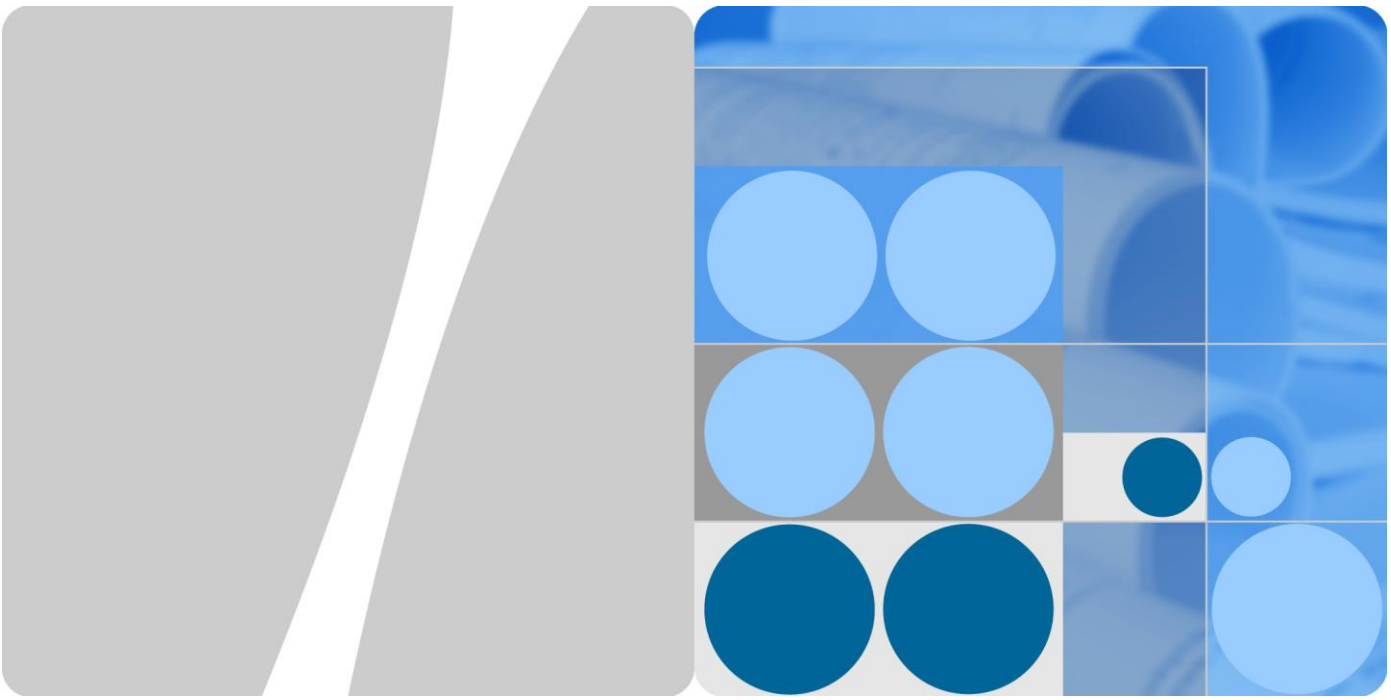

VS Technology White Paper

Issue 02

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1 VS

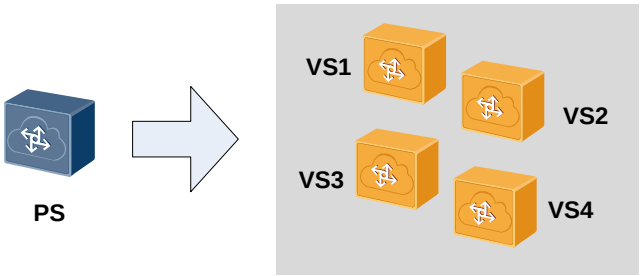
About This Chapter

1.1 Introduction to VS

Definition

Virtual system (VS) technology virtualizes a single physical system (PS) into multiple logical systems that are independent of each other. Each VS functions like an individual physical device to process services, as shown in Figure 1-1.

