VYATTA, INC. | Vyatta System

OSPF

REFERENCE GUIDE

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Quick Reference to Commands

Use this section to help you quickly locate a command.

Quick List of Examples

Use this list to help you locate examples you'd like to try or look at.

Preface

This guide describes commands for the Open Shortest Path First (OSPF) routing protocol.

This preface provides information about using this guide. The following topics are covered:

- Intended Audience
- Organization of This Guide
- Document Conventions
- Vyatta Publications

Intended Audience

This guide is intended for experienced system and network administrators. Depending on the functionality to be used, readers should have specific knowledge in the following areas:

- Networking and data communications
- TCP/IP protocols
- General router configuration
- Routing protocols
- Network administration
- Network security

Organization of This Guide

This guide has the following aid to help you find the information you are looking for:

- **Quick Reference to Commands**

  Use this section to help you quickly locate a command.

- **Quick List of Examples**

  Use this list to help you locate examples you'd like to try or look at.

This guide has the following chapters:

Document Conventions

This guide contains advisory paragraphs and uses typographic conventions.

Advisory Paragraphs

This guide uses the following advisory paragraphs:

Warnings alert you to situations that may pose a threat to personal safety, as in the following example:

WARNING *Risk of injury. Switch off power at the main breaker before attempting to connect the remote cable to the service power at the utility box.*

Cautions alert you to situations that might cause harm to your system or damage to equipment, or that may affect service, as in the following example:

CAUTION *Risk of loss of service. Restarting a running system will interrupt service.*

Notes provide information you might need to avoid problems or configuration errors:

NOTE *You must create and configure network interfaces before enabling them for routing protocols.*

Typographic Conventions

This document uses the following typographic conventions:

`Courier`	Examples, command-line output, and representations of configuration nodes.
`boldface Courier`	In an example, your input: something you type at a command line.
boldface	In-line commands, keywords, and file names .
italics	Arguments and variables, where you supply a value.
<key>	A key on your keyboard. Combinations of keys are joined by plus signs (“+”). An example is <Ctrl>+<Alt>+<Del>.
[*arg1* | *arg2*]	Enumerated options for completing a syntax. An example is [enable | disable].

num1–numN	A inclusive range of numbers. An example is 1–65535, which means 1 through 65535.
arg1..*argN*	A range of enumerated values. An example is eth0..eth3, which means eth0, eth1, eth2, and eth3.
arg [*arg* ...] *arg*,[*arg*,...]	A value that can optionally represent a list of elements (a space-separated list in the first case, and a comma-separated list in the second case).

Vyatta Publications

More information about the Vyatta system is available in the Vyatta technical library, and on www.vyatta.com and www.vyatta.org.

Full product documentation is provided in the Vyatta technical library. To see what documentation is available for your release, see the *Vyatta Documentation Map*. This guide is posted with every release of Vyatta software and provides a great starting point for finding what you need.

Chapter 1: Router-Level Configuration

This chapter describes commands for router-level OSPF configuration.

This chapter presents the following topics:

- OSPF Commands

OSPF Commands

This chapter contains the following commands.

Configuration Commands	
protocols ospf	Enables the Open Shortest Path First (OSPF) routing protocol on the router.
protocols ospf access-list <list-num>	Specifies access list to filter networks in routing updates.
protocols ospf auto-cost reference-bandwidth <bandwidth>	Directs the system to use the reference bandwidth method for calculating administrative cost.
protocols ospf default-information originate	Sets the characteristics of an external default route originated into an OSPF routing domain.
protocols ospf default-metric <metric>	Sets default metric to be applied to routes being redistributed into OSPF.
protocols ospf distance	Sets the OSPF administrative distance by route type.
protocols ospf log-adjacency-changes	Enables or disables logging of changes in adjacency state of neighbors.
protocols ospf max-metric router-lsa	Enables or disables an OSPF stub router to advertise a maximum metric value when the router is started up or reloaded.
protocols ospf mpls-te	Sets Multi-Protocol Label Switching (MPLS) Traffic Engineering (MPLS-TE) parameters.
protocols ospf neighbor <ipv4>	Defines an OSPF neighbor.
protocols ospf parameters	Sets global OSPF parameters, such as router ID.
protocols ospf passive-interface <ethx>	Suppress routing updates on an interface.
protocols ospf refresh timers <value>	Sets values for OSPF refresh timers.
protocols ospf timers throttle spf	Enables or disables OSPF SPF throttling.
OSPF Route Redistribution Commands	
protocols ospf redistribute bgp	Sets the parameters for redistribution of BGP routes into OSPF.
protocols ospf redistribute connected	Sets the parameters for redistribution of connected routes into OSPF.
protocols ospf redistribute kernel	Sets the parameters for redistribution of kernel routes into OSPF.

protocols ospf redistribute rip	Sets the parameters for redistribution of RIP routes into OSPF.
protocols ospf redistribute static	Sets the parameters for redistribution of static routes into OSPF.
Operational Commands	
debug ospf event	Enables or disables debug message generation related to OSPF events.
debug ospf ism	Enables or disables debug message generation related to the OSPF ISM.
debug ospf lsa	Enables or disables debug message generation related to OSPF link-state advertisements (LSAs).
debug ospf nsm	Enables or disables debug message generation related to the OSPF NSM.
debug ospf nssa	Enables or disables debug message generation related to OSPF not-so-stubby areas (NSSAs).
debug ospf packet all	Enables or disables debug message generation related to all OSPF packets.
debug ospf packet dd	Enables or disables debug message generation related to OSPF Database Description (DD) packets.
debug ospf packet hello	Enables or disables debug message generation related to OSPF hello packets.
debug ospf packet ls-ack	Enables or disables debug message generation related to OSPF link-state acknowledgement (LS Ack) packets.
debug ospf packet ls-request	Enables or disables debug message generation related to OSPF link-state request (LSR) packets.
debug ospf packet ls-update	Enables or disables debug message generation related to OSPF link-state update (LSU) packets.
debug ospf zebra	Enables or disables debug message generation for the Zebra OSPF process.

show debugging ospf	Displays OSPF protocol debugging flags.
show ip ospf	Displays high-level OSPF configuration information.
show ip ospf border-routers	Displays OSPF border router information.
show ip ospf database	Displays OSPF database information.
show ip ospf interface	Displays OSPF configuration and status information for a specified interface.
show ip ospf neighbor	Displays OSPF neighbor information for a specified address or interface.
show ip ospf route	Displays OSPF route information.
show ip route ospf	Displays all IP OSPF routes.

debug ospf event

Enables or disables debug message generation related to OSPF events.

Syntax

debug ospf event

no debug ospf event

Command Mode

Operational mode.

Parameters

None.

Default

None.

Usage Guidelines

Use this command to enable generation of trace-level messages related to OSPF events.

Use the **no** form of this command to disable debugging for OSPF events.

debug ospf ism

Enables or disables debug message generation related to the OSPF ISM.

Syntax

debug ospf ism [**events** | **status** | **timers**]

no debug ospf ism [**events** | **status** | **timers**]

Command Mode

Operational mode.

Parameters

events	Optional. Enables or disables debug message generation related to OSPF ISM events.
status	Optional. Enables or disables debug message generation related to OSPF ISM status.
timers	Optional. Enables or disables debug message generation related to OSPF ISM timers.

Default

When used with no option, this command enables or disables all OSPF ISM messages.

Usage Guidelines

Use this command to enable generation of trace-level messages related to the OSPF ISM.

Use the **no** form of this command to disable debugging for the OSPF ISM.

debug ospf lsa

Enables or disables debug message generation related to OSPF link-state advertisements (LSAs).

Syntax

debug ospf lsa [**flooding** | **generate** | **install** | **refresh**]

no debug ospf lsa [**flooding** | **generate** | **install** | **refresh**]

Command Mode

Operational mode.

Parameters

flooding	Optional. Generates messages related to OSPF LSA flood events.
generate	Optional. Generates messages relates to OSPF LSA generation.
install	Optional. Generates messages relates to OSPF LSA installation.
refresh	Optional. Generates messages relates to OSPF LSA refreshes.

Default

When used with no option, this command enables debugging for all OSPF link-state advertisement activity.

Usage Guidelines

Use this command to enable generation of trace-level messages related to OSPF link-state advertisements.

Use the **no** form of this command to disable debugging for OSPF link-state advertisements.

debug ospf nsm

Enables or disables debug message generation related to the OSPF NSM.

Syntax

debug ospf nsm [**events** | **status** | **timers**]

no debug ospf nsm [**events** | **status** | **timers**]

Command Mode

Operational mode.

Parameters

events	Optional. Enables or disables debug message generation related to OSPF NSM events.
status	Optional. Enables or disables debug message generation related to OSPF NSM status.
timers	Optional. Enables or disables debug message generation related to OSPF NSM timers.

Default

When used with no option, this command enables or disables all OSPF NSM messages.

Usage Guidelines

Use this command to enable generation of trace-level messages related to the OSPF NSM.

Use the **no** form of this command to disable debugging for the OSPF NSM.

debug ospf nssa

Enables or disables debug message generation related to OSPF not-so-stubby areas (NSSAs).

Syntax

debug ospf nssa

no debug ospf nssa

Command Mode

Operational mode.

Parameters

None.

Default

None.

Usage Guidelines

Use this command to enable generation of trace-level messages related to OSPF not-so-stubby areas (NSSAs).

Use the **no** form of this command to disable debugging for OSPF not-so-stubby areas (NSSAs).

debug ospf packet all

Enables or disables debug message generation related to all OSPF packets.

Syntax

debug ospf packet all [**detail** | **recv** [**detail**] | **send** [**detail**]]

no debug ospf packet all [**detail** | **recv** [**detail**] | **send** [**detail**]]

Command Mode

Operational mode.

Parameters

detail	Optional. Generates detailed debug messages for all OSPF packets, both sent and received.
recv	Optional. Generates debug messages for all received OSPF packet types.
detail	Optional. Generates detailed debug messages for all received OSPF packets.
send	Optional. Generates debug messages for all transmitted OSPF packets.
detail	Optional. Generates detailed debug messages for all transmitted OSPF packets.

Default

Debug messages are generated for all OSPF packets at a medium level of detail.

Usage Guidelines

Use this command to enable generation of trace-level messages related to all OSPF packet types arriving and leaving the router.

Use the **no** form of this command to disable debugging for all OSPF packet types.

debug ospf packet dd

Enables or disables debug message generation related to OSPF Database Description (DD) packets.

Syntax

debug ospf packet dd [**detail** | **recv** [**detail**] | **send** [**detail**]]

no debug ospf packet dd [**detail** | **recv** [**detail**] | **send** [**detail**]]

Command Mode

Operational mode.

Parameters

detail	Optional. Generates detailed debug messages for OSPF DD packets, both sent and received.
recv	Optional. Generates debug messages for received OSPF DD packets.
detail	Optional. Generates detailed debug messages for received OSPF DD packets.
send	Optional. Generates debug messages for transmitted OSPF DD packets.
detail	Optional. Generates detailed debug messages for transmitted OSPF DD packets.

Default

Debug messages are generated for OSPF DD packets at a medium level of detail.

Usage Guidelines

Use this command to enable generation of trace-level messages related to OSPF Database Description (DD) packets. OSPF DD packets provide a summary (digest) of each link-state advertisement in the link-state databases. OSPF routers exchange these packets to keep data synchronized.

Use the **no** form of this command to disable debugging for OSPF DD packets.

debug ospf packet hello

Enables or disables debug message generation related to OSPF hello packets.

Syntax

debug ospf packet hello [**detail** | **recv** [**detail**] | **send** [**detail**]]

no debug ospf packet hello [**detail** | **recv** [**detail**] | **send** [**detail**]]

Command Mode

Operational mode.

Parameters

detail	Optional. Generates detailed debug messages for OSPF hello packets, both sent and received.
recv	Optional. Generates debug messages for received OSPF hello packets.
detail	Optional. Generates detailed debug messages for received OSPF hello packets.
send	Optional. Generates debug messages for transmitted OSPF hello packets.
detail	Optional. Generates detailed debug messages for transmitted OSPF hello packets.

Default

Debug messages are generated for OSPF hello packets at a medium level of detail.

Usage Guidelines

Use this command to enable generation of trace-level messages related to OSPF hello packets. OSPF hello packets are sent at intervals to discover neighbors and ensure that neighbors are reachable. Hello packets include information about certain OSPF timers, the Designated Router (DR), the Backup Designated Router (BDR), and known neighbors.

Use the **no** form of this command to disable debugging for OSPF hello packets.

debug ospf packet ls-ack

Enables or disables debug message generation related to OSPF link-state acknowledgement (LS Ack) packets.

Syntax

debug ospf packet ls-ack [**detail** | **recv** [**detail**] | **send** [**detail**]]

no debug ospf packet ls-ack [**detail** | **recv** [**detail**] | **send** [**detail**]]

Command Mode

Operational mode.

Parameters

detail	Optional. Generates detailed debug messages for OSPF LS Ack packets, both sent and received.
recv	Optional. Generates debug messages for received OSPF LS Ack packets.
detail	Optional. Generates detailed debug messages for received OSPF LS Ack packets.
send	Optional. Generates debug messages for transmitted OSPF LS Ack packets.
detail	Optional. Generates detailed debug messages for transmitted OSPF LS Ack packets.

Default

Debug messages are generated for OSPF LS Ack packets at a medium level of detail.

Usage Guidelines

Use this command to enable generation of trace-level messages related to OSPF LS Ack packets. LS Ack packets are sent to OSPF neighbors to acknowledge receipt of a neighbor's link-state advertisement update (LSU packet).

Use the **no** form of this command to disable debugging for OSPF LS Ack packets.

debug ospf packet ls-request

Enables or disables debug message generation related to OSPF link-state request (LSR) packets.

Syntax

debug ospf packet ls-request [**detail** | **recv** [**detail**] | **send** [**detail**]]

no debug ospf packet ls-request [**detail** | **recv** [**detail**] | **send** [**detail**]]

Command Mode

Operational mode.

Parameters

detail	Optional. Generates detailed debug messages for OSPF LSR packets, both sent and received.
recv	Optional. Generates debug messages for received OSPF LSR packets.
detail	Optional. Generates detailed debug messages for received OSPF LSR packets.
send	Optional. Generates debug messages for transmitted OSPF LSR packets.
detail	Optional. Generates detailed debug messages for transmitted OSPF LSR packets.

Default

Debug messages are generated for OSPF LSR packets at a medium level of detail.

Usage Guidelines

Use this command to enable generation of trace-level messages related to OSPF link-state request (LSR) packets. After exchanging Database Description packets, neighboring OSPF routers determine which LSAs are missing from the local link-state database. The local router sends an LSR packet to the neighbor to request the missing LSAs.

Use the **no** form of this command to disable debugging for OSPF LSR packets.

debug ospf packet ls-update

Enables or disables debug message generation related to OSPF link-state update (LSU) packets.

Syntax

debug ospf packet ls-update [**detail** | **recv** [**detail**] | **send** [**detail**]]

no debug ospf packet ls-update [**detail** | **recv** [**detail**] | **send** [**detail**]]

Command Mode

Operational mode.

Parameters

detail	Optional. Generates detailed debug messages for OSPF LSU packets, both sent and received.
recv	Optional. Generates debug messages for received OSPF LSU packets.
detail	Optional. Generates detailed debug messages for received OSPF LSU packets.
send	Optional. Generates debug messages for transmitted OSPF LSU packets.
detail	Optional. Generates detailed debug messages for transmitted OSPF LSU packets.

Default

Debug messages are generated for OSPF LSU packets at a medium level of detail.

Usage Guidelines

Use this command to enable generation of trace-level messages related to OSPF link-state update (LSU) packets. LSU packets send any required LSA updates to an OSPF neighbor.

Use the **no** form of this command to disable debugging for OSPF LSU packets.

debug ospf zebra

Enables or disables debug message generation for the Zebra OSPF process.

Syntax

debug ospf zebra [**interface** | **redistribute**]

no debug ospf zebra [**interface** | **redistribute**]

Command Mode

Operational mode.

Parameters

interface	Optional. Generates debug messages for interfaces on which Zebra OSPF is enabled.
redistribute	Optional. Generates debug messages for routes redistributed into Zebra OSPF.

Default

Debug messages are generated for actions related to the Zebra OSPF process.

Usage Guidelines

Use this command to enable generation of trace-level messages related to the Zebra OSPF process.

Use the **no** form of this command to disable debugging for the Zebra OSPF process.

protocols ospf

Enables the Open Shortest Path First (OSPF) routing protocol on the router.

Syntax

set protocols ospf

delete protocols ospf

show protocols ospf

Command Mode

Configuration mode.

Configuration Statement

```
protocols {
   ospf
}
```

Parameters

None

Default

None.

Usage Guidelines

Use this command to enable the Open Shortest Path First (OSPF) routing protocol on the system.

Use the **set** form of this command to enable the OSPF routing protocol.

Use the **delete** form of this command to disable OSPF and remove all OSPF configuration.

Use the **show** form of this command to display OSPF configuration.

protocols ospf access-list <list-num>

Specifies access list to filter networks in routing updates.

Syntax

set protocols ospf access-list *list-num* [**export** *type*]

delete protocols ospf access-list *list-num* [**export** *type*]

show protocols ospf access-list *list-num*

Command Mode

Configuration mode.

Configuration Statement

```
protocols {
   ospf {
      access-list u32 {
         export text
      }
   }
}
```

Parameters

list-num	Mandatory. The access list number used to filter networks in routing updates.
type	Optional. The type of routes to filter. Possible values include: **bgp**, **connected**, **kernel**, **rip**, or **static**. Multiple types can be specified by creating additional **export** configuration nodes.

Default

None.

Usage Guidelines

Use this command to specify an access list to filter networks in routing updates.

Use the **set** form of this command to specify an access list.

Use the **delete** form of this command to remove an access list.

Use the **show** form of this command to display the configuration.

protocols ospf auto-cost reference-bandwidth <bandwidth>

Directs the system to use the reference bandwidth method for calculating administrative cost.

Syntax

set protocols ospf auto-cost reference-bandwidth *bandwidth*

delete protocols ospf auto-cost reference-bandwidth

show protocols ospf auto-cost reference-bandwidth

Command Mode

Configuration mode.

Configuration Statement

```
protocols {
   ospf {
      auto-cost {
         reference-bandwidth: 1-4294967
      }
   }
}
```

Parameters

bandwidth	Mandatory. The reference bandwidth rate in Megabits per second. The range is 1 to 4294967.

Default

The default reference bandwidth is 108.

Usage Guidelines

Use this command to set a reference bandwidth for calculating OSPF cost. The OSPF metric is calculated as the reference bandwidth divided by actual bandwidth.

An explicitly set cost for an area overrides automatically calculated values.

Use the **set** form of this command to set the reference bandwidth.

Use the **delete** form of this command to restore the default reference bandwidth.

Use the **show** form of this command to display OSPF auto-cost configuration.

protocols ospf default-information originate

Sets the characteristics of an external default route originated into an OSPF routing domain.

Syntax

set protocols ospf default-information originate [**always** | **metric** *metric* | **metric-type** *type* | **route-map** *map-name*]

delete protocols ospf default-information originate [**always** | **metric** | **metric-type** | **route-map**]

show protocols ospf default-information originate [**always** | **metric** | **metric-type** | **route-map**]

Command Mode

Configuration mode.

Configuration Statement

```
protocols {
   ospf {
      default-information {
         originate {
            always
            metric: 0-16777214
            metric-type: 1-2
            route-map: text
         }
      }
   }
}
```

Parameters

always	Optional. Always advertises the default route.
metric *metric*	Optional. The metric to be applied to the default route. The range is 0 to 16777214. The default is 1.

metric-type *type*	Optional. The external route metric type to be associated with the Type 5 default link-state advertisement (LSA). Supported values are as follows: **1**: Type 1 external route. **2**: Type 2 external route The default is 2.
map-name	Optional. The default route is generated if the specified route map is satisfied.

Default

By default, the system does not generate an external default route into the OSPF routing domain. When enabled to do so, the defaults depend on the type of area into which the default route is being advertised:

- In stub areas, a Type 3 link-state advertisement is generated with a metric of 1 and the metric type is ignored.
- In not-so-stubby areas (NSSAs) configured to import summary advertisements, a Type 7 LSA with a metric of 1 and a metric type of 2 is generated.
- In NSSAs configured not to import summary advertisements, a Type 3 LSA with metric of 1 and the metric type is ignored.

Usage Guidelines

Use this command to redistribute the default route (0.0.0.0) into an OSPF routing domain.

If you redistribute routes in this way, the router automatically becomes an Autonomous System Boundary Router (ASBR). The router must have a default route configured before it can generate one, unless the **always** keyword is specified.

Use the **set** form of this command to enable generation of external default route into the OSPF routing domain.

Use the **delete** form of this command to disable generation of external default route into the OSPF routing domain or to restore default parameter values.

Use the **show** form of this command to display default route distribution configuration.

protocols ospf default-metric <metric>

Sets default metric to be applied to routes being redistributed into OSPF.

Syntax

set protocols ospf default-metric *metric*

delete protocols ospf default-metric

show protocols ospf default-metric

Command Mode

Configuration mode.

Configuration Statement

```
protocols {
   ospf {
      default-metric: 0-16777214
   }
}
```

Parameters

metric	Mandatory. The metric to be applied to routes from other protocols being redistributed into OSPF. The range is 0 to 16777214.

Default

None.

Usage Guidelines

Use this command to set the default metric to be applied to routes from other protocols being redistributed into OSPF.

Use the **set** form of this command to set the default OSPF metric.

Use the **delete** form of this command to restore the default value for default metric.

Use the **show** form of this command to display OSPF default metric configuration.

protocols ospf distance

Sets the OSPF administrative distance by route type.

Syntax

set protocols ospf distance {**global** *global* | **ospf** [**external** *external* | **inter-area** *inter* | **intra-area** *intra*]}

delete protocols ospf distance [**global** | **ospf** [**external** | **inter-area** | **intra-area**]]

show protocols ospf distance [**global** | **ospf** [**external** | **inter-area** | **intra-area**]]

Command Mode

Configuration mode.

Configuration Statement

```
protocols {
    ospf {
        distance {
            global: 1-255
            ospf {
                external: 1-255
                inter-area: 1-255
                intra-area: 1-255
            }
        }
    }
}
```

Parameters

global	Sets the administrative distance for all routes. The range is 1 to 255.
external	Sets the OSPF administrative distance for external routes (routes learned from another protocol by redistribution). The range is 1 to 255. The default is 110.
inter	Sets the OSPF administrative distance for inter-area routes (routes to another area). The range is 1 to 255. The default is 110.
intra	Sets the OSPF administrative distance for intra-area routes (routes within an area). The range is 1 to 255. The default is 110.

Default

The default administrative distance for OSPF routes is 110.

Usage Guidelines

Use this command to set the administrative distance for OSPF routes.

The administrative distance indicates the trustworthiness of a router or group of routers as a source of routing information. In general, the higher the value, the less trusted the entity. An administrative distance of 1 usually represents a directly connected network, and and an administrative distance of 255 the routing source is unreliable or unknown. The administrative distance conventionally applied to OSPF is 110.

Use the **set** form of this command to set the administrative distance.

Use the **delete** form of this command to restore the default value for administrative distance.

Use the **show** form of this command to display administrative distance configuration.

protocols ospf log-adjacency-changes

Enables or disables logging of changes in adjacency state of neighbors.

Syntax

set protocols ospf log-adjacency-changes [**detail**]

delete protocols ospf log-adjacency-changes

show protocols ospf log-adjacency-changes

Command Mode

Configuration mode.

Configuration Statement

```
protocols {
   ospf {
      log-adjacency-changes {
         detail
      }
   }
}
```

Parameters

detail	Optional. Logs all state changes, not just changes in adjacency state.

Default

Logging of adjacency changes is disabled. When used without the **detail** option, only adjacency state changes are logged.

Usage Guidelines

Use this command to enable logging of adjacency state changes.

Use the **set** form of this command to enable adjacency state change logging.

Use the **delete** form of this command to disable adjacency state change logging.

Use the **show** form of this command to display adjacency state change logging configuration.

protocols ospf max-metric router-lsa

Enables or disables an OSPF stub router to advertise a maximum metric value when the router is started up or reloaded.

Syntax

set protocols ospf max-metric router-lsa [**administrative** | **on-shutdown** *shutdown* | **on-startup** *startup*]

delete protocols ospf max-metric router-lsa [**administrative** | **on-shutdown** | **on-startup**]

show protocols ospf max-metric router-lsa [**on-shutdown** | **on-startup**]

Command Mode

Configuration mode.

Configuration Statement

```
protocols {
   ospf {
      max-metric {
         router-lsa {
            administrative
            on-shutdown: 5-86400
            on-startup: 5-86400
         }
      }
   }
}
```

Parameters

administrative	Optional. Advertise the maximum metric for an indefinite period.
on-shutdown *shutdown*	Advertise the maximum metric when the OSPF process is shut down. The *shutdown* argument specifies the interval, in seconds, after which advertisement of maximum metric should be stopped and the normal OSPF metric even if BGP convergence has not completed. The range is 5 to 86400. The default is 600.

on-startup *startup*	Advertise the maximum metric when the OSPF process is started up or reloaded. The *startup* argument specifies the interval, in seconds, after which advertisement of maximum metric should be stopped and the normal OSPF metric even if BGP convergence has not completed. The range is 5 to 86400. The default is 600.

Default

None.

Usage Guidelines

Use this command to set the Router-LSA advertising metric.

Using this command allows an OSPF router to advertise a maximum metric to other routers as described in RFC 3137. Advertising a maximum metric effectively makes the router the least-preferred router in the network for forwarding other traffic to another network. During the interval when the router is least-preferred, the BGP routing tables can converge and the router can be gracefully brought into service or taken out of service without interfering with traffic.

The period of maximum metric advertisement comes to an end if either the BGP tables complete convergence or the timers expire. At this point, the maximum advertised metric is replaced with the normal OSPF metric.

Use the the **set** form of this command to enable maximum metric advertising.

Use the **delete** form of this command to disable maximum metric advertising.

Use the **show** form of this command to display maximum metric advertising configuration.

protocols ospf mpls-te

Sets Multi-Protocol Label Switching (MPLS) Traffic Engineering (MPLS-TE) parameters.

Syntax

set protocols ospf mpls-te [**enable** | **router-address** *ipv4*]

delete protocols ospf mpls-te [**enable** | **router-address**]

show protocols ospf mpls-te [**router-address**]

Command Mode

Configuration mode.

Configuration Statement

```
protocols {
   ospf {
      mpls-te {
         enable
         router-address: ipv4
      }
   }
}
```

Parameters

enable	Optional. Enables MPLS-TE functionality.
ipv4	Optional. The stable IP address of the advertising router.

Default

None.

Usage Guidelines

Use this command to enable Multiprotocol Label Switching traffic engineering (MPLS-TE).

Use the **set** form of this command to enable MPLS-TE.

Use the **delete** form of this command to remove MPLS-TE configuration.

Use the **show** form of this command to display MPLS-TE configuration.

protocols ospf neighbor <ipv4>

Defines an OSPF neighbor.

Syntax

set protocols ospf neighbor *ipv4* [**poll-interval** *interval* | **priority** *priority*]

delete protocols ospf neighbor *ipv4* [**poll-interval** | **priority**]

show protocols ospf neighbor *ipv4* [**poll-interval** | **priority**]

Command Mode

Configuration mode.

Configuration Statement

```
protocols {
   ospf {
      neighbor ipv4 {
         poll-interval: 1-65535
         priority: 0-255
      }
   }
}
```

Parameters

ipv4	Mandatory. The IPv4 address of the OSPF neighbor.
interval	Optional. The interval, in seconds, at which this neighbor should be polled to determine whether it is still reachable. The range is 1 to 65535. The default is 120.
priority	Optional. The priority of this neighbor. The range is 0 to 255, where the lower the number, the higher the priority. The default is 1.

Default

None.

Usage Guidelines

Use this command to define an OSPF neighbor and set its characteristics.

Use the **set** form of this command to create an OSPF neighbor or modify its characteristics.

Use the **delete** form of this command to remove an OSPF neighbor or reset neighbor parameters to default values.

Use the **show** form of this command to display OSPF neighbor configuration.

protocols ospf parameters

Sets global OSPF parameters, such as router ID.

Syntax

set protocols ospf parameters [**abr-type** *type* | **opaque-lsa** | **rfc1583-compatibility** | **router-id** *ipv4*]

delete protocols ospf parameters [**abr-type** | **opaque-lsa** | **rfc1583-compatibility** | **router-id**]

show protocols ospf parameters

Command Mode

Configuration mode.

