Sun Ethernet Fabric Operating System

OSPF Administration Guide

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Contents

Using This Documentation

- **Overview** – Provides information about configuring OSPF protocol that is running as a part of the SEFOS
- **Audience** – Users implementing OSPF protocol with other protocols in the router stack
- **Required Knowledge** – Basic knowledge of the OSPF protocol

Product Documentation Library

Documentation and resources for this product and related products are available at:

- http://www.oracle.com/goto/es2-72_es2-64/docs
- http://www.oracle.com/goto/ES1-24/docs
- http://www.oracle.com/goto/sn-10gbE-72p/docs
- http://www.oracle.com/goto/sb6k-24p-10gbe/docs

Acronyms and Abbreviations

Acronym or Abbreviation	Explanation
ABR	Area border router
AS	Autonomous system
ASBR	Autonomous system border router
CLI	Command-line interface
DDP	Database description packet
LSA	Link state advertisement
NSSA	Not-so-stubby-area
NBMA	Non broadcast multi access
OSPF	Open shortest path first
RRD	Route redistribution
RT	Routing table
RTM	Route table manager

Acronym or Abbreviation	Explanation
SEFOS	Sun Ethernet Fabric Operating System
SPF	Shortest path first
VL	Virtual link

CLI Command Modes

The following table lists the configuration modes used in this document with their access and exit methods.

Command Mode	Access Method	Prompt	Exit Method
User EXEC	Access SEFOS from Oracle ILOM with read-only rights (privilege level 1).	`SEFOS>`	Use the `logout` or `exit` command to return to the Oracle ILOM prompt.
Privileged EXEC	Access SEFOS from Oracle ILOM with full administrative rights (privilege level 15).	`SEFOS#`	Use the `logout` or `exit` command to return to the Oracle ILOM prompt.
Global Configuration	From User EXEC mode, use the `enable` command.	`SEFOS(config)#`	Use the `end` command to return to Privileged EXEC mode.
Interface Configuration	From Global Configuration mode, use the `interface interface-type interface-id` command.	`SEFOS(config-if)#`	Use the `exit` command to return to Global Configuration mode, or use the `end` command to return to Privileged EXEC mode.

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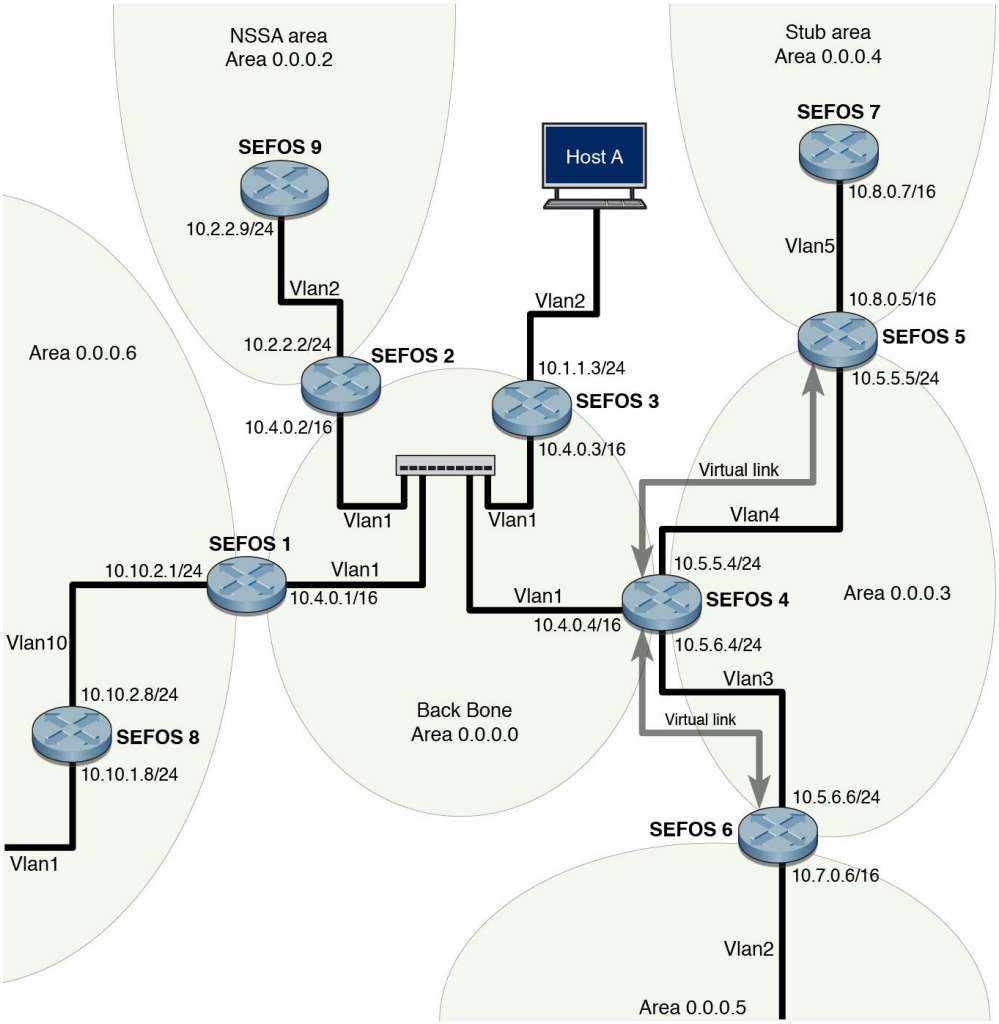
OSPF Overview

These sections provide an overview of OSPF.

Protocol Description

OSPF protocol is an Interior Gateway Protocol used to distribute routing information within a single autonomous system. Routers use link-state algorithms to send routing information to all nodes in an inter-network by calculating the shortest path to each node based on the complete routing structure, or the topography, of the Internet constructed by each node. Routing tables keep track of routes to particular network destinations. Each router sends the portion of the routing table that describes the state of its own links to the nodes in the inter-network. The routers also send the topography of the inter-network to the nodes.

Topology Example



Configuring OSPF

These sections describe the configuration of OSPF running as a part of Oracle's SEFOS.

Examples in this document use interface `0/1, 0/2`, and `0/3`. Variables such as interfaces, IP addresses, and other ID numbers might be different based on your site configuration.

Configuration Guidelines

See "Topology Example" on page 12 for information on setting up the topology. You must configure all the switches (SEFOS1 to SEFOS9) using these values before configuring OSPF.

Feature	Default Setting
Stability interval	40
`translation-role`	candidate
`compatible rfc1583`	Enabled
`abr-type`	standard
`neighbor priority`	1
`area default-cost`	10
`area tos`	0
`area metric`	10
`area - metric-type`	1
`area - tos`	0
`default-information originate always metric`	10

Feature	Default Setting
`default-information originate always metric metric-type`	2
Authentication	no authentication
`hello-interval`	10
`retransmit-interval`	5
`transmit-delay`	1
`dead-interval`	40
`tag`	2
`summary-address`	advertise
`translation`	disabled
`redist-config metric-value`	10
`redist-config metric-type`	asExttype2
`redist-config tag`	manual
`nssa asbr-default-route translator`	disable

Configuring VLAN Interfaces

You must separately configure VLAN interfaces associated with each switch.

▼ Configure VLAN Interfaces Associated With SEFOS1

- **Type.**

```
SEFOS# configure terminal
SEFOS(config)# set gvrp disable
```

```
SEFOS(config)# set gmrp disable
SEFOS(config)# interface vlan 1
SEFOS(config-if)# shut
SEFOS(config-if)# ip address 10.4.0.1 255.255.0.0
SEFOS(config-if)# no shut
SEFOS(config-if)# exit
SEFOS(config)# vlan 1
SEFOS(config-vlan)# ports extreme-ethernet 0/1 untagged extreme-ethernet 0/1
SEFOS(config-vlan)# exit
SEFOS(config)# interface vlan 10
SEFOS(config-if)# shut
SEFOS(config-if)# ip address 10.10.2.1 255.255.255.0
SEFOS(config-if)# no shut
SEFOS(config-if)# exit
SEFOS(config)# vlan 10
SEFOS(config-vlan)# ports extreme-ethernet 0/10 untagged extreme-ethernet 0/10
SEFOS(config-vlan)# exit
SEFOS(config)# interface extreme-ethernet 0/10
SEFOS(config-if)# switchport pvid 10
SEFOS(config-if)# no shut
SEFOS(config-if)# exit
```

Configure VLAN Interfaces Associated With SEFOS2

- **Type.**

```
SEFOS# configure terminal
SEFOS(config)# set gvrp disable
SEFOS(config)# set gmrp disable
SEFOS(config)# interface vlan 1
SEFOS(config-if)# shut
SEFOS(config-if)# ip address 10.4.0.2 255.255.0.0
SEFOS(config-if)# no shut
SEFOS(config-if)# exit
SEFOS(config)# vlan 1
SEFOS(config-vlan)# ports extreme-ethernet 0/1 untagged extreme-ethernet 0/1
SEFOS(config-vlan)# exit
SEFOS(config)# interface vlan 2
SEFOS(config-if)# ip address 10.2.2.2 255.255.255.0
SEFOS(config-if)# no shut
SEFOS(config-if)# exit
SEFOS(config)# vlan 2
SEFOS(config-vlan)# ports extreme-ethernet 0/2 untagged extreme-ethernet 0/2
SEFOS(config-vlan)# exit
SEFOS(config)# interface extreme-ethernet 0/2
SEFOS(config-if)# no shut
SEFOS(config-if)# switchport pvid 2
```

```
SEFOS(config-if)# exit
```

Configure VLAN Interfaces Associated With SEFOS3

- **Type.**

```
SEFOS# configure terminal
SEFOS(config)# set gvrp disable
SEFOS(config)# set gmrp disable
SEFOS(config)# interface vlan 1
SEFOS(config-if)# shut
SEFOS(config-if)# ip address 10.4.0.3 255.255.0.0
SEFOS(config-if)# no shut
SEFOS(config-if)# exit
SEFOS(config)# vlan 1
SEFOS(config-vlan)# ports extreme-ethernet 0/1 untagged extreme-ethernet 0/1
SEFOS(config-vlan)# exit
SEFOS(config)# interface vlan 2
SEFOS(config-if)# ip address 10.1.1.3 255.255.255.0
SEFOS(config-if)# no shut
SEFOS(config-if)# exit
SEFOS(config)# vlan 2
SEFOS(config-vlan)# ports extreme-ethernet 0/2 untagged extreme-ethernet 0/2
SEFOS(config-vlan)# exit
SEFOS(config)# interface extreme-ethernet 0/2
SEFOS(config-if)# no shut
SEFOS(config-if)# switchport pvid 2
SEFOS(config-if)# exit
```

Configure VLAN Interfaces Associated With SEFOS4

- **Type.**

```
SEFOS# configure terminal
SEFOS(config)# set gvrp disable
SEFOS(config)# set gmrp disable
SEFOS(config)# interface vlan 1
SEFOS(config-if)# shut
SEFOS(config-if)# ip address 10.4.0.4 255.255.0.0
SEFOS(config-if)# no shut
SEFOS(config-if)# exit
SEFOS(config)# vlan 1
```

```
SEFOS(config-vlan)# ports extreme-ethernet 0/1 untagged extreme-ethernet 0/1
SEFOS(config-vlan)# exit
SEFOS(config)# interface vlan 3
SEFOS(config-if)# ip address 10.5.6.4 255.255.255.0
SEFOS(config-if)# no shut
SEFOS(config-if)# exit
SEFOS(config)# vlan 3
SEFOS(config-vlan)# ports extreme-ethernet 0/3 untagged extreme-ethernet 0/3
SEFOS(config-vlan)# exit
SEFOS(config)# interface extreme-ethernet 0/3
SEFOS(config-if)# no shut
SEFOS(config-if)# switchport pvid 3
SEFOS(config-if)# exit
SEFOS(config)# interface vlan 4
SEFOS(config-if)# ip address 10.5.5.4 255.255.255.0
SEFOS(config-if)# no shut
SEFOS(config-if)# exit
SEFOS(config)# vlan 4
SEFOS(config-vlan)# ports extreme-ethernet 0/4 untagged extreme-ethernet 0/4
SEFOS(config-vlan)# exit
SEFOS(config)# interface extreme-ethernet 0/4
SEFOS(config-if)# no shut
SEFOS(config-if)# switchport pvid 4
SEFOS(config-if)# exit
```

▼ Configure VLAN Interfaces Associated With SEFOS5

- **Type.**

```
SEFOS# configure terminal
SEFOS(config)# set gvrp disable
SEFOS(config)# set gmrp disable
SEFOS(config)# interface vlan 1
SEFOS(config-if)# shut
SEFOS(config-if)# ip address 10.8.0.5 255.255.0.0
SEFOS(config-if)# no shut
SEFOS(config-if)# exit
SEFOS(config)# vlan 1
SEFOS(config-vlan)# ports extreme-ethernet 0/1 untagged extreme-ethernet 0/1
SEFOS(config-vlan)# exit
SEFOS(config)# interface vlan 4
SEFOS(config-if)# ip address 10.5.5.5 255.255.255.0
SEFOS(config-if)# no shut
SEFOS(config-if)# exit
SEFOS(config)# vlan 4
SEFOS(config-vlan)# ports extreme-ethernet 0/4 untagged extreme-ethernet 0/4
SEFOS(config-vlan)# exit
```

```
SEFOS(config)# interface extreme-ethernet 0/4
SEFOS(config-if)# no shut
SEFOS(config-if)# switchport pvid 4
SEFOS(config-if)# exit
```