Figure 1-1 Virtual systems



Purpose

As the network scale expands, more network infrastructure devices are required. However, some of the devices are not fully utilized, which causes a waste of resources.

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VS technology allows a PS to function as multiple physical network nodes, which makes full use of existing resources and reduces the operating expenditure (OPEX). Different VSs have different services deployed to isolate services and faults, which improves network security and reliability.

Benefits

VS technology has the following advantages:

- Service and fault isolation: Different services are deployed on separate VSs. A fault of a VS affects only the services on the VS. This mechanism improves network security and reliability.
- Independent management: Each VS has a management plane and can process services independently. VSs can be configured and managed as independent devices.
- Reduced network OPEX: After a PS is virtualized into multiple VSs, the PS can carry services of multiple network nodes. This improves resource use efficiency and reduces the number of physical devices on a network.

1.2 Applications

User Group Virtualization

As shown in Figure 1-2, VSs serve different user groups to isolate traffic and faults. The user groups are managed through different networks, ensuring high network reliability and security.

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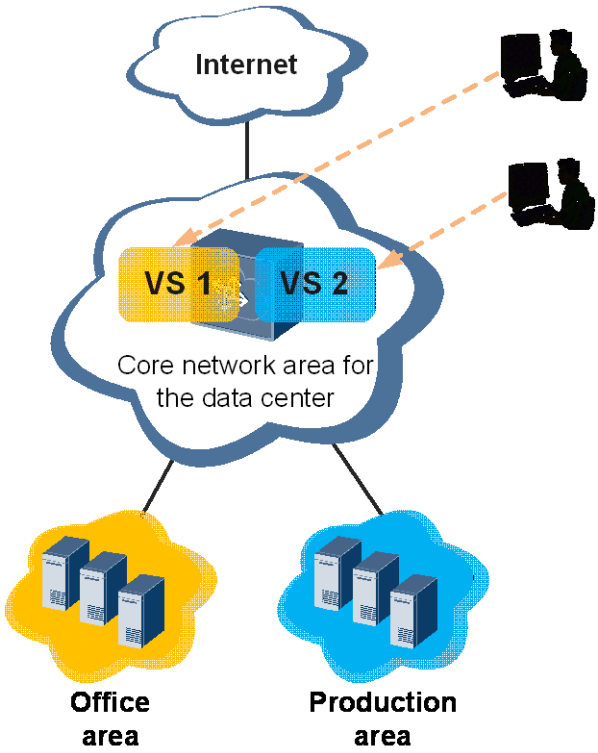
Figure 1-2 VS assignment based on user groups



Network Node Virtualization

As shown in Figure 1-3, VS technology allows vertical and horizontal network virtualization without changing the logical network topology. This reduces the number of physical devices on a network, improves the resource use efficiency, and lowers network OPEX.