Configuration Statement

```
protocols {
   ospf {
      parameters {
         abr-type: [cisco|ibm|shortcut|standard]
         opaque-lsa
         rfc1583-compatibility
         router-id: ipv4
      }
   }
}
```

Parameters

type	Optional. Supported only for Area Border Routers (ABRs). Set the OSPF ABR type. Supported values are as follows: **cisco**: Designates the router as a Cisco ABR **ibm**: Designates the router as an IBM ABR **shortcut**: Designates the router as an ABR supporting shortcut mode as described in **draft-ietf-ospf-shortcut-abr-02.txt**. **standard**: Designates the router as a standard ABR The default is **standard**.
opaque-lsa	Optional. Enables support for opaque link-state advertisement as described in RFC 2370.

rfc1583-compatibility	Optional. Enables compliance with RFC 1583 for handling AS external routes.
ipv4	Optional. Sets an explicit router ID, overriding the router ID calculated by the OSPF process. The format is an IPv4 address.

Default

By default, support for opaque LSAs is disabled. By default, RFC 1583 support is disabled.

If no router ID is explicitly configured, the OSPF process calculates an ID for the router using the following algorithm:

1. Use the IP address of the loopback interface.
2. Use the highest IP address of the address on router interfaces.
3. If no interfaces are defined, use 0.0.0.0.

Usage Guidelines

Use this command to set OSPF-specific parameters.

NOTE *Modifying the router ID causes the router to restart.*

Use the **set** form of this command to specify parameter values.

Use the **delete** form of this command to restore defaults for global OSPF parameters.

Use the **show** form of this command to display global OSPF parameter configuration.

protocols ospf passive-interface <ethx>

Suppress routing updates on an interface.

Syntax

set protocols ospf passive-interface *ethx*

delete protocols ospf passive-interface *ethx*

show protocols ospf passive-interface

Command Mode

Configuration mode.

Configuration Statement

```
protocols {
   ospf {
      passive-interface eth0..eth23 {}
   }
}
```

Parameters

eth0..eth23	Mandatory. Multi-node. The Ethernet interface for which routing updates are to be suppressed. You can suppress routing updates on multiple interfaces by creating multiple passive-interface configuration nodes.

Default

Routing updates are not suppressed.

Usage Guidelines

Use this command to specify suppression for OSPF routing updates on an interface.

Use the **set** form of this command to suppress routing updates for an interface.

Use the **delete** form of this command to remove routing update suppression.

Use the **show** form of this command to display a routing update suppression configuration.

protocols ospf redistribute bgp

Sets the parameters for redistribution of BGP routes into OSPF.

Syntax

set protocols ospf redistribute bgp [**metric** *metric* | **route-map** *map-name*]

delete protocols ospf redistribute bgp [**metric** | **route-map**]

show protocols ospf redistribute bgp [**metric** | **route-map**]

Command Mode

Configuration mode.

Configuration Statement

```
protocols {
   ospf {
      redistribute {
         bgp {
            metric: 1-16
            route-map: text
         }
      }
   }
}
```

Parameters

metric *metric*	Optional. Applies the specified metric to BGP routes being redistributed into OSPF. The range is 1 to 16. The default is 1.
route-map *map-name*	Optional. Redistributes routes satisfying the specified route map.

Default

BGP routes being redistributed into OSPF are assigned a routing metric of 1. By default, no route map is applied to redistributed BGP routes.

Usage Guidelines

Use this command to define the routing cost (metric) for BGP routes being redistributed into OSPF.

Use the **set** form of this command to set BGP route redistribution parameters.

Use the **delete** form of this command to remove BGP route redistribution parameters.

Use the **show** form of this command to display BGP route redistribution configuration.

protocols ospf redistribute connected

Sets the parameters for redistribution of connected routes into OSPF.

Syntax

set protocols ospf redistribute connected [**metric** *metric* | **route-map** *map-name*]

delete protocols ospf redistribute connected [**metric** | **route-map**]

show protocols ospf redistribute connected [**metric** | **route-map**]

Command Mode

Configuration mode.

Configuration Statement

```
protocols {
   ospf {
      redistribute {
         connected {
            metric: 1-16
            route-map: text
         }
      }
   }
}
```

Parameters

metric *metric*	Optional. Applies the specified metric to connected routes being redistributed into OSPF. The range is 1 to 16. The default is 1.
route-map *map-name*	Optional. Redistributes routes satisfying the specified route map.

Default

Connected routes being redistributed into OSPF are assigned a routing metric of 1. By default, no route map is applied to redistributed connected routes.

Usage Guidelines

Use this command to specify the routing cost (metric) for directly connected routes being redistributed into OSPF.

Use the **set** form of this command to set the routing metric for redistributed connected routes.

Use the **delete** form of this command to remove connected route redistribution parameters.

Use the **show** form of this command to display connected route redistribution configuration.

protocols ospf redistribute kernel

Sets the parameters for redistribution of kernel routes into OSPF.

Syntax

set protocols ospf redistribute kernel [**metric** *metric* | **route-map** *map-name*]

delete protocols ospf redistribute kernel [**metric** | **route-map**]

show protocols ospf redistribute kernel [**metric** | **route-map**]

Command Mode

Configuration mode.

Configuration Statement

```
protocols {
   ospf {
      redistribute {
         kernel {
            metric: 1-16
            route-map: text
         }
      }
   }
}
```

Parameters

metric *metric*	Optional. Applies the specified metric to kernel routes being redistributed into OSPF. The range is 1 to 16. The default is 1.
route-map *map-name*	Optional. Redistributes routes satisfying the specified route map.

Default

Kernel routes being redistributed into OSPF are assigned a routing metric of 1. By default, no route map is applied to redistributed kernel routes.

Usage Guidelines

Use this command to specify the routing cost (metric) for kernel routes being redistributed into OSPF.

Use the **set** form of this command to set the routing metric for redistributed kernel routes.

Use the **delete** form of this command to remove kernel route redistribution parameters.

Use the **show** form of this command to display kernel route redistribution configuration.

protocols ospf redistribute rip

Sets the parameters for redistribution of RIP routes into OSPF.

Syntax

set protocols ospf redistribute rip [**metric** *metric* | **route-map** *map-name*]

delete protocols ospf redistribute rip [**metric** | **route-map**]

show protocols ospf redistribute rip [**metric** | **route-map**]

Command Mode

Configuration mode.

Configuration Statement

```
protocols {
   ospf {
      redistribute {
         rip {
            metric: 1-16
            route-map: text
         }
      }
   }
}
```

Parameters

metric *metric*	Optional. Applies the specified metric to RIP routes being redistributed into OSPF. The range is 1 to 16. The default is 1.
route-map *map-name*	Optional. Redistributes routes satisfying the specified route map.

Default

RIP routes being redistributed into OSPF are assigned a routing metric of 1. By default, no route map is applied to redistributed RIP routes.

Usage Guidelines

Use this command to specify the routing cost (metric) for RIP routes being redistributed into OSPF.

Use the **set** form of this command to set the routing metric for redistributed RIP routes.

Use the **delete** form of this command to remove RIP route redistribution parameters.

Use the **show** form of this command to display RIP route redistribution configuration.

protocols ospf redistribute static

Sets the parameters for redistribution of static routes into OSPF.

Syntax

set protocols ospf redistribute static [**metric** *metric* | **route-map** *map-name*]

delete protocols ospf redistribute static [**metric** | **route-map**]

show protocols ospf redistribute static [**metric** | **route-map**]

Command Mode

Configuration mode.

Configuration Statement

```
protocols {
   ospf {
      redistribute {
         static {
            metric: 1-16
            route-map: text
         }
      }
   }
}
```

Parameters

metric *metric*	Optional. Applies the specified metric to static routes being redistributed into OSPF. The range is 1 to 16. The default is 1.
route-map *map-name*	Optional. Redistributes routes satisfying the specified route map.

Default

Static routes being redistributed into OSPF are assigned a routing metric of 1. By default, no route map is applied to redistributed static routes.

Usage Guidelines

Use this command to specify the routing cost (metric) for static routes being redistributed into OSPF.

Use the **set** form of this command to set the routing metric for redistributed static routes.

Use the **delete** form of this command to remove static route redistribution parameters.

Use the **show** form of this command to display static route redistribution configuration.

protocols ospf refresh timers <value>

Sets values for OSPF refresh timers.

Syntax

set protocols ospf refresh timers *value*

delete protocols ospf refresh timers

show protocols ospf refresh timers

Command Mode

Configuration mode.

Configuration Statement

```
protocols {
    ospf {
        refresh {
            timers: 10-1800
        }
    }
}
```

Parameters

value	Mandatory. The timer value, in seconds. The range is 10 to 1800. The default is 1800 (30 minutes).

Default

By default, the refresh timer expires every 30 minutes (1800 seconds).

Usage Guidelines

Use this command to specify the values for the OSPF link-state refresh timer.

A link-state refresh is a mechanism for validating a link-state advertisement (LSA) and resetting its age before it reaches the maximum age. When the link-state refresh timer expires, the router floods a new link-state update to all its neighbors who reset the age of the LSA.

Use the **set** form of this command to set the refresh timer value.

Use the **delete** form of this command to restore the default refresh timer value.

Use the **show** form of this command to display refresh timer configuration.

protocols ospf timers throttle spf

Enables or disables OSPF SPF throttling.

Syntax

set protocols ospf timers throttle spf [**delay** *delay* | **initial-holdtime** *initial* | **max-holdtime** *max*]

delete protocols ospf timers throttle spf [**delay** | **initial-holdtime** | **max-holdtime**]

show protocols ospf timers throttle spf [**delay** | **initial-holdtime** | **max-holdtime**]

Command Mode

Configuration mode.

Configuration Statement

```
protocols {
    ospf {
        timers {
            throttle {
                spf {
                    delay: 0-600000
                    initial-holdtime: 0-600000
                    max-holdtime: 0-600000
                }
            }
        }
    }
}
```

Parameters

delay	Optional. The delay, in milliseconds, from the first network topology change received until SPF calculation. The range is 0 to 600000.
initial	Optional. The initial interval, in milliseconds, between consecutive SPF calculations. The range is 0 to 600000.
max	Optional. The maximum interval, in milliseconds, between consecutive SPF calculations. The range is 0 to 600000.

Default

SPF throttling is disabled.

Usage Guidelines

Use this command to set the timer characteristics of SPF throttling.

Shortest Path First (SPF) calculations, which calculate the Shortest Path Tree (SPT), are generally performed whenever there is a change of network topology. In an unstable network this can cause excessive path calculation. SPF throttling allows you delay SPF calculation. You can delay the first calculation and set a minimum and maximum interval between calculations.

Use the **set** form of this command to enable SPF throttling and set its characteristics.

Use the **delete** form of this command to disable SPF throttling.

Use the **show** form of this command to display SPF throttling configuration.

show debugging ospf

Displays OSPF protocol debugging flags.

Syntax

show debugging ospf

Command Mode

Operational mode.

Parameters

None

Default

None.

Usage Guidelines

Use this command to see how debugging is set for OSPF.

show ip ospf

Displays high-level OSPF configuration information.

Syntax

show ip ospf

Command Mode

Operational mode.

Parameters

None.

Default

None.

Usage Guidelines

Use this command to display high-level OSPF information.

Examples

Example 1-7 shows OSPF information.

Example 1-1 “show ip ospf”: Displaying OSPF configuration information

```
vyatta@vyatta:~$  show ip ospf
OSPF Routing Process, Router ID: 10.100.10.1
 Supports only single TOS (TOS0) routes
 This implementation conforms to RFC2328
 RFC1583Compatibility flag is disabled
 OpaqueCapability flag is disabled
 Initial SPF scheduling delay 200 millisec(s)
 Minimum hold time between consecutive SPFs 1000 millisec(s)
 Maximum hold time between consecutive SPFs 10000 millisec(s)
 Hold time multiplier is currently 1
 SPF algorithm last executed 1w2d01h ago
 SPF timer is inactive
 Refresh timer 10 secs
 Number of external LSA 1. Checksum Sum 0x000083e4
```

```
 Number of opaque AS LSA 0. Checksum Sum 0x00000000
 Number of areas attached to this router: 1

 Area ID: 10.1.0.0
   Shortcutting mode: Default, S-bit consensus: no
   Number of interfaces in this area: Total: 1, Active: 1
   Number of fully adjacent neighbors in this area: 2
   Area has no authentication
   Number of full virtual adjacencies going through this area: 0
   SPF algorithm executed 3 times
   Number of LSA 4
   Number of router LSA 3. Checksum Sum 0x0000ccad
   Number of network LSA 1. Checksum Sum 0x00000df2
   Number of summary LSA 0. Checksum Sum 0x00000000
   Number of ASBR summary LSA 0. Checksum Sum 0x00000000
   Number of NSSA LSA 0. Checksum Sum 0x00000000
   Number of opaque link LSA 0. Checksum Sum 0x00000000
   Number of opaque area LSA 0. Checksum Sum 0x00000000

vyatta@vyatta:~$
```

show ip ospf border-routers

Displays OSPF border router information.

Syntax

show ip ospf border-routers

Command Mode

Operational mode.

Parameters

None.

Default

None.

Usage Guidelines

Use this command to display OSPF border router information.

Examples

Example 1-2 shows OSPF border router information.

Example 1-2 "show ip ospf border-router": Displaying OSPF border router information

```
vyatta@vyatta:~$  show ip ospf border-routers
============ OSPF router routing table =============
R    10.1.0.58             [10] area: 10.1.0.0, ASBR
                           via 10.1.0.58, eth2

vyatta@vyatta:~$
```

show ip ospf database

Displays OSPF database information.

Syntax

show ip ospf database [**max-age** | **self-originate** | {**asbr-summary** | **external** | **network** | **nssa-external** | **opaque-area** | **opaque-as** | **opaque-link** | **router** | **summary**} [**adv-router** <*ipv4*> |<*ipv4*> [**adv-router** <*ipv4*> | **self-originate**]]]

Command Mode

Operational mode.

Parameters

max-age	Display OSPF max-age database.
self-originate	Display OSPF self-originate database.
asbr-summary	Display OSPF ASBR (Autonomous System Border Router) summary database.
external	Display OSPF external database.
network	Display OSPF network database.
nssa-external	Display OSPF NSSA external database.
opaque-area	Display OSPF opaque-area database.
opaque-as	Display OSPF opaque-as database.
opaque-link	Display OSPF opaque-link database.
router	Display OSPF router database.
summary	Display summary of OSPF database.
adv-router *ipv4*	Optional. Display the OSPF database for a given address of the advertised router specified.
ipv4	Optional. Display the OSPF database for a given address.
self-originate	Optional. Display the self-originate OSPF database for a given address.

Default

None.

Usage Guidelines

Use this command to display OSPF database information.

Examples

Example 1-3 shows general OSPF database information.

Example 1-3 “show ip ospf database”: Displaying general OSPF database information

```
vyatta@vyatta:~$  show ip ospf database

       OSPF Router with ID (10.100.10.1)

                Router Link States (Area 10.1.0.0)

Link ID         ADV Router      Age  Seq#       CkSum  Link count
10.1.0.33       10.1.0.33        123 0x800003e5 0x791f 1
10.1.0.58       10.1.0.58        123 0x80000562 0x4e7e 1
10.100.10.1     10.100.10.1      117 0x800001b6 0xfe13 1

                Net Link States (Area 10.1.0.0)

Link ID         ADV Router      Age  Seq#       CkSum
10.1.0.58       10.1.0.58        123 0x800003df 0x0bf3

                AS External Link States

Link ID         ADV Router      Age  Seq#       CkSum  Route
76.0.0.0        10.1.0.58       1850 0x800000b3 0x83e4 E2
76.0.0.0/8 [0x0]

vyatta@vyatta:~$
```

show ip ospf interface

Displays OSPF configuration and status information for a specified interface.

Syntax

show ip ospf interface [*interface*]

Command Mode

Operational mode.

Parameters

interface	Optional. Interface to view OSPF configuration and status on.

Default

If no interfaces are specified then information on all interfaces will be displayed.

Usage Guidelines

Use this command to display OSPF configuration information for an interface.

Examples

Example 1-4 shows OSPF information on all interfaces.

Example 1-4 "show ip ospf interface": Displaying OSPF configuration and status information

```
vyatta@vyatta:~$  show ip ospf interface
eth0 is down
  ifindex 3, MTU 1500 bytes, BW 0 Kbit <UP,BROADCAST,MULTICAST>
  OSPF not enabled on this interface
eth1 is down
  ifindex 4, MTU 1500 bytes, BW 0 Kbit <UP,BROADCAST,MULTICAST>
  OSPF not enabled on this interface
eth1_rename is down
  ifindex 0, MTU 1500 bytes, BW 0 Kbit <BROADCAST,MULTICAST>
  OSPF not enabled on this interface
eth2 is up
```

```
  ifindex 5, MTU 1500 bytes, BW 0 Kbit
<UP,BROADCAST,RUNNING,MULTICAST>
  Internet Address 10.1.0.62/24, Broadcast 10.1.0.255, Area
10.1.0.0
  MTU mismatch detection:enabled
  Router ID 10.100.10.1, Network Type BROADCAST, Cost: 10
  Transmit Delay is 1 sec, State DROther, Priority 1
  Designated Router (ID) 10.1.0.58, Interface Address 10.1.0.58
  Backup Designated Router (ID) 10.1.0.33, Interface Address
10.1.0.33
  Multicast group memberships: OSPFAllRouters
  Timer intervals configured, Hello 10s, Dead 40s, Wait 40s,
Retransmit 5
    Hello due in 0.721s
  Neighbor Count is 2, Adjacent neighbor count is 2
eth2_rename is down
  ifindex 0, MTU 1500 bytes, BW 0 Kbit <BROADCAST,MULTICAST>
  OSPF not enabled on this interface
eth3 is down
  ifindex 2, MTU 1500 bytes, BW 0 Kbit <BROADCAST,MULTICAST>
  OSPF not enabled on this interface
lo is up
  ifindex 1, MTU 16436 bytes, BW 0 Kbit <UP,LOOPBACK,RUNNING>
  OSPF not enabled on this interface
vyatta@vyatta:~$
```

show ip ospf neighbor

Displays OSPF neighbor information for a specified address or interface.

Syntax

show ip ospf neighbor [*interface* | *ipv4* | **detail** | **address** *ipv4*]

Command Mode

Operational mode.

Parameters

interface	Optional. Display neighbor information for the specified interface.
ipv4	Optional. Display neighbor information for the specified address.
detail	Optional. Display detailed neighbor information for all neighbors.
address *ipv4*	Optional. Display neighbor information for the specified address.

Default

If no interfaces are specified then information on all neighbors will be displayed.

Usage Guidelines

Use this command to display OSPF neighbor information for a specified address or interface.

Examples

Example 1-5 shows OSPF neighbor information for all neighbors.

Example 1-5 “show ip ospf neighbor”: Displaying OSPF neighbor information

```
vyatta@vyatta:~$  show ip ospf neighbor

    Neighbor ID Pri State           Dead Time Address
Interface             RXmtL RqstL DBsmL
10.1.0.33         1 Full/Backup       33.842s 10.1.0.33
eth2:10.1.0.62          0     0     0
```

```
10.1.0.58         1 Full/DR           38.581s 10.1.0.58
eth2:10.1.0.62           0     0     0
vyatta@vyatta:~$
```

show ip ospf route

Displays OSPF route information.

Syntax

show ip ospf route

Command Mode

Operational mode.

Parameters

None.

Default

None.

Usage Guidelines

Use this command to display OSPF route information.

Examples

Example 1-6 shows OSPF route information.

Example 1-6 “show ip ospf route”: Displaying OSPF route information

```
vyatta@vyatta:~$  show ip ospf route
============ OSPF network routing table ============
N    10.1.0.0/24           [10] area: 10.1.0.0
                           directly attached to eth2

============ OSPF router routing table =============
R    10.1.0.58             [10] area: 10.1.0.0, ASBR
                           via 10.1.0.58, eth2

============ OSPF external routing table ===========
N E2 76.0.0.0/8            [10/20] tag: 0
                           via 10.1.0.7, eth2

vyatta@vyatta:~$
```

show ip route ospf

Displays all IP OSPF routes.

Syntax

show ip route ospf

Command Mode

Operational mode.

Parameters

None.

Default

None.

Usage Guidelines

Use this command to display all the IP OSPF routes.

Examples

Example 1-7 shows all IP OSPF routes.

Example 1-7 “show ip route ospf”: Displaying routes

```
vyatta@vyatta:~$  show ip route ospf
Codes: K - kernel route, C - connected, S - static, R - RIP, O -
OSPF,
       I - ISIS, B - BGP, > - selected route, * - FIB route

O   10.1.0.0/24 [110/10] is directly connected, eth2, 01w2d21h
O>* 76.0.0.0/8 [110/20] via 10.1.0.7, eth2, 4d12h48m
vyatta@vyatta:~$
```

Chapter 2: OSPF Areas

This chapter describes commands for configuring OSPF areas.

This chapter presents the following topics:

- OSPF Area Commands

OSPF Area Commands

This chapter contains the following commands.

Configuration Commands	
protocols ospf area <area-id>	Defines an OSPF area.
protocols ospf area <area-id> area-type normal	Designates an OSPF area as a normal area.
protocols ospf area <area-id> area-type nssa	Designates an OSPF area as a not-so-stubby area (NSSA).
protocols ospf area <area-id> area-type stub	Designates an OSPF area as a stub area.
protocols ospf area <area-id> authentication	Specifies the authentication type for an OSPF area.
protocols ospf area <area-id> network <ipv4net>	Specifies a network address for an OSPF area.
protocols ospf area <area-id> range <ip4net>	Allows an ABR to summarize routes matching a prefix range.
protocols ospf area <area-id> shortcut <mode>	Sets the OSPF shortcut mode for an Area Border Router (ABR).
protocols ospf area <area-id> virtual-link <ipv4> authentication	Specifies the authentication characteristics for a virtual link.
protocols ospf area <area-id> virtual-link <ipv4> dead-interval <interval>	Specifies the dead interval for a virtual link.
protocols ospf area <area-id> virtual-link <ipv4> hello-interval <interval>	Sets the interval between OSPF hello packets on a virtual link.
protocols ospf area <area-id> virtual-link <ipv4> retransmit-interval <interval>	Specifies the retransmit interval for a virtual link.
protocols ospf area <area-id> virtual-link <ipv4> transmit-delay <delay>	Specifies the transmit delay for a virtual link.
Operational Commands	
None.	

protocols ospf area <area-id>

Defines an OSPF area.

Syntax

set protocols ospf area *area-id*

delete protocols ospf area *area-id*

show protocols ospf area *area-id*

Command Mode

Configuration mode.

Configuration Statement

```
protocols {
    ospf {
        area text
    }
}
```

Parameters

area-id	Mandatory. The ID of the OSPF area, expressed either as an IP address or as a decimal value.

Default

None.

Usage Guidelines

Use this command to define an area within an OSPF Autonomous System (AS)

Use the **set** form of this command to create an OSPF area or define its characteristics.

Use the **delete** form of this command to remove an OSPF area.

Use the **show** form of this command to display OSPF area configuration.

protocols ospf area <area-id> area-type normal

Designates an OSPF area as a normal area.

Syntax

set protocols ospf area *area-id* **area-type normal**

delete protocols ospf area *area-id* **area-type**

show protocols ospf area *area-id* **area-type**

Command Mode

Configuration mode.

Configuration Statement

```
protocols {
    ospf {
        area text {
            area-type {
                normal
        }
    }
}
```

Parameters

area-id	Mandatory. The ID of the OSPF area being configured, expressed as an IP address or a decimal value.

Default

None.

Usage Guidelines

Use this command to designate an OSPF area as a normal area.

A normal area is an area that is neither a stub area nor a not-so-stubby area. All external routes are advertised into normal areas.

Use the **set** form of this command to set the OSPF area type as normal.

Use the **delete** form of this command to remove area type configuration.

Use the **show** form of this command to display an area type configuration.

protocols ospf area <area-id> area-type nssa

Designates an OSPF area as a not-so-stubby area (NSSA).

Syntax

set protocols ospf area *area-id* **area-type nssa** [**default-cost** *cost* | **no-summary** | **translate** {**always** | **candidate** | **never**}]

delete protocols ospf area *area-id* **area-type nssa** [**default-cost** | **no-summary** | **translate**]

show protocols ospf area *area-id* **area-type nssa** [**default-cost** | **translate**]

Command Mode

Configuration mode.

Configuration Statement

```
protocols {
    ospf {
        area text {
            area-type {
                nssa {
                    default-cost: 0-16777215
                    no-summary
                    translate {
                        always
                        candidate
                        never
                    }
                }
            }
        }
    }
}
```

Parameters

area-id	Mandatory. The ID of the OSPF area being configured, expressed as an IP address or a decimal value.
cost	Optional. The administrative cost, or metric, that will be applied to the default route in this area. The range is 0 to 6777215.

no-summary	Optional. Prevents route summaries from being generated into the area.
translate	Optional. Directs the NSSA ABR when to translate Type 7 LSAs into Type 5 AS-external LSAs.
always	Always translates Type 7 LSAs into Type 5 AS-external LSAs.
candidate	Translates only Type 7 LSAs from the candidate NSSA border router.
never	Never translates Type 7 LSAs into Type 5 AS-external LSAs.

Default

By default, summary routes are generated into the area, and only Type 7 LSAs from the candidate NSSA Border router are translated.

Usage Guidelines

Use this command to designate this OSPF area as a not-so-stubby area.

Type 5 AS-external LSAs are not allowed in stubby areas, but Type 7 LSAs may be translated into Type 5 LSAs by the NSSA Area Border Router (ABR) and may traverse the NSSA in this manner. Inter-area routes are not allowed.

Use the **set** form of this command to set the OSPF area type to not-so-stubby.

Use the **delete** form of this command to remove area type configuration.

Use the **show** form of this command to display an area type configuration.

protocols ospf area <area-id> area-type stub

Designates an OSPF area as a stub area.

Syntax

set protocols ospf area *area-id* **area-type stub** [**default-cost** *cost* | **no-summary**]

delete protocols ospf area *area-id* **area-type stub** [**default-cost** | **no-summary**]

show protocols ospf area *area-id* **area-type stub** [**default-cost**]

Command Mode

Configuration mode.

Configuration Statement

```
protocols {
   ospf {
      area text {
         area-type {
            stub {
               default-cost: 0-16777215
               no-summary
            }
         }
      }
   }
}
```

Parameters

area-id	Mandatory. The ID of the OSPF area being configured, expressed as an IP address or a decimal value.
cost	Optional. The administrative cost, or metric, that will be applied to the default route in this area. The range is 0 to 6777215.
no-summary	Optional. Prevents route summaries from being generated into the area.

Default

By default, summary routes are generated into the area.

Usage Guidelines

Use this command to designate this OSPF area as a stub area. No Type 5 AS-external LSAs are allowed into a stub area.

Use the **set** form of this command to set the OSPF area type to stub.

Use the **delete** form of this command to remove area type configuration.

Use the **show** form of this command to display an area type configuration.

protocols ospf area <area-id> authentication

Specifies the authentication type for an OSPF area.

Syntax

set protocols ospf area *area-id* **authentication** *type*

delete protocols ospf area *area-id* **authentication**

show protocols ospf area *area-id* **authentication**

Command Mode

Configuration mode.

Configuration Statement

```
protocols {
   ospf {
      area text {
         authentication txt
      }
   }
}
```

Parameters

area-id	Mandatory. The ID of the OSPF area being configured, expressed as an IP address or a decimal value.
type	The type of authentication to be used. Supported values are as follows: **md5**: A hash value is sent through the network, computed from the password in the OSPF packet and the password, using the Message Digest algorithm. **plaintext-password**: Passwords are sent through the network in plain text.

Default

The default is plain-text authentication.

Usage Guidelines

Use this command to set the authentication type for an OSPF area.

In plain text authentication, passwords are sent through the network in plain text. In MD5 authentication, the system uses the Message Digest 5 (MD5) algorithm to compute a hash value from the contents of the OSPF packet and the password. The hash value and the MD5 key are included in the transmitted packet, and the receiving system (configured with the same password) calculates its own hash function, which must match.

Use the **set** form of this command to set the the authentication type.

Use the **delete** form of this command to remove the authentication type.

Use the **show** form of this command to display the authentication type.

protocols ospf area <area-id> network <ipv4net>

Specifies a network address for an OSPF area.

