptive network architecture that solves the three major problems facing traditional networking – lack of user-experience guarantees, inefficient service deployment, and slow adaptation to new services. Huawei Agile Network lays the foundation necessary to establish quality and efficient networks for customers.>>

Bottlenecks in Traditional Networking

The Internet is developing at a rate that outpaces all existing data networks in both speed and scale – except for perhaps the rate at which Internet service innovation is occurring. As the variety of real-time services continue to develop, including video and audio, cloud data center, and mobile services, bottlenecks can form that prevent traditional networks from delivering expected service quality. In this environment, traditional networks face three problems:

• Lack of user experience guarantees: Most IP networks are connectionless, providing only minimum bandwidth service quality. The lack of quality controls for delivered services results in situations that thwart user expectations for a quality experience and impacts customer relationships.

• Inefficient service deployment: In traditional networking, services and networks are deployed separately. Most networks are configured using commands or network management systems. These networks are essentially static and inefficient at deploying dynamic services that require timely adjustments. In extreme cases, these networks may even fail to support such services.

• Slow adaptation to new services: It may take years for traditional networks to upgrade features, adjust architectures, or introduce new devices to meet new service requirements. For example, the traditional Layer 2 VLAN mechanism of a cloud data center with virtual machines and virtual networks is required to run new bearer protocols on switches to meet scalability requirements; however, the physical devices involved cannot adapt to these requirements quickly enough. In this situation, software-defined virtual switches and Virtual Extensible Local Area Network/Network Virtualization Generic Routing Encapsulation (VXLAN/NVGRE) overlay networking can bypass the limitations of physical switches and still satisfy the scalability requirements of the network.

Over the years, many solutions have been proposed to solve the problems facing traditional networks. As is often the case, when one problem is solved, another one crops up. The nature of traditional networking determines the decoupling between networks and services (represented by IP and Ethernet services). Networks and services are transparent to each other. This decoupling mode enables rapid Internet service innovations, but creates a barrier between networks and services. The problems facing traditional networking cannot be solved without focusing on the fundamental design of network infrastructure.

SDN Industry Conundrums

SDN was proposed as the answer to problems with IP network architecture and to support future network growth. The scope of SDN, however, has constantly shifted since the original proposals. The characteristics of SDN technologies as understood by the networking industry can be summarized as follows:

• Centralized control architecture: An SDN characteristic first put forward by the Clean Slate project team, this architecture removes the control functions from IP network devices and moves them into a logically separate server, called the controller. In this architecture, network devices forward traffic based on the control data delivered by the controller. The controller requires no direct knowledge of the network architecture. The Open Network Foundation (ONF) currently sponsors this architecture and the control protocol is called OpenFlow. However, the IETF and some equipment vendors believe that traditional device control protocols, such as Network Configuration Protocol (NETCONF), Command Line Interface (CLI), Simple Network Management Protocol (SNMP), Path Computation Element Protocol (PCEP), and the latest, Internet Routing System (IRS), are already sufficient to meet the requirements for centralized control and this function should be inherited. An architecture that separates forwarding from control cannot be equated with OpenFlow because OpenFlow is merely a control option.

• Open network capabilities: This SDN characteristic provides additional benefits. The core concept involves packaging network capabilities into an operating-system-like controller. In this architecture, upper-layer applications and services obtain network capabilities through APIs at the controller, thereby closely integrating services and networks. There are currently two open network capability standards: a network-specific plug-in interface and Quantum API defined by OpenStack, and a device-specific OpenFlow interface defined by ONF. Because APIs defined in these two standards cannot apply to all network applications, equipment vendors have gradually developed their own APIs.

• Overlay and network function virtualization: Virtual network devices in data centers, such as vSwitch, vRouter, and vFirewall, can be regarded as virtualized server resources. The universal server virtual machine platform uses software to simulate traditional device functions, breaking through the limitations posed by Application-Specific Integrated Circuits (ASICs) used by traditional devices. As a result, the virtual machine platform can provide flexible device capabilities, facilitating new service deployment and management.

The preceding three characteristics, although all are called SDN characteristics, are loosely related and can be implemented separately. When discussing SDN, different organizations may focus only on a single SDN characteristic, which may explain why SDN is perceived as confusing and controversial.

Huawei Agile Network: Adapting Networks to Services

Huawei has launched the Agile S12700 Series, the industry's first Agile Network Architecture, SDN-ready switches. Huawei Agile Network provides a highly adaptive network architecture that

The scope of SDN has constantly shifted since the original proposals. The characteristics of SDN technologies as understood by the networking industry can be summarized as follows: Centralized control architecture, Open network capabilities, and Overlay and network function virtualization.>>

resolves the three major problems facing traditional networking – lack of user experience guarantees, inefficient service deployment, and slow adaptation to services. Furthermore, it lays the foundation necessary to establish quality-focused and efficient networks for customers. Huawei Agile Network architecture inherits the SDN industry's latest achievements as well as Huawei's extensive experience deploying efficient and high-quality networks over the past 20 years.

The Huawei Agile Network architecture consists of three layers: the device layer, the control layer, and the management orchestration layer. Physical Huawei devices and virtual machines running on the hypervisor (the virtual machine monitor) reside on the device layer. The controller resides on the control layer. The management orchestration layer controls the entire network to implement end-to-end service deployment. The three layers provide abstracted device, network, and service capabilities, respectively, through independent, open APIs that meet the programming needs of different user levels. Currently, three Huawei Agile Network-architecture-based solutions are available: Cloud Data Center, Efficient WAN, and Agile Campus.

To eliminate the problems facing traditional networking, Huawei Agile Network adds three new mechanisms to the centralized control, open network capabilities, and network function virtualization characteristics common to SDN: full programmability, a service-friendly architecture, and smooth evolution from traditional networks. These three new mechanisms enable Huawei Agile Network to quickly respond to cloud and mobile service deployments and to facilitate fast programming for new services as well. In addition, the new mechanisms allow Huawei Agile Network to quickly identify and locate factors affecting the user experience, enabling efficient fault location and prompt adjustments to ensure network quality.

• Fully Programmable Network: Software-Defined Flexibility with Hardware Performance

"Software-defined" mechanisms are at the core of SDN. These mechanisms enable networks to quickly and flexibly implement new service requirements and innovations. In practical terms, SDN's central control and open network capabilities cannot be applied to all existing networks. In the forwarding plane of physical devices, fixed ASICs cannot be reprogrammed, thereby limiting the deployment of future services. In response, Huawei has developed a low-cost, high-throughput programmable Ethernet Network Processor (ENP) chip to break the restrictions of fixed ASICs. vSwitches and vFirewalls in Overlay Mode provide device capabilities by means of server virtualization. The ENP chip enables the forwarding and control planes to be fully programmable. Huawei Agile switches maintain the high forwarding speeds of hardware switches and still provide software-defined flexibility, high performance, low power consumption, and low-cost switch forwarding.

> ***To eliminate the problems facing traditional networking, Huawei Agile Network adds three new mechanisms to the centralized control, open network capabilities, and network function virtualization characteristics common to SDN: full programmability, a service-friendly architecture, and smooth evolution from traditional networks.>>***

• Service-Friendly Architecture

In traditional networking, the separation of services from networks prevents basic mechanisms to guarantee a quality user experience. Continuous and discontinuous quality deterioration remain a constant headache. After years of research, Huawei has developed the Packet Conservation Algorithm for Internet (iPCA) technology to solve the user experience guarantee problem in IP networks. This technology provides a proactive quality detection mechanism for traditional networks, which enables real-time quality detection and prompt fault location. The inspiration behind this technology is packet detection and quality assurance. By globally ensuring the quality of each packet, the quality of the entire service is ensured. This technology differs from traditional connection-oriented quality detection technologies in that it preserves the advantages of connectionless IP networks while enabling the quality assurance measures previously only available in traditional connection-oriented (such as switch-based) environments.

The iPCA technology applies not only to IP networks, but also to other connectionless networks, such as Ethernet. This technology fundamentally improves the user experience and fault location efficiency of traditional networks.

• Smooth Evolution

SDN paints a bright future for networks, but there is still a long way to go before mature SDN technologies and architectures become practical for large-scale deployment. Can we enjoy the benefits

of SDN today while preparing existing networks for a smooth transition to comprehensive SDN architectures? Huawei's answer is "yes" – with the SDN strategy of "smooth evolution."

By leveraging its mature network technologies and architectures, including the newly-developed ENP chip and iPCA technologies, Huawei is already providing customers with many core SDN benefits, such as efficient and dynamic service deployment, quick adaptation to new services, and powerful user experience guarantees. What's more, transitioning to the SDN architecture of the future will require only a simple upgrade to device software. The separate controller architecture available today can easily be upgraded to Huawei Uni-Controller architecture in the future. With this controller architecture, Huawei can help customers build multi-tenant cloud data centers, provide efficient WAN link optimization solutions, and build agile campus networks centered on wireless, security, cloud, and video services without the wait.

• Adaptable Product Innovation

Huawei's smooth-evolution SDN architecture is the result of a handful of core innovations. The first innovation is agile switches. ENP chip technology enables switches to adapt to almost any future service or protocol, including potential OpenFlow upgrades.

The second innovation is the Huawei controller technology, which includes the Cloud Controller for data centers, Campus Controller for campus networks, and WAN Controller for WANs. These centralized controllers allow customers to enjoy the benefits of SDN without the commitment of a full SDN deployment. The Uni-Controller technology will be compatible with the three controllers and will also provide interfaces to OpenFlow and IRS architectures.

The third innovation is the Hybrid SDN architecture. This architecture allows physical devices to be managed by the SDN controller while maintaining traditional routing mechanisms and effectively eradicating the reliability and smooth evolution problems found with SDN controller deployments.

