Huawei Cloud Fabric Data Center Solution
A data center is an integrated Information and Communications Technology (ICT) application environment resulting from data concentration. By combining computing, network transmission, and storage resources, data centers have become the most critical infrastructure for an enterprise’s business operations. In the cloud computing era, enterprises and carriers of all sizes are focusing on how to build data center infrastructure capable of supporting sustainable cloud service development.

Cloud computing assists enterprises in lowering Operating Expense (OPEX) and improving the efficiency of Operations and Maintenance (O&M). By leveraging cloud computing technology, enterprises can maximize Return on Investment (ROI) while minimizing resource usage. According to Forrester Research, a research and advisory firm, cloud computing applications are being implemented on a large scale around the globe. Their market size will reach up to US$241 billion by the end of 2020, up from US$40.7 billion in 2011. The global Infrastructure as a Service (IaaS) market is expected to garner US$5.9 billion in total revenue by the end of 2014. In addition, the global Software as a Service (SaaS) market will skyrocket from US$21.2 billion in 2011 to US$92.8 billion by the end of 2016. Meanwhile, the cloud computing ecosystem is maturing day by day. For example, Amazon Web Services (AWS) have been deployed in over 190 countries and regions across the globe, with 400,000 or more commercial users, including The New York Times and NASDAQ.

Enterprises’ requirements for cloud computing are not only IT resources that can be purchased on demand, but also high-value cloud computing that is an important driver for service innovation and development. Cloud computing and data center service providers can acquire more markets and customers only by offering better high-value cloud computing services. The rapid development of cloud computing applications is driving the emergence of Software-Defined Networking (SDN) in data centers. Undoubtedly, SDN architecture can flexibly schedule data center resources and provide users with on-demand services like water and electricity. Therefore, SDN can accelerate cloud computing development. According to a survey by QuinStreet Enterprise, one of the industry’s most notable technology media brands, nearly 30 percent of the surveyed data centers have deployed or plan to deploy SDN in 2014. The SDN marketplace is expected to increase to US$2 billion by the end of 2016.

Cloud computing applications are scaling up, and cloud computing services and SDN applications are moving data centers towards Big Data, new services, and diversity. As a result, cloud computing services pose new challenges on data centers and their network architecture.
Cloud Fabric Data Center Solution

Trend 1: Big Data Leads to Exponential Network Traffic Growth

Big Data is a fast growing, massive, and diversified information asset. Stronger decision-making and insight as well as higher process optimization capabilities are achieved by leveraging new processing models. Big Data is characterized by huge volume, broad variety, high velocity, and significant value. There are four typical Big Data service architectures: distributed architecture, server cluster, parallel computing, and social media application. Recent years have seen unprecedented development for Big Data. According to International Data Corporation (IDC), a major market research, analysis, and advisory firm, total Internet traffic will increase fourfold to 966 EB by 2015. Gartner, the world’s leading IT research and advisory firm, predicts that the average data traffic volume of enterprises around the globe will grow to 800 percent of current levels over the next five years. Gartner also forecasts that the Average Annual Growth Rate (AAGR) of global data center IP traffic will rise to 33 percent, and the world’s total data will reach 4.8 ZB by 2016. Amidst the Big Data tide, data centers are inevitably going to scale out. It is predicted that by the end of 2020, the global data will grow by 50 times, with a 10-fold increase in the total number of servers. Additionally, data center network capacity is also predicted to grow by 40 times.

As Big Data leads to exponential traffic growth, 10GE servers have been predominant in data centers. By the end of 2020, 40GE/100GE servers will dominate the market. In addition, internal traffic also predominates in data centers because interfaces connecting data center networks have evolved to 40GE/100GE. To adapt to this trend, data centers have an urgent need for a flattened, scalable network architecture that provides non-blocking, high-speed packet forwarding capabilities.

Trend 2: IT Systems Must Quickly Respond to Accelerated Service Upgrades

Enterprise data center management is divided into IT system management and network system management. IT system administrators create services and allocate computing and storage resources through IT systems. Network administrators are in charge of network resource construction and maintenance. Currently, enterprises have significantly improved IT system deployment efficiency. However, cloud services require not only computing and storage resources but also network resources. Low physical network deployment efficiency and the split between physical networks and IT systems becomes a critical challenge to cloud data center construction.