Syntax

set protocols ospf area *area-id* **network** *ipv4net*

delete protocols ospf area *area-id* **network** *ipv4net*

show protocols ospf area *area-id* **network**

Command Mode

Configuration mode.

Configuration Statement

```
protocols {
    ospf {
        area text {
            network: ipv4net
        }
    }
}
```

Parameters

area-id	Mandatory. The ID of the OSPF area being configured, expressed as an IP address or a decimal value.
ipv4net	Mandatory. Multi-node. Specify the network to be used for the OSPF area. The format is *ip-address/prefix*.

Default

None.

Usage Guidelines

Use this command to specify the network to be used for an OSPF area.

Use the **set** form of this command to specify the area network.

Use the **delete** form of this command to remove OSPF area network configuration.

Use the **show** form of this command to display OSPF area network configuration.

protocols ospf area <area-id> range <ip4net>

Allows an ABR to summarize routes matching a prefix range.

Syntax

set protocols ospf area *area-id* **range** *ipv4net* [**cost** *cost* | **not-advertise** | **substitute** *ipv4net*]

delete protocols ospf area *area-id* **range** [*ipv4net* [**cost** | **not-advertise** | **substitute**]]

show protocols ospf area *area-id* **range** [*ipv4net* [**cost** | **substitute**]]

Command Mode

Configuration mode.

Configuration Statement

```
protocols {
    ospf {
        area text {
            area-type {
                range {
                    cost: 0-16777215
                    not-advertise
                    substitute: ipv4net
                }
            }
        }
    }
}
```

Parameters

area-id	Mandatory. The ID of the OSPF area being configured, expressed as an IP address or a decimal value.
ipv4net	Mandatory. The range to be summarized, expressed as an IPv4 network in the format *ip-address/prefix*.
cost	Optional. The administrative cost, or metric, to be applied to routes in this range. The range is 0 to 16777215.
not-advertise	Optional. Directs the router not to advertise routes in this range.

substitute *ipv4net*	Optional. Directs the router to announce routes in this range as being in the specified prefix instead. The format is *ip-address/prefix*.

Default

By default, routes are advertised and routes are not substituted.

Usage Guidelines

Use this command to direct the router to summarize routes matching a prefix range. This command may only be used with an Area Border Router (ABR).

Use the **set** form of this command to set the area range.

Use the **delete** form of this command to remove area range configuration.

Use the **show** form of this command to display area range configuration.

protocols ospf area <area-id> shortcut <mode>

Sets the OSPF shortcut mode for an Area Border Router (ABR).

Syntax

set protocols ospf area *area-id* **shortcut** [**default** | **disable** | **enable**]

delete protocols ospf area *area-id* **shortcut**

show protocols ospf area *area-id* **shortcut**

Command Mode

Configuration mode.

Configuration Statement

```
protocols {
    ospf {
        area text {
            shortcut text
        }
    }
}
```

Parameters

area-id	Mandatory. The ID of the OSPF area being configured, expressed as an IP address or a decimal value.

mode	Mandatory. The shortcut mode. Supported values are as follows: **default**: If the ABR has an active backbone connection, the area is not used for shortcutting and the ABR does not set the shortcut bit (S-bit) in the router-LSA originated for the area. If the ABR does not have a backbone connection, the area is always used for shortcutting and the ABR sets the S-bit in the router-LSA for that area. **disable**: The ABR does not use this area for shortcutting and does not set the S-bit in the router-LSA originated for the area. **enable**: If the ABR has an active backbone connection, the ABR sets the S-bit in the router-LSA and the area is used for shortcutting provided that all other ABRs seen through this area also report the S-bit. If the ABR has does not have a backbone connection, the ABR unconditionally uses the area for shortcutting and sets the S-bit in the router-LSA originated for the area.

Default

The shortcut mode is **default**.

Usage Guidelines

Use this command to set the shortcut mode for an OSPF Area Border Router, (ABR) according to the standard described in **draft-ietf-ospf-shortcut-abr-02.txt**. This command may only be used with an ABR.

Use the **set** form of this command to set the ABR shortcut mode.

Use the **delete** form of this command to remove ABR shortcut configuration.

Use the **show** form of this command to display ABR shortcut configuration.

protocols ospf area <area-id> virtual-link <ipv4> authentication

Specifies the authentication characteristics for a virtual link.

Syntax

set protocols ospf area *area-id* **virtual-link** *ipv4* **authentication** [**md5 key-id** *key-id* **md5-key** *md5-key* | **plaintext-password** *password*]

delete protocols ospf area *area-id* **virtual-link** *ipv4* **authentication** [**md5 key-id** *key-id* **md5-key** | **plaintext-password**]

show protocols ospf area *area-id* **virtual-link** *ipv4* **authentication** [**md5 key-id** *key-id* **md5-key** | **plaintext-password**]

Command Mode

Configuration mode.

Configuration Statement

```
protocols {
    ospf {
        area text {
            virtual-link ipv4 {
                authentication {
                    md5 {
                        key-id 1-255 {
                            md5-key: text
                        }
                    }
                    plaintext-password: text
                }
            }
        }
    }
}
```

Parameters

area-id	Mandatory. The ID of the OSPF area being configured, expressed as an IP address or a decimal value.

ipv4	Mandatory. The area ID of the virtual link, expressed as an IPv4 address.
key-id	Optional. The authentication key id. This must be the same on both the sending and receiving systems. The range is 1 to 255.
md5-key	Optional. The MD5 key to be used as input to the MD5 hashing algorithm. This must be the same on both the sending and receiving systems.
password	Optional. The password to use in plain-text authentication. This must be eight characters or less and the same on both the sending and receiving systems.

Default

None.

Usage Guidelines

Use this command to set the authentication for a virtual link.

In plain text authentication, passwords are sent through the network in plain text. In MD5 authentication, the system uses the Message Digest 5 (MD5) algorithm to compute a hash value from the contents of the OSPF packet and the password. The hash value and the MD5 key are included in the transmitted packet, and the receiving system (configured with the same password) calculates its own hash function, which must match.

Use the **set** form of this command to specify the authentication.

Use the **delete** form of this command to remove virtual link authentication configuration information.

Use the **show** form of this command to display virtual link authentication configuration information.

protocols ospf area <area-id> virtual-link <ipv4> dead-interval <interval>

Specifies the dead interval for a virtual link.

Syntax

set protocols ospf area *area-id* **virtual-link** *ipv4* **dead-interval** *interval*

delete protocols ospf area *area-id* **virtual-link** *ipv4* **dead-interval**

show protocols ospf area *area-id* **virtual-link** *ipv4* **dead-interval**

Command Mode

Configuration mode.

Configuration Statement

```
protocols {
   ospf {
      area text {
         virtual-link ipv4 {
            dead-interval: 1-65535
         }
      }
   }
}
```

Parameters

area-id	Mandatory. The ID of the OSPF area being configured, expressed as an IP address or a decimal value.
ipv4	Mandatory. The area ID of the virtual link, expressed as an IPv4 address.
interval	Specifies the time, in seconds, that the virtual link should wait to detect hello packets from neighboring routers before declaring the neighbor down. The range is 1 to 65535. The default is 4 times the hello interval.

Default

The dead interval is 4 times the hello interval.

Usage Guidelines

Use this command to specify the interval during which a virtual link should expect a hello packet from its neighbor.

If the dead interval passes without the interface receiving a hello packet from the neighbor, the neighbor’s status is changed to out-of-service, and all associated state is cleared.

The dead interval must be the same for all routers that are to establish two-way communication within a network. If two routers do not agree on these parameters, they will not establish adjacencies and will disregard one another’s communications.

Use the **set** form of this command to specify the dead interval.

Use the **delete** form of this command to restore the default dead interval.

Use the **show** form of this command to display dead interval configuration.

protocols ospf area <area-id> virtual-link <ipv4> hello-interval <interval>

Sets the interval between OSPF hello packets on a virtual link.

Syntax

set protocols ospf area *area-id* **virtual-link** *ipv4* **hello-interval** *interval*

delete protocols ospf area *area-id* **virtual-link** *ipv4* **hello-interval**

show protocols ospf area *area-id* **virtual-link** *ipv4* **hello-interval**

Command Mode

Configuration mode.

Configuration Statement

```
protocols {
   ospf {
      area text {
         virtual-link ipv4 {
            hello-interval: 1-65535
         }
      }
   }
}
```

Parameters

area-id	Mandatory. The ID of the OSPF area being configured, expressed as an IP address or a decimal value.
ipv4	Mandatory. The area ID of the virtual link, expressed as an IPv4 address.
interval	Mandatory. The interval, in seconds, between hello packets. This value must be the same for all nodes on the network.The range is 1 to 65535. The default is 10.

Default

Hello packets are sent every 10 seconds.

Usage Guidelines

Use this command to set the interval at which OSPF hello packets are sent for a virtual link.

A hello packet is an OSPF packet used to detect and maintain relationships with neighbors on the same network (directly connected routers). The greater the interval between hello packets, the less router traffic occurs, but the longer it takes for topological changes to be detected.

The hello interval must be the same for all routers that are to establish two-way communication within a network. If two routers do not agree on these parameters, they will not establish adjacencies and will disregard one another's communications.

Use the **set** form of this command to set the hello interval.

Use the **delete** form of this command to restore the default hello interval.

Use the **show** form of this command to display hello interval configuration.

protocols ospf area <area-id> virtual-link <ipv4> retransmit-interval <interval>

Specifies the retransmit interval for a virtual link.

Syntax

set protocols ospf area *area-id* **virtual-link** *ipv4* **retransmit-interval** *interval*

delete protocols ospf area *area-id* **virtual-link** *ipv4* **retransmit-interval**

show protocols ospf area *area-id* **virtual-link** *ipv4* **retransmit-interval**

Command Mode

Configuration mode.

Configuration Statement

```
protocols {
    ospf {
        area text {
            virtual-link ipv4 {
                retransmit-interval: 1-65535
            }
        }
    }
}
```

Parameters

area-id	Mandatory. The ID of the OSPF area being configured, expressed as an IP address or a decimal value.
ipv4	Mandatory. The area ID of the virtual link, expressed as an IPv4 address.
interval	Mandatory. The interval, in seconds, between retransmitting unacknowledged link-state advertisements (LSAs). This value must be the same for all nodes on the network. The range is 1 to 65535. The default is 5.

Default

Unacknowledged LSAs are retransmitted at 5-second intervals.

Usage Guidelines

Use this command to set the retransmit interval for a virtual link. This is the number of seconds before retransmitting an unacknowledged link-state advertisement.

When an OSPF router sends a link-state advertisement (LSA) to a neighbor, the neighbor acknowledges receipt with a link-state acknowledgement (LS Ack) packet. If the local router fails to receive the expected LS Ack packet, it retransmits the LSA at the interval specified by this command. This value must be the same for all nodes on the network.

Use the **set** form of this command to set the default retransmit interval.

Use the **delete** form of this command to restore the default retransmit interval.

Use the **show** form of this command to display retransmit interval configuration.

protocols ospf area <area-id> virtual-link <ipv4> transmit-delay <delay>

Specifies the transmit delay for a virtual link.

Syntax

set protocols ospf area *area-id* **virtual-link** *ipv4* **transmit-delay** *delay*

delete protocols ospf area *area-id* **virtual-link** *ipv4* **transmit-delay**

show protocols ospf area *area-id* **virtual-link** *ipv4* **transmit-delay**

Command Mode

Configuration mode.

Configuration Statement

```
protocols {
   ospf {
      area text {
         virtual-link ipv4 {
            transmit-delay: 1-65535
         }
      }
   }
}
```

Parameters

area-id	Mandatory. The ID of the OSPF area being configured, expressed as an IP address or a decimal value.
ipv4	Mandatory. The area ID of the virtual link, expressed as an IPv4 address.
delay	Mandatory. The delay, in seconds, between link state transmits. This value must be the same for all nodes on the network. The range is 1 to 65535. The default is 1.

Default

Link-state transmits occur at 1-second intervals.

Usage Guidelines

Use this command to set the transmit delay for a virtual link in an area. This is the estimated time required to send a link-state update (LSU) packet.

This timer is used to accommodate transmission and propagation delays on the network, particularly on low-speed networks where delays may be significant. The router increments the age of link-state advertisements in LSU packets to account for these delays.

The value includes both the transmission time and the propagation delay across the network. The transmit delay is added to the age of the LSA packet before the LSA is transmitted The LSA age is used to help the network sequence LSAs, so that it can determine which of competing LSAs is the more recent and trustworthy.

LSAs are numbered in sequence, but the sequence numbers are finite, and so cannot be used as the sole determinant of the most recent LSA. Instead, OSPF also tracks the age of LSAs. Each time the LSA is forwarded to another router, its current age is incremented by the transmit delay. The packet's age, together with its sequence number, helps the receiving router to determine which version of a received LSA is more recent, and therefore to be used.

Use the **set** form of this command to set the transmit delay.

Use the **delete** form of this command to restore the default transmit delay.

Use the **show** form of this command to display transmit delay configuration.

show debugging ospf

Displays OSPF protocol debugging flags.

Syntax

show debugging ospf

Command Mode

Operational mode.

Parameters

None

Default

None.

Usage Guidelines

Use this command to see how debugging is set for OSPF.

show ip ospf

Displays high-level OSPF configuration information.

Syntax

show ip ospf

Command Mode

Operational mode.

Parameters

None.

Default

None.

Usage Guidelines

Use this command to display high-level OSPF information.

Examples

Example 2-7 shows OSPF information.

Example 2-1 “show ip ospf”: Displaying OSPF configuration information

```
vyatta@vyatta:~$  show ip ospf
OSPF Routing Process, Router ID: 10.100.10.1
 Supports only single TOS (TOS0) routes
 This implementation conforms to RFC2328
 RFC1583Compatibility flag is disabled
 OpaqueCapability flag is disabled
 Initial SPF scheduling delay 200 millisec(s)
 Minimum hold time between consecutive SPFs 1000 millisec(s)
 Maximum hold time between consecutive SPFs 10000 millisec(s)
 Hold time multiplier is currently 1
 SPF algorithm last executed 1w2d01h ago
 SPF timer is inactive
 Refresh timer 10 secs
 Number of external LSA 1. Checksum Sum 0x000083e4
```

```
 Number of opaque AS LSA 0. Checksum Sum 0x00000000
 Number of areas attached to this router: 1

 Area ID: 10.1.0.0
   Shortcutting mode: Default, S-bit consensus: no
   Number of interfaces in this area: Total: 1, Active: 1
   Number of fully adjacent neighbors in this area: 2
   Area has no authentication
   Number of full virtual adjacencies going through this area: 0
   SPF algorithm executed 3 times
   Number of LSA 4
   Number of router LSA 3. Checksum Sum 0x0000ccad
   Number of network LSA 1. Checksum Sum 0x00000df2
   Number of summary LSA 0. Checksum Sum 0x00000000
   Number of ASBR summary LSA 0. Checksum Sum 0x00000000
   Number of NSSA LSA 0. Checksum Sum 0x00000000
   Number of opaque link LSA 0. Checksum Sum 0x00000000
   Number of opaque area LSA 0. Checksum Sum 0x00000000

vyatta@vyatta:~$
```

show ip ospf border-routers

Displays OSPF border router information.

Syntax

show ip ospf border-routers

Command Mode

Operational mode.

Parameters

None.

Default

None.

Usage Guidelines

Use this command to display OSPF border router information.

Examples

Example 2-2 shows OSPF border router information.

Example 2-2 “show ip ospf border-router”: Displaying OSPF border router information

```
vyatta@vyatta:~$  show ip ospf border-routers
============ OSPF router routing table =============
R    10.1.0.58             [10] area: 10.1.0.0, ASBR
                           via 10.1.0.58, eth2

vyatta@vyatta:~$
```

show ip ospf database

Displays OSPF database information.

Syntax

show ip ospf database [**max-age** | **self-originate** | {**asbr-summary** | **external** | **network** | **nssa-external** | **opaque-area** | **opaque-as** | **opaque-link** | **router** | **summary**} [**adv-router** <*ipv4*> |<*ipv4*> [**adv-router** <*ipv4*> | **self-originate**]]]

Command Mode

Operational mode.

Parameters

max-age	Display OSPF max-age database.
self-originate	Display OSPF self-originate database.
asbr-summary	Display OSPF ASBR (Autonomous System Border Router) summary database.
external	Display OSPF external database.
network	Display OSPF network database.
nssa-external	Display OSPF NSSA external database.
opaque-area	Display OSPF opaque-area database.
opaque-as	Display OSPF opaque-as database.
opaque-link	Display OSPF opaque-link database.
router	Display OSPF router database.
summary	Display summary of OSPF database.
adv-router *ipv4*	Optional. Display the OSPF database for a given address of the advertised router specified.
ipv4	Optional. Display the OSPF database for a given address.
self-originate	Optional. Display the self-originate OSPF database for a given address.

Default

None.

Usage Guidelines

Use this command to display OSPF database information.

Examples

Example 2-3 shows general OSPF database information.

Example 2-3 “show ip ospf database”: Displaying general OSPF database information

```
vyatta@vyatta:~$  show ip ospf database

       OSPF Router with ID (10.100.10.1)

                Router Link States (Area 10.1.0.0)

Link ID         ADV Router      Age  Seq#       CkSum  Link count
10.1.0.33       10.1.0.33        123 0x800003e5 0x791f 1
10.1.0.58       10.1.0.58        123 0x80000562 0x4e7e 1
10.100.10.1     10.100.10.1      117 0x800001b6 0xfe13 1

                Net Link States (Area 10.1.0.0)

Link ID         ADV Router      Age  Seq#       CkSum
10.1.0.58       10.1.0.58        123 0x800003df 0x0bf3

                AS External Link States

Link ID         ADV Router      Age  Seq#       CkSum  Route
76.0.0.0        10.1.0.58       1850 0x800000b3 0x83e4 E2
76.0.0.0/8 [0x0]

vyatta@vyatta:~$
```

show ip ospf interface

Displays OSPF configuration and status information for a specified interface.

Syntax

show ip ospf interface [*interface*]

Command Mode

Operational mode.

Parameters

interface	Optional. Interface to view OSPF configuration and status on.

Default

If no interfaces are specified then information on all interfaces will be displayed.

Usage Guidelines

Use this command to display OSPF configuration information for an interface.

Examples

Example 2-4 shows OSPF information on all interfaces.

Example 2-4 "show ip ospf interface": Displaying OSPF configuration and status information

```
vyatta@vyatta:~$  show ip ospf interface
eth0 is down
  ifindex 3, MTU 1500 bytes, BW 0 Kbit <UP,BROADCAST,MULTICAST>
  OSPF not enabled on this interface
eth1 is down
  ifindex 4, MTU 1500 bytes, BW 0 Kbit <UP,BROADCAST,MULTICAST>
  OSPF not enabled on this interface
eth1_rename is down
  ifindex 0, MTU 1500 bytes, BW 0 Kbit <BROADCAST,MULTICAST>
  OSPF not enabled on this interface
eth2 is up
```

```
  ifindex 5, MTU 1500 bytes, BW 0 Kbit
<UP,BROADCAST,RUNNING,MULTICAST>
  Internet Address 10.1.0.62/24, Broadcast 10.1.0.255, Area
10.1.0.0
  MTU mismatch detection:enabled
  Router ID 10.100.10.1, Network Type BROADCAST, Cost: 10
  Transmit Delay is 1 sec, State DROther, Priority 1
  Designated Router (ID) 10.1.0.58, Interface Address 10.1.0.58
  Backup Designated Router (ID) 10.1.0.33, Interface Address
10.1.0.33
  Multicast group memberships: OSPFAllRouters
  Timer intervals configured, Hello 10s, Dead 40s, Wait 40s,
Retransmit 5
    Hello due in 0.721s
  Neighbor Count is 2, Adjacent neighbor count is 2
eth2_rename is down
  ifindex 0, MTU 1500 bytes, BW 0 Kbit <BROADCAST,MULTICAST>
  OSPF not enabled on this interface
eth3 is down
  ifindex 2, MTU 1500 bytes, BW 0 Kbit <BROADCAST,MULTICAST>
  OSPF not enabled on this interface
lo is up
  ifindex 1, MTU 16436 bytes, BW 0 Kbit <UP,LOOPBACK,RUNNING>
  OSPF not enabled on this interface
vyatta@vyatta:~$
```

show ip ospf neighbor

Displays OSPF neighbor information for a specified address or interface.

Syntax

show ip ospf neighbor [*interface* | *ipv4* | **detail** | **address** *ipv4*]

Command Mode

Operational mode.

Parameters

interface	Optional. Display neighbor information for the specified interface.
ipv4	Optional. Display neighbor information for the specified address.
detail	Optional. Display detailed neighbor information for all neighbors.
address *ipv4*	Optional. Display neighbor information for the specified address.

Default

If no interfaces are specified then information on all neighbors will be displayed.

Usage Guidelines

Use this command to display OSPF neighbor information for a specified address or interface.

Examples

Example 2-5 shows OSPF neighbor information for all neighbors.

Example 2-5 “show ip ospf neighbor”: Displaying OSPF neighbor information

```
vyatta@vyatta:~$  show ip ospf neighbor

    Neighbor ID Pri State           Dead Time Address
Interface            RXmtL RqstL DBsmL
10.1.0.33         1 Full/Backup       33.842s 10.1.0.33
eth2:10.1.0.62           0     0     0
```

```
10.1.0.58         1 Full/DR           38.581s 10.1.0.58
eth2:10.1.0.62           0     0     0
vyatta@vyatta:~$
```

show ip ospf route

Displays OSPF route information.

Syntax

show ip ospf route

Command Mode

Operational mode.

Parameters

None.

Default

None.

Usage Guidelines

Use this command to display OSPF route information.

Examples

Example 2-6 shows OSPF route information.

Example 2-6 “show ip ospf route”: Displaying OSPF route information

```
vyatta@vyatta:~$  show ip ospf route
============ OSPF network routing table ============
N    10.1.0.0/24           [10] area: 10.1.0.0
                           directly attached to eth2

============ OSPF router routing table =============
R    10.1.0.58             [10] area: 10.1.0.0, ASBR
                           via 10.1.0.58, eth2

============ OSPF external routing table ===========
N E2 76.0.0.0/8            [10/20] tag: 0
                           via 10.1.0.7, eth2

vyatta@vyatta:~$
```

show ip route ospf

Displays all IP OSPF routes.

Syntax

show ip route ospf

Command Mode

Operational mode.

Parameters

None.

Default

None.

Usage Guidelines

Use this command to display all the IP OSPF routes.

Examples

Example 2-7 shows all IP OSPF routes.

Example 2-7 "show ip route ospf": Displaying routes

```
vyatta@vyatta:~$  show ip route ospf
Codes: K - kernel route, C - connected, S - static, R - RIP, O -
OSPF,
       I - ISIS, B - BGP, > - selected route, * - FIB route

O   10.1.0.0/24 [110/10] is directly connected, eth2, 01w2d21h
O>* 76.0.0.0/8 [110/20] via 10.1.0.7, eth2, 4d12h48m
vyatta@vyatta:~$
```

Chapter 3: Ethernet Interfaces and Vifs

This chapter describes commands for configuring OSPF on Ethernet interfaces and Ethernet vifs.

This chapter presents the following topics:

- Ethernet Interface and Vif OSPF Commands

Ethernet Interface and Vif OSPF Commands

This chapter contains the following commands.

Configuration Commands	
OSPF for Ethernet Interfaces	
interfaces ethernet <ethx> ip ospf authentication	Specifies the authentication method for OSPF on an Ethernet interface.
interfaces ethernet <ethx> ip ospf bandwidth <bandwidth>	Specifies the bandwidth of an Ethernet interface for calculating OSPF cost.
interfaces ethernet <ethx> ip ospf cost <cost>	Sets the routing cost for OSPF on an Ethernet interface.
interfaces ethernet <ethx> ip ospf dead-interval <interval>	Sets the OSPF dead interval for an Ethernet interface.
interfaces ethernet <ethx> ip ospf hello-interval <interval>	Sets the interval between OSPF hello packets on an Ethernet interface.
interfaces ethernet <ethx> ip ospf mtu-ignore	Disables MTU mismatch detection for an Ethernet interface.
interfaces ethernet <ethx> ip ospf network <type>	Specifies the OSPF network type for an Ethernet interface.
interfaces ethernet <ethx> ip ospf priority <priority>	Sets the OSPF priority for an Ethernet interface.
interfaces ethernet <ethx> ip ospf retransmit-interval <interval>	Sets the OSPF retransmit interval for an Ethernet interface.
interfaces ethernet <ethx> ip ospf transmit-delay <delay>	Specifies the OSPF transmit delay for an Ethernet interface.
OSPF for Ethernet Vifs	
interfaces ethernet <ethx> vif <vlan-id> ip ospf	Enables OSPF on a virtual interface.
interfaces ethernet <ethx> vif <vlan-id> ip ospf authentication	Specifies the authentication method for OSPF on a virtual interface.
interfaces ethernet <ethx> vif <vlan-id> ip ospf bandwidth <bandwidth>	Specifies the bandwidth of a virtual interface for calculating OSPF cost.
interfaces ethernet <ethx> vif <vlan-id> ip ospf cost <cost>	Sets the routing cost for OSPF on a virtual interface.
interfaces ethernet <ethx> vif <vlan-id> ip ospf dead-interval <interval>	Sets the OSPF dead interval for a virtual interface.

interfaces ethernet <ethx> vif <vlan-id> ip ospf hello-interval <interval>	Sets the interval between OSPF hello packets on a virtual interface.
interfaces ethernet <ethx> vif <vlan-id> ip ospf mtu-ignore	Disables MTU mismatch detection for a virtual interface.
interfaces ethernet <ethx> vif <vlan-id> ip ospf network <type>	Specifies the OSPF network type for a virtual interface.
interfaces ethernet <ethx> vif <vlan-id> ip ospf priority <priority>	Sets the OSPF priority for a virtual interface.
interfaces ethernet <ethx> vif <vlan-id> ip ospf retransmit-interval <interval>	Sets the OSPF retransmit interval for a virtual interface.
interfaces ethernet <ethx> vif <vlan-id> ip ospf transmit-delay <delay>	Specifies the OSPF transmit delay for a virtual interface.
Operational Commands	
None.	

interfaces ethernet <ethx> ip ospf

Enables OSPF on an Ethernet interface.

Syntax

set interfaces ethernet *ethx* **ip ospf**

delete interfaces ethernet *ethx* **ip ospf**

show interfaces ethernet *ethx* **ip ospf**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
   ethernet eth0..eth23 {
      ip {
         ospf
      }
   }
}
```

Parameters

ethx	Mandatory. Multi-node. An identifier for the Ethernet interface you are defining. This may be **eth0** to **eth23**, depending on what Ethernet interfaces that are actually available on the system. To see the interfaces available to the system kernel, use the **system** option of the **show interfaces** command (see page 76).

Default

None.

Usage Guidelines

Use this command to enable the Open Shortest Path First (OSPF) routing protocol on an Ethernet interface.

Use the **set** form of this command to enable OSPF on an interface.

Use the **delete** form of this command to remove all OSPF configuration and disable OSPF on an interface.

Use the **show** form of this command to display OSPF configuration.

interfaces ethernet <ethx> ip ospf authentication

Specifies the authentication method for OSPF on an Ethernet interface.

Syntax

set interfaces ethernet *ethx* **ip ospf authentication** [**md5 key-id** *key-id* **md5-key** *md5-key* | **plaintext-password** *password*]

delete interfaces ethernet *ethx* **ip ospf authentication** [**md5 key-id** *key-id* **md5-key** | **plaintext-password**]

show interfaces ethernet *ethx* **ip ospf authentication** [**md5 key-id** *key-id* **md5-key** | **plaintext-password**]

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
   ethernet eth0..eth23 {
      ip {
         ospf {
            authentication {
               md5 {
                  key-id 1-255 {
                     md5-key: text
                  }
               }
               plaintext-password: text
            }
         }
      }
   }
}
```

Parameters

ethx	Mandatory. Multi-node. An identifier for the Ethernet interface you are defining. This may be **eth0** to **eth23**, depending on what Ethernet interfaces that are actually available on the system. To see the interfaces available to the system kernel, use the **system** option of the **show interfaces** command (see page 76).

key-id	Optional. The key used to identify the MD5 key. This must be the same on both the sending and receiving systems. The range is 1 to 255.
md5-key	Optional. A password-like MD5 key of up to 16 alphanumeric characters to be used as input to the MD5 hashing algorithm. The longer the key, the stronger the security. This must be the same on both the sending and receiving systems.
password	Optional. The password to use in plain-text authentication. This must be eight characters or less and the same on both the sending and receiving systems.