Huawei Agile Network is engineered to address the core necessities of network development and to eliminate the major network infrastructure problems facing traditional networks. The transition from reactive mode (adapting services to networks) to proactive mode (adapting networks to services) forms the foundation for building service-friendly networks. Huawei's ultimate goal is to help enterprise customers deploy the most modern, easy-to-use, and efficient communication technologies available for their networks.▲

> ***Huawei Agile Network is engineered to address the core necessities of network development and to eliminate the major network infrastructure problems facing traditional networks. Huawei's ultimate goal is to help enterprises deploy the most modern, easy-to-use, and efficient technologies available for their networks.>>***

SDN Solution for Data Center Networks

By *Jason Ning, Data Center Network Switch and Solution Planning Manager, Huawei Enterprise Business Group*

Jason Ning

Huawei SDN architecture for data center networks makes use of a cloud service-driven hierarchy, unified network virtualization, cloud experience optimization, and sustainable migration. SDN ensures data center networks can keep pace with IT development regardless of performance or features. >>

As cloud computing matures, more and more enterprises are moving services to cloud-computing platforms. What will next-generation data center networks look like?

SDN offers a new approach to resolving data center network issues. For example, the Open Networking Foundation (ONF) has defined the SDN OpenFlow communications protocol, which separates the forwarding plane from the control plane. IT vendors have proposed the concept of software overlay. Can SDN resolve core issues such as these for data center networks?

Core Data Center Network Issues

In recent years, data center networks have undergone the following major changes:

- Transition from 1 GE servers to 10 GE servers;
- Transition from high-density 10 GE convergence to high-density 40 GE or 100 GE convergence;
- Proposed use of optical switching backplanes;
- Emergence of vSwitch and disputes about the network border;
- Virtual machine migration and changing demands for rapid network policy migration;
- Virtualization using large Layer 2 networks and shifting demands for Transparent Interconnection of Lots of Links (TRILL), Shortest Path Bridging (SPB), and software overlay;
- Transition from Communications Technology (CT) solutions to Information Technology (IT) solutions;
- Transition from a traditional solution to an SDN solution.

These changes have been discussed in various forums and exchanges; however, many issues remain.

What issues and challenges must be dealt with before networks are capable of effectively supporting cloud services? Some important issues are under discussion: reducing network congestion, network virtualization, network experience, and network evolution.>>

These issues are broadly categorized as follows:

- Compartmentalization between the Network and the Cloud

There are two major aspects to this issue:

(1) Network design and deployment are not typically associated with services. Except for service security and reliability, data center networks are independently designed, procured, and deployed. However, computing, storage, and network resources must be integrated and orchestrated to instantly provide users with on-demand cloud computing services.

(2) Open Application Programming Interfaces (APIs) on networks are bottom-layer interfaces, which make it difficult for cloud-computing services to invoke these APIs to provide important functions.

- Key Barriers that Prevent Networks from Supporting Cloud-Computing Services

If experts agree that the essence of networks is connectivity, what connections are necessary for cloud services? What other issues and challenges must be dealt with before networks are capable of effectively supporting cloud services?

Here are a few important issues under discussion:

(1) Reducing network congestion. As the enterprises' own data volume and the horizontal traffic volume that comes with cloud computing increase, and servers' transition from 1 GE to 10 GE interfaces, data center networks must enable congestion-free switching to ensure consistent quality of services.

(2) Network virtualization. Cloud computing services necessitate the scheduling of network resources. Therefore, networks must support virtualization, especially for tenants' network resources, which include devices, Layer 2, Layer 3, and value-added services. Virtualization for resilient Layer 2 networks depends heavily on new devices and technologies, such as TRILL, SPB, Virtual Extensible LAN (VXLAN), and Network Virtualization using Generic Routing Encapsulation (NVGRE). These technologies, however, are immature and non-serialized due to their strong reliance on ASIC chips.

(3) Network experience. Traditional networks are characterized by best-effort and shared forwarding. Indeed, there is no guaranteed way to ensure end-to-end quality and effective fault location. In the cloud-computing era, enterprises are moving more services to cloud platforms, and device services are increasingly dependent on cloud center services. It is therefore essential to deploy networks with quality assurance and proactive fault location.

(4) Network evolution. A primary concern for enterprise customers is how best to migrate to SDN networks in a way that protects current network investments. Are there viable SDN solutions that interoperate with existing networks? Are current networks being built SDN-ready?

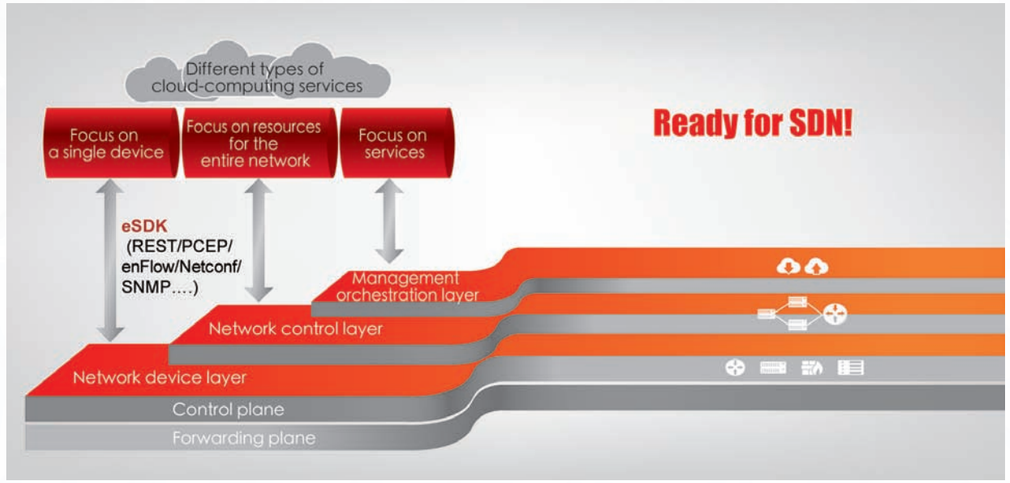
SDN Solution

To better resolve data center network issues, Huawei has been actively exploring SDN technologies and engaging in joint SDN innovation with partners. Collaborations include Tencent SRP (Sequoia Routing Protocol) and Microsoft NVGRE. Based on the strengths and practices of SDN, Huawei approaches data center network issues with these design innovations:

- Cloud Service-Driven Hierarchy

Different user types and services present a range of concerns and requirements centered on network services, resources, devices, and forwarding stream customization. In a cloud service-driven hierarchy, the SDN architecture is divided into the management orchestration layer, controller layer, and device layer. Every network layer is abstracted, and network capabilities at each layer (including device, resource, and service layers) are open.

User-facing interfaces are simplified so that users can select APIs in different layers for different service demands. The Huawei Enterprise Software Development Kit (eSDK) contains these APIs and uses RESTful, OpenFlow, and NETCONF as key interfaces to rapidly adapt platforms to service needs. Interfaces at the resource or service layers can be used – depending on actual situations – for cloud services and



> *The Huawei cloud service experience optimization function monitors and optimizes the user experience in real time. It can be deployed in conjunction with cloud services and network resources. This function provides service customization for users and enables unified management and control in real time.>>*

platforms, enabling the rapid provision of cloud services. The use of interfaces at these layers also eliminates the need to directly invoke device interfaces, which is generally quite complicated.

Huawei also proposes using agile switches by opening the forwarding plane to:

- Provide greater network programmability;
- Reduce the amount of time it takes to update hardware (closer to software update time) and gear networks towards the fast-changing needs of cloud computing;
- Provide a hierarchical and adaptable SDN architecture capable of facilitating rapid service innovations for users.

● Unified Network Virtualization

Network virtualization aims to classify, schedule, and expand network resources in a flexible structure. In Huawei's SDN unified network virtualization, Layer 2/3 connections and value-added services are centrally integrated and managed by an SDN controller. At the network layer, unified overlay technologies are used to integrate intra-Data Center (intra-DC), inter-DC, and DC access and to manage physical and virtual networks from a central location. The SDN controller schedules network resources from end-to-end to facilitate fast provisioning of cloud-computing services. Unified network virtualization greatly simplifies network architectures and bearer technologies while ensuring flexible access at the edge layer and high-performance forwarding at the core layer. Moreover, unified technologies eliminate complex networking conversions and make networks simpler to manage, more efficient, and more easily scaled. With unified differentiation and orchestration under an SDN controller, device interconnectivity is further enhanced to guarantee fast connectivity and orchestration among multiple data centers.

● Cloud Service Experience Optimization

The Huawei cloud service experience optimization function monitors and optimizes the user experience in real time. It can be deployed in conjunction with cloud services and network resources. This function provides service customization for users and enables unified management and control in real time. To meet end-to-end quality and O&M requirements for cloud services, the optimization function instantly identifies service quality issues and dynamically changes network operations through central controls. This function implements all these features immediately: identification of service quality issues, fault location, network recovery, and guaranteed service continuity.

Huawei's proprietary Packet Conservation Algorithm for Internet (iPCA) presents a fresh approach to monitoring service quality and locating faults. When a network is being deployed, iPCA enables the network to monitor service quality through real-time monitoring of packet loss ratios, delays, and jitter on service paths. This function does not require manual intervention. It instantly reschedules network resources to ensure a consistent end-to-end service experience and dynamically adjusts the network as required.

Huawei's service-centric SDN architecture will be implemented in phases:

- Local monitoring and local recovery;
- Global monitoring and local recovery;
- Global monitoring and global recovery.

Huawei has resolved global monitoring issues using iPCA, which can be applied to any network or service and provides reference information and suggestions for local recovery.

● Sustainable, Smooth Evolution

Smooth evolution focuses on making full use of existing networks. Huawei uses a cloud controller (data center SDN controller V1.0) to provide a virtual machine migration automation solution for data centers. The cloud controller centrally manages and controls existing physical and virtual networks and connects to mainstream controllers over open APIs, implementing automatic network policy migration. Huawei will continue development of the cloud controller through cooperation with strategic partners to provide comprehensive SDN solutions that address user demands while fully utilizing existing networks. This solution will allow users to benefit from SDN earlier than expected.

> *Huawei provides mature SDN solutions to help users unleash the full potential of existing networks and benefit from the advantages that SDN offers. Huawei also offers an smooth-evolution SDN architecture that aligns customers' newly-built networks with future SDN developments through regular software upgrades.>>*

Huawei will also launch agile switches with Protocol-Oblivious Forwarding (POF) to implement high-efficiency forwarding on SDN networks. POF frees forwarding devices from the need to support special protocols. By abstracting the controller and forwarding device interfaces to packet-forwarding instruction sets, forwarding devices are unaware of packet protocol types. All packet-forwarding functions are controlled by the controller's software. By specifying data offsets and lengths, the controller reads or writes packet data using generic instructions.

