Cloud Computing Concepts and Values

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Objectives

- After completing this course, you will be able to know the following information about cloud computing:
  - Cloud computing concepts and background
  - Cloud computing deployment model
  - Cloud computing business model
  - Cloud computing key technologies
  - Cloud computing values

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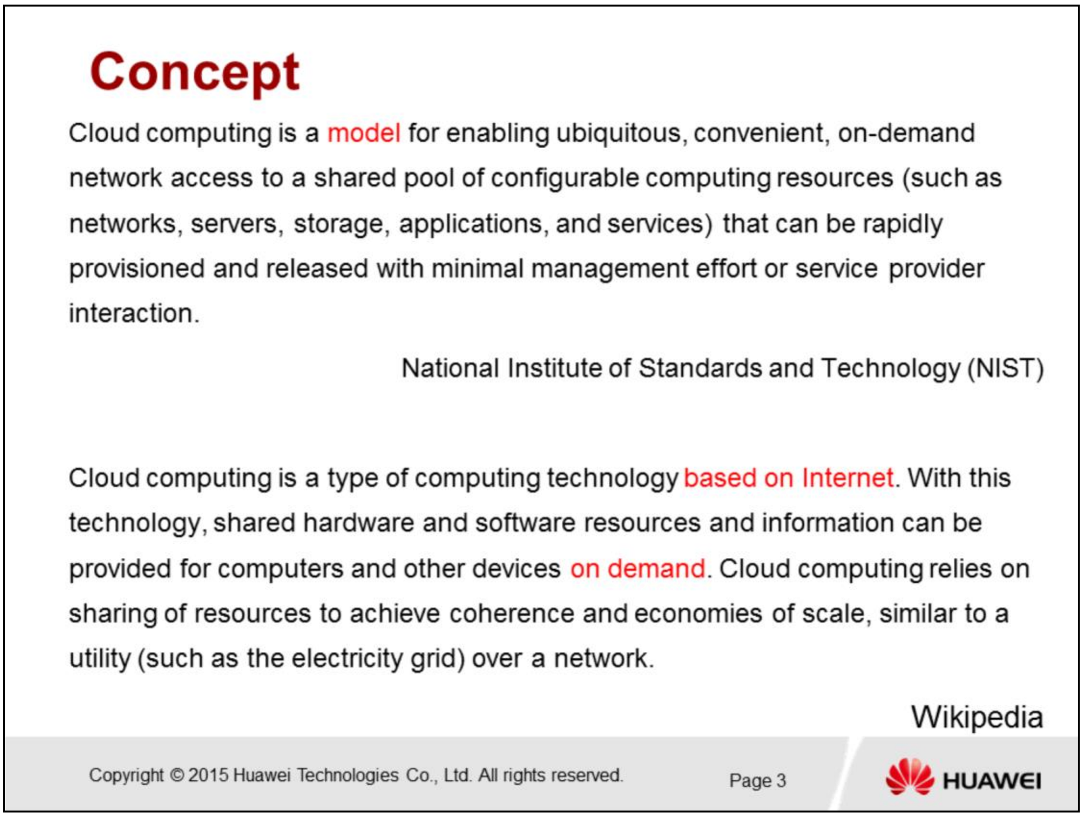
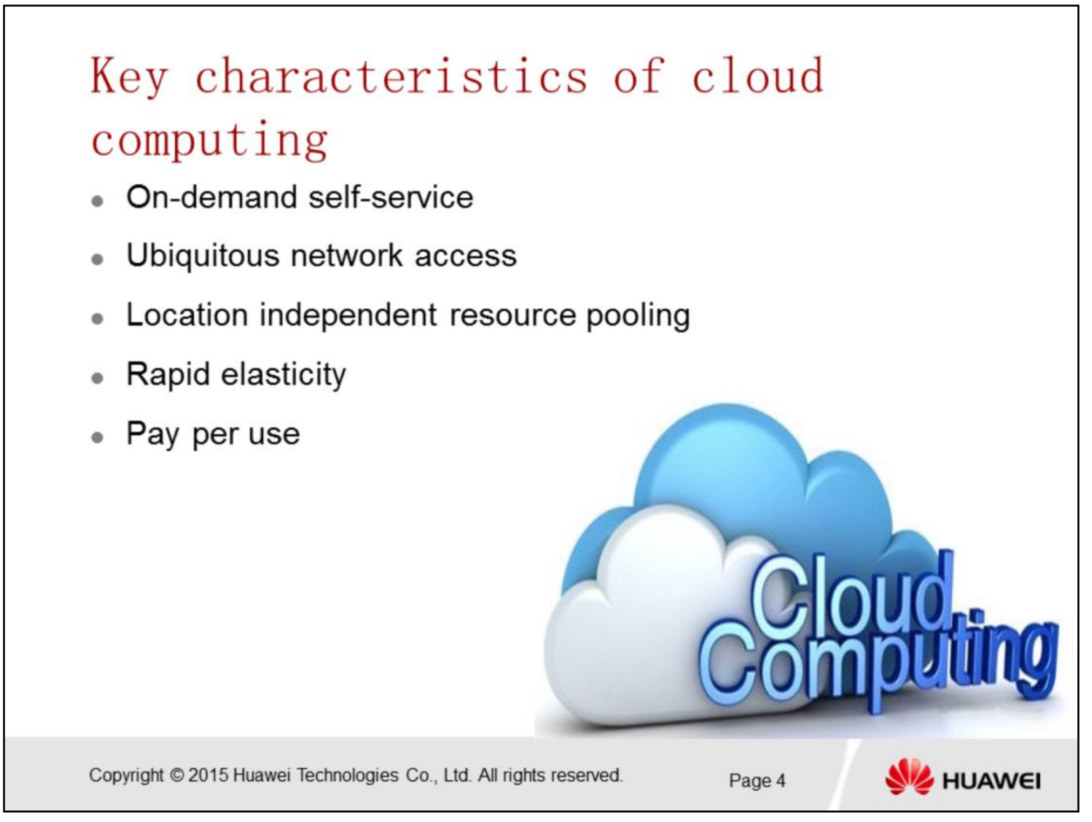
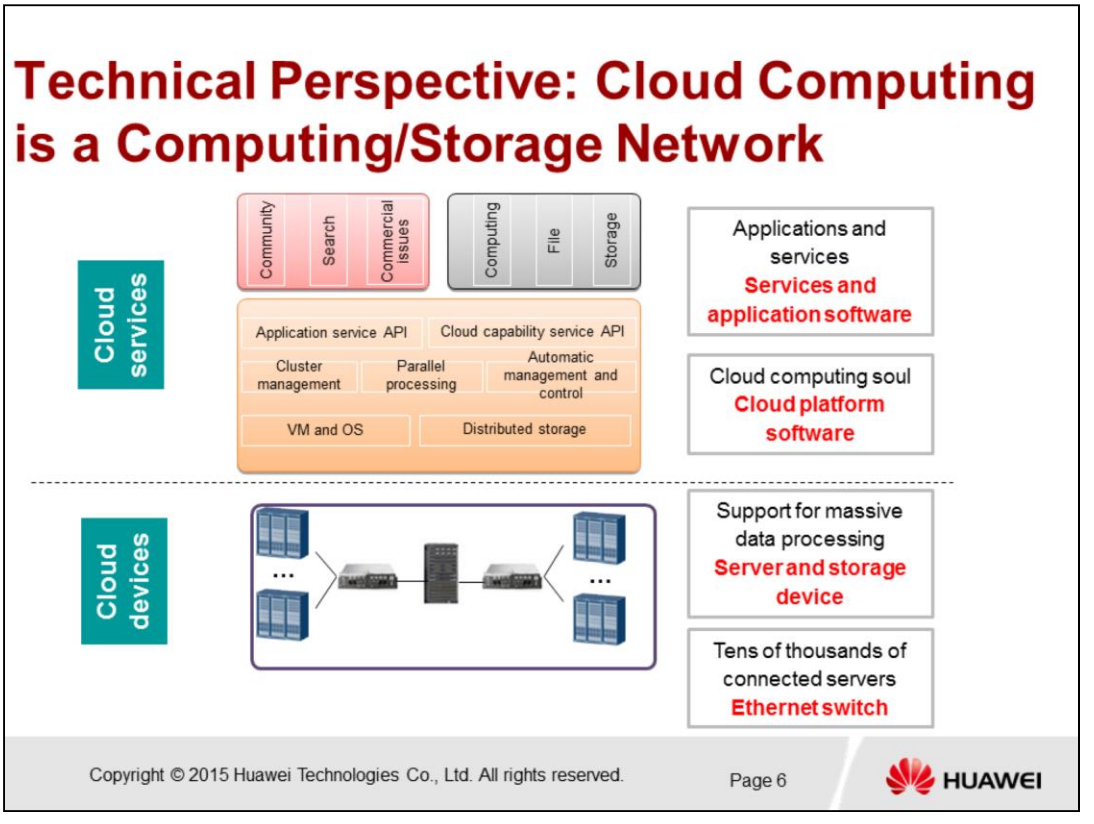


- The key characteristics of cloud computing?
- On-demand self-service, Location-independent resource pool, Pay per use, Elasticity
- Cloud computing is a service delivery and usage model. It provides dynamic and scalable virtual resources over the Internet. The term "cloud" is a metaphor for the network and Internet. In the past, the cloud image was used to refer to the telecommunications network, and then it was used to refer to the abstraction of the Internet and underlying infrastructure. Cloud computing, in a narrow sense, refers to an IT infrastructure delivery and usage model, in which users can obtain scalable resources they require over the network on demand. While cloud computing, in a broad sense, refers to a service delivery and usage model, in which users can obtain scalable resources they require over the network on demand. The services can be IT, software, and Internet services or other services. This service model indicates that computing capabilities can be circulated as commodities through the Internet.
- Cloud computing resources, provided through the Internet, are dynamic, scalable and virtualized. It is unnecessary for end users to control the cloud computing resources directly, know the details about infrastructure resources in the "Cloud" or master the relevant professional knowledge, and they only need to focus on required resources and the method to obtain the services through the network.

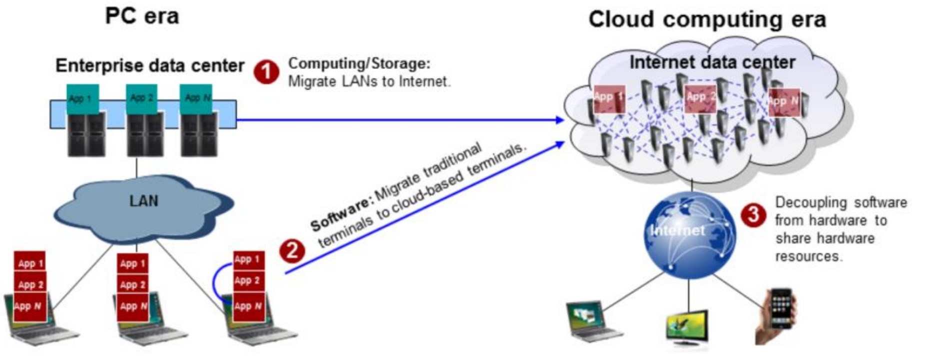


- On-demand self-service: Consumers can deploy the processing capability based on the actual requirements on the server time and network storage, and do not need to communicate with each service provider.
- Ubiquitous network access: Various capabilities can be obtained over the Internet, and the Internet can be accessed by using the standard mode to implement Internet access for various clients, such as mobile phones, laptops, and PDAs.
- Location independent resource pooling: Computing resources of the service provider are centralized so that customers can rent services. Different physical and virtual resources can be dynamically allocated or reallocated based on the customer requirements. Generally, users cannot control or know the exact location of the resources. The resources include storage media, processors, memories, network bandwidths, and virtual machines (VMs).
- Rapid elasticity: The users are provided with scalable services. Users can expand or reduce resources rapidly. A user can rent unlimited resources any time.



- From the technical prospective, cloud computing includes cloud devices and cloud services.
  - Cloud devices include the servers used for data processing, the devices used for data storage, and the switches used for data communications.
  - Cloud services include the cloud platform software used for physical resource virtualization, scheduling, and management, and the application platform software used for providing.
- Development trend of cloud computing:
  - Numerous low-cost servers are used to replace the specialized mainframes, minicomputers, and high-end servers.
  - Distributed software is used to replace the traditional standalone operating system.
  - Automatic management and control software is used to replace the traditional centralized management.

Business Perspective: Cloud Computing is an Information Power Plant



- Changes in the consumption model
  - Software, hardware, and services are provided over the Internet. Users use browsers or lightweight terminals to obtain and use the services.
- Changes in the business model
  - Users tend to purchase information services instead of hardware and software. This change is similar to the evolution of electricity 100 years ago.

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- IT means services. Cloud computing is used to build power plants in the information industry to provide IT services. Cloud computing provides software, hardware, and services over the Internet, allowing users to obtain and use these services by using the network browser or lightweight terminal software. Services are transferred from the local area network (LAN) to the Internet, and terminal computing and storage are transferred from local terminals to the cloud.
- Cloud computing enables the transformation of the IT industry from the "single generator" to "centralized power supply enabled by power plants". This transformation indicates that computing capabilities can be circulated as commodities, such as electric power, which is easy to use and cost-effective.
  - PC: Personal Computer
  - App: Application
  - LAN: Local Area Network

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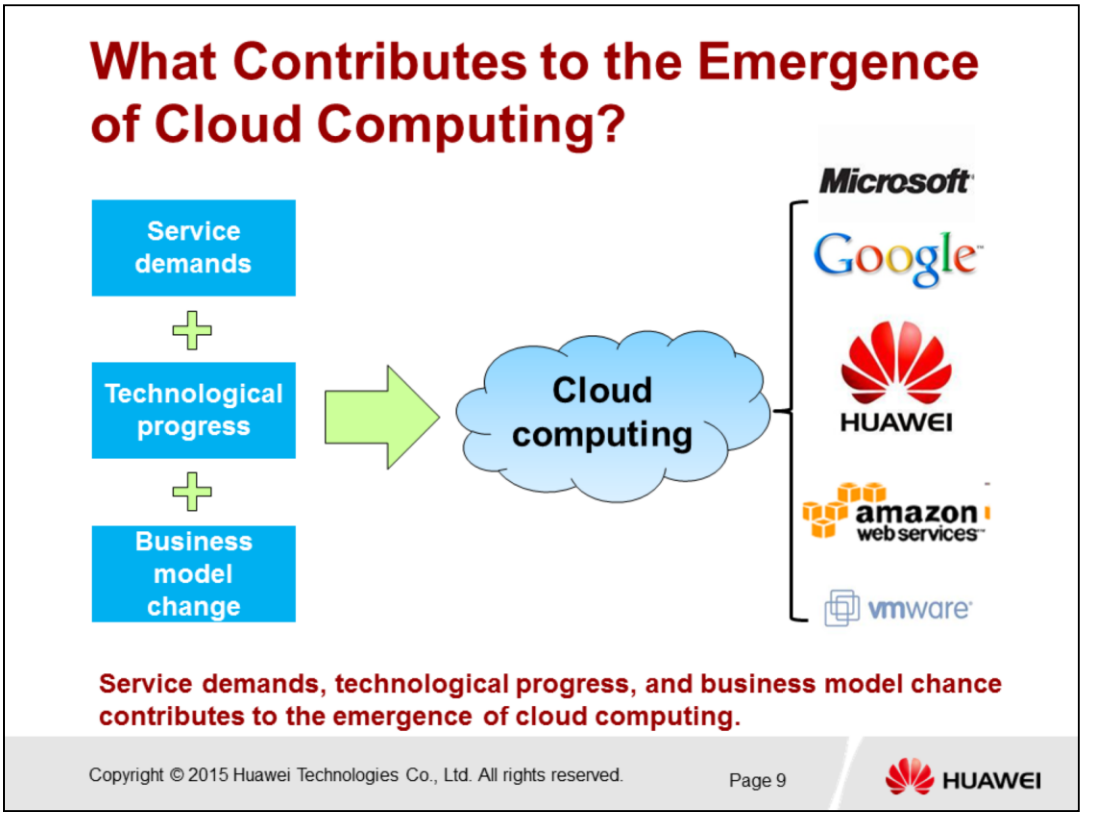
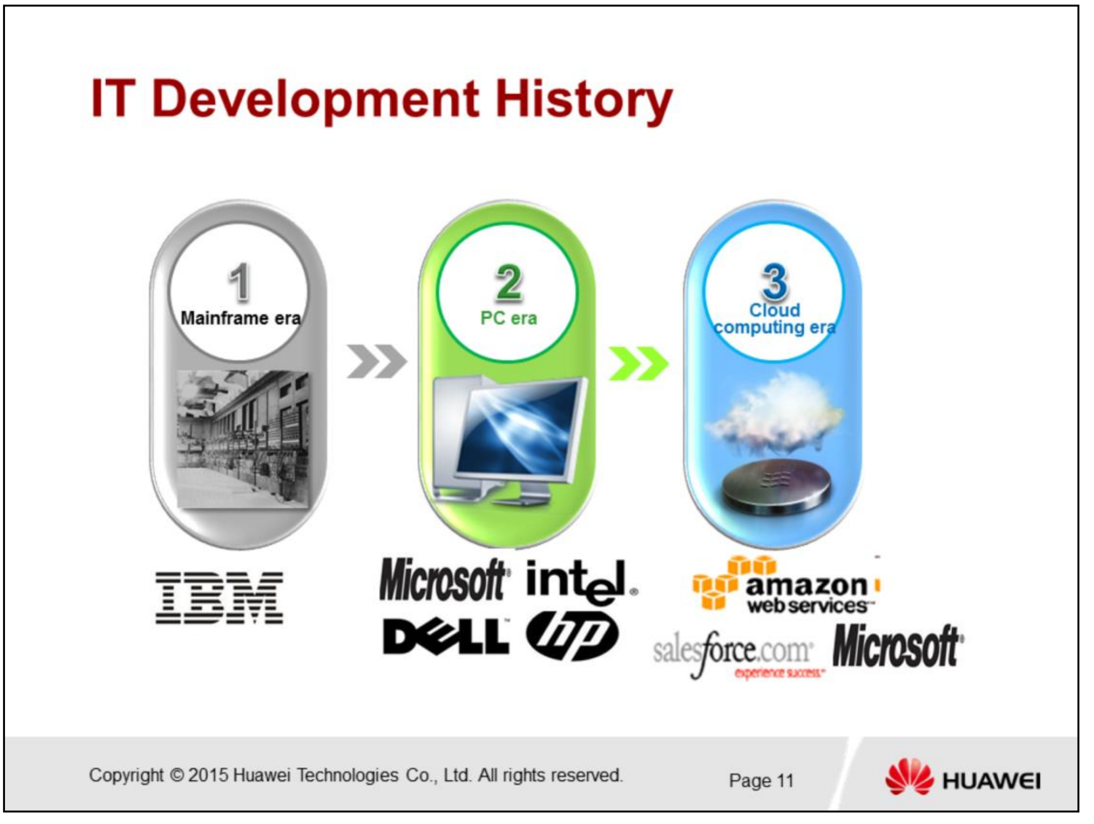
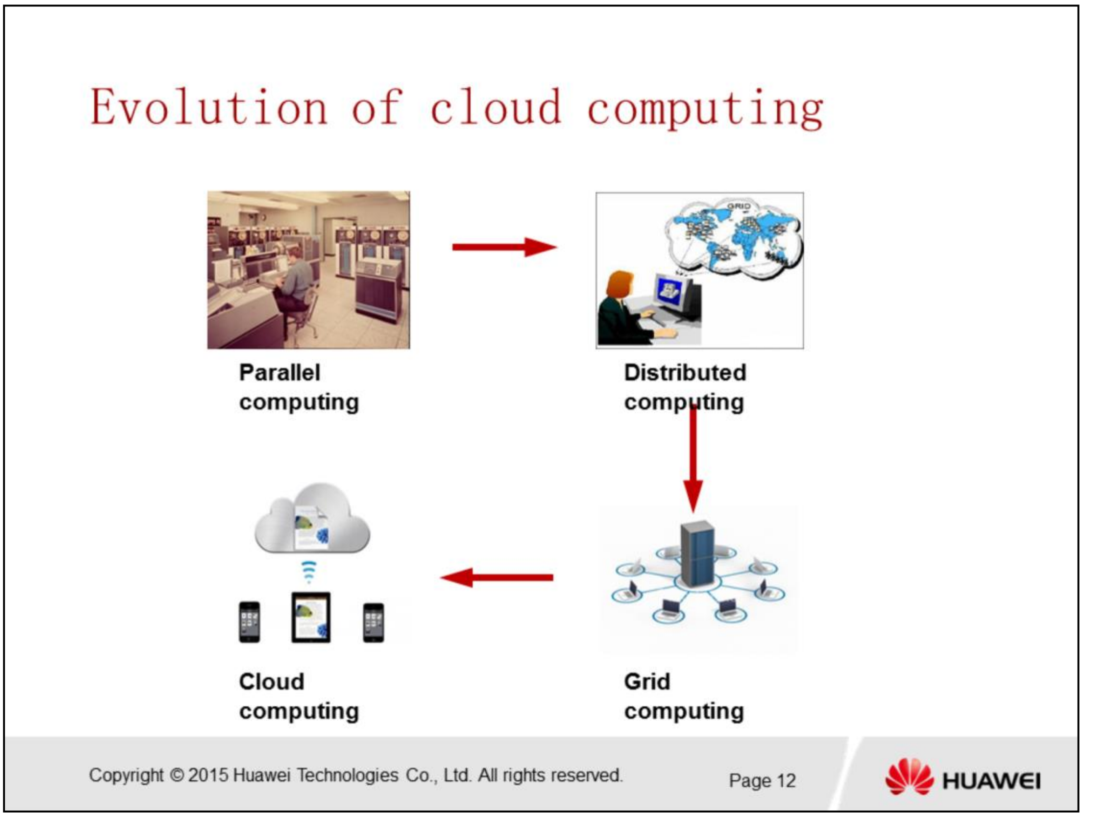


- Service demands, technological progress, and business model chance contributes to the emergence of cloud computing.
- Service demands:
  - Governments and enterprises require high-performance and low-cost IT services.
  - Strong demands of individual users for Internet and mobile Internet applications, pursuing better user experience.
- Technological progress:
  - The mature virtualization technology, distributed and parallel computing, and Internet technologies make it possible to provide IT infrastructures, development platforms, and development platforms, and software applications.
  - The bandwidth technology development and an increasing number of users make the Internet-based service mode become the mainstream.



- Mainframe centralized mode: applies mainly to large application processing and is restricted by the data center.
- Server/Client mode: Enables applications to be moved from data center to end users' clients.
- PC： Personal Computer
- Cloud computing mode: Meets requirements of explosive information growth and for a dynamic and flexible architecture.



- Cloud computing is based on existing techniques such as distributed computing, parallel computing, and grid computing, or is the business implementation of such computer technology concepts.
- Parallel computing enables multiple instructions to be executed at the same time. The computing process is divided into several smaller parts that are conducted concurrently.
- In distributed computing, a computation-intensive task is divided into smaller parts that are assigned to different computers.
- Then a final overall computation result is obtained based on the multiple computation sub-results.

Cloud computing and other computing models

Computing Model	Definition	Characteristics
Parallel computing	Combines multiple types of computing resources for handling large and complicated computations.	Uses multiple computing units working together for a common computation task.
Distributed computing	Divides a computing-intensive task into multiple smaller tasks and assigns them to multiple computing units. An overall computing result is obtained based on the multiple sub results.	Assigns a computation task to multiple independent computers on the network.
Grid computing	Interconnects geographically scattered resources into a logical one over the Internet, making them work like a super computer.	It is one type of distributed computing. It provides integrated information and application services.
Cloud computing	Over the Internet, provides shared software and hardware resources as well as data information on demand to computers and other devices.	Uses the Internet to offer on-demand, scalable computing and application services.

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- Cloud computing is an integration of grid computing, distributed computing, parallel computing, network storage technologies, virtualization, load balancing, and other traditional computer and network technologies.

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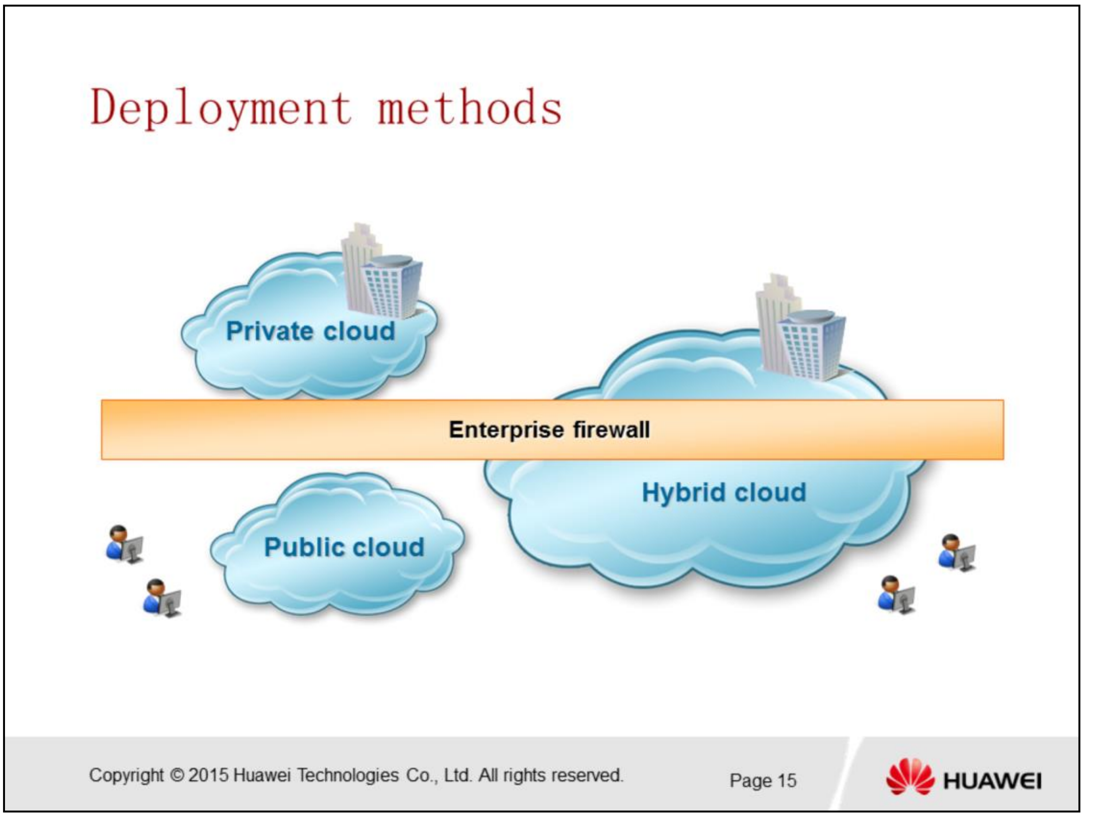
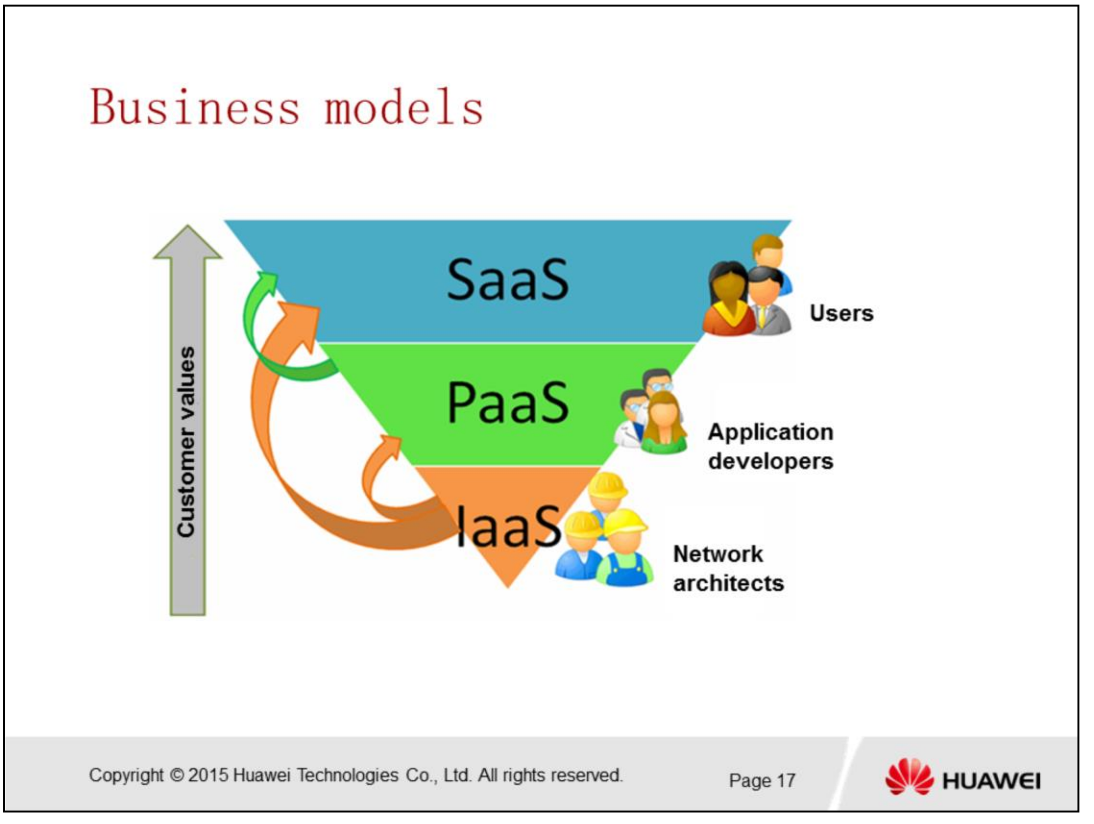


- Cloud computing consists of four deployment models: private, public, community, and hybrid cloud computing.
- Private cloud: It is often used and operated by an organization. Huawei data center is an example of such cloud computing. Huawei acts as both the operator and user of Huawei data center.
- Public cloud: It is similar to a switch, which is owned by a telecom carrier and used by general public.
- Community cloud: It shares infrastructure between several organizations from a specific community with common concerns (such as security, compliance, and jurisdiction). For example, Huawei constructs a settlement or logistics system and shares the system with Huawei's suppliers. Another example is education networks, which provide computing resources for colleges and scientific research institutions.



- The Infrastructure as a Service (IaaS) provides all kinds of resources to users, including processors, storage devices, networks, and other basic computing resources. With the IaaS service, users can deploy and run any software from operating systems to applications. Without the need for managing or controlling any cloud computing facility, users can select the operating system, storage space, and applications, or control a limited number of networking components (for example, the firewall and load balancer).
    - For example, Amazon EC2
- Platform as a Service (PaaS) provides users with application development platforms (such as Java and .Net), which are deployed on cloud computing infrastructure. Users do not need to manage or control the cloud computing infrastructure, but they can control the deployed application development platform.
    - For example, Microsoft Azure
- Software as a Service (SaaS) provides users with applications (such as CRM, ERP, and OA), which run on cloud computing infrastructure.
    - For example, Salesforce online CRM

Business models

Model	Services	Profit Model	Example
SaaS	- Web 2.0 applications - Enterprise applications - Telecom services	- Provides desired services to users and charges them on pay-per-use basis.	- Salesforce: CRM
PaaS	- Provides application running and development environments. - Provides application development components (such as databases, emails, and messages)	- Provides a hosted collection of IT resources, general web capabilities, and communication capabilities to application developers and operators, and charges them on pay-per-use basis.	- Microsoft: Azure's Visio Studio
IaaS	- Leases computing, storage, and network resources.	- Charges on pay-per-use basis. - Earns profits by enlarging the business scale.	- Amazon: EC2 cloud host

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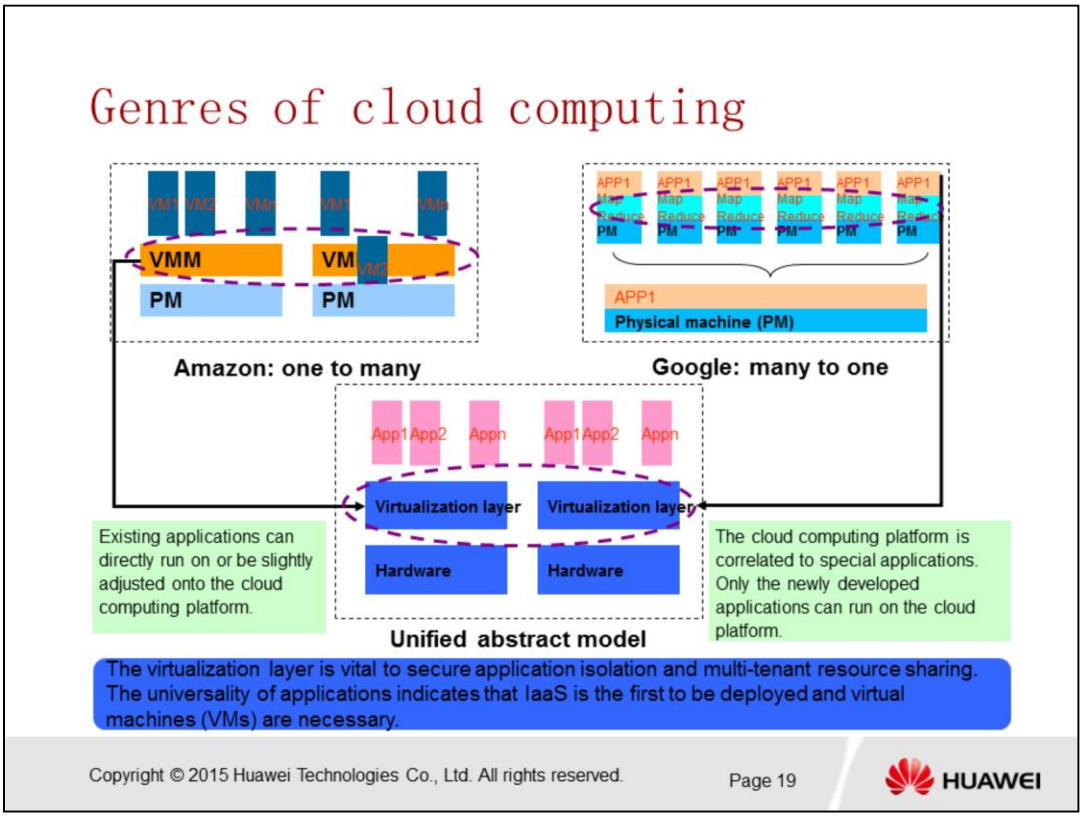
- Web 2.0 is a general term for the new generation Internet applications. With Web 1.0, users were only able to obtain information through web browsers, however with Web 2.0 users can not only browse but also create website contents. Users are the readers as well as the authors on the Internet.
- Web hosting provides an online system where individuals and organizations can store data, images, videos, and any other content to be made available over the Internet.



- Amazon application scenario
  - Resources are multiplexed among applications using time-division technology.
- Key technologies
  - Computing, storage, and network virtualization
  - VM monitoring, scheduling, and migration
- Example
  - Amazon EC2

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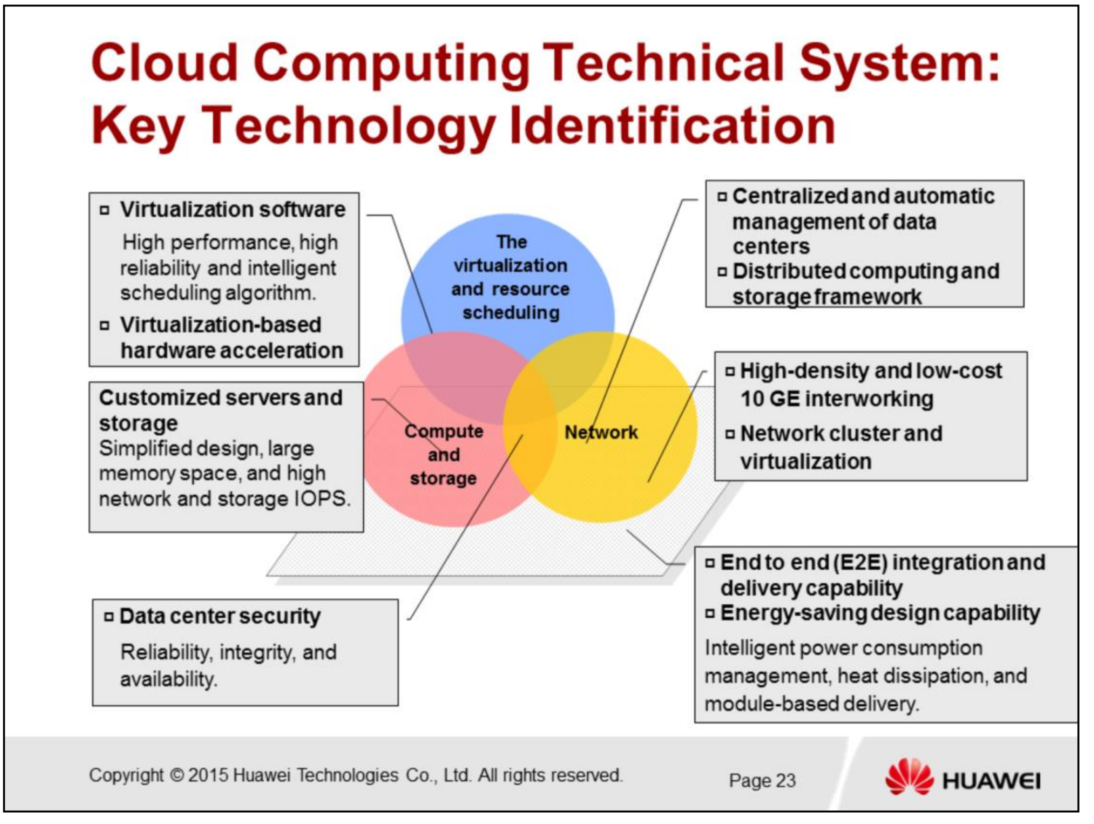
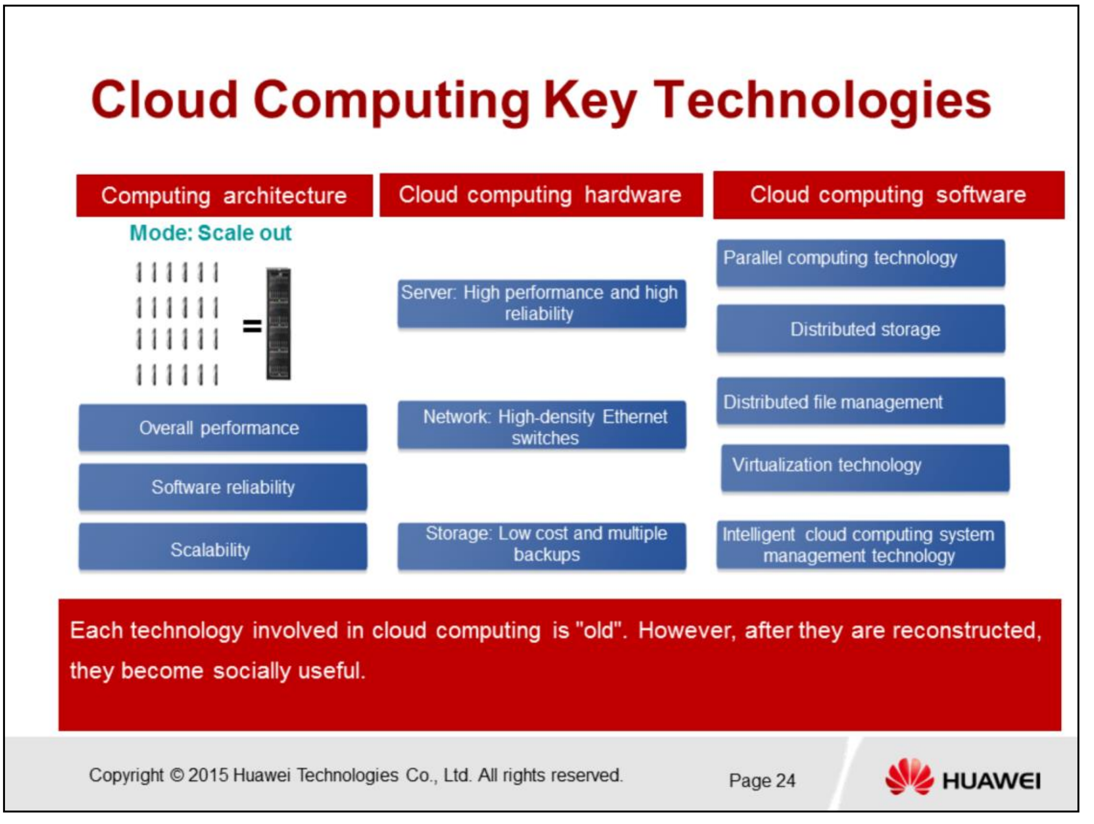
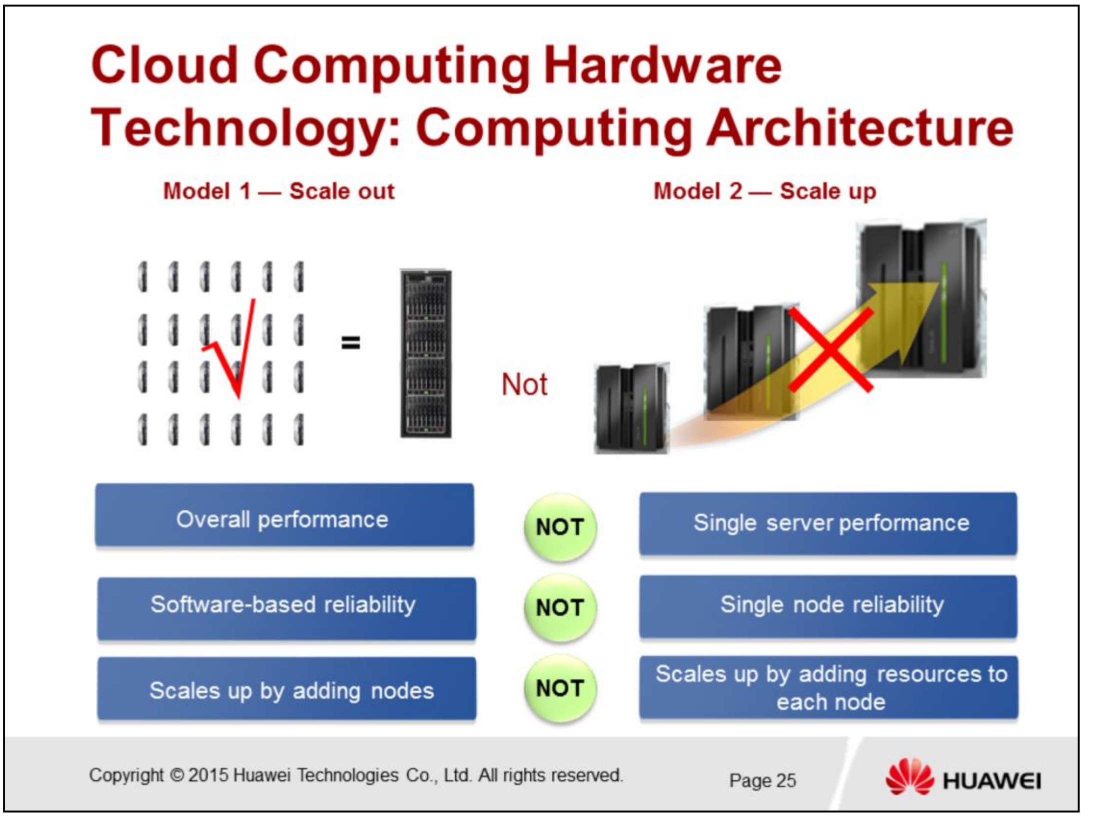


Key technologies to build a highly efficient and energy-saving cloud data centers include physical devices (servers, storage, and network devices), virtualization platform software, distributed computing, storage resource scheduling, integrated automatic management software, virtual data center security, and E2E integration delivery capabilities.

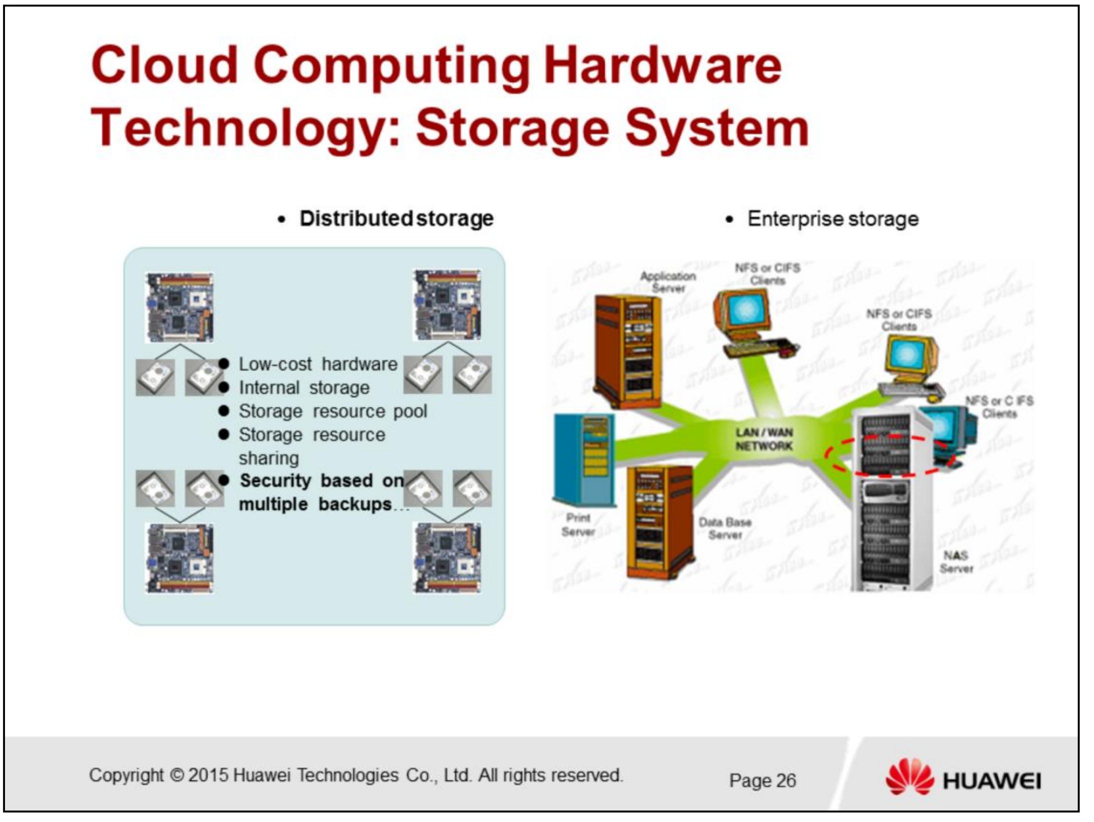
- Servers with large memory space and high network and storage IOPS can provide powerful computing capabilities for cloud data centers.
- Storage devices with high IOPS as well as linked cloning, thin provisioning, and snapshot functions can provide powerful storage capabilities for data centers.
- High-density and low-cost switches that supports large layer 2 networks can provide powerful switching capabilities for data switching.
- The virtualization software platform can abstract physical resources into resource pools to provide underlying resources for VMs with different specifications.
- The flexible and efficient distributed computing and storage architecture supports cloud computing resource scheduling and adjustment.
- Door and network access control, virtualization software, OS, and database security hardening, and rights-and domain-based management of users are used to ensure data center security.
- Integrated and automatic management software improves the maintenance efficiency and reduces the enterprise costs.



- Key technologies can be classified into three aspects: the overall computing architecture, hardware, and software.
- The overall computing architecture must provide high performance, reliability, and scalability, and can be extended.
- Cloud computing hardware includes high-performance and highly reliable computing servers to provide computing resources, security and low-cost storage devices to provide data storage space. High-density switches that support large layer 2 network for data communication and exchanges.
- Cloud computing software uses parallel computing technology for big data analytics, distributed storage technology for integrating storage resources and providing scalable resource pools, distributed file management for data management, virtualization technology for computing and storage resource pooling, and effective and intelligent O&M management technology for simplifying the work of maintenance personnel.

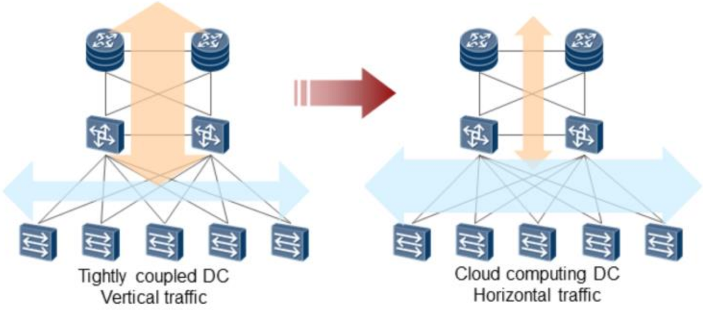


- Many systems are simple at the beginning but become complicated if the system capacity is expanded. Usually, a system is upgraded for more capacity to support more users, files, applications, or to have more servers connected. Common system capacity expansion modes include scale up and scale out.
- Scale up (vertical expansion): Adds storage capacity to existing systems to meet increasing data storage requirements. In this mode, only the storage capacity increases, but the bandwidth and computing capabilities are not increased accordingly. Therefore, the entire system will soon reach performance bottlenecks and needs to be scaled again.
- Scale out (horizontal expansion): Adds nodes. Each node can provide storage capacity, processing capabilities, and I/O bandwidth. If one node is added to the system, the storage capacity, processing capabilities, and I/O bandwidth all increase. In addition, After a scale-out operation, the system is still a single system from the perspective of users. The scale-out mode simplifies system upgrade, and users can purchase resources on demand to reduce the Total Cost of Ownership (TCO).
- Cloud computing is designed to achieve optimal performance with minimum costs, which is completely different from the design principle of traditional telecom and IT devices. These devices (including servers, mainframes, and enterprise storage devices) are designed to achieve high reliability and performance.



- Enterprise usually uses specialized storage devices that are usually expensive.
- The distributed storage system consolidates low-cost IDE and SATA hard disks on servers into storage resource pools, which reduces storage costs and provides cost-effective computing and storage resources. Distributed storage and Multi-data-backups are used to store massive information and ensure system reliability. A set of data can be stored in multiple identical copies to ensure data security.

Cloud Computing Hardware Technology: Data Center Networking



- Increase of horizontal traffic

  Concurrent computing services, such as searching, requires cooperation between server clusters, generating a large volume of horizontal traffic.

  Flexible deployment and dynamic migration of VMs require real-time synchronization of a large amount of data.

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- With the development of the cloud computing, more and more services are carried on VMs in the data center, and the service data flow changes from vertical traffic to horizontal traffic, which is a big shock and challenge for network requirements in the data center.
- The migration of VMs in the data center promotes the development of layer 2 network, which supports high-density ports and large-capacity data communications and can connect more servers to improve the processing ability of the data center.

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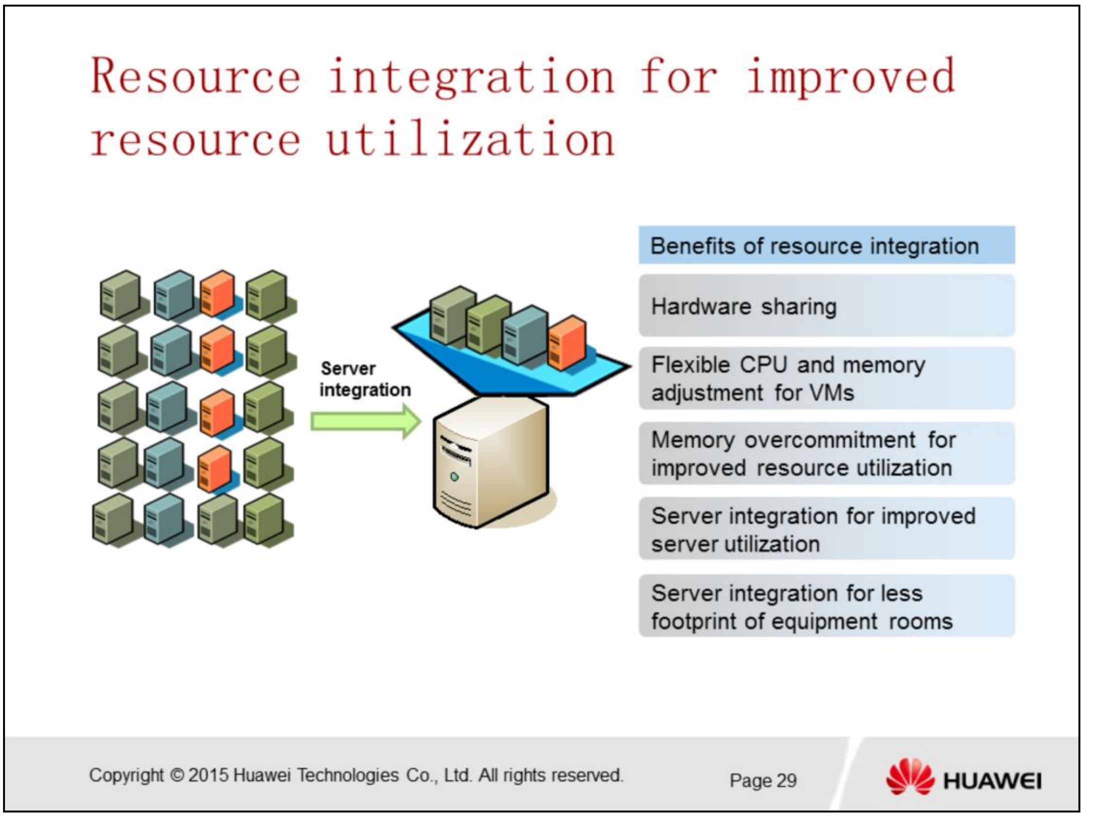
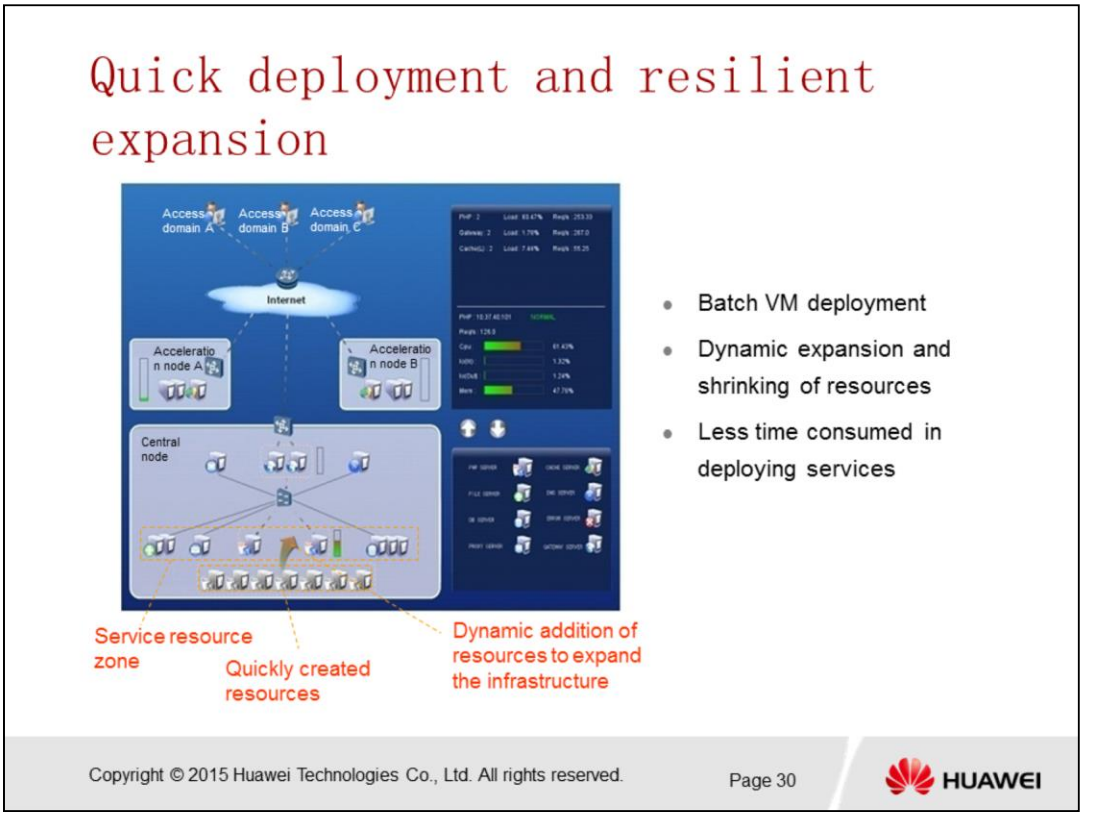
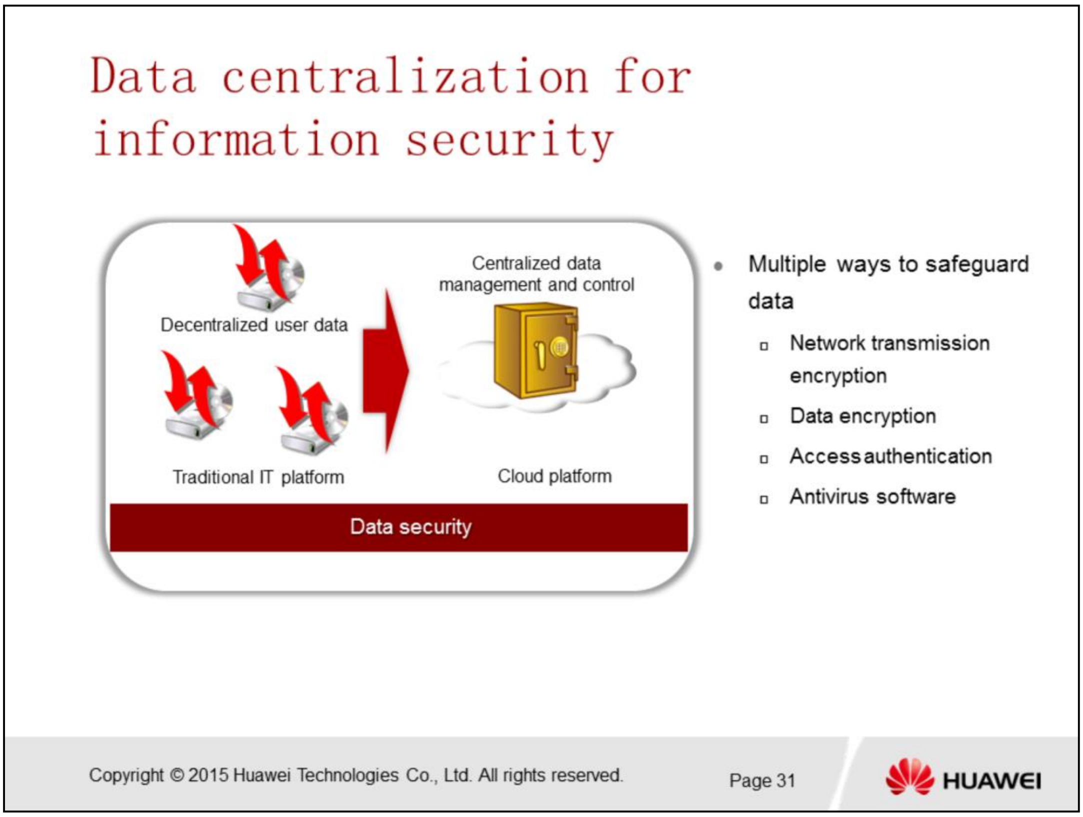


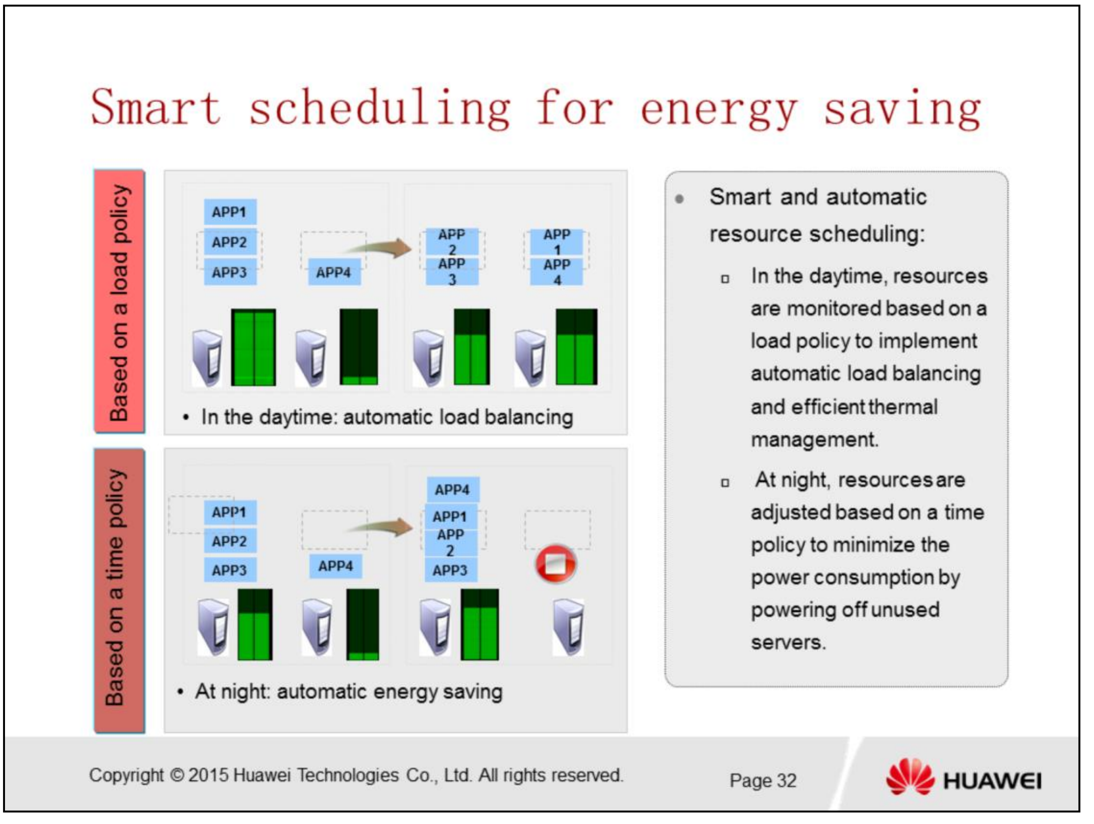
- The virtualization technology supports elastic scalability of server resources:
- 1. Each server is virtualized into multiple VMs, preventing exclusive occupation of a server by a specific service.
- 2. VM specifications (CPU and memory) can be flexibly changed to increase or reduce the number of VMs. This meets the computing resource requirements of services.
- 3. With the virtualization computing technology, physical memory resources can be virtualized into more virtual memory resources, creating more VMs.



- You can deploy a small number of servers during the initial deployment when the service scale is small, and add servers later when the service scale grows. The expansion can be implemented by using the PXE or an ISO file to add computing nodes and the maintenance portal to add servers to the existing system.
  - Cloud-based service systems employ batch VM deployment.
  - Resources can be deployed in a large scale within a short time, quickening response to service requirements.
  - Resources can be dynamically expanded and shrunk to best meet service requirements.
  - Manual operations are less due to the adoption of automatic deployment.
  - Customers can seize market opportunities in a timely manner due to quick service deployment.
  - Compared with traditional service deployment that is planned on a monthly basis, cloud-based service deployment is planned on a minute or hour basis.



- On traditional IT platforms, data is scattered on application servers. Security holes may occur on any server. In comparison, cloud systems have all data centrally stored and maintained and provides the following security means:
- 1. Network transfer: Data is transferred through HTTPS.
- 2. System access: requires certificates or accounts.
- 3. Data security: (1) A secure architecture and the hardened VMM to isolate VMs from each other. (2) When a VM is released, all disk data is erased to prevent data restoration. (3) The management data such as system accounts are saved after being encrypted.
- 4. Trend Micro antivirus software



- Resource scheduling is based on intelligent resource scheduling policies, which enable resources to be automatically scheduled and allocated on demand with load balancing and peak load shifting, reducing power consumption and emission.
  - In the daytime, resources are monitored based on the load policy to implement automatic load balancing and efficient thermal management.
  - At night, resources are adjusted based on the time policy to minimize the power consumption by powering off unused servers.
- Dynamic power management (DPM) helps the system to reduce power consumption. When the system detects that load on a cluster has reached the predefined DRS policy, it migrates the VMs to a smaller number of hosts to consolidate the host resources used and then powers off the idle hosts. When detecting that VMs require more resources, the system powers on some hosts to provide resources to the VMs.

Reduced noise and power consumption

< 55 dB   1 dB

NOTE:
1 dB: threshold of hearing
< 20 dB: can be considered quiet
20 dB to 40 dB: whisper
40 dB to 60 dB: ordinary conversation
> 60 dB: can be considered noise

35°C to 45°C   Close to room temperature

300 W   70 W

NOTE:
The operating temperature of a PC ranges from 35° C to 45° C. In a crowded office, the room temperature is close to the temperature of PCs.

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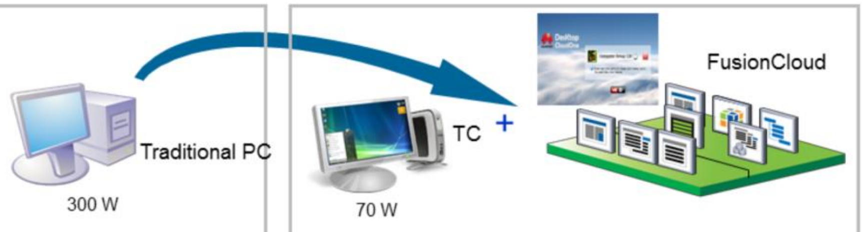
Efficient maintenance for cost reduction



Maintenance

- Process: report faults > assign persons > locate faults > maintain
- The maintenance process lasts up to 2 to 4 hours. The long service interruption causes extra labor costs.
- Maintenance personnel: 3% to 5% of employees

Power consumption

- Traditional PCs have an average power of 300 W. This power level brings about high power costs.

Maintenance

- The front-end devices are free of maintenance.
- Process: fault (crash) > self-service restart > end
- The process takes only 3 minutes, minimizing service interruption.
- Fewer maintenance personnel are required. A single person can maintain an average of 1000 desktops.

Power consumption

- Each thin client (TC) consumes several watts to 20+ watts per hour. Reduced power consumption lowers OPEX and carbon footprints.

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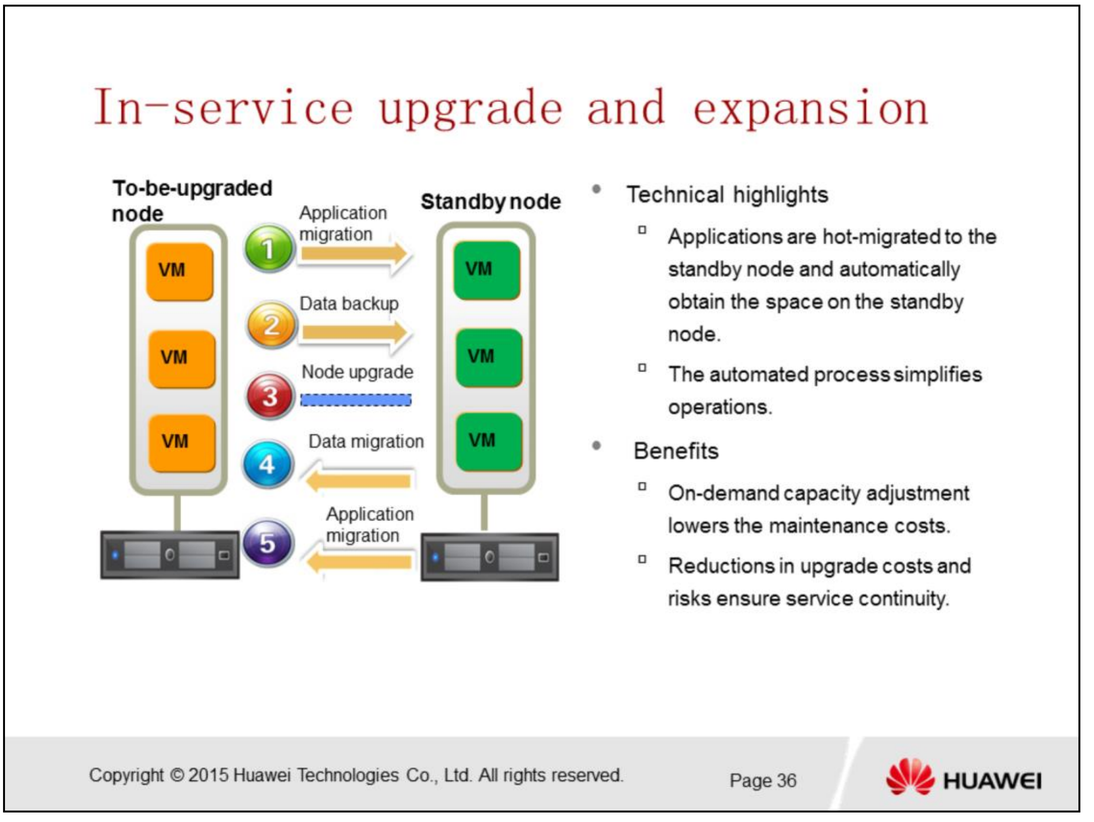
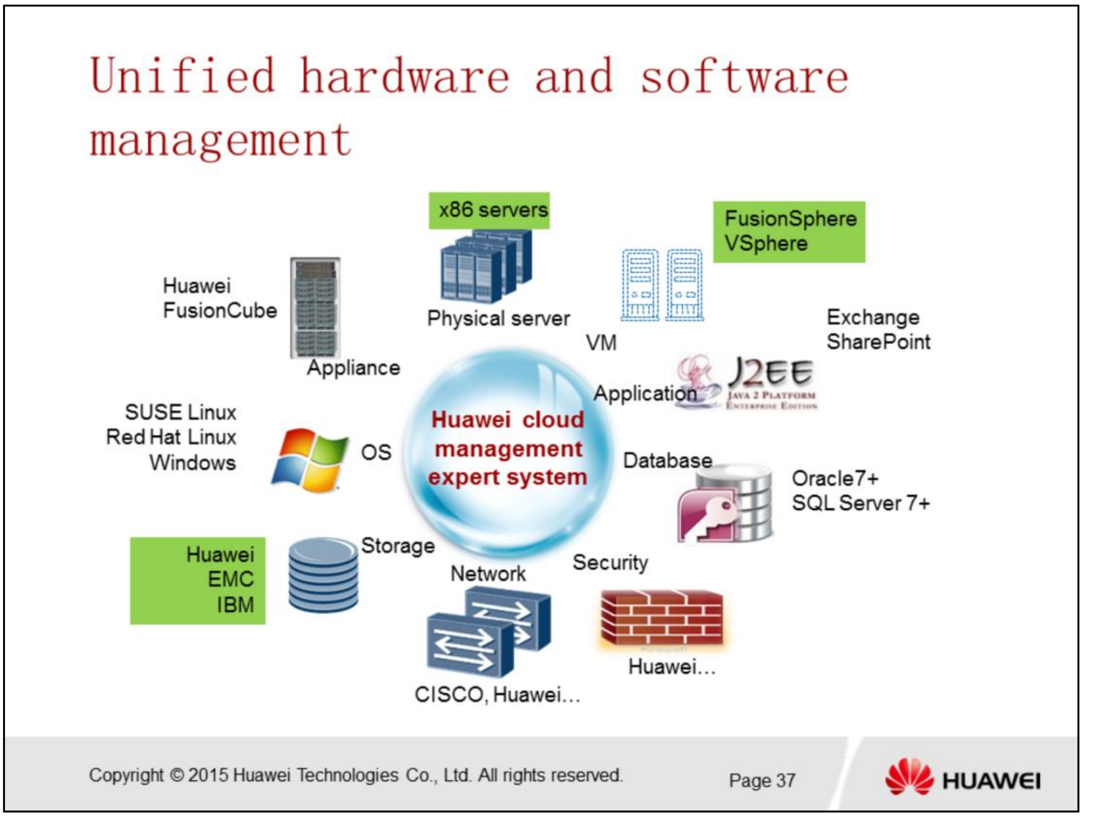
- You can log in to the system desktop using various terminals from your office seat, office, home, or other locations at any time.
- The data and desktops uniformly run and are stored on the data center. The Hot Swap mode is supported. Users do not need to stop the running applications during terminal replacement.



- 1. Regarding the upgrade of management nodes, first you can upgrade the current standby node, next perform an active-standby switchover, and then upgrade the new standby node.
- 2. Regarding the upgrade of a computing node, first you can switch VMs from that computing node to another, next upgrade that computing node, and then migrate VMs back to that computing node.



- Huawei cloud solution supports:
- 1.The ability to manage physical servers, switches, and Huawei firewall devices (E1000 and E8000) in a unified manner.
- 2. Mainstream servers and storage devices from other vendors.
- 3. Both Huawei virtualization software FusionCompute and VMware virtualization software.

