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HUAWEI

# Huawei Lays Foundation for Next-Gen Data Center Networks

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

Rapid technological advancements have fueled innovative developments of data center architectures in recent years. These advances are mainly shaped by the following four major trends:

First, the demands for high-performance devices are increasing rapidly. Servers are being upgraded to adopt 10 GE interfaces, and networks are under pressure to offer larger bandwidths.

Second, virtualization is a necessity in dealing with the massive shift to centralize data, especially when coupled with the multi-tenancy mode of public clouds. Two reasons are responsible for this trend: using virtual machines to migrate data boosts resource utilization, and virtualization technology is needed to separate multiple tenants and guarantee security.

Third, data centers are becoming increasingly convergent. Converging data centers can increase flexibility and boost the efficiency of resource utilization.

Fourth, as data centers support ever more tenants and servers grow in size, it is important to ensure that devices in the centers are easy to manage and maintain. SDN and OpenFlow technologies are a response to this need for flexibility and better administration.

In 2011, Huawei officially entered the enterprise market, which will be the main arena of ICT convergence over the next decade. Building on its success with the carrier industry, Huawei is well positioned to address the growing enterprise data center needs. In addition to providing state-of-the-art technologies (e.g. disaster recovery and optical transmission) and top-of-the-line products (e.g. switches and high-end routers), Huawei also has many relevant experiences to draw upon.

To accommodate the quantum leap of data centers and the aforementioned trends, Huawei launched its CloudEngine series core switches for data centers in May 2012. The flagship product – the CloudEngine12800 – supports 96 100 GE interfaces with full line-rate forwarding capability. A single CloudEngine12800 delivers a switching capacity of 48 T, the largest in the industry, and supports server interfaces evolution from the 1GE to 10 GE range and the 40 GE to 100 GE range.

By capitalizing on its comprehensive R&D strengths, engineering capabilities (e.g. chipsets, platforms, and integrated equipment), and open innovations in standards, Huawei will provide cost-effective products and professional services to best suit global customer needs. ▲


## Comment



## News



## Features



What is the SDN architecture, what problems does SDN solve, and how should vendors and customers prepare for SDN? >>



What comes after IP? And what kind of communications infrastructure does a post-Internet world need? The answers are surprising, and include a new architecture – Huawei's FICA. >>



NDN is part of a future-looking networking architecture. What problems in existing networks can be addressed with NDN? How does it work? >>



Huawei exhibited several firsts last fall at the GITEX2012 – one of the world's top three ICT conferences and the most influential exhibition in the Middle East. >>



What challenges are there across all industries in the Gulf area? What type of solutions do customers here need? Mr. Abdellatif explained ICT trends in the Middle East area. >>

## Ecosystem



## Focus



The overall goal is to make cloud computing networks congestion-free with self-recovery and Plug-and-Play (PnP) capabilities – a virtual black box that delivers open network services to embrace the requirements of rapidly evolving cloud computing services. >>







Huawei's next-gen data centers core switches possess outstanding advantages in scalability, virtualization, openness, sharing, and energy savings, positioning them as the perfect cloud computing service gears. >>



TRILL is designed to meet the increasing service requirements in the cloud era by offering efficient forwarding, loop prevention, rapid convergence, and ease of deployment. >>



Huawei's professional services cover all data center utilities, and can help enterprises improve energy efficiency, establish a positive sustainability image, and reduce OPEX. >>

## Success



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# Enterprise News and Announcements in Q3 2012

2012 Sept 18

The Huawei IT Solution Exhibition Tour and Channel Partner Recruitment were held in Beijing, where Huawei presented enterprises with storage, server, and virtualization platforms, as well as data center series solutions that offer advanced and efficient IT. Huawei also launched new distribution products, including RH2265/RH2268 servers and the S2200T storage array, which are designed to enhance the marketing performance of channel partners.

2012 Sept 18

Huawei attended the Ninth International Rail Transit Exhibition (Innotrans 2012) – the world's largest – and presented its innovative digital railway solution, GSM-R 5.0. With differentiated ICT products and solutions for railway customers, Huawei helps improve industry operational safety and work efficiency using the latest LTE technologies.

2012 Sept 17

Huawei brought its high-performance LTE broadband communications solution to the first Professional LTE Expo 2012, demonstrating its mobile broadband communications solutions specific to the fields of government, transportation, energy, and electric power. These solutions bolster the productivity and ICT development of enterprises.

2012 Sept 12

During a special banquet at the 2012 Tianjin Summer Davos Forum, Huawei demonstrated its high-end immersive telepresence product, adding a glimpse of science and technology to the Forum. At the banquet, Huawei demonstrated remote integrated live magic shows, giving guests a high-tech visual and audio feast with high-definition, smooth and immersive video and audio effects.

2012 Sept 5

Huawei and Intel jointly announced the signing of a cooperation agreement during HCC 2012, establishing a global strategic partnership for IT products and solutions. The agreement includes deepening R&D collaboration; building competitive products and solutions in servers, storage, data centers, and cloud computing; and carrying out market development and brand marketing activities.

2012 Sept 5

The Huawei Cloud Congress 2012 (HCC 2012) convened in Shanghai and attracted approximately 3,000 partners, customers, and industry insiders. With the theme "Make IT Simple, Make Business Agile", HCC 2012 aimed to seize development opportunities in the Cloud Era, identify development trends in the IT industry, work with partners to lead the way in innovation, and demonstrate the comprehensive achievements made by Huawei and its more than 400 partners in various fields – such as IT product layout, solution capabilities, industry chain depth, and business innovations.

2012 Sept 4

Huawei announced it would launch a compatible storage solution at the same time that Microsoft's latest operating system, Windows Server 2012, was introduced. This solution provides full support for such newly added functions as Offload Data Transfer (ODX), Server Message Block (SMB) 3.0, and thin provisioning, which combine to provide customers with a more satisfying user experience.

2012 Aug 17

Huawei launched the Enterprise Network Simulation Platform (eNSP), which is offered free of charge to ICT practitioners and individuals around the globe who are interested in acquiring or updating their ICT knowledge. This platform allows ICT practitioners and customers to quickly become acquainted with Huawei's router and switch series products, providing the ability to master operation and configuration of products and fault location methods. It also enables ICT practitioners and customers to improve their enterprise network planning, construction, and O&M capabilities for better quality and efficiency.

2012 Jul 28

Huawei launched the Online Support Center for Enterprise (Support-E), a new online service platform for customers, partners, and other individual learners. Support-E integrates the "Support" and "Training" sections from Huawei's enterprise service portal into an upgraded, comprehensive platform.

2012 Jul 12

Huawei launched its 10 GE campus network solution, next-generation WLAN products, and high-end S9700 series switches for the enterprise market, as well as Network Management System (NMS) products and a series of Operation and Maintenance (O&M) tools. Huawei also demonstrated its network infrastructure solutions for enterprises of varying sizes, and solutions with diverse services, such as solutions that handle telepresence O&M, desktop clouds, Network Admission Control (NAC), voice, and IPv6. Huawei offers a variety of products and solutions to help enterprises greatly to boost their IT-based capabilities and cope effectively with digital information overflow.

2012 Jul 10

Huawei held a Beijing product launch conference with the theme, "Simplify Your Business, Accelerate Your Success", as it introduced new unified storage and servers series. Huawei announced the global launch of four unified storage products (OceanStor T series) and four high-end servers (Tecal series) for enterprises. The OceanStor T series contains four product models: the OceanStor S2600T, the OceanStor S5500T, the OceanStor S5600T, and the OceanStor S5800T, offering such benefits as convergence, intelligence, and simplicity. They also provide customers with improved storage product options in the cloud era. The four high-end Tecal servers feature powerful performance and superior reliability, which help to improve metrics for key enterprise business applications. The line consists of the four-socket rack server RH2485 V2 and blade server BH640 V2 (based on Intel E5-4600), as well as the four-socket and eight-socket versions of its top-end server RH5885 V2 (based on the Intel E7-4800 and E7-8800).

2012 Jul 5

Huawei announced deployment of a smart grid, which is the first of its kind that uses TD-LTE technology, for China Southern Power Grid in Zhuhai City. The construction of this smart grid is an example of the comprehensive plan to implement smart grids throughout China. To address the need for automation of power distribution networks in Zhuhai City, Huawei's solution provides such advantages as powerful non-line-of-sight transmission capability; increased resistance to natural disasters; long transmission distance; and high bandwidth; without the need for ground-line structures.

2012 Jul 3

In Asia's first global cloud plugfest, the Huawei Universal Distributed Storage (UDS), a next-generation cloud storage system, successfully passed interoperability testing with the Cloud Data Management Interface (CDMI) Client/Server. The Huawei UDS also passed tests of interconnection verification with mainstream industry integrators. (CDMI, which is published by the Storage Networking Industry Association (SNIA), is the leading authoritative standard in the cloud storage field.)▲

# SDN: The Unstoppable Evolution in Networking?

## – An interview with Dan Pitt, Executive Director of the Open Networking Foundation

**Dan Pitt**

Dan Pitt is the executive director of the Open Network Foundation and is also president of Palo Alto Innovation Advisors, which advises entrepreneurs in Silicon Valley and Canada. He is also a past Dean of the school of engineering at Santa Clara University.

Software-Defined Networking (SDN) is becoming the new focus of the ICT industry. More and more ICT professionals have ensured that SDN will bring revolutionary changes to the traditional network architecture. Then what is the SDN architecture, what problems does SDN solve, and how should vendors and customers prepare for SDN? In An interview, Dan Pitt – Executive Director of the Open Networking Foundation (ONF) – answered these questions for us. The ONF was launched in 2011 by Deutsche Telekom, Facebook, Google, Microsoft, Verizon, and Yahoo to bring SDN to the market by standardizing OpenFlow and developing other aspects of SDN to meet the needs of the users. ONF is innovating in both the SDN technology and in how standards are created for the benefit of users.

*ICT Insights: Why do we need a new network paradigm like SDN?*

*Dan Pitt:* We have been operating on a 30-year-old network paradigm, where a networking switch or router has had to have the complete network intelligence in it governed by (up to 6000) distributed protocols. This has led to nearly every new organizational need being met with yet another protocol tacked onto the others, ultimately creating a "bucket of networking protocols" that takes years to work through standards committees and proprietary implementation environments. SDN makes networks directly programmable and thereby able to more flexibly meet operators' needs.