Decoupling software from hardware enables the forwarding and control planes to independently evolve, facilitating rapid service deployment without the need for hardware upgrades. In this way, Huawei's sustainable, smooth-evolution architecture actively protects user investments. Huawei provides mature SDN solutions to help users unleash the full potential of existing networks and benefit from the advantages that SDN offers. Huawei also offers an smooth-evolution SDN architecture that aligns customers' newly-built networks with future SDN developments through regular software upgrades.

Conclusion

Conventional wisdom indicates SDN will first be applied to cloud data center networks to handle key issues, such as compartmentalization between the network and the cloud, immature network virtualization, poor user experience, and barriers to network evolution. These issues prevent networks from supporting mature cloud services. An expert once commented: "Networks always lag behind."

Through joint innovation with partners, participation in standards organizations, and our own strengths in developing key technologies, Huawei has proposed the following SDN architecture for data center networks:

- Cloud service-driven hierarchy;
- Unified network virtualization;
- Cloud service experience optimization;
- Sustainable, smooth evolution.

SDN allows data center networks to keep pace with IT development regardless of performance or features by transitioning from closed to open networks, from hardware dependency to full programmability, from fragmented technologies to full quality assurance, and from complete overhaul to gradual evolution. Using our in-house programmable hardware platform and data center controller, Huawei SDN architecture implements key technologies such as iPCA and POF while making hybrid SDN available to existing networks. This ensures the system can perform instant monitoring, local traffic optimization, and rapid user service customization.

Huawei proposals include a gradual SDN evolution strategy that protects user investments by avoiding a complete network overhaul. With these innovative technologies, Huawei provides a stable, smooth-evolution SDN platform to usher users into the cloud computing era.▲

Manageable Data Center Internet on Wide Area Networks

By *Daniel Yu, Enterprise Networking Product Mgmt Dept, Huawei Enterprise Business Group*

Daniel Yu

Traffic control and network monitoring are the first steps for deploying SDN on the data center Internet. SDN controller technologies are the foundation for all-service-based traffic control and flexible schedule management developments that have followed.>>

Huge traffic increases in data centers require high-performance data processing, fueling the deployment of new data centers and the integration of small- and medium-sized data centers into centralized computing and storage resources. These new data centers have higher bandwidth requirements, more complicated Internet architectures, and require more complex service bearer management. Also, the "cloud" technique used for IT resource reintegration, distribution, and delivery extends to the construction of different enterprise data centers. Therefore, the problem of how to eliminate area differences, ensure service continuity, and simplify network monitoring becomes very important.

The technologies and protocols deployed in existing data center networks have been developed over the last 30 years where all network intelligence addressing switches or routers is governed by more than 6,000 protocols. New requirements are met with yet another protocol added to the stack. Understandably, the deployment of new services was a constant challenge. SDN resolves this issue by making networks directly programmable from a separate control plane. SDN-based solutions for controlling WAN traffic and simplifying network monitoring will have widespread application.

SDN deployments for data center networks have increased resource utilization, enabled greater traffic volume, and reduced operating expenses. The trade-off is an increased requirement for network monitoring to guarantee service stability.

The Huawei solution proposes full-path management and full-network optimization, rather than partial-FIB (Forwarding Information Base) path optimization, by using network virtualization on cloud platforms for complex, multi-tenant, multi-path networks. The proposed data center Internet is designed to solve the problems caused by high traffic volumes over complicated topologies. In terms of network monitoring, Huawei promotes the unification of quality metrics and fault location into service flows with the goal of implementing real-time monitoring and service quality reports. In turn, we expect to eliminate point-by-point service deployments, segment-by-segment monitoring, and simulated service measurements.

SDN Traffic Control on the Optical-Transmission-Based Data Center Internet

Most data centers using optical transmission will employ Automatically Switched Optical Network (ASON) devices. The ASON optical and electrical layers are most often separated; however, in configurations such as Shared Risk Link Group (SRLG) and distance, they are often dependent upon each other. If and when the two layers fail to communicate, tens of thousands of SRLGs must be manually configured at great expense and potential risk of error. This manual reservation operation is complicated and inflexible.

Path Computation Elements (PCEs) have been introduced to link the optical and electrical layers and calculate multi-layer end-to-end paths. PCE results deliver end-to-end path configurations to each transmission network element such that all devices on an optical network have received a single set of instructions. A PCE central controller provides standard User Network Interfaces (UNIs) to implement communication between Internet Protocol (IP) devices (i.e. routers) and optical networks. The Path Computation Element Protocol (PCEP) is used to communicate between the PCE central controller and the transmission network elements. PCEP is used to detect and report network resource status in real time, and delivers computation results.

SDN Traffic Control Implementation on the IP-Based Data Center Internet

An IP-based data center Internet uses Layer 2 or 3 networking, and will run a traditional IP signaling protocol, such as Border Gateway Protocol (BGP), Open Shortest Path First (OSPF), or Reservation Protocol-Traffic Engineering (RSVP-TE) over the control plane. Each network element uses its own IP FIB table to compute the shortest-path next hop in order to create a complete forwarding path. This path computation method is sub-optimal on networks with large numbers of service flows as the consumption of bandwidth for the forwarding path calculation leads to improper flow distribution with some links congested and others idle. Manual configurations, time-consuming and difficult, are not best choice for a quick resolution. As a result, deploying standalone computation elements becomes the only solution.

The Huawei solution substitutes stand-alone PCEs for traditional routing protocols. PCEs collects information for each network element in real time (i.e. delay, jitter, remaining bandwidth) and allow users to configure time periods, service attributes, and other parameters. The PCE then computes an optimal path using actual conditions. After path computation, the PCE uses the PCEP protocol to deliver the result to all other network elements. After a PCE is deployed, a network element's control plane only needs to receive control information from the PCE, so it will be able to concentrate on rapid and efficient data forwarding.

"The Huawei solution proposes full-path management and full-network optimization, rather than partial-FIB (Forwarding Information Base) -path optimization, by using network virtualization on cloud platforms for complex, multi-tenant, multi-path networks.>>

Service-Flow-Based Network Monitoring

Live networks currently use simulation tests to monitor and detect network quality. This method is implemented by deploying probes on each network element and advertising probe packets to the entire network, and is used to monitor single and specific packet types. For example, the Y.1731 technique is dedicated to Ethernet VLAN (Virtual Local Area Network) packets, RFC 6375 is dedicated to MPLS-TP packets, and RFC 6374 is dedicated to MPLS LSP packets. Therefore, the simulation test method does not apply to multipoint-to-multipoint or Equal-Cost Multipath (ECMP) scenarios – and, in many cases, is insufficient to provide accurate monitoring results or fails to monitor network quality. In addition, the simulation test method encounters many problems on hierarchical networks (such as L2 + L3) and cannot simultaneously monitor primary and backup links.

With ten years of experience in IP device development, Huawei proposes its proprietary Packet Conservation Algorithm for Internet (iPCA) technique. iPCA can implement proactive and real-time quality detection, as well as real-time fault locating. iPCA is capable of labeling, measuring, and collecting statistics on real service packets, thus preventing the accuracy issues found in simulation tests. iPCA also supports IP packets and can distinguish between different types of encapsulated packets and thus collect statistics on a specific type of service packet. These advantages enable iPCA to be applied to various tunnel encapsulation scenarios and networks. With iPCA enabled on a network, all devices on the network periodically report statistics to the central control unit, and all devices use the uniform packet format to report statistics. The central control unit can then calculate packet loss and jitter for the entire network instantly, improving fault isolation efficiency.

Using SDN to control traffic and monitor network quality is just the first step for deploying SDN on the data center Internet. The development of SDN and controller technologies acts as a foundation for the development of all-service-based traffic control and flexible traffic scheduling and management. ▲

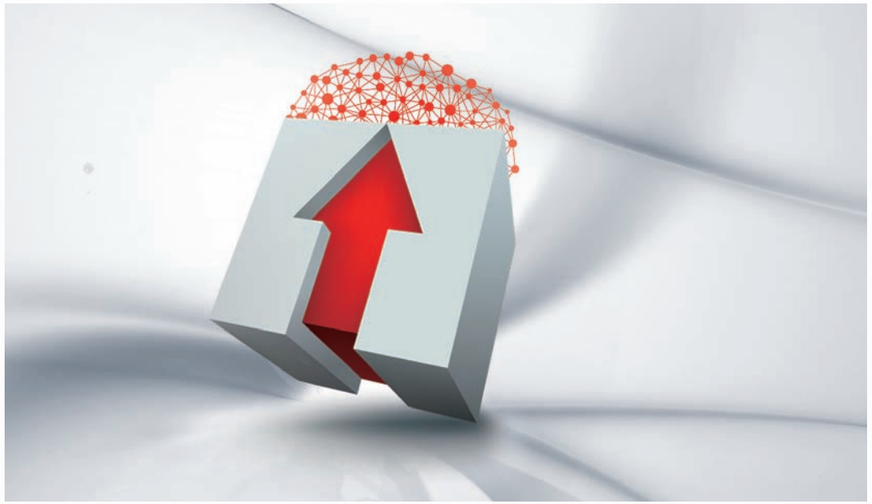
SDN: The Best Answer to Campus Network Challenges

By *Wang Lei, Director of Enterprise Networking Product Mgmt Dept, Huawei Enterprise Business Group*

Wang Lei

Based on Huawei's core programmable network technology and unified policy control, the company has launched two SDN solutions for campus networks: Programmable Hybrid SDN and Wireless and Wired Integrated Policy Control. These SDN solutions break the barriers to the smooth evolution to next-generation SDN campus networks.>>

SDN is generating a great deal of new activity in the data center field. Concepts, such as open APIs, unified O&M, and SDN-overlay have been introduced, and vendors are launching their own distinctive devices and solutions. In the WAN arena, Google and others are applying SDN to bandwidth optimization. Customer needs for SDN on campus networks are urgent because steep barriers for upgrading the functionality of traditional network solutions. At US$10B per year, the campus market is likely to become the most dynamic of all the SDN sectors.