Configure VLAN Interfaces Associated With SEFOS6

- **Type.**

```
SEFOS# configure terminal
SEFOS(config)# set gvrp disable
SEFOS(config)# set gmrp disable
SEFOS(config)# interface vlan 1
SEFOS(config-if)# shut
SEFOS(config-if)# ip address 10.7.0.6 255.255.0.0
SEFOS(config-if)# no shut
SEFOS(config-if)# exit
SEFOS(config)# vlan 1
SEFOS(config-vlan)# ports extreme-ethernet 0/1 untagged extreme-ethernet 0/1
SEFOS(config-vlan)# exit
SEFOS(config)# interface vlan 3
SEFOS(config-if)# ip address 10.5.6.6 255.255.255.0
SEFOS(config-if)# no shut
SEFOS(config-if)# exit
SEFOS(config)# vlan 3
SEFOS(config-vlan)# ports extreme-ethernet 0/3 untagged extreme-ethernet 0/3
SEFOS(config-vlan)# exit
SEFOS(config)# interface extreme-ethernet 0/3
SEFOS(config-if)# no shut
SEFOS(config-if)# switchport pvid 3
SEFOS(config-if)# exit
```

Configure VLAN Interfaces Associated With SEFOS7

- **Type.**

```
SEFOS# configure terminal
SEFOS(config)# set gvrp disable
SEFOS(config)# set gmrp disable
SEFOS(config)# interface vlan 1
SEFOS(config-if)# shut
```

```
SEFOS(config-if)# ip address 10.8.0.7 255.255.0.0
SEFOS(config-if)# no shut
SEFOS(config-if)# exit
SEFOS(config)# vlan 1
SEFOS(config-vlan)# ports extreme-ethernet 0/1 untagged extreme-ethernet 0/1
SEFOS(config-vlan)# exit
```

Configure VLAN Interfaces Associated With SEFOS8

- **Type.**

```
SEFOS# configure terminal
SEFOS(config)# set gvrp disable
SEFOS(config)# set gmrp disable
SEFOS(config)# interface vlan 10
SEFOS(config-if)# shut
SEFOS(config-if)# ip address 10.10.2.8 255.255.0.0
SEFOS(config-if)# no shut
SEFOS(config-if)# exit
SEFOS(config)# vlan 10
SEFOS(config-vlan)# ports extreme-ethernet 0/10 untagged extreme-ethernet 0/10
SEFOS(config-vlan)# exit
SEFOS(config)# interface extreme-ethernet 0/10
SEFOS(config-if)# switchport pvid 10
SEFOS(config-if)# no shut
SEFOS(config-if)# exit
SEFOS(config)# interface vlan 1
SEFOS(config-if)# shut
SEFOS(config-if)# ip address 10.10.1.8 255.255.255.0
SEFOS(config-if)# no shut
SEFOS(config-if)# exit
SEFOS(config)# vlan 1
SEFOS(config-vlan)# ports extreme-ethernet 0/1 untagged extreme-ethernet 0/1
SEFOS(config-vlan)# exit
SEFOS(config)# interface extreme-ethernet 0/1
SEFOS(config-if)# switchport pvid 1
SEFOS(config-if)# no shut
SEFOS(config-if)# exit
```

Configure VLAN Interfaces Associated With SEFOS9

- **Type.**

```
SEFOS# configure terminal
SEFOS(config)# set gvrp disable
SEFOS(config)# set gmrp disable
SEFOS(config)# interface vlan 2
SEFOS(config-if)# shut
SEFOS(config-if)# ip address 10.2.2.9 255.255.0.0
SEFOS(config-if)# no shut
SEFOS(config-if)# exit
SEFOS(config)# vlan 2
SEFOS(config-vlan)# ports extreme-ethernet 0/2 untagged extreme-ethernet 0/2
SEFOS(config-vlan)# exit
SEFOS(config)# interface extreme-ethernet 0/2
SEFOS(config-if)# switchport pvid 2
SEFOS(config-if)# no shut
SEFOS(config-if)# exit
```

▼ Enable OSPF

Enabling OSPF takes you to Router Configuration mode, where you can use the router-related commands.

- **Type.**

```
SEFOS# configure terminal
SEFOS(config)# router ospf
```

▼ Disable OSPF

Disabling OSPF terminates the OSPF process.

- **Disable OSPF globally in switch SEFOS1.**

```
SEFOS(config)# no router ospf
```

Configuring the Router ID and OSPF Interface

These sections show how to configure the router ID and OSPF interface.

- "Configure the Router ID" on page 21
- "Configure the OSPF Interface" on page 21

Configure the Router ID

The router ID that you configure must be one of the IP addresses of the IP interfaces configured in the switch.

You can configure an arbitrary value for the IP address for each router. However, each router ID must be unique. To ensure uniqueness, the router ID must match with one of the IP interface addresses of the router.

1. **Configure the router ID.**

```
SEFOS# configure terminal
SEFOS(config)# router ospf
SEFOS(config-router)# router-id 10.10.2.1
SEFOS(config-router)# exit
```

2. **Examine the configuration details.**

```
SEFOS# show ip ospf

OSPF Router ID 10.10.2.1
Supports only single TOS(TOS0) route
ABR Type supported is Standard ABR
It is an Area Border Router
Number of Areas in this router is 2
Area is 0.0.0.6
Number of interfaces in this area is 1
SPF algorithm executed 6 times
Area is 0.0.0.0
Number of interfaces in this area is 1
OSPF algorithm executed 6 times
```

Configure the OSPF Interface

1. **Configure the OSPF interface.**

```
SEFOS# configure terminal
SEFOS(config)# router ospf
SEFOS(config-router)# router-id 10.10.2.1
```

2. **Enable OSPF over the VLAN interface, and associate the interface with an OSPF area.**

   VLAN Interfaces `VLAN 1` and `VLAN 10` are created as part of the prerequisite configuration.

```
SEFOS(config-router)# network 10.4.0.1 area 0.0.0.0
SEFOS(config-router)# network 10.10.2.1 area 0.0.0.6
```

Enabling OSPF over the VLAN interfaces defines the interfaces on which OSPF runs and the area ID for those interfaces.

3. Examine the configuration details.

```
SEFOS# show ip ospf

OSPF Router ID 10.10.2.1
Supports only single TOS(TOS0) route
ABR Type supported is Standard ABR
It is an Area Border Router
Number of Areas in this router is 2
Area is 0.0.0.6
Number of interfaces in this area is 1
SPF algorithm executed 6 times
Area is 0.0.0.0
Number of interfaces in this area is 1
SPF algorithm executed 6 times
```

4. Examine the OSPF interfaces.

```
SEFOS# show ip ospf interface

vlan1 is line protocol is up
Internet Address 10.4.0.1, Mask 255.255.0.0, Area 0.0.0.0
AS 1, Router ID 10.10.2.1, Network Type BROADCAST, Cost 1
Transmit Delay is 1 sec, State 4, Priority 1
Designated RouterId 10.10.2.1, Interface address 10.4.0.1
Backup Designated RouterId 10.4.0.4, Interface address 10.4.0.4
Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
Hello due in 8 sec
Neighbor Count is 3, Adjacent neighbor count is 3
Adjacent with the neighbor 10.4.0.4
Adjacent with the neighbor 10.4.0.3
Adjacent with the neighbor 10.4.0.2

vlan10 line protocol is up
Internet Address 10.10.2.1, Mask 255.255.255.0, Area 0.0.0.6
AS 1, Router ID 10.10.2.1, Network Type BROADCAST, Cost 1
Transmit Delay is 1 sec, State 4, Priority 1
Designated RouterId 10.10.2.1, Interface address 10.10.2.1
Backup Designated RouterId 10.10.1.8, Interface address 10.10.2.8
Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
Hello due in 6 sec
Neighbor Count is 1, Adjacent neighbor count is 1
Adjacent with the neighbor 10.10.1.8 OSPF Router ID 10.10.2.1
```

5. Disable OSPF routing for the interfaces defined, and remove the area ID of the interface.

```
SEFOS(config-router)# no network 10.4.0.1 area 0.0.0.0
```

Configuring the OSPF Interface Parameters

These sections show how to configure the OSPF interface parameters.

▼ Enable OSPF Over the VLAN Interface

Configure the interface parameters in Interface Configuration mode.

- **Enable OSPF over the VLAN interface and associate the interface with an OSPF area before configuring OSPF interface parameters.**

  VLAN interfaces `VLAN 1` and `VLAN 10` are created as part of the prerequisite configuration.

```
SEFOS# configure terminal
SEFOS(config)# router ospf
SEFOS(config-router)# router-id 10.10.2.1
SEFOS(config-router)# network 10.4.0.1 area 0.0.0.0
SEFOS(config-router)# network 10.10.2.1 area 0.0.0.6
SEFOS(config-router)# exit
```

```
SEFOS(config)# interface vlan 1
SEFOS(config-if)#
```

Configure the OSPF Interface Priority

The interface priority of the router helps determine the designated router for the link connected to the interface.

1. **Configure the `VLAN 1` interface priority as 10.**
   VLAN interfaces `VLAN 1` and `VLAN 10` are created as part of the prerequisite configuration.

```
SEFOS(config-if)# ip ospf priority 10
```

2. **Examine the configuration details.**

```
SEFOS# show ip ospf interface vlan 1

vlan1 is line protocol is up
Internet Address 10.4.0.1, Mask 255.255.0.0, Area 0.0.0.0
AS 1, Router ID 10.10.2.1, Network Type BROADCAST, Cost 1
Transmit Delay is 1 sec, State 4, Priority 10
Designated RouterId 10.10.2.1, Interface address 10.4.0.1
No backup designated router on this network
Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
Hello due in 4 sec
Neighbor Count is 0, Adjacent neighbor count is 0
```

Restore the Default Value of the OSPF Interface

A priority value of 0 signifies that the router is not eligible to become the designated router on a particular network. The default interface priority value is 1.

- **Type.**

```
SEFOS(config-if)# no ip ospf priority
```

Configure the LSA Retransmission Interval

This procedure specifies the time interval between the successive LSA retransmissions.

1. **Configure the `VLAN 1` retransmission interval as 10 seconds.**

```
SEFOS(config-if)# ip ospf retransmit-interval 10
```

2. **Examine the configuration details.**

```
SEFOS# show ip ospf interface vlan 1

vlan1 is line protocol is up
Internet Address 10.4.0.1, Mask 255.255.0.0, Area 0.0.0.0
AS 1, Router ID 10.10.2.1, Network Type BROADCAST, Cost 1
Transmit Delay is 1 sec, State 4, Priority 1
Designated RouterId 10.10.2.1, Interface address 10.4.0.1
No backup designated router on this network
Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 10
Hello due in 4 sec
Neighbor Count is 0, Adjacent neighbor count is 0
```

Restore the Default Value of the Retransmission Interval

- **Type.**

```
SEFOS(config-if)# no ip ospf retransmit-interval
```

Configure the Link State Update Packet Transmission Delay

1. **Configure the `VLAN 1` transmission delay as 5 seconds.**

```
SEFOS(config-if)# ip ospf transmit-delay 5
```

2. **Examine the configuration details.**

```
SEFOS# show ip ospf interface vlan 1

vlan1 is line protocol is up
Internet Address 10.4.0.1, Mask 255.255.0.0, Area 0.0.0.0
AS 1, Router ID 10.10.2.1, Network Type BROADCAST, Cost 1
Transmit Delay is 5 sec, State 4, Priority 1
Designated RouterId 10.10.2.1, Interface address 10.4.0.1
No backup designated router on this network
Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
```

```
Hello due in 4 sec
Neighbor Count is 0, Adjacent neighbor count is 0
```

Restore the Default Value of the OSPF Transmission Delay

The default time for transmitting a link state update packet on an interface is 1 second.

- **Type.**

```
SEFOS(config-if)# no ip ospf transmit-delay
```

Configure the Interval Between Hello Packets

This procedure specifies the interval between the hello packets sent on the interface.

1. **Configure the `VLAN 1` interval as 40 seconds.**

```
SEFOS(config-if)# ip ospf hello-interval 40
```

2. **Examine the configuration details.**

```
SEFOS# show ip ospf interface vlan 1

vlan1 is line protocol is up
Internet Address 10.4.0.1, Mask 255.255.0.0, Area 0.0.0.0
AS 1, Router ID 10.10.2.1, Network Type BROADCAST, Cost 1
Transmit Delay is 1 sec, State 4, Priority 1
Designated RouterId 10.10.2.1, Interface address 10.4.0.1
No backup designated router on this network
Timer intervals configured, Hello 40, Dead 40, Wait 40, Retransmit 5
Hello due in 4 sec
Neighbor Count is 0, Adjacent neighbor count is 0
```

Restore the Default Value for the Interval Between Hello Packets

- **Type.**

```
SEFOS(config-if)# no ip ospf hello-interval
```

Configure the Interval That Declares a Router Is Down

This procedure sets the interval at which hello packets must not be seen before the neighbors declare the router down.