> ***SDN facilitates direct, real-time programming of network functionality by moving control functions into a network operating system, so programmability of a logically-centralized control plane is the essence of SDN. >>***

*ICT Insights: How do you define SDN? What is the SDN architecture?*

*Dan Pitt:* SDN facilitates direct, real-time programming of network functionality by taking the control functions out of the switching devices in the network and moving them into a logically separate control environment, called a network operating system, that runs on a garden-variety computer server that anyone can program. So control no longer resides solely in routers that only the manufacturer can program. Programmability of a logically-centralized control plane is the essence of SDN.

*ICT Insights: What is OpenFlow's role in SDN?*

*Dan Pitt:* OpenFlow is one of the three critical components of SDN. The first is the separation of forwarding from control, with forwarding becoming simply fast packet processing in network switches, and control becoming logically centralized in the network operating system as just described.

The second is the OpenFlow protocol, which conveys to the switches the forwarding tables they need to process the packets. (With traditional networking, the switches and routers had to determine this themselves, with all of the negative consequent cost, performance, and time-to-market implications. With SDN, the control software determines the paths according to how the operator wants to govern the network.)

*If separation of forwarding and control is 1, the OpenFlow protocol is 2, and the consistent, system-wide programming interface is 3, then SDN = 1 + 2 + 3. >>*

The third is the consistent, system-wide programming interface to the network operating system, which actually makes the network programmable, or software-defined. Without separating forwarding from control, nearly all the benefit of SDN is lost. With separation of forwarding and control but without OpenFlow, some other means of conveying the flow-table information to the switches is required. OpenFlow is the industry standard for doing so and is extremely general purpose.

If separation of forwarding and control is 1, the OpenFlow protocol is 2, and the consistent, system-wide programming interface is 3, then SDN = 1 + 2 + 3.

*ICT Insights: Why SDN? What problems does SDN solve?*

*Dan Pitt:* Primarily SDN solves the problems of network inflexibility, slowness in response to changing requirements, inability to be virtualized, and high costs. With the infrastructure the way it is now, operators aren't able to offer new services quickly because they must wait for vendors (and standards committees) to approve and incorporate new functions in proprietary operating environments.

With SDN, the operators can simply write their own software to determine network functions. SDN enables new initiatives through flexibility, agility, and virtualization. SDN allows network operators and enterprises to create and offer new services virtually anytime using ordinary software. By abstracting the networking functionality through OpenFlow's forwarding instruction set, networks can now be virtualized and treated by applications as logical resources.

Eliminating the need to tie applications to specific network details like ports and addresses makes it possible to evolve the network's physical aspects without the delay and cost of both rewriting the applications and manually configuring the network devices. The perpetuation of manual configuration through command-line interfaces has long held networking back from the advances in virtualization enjoyed by the computing world, and has led to high operating costs, long delays in updating networks to meet business needs, and the introduction of errors.

*ICT Insights: What are other benefits of SDN? Business? Economics?*

*Dan Pitt:* SDN is making networks programmable by ordinary programmers using ordinary software running on ordinary operating systems on ordinary servers. This opens the door to a huge market with vast customer choice for highly-customized solutions. The whole way the network behaves becomes based on open software, not on vendor-proprietary hardware and software to implement new features.

Moreover, some network features become vastly simpler to provide, such as multicast and load balancing. Topology restrictions (such as tree structures that inhibit the now-dominant east-west traffic in data centers) also disappear.

In general, the five biggest benefits of SDN are:

- It creates flexibility in how the network is used, operated, and sold.
- It promotes rapid service introduction, because network operators can implement the features they want in software they control, rather than having to wait for a vendor to put it in plan in their proprietary products.
- It lowers operating expenses and has fewer errors because of the reduction in manual configuration.
- It enables virtualization of the network and therefore the integration of the network with computing and storage so the entire IT operation can be governed more sleekly with a single set of tools.
- And it better aligns the network –

*With SDN, the operators can simply write their own software to determine network functions. SDN enables new initiatives through flexibility, agility, and virtualization. >>*

> ***ONF will continue to advance technical standards and architectural understanding to increase SDN's applicability, utility, and implementation. We are rapidly seeing OpenFlow capabilities being added to switch and router families and to network control and virtualization software products. >>***

and all of IT – with business objectives.

*ICT Insights: What progress has been made recently in paving the way for the acceptance of SDN? What are the biggest hurdles that remain, and what are the prospects for addressing them?*

*Dan Pitt:* In the last year, ONF has fostered implementation and deployment of OpenFlow-based SDN through the production of implementable standards, prototype demonstrations, interoperability experiments, plug fests, white papers, solution briefs, and tutorials. These have driven product announcements and releases involving vendors and operators.

OpenFlow-based SDN has already been applied to environments as diverse as hyper scale data centers, enterprise data centers, public and private cloud service providers, multi-tenant hosting facilities, logistics coordination, telecom networks, campus networks, circuit-switched networks, and optical networks. It is also being used for services ranging from network virtualization, security, and access control to load balancing, traffic engineering, address administration, and energy management.

Progress on the OpenFlow standard has included updating it to incorporate IPv6, extensible expression, tunnels and other features. The Foundation has also added standards covering switch configuration, interoperability testing, and conformance testing. ONF is exploring the architecture of the orchestration functions above OpenFlow that interface to applications, management systems, existing control planes and carrier services, and we are enabling OpenFlow to be used not just for switching Ethernet LANs but also optical, circuit, and wireless transport technologies.

Finally, we are making it easier for networks to exploit the performance benefits of hardware OpenFlow switches and for those deploying OpenFlow-based SDNs to easily introduce OpenFlow capability into the legacy networks in which they have significant investment. With so much of the OpenFlow technical foundation in place and now in development by vendors, we are starting to see the emergence of value-added elements that ride on OpenFlow. That is the benefit of our having made OpenFlow an industry standard.

*ICT Insights: What are the next steps for vendors?*

*Dan Pitt:* Next year, the market will see that networking is not only getting exciting again but is capable of driving tremendous business value, and vendors want to bring this value to their customers. We are rapidly seeing OpenFlow capabilities being added to switch and router families and to network control and virtualization software products. Others are hastening to produce L4-7 software-based virtual appliances that run over an OpenFlow substrate and replace purpose-built hardware appliances.

We will continue to advance technical standards and architectural understanding to increase applicability, utility, and implementation, and the next step for vendors is to translate these advances into announcements of prototypes, products, platforms and tools designed to facilitate rollout of SDN.

> ***I always encourage those who deploy or operate networks to take a three-step approach to SDN. First, ask your vendors for their SDN solutions; Second, try a trial deployment; Finally, consider joining ONF. >>***

*ICT Insights: What are the next steps for customers to prepare for SDN?*

*Dan Pitt:* I always encourage those who deploy or operate networks to take a three-step approach to SDN. First, ask your vendors for their SDN solutions and how closely they adhere to the OpenFlow standard and how well they interoperate with products from other suppliers.

Second, try to at least get your hands dirty with a trial deployment. Find out what works for you, what needs drive your interest, what products you want to procure and what software you want to write yourself, and what skills you need to upgrade or acquire. Determine if your adoption of SDN is primarily to save money or make money; this will determine how to approach upper management to fund larger and larger projects.

Finally, consider joining ONF to drive the technology in a way that best meets user needs. We particularly welcome users of the technology, and ONF is set up to give users a controlling role in what gets worked on and approved, and how. ▲

# What Comes After IP?

## – Reinventing Network Architecture for Future Generations

Guo Qiang Wang

***What comes after IP? And what kind of communications infrastructure does a post-Internet world need? The answers are surprising, and include a new architecture – Huawei's FICA. >>***

Guo Qiang ("GQ") Wang, principal technology architect for Huawei's U.S. corporate research, is part of a Huawei R&D team that is trying to answer the questions: What comes after IP? And what kind of communications infrastructure does a post-Internet world need? The answers are surprising, and include a new architecture – Huawei's Future Information-Centric Architecture (FICA) – designed for the evolving needs of billions of highly mobile, connected people and devices.

*ICT Insights: What are some of the problems that a new, post-Internet architecture would solve?*

*GQ Wang:* Our research is about architecture. Today, all of the traffic on the Internet is based on IP and knowing the IP address. And now, you always have to get the address from somewhere else. That's because when the Internet was created, people only had fixed computers, so everything was based on servers and the location of those servers, which didn't change. When someone wanted to send or receive content, they needed to know the IP address of a server.

Now, when you want a video from YouTube, it comes from an IP address of a YouTube host, and sends to an IP address of your host. If your service provider is AT&T, then you get the address from AT&T; if it's Huawei, you get it from Huawei. You have to go through Domain Name Service (DNS) or Dynamic Host Configuration Protocol (DHCP) to get these addresses. Everything depends on IP. You need someone to allocate an IP address for you, and you need something to translate it, too.

On top, you have many choices of applications. Underneath, you have so many choices for Layer 2 – Bluetooth, DSL, Ethernet, LTE, Wi-Fi, and many other options for access. In the middle, you have no choice. No choice at all, only IP.

People call that the "narrow waist" system. In IP networks, everything has to go through a narrow place, or "waist" – a server – with an IP address. This is not very efficient and you don't have a choice for the middle of the network.

Also, now we have mobile devices, and people have content they want to share and use on those devices. If I want to get a video from my friend's phone or laptop, I don't want to know where the device is. I just want to get the content from wherever it is stored, even if the device is moving around. There should not be a need for the content to always go through servers; we should be able to let our devices just talk to each other, without always needing to have servers in the middle.

> ***On top, you have many choices of applications. Underneath, you also have many choices for Layer 2 for access. But in the middle, you have no choice. No choice at all, only IP. >>***

*ICT Insights: How do you see architecture changing to meet new needs?*

*GQ Wang:* Two things determine the evolution of architecture: the things to be connected and the services provided through those connections.

Dr. Van Jacobson, a chief scientist at Palo Alto Research Center (PARC), described network evolution as taking place in three stages. Before IP, connections were through wires and switches – circuit centric. The goal of the network was to connect circuits based on location. Forty years ago, we moved from connecting circuits to connecting hosts with IP. It was more flexible, because at least you could move your device – not like moving your telephone wire, but you are still just connecting hosts. You're therefore host-centric, and you need the host's IP address.

But future networks will be "information-centric." People won't care where the information is stored, or where it is located, only about the information itself. They will only be concerned with "what," not "where."

That is a totally different view, and a totally different architecture from IP. If I want a YouTube video, I don't care where it is, whether it's stored on a YouTube server or on someone else's phone. I just want the information, the content, and all I have to supply is the content's name.

Forty years ago, nobody considered mobility or security. Nobody thought that there would be business models that depended on mobility or security, but now people need these things. Industry analysts recently predicted that there would be 50 - 100 billion connected devices by 2020. The information produced by those devices will be huge, producing a network traffic problem.