Two Challenges Confronting Campus Networks

As more new services like telepresence, network storage, and Virtual Desktop Infrastructure (VDI) are added to traditional office networks, customers face two major quandaries in campus network services:

(1) How do customers avoid building separate physical networks for high reliability services with minimal jitter and delay? Is it possible to run all services on a single physical network and ensure service separation? How do customers build campus networks that offer compatibility with potential new services and avoid constant network upgrades?

(2) With the popularity of BYOD office capabilities on integrated wireless and wired networks, users must be identified by name, password, device, location, and time stamp. As the 802.11ac era unfolds, customers must be able to implement a unified control policy for wireless and wired forwarding at line speed.

SDN is widely accepted as a good way to resolve these dilemmas for campus network services. However, the ASIC-based SDN solution for campus networks has technical limits and is used only in small research networks rather than large-scale commercial deployments. Huawei Enterprise has years of experience in network deployment and has monitored the development trends of wireless and wired networks as well as virtual networks carrying multiple services.

Programmable Hybrid SDN Solution for Campus Networks

Hybrid SDN enables OpenFlow and traditional data and control planes to forward and control traffic from a single control application. Hybrid SDN has been confined to education and research environments, and is not ready for large-scale commercial use for the following reasons:

(1) By using either commercially available or internally developed ASIC chips, vendors have been able to implement OpenFlow flow tables that each contain thousands of flow table entries, yet millions of OpenFlow flow table entries are needed to achieve large-scale commercial deployment of reliable, separate virtual networks.

(2) ASIC-based hybrid SDN can forward traffic of known fixed types but has not been able to support value-added functions such as programming service identification and security encryption on OpenFlow pipelines. Additionally, ASIC-based hybrid SDN has not allowed identification of unknown traffic, forwarding of unknown traffic, or deployment of virtual networks.

Based on fifth-generation agile switches, Huawei next-generation hybrid SDN focuses on programmable campus networks that can be used for large-scale commercial deployment.

Programmable hybrid SDN has the following characteristics:

- Support for Hundreds or Thousands of Large-Sized Virtual Networks on One Campus Network

Using agile switches, Huawei next-generation hybrid SDN provides as many as 16 million OpenFlow flow table entries. This ensures tremendous traffic-forwarding capability and allows users to construct hundreds or thousands of large-sized virtual networks that are securely separated. The enormous number of flow table entries also means that a large number of virtual backup paths can be created on the virtual networks to load-balance traffic and ensure reliable paths.

- Programmable POF to Adapt to Any New Service Deployment, Protecting Customers' Long-Term Network Investments

Based on Huawei's proprietary agile switch and Protocol-Oblivious Forwarding (POF) technology, programmable hybrid SDN allows enterprises to define flexible policies on the control plane to identify new service packets and adapt new services to existing physical networks. This protects customers' long-term network investments.

"As more new services are added to traditional office networks, customers face two major quandaries in campus network services. >>

- Programmable Fault Detection for Service Traffic, Providing Detection and Location of Faults across the Entire Network

The agile switches can insert fault detection identifications into traffic flows across the entire network. The switches can also detect and locate faults according to all traffic flows or a limited number of specified flows. The switches can detect service deterioration and monitor faults on the entire network.

Applications of the Programmable Hybrid SDN Solution for Campus Networks

- High-Quality Virtual Campus Networks for Telepresence and Other Video Services

Telepresence and video services are key enterprise services because they are used in business meetings and receive direct attention from the leadership. At present, enterprises generally rent carrier links for their WANs and sign Service Level Agreements (SLAs) for support. However, the convergence of multiple routes, node congestion, and limited device capacities can lead to sudden packet losses on campus networks, which impairs video quality. To ensure telepresence service quality and minimize packet loss, Huawei constructs separate physical networks to the egress nodes of the campus network, bypassing the office network.

With agile switches, Huawei hybrid SDN can select links on the campus network with high bandwidth and reliability to meet the needs of telepresence and video services as well as switch low-priority services to other paths. In this way, a highly reliable virtual network for video services is implemented. Huawei hybrid SDN provides hardware-level Network Quality Assurance (NQA) fault detection along any specified paths and can adjust service paths immediately according to detection results, improving the video experience.

- Campus Network Virtualization that Automatically Adapts to Organizational Restructuring of Departments

To enhance security, enterprises usually divide campus networks according to departments or services. However, each adjustment in service separation and network restructuring involves thousands of configuration and policy changes, which is difficult to maintain

Based on fifth-generation agile switches, Huawei next-generation hybrid SDN has three characteristics: Support for huge virtual networks on one campus network, adapt to any new service deployment, and provide detection and location of faults cross the entire network.>>

and prone to errors. Take Neusoft's R&D operation as an example: Neusoft expected that its campus network could be divided flexibly according to development projects. However, Neusoft's IT department was not able to plan or control the establishment or completion of the development projects. As a result, the Virtual Local Area Network (VLAN) and Access Control List (ACL) configurations changed constantly, and the maintenance workload was huge. Huawei programmable hybrid SDN provided large-scale virtual network capabilities based on the Policy Center controller and agile switches. On the hybrid SDN, a large number of virtual networks can be added, deleted, or modified in batches, improving Operations and Maintenance (O&M) efficiency and meeting customer needs for flexible service separation.

• iPCA for Fault Detection and Service Statistics Collection across the Entire Network

Today's IP-based enterprise campus networks carry multiple services, such as video, voice, data, and VPNs. With customers increasingly reliant on real-time services, fault detection for packet loss, delay, and jitter demands more sophisticated measures. Traditional detection methods, such as Y.1731, implement fault detection by inserting test packets into service traffic to simulate services, which affects existing services and can lead to errors in test results. As a result, traditional detection methods are ill-suited for campus networks.

The Huawei programmable hybrid SDN provides Packet Conservation Algorithm for Internet (iPCA), which detects real-time service performance, based on the programmed network state. iPCA directly identifies and measures real-time service packets and inserts detection identification into service flows. The measurement points are distributed among devices, while statistics are collected to carry out unified performance calculations. iPCA has the following advantages:

(1) Immediate measurement – iPCA does not simulate packets or affect existing services.

(2) Distributed architecture – with the decoupling of measurement and statistics collection.

(3) Periodic output of network indicators, such as packet loss and delay, using a network synchronization protocol.

Wireless and Wired Integration Policy Control

• Wireless-and-Wired Integrated High-Speed Networks

The "thin" Access Point (AP) solution is commonly used for wireless deployment on large- and medium-sized campus networks. With this solution, traffic from APs is aggregated through Control And Provisioning of Wireless Access Points (CAPWAP) tunnels to Access Controllers (ACs) in a centralized forwarding architecture. The result is that the ACs become a bottleneck on the wireless network. As WLAN technology progressed through 802.11a/b, 802.11n, and 802.11ac, wireless bandwidth grew from Mbits/s to Gbits/s. Over the same time frame, wireline bandwidth has increased to tens of Gbits/s. Overall, the AC bottleneck has become more severe, especially for services requiring identification.

Like Huawei's hybrid SDN solution, the company's wireless and wired integration policy control relies on fourth-generation programmable switches that integrate wireless AC forwarding, including CAPWAP tunnel termination, into traditional wireline forwarding by programming the forwarding plane. With this approach, the APs become extensions of the access interfaces on existing switches, and the AC traffic bottleneck is no longer an issue. Both wired and wireless services are integrated, processed, and forwarded along the same paths.

• Policy Center-Based Unified Policy Control, Automatic Deployment, and Simplified O&M

A prerequisite for large-scale mobile office deployments is the ability to implement sound security policies, such as visitor identification and access control, intelligent device type identification and access control, and access control between users.

Security policy control is the key to enterprise information security on networks for several reasons.

Unfortunately, distributed policy control points lead to complex management configurations. Integrating wireless and wired in the same network further complicates the situation. Access and aggregation switches on wired networks are potential policy control points. O&M engineers must set up multiple configurations, including user group policies and authentication parameters. For wireless users, the ACs are policy control points, which also increase the configuration workload. Currently, many enterprises prefer to deploy unified policy control points on the devices at the aggregation or core layer to simplify management and configurations. This approach completely opens the underlayer network to users. Unauthorized users can communicate with authorized users, increasing the potential for information leaks and malicious attacks. Staff mobility and network access of intelligent devices further expand security concerns. In the mobile office era, policy control will extend to large numbers of access devices, in turn making the policy management and network configuration increasingly complex.

Policy control is based on multiple attributes. At present, most enterprise policy control is based on user identification and department. Mobility requires further diversification. For example, users have different access authorizations for desktop computers, tablets, and laptops in both wired and wireless networks. User access is controlled by time and identification. A similar variety of attributes should be considered when customers are planning their security policy controls.

Huawei wireless and wired integration uses a unified Policy Center to automatically detect multiple user attributes and deliver fine-grained control. User access is applied at agile switches. This feature allows the integration of scattered policy control points, such as between switches and ACs. Further, the integrated control points can be associated with access switches based on the wireless AP/AC centralized management mode. The policies are delivered to the access switches only, which substantially reduces the number of policy control points and O&M workload.

SDN Vision for Campus Networks

Huawei hybrid SDN for campus networks is based on fifth-generation agile switches to make network resource usage more flexible than ever. This solution overcomes the challenges brought by new services. The deployment of programmable hybrid SDN will integrate core enterprise services, bringing an end to the coexistence of multiple, traditional networks.▲

Huawei wireless and wired integration uses a unified Policy Center to automatically detect multiple user attributes and deliver fine-grained control. User access is applied at agile switches. >>

SDN: The Solution for More Intelligent Distributed Cloud Data Centers

By *Sam Tang, Data Center Product Management Dept, Huawei IT Product Line*

Sam Tang

Traditional data centers, with predesigned network architecture and devices, have high costs and low flexibility. In contrast, SDN-based distributed data centers can provide intelligent network services that are efficient and flexible, enhancing the SLA for upper-layer services in the data center.>>

Challenges of Multiple Data Centers

Enterprise IT applications are growing in complexity and are usually scattered across multiple data centers. To reduce costs and improve efficiency, enterprises use cloud computing to build data center infrastructure, which poses three challenges for enterprise Chief Information Officers (CIOs).