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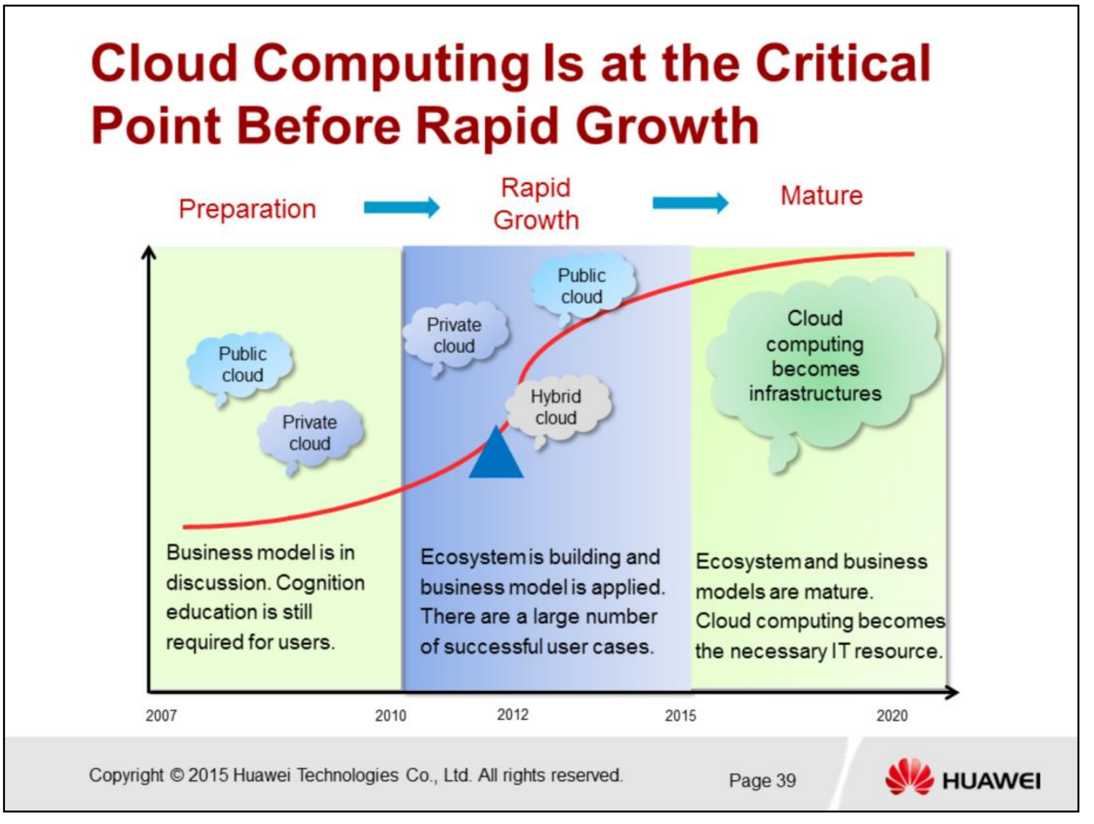
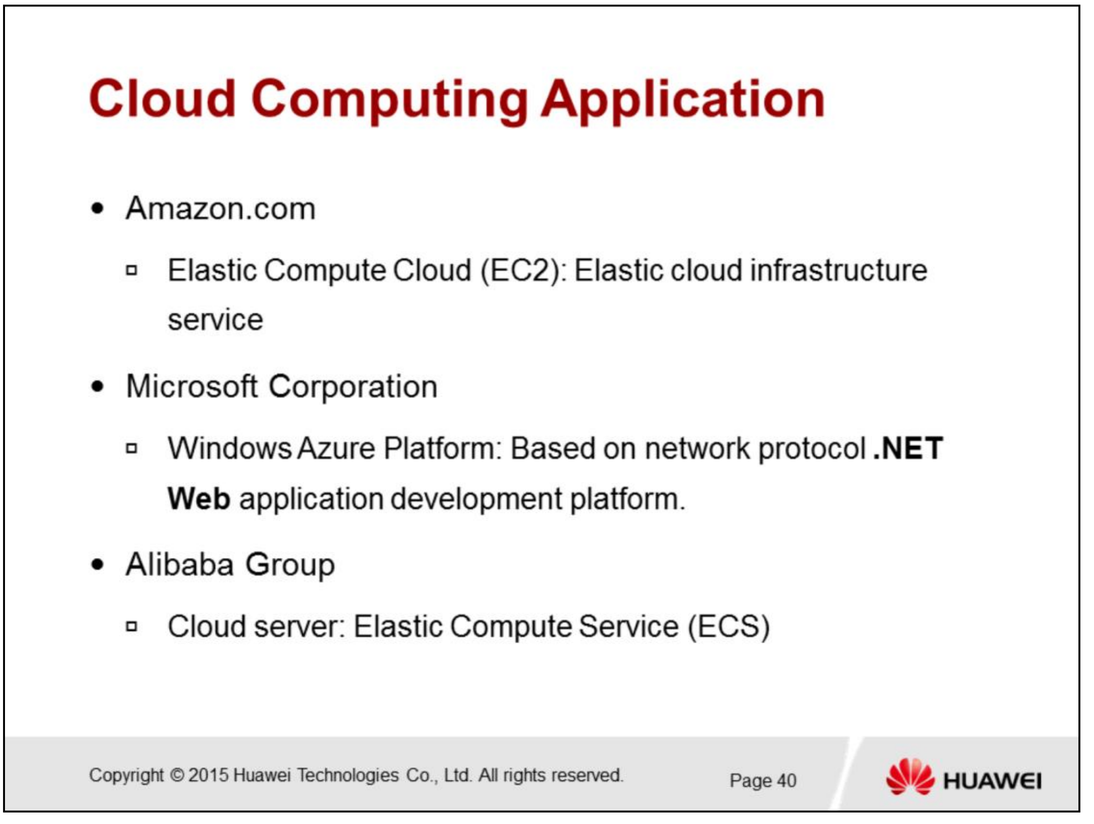


- Cloud computing has three phases: preparation, rapid growth, and mature.
  - Preparation phase: Cloud computing models were in the exploration stage, seldom used, and no successful cases for reference.
  - Rapid growth phase: several application modes were successfully explored after preparation phase.
  - Mature phase: Cloud computing business model is mature, the entire ecosystem is complete, and cloud computing has become the necessary IT resources required by enterprises to achieve success.



- Amazon EC2 supports VM leasing, VMs used in Linux and Windows, data processing, and storage leasing.
- Microsoft Azure provides the VM development platform, Visual Studio which is based on Windows server and Linux systems.
- Alibaba cloud server, Elastic Compute Service (ECS), is a simple, reliable computing service with scalable compute capacity.

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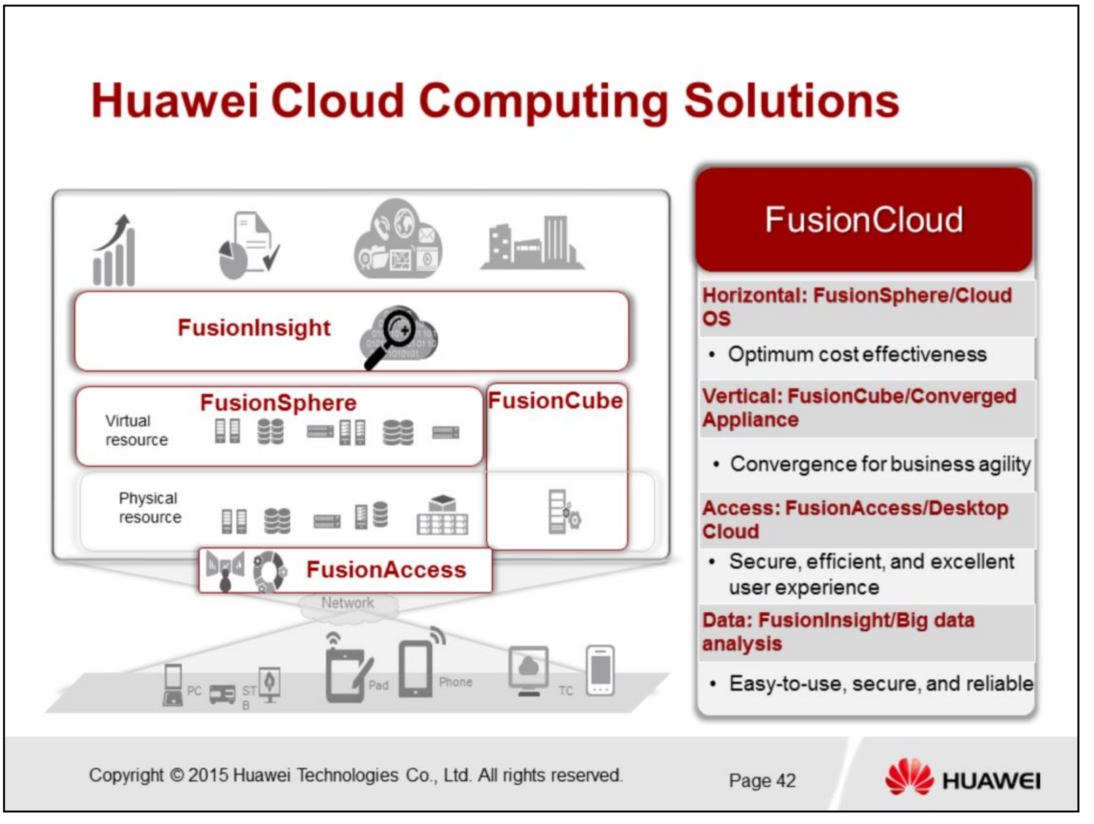
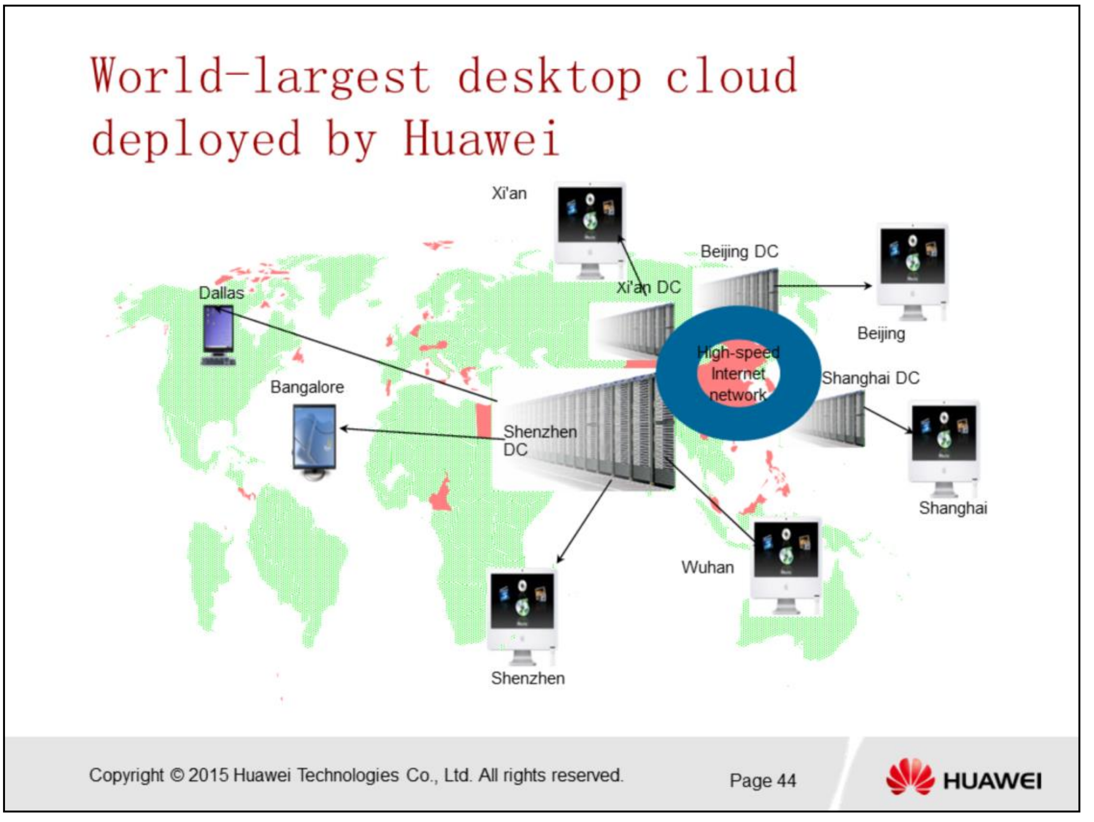
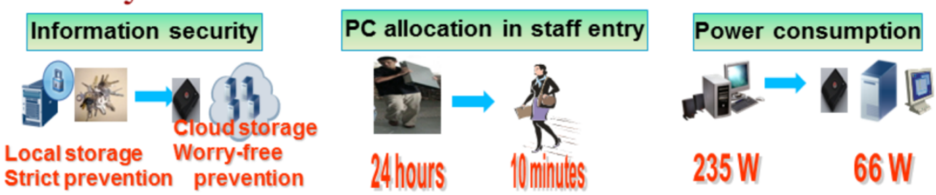


- Integrating the latest IT technologies, Huawei FusionCloud solution helps enterprises to build a cloud computing architecture-based IT infrastructure and implement ICT transformation. With "convergence" as its core strategy in cloud computing, Huawei dissolves the concept into its four FusionCloud products: FusionSphere, FusionCube, FusionAccess, and FusionInsight.
  - The "horizontal fusion" strategy mainly implements horizontal fusion development trend of the IT infrastructure, by which IT infrastructure can realize the unified operation management. The product developed by Huawei based on horizontal fusion strategy is FusionSphere.
  - The "vertical fusion" strategy is derived from the cost-effectiveness optimization requirements of enterprises for IT systems. Only the vertical end-to-end fusion of Hardware at the bottom layer to applications at the top layer can achieve the optimal cost-effective solution. The product developed by Huawei based on vertical fusion strategy is FusionCube.



- Various security levels of areas are decided based on the responsibilities of employees and are displayed as either red, yellow, or green.
- No logical hard disk of the TC and access authentication is performed using digital certificates.
- Messages are sent via SSL encryption.
- Multiple access authentication methods are available for unified authentication by the platform.
- Security levels of areas allow dispatching and management of resources in several data centers.
- Office and integration tests have timeshared resources (during the daytime or at night).

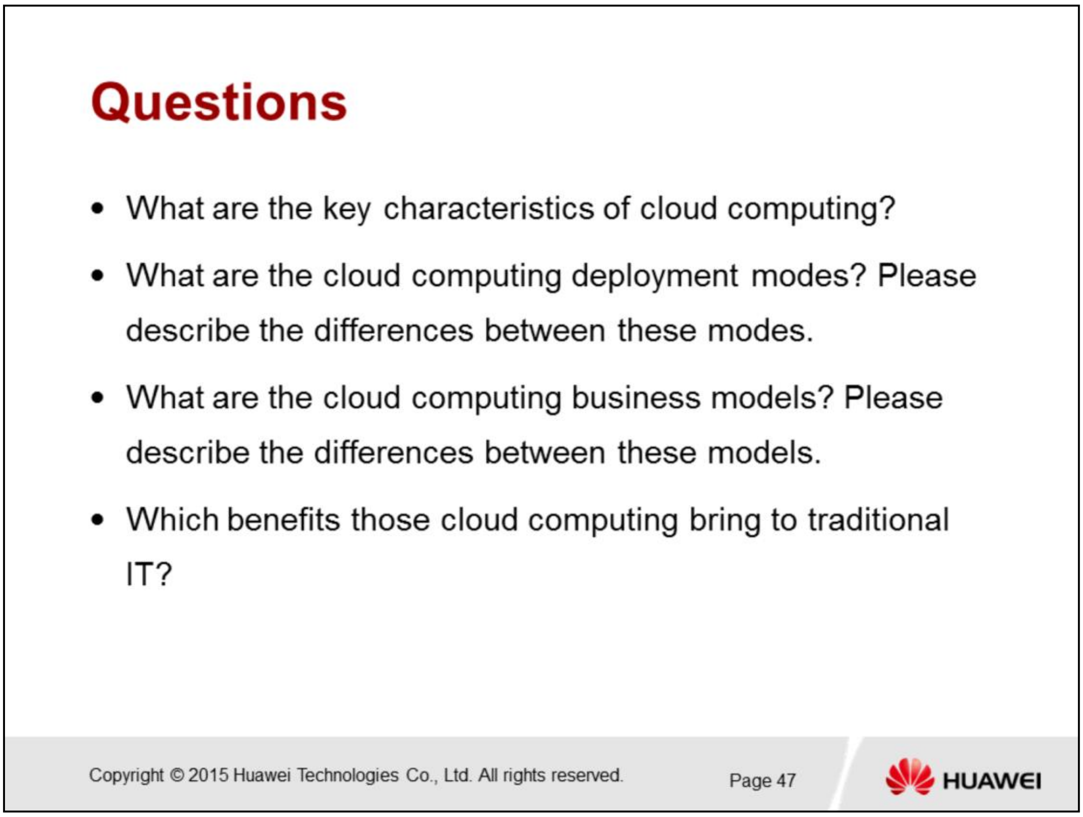
Huawei desktop cloud case: effect analysis



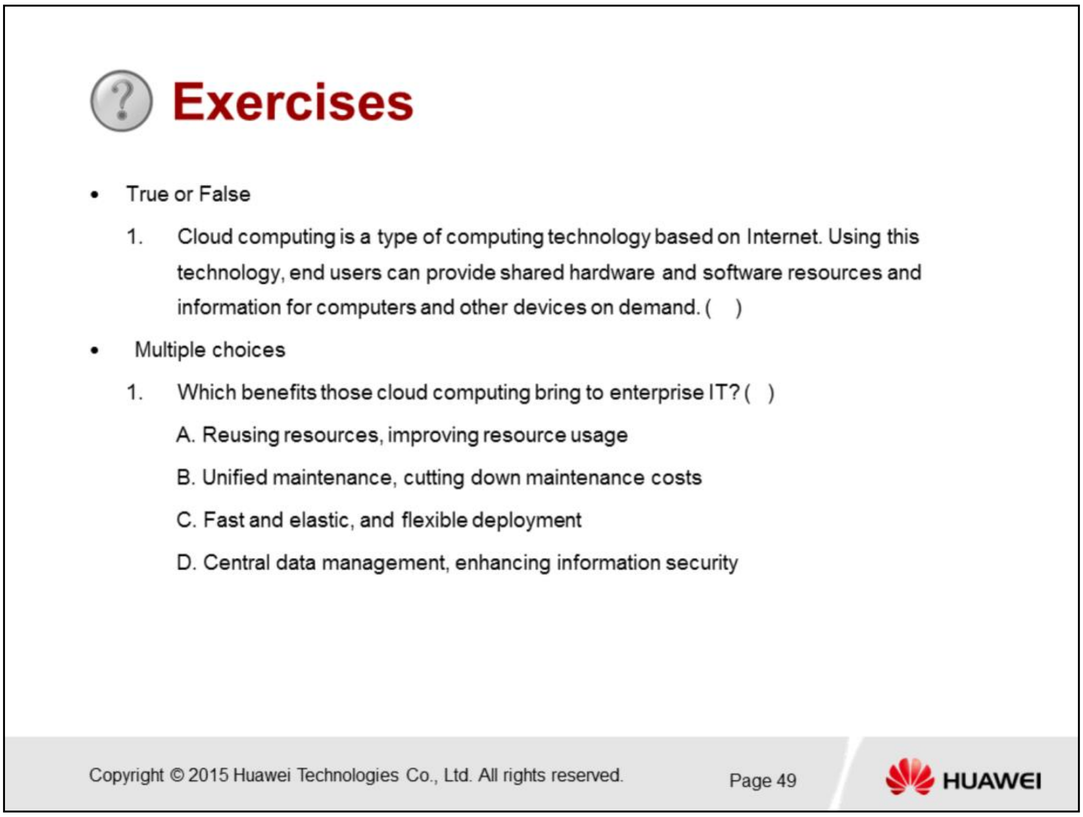
	Traditional PC	Desktop Cloud	Effect
PC/Server	57,300 PCs + 5730 PCs	2292 servers + 5730 TCs	**Investment reduced by 55%**
Power consumption	230 million yuan per year	34 million yuan per year	**Electricity bills reduced by 85%**
Office equipment allocation	4.73 million yuan per year	100 thousand yuan per year	**Expenses reduced by 98%**
	1 day per person-time	10 minutes per person-time	
Employee's removal	13.56 million yuan per year	2.26 million yuan per year	**Expenses reduced by 80%**
	2 hours per person-time	20 minutes per person-time	
Maintenance efficiency	< 100 devices/person	> 1000 devices/person	**Increased by 9 times**
Equipment replacement frequency	3 years	> 10 years	**Expenses reduced by 88%**
	90.34 million yuan per year	11.46 million yuan	

Summary

- Cloud computing concepts and background
- Cloud computing deployment model
- Cloud computing business model
- Cloud computing key technologies
- Cloud computing values



- Key features of cloud computing: rapid and elastic, on-demand self-service, anywhere and anytime access to network, pay-per-use, and location-independent resource pools.
- Cloud computing deployment modes include public cloud, private cloud, and hybrid cloud. These modes are distinguished from the perspectives of cloud service providers and cloud service consumers:
  - Private cloud is a cloud computing mode constructed by an enterprise to provide internal services for the enterprise.
  - Public cloud is a service mode constructed by an enterprise to provide resources, such as applications and storage for other enterprises and users.
  - Hybrid cloud: Hybrid cloud features a public cloud and a private cloud, having a private cloud computing infrastructure while using services provided by the external public cloud.



- Answers:
  - True or false: 1. T
  - Multiple choices: 1. ABCD

Thank you!

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Chapter 2 Virtualization Technology

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Objectives

- After completing this course, you will be able to know:
  - Virtualization technologies.
  - Computing virtualization.
  - Storage virtualization.
  - Network virtualization.
  - How to create a virtual machine.

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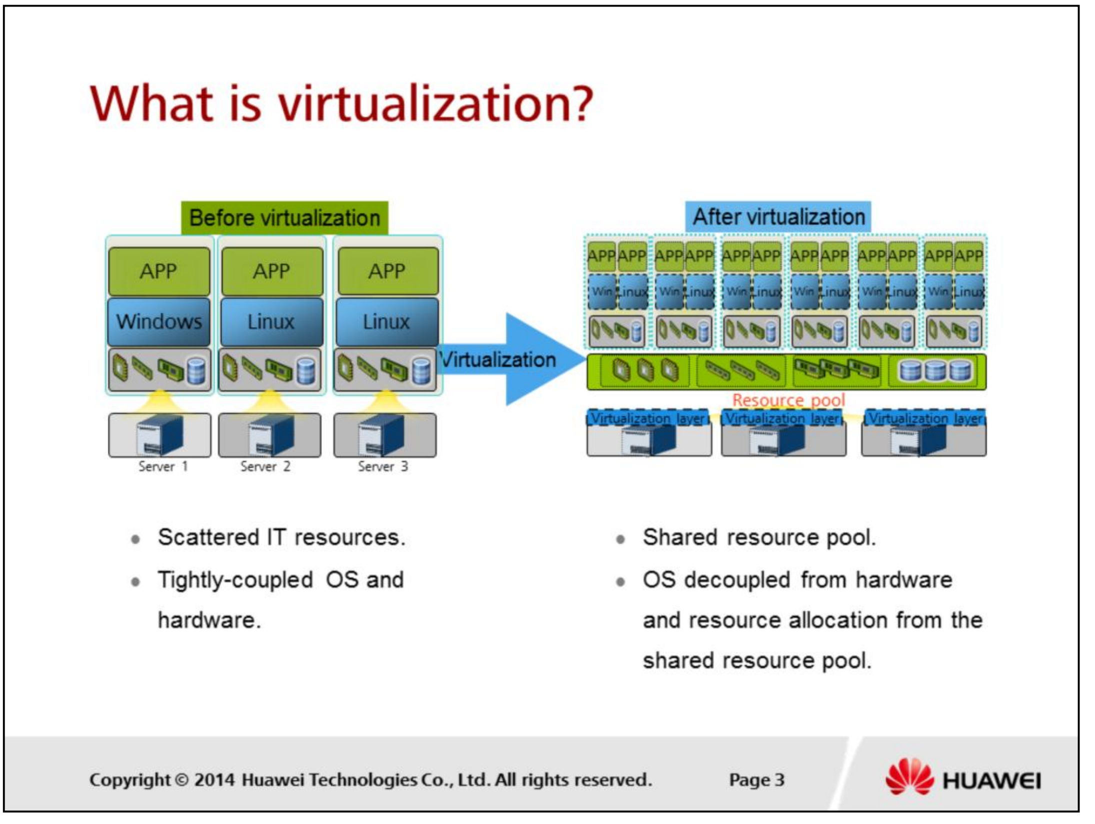
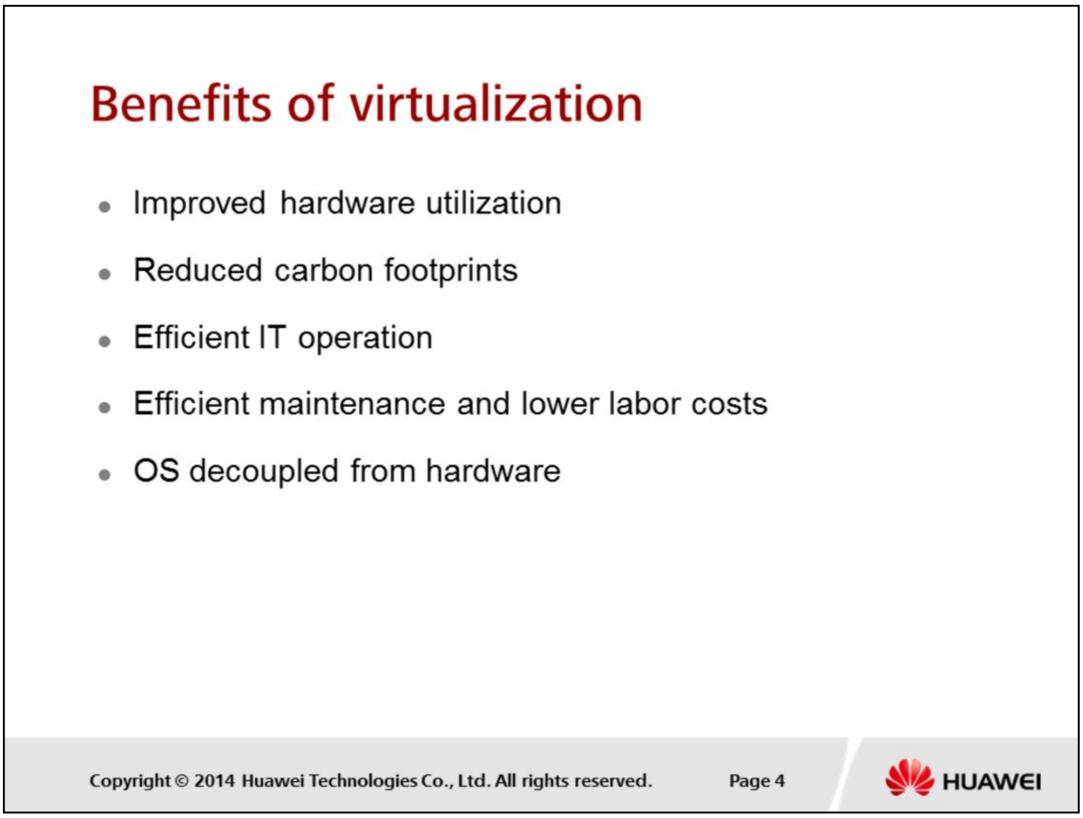
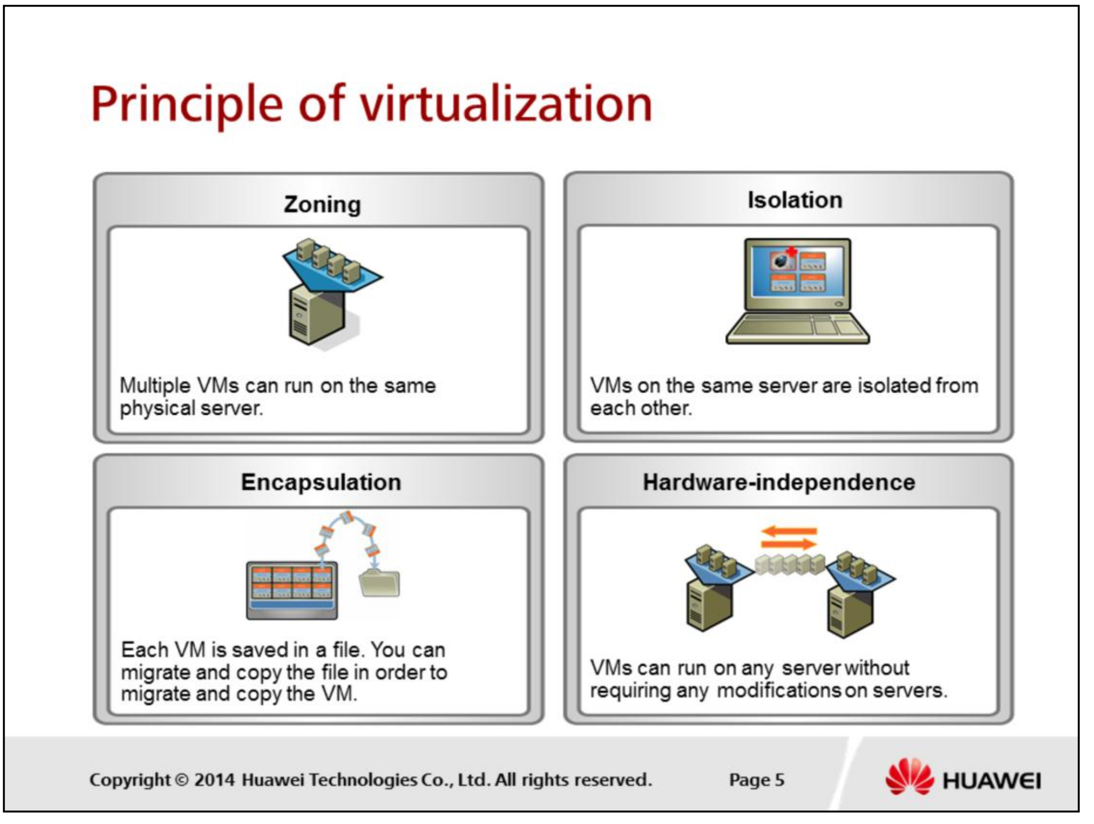


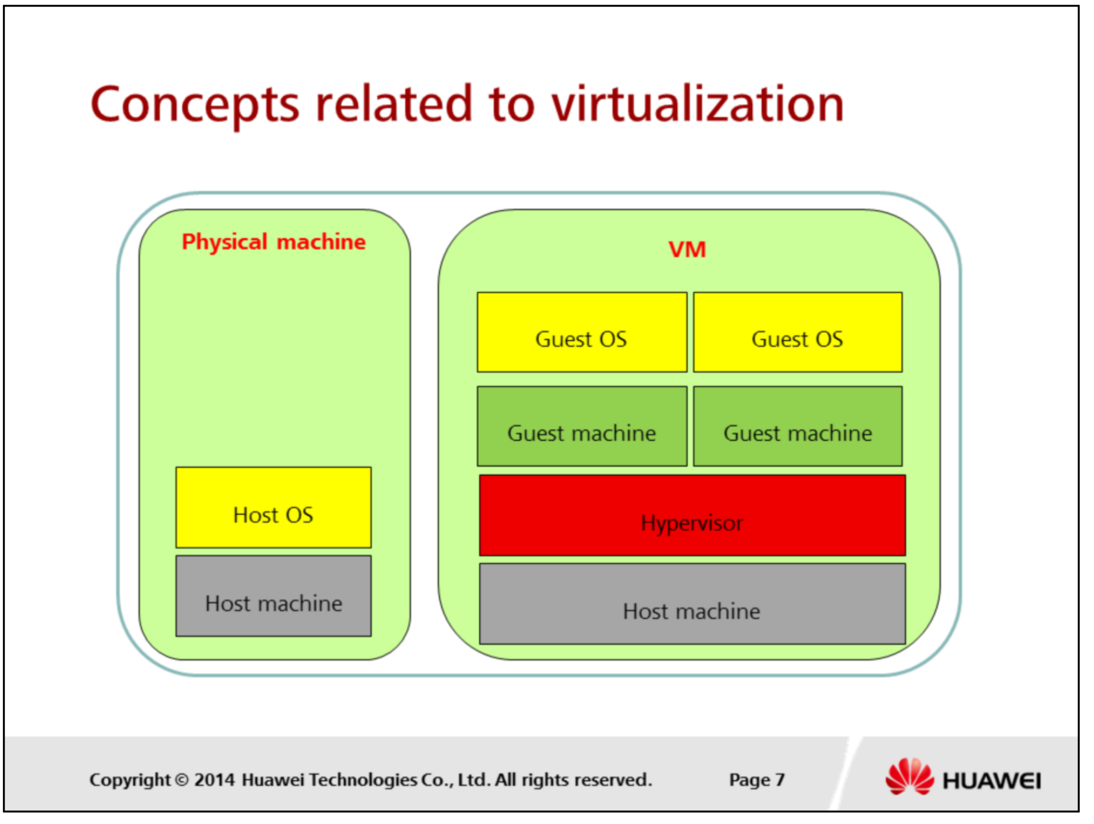
- Definition
  - Virtualization converts “physical” resources into “logical” resources.
  - The virtualization technology adds a virtualization layer on the system to virtualize its underlying resources.



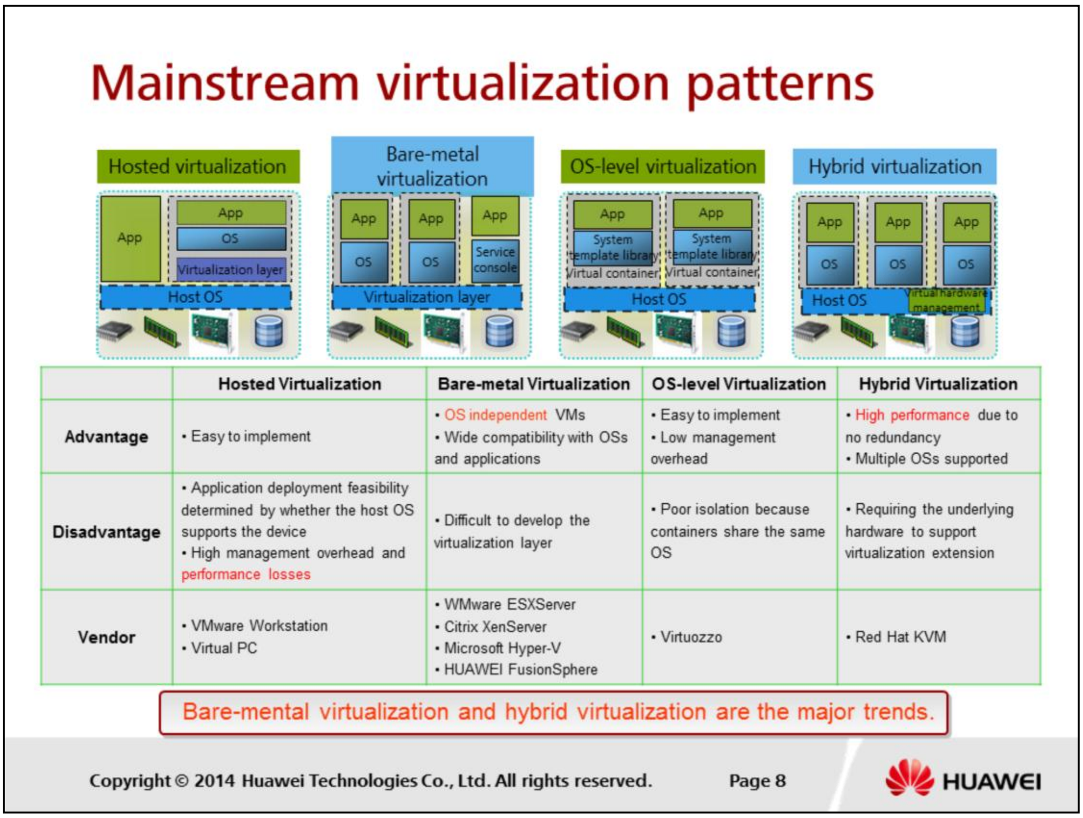
- Changes brought by Huawei desktop cloud solution
- Traditional method
    - Servers: 57,300 PCs + 5730 PCs
    - Resource utilization: < 5%
    - Power consumption/24 hours (w): 78,283,260
    - Service/Server preparation period: > 3 months
    - Maintenance efficiency: 100 servers per person
- Cloud computing method
    - Servers: 4093 servers + 57,300 TCs
    - Resource utilization: >52% (NC+CI)
    - Power consumption/24 hours (w): 22,622,750
    - Service/Server preparation period: < 3 days
    - Maintenance efficiency: > 1000 servers per person



- Zoning indicates that the virtualization layer is capable of allocating server resources to multiple VMs. Each VM can run an independent OS such that multiple applications can co-exist on the same server. Each OS only has access to its own virtual hardware (including the virtual network adapter, virtual memory, and virtual CPU) provided by the virtualization layer, just like they run on a dedicated server.
- Isolation: VMs are isolated from each other.
  - The breakdown or failure (such as OS faults, application suspension, and driver bugs) of one VM does not affect other VMs on the same physical server.
  - The viruses and worms on one VM are isolated from other VMs, as if each VM resides on an independent physical server.
  - Performance isolation is implemented using resource control; You can specify the minimum and maximum resource usage of each VM. The resource control prevents problems where one VM occupies all resources leaving other VMs with no resources to use.

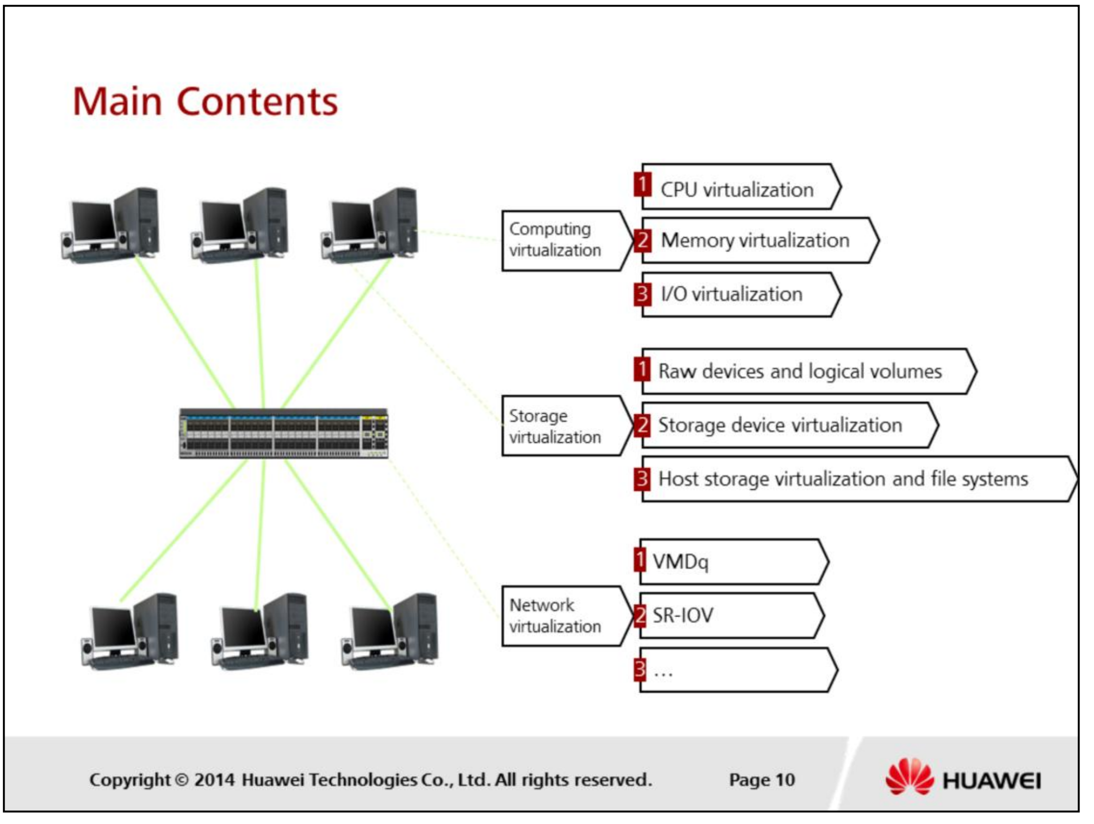


- Host machine
  - Hosts refer to physical resources.
- Guest machine
  - Guests refer to virtualized resources.
- Guest OS and host OS
  - If a physical machine is virtualized into multiple VMs, that physical machine is called a host machine, its OS is called a host OS, the VMs are called guest machines, and the VMs' OSs are called guest OSs.
- Hypervisor
  - With the simulation by the virtualization layer, VMs are presented as actual machines to upper-layer software. This virtualization layer is called the Virtual Machine Monitor (VMM) or Hypervisor.



	Hosted Virtualization	Bare-metal Virtualization	OS-level Virtualization	Hybrid Virtualization
Advantage	• Easy to implement	• OS independent VMs • Wide compatibility with OSs and applications	• Easy to implement • Low management overhead	• High performance due to no redundancy • Multiple OSs supported
Disadvantage	• Application deployment feasibility determined by whether the host OS supports the device • High management overhead and performance losses	• Difficult to develop the virtualization layer	• Poor isolation because containers share the same OS	• Requiring the underlying hardware to support virtualization extension
Vendor	• VMware Workstation • Virtual PC	• WMware ESXServer • Citrix XenServer • Microsoft Hyper-V • HUAWEI FusionSphere	• Virtuozzo	• Red Hat KVM

- Hosted virtualization: The virtualization management software functions as a common application running on the underlying OS (Windows or Linux). VMs created using the virtualization management software share the underlying server resources.
- Bare-metal virtualization: Hypervisor is a VM monitor application that runs directly on physical hardware. Hypervisor performs the two basic functions: identifies, captures, and responds to the CPU privileged instructions or protection instructions; queues and schedules VMs and returns the processing results of physical hardware to corresponding VMs.
- OS-level virtualization: No independent Hypervisor layer is involved. The host OS allocates hardware resources among virtual servers and separates virtual servers from each other. With OS-level virtualization, all virtual servers must run the same OS (but each instance may have their own independent applications and user accounts).



- Virtualization covers the following aspects: computing virtualization, storage virtualization, and network virtualization.

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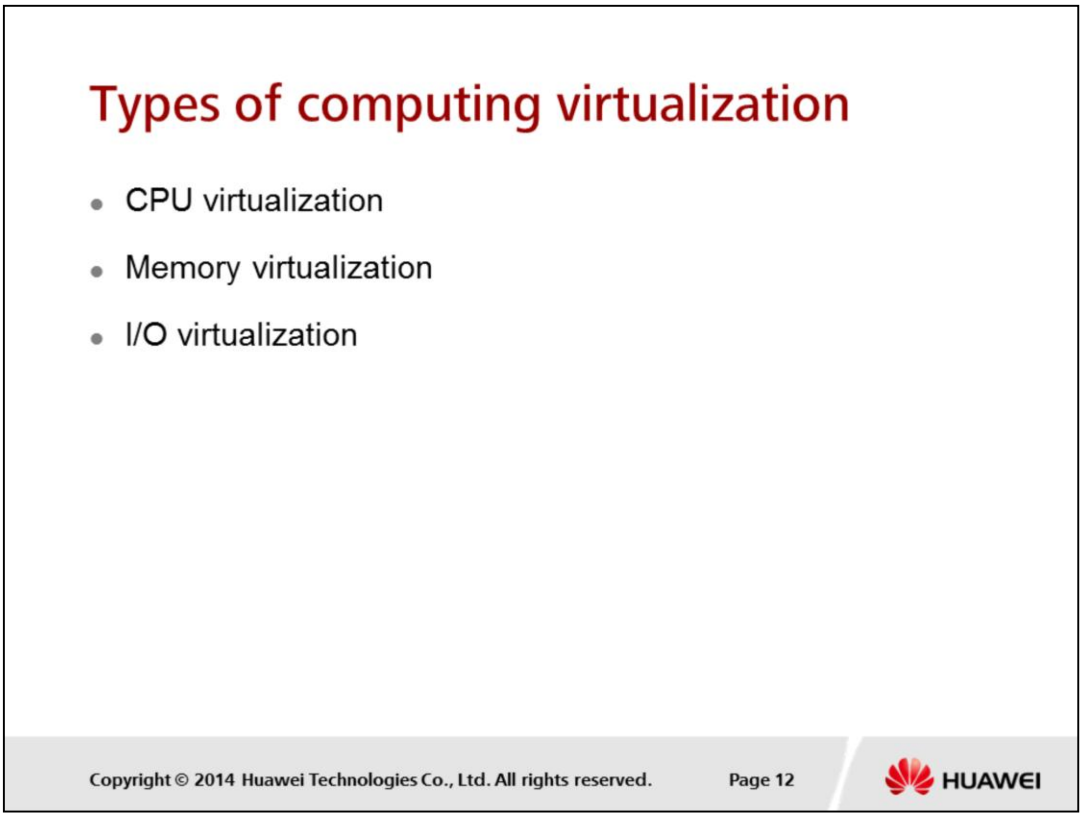
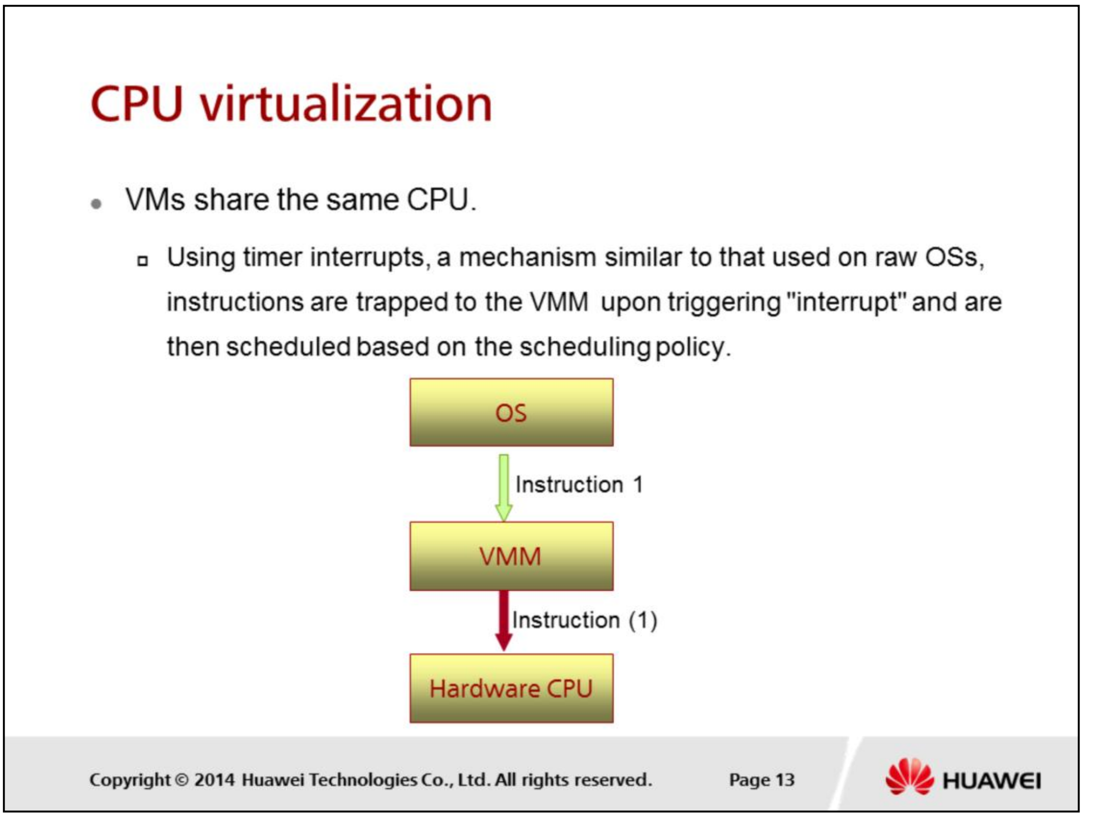
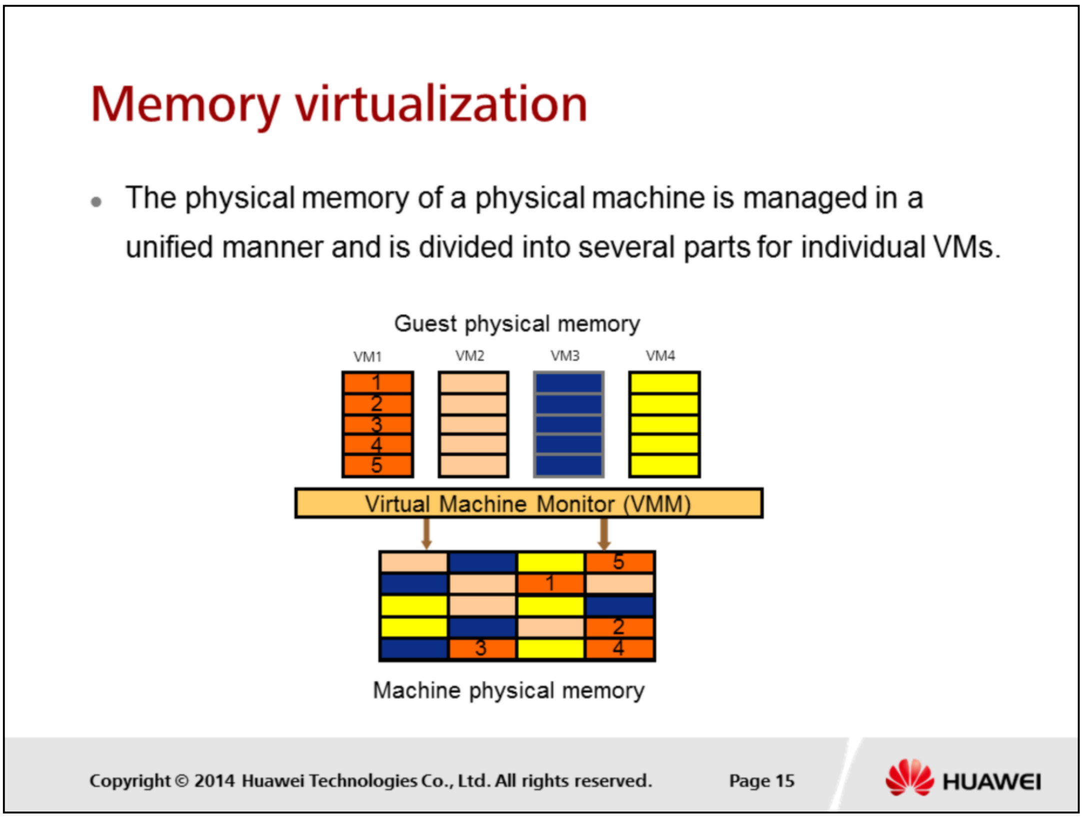


- The following resources need to be controlled:
  - CPU: Multiple VMs share the same CPU. Sensitive instructions in VMs are intercepted, simulated, and executed.
  - Memory: Multiple VMs share the same physical memory and they need to be isolated from each other.
  - I/O device: Multiple VMs share the same physical device, such as a disk or network adapter. Those I/O devices are multiplexed using time-division technology.



- Hypervisor get the instruction and put them into queue.
- An x86 processor has four priorities in protected mode, Ring 0, Ring 1, Ring 2, and Ring 3. The priority of each Ring is subject to the performed function. Ring 0 is used for the OS kernel and has the highest priority. Ring 1 and Ring 2 are used for OS services and have lower priorities. Ring 3 is used for applications and has the lowest priority.
- The typical virtualization approaches are privilege deprivileging and trap-and-emulation. Specifically, guest OSs run at a non-privileged level (deprivileging) whereas the Virtual Machine Monitor (VMM) runs at the highest privilege level (full control of system resources). After guest OSs are de-privileged, most of their instructions can still be executed on hardware. Only the privileged instructions are trapped and emulated by the VMM.



- Physical machine OSs' comprehension and management of memory:
  - Memory begins with physical address 0.
  - Memory is sequential.
- Virtualization brings about the following problems:
  - Beginning with physical address 0: There is only one physical address 0, making it impossible for all clients to begin at 0.
  - Sequential address: Although sequential physical addresses can be allocated, the memory usage is low and rigid (unable to share memory).
- The key point of memory virtualization lies in introducing a new layer of address space, that is, the physical address space of clients. Clients think that they run in the actual physical address space; however, they access physical addresses through the VMM in fact. The VMM saves the mapping table that records relationships between clients' address spaces and physical machines' address spaces.

I/O virtualization

- Peripherals are sometimes insufficient to bear multiple client OSs. To resolve this issue, the VMM virtualizes I/Os to reuse the limited peripherals.
- The VMM intercepts the client OSs' access requests on devices and uses software to simulate itself as the actual device.

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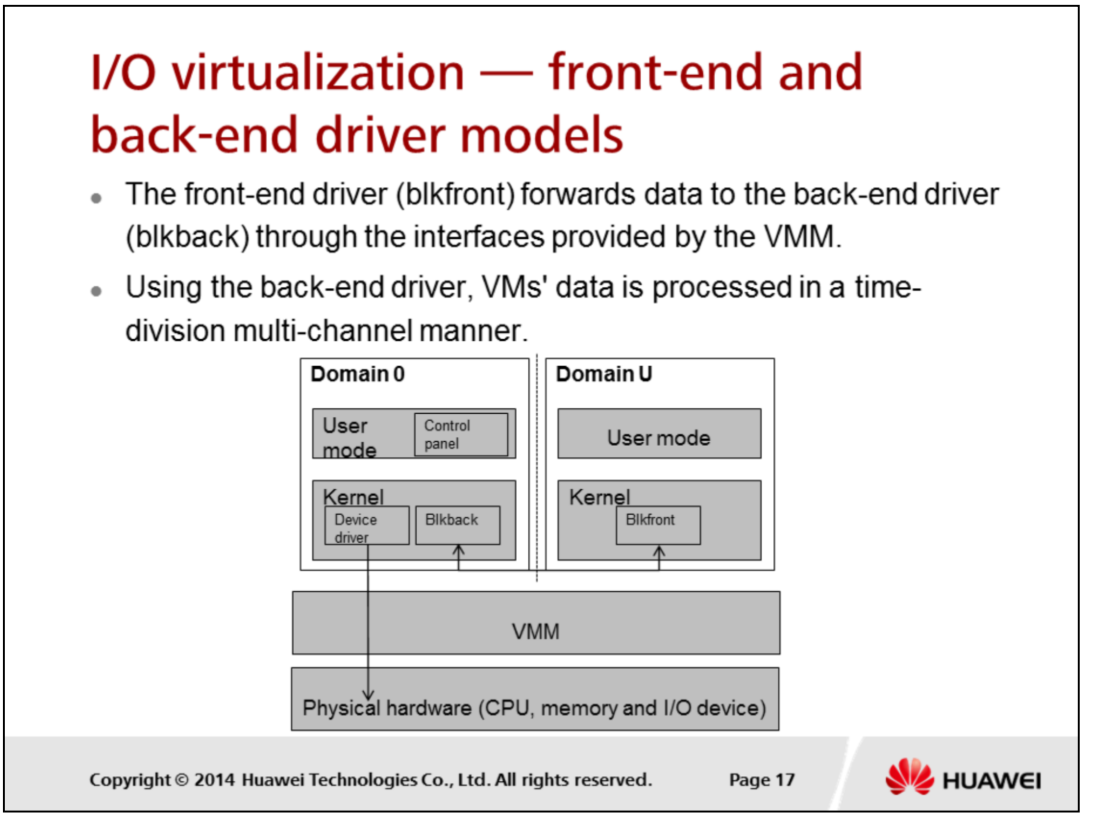
- peripherals
- I/O virtualization needs to resolve the following two problems:
- Device discovery
  - Controls the devices accessible to VMs.
- Access interception
  - Processes devices' access requests through I/O ports.

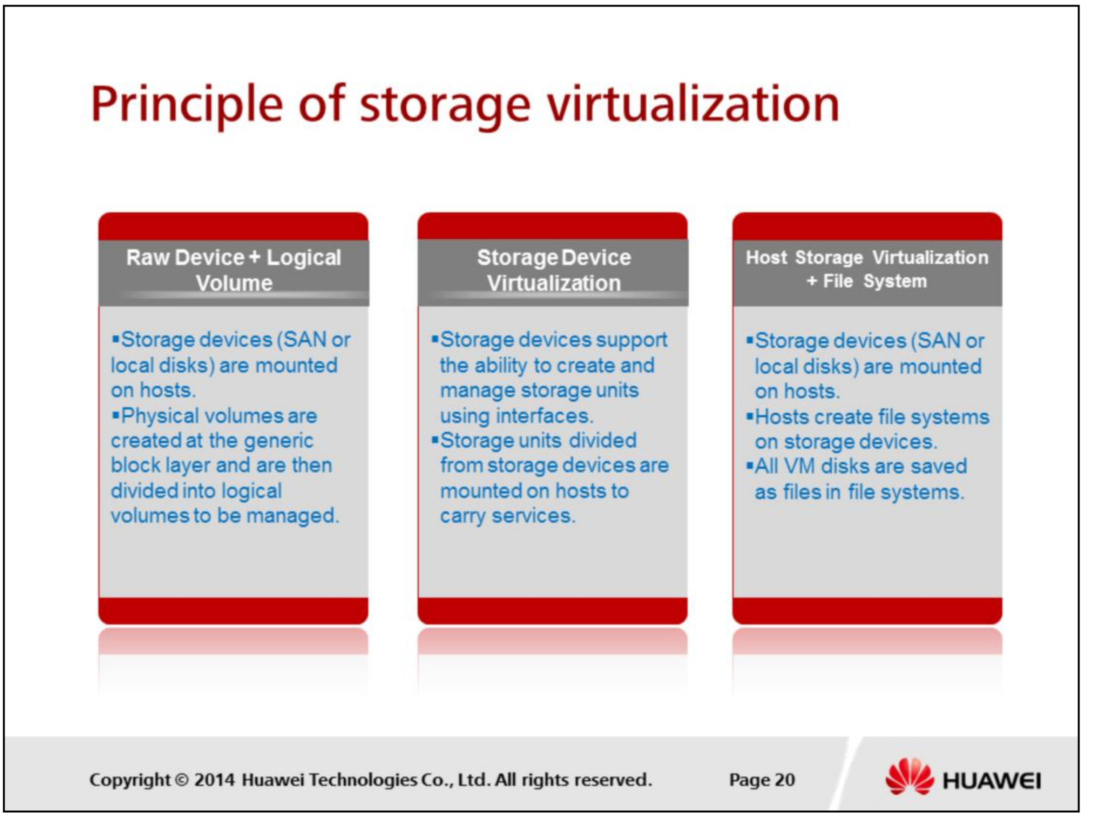


- The front-end and back-end driver models require the re-enablement of drivers.
- How to discover a device?
  - The device information about all VMs is saved on the XenStore of Domain0.
  - The XenBus (a paravirtualization driver designed for Xen) on VMs communicates with the XenStore of Domain0 to obtain device information.
  - The front-end driver for the device is loaded.
- How to intercept device data?
  - The front-end device driver forwards data completely to the back-end driver through the interfaces provided by the VMM.
  - The back-end driver processes VM data on a time and channel basis.

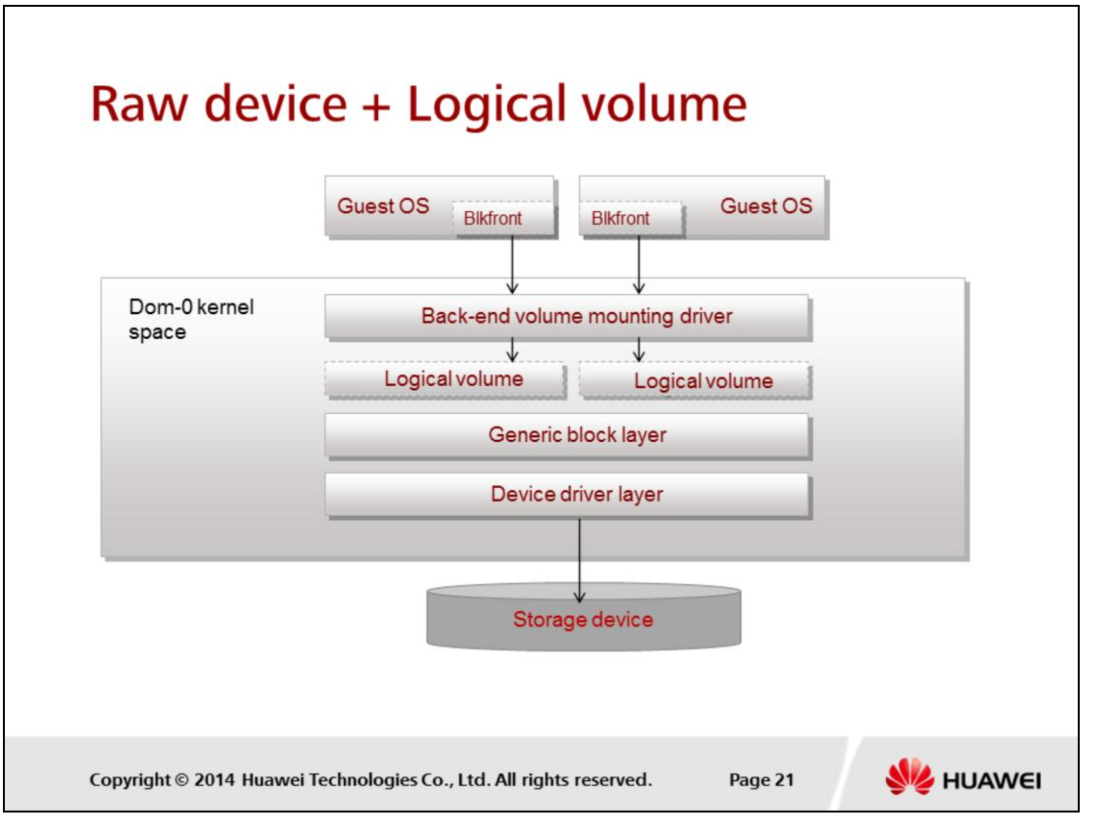
Contents

What is storage virtualization?

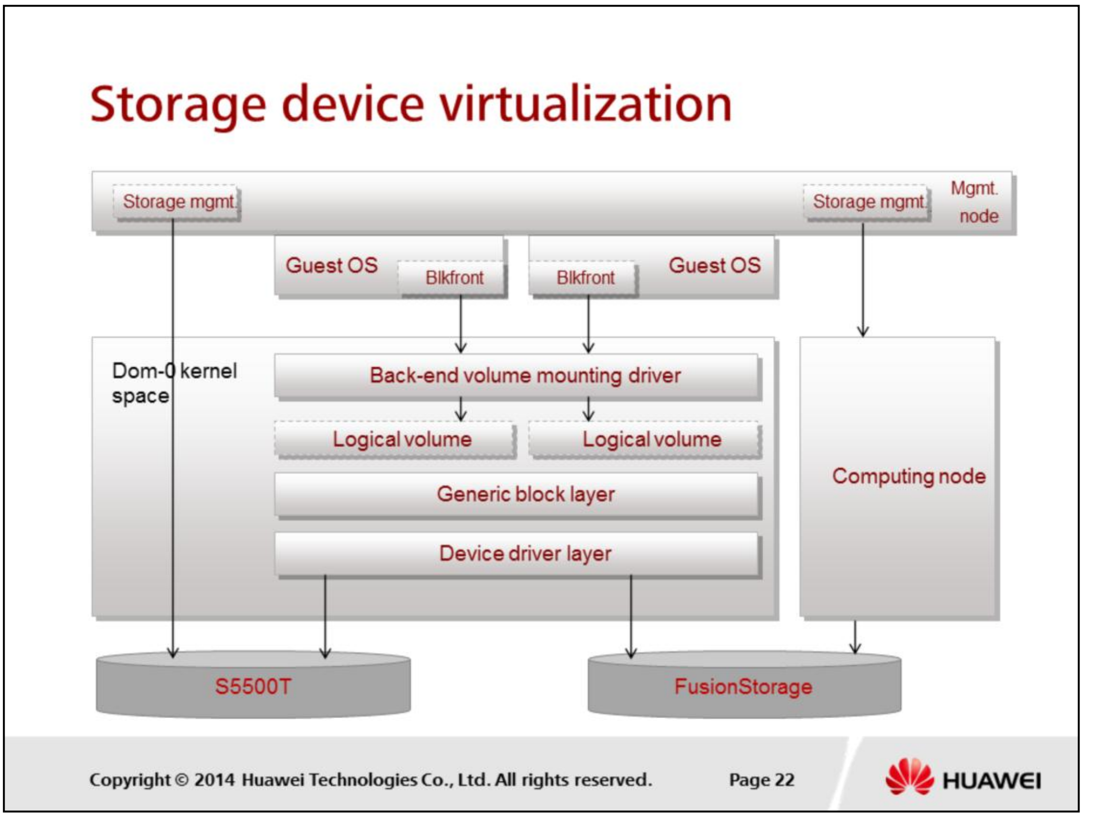
- Definition
  - Storage virtualization creates a logical layer of storage from physical storage devices so that the storage resources are available through the logical layer.
  - Administrators can easily adjust storage resources to improve storage utilization.
  - End users can enjoy better storage performance and usability due to the centralization of storage devices.
- Implementation of storage virtualization
  - Raw Device + Logical Volume
  - Storage Device Virtualization
  - Host Storage Virtualization + File System



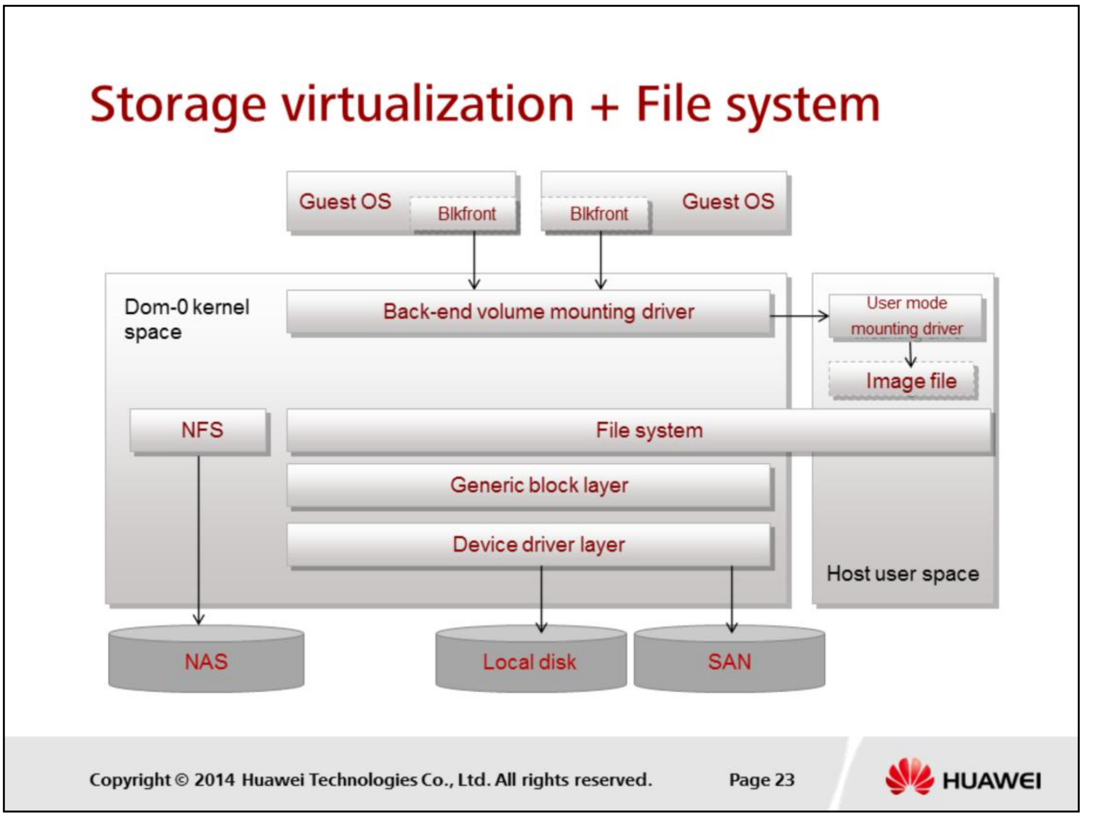
- "Raw device + Logical volume" is the most direct storage controller method. Raw devices are divided into blocks in the unit of 1 GB at the generic block layer. The system manages such blocks to maintain volumes.
- Storage device virtualization leverages storage devices capabilities to maintain volumes. With this type of virtualization, storage devices can offer some advanced storage functions such as thin provisioning, snapshot, and linked clone.
- "Host storage virtualization + File system" allows hosts to manage VM disk files through file systems. This type of virtualization allows the virtualization layer to provide advanced services that are independent of storage devices.



- "Raw device + logical volume" is the most direct storage controller method. Raw devices are divided into blocks with 1GB unit at the generic block layer. The system manages such blocks to maintain volumes.
  - Simple I/O paths and highest read & write performance.
  - No support for advanced services.



- Storage device virtualization leverages the capabilities of storage devices to maintain volumes. With this type of virtualization, storage devices can offer some advanced storage functions such as thin provisioning, snapshot, and linked clone.
- Currently, storage device virtualization applies only to Huawei Advanced SAN and FusionStorage and provides a small number of advanced functions.



- "Host Storage Virtualization + File System" allows hosts to manage VM disk files through file systems. This type of virtualization allows the virtualization layer to provide advanced services. Currently, this type of virtualization is widely applied.
  - Support for heterogeneous storage devices and heterogeneous servers.
  - Rich advanced functions, independent of hardware devices.
  - Performance loss due to long I/O paths.

Types of storage virtualization

Type	Raw Device + Logical Volume	Storage Device Virtualization	Host Storage Virtualization + File System
Supported service	•Thin provisioning (only for IP SAN 3900) •Full snapshot	•Thin provisioning •Differential snapshot •Linked clone	•Thin provisioning •Differential snapshot •Live and offline storage migration •Disk expansion •Reclamation of thin disk space •Linked clone
Supported storage	•IP SAN •FC SAN •Local storage	•HUAWEI 5500T •HUAWEI FusionStorage	•IP SAN •FC SAN •NAS •Local storage

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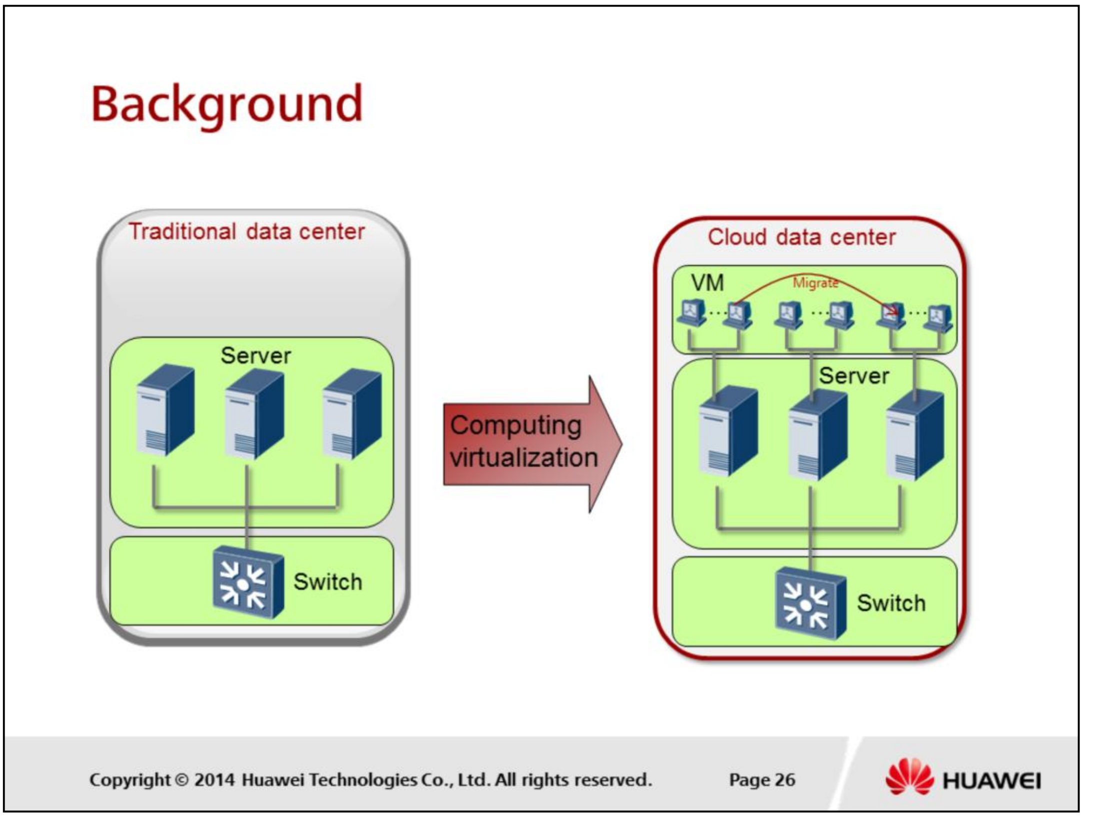
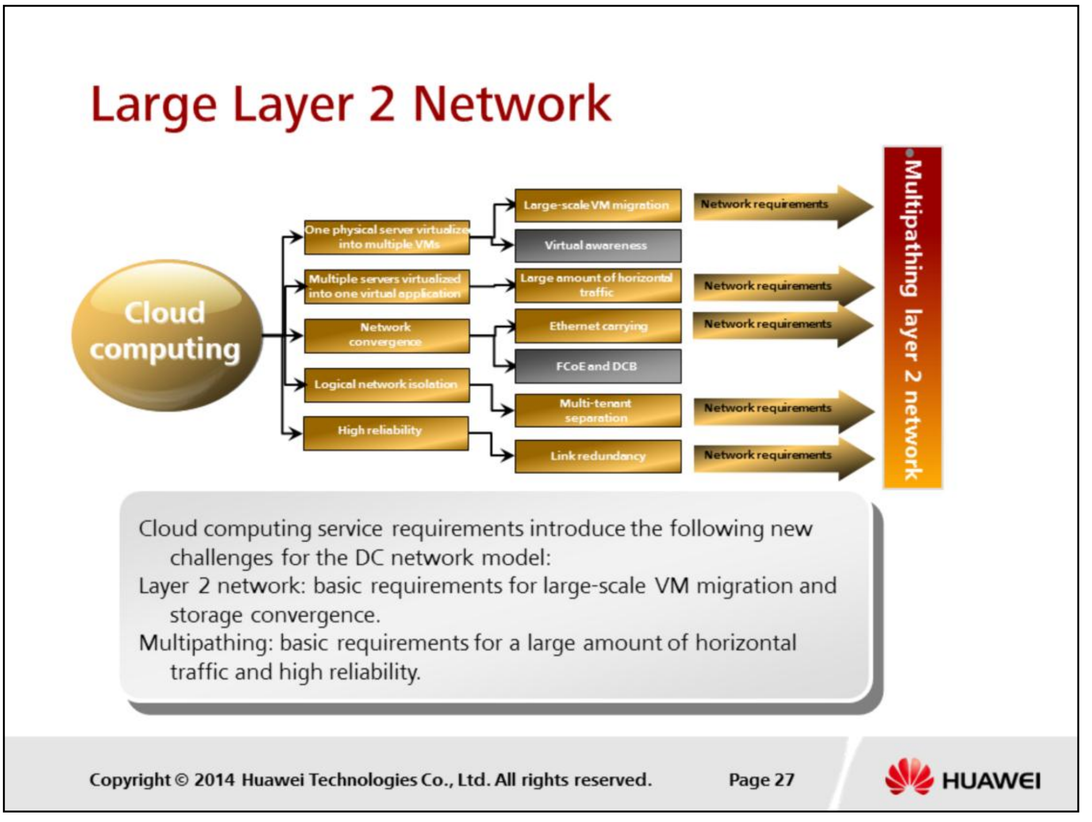
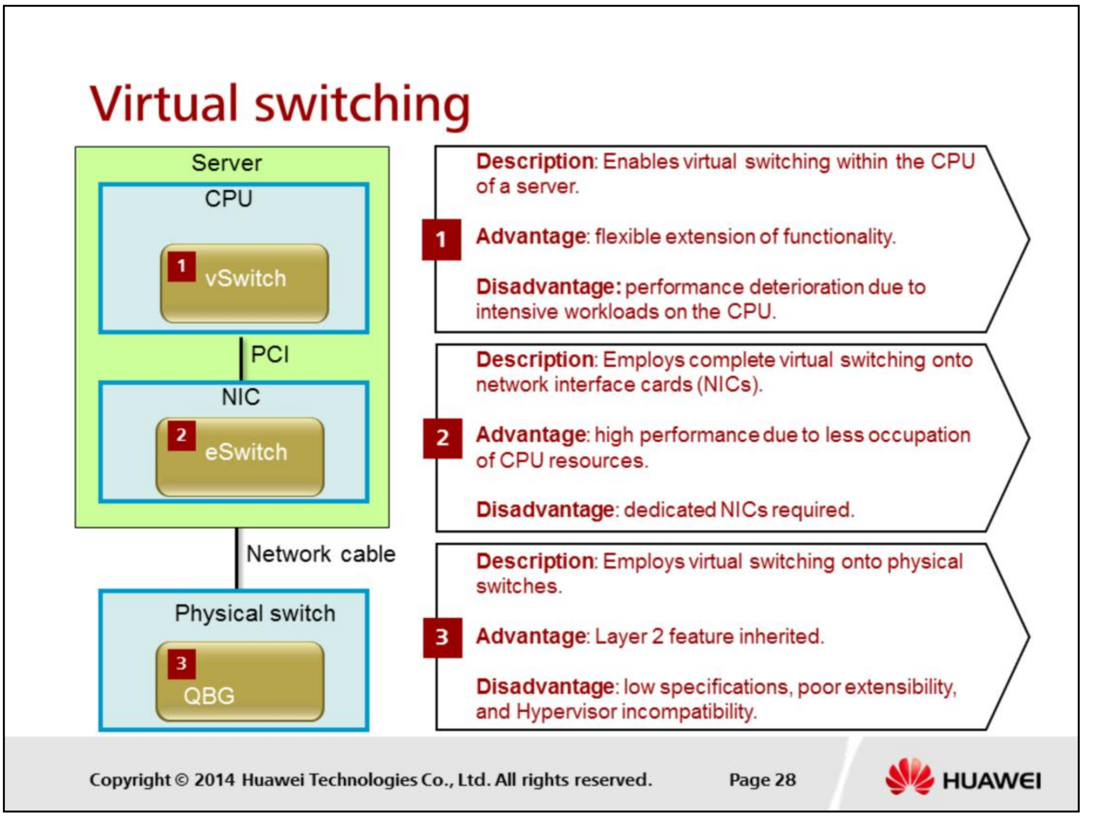


- With computing virtualization, a server can be virtualized into multiple hosts, meeting the inter-VM communication requirements that traditional networks are unable to handle.
- A cloud computing data center allows dynamic migration of VMs, which is hardly impossible in traditional data centers.