Default

None.

Usage Guidelines

Use this command to specify the authentication method to be used for OSPF on an Ethernet interface. This authentication is independent of the authentication configured for the OSPF area.

In plain text authentication, passwords are sent through the network in plain text. In MD5 authentication, the system uses the Message Digest 5 (MD5) algorithm to compute a hash value from the contents of the OSPF packet and the password. The hash value and the MD5 key are included in the transmitted packet, and the receiving system (configured with the same password) calculates its own hash function, which must match.

The authentication parameters must be the same for all routers that are to establish two-way communication within a network. If two routers do not agree on these parameters, they will not consider establish adjacencies, and will disregard one another's communications.

Use the **set** form of this command to set the authentication for an Ethernet interface.

Use the **delete** form of this command to remove Ethernet interface authentication configuration information.

Use the **show** form of this command to display Ethernet interface authentication configuration information.

interfaces ethernet <ethx> ip ospf bandwidth <bandwidth>

Specifies the bandwidth of an Ethernet interface for calculating OSPF cost.

Syntax

set interfaces ethernet *ethx* **ip ospf bandwidth** *bandwidth*

delete interfaces ethernet *ethx* **ip ospf bandwidth**

show interfaces ethernet *ethx* **ip ospf bandwidth**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
   ethernet eth0..eth23 {
      ip {
         ospf {
            bandwidth: u32
         }
      }
   }
}
```

Parameters

ethx	Mandatory. Multi-node. An identifier for the Ethernet interface you are defining. This may be **eth0** to **eth23**, depending on what Ethernet interfaces that are actually available on the system. To see the interfaces available to the system kernel, use the **system** option of the **show interfaces** command (see page 76).
bandwidth	The bandwidth of the Ethernet interface in kilobits/sec. The range is 1 to 10000000.

Default

None.

Usage Guidelines

Use this command to specify the bandwidth of the Ethernet interface for the purpose of computing OSPF cost.

Use the **set** form of this command to specify the bandwidth of the Ethernet interface.

Use the **delete** form of this command to remove the bandwidth parameter.

Use the **show** form of this command to display the bandwidth configuration.

interfaces ethernet <ethx> ip ospf cost <cost>

Sets the routing cost for OSPF on an Ethernet interface.

Syntax

set interfaces ethernet *ethx* **ip ospf cost** *cost*

delete interfaces ethernet *ethx* **ip ospf cost**

show interfaces ethernet *ethx* **ip ospf cost**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
   ethernet eth0..eth23 {
      ip {
         ospf {
            cost: u32
         }
      }
   }
}
```

Parameters

ethx	Mandatory. Multi-node. An identifier for the Ethernet interface you are defining. This may be **eth0** to **eth23**, depending on what Ethernet interfaces that are actually available on the system. To see the interfaces available to the system kernel, use the **system** option of the **show interfaces** command (see page 76).
cost	The link-state metric (OSPF cost) to be advertised in the link-state advertisement (LSA) as the cost of sending packets over the ethernet interface. The range is 1 to 65535.

Default

For details on the default of OSPF cost, please see the Usage Guidelines.

Usage Guidelines

Use this command to manually override the default OSPF cost computed by the system for an Ethernet interface. You can only assign one cost per interface.

By default, the metric associated with a link is computed as follows:

```
Cost = 108 / bandwidth
```

The cost of reaching any destination is the sum of the costs of the individual hops. Costs are always rounded to the nearest integer. Costs lower than 1 are rounded up to 1.

Table 3-1 shows the OSPF costs for some common media types.

Table 3-1 OSPF Costs for Common Media Types

Media Type	OSPF Cost
56 Kbps	1785
64 Kbps	1562
128 Kbps	781
256 Kbps	390
512 Kbps	195
768 Kbps	130
T1 (1.544 Mbps)	64
E1 (2.048 Mbps)	48
4 Mbps Token Ring	6
10 Mbps Ethernet	10
16 Mbps Token Ring	6
T3 (44.736 Mbps	2
100+ Mbps	1

The values in Table 3-1 show how OSPF fails to distinguish between interfaces faster than 100 Mbps, for example, between Fast Ethernet (100 Mbps) and Gigabit Ethernet (1000 Mbps) interfaces. If you want to distinguish interfaces equal to or greater than 100 Mbps, you must manually configure the cost of the interface using this command.

Use the **set** form of this command to specify the OSPF cost for the Ethernet interface.

Use the **delete** form of this command to restore the default cost.

Use the **show** form of this command to display cost configuration.

interfaces ethernet <ethx> ip ospf dead-interval <interval>

Sets the OSPF dead interval for an Ethernet interface.

Syntax

set interfaces ethernet *ethx* **ip ospf dead-interval** *interval*

delete interfaces ethernet *ethx* **ip ospf dead-interval**

show interfaces ethernet *ethx* **ip ospf dead-interval**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
   ethernet eth0..eth23 {
      ip {
         ospf {
            dead-interval: u32
         }
      }
   }
}
```

Parameters

ethx	Mandatory. Multi-node. An identifier for the Ethernet interface you are defining. This may be **eth0** to **eth23**, depending on what Ethernet interfaces that are actually available on the system. To see the interfaces available to the system kernel, use the **system** option of the **show interfaces** command (see page 76).
interval	Specifies the time, in seconds, that this interface should wait to detect hello packets from neighboring routers before declaring the neighbor down. The range is 1 to 65535. The default is 4 times the hello interval.

Default

The dead interval is 4 times the hello interval.

Usage Guidelines

Use this command to specify the interval during which an Ethernet interface should expect a hello packet from its neighbor.

If the dead interval passes without the interface receiving a hello packet from the neighbor, the neighbor's status is changed to out-of-service, and all associated state is cleared.

The dead interval must be the same for all routers that are to establish two-way communication within a network. If two routers do not agree on these parameters, they will not establish adjacencies and will disregard one another's communications.

Use the **set** form of this command to specify the dead interval.

Use the **delete** form of this command to restore the default dead interval.

Use the **show** form of this command to display dead interval configuration.

interfaces ethernet <ethx> ip ospf hello-interval <interval>

Sets the interval between OSPF hello packets on an Ethernet interface.

Syntax

set interfaces ethernet *ethx* **ip ospf hello-interval** *interval*

delete interfaces ethernet *ethx* **ip ospf hello-interval**

show interfaces ethernet *ethx* **ip ospf hello-interval**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
   ethernet eth0..eth23 {
      ip {
         ospf {
            hello-interval: u32
         }
      }
   }
}
```

Parameters

ethx	Mandatory. Multi-node. An identifier for the Ethernet interface you are defining. This may be **eth0** to **eth23**, depending on what Ethernet interfaces that are actually available on the system. To see the interfaces available to the system kernel, use the **system** option of the **show interfaces** command (see page 76).
interval	Mandatory. The interval, in seconds, between hello packets. This value must be the same for all nodes on the network.The range is 1 to 65535. The default is 10.

Default

Hello packets are sent every 10 seconds.

Usage Guidelines

Use this command to set the interval at which OSPF hello packets are sent for an Ethernet interface.

A hello packet is an OSPF packet used to detect and maintain relationships with neighbors on the same network (directly connected routers). The greater the interval between hello packets, the less router traffic occurs, but the longer it takes for topological changes to be detected.

The hello interval must be the same for all routers that are to establish two-way communication within a network. If two routers do not agree on these parameters, they will not establish adjacencies and will disregard one another's communications.

Use the **set** form of this command to set the hello interval.

Use the **delete** form of this command to restore the default hello interval.

Use the **show** form of this command to display hello interval configuration.

interfaces ethernet <ethx> ip ospf mtu-ignore

Disables MTU mismatch detection for an Ethernet interface.

Syntax

set interfaces ethernet *ethx* **ip ospf mtu-ignore**

delete interfaces ethernet *ethx* **ip ospf mtu-ignore**

show interfaces ethernet *ethx* **ip ospf**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
    ethernet eth0..eth23 {
        ip {
            ospf {
                mtu-ignore
            }
        }
    }
}
```

Parameters

ethx	Mandatory. Multi-node. An identifier for the Ethernet interface you are defining. This may be **eth0** to **eth23**, depending on what Ethernet interfaces that are actually available on the system. To see the interfaces available to the system kernel, use the **system** option of the **show interfaces** command (see page 76).

Default

MTU mismatch detection is enabled by default.

Usage Guidelines

Use this command to disable MTU mismatch detection on an OSPF interface.

OSPF sends the MTU of the interface in a database description packet. If the MTUs of OSPF neighbors do not match, they cannot form an OSPF adjacency. MTU mismatch detection detects MTU mismatches and indicates them in the form of a debug message.

MTU mismatch is an important troubleshooting feature. If MTU mismatch is not enabled, MTU mismatches can only be detected by examining configuration for both interfaces.

There are some network setups where MTU mismatches are unavoidable, and even part of the normal set-up. It is for these cases only that MTU mismatch detection should be disabled, so that normal OSPF adjacencies can be formed.

Use the **set** form of this command to disable MTU mismatch detection.

Use the **delete** form of this command to re-enable MTU mismatch detection.

Use the **show** form of this command to display OSPF configuration.

interfaces ethernet <ethx> ip ospf network <type>

Specifies the OSPF network type for an Ethernet interface.

Syntax

set interfaces ethernet *ethx* **ip ospf network** [**broadcast** | **non-broadcast** | **point-to-multipoint** | **point-to-point**]

delete interfaces ethernet *ethx* **ip ospf network**

show interfaces ethernet *ethx* **ip ospf network**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
   ethernet eth0..eth23 {
      ip {
         ospf {
            network: text
         }
      }
   }
}
```

Parameters

ethx	Mandatory. Multi-node. An identifier for the Ethernet interface you are defining. This may be **eth0** to **eth23**, depending on what Ethernet interfaces that are actually available on the system. To see the interfaces available to the system kernel, use the **system** option of the **show interfaces** command (see page 76).

type	The network type for this interface. Supported values are as follows: **broadcast**: The interface supports broadcast mode, such as a LAN link. **non-broadcast**: The interface does not support broadcast mode. **point-to-point**: This interface supports point-to-point mode, such as an NBMA interface. **point-to-multipoint**: This interface supports point-to-multipoint mode, such as a PPP interface or a point-to-point logical interface on Frame Relay. The default is broadcast.

Default

Broadcast is supported.

Usage Guidelines

Use this command to configure and display the network type for the interface.

Use the **set** form of this command to specify the network type.

Use the **delete** form of this command to remove the network type.

Use the **show** form of this command to display the network type.

interfaces ethernet <ethx> ip ospf priority <priority>

Sets the OSPF priority for an Ethernet interface.

Syntax

set interfaces ethernet *ethx* **ip ospf priority** *priority*

delete interfaces ethernet *ethx* **ip ospf priority**

show interfaces ethernet *ethx* **ip ospf priority**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
   ethernet eth0..eth23 {
      ip {
         ospf {
            priority: u32
         }
      }
   }
}
```

Parameters

ethx	Mandatory. Multi-node. An identifier for the Ethernet interface you are defining. This may be **eth0** to **eth23**, depending on what Ethernet interfaces that are actually available on the system. To see the interfaces available to the system kernel, use the **system** option of the **show interfaces** command (see page 76).
priority	Specifies the OSPF router priority for this interface. The range is 0 to 255, where a router with priority 0 can never become the designated router. The default is 1.

Default

An OSPF interface has a priority of 1.

Usage Guidelines

Use this command to set the priority for an Ethernet interface on the broadcast network to which the interface is connected. The priority determines which routers are selected as the area's Designated Router (DR) and Backup Designated Router (BDR).

The DR and BDR are used to reduce the amount of traffic on OSPF overhead on broadcast networks, by reducing the number of adjacent routers to which a router must flood its topological information. In broadcast networks (such as Ethernet), each router establishes an adjacency with only the DR and the BDR, rather than with every router in its area. The DR and the BDR then flood this information to all other routers on the network segment.

Priority can range from 0 to 255. In general, the router with the highest priority is elected as the DR, and the router with the second-highest priority is elected as the BDR. The higher the number, the higher the priority.

Routers with a priority of 0 are ineligible for election.

Use the **set** form of this command to specify the OSPF priority.

Use the **delete** form of this command to restore the default priority.

Use the **show** form of this command to display priority configuration.

interfaces ethernet <ethx> ip ospf retransmit-interval <interval>

Sets the OSPF retransmit interval for an Ethernet interface.

Syntax

set interfaces ethernet *ethx* **ip ospf retransmit-interval** *interval*

delete interfaces ethernet *ethx* **ip ospf retransmit-interval**

show interfaces ethernet *ethx* **ip ospf retransmit-interval**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
   ethernet eth0..eth23 {
      ip {
         ospf {
            retransmit-interval: u32
         }
      }
   }
}
```

Parameters

ethx	Mandatory. Multi-node. An identifier for the Ethernet interface you are defining. This may be **eth0** to **eth23**, depending on what Ethernet interfaces that are actually available on the system. To see the interfaces available to the system kernel, use the **system** option of the **show interfaces** command (see page 76).
interval	Specifies the time in seconds to wait for an acknowledgement, after which the system retransmits an LSA packet to its neighbors. The range is 3 to 65535. The default is 5.

Default

Unacknowledged LSAs are retransmitted at 5-second intervals.

Usage Guidelines

Use this command to specify how long an Ethernet interface will wait for an acknowledgment of a link-state update before resending the update.

The link-state update packet is part of the exchange of topology databases between routers. When the initial database description (DD) packet is sent, it contains only the headers of the LSAs. If the receiving router determines that it requires that piece of the OSPF topology, it sends a link state request packet to request the complete LSA from the sending router.

After the update packet is sent, the sending router waits for an acknowledgement, either implicit or explicit, from the receiving router. In an explicit acknowledgement, the receiving router sends a link-state acknowledge (LS-Ack) packet to the router that sent the update. In an implicit acknowledgement, the router that sent the update receives an LSA from the receiving router that contains the update information.

If the retransmit interval passes with neither an explicit nor an implicit acknowledgement, the sending router will retransmit the link-state update packet.

Too high an interval slows network convergence. Too small an interval causes unnecessary retransmission.

Use the **set** form of this command to set the OSPF retransmit interval for an Ethernet interface.

Use the **delete** form of this command to restore the default retransmit interval.

Use the **show** form of this command to display retransmit interval configuration.

interfaces ethernet <ethx> ip ospf transmit-delay <delay>

Specifies the OSPF transmit delay for an Ethernet interface.

Syntax

set interfaces ethernet *ethx* **ip ospf transmit-delay** *delay*

delete interfaces ethernet *ethx* **ip ospf transmit-delay**

show interfaces ethernet *ethx* **ip ospf transmit-delay**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
   ethernet eth0..eth23 {
      ip {
         ospf {
            transmit-delay: u32
         }
      }
   }
}
```

Parameters

ethx	Mandatory. Multi-node. An identifier for the Ethernet interface you are defining. This may be **eth0** to **eth23**, depending on what Ethernet interfaces that are actually available on the system. To see the interfaces available to the system kernel, use the **system** option of the **show interfaces** command (see page 76).
delay	Mandatory. The delay, in seconds, between link-state transmits. This value must be the same for all nodes on the network. The range is 1 to 65535. The default is 1.

Default

Link-state transmits occur at 1-second intervals.

Usage Guidelines

Use this command to set the transmit delay for an Ethernet interface. This is the estimated time required to send a link-state update (LSU) packet.

This timer is used to accommodate transmission and propagation delays on the network, particularly on low-speed networks where delays may be significant. The router increments the age of link-state advertisements in LSU packets to account for these delays.

The value includes both the transmission time and the propagation delay across the network. The transmit delay is added to the age of the LSA packet before the LSA is transmitted The LSA age is used to help the network sequence LSAs, so that it can determine which of competing LSAs is the more recent and trustworthy.

LSAs are numbered in sequence, but the sequence numbers are finite, and so cannot be used as the sole determinant of the most recent LSA. Instead, OSPF also tracks the age of LSAs. Each time the LSA is forwarded to another router, its current age is incremented by the transmit delay. The packet's age, together with its sequence number, helps the receiving router to determine which version of a received LSA is more recent, and therefore to be used.

Use the **set** form of this command to set the transmit delay.

Use the **delete** form of this command to restore the default transmit delay.

Use the **show** form of this command to display transmit delay configuration.

interfaces ethernet <ethx> vif <vlan-id> ip ospf

Enables OSPF on a virtual interface.

Syntax

set interfaces ethernet *ethx* **vif** *vlan-id* **ip ospf**

delete interfaces ethernet *ethx* **vif** *vlan-id* **ip ospf**

show interfaces ethernet *ethx* **vif** *vlan-id* **ip ospf**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
   ethernet eth0..eth23 {
      vif 0-4095 {
         ip {
            ospf
         }
      }
   }
}
```

Parameters

ethx	Mandatory. Multi-node. An identifier for the Ethernet interface you are defining. This may be **eth0** to **eth23**, depending on what Ethernet interfaces that are actually available on the system. To see the interfaces available to the system kernel, use the **system** option of the **show interfaces** command (see page 76).
vlan-id	Mandatory. Multi-node. The VLAN ID for the vif, for use with 802.1q VLAN tagging. Only tagged packets are received on vifs configured on Ethernet interfaces. The range is 0 to 4095. You can define more than one vif for a single interface by creating multiple **vif** configuration nodes.

Default

None.

Usage Guidelines

Use this command to enable the Open Shortest Path First (OSPF) routing protocol on a virtual interface.

Use the **set** form of this command to enable OSPF on an interface.

Use the **delete** form of this command to remove all OSPF configuration and disable OSPF on an interface.

Use the **show** form of this command to display OSPF configuration.

interfaces ethernet <ethx> vif <vlan-id> ip ospf authentication

Specifies the authentication method for OSPF on a virtual interface.

Syntax

set interfaces ethernet *ethx* **vif** *vlan-id* **ip ospf authentication** [**md5 key-id** *key-id* **md5-key** *md5-key* | **plaintext-password** *password*]

delete interfaces ethernet *ethx* **vif** *vlan-id* **ip ospf authentication** [**md5 key-id** *key-id* **md5-key** | **plaintext-password**]

show interfaces ethernet *ethx* **vif** *vlan-id* **ip ospf authentication** [**md5 key-id** *key-id* **md5-key** | **plaintext-password**]

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
    ethernet eth0..eth23 {
        vif 0-4095 {
            ip {
                ospf {
                    authentication {
                        md5 {
                            key-id 1-255 {
                                md5-key: text
                            }
                        }
                        plaintext-password: text
                    }
                }
            }
        }
    }
}
```

Parameters

ethx	Mandatory. Multi-node. An identifier for the Ethernet interface you are defining. This may be **eth0** to **eth23**, depending on what Ethernet interfaces that are actually available on the system. To see the interfaces available to the system kernel, use the **system** option of the **show interfaces** command (see page 76).
vlan-id	Mandatory. Multi-node. The VLAN ID for the vif, for use with 802.1q VLAN tagging. Only tagged packets are received on vifs configured on Ethernet interfaces. The range is 0 to 4095. You can define more than one vif for a single interface by creating multiple **vif** configuration nodes.
key-id	Optional. The key used to identify the MD5 key. This must be the same on both the sending and receiving systems. The range is 1 to 255.
md5-key	Optional. A password-like MD5 key of up to 16 alphanumeric characters to be used as input to the MD5 hashing algorithm. The longer the key, the stronger the security. This must be the same on both the sending and receiving systems.
password	Optional. The password to use in plain-text authentication. This must be eight characters or less and the same on both the sending and receiving systems.

Default

None.

Usage Guidelines

Use this command to specify the authentication method to be used for OSPF on a virtual interface. This authentication is independent of the authentication configured for the OSPF area.

In plain text authentication, passwords are sent through the network in plain text. In MD5 authentication, the system uses the Message Digest 5 (MD5) algorithm to compute a hash value from the contents of the OSPF packet and the password. The hash value and the MD5 key are included in the transmitted packet, and the receiving system (configured with the same password) calculates its own hash function, which must match.

The authentication parameters must be the same for all routers that are to establish two-way communication within a network. If two routers do not agree on these parameters, they will not consider establish adjacencies, and will disregard one another's communications.

Use the **set** form of this command to set the authentication for a virtual interface.

Use the **delete** form of this command to remove virtual interface authentication configuration information.

Use the **show** form of this command to display virtual interface authentication configuration information.

interfaces ethernet <ethx> vif <vlan-id> ip ospf bandwidth <bandwidth>

Specifies the bandwidth of a virtual interface for calculating OSPF cost.

Syntax

set interfaces ethernet *ethx* **vif** *vlan-id* **ip ospf bandwidth** *bandwidth*

delete interfaces ethernet *ethx* **vif** *vlan-id* **ip ospf bandwidth**

show interfaces ethernet *ethx* **vif** *vlan-id* **ip ospf bandwidth**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
    ethernet eth0..eth23 {
        vif 0-4095 {
            ip {
                ospf {
                    bandwidth: u32
                }
            }
        }
    }
}
```

Parameters

ethx	Mandatory. Multi-node. An identifier for the Ethernet interface you are defining. This may be **eth0** to **eth23**, depending on what Ethernet interfaces that are actually available on the system. To see the interfaces available to the system kernel, use the **system** option of the **show interfaces** command (see page 76).

vlan-id	Mandatory. Multi-node. The VLAN ID for the vif, for use with 802.1q VLAN tagging. Only tagged packets are received on vifs configured on Ethernet interfaces. The range is 0 to 4095. You can define more than one vif for a single interface by creating multiple **vif** configuration nodes.
bandwidth	The bandwidth of the Ethernet interface in kilobits/sec. The range is 1 to 10000000.

Default

None.

Usage Guidelines

Use this command to specify the bandwidth of the virtual interface for the purpose of computing OSPF cost.

Use the **set** form of this command to specify the bandwidth of the virtual interface.

Use the **delete** form of this command to remove the bandwidth parameter.

Use the **show** form of this command to display the bandwidth configuration.

interfaces ethernet <ethx> vif <vlan-id> ip ospf cost <cost>

Sets the routing cost for OSPF on a virtual interface.

Syntax

set interfaces ethernet *ethx* **vif** *vlan-id* **ip ospf cost** *cost*

delete interfaces ethernet *ethx* **vif** *vlan-id* **ip ospf cost**

show interfaces ethernet *ethx* **vif** *vlan-id* **ip ospf cost**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
    ethernet eth0..eth23 {
        vif 0-4095 {
            ip {
                ospf {
                    cost: u32
                }
            }
        }
    }
}
```

Parameters

ethx	Mandatory. Multi-node. An identifier for the Ethernet interface you are defining. This may be **eth0** to **eth23**, depending on what Ethernet interfaces that are actually available on the system. To see the interfaces available to the system kernel, use the **system** option of the **show interfaces** command (see page 76).

vlan-id	Mandatory. Multi-node. The VLAN ID for the vif, for use with 802.1q VLAN tagging. Only tagged packets are received on vifs configured on Ethernet interfaces. The range is 0 to 4095. You can define more than one vif for a single interface by creating multiple **vif** configuration nodes.
cost	The link-state metric (OSPF cost) to be advertised in the link-state advertisement (LSA) as the cost of sending packets over the ethernet interface. The range is 1 to 65535.

Default

For details on the default of OSPF cost, please see the Usage Guidelines.

Usage Guidelines

Use this command to manually override the default OSPF cost computed by the system for a virtual interface. You can only assign one cost per interface.

By default, the metric associated with a link is computed as follows:

```
Cost = 108 / bandwidth
```

The cost of reaching any destination is the sum of the costs of the individual hops. Costs are always rounded to the nearest integer. Costs lower than 1 are rounded up to 1.

Table 3-2 shows the OSPF costs for some common media types.

Table 3-2 OSPF Costs for Common Media Types

Media Type	OSPF Cost
56 Kbps	1785
64 Kbps	1562
128 Kbps	781
256 Kbps	390
512 Kbps	195
768 Kbps	130
T1 (1.544 Mbps)	64
E1 (2.048 Mbps)	48
4 Mbps Token Ring	6

Table 3-2 OSPF Costs for Common Media Types

10 Mbps Ethernet	10
16 Mbps Token Ring	6
T3 (44.736 Mbps	2
100+ Mbps	1

The values in Table 3-2 show how OSPF fails to distinguish between interfaces faster than 100 Mbps, for example, between Fast Ethernet (100 Mbps) and Gigabit Ethernet (1000 Mbps) interfaces. If you want to distinguish interfaces equal to or greater than 100 Mbps, you must manually configure the cost of the interface using this command.

Use the **set** form of this command to specify the OSPF cost for the virtual interface.

Use the **delete** form of this command to restore the default cost.

Use the **show** form of this command to display cost configuration.

interfaces ethernet <ethx> vif <vlan-id> ip ospf dead-interval <interval>

Sets the OSPF dead interval for a virtual interface.

Syntax

set interfaces ethernet *ethx* **vif** *vlan-id* **ip ospf dead-interval** *interval*

delete interfaces ethernet *ethx* **vif** *vlan-id* **ip ospf dead-interval**

show interfaces ethernet *ethx* **vif** *vlan-id* **ip ospf dead-interval**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
    ethernet eth0..eth23 {
        vif 0-4095 {
            ip {
                ospf {
                    dead-interval: u32
                }
            }
        }
    }
}
```

Parameters

ethx	Mandatory. Multi-node. An identifier for the Ethernet interface you are defining. This may be **eth0** to **eth23**, depending on what Ethernet interfaces that are actually available on the system. To see the interfaces available to the system kernel, use the **system** option of the **show interfaces** command (see page 76).

vlan-id	Mandatory. Multi-node. The VLAN ID for the vif, for use with 802.1q VLAN tagging. Only tagged packets are received on vifs configured on Ethernet interfaces. The range is 0 to 4095. You can define more than one vif for a single interface by creating multiple **vif** configuration nodes.
interval	Specifies the time, in seconds, that this interface should wait to detect hello packets from neighboring routers before declaring the neighbor down. The range is 1 to 65535. The default is 4 times the hello interval.

Default

The dead interval is 4 times the hello interval.

Usage Guidelines

Use this command to specify the interval during which a virtual interface should expect a hello packet from its neighbor.

If the dead interval passes without the interface receiving a hello packet from the neighbor, the neighbor's status is changed to out-of-service, and all associated state is cleared.

The dead interval must be the same for all routers that are to establish two-way communication within a network. If two routers do not agree on these parameters, they will not establish adjacencies and will disregard one another's communications.

Use the **set** form of this command to specify the dead interval.

Use the **delete** form of this command to restore the default dead interval.

Use the **show** form of this command to display dead interval configuration.

interfaces ethernet <ethx> vif <vlan-id> ip ospf hello-interval <interval>

Sets the interval between OSPF hello packets on a virtual interface.

Syntax

set interfaces ethernet *ethx* **vif** *vlan-id* **ip ospf hello-interval** *interval*

delete interfaces ethernet *ethx* **vif** *vlan-id* **ip ospf hello-interval**

show interfaces ethernet *ethx* **vif** *vlan-id* **ip ospf hello-interval**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
   ethernet eth0..eth23 {
      vif 0-4095 {
         ip {
            ospf {
               hello-interval: u32
            }
         }
      }
   }
}
```

Parameters

ethx	Mandatory. Multi-node. An identifier for the Ethernet interface you are defining. This may be **eth0** to **eth23**, depending on what Ethernet interfaces that are actually available on the system. To see the interfaces available to the system kernel, use the **system** option of the **show interfaces** command (see page 76).

vlan-id	Mandatory. Multi-node. The VLAN ID for the vif, for use with 802.1q VLAN tagging. Only tagged packets are received on vifs configured on Ethernet interfaces. The range is 0 to 4095. You can define more than one vif for a single interface by creating multiple **vif** configuration nodes.
interval	Mandatory. The interval, in seconds, between hello packets. This value must be the same for all nodes on the network.The range is 1 to 65535. The default is 10.

Default

Hello packets are sent every 10 seconds.

Usage Guidelines

Use this command to set the interval at which OSPF hello packets are sent for a virtual interface.

A hello packet is an OSPF packet used to detect and maintain relationships with neighbors on the same network (directly connected routers). The greater the interval between hello packets, the less router traffic occurs, but the longer it takes for topological changes to be detected.

The hello interval must be the same for all routers that are to establish two-way communication within a network. If two routers do not agree on these parameters, they will not establish adjacencies and will disregard one another’s communications.

Use the **set** form of this command to set the hello interval.

Use the **delete** form of this command to restore the default hello interval.

Use the **show** form of this command to display hello interval configuration.

interfaces ethernet <ethx> vif <vlan-id> ip ospf mtu-ignore

Disables MTU mismatch detection for a virtual interface.

Syntax

set interfaces ethernet *ethx* **vif** *vlan-id* **ip ospf mtu-ignore**

delete interfaces ethernet *ethx* **vif** *vlan-id* **ip ospf mtu-ignore**

show interfaces ethernet *ethx* **vif** *vlan-id* **ip ospf**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
    ethernet eth0..eth23 {
        vif 0-4095 {
            ip {
                ospf {
                    mtu-ignore
                }
            }
        }
    }
}
```

Parameters

ethx	Mandatory. Multi-node. An identifier for the Ethernet interface you are defining. This may be **eth0** to **eth23**, depending on what Ethernet interfaces that are actually available on the system. To see the interfaces available to the system kernel, use the **system** option of the **show interfaces** command (see page 76).

vlan-id	Mandatory. Multi-node. The VLAN ID for the vif, for use with 802.1q VLAN tagging. Only tagged packets are received on vifs configured on Ethernet interfaces. The range is 0 to 4095. You can define more than one vif for a single interface by creating multiple **vif** configuration nodes.