Plus, maybe 95 percent of those devices will be on the move, and that is the second challenge: the network will have to be dynamic. There will be lots of dynamic networks, such as networks centered on the human body – that maybe help monitor medical conditions – and networks in mobile platforms, such as cars. These are constantly moving, mobile networks. These networks will become new collectors of data, and someday, they will become data producers.

> ***Future networks will be "information-centric." People won't care where the information is stored, or where it is located, only about the information itself. They will only be concerned with "what," not "where." >>***

*Under FICA, all data will have context associated with it. Because FICA protocol can handle this contextualized information, the network will do a lot of things that networks can't do today. >>*

Large data centers like the ones we have today will become consumers of this data.

*ICT Insights: How will the new FICA that Huawei is developing be different?*

*GQ Wang:* Under FICA, all data will have context associated with it. It will include where the data is collected – maybe medical data generated at home or somewhere else. Another example of context is that in a small social circle, I might be willing to share a lot of data, but I don't want to share it outside of that circle. That named information would have the sharing context info embedded with it.

We think of this new protocol as a way to help different devices and networks to deliver, to store, and to share contextualized data. The context wouldn't rely on the IP address, but it would include device type, because different devices have different limitations on their data, for instance, resolution.

Say I have an interest in a video, I can send a request with that interest from my iPhone, and the network will realize that the video will be sent to my iPhone using the video encoding scheme that my iPhone uses. But if the interest comes from my iPad, the network would realize that it should send it using an iPad encoding. The interest can also include my location, because iPhones have a GPS, so the interest could express the fact that I sent the interest from my iPhone, from a Walmart. Then the network would know my location, and that my location is inside the Walmart. And it could even send me a message saying that there was a special at a nearby Chinese restaurant, because the phone knows that I like Chinese food. So the context can also carry social information. You can have a mash-up of YouTube and all of this other information.

Because our FICA protocol can handle this contextualized information, the network will do a lot of things that networks can't do today.

*ICT Insights: What are some of the advantages of this kind of architecture?*

*GQ Wang:* For one thing, an IP router doesn't store content. It just passes it along through the network. If 1,000 people want a video, and the video starts downloading the first person's copy, and then other requests come in at about the same time, under IP, that means you have 1,000 copies flowing on a link 1,000 times. That takes a lot of bandwidth, especially if requests are not thousands, but hundreds of thousands, or millions.

But with FICA, when more requests with an interest come in for the same video after the first guy sends an interest, before the first guy's request has been finished, the router will see that it just got an interest, it's downloading the content, and it can send the same video to all of them. Just one copy gets sent, but it goes to all of the people who showed the interest. It would be sent to a content router, where it could be stored temporarily and downloaded by all of the people with the interest.

*ICT Insights: Do you foresee, if we use this encoding scheme, we can use the current IP infrastructure for a while during the transition, but eventually evolve to a system that has a "contextualized waist," as you put it?*

*GQ Wang:* Yes, we have that capability. We call it the "IP Context Router." We can do that with regular IP, but with a little bit of multiplication in IP. We can add some context information in the IP header. We ask the IP packet to carry some extra context information, and then we can make smart routers that understand that information. They will store information, caching it, and they will process information. We will also add a service engine based on the context, and the router will understand what services are needed.

*ICT Insights: What about security?*

*GQ Wang:* Today's IP network secures the host-oriented "pipes". Instead, the design of the new architecture secures information chunks, which will be more secure than the current IP routers. For example, a data chunk with a signature will let receivers verify whether the data comes from a trusted party. The signed data can also be stored anywhere within the network. Again, the signature here is a context.

As a second example, think of distributed denial of service attacks, particularly as Malware attacks. We have an interest table that keeps track of the interests for some content, but if we keep seeing the same interest for the same piece of Malware, we can just depress it so it doesn't keep getting sent. Or if we see many interests coming from the same source, we would know that the attack is malicious and stop it.

That also puts the publishers back in control, gives them more security. If their content is on the network, they want protection. They can control who has the right to see their content, and they can verify the location of the request [from the context]. It is user empowerment.

But it is not today. Today's IP is a sender-centric protocol. Once I know your IP address, you can't stop me from dumping garbage into it. This architecture is receiver-centric. If I don't send an interest, nobody can send me data back, not anything. One interest, one data chunk. No interest, no data chunk.

*ICT Insights: So you can address the mobility, bandwidth, and security problems of the current IP networking that we now use, and you can evolve our networks over time by incorporating FICA protocols into routers and switches?*

*GQ Wang:* Yes, we can fix some of the problems with the old Internet architecture, by adding scalability, mobility, and security, but new generations need more than these. ▲

*We can fix some of the problems with the old Internet architecture, by adding scalability, mobility, and security, but new generations need more than these. >>*

Jun Wei

*NDN is part of a future-looking networking architecture. Then what problems in existing networks can be addressed with NDN? And how does it work? >>*

# The Future of Mobile Network Connectivity: Named Data Networks, Content Driven Networking

## – An Interview with Dr. Jun Wei, Huawei R&D, Santa Clara, California

To show the benefits of Future Information-Centric Architecture (FICA), Dr. Jun Wei recently demonstrated the new video conferencing system, which uses the Named Data Networks (NDN) protocol. NDN is part of a future-looking networking architecture. NDN can make networking architecture much more efficient. Because it separates the location and the content itself, so people can address the content directly by its name but not by the location. Then, what problems in existing networks can be addressed with NDN? How does it work? In an interview, Dr. Jun Wei answered these questions for us.

*ICT Insights:* What are some of the problems in existing conference systems that could be addressed with a new protocol?

*Jun Wei:* NDN is part of a future-looking networking architecture. The current networks just look at how to find a location, and then the networks find whatever content is there and get it back to the requestor. We have tons of research into how to design a network so that if all I know is the name of the content, I can get the content based on that information alone.

In the NDN protocol, we separate the location and the content itself, so you can address the content directly by its name. We do this because what people are actually looking for is usually the content itself, not the location, and NDN separates these two things and doesn't bind them together.

*ICT Insights: How would that approach change current conferencing systems?*

*Jun Wei:* In current conferencing systems, you usually have a bridge, which is essentially a server, and everyone connects to it, and the server redistributes content to the participants. The problem you have is that you get a lot of traffic concentrated towards the server, which isn't efficient. Also, you have a single point of failure, and if it goes down, the conference is over.

Also, you could have two people in California conferencing with each other, but the server is on the East Coast. It is not designed to be peer-to-peer, i.e. to let people who are close talk to each other without extra delay by going through a server.

With NDN and the FICA, we can eliminate the need to have a central server, which makes NDN a much more efficient architecture.

*NDN is part of a future-looking networking architecture, which separates the location and the content itself, so people can address the content directly by its name, and this will make networking architecture much more efficient. >>*

*ICT Insights: And how do you do that?*

*Jun Wei:* UCLA and NSF are also doing work on this under grants to work out the Future Internet Architecture. One approach is a completely distributed one, which is what UCLA is doing.

What is unique in our work in this area is that we have a hybrid system; to achieve this flexibility, we separate the control plane from the data plane.

*ICT Insights: How does that work?*

*Jun Wei:* Think about what you have in a typical conference. You have media, which is the audio or the video traffic, and you have controls, such as a moderator, or maybe rules that control who can enter the conference, who can speak, who can present slides or write on the white board, and whose turn it is.

We take the approach of extending the conference's server system by distributing the control among several different servers. So you can start with one server – and it might be far away, across the country, say – as more requests come in, other servers will join. Then these systems go with your request, so if

> *What is unique in our work is that we separate the control plane from the data plane in a hybrid system. So we can allow the control part to go through the server, but let the media traffic go peer-to-peer. This results in much greater efficiency, and the server isn't overtaxed.* >>

lots of people in one region join and have interests, then new servers that are closer to the participants can take the distributed load.

*ICT Insights: So in what sense is your approach a hybrid?*

*Jun Wei:* By hybrid, we mean the media traffic goes "server-less," while control traffic goes through server. When I started looking at this problem, there were already systems like ICQ and Multi-User Chat rooms, and they could already handle control. They have all that logic. So why reinvent the wheel?

I thought that I would like to use those controls. So I decided to connect just the control traffic to the server. This kind of traffic is usually much lighter than most media traffic, such as audio and video, which have much higher bandwidth requirements. So we can allow the control part to go through the server, but let the media traffic go peer-to-peer. This results in much greater efficiency, and the server isn't overtaxed.

*ICT Insights: That takes care of the control function. What about the content, or the data?*

*Jun Wei:* Remember that NDN means that we address content by its name, not by its IP address. I can say, "I want a video stream from Lisa", and this architecture can find it. I don't have to know your address, such as your building, or your city to get your video stream. I only need to say, "Give me the video content from Lisa", and this network can find it.

We only need to know the names, such as "Lisa's video stream" or "Lisa's audio stream", and we need to know that you will be talking in a particular meeting. That is what the control system will handle. Instead of saying, "Connect to Lisa's machine, which is here", we will just say, "Give me Lisa's content".

*ICT Insights: Why is that better?*

*Jun Wei:* For some things, you need

> *With FICA, you can easily get the popular content which has a lot of requests, and you can easily have conferences with hundreds or thousands of people. This system is one that can grow to meet the demands that are expanding as the number of networked people and machines becomes much larger.* >>

server control, and we can still do that. For instance, if it is a paid event, you want centralized control, because if someone hasn't paid, they shouldn't participate.

But what if your server dies? Usually, the way it's done today is that you have a backup server and switch to it. We extend this approach by adding new servers as people join the conference. We have a request-oriented system; if you want some content, you express an interest, and when the server hears the interest, the system starts distributing the load to places closer to where the users are expressing interests.

*ICT Insights: So your approach can grow organically as the network receives more requests with interest?*

*Jun Wei:* Yes, you could start a conference on the East Coast, and if the people who join and send interests are on the other coast, pretty soon most of the traffic will be distributed to servers closer to the place where the interests are registering. The control system can grow and expand where the interests are clustered, which is more efficient, and less prone to failure.

*ICT Insights: How is this different from mobile IP systems?*

*Jun Wei:* The primitives in IP networking need to know your location. With mobile IP, you get asked, "Tell me where you moved, and I will forward the packet". But then you move again, and your session can break. And today's networks also don't handle multicasts well, whereas FICA does. Today, if everyone wants to see the Olympics, the routers send the content to each person, which multiplies the network traffic by however many people want it. With FICA, popular content – which has a lot of requests – can be cached for a while, so lots of people can get the copy from cache.