- Challenge 1: How can CIOs fulfill the Service Level Agreement (SLA) for applications deployed across data centers?

CIOs of large enterprises tend to have the following concerns: What is the best way to improve the availability and end-user experience of enterprise application systems? How can CIOs find the most suitable resources for deploying enterprise applications over hundreds of data centers housing hundreds of thousands of servers on interwoven networks? How can enterprises launch Virtual Private Network (VPN) services as quickly as possible? What is the best way to quickly add or remove devices while ensuring consistent service performance during peak hours?

- Challenge 2: How can CIOs manage virtual data centers?

As cloud-enabled internal data center resources are presented in matrix form, virtual data centers are showing up. How can CIOs best manage these virtual data centers?

- Challenge 3: What resources are needed for data centers to effectively support a cloud-computing platform architecture?

Gartner reported that over 50% of data center servers have been migrated to the cloud. On the large-scale cloud platform, dynamic Virtual Machine (VM) migration will occur frequently and on a larger scale across multiple data centers. What network solution can CIOs use to ensure high migration speed while avoiding service interruption? How can CIOs meet the requirement for large numbers of VLANs in multi-tenant scenarios?

SDN as the Best Option for Network Virtualization

There are two solutions in the industry for supporting cloud-computing platforms, but both are somewhat unsatisfactory.

First is the CT solution using TRansparent Interconnection of Lots of Links (TRILL) or Shortest Path Bridging (SPB), which is implemented by hardware. TRILL and SPB protocols change the control plane of switches and expand Layer 2 networks, allowing for large-scale migrations. However, this solution may be inapplicable for interoperability between multi-vendor devices. This solution usually applies to newly built data centers.

Second is the IT solution that uses software overlays to implement a Virtual eXtensible Local Area Network (VXLAN), which encapsulates Layer 2 networks into Layer 3. This solution supports flexible VM migrations and as many as 16,000,000 VLANs, but adds forwarding performance problems.

To fulfill the SLA for applications across multiple data centers and to manage virtual data centers effectively, an open and flexible network solution must be available to configure networks dynamically and rapidly, pool computing and storage resources, enhance application performance and the user experience, and manage resources flexibly.

SDN offers the best solution by separating the control plane from the data plane on traditional network devices. With all control functions on a central controller, SDN configures and manages various network devices through standardized interfaces. SDN is receiving much attention throughout the industry lately from carriers, Internet Service Providers (ISPs), and information technology, chip, and device vendors as well as startups, standards organizations, and consulting institutes. SDN is also being well received by users.

More Intelligent Distributed Cloud Data Centers

Traditional data centers, with predesigned network architecture and devices, have high costs and low flexibility. In contrast, SDN-based distributed data centers can provide intelligent network services that are efficient and flexible, which enhances the SLA for upper-layer services in data centers.

To reduce costs and improve efficiency, enterprises use cloud computing to build data center infrastructure, which poses three challenges: How to fulfill the SLA for applications deployed across data centers? How to manage virtual data centers? What resources are needed to effectively support a cloud-computing platform architecture?>>

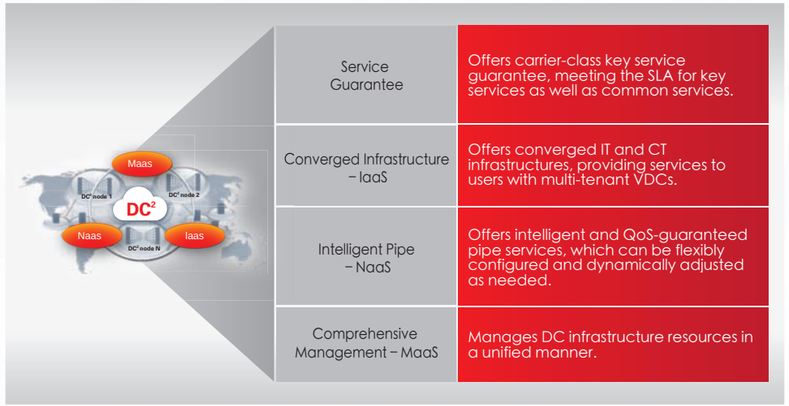
- On-demand dynamic network configuration provides rapid service platform deployment and shortened service launch time

Before deploying new services on traditional data centers, network planning must begin several months ahead of time. The data center must be statically preconfigured, and all devices configured sequentially. With this slow process, it takes about a month for a VPN service to finally be launched.

In contrast, SDN-based data centers are able to provide on-demand network services. As requested by customers, the system can dynamically re-configure the network as needed. As a result, SDN reduces the amount of time it takes to launch a VPN service from a month to less than an hour. With SDN, deploying enterprise applications in distributed data centers takes only days or hours rather than months.

- Dynamic Layer 3 network connectivity and intelligent detection of VM migration across data centers

In traditional data centers, VM migration requires manual reconfiguration of VM, Internet Protocol (IP),



Huawei DC² solution transforms traditional data centers into distributed cloud data centers, allows different data centers become virtualized into a single "logical resource pool." The result is an SLA-guaranteed virtual data center with uniform management, presentation, and operations.>>

and Media Access Control (MAC) addresses, which causes service interruption, greatly affecting enterprises as well as customers.

Here, SDN-based distributed data centers offer a big advantage. Before VMs are migrated across data centers, VXLANs are dynamically configured. After VMs are migrated, VM locations can be automatically detected and topologies automatically generated.

• Intelligent Routing, with Enhanced User Experience and Guaranteed SLA

Traditional data centers are not able to provide intelligent routing and dynamic bandwidth adjustment for services and therefore cannot satisfy user demands. SDN solutions, however, allow customers greater freedom to select bandwidth and routes with low delay, in compliance with SLA requirements.

• Flexible Networking Enables Rapid Virtual Data Center Build-Outs

SDN solutions allow for flexible networking, self-service applications for virtual data centers and on-demand virtual data center build-outs, making it possible for data center management to bond naturally with service and resource management. Service management is simplified as a result.

• Simple Network O&M for Higher Efficiency

The traditional data center network model requires expert planning and pre-configuration, and uses static topologies. In this model, all devices must be configured one after another, which is both time-consuming and tedious, in large part because devices from different vendors have different interfaces. In contrast, SDN only requires configuring the outer VLAN on switches; the SDN automatically handles all other configurations, reducing manual operations and minimizing errors.

Huawei DC²

Huawei Distributed Cloud Data Center (DC²) solution transforms traditional data centers that are dispersed, layered, and heterogeneous into distributed cloud data centers that are physically dispersed and logically centralized, with self-managed resources. This solution also allows data centers in different regions, at different phases of development, and different in scale to become virtualized into a single "logical resource pool" containing both physical and virtual resources from multiple data centers. The result is an SLA-guaranteed virtual data center with uniform management, presentation, and operations.

Huawei DC² solution offers the following advantages:

• SLA-centered: Huawei DC² solution offers computing, storage, networking, and security and fault tolerance services at different levels, meeting the SLA for priority services as well as common services.

• Infrastructure-as-a-Service (IaaS): With converged IT and CT infrastructures, virtual and physical resources as well as intra- and inter-DC networks are converged completely. Multi-tenant virtual data centers become available to provide services to users.

• Network-as-a-Service (NaaS): Huawei DC² solution provides automated services on end-to-end networks and Quality of Service (QoS)-guaranteed network services through intra- and inter-DC connectivity, bandwidth, access, and isolation. These network services can be flexibly configured and dynamically adjusted as needed.

• Management-as-a-Service (MaaS): Unified architectures and processes are provided to manage physical and virtual infrastructure resources, irrespective of where they are located and how they are administered.

SDN is the key to implementing NaaS in Huawei DC² by providing core control and scheduling over intelligent networks. With intra-DC and inter-DC controllers, Huawei DC² provides overlay, elastic, and programmable SDN intelligent network pipes for upper layers, as well as highly agile, automated, and reliable distributed data centers.

Using self-service management services provided by ManageOne (Huawei's cross-DC resource management and scheduling software), end users can apply for virtual data center services at different SLA levels. Designed to satisfy customer demands, ManageOne automatically invokes intra- and inter-DC controllers through the intelligent policy-scheduling center to configure and deploy resources.

• Intra-DC Controller

With virtualization software and physical equipment integrated, and physical and virtual resources (e.g. computing, storage, and networks) orchestrated, the intra-DC controller provides a range of capabilities, including data center resource management, service monitoring, automated resource deployment (including networks) inside data centers, and flexible resource expansion. The intra-DC controller also manages and controls networks and is integrated with the SDN controller for both virtual and physical networks. It uses overlay networking with TRILL-based large Layer 2 networks and SDN + VXLAN. Additional support includes automatic delivery and configuration of virtual networks in cloud-computing scenarios, network automation for QoS control and security policy customization, auto-sensing of VM migrations, and large, software-based Layer 2 firewalls, load balancers, and Virtual Service Gateways (VSGs).

The new economics for IT environments increasingly require intelligent data center networks. When building new data centers or revamping existing ones, enterprises should adopt a distributed data center solution capable of providing SLA-guaranteed virtual data centers and managing multiple data centers in a unified manner.>>

• Inter-DC Controller

The inter-DC controller provides a flexible and SLA-compliant interconnected network across data centers, including Multi-Protocol Label Switching (MPLS) networks and VPNs, and manages Wide Area Network (WAN) information such as reserved bandwidth, delay, and dynamic routing.

The new economics for IT environments increasingly require intelligent data center networks. When building new data centers or revamping existing ones, enterprises should adopt a distributed data center solution capable of providing SLA-guaranteed virtual data centers and managing multiple data centers in a unified manner. Our most successful enterprise customers are leveraging advanced SDN solutions to deliver intelligent and elastic network services. ▲

The Progression of Holography into Business

– An interview with Dr. V. Michael Bove, Jr. MIT Media Lab

Dr. V. Michael Bove

Dr. Bove holds an S.B.E.E., an S.M. in Visual Studies, and a Ph.D. in Media Technology, all from the Massachusetts Institute of Technology, where he is currently head of the Object-Based Media Group at the Media Laboratory.

