# 13 Data Center Storage Management

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# Foreword

- This module mainly introduces:
  - Initial Configuration Process And Configuration Methods Of Storage Systems In the Data Center.
  - Basic Block Storage Services Application Scenario and Its Configuration Methods In The Data Center.
  - File Services Application Scenario and Its Configuration Methods In The Data Center.

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# Objectives

- Upon completion of this module, you will be able to:
  - Describe the initial operations and configuration of the storage system in the data center.
  - Describe the configuration process of the block storage services, its application scenario including the disk domain, storage pool allocation configuration and how the host and application servers accesses the storage volumes.
  - Describe the configuration process and application scenario of file services, including the application scenario and configuration methods of CIFS and NFS.

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# Contents

1. **Initial System Configuration.**
2. Configuration of SAN Storage Service.
3. Configuration of NAS Storage Service.

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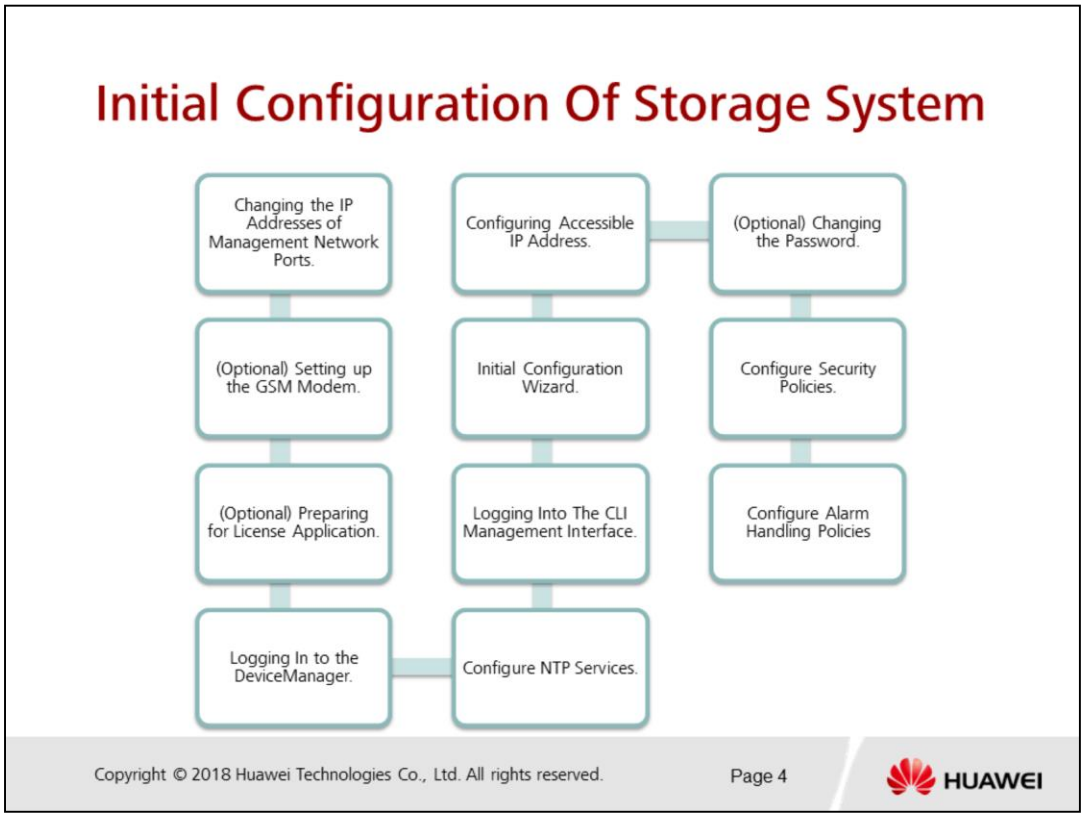


- After checking that the storage is correctly powered on, we need to initialize the storage system. The steps for the initial configurations are as follows:
- Changing the IP Addresses of Management Network Ports:
  - The storage system can be accessed through the IP addresses of the management network ports to configure and manage the storage system. During system initialization, you need to modify the IP addresses of the management network ports to connect those ports to user networks. After the management network ports communicate with the maintenance terminal properly, you can use the maintenance terminal to configure and manage the storage system.
- (Optional) Setting up a GSM Modem:
  - After setting the GSM modem, you can configure short message notification in management software. The storage system will send alarm information to a specified mobile phone. Thus, you can learn about storage system exceptions and solve them in a timely manner.

- (Optional) Preparing for License Application:
  - A license file is a credential that entitles you to use value-added features. You can apply for licenses based on your service needs. The license application process is completed on the Electronic Software Delivery Platform (ESDP). After the application of licenses is successful, import the license to your device.
- Logging In to the DeviceManager:
  - The DeviceManager is a device management program developed by Huawei. The DeviceManager has been loaded to the storage system before delivery. To log in to the DeviceManager, you may choose either of the two ways: through the Web or using a tablet.
- Configure NTP Service:
  - NTP servers can be installed on both Windows and Linux servers, and the storage system can obtain the time from these NTP servers. By configuring the NTP service and obtaining the NTP server certificate and related keys, it ensures that your storage system obtains the correct time from a trusted server.
- Logging Into The CLI(Command Line Interface) Management Interface:
  - After logging in to the CLI of a storage system, you can query, set, manage, and maintain the storage system. On any maintenance terminal connected to a storage system, you can log in to the CLI by using PuTTY to access the IP address of the management network port on the controller of a storage system. Two authentication modes supported by the SSH protocol for a CLI login are Username + Password and Public Key.
- Initial Configuration Wizard:
  - This operation enables you to initialize a storage device using the initial configuration wizard. The initialization includes configuring the basic information, device time, disk domain, alarm notification and managing license files for a storage device.
- Configuring Accessible IP Address:
  - To prevent other IP addresses to access and run operations to the storage system in the DeviceManager, you can configure a list of IP addresses that can access the system. After enabling the security restrictions on the IP address, only the IP addresses or IP segment in the list can access the DeviceManager.
- (Optional) Changing the Password:
  - To ensure the storage system security, you can periodically change the password used for logging in
  - to the storage system.
- Configure the Security Policies:
  - System security policies includes username policies, password policies, login policies, and advanced configurations. Configuring the system security policies is good for increasing the system security of the storage system.
- Configure the Alarm Handling Policies:
  - Configure the policies for notifications, alarms and logs.