1. **Configure the `VLAN 1` interval as 120 seconds.**

```
SEFOS(config-if)# ip ospf dead-interval 120
```

2. **Examine the configuration details.**

```
SEFOS# show ip ospf interface vlan 1

vlan1 is line protocol is up
Internet Address 10.4.0.1, Mask 255.255.0.0, Area 0.0.0.0
AS 1, Router ID 10.10.2.1, Network Type BROADCAST, Cost 1
Transmit Delay is 1 sec, State 4, Priority 1
Designated RouterId 10.10.2.1, Interface address 10.4.0.1
No backup designated router on this network
Timer intervals configured, Hello 10, Dead 120, Wait 120, Retransmit 5
Hello due in 4 sec
Neighbor Count is 0, Adjacent neighbor count is 0
```

Restore the Default Value for Declaring a Router Is Down

The default value is 40 seconds.

- **Type.**

```
SEFOS(config-if)# no ip ospf dead-interval
```

Configure the Network Type

The OSPF network type can be broadcast, nonbroadcast, point-to-multipoint, or point-to-point. The default type is broadcast. The OSPF network type can be configured to a type other than the default for a given media.

1. **Configure the `VLAN 1` network type as point-to-point.**

```
SEFOS(config-if)# ip ospf network point-to-point
```

2. **Examine the configuration information.**

```
SEFOS# show ip ospf interface vlan 1

vlan1 is line protocol is up
Internet Address 10.4.0.1, Mask 255.255.0.0, Area 0.0.0.0
AS 1, Router ID 10.10.2.1, Network Type PointToPoint, Cost 1
Transmit Delay is 1 sec, State 4, Priority 1
Designated RouterId 10.10.2.1, Interface address 10.4.0.1
No backup designated router on this network
Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
Hello due in 4 sec
Neighbor Count is 0, Adjacent neighbor count is 0
```

Restore the Default Value for the OSPF Network Type

The default value is broadcast.

- **Type.**

```
SEFOS(config-if)# no ip ospf network
```

Configure the Demand Circuit

This procedure enables OSPF to treat the specified interface as an OSPF demand circuit.

1. **Configure `VLAN 1` as OSPF demand circuit.**

```
SEFOS(config-if)# ip ospf demand-circuit
```

2. **Examine the configuration details.**

```
SEFOS# show ip ospf interface vlan 1

vlan1 is line protocol is up
  Internet Address 10.4.0.1, Mask 255.255.0.0, Area 0.0.0.0
  AS 1, Router ID 10.10.2.1, Network Type BROADCAST, Cost 1
```

```
Configured as demand circuit.
Run as demand circuit.
Transmit Delay is 5 sec, State 2, Priority 1
No designated router on this network
No backup designated router on this network
Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
Hello due in 4 sec
Neighbor Count is 0, Adjacent neighbor count is 0
```

Remove the Demand Circuit Designation From the Interface

- **Type.**

```
SEFOS(config-if)# no ip ospf demand-circuit
```

Configure the Interface Cost

This procedure explicitly specifies the cost of sending a packet on an interface.

1. **Configure the `VLAN 1` interface cost as 20.**

```
SEFOS(config-if)# ip ospf cost 20
```

2. **Examine the configuration details.**

```
SEFOS# show ip ospf interface vlan 1

vlan1 is line protocol is up
Internet Address 10.4.0.1, Mask 255.255.0.0, Area 0.0.0.0
AS 1, Router ID 10.10.2.1, Network Type BROADCAST, Cost 20
Transmit Delay is 1 sec, State 4, Priority 1
Designated RouterId 10.10.2.1, Interface address 10.4.0.1
No backup designated router on this network
Timer intervals configured, Hello 10, Dead 120, Wait 120, Retransmit 5
Hello due in 4 sec
Neighbor Count is 0, Adjacent neighbor count is 0
```

Restore the Default Value for Interface Cost

- **Type.**

```
SEFOS(config-if)# no ip ospf cost
```

Configuring the OSPF Testing Authentication Topology Example

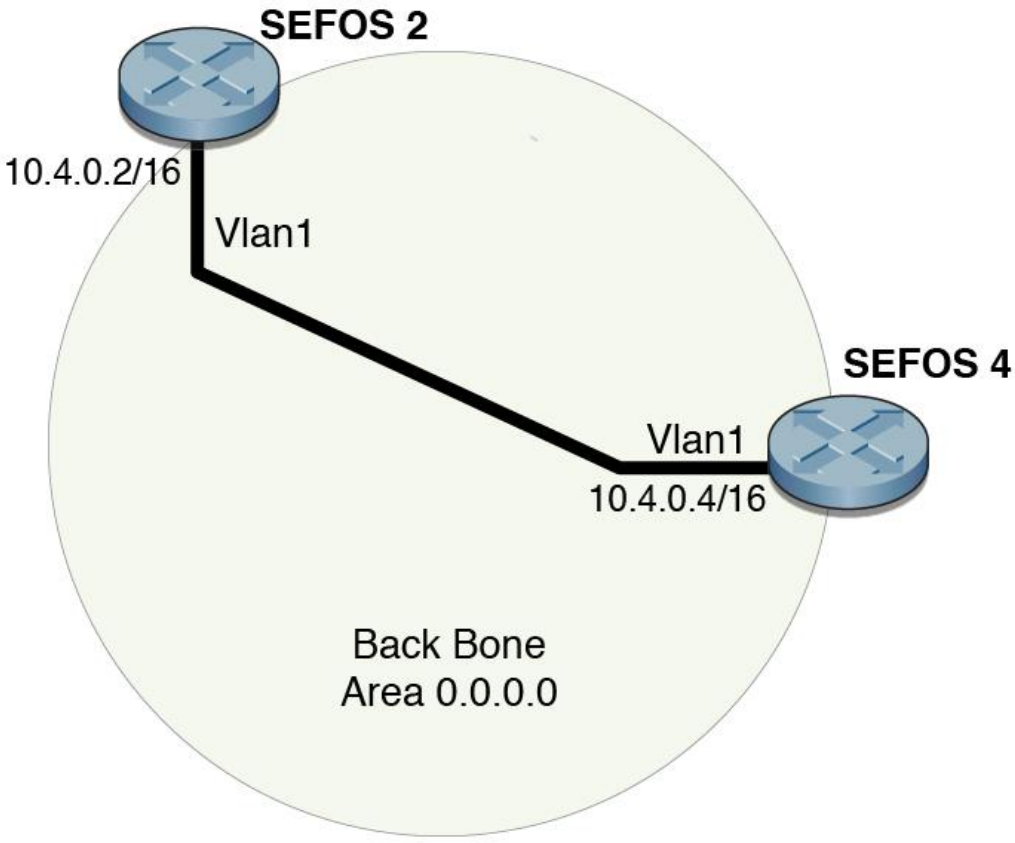
The authentication type for OSPF can be configured as Simple Password Authentication, Message-Digest Authentication, or Null Authentication.

Use Interface Configuration mode to perform authentication-related configuration.

Enable OSPF over the VLAN interface and associate the interface with an OSPF area before configuring OSPF authentication. See "Enable OSPF Over the VLAN Interface" on page 23.

Testing Authentication Topology Example

This figure is an example topology for testing authentication. To use this topology, you must configure the SEFOS2 and SEFOS4 switches before configuring OSPF. See "Configuration Guidelines" on page 13 and "Configure VLAN Interfaces Associated With SEFOS5" on page 17.



▼ Configure Simple Password Authentication

1. **Configure simple password authentication in SEFOS2.**

   a. **Type.**

```
SEFOS# configure terminal
SEFOS(config)# router ospf
SEFOS(config-router)# router-id 10.4.0.2
```

   b. **Enable OSPF over the VLAN interface and associate the interface with an OSPF area.**

```
SEFOS(config-router)# network 10.4.0.2 area 0.0.0.0
```

c. **Exit Router Configuration mode.**

```
SEFOS(config-router)# exit
```

d. **Enter Interface Configuration mode.**

```
SEFOS(config)# interface vlan 1
```

e. **Configure the authentication key for simple password authentication.**

```
SEFOS(config-if)# ip ospf authentication-key 1234
```

f. **Enable simple password authentication.**

```
SEFOS(config-if)# ip ospf authentication
```

g. **Exit Interface Configuration mode.**

```
SEFOS(config-if)# exit
```

h. **Exit Configuration mode.**

```
SEFOS(config)# exit
```

2. **Configure simple password authentication in SEFOS4.**

a. **Type.**

```
SEFOS# configure terminal
SEFOS(config)# router ospf
SEFOS(config-router)# router-id 10.4.0.4
```

b. **Enable OSPF over the VLAN interface and associate the interface with an OSPF area.**

```
SEFOS(config-router)# network 10.4.0.4 area 0.0.0.0
```

c. **Exit Router Configuration mode.**

```
SEFOS(config-router)# exit
```

d. Enter Interface Configuration mode.

```
SEFOS(config)# interface vlan 1
```

e. Configure the authentication key for simple password authentication.

```
SEFOS(config-if)# ip ospf authentication-key 1234
```

f. Enable simple password authentication.

```
SEFOS(config-if)# ip ospf authentication
```

g. Exit Interface Configuration mode.

```
SEFOS(config-if)# exit
```

h. Exit Configuration mode.

```
SEFOS(config)# exit
```

3. Examine the authentication type configured.

```
SEFOS# show ip ospf interface

vlan1 is line protocol is up
Internet Address 10.4.0.2, Mask 255.255.0.0, Area 0.0.0.0
AS 1, Router ID 10.4.0.2, Network Type BROADCAST, Cost 1
Transmit Delay is 1 sec, State 5, Priority 1
Designated RouterId 10.4.0.4, Interface address 10.4.0.4
Backup Designated RouterId 10.4.0.2, Interface address 10.4.0.2
Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
Hello due in 0 sec
Neighbor Count is 1, Adjacent neighbor count is 1
Adjacent with the neighbor 10.4.0.4
Simple password authentication enabled
```

4. Examine the adjacency formed between the neighbors in SEFOS 2 and SEFOS 4.

```
SEFOS# show ip ospf neighbor detail

Neighbor 10.4.0.4, interface address 10.4.0.4
In the area 0.0.0.0 via interface vlan1
Neighbor priority is 1,  State is FULL/BACKUP, 5 state changes
DR is 10.4.0.4 BDR is 10.4.0.2
```

```
Options is 0x2
```

5. **Remove a previously assigned OSPF password.**

```
SEFOS(config-if)# no ip ospf authentication-key
```

Configure the Message-Digest Authentication

Message-Digest authentication is a cryptographic authentication. A key (password) and key ID are configured on each router. The router uses an algorithm based on the OSPF packet, the key, and the key ID to generate a message digest that appends to the packet.

1. **Configure the message-digest authentication in SEFOS2.**

   a. **Type.**

   ```
   SEFOS# configure terminal
   SEFOS(config)# interface vlan 1
   ```

   b. **Delete the authentication key for simple password authentication.**

   ```
   SEFOS(config-if)# no ip ospf authentication-key
   ```

   c. **Configure the authentication key for message-digest authentication.**

   ```
   SEFOS(config-if)# ip ospf message-digest-key 0 md5 asdf
   ```

   d. **Enable message-digest authentication.**

   ```
   SEFOS(config-if)# ip ospf authentication message-digest
   ```

   e. **Exit Interface Configuration mode.**

   ```
   SEFOS(config-if)# exit
   ```

   f. **Exit Configuration mode.**

   ```
   SEFOS(config)# exit
   ```

2. **Configure the message-digest authentication in SEFOS4.**

a. Type.

```
SEFOS# configure terminal
SEFOS(config)# interface vlan 1
```

b. Delete the authentication key for simple password authentication.

```
SEFOS(config-if)# no ip ospf authentication-key
```

c. Configure the authentication key for the message-digest authentication.

```
SEFOS(config-if)# ip ospf message-digest-key 0 md5 asdf
```

d. Enable message-digest authentication.

```
SEFOS(config-if)# ip ospf authentication message-digest
```

e. Exit Interface Configuration mode.

```
SEFOS(config-if)# exit
```

f. Exit Configuration mode.

```
SEFOS(config)# exit
```

3. Examine the configuration details in SEFOS2.

a. Examine the type of authentication configured.

```
SEFOS# show ip ospf interface

0
vlan1 is line protocol is up
Internet Address 10.4.0.2, Mask 255.255.0.0, Area 0.0.0.0
AS 1, Router ID 10.4.0.2, Network Type BROADCAST, Cost 1
Transmit Delay is 1 sec, State 5, Priority 1
Designated RouterId 10.4.0.4, Interface address 10.4.0.4
Backup Designated RouterId 10.4.0.2, Interface address 10.4.0.2
Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
Hello due in 0 sec
Neighbor Count is 1, Adjacent neighbor count is 1
Adjacent with the neighbor 10.4.0.4
Message digest authentication enabled
```

```
Youngest key id is 0
```

b. Examine the adjacency formation between the neighbors.

```
SEFOS# show ip ospf neighbor detail

Neighbor 10.4.0.4, interface address 10.4.0.4
In the area 0.0.0.0 via interface vlan1
Neighbor priority is 1,  State is FULL/BACKUP, 5 state changes
DR is 10.4.0.4 BDR is 10.4.0.2
Options is 0x2
```

▼ Configure the Null Authentication

1. Configure the OSPF authentication type as null authentication in SEFOS2.

a. Type.

```
SEFOS# configure terminal
SEFOS(config)# interface vlan 1
```

b. Delete the authentication key for message-digest authentication.

```
SEFOS(config-if)# no ip ospf message-digest-key 0
```

c. Enable null-digest authentication.

```
SEFOS(config-if)# ip ospf authentication null
```

d. Exit Interface Configuration mode.

```
SEFOS(config-if)# exit
```

e. Exit Configuration mode.

```
SEFOS(config)# exit
```

2. Configure the OSPF authentication type as null authentication in SEFOS4.

a. Type.

```
SEFOS# configure terminal
SEFOS(config)# interface vlan 1
```

b. Delete the authentication key for message-digest authentication.

```
SEFOS(config-if)# no ip ospf message-digest-key 0
```

c. Enable null-digest authentication.

```
SEFOS(config-if)# ip ospf authentication null
```

d. Exit Interface Configuration mode.

```
SEFOS(config-if)# exit
```

e. Exit Configuration mode.

```
SEFOS(config)# exit
```

3. Examine the adjacency formation between the neighbors.

```
SEFOS# show ip ospf neighbor detail
Neighbor 10.4.0.4, interface address 10.4.0.4
In the area 0.0.0.0 via interface vlan1
Neighbor priority is 1,  State is FULL/BACKUP, 5 state changes
DR is 10.4.0.4 BDR is 10.4.0.2
Options is 0x2
```

Configuring the Passive Interface

Configuring the passive interface suppresses routing updates on all interfaces.