This also addresses the problem that our current systems don't scale well. You can't easily have conferences with hundreds or thousands of people. But with this distributed architecture, you can support much larger groups.

We believe that this system is one that can grow to meet the demands that are expanding as the number of networked people and machines becomes much larger. And in this way, we can expand our networks to meet the demand, with an efficiency that supports worldwide networks. ▲


# GITEX 2012: Huawei Industry Focused Applications Stand Out Amongst Contenders

Huawei exhibited several firsts last fall at the Gulf Information Technology Exhibition (GITEX) 2012 – one of the world's top three ICT conferences and the most influential exhibition in the Middle East – including the world's first full-view telepresence system and the CloudEngine 12800 data center switch, which boasts the highest capacity in the industry. Huawei also presented its cloud data center solution, as well as high-end storage and server products, and met with IT and business professionals in the Middle East to discuss how to focus on present problems while anticipating future challenges in enterprise ICT development.






## Full Set of Industry-specific Applications Displayed

In recent years, industries such as finance, education, healthcare, and energy in the Middle East and North Africa have developed rapidly. During GITEX 2012, vendors demonstrated various ICT solutions for vertical industries based on the unique requirements of customers in the region. The displays for the industry-specific solutions – including telemedicine, mobile banking, video surveillance for the energy industry, and distance education – created lots of "buzz" during the event.


## BYOD and Cloud Computing Attract Wide Attention

Two topics garnered the lion's share of attention and were the focus of many product demonstrations, forums, and award ceremonies during the five-day exhibition: cloud computing and BYOD (Bring Your Own Device). Attendees enthusiastically discussed the significance of BYOD and the problems regarding its deployment, while also checking out various BYOD applications at the demonstration booths. As for cloud computing, people no longer merely engaged in conceptual and theoretical discussions as they had in previous shows, before cloud computing became something tangible. Instead, they discussed cloud call centers, desktop clouds, and hybrid clouds. All sorts of solutions and practical applications continue to emerge, indicating that cloud computing could become the next investment hot spot for the Middle Eastern enterprise market.


**Huawei at GITEX 2012**

① *Huawei showcased a series of industry-specific solutions for government, transportation, finance, and energy. These solutions drew great interest from customers.*

② *Huawei's CloudEngine 12800 Data Center Switch took the spotlight.*

③ *The first full-view telepresence system in the world was a popular attraction.*

④ *The "all-in-one" container data center solution was developed specifically for the Middle Eastern region.*

⑤ *Attendees flocked to the Huawei booth for channel partnering.*

⑥ *Huawei unveiled the cloud data center solution.*


⑦ *Huawei's customer won an important award during the event.*

# ICT in the Middle East

## – An Interview with Abdelrahman Abdellatif, Principal Consultant, Special Industries, Huawei Enterprise Middle East

What are the common challenges across all industries in the Gulf area? What type of vertical solutions do customers here need? How can we understand customers' needs in this area? During the GITEX2012, we have an interview with Abdelrahman Abdellatif. As principal consultant for Huawei Enterprise in the Middle East region, Mr. Abdellatif answered these questions and explained ICT trends in the area.

*ICT Insights: What type of vertical solutions do you see leading the industry in the Gulf area?*

*Mr. Abdellatif:* Here there are common challenges across all industries, including financial industry, energy, transportation, government, and telecom. These common challenges are mainly about business agility and how well business can quickly respond to market needs.

The second challenge is the global recession, so businesses are looking for a cost-effective solution when it comes to ICT. They're not just going for a cheap solution, but they are expecting to maximize the values of their IT infrastructure do more with less.

In addition, competition is very high, especially in the financial industry. There are many banks, so they have a challenge in coming up with innovative solutions that will add value in satisfying their customers, distinguish them from their competitors, and grow their customer base.

Another challenge is compliance with regulations, such as how we can bring in green ICT and how we can minimize risk in the financial industry.

And of course, security is always a big challenge across all industries, though specific needs vary from industry to industry.

All of this means, that when it comes to solutions, we have to add value; solutions should be business-driven rather than relying on technology alone. Middle Eastern business people need to see tangible benefits from these solutions.

Another important trend is the rise of government solutions: Here they are looking for ways to adopt

> ***Middle Eastern business people need to see tangible benefits from the ICT solutions. So solutions should be business-driven rather than relying on technology alone. >>***

**Abdelrahman Abdellatif**

As principal consultant for Huawei Enterprise in the Middle East region, Abdelrahman Abdellatif is taking charge of directing and positioning end-to-end ICT solutions in the vertical industries. He has more than two decades of IT experience and particularly focuses on the financial industry.

> ***SMBs have a big need for ICT solutions, because they believe that ICT solutions or infrastructure will effectively and rapidly help them to grow their business and enter new markets. >>***

e-government solutions and services in e-education, e-health, and e-city, which is actually part of the government's necessary services for the public.

We also see prospects for ICT in energy renewal. There are many oil and gas companies here who face an aging infrastructure, so they have to transform what they have. So, for instance in the energy sector, Huawei offers digital pipeline, digital oil field, and emergency command center solutions. There's also a big need for ICT infrastructure solutions in transportation, mainly for railway and metro; there is a huge project underway in Saudi Arabia and other GCC countries in the UAE, Qatar, and Bahrain, etc which is part of the Gulf Railway regional project which is supposed to connect all the GCC countries.

This is something new that most of the Gulf countries have initiated, and Huawei recently won a project in Abu Dhabi, which was for the first phase of an Etihad railway.

The power utility companies in this region are currently facing many challenges which include compliance with global regulations to generate and to distribute clean electric power, to modernize their legacy ICT infrastructure, to cut the operations and maintenance cost and to enhance the consumers satisfaction. This creates a lot of interest and necessity for smart grid solutions including Advanced Metering Infrastructure (AMI).

Also, the financial sector invests heavily in IT every year. We have a very good and competitive solution for the financial industry, banking mainly, called Virtual Mini Branch (VMB). Since more than one year we have been talking about this potential solution to our customers here in the region and most, if not all, of them are really excited and interested in adopting our solution.

*ICT Insights: What type of customers are interested in Huawei's solutions?*

*Mr. Abdellatif:* Many corporations, including us, major telecom operators, and most of our competitors have begun to realize the importance of Small & Medium enterprise Businesses (SMBs), because the SMB sector forms about 75 percent of all businesses in the countries in this region.

They have a big need for ICT solutions, because they believe that ICT solutions or infrastructure will effectively and rapidly help them to grow their business and enter new markets.

Also, most of the customers, including government, have islands of data and solutions. Now the trend is to go for a consolidated, centralized solution. Governments like those in UAE, Saudi Arabia, and Qatar want to centralize e-services through a common or central ICT infrastructure. Cloud computing, for instance, is a solution that has big potential to address the needs of this sector.

*ICT Insights: SMBs are actually relying on the government to provide those infrastructure services for them in this region?*

*Mr. Abdellatif:* Yes. Most SMBs need basic integrated and secure infrastructure when it comes to ICT, and we know their business model is very sensitive to cost. They can't afford to invest a lot in ICT from day one. So they expect a shared service model. Many telecom operators can really fill this gap by providing IT as a service to this sector. They've started approaching us about how they can really target that sector.

Some of the SMBs actually have a fast growth pace, but it slows them down if they have to acquire and deploy a new infrastructure themselves. But if there is a service provider who can provide that as a shared service, it doesn't take a long time at all and it will be a cost-effective service in line with their business model.

And they can walk away if they have an issue with their service or they can increase or shrink the acquired services inline with their business growth.

*ICT Insights: Is the telecom industry trying to provide new cloud services and SaaS services for SMBs?*

*Mr. Abdellatif:* Yeah. As the core business of the telecom operators is almost saturated through high competition and due to the convergence trends of IT & CT technologies the telecom operators are now trying their best to create new business lines and to come up with new business models in order to grow their business and align with the industry trends. So the telecom operators are now the leaders trying to offer effective cloud computing services. They offer voice, WAN outsourcing, data center & DR hosting, email services, managed IT services, website hosting, call center, and videoconferencing.

*ICT Insights: Did you see anything interesting or exciting at GITEX?*

*Mr. Abdellatif:* Last year, we were already talking about cloud computing, but many customers, mainly in financial industry, were concerned about adopting cloud computing solutions. This year, most of the solutions are already mature, and security and regulations issues have been mostly settled.

One big new trend in the ICT industry is video solutions. For example, video banking is already here. We can see video call centers going up, and that's something really very attractive and interesting for most industries.

Industries can come up with innovative video-based solutions, like remote advisor for the bank industry, the Virtual Mini Branch (VMB) from Huawei, similar to a video call center. These solutions will really contribute to the bottom line of the business and are end-to-end solutions from the user device to the backend systems.

I have also noticed that Bring-Your-Own Device (BYOD) solutions are gaining more interest.

> ***People in many industries look at technology as a black box, they don't focus much on the technical details. So the challenge is in understanding customers' needs and the common related industry challenges and accordingly positioning our solutions. >>***

*ICT Insights: Compared with our competitors, do you think Huawei's industry solutions have any advantage?*

*Mr. Abdellatif:* Although, we are a newcomer to the enterprise field, having entered it for only two or three years, we are really doing very well in the technology. As a global ICT solutions provider we have many competitive advantages including provisioning of converged end-to-end, being highly customizable and cost-effective, and an aggressive and innovative solutions and products roadmap. Furthermore our solutions span most, if not all, of the vertical business industries.

When we compare the specifications of our products and solutions to our competitors, we surpass them in many cases. For example, we now have the CloudEngine, which is the fastest data center switch fabric in the world. Such feedback comes from our customers and competitors alike.

But the challenge is in understanding our customers' needs and the common related industry challenges and accordingly positioning our solutions. We now know that people in many industries look at technology as a black box, without focusing much on the technical details. What they really want to see are the functional and business values of that solution – how to grow their business, how to secure it, be more competitive, and how to comply with regulations. That's where our focus has to be.