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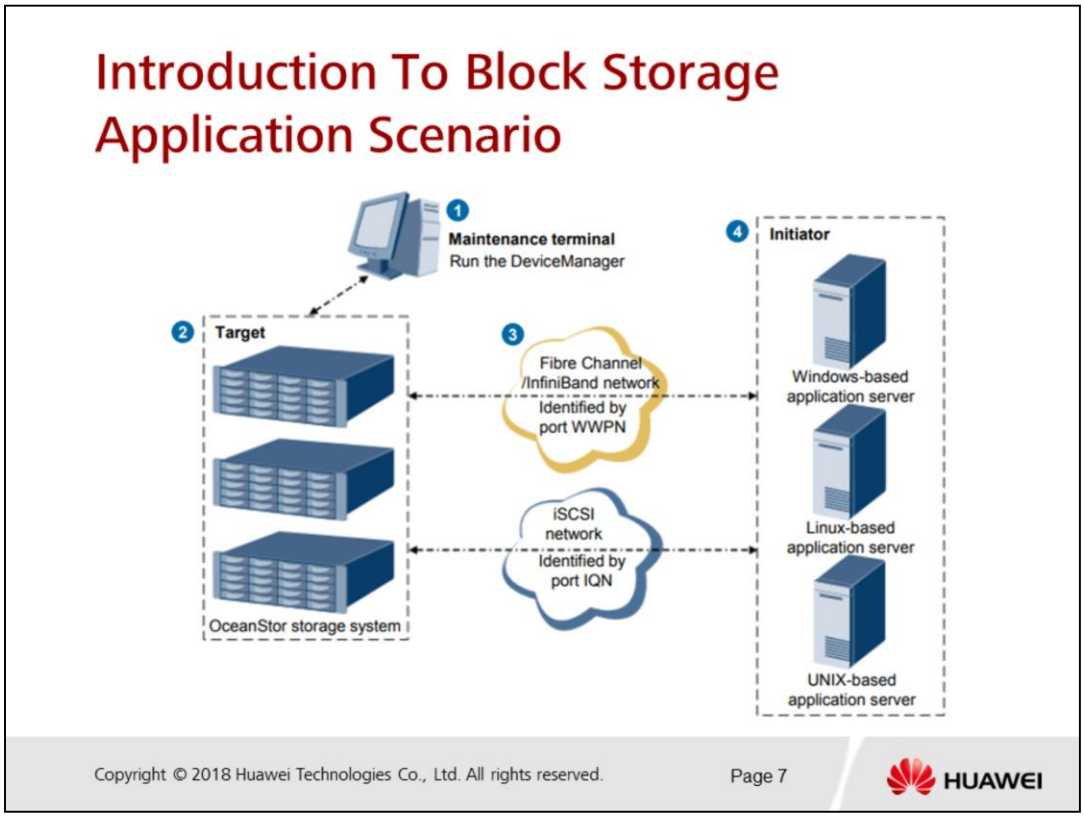
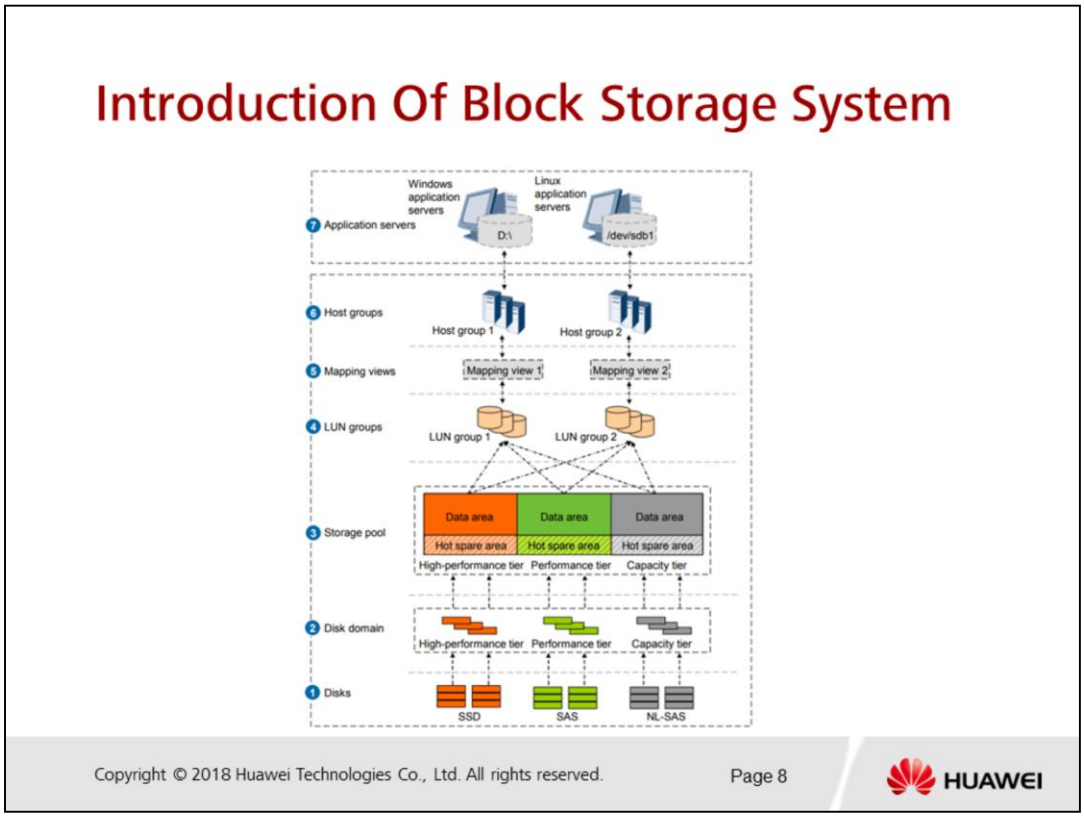
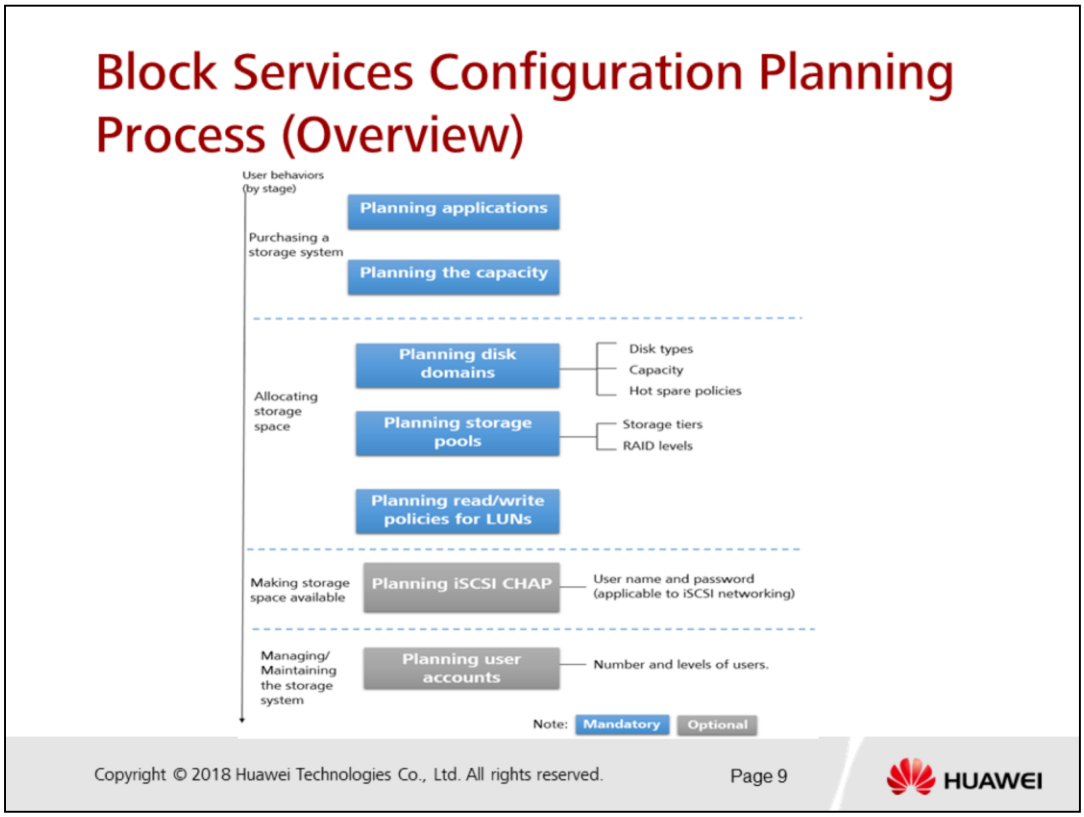


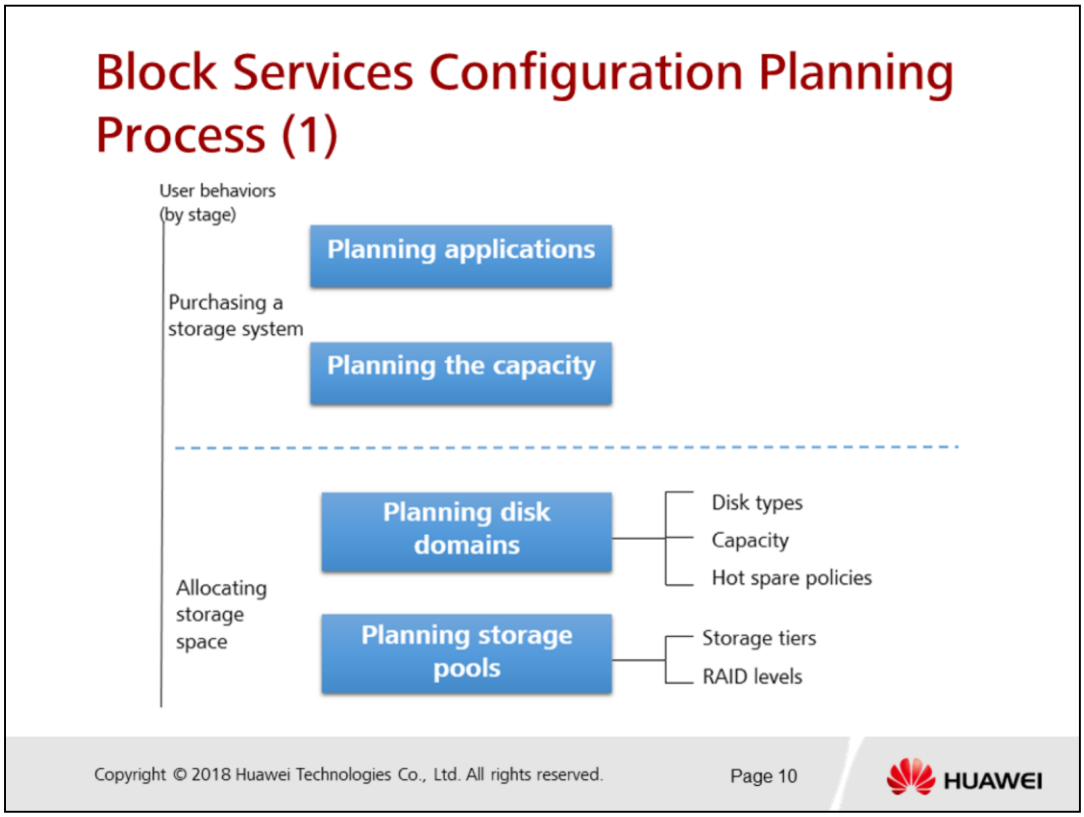

- Refer to 1: Users can manage and maintain the storage systems through the DeviceManager software from a maintenance terminal that is connected to the storage management network ports or SVP(Service Processor in 18000 series or 18000F series). DeviceManager is the integrated management software developed by Huawei.
- Refer to 2: Storage systems provide storage space for application servers.
- Refer to 3: The OceanStor enterprise storage systems can be connected to application servers running different operating systems including Windows, Linux, and UNIX over an Internet Small Computer Systems Interface (iSCSI), Fibre Channel, and InfiniBand network. According to data transmission protocols, an application server functions as the initiator for data transmission, and a storage system serves as the target for the information. The initiator sends data read and write requests to the target. The target receives, processes, and responds to the requests.
- Refer to 4: Application servers runs client programs. The storage system can connect to application servers running different operating systems including Windows, Linux (SUSE, and Red Hat), and UNIX (Solaris, AIX, and HP-UX).