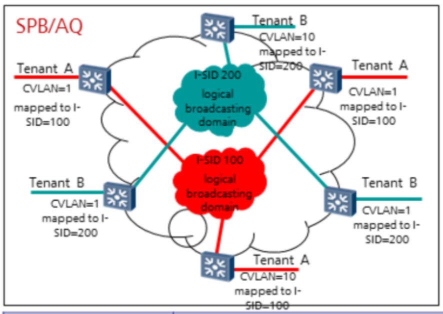


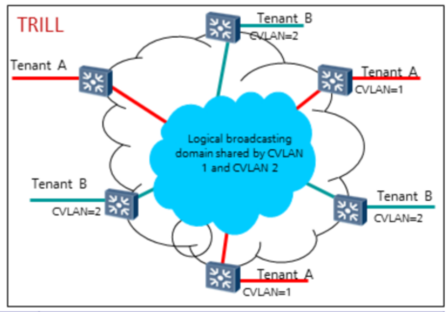
- VM：Virtual Machine
- ETH：Ethernet
- Fiber Channel over Ethernet (FCoE) maps fiber channels (FCs) to Ethernet and inserts FC information to Ethernet packets so that FC requests and data can be transmitted from servers to FC SAN storage devices over Ethernet without dedicated FCs. FCoE allows the transmission of LAN and FC SAN data over the same communication cable. A converged network supports both LAN and SAN data transmission, thereby reducing the number of data center devices and cables, reducing power consumption, cooling loads, and the number of network nodes, and simplifying management. It provides I/O integration solutions based on the FC storage protocol to transmit SAN data over the Ethernet and maximizes return on investment (ROI) in the existing FC SAN, such as FC-SAN tools, employee training, established FC-SAN devices, and the corresponding management architecture.
- Data Center Bridging (DCB) is defined to enhance traditional Ethernet and build a lossless Ethernet network that can prevent packet loss. The FCoE technology is the FC protocol that can be used on Ethernet networks and does not allow packet loss, and both Ethernet and the FCoE protocol can run properly over Ethernet networks.



- vSwitch: is short for virtual switch. vSwitch implements Layer 2 Ethernet switching functions on servers CPUs, including VM switching, QoS control, and security isolation.
- eSwitch: is short for embedded switch. eSwitch implements Layer 2 Ethernet switching functions on servers network adapters, including VM switching, QoS control, and security isolation.

Large Layer 2 Network Technology





Feature	SPB	TRILL
Camp	Huawei, Avaya, HP, Ericsson, and AL	Cisco, Huawei, Brocade, HP, and IBM
VM live migration	Supported	Supported
Multi-tenant	16 million (24-bit I-SID identifier)	4000 (12-bit VLAN ID identifier)
Convergence speed	Slow (integrated source computing paths and heavy workload)	Fast (distributed computing paths based on per-hop behavior (PHB) and light workload)
Compatibility	Not supported (non-compatible with existing switches)	Supported (compatible with existing switches)

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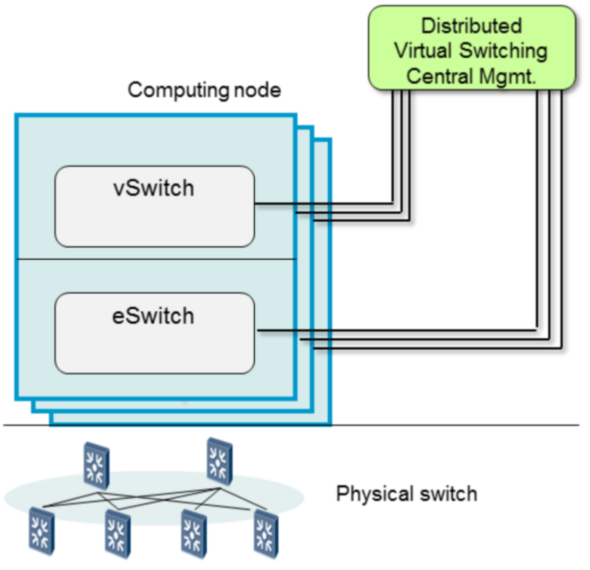
- SPB: Shortest Path Bridging
- TRILL: Transparent Interconnection of Lots of Links
- The two technologies belong to the larger layer 2 network technology based on both the Ethernet layer 2 network and the dynamic routing intermediate system to intermediate system (IS-IS).
- Difference: SPB supports a maximum of 16 million isolation domain labels but is not compatible with existing switches.

Huawei solution



- Huawei's network virtualization solution:
  - Implements distributed virtual switching using vSwitches or eSwitches.
  - Supports large Layer 2 solutions provided by network devices.

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Investment on VMs

Usage	QTY	CPU	Memory	Disk
Text editing	2	2 GHz, 1-core	2 GB	10 GB
Image processing	1	2 GHz, 4-core	4 GB	80 GB
File sharing server	1	2 GHz, 1-core	2 GB	500 GB
Total	4	7 x 80% ≈ 6-core	10 x 80% = 8 GB	600 GB

Virtualization improves resource utilization: 6 cores are functionally equivalent to 7 cores and 8 GB functionally equivalent to 10 GB.

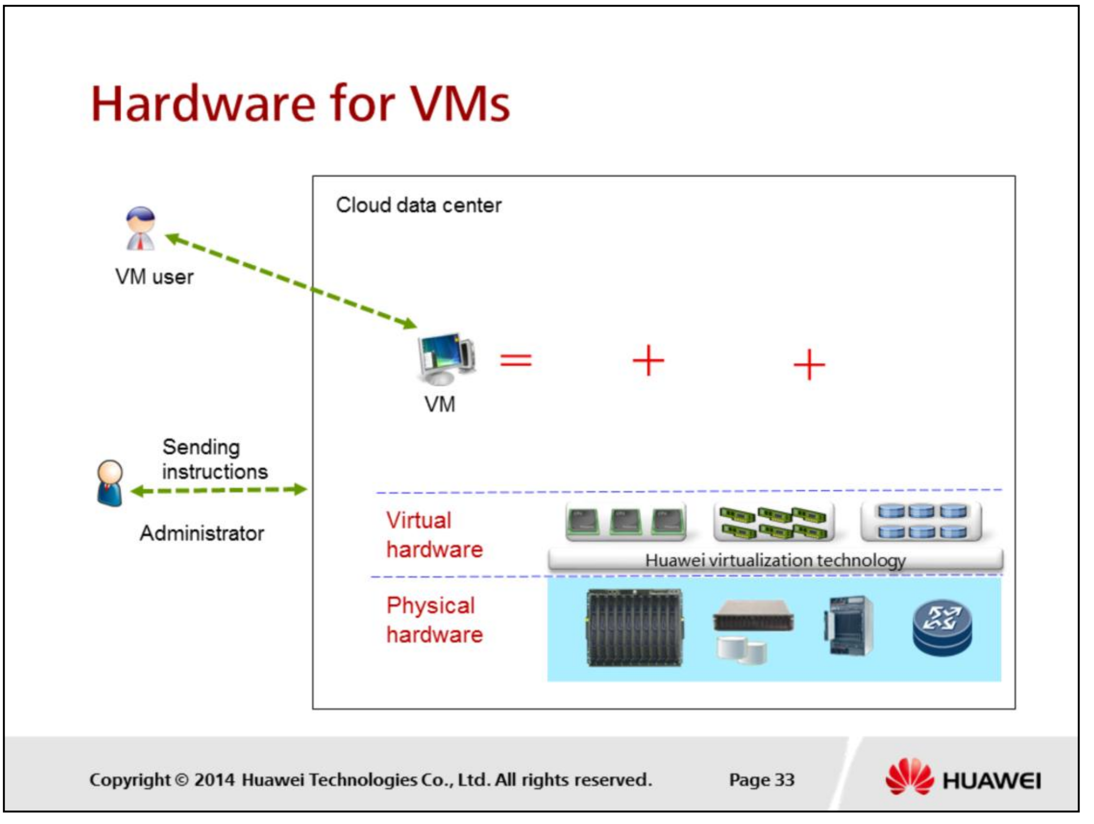
+

One low-end server may cost 10,000 RMB, enough to deploy four VMs. The four VMs are functionally equivalent to four PCs.

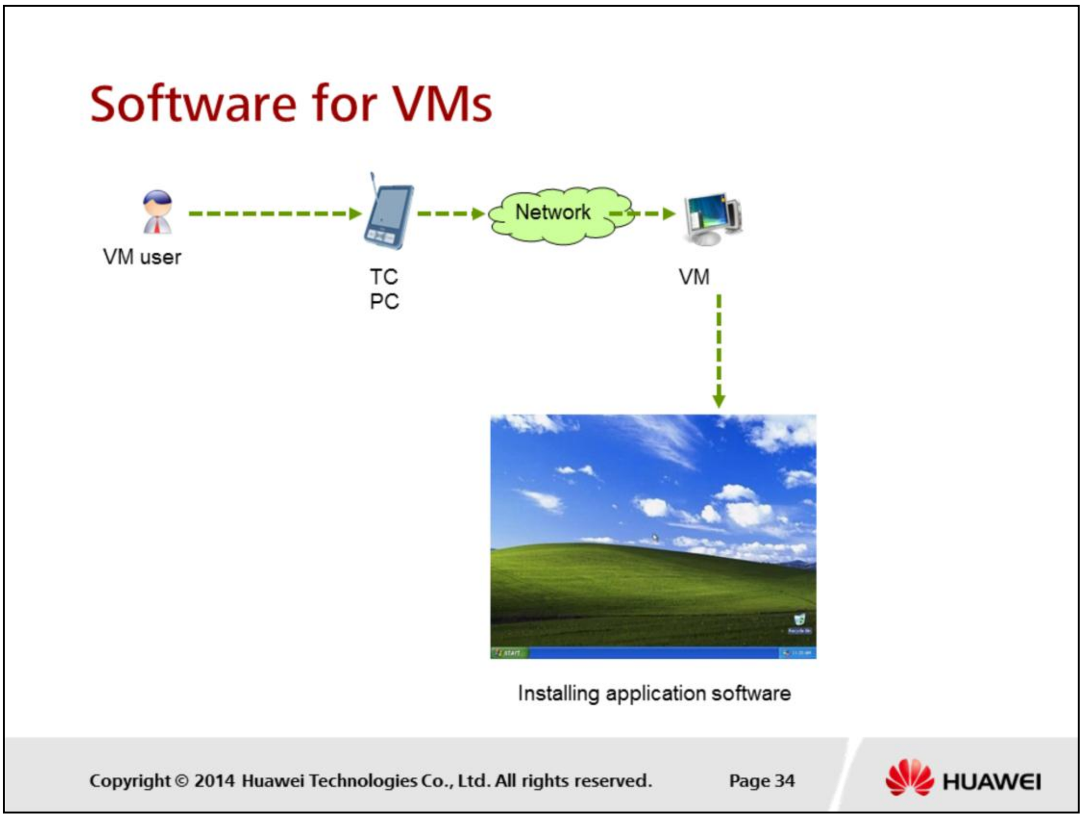
=

Dramatically reduced costs

- What is a VM?
  - A computer system that is simulated by software and possess complete hardware system functions.
- VM hardware
  - CPU
  - Memory
  - Disk
  - Network adapter



- Virtual hardware does not correspond to physical hardware in a one-to-one mapping. Virtualization technologies can virtualize one physical device into multiple virtual devices.



- A VM has a built-in OS, which is specified by the administrator when delivering the instructions for creating VMs.
- For a VM that does not have a built-in OS, the administrator can use an ISO file to install an OS or install an OS using the CD-ROM driver of a TC.

Process for creating a VM

Service requirement

I want a VM, which should have dual CPUs, 2 GB memory, 100 GB disk space, and one NIC.

The OS is Windows 7 and has preinstalled office software such as MS Office and Foxmail.

VM specification

Please wait a moment.

Block storage resources

- Pick a 100 GB disk from the storage pool. It is virtual and vacant.
- Pick one among a bundle of physical servers. This server has two idle CPUs (virtual), 2 GB memory, and one virtual NIC.
- Mount the virtual disk to the physical server.
- Use the CPUs, memory, and disk to boot an OS-less VM.
- Make ready an ISO file that contains Windows 7, MS Office, and Foxmail.
- Use CIFS to mount the ISO file to the VNA node. Set the VM to boot from the virtual drive and then load the ISO file.
- Install an OS as prompted on the VNC login page.

Done!

Virtual disk

Server cluster

VM

Install OS

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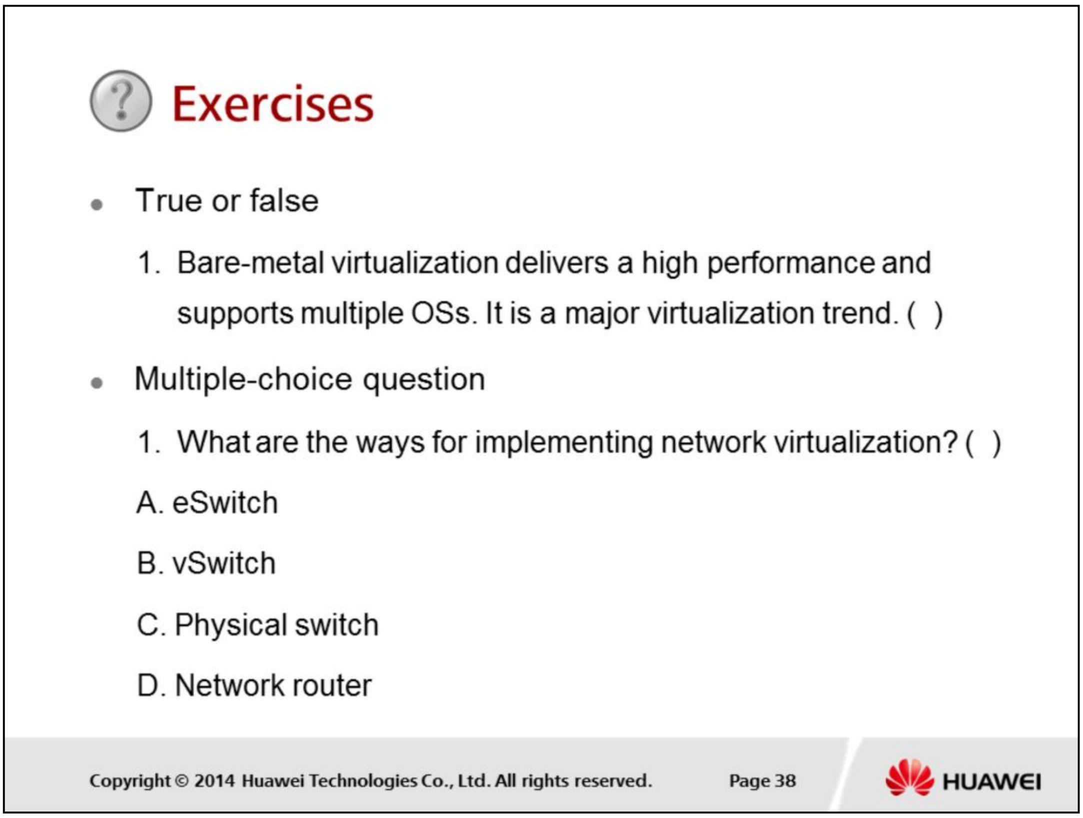
Summary

- Virtualization technologies overview
- Computing virtualization
- Storage virtualization
- Network virtualization
- Creating a VM

Questions

- What are the major virtualization patterns? What are their differences?
- What are the types of computing virtualization? What are their technical principles?
- What are the types of storage virtualization?
- What are the ways for implementing network virtualization?



- Answers:
  - True or false: 1. T
  - Multiple-choice question: 1. ABC

Acronyms and abbreviations

APP: application

CPU: central processing unit

I/O: input and output

VM: virtual machine

VMM: Virtual Machine Monitor

ISA: Instruction Set Architecture

PCI: Peripheral Component Interconnect

TRILL: Transparent Interconnection of Lots of Links

SPB: Shortest Path Bridging

Thank you

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Chapter 3
Huawei FusionCloud Solutions

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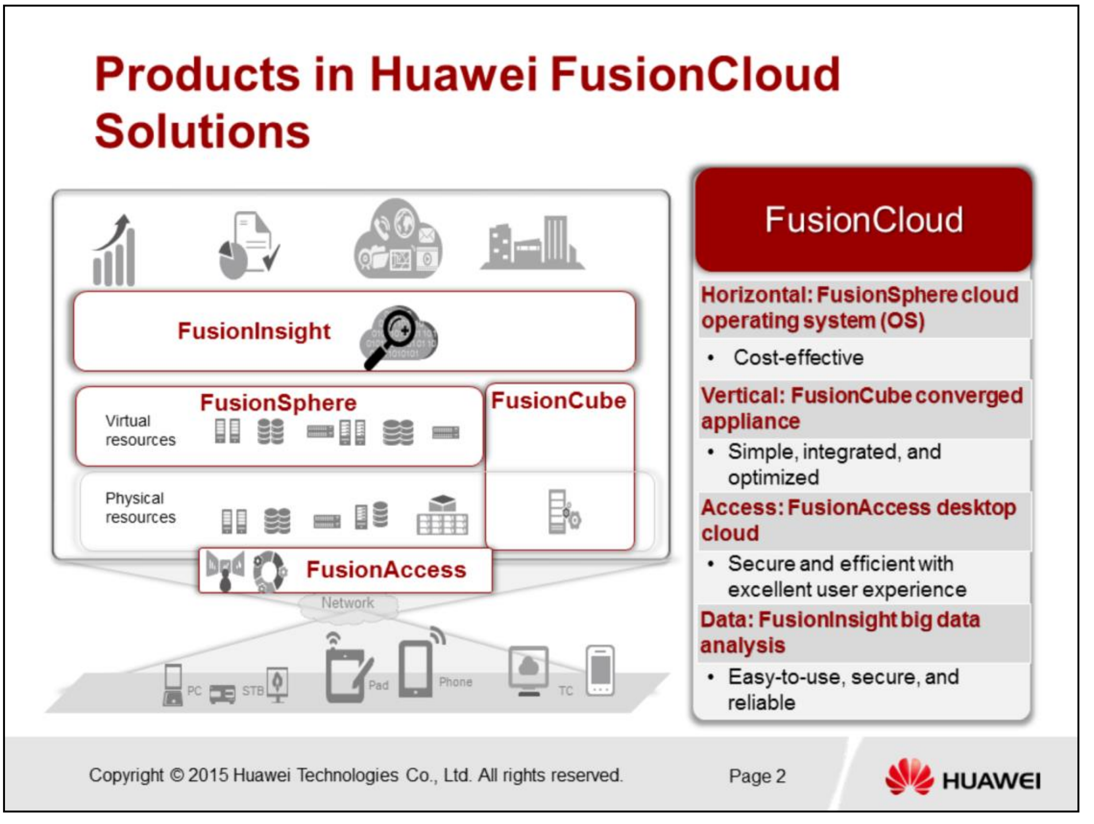
Objectives

- Upon completion of this course, you will be able to:
  - Understand the highlights of Huawei FusionSphere Solution.
  - Understand the highlights of Huawei FusionCube Solution.
  - Understand the highlights of Huawei FusionAccess Solution.



- FusionCloud is the general brand name for Huawei cloud computing solutions, including the desktop cloud product FusionAccess, the converged appliance FusionCube, the cloud operating system FusionSphere, and the big data platform FusionInsight.
- FusionInsight is a highly industry-targeted product. It is usually customized for specified industries and is suitable for large enterprises.

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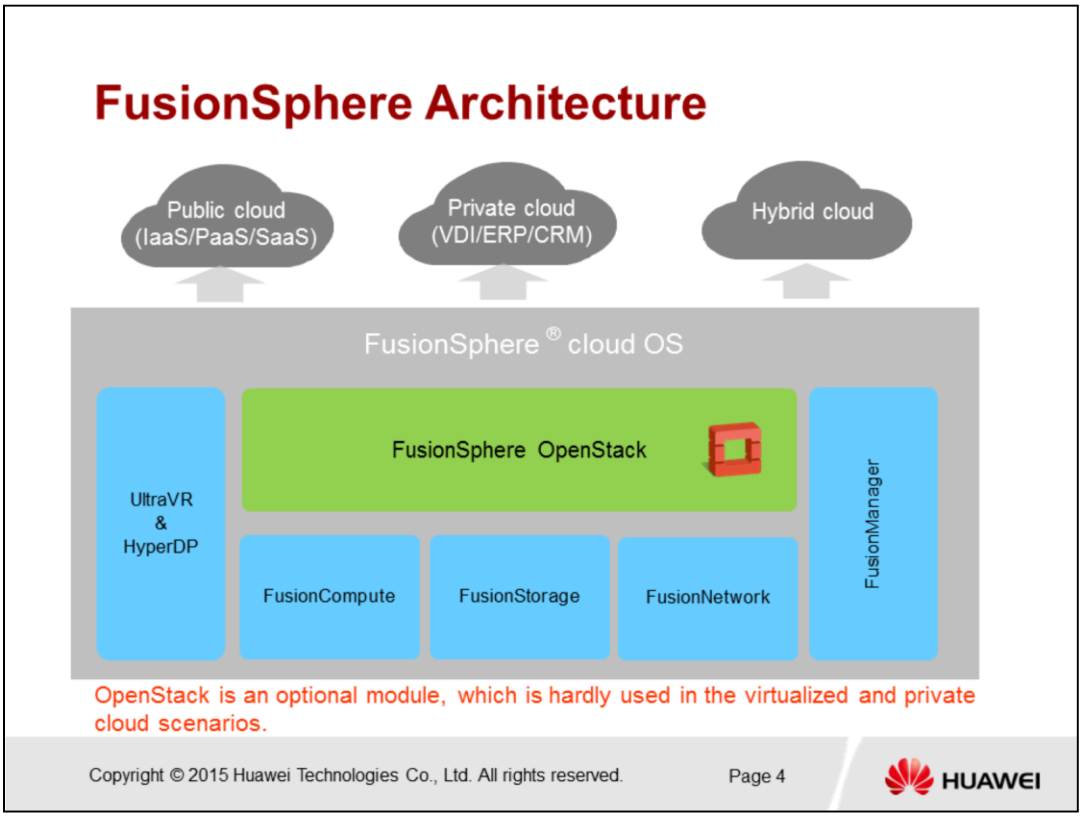
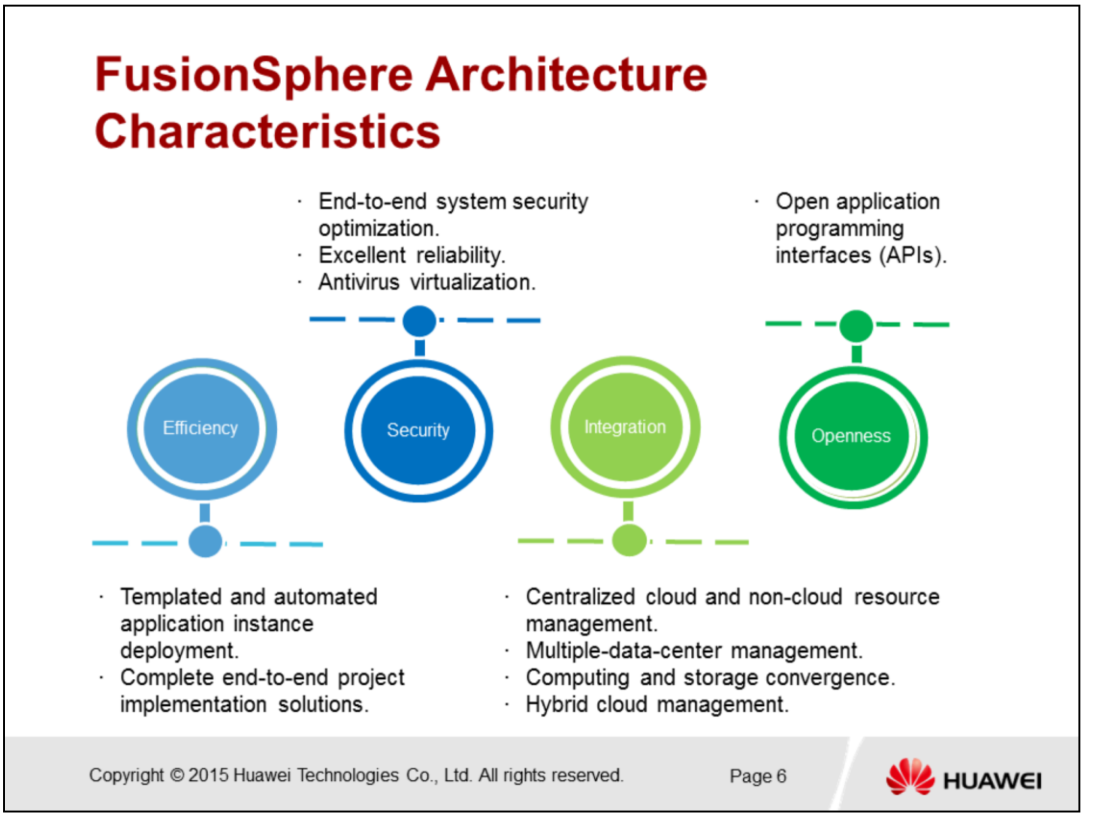


- FusionSphere includes the following modules:
  - UltraVR: manages the disaster recovery (DR), implementing the overall system remote DR capabilities.
  - HyperDP: manages the backup, implementing VM-level backup management capabilities.
  - FusionCompute: virtualizes computing resources, implementing the virtualization of CPUs, memory, disks, and peripheral devices. VMs are created using FusionCompute.
  - FusionStorage: virtualizes storage resources by means of integrating local disks on generic servers, providing distributed Server SAN capabilities.



- This section introduces the characteristics of FusionSphere from the following four aspects: efficiency, security, integration, and openness.

FusionSphere Version Overview

★ Standard capabilities ☆ Optional capabilities

Category	Feature	Product	FusionSphere Edition			
			Trial Edition	Standard Edition	Advanced Edition	Platinum Edition
Virtualization	Computing, storage, and network virtualization	FusionCompute	★	★	★	★
	VM reliability		★	★	★	★
	Security management		★	★	★	★
	Antivirus virtualization		★		★	★
	VXLAN		★			★
VDC	VM and infrastructure O&M management	FusionManager	★		★	★
	VPC management		★		★	★
	Metering		★		★	★
	Automatic Application Instance Deployment		★		★	★
	Application instance monitoring		★		★	★
	Hypervisor compatibility		★		★	★
	Hardware management		★		★	★
Basic cloud services	Basic cloud service APIs					★
	Multi-DC management					★
	Load Balancing Service		★		★	★
Backup and DR	Data backup	HyperDP		★	★	★
	Array-based Remote Replication DR	UltraVR		☆	☆	★
	Host-based Remote Replication DR			☆	☆	★
Performance optimization	System Operation Insight	FusionSphere SOI				★

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- The trial edition has a 90-day limitation. After 90 days, the system supports normal operations of 6 CPUs to the uttermost.
- FusionSphere System Operation Insight (SOI) implements advanced analysis on running systems. FusionSphere SOI collects and displays VM performance indicators in the FusionSphere cloud system, models and analyzes the collected data, makes predictions on future performance changes based on the collected data, and provides suggestions on system performance management.
- FusionSphere SOI analyzes and displays the system performance indicators of infrastructures in terms of the system health, risks, and efficiency.
- It also analyzes dynamic thresholds and capacity compliance and provides predictions based on the analysis, thereby implementing intelligent management. FusionSphere SOI not only displays historical data, but also predicts future trends.

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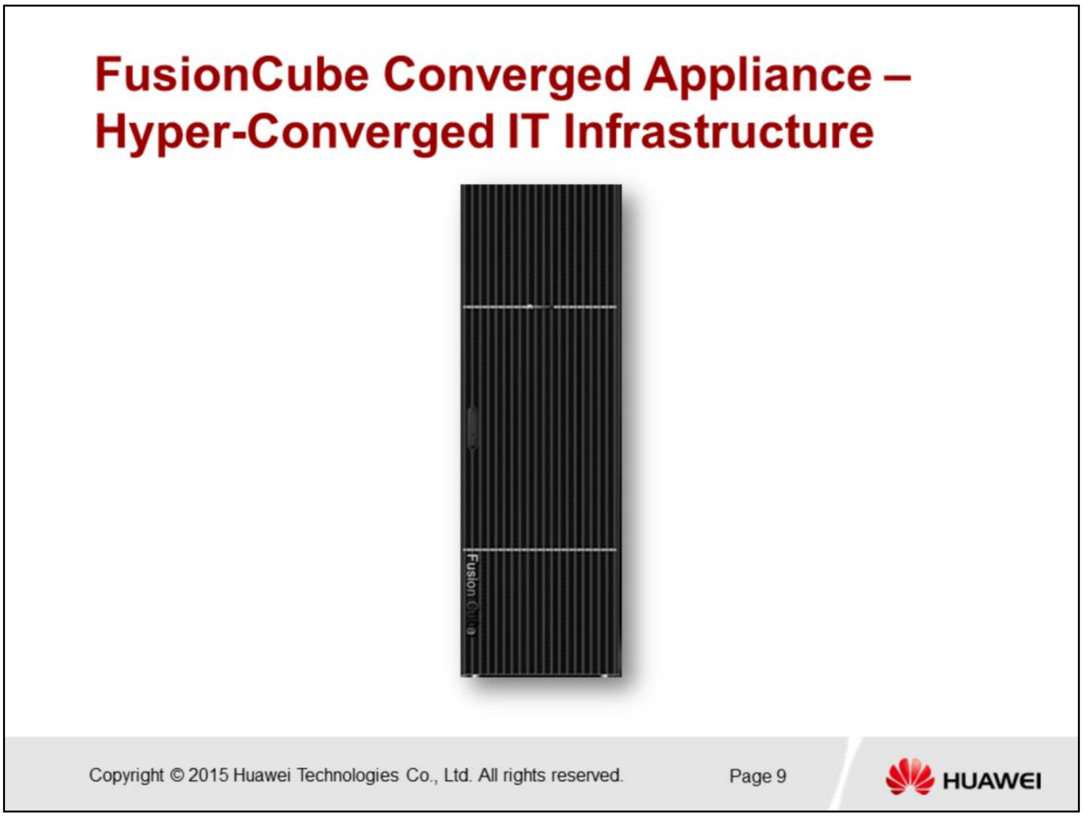
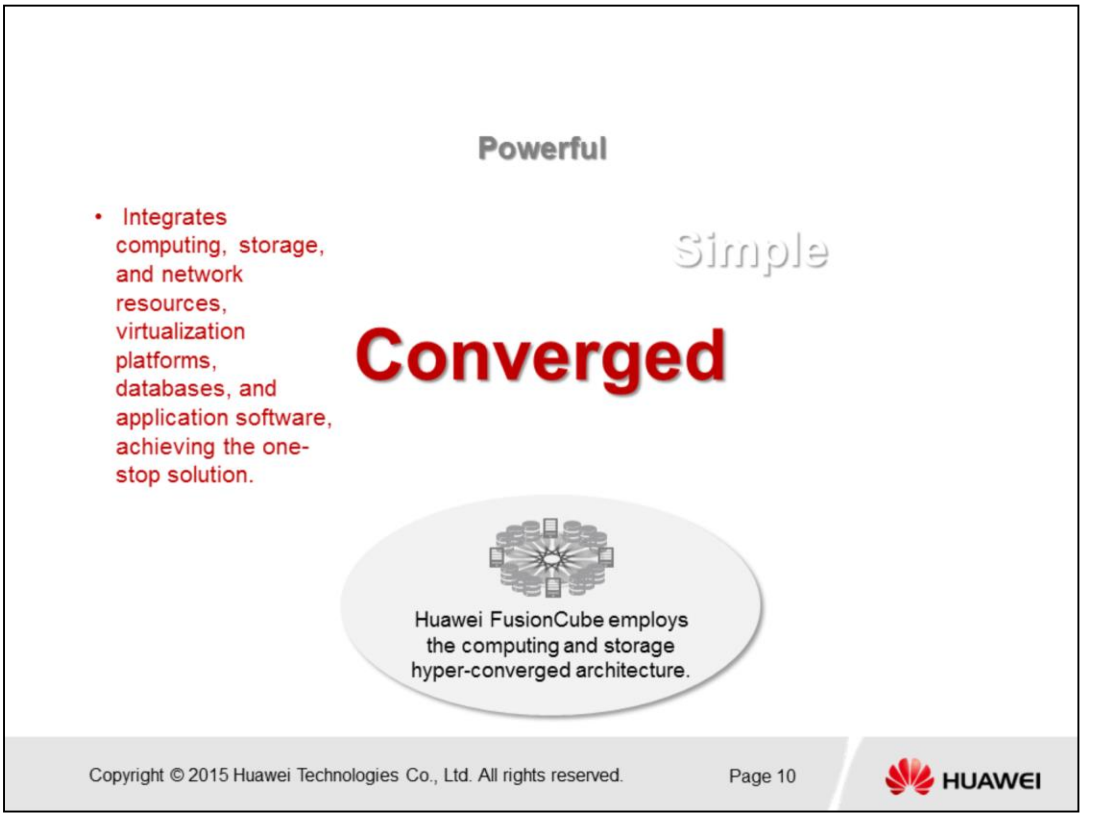
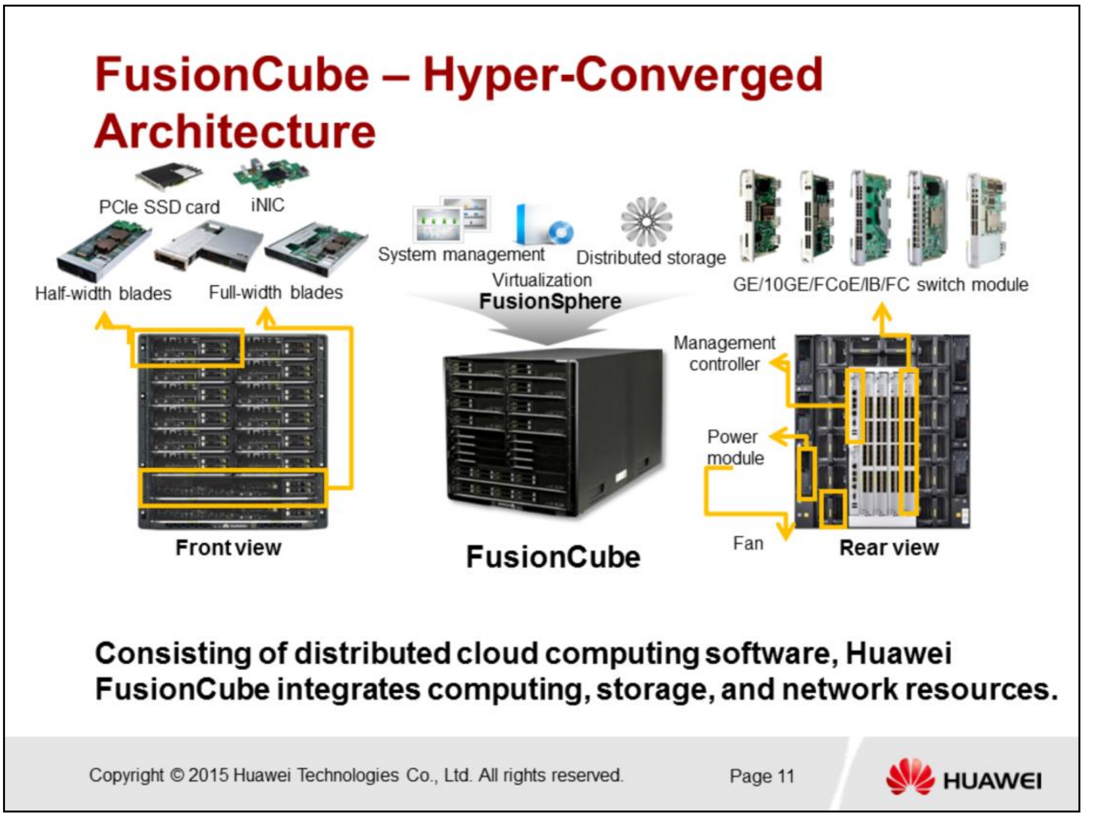


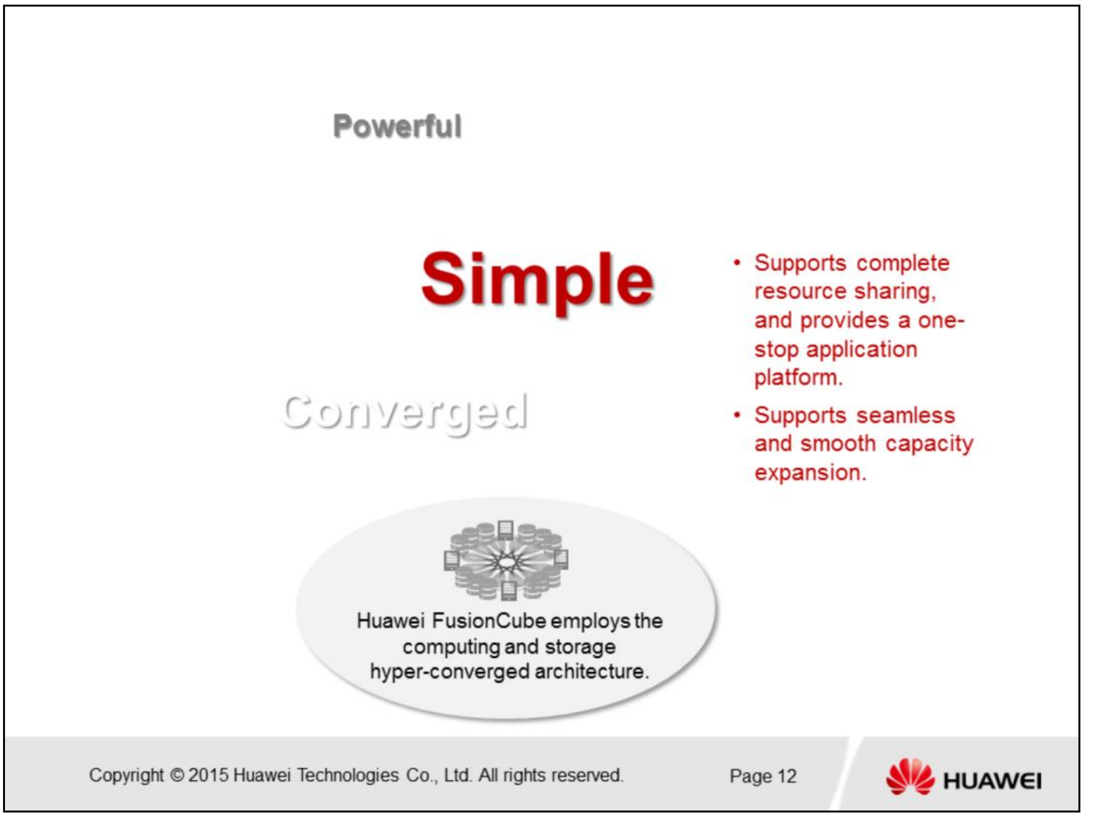
- FusionCube has three main features: converged, simple, and powerful. They are introduced in the following slides.



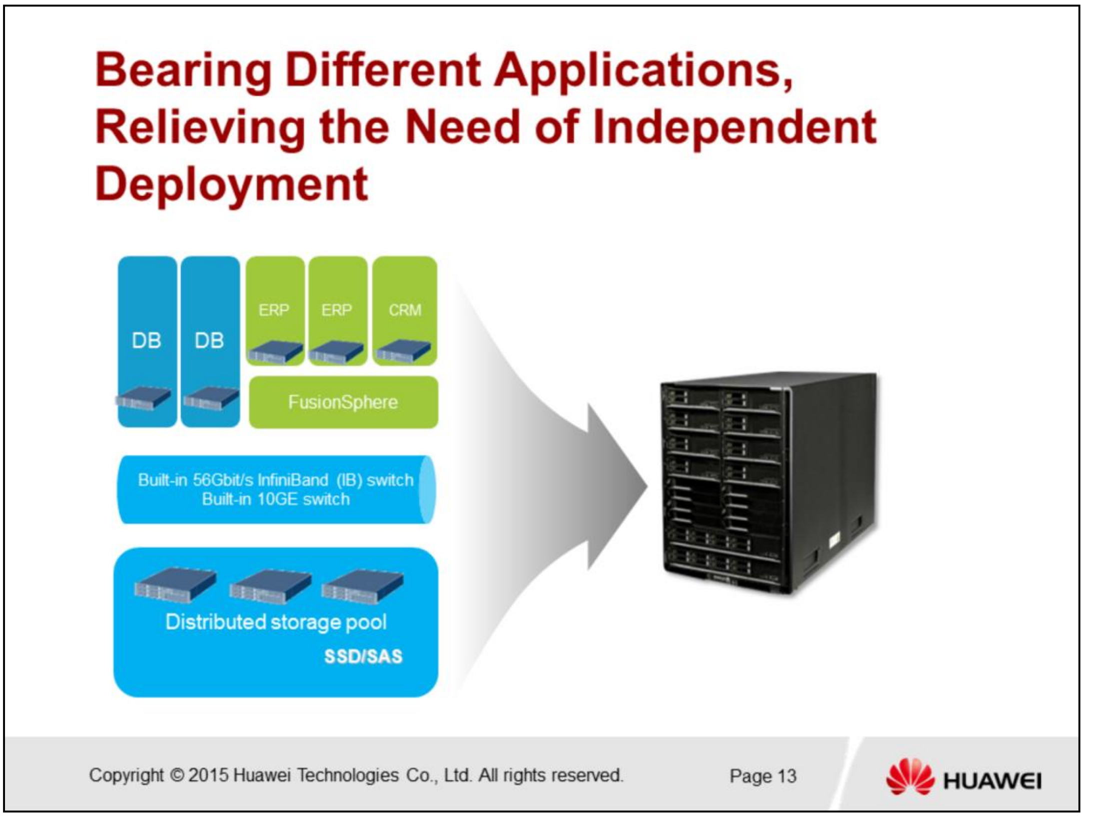
- Converged means that FusionCube integrates computing, storage, network resources, virtualization platforms, databases, and application software, thereby achieving the one-stop solution.



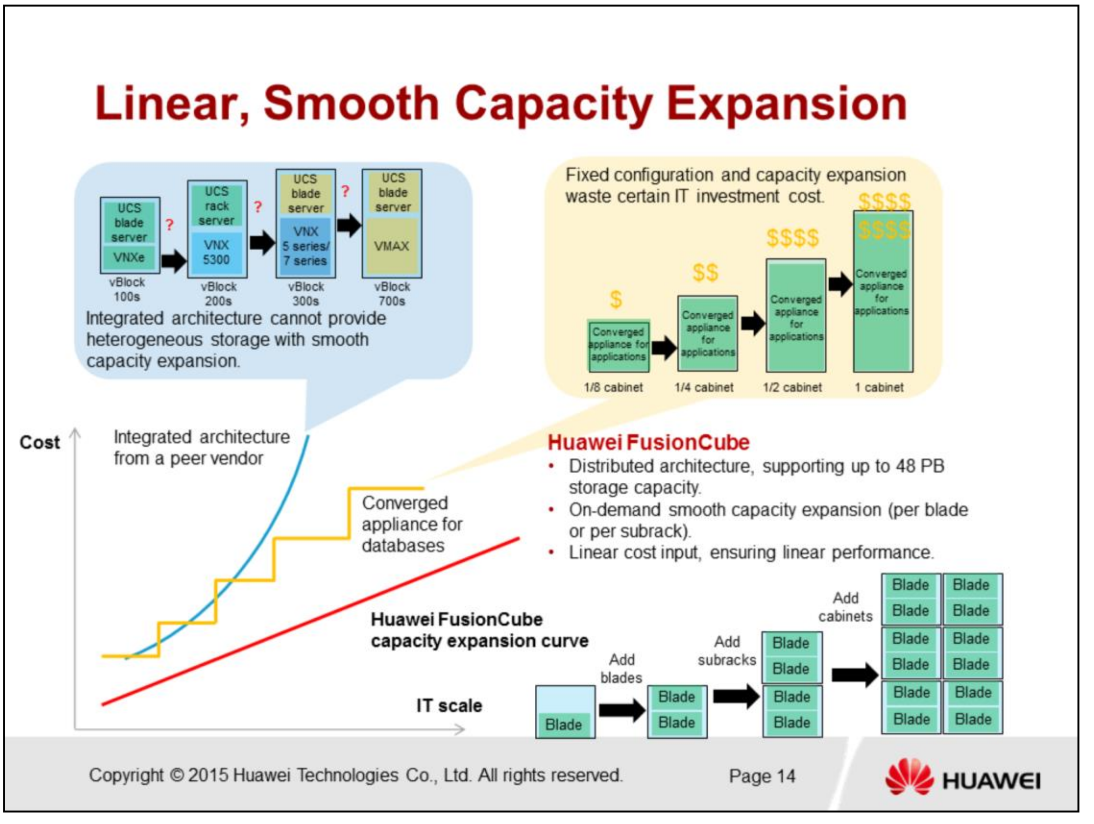
- The core of the FusionCube integration is the distributed cloud computing software (FusionCompute, FusionManager, and FusionStorage).



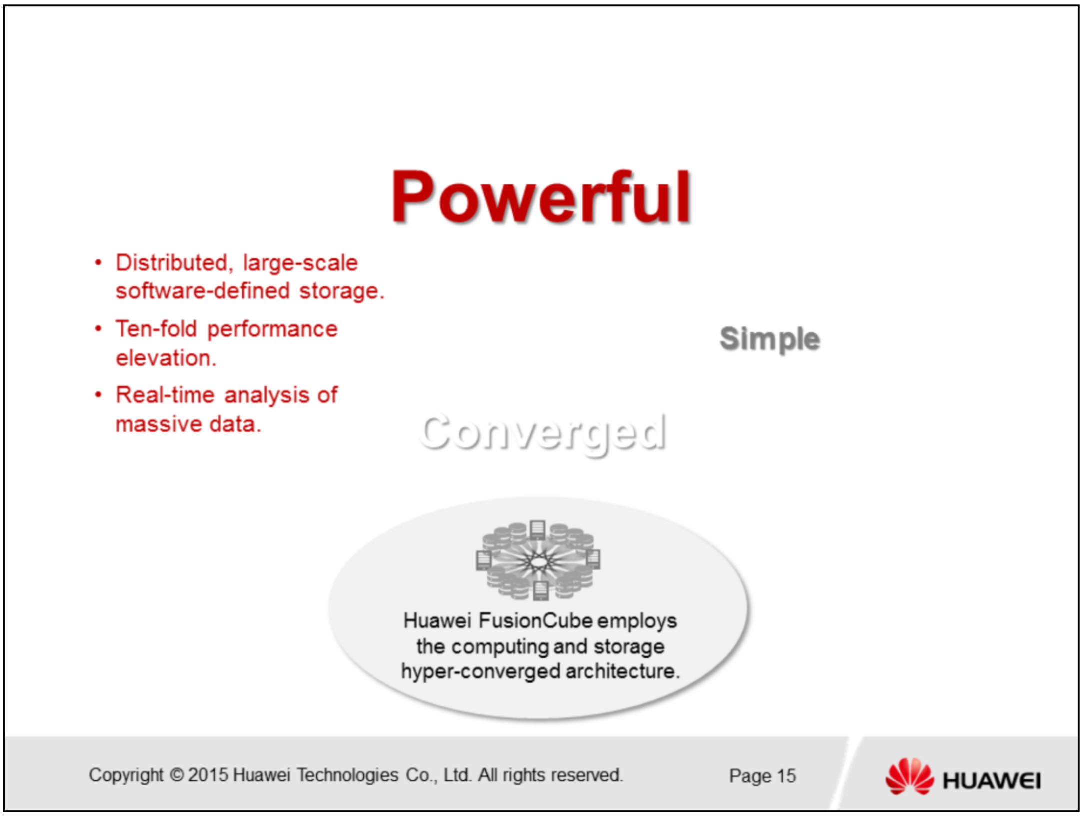
- Simple means that FusionCube supports resource sharing, seamless and smooth capacity expansion, and is an one-stop application platform.
- The software and hardware from top to bottom are all Huawei-developed products, providing end-to-end refined management deployment.



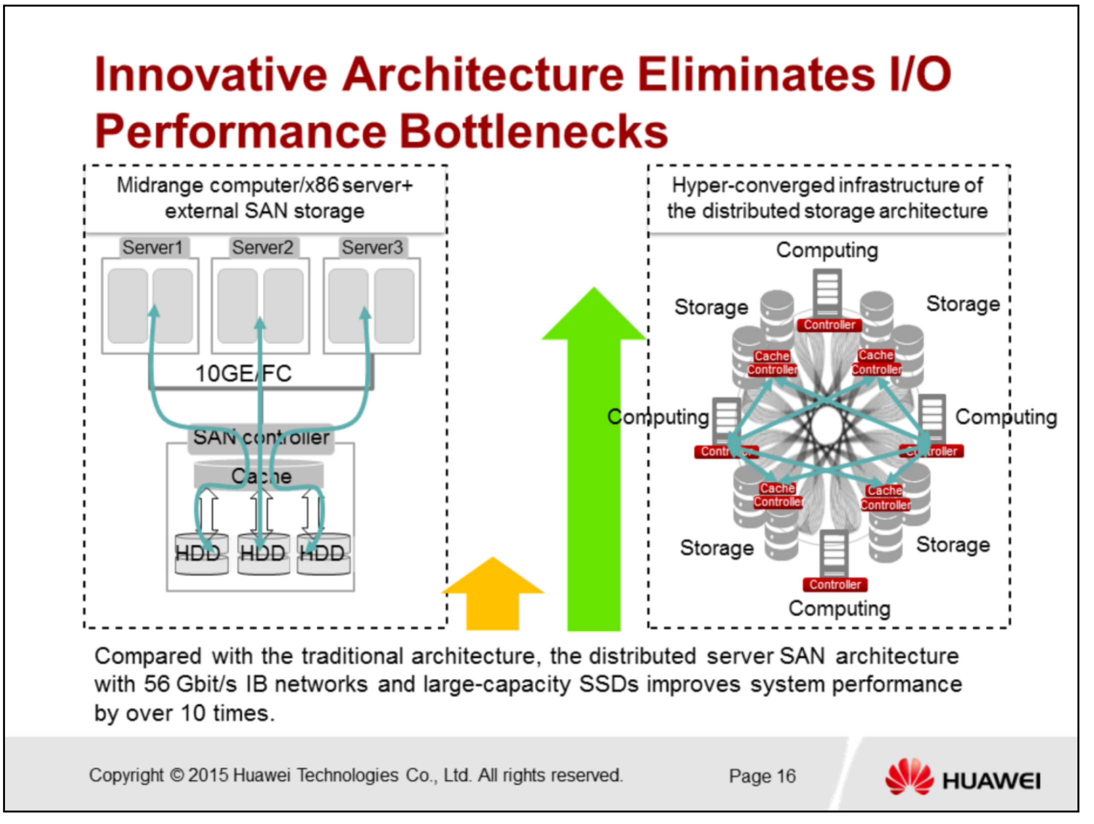
- The distributed cloud computing software virtualizes different hardware resources into a unified pool of virtual resources. Different applications can be deployed on the same hardware platform.



- FusionCube supports linear and smooth expansion in capacity of blades, subracks, and cabinets, which ensures uninterrupted operation of upper-layer applications irrespective of changes in hardware.



- Powerful means that FusionCube provides high-performance storage capabilities by implementing the innovative, distributed, and software-defined storage architecture (FusionStorage).



- Traditional storage architecture is easily subject to storage controller performance, and has low capacity expansion capabilities.
- FusionStorage employs distributed server SAN architecture, high-speed IB networks and SSDs, thereby achieving high performance and high capacity expansion capabilities.

Application Scenarios of FusionCube

Virtualization

FusionCube

Database acceleration

Desktop virtualization	Enterprise cloud data centers	Database application acceleration
Desktop cloud appliance	• Dedicated servers • VMs • Converged infrastructure	• Business intelligence and data warehouse • Database application acceleration • HANA in-memory database

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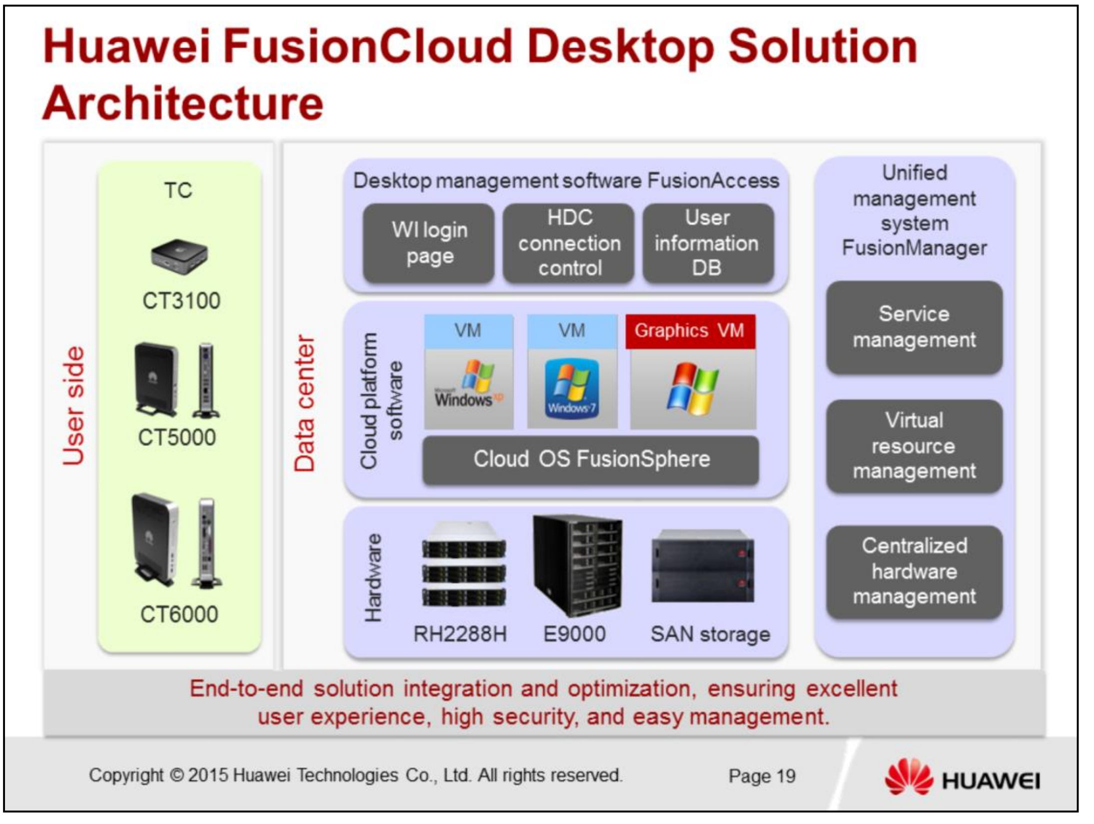

- 华为作为整体解决方案供应商，为客户提供端到端优化整合的解决方案，确保系统的综合性能和用户体验
  - 硬件：针对不同规模客户提供三种不同的硬件形态（两种一体机形态，服务器+SAN存储形态）， 提供高性能计算及海量存储
  - 云平台：屏蔽底层硬件差异，构建虚拟化资源池，实现资源共享，为上层应用提供运行平台
  - 桌面接入：提供从终端到虚拟机的远程桌面连接，进行用户身份鉴权、会话建立与管理
  - 云管理：物理及虚拟资源的统一监控及管理，提供丰富的资源调度策略，实现桌面云系统的自动化管理调度

Contents

- Huawei FusionSphere Solution
- Huawei FusionCube Solution
- Huawei FusionAccess Solution
- **Summary of Huawei FusionCloud Solutions**

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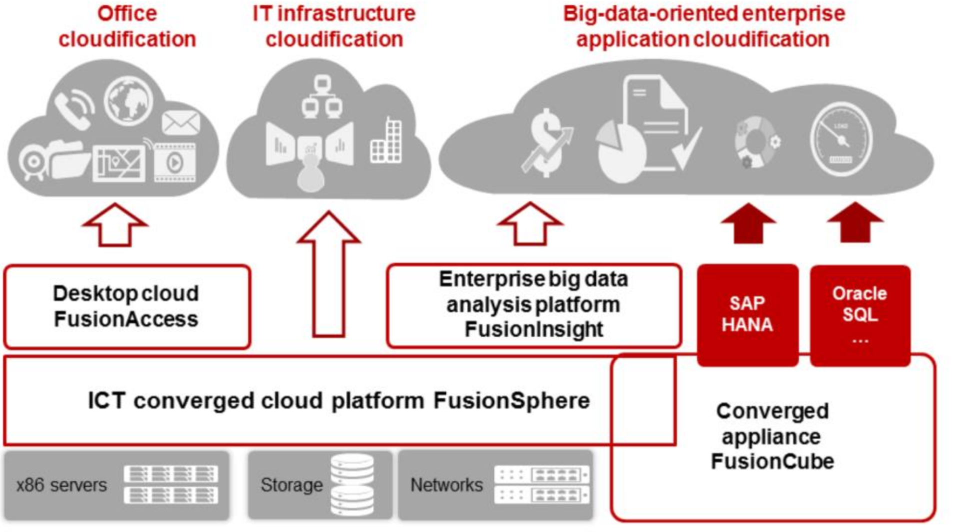
FusionCloud Solutions



Thank You!

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Chapter 4 Huawei Cloud Computing Hardware System

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Objectives

- Upon completion of this course, you will be able to:
  - Understand the cloud computing hardware overview.
  - Understand the basic knowledge about Huawei servers.
  - Understand the basic knowledge about Huawei storage devices.
  - Understand the basic knowledge about Huawei switches.
  - Understand the basic knowledge about Huawei TCs.
  - Understand the typical hardware deployment modes of cloud computing.

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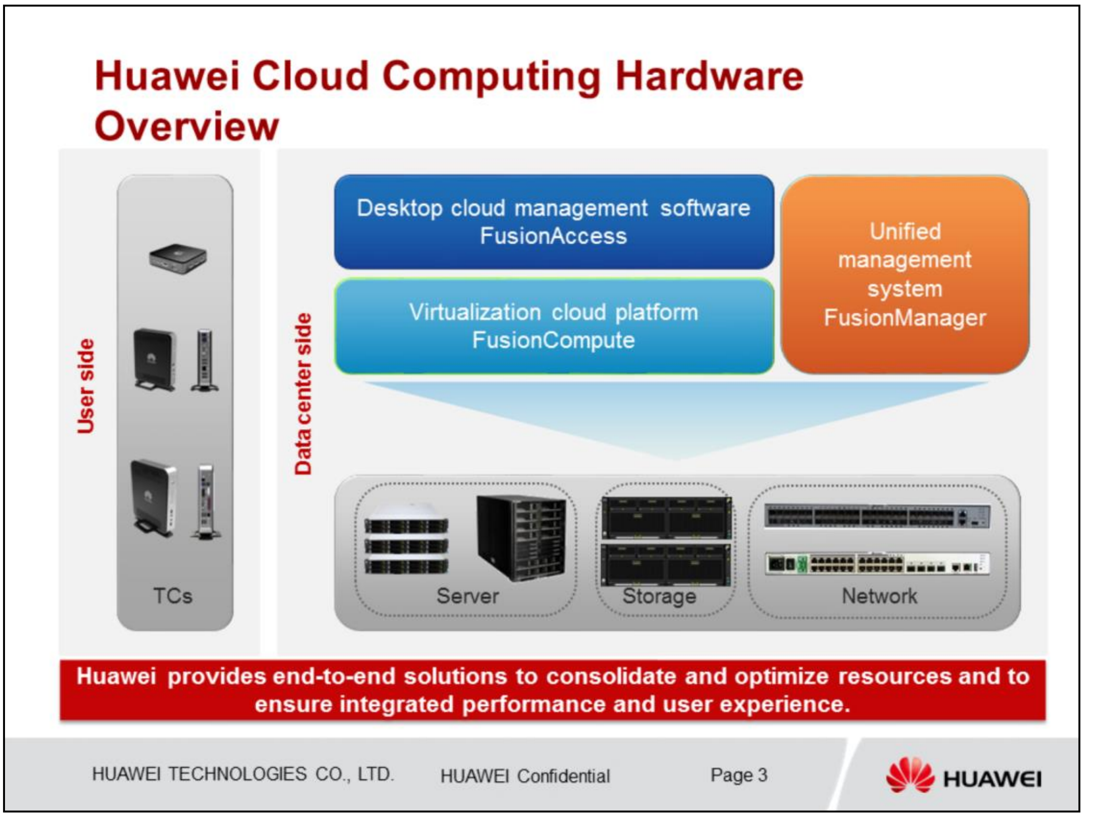
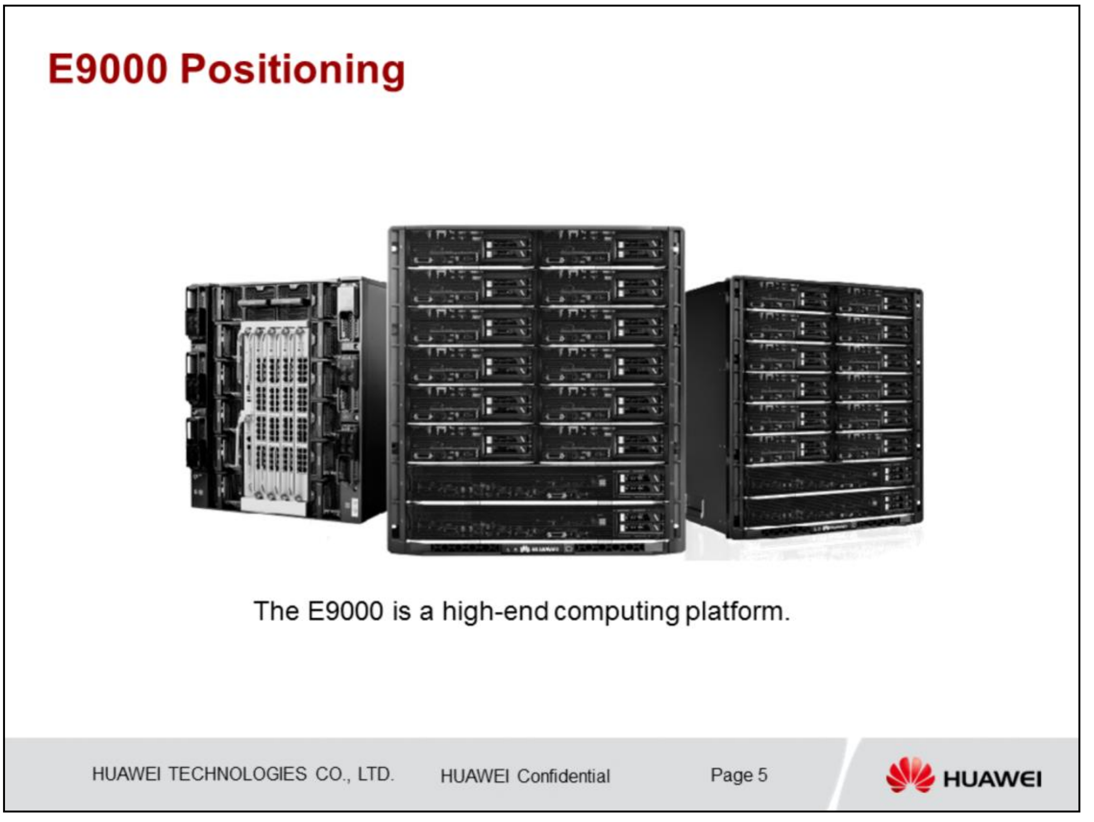
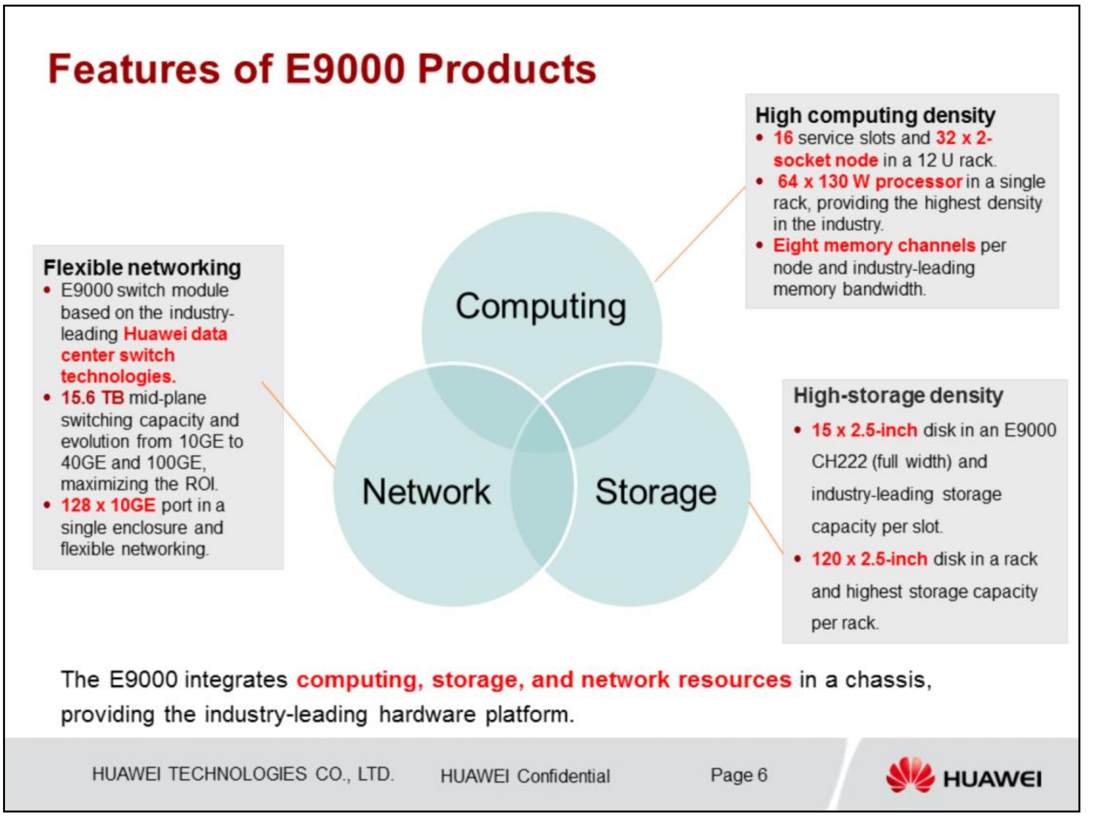


- Huawei chooses hardware that can perfectly meet the CPU, memory, storage space, storage IOPS, and network bandwidth requirements to eliminate performance bottlenecks and avoid hardware resource waste.
- Huawei provides end-to-end desktop cloud hardware devices. Huawei devices are also compatible with mainstream servers and storage devices from vendors such as IBM, HP, and Dell.

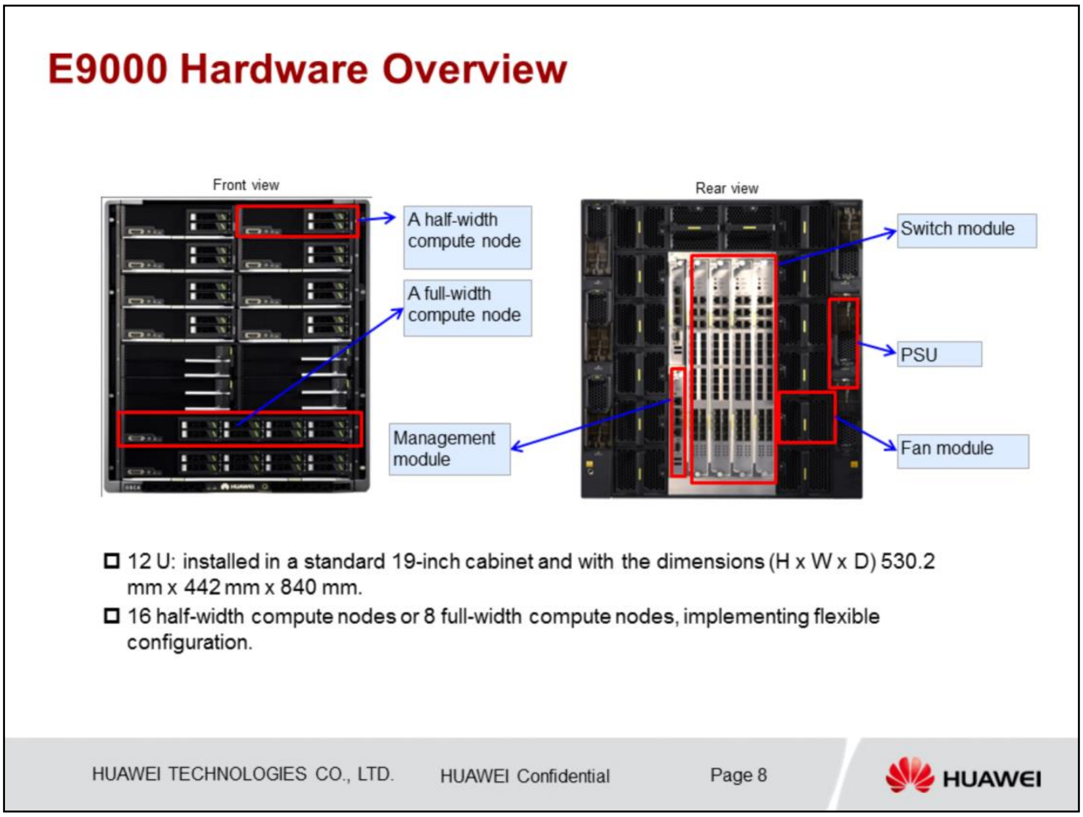
Contents



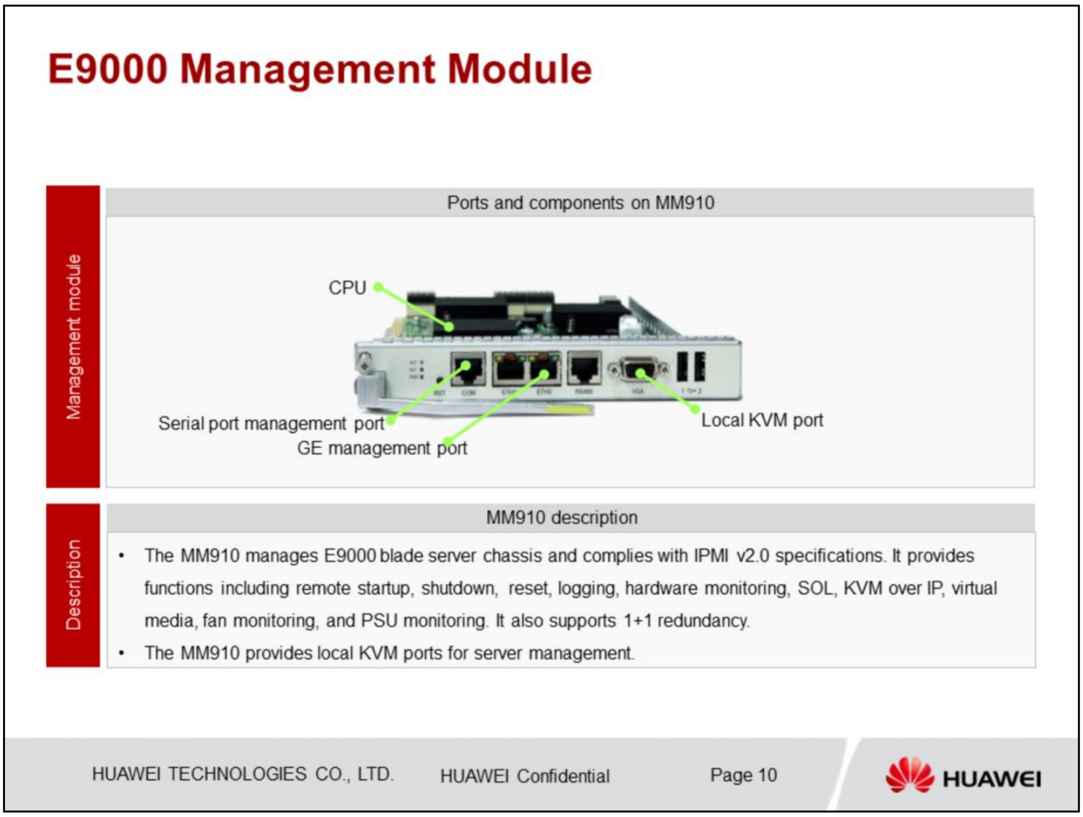
- The Huawei E9000 blade server is a high-performance, high-end enterprise server designed for elastic computing and telecom computing and integrates computing, storage, and networking resources to support high-end core applications of carriers and enterprises. The E9000 is an industry-leading hardware computing platform that features reliability, availability, and serviceability (RAS), high computing density, energy saving, high mid-plane bandwidth, intelligent management and service, elastic configuration and flexible expansion for computing and storage resources, low network latency, and network acceleration. These features improve competitiveness of the E9000 server.
    - Enhances competitiveness for telecom carrier services and enterprise software services by providing equivalent quality and service capability of midrange computers.
    - Provides the same competitiveness as cost-effective servers for carrier's universal services and Internet services.
    - Provides the switching capability of high bandwidth and short latency for services that require the convergence of computing and data or media.
- The E9000 meets various workload requirements in the following typical scenarios:
    - Cloud computing: The E9000 uses high-performance CPUs and compute nodes with large-capacity memory to meet requirements for flexible virtual machine (VM) deployment. The built-in storage nodes with large capacity and low power consumption provide high-throughput shared storage to meet requirements for elastic computing applications.
    - HPC: The E9000 applies to HPC scenarios and provides InfiniBand switching capability with high performance and short latency.