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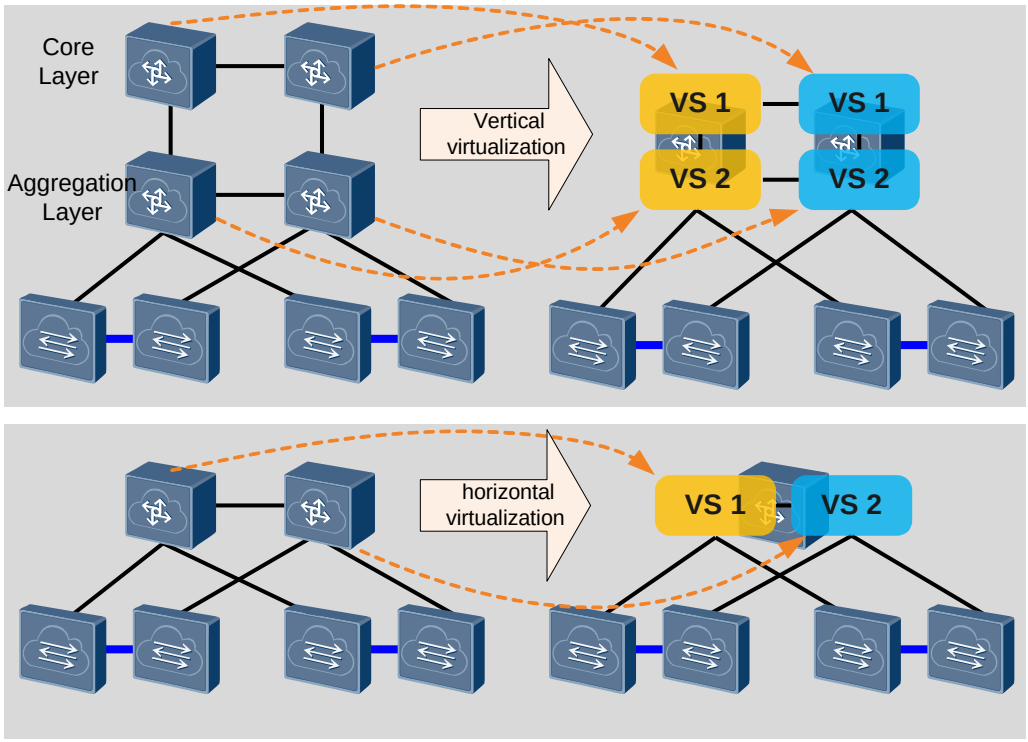
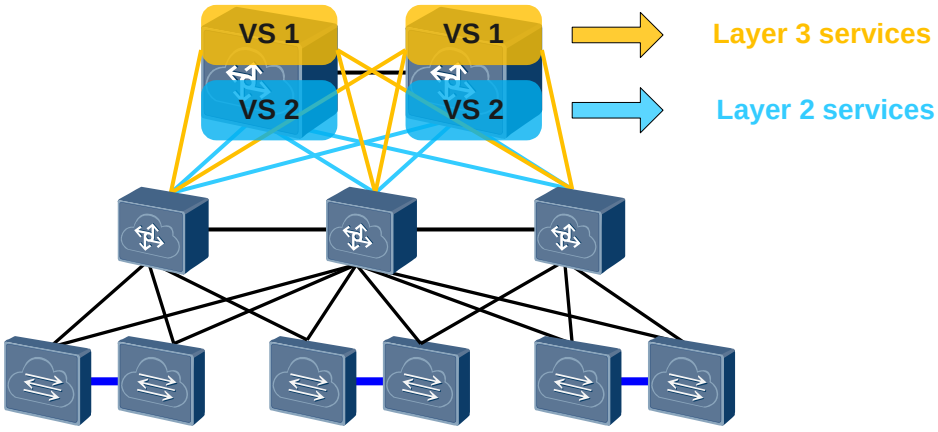
Figure 1-3 VS assignment based on network nodes



Service virtualization

As shown in Figure 1-4, different services are isolated and processed independently on VSs to improve security and reliability.

Figure 1-4 VS assignment based on services



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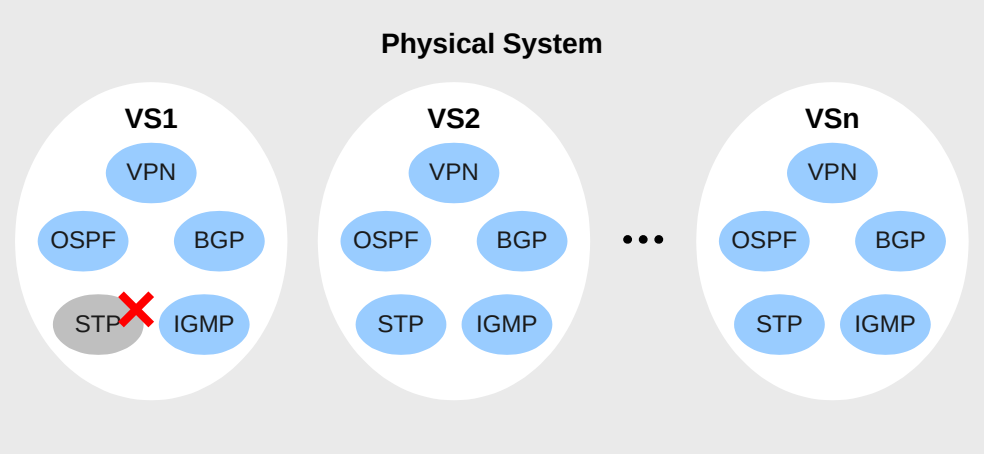
1.3 Principles

1.3.1 Basic VS Principles

The system software copies processes of the PS to implement virtualization in the following aspects.