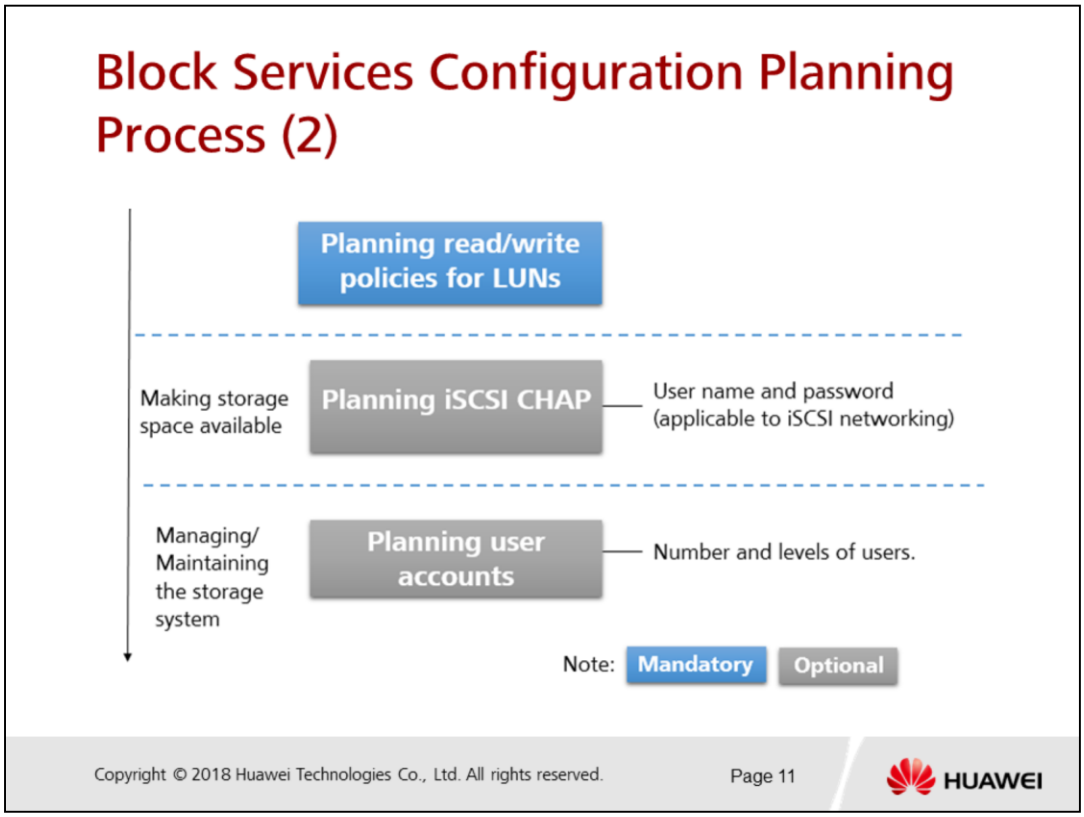

- Refer to 1: The storage system automatically identifies all disks.
- Refer to 2: Disk domains are comprised of different types of disks. Services of different disk domains are isolated from each other.
- Refer to 3: Storage pools are created in disk domains and comprised of RAID groups formed by disks of different performance. Storage pools provide logical storage space.
- Refer to 4: A LUN obtains storage space from the storage pool. LUNs are the minimum logical storage units that can be identified by application servers. A LUN group may contain one or multiple LUNs.
- Refer to 5: After mappings between host groups and LUN groups are established, related application servers can access the LUNs.
- Refer to 6: After initiators are added to hosts, one-to-one logical mappings between hosts and application servers are established. Then application servers can use storage space provided by the storage system. A host group may contain one or multiple hosts.
- Refer to 7: The application server identifies LUNs as logical disks. Then it can access the detected logical disks in the same way it would access local disks.



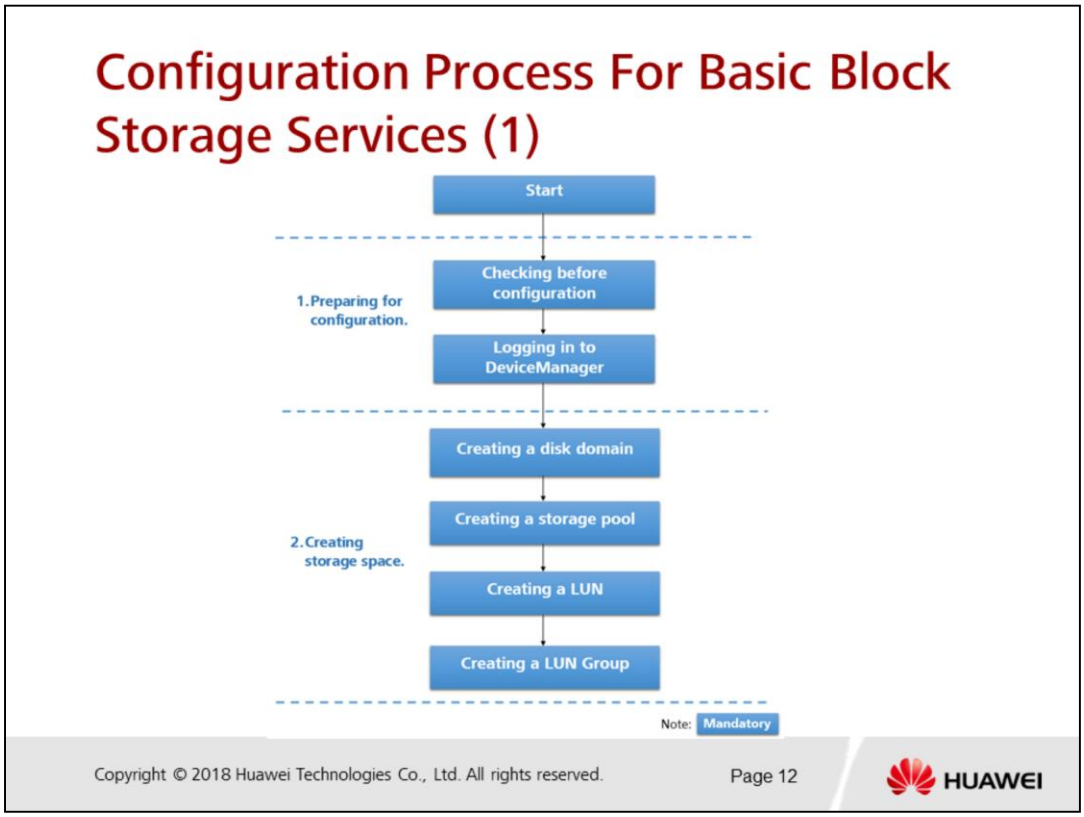

- Before using the storage systems, please plan the logical sequence of the steps that need to be followed in order to efficiently configure the basic storage services.
- The planning process is shown as the diagram above, with the phases set according to user behaviors when they are using the storage system.
- Planning applications: The storage system provides application-based wizards to create storage resources. The applications include Microsoft Exchange, VMware, Hyper-V, Oracle, and SQL Server. Therefore, you can use the corresponding wizard to create storage resources for the preceding five applications. To create storage resources for other applications, follow the configuration procedure for basic storage services as shown at the diagram above.
- Planning the capacity: Storage capacity is the user's most basic requirement and must be planned first.
- Planning disk domains: A disk domain provides storage space for storage pools, whose storage tiers and available capacities depend on the disk types, capacity, and hot spare policy of the disk domain. Therefore, the disk types, capacity, and hot spare policy must be properly planned for a disk domain.
    - Disk type: Disk types of a disk domain determine the storage tiers of storage pools. Plan disk types based on your requirements.



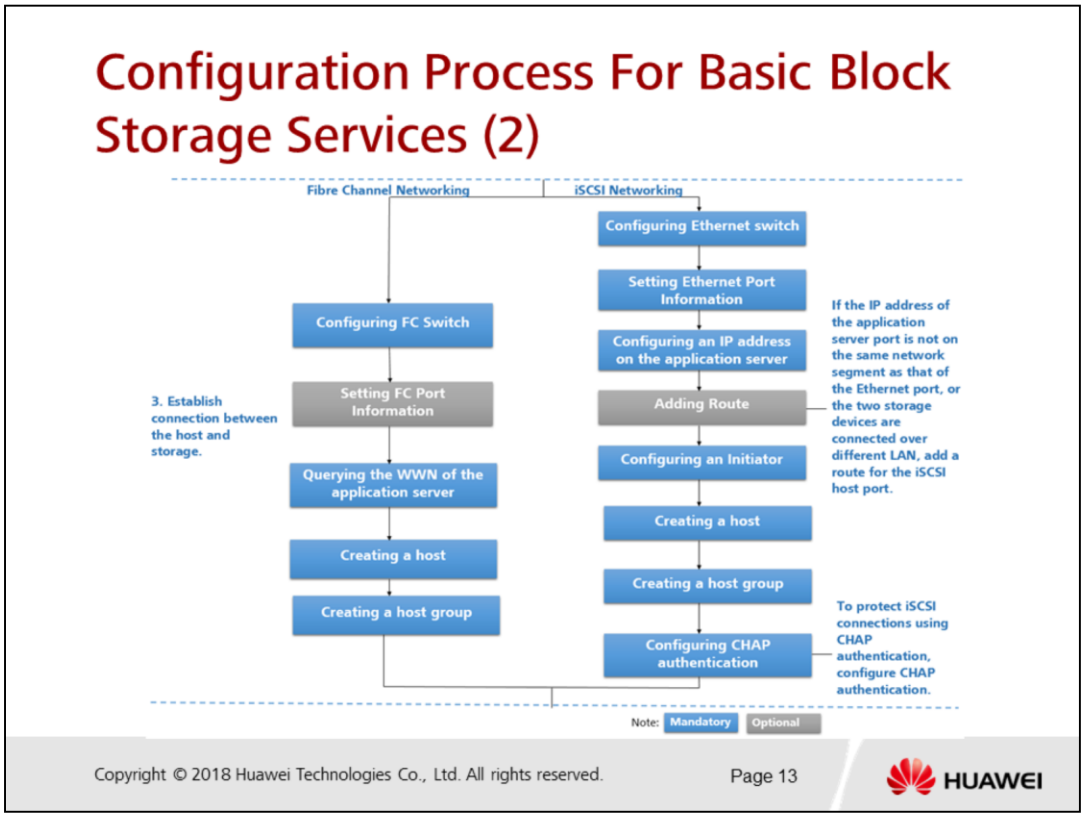

  - Capacity: The capacity of a disk domain determines the available capacities of storage pools.
  - Hot spare policy: Plan hot spare policies and hot spare space so that the hot spare space can take over data from failed member disks.
- Planning storage pools: A storage system provides storage space for application servers in the form of storage pools.
  - The storage tiers and RAID levels of the storage pools must be properly planned in advance for better storage utilization.
  - Storage tier: Plan storage tiers to meet the need for optimal distribution of hot data and cold data.
  - RAID level: Plan RAID levels based on actual needs because RAID levels vary in performance, cost, and reliability.
- Planning read/write policies for LUNs: Different read/write policies configured for LUNs affect the response time of the storage system. Properly planned write policies and prefetching policies can help improve the response speed of the storage system.




- (Optional) Planning iSCSI challenge handshake authentication protocol (CHAP): Considering the storage system access security when application servers connect to the storage system through iSCSI and use the storage space provided by the storage system, you should plan the CHAP user name and password to control the access to the storage system.
- Planning user accounts: Plan the number of users and their privileges carefully for subsequent management and maintenance. Users with different responsibilities should have different permissions.