Suppress Routing Updates on All the Interfaces

All the OSPF interfaces created after you perform this procedure will be passive. This situation is useful in ISP and large enterprise networks where many of the distribution routers have more than 200 interfaces.

1. **Enter Global Configuration mode in SEFOS1.**

```
SEFOS# configure terminal
```

2. **Enable OSPF globally in the switch SEFOS1.**

```
SEFOS(config)# router ospf
```

3. **Configure the OSPF router ID.**

```
SEFOS(config-router)# router-id 10.10.2.1
```

4. **Suppress routing updates.**

```
SEFOS(config-router)# passive-interface default
```

5. **Enable OSPF over the VLAN interface.**

```
SEFOS(config-router)# network 10.4.0.1 area 0.0.0.0
```

6. **Examine the configuration details.**

```
SEFOS# show ip ospf interface vlan 1

vlan1 is line protocol is up
Internet Address 10.4.0.1, Mask 255.255.0.0, Area 0.0.0.0
AS 1, Router ID 10.10.2.1, Network Type BROADCAST, Cost 1
Transmit Delay is 1 sec, State 2, Priority 1
No designated router on this network
No backup designated router on this network
Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
No Hellos (Passive interface)
Neighbor Count is 0, Adjacent neighbor count is 0
```

Restore Routing Updates on All Interfaces

It is also possible to suppress routing updates on a specified interface. See “Suppress Routing Updates on All the Interfaces” on page 38.

- **Type.**

```
SEFOS(config-if)# no network 10.4.0.1 area 0.0.0.0
SEFOS(config-if)# no passive-interface default
```

Suppress Routing Updates on a Specified Interface

1. **Type.**

```
SEFOS# configure terminal
SEFOS(config)# router ospf
SEFOS(config-router)# router-id 10.10.2.1
SEFOS(config-if)# passive-interface vlan 1
```

2. **Examine the configuration details.**

```
SEFOS# show ip ospf interface vlan 1

vlan1 is line protocol is up
Internet Address 10.4.0.1, Mask 255.255.0.0, Area 0.0.0.0
AS 1, Router ID 10.10.2.1, Network Type BROADCAST, Cost 1
Transmit Delay is 1 sec, State 2, Priority 1
No designated router on this network
No backup designated router on this network
Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
No Hellos (Passive interface)
Neighbor Count is 0, Adjacent neighbor count is 0
```

Restore Routing Updates on Interface VLAN 1

- **Type.**

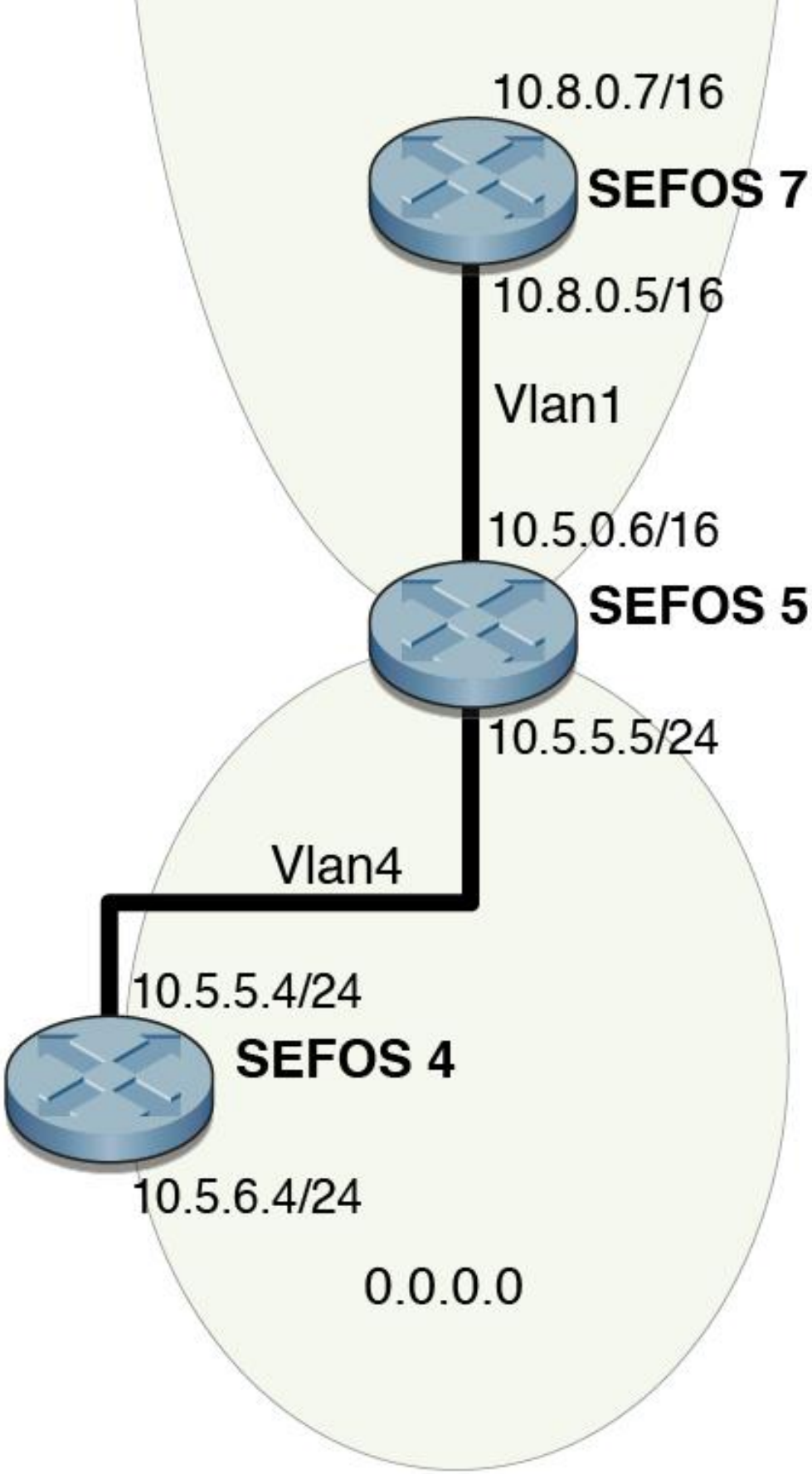
```
SEFOS(config-router)# no passive-interface vlan 1
```

Configuring OSPF Area Parameters

These sections explain how to configure OSPF area parameters.

Configuring the Stub Area, ASBR, and Route Redistribution

You can configure area parameters only after enabling the OSPF process. You configure area parameters in Router Configuration mode.


10.8.0.7/16
SEFOS 7
10.8.0.5/16
Vlan1
10.5.0.6/16
SEFOS 5
10.5.5.5/24
Vlan4
10.5.5.4/24
SEFOS 4
10.5.6.4/24
0.0.0.0

You must configure switches SEFOS4, SEFOS5, and SEFOS7 for OSPF. See “Configuration Guidelines” on page 13 for more information.

Configure the Stub Area

Configuring the stub area specifies an area as a stub area. This procedure also configures other parameters related to that area. See “Stub Area, ASBR, and Route Redistribution Topology Example” on page 42 for the topology for this procedure.

1. **Type.**

```
SEFOS# configure terminal
SEFOS(config)# router ospf
SEFOS(config-router)# router-id 10.10.2.1
SEFOS(config-router)# network 10.4.0.1 area 0.0.0.0
SEFOS(config-router)# network 10.10.2.1 area 0.0.0.6
```

2. **Configure the area `0.0.0.6` as a normal area.**

```
SEFOS(config-router)# area 0.0.0.6 stub
```

3. **Reconfigure the area `0.0.0.6` as a normal area.**

```
SEFOS(config-router)# no area 0.0.0.6 stub
```

Configure the ASBR Router

Routers that act as gateways (redistribution) between OSPF and other routing protocols (IGRP, EIGRP, RIP, BGP, Static) or other instances of the OSPF routing process are called ASBR. See “Stub Area, ASBR, and Route Redistribution Topology Example” on page 42 for the topology for this procedure.

1. **Enter Global Configuration mode in SEFOS1.**

```
SEFOS# configure terminal
```

2. **Enable OSPF globally in the switch SEFOS1.**

```
SEFOS(config)# router ospf
```

3. **Configure the OSPF router ID.**

```
SEFOS(config-router)# router-id 10.10.2.1
```

4. **Configure the ASBR router.**

```
SEFOS(config-router)# asbr router
```

Disable the ASBR Router

- **Type.**

```
SEFOS(config-router)# no asbr router
```

Configure Redistribution

Redistribution configures the protocol from which the routes have to be redistributed into OSPF.

1. **Enter Global Configuration mode in SEFOS1.**

```
SEFOS# configure terminal
```

2. **Enable OSPF globally in SEFOS1.**

```
SEFOS(config)# router ospf
```

3. **Configure the OSPF router ID.**

```
SEFOS(config-router)# router-id 10.10.2.1
```

4. **Configure the router as an ASBR router.**

```
SEFOS(config-router)# asbr router
```

5. **Configure the redistribution of all routes.**

```
SEFOS(config-router)# redistribute all
```

Disable Redistribution of Routes

- **Type.**

```
SEFOS(config-router)# no redistribute all
```

Configure SEFOS4

SEFOS4 is configured as an ASBR router for redistributing the external routes into the OSPF domain.

- **Type.**

```
SEFOS# configure terminal
SEFOS(config)# router ospf
SEFOS(config-router)# router-id 10.4.0.4
SEFOS(config-router)# asbr router
SEFOS(config-router)# redistribute all
SEFOS(config-router)# network 10.5.5.4 area 0.0.0.0
SEFOS(config-router)# exit
SEFOS(config)# ip route 100.0.0.0  255.0.0.0  10.5.5.5
SEFOS(config)# end
```

Configure SEFOS5

In SEFOS5, area `0.0.0.4` is configured as a stub area.

- **Type.**

```
SEFOS# configure terminal
SEFOS(config)# router ospf
SEFOS(config-router)# router-id 10.8.0.5
SEFOS(config-router)# network 10.8.0.5 area 0.0.0.4
SEFOS(config-router)# network 10.5.5.5 area 0.0.0.0
SEFOS(config-router)# area 0.0.0.4 stub
SEFOS(config-router)# exit
```

Configure SEFOS7

In SEFOS7, area `0.0.0.4` is configured as a stub area. External routes are not redistributed into the stub area.