The ultimate goal of holography is to make very rich communication systems. If we do it well, the human/computer interface disappears; this will change the mode of how we get the information, how we use the information, and how we share the information.>>

ICT Insights: You have long been involved in advanced multimedia and video conferencing. How is it that you got interested in working to commercialize holography?

Dr. Bove: Holography at the Media Lab began with the late Professor Stephen Benton, who invented the white light holograms used on credit cards. Up until the late 1980s, these had to be recorded photographically with lasers. Now, with advances in computer graphics computation, it is possible to generate holograms cost-effectively for many specialized purposes.

Steve's students did pioneering work in the late 1980s, and, in about 1989, they built a pioneering holographic video display. My group at the time was doing work in computation for advanced TV and ended up building specialized parallel computers to generate the holographic data they needed.

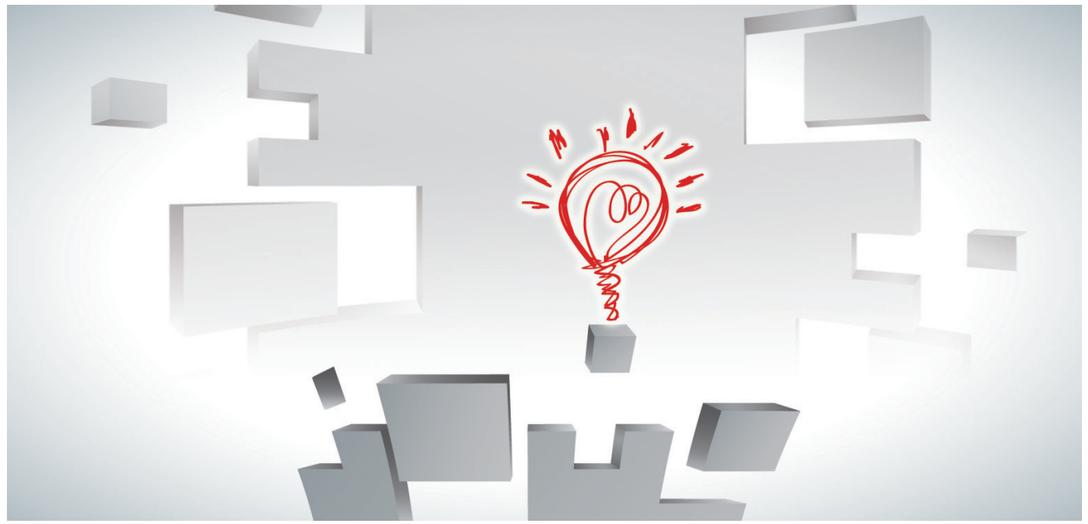
We continued collaborating on hardware and algorithms through the 1990s, in part because of the very strong cool factor associated with having a holography lab in the building. Unfortunately, Steve became ill and we ended up moving all of the electronic holography work into my group when Steve passed away.

Since then my group decided to try to do holographic video as a consumer technology. We wanted to build things to work with PCs and the kinds of Graphics Processing Units (GPUs) that NVIDIA was putting into PCs. We wanted to work with traditional software, like OpenGL. We wanted to be able to send the video over the Internet and to drive the cost to where a holographic video monitor plugged into your PC will cost $500.

It was almost ten years before we achieved our goal of advancing the science and art of synthetic holography. For instance, we are the first people to have generated holographic video with a Kinect camera.

On top of the coolness and the science fiction factors, there is also an interest in 3D imagery for entertainment, gaming, or for serious applications like scientific visualization, teleoperation, and telemanipulation. For each of these situations it's important to have 3D displays that don't require one to wear glasses. Second to have 3D displays that provide comfort: i.e. a surgeon shouldn't become fatigued from using a 3D display.

Further, it's important for maximum accuracy to have the ability to judge distances between two points – whether for manipulation or simply viewing complex data sets to assess relative distance in a three-dimensional volume. Holographic displays provide all of the visual cues to reality, unlike stereoscopic displays where your eyes are always focused on the distance to the screen.



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ICT Insights: You are working on Object-Based Media, what does that really mean?

Dr. Bove: In the early 1990s, when the group got that name, we were working on making communication systems that recognized the world in terms of objects not pixels. So, think about semantic video: It's important in a conferencing system for me to know which pixels are you and which pixels are the wall. Whether that's for interactive reasons or limited network bandwidth, I should be concentrating on the bits to make your face look natural and not about making the wallpaper behind you look good.

So we developed visual and audio systems that knew the difference between voice and noise, face and wallpaper, and allowed the creation of more efficient data transmission and richer interactions. We continued to work on self-aware systems that allowed us to do very interesting context-aware and interactive applications.

Along the way, we became interested in making the physical world smart and putting intelligence, interactivity, and context-awareness into things. And so, accidentally, the name "Object-Based Media" continued to be relevant with our new work as well, consequently we kept the name.

ICT Insights: What happens when self-aware content meets context-aware consumer electronics?

Dr. Bove: We are in a unique age right now. It was not so long ago that the computational power, connectivity, the amount of storage, and the kinds of interactions that were available to consumers were much less advanced than those available to industry or the military. Nowadays all of the really exciting stuff is happening in the consumer space and this shows up in a lot of different ways.

In terms of the context of self-aware content meeting context-aware electronics, what I'm really saying is you have a chain where the bits know something about themselves – they have rich metadata – and the electronics knows something about the environment and something about the users.

The ultimate goal is to make very rich communication systems. If we do it well, the human/computer interface disappears: I don't think I'm using a conferencing system, I just think I'm talking to you. I don't think I'm working with a computer program: I just have information in front of me and

I can reach in and push it around and change how I look at it and share it with other people.

ICT Insights: So there has to be still something that creates that holographic image, some equipment?

Dr. Bove: Certainly. There are electronics, software, and a huge amount of cloud services computation in the background. And, when done right, it's all invisible. A good analogy is typography: if you notice the typography in a book you won't enjoy reading the book, unless maybe you are a typographer. And I think of much of Human-Computer Interaction (HCI) as being similar to that: if you notice it, it's wrong.

ICT Insights: Can you describe to us the project with Joi Ito [Media Lab Director] holding a hologram meeting with people from a distance, and expand on why that might be better than current telepresence?

Dr. Bove: The first goal is to make you forget there's a telepresence system. You know, there aren't a bunch of black boxes at one side of the room that have a technician operating them but rather there's a person who is sitting in a chair on the other side of the room. Now he may actually be in a hotel room on another continent but, subconsciously, I think there's a person sitting in that chair.

So how did we make that happen? We created a telepresence system in the form factor of an office chair. The mechanism we used for doing that is very old: it's a magician's trick called a Pepper's Ghost that dates from somewhere between the mid-16th and the mid-19th centuries: If we take a half-silvered mirror and I put it at an angle such that you can't see the mirror but you can see what's reflected in it, we can make Joi be reflected in the mirror but you see him in the chair when he's really in a remote place.

And this is a technology that resurfaces every so often and it's most recently been used to reconstruct deceased hip-hoppers on stage and people call it a hologram: it's not. It's ancient and it's not even 3D, it's 2D. So the next thing that we did was create a 3D technology for electronic Pepper's Ghosts so we can make Joi appear in his chair as 3D. Now at the other end we can't just point a single camera at him: we have to point multiple cameras or a Kinect at him. But that's cheap and that's ubiquitous and I can go to Target and buy everything I need at the capture end.

Now Joi appears, as a 3D object sitting in his office chair and it's even more natural.

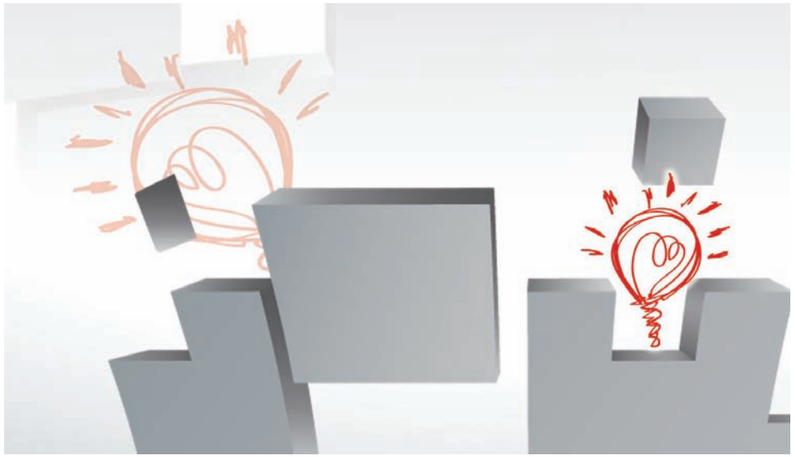
The goal of building a holographic display is to make an object appear not inside a box but have it appear in space. Now it's hard for marketers to get their minds around "the best product is the one that you don't see." You know, in the future if that's your business, instead of having a Huawei logo on something, you might have to have a little bug in the corner the way broadcasters do on TV channels so they know it's your system, because there will be nothing else visible. Or maybe you could have Joi have a Huawei T-shirt on when he's in the system – you know, a virtual T-shirt.

> **The goal of building a holographic display is to make an object appear not inside a box but have it appear in space. In the future instead of having a Huawei logo on something, you might have to have a little bug in the corner the way broadcasters do on TV channels so they know it's your system, because there will be nothing else visible.>>**

The next step is a collaborative distributed experience that's better than what we could have had in the meeting room. How do we do that? First of all, of course, we need to bring all the people together. The second thing is we need to have a system that recognizes their goals and their intentions, that brings in additional resources, maybe from the cloud, maybe locally, so that we can collaborate about something.

ICT Insights: Do you already have all the technology that you need to accomplish all of this and move to the next steps of making this happen?

Dr. Bove: We have the technology. There are pieces of the chain that might be missing, so we might not have all of the protocols we need to send these things efficiently over existing networks or we might not have certain pieces of software that need to be written. If one threw



enough money and enough people at it – of course that implies that you could come up with a business model – certain parts of this are just straight engineering at this point.

There are places where people are doing holographic video by brute force – if you can go take a room and fill it with Blade servers and do the computations for the arbitrarily large display and, yes, you need 10,000 watts of electricity to run it, and you can get huge quantities of the electro-optic hardware and make the display. So that's not going to be in your house any time soon...

