HUAWEI FusionSphere

AN OPEN CLOUD PLATFORM OPTIMIZED FOR ICT CONVERGENCE

HUAWEI

THE FUSION OF IT AND TELECOM

Smart phones, cloud computing and social networking are rapidly blurring the boundaries between telecommunications (CT) and IT; in many cases they are rapidly replacing traditional telecom services. In the UK, the amount of time smart phone users spend on Facebook is almost 3 times more than they spend on traditional voice calling. Another example is WeChat, a messaging application from China which has grown to almost 300 million active users in three years, while revenues from traditional mobile messaging applications such as SMS have shrunk by 15%.

The story is the same in IT, where Internet service providers such as Amazon have begun to offer advanced IT services to large enterprises and governments using cloud-based IT services to replace traditional IT. A telling case is the US CIA intelligence agency choosing Amazon and cloud-based IT over the offering from the traditional vendor - IBM.

All of these new services utilize the "pipes" provided by telecom operators, requiring the continuing investment of vast sums for faster infrastructure, while at the same time these new services are reducing telecom operator revenues. The key for long-term success for operators is to move beyond basic telecom services such as voice and SMS to services which also take advantage of the improved mobile and fixed-line data services. Some of these efforts involve the acquisition of IT service providers, but operators are also exploring offering cloud services to enterprises, as shown by the fact that between 2009 and 2013, the number of large operators offering cloud services doubled. So while cloud-based services threaten traditional telecom services, they also offer opportunities for telecom operators who are able to transform their offerings to take advantage of the convergence of IT and CT and the concepts of cloud-based services will have a major impact on the structure of the telecom networks.

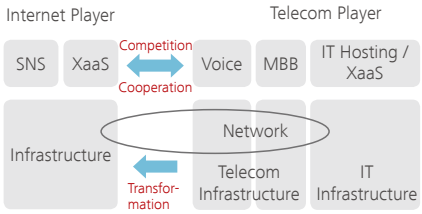


Figure 1: The Fusion of IT and Telecom

	Present situation	Trends
Service	Internet Player	Competition • "New" communication patterns like social networking increase in popularity, reducing revenue from network-centric services. • Many operators enter the market for IT services to enterprises by building or expanding data centers and by acquiring IT providers. Cooperation • Operators work with software providers to build partner ecosystem offering end-to-end cloud services. • Operators "white-label" existing cloud services, adding value through customer acquisition and support.
	• Social applications replacing telecom services • Offer cloud-based IT to large enterprises and government	
	Telecom Player	
	• Revise business model for existing telecom service • Invest in cloud-based services	
Infrastructure	Internet Player	Transformation • Adopt Internet Player infrastructure • Universal platform for telecom and IT • Move to X86 servers and scale-out storage • Software-defined network and virtualized everything • Big data capability for real-time marketing
	• Universal architecture • Open source-based software on commodity hardware • Rapid iteration for new services	
	Telecom Player	
	• Separated architecture • Dedicated hardware • Long time to market	

CHALLENGES AND OPPORTUNITIES FOR OPERATORS IN ICT CONVERGENCE

The rapid growth in Internet usage from mobile devices is having a huge impact on the telecom industry. To serve this growth, telecom operators are working to improve efficiency through dramatic changes such as centralized procurement, network sharing and service outsourcing. Traditional network construction, however creates bottlenecks when trying to reduce expenditure and at the same time increase revenues. While Internet service providers can utilize low-cost commodity hardware and open source software to build their software-based infrastructure, telecom operators build their networks using dedicated hardware, which is expensive and greatly reduces service flexibility and deployment speed. It is imperative that telecom operators think about the transformation of their networks.

It was to address this need for transformation that led Huawei to create SoftCOM, a telecom network architecture and evolution strategy. SoftCOM uses cloud computing and software-defined networking (SDN) to transform telecom networks, operations, and businesses. SoftCOM involves four main areas: architecture transformation, network transformation, service transformation and operation transformation. The foundation for these transformations is an efficient and open platform, which allows both IT systems and telecom services to be run in a cloud.