- **Type.**

```
SEFOS# configure terminal
SEFOS(config)# router ospf
SEFOS(config-router)# router-id 10.8.0.7
SEFOS(config-router)# network 10.8.0.7 area 0.0.0.4
SEFOS(config-router)# area 0.0.0.4 stub
SEFOS(config-router)# exit
```

Examine the Configuration Details in SEFOS4

- **Type.**

```
SEFOS# show ip ospf route

OSPF Process Routing Table
Dest/Mask                     TOS NextHop/Interface Cost Rt.Type   Area
---------                     --- -------/--------- ---- -------   ----SEFOS# show ip ospf
 0.0.0.0 database external
10.5.5.0/255.255.255.0        0   0.0.0.0/vlan4     1    IntraArea 0.0.0.0
10.8.0.0/255.255.0.0          0   10.5.5.5/vlan4    2    InterArea 0.0.0.0OSPF Router with ID
 (10.4.0.4)                 AS External Link States                  -----------------------
LS age             : 300Options            : (No ToS Capability, DC)LS Type           : AS
 External LinkLink State ID     : 10.4.0.0Advertising Router  : 10.4.0.4LS Seq Number
  : 0x80000001Checksum          : 0x2a6Length            : 36Network Mask      : 255.255.0.0
Metric Type       : 0x80Metric         : 10Forward Address   : 0.0.0.0Externel Route Tag :
 0                  AS External Link States                  ----------------------LS
 age             : 300Options            : (No ToS Capability, DC)LS Type           :
 AS External LinkLink State ID      : 10.5.5.0Advertising Router : 10.4.0.4LS Seq Number
      : 0x80000001Checksum           : 0xbee3Length             : 36Network Mask       :
 255.255.255.0Metric Type        : 0x80Metric             : 10Forward Address    : 0.0.0.0
Externel Route Tag : 0
 AS External Link States
 -----------------------
LS age             : 300AS External Link States                  -----------------------LS
 age             : 300Options            : (No ToS Capability, DC)LS Type            : AS
 External LinkLink State ID      : 100.0.0.0Advertising Router : 10.4.0.4LS Seq Number      :
 0x80000001Checksum           : 0xcd6bLength             : 36Network Mask       : 255.0.0.0
Metric Type        : 0x80Metric             : 10Forward Address    : 10.5.5.5Externel Route
 Tag : 0
Options            : (No ToS Capability, DC)
LS Type            : AS External Link
```

```
Link State ID      : 10.5.6.0
Advertising Router : 10.4.0.4
LS Seq Number      : 0x80000001
Checksum           : 0xb3ed
Length             : 36
Network Mask       : 255.255.255.0
Metric Type        : 0x80
Metric             : 10
Forward Address    : 0.0.0.0
Externel Route Tag : 0
```

▼ Examine the Redistributed External Routes in SEFOS5

- **Type.**

```
SEFOS# show ip ospf route

OSPF Process Routing Table
Dest/Mask                    TOS NextHop/Interface Cost Rt.Type   Area
---------                    --- -------/--------- ---- -------   ----SEFOS# show ip ospf
 0.0.0.0 database external
10.4.0.0/255.255.0.0         0   10.5.5.4/vlan4    10   Type2Ext  0.0.0.0
10.5.5.0/255.255.255.0       0   0.0.0.0/vlan4     1    IntraArea 0.0.0.0OSPF Router with ID
 (10.8.0.5)                 AS External Link States                 ----------------------
LS age            : 300Options            : (No ToS Capability, DC)LS Type            : AS
 External LinkLink State ID      : 10.4.0.0Advertising Router : 10.4.0.4LS Seq Number      :
 0x80000001Checksum           : 0x2a6Length             : 36Network Mask       : 255.255.0.0
Metric Type        : 0x80Metric             : 10Forward Address    : 0.0.0.0Externel Route Tag
  : 0
10.5.6.0/255.255.255.0       0   10.5.5.4/vlan4    10   Type2Ext  0.0.0.0
10.8.0.0/255.255.0.0         0   0.0.0.0/vlan1     1    IntraArea
 0.0.0.4----------------------LS age             : 300Options            : (No ToS
 Capability, DC)LS Type            : AS External LinkLink State ID      : 10.5.5.0Advertising
 Router : 10.4.0.4LS Seq Number      : 0x80000001Checksum           : 0xbee3Length
  : 36Network Mask       : 255.255.255.0   Metric Type       : 0x80   Metric            : 10
 Forward Address   : 0.0.0.0   Externel Route Tag: 0
100.0.0.0/255.0.0.0          0   10.5.5.5/vlan4    10   Type2Ext  0.0.0.0AS External Link
 States                  ----------------------LS age             : 300Options            :
 (No ToS Capability, DC)LS Type            : AS External LinkLink State ID      : 10.5.6.0
Advertising Router : 10.4.0.4LS Seq Number      : 0x80000001Checksum           : 0xb3edLength
             : 36Network Mask       : 255.255.255.0Metric Type        : 0x80Metric
  : 10Forward Address    : 0.0.0.0Externel Route Tag : 0
```

▼ Examine the External Routes Not Distributed in Stub Area 0.0.0.4 in SEFOS7

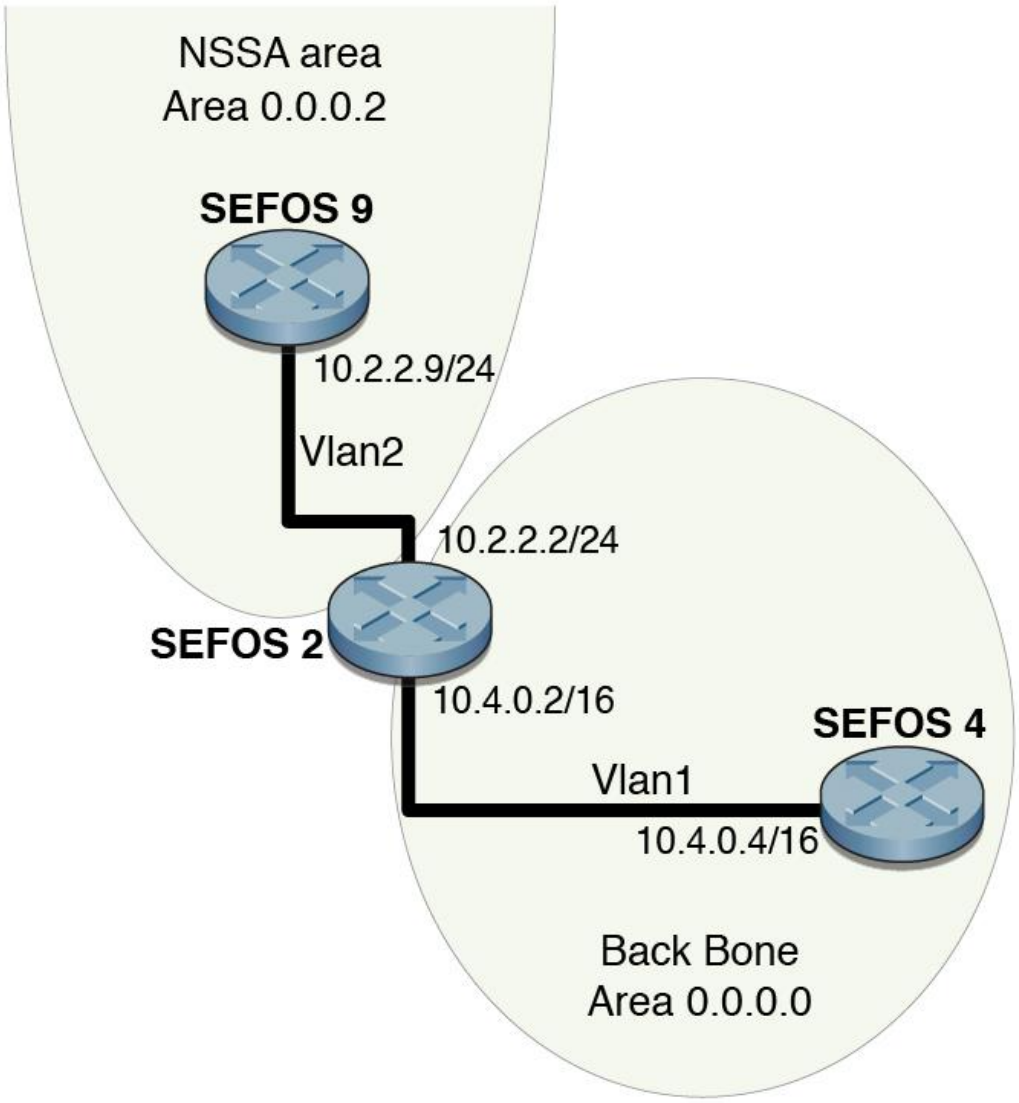
- **Type.**

```
SEFOS# show ip ospf route

OSPF Process Routing Table
Dest/Mask                    TOS NextHop/Interface Cost Rt.Type   Area
---------                    --- -------/--------- ---- -------   ----
0.0.0.0/0.0.0.0              0   10.8.0.5/vlan1    2    InterArea 0.0.0.4
10.5.5.0/255.255.255.0       0   10.8.0.5/vlan1    2    InterArea 0.0.0.4
10.8.0.0/255.255.0.0         0   0.0.0.0/vlan1     1    IntraArea 0.0.0.4
SEFOS# show ip ospf 0.0.0.4 database external

OSPF Router with ID (10.8.0.7)
```

Configuring the NSSA Area, Summary Address, and Area Default Cost

These sections explain how to configure the NSSA area, summary address, and area default cost.

NSSA Configuration, Summary Address Configuration, and Area Default-Cost



You must configure switches SEFOS2, SEFOS4, and SEFOS9 before configuring OSPF. See "Configuration Guidelines" on page 13 for more information.

Configure the NSSA Area

See “NSSA Configuration, Summary Address Configuration, and Area Default-Cost” on page 50 for the topology for this procedure. An NSSA area has the capability to import a limited number of external routes.

1. **Enter Global Configuration mode in SEFOS1.**

```
SEFOS# configure terminal
```

2. **Enable OSPF globally in the switch SEFOS1.**

```
SEFOS(config)# router ospf
```

3. **Configure the OSPF router ID.**

```
SEFOS(config-router)# router-id 10.10.2.1
```

4. **Configure the OSPF interface.**

```
SEFOS(config-router)# network 10.4.0.1 area 0.0.0.0
SEFOS(config-router)# network 10.10.2.1 area 0.0.0.6
```

5. **Configure the area `0.0.0.6` as an NSSA area.**

```
SEFOS(config-router)# area 0.0.0.6 nssa
```

Reconfigure Area `0.0.0.6` as a Normal Area

- **Type.**

```
SEFOS(config-router)# no area 0.0.0.6 nssa
```

Configure the Summary Address

See “NSSA Configuration, Summary Address Configuration, and Area Default-Cost” on page 50 for the topology for this procedure.

1. **Enter Global Configuration mode in SEFOS1.**

```
SEFOS# configure terminal
```

2. **Enable OSPF globally in the switch SEFOS1.**

```
SEFOS(config)# router ospf
```

3. **Configure the OSPF router ID.**

```
SEFOS(config-router)# router-id 10.10.2.1
```

4. **Configure the OSPF interface.**

```
SEFOS(config-router)# network 10.4.0.1 area 0.0.0.0
SEFOS(config-router)# network 10.10.2.1 area 0.0.0.6
```

5. **Configure the area 0.0.0.6 as an NSSA area.**

```
SEFOS(config-router)# area 0.0.0.6 nssa
```

6. **Configure the summary address for 90.0.0.0/8 in the NSSA area.**

```
SEFOS(config-router)# summary-address 90.0.0.0  255.0.0.0  0.0.0.6
```

Delete the Summary Address Configuration for 90.0.0.0/8 in the NSSA Area

- **Type.**

```
SEFOS(config-router)# no summary-address 90.0.0.0  255.0.0.0  0.0.0.6
```

Configure the Area Default Cost

This procedure specifies the cost for the default summary route sent into a stub or NSSA.

1. **Enter Global Configuration mode in SEFOS1.**

```
SEFOS# configure terminal
```

2. **Enable OSPF globally in the switch SEFOS1.**

```
SEFOS(config)# router ospf
```

3. **Configure the OSPF router ID.**

```
SEFOS(config-router)# router-id 10.10.2.1
```

4. **Configure the OSPF interface.**

```
SEFOS(config-router)# network 10.4.0.1 area 0.0.0.0
SEFOS(config-router)# network 10.10.2.1 area 0.0.0.6
```

5. **Configure the area `0.0.0.6` as an NSSA area.**

```
SEFOS(config-router)# area 0.0.0.6 nssa
```

6. **Configure the cost for the default summary route sent into the NSSA area.**

```
SEFOS(config-router)# area 0.0.0.6 default-cost 50
```

Configure Default-Cost for the Default Summary Route Sent Into the NSSA Area

- **Type.**

```
SEFOS(config-router)# no area 0.0.0.6 default-cost
```

Configure SEFOS2

1. **Configure the area.**

```
SEFOS# configure terminal
SEFOS(config)# router ospf
SEFOS(config-router)# router-id 10.4.0.2
SEFOS(config-router)# network 10.4.0.2 area 0.0.0.0
SEFOS(config-router)# network 10.2.2.2 area 0.0.0.2
```

2. **Configure area `0.0.0.2` as an NSSA area.**

```
SEFOS(config-router)# area 0.0.0.2 nssa
SEFOS(config-router)# exit
```

Configure SEFOS4

- **Configure the area.**

```
SEFOS# configure terminal
SEFOS(config)# router ospf
SEFOS(config-router)# router-id 10.4.0.4
SEFOS(config-router)# network 10.4.0.4 area 0.0.0.0
SEFOS(config-router)# end
```

Configure SEFOS9

1. **Configure the area.**

```
SEFOS# configure terminal
SEFOS(config)# router ospf
```

2. **Configure ASBR status and redistribute static routes into the OSPF domain.**

```
SEFOS(config-router)# asbr router
SEFOS(config-router)# redistribute static
SEFOS(config-router)# router-id 10.2.2.9
SEFOS(config-router)# network 10.2.2.9 area 0.0.0.2
```

3. **Configure area `0.0.0.2` as an NSSA area.**

```
SEFOS(config-router)# area 0.0.0.2 nssa
```

4. **Configure summary address for the range `90.0.0.0/8` in the area `0.0.0.2`.**

```
SEFOS(config-router)# summary-address 90.0.0.0  255.0.0.0  0.0.0.2
SEFOS(config-router)# exit
```

5. **Configure static routes.**

```
SEFOS(config)# ip route 90.1.0.0  255.255.0.0  10.2.2.2
SEFOS(config)# ip route 90.2.0.0  255.255.0.0  10.2.2.2
```

```
SEFOS(config)# ip route 90.3.0.0  255.255.0.0  10.2.2.2
SEFOS(config)# ip route 90.4.0.0  255.255.0.0  10.2.2.2
SEFOS(config)# ip route 90.5.0.0  255.255.0.0  10.2.2.2
SEFOS(config)# end
```

Examine the Configuration Details in SEFOS2

Examine the two NSSA external LSAs, one for `90.0.0.0/8`, matching the summary range configured, and the other for the default external route in the NSSA area.