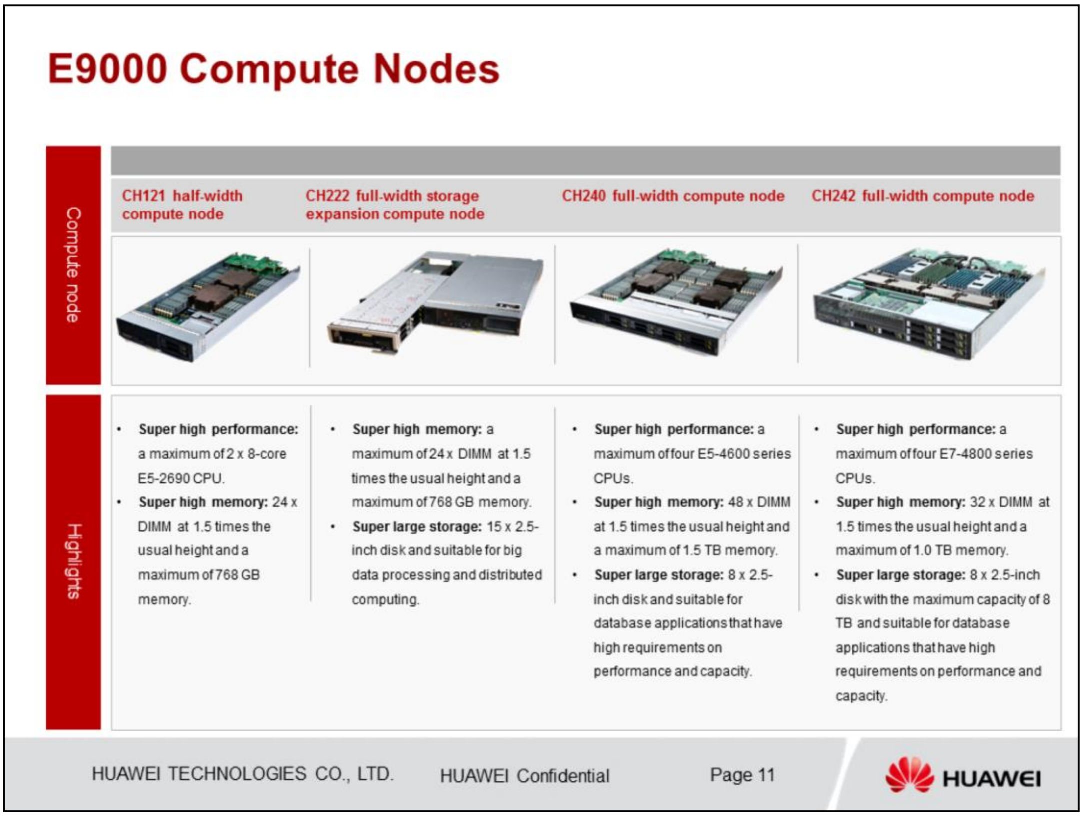
- The E9000, as a universal service processing platform, provides an industry-leading hardware infrastructure by integrating computing, storage, and networking resources in a 12 U chassis.
- High-performance compute node
  - Supports full series of Intel® x86 CPUs to meet requirements for CPU evolution in the future.
  - Supports compute nodes of various specifications: 2-socket, 4-socket, half-width, and full-width compute nodes.
  - Supports various network ports on mezz modules and acceleration cards to meet demands for high-performance processing.
- Built-in Large-capacity storage
  - A half-width storage resource expansion module is integrated with a half-width compute node to form a full-width compute node, which integrates storage and computing resources.
  - Supports fifteen 2.5-inch Serial Attached SCSI (SAS) or Serial Advanced Technology Attachment (SATA) disks or solid-state drives (SSDs). SCSI refers to Small Computer System Interface.
  - Supports disk installation through removable drive trays and hot swap.
  - Supports power-off protection for the write cache.



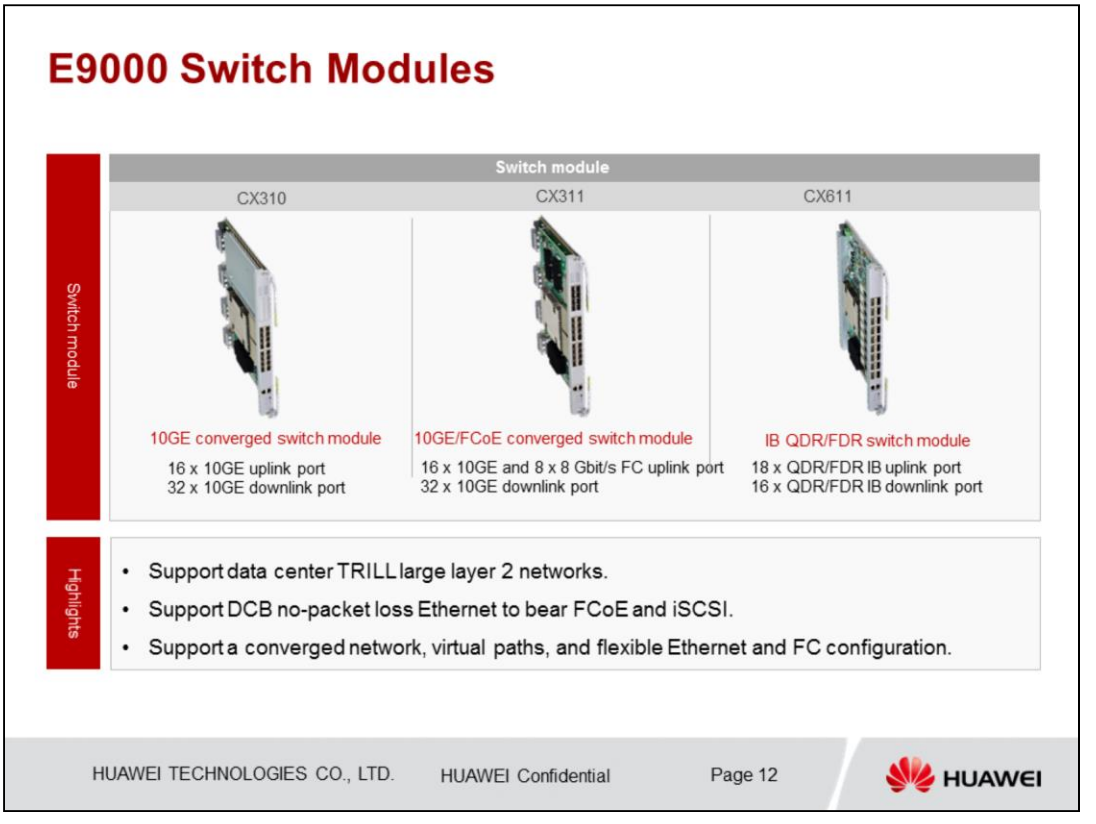
- The E9000 has the following functions and features:
  - The E9000 chassis houses eight full-width compute nodes or 16 half-width compute nodes for flexible slot configuration.
  - A half-width slot supports a compute node with two sockets and 24 DIMMs or two sets of two sockets and eight DIMMs.
  - A full-width slot supports a compute node with four sockets and 48 DIMMs.
  - A chassis provides the computing density of 64 processors or 768 cores with a maximum memory capacity of 12 TB.
  - The maximum mid-plane switch capacity reaches 15.6 Tbit/s.
  - Four switch modules (in two pairs) support Ethernet, fibre channel (FC), fibre channel over Ethernet (FCoE), and Infiniband (IB) switching protocols and provide I/O ports on panels.



- Each chassis is configured with two MM910s in active/standby mode. They support active/standby switchover and hot swap.



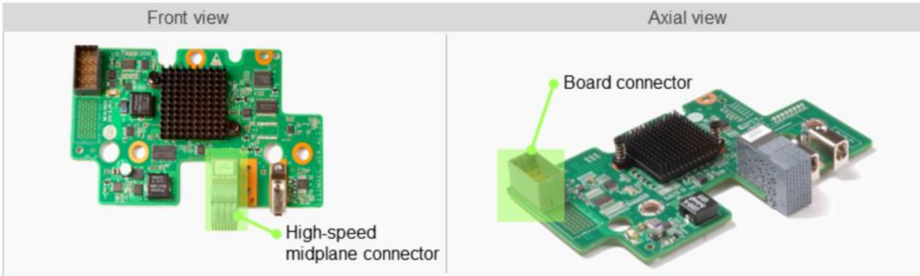
- Select a compute node as required.



- The E9000 switch modules use industry-leading Huawei data center switch technologies, which provide the mid-plane switching capacity of 15.6 TB, and support the evolution from 10GE to 40GE and 100GE. Each E9000 chassis provides one hundred and twenty-eight 10GE upstream ports and support various interfaces types, such as Ethernet, IB, and FC.
- The switch modules are installed in the rear slot of the E9000 chassis and connected to compute nodes, storage nodes, and management modules through the mid-plane. The switch modules exchange internal data packets and control management packets to provide high-speed data transmission.
- IB QDR/FDR and InfiniBand quad data rate/fourteen data rate
- A transparent interconnection of lots of links (TRILL) network functions as the high-speed bus in a data center and has many advantages. It can meet data center service requirements in the cloud computing era, such as random VM migration, non-blocking, low-delay data forwarding, multi-tenant, and large network scale.

Mezz Modules on E9000 Compute Nodes

Mezz module



Functions and models

Category	Model	Pluggable Mezz Slot	Specifications
10GE mezz module	MZ510	Mezz1/2	2 x 10GE CNA daughter card
	MZ512	Mezz1/2	2 x (2 x 10GE) CNA daughter card

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- The mezz module is used for I/O expansion and supports NICs and SAS cards.

Contents

1. Cloud Computing Hardware Overview
2. **Servers**

    2.1 Introduction to the E9000 Server

    2.2 Introduction to the RH2288H Server

3. Storage Devices
4. Switches
5. TCs
6. Typical Hardware Deployment Modes of Cloud Computing

RH2288H Server

RH2288H

Front view

Rear view

Form Factor	2U 2-Socket Rack Server
Number of CPUs	One or two
CPU model	Intel® Xeon® E5-2600/E5-2600 v2 series processors
DIMM slot	24 x DIMM slot for DDR3 RDIMMs/LRDIMMs and a maximum of 768 GB
Number of hard disks	8 or 26 x 2.5-inch SAS or SATA disk or SSD, or 12 x 3.5-inch SAS or SATA disk and 2 x 2.5-inch SAS or SATA disk or SSD
RAID supported	RAID 0, 1, 10, 5, 50, 6, and 60 with a RAID cache of 512 MB or 1 GB, optional battery or supercapacitor, and 3/24 hour power-off protection
PCIe expansion capacity	A maximum of seven PCIe slots
LOM	Two or four GE ports, or two 10GE ports
PSU	Two hot-swappable 460 W or 800 W AC PSUs or 800 W –48 V DC PSUs in N+1 redundancy mode
Fan module	Four hot-swappable counter-rotating fan modules in N+1 redundancy mode
Dimensions (H x W x D)	447 mm × 740 mm × 87.5 mm

Highlights

- **Super high performance:** a maximum of 2 x 8-core E5-2600 CPU
- **High memory capacity:** 24 x DIMM with a maximum of 768 GB memory
- **Flexible and openness:** standard PCIe expansion slots for a variety of PCIe cards

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- The RH2288H supports HPC, databases, virtualization, basic enterprise applications, and telecommunication service applications thanks to its outstanding computing performance, large storage capacity, low energy consumption, high reliability, and ease of deployment and management.

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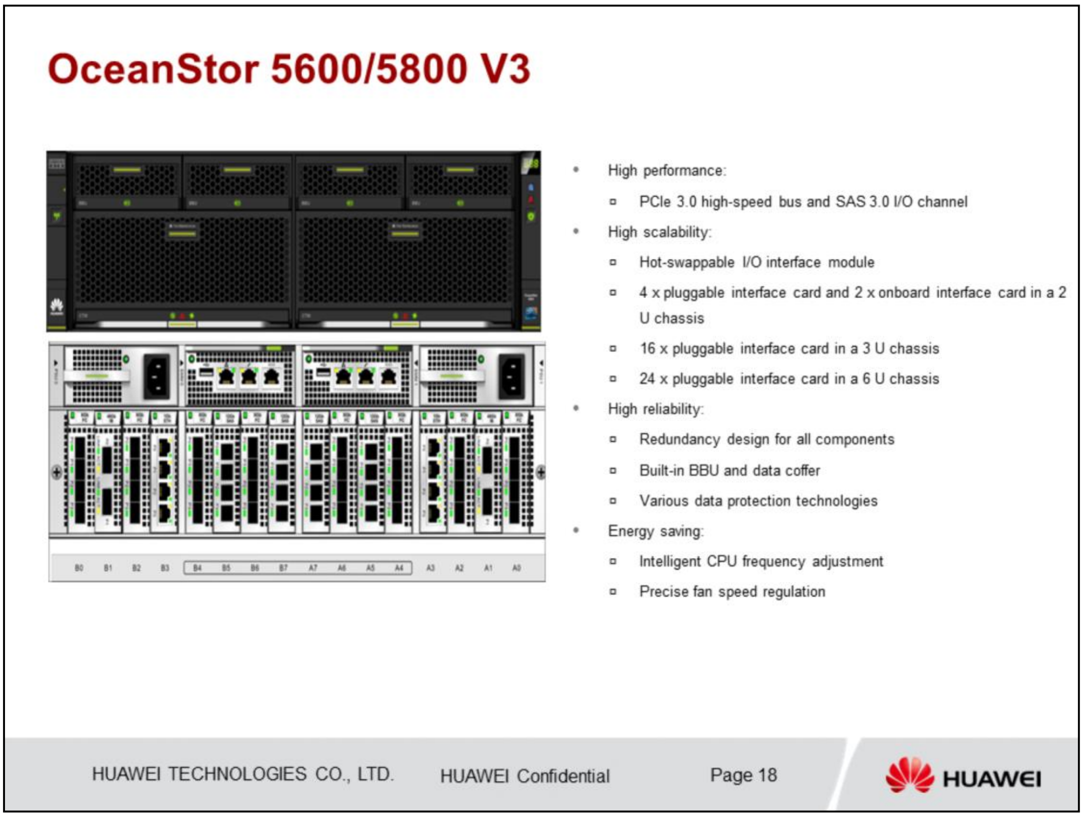
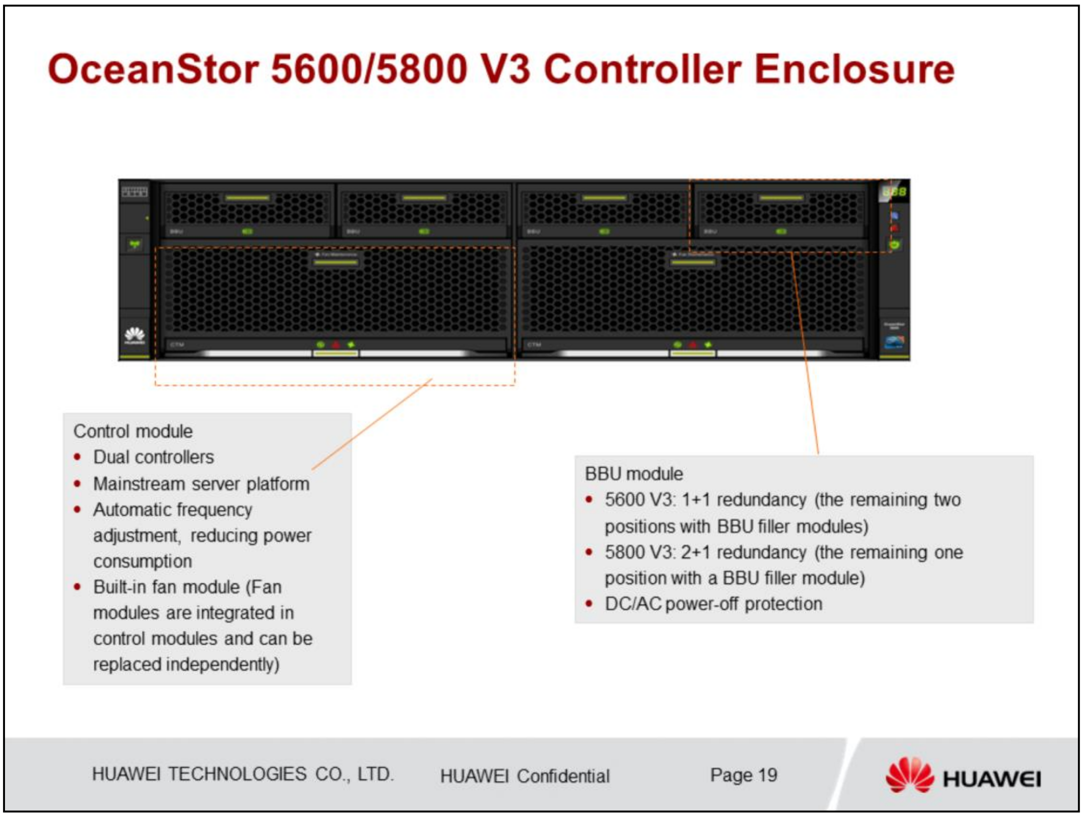
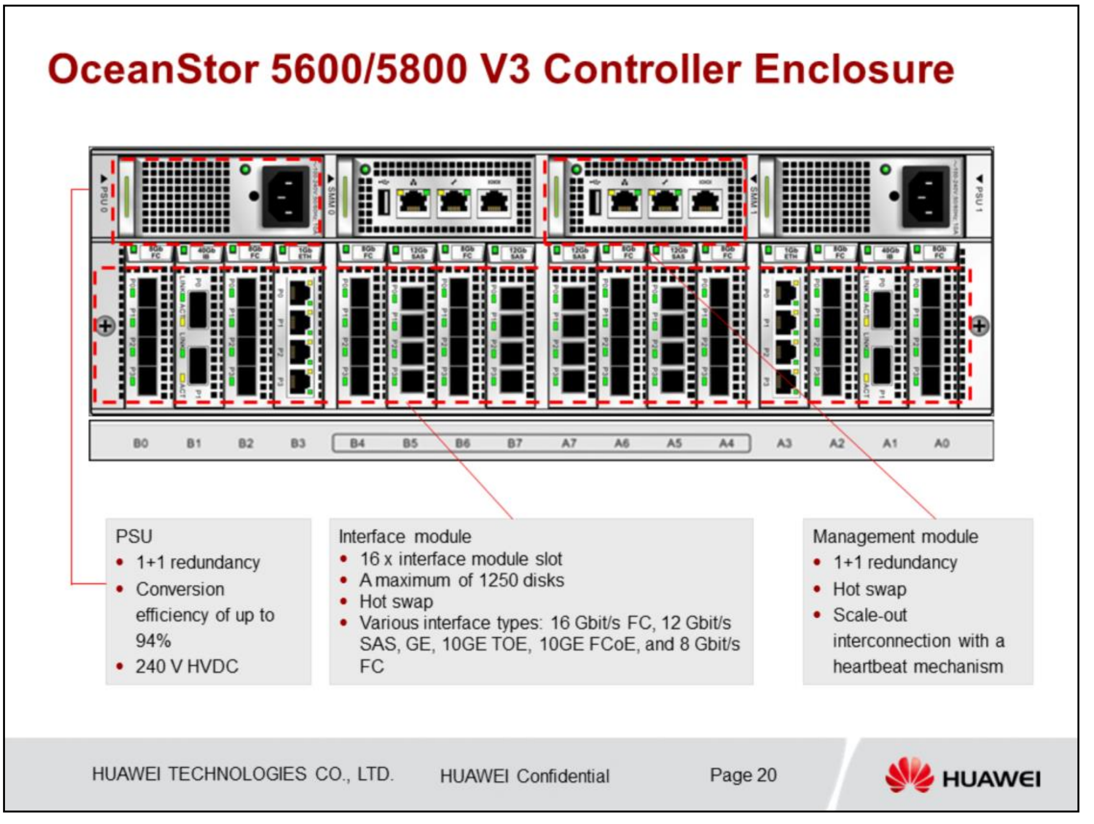


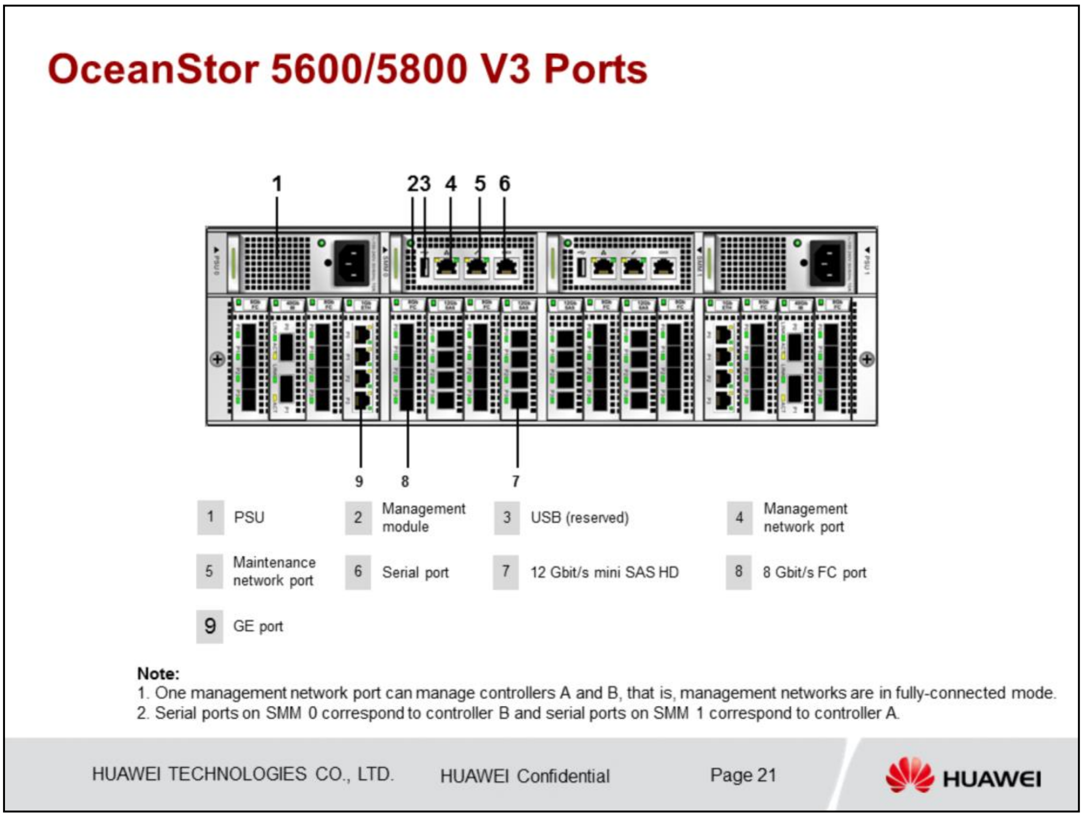
- Huawei V3 series storage devices use the latest technologies to provide the following features:
  - Use brand-new hardware architecture to provide industry-leading performance and specifications, support 16 Gbit/s FC and 10 Gbit/s FCoE host ports, and provide up to 40 GB/s of system bandwidth, 4 TB cache capacity, and 8 PB storage capacity.
  - SAN and NAS are converged to provide elastic storage, simplify service deployment, improve storage resource utilization, and reduce total cost of ownership (TCO).
  - Powerful scalability enables up to eight controllers and linear growth of performance and capacity. Loads are balanced among controllers that serve as hot backup for each other, achieving higher reliability. Resources are centrally stored, simplifying resource management.



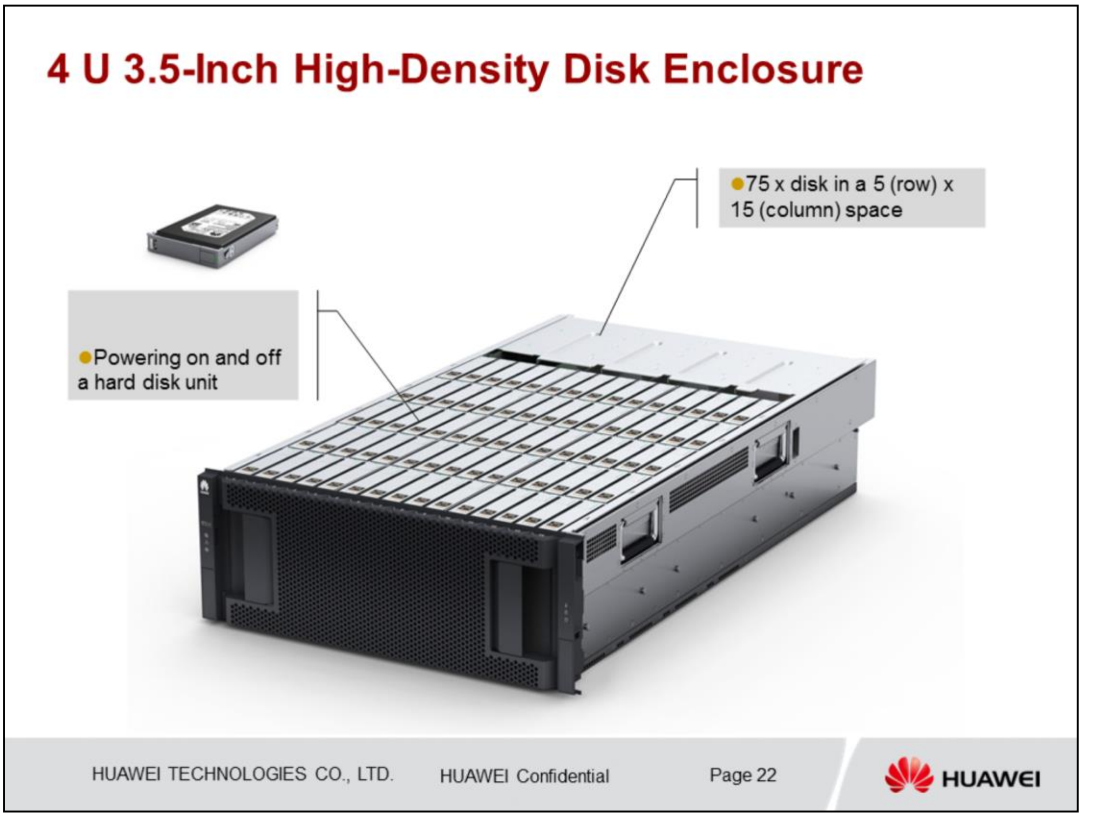
- Storage 5600 V3/5800 V3 uses disk and controller separation architecture (3 U independent engine). Controller modules and BBUs support redundancy and provide high availability.



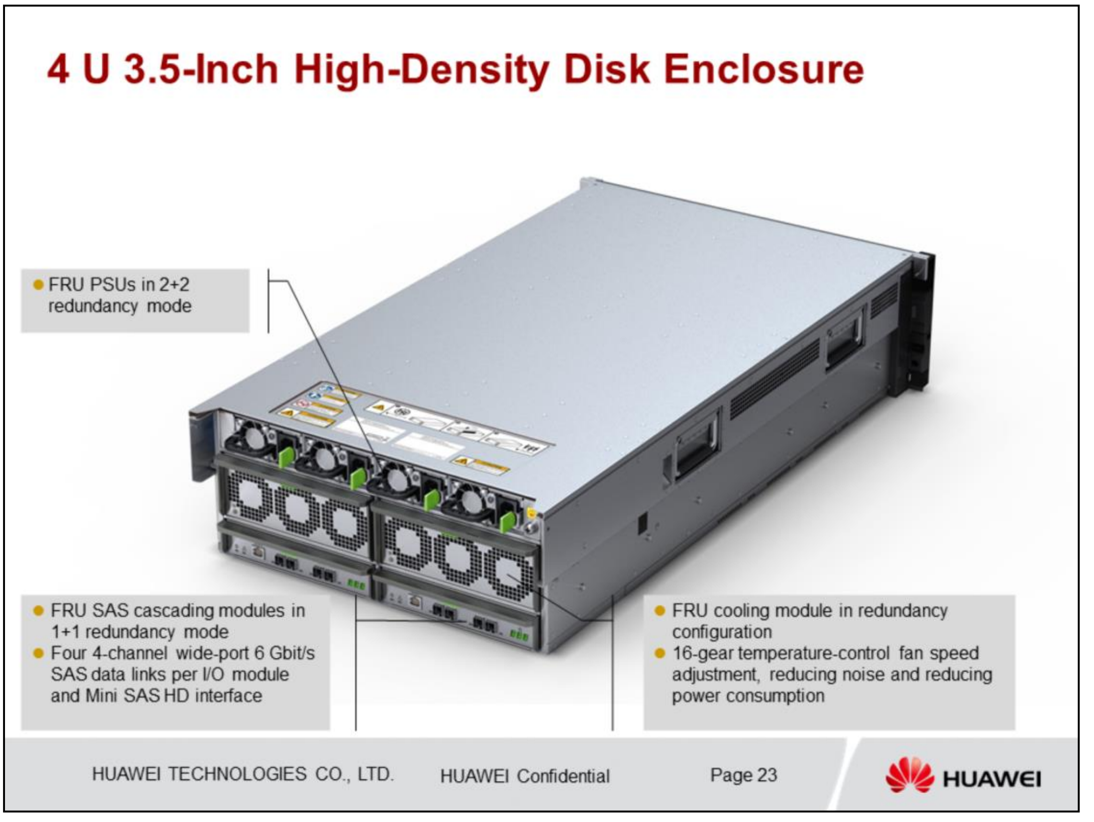
- Controller enclosures can be managed in a cascading manner.



- All ports use a modular design, facilitating replacement and upgrade.



- Disk enclosures connect to controller enclosures to provide disk capacity for the controller enclosures.



- Disk enclosures connect to controller enclosures using Mini SAS HD cables or are cascaded to other disk enclosures to implement capacity expansion.

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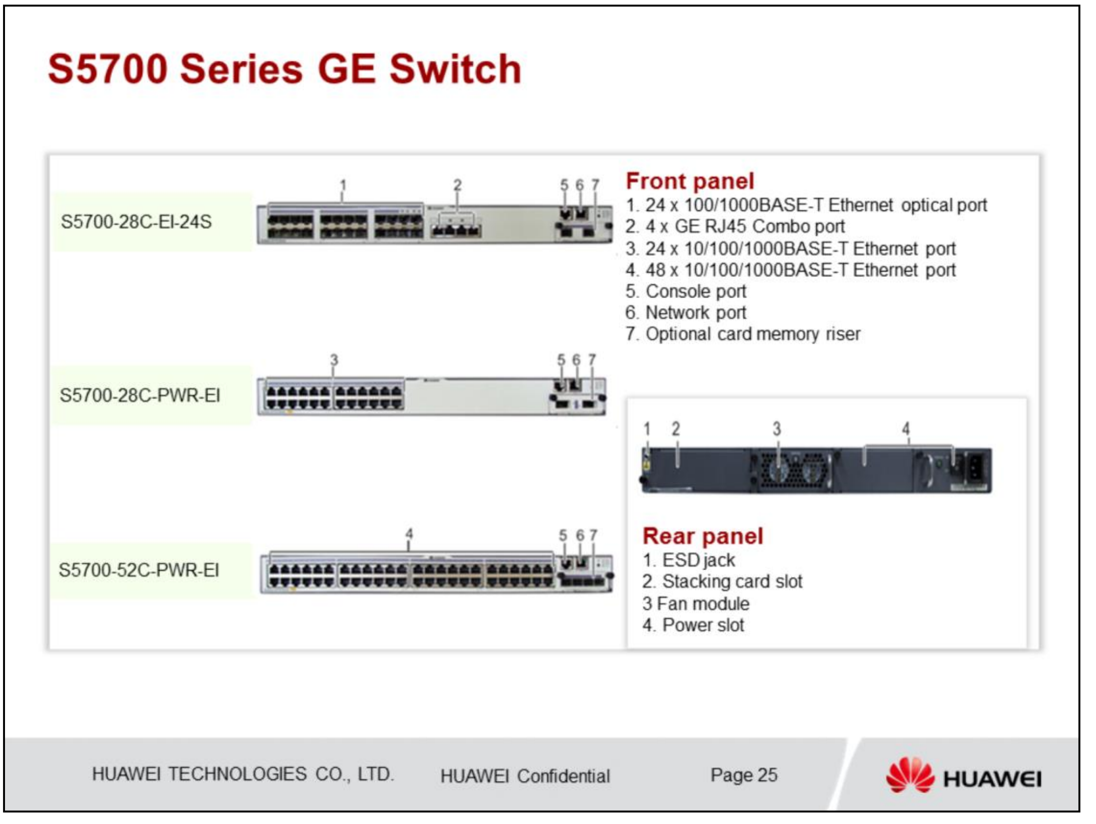
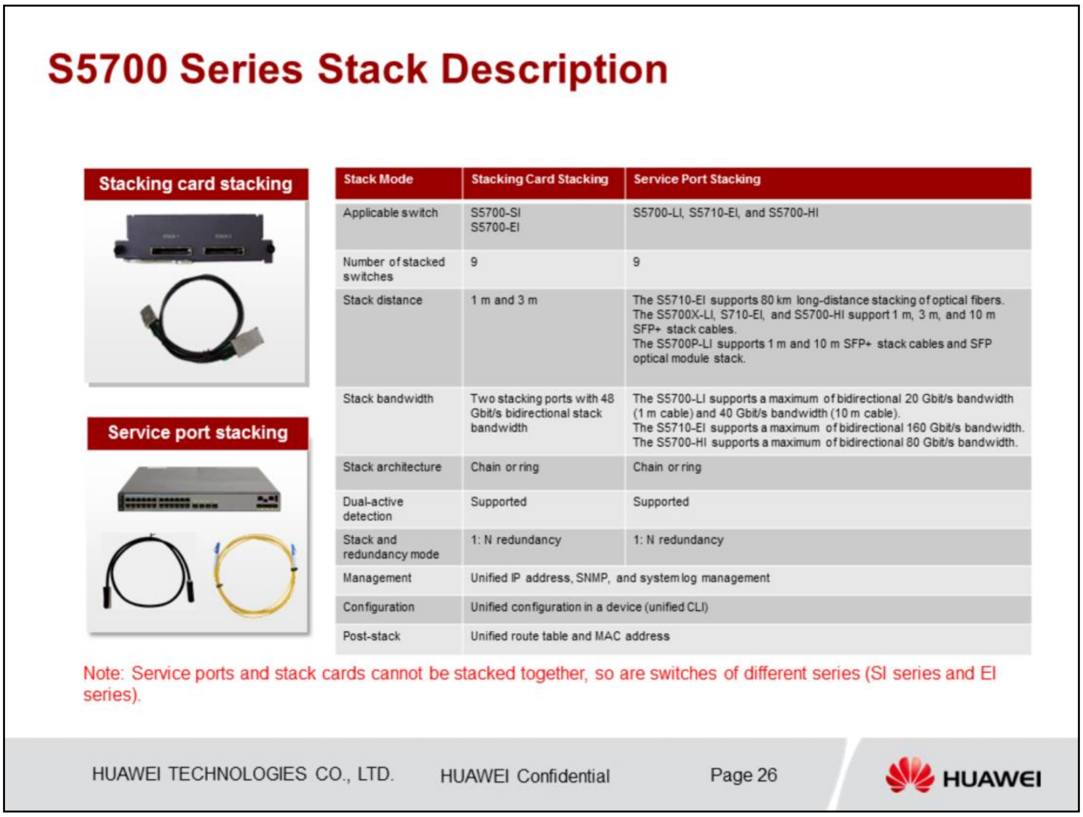


- Electrostatic discharge (ESD) jack
- The S5700 series Ethernet switches (S5700 for short) are the new-generation energy-saving full gigabit Ethernet switches developed by Huawei to meet large bandwidth access and Ethernet service convergence requirements. The S5700 is developed based on new-generation high-performance hardware and Huawei unified versatile routing platform (VRP) software. It offers large-capacity, high-reliability (dual power supply sockets and hardware-based Ethernet OAM), high-density GE ports, provides 10GE uplink capability, and supports energy efficient Ethernet (EEE) and iStack, meeting customer requirements of access to campus networks, aggregation, IDC GE access, and GE access to desktops.



Stack Mode	Stacking Card Stacking	Service Port Stacking
Applicable switch	S5700-SI S5700-EI	S5700-LI, S5710-EI, and S5700-HI
Number of stacked switches	9	9
Stack distance	1 m and 3 m	The S5710-EI supports 80 km long-distance stacking of optical fibers. The S5700X-LI, S710-EI, and S5700-HI support 1 m, 3 m, and 10 m SFP+ stack cables. The S5700P-LI supports 1 m and 10 m SFP+ stack cables and SFP optical module stack.
Stack bandwidth	Two stacking ports with 48 Gbit/s bidirectional stack bandwidth	The S5700-LI supports a maximum of bidirectional 20 Gbit/s bandwidth (1 m cable) and 40 Gbit/s bandwidth (10 m cable). The S5710-EI supports a maximum of bidirectional 160 Gbit/s bandwidth. The S5700-HI supports a maximum of bidirectional 80 Gbit/s bandwidth.
Stack architecture	Chain or ring	Chain or ring
Dual-active detection	Supported	Supported
Stack and redundancy mode	1: N redundancy	1: N redundancy
Management	Unified IP address, SNMP, and system log management	
Configuration	Unified configuration in a device (unified CLI)	
Post-stack	Unified route table and MAC address	

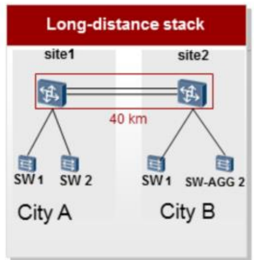
- The S5700 supports intelligent stack (iStack). This technology combines multiple switches into a logical switch.
- Member devices in the iStack system implement redundancy backup to improve device reliability and use inter-device link aggregation to improve link reliability. iStack provides high network scalability. You can increase ports, bandwidth, and processing capacity of a stack system by simply adding member devices to the stack. iStack also simplifies device configuration and management. After a stack is set up, multiple physical devices are virtualized into one logical device. You can log in to the stack system over any member device to configure and manage member devices in a unified manner.
- Note: S5700-10P-LI, 700-10P-PWR-LI, and S5700-26X-SI-12S-AC do not support iStack.

S6700 High-Density Full-10GE Box-Type Switch

S6700-24-EI

S6700-48-EI

Rear view:
Redundant fan modules and PSUs



Long-distance stack: a maximum of 40 km

- High network reliability and port usage
- Maximum ROI

Function	Specifications
Number of 10GE ports	A maximum of 48 in 1 U
MAC and Buffer	MAC: 128 KB Buffer: 9 MB
Stacking	Service port stacking

GE/10GE auto-adaptation

S6700

GE SFP 10GE SFP+

Contents

Huawei Desktop Cloud Hardware Client

Specifications	CT3100	CT5000	CT6000
Net weight	To be measured	To be measured	To be measured
Power consumption	< 6 W	< 14.52 W	< 11.42 W
Processor	Dual-core ARM Cortex-A9 1.5 GHz	Dual-core AMD T40N 1.0 GHz	Intel D2550 1.86 GHz
Memory	1024 MB DDR3	2 GB DDR3 (a maximum of 4 GB)	2 GB DDR3 (a maximum of 4 GB)
OS	Linux	WES7 Linux	WES7 Linux
Display port	Extended dual display DVI+VGA: 1920 x 1200	Extended dual display DVI+VGA: 1920 x 1200	Extended dual display DVI+VGA: 1920 x 1200
Application scenarios	High-performance offices	High-performance graphics and video playback	High-performance graphics and customer service center
Others	6 x USB	Radeon HD 6200 series graphics card	6 x USB+1 x COM+1 x LPT

Various TCs for different application scenarios.

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- This is a typical description about Huawei thin clients. Different models are distinctive in their own way. Users can choose models based on specified scenarios. Some TC operating systems can be hardened, such as blocking operation interface of the operating system, and forbidding use of USB flash drives.

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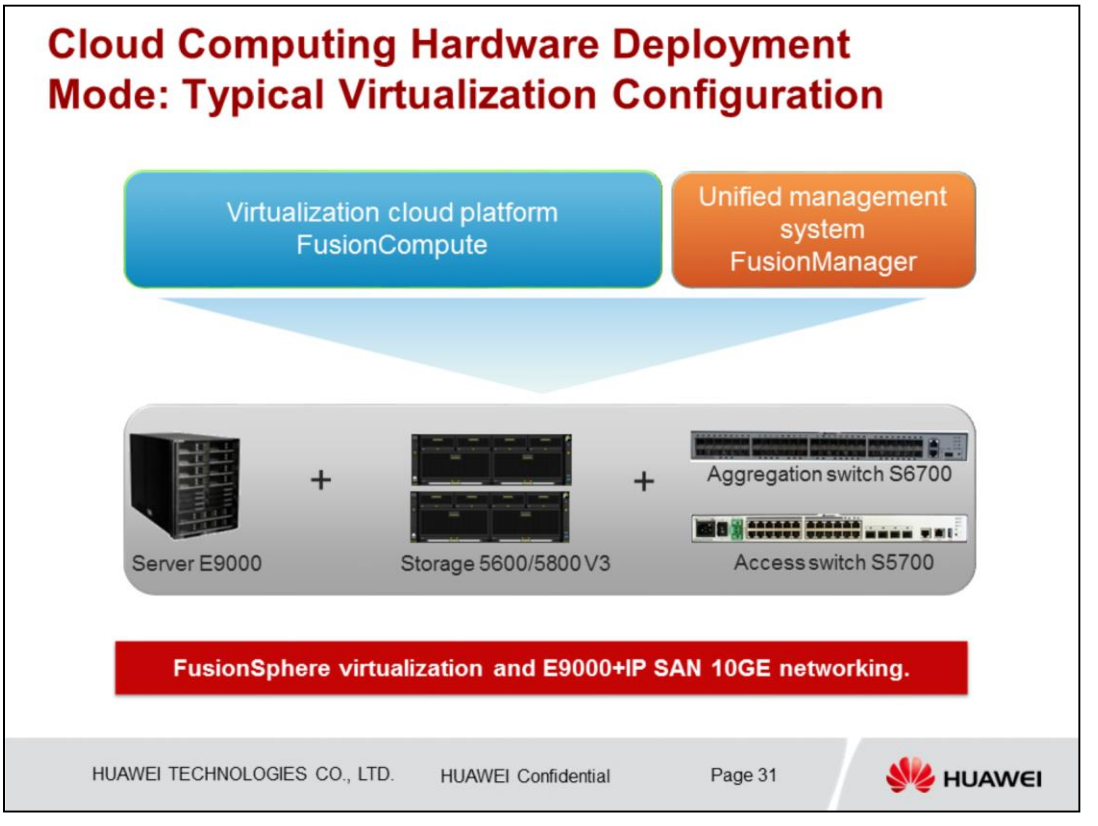
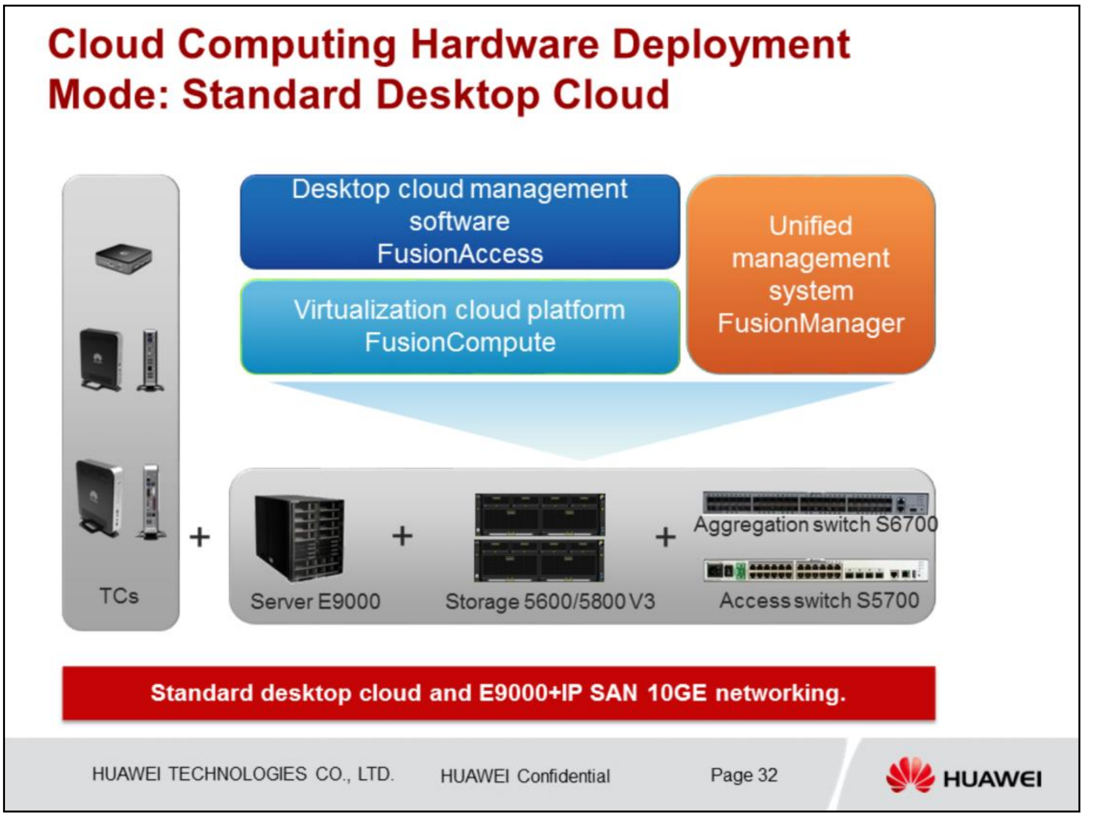
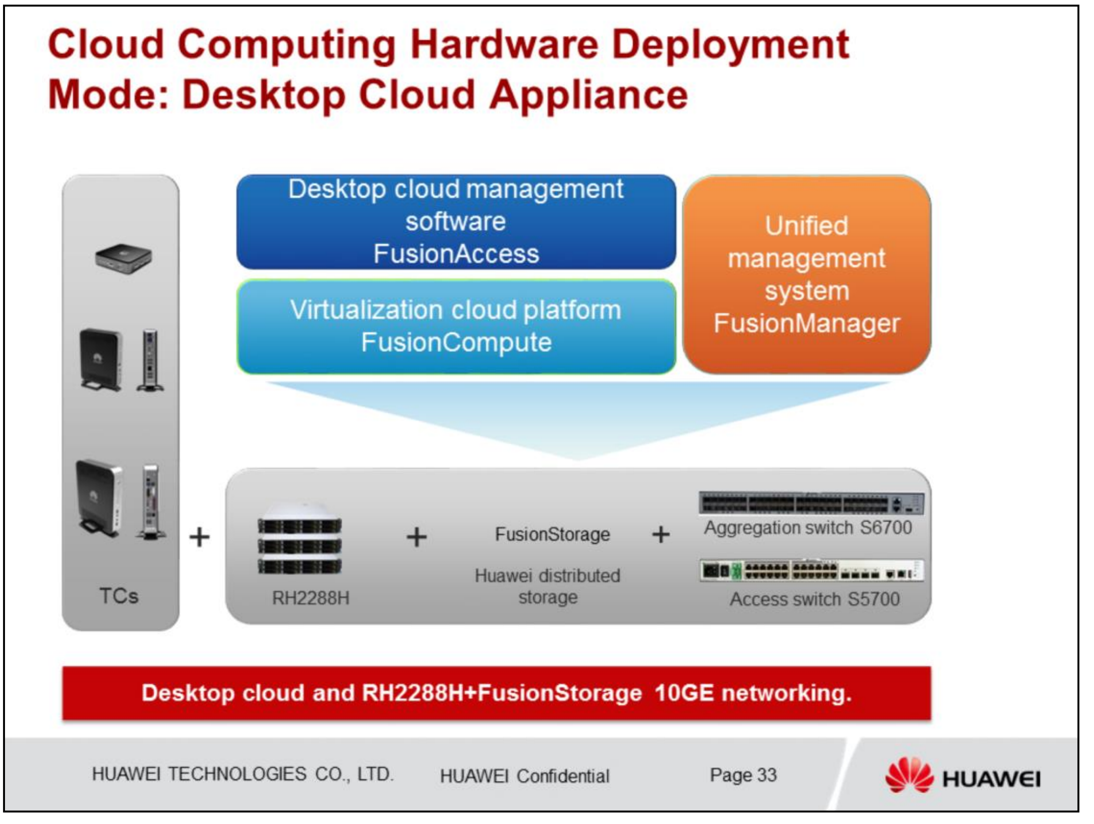


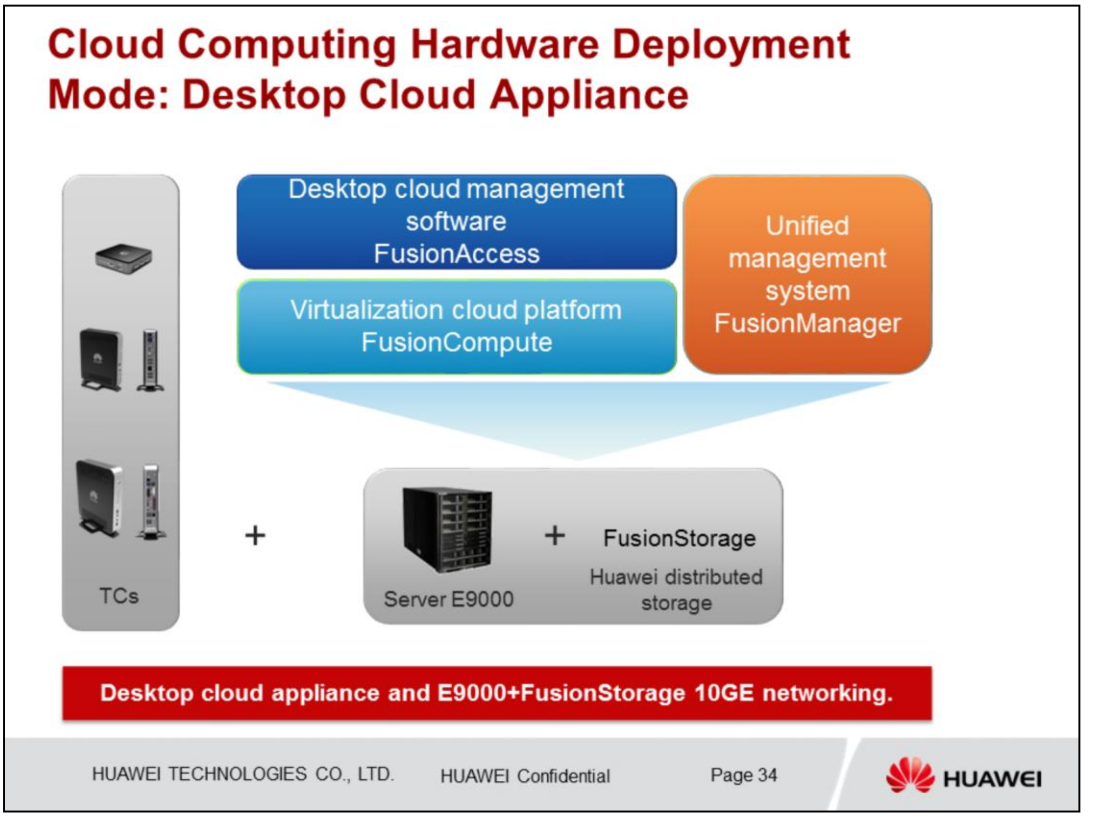
- Typical virtualization configuration: E9000 (half-width blade)+IP/FC SAN+GE/10GE switches, and software FusionCompute+FusionManage.
- Virtualization configuration: RH2288H+IP/FC SAN+GE/10GE switches.
- When FC SANs are used for networking, FC switches need to be added.



- Standard desktop cloud: E9000+IPSAN+GPU (optional)+GE/10 GE switches+TCs (optional), software FusionCompute+FusionManager+FusionAccess, and 5000 VMs in a cluster.
  The standard desktop cloud does not support automatic deployment and pre-installation. GPU solution: Full-width blades are used. Each full-width blade supports four Q2000 GPUs or two Q4000 GPUs. A 1.5 U blade supports four GPUs. The E9000 configured with Q2000 or Q4000 can be delivered.



- Desktop cloud appliance: RH2288H+FusionStorage+GE/10 GE switches+TCs (optional), and software FusionCompute+FusionManager+FusionAccess+FusionStorage.
  The appliance supports automatic deployment and pre-installation and 3000 VMs in a cluster.



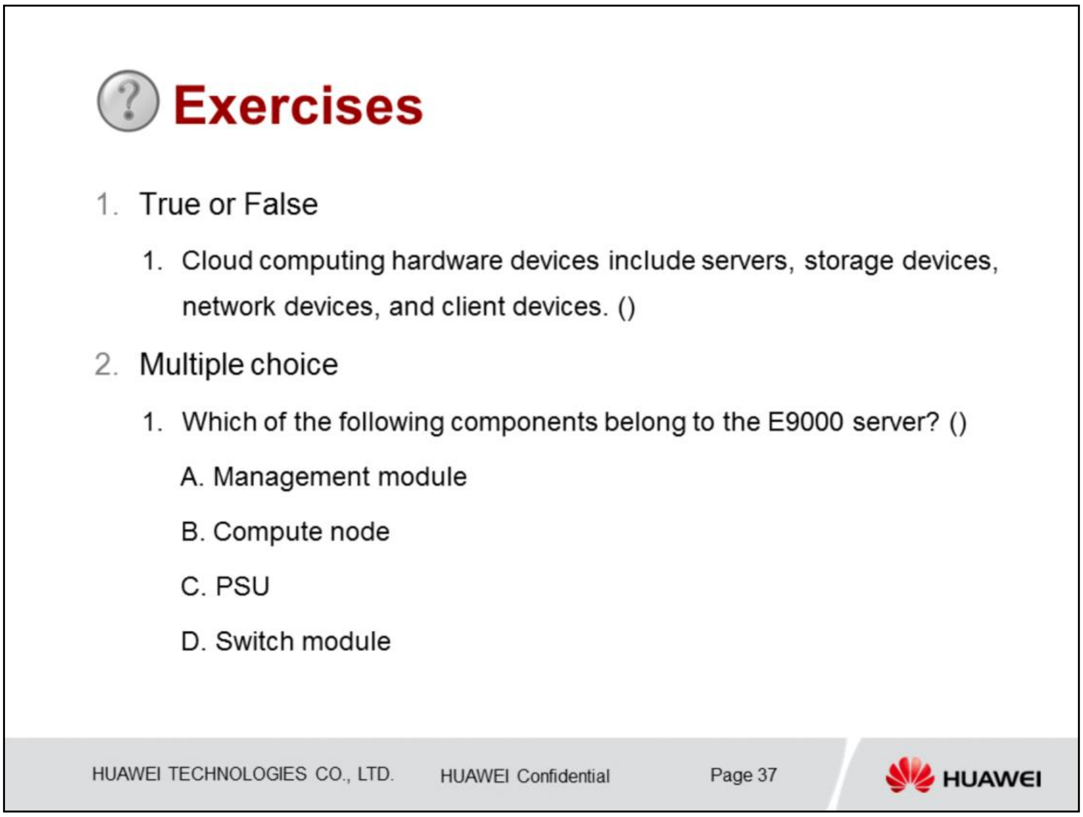
- Desktop cloud appliance: E9000 (full-width)+FusionStorage+GE/10 GE switches+TCs (optional), and software FusionCompute+FusionManager+FusionAccess+FusionStorage.
  The appliance supports automatic deployment and pre-installation and 3000 VMs in a cluster.

Summary

- Cloud computing hardware overview
- Servers
- Storage devices
- Switches
- TCs
- Typical hardware deployment modes of cloud computing

Exercises

1. What types of hardware are used in cloud computing?
2. What typical server models are used in cloud computing?
3. What functions do storage disk enclosures provide?
4. Which Huawei cloud computing scenarios do TCs apply to?



- Answers
  - True or false questions: 1.T
  - Multiple choice questions: 1.ABCD

Thank you

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Chapter 5 FusionCompute Architecture

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Objective

- Upon completion of this course, you will be able to:
  - Understand the position of FusionCompute in the FusionSphere solution.
  - Be familiar with the organizational architecture of FusionCompute.
  - Be familiar with main features of FusionCompute.

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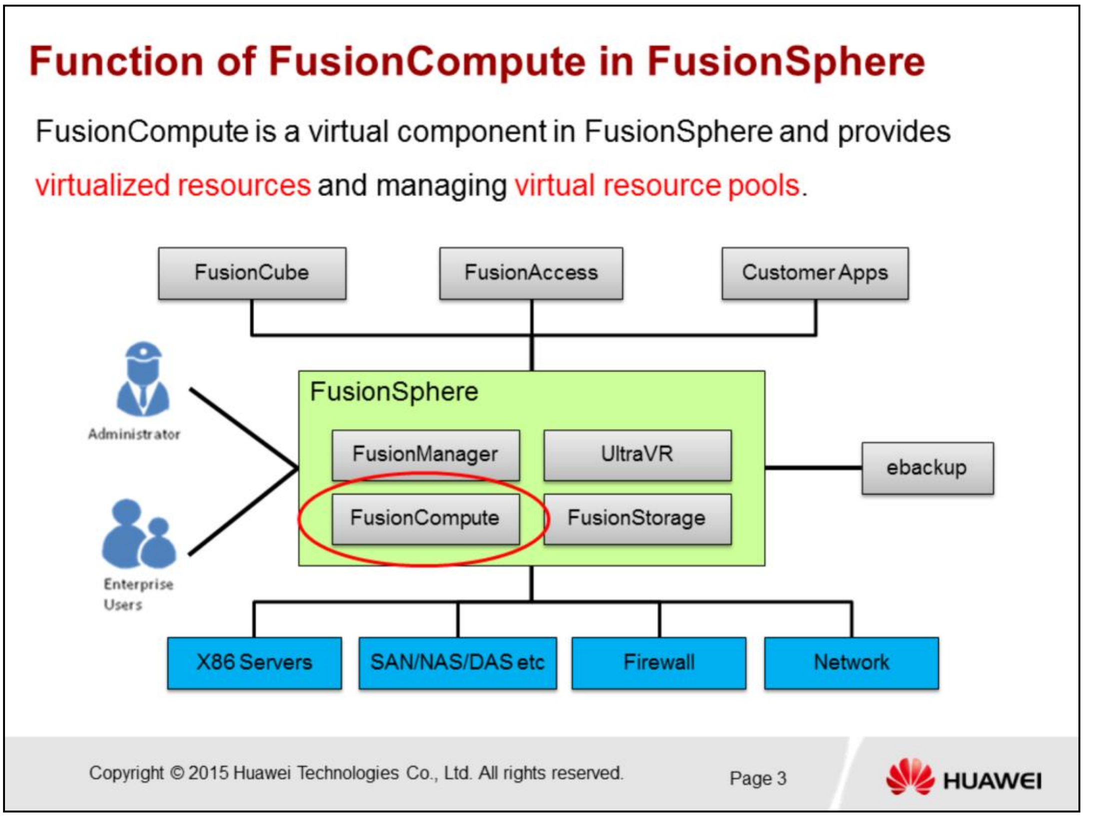

- Resource virtualization virtualizes physical resources, such as CPU, memory, network, and storage resources into virtual resources. For example, one 2.4 GHz CPU can be virtualized to three vCPUs with the specifications of 1.2 GHz, 0.8 GHz, and 0.4 GHz, respectively, for three VMs. Virtual resource pool management enables the system to centrally manage and schedule virtualized resources. For example, the system can be aware of the VMs to which the vCPUs are allocated and the VMs respective vCPU usages.
- FusionManager is cloud management software for implementing orchestration, provisioning, and automatic deployment of IT services by providing functions including service catalogs, automatic resource provisioning, and centralized monitoring and O&M.
- FusionCompute virtualizes x86 servers, storage, and network devices into elastic IT resource pools.
- The relationship between FusionManager and FusionCompute is as follows:
  - FusionCompute is a virtualization system, providing virtual resource pool management.
  - FusionManager is a large management platform of cloud computing resources, which manages hardware resources and virtual resources in a data center in a unified manner.

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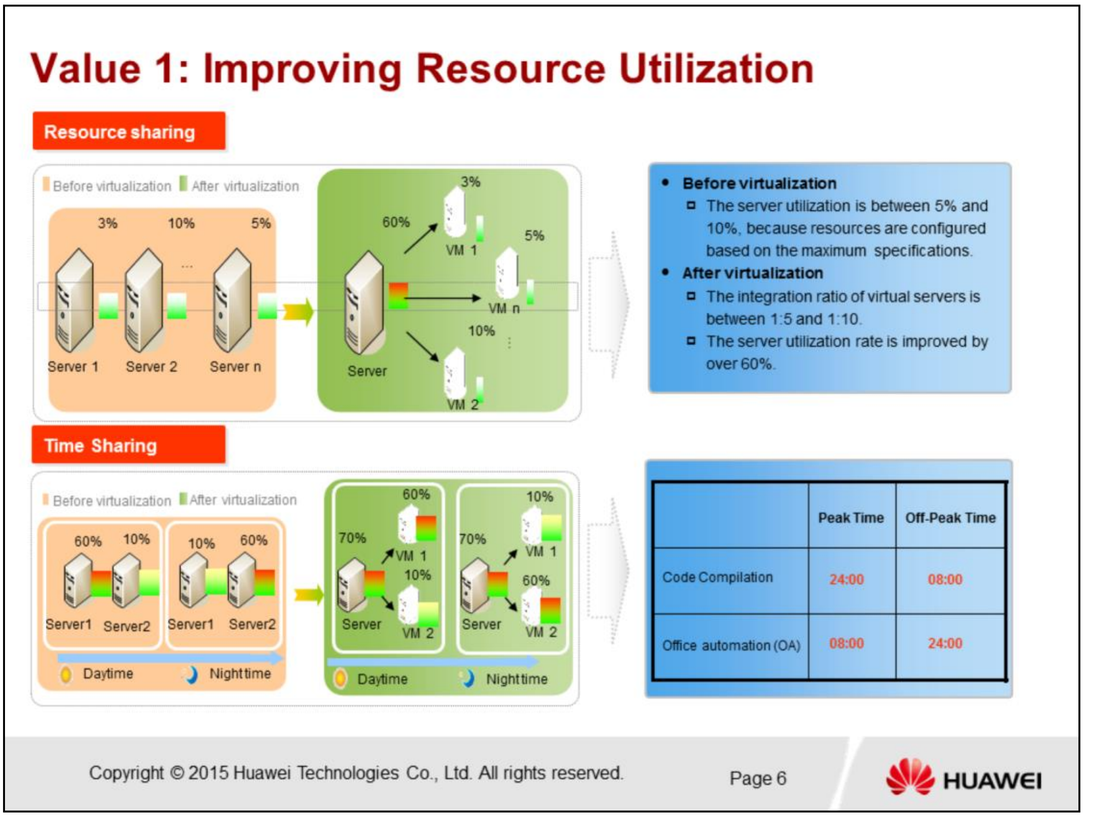
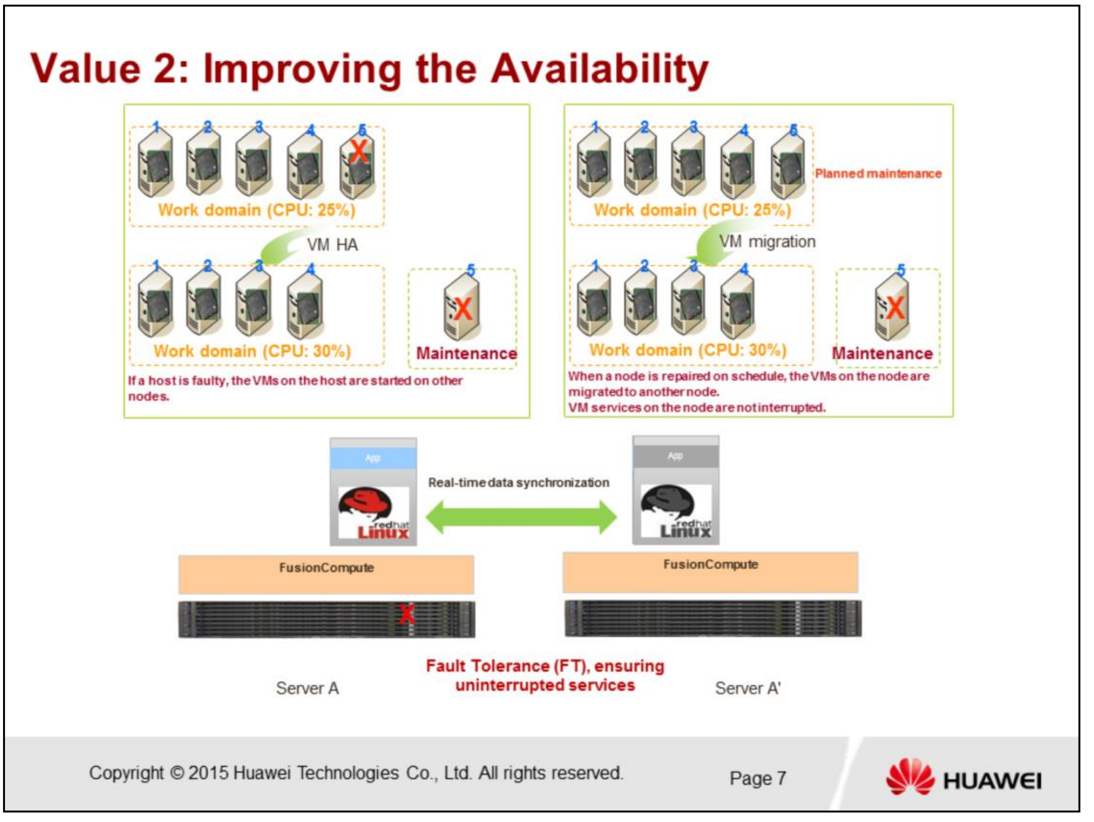


- Integration ratio: The ratio of the number of physical servers to the number of VMs that can be created on the servers, namely, the number of VMs that can be created on a single physical server. For example, if 70 VMs are created on six blade servers, the integration ratio is 11:1 (round up 70/6).



- High Availability (HA), a VM feature, provides easy-to-use, efficient, and cost effective VM service assurance capabilities. If a fault occurs on a physical server or VM, the HA feature can be used to minimize the downtime and service interruption time. The HA feature is used to shorten the downtime caused by routine maintenance (scheduled) or sudden system breakdown (unscheduled) as much as possible, to improve the system and application availability.
- Fault Tolerance (FT) ensures that a module can still run properly with the expected performance in the case of one or more failed components. This feature applies to systems with a high availability requirement.

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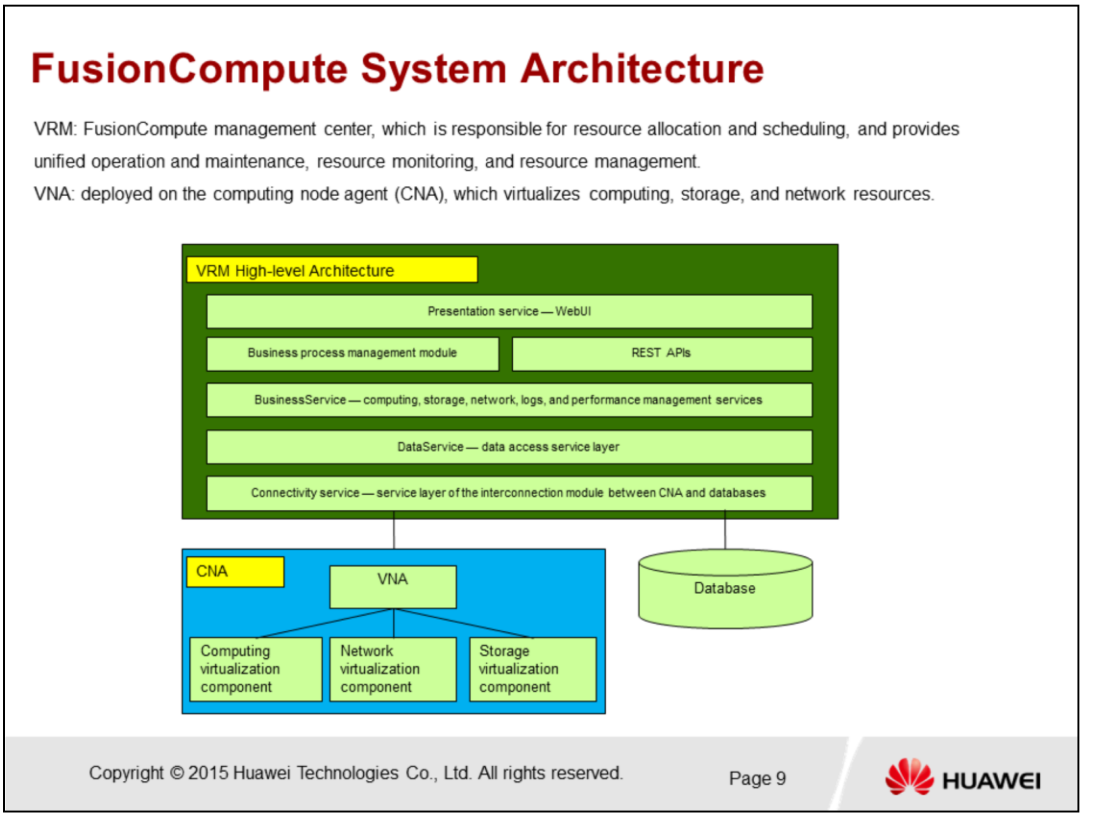
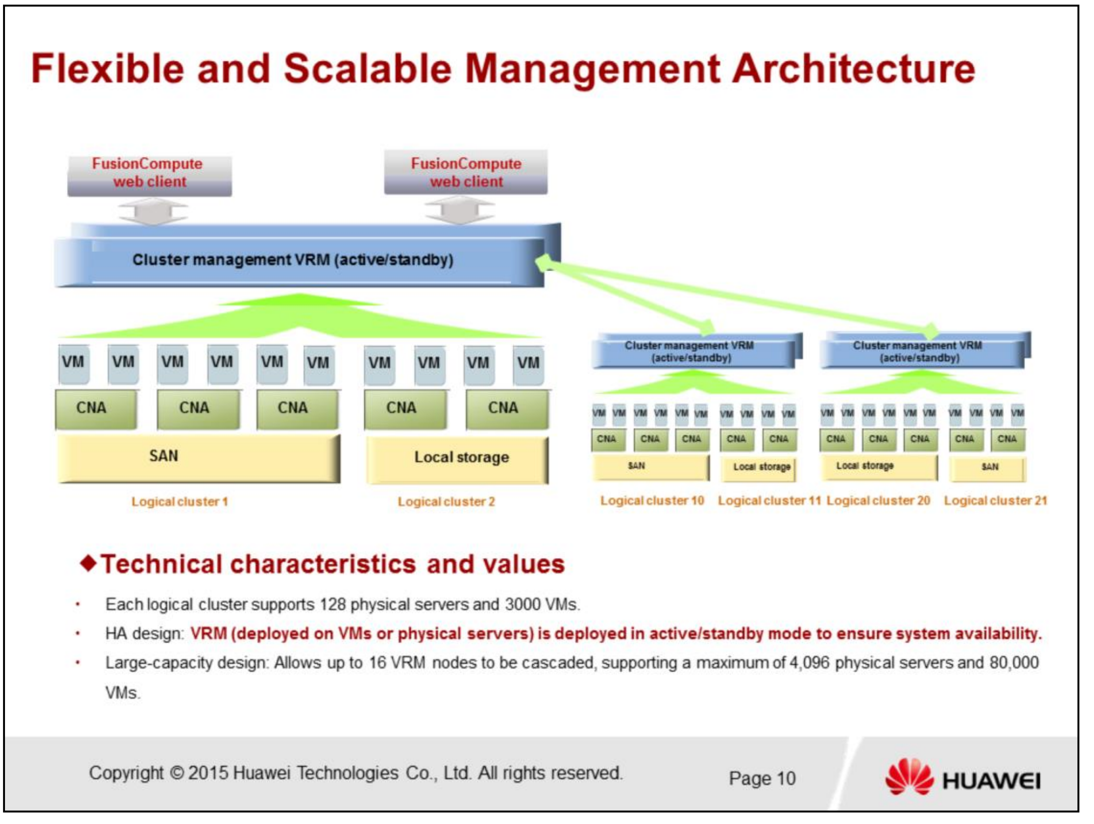


- Virtual Resource Management (VRM).
- Virtual Node Agent (VNA).
- Computing Node Agent (CNA).
- Presentation service provides an external operation and management interface, such as WebUI.
- Based on BusinessService, business process provides complicated resource management and policy-based distributed resource management services.
- REST APIs are open resource management interfaces for WebUI.
- Business service provides basic resource management services, including computing, storage, network, node, performance, fault, patch, and log management.
- Data service provides data access services.
- Connectivity service allows upper-layer management services to gain access to underlying CNAs and databases.
- Database uses Huawei-developed GaussDB database to store various management data, including the host or VM node information and status information.