Separation of the virtual world (IT systems) from the physical world of a data center results in massive, manual configurations during new service provisioning and service changes. Faced with requirements for fast service innovation, traditional data centers cannot respond to service quickly, and service deployment becomes insufficient. As a result, the speed of commercial use networks is far slower than that required by new services. For example, provisioning of a single service takes 30 days on average. What makes the matter worse, such separation causes a set of problems in uniform resource distribution and associative fault diagnosis, becoming the biggest barrier for deploying cloud services.

Trend 3: Diversified Ecosystems Require More Open Networking Environments

The rapid development of virtualization and cloud computing shapes data centers into diversified ecosystems. However, standards for interfaces among platforms are inconsistent. As a result, the platforms cannot interoperate with each other, and service languages are not understandable. Additionally, the original Layer 3 network architecture is incompatible with the data center network architecture. If a bandwidth bottleneck occurs and management becomes complex, network hardware devices can hardly cope with east-west traffic changes caused by virtualization. To solve this problem, data center networks must be open and converged to tackle barriers in the traditional chimney mode.
Solution Overview

To help customers quickly adapt to changes in cloud computing services, Huawei has unveiled its Cloud Fabric Data Center Solution (Cloud Fabric). By deploying this solution, customers are able to build an elastic, simple, and open next-generation cloud data center network that supports sustainable cloud service development. Huawei Cloud Fabric uses Huawei’s flagship, high-performance CloudEngine (CE) series data center switches. Based on Huawei’s next-generation Versatile Routing Platform version 8 (VRPv8), the Huawei CE series provides ample features for data center services. The solution also uses Huawei’s Agile Controller, which uniformly controls and schedules ICT resources and quickly deploys cloud services. Huawei Cloud Fabric is compatible with multiple mainstream cloud platforms in the industry and supports a broad variety of cloud services and applications. This solution applies to Internet companies, financial services organizations, governments, energy companies, large enterprises, and carriers.

Traditional data center network functions rely heavily on hardware and evolve slowly. Current network devices cannot adapt to new services quickly. To deploy new services and functions, existing network devices must be replaced, and service provisioning efficiency is particularly low. Consequently, the speed of commercial use networks is far slower than that required by new services. How can we ensure that an enterprise’s ICT system will remain competitive? How can we quickly provision new services and functions? How do we enable network administrators to focus more on user experience and service innovation without being constrained by handling complicated and tedious network device faults? The answer is SDN, that is, programmable networking.

Huawei Cloud Fabric provides multi-layered network products to provision one-stop-shop services for users and to simplify customer data center network construction. By leveraging Huawei CE12800 series flagship core switches, which have the world’s highest specifications, and CE7800/CE6800/CE5800 series high-performance Top of Rack (TOR) switches, this solution provides highly scalable networks that connect to each other inside a data center. Taking advantage of its full-series transmission, routing, security, and Network Management System (NMS) product families, Huawei provides the all-in-one data center network solution. In terms of network architecture and functions, Huawei Cloud Fabric consists of the following sub-solutions:
Customer Benefits

By leveraging an industry-leading architecture, Huawei Cloud Fabric helps customers build elastic, simple, and open cloud data centers. This architecture also provides agile, innovative solutions that enable networks to quickly adapt to rapidly changing cloud services, and supports continued cloud service development.
Elastic: Flexible Cloud Service Scalability, Providing Big Pipes for Big Data

Huawei Cloud Fabric provides device-, system-, and data center-level elastic scalability for data center networks, and is capable of satisfying high-speed development requirements of enterprise cloud services over the next ten years or longer.

**Device-Level Elastic Scalability:** Huawei Cloud Fabric provides data center network products that feature large switching capacity and continuous, seamless capacity expansion. No device replacement is required. As a result, data center equipment rooms do not need to be reconstructed. Huawei CE12800 series data center core switches have the industry’s highest switching capacity (64 Tbit/s), which can seamlessly scale to over 100 Tbit/s. A single CE12800 line card has a terabit-level forwarding capacity. The CE12800 provides 12 x 100GE super high-performance line cards, providing users with a continuously stable switching core. Huawei USG9500 series data center security gateways adopt the industry-leading “NP + multi-core + distributed” architecture. A single USG9500 card provides a 160 Gbit/s application-layer firewall throughput. The whole device’s throughput can reach up to 1 Tbit/s. Huawei USG9500 also supports a maximum of 960 million concurrent connections.