Because we have decided we're trying to make these things with consumer-grade technology we have to use more finesse.

ICT Insights: So can you talk about the specific technologies that you use in your studies?

Dr. Bove: We use a huge range of technologies. On the input side, we use various combinations and types of range-sensing, machine-vision, gesture-recognition, and touch-sensing. We have a variety of algorithms for statistical pattern-recognition, machine learning, and so forth. We have a range of rendering algorithms just for working with images, doing interesting things with images, and turning image data into holograms in real-time. We have technologies for building holographic displays – we're actually making our own light-modulator chips on campus because we can't buy the kinds of chips we need for the display.

Some people would say that the whole interaction model is itself a technology. We have a variety of interaction models we work with, we build various kinds of sensors that we work with, and those sensors are rather unusual and show up in rather unusual form factors. For instance, we provided the basketball nets for the Slam Dunk Competition at the NBA All-Star game last year. Those nets were standard nets but they were able to measure the amount of energy in the ball dunked and transmit that to the system for the broadcast so it immediately showed the amount of energy behind the dunk.

It's an unusual form factor for a sensor, but it has the same characteristics of some of our other work. In that instance the sensor measures something and then makes it visible to a viewer – something they have not been able to see before. In the case of some of our context-aware work, we're figuring out what we can find out about a person or what we can find out about an environment unobtrusively, and then using that to make technology behave in a more useful, appropriate, or helpful way.▲

> **We have technologies for building holographic displays – we're actually making our own light-modulator chips on campus because we can't buy the kinds of chips we need for the display.>>**

A New Standard for Training in the ICT Era

By *Emilio Da Silva*

Convergence is happening and the world is getting more connected everyday. As this happens, new challenges in the consumer and enterprise marketplace have created an upheaval in the way ICT is managed.

Through the eyes of the CIO, new roles must be defined, and new skill sets must be identified and nurtured.

Emilio Da Silva
He is an independent ICT consultant and network engineer. He is Senior Editor at M.I.C. Gadget and IT Certification Master as well.

Successful ICT integrations require three things: A well designed solution, the appropriate equipment on which to operate the solution, and perhaps the most challenging, proper training to keep everything up and running.>>

ICT professionals understand that adapting to this new world of convergence and integration is key to competing successfully, both individually and corporately. Emerging technologies routinely break or blur barriers. A good example is Google; a service provider, but also a manufacturer and an open-source software provider. Or, Apple Computer; a manufacturer, but also a service provider of music, books, video, and a platform for advertising. Walmart is a brick and mortar retailer and a large on-line service provider.

ICT Convergence Brings Talent Challenges

Every industry will be touched by ICT and the Internet of Things (IoT); smart grid, intelligent transportation, digital media, and entertainment are all more complex and more interconnected than ever before.

Among the list of resources to be considered for investing in a modern ICT deployment are: cloud computing, virtual collaboration, big data, mobility, and BYOD.

Successful ICT integrations require three things: A well designed solution that leverages the combined technologies for the end-user, the appropriate equipment on which to operate the solution, and perhaps the most challenging, proper training to keep everything up and running.

Limitations of Training Certification

Revolutions in industry drive changes in knowledge and skills. Technical evolutions are propagated through industries with updated standards. The ICT industry as a whole is no different. Knowing this, is there a logical next step for changing the way that technical talent is tested and measured?

The current approach to training and certification is insufficient, and the solution requires custom, on-line courses that involve exercises with the exact equipment for which the certifications will be issued.

Vendors have little chance of their equipment being fully utilized if the technical talent charged with configuration and management are not appropriately trained or screened.

Re-thinking the Criteria for Evaluating Talent

A new way to train and measure talent must be created. It must cover the extent and depth previously mentioned, and show without doubt that an individual possesses the integrated knowledge required for proper execution on the job.

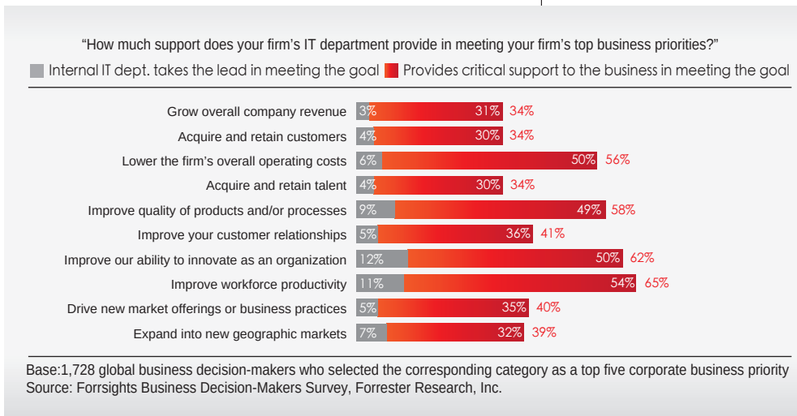
The principles for this new way of measuring talent must reflect the full convergence of the IT and communication industries: a "one platform, single-view" solution rather than today's mix of independent, isolated examinations. Maybe most critical is to train and test people on the latest equipment and technology. In a perfect world, the examinations would be customized to replicate specific enterprise environments.

A successful transition with the current "step" system of IT training will give CIOs the flexibility to determine the optimum environment for their own business needs. The goal is to make it easy to accurately measure individual skills across a wide variety of specializations.

There is never a simple answer for how to best to incentivize and retain the brightest talent. The value of nurturing diversity and minimizing turnover cannot be overstated. I feel that it is extremely important that opportunities for continued education and training are essential: diversity is highly valued by your staff, and the cost of turnover extremely high.

Retaining talent within an environment of continuous change is an everyday priority. Showing new talent that ongoing training is valued and expected creates a positive impact throughout the business culture that benefits organizations and individuals alike. Supplying test vouchers and textbooks as a component of the ICT budget goes a long way towards reinforcing this objective.

It is painful to see companies lose talent for lack of training. Positive training environments are crucial to the success of any enterprise in the ICT industry.



Base:1,728 global business decision-makers who selected the corresponding category as a top five corporate business priority
Source: Forrsights Business Decision-Makers Survey, Forrester Research, Inc.

Increased Decision-Making Efficiency of ICT

The responsibilities of the CIO in the era of ICT are increasingly complex. In addition to having a more direct influence on the leverage of key information assets for improving customer relations and reducing costs, modern CIOs must also nurture technical talents and minimize turnover. This is best achieved through improvement in the quality of in-house training. This is particularly important in the areas where multi-disciplinary skills are critical to maintaining optimal staffing, operating from a tailored knowledge base, to meet the unique requirements for the new generation of ICT technology.

Mastering Technology

ICT convergence is here to stay, and mastering a diverse technical range is the key to our survival. As this world leaps ahead at an unprecedented rate to the point where everything is connected, it is vitally important to stay abreast of the current trends and meet the challenge head on. The world is running forward, and it is our job to keep up. ▲

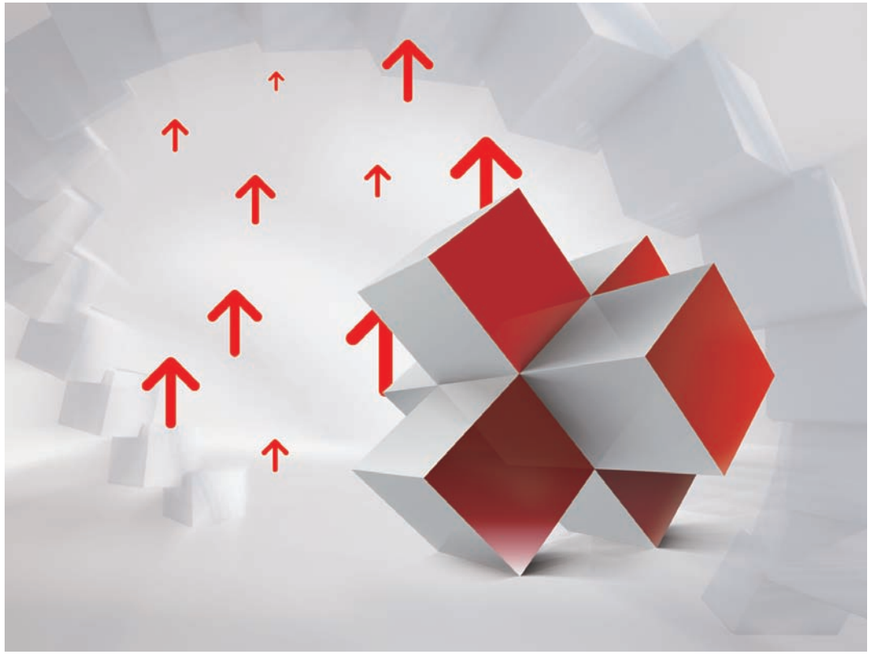
Modern CIOs must nurture technical talents and minimize turnover. This is best achieved through improvement in the quality of in-house training.>>

Case Study

Huawei Container DC: Innovation Begins at Home

By *Li Xuefeng*

A next-generation DC could be regarded as the ideal vessel for cloud computing. Huawei has deployed its desktop cloud container DC solution for in-house use; it has been recognized by the industry as one of the most reliable and capacious solutions of its kind.>>



A next-generation Data Center (DC) could be regarded as the ideal vessel for cloud computing. Huawei has deployed its desktop cloud container data center solution for in-house use; it now serves some 45,000 engineers, and has been recognized by the industry as one of the most reliable and capacious solutions of its kind, ushering in a new era of collaboration for the vendor.

Clouds Roll in at Huawei

Desktop cloud can help enterprises centralize IT resource management, enhance data security, reduce Total Cost of Ownership (TCO), and "ubiquitize" employee access. Huawei embarked on its cloud journey in 2009, with employees at its Shanghai research center the first to enjoy desktop cloud services such as cloud storage and collaboration via Huawei's self-developed thin client and cloud computing data center. Experiences in Shanghai proved promising, and this motivated the vendor to expand its cloud efforts in the container DC sphere.

Huawei Container Data Center

Huawei initiated a container DC project for desktop cloud at its Shenzhen headquarters in July 2012. This particular model (IDS1000) adopts tier-III+ (99.98%) availability in terms of planning and design and a 2N architectural design for the core system. The first phase of this project aimed to serve some 10,000 R&D personnel, with another 20,000 R&D personnel joining in for the second phase.