- Virtualization of the control plane: Each VS runs its own control protocol processes. A process error in one VS does not affect processes in other VSs. For example, if the STP process fails in a VS, STP processes run normally in other VSs, as shown in Figure 1-5.

  Figure 1-5 VS fault isolation



- Virtualization of the management plane: Each VS maintains its own configuration files and can be managed by a different administrator.
- Virtualization of the forwarding plane: Each VS maintains its own forwarding table and protocol stacks. Traffic is processed independently on each VS. Data flows are isolated between VSs to ensure service isolation and security.

Through plane virtualization, a new VS functions as an individual physical device.

Admin-VS

Admin-VS: the administrative VS. Each PS has an Admin-VS that retains in running state. The Admin-VS cannot be created, deleted, or shut down. An administrator enters the Admin-VS after logging in to the PS. In the Admin-VS, the administrator can create, delete, or allocate resources to VSs.

Administrator

Users on a PS can be a PS administrator or a VS administrator. The two kinds of administrators are assigned different rights.

- PS administrator: the only user that can perform operations in the Admin-VS. A PS administrator has the highest privilege level and can create, delete, or allocate resources to VSs. The PS administrator can also enter a non Admin-VS.

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- VS administrator: manages only a local VS. A VS administrator can configure services in the local VS but cannot perform operations related to the entire PS, such as resetting boards and backing up electrical labels.

MAC Address

Each VS including the Admin-VS is automatically assigned an MAC address. The MAC address cannot be changed.

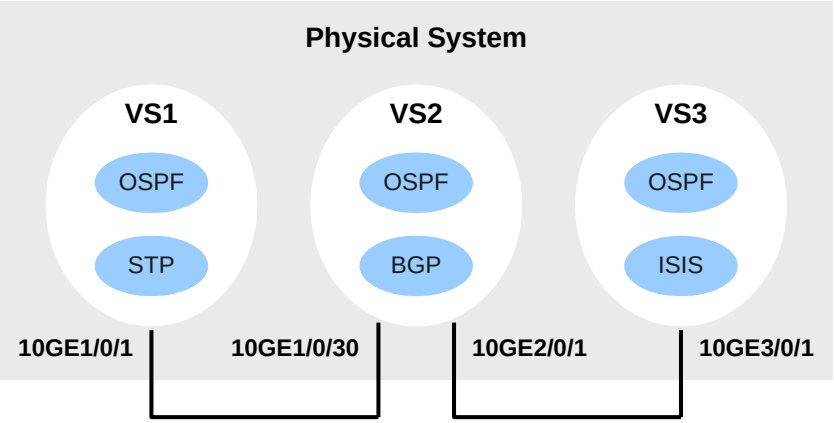
File System

Each VS has an independent file system and manages its configuration files and log files. A VS administrator is only allowed to perform file operations on the local file system. Operations on one VS do not affect other VSs, so security is guaranteed.

Communication Between VSs

VSs can communicate with each other only through configured physical interfaces between them, and cannot communicate directly, as shown in Figure 1-6.

Figure 1-6 Communication between VSs



1.3.2 Resources Allocation

The PS administrator can allocate resources on the PS to VSs. Resources allocated to a VS are exclusively used by the VS. A VS administrator can check and manage only local VS resources after logging in to the VS.

Allocable resources on the PS include physical and logical resources.

Physical Resources

Only physical Ethernet interfaces on interface cards can be allocated to VSs. Physical interfaces can be allocated in two modes:

- Port mode: All interfaces on an interface card can be allocated to any VS, as shown in Figure 1-7.