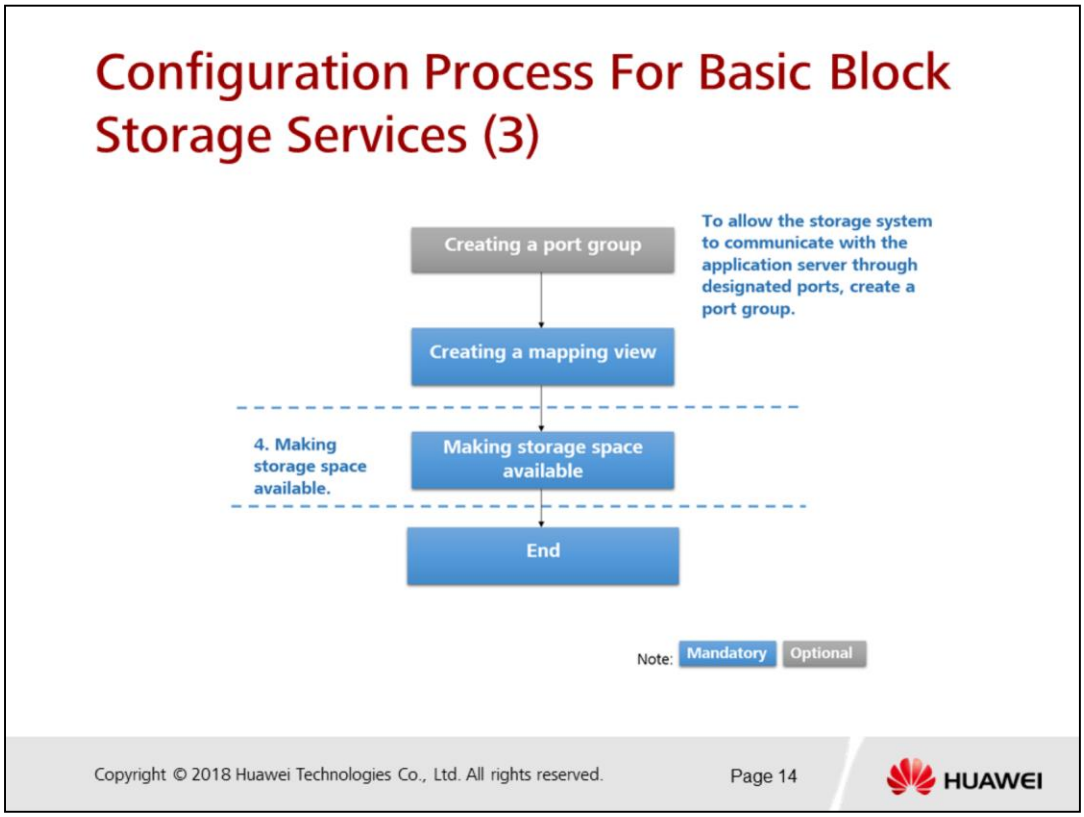



- The configuration process shown above introduces the main configuration procedures for basic block storage services. You can understand the configuration logic of the storage space configuration procedure through the flowchart shown above.
- Preparing for configuration:
  - Checking before configuration: Before configuring the storage services, check whether the software installation and initial configuration meet the requirements for storage space configuration.
  - Logging in to the DeviceManager: The DeviceManager is a device management platform program developed by Huawei. You can log in to the DeviceManager to manage and maintain the storage system. Make sure that you have all the login credentials prepared for logging into DeviceManager.
- Creating storage space:
  - Creating a disk domain: A disk domain provides storage space for storage pools, whose storage tiers and available capacities depend on the disk types, capacity, and hot spare policy of the disk domain. The storage system automatically allocates hot spare space with different capacities based on hot spare policies to take over data from failed member disks.




- Creating a storage pool: The storage space used by application servers is provided by the storage pools on the storage system.
- Creating a LUN: A LUN indicates a logical unit in storage space.
- Creating a LUN group: A LUN group is a set of LUNs. Only LUN groups can be added to a mapping view. Single LUN cannot be added to the mapping view. Mapping view is the logical relationship and connection between the storage space allocated (such as LUNs in block storage) and the host that accesses the storage.

- Configuring Host Connectivity and Setting Up A Connection:
  - Configuring Host Connectivity:
    - IP SAN: Need to configure Ethernet switch, set Ethernet port information, add route and configure the IP address of the application server. Need to configure an initiator on the application server.
    - FC SAN: Need to configure FC switch and set FC port information of the storage system. Need to query the WWN of the application server.
  - Configure the connectivity between host and storage system.




- Creating a host: A host is a virtual concept of an application server. Each host has its own application server. The host can be a physical machine or a virtual host like a virtual machine. An initiator is added to a virtual host to establish a logical connection between the application server, the storage system and the virtual host.
- Creating a host group: A host group is a set of hosts. Only host groups can be added to a mapping view. Single host cannot be added to the mapping view. A mapping view allows LUN Group to connect to Host Group, in which all the LUNs in the LUN Group is accessible by all the hosts in the Host Group.
- (Optional) Configuring CHAP authentication (iSCSI connection): CHAP authentication is configured to restrict the access to the storage system from application servers to increase the security of the storage system.
- (Optional) Creating a port group: Multiple ports can be logically added to a port group to facilitate port management.

    - Creating a mapping view: The application server corresponding to a host in a host group can use the storage space designated by a LUN in a LUN group only after the host group and LUN group are added to the same mapping view.
    - (Optional) Configuring LUN mapping using a cipher machine: Use a cipher machine to configure mapping relationships between application servers and LUNs to keep critical services running in an encrypted environment.
- Making storage space available for application servers:
    - Application servers must scan for hard disks to detect the LUNs mapped by the storage system and use the storage space. Once the LUNs are detected by the application server operating system, the storage space can be formatted with file system for file management.

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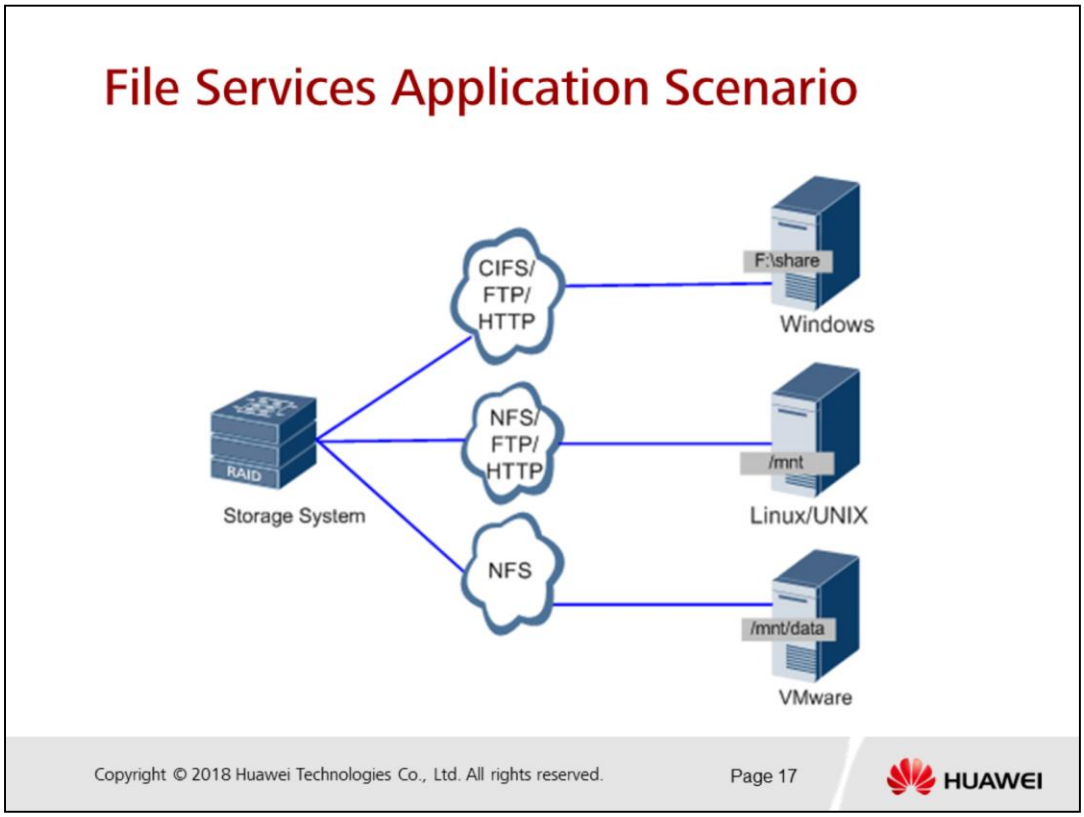
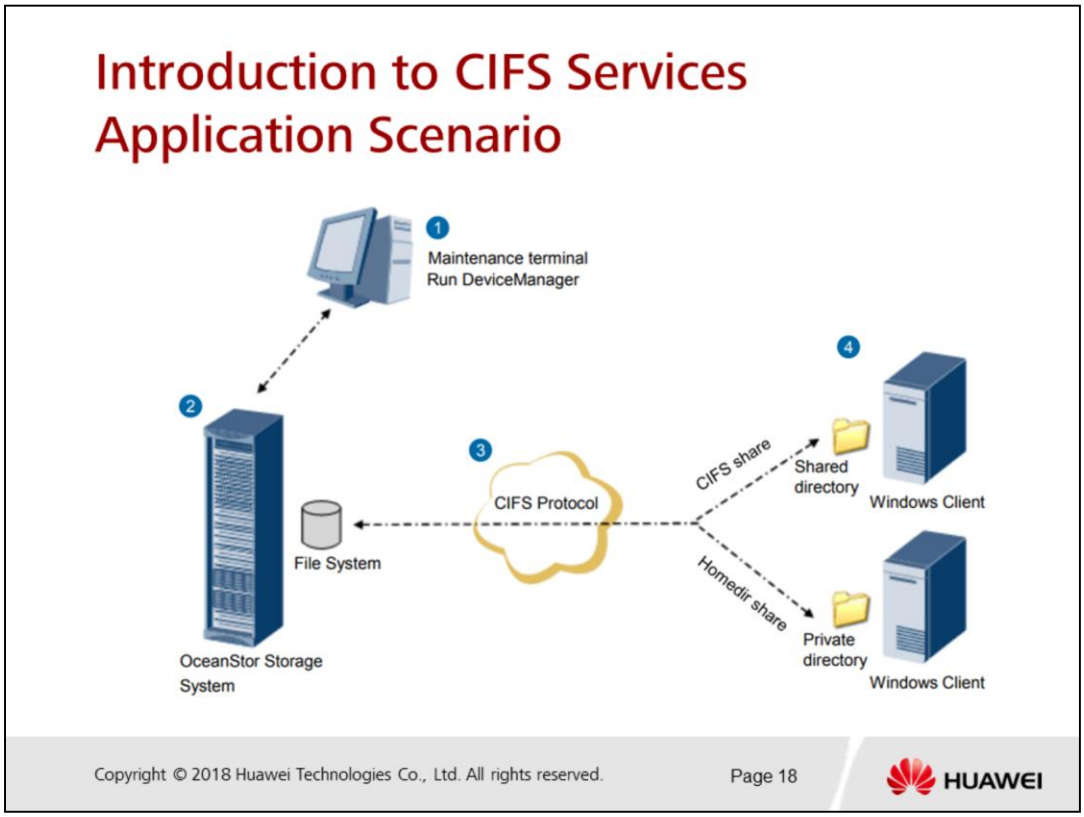



- Storage systems supports application servers to access shared files via NFS, CIFS, FTP or HTTP protocols. Application servers include Windows application servers, Linux application servers, UNIX application servers (such as AIX application servers, HP-UX application servers and Solaris application servers) and VMware application servers.
- The scenario where application accesses the storage system is shown on the diagram above.
- The way that each operating system(OS) accesses the storage space in the storage system using file storage services is different. In Windows, the OS access the storage space through shared directories with specified share names. For example, the shared directory such as F:\Share. In Unix, the OS can mount the shared directory to the /mnt directory. After mounting, the users can access the remote files as if they are accessing files on the local system. Similarly, virtual machines created under VMware can also mount shared file directories and use it to store and access files.