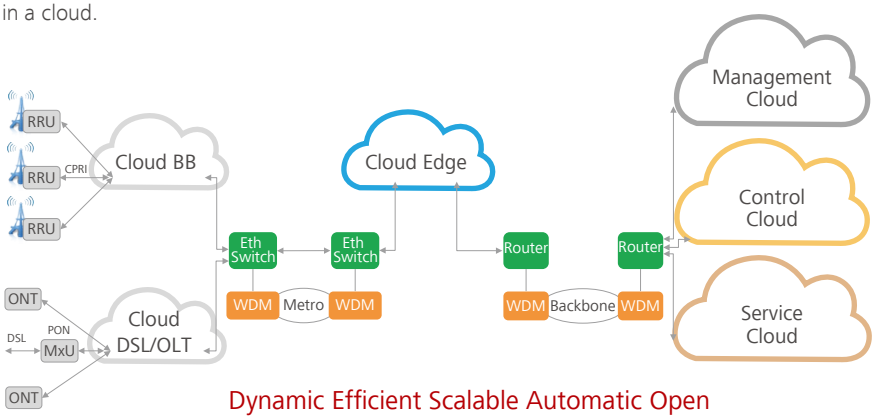
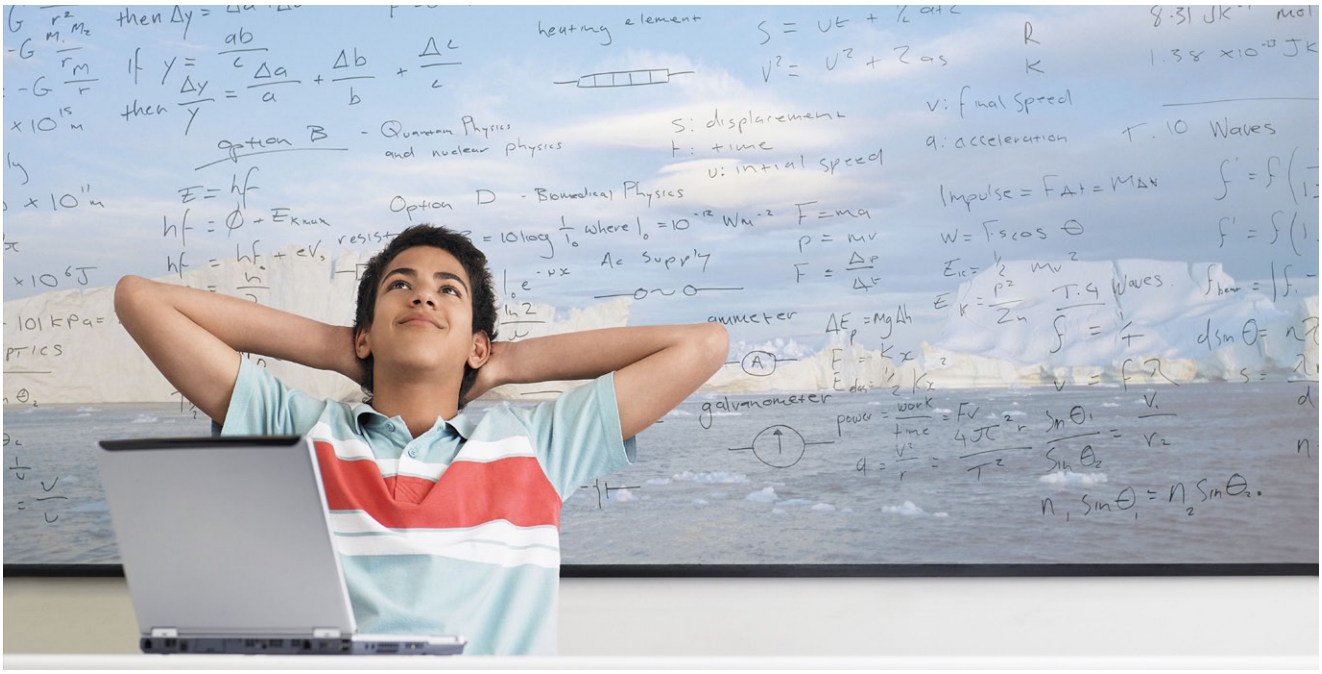


Figure 2: SoftCOM - telecom network transformation



A TELECOM CLOUD PLATFORM MUST BE OPEN

Maximizing the value of transition to the cloud

A large-scale survey of telecom operators' plans for Network Function Virtualization (NFV) revealed that the major factors driving cloud platform deployment plans are the desire to reduce network total cost of ownership (TCO) and increase network flexibility through open interfaces (APIs). Having an open cloud platform is the key to realizing these benefits.