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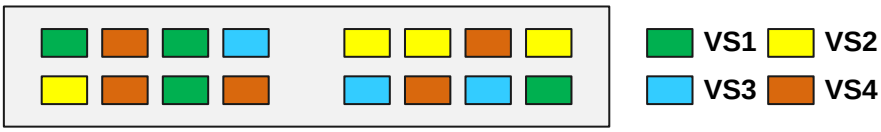
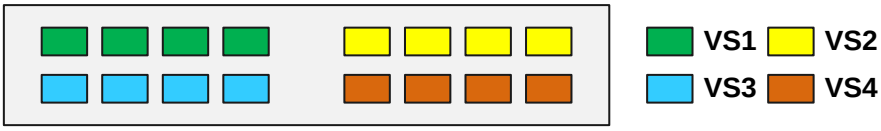
Figure 1-7 Port mode



- Group mode: All interfaces on the same forwarding chip of an interface card must be allocated to the same VS, as shown in Figure 1-8.

Figure 1-8 Group mode



Interface resource allocation has the following characteristics:

- A PS can have both VS using the port mode and VSs using the group mode.
- By default, all interfaces on an interface card belong to the Admin-VS.
- The PS administrator can assign interfaces in the Admin-VS to VSs, but an interface can only be allocated to one VS.
- Interfaces on different interface cards can be allocated to the same VS.
- After an interface is allocated to a VS, original configurations on the interface are deleted.
- A VS administrator can check and configure only interfaces in the local VS.

Logical Resources

Table 1-1 lists logical resources that can be allocated to VSs.

Table 1-1 Logical resources and specifications

Resource	System Specifications	Default VS Specifications	
		Group mode	Port mode
IPv4 unicast routing entries	1000000	60000	60000
IPv4 multicast routing entries	16000	1000	1000
IPv6 unicast routing entries	256000	16000	16000
IPv6 multicast routing entries	2000	100	100
VLANs	Port mode: 4063 Group mode: 28672	4063	200

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Resource	System Specifications	Default VS Specifications	
		Group mode	Port mode
VPN instances	Port mode: 4096 Group mode: 61440	4096	256
MPLS	Supported	Supported	Not supported
TRILL	Supported	Supported	Not supported
Multicast	Supported	Supported	Not supported

Logical resource allocation has the following characteristics:

- A new VS has the default logical resource specifications. The PS administrator can change the specifications in the VS.
- Logical resources of two VSs can have the same name. For example, VS1 and VS2 can both have a VLAN named **VLAN 10**.
- VSs in port mode share service specifications configured on a PS. For example, a PS supports a maximum of service 4063 VLANs, and interfaces are assigned to VS1 and VS2 in port mode. If VS1 and the Admin-VS are allocated a total of 3000 VLANs (the Admin-VS is in port mode), VS2 can only use the remaining 1063 VLANs.
- Service specifications are exclusive to VSs in group mode. For example, if a maximum of 4063 VLANs are supported by device PS, and interfaces are assigned to VS1 and VS2 in group mode, VS1 and VS2 each can have a maximum of 4063 VLANs. Note that resource allocation is restricted by the system specifications. For example, a PS supports a maximum of 28672 VLANs. If seven VSs in group mode occupy a total of 28441 (7 x 4063) VLANs, the remaining VLAN resources are insufficient for another VS in group mode.
- A VS administrator can check and manage only logical resources in the local VS.

1.3.3 VS Management

A user can implement remote VS management in inband and out-of-band mode.

Out-of-Band Management

The system software provides each VS with a virtual network interface MEth0/0/0. Each virtual management interface can have an independent IP address for each virtual management interface. Through the virtual management interfaces, different VSs can be managed remotely using the same management network, as shown in Figure 1-9.