The other challenge is to increase the number of our partners and train them so they can position our products and solutions faster, as direct sales to customers is not really effective in the enterprise business; the most effective way is to work through partners. ▲

# Huawei Proudly Hosted the 20th Annual IEEE Hot Interconnects Symposium

*IEEE Hot Interconnects is the premier international forum for researchers and developers of state-of-the-art hardware and software architectures and implementations for interconnection networks of all scales, ranging from multi-core, on-chip interconnects to those within systems, clusters, and data centers. Leaders in industry and academia attend the conference to interact with individuals at the forefront of this field.*

*Huawei, an avid participant in more than 140 industry standards organizations and associations, was selected to host this event last August at its U.S. Enterprise headquarters in Santa Clara, California. Two days of technical sessions and one day of tutorials captivated the audience with the latest developments in industry and academia.*


## Network Acceleration: Ultra-high Performance Even at "Relaxed" Frequencies

*Several presentations focused on ways to accelerate ultra high-speed networks. An IBM team – Francois Abel, Christhoph Hagleitner, and Fabrice Verplanken – focused on Rx stack acceleration for 10 GbE integrated NICs, reporting performance results of 15 Mfps, 20 Gb/s at "relaxed" clock frequencies of 625 MHz, saving hundreds of CPU cycles per frame and reducing power consumption.*





## How Do Network Protocols Stack Up for HPC, Cloud Applications?

*What's the fastest network protocol for cloud computing and HPC? Jerome Vienne presented the results from a team at The Ohio State University's Network-Based Computing Laboratory. The researchers found that the latest InfiniBand FDR interconnects achieved the highest performance. On network-level evaluations and for HPC applications, RoCE 40 Gb Ethernet performance was better than IB QDR, but the reverse was true for cloud-computing middleware.*

## User Demands Never Change

*Some of the IEEE attendees had also been to the earliest Hot Interconnects, and mentioned that they were struck with how similar today's problems and solutions are to those faced by companies and technologists a generation ago – when attainable speeds and capacities were a small fraction of what they are today.*

*"Some things never change in the data center," a Huawei spokesman told the crowd. "First, no matter how fast the network is, it's never fast enough. Second, no matter how much you want predictable, static structure, it never happens because people are unpredictable."*

## Is the Network Moving into the Socket?

*In a well-attended panel discussion and debate over the proposition, "The network is moving into the socket," Mellanox Technologies' VP of market development Gilad Shainer argued that the panel was misnamed.*

*"It should have been 'The Socket is Moving Into the Network,'" he quipped, just before he quoted Sun Microsystems' former CEO Scott McNealy and his oft-repeated 1990s slogan, "The network is the computer."*

*Bay Storage Technology's Lloyd Dickman, on the other hand, took the position that integrating more capabilities onto single silicon die and supporting chip sets is a natural progression of technology. "We're already seeing this phenomenon in graphics, memory controllers, PCIe, and a host of other technologies," Dickman explained.*

For more information on the IEEE Hot Interconnect sessions and tutorials, please visit http://www.hoti.org/hoti20/program. ▲

# Approaches to Optimizing Network Infrastructures in the Cloud Era

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

Jason Ning

***The overall goal is to make cloud computing networks congestion-free with self-recovery and Plug-and-Play (PnP) capabilities – a virtual black box that delivers open network services to embrace the requirements of rapidly evolving cloud computing services. >>***

As emerging technologies and new business models drive cloud computing from the concept to pilot deployments, to the final phase of optimization, and to wide-spread practical application, thoughtful observers almost can't help but ask: What cloud-driven trends will we see over the next several years? And how can we make network infrastructure architecture choices that exploit the best aspects of those trends?

## Four Cloud Computing Trends

Answering these two crucial questions can help organizations move confidently from cloud pilot projects to full practical applications that create strategic business advantages. And understanding four emerging and continuing trends is the best way to make sound decisions about ICT infrastructure.

### • Trend 1: Ongoing IT architecture integration and optimization; migration to cloud computing platforms

Recently, many enterprises and government agencies have integrated and optimized their IT architectures, and these projects are now yielding returns. Huawei itself is an example. Not only does Huawei create ICT infrastructure, it is a major worldwide technology user, and Huawei is dedicated to promoting virtualization and desktop cloud applications, with hundreds of virtualized servers improving the reliability of service provisioning. More than 10,000 virtual desktops have been deployed successfully at Huawei's Shanghai Research Center alone. This initial deployment was later expanded to Huawei's headquarters in Shenzhen and to Huawei's research centers in Beijing and Xi'an.

Worldwide, enterprises are gradually migrating IT services to cloud computing platforms. A 2011 report by IDC Corp. revealed that about 80 percent of all new enterprise applications were developed on cloud computing platforms; in 2014, the cost of cloud-based services would account for 30 percent of enterprise spending on applications.

*Enterprise impact: IT architecture integration and virtualization is leading to an increase in server density and utilization. As a result, cloud computing networks must support high-performance devices and high-density ports.*

### • Trend 2: Increased cloud computing traffic and big data troves

An estimated 15 billion devices and 3 billion users will need Internet access by 2015. Analysts predict that the IP traffic processed through data centers worldwide will see an average growth rate of 33 percent annually, hitting 4.8 ZB by 2016. With the enormous expansion of Internet services – especially social networking and e-commerce – and the growing capacity of smart mobile devices, data transmitted over the Internet continues to swell.

Enterprise IT applications and the Internet of Things also stimulate the growth of enterprise data. According to IDC, global data reached 1.8 ZB in 2011; the number of storage servers around the world will increase ten-fold over the next decade; and the volume of data to be managed will increase fifty-fold.

Also, the lion's share of Big Data is unstructured, but it is exactly this form of data that will become a strategic asset for enterprises hoping to find new business opportunities. How to process and maintain this data cost effectively becomes a big challenge.

***Worldwide, enterprises are gradually migrating IT services to cloud computing platforms. A 2011 report by IDC Corp. revealed that about 80 percent of all new enterprise applications were developed on cloud computing platforms. >>***

*Enterprise impact: New tools, such as the cost-effective Hadoop architecture, are required to process Big Data troves. Any assessment of the Hadoop architecture reveals a need for the network to offer higher bandwidth, higher reliability, sufficient cache space, and higher signal priority.*

### • Trend 3: Servers are transitioning from GE to 10 GE

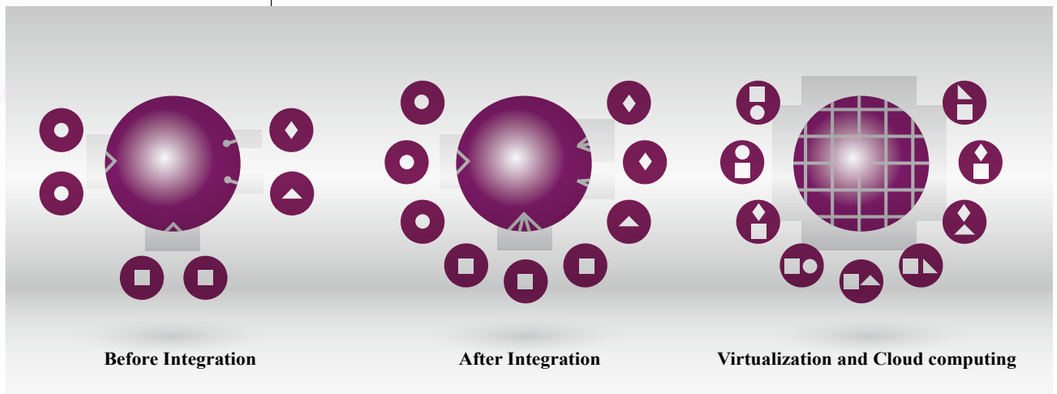
In March 2012, Intel launched new Romley servers, based on its next-generation Xeon E5 processor. The Romley servers offer an outstanding product for cloud computing, with modular 10 GE LAN-on-Motherboard (LOM) devices that support 10 G Base-T ports on their main boards providing additional powerful processing capabilities.

Indeed, IDC foresees that the number of 10 GE ports for data centers will exceed the number of GE ports sometime between 2012 and 2014.

*Enterprise Impact: The next 10 years will see decreased reliance on GE technologies, as the world makes the transition to a new 10 GE era.*

### • Trend 4: Open ecosystems

Cloud computing encompasses numerous




**The changes in cloud computing services influence the way networks are connected**

> *Driven by trends in cloud computing, data center networks that use campus switches cannot keep up with cloud computing requirements. In the past two years, switch vendors have started providing self-defined data center switches to satisfy cloud computing requirements. >>*

components, including cloud applications, cloud management platforms, virtualization platforms, distributed storage architectures, middleware, servers, networks, and storage devices. The number of segments required makes it difficult to piece together a cloud-based end-to-end solution that allows best-of-breed choices. Increasingly, cloud platforms will be forced to provide open source and external interfaces for companies that require integration with their other technology investments.

OpenStack is an example of open source in cloud platforms, attracting – thanks to its ease of scalability – about 2,100 members from more than 144 cloud computing IT companies since its launch in 2010. Some of these companies have already released commercial OpenStack solutions, and more are on the way. Industry experts expect a wave of private and public clouds will introduce OpenStack-based solutions in 2013.

*Enterprise impact: Cloud computing networks must unlock their full capabilities and let vendors further integrate networks. This is a critical step in the cloud computing industrial chain, and the only way to provide more comprehensive solutions.*

## Cloud Computing Requirements on Networks

The aforementioned trends in cloud computing show that service changes are leading to profound network changes.

Driven by trends in cloud computing, data center networks that use campus switches cannot keep up with cloud computing requirements. In the past two years, switch vendors have started providing self-defined data center switches. Although definitions differ, the purpose is clearly the same: satisfy cloud computing requirements.

Based on these four trends in cloud computing, several key requirements for networks emerge:

- More elastic networking

Cloud computing requires high computing performance of servers reliant on high-density servers, more 10 GE Network Interface Cards (NICs), and virtualized servers. Cloud computing also demands high network performance; networks must be elastic and evolve to support access of high-density GE and 10 GE servers. Elastic methods are required to enable the dynamic migration of virtual machines following network configurations: VLAN, QoS, and security configurations. These elastic configuration methods eliminate the need for manual processing. Logical resources for multi-tenant networks must also be elastically deployed to support flexible provisioning of computing resources.

- Easier network Operation and Management (O&M)

Cloud computing results in easier network O&M for several reasons. First of all, large-scale cloud computing data centers and new technological applications (such as large Layer 2 networks) entail a rich set of O&M approaches and tools that are conducive to easy network O&M. In addition, as cloud computing resources are deployed quickly, network resources must also be available to provide cloud computing services whenever needed. Finally, server virtualization brings Virtual Switch (vSwitch), also known as virtual networking. Currently, virtual and physical networks are separately managed.

- Open networks

Cloud computing networks, by their very nature, are connected platforms, so networks must be open to accommodate new cloud computing platforms. The network itself must work as an open platform, enabling users to delete or add value-added network services to suit their particular needs. The integration between the open network and the cloud computing and virtualization platform contributes to a comprehensive, efficient, and cost-effective cloud computing solution.