- VRM is the FusionCompute management node, which is responsible for resource allocation and scheduling, and provides unified O&M, resource monitoring, and resource management functions.
- CNA implements virtualization.
  - Each logical cluster supports 128 physical servers and applies to high-performance and large-scale service group deployment, reducing redundancy ratio.
  - Each logical cluster supports 3,000 VMs and applies to large-scale service deployment that does not require high performance, such as desktop.
  - HA design and VRM (on VMs or physical servers) deployed in active/standby mode ensure system availability.
  - Large-capacity design is used to cascade a maximum of 16 VRMs to support 4,096 physical servers and 80,000 VMs.
- A pair of VRM nodes (in active/standby mode) manages small-scale data centers to ensure thin provisioning. Large-scale data centers are managed by multiple cascaded VRMs to expand capacity (supporting a maximum of 4,096 physical servers and 80,000 VMs).
- Multiple VRM nodes require to be cascaded in a system. Two VRM nodes (in active/standby mode) are promoted as the primary domain controller (PDC). The web clients of all VRMs must be connected to the VRMs functioning as the PDC. Other VRMs are cascaded to the active VRM node functioning as the PDC. In this case, a VRM web client can access other VRMs through the active VRM node.

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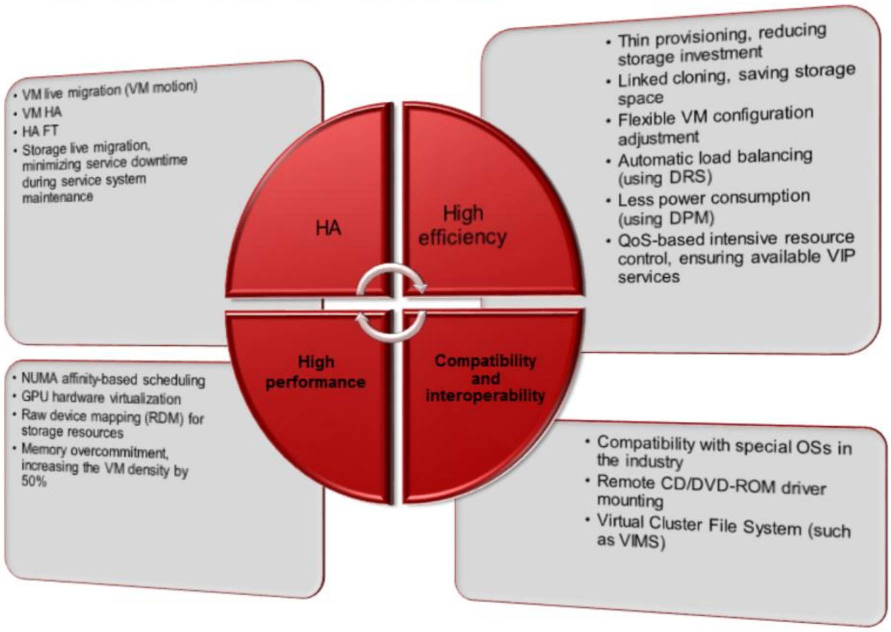
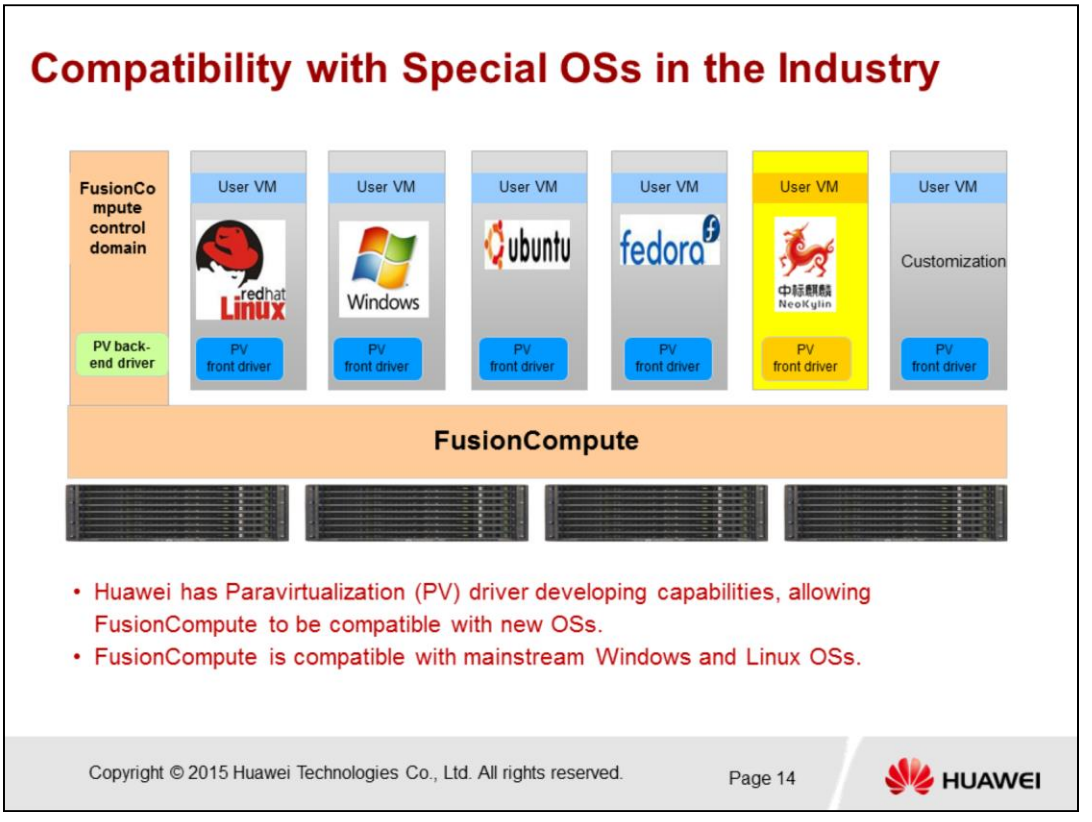
Main Functions and Features



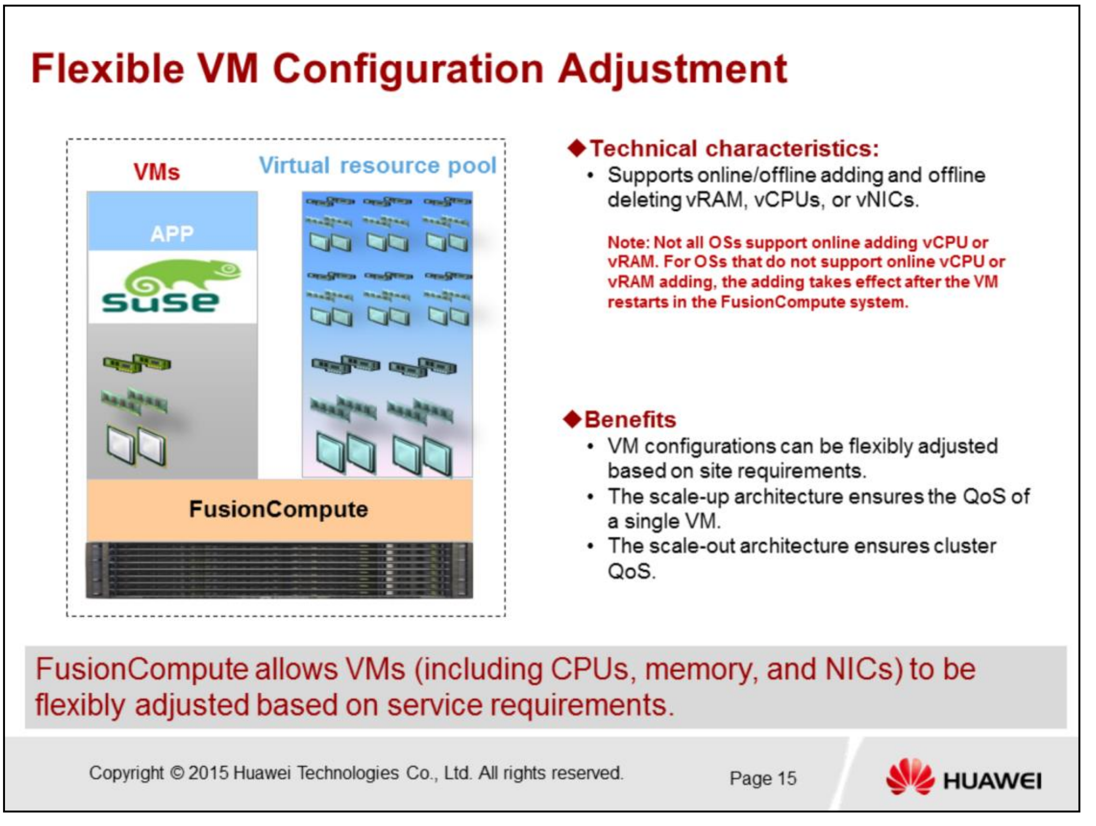


- Specific OS versions may require custom drivers.
- FusionCompute virtualization technology is hardened and enhanced based on open-source Xen.
  - Introduction to the Xen architecture and PV driver:

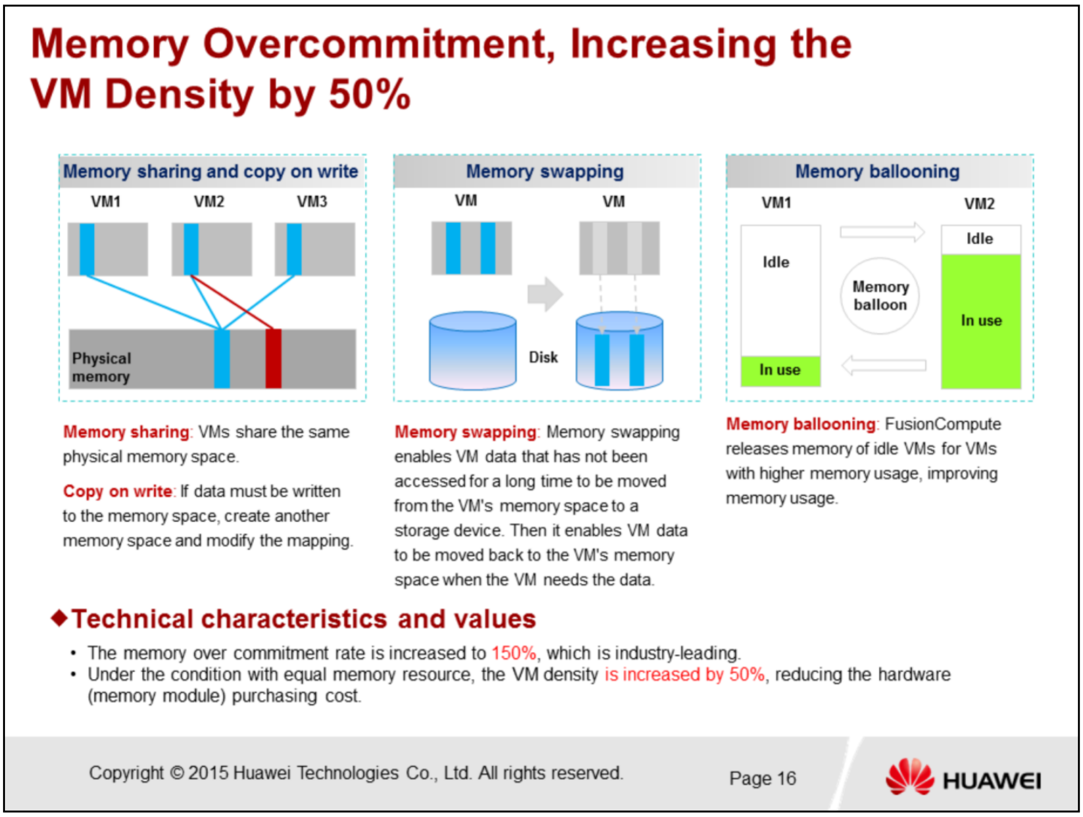
    x86 virtualization can be classified into full virtualization represented by VMware and paravirtualization represented by Xen. The difference between full virtualization and paravirtualization is how they process some special instructions.

    In full virtualization, instructions are monitored during runtime and emulated in the virtual machine monitor (VMM) after being captured. Paravirtualization actively replaces all non-privileged sensitive instructions used in the VMM to improve performance. The instructions are replaced by PV drivers in their communications.

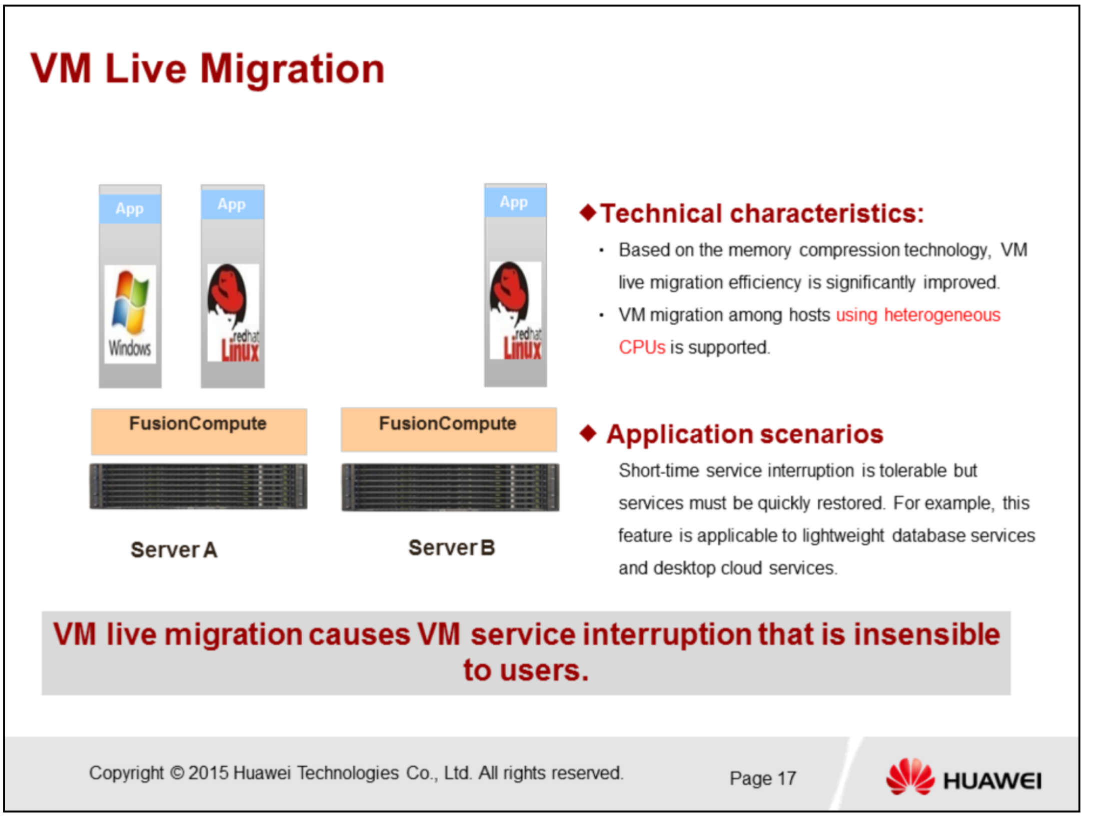
    The VMM provides a back-end driver, and the guest OS provides a front-end driver. The front-end driver sends requests from other modules to the back-end driver using a special communication mechanism. The back-end driver sends message to the front-end driver after the requests are processed. Therefore, instruction processing method varies depending on different types of VM OSs used by customers. PV drivers must be developed to support instruction processing using different VM OSs.



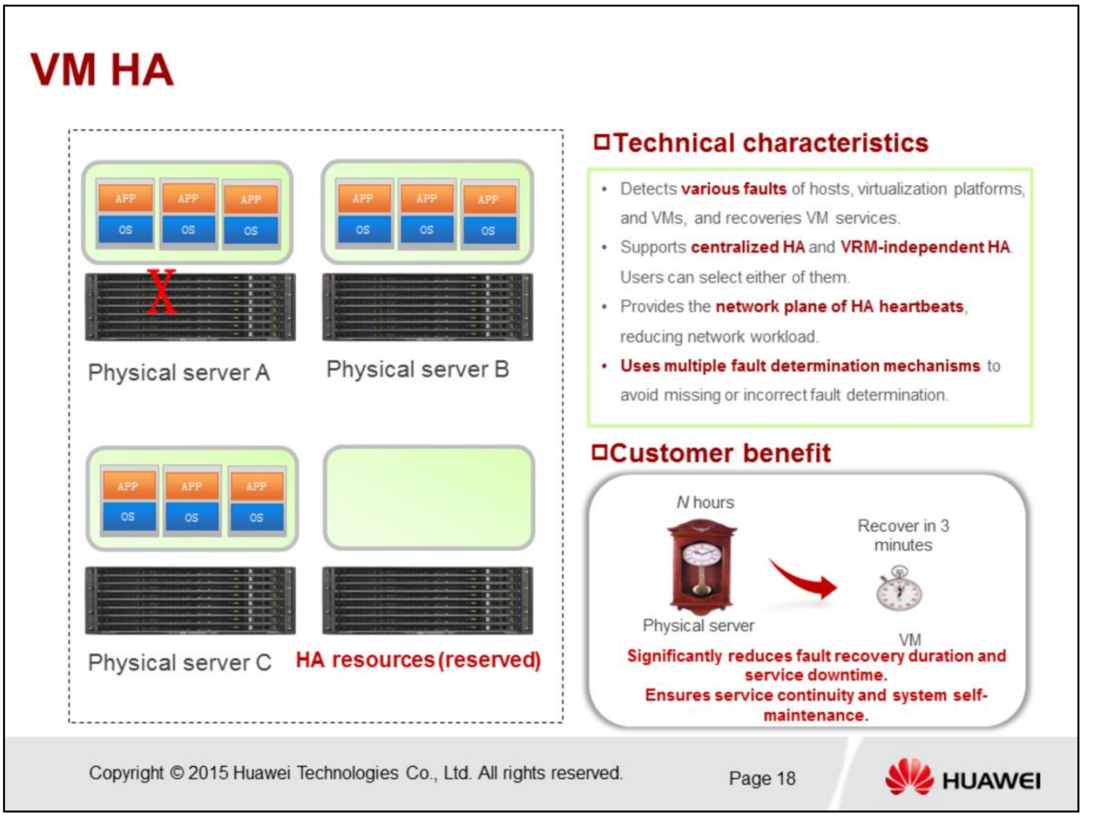
- Quality of Service (QoS) is used to measure the transmission quality and service effectiveness of a transmission system, and evaluate the capability of a service provider to meet the requirements of customers.
- The VM hot CPU and memory add functions must be supported by OSs. Various OSs support these functions, including Windows Server 2008 and SUSE Linux OSs. However, all OSs do not support the hot CPU and memory remove. Therefore, FusionCompute does not support hot CPU and memory remove.
- Based on virtualized storage, FusionCompute supports the online capacity expansion and disk reduction. In the virtualization solution, vDisk is not described in detail because it has much more to do with the storage virtualization function.
- Vertical scalability (scale-up): improves the VM resource configurations to provide better performance and QoS.
  Horizontal expansion (scale-out): adds nodes (rather than configurations) to improve the performance and QoS of the entire cluster.



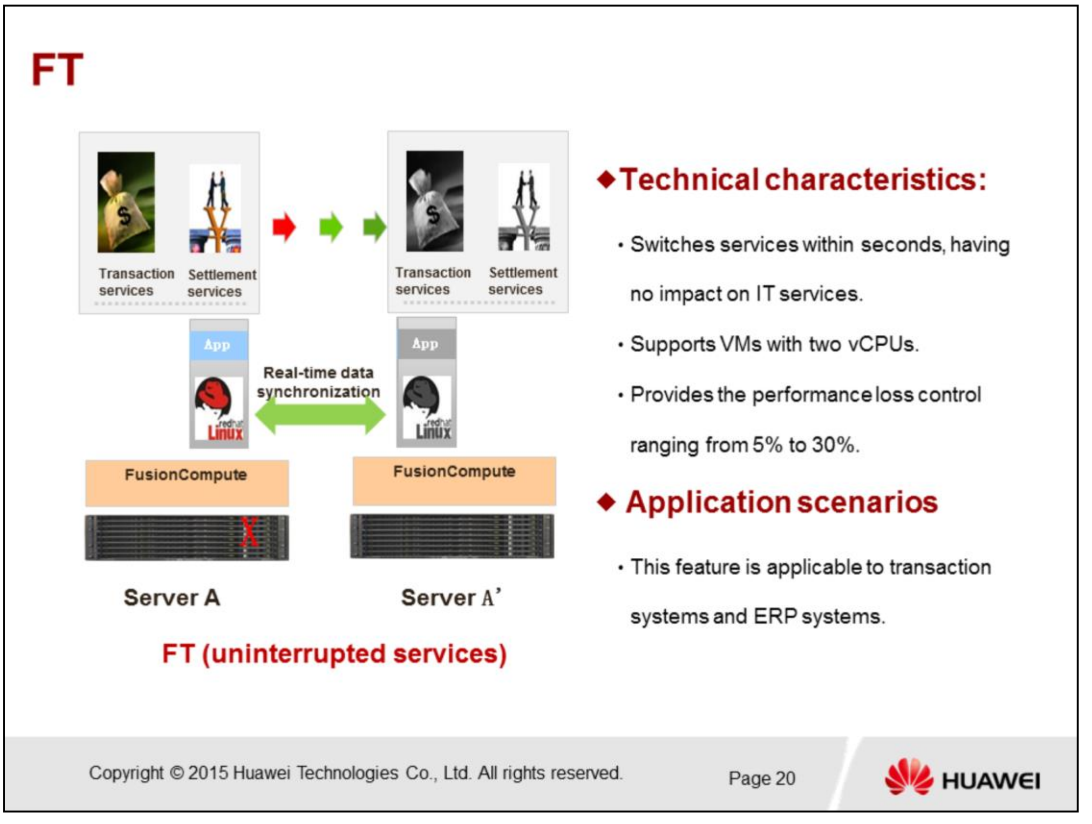
- The memory over commitment function is configurable. If it is enabled, memory sharing and copy on write, memory swapping, and memory balloon are all enabled.
- Memory sharing and copy on write: The VMs sharing memory must run the same OS.
  - Memory sharing is a technique that enables VMs to share the same physical memory space. In this case, the memory is read-only for these VMs.
  - Copy on write: If data must be written to the memory space, VMs create another memory space and modify the mapping.
- Memory swapping: Memory swapping enables VM data that has not been accessed for a long time to be moved from the VM's memory space to a storage device, and the system creates a mapping for this movement path. The data is moved back to the VM's memory space when the VM needs the data. The unused memory is swapped to the VM storage space. The large memory pages are supported in this technology.
- Memory balloon: The Hypervisor uses the memory bubble technology to release memory of idle VMs for VMs with a high memory usage to use. This technology improves the memory usage, and supports memory page borrowing between different VMs.
- The balloon driver applies for an available memory page in the source VM, grants the page to the target VM according to the grant table, and updates the mapping between the physical addresses and VM machine addresses in the table.



- Heterogeneous CPUs indicate CPUs of different generations from the same vendor. CPUs of different models in the same generation are not heterogeneous CPUs. For example, E5 2620 and E5 2680 CPUs are homogeneous CPUs.
- Memory compression technology is used to compress the memory data according to a certain algorithm before the data is transmitted, reducing network bandwidth occupation and improving transmission efficiency. FusionCompute uses the zero-memory compression technology to store only one copy of the zero-memory pages (which is similar to deduplication). This technology doubles the migration efficiency in specific scenarios.

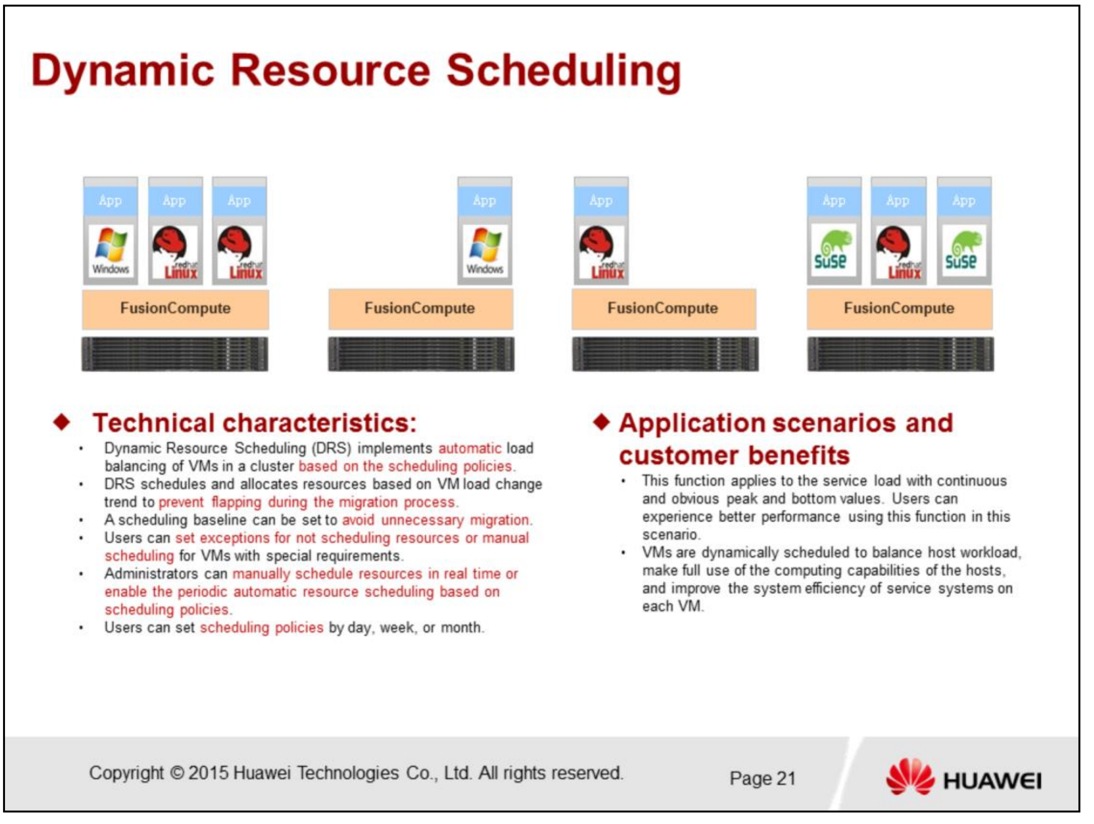


- FusionSphere 3.1 supports the VM HA mechanism that is implemented by VRM nodes. All nodes in a cluster maintain heartbeats with the VRM nodes on the management plane. The VRM nodes determine node and VM status and trigger an HA action. **FusionSphere 5.0 enhanced the HA mechanism** by introducing the VRM-independent HA. The HA function works independently from the VRM nodes. The enhancement enables a single node to be automatically elected as the master node when you create a HA cluster. The master node maintains management and storage heartbeats with slave nodes. A loss of the heartbeat enables the master node to trigger VM HA. Management plane heartbeat is implemented by heartbeat packet transmission, and storage plane heartbeat is implemented by writing data to files. The loss of both management and storage heartbeats will trigger VM HA. Users can configure whether to use the management plane or non-management plane to detect storage heartbeats based on the network plane loads.
  - Limitation 1: The VRM-independent HA can be used only when all hosts in the cluster use Virtual Image Management System (VIMS) storage.
  - Limitation 2: To ensure reliability, a cluster that has VRM-independent HA enabled can accommodate a maximum of 32 hosts.

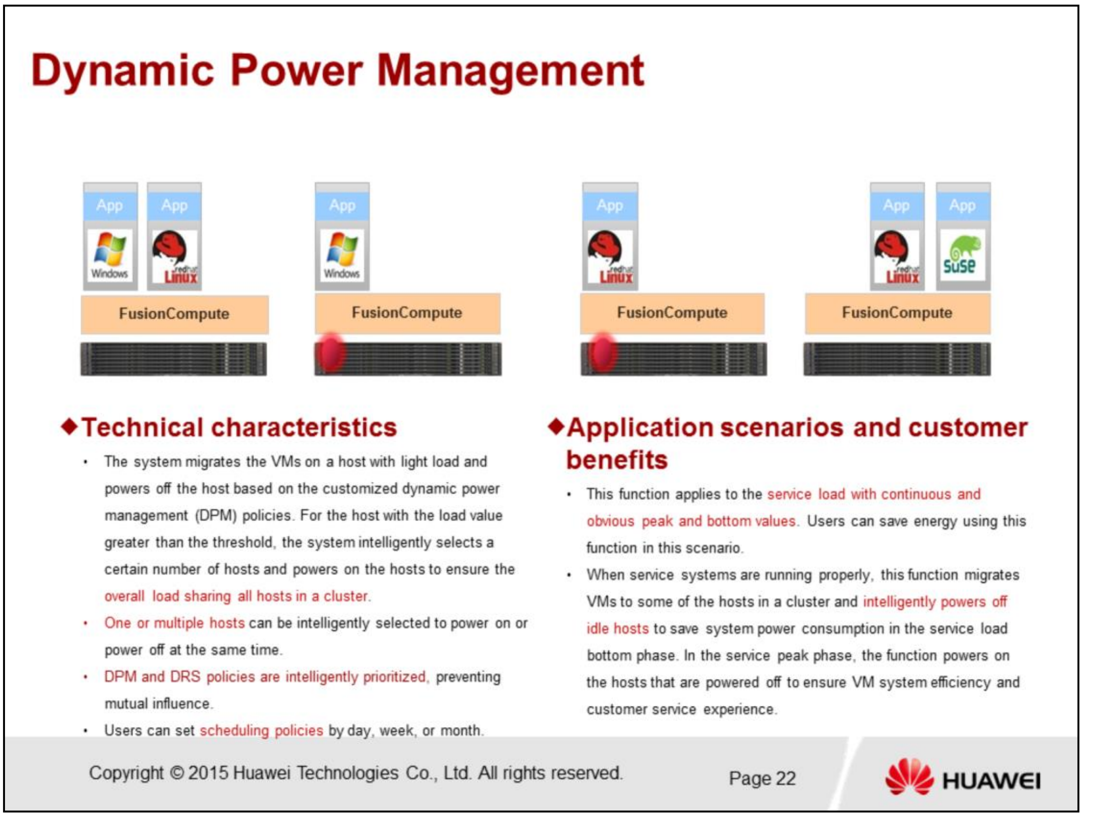


- Differences between FT and HA:
  - FT synchronizes data between the active and standby nodes in real time using **the redundancy configuration similar to the active/standby configuration**. When the active VM is faulty, services running on the VM can be switched to the standby VM within seconds. FT applies to the HA system.
  - HA uses the dynamic scheduling policy, which **migrates the VM that is faulty or overloaded to the destination host** to ensure service continuity.

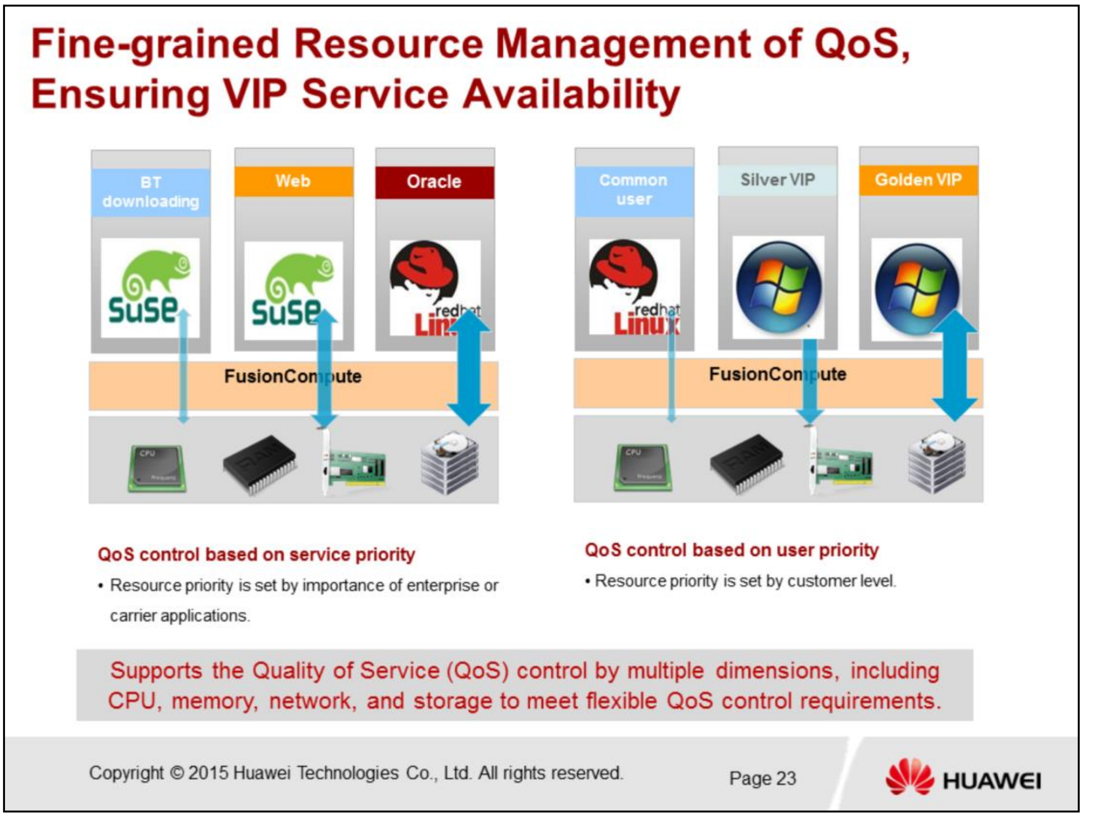
FT requires a short time for data recovery, but it incurs high costs and only applies to key systems with HA requirements. In contrast, HA mechanism requires a long time to recover data using flexible restoration modes, but it incurs a relatively low cost and applies to systems that can tolerate a short interruption.



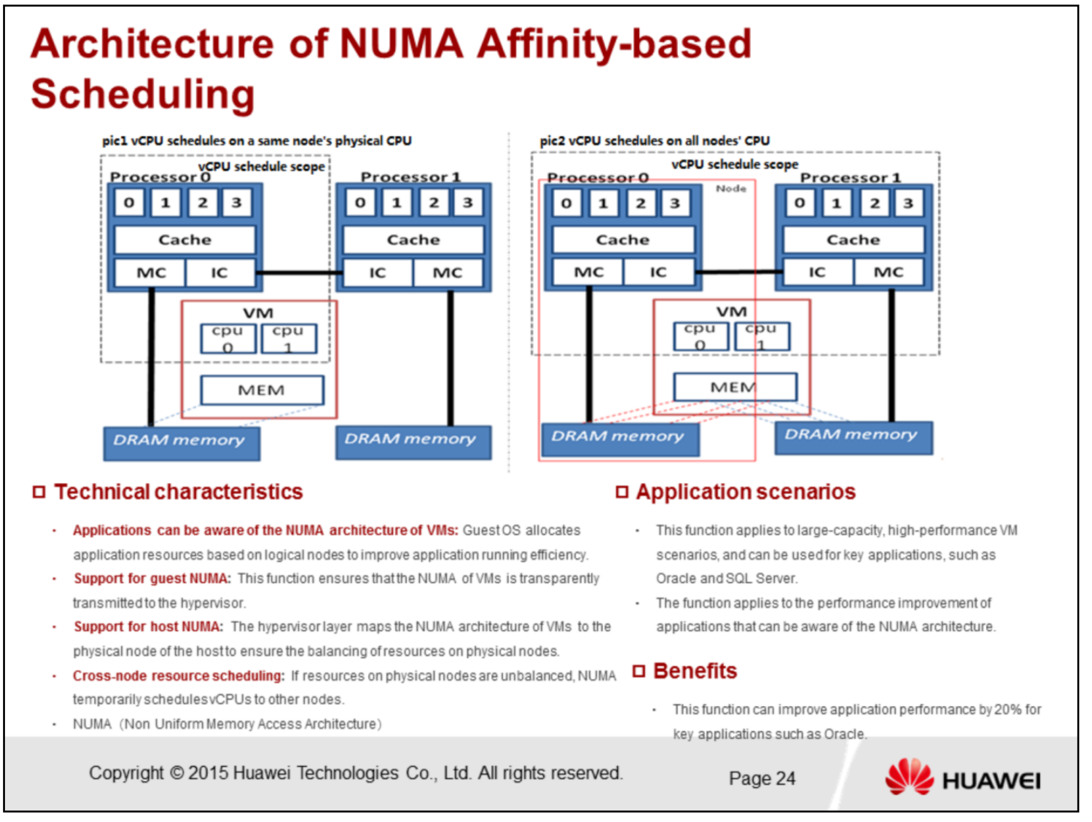
- DRS enables resources to be automatically scheduled and allocated on demand with load balancing and peak load shifting.
- Supports automatic and intelligent resource scheduling based on scheduling policies.
- Supports manual or automatic configuration of scheduling policies. The migration thresholds include conservative, slightly conservative, medium, slightly radical, and radical.
- The load balancing is implemented in a logical cluster.
- In Huawei server virtualization solution, a logical cluster includes 128 servers compared with 32 servers in a logical cluster supported by the VMware virtualization platform.
- If the performance load of all VMs in a cluster is lower than the scheduling baseline, the scheduling is not enabled, even if the load variance exceeds the threshold specified by users, because users set scheduling baseline as the performance load upper threshold to ensure proper running of VMs. A VM running with the performance load lower than the baseline can have stable performance. DRS scheduling is enabled to ensure VMs to run properly. Therefore, DRS scheduling is not required if the performance load is lower than the baseline.



- DPM policies can be configured and DPM takes effect only when DRS is configured for the cluster. DRS is required to migrate VMs when the system executes the DPM policies.
- The thresholds for DPM to power on or power off hosts include conservative, slightly conservative, medium, slightly radical, and radical.
  - Conservative: DPM does not automatically power off hosts by default. It powers on hosts that are powered off in a cluster only when the average host utilization in the cluster exceeds a heavy load threshold.
  - Medium: If the average host utilization exceeds a heavy load threshold, DPM powers on hosts that are powered off in a cluster. If the average host utilization is lower than a light load threshold, DPM powers off hosts in a cluster.
  - Radical: DPM does not automatically power on hosts by default. It powers off hosts in a cluster only when the average host utilization in the cluster is lower than a light load threshold.
- The thresholds ranging from conservative to radical indicate the energy-saving policies with different sensitivities. Users can set the threshold based on specific application scenarios.



- QoS is used to measure the transmission quality and service effectiveness of a transmission system, and evaluate the capability of a service provider to meet the requirements of customers.
- The CPU QoS mechanism in a VM and online adding of CPUs are different. The CPU QoS mechanism is the priority mechanism. When a VM is busy, the physical CPU resources can be insufficient because the physical CPUs are shared by multiple VMs. The VM with a higher priority can preferentially obtain the physical CPU resources. The CPU QoS mechanism cannot temporarily add CPUs to a VM.
- The memory and network QoS mechanisms are similar.

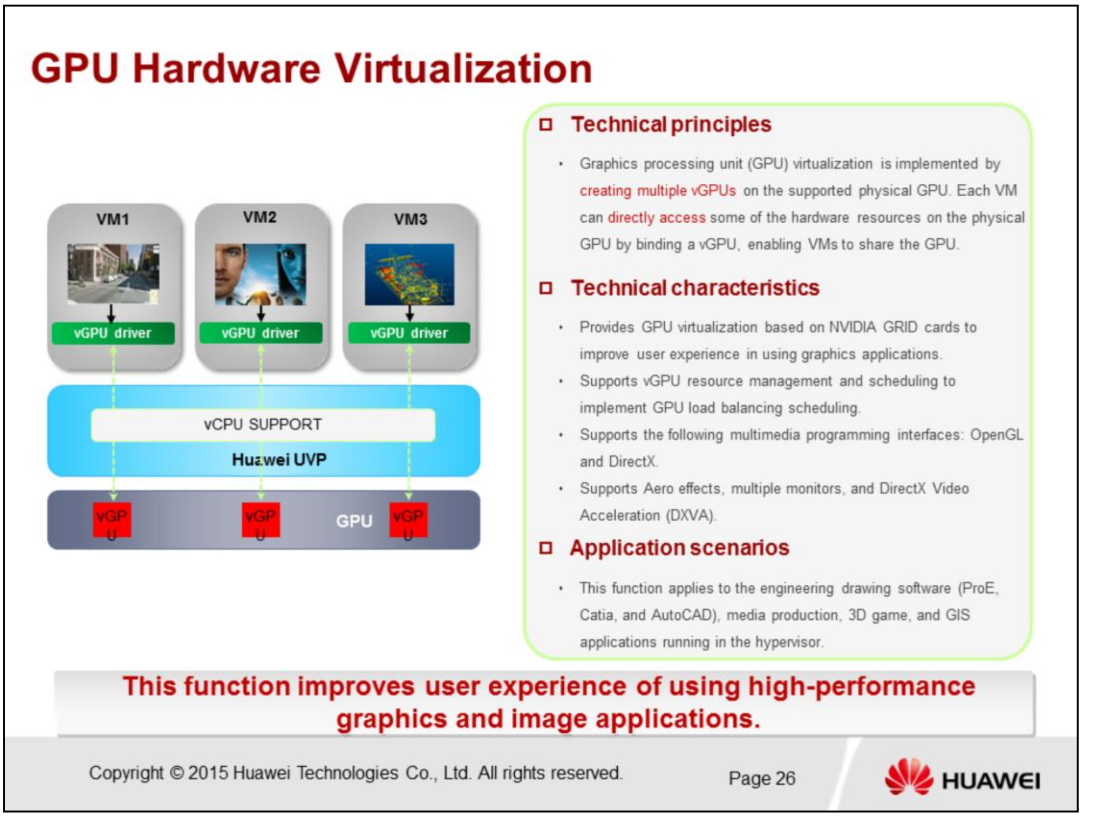


- NUMA

  Each physical computer has multiple CPUs which are connected by a front-side bus. The CPUs and the corresponding memory modules connected to the CPUs constitute a NUMA system. A CPU and its interconnected memory constitute a node.

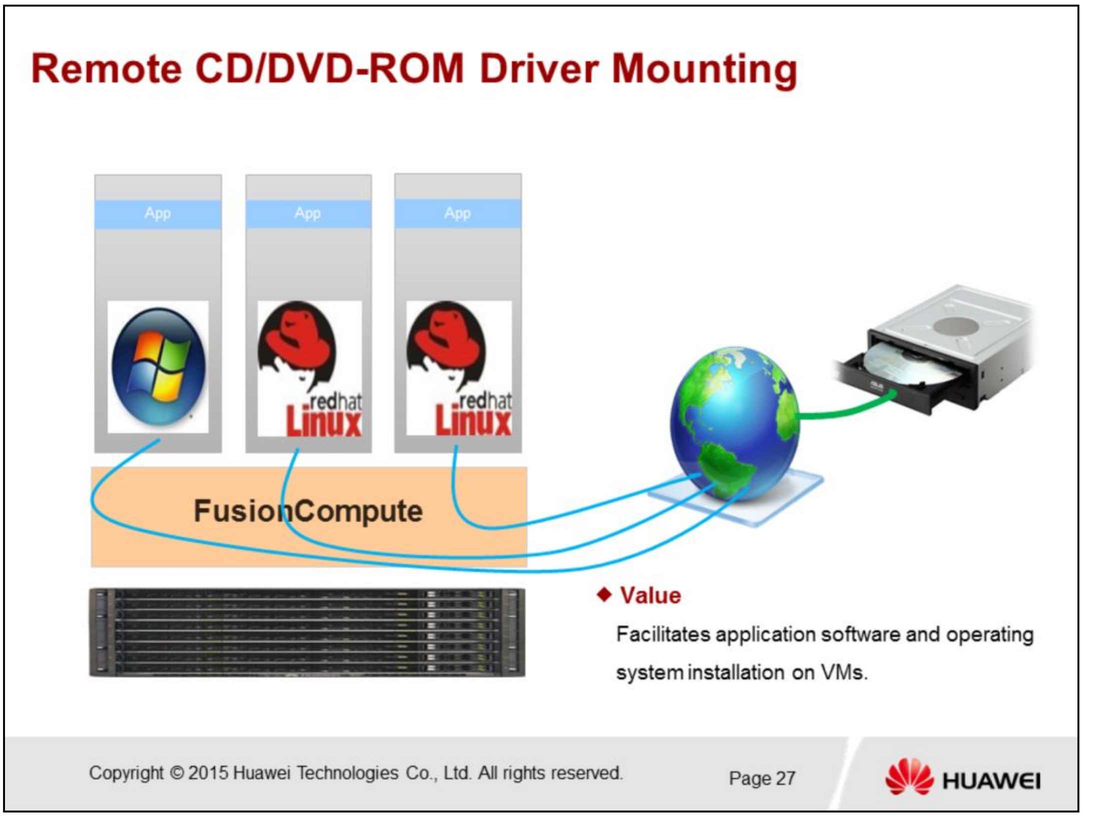
- Random access memory (RAM)
- Guest NUMA principles:

  NUMA nodes are introduced in physical servers to improve memory access efficiency of CPUs. The CPUs and memory resources used by VMs (guests) are grouped into NUMA nodes based on the memory access efficiencies of the CPUs. A CPU can achieve its maximum memory access efficiency when accessing memory within its own NUMA node. However, if any VM OS or application requires a second NUMA node, the overall performance of the VM will deteriorate. In this case, Guest NUMA, an enhanced NUMA feature, enables that the NUMA topology is transparently transmitted to the VM and enables a VM to preferably use memory resources on one NUMA node, thereby improving memory performance.

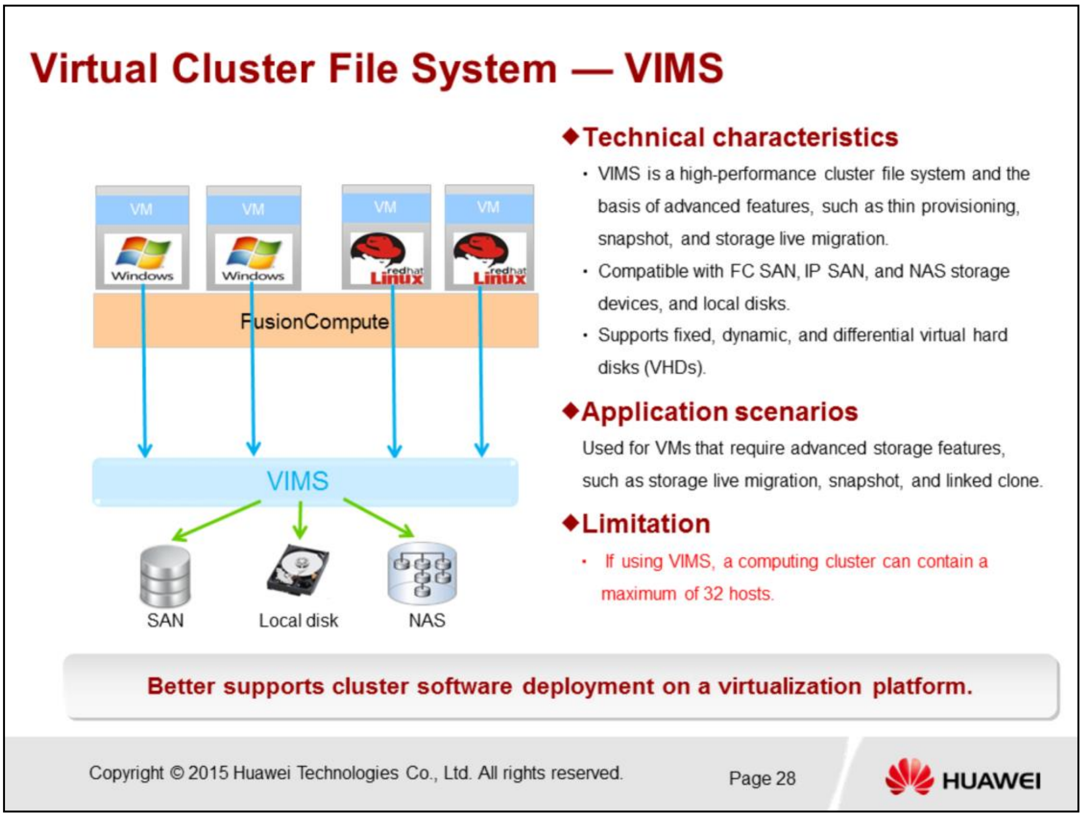


- Technical Principle:

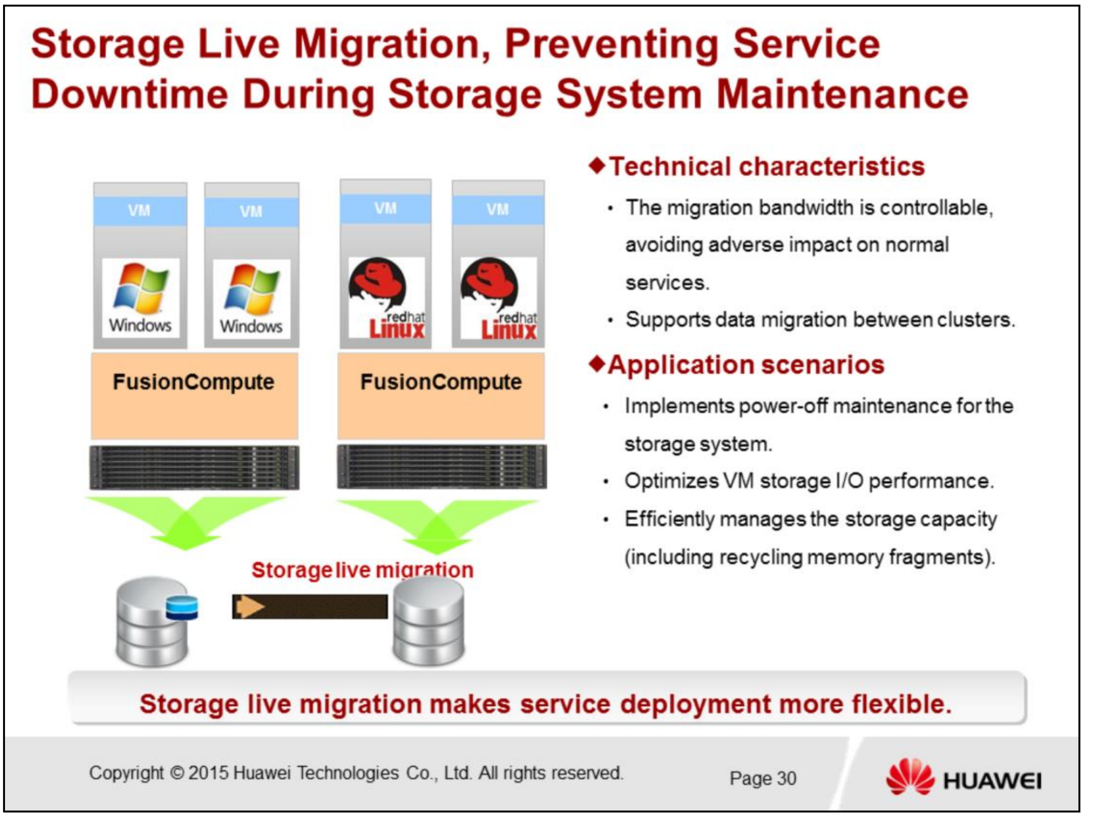
GPU virtualization is implemented as follows: Multiple vGPUs are created on a physical GPU. The physical GPU is time-sliced to enable vGPUs created on it to share the 3D graphics engine and video encoding and decoding engine of the physical GPU and to allow each vGPU has independent video RAM. A physical GPU can use direct memory access (DMA) to directly obtain the 3D commands delivered to the vGPU driver by graphics applications. After the GPU renders the graphics, it stores the graphics to the video RAM of each vGPU. Then the vGPU driver in the VMs can directly capture rendering data from the physical memory. Upper-layer applications can directly obtain the physical GPU hardware capabilities, which are similar to using physical GPUs. Therefore, GPU virtualization function enables high graphics performance and program compatibility.



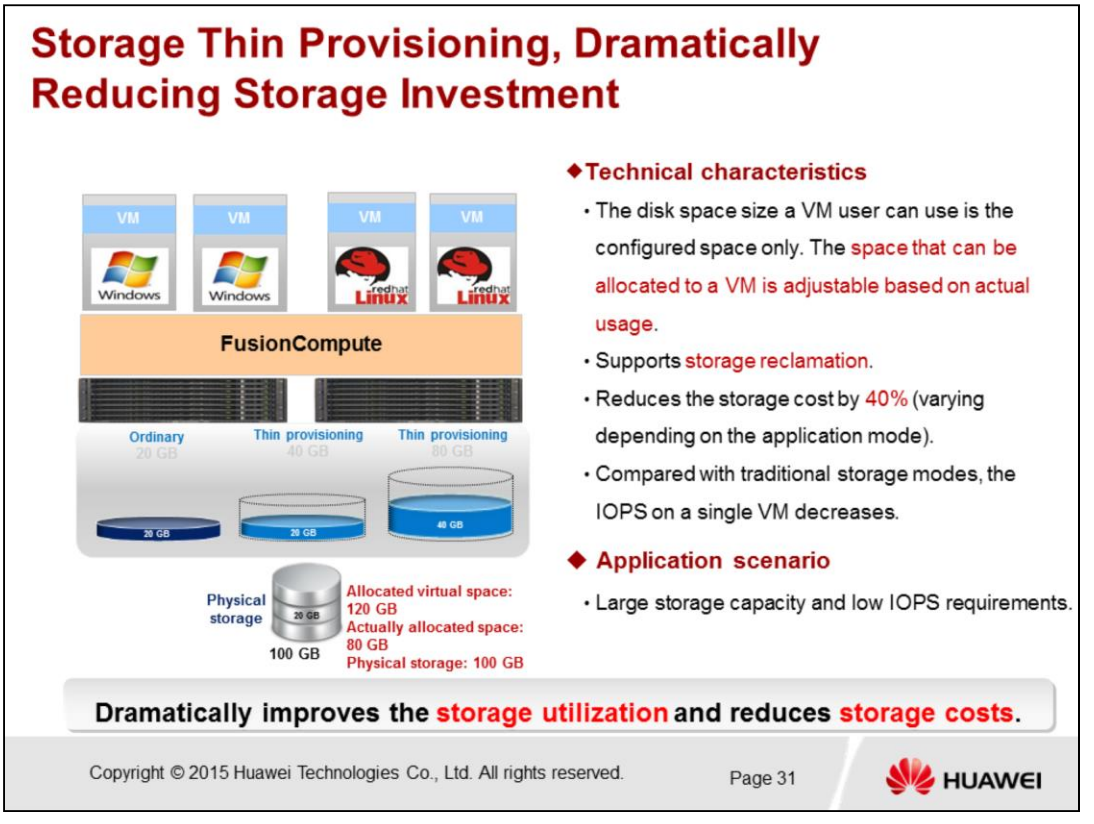
A VM can read data of the CD-ROM drive attached to the host.



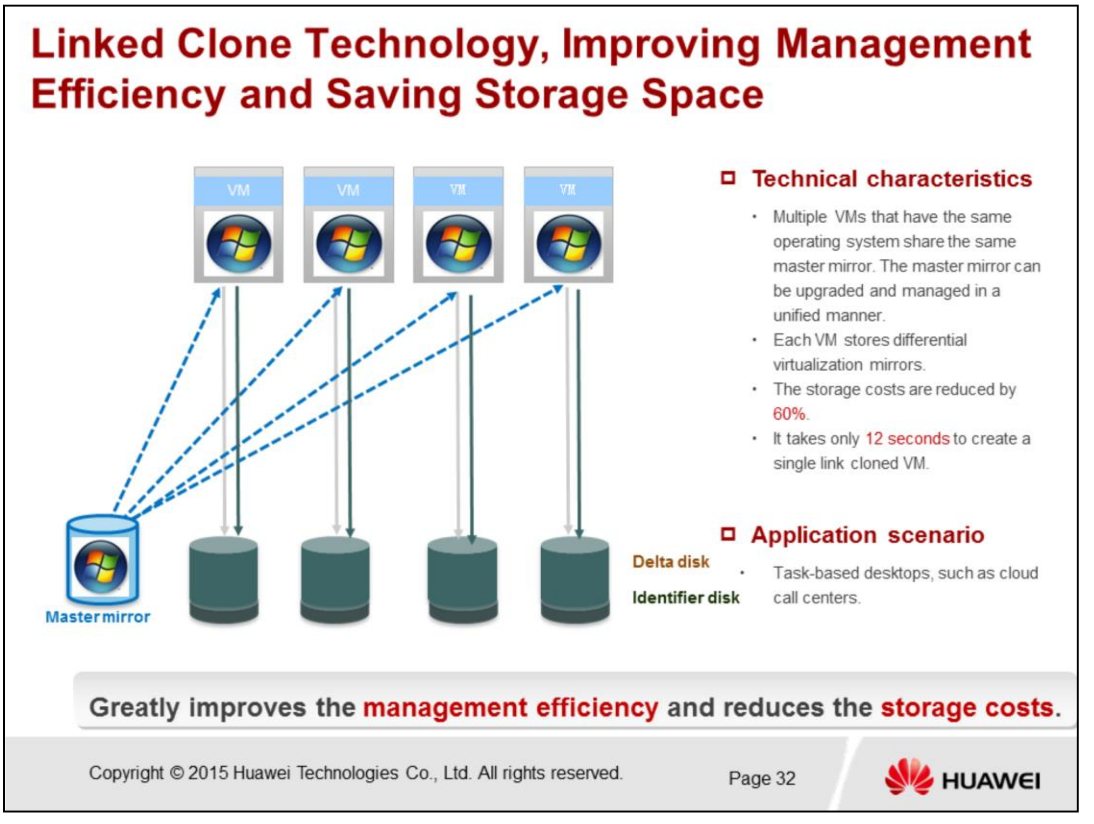
- The Virtual Image Management System (VIMS) has the following features:
  - Customized based on the open-source OCFS2.
  - Manages the VM image and configuration files as files.
  - Uses jbd2 to record file system logs, ensuring data consistency and rapid recovery of services.
  - Uses the distributed lock mechanism to ensure data read/write consistency.
  - Uses the disk heartbeat to detect the connection status with the SAN (in storage disconnection scenarios).
  - Uses the network heartbeat to detect the connection status between the nodes (in network division scenarios).
- Thin provisioning: The allocated space is separated from the actual space. The actual storage space is allocated only during actual use. When the allocated space is fully used, the allocated space is the same as the storage space.



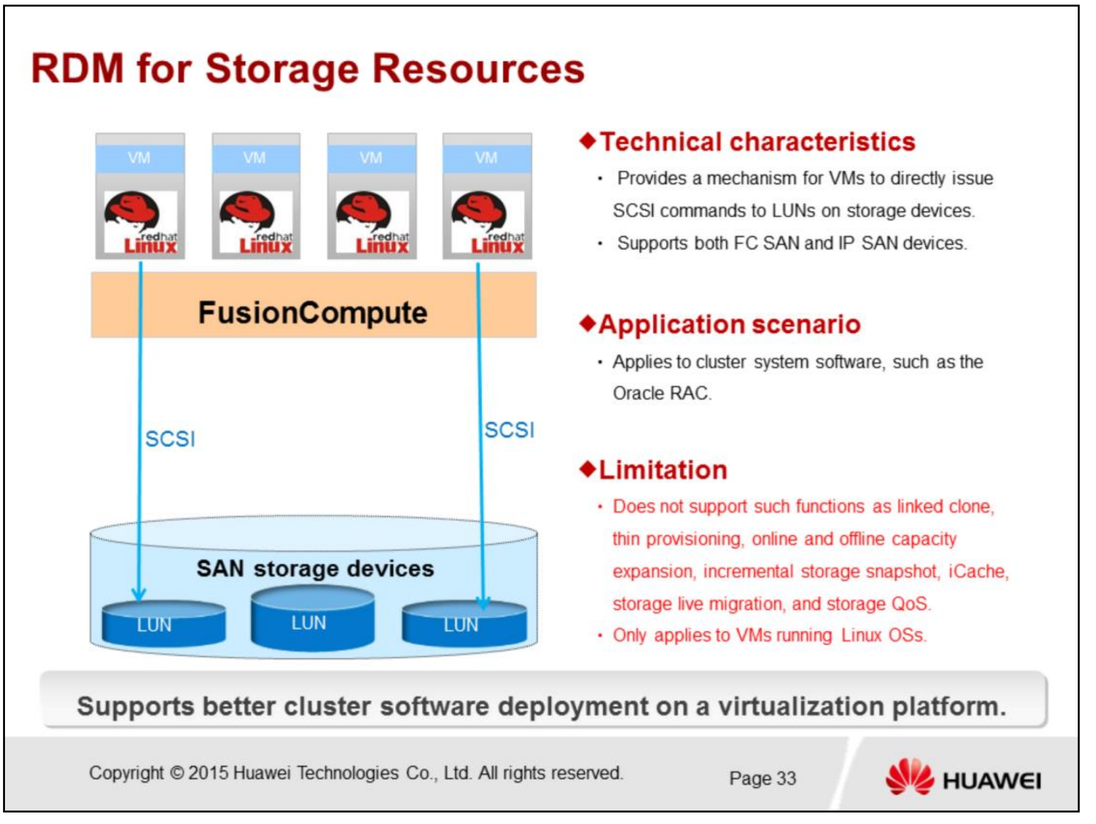
- The storage live migration ensures that the virtual storage can be migrated from one storage device to another storage device without service interruption. In this case, the load balancing and upgrade and maintenance of storage resources can be implemented. Storage devices are the shared storage based on a storage array. Storage live migration supports various storage arrays.
- Implementation principles:
  - 1. On the destination data store, create an empty image, the same as that of the source data store.
  - 2. Set the destination image to the mirror of the source image. In this case, the VM data I/O can be written to the destination data store, thereby synchronizing the dirty data blocks between the source and destination data stores.
  - 3. Migrate the source mirror data to the destination image using the iteration migration technology to ensure the baseline data synchronization.
  - 4. After the baseline data synchronization is complete, suspend VM IO requests in a short time and migrate the VM storage files from the source image to the destination image.



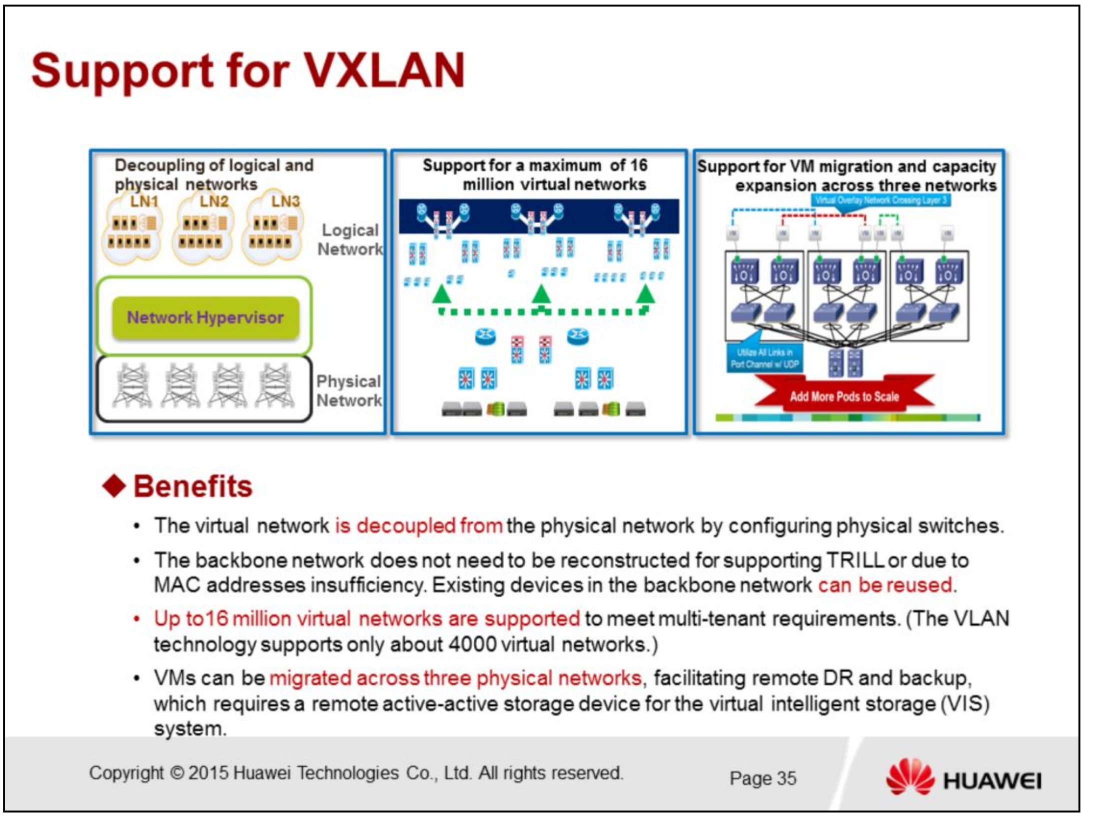
- The storage resources actually used on a VM are generally less than the resources allocated to the VM, causing resource waste.
- Example: If the storage capacity is increased by 30% and the original capacity is 100 GB, the storage capacity that can be allocated is 130 GB.
- Application scenario: Large storage capacity and low input/output operations per second (IOPS, an important storage indicator) requirements.
- A VM user can view the configured capacity only. Actually, a storage system allocates corresponding storage capacity based on the amount of data used by VMs, that is, the storage capacity is allocated on demand.
- Compared with common storage modes, thin provisioning allows a storage device to support more VMs. Therefore, the IOPS of a single VM reduces.



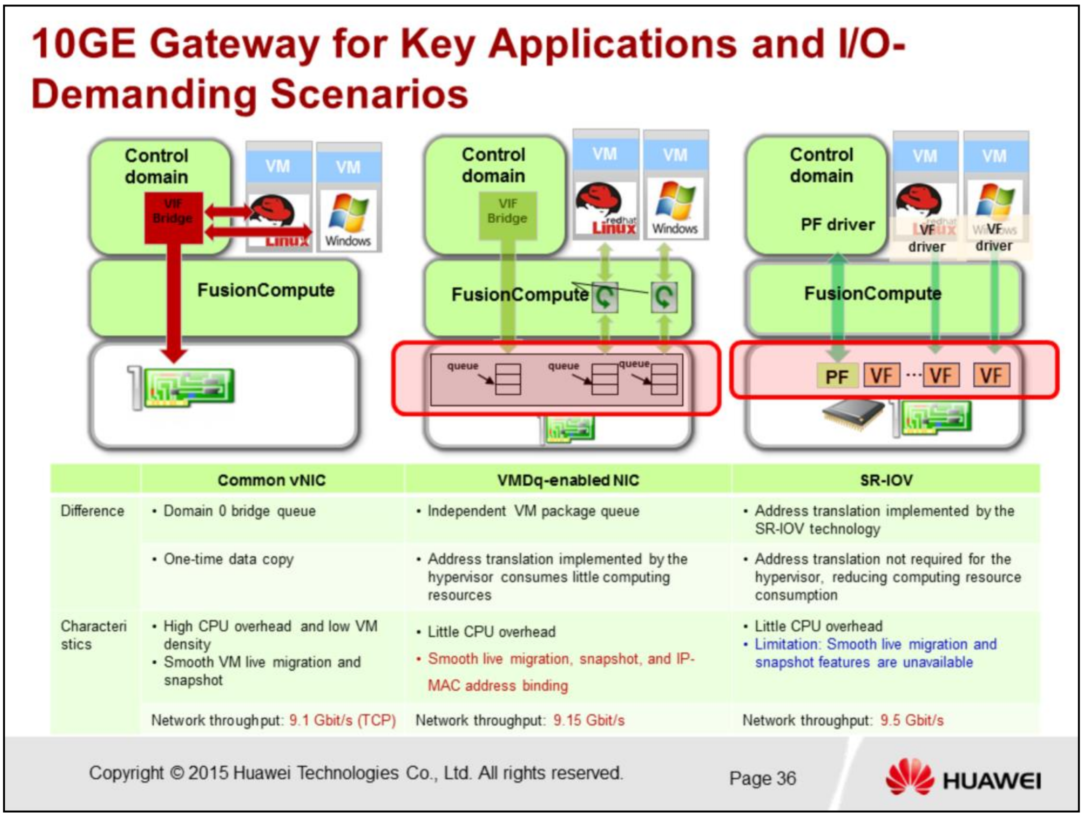
- Cost calculation: Multiple linked clones can share one master disk which requires cache acceleration, and each linked clone must also have one delta disk. If multiple users share a master disk, the costs can be reduced. The size of a delta disk is about 1/3 that of the master disk. Therefore, the costs can be reduced by 60%.
- The test period is 12 seconds.



- Raw device mapping (RDM) allows VMs to directly access a physical storage device.
- Small Computer System Interface (SCSI) is a protocol used to connect a host to a storage device, such as a disk drive, in a distance of 25 meters or shorter.
- Logical unit number (LUN) is a logical disk that comprises all or some physical disks on a SAN storage device.

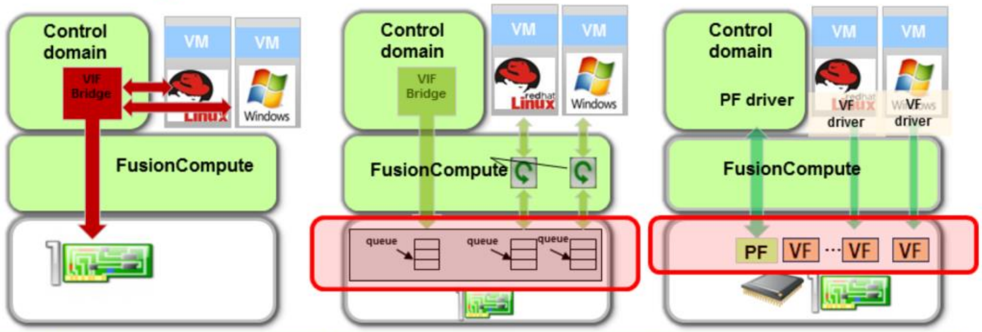


- VXLAN adopts an outer User Datagram Protocol (UDP) tunnel as a data link layer and transfers original data packets as tunnel payloads. With the outer UDP tunnel, inner payload data can be quickly transferred on the layer 2 and layer 3 networks.
  - New packet format: VXLAN outer encapsulation (tunnel) + Original inner payloads: Virtual network identifier (VNID) can be extended from 12 bits (4096) to 24 bits (16 million), and can be transmitted across the layer 2 network.
  - Virtual tunnel end point (VTEP), a logical entity, is used for VXLAN packet encapsulation and decapsulation. It is assigned an IP address of the physical network to connect to the physical network.
  - A VXLAN gateway is defined in the VXLAN network to implement communication between virtual networks and between virtual networks and physical networks.



- Different hardware devices support different technologies for VMs to communicate with external networks.
- Common vNIC
  - The hypervisor (dom0) implements network I/O transmissions between different VMs running on the same host or VM's external data transmissions. It also optimizes the transmission queues and scheduling mechanism. Therefore, the data computing volume is large, and the CPU overhead is high.
- VMDq-enabled NIC
  - Huawei-developed intelligent network interface card (iNIC) supports the Virtual Machine Device Queues (VMDq) technology.
  - On the VMDq-enabled NIC, VMDq implements layer 2 classifier/sorter using hardware. Data packages are directly sent to specific NIC queues based on MAC addresses and VLAN information without passing through the domain 0, which reduces CPU overhead and improves network performance.

10GE Gateway for Key Applications and I/O-Demanding Scenarios



	Common vNIC	VMDq-enabled NIC	SR-IOV
Difference	• Domain 0 bridge queue	• Independent VM package queue	• Address translation implemented by the SR-IOV technology
	• One-time data copy	• Address translation implemented by the hypervisor consumes little computing resources	• Address translation not required for the hypervisor, reducing computing resource consumption
Characteristics	• High CPU overhead and low VM density • Smooth VM live migration and snapshot	• Little CPU overhead • Smooth live migration, snapshot, and IP-MAC address binding	• Little CPU overhead • Limitation: Smooth live migration and snapshot features are unavailable
	Network throughput: 9.1 Gbit/s (TCP)	Network throughput: 9.15 Gbit/s	Network throughput: 9.5 Gbit/s

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- SR-IOV
  - This technology allows a physical NIC to create multiple physical functions (PFs), each of which provides multiple virtual functions (VFs).
  - This feature allows a VM to exclusively use a VF which is derived from a PF. In this case, the VM can directly use physical NIC resources without CPU overhead caused by virtual switching. Therefore, this feature improves network performance and reduces latency for VMs.
  - However, different hardware devices have different hardware binding capabilities (for example, PF and VF). Therefore, the live migration and snapshot features are unavailable on SR-IOV-enabled NICs.