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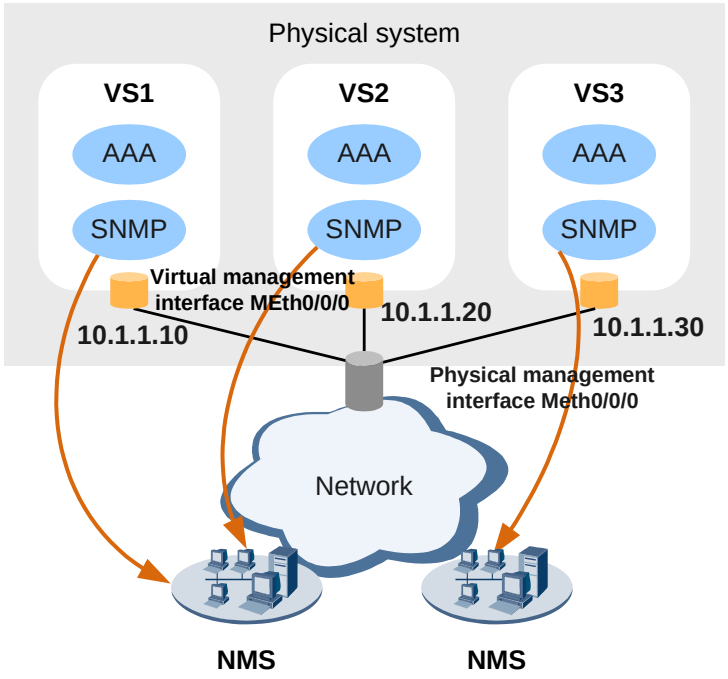
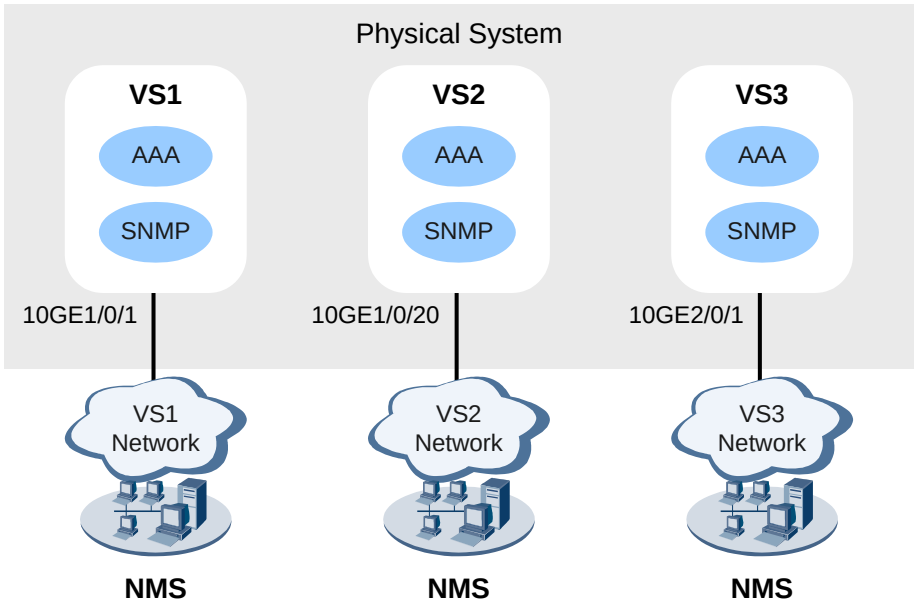
Figure 1-9 Out-of-band management



Inband Management

A user can connect to a VS through the assigned physical interface. Through inband management, the user can manage each VS using an independent management network.

Figure 1-10 Inband management



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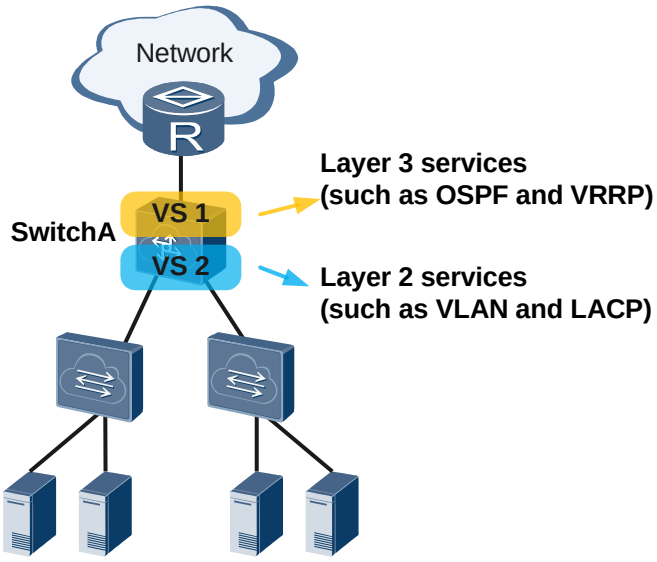
1.4 Example for Configuring VSs

Networking Requirements

As shown in Figure 1-11, SwitchA is a core switch on the network and carries multiple Layer 2 and Layer 3 services.