## Optimizing Network Infrastructures

Elastic networking, easier network operations, and open networks are three key requirements of cloud computing in the future. Many vendors have proposed their own network solutions to meet trends in cloud computing. A typical solution involves treating the network as a comprehensive device that contains one core line card and multiple remote line cards, aiming to provide a high-performance centrally managed network platform with optimized traffic balancing capabilities. However, existing technologies are not able to fully implement this solution. Another common solution redefines the network forwarding architecture and completely opens up network capabilities. These two network solutions increase network complexity and fail to avoid critical defects.

> *Many vendors have proposed their own network solutions to meet trends in cloud computing. One solution involves treating the network as a comprehensive device, aiming to provide a high-performance centrally managed network platform. Another redefines the network forwarding architecture and completely opens up network capabilities. These two solutions increase network complexity and fail to avoid critical defects. >>*

The ideal cloud computing network architecture is an open and congestion-free data center network with self-recovery and PnP capabilities – a virtual black box. This black-box-like architecture enables consistent performance between all points in the network, allowing the network to provide and maintain basic connectivity without external components, and supports the PnP mode for any network component.

In the future, network architectures will support 10GE servers and allow access to servers range from 40GE to 100GE, providing elastic performance. In this scenario, all network services are also elastic. For example, IPv6 networks can be upgraded, and FCoE network integration can be seamless.

In addition, network capabilities are open to upper-layer applications and services based on service requirements, and can be quickly integrated with the offerings of other cloud computing companies to form unique cloud-based solutions.

To support cloud computing, companies are integrating services and exploring how to migrate them to cloud computing platforms to reduce costs and improve efficiency. The overall goal is for cloud computing networks to deliver open network services that meet the requirements of rapidly evolving cloud computing services. ▲

# The CloudEngine 12800: A Unique Core Switch For Next-Generation Data Centers

| By *Mark Wu, Chief Technology Officer of Enterprise Business Solution Sales Dept., Huawei Enterprise Business Group*

Mark Wu

***Huawei's next-gen data center core switches possess outstanding advantages in scalability, virtualization, openness, sharing, and energy savings, positioning them as the perfect cloud computing service gears. >>***

Cloud computing has increased in popularity since its emergence in 2006, with most enterprises migrating some of their IT services to the Cloud. Meanwhile, the number of data center network devices has increased, achieving an annual growth rate of more than 40 percent. Core switches play a key role in the overall cloud computing network architecture, but many aren't up to the task. The Huawei CloudEngine (CE) 12800, on the other hand, can not only handle current network loads effortlessly, but also power custom data centers and provide plenty of expansion capabilities to handle unanticipated growth needs.

## The Tumultuous Evolution of Data Center Core Switches

Data center core switches were born out of necessity. The application model of the entire IT industry experienced revolutionary change, evolving from the client/server traffic model to the server/server traffic model, and from the unicast-dominated traffic model to the large-scale use of incast and multicast traffic. Service requirements from such technologies as large-scale server clusters, virtualization, and big data have also contributed to the need for these core switches.

The Figure shows that the success of data center core switches is driven by growing service application requirements and mature product technologies. With this in mind, next-generation data center core switches should be designed to accommodate growing service application requirements, while leveraging new technologies as they become widely available.

## Most Vendors Can't Meet All Enterprise's Needs

Currently, most data center core switches feature high scalability, integrated virtualization capabilities, and support for multiple services and network convergence.

- High scalability

Few vendors can provide core switches that will meet network development requirements over the next five to ten years. The fundamental reason is that device architecture designs cannot match the speed at which network services are expanding.

For example, server virtualization has high Layer 2 data switching requirements, but the scalability of network nodes is limited due to the inherent limitations of Layer 2 networks. Some traditional Layer 2 network technologies, such as Spanning Tree Protocol (STP), can only prevent loops on Layer 2 networks, but cannot be used to build large Layer 2 networks. The upshot is that until recently, there has been no mature solution for Layer 2 interconnection among VMs in multiple data centers.

- Virtualization capabilities

In terms of virtualization capabilities, vendors give serious consideration to simplifying network topologies while reducing Q&M burdens, flexible allocation of network resources, and adaptability to virtualization when developing core switches.

Data center core switches should simplify network topology and reduce the complexities in network O&M. Data center core switches must share and allocate network resources flexibly using virtual system technologies. Data center core switches also need to enable networks to be aware of VMs and adapt to virtualization.

- Multi-service support and network convergence

Data center core switches must support complex network services, such as multi-tenancy, mobile IP, and Virtual Private Networks (VPN).

Data center core switches must also integrate traditional services, including firewalls, network analysis, and load balancing. Generally, multiple service cards are used on switches to integrate traditional services. Because complex services cannot be fulfilled directly on Application-Specific Integrated Circuit (ASIC) chips, using service cards loaded with CPUs is a fast and flexible solution. The advantage of using service cards is that multiple and even customized services are supported. The disadvantage, however, is that card performance is not high.

Data center core switches must also support network convergence. Fiber Channel (FC) and High-Performance

| | Cloud Computing | Scalability | Multi-service Integration | High Reliability |
|---|---|---|---|---|
| Service (Application) driven | Application virtualization | Quick scale up and scale out of data centers | Ethernet, storage network, and high performance computing | IT-enabled services; cluster system |
| Technology (Vendor) driven | Networks must adapt to virtualization | High performance hardware platform and innovative control protocols | To achieve Everything over Ethernet, 10 GE to 100 GE interfaces are used to provide higher bandwidth | In-Service Software Upgrade (ISSU), micro-kernel, and distributed network |

Data Center Core Switch

**Factors influencing the development of new data center core switches**

*Although many vendors have made significant breakthroughs in data center core switch services and technologies, these products still have deficiencies in scalability, network and application virtualization, network openness, cost-effectiveness, and energy efficiency. >>*

Computing (HPC) networks are converged in data centers to achieve everything over Ethernet. New technologies, such as 10 GE and Data Center Bridging (DCB), enable Ethernet to support such heterogeneous networks as Fiber Channel over Ethernet (FCoE) and Remote Direct Memory Access over Ethernet (RDMAoE) that were previously unsupportable.

But while technologies such as OpenFlow, OpenStack, and Software Defined Networking (SDN) are being developed to meet these needs, these technologies are still immature and cannot fully adapt to all devices.

Customized network requirements cannot be ignored, no matter what technologies are ultimately adopted. In all likelihood, the only viable solutions are technologies that separate the control and forwarding planes, those that provide application programming interfaces (APIs) on network devices, and innovations that provide middleware on open platforms.

- Repeated investments in core devices for data centers and campus networks

Deploying two sets of core devices ensures security, but increases management and maintenance costs.

From a customer's viewpoint, using one hardware platform to support both the data center and the campus network has the advantages of unified management. From a technical perspective, it is a mainstream development trend that warrants the investment required to make the transition from deploying two sets of core devices to using one hardware platform.

- Extremely high power costs

A comparison of power consumptions among past generations of core switches reveals that the latest generations of most switches consume much more power. Power supply for these switches is a big problem if these new-generation switches are installed in data center equipment rooms with traditional power supply designs.

## Huawei Provides Solutions for Cloud Computing

Although many vendors have made significant breakthroughs in data center core switch services and technologies, these products still have deficiencies in scalability, network and application virtualization, network openness, cost-effectiveness, and energy efficiency.

*Huawei CE12800 data center core switches are designed for the cloud era and positioned to become enterprises' first choice for building super large and virtualized data center networks. CE12800 series has clear advantages in terms of scalability, virtualization, openness, ease of use, and energy efficiency, making it an excellent choice for today, and well into the future. >>*

Huawei is dedicated to providing competitive data center core switches and related network solutions for worldwide customers. Huawei provides its next-generation data center core switches: the CloudEngine 12800 series. To meet service requirements in the cloud computing era, Huawei has designed the CE12800 series to meet stronger scalability, virtualization, openness, resource sharing, and energy efficiency requirements.

- Stronger scalability

In 2012, first-rate data center core switches provided 480 Gbit/s switching capacity per slot because the front panel can provide a port density of 48×10 GE. To support network development in the next five to ten years, data center core switches should provide at least 4 Tbit/s of switching capacity per slot, or eight times that of the current bandwidth.

To provide services on large Layer 2 networks, Huawei supports TRILL and other standard Layer 2 protocols. Huawei also supports seamless interconnection between TRILL-based Layer 2 networks and standard Layer 3 IP networks, providing more customer freedom in network deployments.

- Improved virtualization between applications and networks

In-band protocols between network adapters on servers and network devices allow fast detection of a large number of dynamic VM changes, and enable network devices to respond to these changes. While this is an advantage for virtualization, it does not meet expanding virtualization requirements.

Huawei supports in-band protocols and also focuses on out-of-band service NMS interfaces. By using tight coupling between network virtualization and application changes, Huawei achieves end-to-end virtualized adaptation using comprehensive technical means.

- Openness: supporting and optimizing customized network requirements

Huawei supports such technologies as OpenFlow, OpenStack, and SDN with continuous investment to optimize, implement, and supplement these control protocols.

Huawei also provides an open service platform to supplement current standard protocols through APIs or middleware.

- Enhanced resource sharing between data centers and campus networks

The CE12800 series switches support VM technology, which virtualizes a physical switch into eight independent logical switches (the number of logical switches can be increased to 16). With its excellent forwarding performance, CE12800 core switches can provide a two-in-one service platform that integrates data center and campus network for customers, reducing CAPEX and OPEX.

- Improved energy efficiency

Next-generation switches use energy-saving ASIC chips and processors as well as the most efficient digital power modules in the industry. The CE12800 series switches can adjust the power consumption of components to adapt to changes in service traffic volume, thereby optimizing power consumption.

With a longer lifecycle and at least eight times the expansion capability of currently available competing technologies, the Huawei CE12800 data center core switches are designed for the cloud computing era and positioned to become enterprises' first choice for building super large and virtualized data center networks. As next-generation core switches, the CE12800 series has clear advantages over non-Huawei core switches in terms of scalability, virtualization, openness, ease of use, and energy efficiency, making it an excellent choice for today, and well into the future. ▲

# Why TRILL-based Networks are Better:
## Building a Flexible, High-Speed Bus for Data Centers

| By *Jason Hao, system engineer, VRP Network Solution Division, Huawei Enterprise Business Group*

Jason Hao

***TRILL is designed to meet the increasing service requirements in the cloud era by offering efficient forwarding, loop prevention, rapid convergence, and ease of deployment. >>***

Enterprise managers who want to exploit emerging hardware and cloud capabilities should consider basing their expansion plans on network architecture of transparent connections of lots of links, or TRILL (Transparent Interconnection of Lots of Links). A TRILL-based network offers many advantages: it can serve as a high-speed bus for a data center, and its architecture supports dynamic Virtual Machine (VM) migration, non-blocking and low-latency data forwarding, multi-tenancy, and large-scale networking in the cloud era – all of which allow for business expansion and redefinition.