Default

MTU mismatch detection is enabled by default.

Usage Guidelines

Use this command to disable MTU mismatch detection on an OSPF interface.

OSPF sends the MTU of the interface in a database description packet. If the MTUs of OSPF neighbors do not match, they cannot form an OSPF adjacency. MTU mismatch detection detects MTU mismatches and indicates them in the form of a debug message.

MTU mismatch is an important troubleshooting feature. If MTU mismatch is not enabled, MTU mismatches can only be detected by examining configuration for both interfaces.

There are some network setups where MTU mismatches are unavoidable, and even part of the normal set-up. It is for these cases only that MTU mismatch detection should be disabled, so that normal OSPF adjacencies can be formed.

Use the **set** form of this command to disable MTU mismatch detection.

Use the **delete** form of this command to re-enable MTU mismatch detection.

Use the **show** form of this command to display OSPF configuration.

interfaces ethernet <ethx> vif <vlan-id> ip ospf network <type>

Specifies the OSPF network type for a virtual interface.

Syntax

set interfaces ethernet *ethx* **vif** *vlan-id* **ip ospf network** [**broadcast** | **non-broadcast** | **point-to-multipoint** | **point-to-point**]

delete interfaces ethernet *ethx* **vif** *vlan-id* **ip ospf network**

show interfaces ethernet *ethx* **vif** *vlan-id* **ip ospf network**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
   ethernet eth0..eth23 {
      vif 0-4095 {
         ip {
            ospf {
               network: text
            }
         }
      }
   }
}
```

Parameters

ethx	Mandatory. Multi-node. An identifier for the Ethernet interface you are defining. This may be **eth0** to **eth23**, depending on what Ethernet interfaces that are actually available on the system. To see the interfaces available to the system kernel, use the **system** option of the **show interfaces** command (see page 76).

vlan-id	Mandatory. Multi-node. The VLAN ID for the vif, for use with 802.1q VLAN tagging. Only tagged packets are received on vifs configured on Ethernet interfaces. The range is 0 to 4095. You can define more than one vif for a single interface by creating multiple **vif** configuration nodes.
type	The network type for this interface. Supported values are as follows: **broadcast**: The interface supports broadcast mode, such as a LAN link. **non-broadcast**: The interface does not support broadcast mode. **point-to-point**: This interface supports point-to-point mode, such as an NBMA interface. **point-to-multipoint**: This interface supports point-to-multipoint mode, such as a PPP interface or a point-to-point logical interface on Frame Relay. The default is broadcast.

Default

Broadcast is supported.

Usage Guidelines

Use this command to configure and display the network type for the interface.

Use the **set** form of this command to specify the network type.

Use the **delete** form of this command to remove the network type.

Use the **show** form of this command to display the network type.

interfaces ethernet <ethx> vif <vlan-id> ip ospf priority <priority>

Sets the OSPF priority for a virtual interface.

Syntax

set interfaces ethernet *ethx* **vif** *vlan-id* **ip ospf priority** *priority*

delete interfaces ethernet *ethx* **vif** *vlan-id* **ip ospf priority**

show interfaces ethernet *ethx* **vif** *vlan-id* **ip ospf priority**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
   ethernet eth0..eth23 {
      vif 0-4095 {
         ip {
            ospf {
               priority: u32
            }
         }
      }
   }
}
```

Parameters

ethx	Mandatory. Multi-node. An identifier for the Ethernet interface you are defining. This may be **eth0** to **eth23**, depending on what Ethernet interfaces that are actually available on the system. To see the interfaces available to the system kernel, use the **system** option of the **show interfaces** command (see page 76).

vlan-id	Mandatory. Multi-node. The VLAN ID for the vif, for use with 802.1q VLAN tagging. Only tagged packets are received on vifs configured on Ethernet interfaces. The range is 0 to 4095. You can define more than one vif for a single interface by creating multiple **vif** configuration nodes.
priority	Specifies the OSPF router priority for this interface. The range is 0 to 255, where a router with priority 0 can never become the designated router. The default is 1.

Default

An OSPF interface has a priority of 1.

Usage Guidelines

Use this command to set the priority for a virtual interface on the broadcast network to which the interface is connected. The priority determines which routers are selected as the area's Designated Router (DR) and Backup Designated Router (BDR).

The DR and BDR are used to reduce the amount of traffic on OSPF overhead on broadcast networks, by reducing the number of adjacent routers to which a router must flood its topological information. In broadcast networks (such as Ethernet), each router establishes an adjacency with only the DR and the BDR, rather than with every router in its area. The DR and the BDR then flood this information to all other routers on the network segment.

Priority can range from 0 to 255. In general, the router with the highest priority is elected as the DR, and the router with the second-highest priority is elected as the BDR. The higher the number, the higher the priority.

Routers with a priority of 0 are ineligible for election.

Use the **set** form of this command to specify the OSPF priority.

Use the **delete** form of this command to restore the default priority.

Use the **show** form of this command to display priority configuration.

interfaces ethernet <ethx> vif <vlan-id> ip ospf retransmit-interval <interval>

Sets the OSPF retransmit interval for a virtual interface.

Syntax

set interfaces ethernet *ethx* **vif** *vlan-id* **ip ospf retransmit-interval** *interval*

delete interfaces ethernet *ethx* **vif** *vlan-id* **ip ospf retransmit-interval**

show interfaces ethernet *ethx* **vif** *vlan-id* **ip ospf retransmit-interval**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
    ethernet eth0..eth23 {
        vif 0-4095 {
            ip {
                ospf {
                    retransmit-interval: u32
                }
            }
        }
    }
}
```

Parameters

ethx	Mandatory. Multi-node. An identifier for the Ethernet interface you are defining. This may be **eth0** to **eth23**, depending on what Ethernet interfaces that are actually available on the system. To see the interfaces available to the system kernel, use the **system** option of the **show interfaces** command (see page 76).

vlan-id	Mandatory. Multi-node. The VLAN ID for the vif, for use with 802.1q VLAN tagging. Only tagged packets are received on vifs configured on Ethernet interfaces. The range is 0 to 4095. You can define more than one vif for a single interface by creating multiple **vif** configuration nodes.
interval	Specifies the time in seconds to wait for an acknowledgement, after which the system retransmits an LSA packet to its neighbors. The range is 3 to 65535. The default is 5.

Default

Unacknowledged LSAs are retransmitted at 5-second intervals.

Usage Guidelines

Use this command to specify how long a virtual interface will wait for an acknowledgment of a link-state update before resending the update.

The link-state update packet is part of the exchange of topology databases between routers. When the initial database description (DD) packet is sent, it contains only the headers of the LSAs. If the receiving router determines that it requires that piece of the OSPF topology, it sends a link state request packet to request the complete LSA from the sending router.

After the update packet is sent, the sending router waits for an acknowledgement, either implicit or explicit, from the receiving router. In an explicit acknowledgement, the receiving router sends a link-state acknowledge (LS-Ack) packet to the router that sent the update. In an implicit acknowledgement, the router that sent the update receives an LSA from the receiving router that contains the update information.

If the retransmit interval passes with neither an explicit nor an implicit acknowledgement, the sending router will retransmit the link-state update packet.

Too high an interval slows network convergence. Too small an interval causes unnecessary retransmission.

Use the **set** form of this command to set the OSPF retransmit interval for a virtual interface.

Use the **delete** form of this command to restore the default retransmit interval.

Use the **show** form of this command to display retransmit interval configuration.

interfaces ethernet <ethx> vif <vlan-id> ip ospf transmit-delay <delay>

Specifies the OSPF transmit delay for a virtual interface.

Syntax

set interfaces ethernet *ethx* **vif** *vlan-id* **ip ospf transmit-delay** *delay*

delete interfaces ethernet *ethx* **vif** *vlan-id* **ip ospf transmit-delay**

show interfaces ethernet *ethx* **vif** *vlan-id* **ip ospf transmit-delay**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
   ethernet eth0..eth23 {
      vif 0-4095 {
         ip {
            ospf {
               transmit-delay: u32
            }
         }
      }
   }
}
```

Parameters

ethx	Mandatory. Multi-node. An identifier for the Ethernet interface you are defining. This may be **eth0** to **eth23**, depending on what Ethernet interfaces that are actually available on the system. To see the interfaces available to the system kernel, use the **system** option of the **show interfaces** command (see page 76).

vlan-id	Mandatory. Multi-node. The VLAN ID for the vif, for use with 802.1q VLAN tagging. Only tagged packets are received on vifs configured on Ethernet interfaces. The range is 0 to 4095. You can define more than one vif for a single interface by creating multiple **vif** configuration nodes.
delay	Mandatory. The delay, in seconds, between link-state transmits. This value must be the same for all nodes on the network. The range is 1 to 65535. The default is 1.

Default

Link-state transmits occur at 1-second intervals.

Usage Guidelines

Use this command to set the transmit delay for a virtual interface. This is the estimated time required to send a link-state update (LSU) packet.

This timer is used to accommodate transmission and propagation delays on the network, particularly on low-speed networks where delays may be significant. The router increments the age of link-state advertisements in LSU packets to account for these delays.

The value includes both the transmission time and the propagation delay across the network. The transmit delay is added to the age of the LSA packet before the LSA is transmitted The LSA age is used to help the network sequence LSAs, so that it can determine which of competing LSAs is the more recent and trustworthy.

LSAs are numbered in sequence, but the sequence numbers are finite, and so cannot be used as the sole determinant of the most recent LSA. Instead, OSPF also tracks the age of LSAs. Each time the LSA is forwarded to another router, its current age is incremented by the transmit delay. The packet’s age, together with its sequence number, helps the receiving router to determine which version of a received LSA is more recent, and therefore to be used.

Use the **set** form of this command to set the transmit delay.

Use the **delete** form of this command to restore the default transmit delay.

Use the **show** form of this command to display transmit delay configuration.

Chapter 4: Ethernet PPPoE Interfaces

This chapter describes commands for configuring OSPF on Ethernet interfaces with PPPoE encapsulation.

This chapter presents the following topics:

- Ethernet PPPoE Interface OSPF Commands

Ethernet PPPoE Interface OSPF Commands

This chapter contains the following commands.

Configuration Commands	
interfaces ethernet <ethx> pppoe <num> ip ospf	Enables OSPF on a PPPoE interface.
interfaces ethernet <ethx> pppoe <num> ip ospf authentication	Specifies the authentication method for OSPF on a PPPoE interface.
interfaces ethernet <ethx> pppoe <num> ip ospf bandwidth <bandwidth>	Specifies the bandwidth of a PPPoE interface for calculating OSPF cost.
interfaces ethernet <ethx> pppoe <num> ip ospf cost <cost>	Sets the routing cost for OSPF on a PPPoE interface.
interfaces ethernet <ethx> pppoe <num> ip ospf dead-interval <interval>	Sets the dead interval for OSPF on a PPPoE interface.
interfaces ethernet <ethx> pppoe <num> ip ospf hello-interval <interval>	Sets the interval between OSPF hello packets on a PPPoE interface.
interfaces ethernet <ethx> pppoe <num> ip ospf mtu-ignore	Disables MTU mismatch detection for OSPF on a PPPoE interface.
interfaces ethernet <ethx> pppoe <num> ip ospf network <type>	Specifies the network type for OSPF on a PPPoE interface.
interfaces ethernet <ethx> pppoe <num> ip ospf priority <priority>	Sets the priority for OSPF on a PPPoE interface.
interfaces ethernet <ethx> pppoe <num> ip ospf retransmit-interval <interval>	Sets the retransmit interval for OSPF on a PPPoE interface.
interfaces ethernet <ethx> pppoe <num> ip ospf transmit-delay <delay>	Specifies the transmit delay for OSPF on a PPPoE interface.

Operational Commands
None.

interfaces ethernet <ethx> pppoe <num> ip ospf

Enables OSPF on a PPPoE interface.

Syntax

set interfaces ethernet *ethx* **pppoe** *num* **ip ospf**

delete interfaces ethernet *ethx* **pppoe** *num* **ip ospf**

show interfaces ethernet *ethx* **pppoe** *num* **ip ospf**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
   ethernet eth0..eth23 {
      pppoe 0-15 {
         ip {
            ospf
         }
      }
   }
}
```

Parameters

ethx	Mandatory. Multi-node. An identifier for the Ethernet interface you are defining. This may be **eth0** to **eth23**, depending on what Ethernet interfaces that are actually available on the system. To see the interfaces available to the system kernel, use the **system** option of the **show interfaces** command (see page 76).
num	Mandatory. The name of a defined PPPoE unit. The range of values is 0 to 15.

Default

None.

Usage Guidelines

Use this command to enable the Open Shortest Path First (OSPF) routing protocol on a Point-to-Point over Ethernet (PPPoE) interface.

Use the **set** form of this command to enable OSPF on an interface.

Use the **delete** form of this command to remove all OSPF configuration and disable OSPF on an interface.

Use the **show** form of this command to display OSPF configuration.

interfaces ethernet <ethx> pppoe <num> ip ospf authentication

Specifies the authentication method for OSPF on a PPPoE interface.

Syntax

set interfaces ethernet *ethx* **pppoe** *num* **ip ospf authentication** [**md5 key-id** *key-id* **md5-key** *md5-key* | **plaintext-password** *password*]

delete interfaces ethernet *ethx* **pppoe** *num* **ip ospf authentication** [**md5 key-id** *key-id* **md5-key** | **plaintext-password**]

show interfaces ethernet *ethx* **pppoe** *num* **ip ospf authentication** [**md5 key-id** *key-id* **md5-key** | **plaintext-password**]

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
    ethernet eth0..eth23 {
        pppoe 0-15 {
            ip {
                ospf {
                    authentication {
                        md5 {
                            key-id 1-255 {
                                md5-key: text
                            }
                        }
                        plaintext-password: text
                    }
                }
            }
        }
    }
}
```

Parameters

ethx	Mandatory. Multi-node. An identifier for the Ethernet interface you are defining. This may be **eth0** to **eth23**, depending on what Ethernet interfaces that are actually available on the system. To see the interfaces available to the system kernel, use the **system** option of the **show interfaces** command (see page 76).
num	Mandatory. The name of a defined PPPoE unit. The range of values is 0 to 15.
key-id	Optional. The key used to identify the MD5 key. This must be the same on both the sending and receiving systems. The range is 1 to 255.
md5-key	Optional. A password-like MD5 key of up to 16 alphanumeric characters to be used as input to the MD5 hashing algorithm. The longer the key, the stronger the security. This must be the same on both the sending and receiving systems.
password	Optional. The password to use in plain-text authentication. This must be eight characters or less and the same on both the sending and receiving systems.

Default

None.

Usage Guidelines

Use this command to specify the authentication method to be used for OSPF on a Point-to-Point over Ethernet (PPPoE) interface. This authentication is independent of the authentication configured for the OSPF area.

In plain text authentication, passwords are sent through the network in plain text. In MD5 authentication, the system uses the Message Digest 5 (MD5) algorithm to compute a hash value from the contents of the OSPF packet and the password. The hash value and the MD5 key are included in the transmitted packet, and the receiving system (configured with the same password) calculates its own hash function, which must match.

The authentication parameters must be the same for all routers that are to establish two-way communication within a network. If two routers do not agree on these parameters, they will not consider establish adjacencies, and will disregard one another’s communications.

Use the **set** form of this command to set the authentication for a PPPoE interface.

Use the **delete** form of this command to remove PPPoE interface authentication configuration information.

Use the **show** form of this command to display PPPoE interface authentication configuration information.

interfaces ethernet <ethx> pppoe <num> ip ospf bandwidth <bandwidth>

Specifies the bandwidth of a PPPoE interface for calculating OSPF cost.

Syntax

set interfaces ethernet *ethx* **pppoe** *num* **ip ospf bandwidth** *bandwidth*

delete interfaces ethernet *ethx* **pppoe** *num* **ip ospf bandwidth**

show interfaces ethernet *ethx* **pppoe** *num* **ip ospf bandwidth**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
    ethernet eth0..eth23 {
        pppoe 0-15 {
            ip {
                ospf {
                    bandwidth: u32
                }
            }
        }
    }
}
```

Parameters

ethx	Mandatory. Multi-node. An identifier for the Ethernet interface you are defining. This may be **eth0** to **eth23**, depending on what Ethernet interfaces that are actually available on the system. To see the interfaces available to the system kernel, use the **system** option of the **show interfaces** command (see page 76).
num	Mandatory. The name of a defined PPPoE unit. The range of values is 0 to 15.
bandwidth	The bandwidth of the Ethernet interface in kilobits/sec. The range is 1 to 10000000.

Default

None.

Usage Guidelines

Use this command to specify the bandwidth of the Point-to-Point over Ethernet (PPPoE) interface for the purpose of computing OSPF cost.

Use the **set** form of this command to specify the bandwidth of the PPPoE interface.

Use the **delete** form of this command to remove the bandwidth parameter.

Use the **show** form of this command to display the bandwidth configuration.

interfaces ethernet <ethx> pppoe <num> ip ospf cost <cost>

Sets the routing cost for OSPF on a PPPoE interface.

Syntax

set interfaces ethernet *ethx* **pppoe** *num* **ip ospf cost** *cost*

delete interfaces ethernet *ethx* **pppoe** *num* **ip ospf cost**

show interfaces ethernet *ethx* **pppoe** *num* **ip ospf cost**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
   ethernet eth0..eth23 {
      pppoe 0-15 {
         ip {
            ospf {
               cost: u32
            }
         }
      }
   }
}
```

Parameters

ethx	Mandatory. Multi-node. An identifier for the Ethernet interface you are defining. This may be **eth0** to **eth23**, depending on what Ethernet interfaces that are actually available on the system. To see the interfaces available to the system kernel, use the **system** option of the **show interfaces** command (see page 76).
num	Mandatory. The name of a defined PPPoE unit. The range of values is 0 to 15.
cost	The link-state metric (OSPF cost) to be advertised in the link-state advertisement (LSA) as the cost of sending packets over the ethernet interface. The range is 1 to 65535.

Default

For details on the default of OSPF cost, please see the Usage Guidelines.

Usage Guidelines

Use this command to manually override the default OSPF cost computed by the system for OSPF run on a Point-to-Point over Ethernet (PPPoE) interface. You can only assign one cost per interface.

By default, the metric associated with a link is computed as follows:

```
Cost = 108 / bandwidth
```

The cost of reaching any destination is the sum of the costs of the individual hops. Costs are always rounded to the nearest integer. Costs lower than 1 are rounded up to 1.

Table 4-1 shows the OSPF costs for some common media types.

Table 4-1 OSPF Costs for Common Media Types

Media Type	OSPF Cost
56 Kbps	1785
64 Kbps	1562
128 Kbps	781
256 Kbps	390
512 Kbps	195
768 Kbps	130
T1 (1.544 Mbps)	64
E1 (2.048 Mbps)	48
4 Mbps Token Ring	6
10 Mbps Ethernet	10
16 Mbps Token Ring	6
T3 (44.736 Mbps	2
100+ Mbps	1

The values in Table 4-1 show how OSPF fails to distinguish between interfaces faster than 100 Mbps, for example, between Fast Ethernet (100 Mbps) and Gigabit Ethernet (1000 Mbps) interfaces. If you want to distinguish interfaces equal to or greater than 100 Mbps, you must manually configure the cost of the interface using this command.

Use the **set** form of this command to specify the OSPF cost for the PPPoE interface.

Use the **delete** form of this command to restore the default cost.

Use the **show** form of this command to display cost configuration.

interfaces ethernet <ethx> pppoe <num> ip ospf dead-interval <interval>

Sets the dead interval for OSPF on a PPPoE interface.

Syntax

set interfaces ethernet *ethx* **pppoe** *num* **ip ospf dead-interval** *interval*

delete interfaces ethernet *ethx* **pppoe** *num* **ip ospf dead-interval**

show interfaces ethernet *ethx* **pppoe** *num* **ip ospf dead-interval**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
   ethernet eth0..eth23 {
      pppoe 0-15 {
         ip {
            ospf {
               dead-interval: u32
            }
         }
      }
   }
}
```

Parameters

ethx	Mandatory. Multi-node. An identifier for the Ethernet interface you are defining. This may be **eth0** to **eth23**, depending on what Ethernet interfaces that are actually available on the system. To see the interfaces available to the system kernel, use the **system** option of the **show interfaces** command (see page 76).
num	Mandatory. The name of a defined PPPoE unit. The range of values is 0 to 15.
interval	Specifies the time, in seconds, that this interface should wait to detect hello packets from neighboring routers before declaring the neighbor down. The range is 1 to 65535. The default is 4 times the hello interval.

Default

The dead interval is 4 times the hello interval.

Usage Guidelines

Use this command to specify the interval during which a Point-to-Point over Ethernet (PPPoE) interface should expect an OSPF hello packet from its neighbor.

If the dead interval passes without the interface receiving a hello packet from the neighbor, the neighbor's status is changed to out-of-service, and all associated state is cleared.

The dead interval must be the same for all routers that are to establish two-way communication within a network. If two routers do not agree on these parameters, they will not establish adjacencies and will disregard one another's communications.

Use the **set** form of this command to specify the dead interval.

Use the **delete** form of this command to restore the default dead interval.

Use the **show** form of this command to display dead interval configuration.

interfaces ethernet <ethx> pppoe <num> ip ospf hello-interval <interval>

Sets the interval between OSPF hello packets on a PPPoE interface.

Syntax

set interfaces ethernet *ethx* **pppoe** *num* **ip ospf hello-interval** *interval*

delete interfaces ethernet *ethx* **pppoe** *num* **ip ospf hello-interval**

show interfaces ethernet *ethx* **pppoe** *num* **ip ospf hello-interval**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
   ethernet eth0..eth23 {
      pppoe 0-15 {
         ip {
            ospf {
               hello-interval: u32
            }
         }
      }
   }
}
```

Parameters

ethx	Mandatory. Multi-node. An identifier for the Ethernet interface you are defining. This may be **eth0** to **eth23**, depending on what Ethernet interfaces that are actually available on the system. To see the interfaces available to the system kernel, use the **system** option of the **show interfaces** command (see page 76).
num	Mandatory. The name of a defined PPPoE unit. The range of values is 0 to 15.
interval	Mandatory. The interval, in seconds, between hello packets. This value must be the same for all nodes on the network.The range is 1 to 65535. The default is 10.

Default

Hello packets are sent every 10 seconds.

Usage Guidelines

Use this command to set the interval at which OSPF hello packets are sent for a Point-to-Point over Ethernet (PPPoE) interface.

A hello packet is an OSPF packet used to detect and maintain relationships with neighbors on the same network (directly connected routers). The greater the interval between hello packets, the less router traffic occurs, but the longer it takes for topological changes to be detected.

The hello interval must be the same for all routers that are to establish two-way communication within a network. If two routers do not agree on these parameters, they will not establish adjacencies and will disregard one another's communications.

Use the **set** form of this command to set the hello interval.

Use the **delete** form of this command to restore the default hello interval.

Use the **show** form of this command to display hello interval configuration.

interfaces ethernet <ethx> pppoe <num> ip ospf mtu-ignore

Disables MTU mismatch detection for OSPF on a PPPoE interface.

Syntax

set interfaces ethernet *ethx* **pppoe** *num* **ip ospf mtu-ignore**

delete interfaces ethernet *ethx* **pppoe** *num* **ip ospf mtu-ignore**

show interfaces ethernet *ethx* **pppoe** *num* **ip ospf**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
    ethernet eth0..eth23 {
        pppoe 0-15 {
            ip {
                ospf {
                    mtu-ignore
                }
            }
        }
    }
}
```

Parameters

ethx	Mandatory. Multi-node. An identifier for the Ethernet interface you are defining. This may be **eth0** to **eth23**, depending on what Ethernet interfaces that are actually available on the system. To see the interfaces available to the system kernel, use the **system** option of the **show interfaces** command (see page 76).
num	Mandatory. The name of a defined PPPoE unit. The range of values is 0 to 15.

Default

MTU mismatch detection is enabled by default.

Usage Guidelines

Use this command to disable MTU mismatch detection on an Point-to-Point over Ethernet (PPPoE) OSPF interface.

OSPF sends the MTU of the interface in a database description packet. If the MTUs of OSPF neighbors do not match, they cannot form an OSPF adjacency. MTU mismatch detection detects MTU mismatches and indicates them in the form of a debug message.

MTU mismatch is an important troubleshooting feature. If MTU mismatch is not enabled, MTU mismatches can only be detected by examining configuration for both interfaces.

There are some network setups where MTU mismatches are unavoidable, and even part of the normal set-up. It is for these cases only that MTU mismatch detection should be disabled, so that normal OSPF adjacencies can be formed.

Use the **set** form of this command to disable MTU mismatch detection.

Use the **delete** form of this command to re-enable MTU mismatch detection.

Use the **show** form of this command to display OSPF configuration.

interfaces ethernet <ethx> pppoe <num> ip ospf network <type>

Specifies the network type for OSPF on a PPPoE interface.

Syntax

set interfaces ethernet *ethx* **pppoe** *num* **ip ospf network** [**broadcast** | **non-broadcast** | **point-to-multipoint** | **point-to-point**]

delete interfaces ethernet *ethx* **pppoe** *num* **ip ospf network**

show interfaces ethernet *ethx* **pppoe** *num* **ip ospf network**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
   ethernet eth0..eth23 {
      pppoe 0-15 {
         ip {
            ospf {
               network: text
            }
         }
      }
   }
}
```

Parameters

ethx	Mandatory. Multi-node. An identifier for the Ethernet interface you are defining. This may be **eth0** to **eth23**, depending on what Ethernet interfaces that are actually available on the system. To see the interfaces available to the system kernel, use the **system** option of the **show interfaces** command (see page 76).
num	Mandatory. The name of a defined PPPoE unit. The range of values is 0 to 15.

type	The network type for this interface. Supported values are as follows: **broadcast**: The interface supports broadcast mode, such as a LAN link. **non-broadcast**: The interface does not support broadcast mode. **point-to-point**: This interface supports point-to-point mode, such as an NBMA interface. **point-to-multipoint**: This interface supports point-to-multipoint mode, such as a PPP interface or a point-to-point logical interface on Frame Relay. The default is broadcast.

Default

Broadcast is supported.

Usage Guidelines

Use this command to configure and display the OSPF network type for a Point-to-Point over Ethernet (PPPoE) interface.

Use the **set** form of this command to specify the network type.

Use the **delete** form of this command to remove the network type.

Use the **show** form of this command to display the network type.

interfaces ethernet <ethx> pppoe <num> ip ospf priority <priority>

Sets the priority for OSPF on a PPPoE interface.