NFV envisions a cloud platform which distributes the functionality of traditional telecom "boxes" and uses virtualization software to allow telecom service software to move from specialized hardware to commodity hardware, thereby reducing costs and increasing service deployment efficiency. This move to virtualization is hampered by the current market situation, where a small number of vendors dominate the market. Open virtualization software and an open cloud computing platform are required by operators to avoid vendor lock-in while minimizing the investment in virtualization and cloud platforms. An open cloud platform will also provide standard and open management APIs and service APIs, facilitating telecom operators' service deployment and simplifying resource and service management.

Providing competitive cloud services to enterprises

The first step in moving from traditional IT hosting, a business already provided by many operators, is to offer Infrastructure as a Service (IaaS) and Software as a Service (SaaS) to enterprises. Telecom operators have advantages in providing these two services, such as reliable network and data center infrastructures and strong after-sale support capabilities. In addition, an increasing number of governments require data to be retained locally, giving telecom operators an advantage in developing regional cloud services.

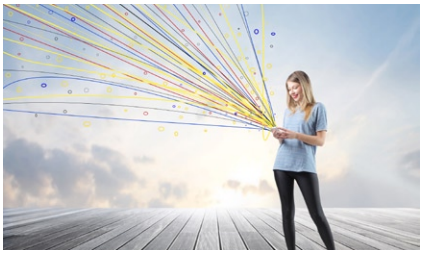
An open cloud platform not only helps telecom operators overcome the challenges posed by software and platform costs, it also can provide standard service APIs which will allow fully open hybrid clouds, enhancing the value of cloud services for enterprises.

FusionSphere OPEN CLOUD PLATFORM

OpenStack is an open source project supported by major IT and telecom companies, along with developers from all over the world. The goal is to build a versatile cloud platform that is easy to deploy and scale. The platform is oriented to public and private clouds and provides an open and standard cloud operating system for data centers. About 850 organizations from 132 countries are involved and Huawei, a gold member of the OpenStack Foundation, has been deeply involved since it was founded, providing vision and contributing key technology to the efforts.

Independent of any enterprise, OpenStack employs transparent management, design, and development to create open APIs and a decoupled modular system architecture. OpenStack is fully open and compatible with heterogeneous physical hardware, heterogeneous virtualization platforms, and diverse upper-layer applications.

Utilizing the open and standard interfaces provided by OpenStack, an open cloud computing platform with excellent flexibility can be built, reducing the costs of cloud data center deployment and management. To meet the unique needs of ICT convergence and telecom operators, Huawei created FusionSphere, an OpenStack-based cloud operating system.



OpenStack-based open APIs and orchestration

A unified, efficient, and open cloud operating system provides telecom operators the benefits from economies of scale, simplifies system integration, allows service scalability, and accelerates service innovation. The operating system can also provide competitive public cloud services and improve business value and transformation.

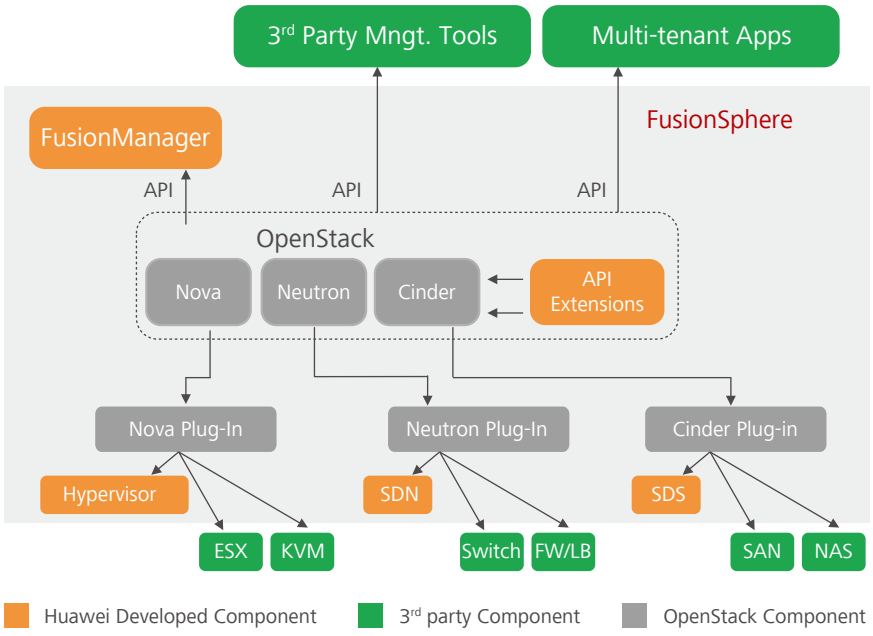


Figure 3: FusionSphere Architecture

By integrating with OpenSpack, FusionSphere supports third-party physical hardware and virtualization software, and can reuse the resources of existing data centers, improving the efficiency of scheduling and managing IT infrastructure resources. In addition to supporting cloud services based on OpenStack, FusionSphere also provides backup, disaster recovery (DR), live migration, resource scheduling across data centers, and customized telecom cloud extensions.