This article analyzes requirements for data center network architectures in the cloud era and explains how the Huawei TRILL-based Layer 2 network solution lets customers deploy data center networks that excel at meeting large-scale, high-performance, cloud-based service requirements.

### Network Architecture Requirements of Data Centers in the Cloud Era

TRILL is a standards-based technology developed by the Internet Engineering Task Force (IETF) to implement Layer 2 routing over the extended Intermediate System to Intermediate System (IS-IS) protocol. TRILL has many interesting capabilities – such as the following features – that make it well-suited for high-volume networks.

- Dynamic VM migration

Server virtualization, a core technology of cloud computing, has gone mainstream. But to meet changing requirements – such as natural disasters or momentary spikes in demand – VMs need to be dynamically migrated within a data center, instead of within an aggregation or access switch. This practice enhances service reliability, improves service deployment flexibility, and minimizes IT costs and O&M expenditures.

TRILL excels at the kind of fast, dynamic migration that next-generation data centers need. Here's why: In a traditional data center, Layer 2 networking is used within each Point of Delivery (POD), and Layer 3 networking is used between PODs. VMs can be migrated only within a POD. To migrate VMs from one POD to another, the VM IP addresses need to be changed, which causes service interruption.

> ***Traditional Layer 2 networking is like a one-lane road; Its broadcast storms caused by Layer 2 network loops and low bandwidth utilization has already failed to meet service requirements for the data center network in the cloud era. >>***

In contrast, a traditional MSTP-based Layer 2 network can seamlessly connect to a TRILL-based large Layer 2 network. Servers on the MSTP-based network can communicate with servers on the TRILL network at Layer 2, and VMs can be migrated within the large Layer 2 network to make full use of data center resources. To meet this requirement, such enterprises can deploy TRILL-based large Layer 2 networks.

- Non-blocking and low-latency data forwarding

Unlike the traditional telecom traffic model, most traffic transmitted over a data center network in the cloud era is eastbound and westbound traffic between servers. During traffic transmission, the network functions as a high-speed bus for the data center.

Traditional Layer 2 networking is like a one-lane road; xSTP (STP/RSTP/MSTP) is required to prevent Layer 2 network loops, which may cause broadcast storms. Only one link is allowed to forward data, which results in low bandwidth utilization. It has failed to meet service requirements for the data center network in the cloud era.

In contrast, a TRILL-based network mimics a multilane highway for data forwarding. Each device on a TRILL-based network uses the Shortest Path First (SPF) algorithm to calculate the shortest path from itself to every other node. Equal-Cost Multipath (ECMP) enables load balancing during transmission of unicast traffic. With ECMP and SPF, data forwarding on a TRILL-based network is considerably improved in forwarding efficiency and network throughput. Indeed, multipath forwarding in a fat-tree data center network actually maximizes network bandwidth utilization.

- Multi-tenancy

A physical data center can be shared among multiple tenants in the cloud era. With a virtual data center instance, each tenant has its own virtual independent server, memory, and network resources. But for security purposes, data traffic must be isolated for each tenant. In traditional Layer 2 networking, the number of tenants is determined by the number of virtual local area networks (VLANs), and tops out at 4,096 tenants. Further development of cloud computing will sometimes require data center network that support more than 4,096 tenants, a job that TRILL networks can handle. TRILL can use 24-bit fine-grained labels to identify a maximum of 16,000,000 tenants

- Large network scale

A large-scale data center in the cloud era requires 100,000 or even 1,000,000 servers for computing and hundreds – or even thousands – of switches for non-blocking forwarding. To support such huge traffic loads, such networks must effectively prevent loops using networking protocols, implement rapid convergence to recover services after a node or link fails on the network, and be easy to deploy and maintain – all features that make TRILL excellent at scaling up:

***Loop prevention*** – In a TRILL-based network, Reverse Path Forwarding (RPF) lets nodes discard multicast packets received from incorrect ports to prevent loops. The hop-count field in each TRILL header further reduces the impact of temporary loops

*The TRILL-based network, which functions as the high-speed bus for the data center, efficiently forwards traffic between servers, and between servers and end users, to facilitate data center service provision. >>*

and prevents storms. TRILL automatically selects a distribution tree root. Each Routing Bridge (RB) calculates the shortest path from the distribution tree root to every other RB. As a result, shared distribution trees are automatically established on the network. The shared distribution trees connect all nodes on the network to transmit Layer 2 broadcast, multicast, and unknown unicast packets, and also prevent loops.

***Rapid convergence*** – When the topology of a traditional xSTP-based Layer 2 network changes, convergence is slow and may occasionally take up to 30 seconds, which dramatically reduces the reliability of data center services. TRILL uses the IS-IS protocol to generate data forwarding entries, and the hop-count field in each TRILL header can tolerate temporary loops. This enables rapid network convergence when a node or link fails on the network.

***Ease of deployment, maintenance*** – A TRILL-based network is easy to deploy and maintain. First, TRILL is easy to configure. The values of some parameters can be automatically generated, and default values can be retained for many other parameters. Second, TRILL controls both unicast and multicast packets, which means that users need to maintain only TRILL. In contrast, on a Layer 3 network, users must maintain multiple routing protocols – such as an Interior Gateway Protocol (IGP) and Protocol Independent Multicast (PIM) – for unicast and multicast packets. Finally, TRILL applies to Layer 2 networks, which support plug-and-play.

## The Huawei TRILL-based Large Layer 2 Network Solution

The Huawei TRILL-based large Layer 2 network solution seamlessly manages high-volume networking traffic. The TRILL-based network, which functions as the high-speed bus for the data center, efficiently forwards traffic between servers, and between servers and end users, to facilitate data center service provision. The solution also makes it easy to dynamically migrate VMs within a data center, so that enterprises can realize the full range of benefits that virtualization offers – such as flexibility; reduced costs of energy; better administration and hardware; and improved business continuity.

Acting as the highway on the data center network, Huawei's TRILL solution has the following features:

- Flexible networking: support for End of Rack (EOR) and Top of Rack (TOR) networking

All Huawei CloudEngine series switches support TRILL, and all boards can forward data over TRILL. This Huawei solution supports two networking modes: TOR and EOR, which enable flexible networking. Access devices can be stacked to enhance reliability.

All devices on the data center network support TRILL – the TRILL-based network functions as a bridging fabric for data centers, which ensures reliability of the core network architecture. With the growth of cloud computing services, users have the flexibility of adding physical servers, IPv4 or IPv6 gateways, firewalls, and load balancers.

- Flexible gateway deployment

The Huawei solution supports two gateway deployment schemes:

(1) The Layer 3 gateway is individually deployed and directly connects to the core RB. Multiple Layer 3 gateways can be deployed in a large-scale data center to implement VLAN-based load balancing.

(2) The Layer 3 gateway is integrated into the core RB. With Virtual Switch (VS) technology, the core RB is divided into two VSs; one VS provides the Layer 3 gateway function, while the other VS provides the TRILL functions.

Enterprises can choose a gateway deployment scheme based on their individual service requirements. In a small- or medium-scale data center, the Layer 3 gateway can be integrated into the core RB. In a large-scale data center, the Layer 3 gateway can be deployed individually.

- O&M management

Huawei CloudEngine series switches support O&M management. Network administrators can log in to the VLANIF interfaces on RBs over a

TRILL-based network to perform configuration and management operations through the Simple Network Management Protocol (SNMP), Telnet, and Netconf protocols. The management network can share a physical network with the TRILL-based network. Users can locate path connectivity faults within the TRILL-based network by TRILL pinging.

- Better performance, load balancing

For unicast traffic on a TRILL-based network, link-level load balancing is implemented by using the ECMP algorithm. For multicast traffic, ingress RBs select different distribution trees for VLANs to implement VLAN-based load balancing. A large Layer 2 network that comprises CloudEngine series switches supports a maximum of four distribution trees, which reduces pressure on the processing of multicast traffic from different root nodes.

- Large network scale and optimal performance

CloudEngine series switches can be used to create a large Layer 2 network that has more than 500 nodes. The network can converge within 500 ms after a link or node fails, and a maximum of 16 next hops are supported for load balancing. These meet data center requirements for large network scale and high performance.

- Two data center evolution modes

Mode 1: The legacy data center is deployed on a traditional MSTP-based Layer 2 network and new devices are deployed on a TRILL-based network. CloudEngine series switches seamlessly connect to the traditional MSTP-based network. As a result, the legacy and new devices all run on the large Layer 2 network, which helps customers maximize their Return on Investment (ROI).

Mode 2: Enterprises have the flexibility to choose the type (TRILL or MSTP) of network to which VLANs are connected, ensuring a smooth transition for O&M. All devices on the newly deployed data center support TRILL. In the initial phase, only a few services are provisioned in VLANs on the TRILL-based network, whereas a majority of services are still provisioned on the traditional MSTP-based network. After enterprises gain experience in large Layer 2 network operation, they can switch all services to the TRILL-based network.

## Great Performance, Smooth Evolution

The TRILL-based network architecture meets service requirements of data centers in the cloud era by offering efficient forwarding, loop prevention, rapid convergence, ease of deployment, and support for multiple tenants. More importantly, TRILL is built to coexist with traditional networks, for a slow, steady migration path. This will make it easier to grow networks that can handle the huge volumes of data flowing through the information clouds – and other large enterprises – of the future. ▲

*TRILL is built to coexist with traditional networks, for a slow, steady migration path. This will make it easier to grow networks that can handle the huge volumes of data flowing through the information clouds – and other large enterprises – of the future. >>*

# Save Money on Data Center Utility This Year

## – Huawei's Data Center Professional Services Can Show You How

| By *Jason Chen, Technical Director of the Global Technical Service Dept., Huawei Enterprise Business Group*

Jason Chen

***Huawei's professional services cover all data center utilities, and can help enterprises improve energy efficiency, establish a positive sustainability image, and reduce OPEX. >>***

### Trends in Green Data Center Solutions

When it comes to the costs of cooling a data center, small changes can add up to big money. Sometimes, simply adjusting cabinet placement, changing the position of indoor air conditioning unit, and replacing airtight flooring with adjustable ventilated flooring can have a tremendous effect on both data center temperature and cooling costs. However, every data center is different, and only long-time experience and state-of-the-art monitoring and technology are up to the task of discovering these hidden savings.