Syntax

set interfaces ethernet *ethx* **pppoe** *num* **ip ospf priority** *priority*

delete interfaces ethernet *ethx* **pppoe** *num* **ip ospf priority**

show interfaces ethernet *ethx* **pppoe** *num* **ip ospf priority**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
   ethernet eth0..eth23 {
      pppoe 0-15 {
         ip {
            ospf {
               priority: u32
            }
         }
      }
   }
}
```

Parameters

ethx	Mandatory. Multi-node. An identifier for the Ethernet interface you are defining. This may be **eth0** to **eth23**, depending on what Ethernet interfaces that are actually available on the system. To see the interfaces available to the system kernel, use the **system** option of the **show interfaces** command (see page 76).
num	Mandatory. The name of a defined PPPoE unit. The range of values is 0 to 15.
priority	Specifies the OSPF router priority for this interface. The range is 0 to 255, where a router with priority 0 can never become the designated router. The default is 1.

Default

An OSPF interface has a priority of 1.

Usage Guidelines

Use this command to set the OSPF priority for a Point-to-Point over Ethernet (PPPoE) interface on the broadcast network to which the interface is connected. The priority determines which routers are selected as the area's Designated Router (DR) and Backup Designated Router (BDR).

The DR and BDR are used to reduce the amount of traffic on OSPF overhead on broadcast networks, by reducing the number of adjacent routers to which a router must flood its topological information. In broadcast networks (such as Ethernet), each router establishes an adjacency with only the DR and the BDR, rather than with every router in its area. The DR and the BDR then flood this information to all other routers on the network segment.

Priority can range from 0 to 255. In general, the router with the highest priority is elected as the DR, and the router with the second-highest priority is elected as the BDR. The higher the number, the higher the priority.

Routers with a priority of 0 are ineligible for election.

Use the **set** form of this command to specify the OSPF priority.

Use the **delete** form of this command to restore the default priority.

Use the **show** form of this command to display priority configuration.

interfaces ethernet <ethx> pppoe <num> ip ospf retransmit-interval <interval>

Sets the retransmit interval for OSPF on a PPPoE interface.

Syntax

set interfaces ethernet *ethx* **pppoe** *num* **ip ospf retransmit-interval** *interval*

delete interfaces ethernet *ethx* **pppoe** *num* **ip ospf retransmit-interval**

show interfaces ethernet *ethx* **pppoe** *num* **ip ospf retransmit-interval**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
   ethernet eth0..eth23 {
      pppoe 0-15 {
         ip {
            ospf {
               retransmit-interval: u32
            }
         }
      }
   }
}
```

Parameters

ethx	Mandatory. Multi-node. An identifier for the Ethernet interface you are defining. This may be **eth0** to **eth23**, depending on what Ethernet interfaces that are actually available on the system. To see the interfaces available to the system kernel, use the **system** option of the **show interfaces** command (see page 76).
num	Mandatory. The name of a defined PPPoE unit. The range of values is 0 to 15.
interval	Specifies the time in seconds to wait for an acknowledgement, after which the system retransmits an LSA packet to its neighbors. The range is 3 to 65535. The default is 5.

Default

Unacknowledged LSAs are retransmitted at 5-second intervals.

Usage Guidelines

Use this command to specify how long a Point-to-Point over Ethernet (PPPoE) interface will wait for an acknowledgment of a link-state update before resending the update.

The link-state update packet is part of the exchange of topology databases between routers. When the initial database description (DD) packet is sent, it contains only the headers of the LSAs. If the receiving router determines that it requires that piece of the OSPF topology, it sends a link state request packet to request the complete LSA from the sending router.

After the update packet is sent, the sending router waits for an acknowledgement, either implicit or explicit, from the receiving router. In an explicit acknowledgement, the receiving router sends a link-state acknowledge (LS-Ack) packet to the router that sent the update. In an implicit acknowledgement, the router that sent the update receives an LSA from the receiving router that contains the update information.

If the retransmit interval passes with neither an explicit nor an implicit acknowledgement, the sending router will retransmit the link-state update packet.

Too high an interval slows network convergence. Too small an interval causes unnecessary retransmission.

Use the **set** form of this command to set the OSPF retransmit interval for a PPPoE interface.

Use the **delete** form of this command to restore the default retransmit interval.

Use the **show** form of this command to display retransmit interval configuration.

interfaces ethernet <ethx> pppoe <num> ip ospf transmit-delay <delay>

Specifies the transmit delay for OSPF on a PPPoE interface.

Syntax

set interfaces ethernet *ethx* **pppoe** *num* **ip ospf transmit-delay** *delay*

delete interfaces ethernet *ethx* **pppoe** *num* **ip ospf transmit-delay**

show interfaces ethernet *ethx* **pppoe** *num* **ip ospf transmit-delay**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
   ethernet eth0..eth23 {
      pppoe 0-15 {
         ip {
            ospf {
               transmit-delay: u32
            }
         }
      }
   }
}
```

Parameters

ethx	Mandatory. Multi-node. An identifier for the Ethernet interface you are defining. This may be **eth0** to **eth23**, depending on what Ethernet interfaces that are actually available on the system. To see the interfaces available to the system kernel, use the **system** option of the **show interfaces** command (see page 76).
num	Mandatory. The name of a defined PPPoE unit. The range of values is 0 to 15.
delay	Mandatory. The delay, in seconds, between link-state transmits. This value must be the same for all nodes on the network. The range is 1 to 65535. The default is 1.

Default

Link-state transmits occur at 1-second intervals.

Usage Guidelines

Use this command to set the transmit delay for a Point-to-Point over Ethernet (PPPoE) interface. This is the estimated time required to send a link-state update (LSU) packet.

This timer is used to accommodate transmission and propagation delays on the network, particularly on low-speed networks where delays may be significant. The router increments the age of link-state advertisements in LSU packets to account for these delays.

The value includes both the transmission time and the propagation delay across the network. The transmit delay is added to the age of the LSA packet before the LSA is transmitted The LSA age is used to help the network sequence LSAs, so that it can determine which of competing LSAs is the more recent and trustworthy.

LSAs are numbered in sequence, but the sequence numbers are finite, and so cannot be used as the sole determinant of the most recent LSA. Instead, OSPF also tracks the age of LSAs. Each time the LSA is forwarded to another router, its current age is incremented by the transmit delay. The packet's age, together with its sequence number, helps the receiving router to determine which version of a received LSA is more recent, and therefore to be used.

Use the **set** form of this command to set the transmit delay.

Use the **delete** form of this command to restore the default transmit delay.

Use the **show** form of this command to display transmit delay configuration.

Chapter 5: Loopback Interfaces

This chapter describes commands for configuring OSPF on loopback interfaces.

This chapter presents the following topics:

- Loopback Interface OSPF Commands

Loopback Interface OSPF Commands

This chapter contains the following commands.

Configuration Commands	
interfaces loopback lo ip ospf	Enables OSPF on the loopback interface.
interfaces loopback lo ip ospf authentication	Specifies the authentication method for OSPF on the loopback interface.
interfaces loopback lo ip ospf cost <cost>	Sets the routing cost for OSPF on the loopback interface.
interfaces loopback lo ip ospf dead-interval <interval>	Sets the OSPF dead interval for the loopback interface.
interfaces loopback lo ip ospf hello-interval <interval>	Sets the interval between OSPF hello packets on the loopback interface.
interfaces loopback lo ip ospf mtu-ignore	Disables MTU mismatch detection for the loopback interface.
interfaces loopback lo ip ospf network <type>	Specifies the OSPF network type for the loopback interface.
interfaces loopback lo ip ospf priority <priority>	Specifies the Open Shortest Path First (OSPF) priority for the loopback interface.
interfaces loopback lo ip ospf retransmit-interval <interval>	Sets the OSPF retransmit interval for the loopback interface.
interfaces loopback lo ip ospf transmit-delay <delay>	Specifies the Open Shortest Path First (OSPF) transmit delay for the loopback interface.
Operational Commands	
None.	

interfaces loopback lo ip ospf

Enables OSPF on the loopback interface.

Syntax

set interfaces loopback lo ip ospf

delete interfaces loopback lo ip ospf

show interfaces loopback lo ip ospf

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
   loopback lo {
      ip {
         ospf
      }
   }
}
```

Parameters

None.

Default

None.

Usage Guidelines

Use this command to enable the Open Shortest Path First (OSPF) routing protocol on the loopback interface.

Use the **set** form of this command to enable OSPF on the loopback interface.

Use the **delete** form of this command to remove all OSPF configuration and disable OSPF on the loopback interface.

Use the **show** form of this command to display OSPF configuration.

interfaces loopback lo ip ospf authentication

Specifies the authentication method for OSPF on the loopback interface.

Syntax

set interfaces loopback lo ip ospf authentication [**md5 key-id** *key-id* **md5-key** *md5-key* | **plaintext-password** *password*]

delete interfaces loopback lo ip ospf authentication [**md5 key-id** *key-id* **md5-key** | **plaintext-password**]

show interfaces loopback lo ip ospf authentication [**md5 key-id** *key-id* **md5-key** | **plaintext-password**]

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
    loopback lo {
        ip {
            ospf {
                authentication {
                    md5 {
                        key-id 1-255 {
                            md5-key: text
                        }
                    }
                    plaintext-password: text
                }
            }
        }
    }
}
```

Parameters

key-id	The key used to identify the MD5 key. This must be the same on both the sending and receiving systems. The range is 1 to 255.

md5-key	A password-like MD5 key of up to 16 alphanumeric characters to be used as input to the MD5 hashing algorithm. The longer the key, the stronger the security. This must be the same on both the sending and receiving systems.
password	Optional. The password to use in plain-text authentication. This must be eight characters or less and the same on both the sending and receiving systems.

Default

None.

Usage Guidelines

Use this command to specify the authentication method to be used for OSPF on the loopback interface. This authentication is independent of the authentication configured for the OSPF area.

In plain text authentication, passwords are sent through the network in plain text. In MD5 authentication, the system uses the Message Digest 5 (MD5) algorithm to compute a hash value from the contents of the OSPF packet and the password. The hash value and the MD5 key are included in the transmitted packet, and the receiving system (configured with the same password) calculates its own hash function, which must match.

The authentication parameters must be the same for all routers that are to establish two-way communication within a network. If two routers do not agree on these parameters, they will not consider establish adjacencies, and will disregard one another’s communications.

Use the **set** form of this command to set the authentication for the loopback interface.

Use the **delete** form of this command to remove loopback interface authentication configuration information.

Use the **show** form of this command to display loopback interface authentication configuration information.

interfaces loopback lo ip ospf cost <cost>

Sets the routing cost for OSPF on the loopback interface.

Syntax

set interfaces loopback lo ip ospf cost *cost*

delete interfaces loopback lo ip ospf cost

show interfaces loopback lo ip ospf cost

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
    loopback lo {
        ip {
            ospf {
                cost: u32
            }
        }
    }
}
```

Parameters

cost	The link-state metric (OSPF cost) to be advertised in the link-state advertisement (LSA) as the cost of sending packets over the loopback interface. The range is 1 to 65535.

Default

For details on the default of OSPF cost, please see the Usage Guidelines.

Usage Guidelines

Use this command to manually override the default OSPF cost computed by the system for the loopback interface you are configuring. You can only assign one cost per interface.

By default, the metric associated with a link is computed as follows:

```
Cost = 108 / bandwidth
```

The cost of reaching any destination is the sum of the costs of the individual hops. Costs are always rounded to the nearest integer. Costs lower than 1 are rounded up to 1.

Table 5-1 shows the OSPF costs for some common media types.

Table 5-1 OSPF Costs for Common Media Types

Media Type	OSPF Cost
56 Kbps	1785
64 Kbps	1562
128 Kbps	781
256 Kbps	390
512 Kbps	195
768 Kbps	130
T1 (1.544 Mbps)	64
E1 (2.048 Mbps)	48
4 Mbps Token Ring	6
10 Mbps Ethernet	10
16 Mbps Token Ring	6
T3 (44.736 Mbps	2
100+ Mbps	1

The values in Table 5-1show how OSPF fails to distinguish between interfaces faster than 100 Mbps, for example, between Fast Ethernet (100 Mbps) and Gigabit Ethernet (1000 Mbps) interfaces. If you want to distinguish interfaces equal to or greater than 100 Mbps, you must manually configure the cost of the interface using this command.

Use the **set** form of this command to specify the OSPF cost for the loopback interface.

Use the **delete** form of this command to restore the default cost.

Use the **show** form of this command to display cost configuration.

interfaces loopback lo ip ospf dead-interval <interval>

Sets the OSPF dead interval for the loopback interface.

Syntax

set interfaces loopback lo ip ospf dead-interval *interval*

delete interfaces loopback lo ip ospf dead-interval

show interfaces loopback lo ip ospf dead-interval

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
    loopback lo {
        ip {
            ospf {
                dead-interval: u32
            }
        }
    }
}
```

Parameters

interval	Specifies the time, in seconds, that this interface should wait to detect hello packets from neighboring routers before declaring the neighbor down. The range is 1 to 65535. The default is 4 times the hello interval.

Default

The dead interval is 4 times the hello interval.

Usage Guidelines

Use this command to specify the interval during which the loopback interface should expect a hello packet from its neighbor.

If the dead interval passes without the interface receiving a hello packet from the neighbor, the neighbor's status is changed to out-of-service, and all associated state is cleared.

The dead interval must be the same for all routers that are to establish two-way communication within a network. If two routers do not agree on these parameters, they will not establish adjacencies and will disregard one another's communications.

Use the **set** form of this command to specify the dead interval.

Use the **delete** form of this command to restore the default dead interval.

Use the **show** form of this command to display dead interval configuration.

interfaces loopback lo ip ospf hello-interval <interval>

Sets the interval between OSPF hello packets on the loopback interface.

Syntax

set interfaces loopback lo ip ospf hello-interval *interval*

delete interfaces loopback lo ip ospf hello-interval

show interfaces loopback lo ip ospf hello-interval

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
   loopback lo {
      ip {
         ospf {
            hello-interval: u32
         }
      }
   }
}
```

Parameters

interval	Mandatory. The interval, in seconds, between hello packets. This value must be the same for all nodes on the network.The range is 1 to 65535. The default is 10.

Default

Hello packets are sent every 10 seconds.

Usage Guidelines

Use this command to set the interval at which OSPF hello packets are sent for the loopback interface.

A hello packet is an OSPF packet used to detect and maintain relationships with neighbors on the same network (directly connected routers). The greater the interval between hello packets, the less router traffic occurs, but the longer it takes for topological changes to be detected.

The hello interval must be the same for all routers that are to establish two-way communication within a network. If two routers do not agree on these parameters, they will not establish adjacencies and will disregard one another's communications.

Use the **set** form of this command to set the hello interval.

Use the **delete** form of this command to restore the default hello interval.

Use the **show** form of this command to display hello interval configuration.

interfaces loopback lo ip ospf mtu-ignore

Disables MTU mismatch detection for the loopback interface.

Syntax

set interfaces loopback lo ip ospf mtu-ignore

delete interfaces loopback lo ip ospf mtu-ignore

show interfaces loopback lo ip ospf mtu-ignore

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
    loopback lo {
        ip {
            ospf {
                mtu-ignore
            }
        }
    }
}
```

Parameters

None.

Default

MTU mismatch detection is enabled by default.

Usage Guidelines

Use this command to disable MTU mismatch detection on an OSPF interface.

OSPF sends the MTU of the interface in a database description packet. If the MTUs of OSPF neighbors do not match, they cannot form an OSPF adjacency. MTU mismatch detection detects MTU mismatches and indicates them in the form of a debug message.

MTU mismatch is an important troubleshooting feature. If MTU mismatch is not enabled, MTU mismatches can only be detected by examining configuration for both interfaces.

There are some network setups where MTU mismatches are unavoidable, and even part of the normal set-up. It is for these cases only that MTU mismatch detection should be disabled, so that normal OSPF adjacencies can be formed.

Use the **set** form of this command to disable MTU mismatch detection.

Use the **delete** form of this command to re-enable MTU mismatch detection.

Use the **show** form of this command to display OSPF configuration.

interfaces loopback lo ip ospf network <type>

Specifies the OSPF network type for the loopback interface.

Syntax

set interfaces loopback lo ip ospf network [**broadcast** | **non-broadcast** | **point-to-multipoint** | **point-to-point**]

delete interfaces loopback lo ip ospf network

show interfaces loopback lo ip ospf network

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
   loopback lo {
      ip {
         ospf {
            network: text
         }
      }
   }
}
```

Parameters

type	Specifies the network type for this interface. The following values are supported: **broadcast**: This is an interface that supports broadcast mode (such as a LAN link). **non-broadcast**: This is an interface that does not support broadcast mode. **point-to-multipoint**: This is an interface that supports point-to-multipoint mode (such as a PPP interface or a point-to-point logical interface on Frame Relay). **point-to-point**: This is an interface that supports point-to-point mode (such as an NBMA interface). The default is broadcast.

Default

Broadcast is supported.

Usage Guidelines

Use this command to configure and display the network type for the interface.

Use the **set** form of this command to specify the network type.

Use the **delete** form of this command to remove the network type.

Use the **show** form of this command to display the network type.

interfaces loopback lo ip ospf priority <priority>

Specifies the Open Shortest Path First (OSPF) priority for the loopback interface.

Syntax

set interfaces loopback lo ip ospf priority *priority*

delete interfaces loopback lo ip ospf priority

show interfaces loopback lo ip ospf priority

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
   loopback lo {
      ip {
         ospf {
            priority: u32
         }
      }
   }
}
```

Parameters

priority	Specifies the OSPF router priority for this interface. The range is 0 to 255, where a router with priority 0 can never become the designated router. The default is 1.

Default

The loopback interface has an priority of 1.

Usage Guidelines

Use this command to set the priority for the loopback interface on the broadcast network to which the interface is connected. The priority determines which routers are selected as the area’s Designated Router (DR) and Backup Designated Router (BDR).

The DR and BDR are used to reduce the amount of traffic on OSPF overhead on broadcast networks, by reducing the number of adjacent routers to which a router must flood its topological information. In broadcast networks (such as Ethernet), each router establishes an adjacency with only the DR and the BDR, rather than with every router in its area. The DR and the BDR then flood this information to all other routers on the network segment.

Priority can range from 0 to 255. In general, the router with the highest priority is elected as the DR, and the router with the second-highest priority is elected as the BDR. The higher the number, the higher the priority.

Routers with a priority of 0 are ineligible for election.

Use the **set** form of this command to specify the OSPF priority.

Use the **delete** form of this command to restore the default priority.

Use the **show** form of this command to display priority configuration.

interfaces loopback lo ip ospf retransmit-interval <interval>

Sets the OSPF retransmit interval for the loopback interface.

Syntax

set interfaces loopback lo ip ospf retransmit-interval *interval*

delete interfaces loopback lo ip ospf retransmit-interval

show interfaces loopback lo ip ospf retransmit-interval

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
   loopback lo {
      ip {
         ospf {
            retransmit-interval: u32
         }
      }
   }
}
```

Parameters

interval	Specifies the time in seconds to wait for an acknowledgement, after which the system retransmits an LSA packet to its neighbors. The range is 3 to 65535. The default is 5.

Default

Unacknowledged LSAs are retransmitted at 5-second intervals.

Usage Guidelines

Use this command to specify how long an Ethernet interface will wait for an acknowledgment of a link-state update before resending the update.

The link-state update packet is part of the exchange of topology databases between routers. When the initial database description (DD) packet is sent, it contains only the headers of the LSAs. If the receiving router determines that it requires that piece of the OSPF topology, it sends a link state request packet to request the complete LSA from the sending router.

After the update packet is sent, the sending router waits for an acknowledgement, either implicit or explicit, from the receiving router. In an explicit acknowledgement, the receiving router sends a link-state acknowledge (LS-Ack) packet to the router that sent the update. In an implicit acknowledgement, the router that sent the update receives an LSA from the receiving router that contains the update information.

If the retransmit interval passes with neither an explicit nor an implicit acknowledgement, the sending router will retransmit the link-state update packet.

Too high an interval slows network convergence. Too small an interval causes unnecessary retransmission.

Use the **set** form of this command to set the OSPF retransmit interval for the loopback interface.

Use the **delete** form of this command to restore the default retransmit interval.

Use the **show** form of this command to display retransmit interval configuration.

interfaces loopback lo ip ospf transmit-delay <delay>

Specifies the Open Shortest Path First (OSPF) transmit delay for the loopback interface.

Syntax

set interfaces loopback lo ip ospf transmit-delay *delay*

delete interfaces loopback lo ip ospf transmit-delay

show interfaces loopback lo ip ospf transmit-delay

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
    loopback lo {
        ip {
            ospf {
                transmit-delay: u32
            }
        }
    }
}
```

Parameters

delay	Mandatory. The delay, in seconds, between link-state transmits. This value must be the same for all nodes on the network. The range is 1 to 65535. The default is 1.

Default

Link-state transmits occur at 1-second intervals.

Usage Guidelines

Use this command to set the transmit delay on the loopback interface. This is the estimated time required to send a link-state update (LSU) packet.

This timer is used to accommodate transmission and propagation delays on the network, particularly on low-speed networks where delays may be significant. The router increments the age of link-state advertisements in LSU packets to account for these delays.

The value includes both the transmission time and the propagation delay across the network. The transmit delay is added to the age of the LSA packet before the LSA is transmitted The LSA age is used to help the network sequence LSAs, so that it can determine which of competing LSAs is the more recent and trustworthy.

LSAs are numbered in sequence, but the sequence numbers are finite, and so cannot be used as the sole determinant of the most recent LSA. Instead, OSPF also tracks the age of LSAs. Each time the LSA is forwarded to another router, its current age is incremented by the transmit delay. The packet's age, together with its sequence number, helps the receiving router to determine which version of a received LSA is more recent, and therefore to be used.

Use the **set** form of this command to set the transmit delay.

Use the **delete** form of this command to restore the default transmit delay.

Use the **show** form of this command to display transmit delay configuration.

Chapter 6: Serial PPP Interfaces

This chapter describes commands for configuring OSPF on serial interfaces with Point-to-Point Protocol encapsulation.

This chapter presents the following topics:

- Serial PPP Interface OSPF Commands

Serial PPP Interface OSPF Commands

This chapter contains the following commands.

Configuration Commands	
interfaces serial <wanx> ppp vif 1 ip ospf	Enables OSPF on the virtual interface of a PPP serial interface.
interfaces serial <wanx> ppp vif 1 ip ospf authentication	Specifies the authentication method for OSPF on the virtual interface of a PPP serial interface.
interfaces serial <wanx> ppp vif 1 ip ospf bandwidth <bandwidth>	Specifies the bandwidth on the virtual interface of a PPP serial interface for calculating OSPF cost.
interfaces serial <wanx> ppp vif 1 ip ospf cost <cost>	Sets the routing cost for OSPF on the virtual interface of a PPP serial interface.
interfaces serial <wanx> ppp vif 1 ip ospf dead-interval <interval>	Sets the OSPF dead interval for the virtual interface of a PPP serial interface.
interfaces serial <wanx> ppp vif 1 ip ospf hello-interval <interval>	Sets the interval between OSPF hello packets on the virtual interface of a PPP serial interface.
interfaces serial <wanx> ppp vif 1 ip ospf mtu-ignore	Disables MTU mismatch detection for the virtual interface of a PPP serial interface.
interfaces serial <wanx> ppp vif 1 ip ospf network <type>	Specifies the OSPF network type for the virtual interface of a PPP serial interface.
interfaces serial <wanx> ppp vif 1 ip ospf priority <priority>	Sets the OSPF priority for the virtual interface of a PPP serial interface.
interfaces serial <wanx> ppp vif 1 ip ospf retransmit-interval <interval>	Sets the OSPF retransmit interval for the virtual interface of a PPP serial interface.
interfaces serial <wanx> ppp vif 1 ip ospf transmit-delay <delay>	Specifies the OSPF transmit delay for the virtual interface of a PPP serial interface.
Operational Commands	
None.	

interfaces serial <wanx> ppp vif 1 ip ospf

Enables OSPF on the virtual interface of a PPP serial interface.

Syntax

set interfaces serial *wanx* **ppp vif 1 ip ospf**

delete interfaces serial *wanx* **ppp vif 1 ip ospf**

show interfaces serial *wanx* **ppp vif 1**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
    serial wan0..wan23 {
        ppp {
            vif 1 {
                ip ospf
            }
        }
    }
}
```

Parameters

wanx	Mandatory. Multi-node. The identifier for the serial interface you are defining. This may be **wan0** to **wan23**, depending on what serial interfaces that are actually available on the system.
1	The identifier of the virtual interface. Currently, only one vif is supported for PPP interfaces, and the identifier must be 1.

Default

OSPF is not enabled on PPP interfaces.

Usage Guidelines

Use this command to enable the Open Shortest Path First (OSPF) routing protocol on the virtual interface of a Point-to-Point Protocol (PPP) serial interface.

Use the **set** form of this command to enable OSPF on a PPP virtual interface.

Use the **delete** form of this command to disable OSPF on a PPP virtual interface.

Use the **show** form of this command to display PPP virtual interface configuration.

interfaces serial <wanx> ppp vif 1 ip ospf authentication

Specifies the authentication method for OSPF on the virtual interface of a PPP serial interface.

Syntax

set interfaces serial *wanx* **ppp vif 1 ip ospf authentication** [**md5 key-id** *key-id* **md5-key** *md5-key* | **plaintext-password** *password*]

delete interfaces serial *wanx* **ppp vif 1 ip ospf authentication** [**md5 key-id** *key-id* **md5-key** | **plaintext-password**]

show interfaces serial *wanx* **ppp vif 1 ip ospf authentication** [**md5 key-id** *key-id* **md5-key** | **plaintext-password**]

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
    serial wan0..wan23 {
        ppp {
            vif 1 {
                ip {
                    ospf {
                        authentication {
                            md5 {
                                key-id 1-255 {
                                    md5-key: text
                                }
                            }
                            plaintext-password: text
                        }
                    }
                }
            }
        }
    }
}
```

Parameters

wanx	Mandatory. Multi-node. The identifier for the serial interface you are defining. This may be **wan0** to **wan23**, depending on what serial interfaces that are actually available on the system.
1	The identifier of the virtual interface. Currently, only one vif is supported for PPP interfaces, and the identifier must be 1.
key-id	Optional. The key used to identify the MD5 key. This must be the same on both the sending and receiving systems. The range is 1 to 255.
md5-key	Optional. A password-like MD5 key of up to 16 alphanumeric characters to be used as input to the MD5 hashing algorithm. The longer the key, the stronger the security. This must be the same on both the sending and receiving systems.
password	Optional. The password to use in plain-text authentication. This must be eight characters or less and the same on both the sending and receiving systems.

Default

None.

Usage Guidelines

Use this command to specify the authentication method to be used for OSPF on the virtual interface of a PPP serial interface. This authentication is independent of the authentication configured for the OSPF area.

In plain text authentication, passwords are sent through the network in plain text. In MD5 authentication, the system uses the Message Digest 5 (MD5) algorithm to compute a hash value from the contents of the OSPF packet and the password. The hash value and the MD5 key are included in the transmitted packet, and the receiving system (configured with the same password) calculates its own hash function, which must match.

The authentication parameters must be the same for all routers that are to establish two-way communication within a network. If two routers do not agree on these parameters, they will not consider establish adjacencies, and will disregard one another's communications.

Use the **set** form of this command to set the authentication for the virtual interface of a PPP serial interface.

Use the **delete** form of this command to remove interface authentication configuration information.

Use the **show** form of this command to display interface authentication configuration information.

interfaces serial <wanx> ppp vif 1 ip ospf bandwidth <bandwidth>

Specifies the bandwidth on the virtual interface of a PPP serial interface for calculating OSPF cost.

Syntax

set interfaces serial *wanx* **ppp vif 1 ip ospf bandwidth** *bandwidth*

delete interfaces serial *wanx* **ppp vif 1 ip ospf bandwidth**

show interfaces serial *wanx* **ppp vif 1 ip ospf bandwidth**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
    serial wan0..wan23 {
        ppp {
            vif 1 {
                ip {
                    ospf {
                        bandwidth: u32
                    }
                }
            }
        }
    }
}
```

Parameters

wanx	Mandatory. Multi-node. The identifier for the serial interface you are defining. This may be **wan0** to **wan23**, depending on what serial interfaces that are actually available on the system.
1	The identifier of the virtual interface. Currently, only one vif is supported for PPP interfaces, and the identifier must be 1.
bandwidth	The bandwidth of the Ethernet interface in kilobits/sec. The range is 1 to 10000000.

Default

None.

Usage Guidelines

Use this command to specify the bandwidth of the virtual interface of a PPP serial interface for the purpose of computing OSPF cost.

Use the **set** form of this command to specify the bandwidth of the interface.

Use the **delete** form of this command to remove the bandwidth parameter.

Use the **show** form of this command to display the bandwidth configuration.

interfaces serial <wanx> ppp vif 1 ip ospf cost <cost>

Sets the routing cost for OSPF on the virtual interface of a PPP serial interface.