Contents

Reference for Main Parameters of Huawei FusionCompute

VM and Host Indicator	Parameter
Maximum number of vCPUs (virtual SMP) supported by a VM	128
Maximum memory size supported by a VM	6 TB
Maximum virtual disk capacity supported by a VM	64 TB
Maximum number of virtual disks supported by a VM	60
Maximum number of virtual NICs supported by a VM	12
Maximum logical CPU cores supported by a host	512
Maximum physical memory size supported by a host	16 TB
Maximum number of running VMs supported by a host	1024

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The data is based on the latest FusionCompute 5.0 commercial release launched by March, 2015.

Reference for Main Parameters of Huawei FusionCompute

Management Indicator	Parameter
Number of HA/DRS physical machines supported by a logical cluster	128 (LUN storage deployed)/32 (virtual storage deployed)
Maximum number of VMs supported by a logical cluster	3,000
Number of logical clusters supported by a VRM node	32
Number of VMs supported by a VRM	1024
Number of VMs supported by a VRM	10,000 running VMs or 30,000 registered VMs
Maximum number of sites in a VRM domain	16
Maximum number of physical machines supported by a cascaded VRM	4,096
Maximum number of VMs supported by a cascaded VRM	80,000 (industry-leading indicator)

Server Requirements

Item	Requirement
CPU	Intel or AMD's 64-bit CPU
	The CPU supports hardware virtualization technology, such as Intel VT-x or AMD-V, and the CPU virtualization function is enabled.
	The CPUs used by the hosts in the same cluster are recommended to be of the same model. To add a host using a different CPU model to the cluster, that is, adding a heterogeneous host to the cluster, enable the incompatible migration cluster (IMC) mode for the cluster.
Memory	≥ 8 GB
	For a host where the management VM is deployed, the VM memory must be greater than 3 GB.
	The recommended memory size is greater than or equal to 48 GB.
Hard disk	≥ 16 GB
	If the VRM VM uses local storage resources to create disks, the hard disk space must be greater than or equal to 96 GB.
Network port	The number of network ports is greater than or equal to 1.
	The recommended number of network ports is six. The recommended network port transmission rate is greater than 1000 Mbit/s.
RAID	Use RAID 1 that consists of hard disks 1 and 2 to install the host OS and create the VRM VM, thereby enhancing host reliability.
	When setting the boot mode for the host BIOS, set RAID 1 as the first boot device.
	If the host has multiple hard disks, you are advised to use all the hard disks except disks 1 and 2 to set up RAID 5.
	If you have higher requirements for RAID, set up RAID based on your requirements.

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- FusionCompute features good compatibility and is compatible with universal servers, storage, and network devices.
- For detailed compatibility information, visit the following website to obtain *Huawei FusionSphere Compatibility List*:

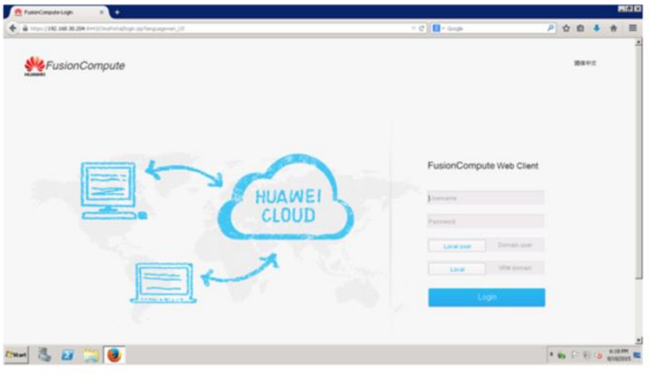
  http://e.huawei.com/en/marketing-material/onLineView?MaterialID={DF55539E-4627-424B-9224-BFE63A2786E2}
- As a mature open-source software product based on Xen, FusionCompute has made significant system simplification, security hardening, and function enhancement. Therefore, it consumes little resources and can be installed on a server with only 8 GB memory (48 GB is recommended) and 16 GB hard disk space.

Contents

Logging In to the FusionCompute Portal

To log in to FusionCompute, enter the following address in the address box of the local browser:

http://IP address of the VRM node

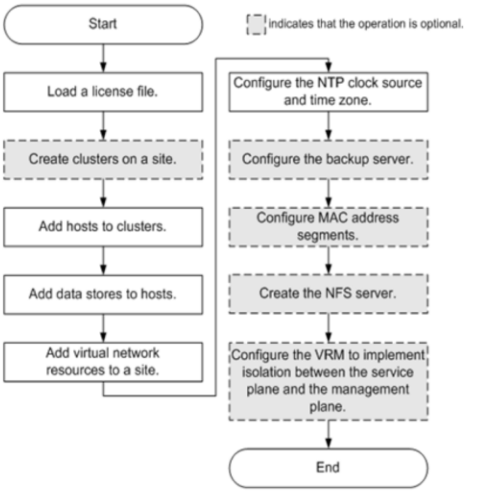


FusionCompute provides a centralized operation and maintenance (O&M) management platform, allowing O&M engineers to log in to the FusionCompute system from a web client to perform O&M operations.

You must change the default password and configure the browser upon your first login to the FusionCompute system.

Initial Configurations

After VRM and CNA are correctly installed, maintain and manage the nodes on the GUI. The initial configuration procedure is described as follows:



- During the project implementation period, you can apply for a license for commissioning.
- FusionCompute can provide services for a 90-day trial period without any license.
- When you configure a host, bind its ports in active/standby or load sharing mode and configure port aggregation on the switch.
- FusionSphere supports multiple storage types, including IP SAN, FC SAN, NAS, FusionStorage, and local disks. For details, see the production documentation.
- The NTP clock source is mandatory. If domain names are configured, deploy a DNS server.

Summary

1. Function of FusionCompute in FusionSphere
2. FusionCompute Customer Values
3. FusionCompute System Architecture
4. FusionCompute Features
5. FusionCompute Specifications
6. FusionCompute Operation and Configuration

Exercises

1. What is the position of FusionCompute in FusionSphere? What are the functions of FusionCompute?
2. Which benefits can FusionCompute bring to users?
3. Which two parts constitute FusionCompute?
4. What features does FusionCompute have?
5. What is the maximum number of physical hosts in a single cluster supported by FusionCompute 5.0?
6. What is the minimum memory a host must have to install FusionCompute?

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Acronyms and Abbreviations

Acronyms and Abbreviations	Full Name
HA	High Availability
FT	Fault Tolerance
VRM	Virtual Resource Management
VNA	Virtual Node Agent
CNA	Compute Node Agent
PV	Para virtualization
VMM	Virtual Machine Monitor
QoS	Quality of Service
DRS	Dynamic Resource Scheduler
DPM	Dynamic Power Management
NUMA	non-uniform memory access architecture

Acronyms and Abbreviations

Acronyms and Abbreviations	Full Name
RAM	Random Access Memory
VIMS	Virtual Image Management System
NAS	Network Attachment System
RDM	Raw Device Mapping
SCSI	Small Computer System Interface
LUN	Logical Unit Number
VSP	Virtual Switch Port
VXLAN	virtual extensible LAN
VMDQ	Virtual Machine Device Queues
SR-IOV	single-root I/O virtualization

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Chapter 6 FusionManager Architecture and Basic Principles

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Objectives

- Upon completion of this course, you will be able to:
  - Learn FusionManager application scenarios.
  - Learn FusionManager design concepts.
  - Be familiar with FusionManager logical architecture and core components.
  - Be familiar with FusionManager core functions.

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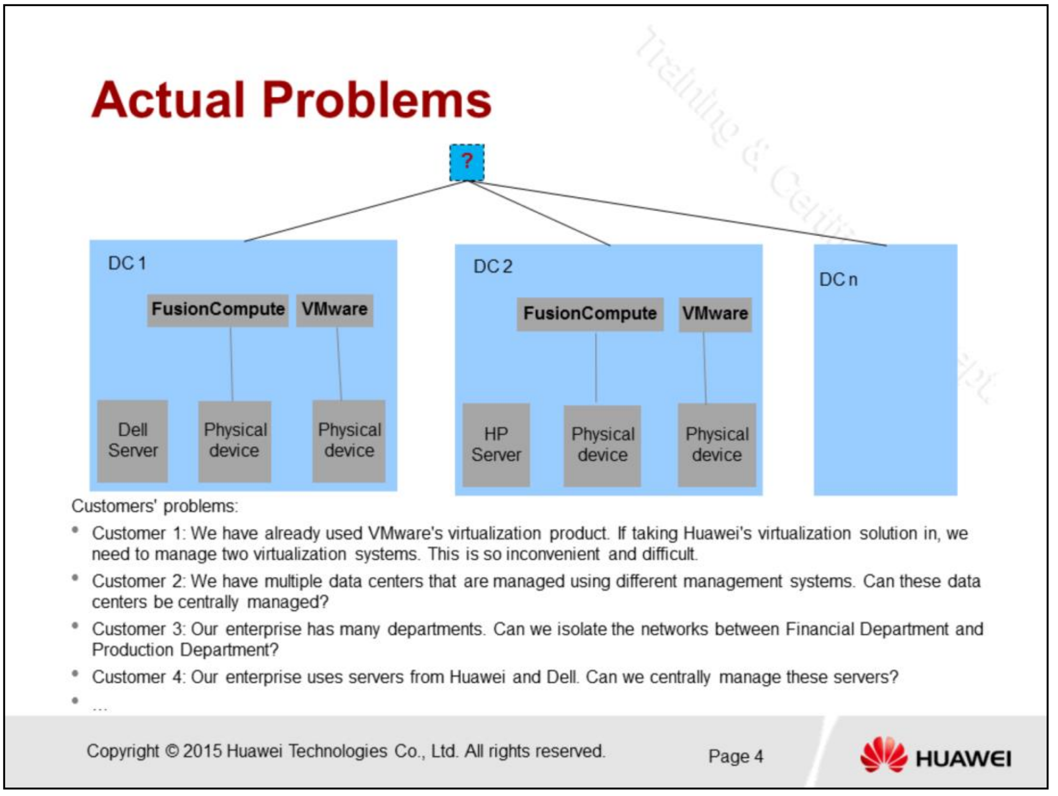
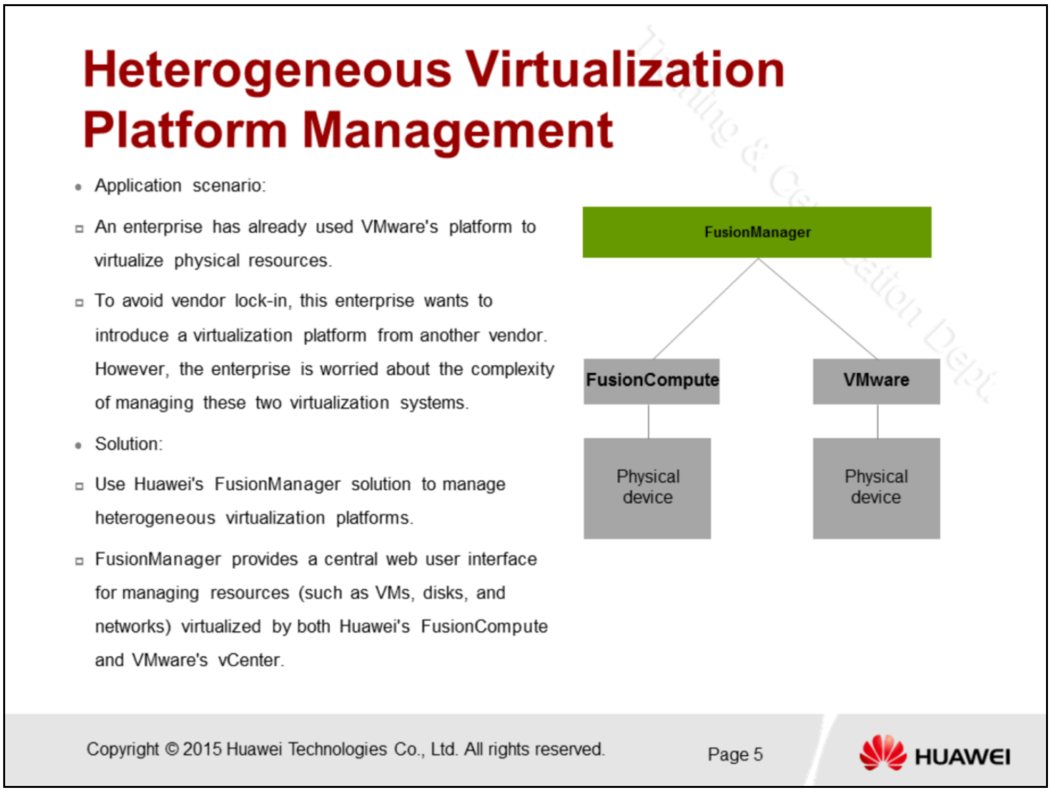


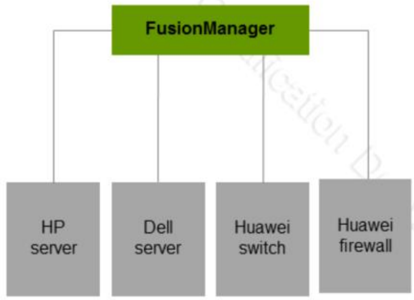
- FusionManager resolves the preceding problems by:
- Managing heterogeneous virtualization platforms, for example, Huawei's FusionCompute and VMware's vCenter.
- Centrally managing physical devices, for example, monitoring servers' CPU temperatures and fans running conditions, and receiving alarms reported by servers.
- Allocating virtual resources, for example, to various departments in an enterprise.
- Centrally manage multiple data centers and virtualization platforms in these data centers, for example, managing an enterprise's independent data centers located in two cities.



- Managing heterogeneous virtualization platforms, for example, Huawei's FusionCompute and VMware's vCenter.

Heterogeneous Hardware Device Monitoring

- Application scenario:
  - An enterprise uses servers, switches, storage devices, and routers from various vendors.
  - The enterprise IT administrator wants to monitor the hardware status of servers, such as CPU temperature, fan status, and port status.
  - The administer expects to handle device alarms without logging in to management interfaces of various vendors.
- Solution:
  - Use Huawei's FusionManager to monitor heterogeneous hardware devices.
  - Use Huawei's FusionManager to centrally display device alarms to facilitate O&M.



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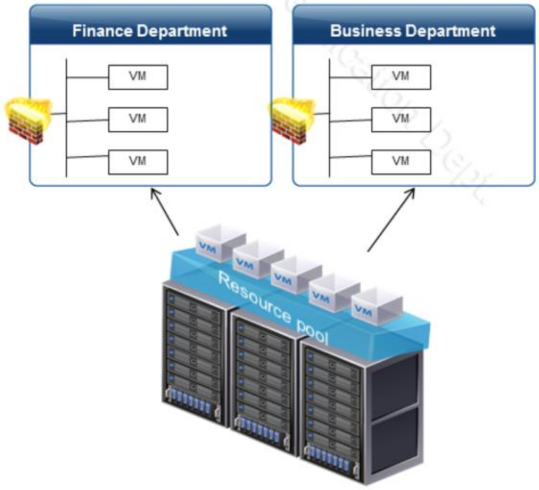
- Centrally managing heterogeneous physical devices, for example, monitoring physical servers CPU temperatures and fans running conditions, and receiving alarms reported by the physical servers.

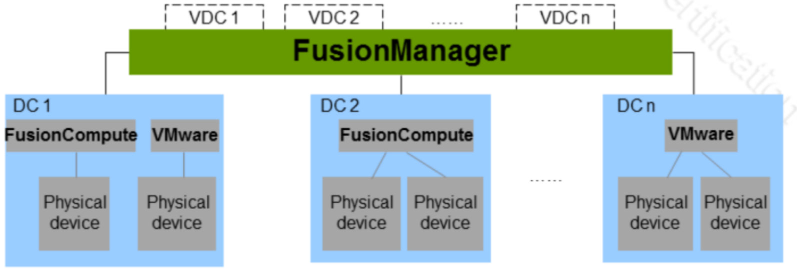
Secure Network Isolation

- Application scenario:
  - An enterprise has various departments.
  - Financial Department manages the enterprise's core financial data. Therefore, the enterprise expects to isolate the networks between the Financial Department and other departments.
- Solution:
  - Use FusionManager's virtual private cloud (VPC) capability to isolate networks between various departments.



- The details about VPC will be described in the sequent sections.

Unified Management of Multiple Data Centers



- Application scenario:
  - A large-sized enterprise has deployed independent data centers in multiple cities and has a single or multiple virtualization platforms deployed in each data center.
  - The enterprise expects to centrally manage these independent data centers and allocate virtualized resources to each independent business department in different regions.
- Solution:
  - Use FusionManager to allocate a virtual data center (VDC) to each business department and specify an administrator for each VDC.
  - The VDC administrator of each business department can allocate network, VMs, and disks in the VDC to employees.

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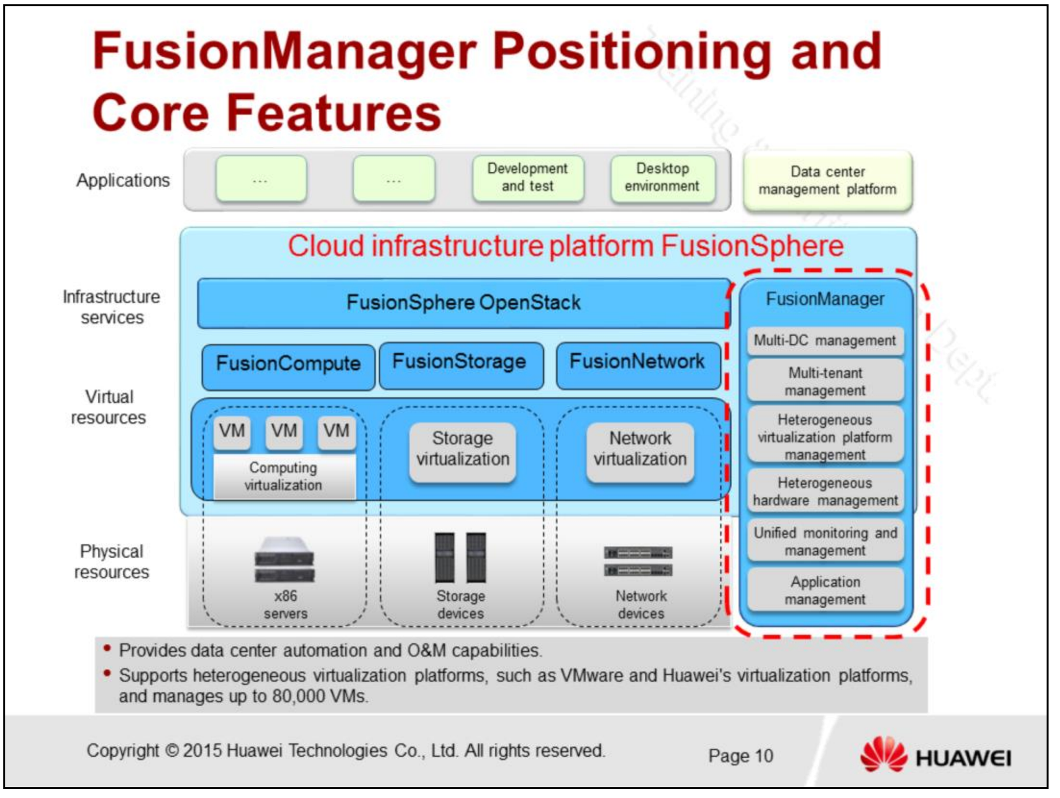
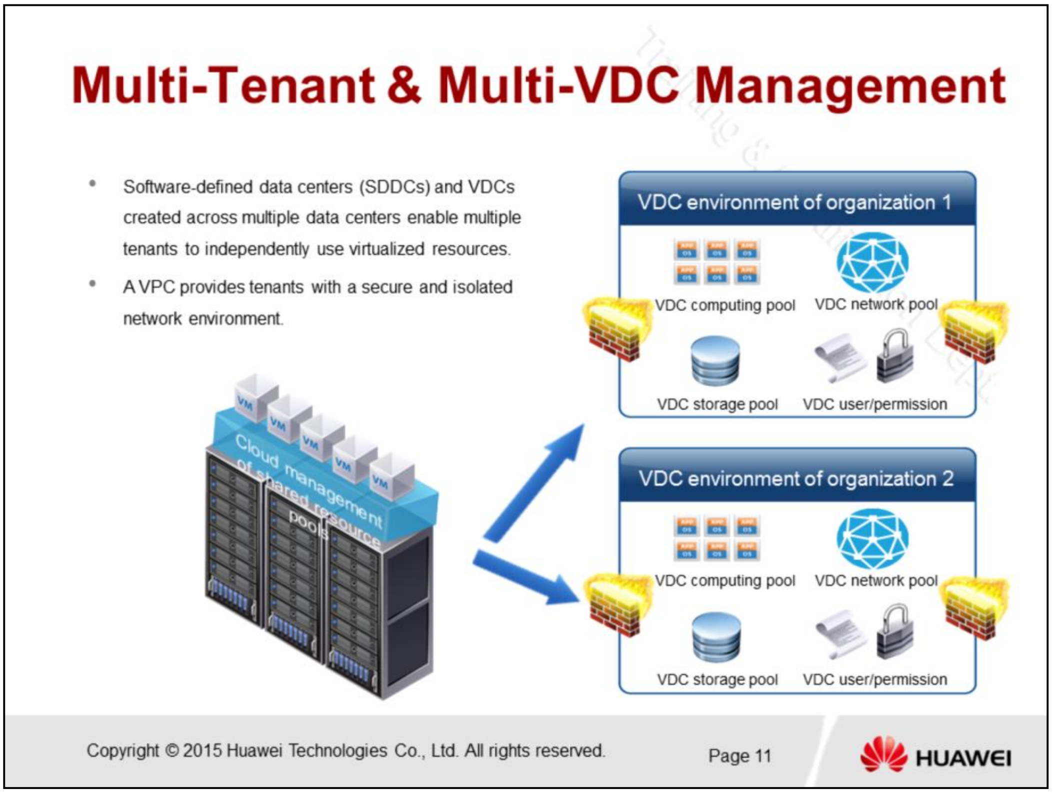
- This slide introduces the concept of VDC.
- A VDC is the primary unit of virtual resources managed in the FusionManager system. For example, an enterprise can assign an independent VDC for each of its departments, and each VDC contains all virtual resources, such as computing, storage, and network resources, that are required by the target department.
- Each VDC can contain multiple users that are managed by the VDC administrator. The administrator can add or delete users to or from a VDC and configure the resource scope and quota available to each user.

Contents

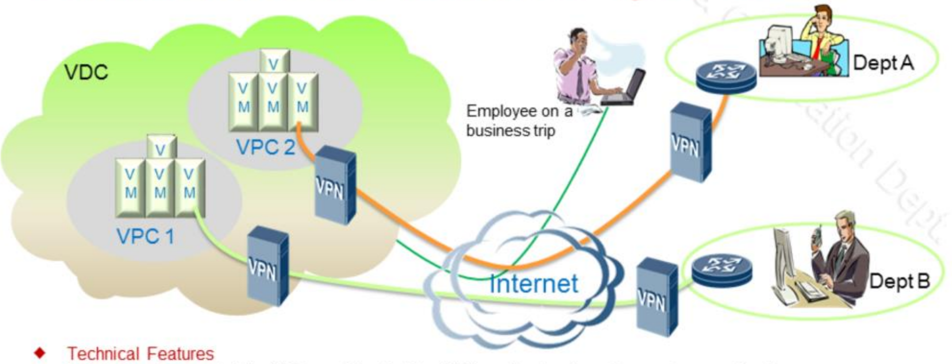


- The OpenStack-based FusionSphere consists of OpenStack, FusionCompute, FusionStorage, FusionNetwork, and FusionManager.
- FusionManager provides:
  - Resource pool management capability:
    - Managing heterogeneous virtualization platforms, for example, Huawei's FusionCompute and VMware's vCenter.
    - Centrally managing hardware, for example, physical servers from Huawei, HP, and Dell, storage devices (IP SAN and FusionCompute SAN), and network devices (switches and firewalls).
    - Centrally managing alarms reported by various Huawei components and hardware devices.
  - Multi-DC management:
    - Multi-tenant management capability.
    - Automatic application management capability. FusionManager supports application template creation and rapid provisioning of application templates.



- A VDC is a unit of virtual resources assigned for tenants.
- A tenant is called an account in industry, a project in OpenStack, or an org in VMware. Usually, a tenant is an independent resource user or an enterprise.
  - For example: Amazon is a well-known public cloud carrier. An individual customer or enterprise can register with Amazon. In this case, the individual customer or enterprise is called a tenant.
- The VDC has the following two definitions:
  - A VDC can be regarded as a department or an enterprise in daily life, that is, an independent department that uses resources or a settlement unit. For example, after an individual customer registered with Amazon, the customer needs to pay for resources using a credit card. In this case, this customer can be regarded as a settlement unit.
  - A VDC is a unit of virtual resources assigned for tenants. FusionManager specifies the CPU capacity, memory size, and storage space of the VDC based on the configured quotas. In this way, the amount of system resources used by a tenant cannot exceed the quota.

Secure and Isolated Network Environment Provided by a VPC



- Technical Features
- Isolated environment: The VPC provides isolated VMs and network environments, meeting the requirements of isolating networks between various departments.
- Comprehensive services: Each VPC can provide the independent virtual firewalls, elastic IP addresses, virtual LBs, security groups, super VLANs, IPSec VPNs, and NAT gateway services. Some of these functions are provided using virtual service appliance (VSA).
- Flexible networking: The VPC provides multiple networking modes, such as direct network, routing network, and internal network.
- Convenient charging method: FusionManager provides pay-per-use and traffic-based resource charging modes.

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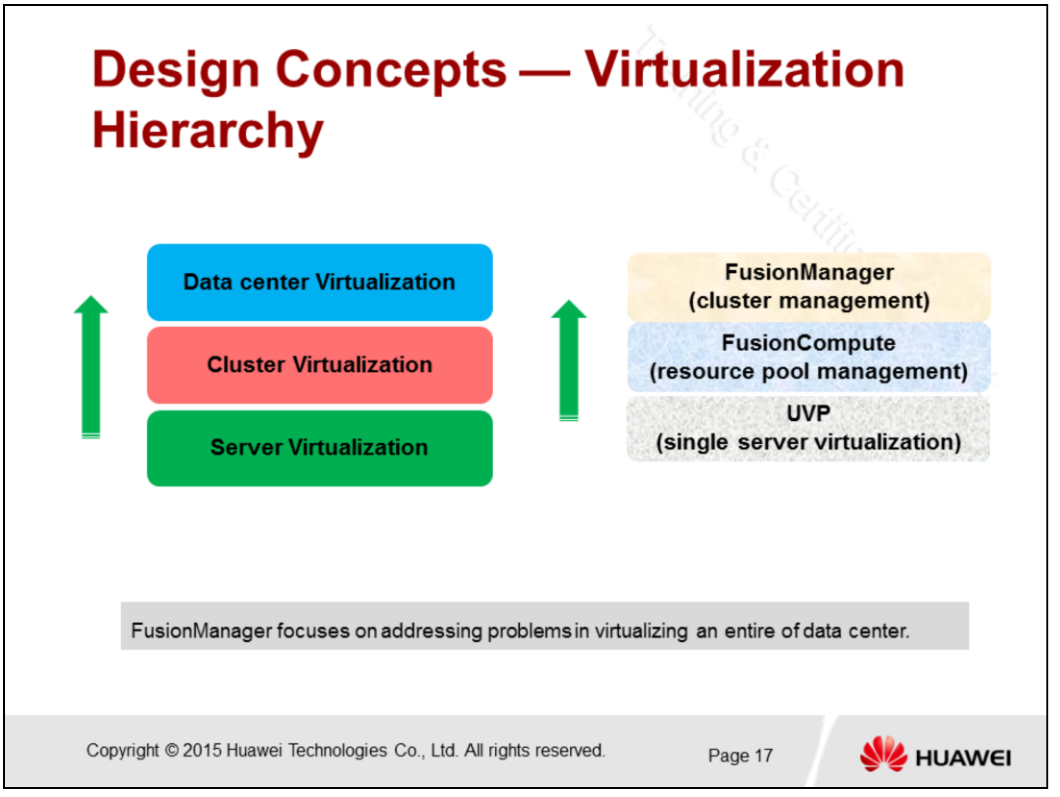
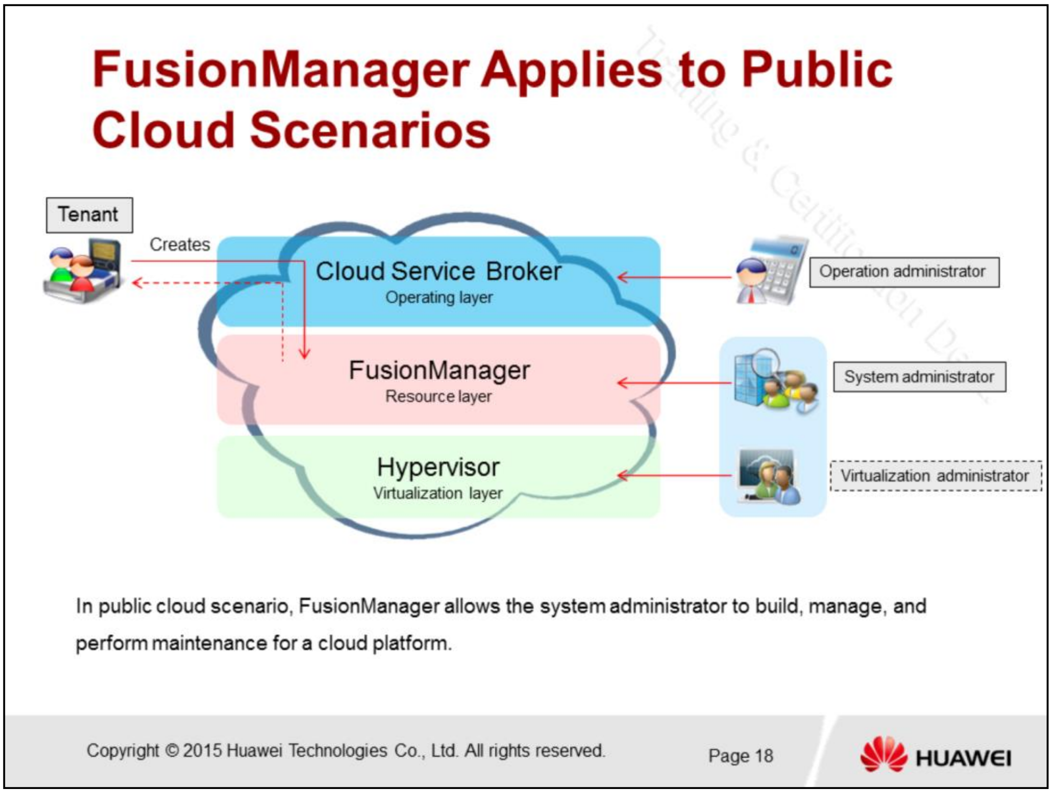
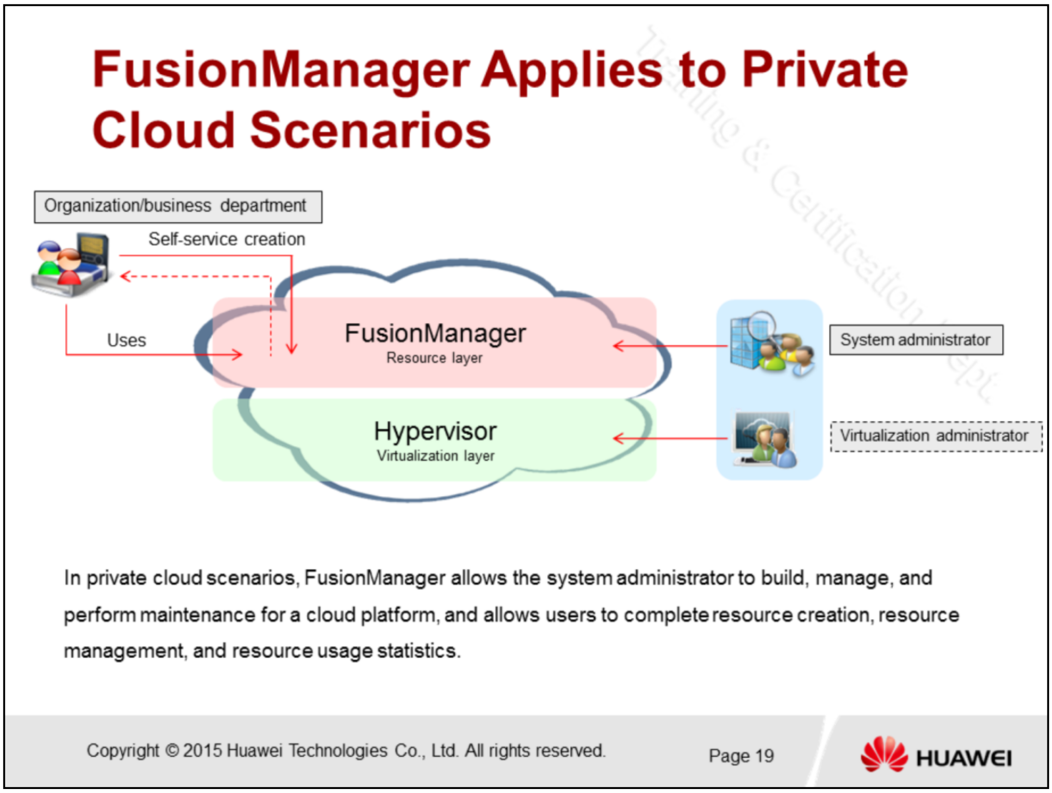


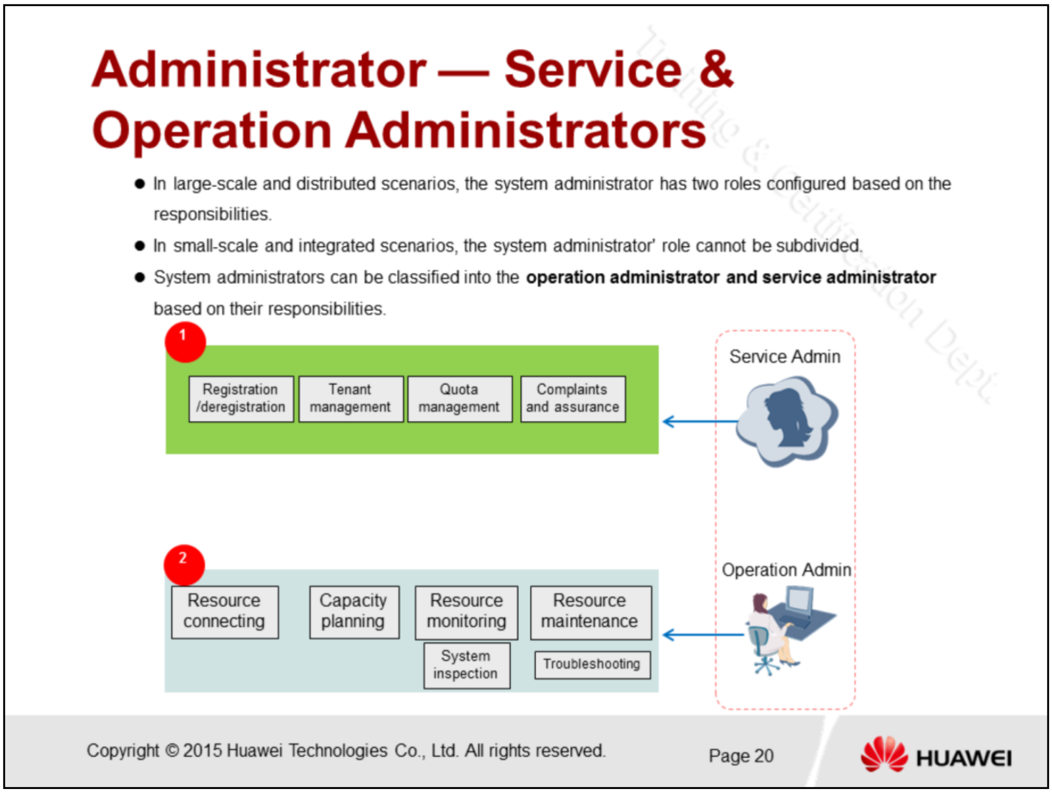
- The virtualization hierarchy is shown on the left of this slide. This hierarchy consists of server virtualization, cluster virtualization, and data center virtualization from bottom to top.
- The right side of this slide shows Huawei's products in each virtualization hierarchy. These products include UVP, FusionCompute, and FusionManager. FusionManager focuses on addressing problems in virtualizing an entire data center, such as heterogeneous virtualization platform management, multiple data center management, and multi-tenant management.



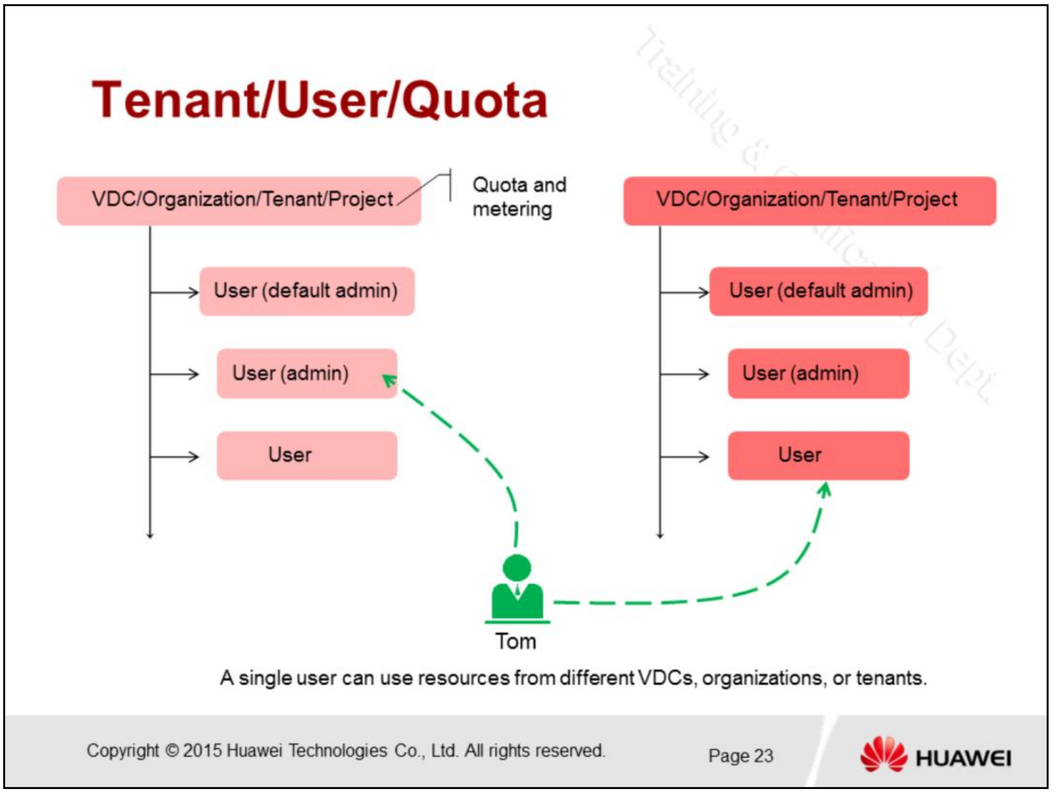
- In public cloud scenarios, FusionManager is at the resource management layer. Above this layer, a public cloud operating platform must be built for providing end users with services.
- The tenants created on the FusionManager web client are displayed to public cloud users after being encapsulated at the operation layer.



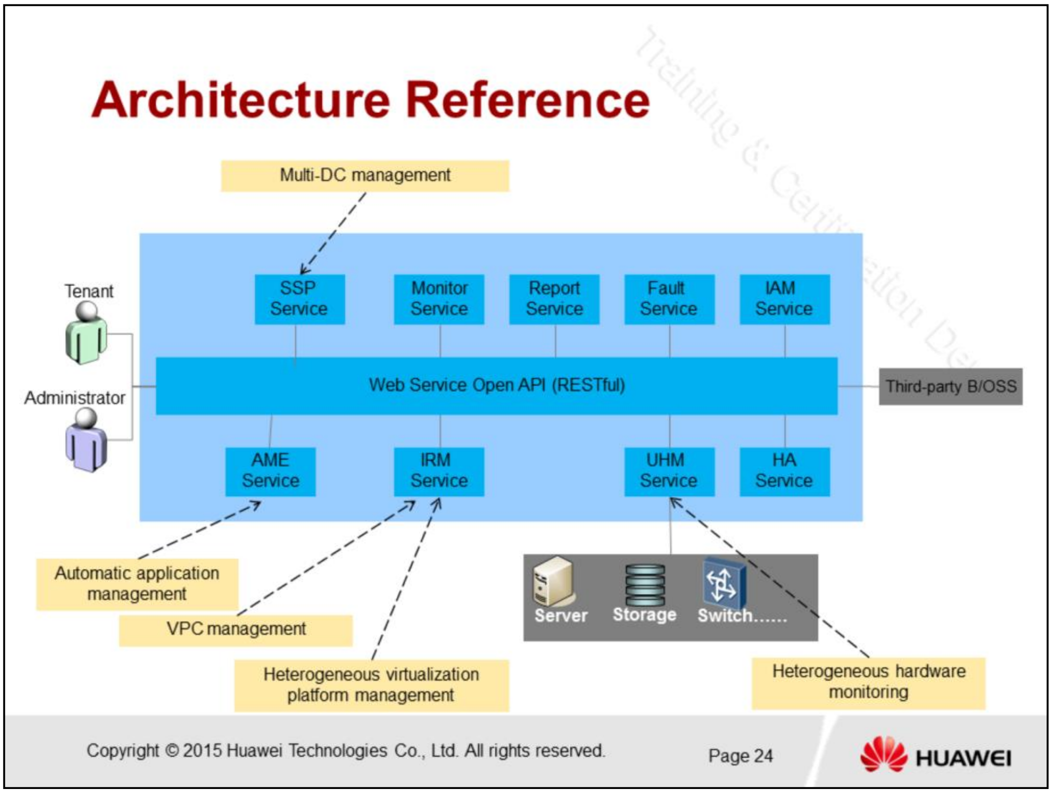
- Private cloud is a cloud computing platform built by an enterprise, such as Huawei's HiCloud.
- In private cloud scenarios, the system administrator in an enterprise is responsible for building resource pools and configuring the basic network. However, end users (such as the business department) only need to create or apply for VMs or disks.



- System administrators can be classified into the service administrator and operation administrator based on their responsibilities. The service administrator is responsible for service operation, and the operation administrator builds, manages, and performs maintenance for resource pools.



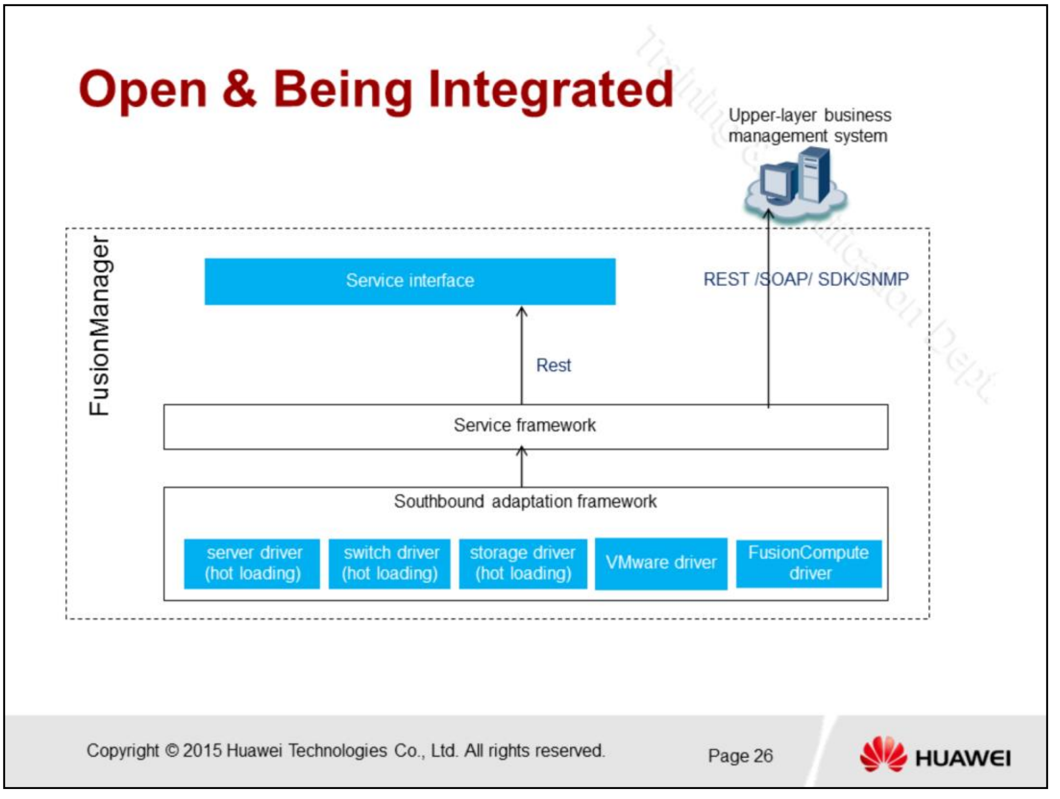
- A VDC is a unit of virtual resources assigned for tenants.
  - A tenant is called an account in industry, a project in OpenStack, or an org in VMware. Usually, a tenant is an independent resource user or an enterprise.
  - For example: Amazon is a well-known public cloud carrier. An individual customer or enterprise can register with Amazon. In this case, the individual customer or enterprise is called a tenant.
- Quota restricts the amount of a resource used by tenants. For example, a tenant is allowed to use only ten VMs and 1 TB storage space.
- A user in FusionManager can play different roles in different VDCs, that is, a user can exist in multiple VDCs.
  - For example, Tom can act as a secretary for Financial Department and Sales Department at the same time.



- FusionManager uses service-oriented architecture (SOA) to support application development. The core components in SOA are described in the next slide.

Component Functions

Component	Function
Monitor Service	Monitors physical devices, virtual resources, and the entire cloud system.
Report Service	Provides the system report service.
Fault Service	Provides alarm, query and management services.
IAM Service	Provides role-based permission control and management functions.
SSP Service	Provides service catalog, service provisioning, application template design, and multi-resource pool scheduling services.
IRM Service	Provides unified management of physical and virtual resources.
UHM Service	Centrally manages all hardware resources.
HA Service	Provides HA services for FusionManager.



- Open & easily integrated (easily integrated into a third-party operation platform):
  - FusionManager provides multiple northbound interfaces, including RESTful, SOAP, Java SDK, and SNMP interfaces. These northbound APIs can be flexible integrated into customers' management service software.
- Southbound adaptation:
  - FusionManager can monitor and manage heterogeneous hardware devices. FusionManager also provides drivers required for new hardware based on its extensive monitoring framework. Users can put drivers into use after hot loading these drivers on FusionManager.
  - FusionManager supports Huawei's FusionCompute and VMware's virtualization platforms using the drivers. In this way, it is convenient for FusionManager to support other virtualization platforms by secondary development. FusionManager is planned to support Microsoft's Hyper-V soon.

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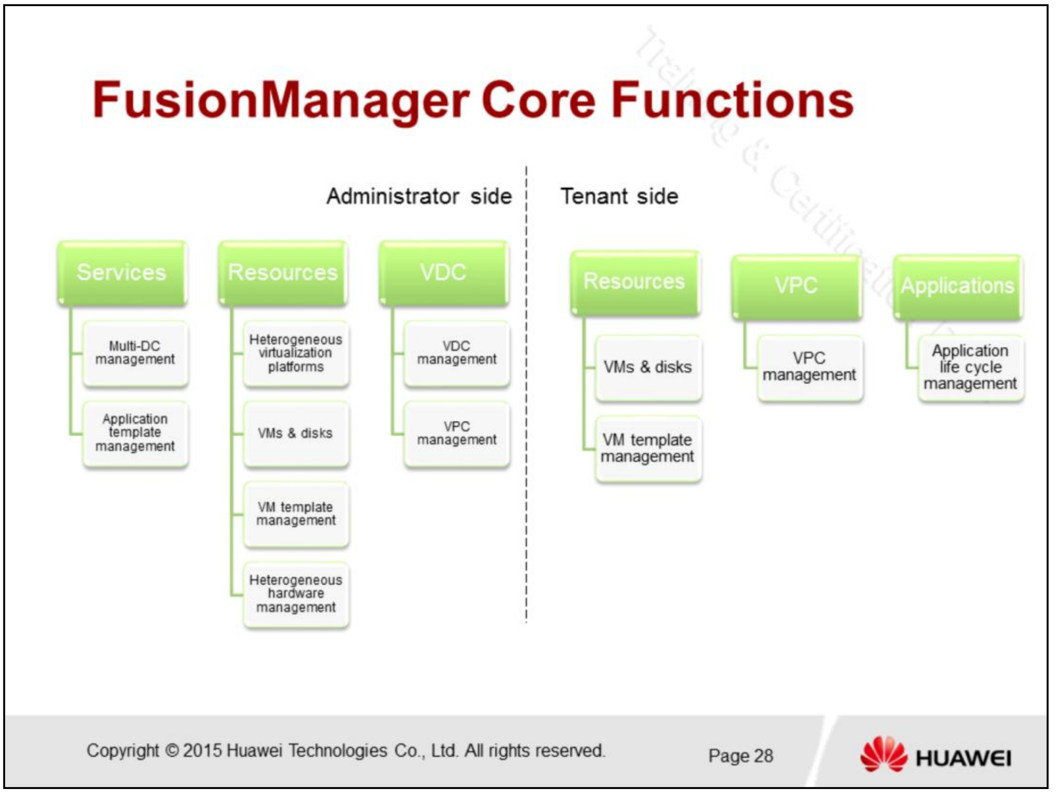
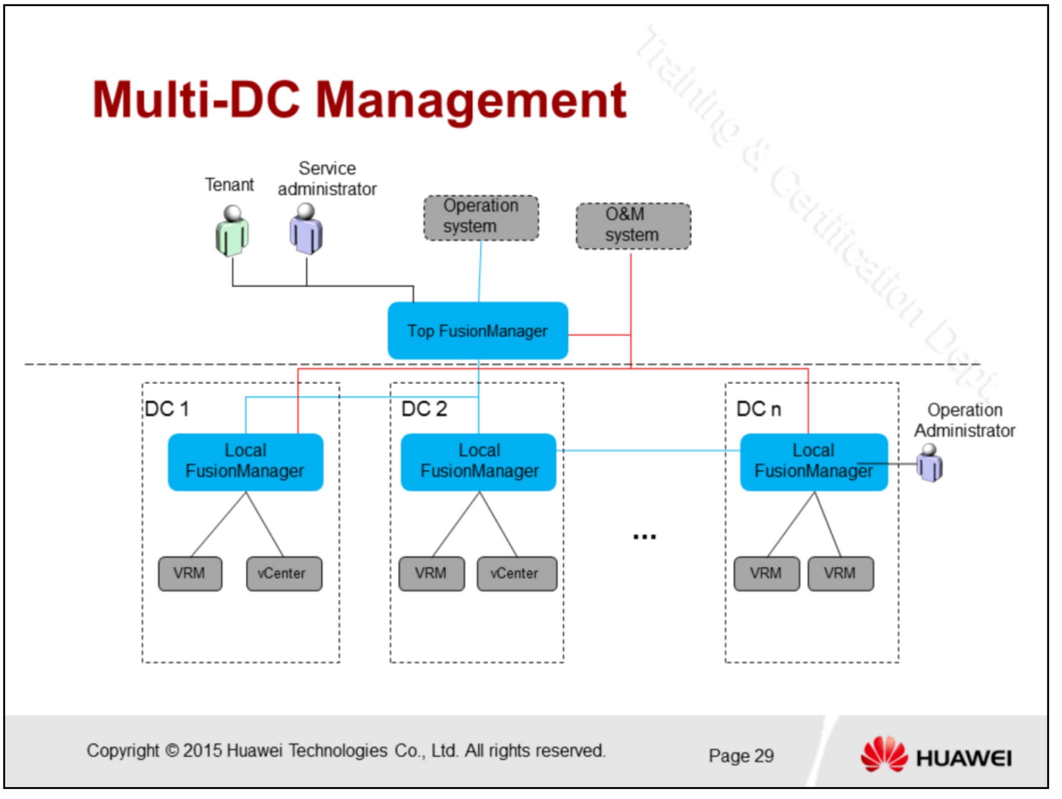
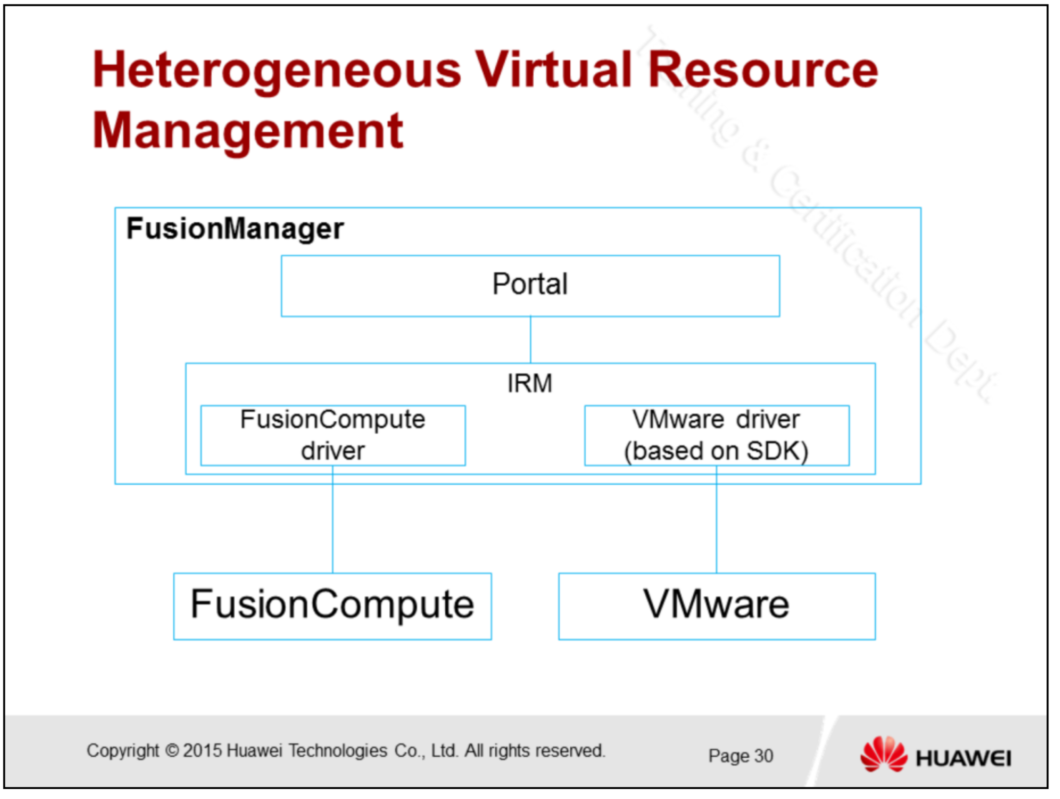


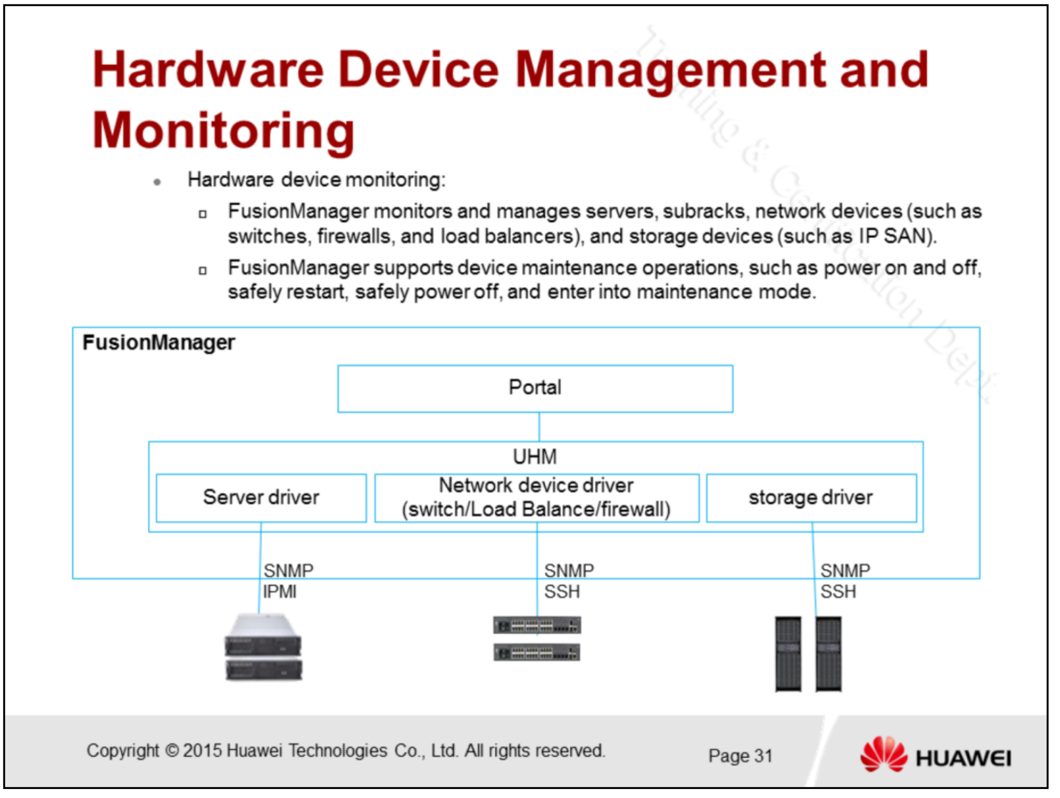
- The tree root is the menu name, and the modules bellow the tree root are core functions.
- The following slides will briefly describe these core functions.



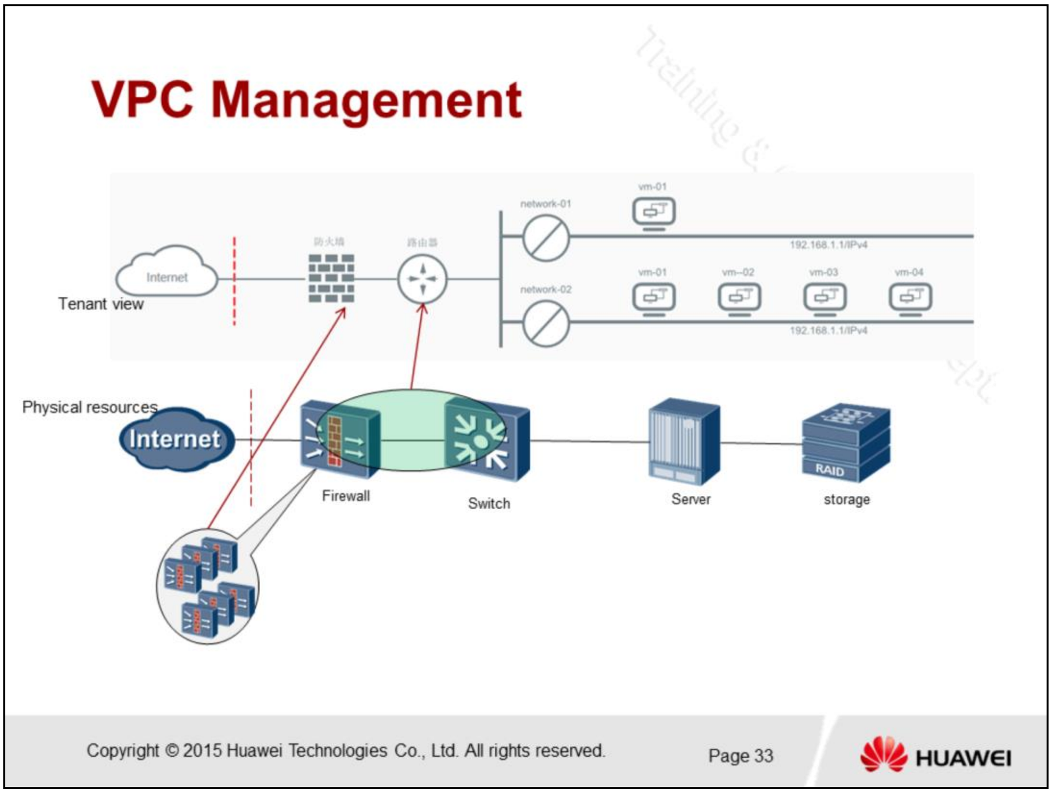
- FusionManager can be deployed in Top-Local mode when managing multiple data centers. This mode is also called distributed deployment architecture.
- In this deployment mode, each Local FusionManager node manages the resources in a single data center. The Top FusionManager node itself uses the resources in the entire data center (by FusionSphere cascading on web client) to provide tenants with services.
- The Top FusionManager administrator and Local FusionManager administrator are service administrator and operation administrator, respectively.



- FusionManager uses separate drivers for various virtualization platforms to integrate the basic functions of these virtualization platforms, such as VM, disk, and network management functions for system administrators and tenant administrators to use on their respective web clients.
- Huawei' FusionCompute virtualization platform uses REST interfaces to interact with drivers. VMware's vCenter virtualization platform uses VMware's software development kit (SDK) to interact with drivers.
- Of course, a third party can also use FusionManager's open REST interfaces to perform secondary development.

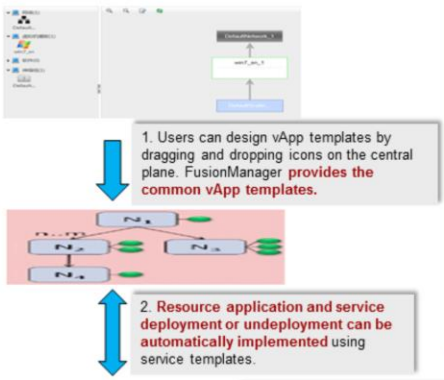


- Hardware device management and monitoring:
  - FusionManager monitors and manages servers, network devices (such as switches, firewalls, and load balancers), and storage devices (such as IP SAN and FC SAN).
  - New plug-ins can be developed for new hardware and be hot loaded to the system.
- Device alarms are sent to FusionManager using Simple Network Management Protocol (SNMP).
- Device maintenance operations are performed using Intelligent Platform Management Interface (IPMI) and SNMP protocols.
- For example:
  - Server configuration information includes the name, location, management IP address, basic input/output system (BIOS), CPU main frequency and quantity, memory size, hard disk capacity, number of NICs, and number of network ports.
  - Switch configuration information includes the location, management IP address, model, type, and status.

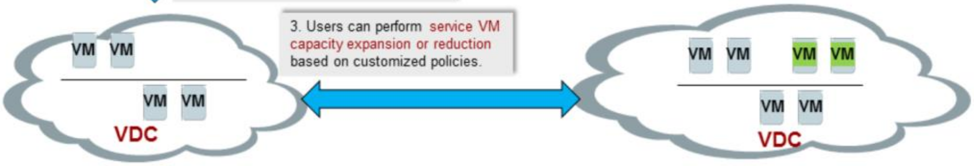


- Users can create their own VPCs in a VDC.
- Users can use various network services, such as routers and virtual load balancers (VLBs) in a VPC.
- In tenant view, users can clearly view the VPC network topology, which facilitates VPC maintenance and management.
- The VPC security management functions are implemented on firewalls:
  - In hardware firewall networking, multiple virtual firewalls are created using the virtualization capability of the hardware firewall. The functions of each virtual firewall equal to those of the hardware firewall, while the performance is poorer than that of the hardware firewall. Therefore, the foresaid network functions provided in a VPC equal to those of the hardware firewall, such as the elastic IP address, Network Address Translation (NAT), and virtual private network (VPN).
  - The software firewall is similar to the hardware firewall, but the hardware uses Huawei's software virtualization solution to virtualize software firewalls. Each software firewall runs on one VM.
- The router capability of the VPC is provided by firewalls or switches based on the actual physical networking.

Automatic and Graphic Deployment of Applications Using Templates



- Service templates designed by dragging icons: This mode enables users to easily design service deployment templates on a graphical user interface (GUI), simplifying service deployment design.
- Automatic service deployment and undeployment: One-click service deployment is supported, thereby facilitating IT service provisioning and resource reclamation.
- Policy-based elastic resource scaling: Scaling groups and scaling policies can be used to automatically and elastically scale application resources, thereby speeding up the response to service requests.



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Summary

- Scenario Description
- FusionManager Positioning and Core Features
- Design Concepts and Architecture
- FusionManager Functions

Questions exercises

1. What problems does FusionManager solve by supporting heterogeneous virtualization platforms?
2. What problems does the VDC solve?
3. What problems does the VPC solve?

Exercises

- True or False
  - FusionManager can centrally manage VMware's vCenter and Huawei's FusionCompute. ()
- Multiple choices
  - Which hardware devices can FusionManager manage? ()
    - A. Storage devices
    - B. Servers
    - C. Switches
    - D. Firewalls
    - E. LBs

Appendix: Acronyms and Abbreviations

Abbreviated Name	Full Name
VDC	Virtual Data Center
VPC	Virtual Private Cloud
IRM	Integrated Resource Management
VLB	Virtual Load Balance
SNMP	Simple Network Management Protocol
VFW	Virtual Firewall

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Chapter 7 FusionAccess Architecture Principles

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Objectives

- Upon completion of this course, you will be able to understand:
  - FusionAccess architecture and component functions.
  - Basic FusionAccess service processes.
  - Basic FusionAccess features.

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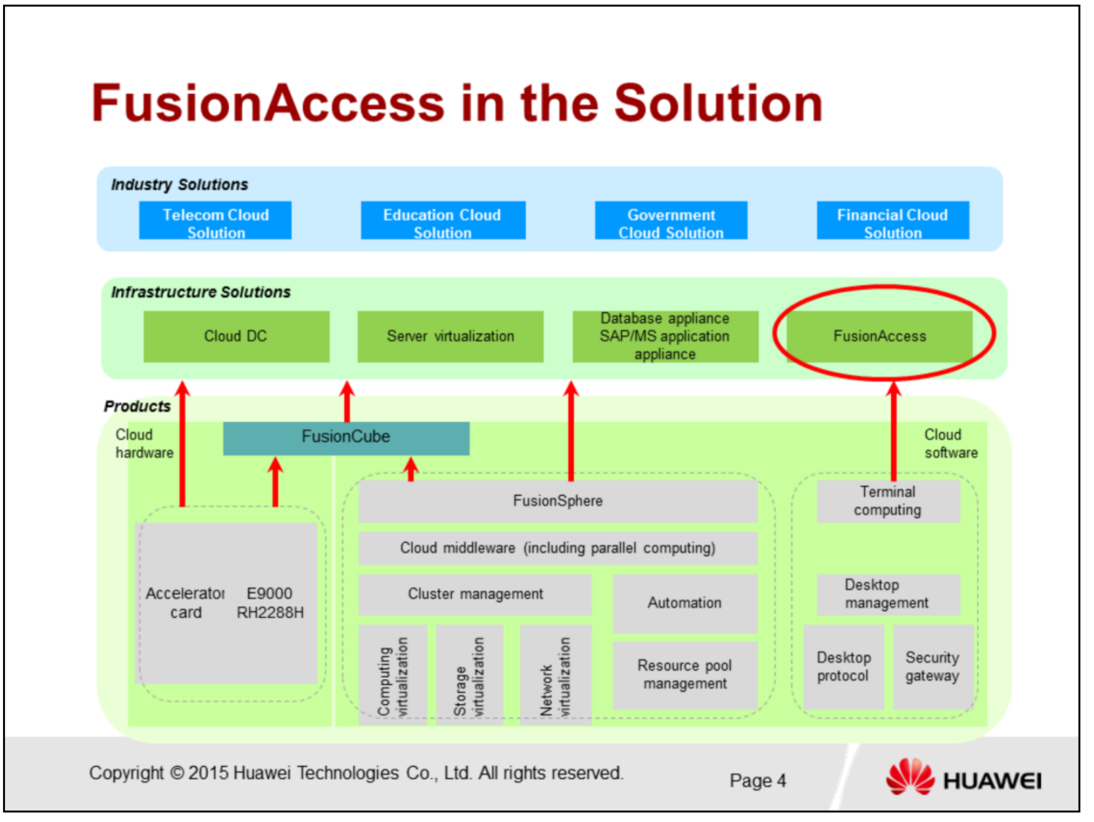


- Huawei FusionAccess is a virtual desktop application deployed on FusionCube or FusionSphere. By deploying software and hardware on the cloud platform, it enables users to access cross-platform virtual desktops by using networked client devices, such as thin clients (TCs).
- FusionAccess provides a graphical user interface (GUI) for administrators to quickly provision, maintain, and reclaim virtual desktops. This helps elastically manage virtual resources, improve resource usage, and reduce operational expenditure (OPEX).
- The Huawei FusionCloud Desktop solution consists of FusionCompute, FusionManager, and FusionAccess.

Key Features

High Security

- Authentication security: USB key and fingerprint authentication
- IT administrator rights control: Rights- and domain-based management and role-based management
- Access security: SSL encryption for access data; restricted thin client (TC) access

GPU Virtualization

- Graphics processing unit (GPU) virtualization based on NVIDIA K1/K2 graphics cards
- Compliant with the latest OpenGL and DirectX standards
- GPU sharing, reducing GPU costs

Full Memory Desktop

- System disks of virtual machines (VMs) are put on the memory, enabling system restoration after restart
- Memory deduplication, compression and reuse technologies, providing high-speed I/O and clone capabilities
- Improved desktop performance with reduced costs

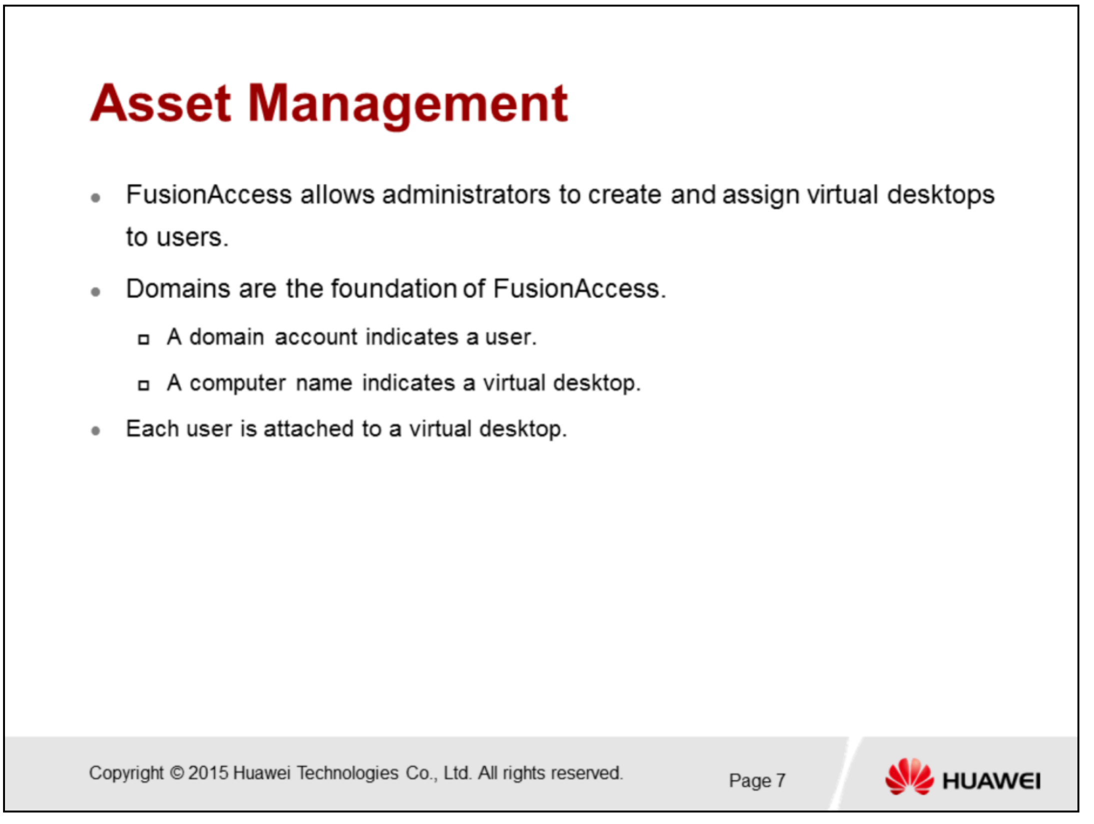
Cost-effective

- Low storage costs: thin provisioning and linked clone desktops
- Low terminal costs: TCs
- High VM density: virtualization performance optimization

Network Position and Functions of FusionAccess

- The desktop virtualization solution consists of FusionAccess, FusionSphere, and TCs.
- Main functions of FusionAccess:
  - Asset management: Manages relationships between users and VMs.
  - User access: Allows users to view and operate their VMs.
  - Desktop delivery: Uses the Huawei Desktop Protocol (HDP) to deliver desktops to users.
- FusionAccess consists of multiple components but is not an independent network element (NE).

- FusionAccess consists of three parts:
- The cloud platform provides virtual desktops for users.
- The desktop access component manages and assigns virtual desktops.
- Terminals connect users to virtual desktops.



- Asset management is implemented on the management portal of the IT adapter (ITA).

User Access Control

- Users can view their own virtual desktops by using browsers.
- Users can start, restart, and log in to their own virtual desktops.
- FusionAccess manages the status of all virtual desktops.

Desktop Transfer Protocols

- FusionAccess transfers contents on a desktop from a VM to a terminal by using the HDP protocol. HDP features high transmission efficiency.
- Desktop transfer is implemented between a server and a client. The server processes applications and transfers desktop images to the client. The client displays desktop images and sends operations on the keyboard and mouse to the server.
- FusionAccess uses HDP.