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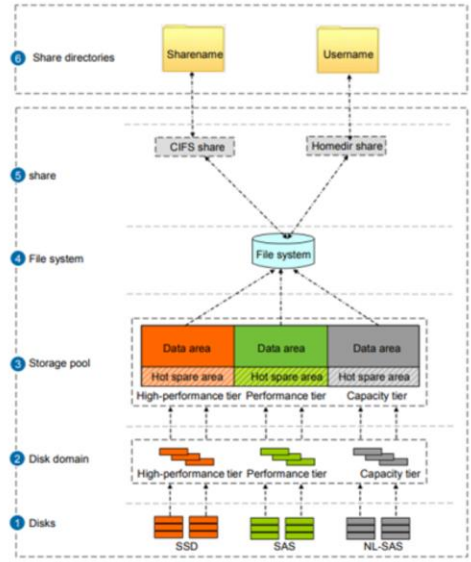
- Refer to 2: File system of storage system provide file level data storage services featuring high performance and enhanced security.
- Refer to 3: CIFS is a file system sharing protocol developed by Microsoft and it is intended for Windows operating system. Through CIFS, files can be transferred and shared between Windows clients.
- Refer to 4: Generally, CIFS shares provided by storage systems are public directories and can be accessed by all authorized users. If you want to set a private directory, enable Homedir so that each user can only access the directory that share the same user name with the user.

# Introduction To CIFS Storage Units

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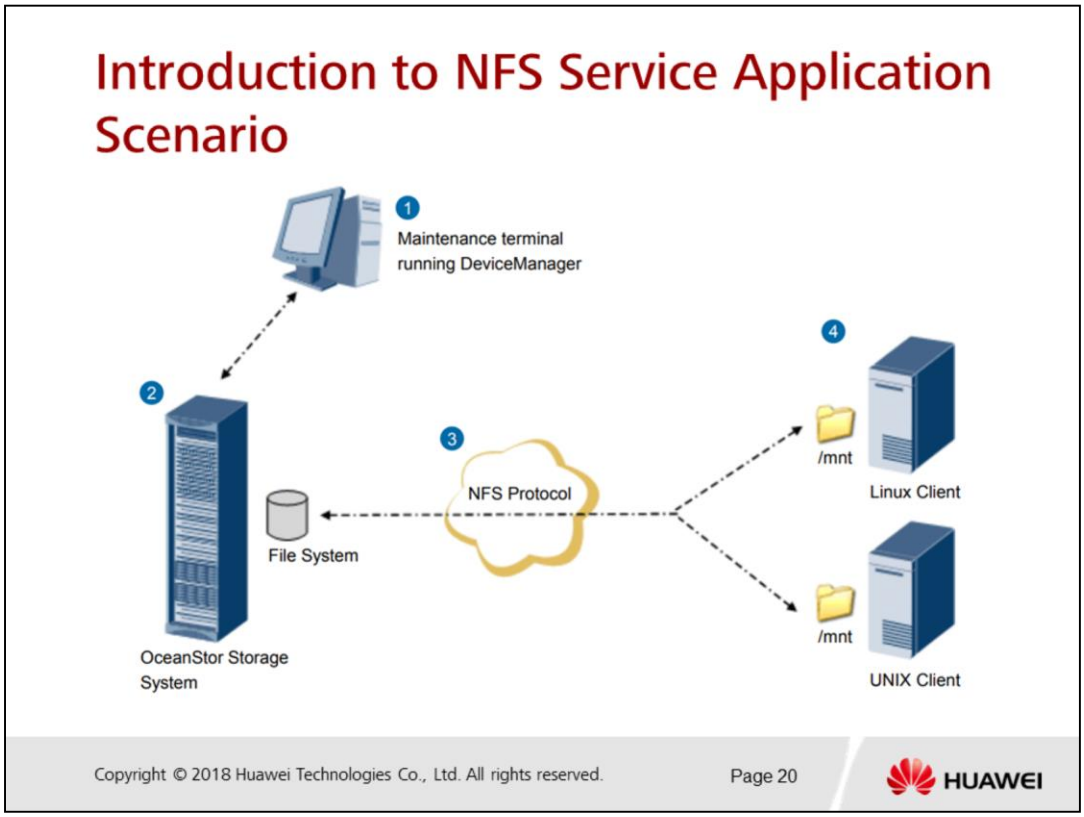
- Refer to 4: A file system can be created in a storage pool to provide storage space for a CIFS share.
- Refer to 5: After creating a CIFS share, you can set different access permissions for users.
- Refer to 6: A shared file system appears as a directory on a Windows-based client when the client accesses the CIFS share provided by a storage system. A storage system shares its file system with a user in CIFS or Homedir mode under the Windows operating platform. If the share mode is CIFS, then the shared file system appears as a directory with any specified sharename. On contrast, if the share mode is Homedir, then the directory name is the same as the user name. The Homedir directory can be accessed only by this user.

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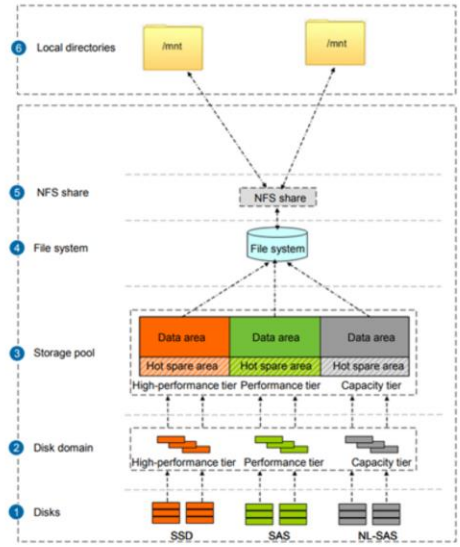
- Refer to 2: File system of storage system provide file level data storage services featuring high performance and enhanced security.
- Refer to 3: NFS is a file system sharing protocol developed by Sun Microsystems and it is intended for operating systems such as Linux and UNIX. Through NFS, files can be transferred and shared between clients that are running Linux (including SUSE and Red Hat) or UNIX (including Solaris, AIX, and HP-UX).
- Refer to 4: By using NFS, a storage system functions as a server and allows clients to access a shared file system. The clients mount the directory where the shared file system resides to their local directories, and then users can access the files on the remote server like they are accessing local files.