Another external LSA is generated in the area `0.0.0.0` corresponding to the nssa-external LSA `90.0.0.0/8`.

- **Type.**

```
SEFOS# show ip ospf database nssa-external

OSPF Router with ID (10.4.0.2)
                 NSSA External Link States (Area 0.0.0.2)
                 ------------------------------------------------
LS age             : 300
Options            : (No ToS Capability, DC)
LS Type            : NSSA External Link
Link State ID      : 90.0.0.0
Advertising Router : 10.2.2.9
LS Seq Number      : 0x80000001
Checksum           : 0xc84f
Length             : 36

               NSSA External Link States (Area 0.0.0.2)
                 ------------------------------------------------
LS age             : 300
Options            : (No ToS Capability, DC)
LS Type            : NSSA External Link
Link State ID      : 0.0.0.0
Advertising Router : 10.4.0.2
LS Seq Number      : 0x80000002
Checksum           : 0x120
Length             : 36

SEFOS# show ip ospf database external

OSPF Router with ID (10.4.0.2)
                 AS External Link States
                 ----------------------
LS age             : 0
Options            : (No ToS Capability, DC)
LS Type            : AS External Link
Link State ID      : 90.0.0.0
```

```
Advertising Router : 10.4.0.2
LS Seq Number      : 0x80000001
Checksum           : 0x49fd
Length             : 36
Network Mask       : 255.0.0.0
Metric Type        : 0x80
Metric             : 10
Forward Address    : 10.2.2.9
Externel Route Tag : 0

SEFOS# show ip ospf route

OSPF Process Routing Table
Dest/Mask                 TOS NextHop/Interface Cost Rt.Type   Area
---------                 --- -------/--------- ---- -------   ----
10.2.2.0/255.255.255.0    0   0.0.0.0/vlan2     1    IntraArea 0.0.0.2
10.4.0.0/255.255.0.0      0   0.0.0.0/vlan1     1    IntraArea 0.0.0.0
90.0.0.0/255.0.0.0        0   10.2.2.9/vlan2    10   Type2Ext  0.0.0.2
```

▼ Examine the Configuration Details in SEFOS4

- **Type.**

```
SEFOS# show ip ospf route

OSPF Process Routing Table
Dest/Mask                 TOS NextHop/Interface Cost Rt.Type   Area
---------                 --- -------/--------- ---- -------   ----
10.2.2.0/255.255.255.0    0   10.4.0.2/vlan1    2    InterArea 0.0.0.0
10.4.0.0/255.255.0.0      0   0.0.0.0/vlan1     1    IntraArea 0.0.0.0
90.0.0.0/255.0.0.0        0   10.4.0.2/vlan1    10   Type2Ext  0.0.0.0
```

▼ Examine the Configuration Details in SEFOS9

- **Type.**

```
SEFOS# show ip ospf database nssa-external

OSPF Router with ID (10.2.2.9)
                 NSSA External Link States (Area 0.0.0.2)
                 ------------------------------------------------
LS age             : 300
Options            : (No ToS Capability, DC)
LS Type            : NSSA External Link
Link State ID      : 90.0.0.0
Advertising Router : 10.2.2.9
LS Seq Number      : 0x80000001
```

```
Checksum           : 0xc84f
Length             : 36

                 NSSA External Link States (Area 0.0.0.2)
                 ------------------------------------------------
LS age             : 300
Options            : (No ToS Capability, DC)
LS Type            : NSSA External Link
Link State ID      : 0.0.0.0
Advertising Router : 10.4.0.2
LS Seq Number      : 0x80000002
Checksum           : 0x120
Length             : 36
SEFOS# show ip ospf summary-address

Display of Summary addresses for Type5 and Type7 from redistributed routes

OSPF External Summary Address Configuration Information
-------------------------------------------------------
Network        Mask           Area           Effect  TranslationState
-------      ----           ----           ------   ----------------
255.0.0.0     0.0.0.2        advertiseMatching     enabled

SEFOS# show ip route

O 0.0.0.0/0  [2] via 10.2.2.2
C 10.2.2.0/24 is directly connected, vlan2
O 10.4.0.0/16 [2] via 10.2.2.2
C 12.0.0.0/8  is directly connected, vlan1
S 90.1.0.0/16 [1] via 10.2.2.2
S 90.2.0.0/16 [1] via 10.2.2.2
S 90.3.0.0/16 [1] via 10.2.2.2
S 90.4.0.0/16 [1] via 10.2.2.2
S 90.5.0.0/16 [1] via 10.2.2.2

SEFOS# show ip ospf route

OSPF Process Routing Table
Dest/Mask                 TOS NextHop/Interface Cost Rt.Type   Area
---------                 --- -------/--------- ---- -------   ----
0.0.0.0/0.0.0.0           0   10.2.2.2/vlan2    2    Type1Ext  0.0.0.2
10.2.2.0/255.255.255.0    0   0.0.0.0/vlan2     1    IntraArea 0.0.0.2
10.4.0.0/255.255.0.0      0   10.2.2.2/vlan2    2    InterArea 0.0.0.2
```

▼ Test SEFOS9

1. Test the `no summary-address` command.

```
SEFOS# configure terminal
SEFOS(config)# router ospf
```

```
SEFOS(config-router)# no summary-address 90.0.0.0  255.0.0.0  0.0.0.2
```

2. **Examine the configuration detail.**

```
SEFOS# show ip ospf summary-address
Display of Summary addresses for Type5 and Type7 from redistributed routes
```

3. **Observe that nssa-external LSA is generated for all the static routes.**

```
SEFOS# show ip ospf database

OSPF Router with ID (10.2.2.9)
                 Router Link States (Area 0.0.0.2)
               ---------------------------------------
Link ID    ADV Router       Age     Seq#        Checksum  Link count
-------    ----------       ---     ----        --------  ----------
10.4.0.2         10.4.0.2       300        0x80000006    0x1dc6    1

10. 10.2.2.9         300        0x80000007    0xec0     1


                 Network Link States (Area 0.0.0.2)
                 ---------------------------------------
Link ID          ADV Router       Age        Seq#          Checksum
-------          ----------       ---        ----          --------
10.2.2.9         10.2.2.9         300        0x80000002    0x5290
                 Summary Link States (Area 0.0.0.2)
                 ---------------------------------------
Link ID          ADV Router       Age        Seq#          Checksum
-------          ----------       ---        ----          --------
10.4.0.0         10.4.0.2         300        0x80000003    0x56c5

                 NSSA External Link States (Area 0.0.0.2)
                 -------------------------------------------
Link ID          ADV Router       Age        Seq#          Checksum
-------          ----------       ---        ----          --------
90.4.0.0         10.2.2.9         300        0x80000001    0x36e4
90.5.0.0         10.2.2.9         300        0x80000001    0x2aef
0.0.0.0          10.4.0.2         300        0x80000003    0xfe21
90.1.0.0         10.2.2.9         300        0x80000001    0x5ac3

90.2.0.0         10.2.2.9         300        0x80000001    0x4ece
90.3.0.0         10.2.2.9         300        0x80000001    0x42d9
```

▼ Test SEFOS2

1. **Examine the OSPF external routes corresponding to all the NSSA external LSAs.**

```
SEFOS# show ip ospf route

OSPF Process Routing Table

Dest/Mask                    TOS NextHop/Interface Cost Rt.Type   Area
---------                    --- -------/--------- ---- -------   ----
10.2.2.0/255.255.255.0       0   0.0.0.0/vlan2     1    IntraArea 0.0.0.2
10.4.0.0/255.255.0.0         0   0.0.0.0/vlan1     1    IntraArea 0.0.0.0
90.1.0.0/255.255.0.0         0   10.2.2.2/vlan2    10   Type2Ext  0.0.0.2
90.2.0.0/255.255.0.0         0   10.2.2.2/vlan2    10   Type2Ext  0.0.0.2
90.3.0.0/255.255.0.0         0   10.2.2.2/vlan2    10   Type2Ext  0.0.0.2
90.4.0.0/255.255.0.0         0   10.2.2.2/vlan2    10   Type2Ext  0.0.0.2
90.5.0.0/255.255.0.0         0   10.2.2.2/vlan2    10   Type2Ext  0.0.0.2
```

2. **Test the `area default-cost` command.**

```
SEFOS# configure terminal
SEFOS(config)# router ospf
SEFOS(config-router)# area 0.0.0.2 default-cost 50
```

Test SEFOS9

SEFOS2 sends a type 7 LSA for the default route with the updated metric as 50. Therefore, the metric for the default route should be 51 in SEFOS9.

1. **In SEFOS9, type.**

```
SEFOS# show ip ospf route

OSPF Process Routing Table
Dest/Mask                  TOS NextHop/Interface Cost Rt.Type   Area
---------                  --- -------/--------- ---- -------   ----
0.0.0.0/0.0.0.0            0   10.2.2.2/vlan2    51   Type1Ext  0.0.0.2
10.2.2.0/255.255.255.0     0   0.0.0.0/vlan2     1    IntraArea 0.0.0.2
10.4.0.0/255.255.0.0       0   10.2.2.2/vlan2    2    InterArea 0.0.0.2
```

2. **In SEFOS2, test the `no area default-cost` command.**

```
SEFOS# configure terminal
SEFOS(config)# router ospf
SEFOS(config-router)# no area 0.0.0.2 default-cost
```

3. **In SEFOS9, type.**

```
SEFOS# show ip ospf route
```

```
OSPF Process Routing Table
Dest/Mask                    TOS NextHop/Interface Cost Rt.Type   Area
---------                    --- -------/--------- ---- -------   ----
0.0.0.0/0.0.0.0              0   10.2.2.2/vlan2    11    Type1Ext 0.0.0.2
10.2.2.0/255.255.255.0       0   0.0.0.0/vlan2     1    IntraArea 0.0.0.2
10.4.0.0/255.255.0.0         0   10.2.2.2/vlan2    2    InterArea 0.0.0.2
```

Configure the P-bit Setting in the Default Type 7 LSA

This procedure enables the setting of the P-bit in the default Type 7 LSA generated by the NSSA internal ASBR.

1. **Type.**

```
SEFOS# configure terminal
SEFOS(config)# router ospf
```

2. **Configure the OSPF router ID.**

```
SEFOS(config-router)# router-id 10.10.2.1
```

3. **Configure the ASBR router status.**

```
SEFOS(config-router)# asbr router
```

4. **Configure the OSPF interface.**

```
SEFOS(config-router)# network 10.10.2.1 area 0.0.0.6
```

5. **Configure the area `0.0.0.6` as an NSSA area.**

```
SEFOS(config-router)# area 0.0.0.6 nssa
```

6. **Enable nssa asbr-default-route translator.**

```
SEFOS(config-router)# set nssa asbr-default-route translator enable
```

Disable the P-bit Setting in the Default Type 7 LSA

- **Type.**

```
SEFOS(config-router)# set nssa asbr-default-route translator disable
```

Configure the NSSA Area Translation Role

This procedure configures the translation role for the NSSA as always or candidate.

1. **Type.**

```
SEFOS# configure terminal
SEFOS(config)# router ospf
```

2. **Configure the OSPF router ID.**

```
SEFOS(config-router)# router-id 10.10.2.1
```

3. **Configure the ASBR router status.**

```
SEFOS(config-router)# asbr router
```

4. **Configure the OSPF interface.**

```
SEFOS(config-router)# network 10.10.2.1 area 0.0.0.6
```

5. **Configure the area `0.0.0.6` as an NSSA area.**

```
SEFOS(config-router)# area 0.0.0.6 nssa
```

6. **Configure the translation role for the NSSA area `0.0.0.6`.**

```
SEFOS(config-router)# area 0.0.0.6 translation-role always
```

7. **Configure the default translation role for the NSSA area `0.0.0.6`.**

```
SEFOS(config-router)# no area 0.0.0.6 translation-role
```

Note - The default translation role is candidate. Configure the default translation role with the `no area area-id translation-role` command.

Configure the Stability Interval for NSSA

This procedure configures the number of seconds after which an elected translator determines that its services are no longer required, and that it must continue to perform its translation duties for NSSA.

1. **Enter Global Configuration mode in SEFOS1.**

```
SEFOS# configure terminal
```

2. **Enable OSPF globally in the switch SEFOS1.**

```
SEFOS(config)# router ospf
```

3. **Configure the OSPF router ID.**

```
SEFOS(config-router)# router-id 10.10.2.1
```

4. **Configure the ASBR router status.**

```
SEFOS(config-router)# asbr router
```

5. **Configure the OSPF interface.**

```
SEFOS(config-router)# network 10.10.2.1 area 0.0.0.6
```

6. **Configure the area `0.0.0.6` as an NSSA area.**

```
SEFOS(config-router)# area 0.0.0.6 nssa
```

7. **Configure the stability interval for the NSSA area `0.0.0.6` as 120 seconds.**

```
SEFOS(config-router)# area 0.0.0.6 stability-interval 120
```

8. **Configure the default stability interval for the NSSA area `0.0.0.6`.**

```
SEFOS(config-router)# no area 0.0.0.6 stability-interval
```

Note - The default value for stability-interval is 40 seconds and is configured using the command `no area area-id stability-interval`.

Configure the ABR Type

This procedure sets the ABR type as either standard, Cisco, or IBM.