Syntax

set interfaces serial *wanx* **ppp vif 1 ip ospf cost** *cost*

delete interfaces serial *wanx* **ppp vif 1 ip ospf cost**

show interfaces serial *wanx* **ppp vif 1 ip ospf cost**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
    serial wan0..wan23 {
        ppp {
            vif 1 {
                ip {
                    ospf {
                        cost: u32
                    }
                }
            }
        }
    }
}
```

Parameters

wanx	Mandatory. Multi-node. The identifier for the serial interface you are defining. This may be **wan0** to **wan23**, depending on what serial interfaces that are actually available on the system.
1	The identifier of the virtual interface. Currently, only one vif is supported for PPP interfaces, and the identifier must be 1.
cost	The link-state metric (OSPF cost) to be advertised in the link-state advertisement (LSA) as the cost of sending packets over the ethernet interface. The range is 1 to 65535.

Default

For details on the default of OSPF cost, please see the Usage Guidelines.

Usage Guidelines

Use this command to manually override the default OSPF cost computed by the system for the virtual interface of a PPP serial interface. You can only assign one cost per interface.

By default, the metric associated with a link is computed as follows:

```
Cost = 108 / bandwidth
```

The cost of reaching any destination is the sum of the costs of the individual hops. Costs are always rounded to the nearest integer. Costs lower than 1 are rounded up to 1.

Table 6-1 shows the OSPF costs for some common media types.

Table 6-1 OSPF Costs for Common Media Types

Media Type	OSPF Cost
56 Kbps	1785
64 Kbps	1562
128 Kbps	781
256 Kbps	390
512 Kbps	195
768 Kbps	130
T1 (1.544 Mbps)	64
E1 (2.048 Mbps)	48
4 Mbps Token Ring	6
10 Mbps Ethernet	10
16 Mbps Token Ring	6
T3 (44.736 Mbps	2
100+ Mbps	1

The values in Table 6-1 show how OSPF fails to distinguish between interfaces faster than 100 Mbps, for example, between Fast Ethernet (100 Mbps) and Gigabit Ethernet (1000 Mbps) interfaces. If you want to distinguish interfaces equal to or greater than 100 Mbps, you must manually configure the cost of the interface using this command.

Use the **set** form of this command to specify the OSPF cost for the interface.

Use the **delete** form of this command to restore the default cost.

Use the **show** form of this command to display cost configuration.

interfaces serial <wanx> ppp vif 1 ip ospf dead-interval <interval>

Sets the OSPF dead interval for the virtual interface of a PPP serial interface.

Syntax

set interfaces serial *wanx* **ppp vif 1 ip ospf dead-interval** *interval*

delete interfaces serial *wanx* **ppp vif 1 ip ospf dead-interval**

show interfaces serial *wanx* **ppp vif 1 ip ospf dead-interval**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
   serial wan0..wan23 {
      ppp {
         vif 1 {
            ip {
               ospf {
                  dead-interval: u32
               }
            }
         }
      }
   }
}
```

Parameters

wanx	Mandatory. Multi-node. The identifier for the serial interface you are defining. This may be **wan0** to **wan23**, depending on what serial interfaces that are actually available on the system.
1	The identifier of the virtual interface. Currently, only one vif is supported for PPP interfaces, and the identifier must be 1.
interval	Specifies the time, in seconds, that this interface should wait to detect hello packets from neighboring routers before declaring the neighbor down. The range is 1 to 65535. The default is 4 times the hello interval.

Default

The dead interval is 4 times the hello interval.

Usage Guidelines

Use this command to specify the interval during which the virtual interface of a PPP serial interface should expect a hello packet from its neighbor.

If the dead interval passes without the interface receiving a hello packet from the neighbor, the neighbor’s status is changed to out-of-service, and all associated state is cleared.

The dead interval must be the same for all routers that are to establish two-way communication within a network. If two routers do not agree on these parameters, they will not establish adjacencies and will disregard one another’s communications.

Use the **set** form of this command to specify the dead interval.

Use the **delete** form of this command to restore the default dead interval.

Use the **show** form of this command to display dead interval configuration.

interfaces serial <wanx> ppp vif 1 ip ospf hello-interval <interval>

Sets the interval between OSPF hello packets on the virtual interface of a PPP serial interface.

Syntax

set interfaces serial *wanx* **ppp vif 1 ip ospf hello-interval** *interval*

delete interfaces serial *wanx* **ppp vif 1 ip ospf hello-interval**

show interfaces serial *wanx* **ppp vif 1 ip ospf hello-interval**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
    serial wan0..wan23 {
        ppp {
            vif 1 {
                ip {
                    ospf {
                        hello-interval: u32
                    }
                }
            }
        }
    }
}
```

Parameters

wanx	Mandatory. Multi-node. The identifier for the serial interface you are defining. This may be **wan0** to **wan23**, depending on what serial interfaces that are actually available on the system.
1	The identifier of the virtual interface. Currently, only one vif is supported for PPP interfaces, and the identifier must be 1.

interval	Mandatory. The interval, in seconds, between hello packets. This value must be the same for all nodes on the network.The range is 1 to 65535. The default is 10.

Default

Hello packets are sent every 10 seconds.

Usage Guidelines

Use this command to set the interval at which OSPF hello packets are sent for the virtual interface of a PPP serial interface.

A hello packet is an OSPF packet used to detect and maintain relationships with neighbors on the same network (directly connected routers). The greater the interval between hello packets, the less router traffic occurs, but the longer it takes for topological changes to be detected.

The hello interval must be the same for all routers that are to establish two-way communication within a network. If two routers do not agree on these parameters, they will not establish adjacencies and will disregard one another's communications.

Use the **set** form of this command to set the hello interval.

Use the **delete** form of this command to restore the default hello interval.

Use the **show** form of this command to display hello interval configuration.

interfaces serial <wanx> ppp vif 1 ip ospf mtu-ignore

Disables MTU mismatch detection for the virtual interface of a PPP serial interface.

Syntax

set interfaces serial *wanx* **ppp vif 1 ip ospf mtu-ignore**

delete interfaces serial *wanx* **ppp vif 1 ip ospf mtu-ignore**

show interfaces serial *wanx* **ppp vif 1 ip ospf**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
    serial wan0..wan23 {
        ppp {
            vif 1 {
                ip {
                    ospf {
                        mtu-ignore
                    }
                }
            }
        }
    }
}
```

Parameters

wanx	Mandatory. Multi-node. The identifier for the serial interface you are defining. This may be **wan0** to **wan23**, depending on what serial interfaces that are actually available on the system.
1	The identifier of the virtual interface. Currently, only one vif is supported for PPP interfaces, and the identifier must be 1.

Default

MTU mismatch detection is enabled by default.

Usage Guidelines

Use this command to disable MTU mismatch detection on an OSPF interface.

OSPF sends the MTU of the interface in a database description packet. If the MTUs of OSPF neighbors do not match, they cannot form an OSPF adjacency. MTU mismatch detection detects MTU mismatches and indicates them in the form of a debug message.

MTU mismatch is an important troubleshooting feature. If MTU mismatch is not enabled, MTU mismatches can only be detected by examining configuration for both interfaces.

There are some network setups where MTU mismatches are unavoidable, and even part of the normal set-up. It is for these cases only that MTU mismatch detection should be disabled, so that normal OSPF adjacencies can be formed.

Use the **set** form of this command to disable MTU mismatch detection.

Use the **delete** form of this command to re-enable MTU mismatch detection.

Use the **show** form of this command to display OSPF configuration.

interfaces serial <wanx> ppp vif 1 ip ospf network <type>

Specifies the OSPF network type for the virtual interface of a PPP serial interface.

Syntax

set interfaces serial *wanx* **ppp vif 1 ip ospf network** [**broadcast** | **non-broadcast** | **point-to-multipoint** | **point-to-point**]

delete interfaces serial *wanx* **ppp vif 1 ip ospf network**

show interfaces serial *wanx* **ppp vif 1 ip ospf network**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
    serial wan0..wan23 {
        ppp {
            vif 1 {
                ip {
                    ospf {
                        network: text
                    }
                }
            }
        }
    }
}
```

Parameters

wanx	Mandatory. Multi-node. The identifier for the serial interface you are defining. This may be **wan0** to **wan23**, depending on what serial interfaces that are actually available on the system.
1	The identifier of the virtual interface. Currently, only one vif is supported for PPP interfaces, and the identifier must be 1.

type	The network type for this interface. Supported values are as follows: **broadcast**: The interface supports broadcast mode, such as a LAN link. **non-broadcast**: The interface does not support broadcast mode. **point-to-point**: This interface supports point-to-point mode, such as an NBMA interface. **point-to-multipoint**: This interface supports point-to-multipoint mode, such as a PPP interface or a point-to-point logical interface on Frame Relay. The default is broadcast.

Default

Broadcast is supported.

Usage Guidelines

Use this command to configure and display the network type for the interface.

Use the **set** form of this command to specify the network type.

Use the **delete** form of this command to remove the network type.

Use the **show** form of this command to display the network type.

interfaces serial <wanx> ppp vif 1 ip ospf priority <priority>

Sets the OSPF priority for the virtual interface of a PPP serial interface.

Syntax

set interfaces serial *wanx* **ppp vif 1 ip ospf priority** *priority*

delete interfaces serial *wanx* **ppp vif 1 ip ospf priority**

show interfaces serial *wanx* **ppp vif 1 ip ospf priority**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
   serial wan0..wan23 {
      ppp {
         vif 1 {
            ip {
               ospf {
                  priority: u32
               }
            }
         }
      }
   }
}
```

Parameters

wanx	Mandatory. Multi-node. The identifier for the serial interface you are defining. This may be **wan0** to **wan23**, depending on what serial interfaces that are actually available on the system.
1	The identifier of the virtual interface. Currently, only one vif is supported for PPP interfaces, and the identifier must be 1.
priority	Specifies the OSPF router priority for this interface. The range is 0 to 255, where a router with priority 0 can never become the designated router. The default is 1.

Default

An OSPF interface has a priority of 1.

Usage Guidelines

Use this command to set the priority for the virtual interface of a PPP serial interface on the broadcast network to which the interface is connected. The priority determines which routers are selected as the area's Designated Router (DR) and Backup Designated Router (BDR).

The DR and BDR are used to reduce the amount of traffic on OSPF overhead on broadcast networks, by reducing the number of adjacent routers to which a router must flood its topological information. In broadcast networks (such as Ethernet), each router establishes an adjacency with only the DR and the BDR, rather than with every router in its area. The DR and the BDR then flood this information to all other routers on the network segment.

Priority can range from 0 to 255. In general, the router with the highest priority is elected as the DR, and the router with the second-highest priority is elected as the BDR. The higher the number, the higher the priority.

Routers with a priority of 0 are ineligible for election.

Use the **set** form of this command to specify the OSPF priority.

Use the **delete** form of this command to restore the default priority.

Use the **show** form of this command to display priority configuration.

interfaces serial <wanx> ppp vif 1 ip ospf retransmit-interval <interval>

Sets the OSPF retransmit interval for the virtual interface of a PPP serial interface.

Syntax

set interfaces serial *wanx* **ppp vif 1 ip ospf retransmit-interval** *interval*

delete interfaces serial *wanx* **ppp vif 1 ip ospf retransmit-interval**

show interfaces serial *wanx* **ppp vif 1 ip ospf retransmit-interval**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
   serial wan0..wan23 {
      ppp {
         vif 1 {
            ip {
               ospf {
                  retransmit-interval: u32
               }
            }
         }
      }
   }
}
```

Parameters

wanx	Mandatory. Multi-node. The identifier for the serial interface you are defining. This may be **wan0** to **wan23**, depending on what serial interfaces that are actually available on the system.
1	The identifier of the virtual interface. Currently, only one vif is supported for PPP interfaces, and the identifier must be 1.
interval	Specifies the time in seconds to wait for an acknowledgement, after which the system retransmits an LSA packet to its neighbors. The range is 3 to 65535. The default is 5.

Default

Unacknowledged LSAs are retransmitted at 5-second intervals.

Usage Guidelines

Use this command to specify how long the virtual interface of a PPP serial interface will wait for an acknowledgment of a link-state update before resending the update.

The link-state update packet is part of the exchange of topology databases between routers. When the initial database description (DD) packet is sent, it contains only the headers of the LSAs. If the receiving router determines that it requires that piece of the OSPF topology, it sends a link state request packet to request the complete LSA from the sending router.

After the update packet is sent, the sending router waits for an acknowledgement, either implicit or explicit, from the receiving router. In an explicit acknowledgement, the receiving router sends a link-state acknowledge (LS-Ack) packet to the router that sent the update. In an implicit acknowledgement, the router that sent the update receives an LSA from the receiving router that contains the update information.

If the retransmit interval passes with neither an explicit nor an implicit acknowledgement, the sending router will retransmit the link-state update packet.

Too high an interval slows network convergence. Too small an interval causes unnecessary retransmission.

Use the **set** form of this command to set the OSPF retransmit interval for the virtual interface of a PPP serial interface.

Use the **delete** form of this command to restore the default retransmit interval.

Use the **show** form of this command to display retransmit interval configuration.

interfaces serial <wanx> ppp vif 1 ip ospf transmit-delay <delay>

Specifies the OSPF transmit delay for the virtual interface of a PPP serial interface.

Syntax

set interfaces serial *wanx* **ppp vif 1 ip ospf transmit-delay** *delay*

delete interfaces serial *wanx* **ppp vif 1 ip ospf transmit-delay**

show interfaces serial *wanx* **ppp vif 1 ip ospf transmit-delay**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
   serial wan0..wan23 {
      ppp {
         vif 1 {
            ip {
               ospf {
                  transmit-delay: u32
               }
            }
         }
      }
   }
}
```

Parameters

wanx	Mandatory. Multi-node. The identifier for the serial interface you are defining. This may be **wan0** to **wan23**, depending on what serial interfaces that are actually available on the system.
1	The identifier of the virtual interface. Currently, only one vif is supported for PPP interfaces, and the identifier must be 1.
delay	Mandatory. The delay, in seconds, between link-state transmits. This value must be the same for all nodes on the network. The range is 1 to 65535. The default is 1.

Default

Link-state transmits occur at 1-second intervals.

Usage Guidelines

Use this command to set the transmit delay for the virtual interface of a PPP serial interface. This is the estimated time required to send a link-state update (LSU) packet.

This timer is used to accommodate transmission and propagation delays on the network, particularly on low-speed networks where delays may be significant. The router increments the age of link-state advertisements in LSU packets to account for these delays.

The value includes both the transmission time and the propagation delay across the network. The transmit delay is added to the age of the LSA packet before the LSA is transmitted The LSA age is used to help the network sequence LSAs, so that it can determine which of competing LSAs is the more recent and trustworthy.

LSAs are numbered in sequence, but the sequence numbers are finite, and so cannot be used as the sole determinant of the most recent LSA. Instead, OSPF also tracks the age of LSAs. Each time the LSA is forwarded to another router, its current age is incremented by the transmit delay. The packet's age, together with its sequence number, helps the receiving router to determine which version of a received LSA is more recent, and therefore to be used.

Use the **set** form of this command to set the transmit delay.

Use the **delete** form of this command to restore the default transmit delay.

Use the **show** form of this command to display transmit delay configuration.

Chapter 7: Serial Cisco HDLC Interfaces

This chapter describes commands for configuring OSPF on serial interfaces with Cisco HDLC encapsulation.

This chapter presents the following topics:

Serial Cisco HDLC OSPF Commands

This chapter contains the following commands.

Configuration Commands	
interfaces serial <wanx> cisco-hdlc vif 1 ip ospf	Enables OSPF on the virtual interface of a Cisco HDLC serial interface.
interfaces serial <wanx> cisco-hdlc vif 1 ip ospf authentication	Specifies the authentication method for OSPF on the virtual interface of a Cisco HDLC serial interface.
interfaces serial <wanx> cisco-hdlc vif 1 ip ospf bandwidth <bandwidth>	Specifies the bandwidth on the virtual interface of a Cisco HDLC serial interface for calculating OSPF cost.
interfaces serial <wanx> cisco-hdlc vif 1 ip ospf cost <cost>	Sets the routing cost for OSPF on the virtual interface of a Cisco HDLC serial interface.
interfaces serial <wanx> cisco-hdlc vif 1 ip ospf dead-interval <interval>	Sets the OSPF dead interval for the virtual interface of a Cisco HDLC serial interface.
interfaces serial <wanx> cisco-hdlc vif 1 ip ospf hello-interval <interval>	Sets the interval between OSPF hello packets on the virtual interface of a Cisco HDLC serial interface.
interfaces serial <wanx> cisco-hdlc vif 1 ip ospf mtu-ignore	Disables MTU mismatch detection for the virtual interface of a Cisco HDLC serial interface.
interfaces serial <wanx> cisco-hdlc vif 1 ip ospf network <type>	Specifies the OSPF network type for the virtual interface of a Cisco HDLC serial interface.
interfaces serial <wanx> cisco-hdlc vif 1 ip ospf priority <priority>	Sets the OSPF priority for the virtual interface of a Cisco HDLC serial interface.
interfaces serial <wanx> cisco-hdlc vif 1 ip ospf retransmit-interval <interval>	Sets the OSPF retransmit interval for the virtual interface of a Cisco HDLC serial interface.
interfaces serial <wanx> cisco-hdlc vif 1 ip ospf transmit-delay <delay>	Specifies the OSPF transmit delay for the virtual interface of a Cisco HDLC serial interface.
Operational Commands	
None.	

interfaces serial <wanx> cisco-hdlc vif 1 ip ospf

Enables OSPF on the virtual interface of a Cisco HDLC serial interface.

Syntax

set interfaces serial *wanx* **cisco-hdlc vif 1 ip ospf**

delete interfaces serial *wanx* **cisco-hdlc vif 1 ip ospf**

show interfaces serial *wanx* **cisco-hdlc vif 1**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
   serial wan0..wan23 {
      cisco-hdlc {
         vif 1 {
            ip ospf
         }
      }
   }
}
```

Parameters

wanx	Mandatory. Multi-node. The identifier for the serial interface you are defining. This may be **wan0** to **wan23**, depending on what serial interfaces that are actually available on the system.
1	The identifier of the virtual interface. Currently, only one vif is supported for Cisco HDLC interfaces, and the identifier must be 1.

Default

OSPF is not enabled on Cisco HDLC interfaces.

Usage Guidelines

Use this command to enable the Open Shortest Path First (OSPF) routing protocol on the virtual interface of a Cisco HDLC serial interface.

Use the **set** form of this command to enable OSPF on a Cisco HDLC virtual interface.

Use the **delete** form of this command to disable OSPF on a Cisco HDLC virtual interface.

Use the **show** form of this command to display Cisco HDLC virtual interface configuration.

interfaces serial <wanx> cisco-hdlc vif 1 ip ospf authentication

Specifies the authentication method for OSPF on the virtual interface of a Cisco HDLC serial interface.

Syntax

set interfaces serial *wanx* **cisco-hdlc vif 1 ip ospf authentication** [**md5 key-id** *key-id* **md5-key** *md5-key* | **plaintext-password** *password*]

delete interfaces serial *wanx* **cisco-hdlc vif 1 ip ospf authentication** [**md5 key-id** *key-id* **md5-key** | **plaintext-password**]

show interfaces serial *wanx* **cisco-hdlc vif 1 ip ospf authentication** [**md5 key-id** *key-id* **md5-key** | **plaintext-password**]

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
   serial wan0..wan23 {
      cisco-hdlc {
         vif 1 {
            ip {
               ospf {
                  authentication {
                     md5 {
                        key-id 1-255 {
                           md5-key: text
                        }
                     }
                     plaintext-password: text
                  }
               }
            }
         }
      }
   }
}
```

Parameters

wanx	Mandatory. Multi-node. The identifier for the serial interface you are defining. This may be **wan0** to **wan23**, depending on what serial interfaces that are actually available on the system.
1	The identifier of the virtual interface. Currently, only one vif is supported for Cisco HDLC interfaces, and the identifier must be 1.
key-id	Optional. The key used to identify the MD5 key. This must be the same on both the sending and receiving systems. The range is 1 to 255.
md5-key	Optional. A password-like MD5 key of up to 16 alphanumeric characters to be used as input to the MD5 hashing algorithm. The longer the key, the stronger the security. This must be the same on both the sending and receiving systems.
password	Optional. The password to use in plain-text authentication. This must be eight characters or less and the same on both the sending and receiving systems.

Default

None.

Usage Guidelines

Use this command to specify the authentication method to be used for OSPF on the virtual interface of a Cisco HDLC serial interface. This authentication is independent of the authentication configured for the OSPF area.

In plain text authentication, passwords are sent through the network in plain text. In MD5 authentication, the system uses the Message Digest 5 (MD5) algorithm to compute a hash value from the contents of the OSPF packet and the password. The hash value and the MD5 key are included in the transmitted packet, and the receiving system (configured with the same password) calculates its own hash function, which must match.

The authentication parameters must be the same for all routers that are to establish two-way communication within a network. If two routers do not agree on these parameters, they will not consider establish adjacencies, and will disregard one another's communications.

Use the **set** form of this command to set the authentication for the virtual interface of a Cisco HDLC serial interface.

Use the **delete** form of this command to remove interface authentication configuration information.

Use the **show** form of this command to display interface authentication configuration information.

interfaces serial <wanx> cisco-hdlc vif 1 ip ospf bandwidth <bandwidth>

Specifies the bandwidth on the virtual interface of a Cisco HDLC serial interface for calculating OSPF cost.

Syntax

set interfaces serial *wanx* **cisco-hdlc vif 1 ip ospf bandwidth** *bandwidth*

delete interfaces serial *wanx* **cisco-hdlc vif 1 ip ospf bandwidth**

show interfaces serial *wanx* **cisco-hdlc vif 1 ip ospf bandwidth**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
    serial wan0..wan23 {
        cisco-hdlc {
            vif 1 {
                ip {
                    ospf {
                        bandwidth: u32
                    }
                }
            }
        }
    }
}
```

Parameters

wanx	Mandatory. Multi-node. The identifier for the serial interface you are defining. This may be **wan0** to **wan23**, depending on what serial interfaces that are actually available on the system.
1	The identifier of the virtual interface. Currently, only one vif is supported for Cisco HDLC interfaces, and the identifier must be 1.
bandwidth	The bandwidth of the Ethernet interface in kilobits/sec. The range is 1 to 10000000.

Default

None.

Usage Guidelines

Use this command to specify the bandwidth of the virtual interface of a Cisco HDLC serial interface for the purpose of computing OSPF cost.

Use the **set** form of this command to specify the bandwidth of the interface.

Use the **delete** form of this command to remove the bandwidth parameter.

Use the **show** form of this command to display the bandwidth configuration.

interfaces serial <wanx> cisco-hdlc vif 1 ip ospf cost <cost>

Sets the routing cost for OSPF on the virtual interface of a Cisco HDLC serial interface.

Syntax

set interfaces serial *wanx* **cisco-hdlc vif 1 ip ospf cost** *cost*

delete interfaces serial *wanx* **cisco-hdlc vif 1 ip ospf cost**

show interfaces serial *wanx* **cisco-hdlc vif 1 ip ospf cost**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
   serial wan0..wan23 {
      cisco-hdlc {
         vif 1 {
            ip {
               ospf {
                  cost: u32
               }
            }
         }
      }
   }
}
```

Parameters

wanx	Mandatory. Multi-node. The identifier for the serial interface you are defining. This may be **wan0** to **wan23**, depending on what serial interfaces that are actually available on the system.
1	The identifier of the virtual interface. Currently, only one vif is supported for Cisco HDLC interfaces, and the identifier must be 1.
cost	The link-state metric (OSPF cost) to be advertised in the link-state advertisement (LSA) as the cost of sending packets over the ethernet interface. The range is 1 to 65535.

Default

For details on the default of OSPF cost, please see the Usage Guidelines.

Usage Guidelines

Use this command to manually override the default OSPF cost computed by the system for the virtual interface of a Cisco HDLC serial interface. You can only assign one cost per interface.

By default, the metric associated with a link is computed as follows:

```
Cost = 108 / bandwidth
```

The cost of reaching any destination is the sum of the costs of the individual hops. Costs are always rounded to the nearest integer. Costs lower than 1 are rounded up to 1.

Table 7-1 shows the OSPF costs for some common media types.

Table 7-1 OSPF Costs for Common Media Types

Media Type	OSPF Cost
56 Kbps	1785
64 Kbps	1562
128 Kbps	781
256 Kbps	390
512 Kbps	195
768 Kbps	130
T1 (1.544 Mbps)	64
E1 (2.048 Mbps)	48
4 Mbps Token Ring	6
10 Mbps Ethernet	10
16 Mbps Token Ring	6
T3 (44.736 Mbps	2
100+ Mbps	1

The values in Table 7-1 show how OSPF fails to distinguish between interfaces faster than 100 Mbps, for example, between Fast Ethernet (100 Mbps) and Gigabit Ethernet (1000 Mbps) interfaces. If you want to distinguish interfaces equal to or greater than 100 Mbps, you must manually configure the cost of the interface using this command.

Use the **set** form of this command to specify the OSPF cost for the interface.

Use the **delete** form of this command to restore the default cost.

Use the **show** form of this command to display cost configuration.

interfaces serial <wanx> cisco-hdlc vif 1 ip ospf dead-interval <interval>

Sets the OSPF dead interval for the virtual interface of a Cisco HDLC serial interface.

Syntax

set interfaces serial *wanx* **cisco-hdlc vif 1 ip ospf dead-interval** *interval*

delete interfaces serial *wanx* **cisco-hdlc vif 1 ip ospf dead-interval**

show interfaces serial *wanx* **cisco-hdlc vif 1 ip ospf dead-interval**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
   serial wan0..wan23 {
      cisco-hdlc {
         vif 1 {
            ip {
               ospf {
                  dead-interval: u32
               }
            }
         }
      }
   }
}
```

Parameters

wanx	Mandatory. Multi-node. The identifier for the serial interface you are defining. This may be **wan0** to **wan23**, depending on what serial interfaces that are actually available on the system.
1	The identifier of the virtual interface. Currently, only one vif is supported for Cisco HDLC interfaces, and the identifier must be 1.
interval	Specifies the time, in seconds, that this interface should wait to detect hello packets from neighboring routers before declaring the neighbor down. The range is 1 to 65535. The default is 4 times the hello interval.

Default

The dead interval is 4 times the hello interval.

Usage Guidelines

Use this command to specify the interval during which the virtual interface of a Cisco HDLC serial interface should expect a hello packet from its neighbor.

If the dead interval passes without the interface receiving a hello packet from the neighbor, the neighbor's status is changed to out-of-service, and all associated state is cleared.

The dead interval must be the same for all routers that are to establish two-way communication within a network. If two routers do not agree on these parameters, they will not establish adjacencies and will disregard one another's communications.

Use the **set** form of this command to specify the dead interval.

Use the **delete** form of this command to restore the default dead interval.

Use the **show** form of this command to display dead interval configuration.

interfaces serial <wanx> cisco-hdlc vif 1 ip ospf hello-interval <interval>

Sets the interval between OSPF hello packets on the virtual interface of a Cisco HDLC serial interface.

Syntax

set interfaces serial *wanx* **cisco-hdlc vif 1 ip ospf hello-interval** *interval*

delete interfaces serial *wanx* **cisco-hdlc vif 1 ip ospf hello-interval**

show interfaces serial *wanx* **cisco-hdlc vif 1 ip ospf hello-interval**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
    serial wan0..wan23 {
        cisco-hdlc {
            vif 1 {
                ip {
                    ospf {
                        hello-interval: u32
                    }
                }
            }
        }
    }
}
```

Parameters

wanx	Mandatory. Multi-node. The identifier for the serial interface you are defining. This may be **wan0** to **wan23**, depending on what serial interfaces that are actually available on the system.
1	The identifier of the virtual interface. Currently, only one vif is supported for Cisco HDLC interfaces, and the identifier must be 1.

interval	Mandatory. The interval, in seconds, between hello packets. This value must be the same for all nodes on the network.The range is 1 to 65535. The default is 10.

Default

Hello packets are sent every 10 seconds.

Usage Guidelines

Use this command to set the interval at which OSPF hello packets are sent for the virtual interface of a Cisco HDLC serial interface.

A hello packet is an OSPF packet used to detect and maintain relationships with neighbors on the same network (directly connected routers). The greater the interval between hello packets, the less router traffic occurs, but the longer it takes for topological changes to be detected.

The hello interval must be the same for all routers that are to establish two-way communication within a network. If two routers do not agree on these parameters, they will not establish adjacencies and will disregard one another's communications.

Use the **set** form of this command to set the hello interval.

Use the **delete** form of this command to restore the default hello interval.

Use the **show** form of this command to display hello interval configuration.

interfaces serial <wanx> cisco-hdlc vif 1 ip ospf mtu-ignore

Disables MTU mismatch detection for the virtual interface of a Cisco HDLC serial interface.