# Introduction To NFS Storage Units

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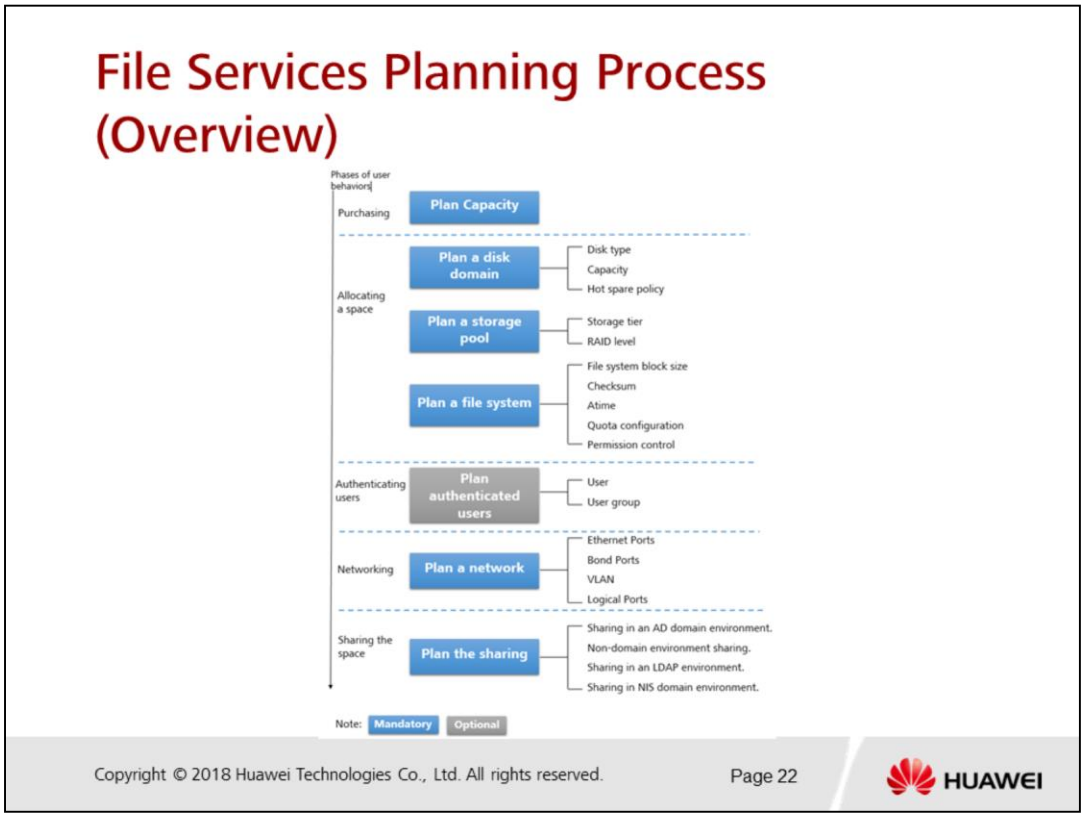
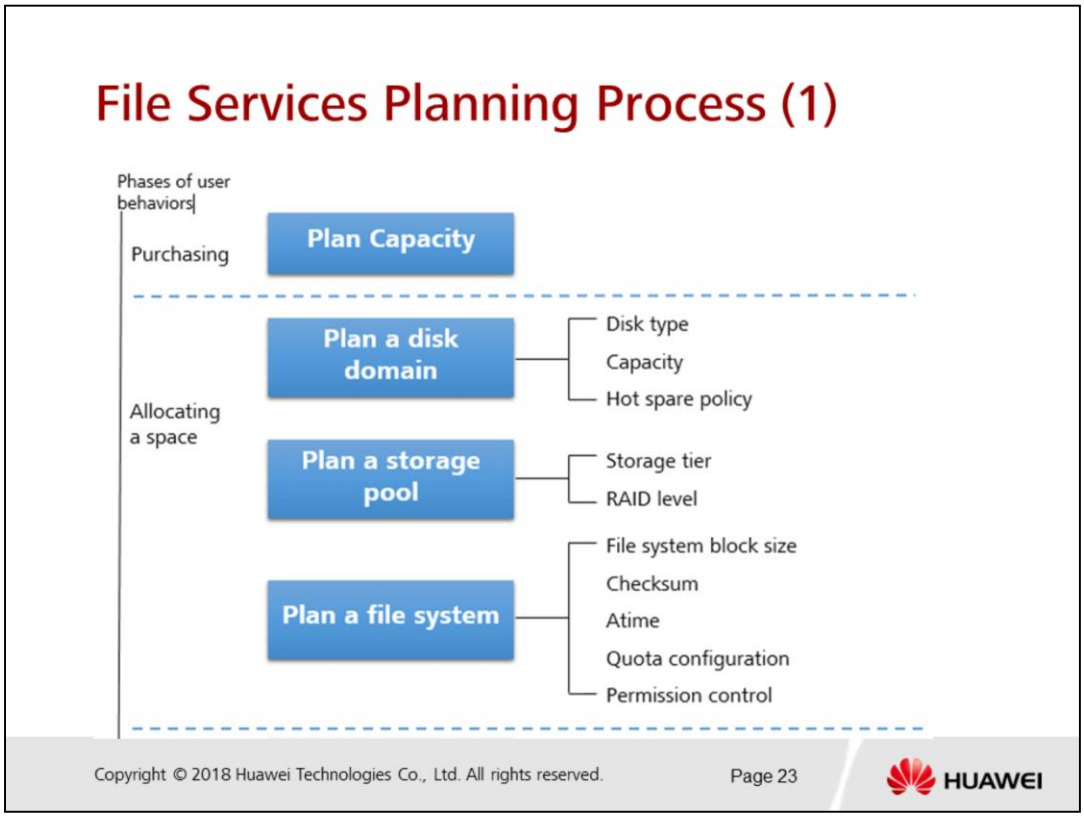
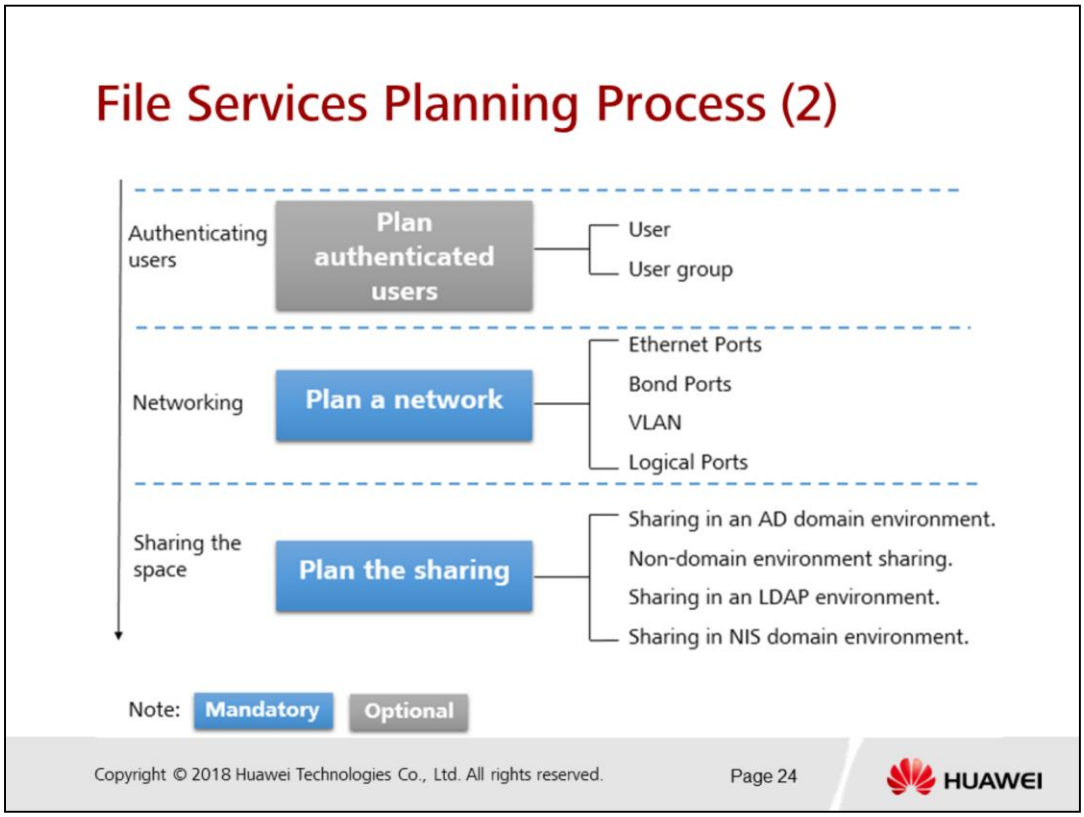
- Refer to 4: A file system can be created in a storage pool to provide storage space for an NFS share.
- Refer to 5: After creating an NFS share, you can set different access permissions for clients.
- Refer to 6: A Linux or UNIX-based client can access an NFS share provided by a storage system. A shared file system appears as a directory. The NFS share is mounted to the mnt directory on the Linux or Unix-based clients.




- Planning the capacity:
  - The storage system capacity is used for service data and system data storage. To ensure sufficient capacity for service data, the storage system capacity must be properly planned.
- Planning disk domains: A disk domain provides storage space for storage pools, whose storage tiers and available capacities depend on the disk types, capacity, and hot spare policy of the disk domain. Therefore, the disk types, capacity, and hot spare policy must be properly planned for a disk domain.
  - Disk type: Disk types of a disk domain determine the storage tiers of storage pools. Plan disk types based on your requirements.
  - Capacity: The capacity of a disk domain determines the available capacities of storage pools.
  - Hot spare policy: Plan hot spare policies and hot spare space so that the hot spare space can take over data from failed member disks.



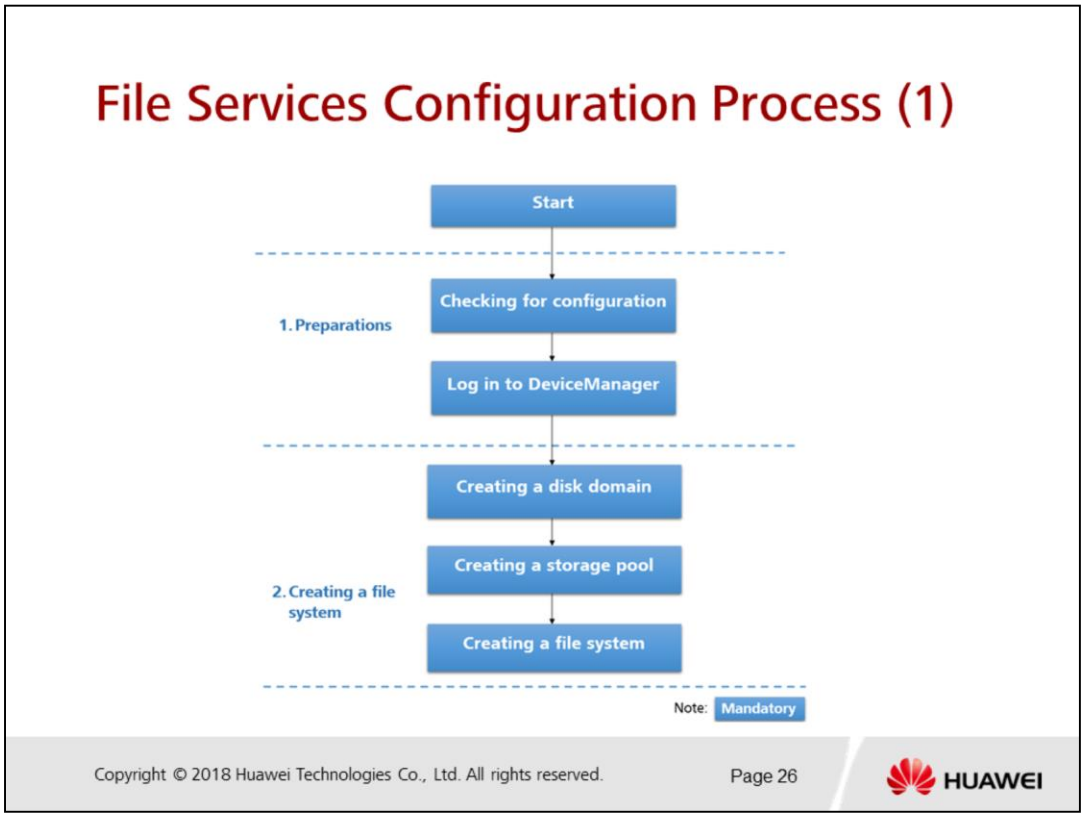

- Planning storage pools: A storage system provides storage space for application servers in the form of storage pools. The storage tiers and RAID levels of the storage pools must be properly planned in advance for better storage utilization.
  - Storage tier: Plan storage tiers to meet the need for optimal distribution of hot data and cold data.
  - RAID level: Plan RAID levels based on actual needs because RAID levels vary in performance, cost, and reliability.
- Planning file systems: File systems must be properly planned to optimize storage system space utilization and effectively accelerate storage system responses.
  - File system block size: The sizes of file system blocks are determined by data blocks written, so that the storage space can be fully utilized.
  - Checksum: Verifies data integrity. After the Checksum function is enabled, Checksum of data is automatically calculated when the data is being written. When the data is being read, Checksum ensures the integrity of the data. You can enable this function based on site requirements.
  - Atime: Updates file system time. Because this function affects system performance, determine whether to enable this function based on site requirements.