1. **Enter Global Configuration mode in SEFOS1.**

```
SEFOS# configure terminal
```

2. **Enable OSPF globally in the switch SEFOS1.**

```
SEFOS(config)# router ospf
```

3. **Configure the OSPF router ID.**

```
SEFOS(config-router)# router-id 10.10.2.1
```

4. **Enable OSPF over the VLAN interface and associate the interface with an OSPF area.**

```
SEFOS(config-router)# network 10.4.0.1 area 0.0.0.0
SEFOS(config-router)# network 10.10.2.1 area 0.0.0.6
```

5. **Configure the ABR type as Cisco.**

```
SEFOS(config-router)# abr-type cisco

The default value ABR type is standard.
SEFOS# show ip ospf
OSPF Router ID 10.10.2.1
  Supports only single TOS(TOS0) route
  ABR Type supported is Cisco ABR
  It is an Area Border Router
  Number of Areas in this router is 2
  Area is 0.0.0.6
  Number of interfaces in this area is 1
  SPF algorithm executed 3 times
  Area is 0.0.0.0
  Number of interfaces in this area is 1
  SPF algorithm executed 3 times
```

Configure RFC 1583 Compatibility

This procedure sets the OSPF compatibility list to be compatible with RFC 1583.

1. **Type.**

```
SEFOS# configure terminal
SEFOS(config)# router ospf
```

2. **Configure the OSPF router ID.**

```
SEFOS(config-router)# router-id 10.10.2.1
```

3. **Enable OSPF over the VLAN interface and associate the interface with an OSPF area.**

```
SEFOS(config-router)# network 10.4.0.1 area 0.0.0.0
SEFOS(config-router)# network 10.10.2.1 area 0.0.0.6
```

4. **Configure RFC 1583 compatibility.**

```
SEFOS(config-router)# compatible rfc1583
```

▼ Disable RFC 1583 Compatibility

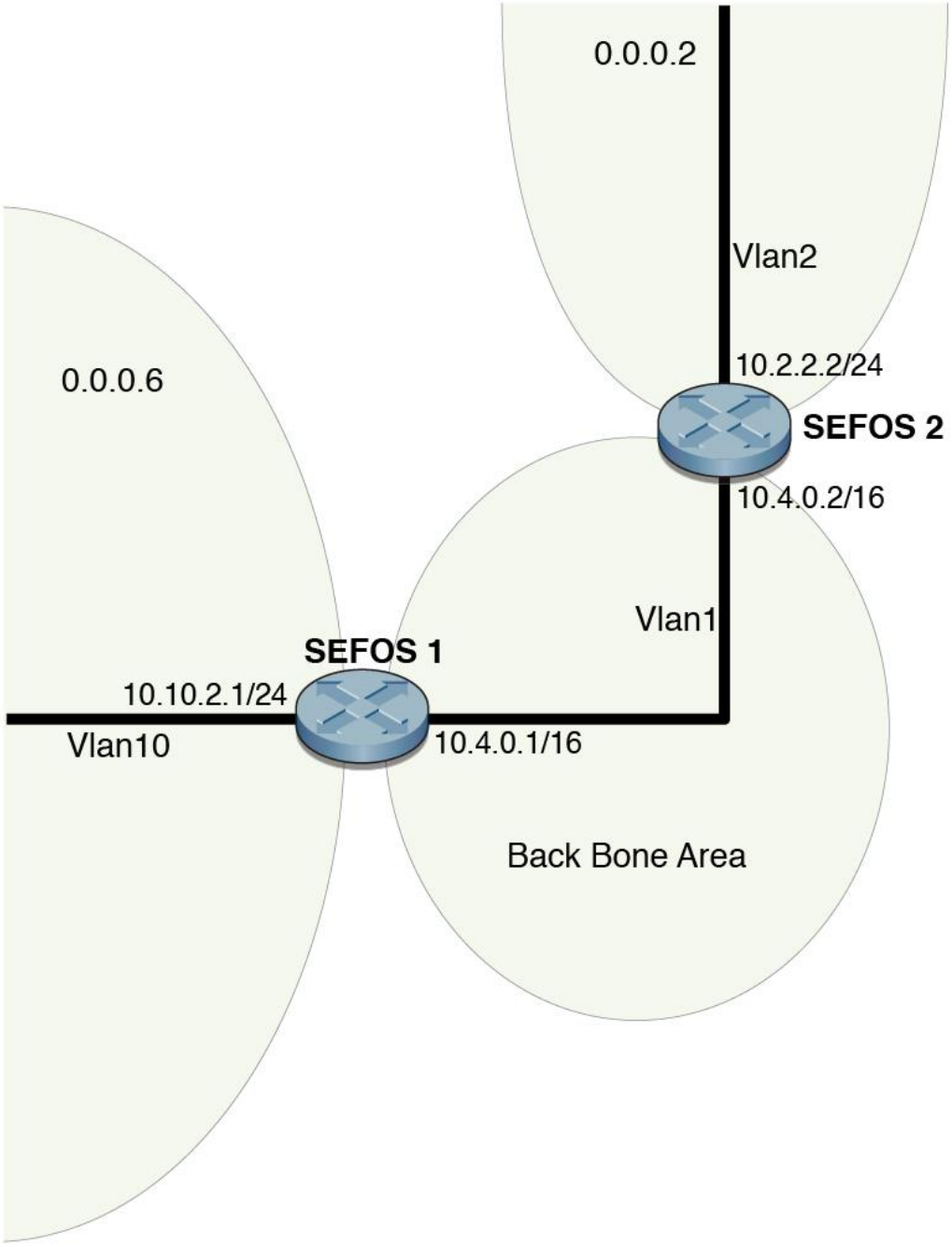
- **Type.**

```
SEFOS(config-router)# no compatible rfc1583
```

Configuring the Generation of a Default External Route and Redistribution Configuration

These sections explain how to configure the generation of a default external route and redistribution configuration.

Generation of a Default External Route and Redistribution Configuration Topology Example



You must configure SEFOS1 and SEFOS2 before configuring OSPF. See “Configuration Guidelines” on page 13 for more information.

Configure the Generation of a Default External Route

This procedure enables the generation of a default external route into the OSPF routing domain and other parameters related to that area. See “Generation of a Default External Route and Redistribution Configuration Topology Example” on page 66 for the topology for this procedure.

1. **Type.**

```
SEFOS# configure terminal
SEFOS(config)# router ospf
```

2. **Configure the OSPF router ID.**

```
SEFOS(config-router)# router-id 10.10.2.1
```

3. **Enable OSPF over the VLAN interface and associate the interface with an OSPF area.**

```
SEFOS(config-router)# network 10.4.0.1 area 0.0.0.0
SEFOS(config-router)# network 10.10.2.1 area 0.0.0.6
```

4. **Configure the ASBR router status.**

```
SEFOS(config-router)# asbr outer
```

5. **Configure the generation of a default external route.**

```
SEFOS(config-router)# default-information originate always metric 40
```

Disable Generation of a Default External Route

- **Type.**

```
SEFOS(config-router)# no default-information originate always
```

Configure the Redistribution Configuration

This procedure configures the information to be applied to routes learned from the RTM.

1. **Type.**

```
SEFOS# configure terminal
SEFOS(config)# router ospf
```

2. **Configure the OSPF router ID.**

```
SEFOS(config-router)# router-id 10.10.2.1
```

3. **Configure the ASBR router.**

```
SEFOS(config-router)# asbr outer
```

4. **Configure the redistribution of static routes.**

```
SEFOS(config-router)# redistribute static
```

5. **Configure the redistribution configuration.**

```
SEFOS(config-router)# redist-config 20.0.0.0 255.0.0.0 metric-value  100 metric-type
 asExttype1 tag 10
```

Delete the Information Applied to the Routes Learned From RTM

- **Type.**

```
SEFOS(config-router)# no redist-config 20.0.0.0 255.0.0.0
```

Configure SEFOS1

1. **Type.**

```
SEFOS# configure terminal
SEFOS(config)# router ospf
```

2. **Configure the OSPF router ID.**

```
SEFOS(config-router)# router-id 10.10.2.1
```

3. **Enable OSPF over the VLAN interface and associate the interface with an OSPF area.**

```
SEFOS(config-router)# network 10.4.0.1 area 0.0.0.0
SEFOS(config-router)# network 10.10.2.1 area 0.0.0.6
```

4. **Configure the ASBR router.**

```
SEFOS(config-router)# asbr router
```

5. **Configure the generation of a default external route.**

```
SEFOS(config-router)# default-information originate always metric 40
```

6. **Exit Router Configuration mode.**

```
SEFOS(config-router)# end
SEFOS#
```

▼ Configure SEFOS2

1. **Configure the generation of a default external network.**

   a. **Type.**

   ```
   SEFOS# configure terminal
   SEFOS(config)# router ospf
   ```

   b. **Configure the OSPF router ID.**

   ```
   SEFOS(config-router)# router-id 10.4.0.2
   ```

   c. **Enable OSPF over the VLAN interface and associate the interface with an OSPF area.**

```
SEFOS(config-router)# network 10.4.0.2 area 0.0.0.0
SEFOS(config-router)# network 10.2.2.2 area 0.0.0.2
```

d. Configure area `0.0.0.2` as an NSSA area.

```
SEFOS(config)# area 0.0.0.2 nssa
```

e. Exit Router Configuration mode.

```
SEFOS(config-router)# end
SEFOS#
```

2. Examine the results.

Type 5 External LSA must be generated for the default route.

```
SEFOS# show ip ospf database external

OSPF Router with ID (10.10.2.1)
                 AS External Link States
                 ----------------------
LS age             : 0
Options            : (No ToS Capability, DC)
LS Type            : AS External Link
Link State ID      : 0.0.0.0
Advertising Router : 10.10.2.1
LS Seq Number      : 0x80000001
Checksum           : 0xb5dd
Length             : 36
Network Mask       : 0.0.0.0
Metric Type        : 0x80
Metric             : 40
Forward Address    : 0.0.0.0
Externel Route Tag : 0
```

3. Examine the configuration details in SEFOS2.

The route entry for the default route must exist.

```
SEFOS# show ip ospf route

OSPF Process Routing Table
Dest/Mask                    TOS NextHop/Interface Cost Rt.Type   Area
---------                    --- -------/--------- ---- -------   ----
0.0.0.0/0.0.0.0           0   10.4.0.1/vlan1    40   Type2Ext  0.0.0.0
10.2.2.0/255.255.255.0    0   0.0.0.0/vlan2     1    IntraArea 0.0.0.2
10.4.0.0/255.255.0.0      0   0.0.0.0/vlan1     1    IntraArea 0.0.0.0
10.10.0.0/255.255.0.0     0   10.4.0.1/vlan1    2    InterArea 0.0.0.0
```

Configure SEFOS1

1. **Disable generation of a default external route.**

```
SEFOS# configure terminal
SEFOS(config)# router ospf
SEFOS(config-router)# no default-information originate always
SEFOS(config-router)# end
SEFOS#
```

2. **Examine the results.**

   Type 5 External LSA for the default route must be flushed.

```
SEFOS# show ip ospf database external

OSPF Router with ID (10.10.2.1)
```

3. **In SEFOS2, observe that the route entry for the default route has been deleted.**

```
SEFOS# show ip ospf route

OSPF Process Routing Table
Dest/Mask                 TOS NextHop/Interface Cost Rt.Type   Area
---------                    --- --------/--------- ---- -------   ----
10.2.2.0/255.255.255.0    0   0.0.0.0/vlan2     1    IntraArea 0.0.0.2
10.4.0.0/255.255.0.0      0   0.0.0.0/vlan1     1    IntraArea 0.0.0.0
10.10.0.0/255.255.0.0     0   10.4.0.1/vlan1    2    InterArea 0.0.0.0
```

Test SEFOS1

1. **Test the redistribution configuration.**

   a. **Type.**

```
SEFOS# configure terminal
SEFOS(config)# router ospf
```

   b. **Configure redistribution of the static route's redistribution configuration.**

```
SEFOS(config-router)# redistribute static
```

   c. **Configure the redistribution configuration.**

```
SEFOS(config-router)# redist-config 20.0.0.0 255.0.0.0 metric-value 100 metric-type
 asExttype1 tag 10
SEFOS(config-router)# exit
```

d. Add a static route for the `20.0.0.0/8` network.

```
SEFOS(config)# ip route 20.0.0.0 255.0.0.0 10.4.0.2
SEFOS(config)# end
SEFOS#
```

e. Examine the configuration details.