**System-Level Elastic Scalability:** Huawei Cloud Fabric seamlessly supports Transparent Interconnection of Lots of Links (TRILL), a standard IETF protocol. A typical TRILL network consisting of core and TOR switches is used to build a large Layer 2 network with over 512 nodes. Over 18,000 10GE servers can be deployed on a TRILL network. Huawei Cloud Fabric provides a combined solution of Huawei’s proprietary Cluster Switch System (CSS) and Super Virtual Fabric (SVF). This combined solution virtualizes multiple homogeneous or heterogeneous physical switches into one logical switch, simplifying network management and improving network reliability. CSS is a core switch clustering technology that horizontally (east-west) virtualizes multiple core switches into one core switch. SVF expands heterogeneous core switches vertically (south-north). Multiple leaf switches are virtualized into remote line cards on a spine switch, which flexibly expands interfaces and simplifies cable layout and device management in equipment rooms. Huawei SVF is the only technology that implements local forwarding on leaf switches. Since the majority of the data center traffic is east-west traffic, SVF can maximize forwarding efficiency and reduce network latency.

**Data Center-Level Elastic Scalability:** Huawei Cloud Fabric provides highly efficient, three-layer connections among data centers, satisfying the interconnection requirements of Layer 2, Layer 3, and Storage Area Network (SAN) layer services. This solution supports the Ethernet Virtual Network (EVN) Layer 2 interconnection, implementing cross-region service expansion for up to 32 data centers across IP Wide Area Networks (WANs). EVN integrates resources of multiple data centers into a super large IT resource pool. This integration not only supports server clusters across multiple data centers, but also enables up to 256K Virtual Machines (VMs) to smoothly migrate across data centers. In addition, by leveraging Huawei’s 400GE core routers and 100GE Wavelength Division Multiplexing (WDM) products, Huawei Cloud Fabric provides a highly reliable “IP + Optical” solution for disaster recovery, ensuring non-stop data center service traffic forwarding.
Simple: 10 Times Faster Cloud Service Provisioning Through Cloud-based Network Migration

Connecting Cloud Services: Service-driven Solution Enables IT Administrators to Easily Schedule Network Resources, Implementing Cloud-based Network Migration

Figure 5 Application framework and logical and physical networks deployed as IT resources

Huawei Cloud Fabric uses a service-oriented open architecture to uniformly allocate ICT resources through the Agile Controller and cloud platforms. The Agile Controller can parse the service language and connect to multiple mainstream cloud platforms to provide a cloud application-oriented network. Users can uniformly schedule network, computing, and storage resources on demand on the cloud platforms.

Because it is service-centric, Huawei Cloud Fabric permits IT administrators to easily schedule network resources and implement cloud-based network migration. IT administrators can use the service language to define and adjust network requirements (application profile views) from the service perspective. Each type of service has an independent application profile view. The Agile Controller can understand three types of views, automatically convert the application profile views into logical networks, and deliver configurations to physical networks. As a result, network resources can be migrated on demand.

Connecting ICT Resources: Physical and Virtual Network Mutual Awareness and Unified Display of Resources

Huawei Cloud Fabric provides IT and network administrators a global view of data center networks that displays physical and virtual network resources. Therefore, IT and network administrators can assess global network resource distribution, resource usage, and fault status in real time.

Figure 6 Separated vs. mutually-aware physical and virtual networks
The Agile Controller simultaneously obtains information about the virtual and physical networks and manages them from a global perspective. When network faults occur, the Agile Controller can accurately locate failure points in a timely manner and adjust the physical and virtual networks accordingly. It can also associate applications with the logical network. In this way, upper-layer applications are aware of network faults, ensuring quick service optimization.

**Reducing TCO: Compatible with Various Physical Network Technologies for Easy Evolution**

Huawei Cloud Fabric builds a cloud-connected world to support service development in cloud data centers, and is compatible with various physical network models to support easy evolution and protect customer investments.

Huawei Cloud Fabric decouples logical networks from physical networks so that IT administrators can focus on logical networks and flexibly customize logical network policies based on service requirements. Logical networks shield the differences between various physical and virtual networks and networking technologies. As a result, Huawei Cloud Fabric is compatible with any physical network model, avoiding reinvestment caused by device replacement.