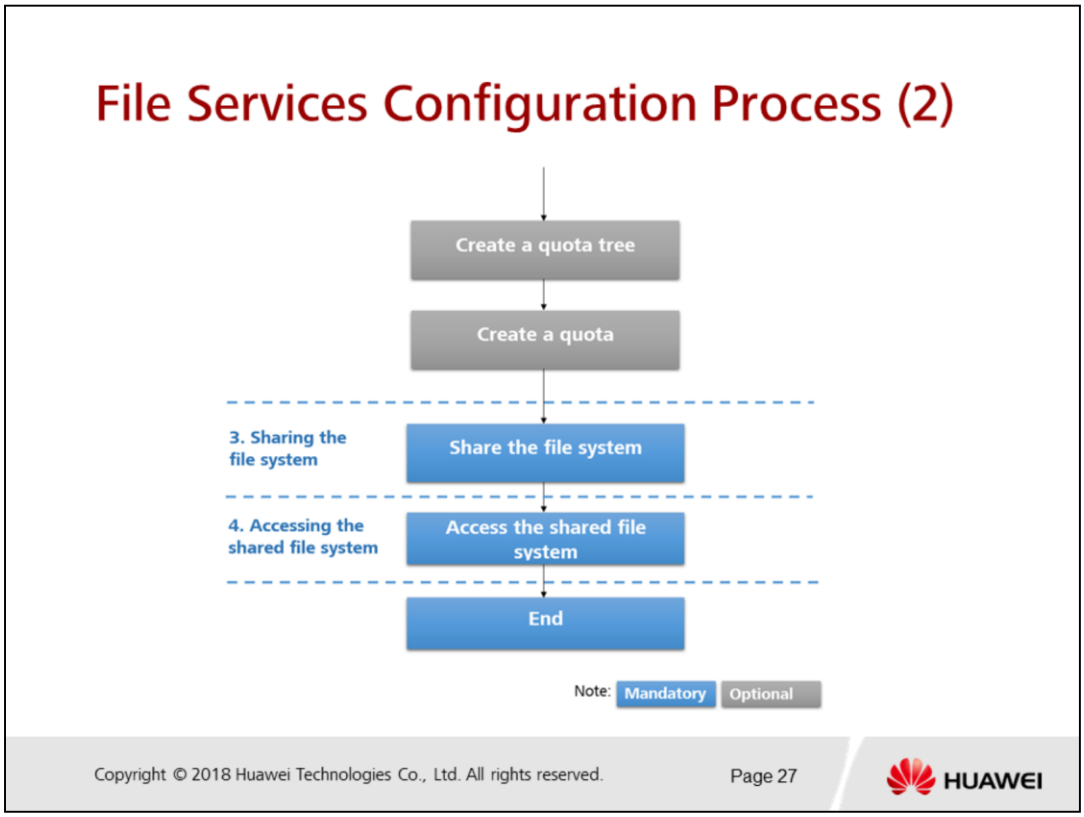

- Quota configuration: Different space sizes and quantities can be configured for different directories to achieve efficient storage resource utilization.
- Permission control: Different permissions of the same directory can be configured for different users, so that the users can only access the directory within their specified permissions.

- (Optional) Planning authenticated users: When CIFS shares are being matched, different authenticated users or user groups need to be selected for easy user permission control and management.
  - User: Different users need to be specified for shared directories.
  - User group: Each user can only belong to a user group to facilitate user group permission control.

- Planning networks: Network security settings of the storage system must be planned properly to ensure that application servers can safely and efficiently access shared files.
    - Ethernet Ports: Physically visible port on a device. Physical ports are the bases of VLANs and logical ports. Multiple physical ports can be bonded to form a bond port.
    - Bond Ports: To increase link redundancy of Ethernet ports, bond them and set bonding names and available ports.
    - VLAN: Logically divides physical port resources of the storage system into multiple broadcast domains. In a VLAN, when service data is being sent or received, a VLAN ID is configured for the data, so that network and service isolation is implemented for each VLAN, further ensuring service data security and reliability.
    - Logical Ports: It is created based on Ethernet ports, bond ports, or VLANs and used for service operation.
- Planning file system sharing: Application servers can access file systems only after these file systems are shared. Because file systems are shared differently in various environments, file system sharing must be planned properly.

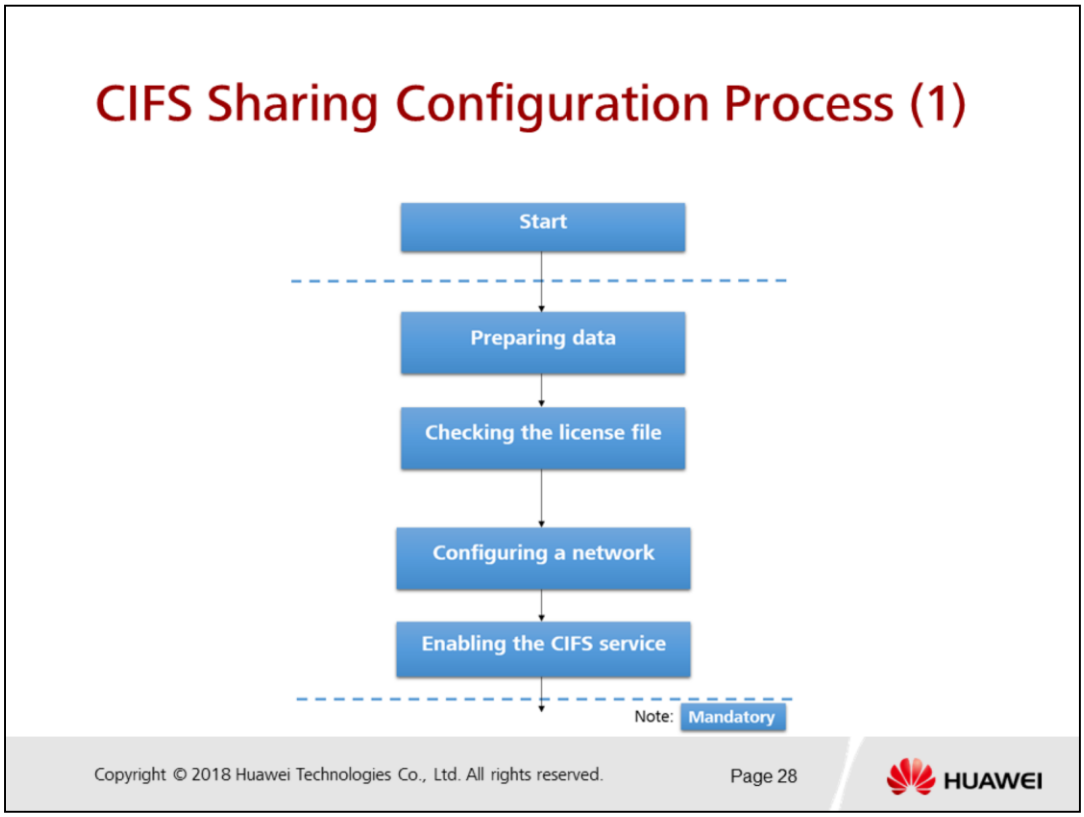



- Preparing for configuration:
  - Logging in to the DeviceManager: Users can manage and maintain the storage systems through the DeviceManager software from a maintenance terminal that is connected to the storage management network ports or SVP(Service Processor in 18000 series or 18000F series). DeviceManager is the integrated management software developed by Huawei.
- Creating the file system:
  - Creating a disk domain: A disk domain provides storage space for storage pools, whose storage tiers and available capacities depend on the disk types, capacity, and hot spare policy of the disk domain. The storage system automatically allocates hot spare space with different capacities based on hot spare policies to take over data from failed member disks
  - Creating a storage pool: The storage space used by application servers is provided by the storage pools on the storage system.
  - Creating a file system: Application servers require a file system to access storage system space.

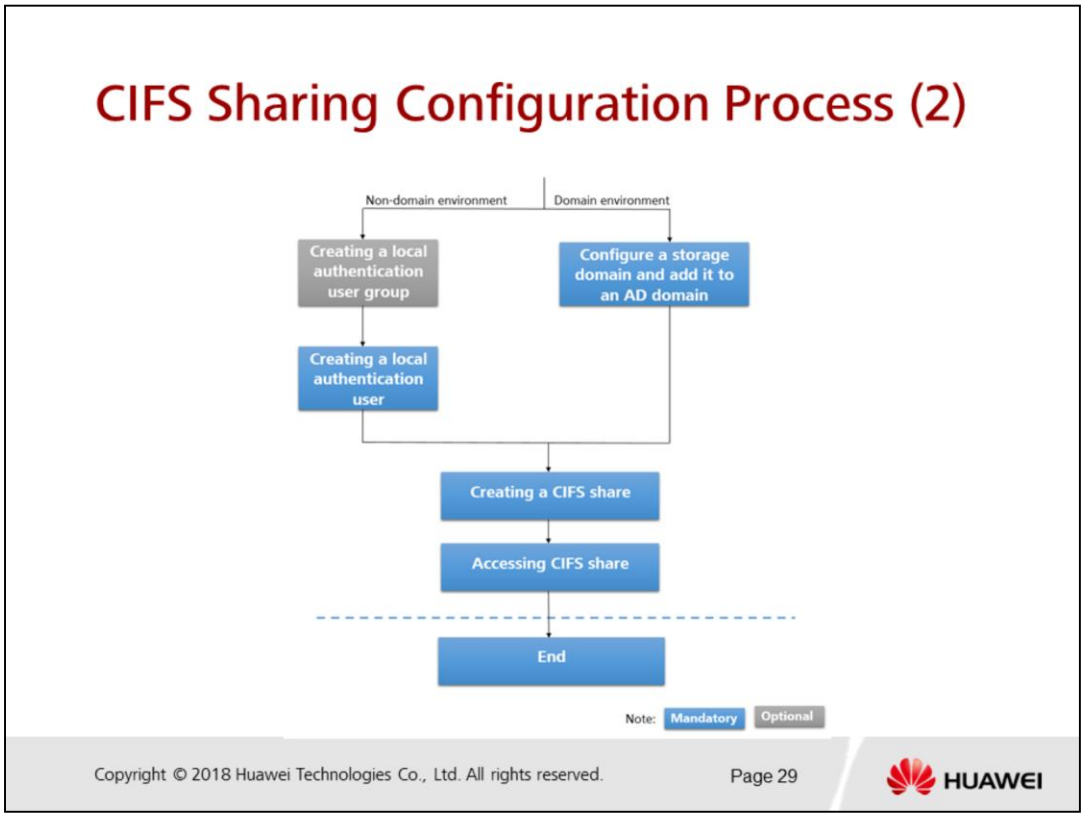



- (Optional) Creating a quota tree: Quota tree is the first level directory of the file system that can be managed by quota. You can set the directory quota, user quota, and user group quota to manage the storage space used by all the files within those directories.
- (Optional) Creating a quota: By creating a quota, you can restrict the amount of storage space used or number of files that can be stored by users or group of users within the first level directory of the file system.