An external LSA is generated for `20.0.0.0` with metric as 100, metric type as `asExtType1` and tag as 10.

```
SEFOS# show ip ospf database external

OSPF Router with ID (10.10.2.1)
                 AS External Link States
                 -----------------------
LS age             : 600
Options            : (No ToS Capability, DC)
LS Type            : AS External Link
Link State ID      : 20.0.0.0
Advertising Router : 10.10.2.1
LS Seq Number      : 0x80000001
Checksum           : 0xf6b2
Length             : 36
Network Mask       : 255.0.0.0
Metric Type        : 0x0
Metric             : 100
Forward Address    : 10.4.0.2
Externel Route Tag : 10
```

2. In SEFOS2, examine the external route `20.0.0.0/8` with metric as 101.

```
SEFOS# show ip ospf route

OSPF Process Routing Table
Dest/Mask                    TOS NextHop/Interface Cost Rt.Type   Area
---------                    --- -------/--------- ---- -------   ----
10.2.2.0/255.255.255.0       0   0.0.0.0/vlan2     1    IntraArea 0.0.0.2
10.4.0.0/255.255.0.0         0   0.0.0.0/vlan1     1    IntraArea 0.0.0.0
10.10.0.0/255.255.0.0        0   10.4.0.1/vlan1    2    InterArea 0.0.0.0
20.0.0.0/255.0.0.0           0   10.4.0.2/vlan1    101  Type1Ext  0.0.0.0
```

3. In SEFOS1, test no `redist-config`.

```
SEFOS# configure terminal
SEFOS(config)# router ospf
```

4. **In SEFOS1, configure the switch to have no redistribution configuration.**

```
SEFOS(config-router)# no redist-config 20.0.0.0 255.0.0.0
SEFOS(config-router)# end
SEFOS#
```

5. **In SEFOS1, examine the configuration details.**

   The external LSA generated for `20.0.0.0` with metric as 100, metric type as `asExtType1`, and tag as 10, is flushed. A new external LSA is generated with the default redistribution configuration.

```
SEFOS# show ip ospf database external

OSPF Router with ID (10.10.2.1)
                 AS External Link States
                 -----------------------
LS age             : 0
Options            : (No ToS Capability, DC)
LS Type            : AS External Link
Link State ID      : 20.0.0.0
Advertising Router : 10.10.2.1
LS Seq Number      : 0x80000002
Checksum           : 0x3c50
Length             : 36
Network Mask       : 255.0.0.0
Metric Type        : 0x80
Metric             : 10
Forward Address    : 10.4.0.2
Externel Route Tag : 0
```

▼ Configure the Neighbor

This procedure specifies an NBMA neighbor router and its priority.

1. **Type.**

```
SEFOS# configure terminal
SEFOS(config)# router ospf
```

2. **Configure the OSPF router ID.**

```
SEFOS(config-router)# router-id 10.10.2.1
```

3. **Configure the OSPF interface.**

```
SEFOS(config-router)# network 10.4.0.1 area 0.0.0.0
SEFOS(config-router)# network 10.10.2.1 area 0.0.0.6
```

4. **Exit Router Configuration mode.**

```
SEFOS(config)# exit
```

5. **Enter Interface Configuration mode.**

```
SEFOS(config)# interface vlan 1
```

6. **Configure the network type as NBMA.**

```
SEFOS(config-if)# ip ospf network non-broadcast
```

7. **Configure the neighbor with priority.**

```
SEFOS(config-if)# exit
SEFOS(config)# router ospf
SEFOS(config-router)# neighbor 10.4.0.2 priority 10
```

8. **Configure the neighbor with default priority.**

```
SEFOS(config-router)# no neighbor 10.4.0.2 priority 10
```

▼ Delete the Configured Neighbor

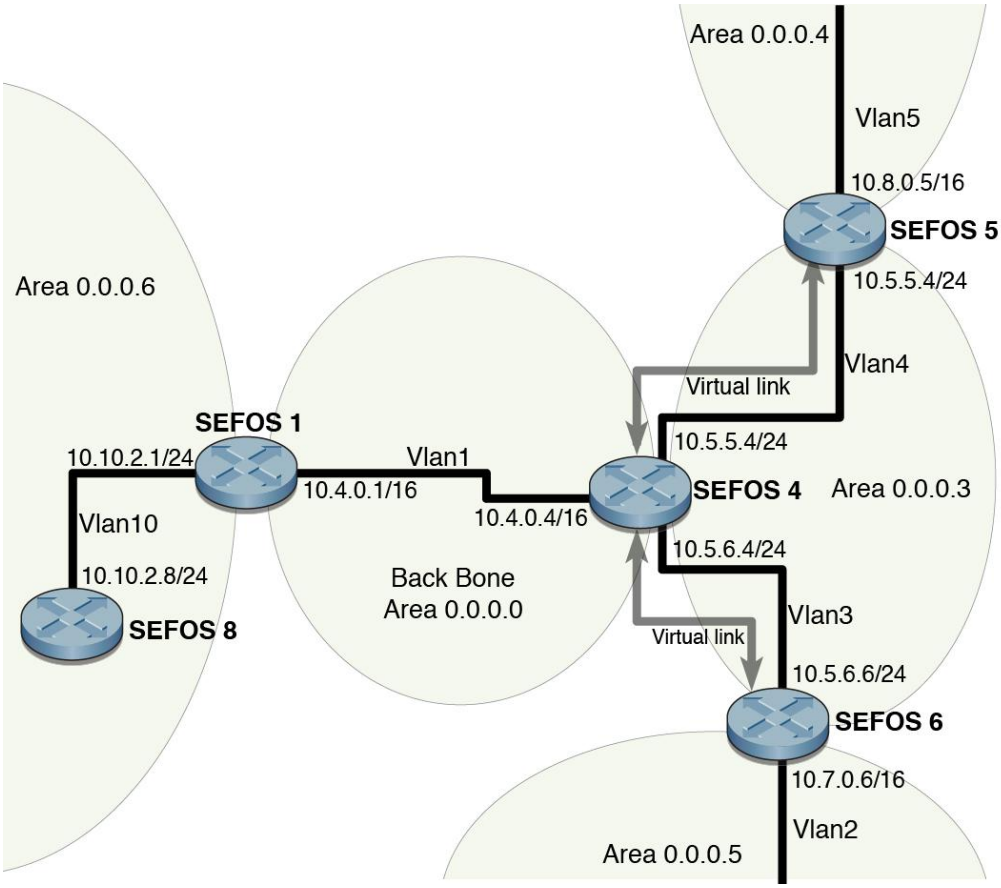
- **Type.**

```
SEFOS(config-router)# no neighbor 10.4.0.2
```

Configuring Virtual Links and Route Configuration

These sections explain how to configure virtual links and route configuration.

Virtual Link and Route Summarization Topology Example



▼ Configure the Virtual Link

This procedure defines an OSPF virtual link and its related parameters.

1. **Type.**

```
SEFOS# configure terminal
SEFOS(config)# router ospf
```

2. **Configure the OSPF router ID.**

```
SEFOS(config-router)# router-id 10.10.2.1
```

3. **Configure the OSPF interface.**

```
SEFOS(config-router)# network 10.4.0.1 area 0.0.0.0
SEFOS(config-router)# network 10.10.2.1 area 0.0.0.6
```

4. **Configure the virtual link.**

```
SEFOS(config-router)# area 0.0.0.6 virtual-link 20.0.0.1 authentication message-digest
 hello-interval 100 retransmit-interval 100 transmit-delay 50 dead-interval 200
 authentication-key asdf
```

Delete the Virtual Link

The no form of the command removes an OSPF virtual link.

- **Type.**

```
SEFOS(config-router)# no area 0.0.0.6 virtual-link 20.0.0.1
```

Configure the Area Range

Area range is configured to consolidate and summarize routes at an area boundary.

1. **Type.**

```
SEFOS# configure terminal
SEFOS(config)# router ospf
```

2. **Configure the OSPF router ID.**

```
SEFOS(config-router)# router-id 10.10.2.1
```

3. **Configure the OSPF interface.**

```
SEFOS(config-router)# network 10.4.0.1 area 0.0.0.0
SEFOS(config-router)# network 10.10.2.1 area 0.0.0.6
```

4. **Configure the route summarization at an area border router.**

```
SEFOS(config-router)# area 0.0.0.6 range 10.10.0.0 255.255.0.0 summary
```

Delete the Route Summarization Information

- **Type.**

```
SEFOS(config-router)# no area 0.0.0.6 range 10.10.0.0 255.255.0.0
```

Configure SEFOS1

1. **Type.**

```
SEFOS# configure terminal
SEFOS(config)# router ospf
```

2. **Configure the OSPF router ID.**

```
SEFOS(config-router)# router-id 10.10.2.1
```

3. **Enable OSPF over the VLAN interface and associate the interface with an OSPF area.**

```
SEFOS(config-router)# network 10.4.0.1 area 0.0.0.0
SEFOS(config-router)# network 10.10.2.1 area 0.0.0.6
```

4. **Configure the route summarization at an area border router.**

```
SEFOS(config-router)#
area 0.0.0.6 range 10.10.0.0 255.255.0.0summary
```

5. **Exit Router Configuration mode.**

```
SEFOS(config-router)# end
```

Configure SEFOS4

1. **Type.**

```
SEFOS# configure terminal
SEFOS(config)# router ospf
```

2. **Configure the OSPF router ID.**

```
SEFOS(config-router)# router-id 10.4.0.4
```

3. **Enable OSPF over the VLAN interface and associate the interface with an OSPF area.**

```
SEFOS(config-router)# network 10.4.0.4 area 0.0.0.0
SEFOS(config-router)# network 10.5.6.4 area 0.0.0.3
SEFOS(config-router)# network 10.5.5.4 area 0.0.0.3
```

4. **Configure the virtual link for backbone connectivity.**

```
SEFOS(config-router)# area 0.0.0.3 virtual-link 10.7.0.6
SEFOS(config-router)# area 0.0.0.3 virtual-link 10.8.0.5
```

5. **Exit Router Configuration mode.**

```
SEFOS(config-router)# end
```

▼ Configure SEFOS5

1. **Type.**

```
SEFOS# configure terminal
SEFOS(config)# router ospf
```

2. **Configure the OSPF router ID.**

```
SEFOS(config-router)# router-id 10.8.0.5
```

3. **Enable OSPF over the VLAN interface and associate the interface with an OSPF area.**

```
SEFOS(config-router)# network 10.8.0.5 area 0.0.0.4
SEFOS(config-router)# network 10.5.5.5 area 0.0.0.3
```

4. **Configure a virtual link for backbone connectivity.**

```
SEFOS(config-router)# area 0.0.0.3 virtual-link 10.4.0.4
```

5. **Exit Router Configuration mode.**

```
SEFOS(config-router)# end
```

Configure SEFOS6

1. **Type.**

```
SEFOS# configure terminal
SEFOS(config)# router ospf
```

2. **Configure the OSPF router ID.**

```
SEFOS(config-router)# router-id 10.7.0.6
```

3. **Enable OSPF over the VLAN interface and associate the interface with an OSPF area.**

```
SEFOS(config-router)# network 10.7.0.6 area 0.0.0.4
SEFOS(config-router)# network 10.5.6.6 area 0.0.0.3
```

4. **Configure the virtual link for backbone connectivity.**

```
SEFOS(config-router)# area 0.0.0.3 virtual-link 10.4.0.4
```

5. **Exit Router Configuration mode.**

```
SEFOS(config-router)# end
```

Configure SEFOS8

1. **Type.**

```
SEFOS# configure terminal
SEFOS(config)# router ospf
```

2. **Configure the OSPF router ID.**

```
SEFOS(config-router)# router-id 10.10.1.8
```

3. **Enable OSPF over the VLAN interface and associate the interface with an OSPF area.**

```
SEFOS(config-router)# network 10.10.1.8 area 0.0.0.6
SEFOS(config-router)# network 10.10.2.8 area 0.0.0.6
```

4. **Exit Configuration mode.**

```
SEFOS(config-router)# end
```

▼ Examine the Route Information and Virtual Links in SEFOS1

1. **Examine the route summarization information in SEFOS1.**

```
SEFOS# show ip ospf area-range

Display of Summary addresses for Type3 and Translated Type5

OSPF Summary Address Configuration Information
-----------------------------------------------
Network     Mask        LSAType Area           Effect          Tag
 -------     ----        ------- ----           ------          ---
 10.10.0.0  255.255.0.0  Summary 0.0.0.6        Advertise       150746304
```

2. **Examine the virtual link and the status of the link in SEFOS4.**

```
SEFOS# show ip ospf virtual-links

Virtual Link to router 10.7.0.6, Interface State is POINT_TO_POINT
  Transit Area 0.0.0.3
  Transmit Delay is 1 sec, Neighbor State FULL
  Timer intervals configured, Hello 10, Dead 60, Retransmit 5

Virtual Link to router 10.8.0.5, Interface State is POINT_TO_POINT
  Transit Area 0.0.0.3
  Transmit Delay is 1 sec, Neighbor State FULL
  Timer intervals configured, Hello 10, Dead 60, Retransmit 5
```

Examine the Virtual Link in SEFOS5

- **Type.**

```
SEFOS# show ip ospf virtual-links

Virtual Link to router 10.4.0.4, Interface State is POINT_TO_POINT
  Transit Area 0.0.0.3
  Transmit Delay is 1 sec, Neighbor State FULL
  Timer intervals configured, Hello 10, Dead 60, Retransmit 5
```

Examine the Virtual Link in SEFOS6

- **Type.**

```
SEFOS# show ip ospf virtual-links

Virtual Link to router 10.4.0.4, Interface State is POINT_TO_POINT
  Transit Area 0.0.0.3
  Transmit Delay is 1 sec, Neighbor State FULL
  Timer intervals configured, Hello 10, Dead 60, Retransmit 5
```

Examine the Route Available to Reach ABR SEFOS1

- **Type.**

```
SEFOS# show ip ospf border-routers

OSPF Process Border Router Information
Destination   TOS  Type  NextHop          Cost       Rt.Type    Area
-----------    ---  ----  -------          ----       -------    ----
10.4.0.4      0    ABR   10.5.6.4         1          intraArea  0.0.0.3
10.8.0.5      0    ABR   10.5.6.4         2          intraArea  0.0.0.3
10.10.2.1     0    ABR   255.255.255.255  00.0.0.0
```