**Figure 7 Decoupling logical networks from physical networks enables IT administrators to customize services**

**Open: Seamless Connection to Mainstream Cloud Platforms, Making Cloud Computing Easier Than Ever**

To adapt to fast-changing cloud services, Huawei Cloud Fabric implements full-scale network openness, providing an open fabric, an open controller, and an open ecosystem. This facilitates agile adaptation to cloud service innovations and rapid provisioning of new services.

**Open Ecosystem:** With its customer-centric focus, Huawei is proactive in building a cloud computing data center ecosystem. Huawei has been cooperating with world-renowned IT vendors and standards organizations, enabling the Huawei Cloud Fabric to seamlessly connect to mainstream cloud platforms such as VMware vCenter, Microsoft System Center, OpenStack, and Huawei FusionSphere. In this way, network and IT resources can be managed in a unified manner. For example, Huawei teamed up with Microsoft to launch a hybrid network virtualization solution. This solution uses Huawei CE12800 as a hardware virtualization gateway to provide high-performance communication between Microsoft VMs and campus and branch users, as well as between Microsoft VMs and VMs and physical servers from other vendors. Additionally, Huawei is China’s first gold member of the OpenStack Foundation and is committed to promoting SDN industry chain development.
Huawei Cloud Fabric provides full-scale openness and programmability.

**Open Controller:** Huawei Agile Controller is a cloud data center network controller that integrates multi-tenant network management, automatic orchestration of service chains, and VM access control. The Agile Controller implements centralized control and dynamic scheduling of ICT resources, as well as fast cloud service deployment. The Agile Controller features superior openness. Its northbound interfaces can connect to a variety of mainstream cloud platforms from other vendors, ensuring that a cloud platform can easily deliver and adjust network policies. Taking advantage of open Application Programming Interfaces (APIs) and OpenFlow standards, the Agile Controller southbound interfaces can control and manage both Huawei and third-party network devices. The open Agile Controller not only improves users’ service delivery efficiency, but also facilitates network customization based on specific service characteristics, implementing seamless convergence of networks and services.

**Open Fabric:** In addition to openness of the Agile Controller, Huawei Cloud Fabric provides device-level openness, offering diversified choices to customers. Huawei CE series data center switches support abundant open APIs and OpenFlow standards, directly connect to mainstream platforms and third-party controllers, and build open, controllable networks. Running on a fully programmable network using Huawei’s Ethernet Network Processor (ENP) chips, Huawei Cloud Fabric helps customers quickly innovate and deploy new services four times more quickly than the industry average.
Product Portfolio

As illustrated in the following figure and table, Huawei Cloud Fabric provides network products at different layers.

Figure 10 Product portfolio

Cloud Computing Data Center Products

- 12x100GE/24x40GE high-speed line cards
- 64 Tbit/s switching capacity
- 4 Tbit/s bandwidth per slot
- T-bit throughput security protection capability
- Defends against 100+ security attack types
- Hierarchical and integrated security protection

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<th>Product Positioning</th>
<th>Model</th>
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<tr>
<td>Data center switches</td>
<td>CE12800 series</td>
<td>Industry-leading data center switches</td>
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<td></td>
<td>CE7800 series</td>
<td>Access or aggregation switches that provide full 40GE ports</td>
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<td></td>
<td>C6800 series</td>
<td>Box switches that provide high-density 10GE ports to connect to downstream devices and 40GE ports to connect to upstream devices</td>
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<td></td>
<td>C5800 series</td>
<td>Box switches that provide high-density GE ports to connect to downstream devices and 40GE or 10GE ports to connect to upstream devices</td>
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<tr>
<td>Security products for data centers</td>
<td>USG9500 series</td>
<td>High-performance firewalls</td>
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<td>Data center network controller</td>
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Why Huawei?

Huawei is proudly backed by 20 years of experience in the IP field and an outstanding series of network products and solutions. Recognized as a leading global network solutions provider, Huawei has an excellent long-term strategy for network development and is resolute in investing in the network field. Most importantly, Huawei’s world-class research capabilities and experts offer unparalleled experience in the areas of network standards and chip development.

As a member of several international standards organizations, for example, ONF, IETF, and IEEE, Huawei contributes to standards research, product development, and customization capability improvements. Huawei also remains committed to providing intelligent, programmable, and open networks to customers through its accumulated carrier-grade network experience and innovative products.

For more information about Huawei Enterprise ICT solutions, visit [http://enterprise.huawei.com](http://enterprise.huawei.com).