### How Much Could You Lose?

The expense of Electrical power consumption accounts for approximately 30 percent of the overall data center OPEX. The majority of data centers operate at high costs and with low energy efficiency, a situation ripe for dramatic improvement.

To understand how inefficiently data centers operate, consider that energy efficiency is measured with Power Usage Effectiveness (PUE), which is the ratio of electrical power consumption of all equipment to that of IT equipment. The ideal PUE value is 1, that is, all electrical power would be consumed by IT equipment. But in practice, this ratio is impossible to achieve, because most electrical power is consumed by cooling machinery.

Energy efficiency increases as PUE decreases. The PUE for newly constructed data centers is generally 1.8. That is, when one kilowatt of electrical power is consumed by IT equipment, another 0.8 kilowatts are consumed by non-IT equipment, such as cooling systems.

To see how much changes in power management can add up, consider how much efficiency varies from country to country. The average PUE value of data centers in developing countries is 3, whereas that ratio in China Hong Kong is around 2; in Europe and the United States that ratio ranges from 1.5 to 1.8. In part, these differences are due to greater use of virtualization in developed countries. Also, in developing countries, data centers are often constructed with excess, unused space for expansion, and cooling this vacant space increases the PUE value.

There's also a tremendous variation in efficiency from data center to data center. That's where Huawei's enterprise professional services team can help; they know how to root out waste and select the best energy-saving technology for any organization. Through integrated design and optimization at all levels, Huawei has built and operated data centers with a PUE value as low as 1.3 for some of its European customers.

For example, during a recent data center operations assessment for China Mobile Hainan, Huawei rearranged the cabinet's alignment and air conditioner indoor unit location. This modification significantly improved cooling efficiency and saved about 30 percent of power consumption costs per year.

In another case, hardware devices in a data center became faulty frequently, and employees working in the equipment room often felt sick. Huawei consultants used professional devices to test the air quality in the equipment room. The consultants discovered and resolved problems in the Air Handling System (AHS), and removed flooring that did not comply with safety standards. After the problems were resolved, the air quality was improved and data center continuity was ensured.

The data center industry is thriving as companies expand and upgrade their data centers to cope with their extra demands on IT capabilities. Some enterprises transform their existing data centers while others construct new data centers to meet user requirements. However, these data centers often consume too much energy, resulting in high OPEX. What they need is a plan to combine the efficiency and power of cloud

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> *Some enterprise managers wonder why they need professional expertise, because many venders tout its server hardware and software as "energy efficient" or even "green." But such suppliers currently focus on providing solutions for different layers of the data center. To reduce energy consumption, enterprises need intelligent analysis of power consumption effects at all levels. >>*

computing and virtualization technology to reduce waste heat – generated unnecessarily and requiring removal to avoid faults and performance degradation – in their data centers, with the Huawei team's ability to use analytical techniques to ferret out savings at all layers. Huawei can even show an organization how it can expand its server computing capabilities with virtualization, delaying the need for new construction for several years and resulting in further savings.

## Why Have a Professional Audit?

Some enterprise managers wonder why they need professional expertise when so much of the server hardware and software they buy touts itself as "energy efficient" or even "green." Such suppliers currently focus on providing solutions for different layers of the data center, but these solutions cannot coordinate and exchange information from one layer to another. To reduce energy consumption, enterprises need intelligent analysis of power consumption effects at all levels.

In contrast, Huawei divides the data center into four logical layers to get a full view of its design and operational lifecycle. This abstraction can efficiently reduce energy consumption. For example, a data center houses devices from different suppliers. The underlying layer includes facilities like air-conditioning, fire-suppression, power distribution, cabling, access control, and monitoring devices. The second layer includes IT infrastructure, such as computing, network, and storage devices. The third layer is the application layer where email, Virtual Desktop Infrastructure (VDI), cloud storage, and hosting all run. The top layer is the data center service layer, which manages operations hosting.

Huawei's services include data center monitoring, optimization, and Disaster Recovery (DR), and cover every aspect from consulting, planning, design, implementation, operation, to optimized management at all layers, thereby reducing overall power consumption. Understanding where there's too much heat and how to reduce it – while increasing performance – is something that the Huawei team can do in a systematic way that is still tailored for each individual data center.

Huawei provides an entire portfolio of data center professional services – ranging from consulting and design to implementation – including integration, consolidation, assessment, optimization, migration, DR, and transformation. Huawei accomplishes these tasks with a series of professional assessment tools, such as Computational Fluid Dynamics (CFD) software to simulate the temperature change of airflows within the data center.

For reducing energy consumption, three types of infrastructure are available: elastic, modular, and hybrid.

(1) Elastic models incorporate such offerings as the Huawei-developed Facility Operating System (FOS) that enables or disables devices in data centers to obtain optimal use of resources and minimize power usage. During off-peak hours at night, FOS can use virtualization technologies to migrate Virtual Machines

(VMs) to consolidated rack zone. This capability disables devices that are not in use to save energy. Such devices include IT infrastructure, air conditioners, and backup power supply modules.

(2) Modular models reduce investments in devices and increase scalability and efficiency.

(3) Hybrid models adopt mixed levels of redundancy and power supply density to reduce investments.

In addition, the Huawei NetEco system monitors data center operations based on the data collected from sensors deployed on different devices, such as power supply, power distribution, Uninterrupted Power Supply (UPS), access control, and surveillance devices. The NetEco system displays alarms when power outage and other faults occur so that corrective measures can be taken to ensure continuous operation. The data collected can also be used to dynamically calculate the PUE value, so that cooling devices can be adjusted based on the PUE value to reduce power consumption.

When combined with the FOS, the NetEco system associates the underlying facilities with layer 2 IT devices and reduces power consumption and heat dissipation through cloud computing and storage migration, optimizing data centers by layer.

## Resolve to Do Things Right This Year

So, if you've decided that this is the last year that your organization will waste energy, consider an initial consultation with the Huawei team. These professional services help enterprises improve energy efficiency, enhance their environmental image, and reduce OPEX this year, and beyond.▲

> *If you've decided that this is the last year that your organization will waste energy, consider an initial consultation with the Huawei team. They will help you improve energy efficiency and reduce OPEX this year, and beyond. >>*

Case Study

# Huawei Builds a Next-Generation Data Center for China Merchants Group

*The next-generation data center designed by Huawei for China Merchants Group follows the philosophy of "meeting requirements, staying future-oriented, as well as secure, reliable, and green". Structural design and equipment selection processes ensure the reliability and sustained scalability of information infrastructure. >>*

Headquartered in Chinese Hong Kong, China Merchants Group (hereinafter referred to as China Merchants) is a large state-owned enterprise focusing on Hong Kong, mainland China, and other dynamic emerging markets with large potential, such as Southeast Asia. By the end of 2011, China Merchants held assets totaling CNY342.3 billion and had generated CNY23.685 billion in profits. Currently, the China Merchants operates three core businesses: transportation and its related infrastructure construction (both operations and services), financial investment and management, and real estate development and management.

As China Merchants increases in scale and business scope, the organization's existing data center is failing to satisfy the business requirements of both headquarters and its subsidiaries. Its network OPEX has also remained stubbornly high. To ensure the continuity of future production operations, cut existing IT OPEX, and better serve both headquarters and its subsidiaries in Guangdong and Hong Kong, China Merchants planned to build a highly stable, secure, available, green, and energy-efficient enterprise-level data center that would significantly improve its IT level.

The planned data center and networks need to provide web services externally and support a variety of key internal business. The data center also had to be upgradable to a disaster recovery center that could share loads and provide emergency assurance for key business operations. In addition, seamless switchover to the new data center was essential to ensure business continuity.

By analyzing China Merchants' existing data center and identifying the company's specific requirements, Huawei has developed a complete solution that is designed to "lead the industry for two years, keep pace with technological developments for five years, and guarantee a service life of ten years". Structural design and equipment selection are designed to boost reliability and sustained scalability of the information infrastructure. In addition, Huawei's solution proactively solves potential switchover problems with targeted solutions for seamless business transition.

## Highly Reliable and Available Core Network

As the hub of a data center network, the core switch plays an important role of transmitting inbound and outbound group data. Therefore, the core switch must be highly reliable and available, and persist during high network usage. Providing a carrier-level reliability of at least 99.999%, the Huawei S9300 switch incorporates a main control unit, power supply, and fans that operate in redundancy mode. All modules are hot-swappable.

Using technology pioneered by Huawei, the solution's Cluster Switch System (CSS) takes a innovative approach of stacking with switch fabrics to resolve legacy architecture problems involving the cross-chassis, multiple switchovers of line card clusters and low switchover efficiency. The CSS delivers a maximum cluster bandwidth of 256 Gbit/s, while cross-chassis link aggregation improves network reliability by increasing link utilization and resolving single-point failures.

## Secure Internet Egress for Multiple Applications

The Internet egress area provides secure and fast Internet access for China Merchants' headquarters and subsidiaries. But a solution of this type also needs a robust firewall to prevent external attacks and control internal access. Additionally, because the group data center will use Internet egresses leased from two carriers, a link load balancer is needed to respond to requests from each carrier. The S9300 switch offers both firewall and load balancer functionality on a bypass mode to ensure the performance of the data center and provide an effective network security mechanism.

## Green and Energy-Efficient

Energy efficiency in data centers is a much discussed topic given the staggeringly high electricity costs they incur. The servers, network equipment, and other heat dissipation equipment are usually the main energy consumers.

Huawei's S-series switches meet IEEE 802.3az energy-saving standards and come equipped with "rotating" air channels, ports that power down to sleep mode, and fans that support intelligent speed adjustment. When combined, these features enable the switches to use between 15 to 20 percent less energy than the industry average.

## Seamless Switchover

To ensure business continuity and reduce project implementation risks, the work will be completed in multiple phases:

- Construct new data center.
- Migrate business operations from the existing data center to the new one, in an ascending order of importance.
- Conduct trial operations.
- Integrate business systems where necessary to optimize resource utilization.
- Convert existing data center into a disaster recovery center and develop the required disaster recovery functions.

### Summary

***Huawei's S-series switches provide a highly reliable CSS, integrated firewalls and load balancers that satisfy China Merchants' need for data center evolution. In addition, Huawei provides a specific solution for business switchover to ultimately facilitate smooth transition and stable operations. The new group data center will enable China Merchants and its subsidiaries to enjoy services that are more efficient and secure – and allow for growth.▲***


## 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 give your suggestions and comments. The editors greatly value your input.

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**We look forward to hearing from you.**