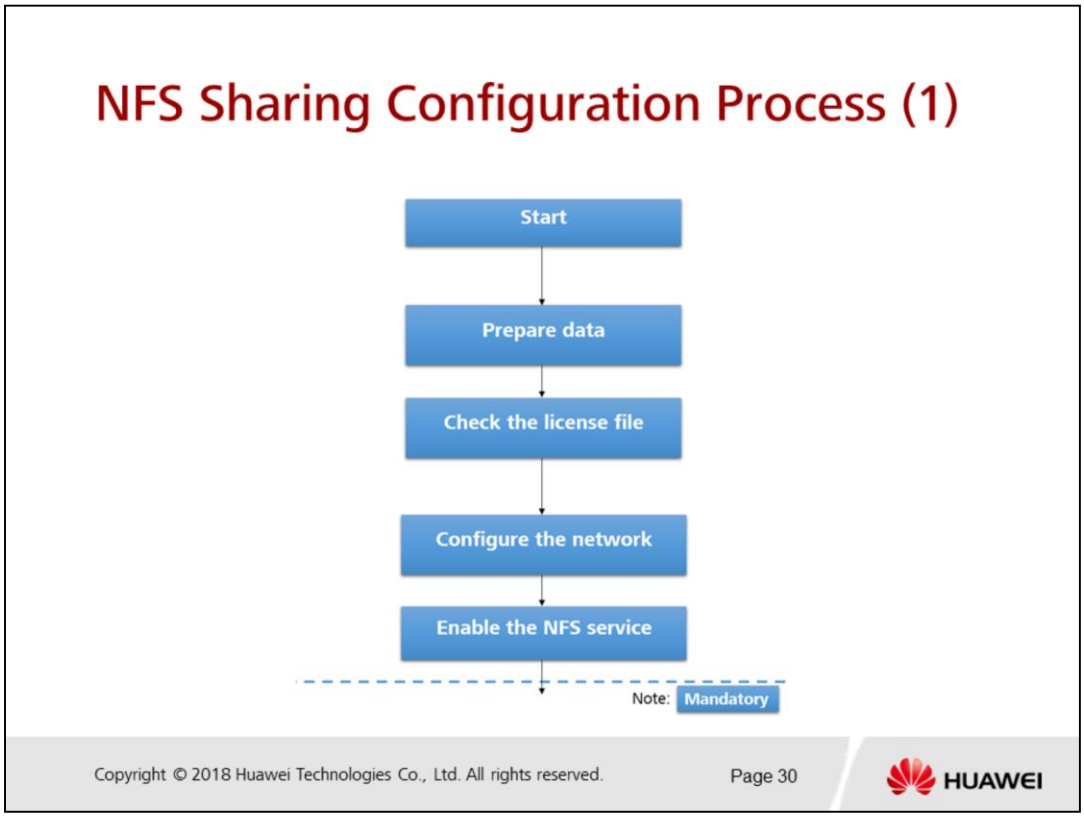
- Sharing storage space and accessing a shared file system:
  - Sharing a file system and using an application server to access a shared file system: A file system must be shared before application servers access storage system space.



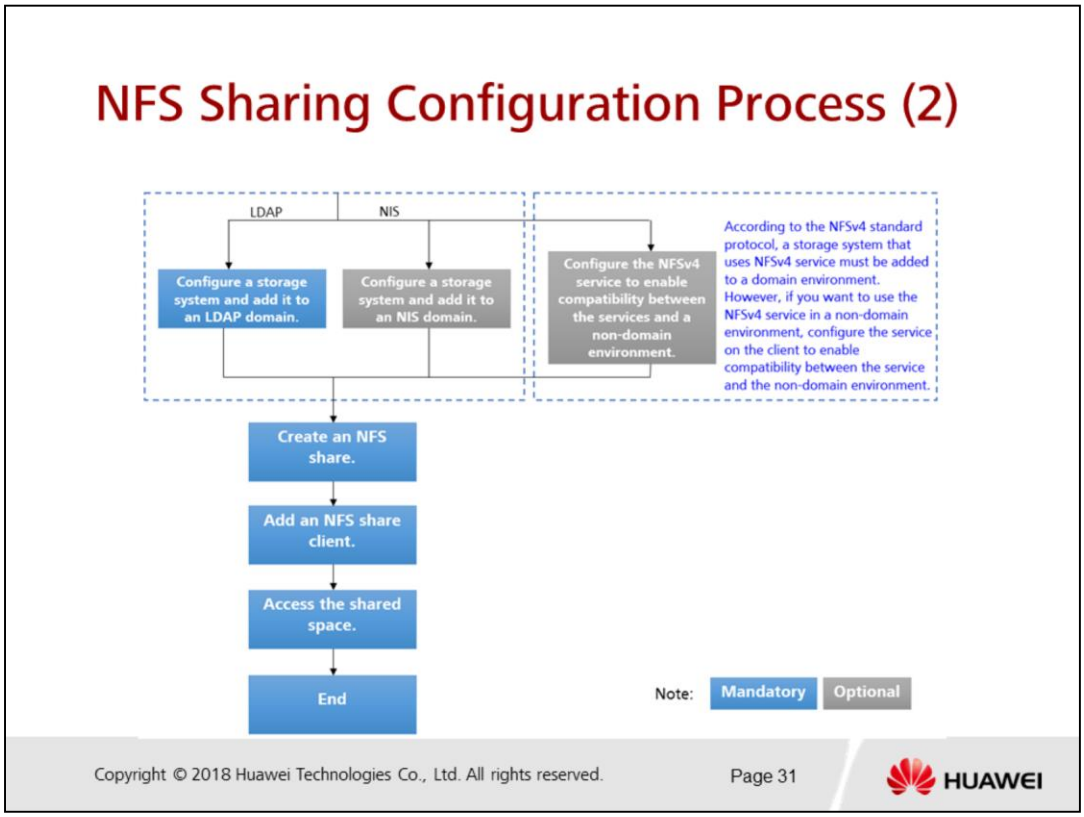

- Before configuring the CIFS share, please prepare the logical IP address for the storage system, file system for the CIFS share directories, CIFS sharename, user rights, local authentication users for non domain environment and Active Directory information for domain environment, for a quicker and smooth configuration process.
- After the file system is shared using the CIFS mode, users can access the storage space and shared directories.
- Preparing Data:
  - Before configuring a CIFS share, obtain information about storage system IP address, local users, quotas, permissions, and AD domain to assist in the follow-up configuration.
- Checking the License File:
  - Each value-added feature requires a license file for activation. Before configuring a value-added feature, ensure that its license file is valid for the feature.
- Configuring a Network:
  - Use the DeviceManager to configure the IP address of the storage ports, gateway, subnet mask, and floating IP address of the storage system.
- Enabling the CIFS Service:
  - Before creating a CIFS share, check whether the CIFS service has been enabled and whether parameters are correct.




- Configuring a Local Authentication User Group:
  - In a non-domain environment, you must configure a local authentication user (or group). The storage system enables you to allocate different CIFS share access permissions to different user (or group).
- Configuring a Storage System to Add It to an AD Domain:
  - After the storage system is added to an AD domain, domain users can access CIFS shares that are allocated to the domain.
- Creating a CIFS share:
  - You may share the file system through CIFS, and afterwards users can access the shared storage space.
- Accessing CIFS Shares:
  - By accessing a CIFS share, different users can access the shared directory based on their user rights and permissions.




- Preparing Data:
  - Before configuring an NFS share in a storage system, plan and collect required data to assist in the follow-up service configuration.
- Checking the License File:
  - Each value-added feature requires a license file for activation. Before configuring a value-added feature, ensure that its license file is valid for the feature.
- Configuring a Network:
  - Use the DeviceManager to configure the IP address of the storage ports, gateway, subnet mask, and floating IP address of the storage system.
- Enabling the NFS Service:
  - Before configuring an NFS share, enable the NFS service for clients to access the NFS share. The storage system supports NFSv3 and NFSv4.




- (Optional) Configuring a Storage System to Add It to a Domain:
  - Add the storage system to a domain such as an LDAP or NIS domain. Afterwards, the domain users can access the NFS shares allocated to the domain. The LDAP (Lightweight Directory Access Protocol) is an open, vendor-neutral, industry standard application protocol for accessing and maintaining distributed directory information services over an Internet Protocol network. The NIS (Network Information Service), is a client–server directory service protocol for distributing system configuration data such as user and host names between computers on a computer network.
- (Optional) Configuring the NFSv4 Service to Enable It to Be Used in a Non-Domain Environment:
  - According to the NFSv4 standard protocol, the NFSv4 service must be used in a domain environment to ensure that the NFSv4 service functions properly. However, if you want to use the NFSv4 service in a non-domain environment, configure the user_name@domain_name mapping mechanism used by the NFSv4 service on your client. After the configuration is complete, the NFSv4 service will use UIDs and GIDs to transfer information about files during service transactions between your storage system and client.

- Creating an NFS Share:
  - After an NFS share is created, the applicable shared file system is accessible to clients that run the OS such as SUSE, Red Hat, HP-UNIX, Sun Solaris, IBM AIX, and Mac OS.
- Adding an NFS Share Client:
  - An NFS share client enables client users to access shared file systems using a network.
- Accessing NFS Share:
  - The operating systems that support the client in accessing NFS shared file systems include SUSE, Red Hat, HP-UX, SUN Solaris, IBM AIX, and Mac OS, etc. Operations used by a client to access an NFS share in an LDAP domain and NIS domain are the same as those used in a non-domain environment.

# Summary

- This module introduced:
  - The Initialization Process and Configuration Methods Of Storage Systems In Data Centers.
  - The Configuration Process, Configuration Methods And Application Scenarios Of Block Storage Services In Data Centers.
  - The Configuration Process, Configuration Methods And Application Scenarios Of File Storage Services In Data Centers.

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## Quiz

1. Which of the following belongs to the file services in data center storage systems?
   A. CIFS
   B. NFS
   C. NTFS
   D. LUN
2. Which of the following are the configuration steps of block storage services?
   A. Creating a disk domain.
   B. Creating a LUN group.
   C. Enabling NFS sharing service.
   D. Configuring CHAP Authentication.

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- Answers:
  - AB.
  - ABD.

# Thank You

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