Item	HDP	RDP
Full Name	Huawei Desktop Protocol	Remote Display Protocol
Source	Developed by Huawei, possesses complete code and intellectual property rights.	Developed by Citrix and sold to Microsoft.
Network bandwidth	200 kbit/s to 300 kbit/s	Higher bandwidth required
Connection speed	Quicker than RDP	
Security	More secure than RDP	
Feature	Various peripherals and multimedia services supported.	Fewer features supported, and poor performance in multimedia services.

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- The HDP, RDP, and PC over IP (PCoIP) protocol used by VMware View are remote desktop display protocols. HDP's overall performance leads in the industry. It provides the following features:
- Requires lower bandwidth.
- Supports more peripherals.
- Implements unified control by using a console.
- Optimizes performance based on scenarios by setting policies on the Huawei Desktop Controller (HDC), for example, enabling the compression function to reduce the definition if bandwidth is insufficient, and disabling redirection of peripherals to VMs in high-security scenarios.

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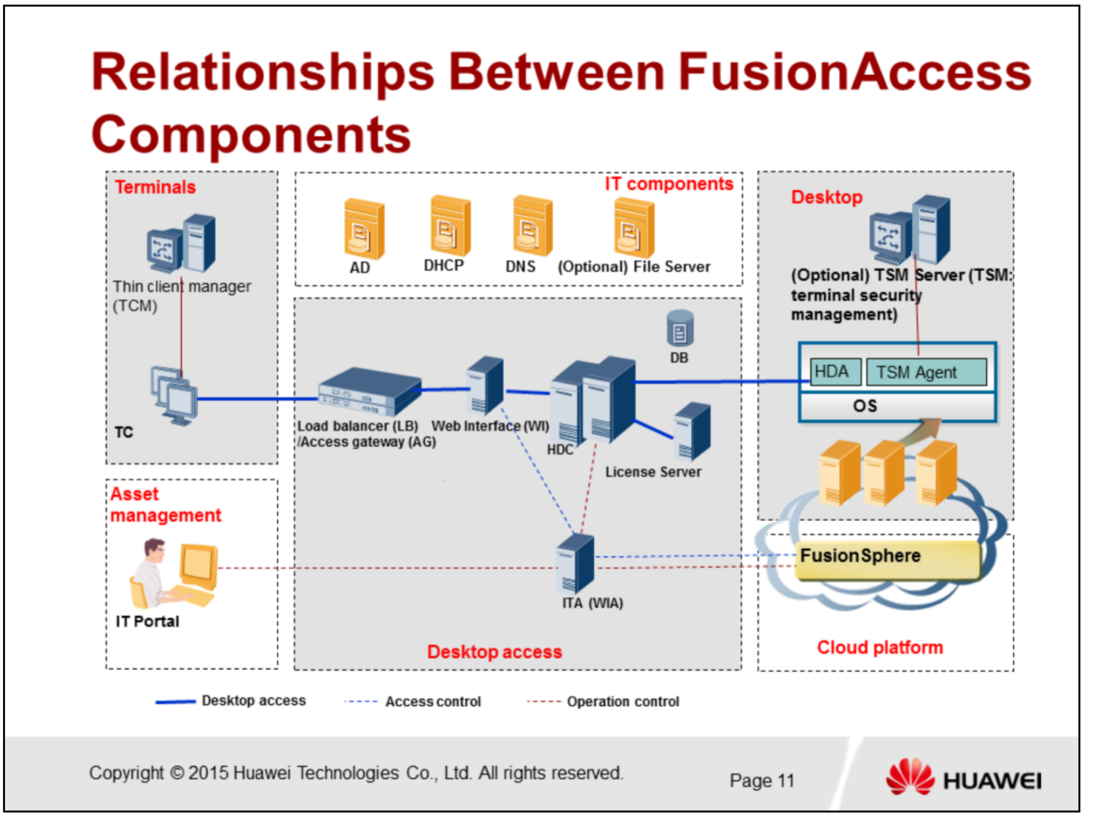

- Desktop access components adopt the HDP. Desktop access components are deployed on a Huawei-developed cloud platform. Huawei has developed the ITA and WI adapter (WIA) components to automatically restart VMs during login and provide enhanced automatic VM creation, provisioning, and operation and maintenance (O&M) capabilities.
- The WI sends a start message to the WIA, and then the WIA notifies the cloud platform to start the specified VM, as indicated by blue dotted lines in the preceding figure. The following details the process.
- The red dotted lines in the preceding figure indicate the service processes in which the IT administrator creates and provisions VMs. Communications between components will be described in the following slides.
- In the preceding figure, only TCs are presented on the terminal side. HDP supports access from various terminals.

FusionAccess Components

- **Terminal components**
  - Hardware: TC
  - Software: TCM
- **Desktop access components**
  - Software: HDC, License Server, WI, and Huawei Desktop Agent (HDA)
  - Hardware: SVN, serving as an LB and an AG
- **Automation management components**
  - Software: ITA
- **Desktop software management components**
  - Software: TSM (including the Server and Agent)
- **IT architecture components**
  - Software: active directory (AD), Dynamic Host Configuration Protocol (DHCP), domain name server (DNS), and File Server

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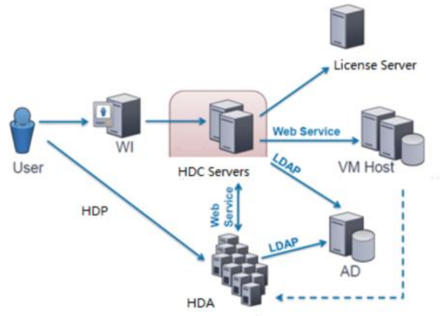
Desktop Access Components

- **WI**
  - The WI provides a web login page for users.
- **License Server**
  - The License Server determines whether users' licenses are sufficient when users access VMs through the HDP.
- **SVN**
  - The SVN balances loads between WIs.
  - The SVN also serves as the HDP protocol gateway to isolate the intranet from the extranet and implement transmission encryption.
- **Huawei Desktop Controller (HDC)**
  - The HDC, as a core component of the desktop virtualization, stores the associations between virtual desktops (domain names) and users (domain accounts) and synchronizes the usage state and connection state of virtual desktops in real time.
  - During desktop access, the HDC provides VM access information for terminals.
- **HDA**
  - The HDA is installed on VMs. It connects users to desktops by using the HDP and reports VM status and connections to the HDC.

HDC

- **The HDC provides the following functions:**
  - Establishes and maintains mapping relationships between users and virtual desktops.
  - Provides access information for the WI during user access.
  - Collects VM status and connection information from HDAs installed on VMs.



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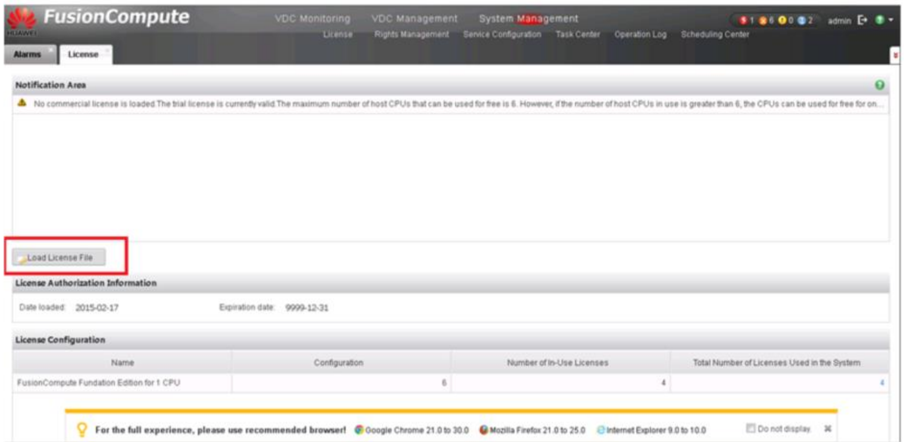
- Administrators create, provision, and maintain VMs on the ITA portal. The ITA invokes the interface provided by the HDC.
- The WI provides a web page for users to log in to VMs.
- The HDA is desktop agent software developed by Huawei. The HDA is installed on each user VM.
- LDAP is short for Lightweight Directory Access Protocol (LDAP). AD is a typical instance of the LDAP.
- The HDC is a core component of FusionAccess and dominates in the FusionAccess software architecture.

License Server

The License Server controls desktop access licenses.

When a user attempts to connect to a VM, the License Server checks whether HDP connection licenses are sufficient. If yes, the user can connect to the VM.



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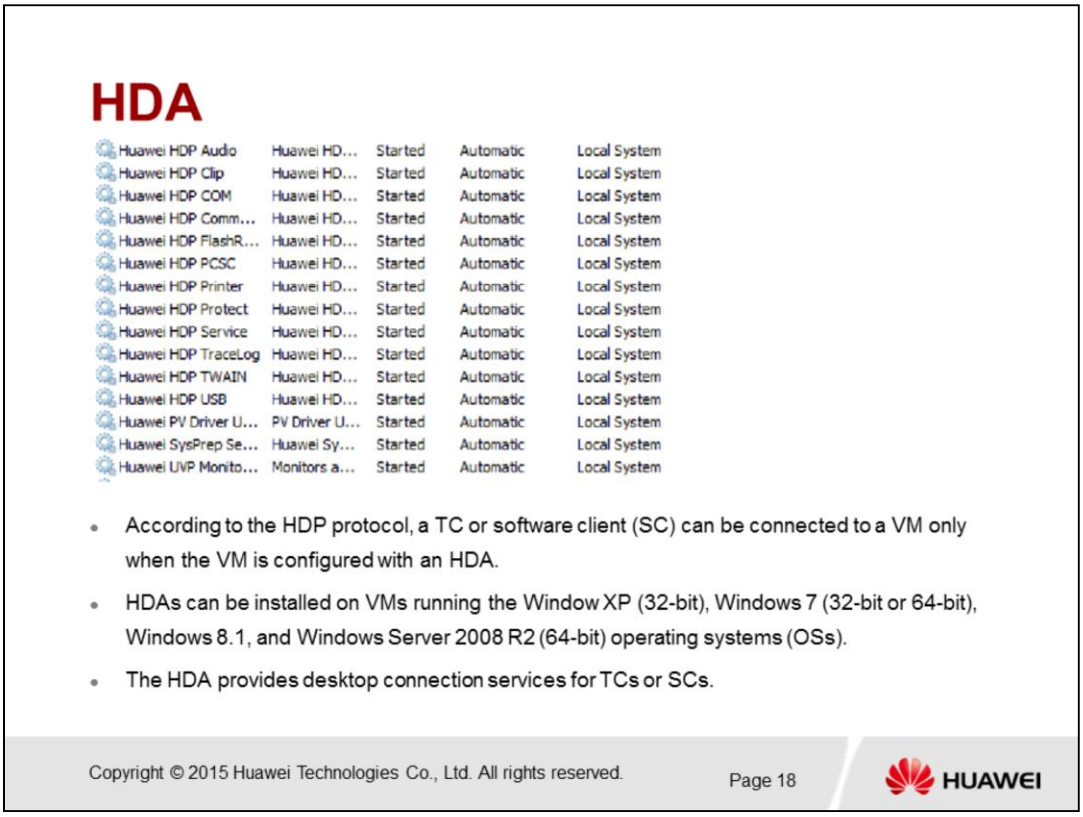
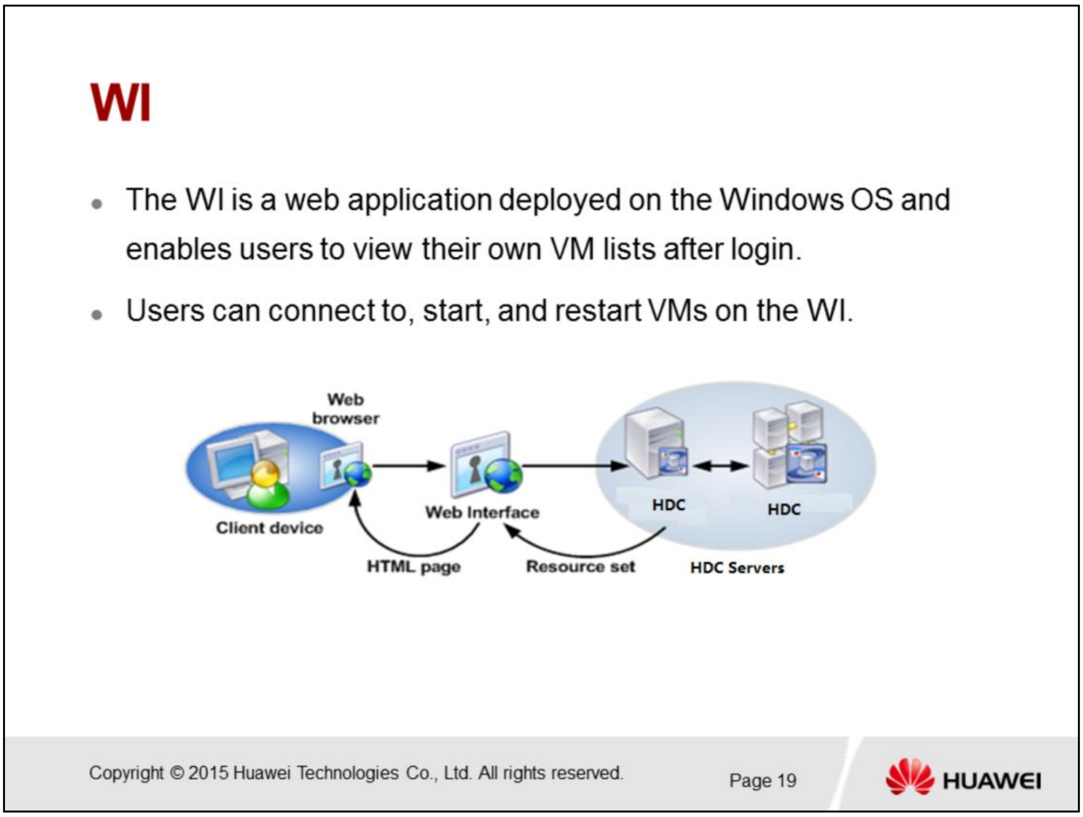
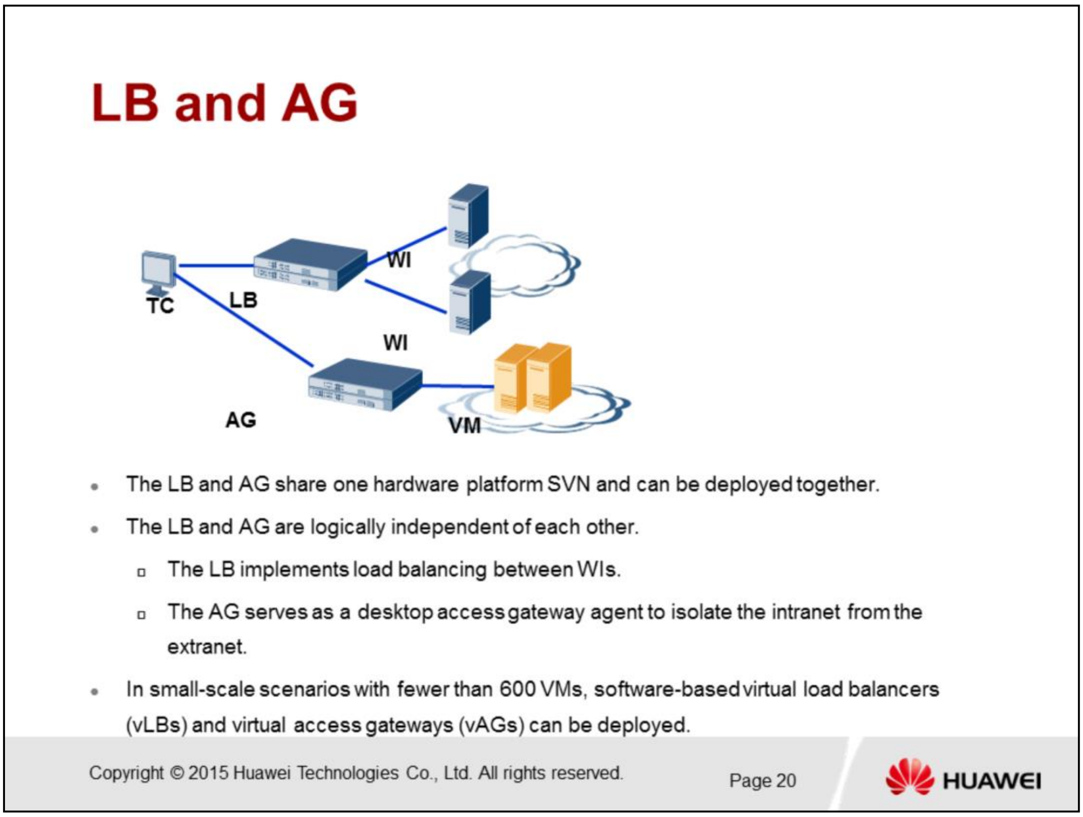
- Licenses can be purchased based on the number of users or concurrent users.



- The HDA is installed on each user VM to connect a terminal and a VM.



- The WI is a web service that provides a web browser for users to log in to VMs.
- After a user enters the domain username and password on the WI login page and passes authentication, the user can view the assigned VMs on the WI and clicks a VM to log in.



- SVN provides load balancing and access gateway functions.
- The SVN is an application switch, which performs traffic analysis on specific applications to assign and optimize the network traffic of web applications at layer 4 to layer 7 intelligently and securely.
- The SVN provides two main functions: switching and security protection. The SVN processes Hypertext Transfer Protocol (HTTP) access requests, provides load balancing for Transmission Control Protocol (TCP)-based connections, ensures secure connections, and implements Network Address Translation (NAT).
- The AG is a virtual private network over Secure Sockets Layer (SSL VPN) device that provides applications securely based on SmartAccess control policies. Users can access any application or data anytime through the AG. Enterprise users can also access data center resources from an extranet through the AG. In addition, access control can be implemented based on various SmartAccess control policies. The AG also supports user authentication, access policy settings, and NAT.

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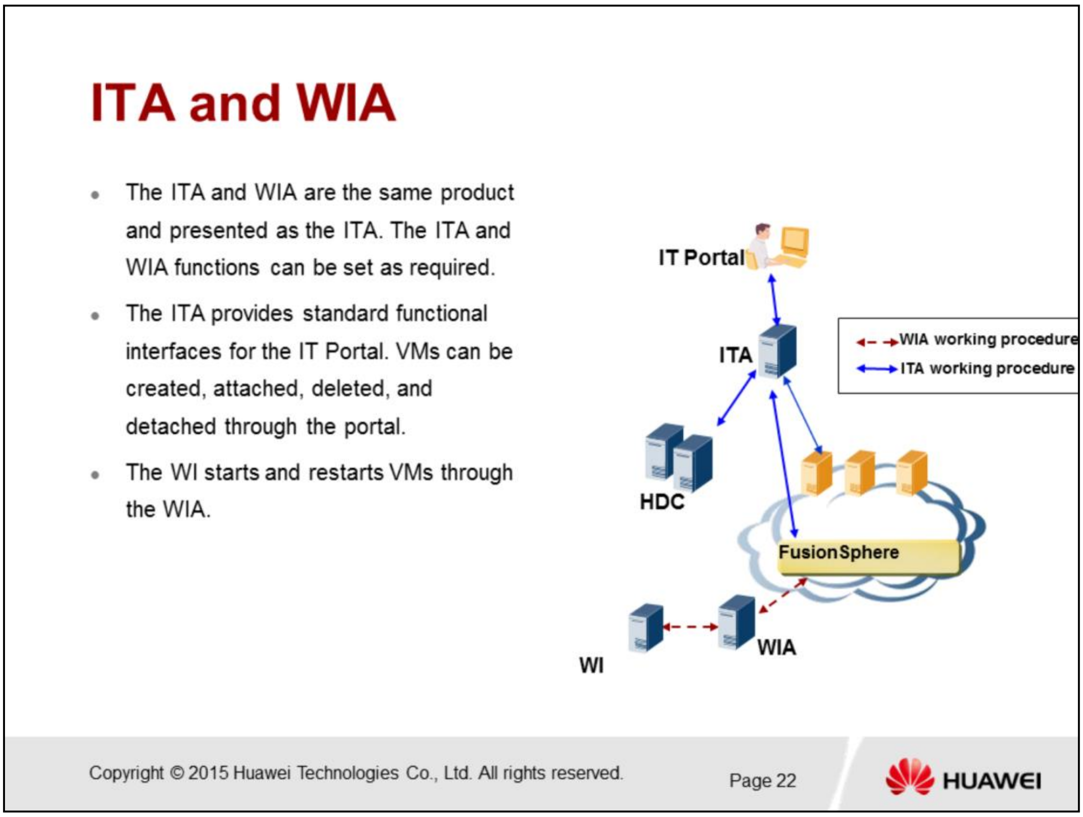

- The ITA or WIA serves as a Tomcat-based web service. The ITA or WIA provides unified interfaces for the upper layer IT Portal and interfaces for the underlying HDC, FusionSphere, VMs, and DNSs.
- The working principle of the WIA is as follows:
- When detecting that a VM is shut down, the WI sends a VM start message to the WIA. After obtaining the VM ID from the message, the WIA sends a start command to FusionSphere.

ITA Functions

Sub-module	Function
Upgrade and patching	Upgrades and patches the ITA.
Task management	Manages all tasks, scheduled tasks, and periodic tasks in the system, such as creating scheduled tasks.
Desktop management	Manages all virtual desktops in the system, such as attaching and detaching VMs, adding VMs to a VM group, and creating desktop groups or VM groups.
Service provisioning	Provisions services quickly by integrating procedures of VM creation and attachment.
Alarm monitoring	Monitors other components in the desktop cloud system, generates an alarm when a component abnormality is detected, imports alarms to the database, and generates notifications.
Data backup	Periodically backs up key and sensitive data in the system to ensure data security and prevent key and sensitive data from being deleted by the system.
Data audit	Periodically verifies data consistency between the ITA and other components when multiple copies of data are saved on different components in the desktop management system.
System configuration	Configures the desktop management subsystem, covering databases, alarm monitoring, FusionCompute, audit, and protocol policies.

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- The ITA serves as a Tomcat-based web service. The ITA provides unified interfaces for the upper layer IT Portal and interfaces for the underlying HDC, FusionSphere, VMs, and DNSs.

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TC

- A TC is a terminal used for desktop access. It is a mini PC.
- The TC supports Linux and Windows WES OSs and also supports HDP- or RDP-based clients for user access.
- When a user clicks a VM on the WI, the user can be automatically connected to the VM through an HDP-enabled terminal.

Specifications	CT3100	CT5000	CT6000	Sunniwell S-Box 8V40
Net weight	0.2 kg (0.441 lb)	0.48 kg (1.06 lb)	1.62 kg (3.57 lb)	0.35 kg (0.77 lb)
Power consumption	< 6 W	< 14.52 W	< 11.42 W	< 6 W
CPU	ARM Cortex A9 1.5 GHz dual-core	AMD T40N 1.0 GHz dual-core	Intel D2550 1.86 GHz	ARM Cortex A9 1.5 GHz dual-core
Memory	1024 MB DDR3	2 GB DDR3 (maximum memory size: 4 GB)	2 GB DDR3 (maximum memory size: 4 GB)	1024 MB DDR3
OS	Linux	WES7 Linux	WES7 Linux	Linux
Display port	Supports extended dual-screen display. DVI+VGA: 1920 x 1200	Supports extended dual-screen display. DVI+VGA: 1920 x 1200	Supports extended dual-screen display. DVI+VGA: 1920 x 1200	Supports extended dual-screen display. DVI+VGA: 1920 x 1200
Application scenario	Common office and video playback	Secure office	High-performance graphics processing	Common office and video playback
Vendor	Huawei	Huawei	Huawei	Sunniwell (resold by Huawei)
Others	Provides four USB ports.	Configured with Radeon HD 6200 series graphics cards.	Provides various ports: 6 x USB + 1 x COM + 1 x LPT Support for serial and parallel ports depends on desktop protocols.	Provides five USB ports.

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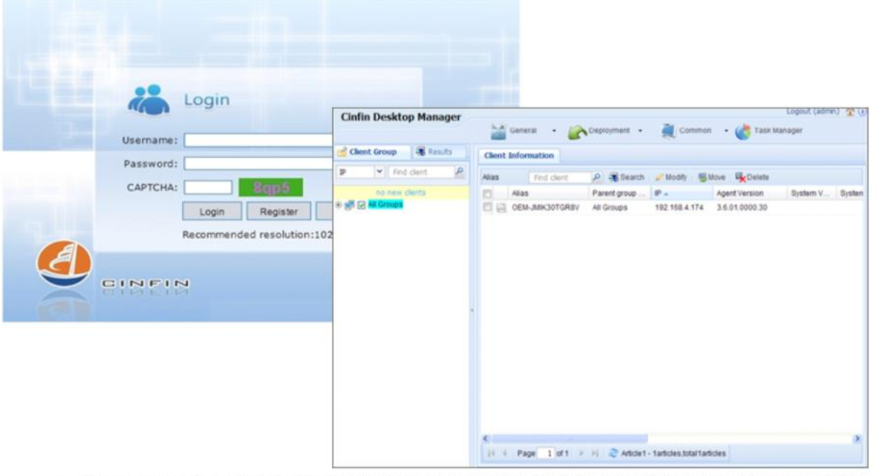
- This is a typical description about Huawei TCs. Different models provide different processing capabilities, ports, and other features. Users can choose models based on specific scenarios. Some TC OSs can be hardened, such as blocking the operation interface of the OS and forbidding the use of USB flash drives.

TCM



- A management server provides centralized management for TCs, including version upgrade, status management, information monitoring, and log management.
- The management server can detect TCs to be managed automatically and manage them.

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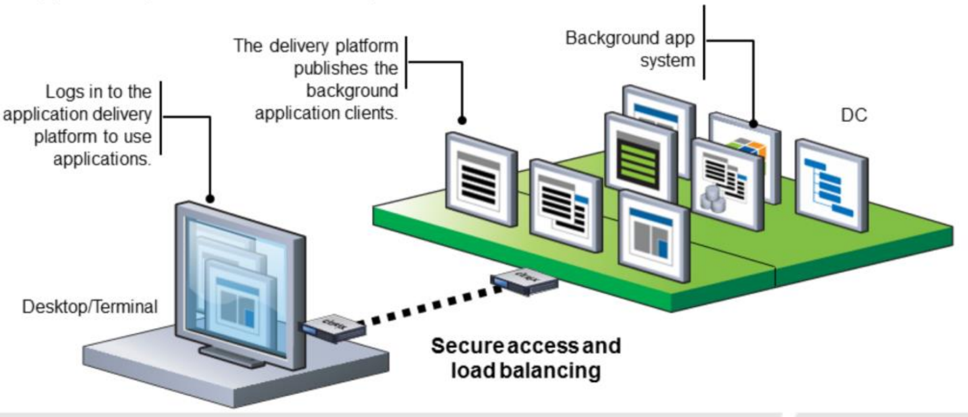
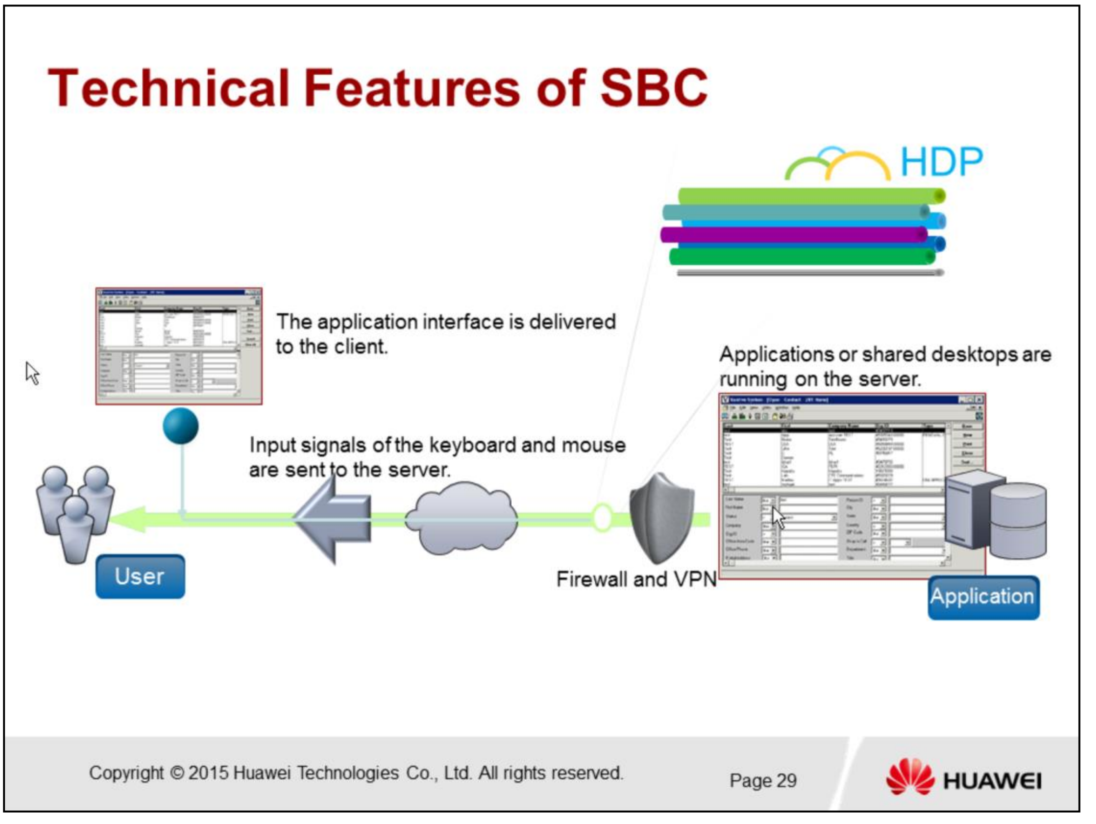
SBC

- **Server-based computing (SBC):** publishes the application system clients (such as the OA and core services) that are installed on the background server to the virtual delivery platform. When a user logs in to the platform to access a certain background application, the application system client runs on the platform, not on the user's local terminal.





- All applications are installed on the application server. Applications are sent to the client as streams and displayed on the client.

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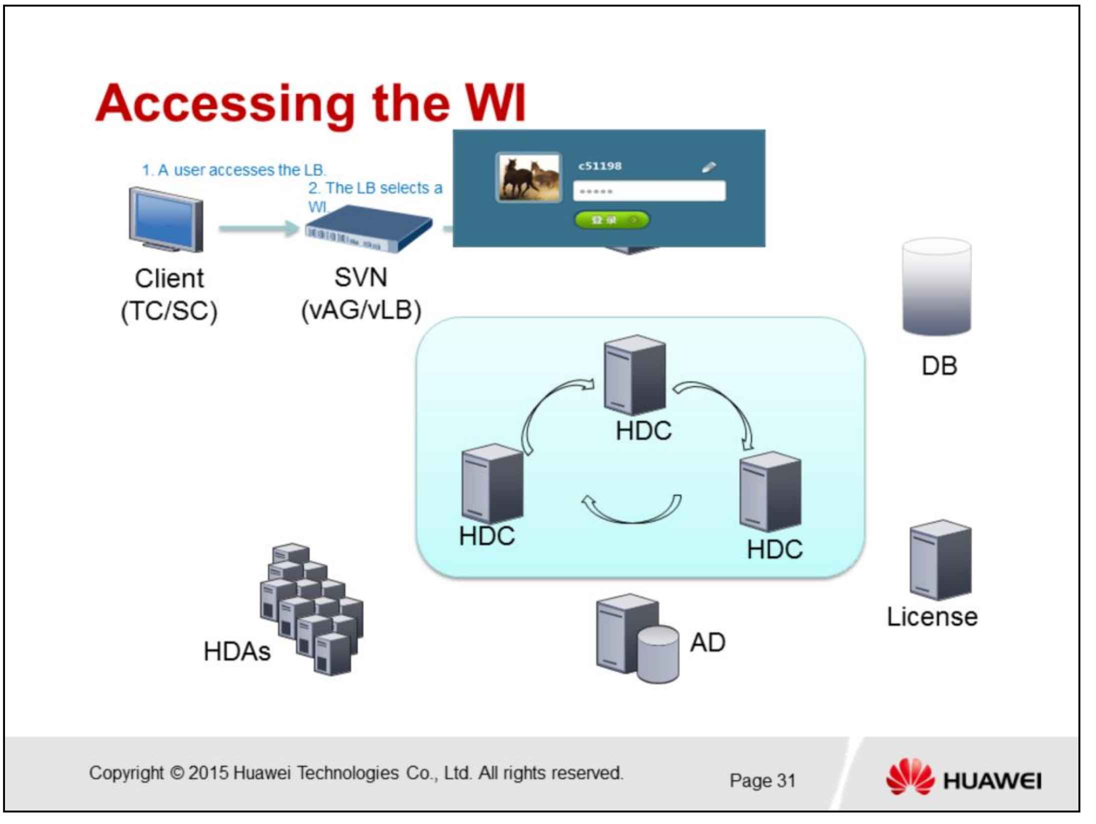
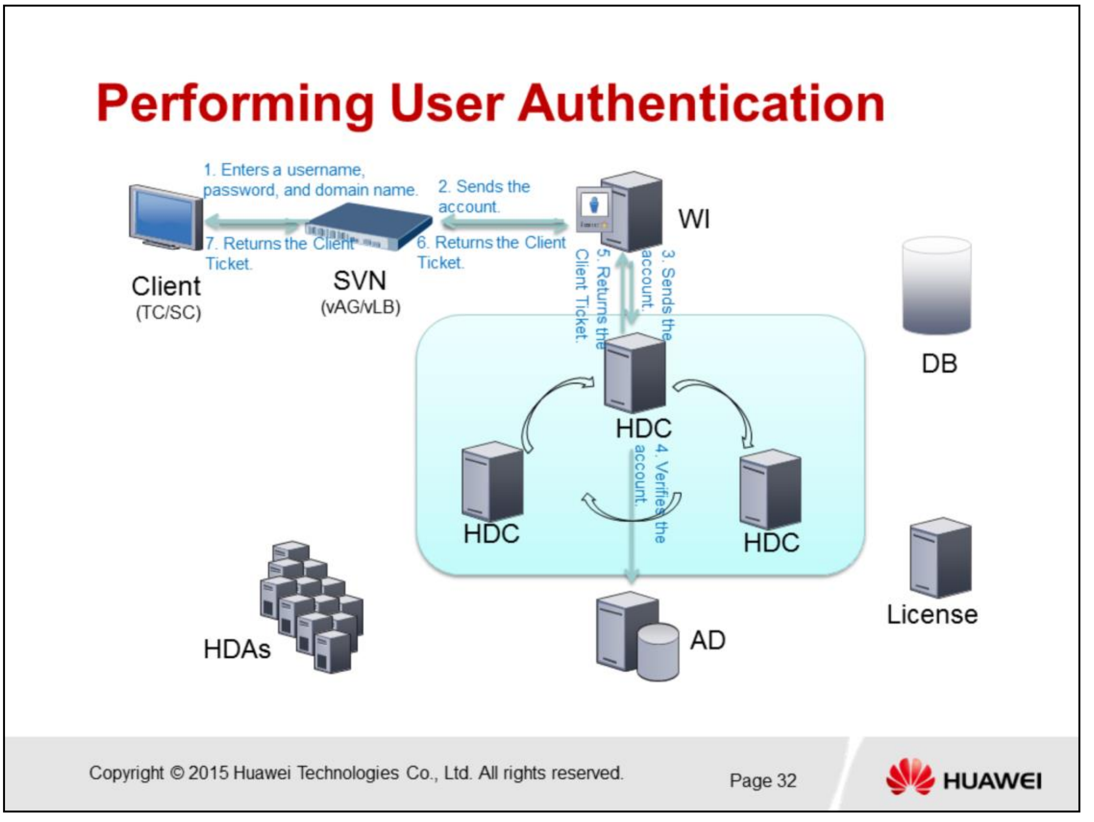
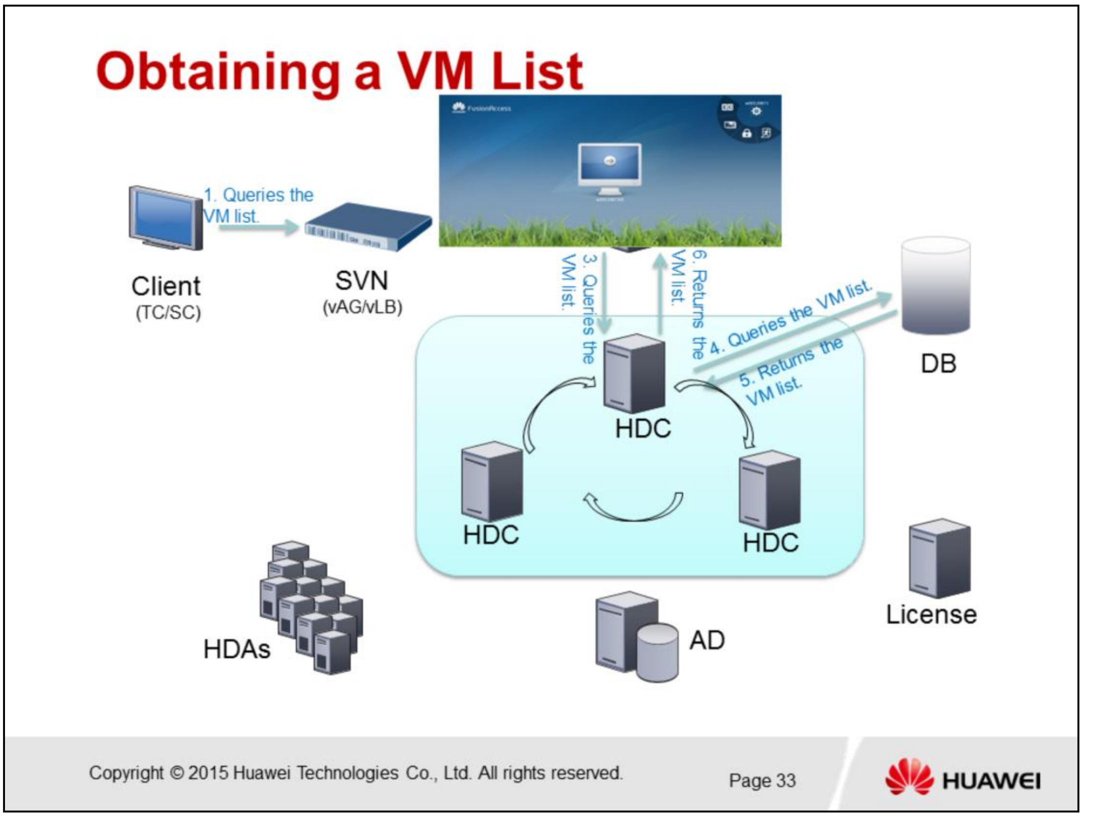


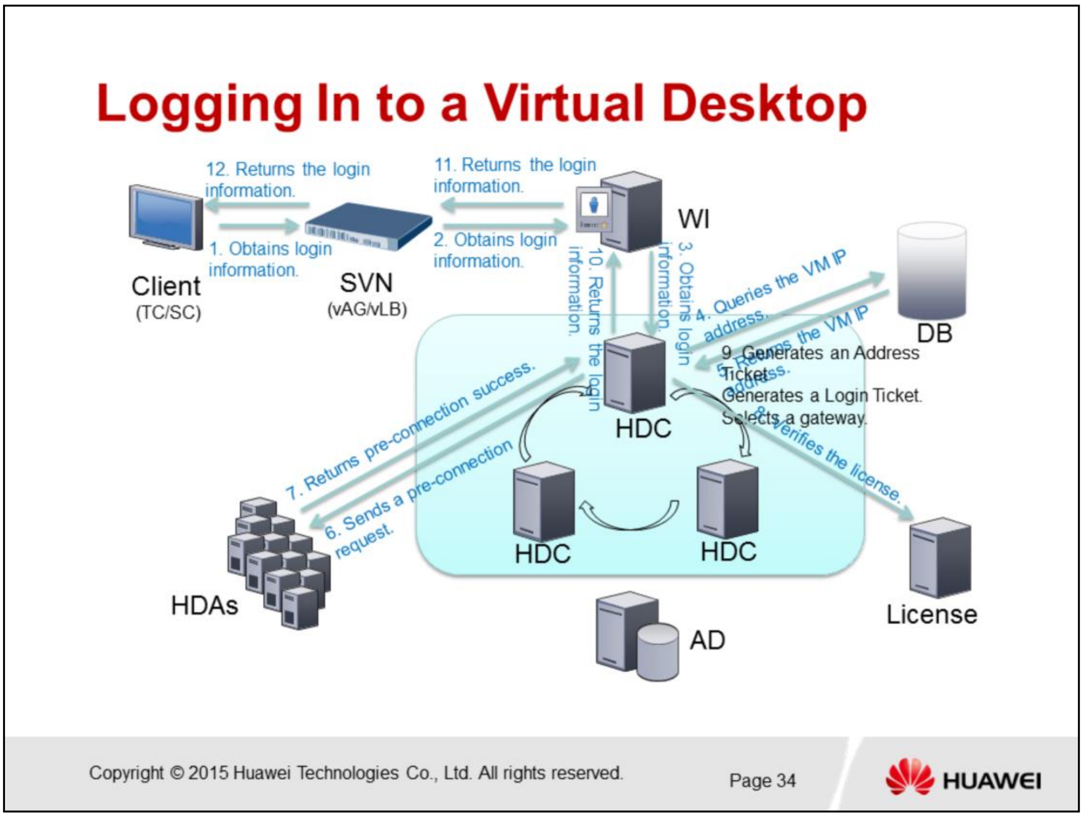
- The client accesses the LB by using the LB domain name. After receiving the access request, the SVN (LB) distributes the request to a WI based on the load balancing algorithm. The WI returns a login page to the client.
- If the SVN or vLB is not deployed, the client directly accesses the WI. In this case, load balancing can be implemented between two WIs by configuring the round robin DNS.



- A user enters the username, password, and domain name (may be a default value) on the WI login page and clicks **Login**. The WI sends the account information to the HDC. Then the HDC authenticates the domain account on the AD.



- After the domain account passes AD authentication, the HDC queries the VM list in the database and returns the VM list to the WI. The WI displays the VM list to the client.

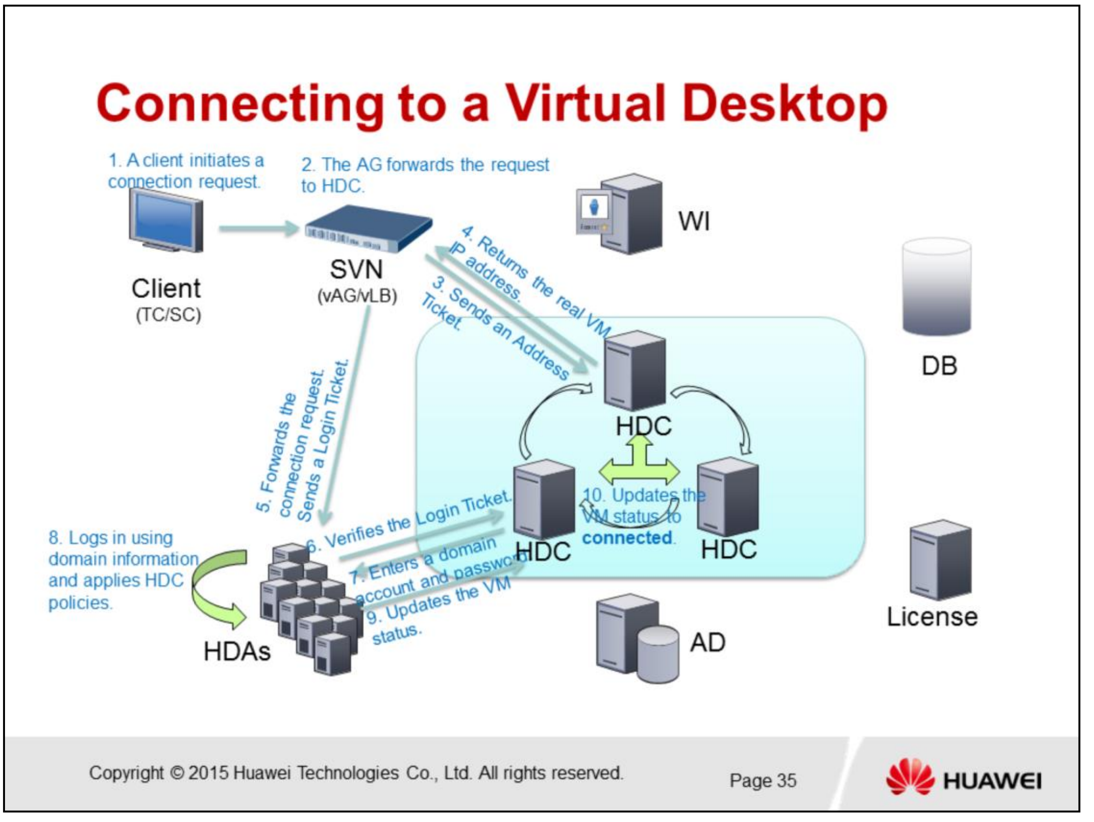


- The login information includes the Address Ticket, Login Ticket, and the IP address and port of the gateway.
- A user clicks a VM from the VM list to log in. The login request is sent to the WI.
- The WI obtains login information from the HDC, including the Address Ticket (VM IP address for intranet access), Login Ticket, and Launch Reference.
- 1. The WI sends a request for querying login information to the HDC.
- 2. The HDC queries the username, password, domain name, IP address, and reference of the VM in the database and returns the information to the WI.

(If the VM is not started or unregistered, the HDC returns an exception to the WI. Then the WI sends a VM start message to the WIA and the WIA notifies FusionSphere to start the VM.)

- 3. The WI determines an intranet or extranet connection based on its configuration information. For an intranet connection, the WI sends the username, password, and domain name to the STA to obtain a Login Ticket. For an extranet connection, the WI sends the username, password, domain name, and IP address of the VM to the STA to obtain a Login Ticket and an Address Ticket.
- 4. The WI puts the VM IP address (or Address Ticket), Login Ticket, and Launch Reference (indicates the validity period of a connection) in a login file based on a

template and sends the login file to the client.



- The HDP client installed on the TC or SC parses the login information and initiates a connection request. For an extranet connection, the login information contains the AG information of the SVN and the connection request is sent to the AG. For an intranet connection, the login information contains the VM IP address and the client directly connects to the VM based on the VM IP address.
- When the SVN (AG) receives the connection request, it does not know the IP address of the VM to be connected. Therefore, the SVN sends the Address Ticket to the HDC to obtain a real VM IP address. After obtaining the real VM IP address, the SVN (AG) sends the connection request to the HDA of the VM.
- After receiving the connection request, the HDA needs to verify the Login Ticket and license. If verification succeeds, the HDA logs in to the VM.
- Login Ticket verification:
- The HDA obtains the Login Ticket from the request and sends the Login Ticket to the HDC by using the HDC ITicketing interface through which the HDA is registered.
- Then the HDC sends the Login Ticket to the STA to obtain the username, password, and domain name and returns the information to the HDA.
- License verification:
- The HDC sends a request for querying whether any available license exists to the License Server. The License Server checks the current usage of license and returns the

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result.

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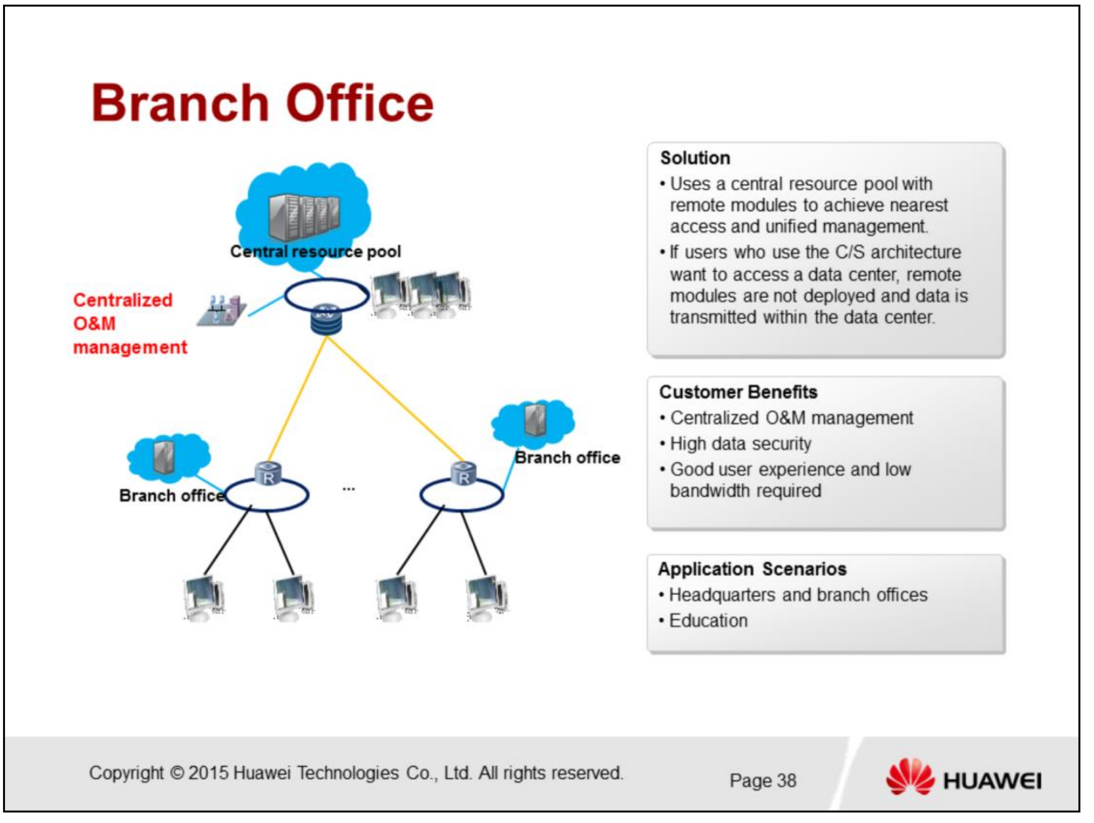
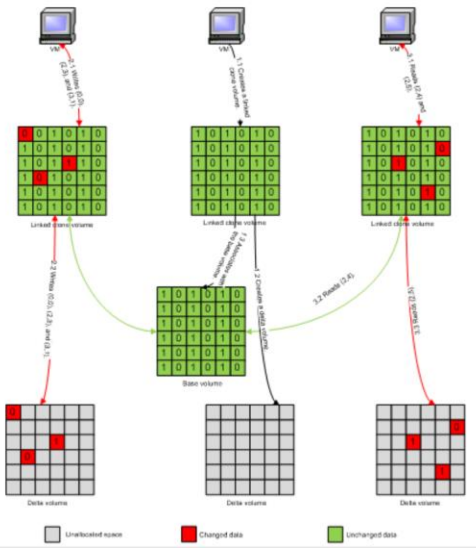


- Each enterprise, apart from its headquarters, has many branch offices. For the branch desktop cloud, TCs can be deployed in branch offices. In the desktop cloud solution for the branch, service systems are deployed in the branch. This ensures sufficient bandwidth and short latency, offers good user experience, and lowers requirements for the network between the headquarters and the branch.
- The branch office feature supports the centralized O&M of dispersed virtual desktops, including hardware management and monitoring, virtual resource management and scheduling, unified alarming, unified operation logging, SSO, and TC management.
- The branch office feature supports the centralized provisioning of virtual desktops, provisioning services for branch offices in a unified manner.
- Services and maintenance operations in a branch are not affected when the network between the headquarters and the branch is interrupted.
- A maximum of 20,000 VMs of branch offices can be centrally managed. Up to 256 branch offices are supported. Each branch office supports up to 500 VMs. Sub-branches are not supported. The network bandwidth between the headquarters and the branch office must be higher than 2 Mbit/s. Only one VM in a branch office can be logged in using virtual network computing (VNC) on the management portal, because VNC login occupies 1.5 Mbit/s to 2 Mbit/s bandwidth.

Linked Clone



- The data in the base volume and the data in the delta volume constitute the data of the cloned VMs. The linked clone technology reduces VM creation duration and disk space usage.

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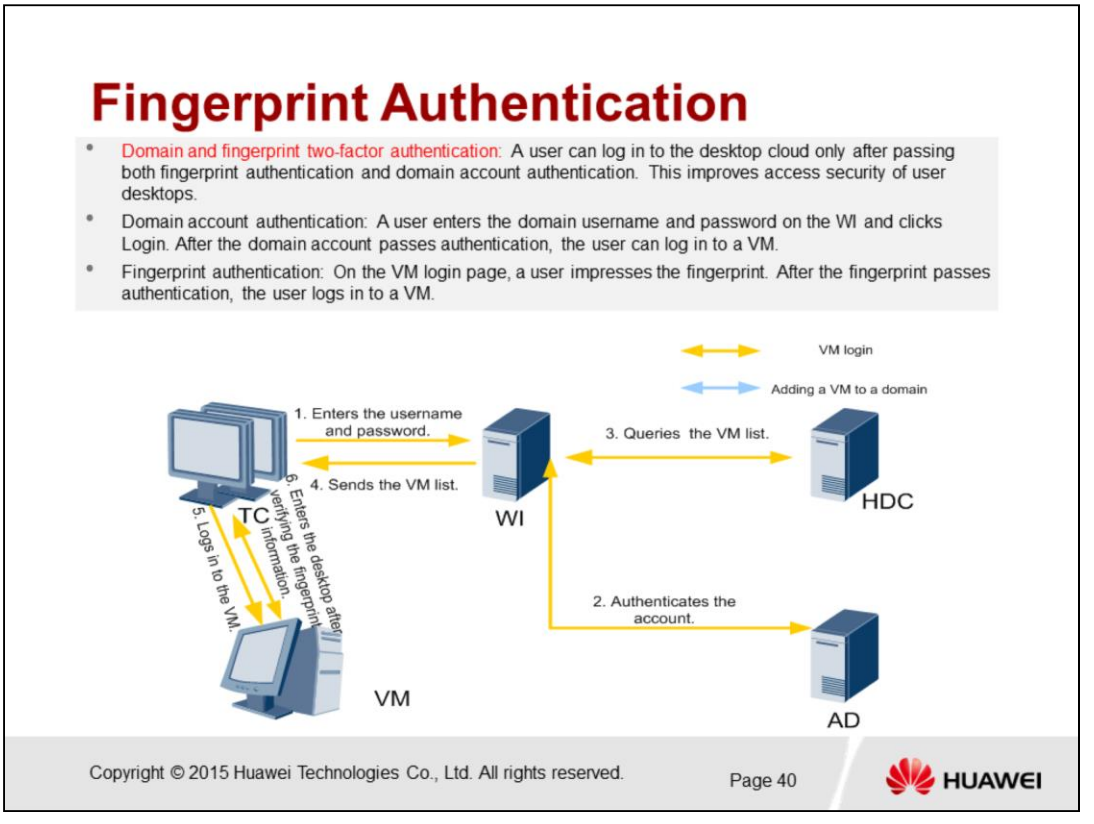
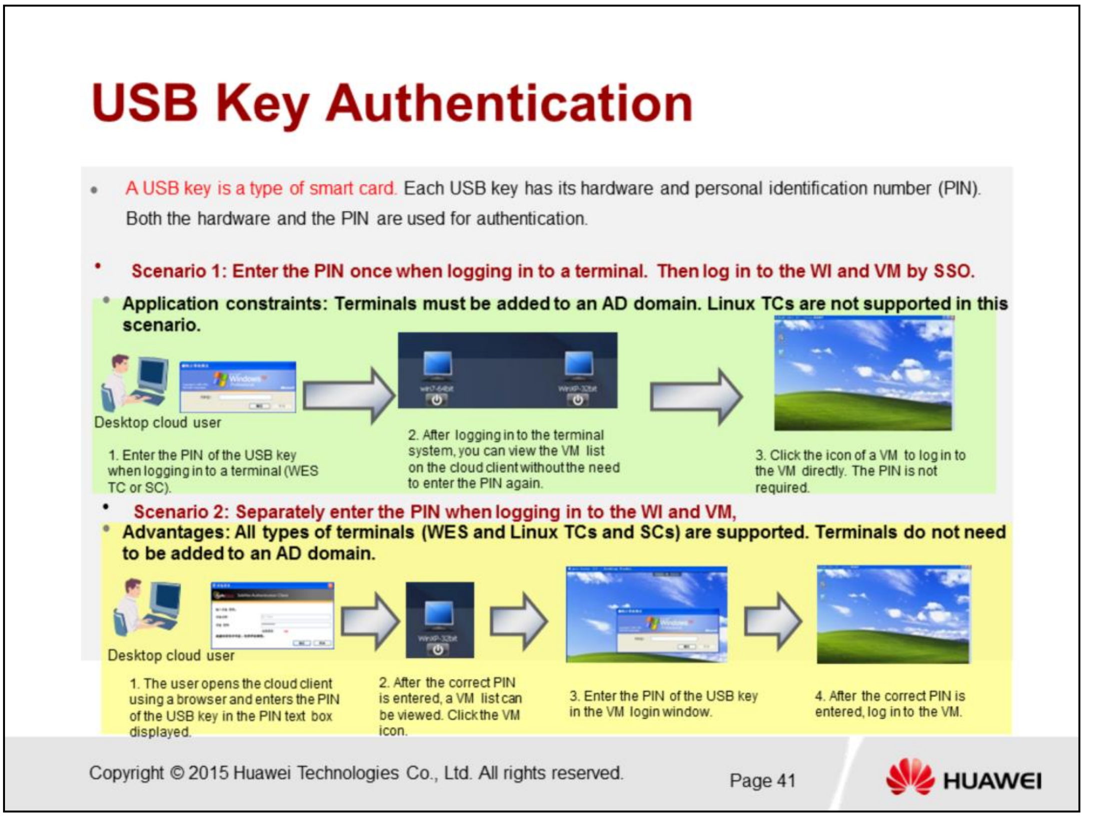
- A shared read-only base volume provides the VM OS and space for VMs to store personalized data. This reduces required system disk space. The linked clone desktop pool provides unified software update and system recovery functions. This greatly reduces maintenance costs and improves desktop maintenance efficiency.

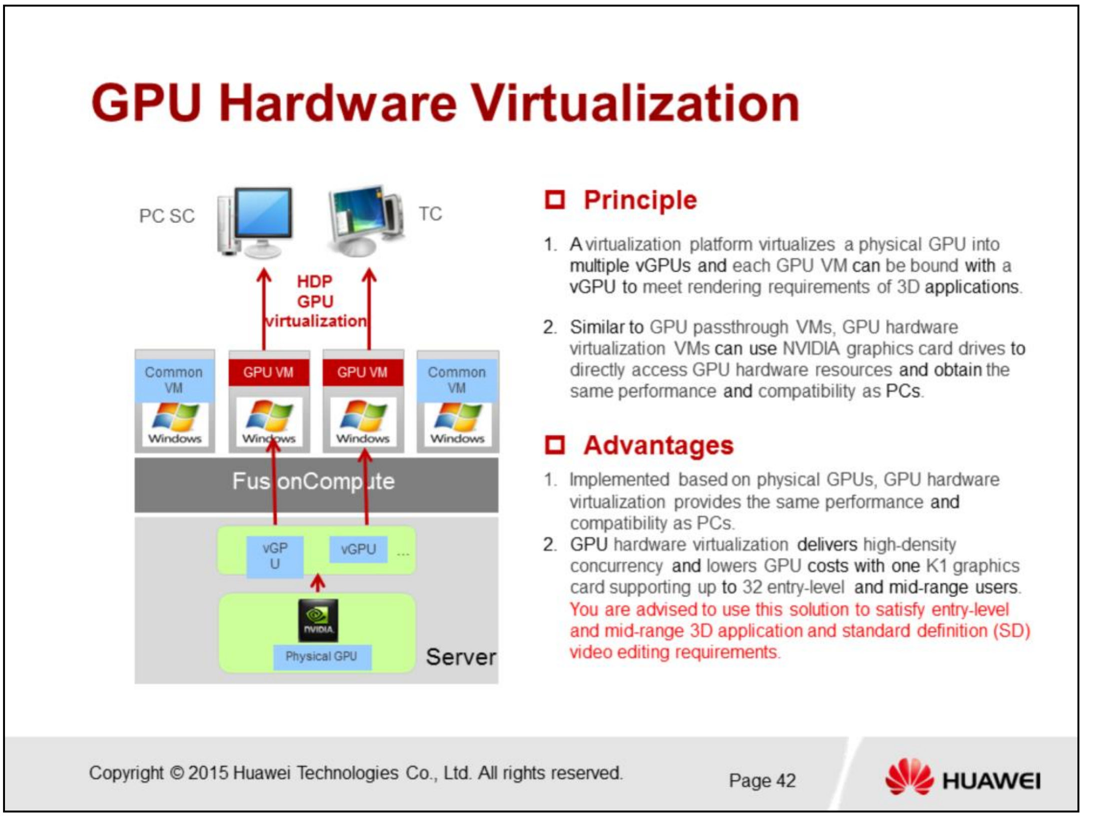


- Fingerprint authentication can greatly improve user access security. Fingerprint authentication applies to virtual desktop logins and virtual application access.
- Domain and fingerprint two-factor authentication
- Before logging in to a virtual desktop using the fingerprint, you need to register or modify the fingerprint on the WI login page. Fingerprint information is encrypted and stored on VMs and the fingerprint information of only one user can be registered on each VM. A maximum of 10 fingerprints can be registered for each account.
- The desktop cloud also supports the fingerprint and domain account two-factor authentication function. A user can log in to the desktop cloud only after passing both fingerprint authentication and domain account authentication. This improves access security of user desktops. The user first enters the domain username and password on the login page. After the username and password are authenticated, the user impresses the fingerprint and logs in to the VM if the fingerprint is also authenticated.
- Application system authentication
- When the fingerprint authentication is used for application system authentication, the desktop management system maps the fingerprint device to the virtual desktop system. You need to install the required fingerprint driver and software on the virtual desktop system. The management of fingerprint scanners and the binding of applications are performed by the software of the virtual desktop system. The

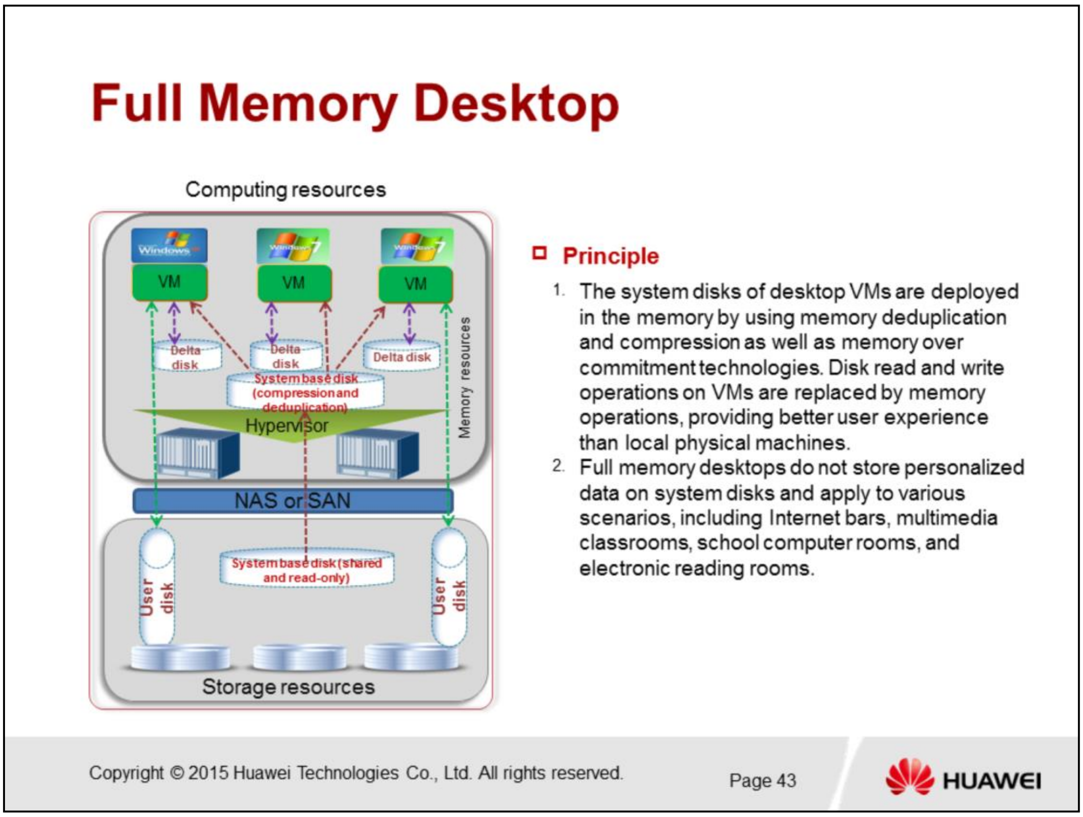
fingerprint encryption data is stored in the user virtual desktop system.



- After the USB key is bound with an account, the USB key can be used for virtual desktop login authentication, improving access security. SSO is supported.

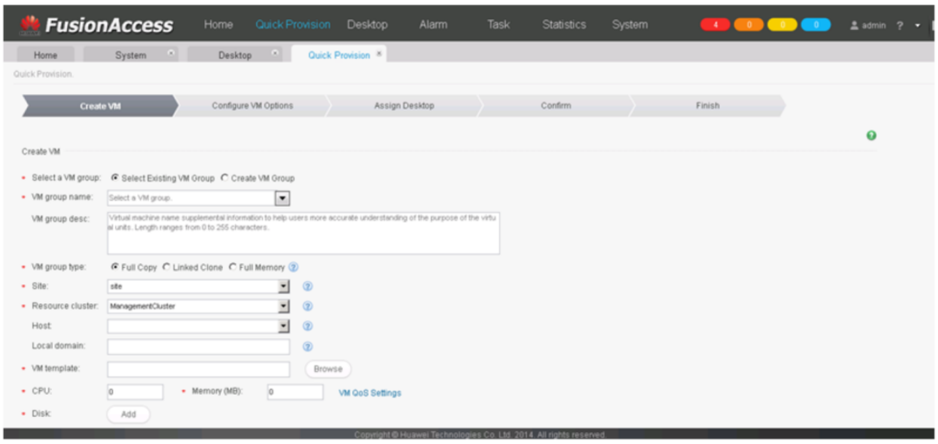


- Currently, only NVIDIA K1 and K2 graphics cards support GPU hardware virtualization. Each CH221 blade or RH2288 V2 server supports one K1 or K2 graphics card.
- The RH2288H V2 appliance does not support GPU hardware virtualization.
- GPU hardware virtualization VMs do not support high availability (HA).



- Full memory desktops not only have the advantages of linked clone desktops, but also have high read/write performance. On full memory desktops, VMs can be started or restarted quickly.
- Full memory desktops support unified VM template deployment, update, and restoration.
- Full memory desktops can be quickly created and provisioned in batches.

Quick Provisioning of Virtual Desktops



VMs are created and provisioned by using a unified process. Multiple types of VMs can be created and assigned in multiple modes.

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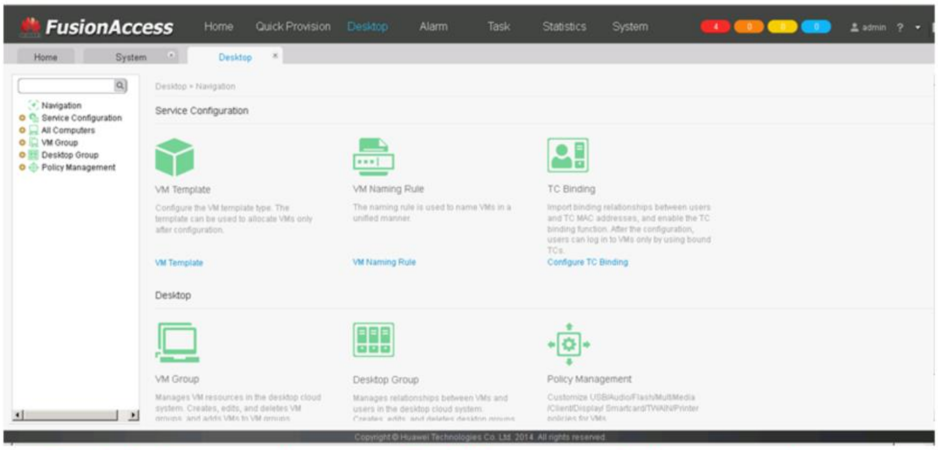
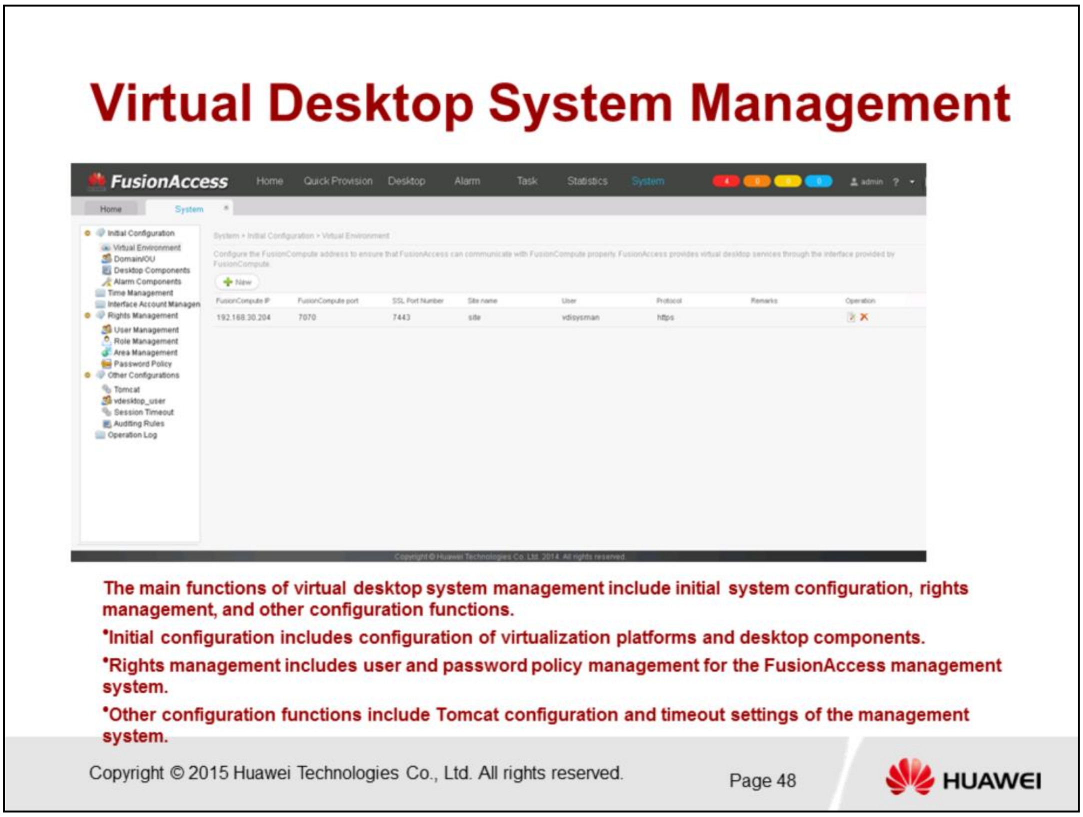
- Quick provisioning of virtual desktops includes VM creation and assignment (binding).
- Multiple types of VMs can be created, including full copy VMs and linked clone VMs.
- You can set the VM specifications, networks, disks, and naming rules during VM creation.
- VMs can be assigned in one-to-one mode or pool mode. User information can be imported.

Virtual Desktop Management



Virtual desktops can be managed by VM group or desktop group. You can start or restart VMs in batches. You can also restore VMs with one click or safely delete VMs by using advanced functions.

- VM group: Each VM belongs to a VM group. The VM group information includes the VM group name, type (full copy or linked clone), and description.
- Desktop group: Each VM belongs to a desktop group. The desktop group information includes the desktop group name, type (private or static pool desktops), and description.



- Other functions of the FusionAccess management system:
- Task center: A task is a system operation. All tasks are recorded and managed in the task center. Scheduled tasks are supported.
- Statistics report: Resource statistics cover VM information and usage information. VM information statistics collect data about VM performance and registration exceptions. VM usage statistics collect information about the use status of VMs, such as the number of online users, user online duration, and user login information.
- Operation logs: record system operations of administrators.

Summary

- FusionAccess architecture and components
- Basic FusionAccess service processes
- Basic FusionAccess features

Questions

- What components are used in FusionAccess? What are their functions?
- What are the features of FusionAccess?
- What are the main functions of FusionAccess?

Exercises

- True or False
  1. FusionAccess is a virtual desktop control system developed by Huawei. It is mainly used to create and provision virtual desktops. ( )
- Multiple choice questions
  1. Which are main components of FusionAccess? ( )

     A. AD, DHCP, and DNS

     B. LB and AG

     C. HDC

     D. WI and ITA

- Answers:
- True or False: 1. T
- Multiple choice questions: 1. ABCD

Acronyms and Abbreviations

SSL: Secure Sockets Layer

VDI: virtual desktop infrastructure

TC: thin client

AD: activity directory

DHCP: Dynamic Host Configuration Protocol

DNS: domain name system

DB: database

SC: software client

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Chapter 8
FusionCloud Solution
Deployment
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Objectives

- Upon completion of this course, you will be able to:
  - Know the deployment process of Huawei FusionCloud Solutions.
  - Know the solution planning and design.
  - Be familiar with hardware configuration.
  - Be familiar with software deployment.
  - Be familiar with service data configuration.