Huawei FusionSphere consists of a carrier-class server virtualization component, a distributed storage virtualization component, and a network and security virtualization component. The network virtualization is based on software-defined networking (SDN) and supports virtual extensible LAN (VXLAN).

Carrier-class virtualization

Server virtualization

Latency is a key performance indicator for carrier-class applications. Telecom applications are typically composed of multiple virtual machines that communicate frequently with one another. Compared with dedicated physical hardware, typical enterprise-class virtualization adversely affects the communication performance of applications. Based on innovative technologies, FusionSphere hypervisor improves the communication performance of VMs by 1.5 to 3 times, greatly reducing the latency, and enabling traditional carrier-class applications to be smoothly migrated to the cloud platform.

FusionSphere's cloud resource scheduling engine has been optimized for telecom applications, allocating virtualized resources according to "affinity" between network elements, thus achieving high performance and high reliability, allowing network elements to migrate from specialized hardware to standard x86 servers.

When deploying telecommunication network elements in the cloud, each virtual machine can be located based on "performance priority". A logical network element contains multiple VMs working together to provide a complete service function. Using the "performance priority" policy, FusionSphere will ensure that all the VMs for that logical network element stay close physically in the network topology to guarantee optimized latency and throughput between VMs.

To meet the requirements of IT and communication applications, FusionSphere provides reliability mechanisms independent of applications, such as high availability (HA) and lightweight fault tolerance (FT). High performance, high reliability, and low latency enable a better user experience in the environment of network function virtualization (NFV).

An indication of FusionSphere's server virtualization hypervisor optimization is that it out-performs enterprise-class virtualization in the SPECvirt_sc2010 tests.

Storage virtualization

Currently, many different storage systems exist in data centers are closely linked with the applications using the storage. Much of this storage is direct attached storage (DAS) located in servers, which is not virtualized and is not available for use outside that physical server. As a result, storage resources are not managed and scheduled in a unified manner, reducing resource efficiency.

FusionSphere adopts SDS(software defined storage), an innovative distributed storage system that provides high performance, low latency, and scale-out capability. SDS can be deployed on general-purpose servers, allowing the local storage of those servers to form a unified resource pool.