On the network, all services need to be processed by the MBs of the PS. In such a case, when a service failure on the PS causes a failure of the PS, other services running on the PS cannot be properly forwarded. To prevent this problem, users require that Layer 2 and Layer 3 services deployed on the PS be isolated from each other to improve network security.

Figure 1-11 Networking diagram for configuring VSs



Configuration Roadmap

The configuration roadmap is as follows:

1. Create VS 1 and VS 2, and allocate physical interfaces and logical resources to them.
2. Configure management IP addresses and management accounts for VSs to facilitate VS management.

Procedure

Step 1 Create VSs and allocate resources to them.

Create logical resource templates **temp1** and **temp2**.

```
<SwitchA> system-view
[~SwitchA] admin
[~SwitchA-admin] resource-template temp1
[~SwitchA-admin-template:temp1] resource u4route upper-limit 50000
[~SwitchA-admin-template:temp1] resource mpls enable
[~SwitchA-admin-template:temp1] quit
[~SwitchA-admin] resource-template temp2
```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```
[~SwitchA-admin-template:temp2] resource m4route upper-limit 800
[~SwitchA-admin-template:temp2] resource trill enable
[~SwitchA-admin-template:temp2] quit
[~SwitchA-admin] commit
```

Create VS 1 and configure the interface assignment mode for VS1 as **group**. Assign physical interfaces 10GE1/0/0 to 10G1/0/23 to VS 1, and load the logical resource template **temp1** on VS 1.

```
[~SwitchA-admin] virtual-system vs1
[~SwitchA-admin-vs:vs1] port-mode group
[~SwitchA-admin-vs:vs1] assign interface 10GE 1/0/0
Warning: All configurations of the interfaces will be deleted. All interfaces of
 the same group will be assigned. Continue? [Y/N]: y
[~SwitchA-admin-vs:vs1] assign resource-template temp1
[~SwitchA-admin-vs:vs1] quit
[~SwitchA-admin] commit
```

Create VS 2 and configure the interface assignment mode for VS 2 as **group**. Assign physical interfaces 10GE2/0/0 to 10GE2/0/23 to VS 2, and load the logical resource template **temp2** on VS 2.

```
[~SwitchA-admin] virtual-system vs2
[~SwitchA-admin-vs:vs2] port-mode group
[~SwitchA-admin-vs:vs2] assign interface 10GE 2/0/0
Warning: All configurations of the interfaces will be deleted. All interfaces of
 the same group will be assigned. Continue? [Y/N]: y
[~SwitchA-admin-vs:vs2] assign resource-template temp2
[~SwitchA-admin-vs:vs2] quit
[~SwitchA-admin] commit
```

Step 2 Verify the configuration.

Check detailed information about VS 1.

```
[~SwitchA-admin] display virtual-system name vs1 verbose
Name        : vs1
Status      : running
Description  :
2013-07-18 17:28:47+08:00
Port mode    : group
System MAC   : 000a-0b0c-0d04
Assigned slot(s)
pvmb        : 9
pvmb        : 10
Assigned interface(s)
  10GE1/0/0, slot 1
  10GE1/0/1, slot 1
  10GE1/0/2, slot 1
  10GE1/0/3, slot 1
  10GE1/0/4, slot 1
  10GE1/0/5, slot 1
  10GE1/0/6, slot 1
  10GE1/0/7, slot 1
  10GE1/0/8, slot 1
```


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```
  10GE1/0/9, slot 1
  10GE1/0/10, slot 1
  10GE1/0/11, slot 1
  10GE1/0/12, slot 1
  10GE1/0/13, slot 1
  10GE1/0/14, slot 1
  10GE1/0/15, slot 1
  10GE1/0/16, slot 1
  10GE1/0/17, slot 1
  10GE1/0/18, slot 1
  10GE1/0/19, slot 1
  10GE1/0/20, slot 1
  10GE1/0/21, slot 1
  10GE1/0/22, slot 1
  10GE1/0/23, slot 1
Assigned resource(s)
u4route     : 50000(Max)
m4route     : 1000(Max)
u6route     : 16000(Max)
m6route     : 100(Max)
vlan        : 4063(Max)
vpn-instance : 4096(Max)
mpls        : enable
trill       : enable
mcast       : enable
```