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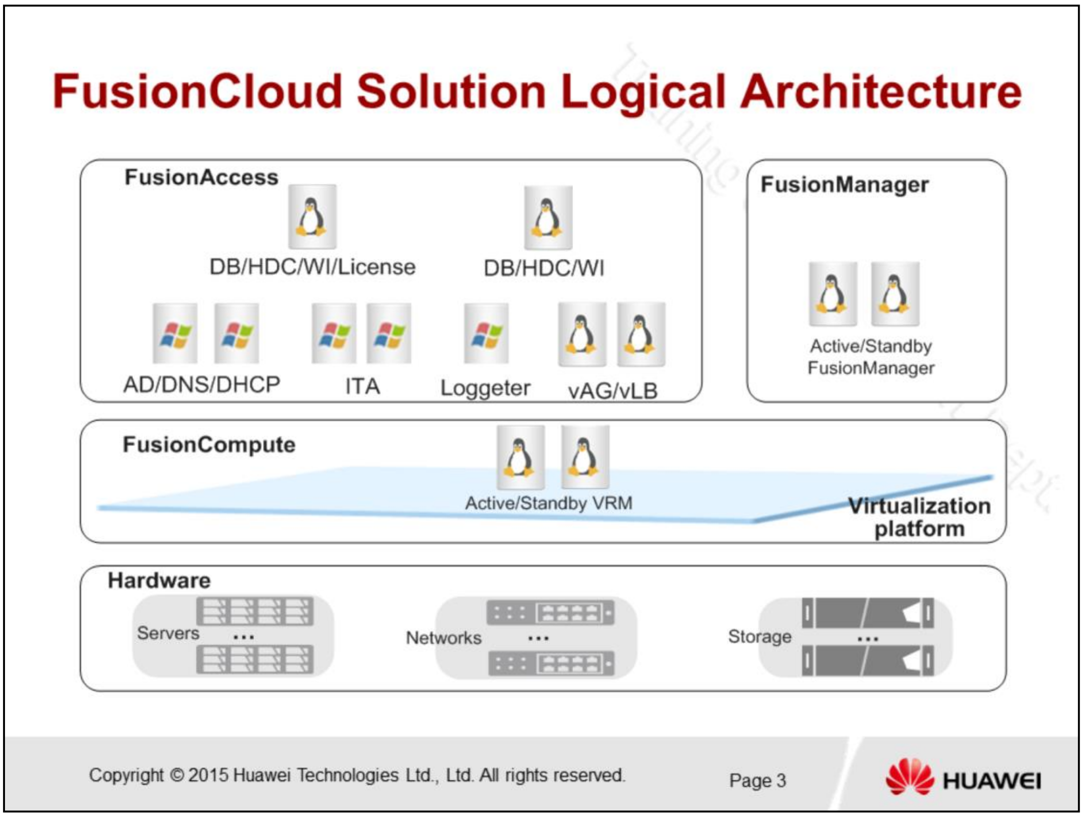
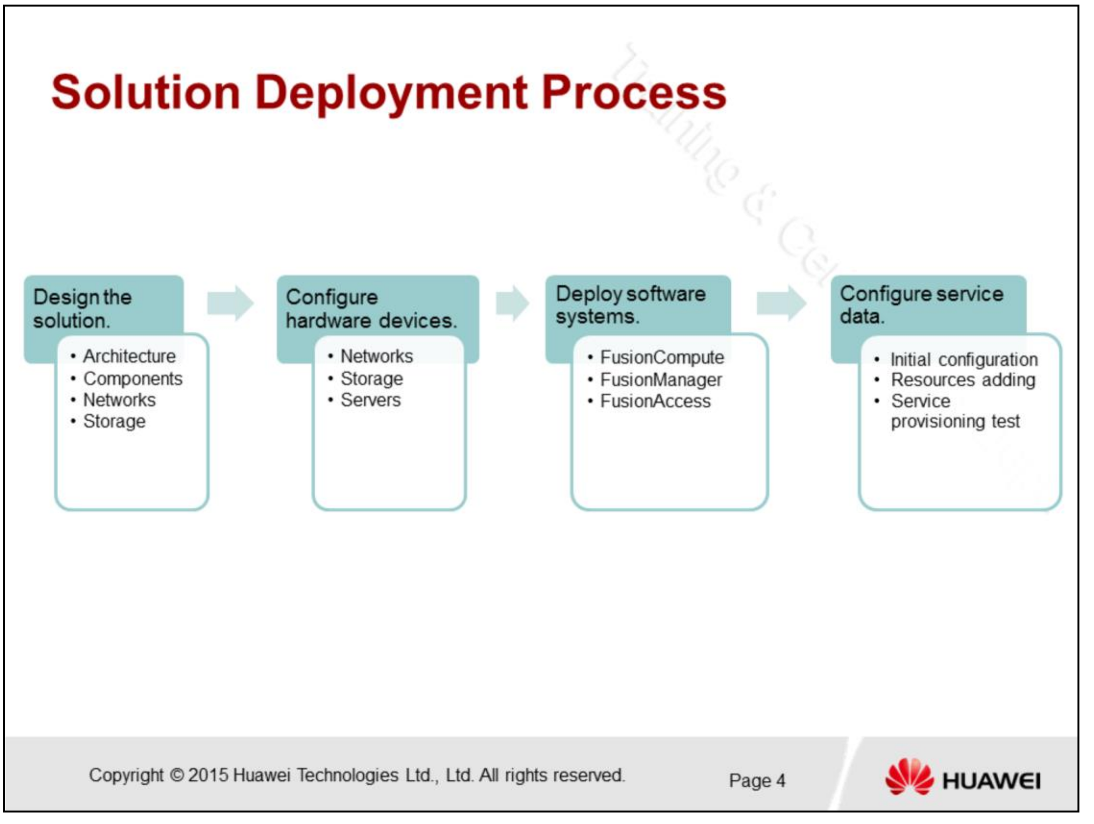


- Huawei FusionCloud Solutions mainly consist of FusionCompute, FusionManager, and FusionAccess.
- FusionCompute is deployed on the underlying hardware. You are advised to deploy VRM nodes in active/standby mode using VMs
- You are advised to deploy FusionManager in active/standby mode using VMs.
- FusionAccess consists of multiple components, and all of them are deployed using VMs. Except for Loggeter, components are all deployed in active/standby mode.



- Solution design: Plans data for the management plane, storage plane, and service plane, designs system deployment modes and required network data, and plans nodes and data of software systems.
- Hardware installation: Configures hardware devices to meet virtualization software deployment requirements, and ensures communication among devices of different network planes.
- Software deployment: Deploys FusionCompute, FusionManager, UltraVR, HyperDP, and other software as required.
- Service data planning: Creates VMs of required specifications, adds domain users, configures VM and desktop groups as required.

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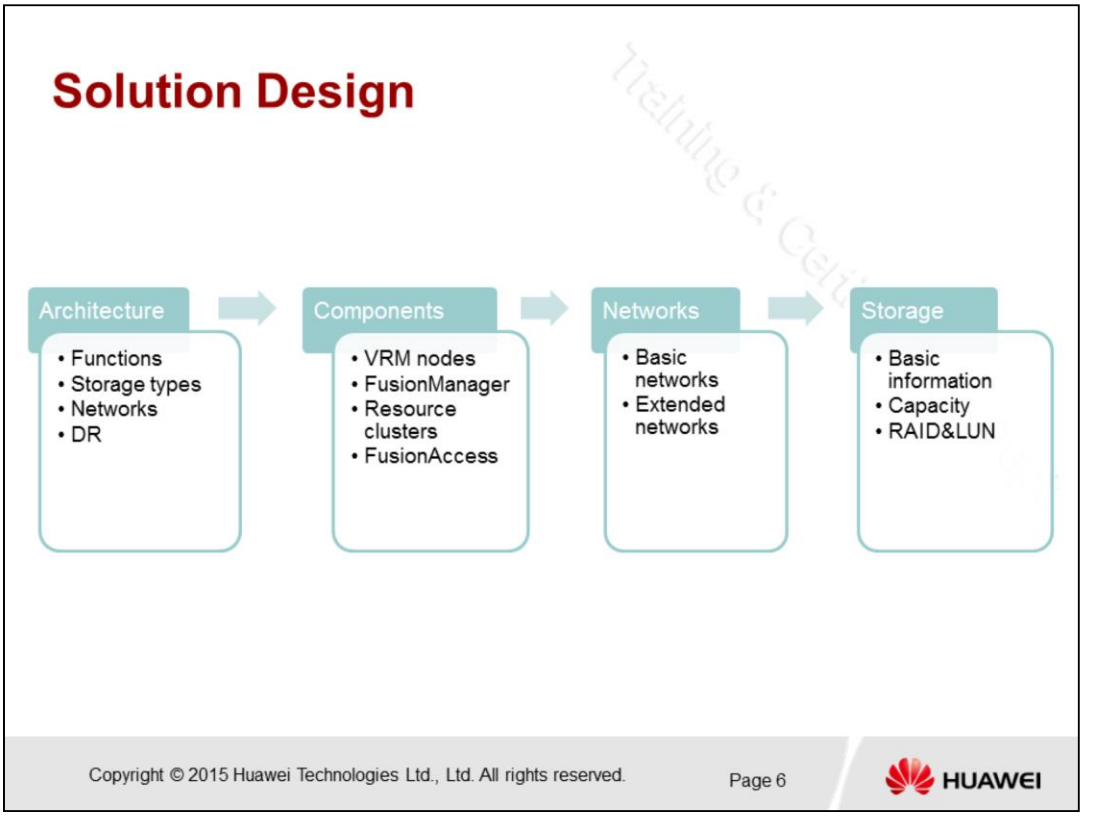
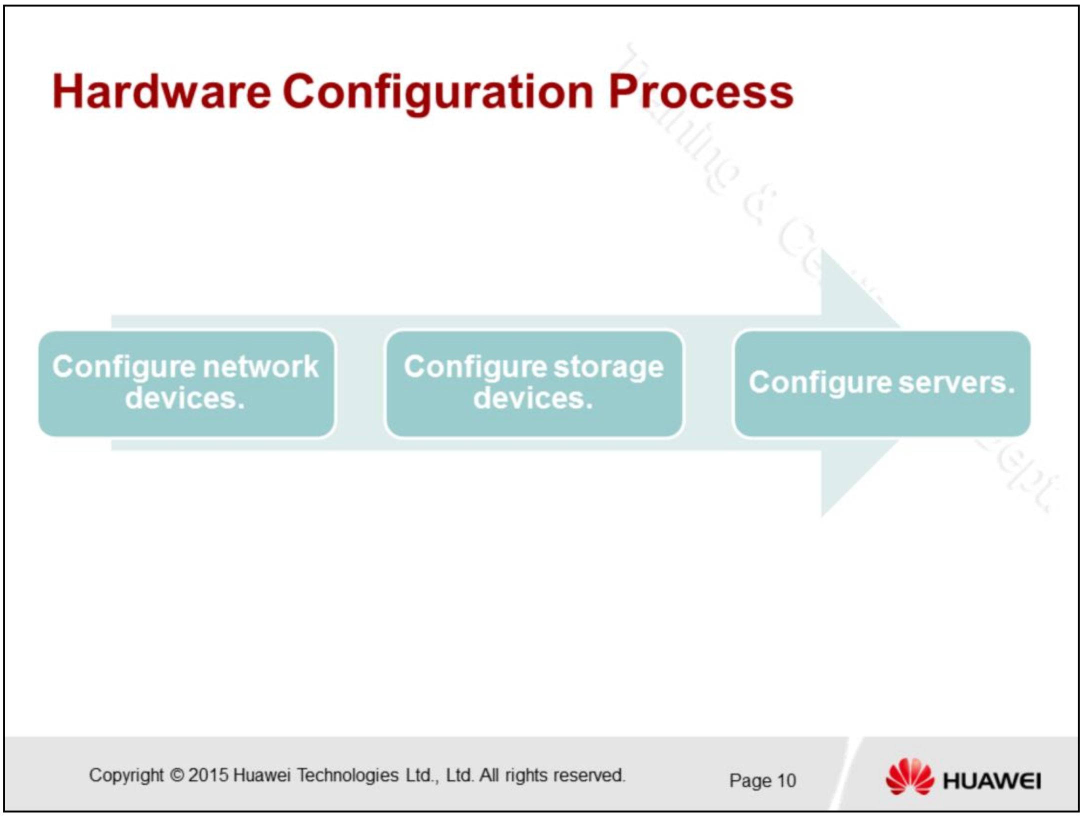


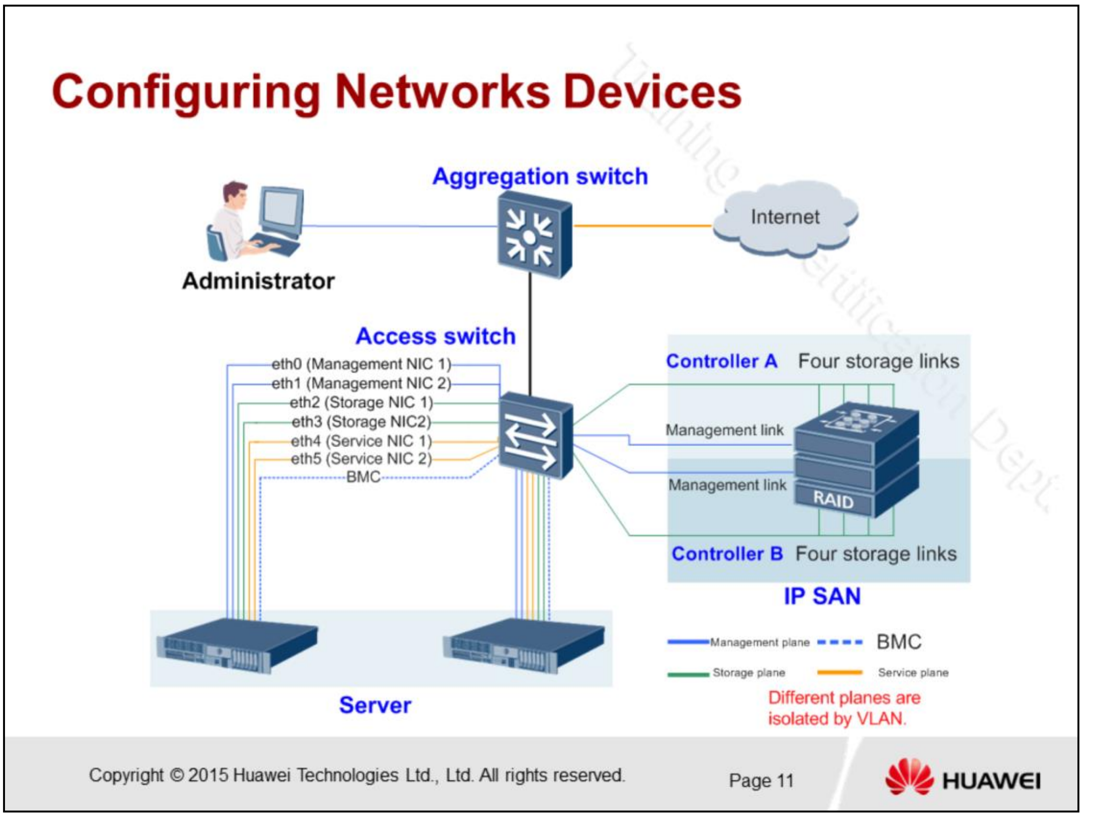
- The architecture design plans requirements of all components and specifies necessary components.
  - Functions: Specifies whether FusionCompute, FusionManager, FusionAccess, UltraVR, HyperDP, and a third-party O&M system are required.
  - Storage types: Specifies whether storage is required and the storage type to use, such as FC SAN, IP SAN, or FusionStorage. Specifies the storage networking type, such as GE, 10 GE, or FC and whether old storage devices are used.
  - Networks: Specifies the networks required, such as the BMC plane, management plane, storage plane, service plane, backup and DR plane, and external networks.
  - Backup and DR: Specifies whether HyperDP, UltraVR, and VIS are required.

Contents

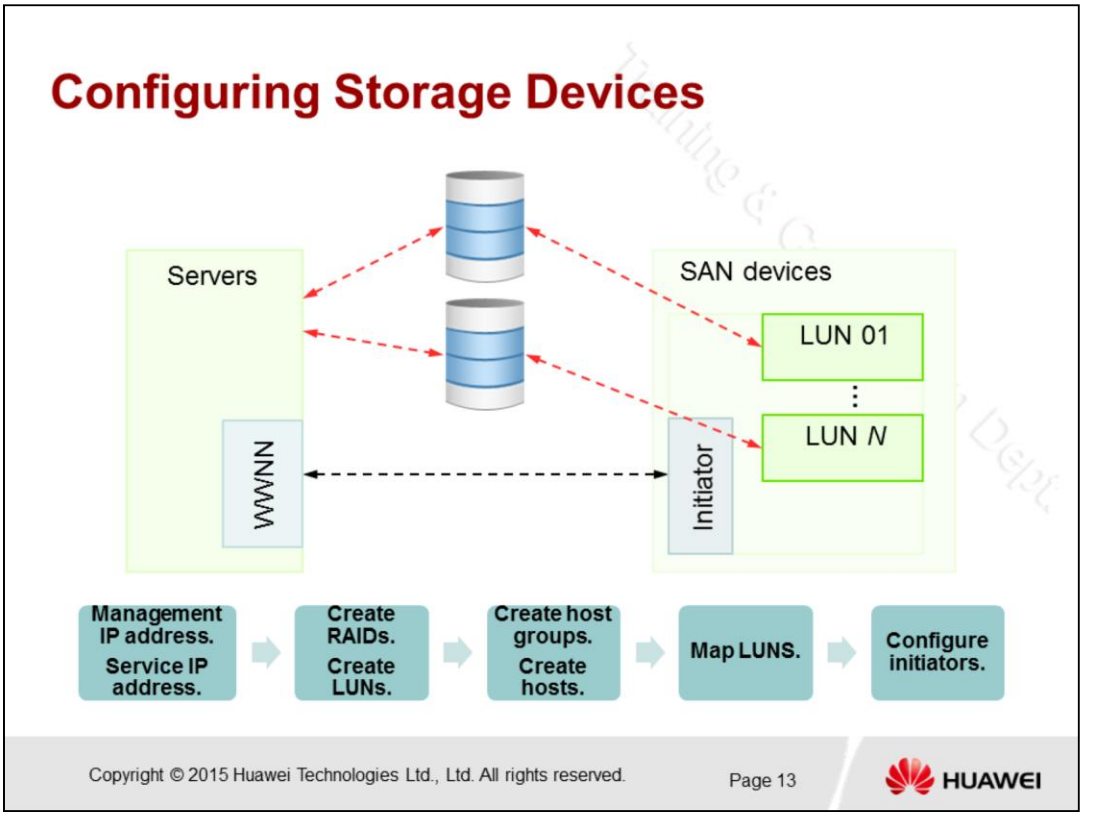
- Overview
- Solution Planning and Design
- **Hardware Configuration**
- Software Deployment
- Service Data Configuration



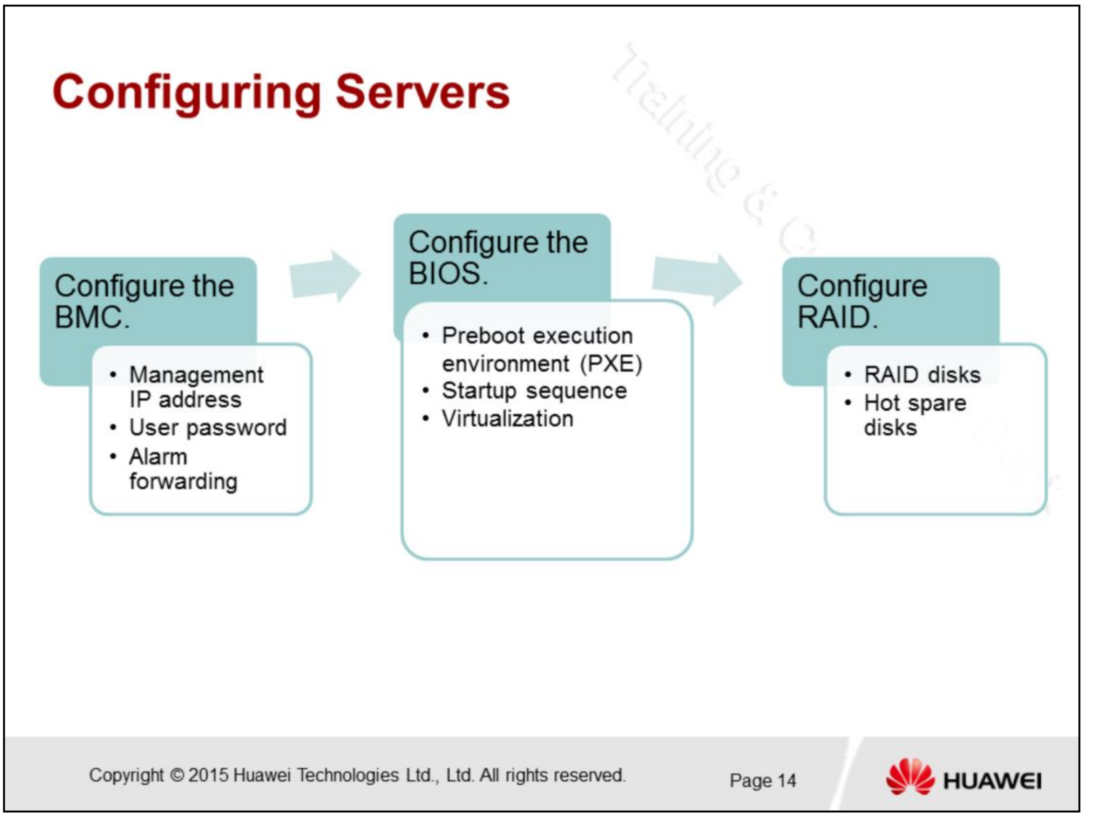
- Network configuration: Log in to the switch, configure VLAN and VLANIF, and configure ports as planned, ensuring communication within each plane and isolation among planes.
- Storage configuration: Log into the Integrated Storage Manager (ISM) and perform the following operations:
  - Configure the management IP address and service IP address.
  - Create a RAID group and divide LUNs.
  - Create hosts and a host group.
  - Map LUNs to hosts or the host group.
- Server configuration: Log in to the server and configure BIOS and RAID.



- The BMC plane: Specifies the network plane used by the host BMC network port. If the management plane and the BMC plane on the VRM node can communicate with each other, they can be combined as one.
- The management plane: Used by the management system for managing all nodes in a unified manner and managing planes used for communication among nodes.
  - The following IP addresses use the management plane:
    - Management IP addresses of all hosts, that is, IP addresses of the management network ports on hosts.
    - IP addresses of VMs deployed on the management node.
    - IP addresses of storage device controllers.
  - You are advised to configure the eth0 port on a host as the management network port. If a host has more than four network ports, configure both eth0 and eth1 as management network ports, and bind them as a pair of active/standby ports after FusionCompute is installed.



- The general storage device configuration process is as follows:
  - Connect storage management ports to the switch management plane and configure IP addresses of related management network segments. Connect storage service ports to the switch storage plane and configure IP addresses of planned storage segments.
  - Create RAIDs and set their names, levels, number of disks, and hot spare disks.
  - Create hosts and host groups.
  - Map LUNs to each host and host group.
  - Configure initiators for hosts and host groups (Initiator are configured after the storage has been added to FusionCompute).
- Data Store Requirements
  - One data store can be added to only one FusionCompute. If it is added to different FusionCompute systems, its data will be overwritten.
  - When using a data store provided by shared storage, add the data store to all hosts within one cluster to ensure that VMs can be migrated within the cluster.
  - To deploy management nodes on VMs, ensure that the data stores to be used by the VMs meet the requirements for the VM disk space.



- BMC: Configure the IP addresses of the planned BMC segments.
- BIOS: Configure PXE and Boot Order and enable the CPU virtualization function, such as VT-x.
- RAID: Configure local disks as RAID.
- In the FusionSphere solution, requirements for server hardware are as follows:
  - CPUs must support virtualization technology provided by Intel or AMD.
  - To ensure smooth VM migration among hosts, you are advised to employ CPUs of the same model within a cluster.
  - The memory size is greater than or equal to 8 GB. If a host is used for deploying management node VMs, its memory must be greater than or equal to 3 GB.
- You are advised to enable Hard disk, Network, and CD-ROM as boot devices on servers. Use Network to start the server for batch deployment. Use CD-ROM to start the server for small-scaled deployment. After the installation is complete, configure servers to start from Hard disk by default.
- Configure local disks as RAID 1 to install the OS and service software on the server and improve data reliability. You are advised to configure local disk 1 and 2 as RAID 1 and reconfigure 1 to 2 hot spare disks to prevent data loss.

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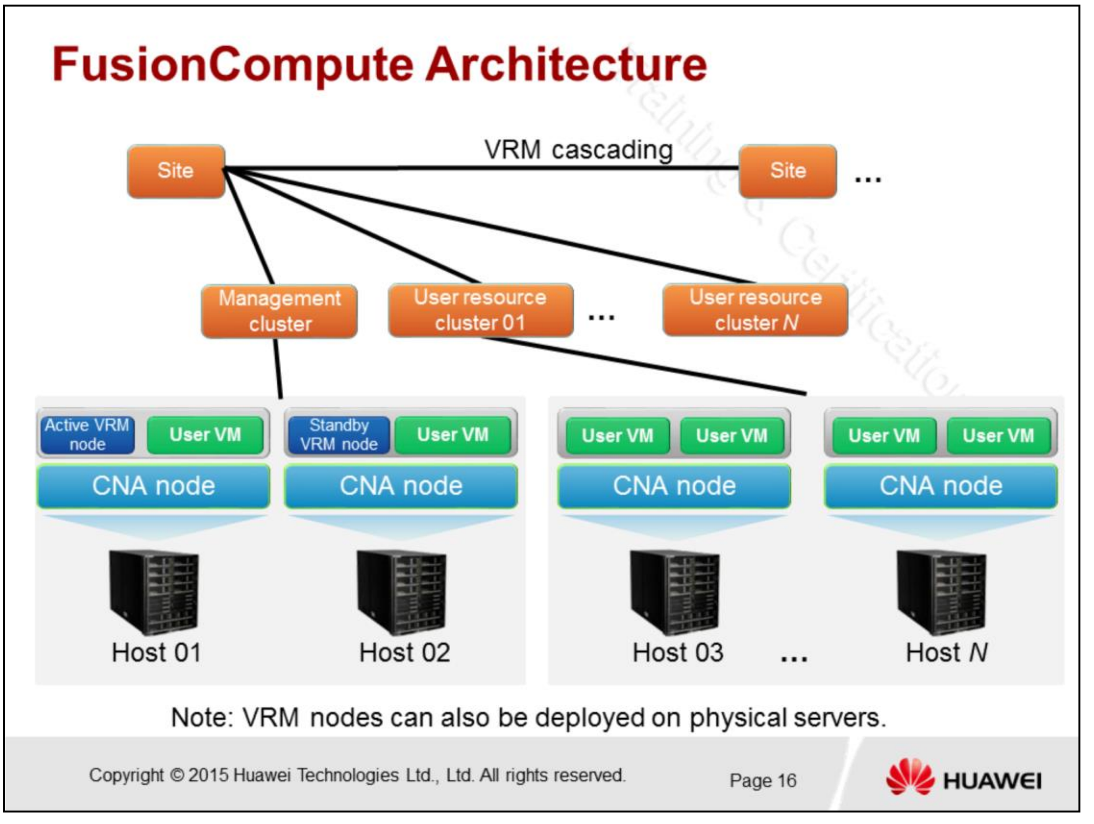
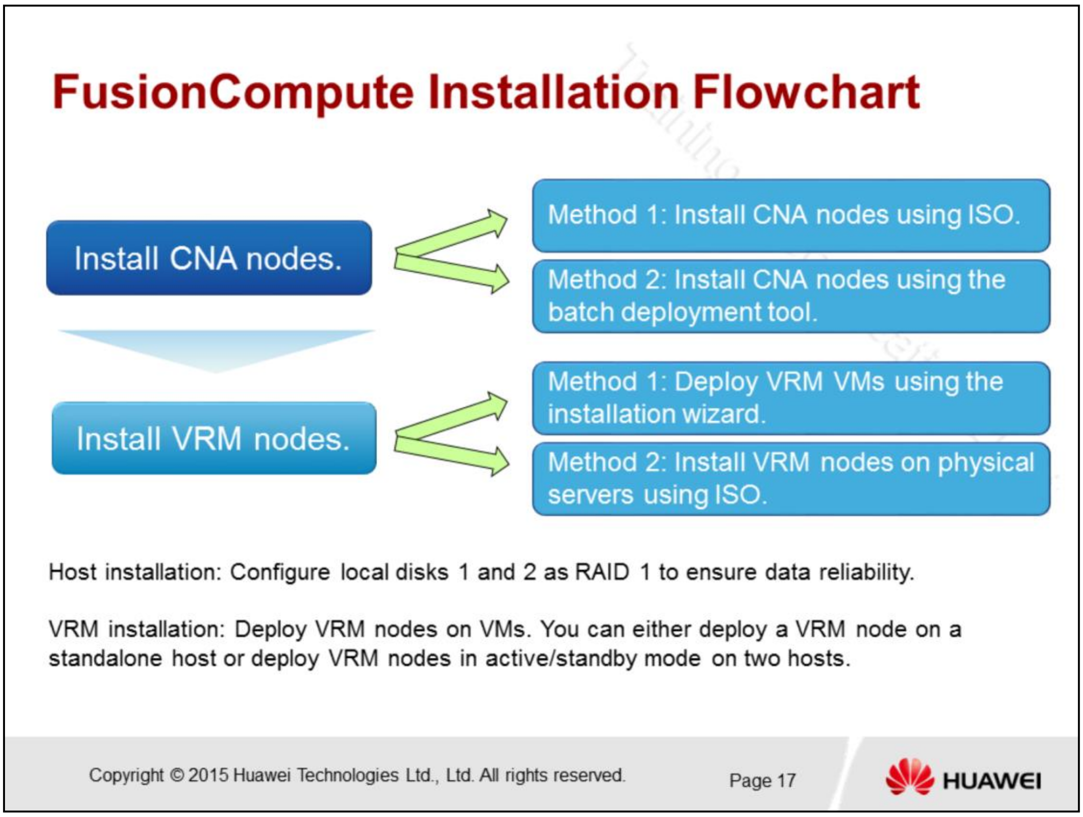


- VRM nodes, the management nodes on FusionCompute, provide centralized virtual resource management on the management portal.
- Hosts, or physical servers, provide computing resources for FusionCompute. When the storage uses local disks, the host provides storage resources as well.
- A physical server with a CNA node deployed on forms a computing node. Multiple computing nodes group into a resource cluster. (A management cluster is the one where management VMs on VRM nodes or FusionManager are located. A resource cluster is the one which contains user VMs only.) Multiple clusters form a site. The management scope of one VRM node is the management scope of a site. Multiple VRM nodes can be cascaded to manage resources in multiple sites with unified portals.
- Deployment rules:
- In virtualization deployment mode, VRM nodes are deployed on VMs created on specified hosts in a management cluster. In physical deployment mode, VRM nodes are deployed on physical servers.
- If VRM nodes are deployed in active/standby mode, VRM nodes must be deployed on two hosts in a management cluster.



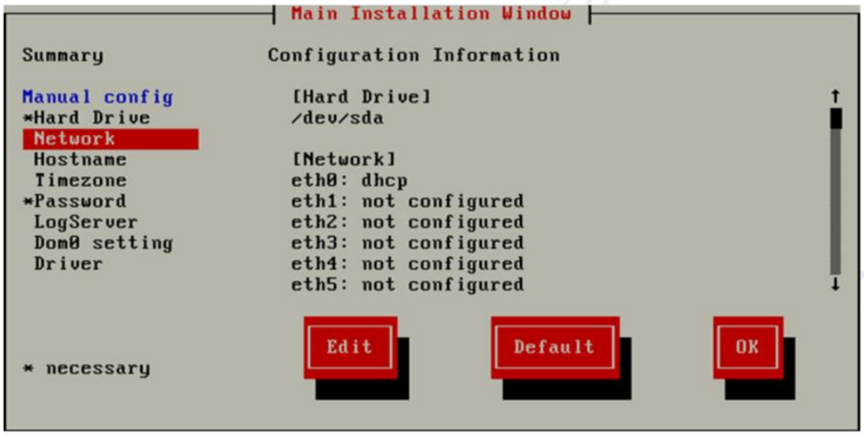
- Host installation:
  - Configure local disk 1 and 2 as RAID 1.
  - Install hosts in the batch deployment mode using PXE or install hosts manually using an ISO image.
- VRM installation:
  - On VMs: You can use the FusionCompute installation wizard to deploy VRM nodes.
  - On physical servers: You need to manually attach the ISO image and configure VRM nodes.

FusionCompute Data Preparation

Parameter category	Parameter	Example value
A. Host information	(A1) IP address of the host BMC system This parameter is used to access the host BMC system.	188.100.200.71
	(A2) The administrator username and password for logging into the host BMC system	Username: root Password: root
	(A3) Host management plane network port When installing a host, configure the first management plane network port. If multiple network ports are used, bind them into one logical interface.	eth0 and eth1
	(A4) Host management plane interface parameters Set the IP address, subnet mask, and gateway for the management plane network port when installing the host OS.	IP address: 188.100.200.90 Subnet mask: 255.255.255.0 Gateway: 188.100.200.1
	(A5) Host name Set this parameter when installing a host for identifying the host.	Host01
	(A6) Password of user root Set this parameter when installing a host for logging in to the host.	huawei_123
B. VRM node information	(B1) Management IP address This parameter specifies the management IP address of the VRM node. Set this parameter when installing the VRM node.	188.100.200.95

- Complete solution design based on the environment and take note of the data required for FusionCompute installation.
- Characters, such as A1 and A2 before each parameter, indicate the stages when the parameters will be used during the installation.

Installing CNA Nodes Using the ISO Image



Key parameter description:

- Hard Drive: By default, the system automatically installs the OS on the first identified disk that has been typically added to RAID 1. The default value is recommended.
- Network: Configure one management NIC for the network configuration. Setting IP addresses for other NICs may cause abnormal network communication.

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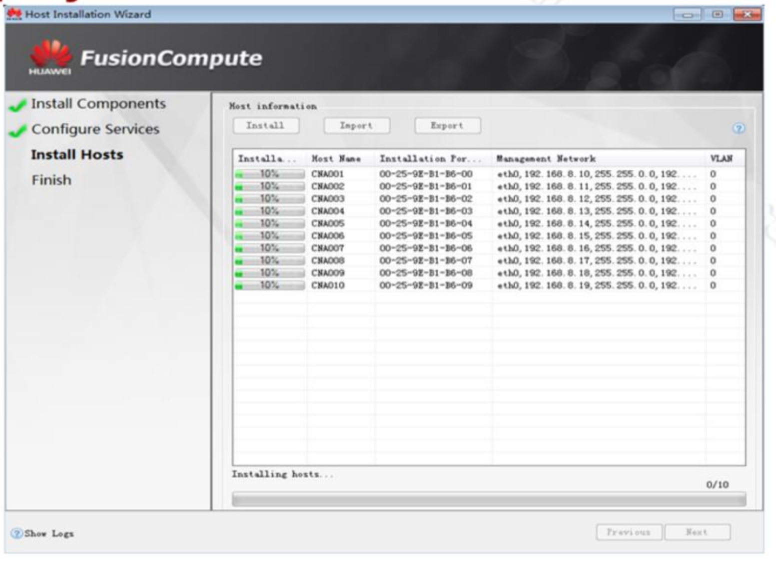
- Hard Drive, Network, Hostname, Timezone, Password, and Dom 0 setting need to be configured during host configuration.
- LogServer, which sets the third-party directory for saving host logs, is configured only when the host OS is installed on the USB drive. Driver allows you to install additional drivers simultaneously. LogServer and Driver do not need to be set when installing the host OS of FusionCompute.
- The installation takes about 10 minutes. After the installation, the server restarts automatically. When the login information is displayed, the host installation is complete.

Installing CNA Nodes Using the Batch Deployment



The batch deployment tool integrates the DHCP, TFTP, and FTP services, and installs CNA nodes using PXE.

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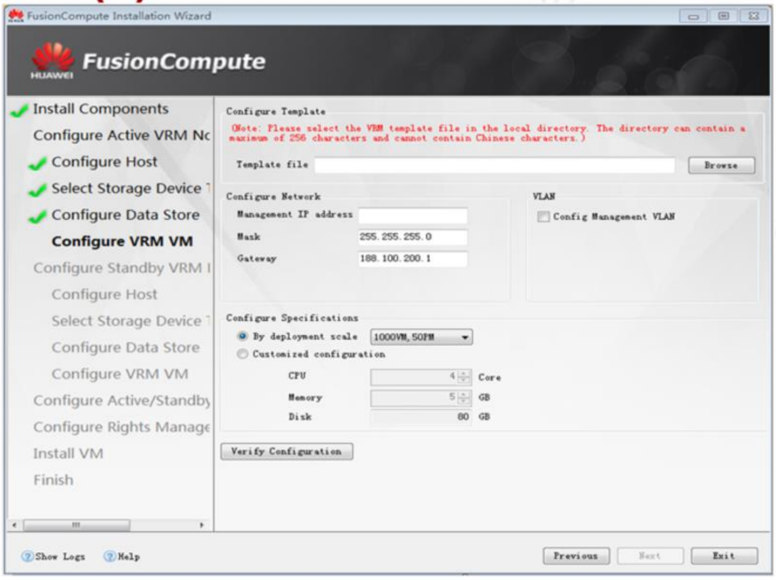
- After you have configured servers to start from the network, refreshed information about hosts will be displayed on the user interface of the tool.
- The tool automatically presents the recommended configuration based on the IP address allocated to the host and the host reporting sequence. You can use the recommended configuration, or modify it based on the planned data to continue the installation.
- If the recommended configuration is used, the IP address allocated during the installation process will be used as the host management plane IP address.
- If multiple disks are installed on the host, the tool automatically installs the host OS on the first boot device.
- If hard disks and USB drives are both available on the host, the tool automatically installs the host OS on the USB drive.
- If the number of hosts to be installed is greater than 10, the tool automatically installs 10 hosts as a batch, which usually takes a maximum of 20 minutes.

Installing VRM Nodes Using the Installation Wizard (1)



- Use the FusionCompute installation wizard to deploy VRM VMs on the specified host using a VRM template.

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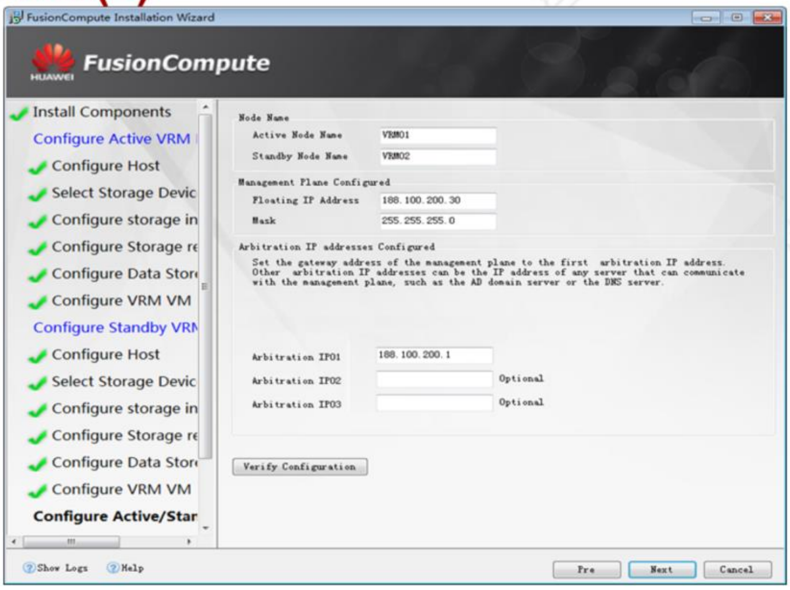
- Use the FusionCompute installation wizard to deploy VMs on the specified host using a VRM template. VRM nodes deployed using VMs are easy to perform maintenance and do not use physical servers exclusively.
- During the installation, a management cluster is automatically created and adds hosts, where VRM VMs locate, into the cluster. The Distributed Virtual Switch (DVS) and port groups on the management plane are also automatically created.
- Host installation: Enter the host management IP address and root user password.
- Storage type selection: Select the local storage and disks that has been configured as RAID 1.
- Data store configuration: Select Local disk › FC SAN, and the system automatically adds the remaining space on the disk where the host OS is installed (if the host OS is installed on the disk), or on the first local storage (if the host OS is installed on an internal USB drive) as a non-virtualized data store to the host.
- VRM VM configuration: To specify the management plane VLAN for VRM nodes, select Configure management VLAN in VLAN and set VLAN ID. If you do not need to specify the management plane VLAN, the system uses VLAN 0 by default as the management plane.

Installing VRM Nodes Using the Installation Wizard (2)



- To deploy VRM nodes in active/standby mode, configure parameters of both active/ standby VRM nodes.

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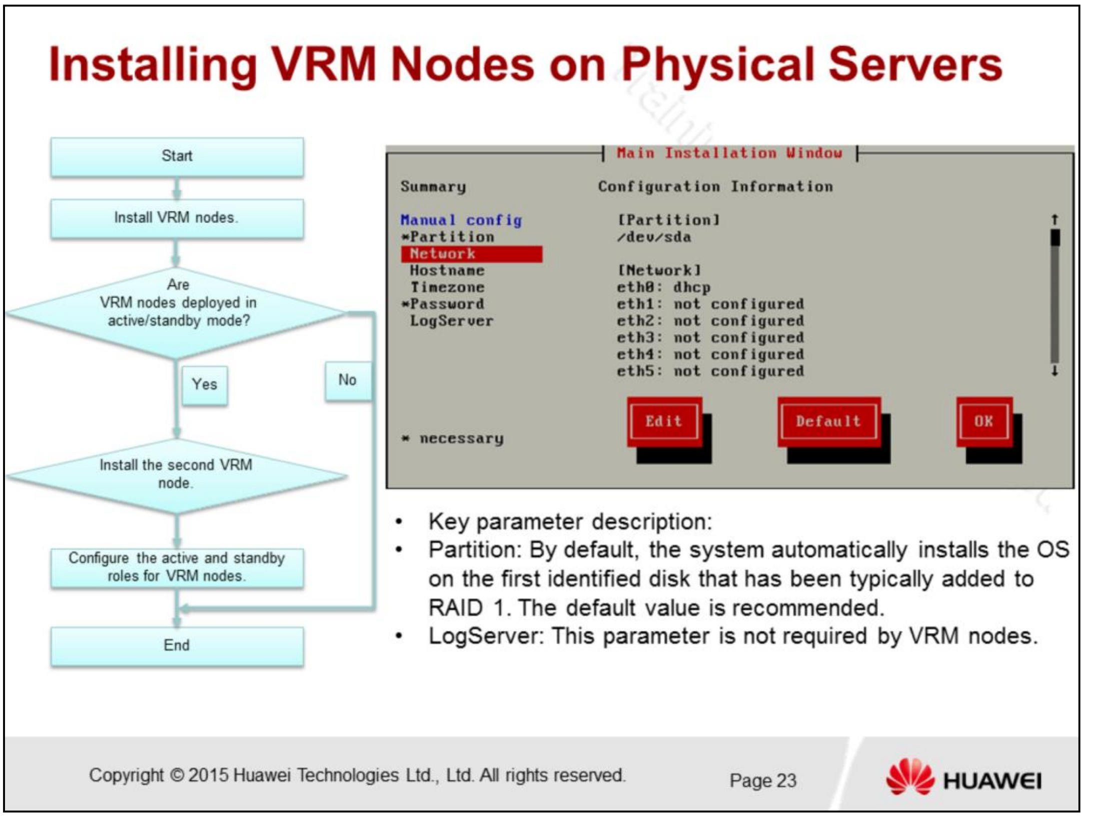
- Active node name
- Standby node name: Set it to a name that is different from the active node name.
- Floating IP address: Enter the floating IP address of the active and standby VRM nodes.
- Subnet mask
- Arbitration IP address 01: Set it to the gateway of the management plane.
- Arbitration IP address 02 and arbitration IP address 03: Set them to IP addresses of servers that can communicate with the management plane, such as the AD server or the DNS server, or management IP addresses of the host where each VRM peer node VM locates. These parameters are optional.
- If all arbitration IP addresses become invalid, the two VRM nodes both work as standby nodes. Therefore, VRM nodes fail to manage the system. You are advised to modify the VRM arbitration IP address before it changes.



- The Network, Hostname, Timezone, and Password need to be configured during the VRM configuration.
- Use Partition by default. Keep the default setting of Partition. By default, VRM nodes are installed on the first specified disk which usually has been configured as RAID 1 disk.
- LogServer sets the third-party directory for saving host logs. This parameter does not need to be set.
- Before configuring VRM nodes in active/standby mode, ensure that both VRM nodes are powered on. During the configuration, do not power them off. Otherwise, the system will break down, and the VRM nodes have to be reinstalled.
- Select System management > System configuration > Service and management node on the FusionCompute portal. Enter the Service and management node page.
- Click Active/standby configuration on the right of VRM service in Service list. The dialog box is displayed.

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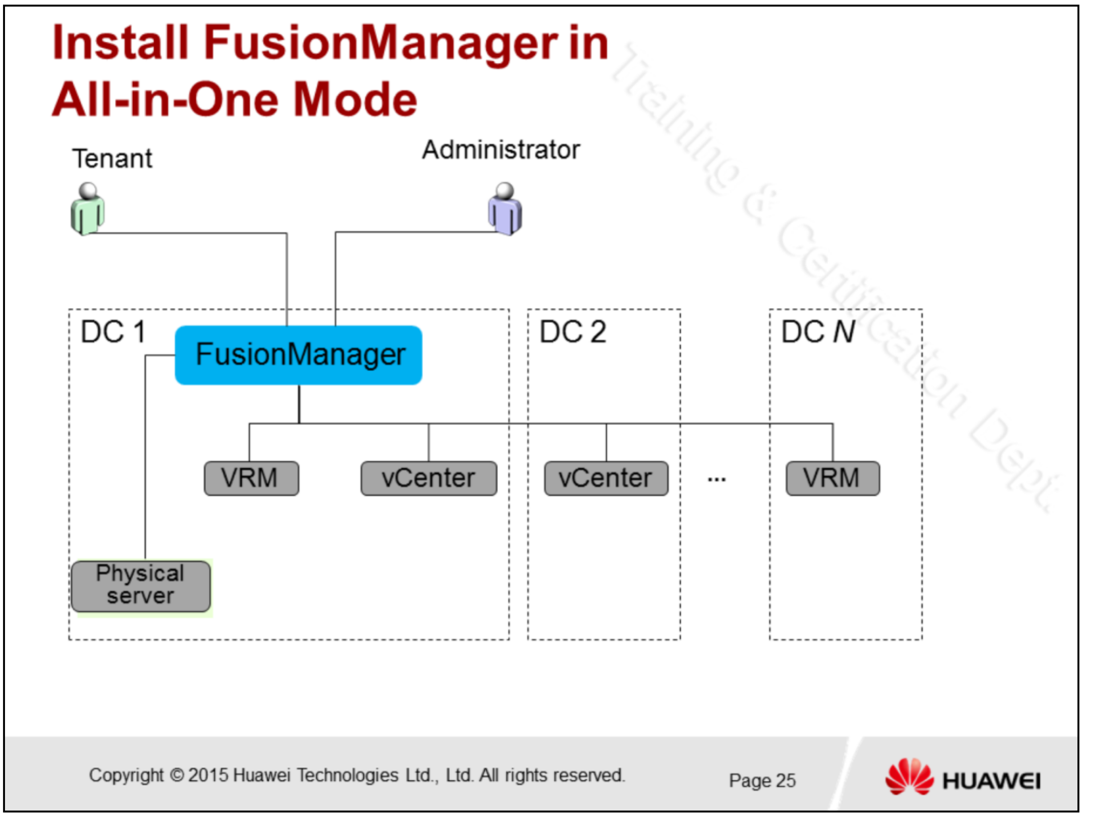
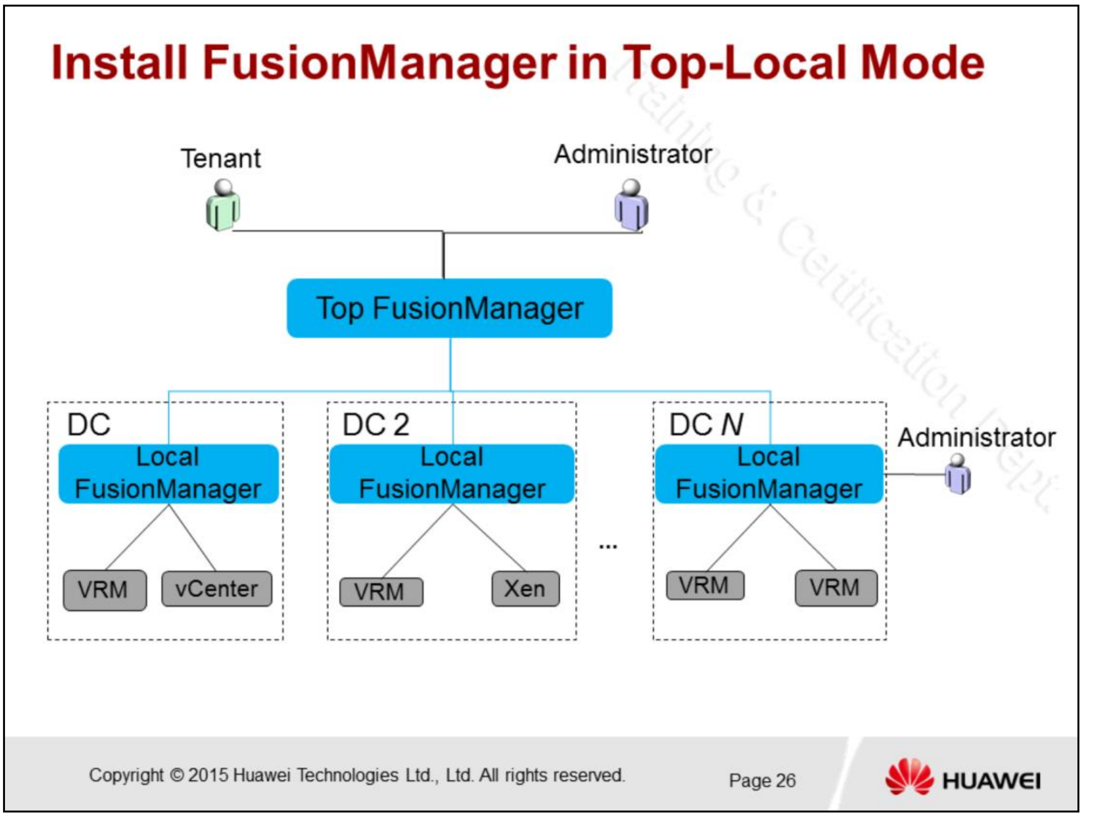
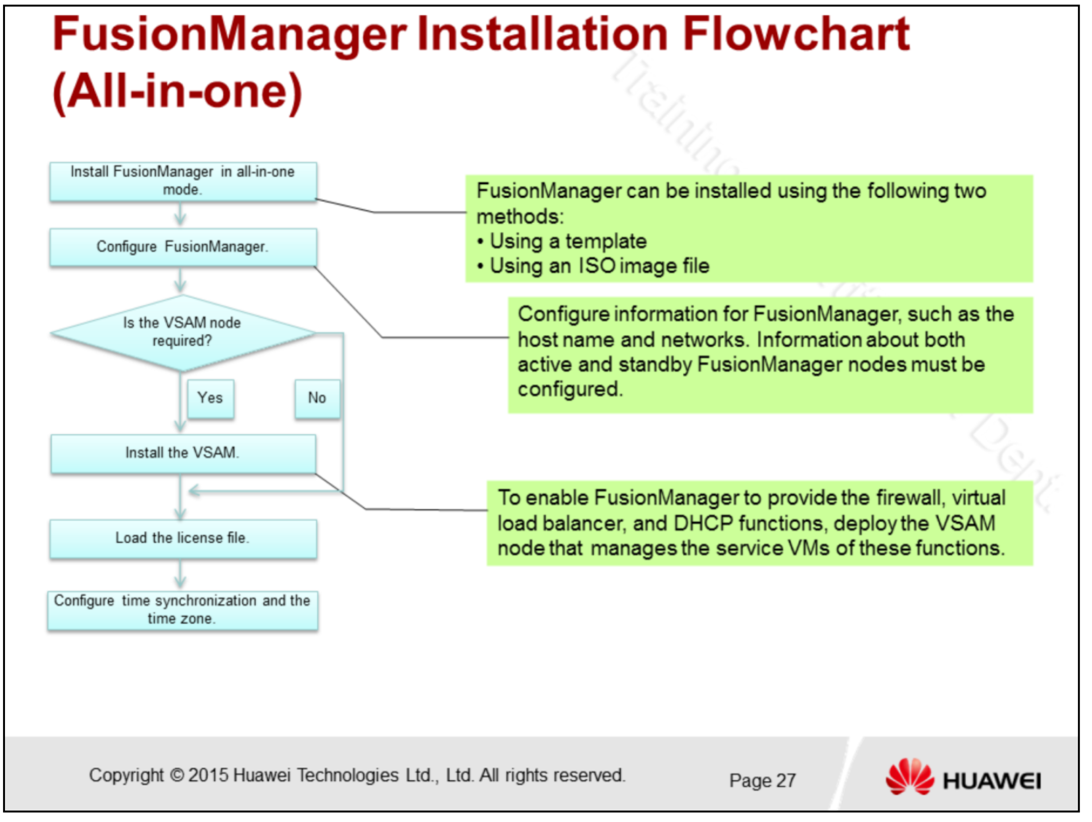


- FusionManager centrally manages resources in all DCs. Virtualization software deployed in DCs can be either Huawei FusionCompute or VMware vCenter.
- The FusionManager system connects to the business operation system and O&M system to implement functions of automatic application of resources or services and alarm reporting to the third-party O&M systems.

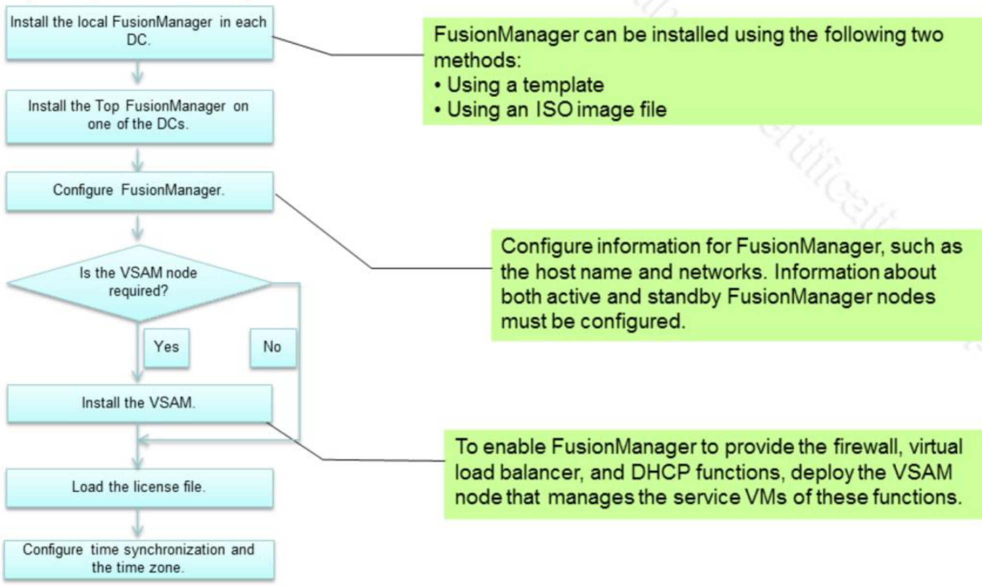


- Local FusionManagers manage resources from DC 1 to DC N. Local FusionManagers interwork with the top FusionManager using REST interfaces. The top FusionManager and local FusionManagers manage DC resources by role, respectively.
- Top FusionManager: It is deployed on a remote VM only in one DC and implements registration, deregistration, and cloud service management.
- Local FusionManagers: They are deployed on local VMs in each DC to add, configure, monitor, and maintain resources.
- The top FusionManager connects to the business operation system and automatically applies for resources or services. Both the local FusionManagers and top FusionManager can connect to O&M systems to report alarms to third-party O&M systems.
- The virtualization software deployed in DCs can be either Huawei FusionCompute or VMware vCenter.



- To deploy FusionManager in FusionCompute, use the installation template to install the OS. When the OS is installed using an ISO image file and the system uses a SAN device, the VM may not be able to automatically recover in the event of a storage link recovery following a disconnection on the host. In this case, you need to manually restart the VM.
- To deploy FusionManager in the VMware hypervisor, the VM OS can only be installed using an ISO image file. In this case, you are advised to use local disks to deploy FusionManager.
- The installation of VSAM node is optional.
- FusionManager supports the following firewall versions: Eudemon8000E V200E001C01 and Eudemon 1000E V300R001C00.

FusionManager Installation Flowchart (Top-local)



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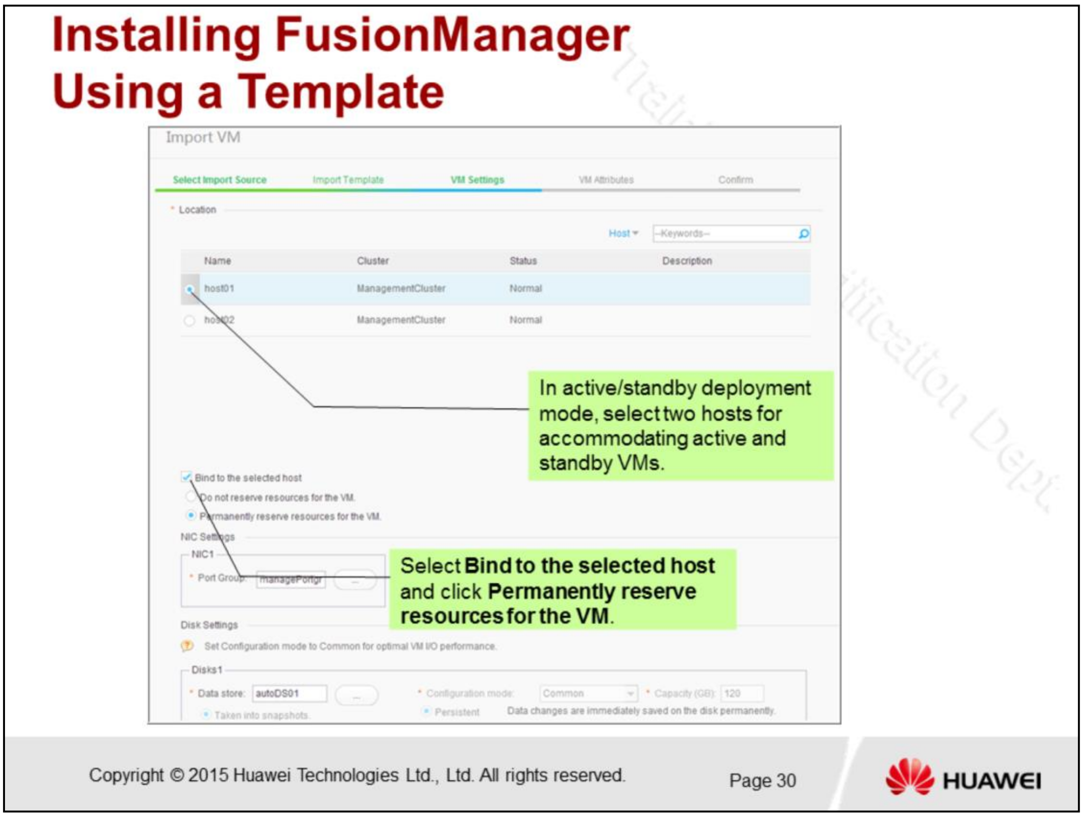
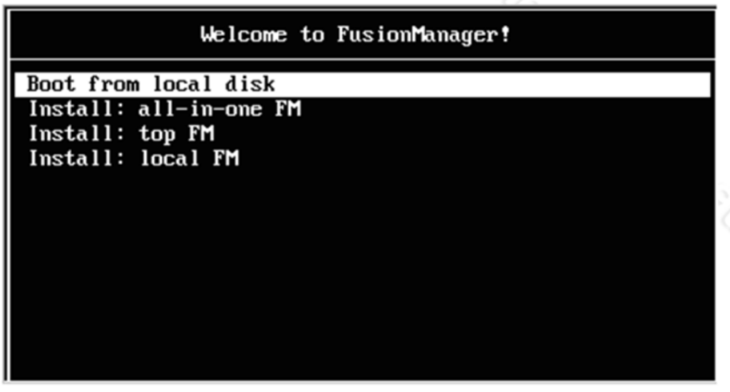
FusionManager Data Preparation

Component	Description	Planned data
FusionManager	Cloud management component, which is deployed on a VM. FusionManager centrally manages and maintains physical and virtual resources and services.	VM name: FM01 Node name: FMN Management IP address: 192.168.210.50 Subnet mask: 255.255.255.0 Gateway: 192.168.210.1
VSAM (Optional)	VSA management component in the FusionSphere solution, which automatically configures and manages the VMs that provide VSA services, including software routers, virtual load balancer, and DHCP. After the VSAM node is deployed, you can apply for software routers on FusionManager, bind public IP addresses to VMs, and configure ACL rules to improve network access security.	VM name: VSAM01 Node name: VSAM Management IP address: 192.168.210.60 Subnet mask: 255.255.255.0 Gateway: 192.168.210



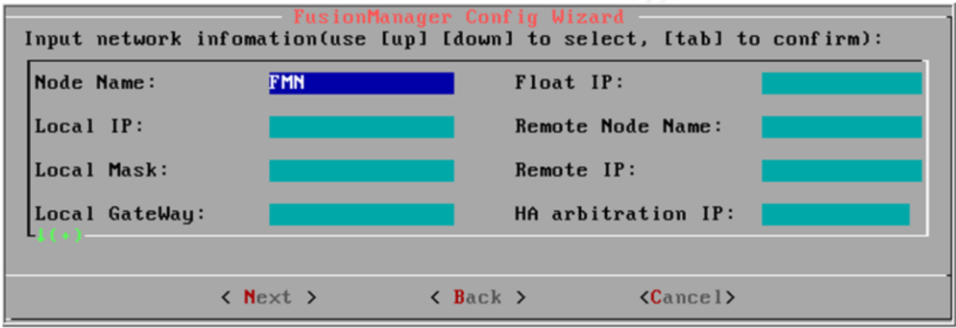
- In active/standby deployment mode, repeat the above operation to install FusionManager on the standby node.

Installing FusionManager Using an ISO Image



- Select the deployment mode as required and press **Enter** within 30 seconds.
- The installation takes about 25 minutes. If login information is displayed, the installation is complete.
- In active/standby deployment mode, you can install the standby VM during the wait time.

FusionManager Configuration



- Log in to the FusionManager console using VMC.
- Run the **fmconfig** command and configure FusionManager as prompted.
- If you entered incorrect information, run the **stopALL** command to stop the process and run the **fmconfig** command to reconfigure the data.

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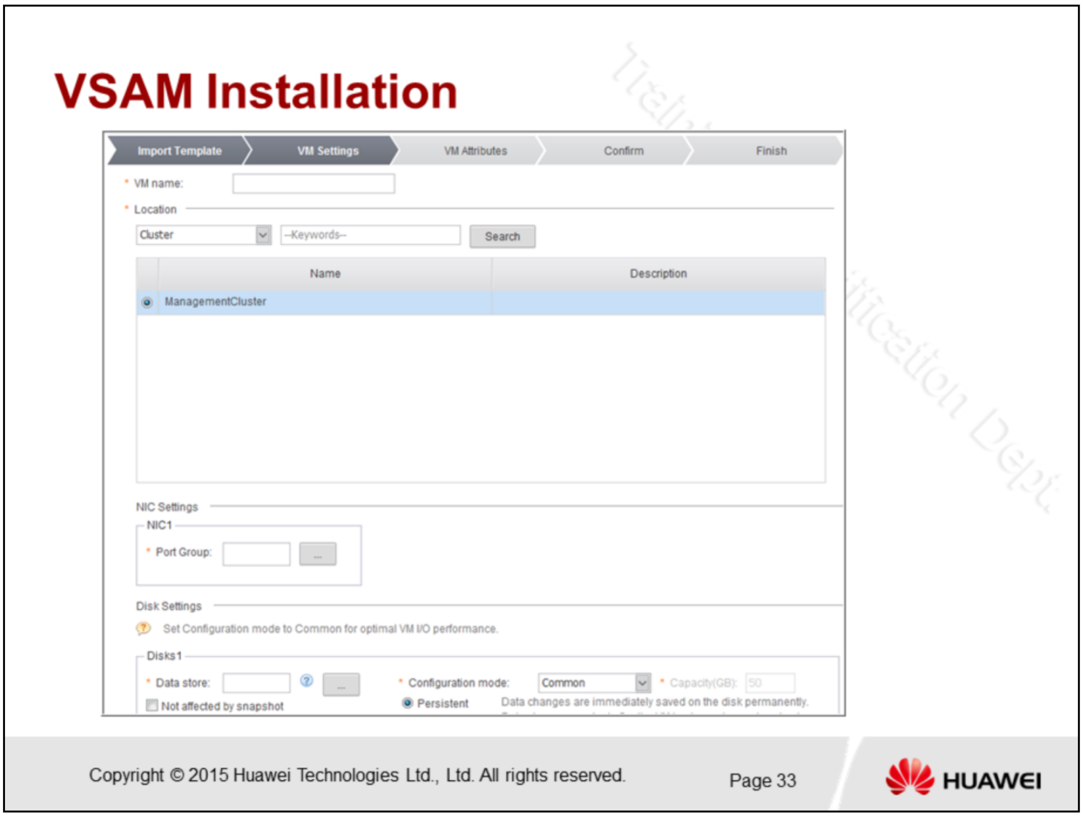
- Configuration information for the standalone deployment mode and active/standby deployment mode is as follows:
- For standalone deployment mode, configure the following parameters:
  - Node Name: specifies the FusionManager node name.
  - Local IP: specifies the management IP address.
  - Local Mask: specifies the subnet mask of the management node.
  - Local Gateway: specifies the gateway address of the management plane.
- For active/standby deployment mode, configure the following parameters:
  - Node Name: specifies the FusionManager node names.
  - Local IP: specifies the management IP addresses.
  - Local Mask: specifies the subnet masks of the management node.
  - Local Gateway: specifies the gateway addresses of the management plane.
  - Float IP: specifies the floating IP address of the management node.
  - Remote Node Name: specifies the peer FusionManager node name.
  - Remote IP: specifies the management IP addresses of the peer FusionManager node.
  - HA arbitration IP: specifies the HA arbitration IP address. This IP address is the gateway address of the management plane.



- In FusionCompute, import a VM template to deploy active and standby VSAM nodes and select Self-defined Wizard to configure the node information.
- VSAM nodes support standalone deployment mode and active/standby deployment mode. If the VSAM node employs standalone deployment mode during initial installation, it can be modified to active/standby deployment mode during the system running process.

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FusionAccess Installation Flowchart

Preparations

1. Configure network resources.

Install Linux OS infrastructure components.

1. Create Linux VMs.
2. Install Gauss DB, HDC, WI, and license.
3. Install the gateway and load balancer.

Install Windows OS infrastructure components.

1. Create an infrastructure VM template.
2. Create and configure infrastructure VMs.
3. Create AD, DNS, and DHCP components.
4. Install the ITA server.
5. Install the Loggetter server.

Initialize configuration.

1. Configure the hypervisor.
2. Configure the domain.
3. Configure desktop components.
4. Configure alarm components.
5. Configure time synchronization.
6. Check the status of each component.
7. Configure a desk cloud address.

Import certificates.

1. Import the WI certificate.
2. Import the root certificate on terminals.

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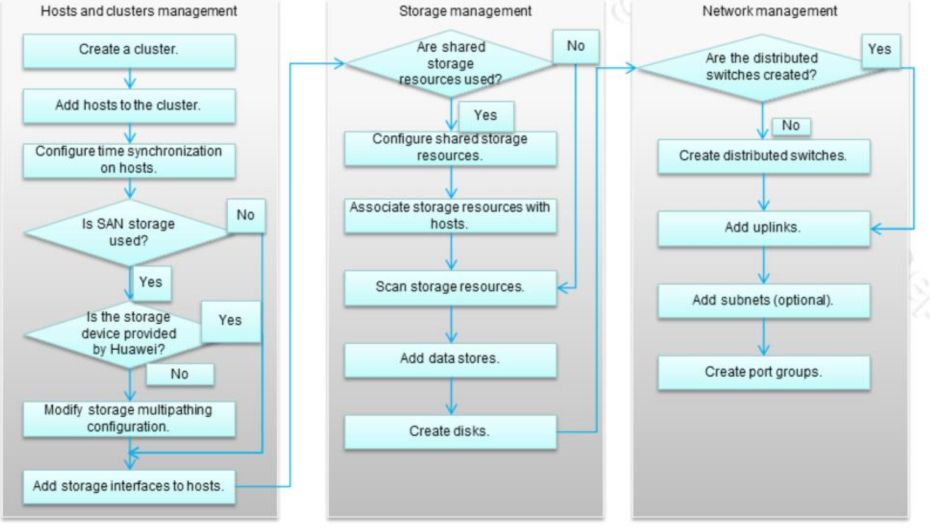
FusionCompute Service Configuration



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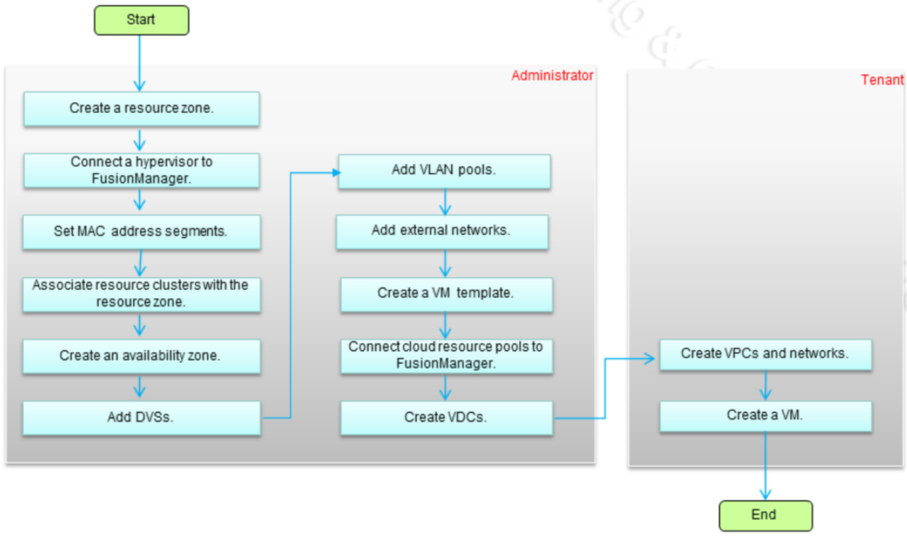
Provisioning a VM on FusionManager



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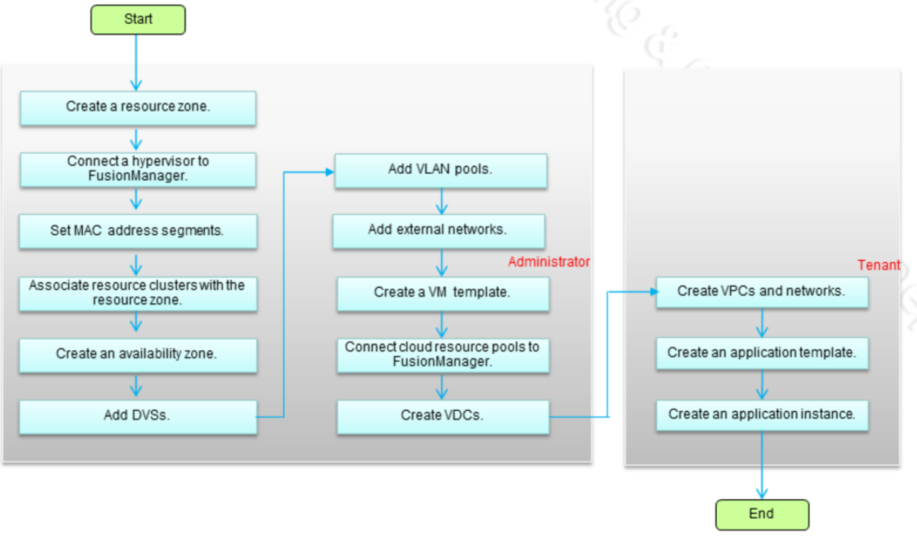
Provisioning an Application on FusionManager



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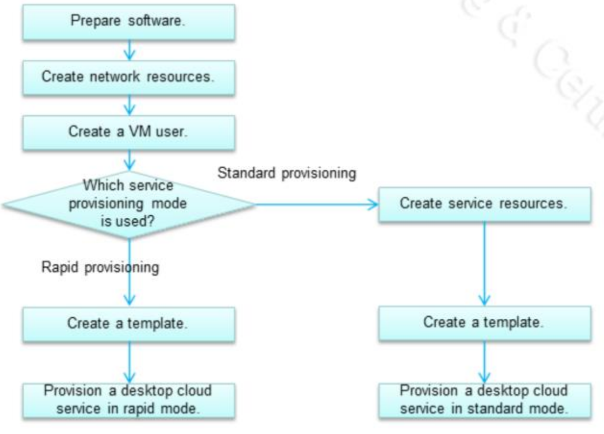
Provisioning Desktop Cloud Services on FusionAccess



Summary

- FusionCloud Main Deployment Processes
- Solution Planning and Design
- Hardware Configuration
- Software Deployment
- Service Data Configuration

Questions

1. What are considered in the design of FusionCloud solution deployment?
2. What are the network planes in FusionCloud? How are these planes isolated?
3. How are VRM nodes installed?
4. Which scenarios can FusionManager be deployed, and what are the differences between the deployment scenarios?
5. Which OS is supported by FusionAccess hosts?

Exercises

- True or false
  1. VRM nodes can be deployed on VMs or on physical servers. ( )
- Multiple choices
  1. Which of the following software systems are mainly involved in the FusionCloud deployment? ( )

     A. FusionCompute

     B. FusionManager

     C. FusionAccess

     D. FusionSphere

- Answers:
  - True or False: 1. T
  - Multiple choices: 1. ABC

Thank You!

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