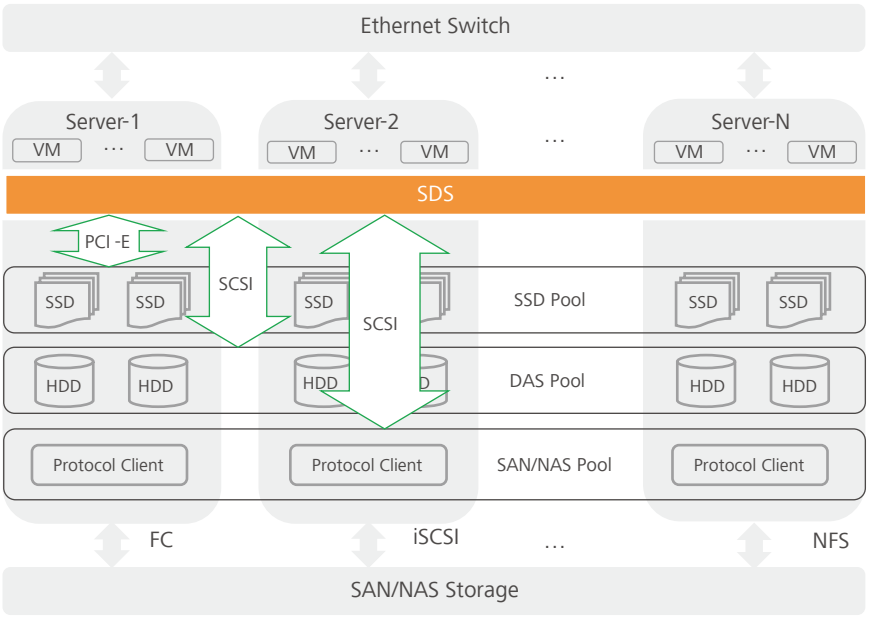


Figure 4: SDS Unified Storage Pool

FusionSphere virtualizes various storage systems and enables storage resources to form resource pools, building application-oriented and software-defined storage systems which have unified management. Based on the performance, capacity, and cost characteristics of various storage media, and service level agreement (SLA) requirements, FusionSphere uses an intelligent storage resource scheduling algorithm to deliver better performance and resource utilization. Compared with traditional disk arrays, SDS increases the IOPS of applications by 2 to 3 times, improves the throughput by 6 times, reduces the latency between server and storage to one fifth to a half and expands the peak I/O bandwidth by 10 times. Thus FusionSphere SDS provides better performance for mission-critical applications and helps telecom operators maximize return on investment.

Distributed cloud data centers

Unified management and scheduling of resources across data centers

FusionSphere allows organizing virtualized infrastructure resources into unified logical resource pools and provides centralized resource management and scheduling across physical data centers, creating a super-large cloud data center housing millions of virtual hosts. By supporting OpenStack APIs, FusionSphere supports an open architecture which is compatible with heterogeneous physical devices and virtualization platforms. Key technologies, such as fine-grained resource scheduling that crosses data centers and SDN-based traffic engineering, deliver higher resource efficiency and better energy efficiency, along with ensuring the QoS of services and reducing the total cost of ownership (TCO).

Some telecom applications and enterprise private clouds require high performance or have special requirements for Reliability, Availability, and Serviceability (RAS). For these applications, FusionSphere centrally schedules and manages heterogeneous physical resource pools and abstracts them as cloud services to respond to cloud tenants' and cloud service developers' requests for physical resources.

Service-aware and agile data center network

FusionSphere uses an overlayed virtualization network component that is based on SDN(Software Defined Network) and VXLAN to construct a full mesh Layer 2 network in and across data centers, simplifying application deployment and making resource scheduling flexible. Being aware of topologies and QoS, the SDN controller dynamically selects the correct routing path and adjusts the WAN routing policy and bandwidth among multiple data centers, reducing cross-data-center link bandwidth cost by 60% to 70% on average. The complete SDN consists of virtual switches, service gateways that provide virtual firewall and VPN functions, and centralized SDN controller clusters. SDN supports Layer 2 to Layer 7 network features, high availability of VMs and live migration across data centers.

By providing automated network configuration to support application/VM deployment, FusionSphere significantly simplifies application deployment and allows flexible resource scheduling.

High reliability across data centers

Service unawareness, active/active DR, active/standby DR, and backup ensure the high availability of telecom operators' telecom

services and mission-critical IT applications. Assuming adequate bandwidth and network quality, the DR resource pool between data centers uses the storage snapshot and mirrored I/O mechanism of FusionSphere to ensure synchronous DR between the production and DR data centers. If a site fails, a mutual-assistant site in the DR resource pool can immediately take over services from the failed site.

For a remote data center (the transmission distance is greater than 100 km), the bandwidth and network quality cannot be ensured, so FusionSphere uses asynchronous DR mode by default. FusionSphere also provides a backup mode, which backs up data to storage resources that reside in the same or different data centers.

CONCLUSION

By merging the cloud computing concepts of Internet Players with the telecom network, not only can traditional telecom services be delivered more efficiently, but the network can also allow IT resources to be delivered as services, opening up new revenue opportunities for operators. Huawei's FusionSphere is designed for ICT convergence and will help telecom operators smoothly migrate IT and telecom services to cloud platforms, delivering benefits both from providing cloud services to enterprises, as well as from supporting the transformation of networks and services. FusionSphere is a proven platform which has been deployed by telecom and enterprise customers in over 40 countries.

Glossary

API	Application Programming Interface
CSP	Cloud Service Provider
DAS	Direct-attached Storage
DR	Disaster Recovery
ICT	Information and Communications Technology
ISV	Independent Software Vendor
MBB	Mobile Broadband
NAS	Network Attached Storage
NFV	Network Functions Virtualization
RAS	Reliability, Availability and Serviceability
SAN	Storage Area Network
SDN	Software-defined Networking
SDS	Software-defined Storage
SNS	Social Networking Services
SSD	Solid-state Drive
VXLAN	Virtual Extensible LAN
XaaS	Anything as a Service

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