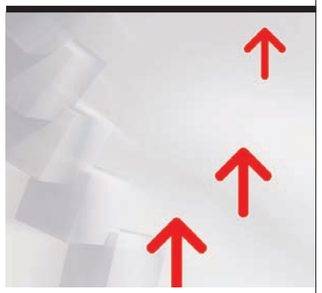
Rapid deployment – Huawei's IDS1000 container solution incorporates modularity into its very core. All components (power supply, refrigeration, IT, and control) are prefabricated and pre-engineered at the factory, with even the spare parts standardized, leading to a trim production cycle of less than two months. Engineers on site need only connect the cabinets to the local communications, power, and water, and this holds the installation time to under one week, with the time spent on construction overall reduced by 80% when compared to a more conventional solution, enabling even the fastest-growing enterprises to keep their storage ahead of the curve.

Power efficiency – Power consumption is a serious hindrance to data center expansion. In 2011, 400,000+ data centers in China accounted for 70 billion kilowatt hours of consumed power, roughly 1.5% of China's total for the year (Gartner). Cooling and heat dissipation are issues as well, especially in the warmer climes (i.e., most of the markets that are growing).

Huawei advocates the strategy of "Green Communications, Green Huawei, Green World" in its operations, products, solutions, and services. For the Shenzhen data center project, the Power Usage Effectiveness (PUE) limit was set at 1.4; this would be good in Iceland, but it's outstanding in a place where the average daytime temperature is above 27℃ (80°F) for roughly six months out of the year.

This savings is accomplished through the channeled separation of hot and cool airflows, made possible through the proper allocation of box and cabinet space. This channeling avoids the partial overheating that can happen when airflows mix. A highly-efficient water cooling solution is also adopted where air conditioning units are located at the near end of the container (closest to the server). Hot air from the servers is captured instantaneously from the source so that the distance between the cooling source and hot air circulation is greatly shortened. This method brings down the power consumption of a fan by around 50%, while the single cabinet power density shoots up to 9 kW.

Huawei's container data center enjoys a 15-year service life, and ensures continued operation in a rough and tumble world. It has been successfully applied in such industries as Telco, education, petroleum, medicine, and power, across Europe, Asia, Latin America, Africa, and the Middle East.>>



Safety & security – Huawei's container data centers are equipped with an air sampling system that enables both the detection and extinguishment of fires, while Huawei's NetEco monitoring system employs Secure Sockets Layer (SSL) technology for data transmission, providing 24-hour smart remote monitoring for each module; this improves management efficiency for the system, making for a nice reduction in O&M costs.

A Big Difference

Starting from scratch, both phases of Huawei's Shenzhen container data center project were completed in less than three months. The container solution reduced CAPEX by 70% when compared with a leased data center and by 28% versus a traditional self-deployed data center, while reducing OPEX by 27% compared with a conventional data center.

In December 2012, Huawei's container data center project won the Data Center Blueprints award (the Oscars of the DC industry) from Datacenter Dynamics, a great achievement for the Chinese vendor. The IDS1000 was also awarded tier-III certification in May 2013 by the Uptime Institute, the DC branch of market analysts The 451 Group.

Huawei's container data center enjoys a 15-year service life, and can work in temperatures from -40℃ to +55℃, while its IP55-certified dustproof and waterproof design, and special corrosion resistance, ensures continued operation in a rough and tumble world. The IDS1000 has been successfully applied in such industries as telco, education, petroleum, medicine, and power, across Europe, Asia, Latin America, Africa, and the Middle East. ▲

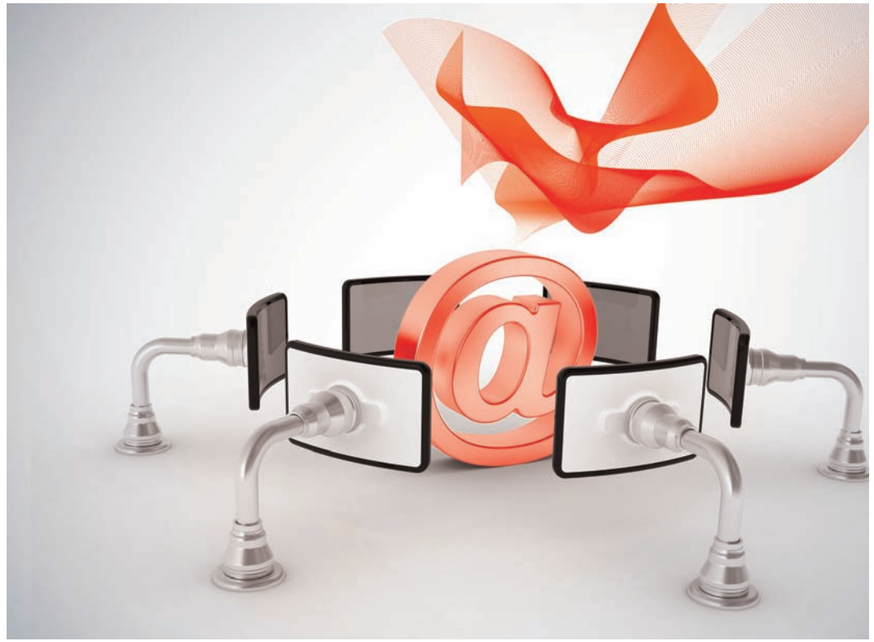
Case Study

EventCity Manchester Excels with Huawei 10 G Campus Network Solutions

EventCity has gained significant, measurable benefits by upgrading to Huawei's 10 G Campus Solution, with room to grow their business over the life of the network. As a result, EventCity's customers immediately noticed improved network accessibility during peak load activity.>>

EventCity Manchester is the leading event, exhibition, and conference venue in the North of England. Serving a regional population of approximately 6.8 million people, EventCity Manchester provides the second largest event space outside of London, and is the most dynamic and growing event brand in the UK. Established in 2010, the facility includes 4 halls totaling 36,000 square meters. Each year, EventCity Manchester hosts more than 45 events, including concerts, conferences, and exhibitions.

The management of EventCity Manchester realized early on that ICT, and specifically a scalable, reliable and fast local network, was key to customer satisfaction. For EventCity, the challenge was to build an infrastructure that would meet their current ICT requirements, while simultaneously being flexible and scalable enough to accommodate new technologies and challenges over the next 5 to 10 years. Therefore, in concert with their ICT partner, The Hub Group, EventCity chose to implement a modern and forward-thinking ICT environment that uses Huawei's 10 G campus network solution as its foundation.



Requirements: Ultra-Fast, Reliable, and Flexible Core Network

When EventCity opened in 2011, their business model was quite straightforward: provide the best exhibition services in the country. Initial efforts focused on creating a unique and versatile space with all the physical requirements for supporting major events. However, EventCity Manchester was not expected to grow so quickly (for example, winning the X-Factor Live Auditions Manchester), so the initial ICT infrastructure was soon oversubscribed. Prior to engaging with The Hub Group, the core ICT network was a mixture of ad hoc switches and routers from various vendors. However, it rapidly became apparent that in order to provide the services demanded by exhibitors and visitors, EventCity required an ultra-fast, reliable, and flexible core network.

Although the services required by EventCity's customers can vary depending on the type of show, there is a consistent demand for reliable, high-speed networking. Service requirements include high-speed Internet access, VPN access, online point-of-sale transactions, remote office access, video conferencing, CCTV, and IPTV.

Huawei's 10 G Campus Network Solution

The Hub Group analyzed EventCity's business model and their existing infrastructure and determined the following requirements for the new network:

- Bandwidth and scalability: EventCity Manchester required a network with capacity for a large number of simultaneous users, plus room for high-bandwidth applications such as video gaming and video.
- Support for BYOD: Each exhibitor and visitor to the exhibition site brings his or her own devices. Therefore, EventCity, acting as an ISP, must have strong BYOD policies in place.
- Resiliency, reliability, and high availability: The network must deliver high levels of uptime during events. The equipment must be built to survive the rugged environments of an active exhibition hall.
- Energy-saving network design: The specification requires that all power management savings can be passed onto the exhibitors.

EventCity and their parent company, The Peel Group, have enjoyed an active collaboration with The Hub Group, their local Huawei ICT partner, for their infrastructure upgrade. While this project initially focused on only EventCity Manchester, Peel understood that achieving their worldwide growth goals (in property, ports, media, hotels, advertising, renewable energy, etc.), they needed an innovative, flexible, and global ICT provider. The Hub Group recommended that Peel standardize on the Huawei's 10 G Campus Network Solution to achieve their economy of scale goals across the entire company.

The Huawei network deployed by EventCity Manchester consists of two Huawei S6700 24 EI Mainframe core switches, one Eudemon 200e-X3 AC Host Firewall with content manager license, six Huawei S5700 28c PWR EI Mainframe switches, and three Huawei S5700 52c PWR EI Mainframe switches.

Advantages: Significantly Increased Performance and Availability

EventCity gained significant advantages due to the increased performance and availability of Huawei's 10 G Campus Network upgrade.

The new network helps EventCity to attract major exhibitions that would have been impossible without the high-bandwidth provided by the 10 G Campus Network. An example of high-end network requirements faced by EventCity Manchester was the Play Expo video game exhibition, held in October 2012, with over 250 exhibitors that required ultra-fast/low latency connections for video game demos and contests.

Another key benefit, with the Huawei Eudemon firewall and content manager license in place, EventCity Manchester is now able to safely offer BYOD to its customers, while maintaining a secure Internet delivery environment to a large population of visitors.

Finally, Huawei offered a Total Cost of Ownership (TCO) that its competitors could not match. The Huawei 10 G solution was priced competitively with other vendors' 1 G network offerings, making the overall cost of the Huawei solution to be significantly less in price and complexity. ▲

Voice of the Customer

"At any point during an event at EventCity Manchester, we can have 14,000 visitors at the site, with up to 35,000 over a weekend. From the start, the Huawei network has provided a much better event experience for our customers, by allowing virtually all our attendees to log-on and use our services."
– Andy Orr, Managing Director, EventCity

Contributions and Feedback

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

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We look forward to hearing from you.