Check detailed information about VS 2.

```
[~SwitchA-admin] display virtual-system name vs2 verbose
Name        : vs2
Status      : running
Description  :
2013-07-18 17:30:51+08:00
Port mode    : group
System MAC   : 000a-0b0c-0d05
Assigned slot(s)
pvmb        : 9
pvmb        : 10
Assigned interface(s)
  10GE2/0/0, slot 2
  10GE2/0/1, slot 2
  10GE2/0/2, slot 2
  10GE2/0/3, slot 2
  10GE2/0/4, slot 2
  10GE2/0/5, slot 2
  10GE2/0/6, slot 2
  10GE2/0/7, slot 2
  10GE2/0/8, slot 2
  10GE2/0/9, slot 2
  10GE2/0/10, slot 2
  10GE2/0/11, slot 2
  10GE2/0/12, slot 2
  10GE2/0/13, slot 2
  10GE2/0/14, slot 2
  10GE2/0/15, slot 2
```


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```
  10GE2/0/16, slot 2
  10GE2/0/17, slot 2
  10GE2/0/18, slot 2
  10GE2/0/19, slot 2
  10GE2/0/20, slot 2
  10GE2/0/21, slot 2
  10GE2/0/22, slot 2
  10GE2/0/23, slot 2
Assigned resource(s)
u4route     : 60000(Max)
m4route     : 800(Max)
u6route     : 16000(Max)
m6route     : 100(Max)
vlan        : 4063(Max)
vpn-instance : 4096(Max)
mpls        : enable
trill       : enable
mcast       : enable
```

Step 3 Configure management IP addresses and management accounts for VSs.

Switch from the Admin-VS to VS 1 and configure a management IP address and management account for VS 1.

```
<SwitchA> switch virtual-system vs1
<SwitchA-vs1> system-view
[~SwitchA-vs1] interface MEth 0/0/0
[~SwitchA-vs1-MEth0/0/0] ip address 10.1.1.10 24
[~SwitchA-vs1-MEth0/0/0] quit
[~SwitchA-vs1] user-interface vty 0 4
[~SwitchA-vs1-vty0-4] authentication-mode aaa
[~SwitchA-vs1-vty0-4] user privilege level 15
[~SwitchA-vs1-vty0-4] quit
[~SwitchA-vs1] aaa
[~SwitchA-vs1-aaa] local-user vs1_user password irreversible-cipher vs1user
[~SwitchA-vs1-aaa] local-user vs1_user service-type telnet
[~SwitchA-vs1-aaa] local-user vs1_user level 3
[~SwitchA-vs1-aaa] quit
[~SwitchA-vs1] commit
```

The configuration of VS 2 is the same as that of VS 1 and is not provided here.

Step 4 Log in to the VSs through a client to verify the configurations.

Use the configured IP address, user name, and password to log in to the VSs through Telnet. Use the PC as an example to log in to the VSs. The routes between the client and VSs must be reachable.

```
C:\Documents and Settings\Administrator> telnet 10.1.1.10
```

Press **Enter**, and enter the configured user name and password in the login window. If authentication is successful, the command-line prompt of the user view is displayed, the user has successfully logged in to the VS.

```
Username:vs1_user
Password:
```


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```
Info: The max number of VTY users is 5, the number of current VTY users online i
s 1, and total number of terminal users online is 2.
     The current login time is 2013-03-08 15:13:12.
     First login successfully.
<vs1>
```

----End

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A A Terms, Acronyms, and Abbreviations

Term/Acronym/Abbreviation	Full Name	Description
PS	Physical System	A physical device.
VS	Virtual System	A logical device virtualized from a PS.

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