Syntax

set interfaces serial *wanx* **cisco-hdlc vif 1 ip ospf mtu-ignore**

delete interfaces serial *wanx* **cisco-hdlc vif 1 ip ospf mtu-ignore**

show interfaces serial *wanx* **cisco-hdlc vif 1 ip ospf**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
    serial wan0..wan23 {
        cisco-hdlc {
            vif 1 {
                ip {
                    ospf {
                        mtu-ignore
                    }
                }
            }
        }
    }
}
```

Parameters

wanx	Mandatory. Multi-node. The identifier for the serial interface you are defining. This may be **wan0** to **wan23**, depending on what serial interfaces that are actually available on the system.
1	The identifier of the virtual interface. Currently, only one vif is supported for Cisco HDLC interfaces, and the identifier must be 1.

Default

MTU mismatch detection is enabled by default.

Usage Guidelines

Use this command to disable MTU mismatch detection on an OSPF interface.

OSPF sends the MTU of the interface in a database description packet. If the MTUs of OSPF neighbors do not match, they cannot form an OSPF adjacency. MTU mismatch detection detects MTU mismatches and indicates them in the form of a debug message.

MTU mismatch is an important troubleshooting feature. If MTU mismatch is not enabled, MTU mismatches can only be detected by examining configuration for both interfaces.

There are some network setups where MTU mismatches are unavoidable, and even part of the normal set-up. It is for these cases only that MTU mismatch detection should be disabled, so that normal OSPF adjacencies can be formed.

Use the **set** form of this command to disable MTU mismatch detection.

Use the **delete** form of this command to re-enable MTU mismatch detection.

Use the **show** form of this command to display OSPF configuration.

interfaces serial <wanx> cisco-hdlc vif 1 ip ospf network <type>

Specifies the OSPF network type for the virtual interface of a Cisco HDLC serial interface.

Syntax

set interfaces serial *wanx* **cisco-hdlc vif 1 ip ospf network** [**broadcast** | **non-broadcast** | **point-to-multipoint** | **point-to-point**]

delete interfaces serial *wanx* **cisco-hdlc vif 1 ip ospf network**

show interfaces serial *wanx* **cisco-hdlc vif 1 ip ospf network**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
   serial wan0..wan23 {
      cisco-hdlc {
         vif 1 {
            ip {
               ospf {
                  network: text
               }
            }
         }
      }
   }
}
```

Parameters

wanx	Mandatory. Multi-node. The identifier for the serial interface you are defining. This may be **wan0** to **wan23**, depending on what serial interfaces that are actually available on the system.
1	The identifier of the virtual interface. Currently, only one vif is supported for Cisco HDLC interfaces, and the identifier must be 1.

type	The network type for this interface. Supported values are as follows: **broadcast**: The interface supports broadcast mode, such as a LAN link. **non-broadcast**: The interface does not support broadcast mode. **point-to-point**: This interface supports point-to-point mode, such as an NBMA interface. **point-to-multipoint**: This interface supports point-to-multipoint mode, such as a PPP interface or a point-to-point logical interface on Frame Relay. The default is broadcast.

Default

Broadcast is supported.

Usage Guidelines

Use this command to configure and display the network type for the interface.

Use the **set** form of this command to specify the network type.

Use the **delete** form of this command to remove the network type.

Use the **show** form of this command to display the network type.

interfaces serial <wanx> cisco-hdlc vif 1 ip ospf priority <priority>

Sets the OSPF priority for the virtual interface of a Cisco HDLC serial interface.

Syntax

set interfaces serial *wanx* **cisco-hdlc vif 1 ip ospf priority** *priority*

delete interfaces serial *wanx* **cisco-hdlc vif 1 ip ospf priority**

show interfaces serial *wanx* **cisco-hdlc vif 1 ip ospf priority**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
   serial wan0..wan23 {
      cisco-hdlc {
         vif 1 {
            ip {
               ospf {
                  priority: u32
               }
            }
         }
      }
   }
}
```

Parameters

wanx	Mandatory. Multi-node. The identifier for the serial interface you are defining. This may be **wan0** to **wan23**, depending on what serial interfaces that are actually available on the system.
1	The identifier of the virtual interface. Currently, only one vif is supported for Cisco HDLC interfaces, and the identifier must be 1.
priority	Specifies the OSPF router priority for this interface. The range is 0 to 255, where a router with priority 0 can never become the designated router. The default is 1.

Default

An OSPF interface has a priority of 1.

Usage Guidelines

Use this command to set the priority for the virtual interface of a Cisco HDLC serial interface on the broadcast network to which the interface is connected. The priority determines which routers are selected as the area’s Designated Router (DR) and Backup Designated Router (BDR).

The DR and BDR are used to reduce the amount of traffic on OSPF overhead on broadcast networks, by reducing the number of adjacent routers to which a router must flood its topological information. In broadcast networks (such as Ethernet), each router establishes an adjacency with only the DR and the BDR, rather than with every router in its area. The DR and the BDR then flood this information to all other routers on the network segment.

Priority can range from 0 to 255. In general, the router with the highest priority is elected as the DR, and the router with the second-highest priority is elected as the BDR. The higher the number, the higher the priority.

Routers with a priority of 0 are ineligible for election.

Use the **set** form of this command to specify the OSPF priority.

Use the **delete** form of this command to restore the default priority.

Use the **show** form of this command to display priority configuration.

interfaces serial <wanx> cisco-hdlc vif 1 ip ospf retransmit-interval <interval>

Sets the OSPF retransmit interval for the virtual interface of a Cisco HDLC serial interface.

Syntax

set interfaces serial *wanx* **cisco-hdlc vif 1 ip ospf retransmit-interval** *interval*

delete interfaces serial *wanx* **cisco-hdlc vif 1 ip ospf retransmit-interval**

show interfaces serial *wanx* **cisco-hdlc vif 1 ip ospf retransmit-interval**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
   serial wan0..wan23 {
      cisco-hdlc {
         vif 1 {
            ip {
               ospf {
                  retransmit-interval: u32
               }
            }
         }
      }
   }
}
```

Parameters

wanx	Mandatory. Multi-node. The identifier for the serial interface you are defining. This may be **wan0** to **wan23**, depending on what serial interfaces that are actually available on the system.
1	The identifier of the virtual interface. Currently, only one vif is supported for Cisco HDLC interfaces, and the identifier must be 1.
interval	Specifies the time in seconds to wait for an acknowledgement, after which the system retransmits an LSA packet to its neighbors. The range is 3 to 65535. The default is 5.

Default

Unacknowledged LSAs are retransmitted at 5-second intervals.

Usage Guidelines

Use this command to specify how long the virtual interface of a Cisco HDLC serial interface will wait for an acknowledgment of a link-state update before resending the update.

The link-state update packet is part of the exchange of topology databases between routers. When the initial database description (DD) packet is sent, it contains only the headers of the LSAs. If the receiving router determines that it requires that piece of the OSPF topology, it sends a link state request packet to request the complete LSA from the sending router.

After the update packet is sent, the sending router waits for an acknowledgement, either implicit or explicit, from the receiving router. In an explicit acknowledgement, the receiving router sends a link-state acknowledge (LS-Ack) packet to the router that sent the update. In an implicit acknowledgement, the router that sent the update receives an LSA from the receiving router that contains the update information.

If the retransmit interval passes with neither an explicit nor an implicit acknowledgement, the sending router will retransmit the link-state update packet.

Too high an interval slows network convergence. Too small an interval causes unnecessary retransmission.

Use the **set** form of this command to set the OSPF retransmit interval for the virtual interface of a Cisco HDLC serial interface.

Use the **delete** form of this command to restore the default retransmit interval.

Use the **show** form of this command to display retransmit interval configuration.

interfaces serial <wanx> cisco-hdlc vif 1 ip ospf transmit-delay <delay>

Specifies the OSPF transmit delay for the virtual interface of a Cisco HDLC serial interface.

Syntax

set interfaces serial *wanx* **cisco-hdlc vif 1 ip ospf transmit-delay** *delay*

delete interfaces serial *wanx* **cisco-hdlc vif 1 ip ospf transmit-delay**

show interfaces serial *wanx* **cisco-hdlc vif 1 ip ospf transmit-delay**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
   serial wan0..wan23 {
      cisco-hdlc {
         vif 1 {
            ip {
               ospf {
                  transmit-delay: u32
               }
            }
         }
      }
   }
}
```

Parameters

wanx	Mandatory. Multi-node. The identifier for the serial interface you are defining. This may be **wan0** to **wan23**, depending on what serial interfaces that are actually available on the system.
1	The identifier of the virtual interface. Currently, only one vif is supported for Cisco HDLC interfaces, and the identifier must be 1.

delay	Mandatory. The delay, in seconds, between link-state transmits. This value must be the same for all nodes on the network. The range is 1 to 65535. The default is 1.

Default

Link-state transmits occur at 1-second intervals.

Usage Guidelines

Use this command to set the transmit delay for the virtual interface of a Cisco HDLC serial interface. This is the estimated time required to send a link-state update (LSU) packet.

This timer is used to accommodate transmission and propagation delays on the network, particularly on low-speed networks where delays may be significant. The router increments the age of link-state advertisements in LSU packets to account for these delays.

The value includes both the transmission time and the propagation delay across the network. The transmit delay is added to the age of the LSA packet before the LSA is transmitted The LSA age is used to help the network sequence LSAs, so that it can determine which of competing LSAs is the more recent and trustworthy.

LSAs are numbered in sequence, but the sequence numbers are finite, and so cannot be used as the sole determinant of the most recent LSA. Instead, OSPF also tracks the age of LSAs. Each time the LSA is forwarded to another router, its current age is incremented by the transmit delay. The packet’s age, together with its sequence number, helps the receiving router to determine which version of a received LSA is more recent, and therefore to be used.

Use the **set** form of this command to set the transmit delay.

Use the **delete** form of this command to restore the default transmit delay.

Use the **show** form of this command to display transmit delay configuration.

Chapter 8: Serial Frame Relay Interfaces

This chapter describes commands for configuring OSPF on serial interfaces with Frame Relay encapsulation.

This chapter presents the following topics:

Frame Relay Interface OSPF Commands

This chapter contains the following commands.

Configuration Commands	
interfaces serial <wanx> frame-relay vif <dlci> ip ospf	Enables OSPF on the virtual interface of a Frame Relay serial interface.
interfaces serial <wanx> frame-relay vif <dlci> ip ospf authentication	Specifies the authentication method for OSPF on the virtual interface of a Frame Relay serial interface.
interfaces serial <wanx> frame-relay vif <dlci> ip ospf bandwidth <bandwidth>	Specifies the bandwidth on the virtual interface of a Frame Relay serial interface for calculating OSPF cost.
interfaces serial <wanx> frame-relay vif <dlci> ip ospf cost <cost>	Sets the routing cost for OSPF on the virtual interface of a Frame Relay serial interface.
interfaces serial <wanx> frame-relay vif <dlci> ip ospf dead-interval <interval>	Sets the OSPF dead interval for the virtual interface of a Frame Relay serial interface.
interfaces serial <wanx> frame-relay vif <dlci> ip ospf hello-interval <interval>	Sets the interval between OSPF hello packets on the virtual interface of a Frame Relay serial interface.
interfaces serial <wanx> frame-relay vif <dlci> ip ospf mtu-ignore	Disables MTU mismatch detection for the virtual interface of a Frame Relay serial interface.
interfaces serial <wanx> frame-relay vif <dlci> ip ospf network <type>	Specifies the OSPF network type for the virtual interface of a Frame Relay serial interface.
interfaces serial <wanx> frame-relay vif <dlci> ip ospf priority <priority>	Sets the OSPF priority for the virtual interface of a Frame Relay serial interface.
interfaces serial <wanx> frame-relay vif <dlci> ip ospf retransmit-interval <interval>	Sets the OSPF retransmit interval for the virtual interface of a Frame Relay serial interface.
interfaces serial <wanx> frame-relay vif <dlci> ip ospf transmit-delay <delay>	Specifies the OSPF transmit delay for the virtual interface of a Frame Relay serial interface.
Operational Commands	
None.	

interfaces serial <wanx> frame-relay vif <dlci> ip ospf

Enables OSPF on the virtual interface of a Frame Relay serial interface.

Syntax

set interfaces serial *wanx* **frame-relay vif** *dlci* **ip ospf**

delete interfaces serial *wanx* **frame-relay vif** *dlci* **ip ospf**

show interfaces serial *wanx* **frame-relay vif** *dlci*

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
   serial wan0..wan23 {
      frame-relay {
         vif 16-991 {
            ip ospf
         }
      }
   }
}
```

Parameters

wanx	Mandatory. Multi-node. The identifier for the serial interface you are defining. This may be **wan0** to **wan23**, depending on what serial interfaces that are actually available on the system.
dlci	The identifier of the virtual interface. For Frame Relay interfaces, this is the DLCI number for the interface. The range is 16 to 991.

Default

OSPF is not enabled on Frame Relay interfaces.

Usage Guidelines

Use this command to enable the Open Shortest Path First (OSPF) routing protocol on a virtual interface of a Frame Relay serial interface.

Use the **set** form of this command to enable OSPF on a Frame Relay virtual interface.

Use the **delete** form of this command to disable OSPF on a Frame Relay virtual interface.

Use the **show** form of this command to display Frame Relay virtual interface configuration.

interfaces serial <wanx> frame-relay vif <dlci> ip ospf authentication

Specifies the authentication method for OSPF on the virtual interface of a Frame Relay serial interface.

Syntax

set interfaces serial *wanx* **frame-relay vif** *dlci* **ip ospf authentication** [**md5 key-id** *key-id* **md5-key** *md5-key* | **plaintext-password** *password*]

delete interfaces serial *wanx* **frame-relay vif dlci ip ospf authentication** [**md5 key-id** *key-id* **md5-key** | **plaintext-password**]

show interfaces serial *wanx* **frame-relay vif dlci ip ospf authentication** [**md5 key-id** *key-id* **md5-key** | **plaintext-password**]

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
    serial wan0..wan23 {
        frame-relay {
            vif 16-991 {
                ip {
                    ospf {
                        authentication {
                            md5 {
                                key-id 1-255 {
                                    md5-key: text
                                }
                            }
                            plaintext-password: text
                        }
                    }
                }
            }
        }
    }
}
```

Parameters

wanx	Mandatory. Multi-node. The identifier for the serial interface you are defining. This may be **wan0** to **wan23**, depending on what serial interfaces that are actually available on the system.
dlci	The identifier of the virtual interface. For Frame Relay interfaces, this is the DLCI number for the interface. The range is 16 to 991.
key-id	Optional. The key used to identify the MD5 key. This must be the same on both the sending and receiving systems. The range is 1 to 255.
md5-key	Optional. A password-like MD5 key of up to 16 alphanumeric characters to be used as input to the MD5 hashing algorithm. The longer the key, the stronger the security. This must be the same on both the sending and receiving systems.
password	Optional. The password to use in plain-text authentication. This must be eight characters or less and the same on both the sending and receiving systems.

Default

None.

Usage Guidelines

Use this command to specify the authentication method to be used for OSPF on the virtual interface of a Frame Relay serial interface. This authentication is independent of the authentication configured for the OSPF area.

In plain text authentication, passwords are sent through the network in plain text. In MD5 authentication, the system uses the Message Digest 5 (MD5) algorithm to compute a hash value from the contents of the OSPF packet and the password. The hash value and the MD5 key are included in the transmitted packet, and the receiving system (configured with the same password) calculates its own hash function, which must match.

The authentication parameters must be the same for all routers that are to establish two-way communication within a network. If two routers do not agree on these parameters, they will not consider establish adjacencies, and will disregard one another's communications.

Use the **set** form of this command to set the authentication for the virtual interface of a Cisco HDLC serial interface.

Use the **delete** form of this command to remove interface authentication configuration information.

Use the **show** form of this command to display interface authentication configuration information.

interfaces serial <wanx> frame-relay vif <dlci> ip ospf bandwidth <bandwidth>

Specifies the bandwidth on the virtual interface of a Frame Relay serial interface for calculating OSPF cost.

Syntax

set interfaces serial *wanx* **frame-relay vif dlci ip ospf bandwidth** *bandwidth*

delete interfaces serial *wanx* **frame-relay vif dlci ip ospf bandwidth**

show interfaces serial *wanx* **frame-relay vif dlci ip ospf bandwidth**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
   serial wan0..wan23 {
      frame-relay {
         vif 16-991 {
            ip {
               ospf {
                  bandwidth: u32
               }
            }
         }
      }
   }
}
```

Parameters

wanx	Mandatory. Multi-node. The identifier for the serial interface you are defining. This may be **wan0** to **wan23**, depending on what serial interfaces that are actually available on the system.
dlci	The identifier of the virtual interface. For Frame Relay interfaces, this is the DLCI number for the interface. The range is 16 to 991.
bandwidth	The bandwidth of the Ethernet interface in kilobits/sec. The range is 1 to 10000000.

Default

None.

Usage Guidelines

Use this command to specify the bandwidth of the virtual interface of a Frame Relay serial interface for the purpose of computing OSPF cost.

Use the **set** form of this command to specify the bandwidth of the interface.

Use the **delete** form of this command to remove the bandwidth parameter.

Use the **show** form of this command to display the bandwidth configuration.

interfaces serial <wanx> frame-relay vif <dlci> ip ospf cost <cost>

Sets the routing cost for OSPF on the virtual interface of a Frame Relay serial interface.

Syntax

set interfaces serial *wanx* **frame-relay vif dlci ip ospf cost** *cost*

delete interfaces serial *wanx* **frame-relay vif dlci ip ospf cost**

show interfaces serial *wanx* **frame-relay vif dlci ip ospf cost**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
   serial wan0..wan23 {
      frame-relay {
         vif 16-991 {
            ip {
               ospf {
                  cost: u32
               }
            }
         }
      }
   }
}
```

Parameters

wanx	Mandatory. Multi-node. The identifier for the serial interface you are defining. This may be **wan0** to **wan23**, depending on what serial interfaces that are actually available on the system.
dlci	The identifier of the virtual interface. For Frame Relay interfaces, this is the DLCI number for the interface. The range is 16 to 991.
cost	The link-state metric (OSPF cost) to be advertised in the link-state advertisement (LSA) as the cost of sending packets over the ethernet interface. The range is 1 to 65535.

Default

For details on the default of OSPF cost, please see the Usage Guidelines.

Usage Guidelines

Use this command to manually override the default OSPF cost computed by the system for the virtual interface of a Frame Relay serial interface. You can only assign one cost per interface.

By default, the metric associated with a link is computed as follows:

```
Cost = 108 / bandwidth
```

The cost of reaching any destination is the sum of the costs of the individual hops. Costs are always rounded to the nearest integer. Costs lower than 1 are rounded up to 1.

Table 8-1 shows the OSPF costs for some common media types.

Table 8-1 OSPF Costs for Common Media Types

Media Type	OSPF Cost
56 Kbps	1785
64 Kbps	1562
128 Kbps	781
256 Kbps	390
512 Kbps	195
768 Kbps	130
T1 (1.544 Mbps)	64
E1 (2.048 Mbps)	48
4 Mbps Token Ring	6
10 Mbps Ethernet	10
16 Mbps Token Ring	6
T3 (44.736 Mbps	2
100+ Mbps	1

The values in Table 8-1 show how OSPF fails to distinguish between interfaces faster than 100 Mbps, for example, between Fast Ethernet (100 Mbps) and Gigabit Ethernet (1000 Mbps) interfaces. If you want to distinguish interfaces equal to or greater than 100 Mbps, you must manually configure the cost of the interface using this command.

Use the **set** form of this command to specify the OSPF cost for the interface.

Use the **delete** form of this command to restore the default cost.

Use the **show** form of this command to display cost configuration.

interfaces serial <wanx> frame-relay vif <dlci> ip ospf dead-interval <interval>

Sets the OSPF dead interval for the virtual interface of a Frame Relay serial interface.

Syntax

set interfaces serial *wanx* **frame-relay vif dlci ip ospf dead-interval** *interval*

delete interfaces serial *wanx* **frame-relay vif dlci ip ospf dead-interval**

show interfaces serial *wanx* **frame-relay vif dlci ip ospf dead-interval**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
   serial wan0..wan23 {
      frame-relay {
         vif 16-991 {
            ip {
               ospf {
                  dead-interval: u32
               }
            }
         }
      }
   }
}
```

Parameters

wanx	Mandatory. Multi-node. The identifier for the serial interface you are defining. This may be **wan0** to **wan23**, depending on what serial interfaces that are actually available on the system.
dlci	The identifier of the virtual interface. For Frame Relay interfaces, this is the DLCI number for the interface. The range is 16 to 991.
interval	Specifies the time, in seconds, that this interface should wait to detect hello packets from neighboring routers before declaring the neighbor down. The range is 1 to 65535. The default is 4 times the hello interval.

Default

The dead interval is 4 times the hello interval.

Usage Guidelines

Use this command to specify the interval during which the virtual interface of a Frame Relay serial interface should expect a hello packet from its neighbor.

If the dead interval passes without the interface receiving a hello packet from the neighbor, the neighbor's status is changed to out-of-service, and all associated state is cleared.

The dead interval must be the same for all routers that are to establish two-way communication within a network. If two routers do not agree on these parameters, they will not establish adjacencies and will disregard one another's communications.

Use the **set** form of this command to specify the dead interval.

Use the **delete** form of this command to restore the default dead interval.

Use the **show** form of this command to display dead interval configuration.

interfaces serial <wanx> frame-relay vif <dlci> ip ospf hello-interval <interval>

Sets the interval between OSPF hello packets on the virtual interface of a Frame Relay serial interface.

Syntax

set interfaces serial *wanx* **frame-relay vif dlci ip ospf hello-interval** *interval*

delete interfaces serial *wanx* **frame-relay vif dlci ip ospf hello-interval**

show interfaces serial *wanx* **frame-relay vif dlci ip ospf hello-interval**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
   serial wan0..wan23 {
      frame-relay {
         vif 16-991 {
            ip {
               ospf {
                  hello-interval: u32
               }
            }
         }
      }
   }
}
```

Parameters

wanx	Mandatory. Multi-node. The identifier for the serial interface you are defining. This may be **wan0** to **wan23**, depending on what serial interfaces that are actually available on the system.
dlci	The identifier of the virtual interface. For Frame Relay interfaces, this is the DLCI number for the interface. The range is 16 to 991.

interval	Mandatory. The interval, in seconds, between hello packets. This value must be the same for all nodes on the network.The range is 1 to 65535. The default is 10.

Default

Hello packets are sent every 10 seconds.

Usage Guidelines

Use this command to set the interval at which OSPF hello packets are sent for the virtual interface of a Frame Relay serial interface.

A hello packet is an OSPF packet used to detect and maintain relationships with neighbors on the same network (directly connected routers). The greater the interval between hello packets, the less router traffic occurs, but the longer it takes for topological changes to be detected.

The hello interval must be the same for all routers that are to establish two-way communication within a network. If two routers do not agree on these parameters, they will not establish adjacencies and will disregard one another’s communications.

Use the **set** form of this command to set the hello interval.

Use the **delete** form of this command to restore the default hello interval.

Use the **show** form of this command to display hello interval configuration.

interfaces serial <wanx> frame-relay vif <dlci> ip ospf mtu-ignore

Disables MTU mismatch detection for the virtual interface of a Frame Relay serial interface.

Syntax

set interfaces serial *wanx* **frame-relay vif dlci ip ospf mtu-ignore**

delete interfaces serial *wanx* **frame-relay vif dlci ip ospf mtu-ignore**

show interfaces serial *wanx* **frame-relay vif dlci ip ospf**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
   serial wan0..wan23 {
      frame-relay {
         vif 16-991 {
            ip {
               ospf {
                  mtu-ignore
               }
            }
         }
      }
   }
}
```

Parameters

wanx	Mandatory. Multi-node. The identifier for the serial interface you are defining. This may be **wan0** to **wan23**, depending on what serial interfaces that are actually available on the system.
dlci	The identifier of the virtual interface. For Frame Relay interfaces, this is the DLCI number for the interface. The range is 16 to 991.

Default

MTU mismatch detection is enabled by default.

Usage Guidelines

Use this command to disable MTU mismatch detection on an OSPF interface.

OSPF sends the MTU of the interface in a database description packet. If the MTUs of OSPF neighbors do not match, they cannot form an OSPF adjacency. MTU mismatch detection detects MTU mismatches and indicates them in the form of a debug message.

MTU mismatch is an important troubleshooting feature. If MTU mismatch is not enabled, MTU mismatches can only be detected by examining configuration for both interfaces.

There are some network setups where MTU mismatches are unavoidable, and even part of the normal set-up. It is for these cases only that MTU mismatch detection should be disabled, so that normal OSPF adjacencies can be formed.

Use the **set** form of this command to disable MTU mismatch detection.

Use the **delete** form of this command to re-enable MTU mismatch detection.

Use the **show** form of this command to display OSPF configuration.

interfaces serial <wanx> frame-relay vif <dlci> ip ospf network <type>

Specifies the OSPF network type for the virtual interface of a Frame Relay serial interface.

Syntax

set interfaces serial *wanx* **frame-relay vif dlci ip ospf network** [**broadcast** | **non-broadcast** | **point-to-multipoint** | **point-to-point**]

delete interfaces serial *wanx* **frame-relay vif dlci ip ospf network**

show interfaces serial *wanx* **frame-relay vif dlci ip ospf network**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
   serial wan0..wan23 {
      frame-relay {
         vif 16-991 {
            ip {
               ospf {
                  network: text
               }
            }
         }
      }
   }
}
```

Parameters

wanx	Mandatory. Multi-node. The identifier for the serial interface you are defining. This may be **wan0** to **wan23**, depending on what serial interfaces that are actually available on the system.
dlci	The identifier of the virtual interface. For Frame Relay interfaces, this is the DLCI number for the interface. The range is 16 to 991.

type	The network type for this interface. Supported values are as follows: **broadcast**: The interface supports broadcast mode, such as a LAN link. **non-broadcast**: The interface does not support broadcast mode. **point-to-point**: This interface supports point-to-point mode, such as an NBMA interface. **point-to-multipoint**: This interface supports point-to-multipoint mode, such as a PPP interface or a point-to-point logical interface on Frame Relay. The default is broadcast.

Default

Broadcast is supported.

Usage Guidelines

Use this command to configure and display the network type for the interface.

Use the **set** form of this command to specify the network type.

Use the **delete** form of this command to remove the network type.

Use the **show** form of this command to display the network type.

interfaces serial <wanx> frame-relay vif <dlci> ip ospf priority <priority>

Sets the OSPF priority for the virtual interface of a Frame Relay serial interface.

Syntax

set interfaces serial *wanx* **frame-relay vif dlci ip ospf priority** *priority*

delete interfaces serial *wanx* **frame-relay vif dlci ip ospf priority**

show interfaces serial *wanx* **frame-relay vif dlci ip ospf priority**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
   serial wan0..wan23 {
      frame-relay {
         vif 16-991 {
            ip {
               ospf {
                  priority: u32
               }
            }
         }
      }
   }
}
```

Parameters

wanx	Mandatory. Multi-node. The identifier for the serial interface you are defining. This may be **wan0** to **wan23**, depending on what serial interfaces that are actually available on the system.
dlci	The identifier of the virtual interface. For Frame Relay interfaces, this is the DLCI number for the interface. The range is 16 to 991.
priority	Specifies the OSPF router priority for this interface. The range is 0 to 255, where a router with priority 0 can never become the designated router. The default is 1.

Default

An OSPF interface has a priority of 1.

Usage Guidelines

Use this command to set the priority for the virtual interface of a Frame Relay serial interface on the broadcast network to which the interface is connected. The priority determines which routers are selected as the area's Designated Router (DR) and Backup Designated Router (BDR).

The DR and BDR are used to reduce the amount of traffic on OSPF overhead on broadcast networks, by reducing the number of adjacent routers to which a router must flood its topological information. In broadcast networks (such as Ethernet), each router establishes an adjacency with only the DR and the BDR, rather than with every router in its area. The DR and the BDR then flood this information to all other routers on the network segment.

Priority can range from 0 to 255. In general, the router with the highest priority is elected as the DR, and the router with the second-highest priority is elected as the BDR. The higher the number, the higher the priority.

Routers with a priority of 0 are ineligible for election.

Use the **set** form of this command to specify the OSPF priority.

Use the **delete** form of this command to restore the default priority.

Use the **show** form of this command to display priority configuration.

interfaces serial <wanx> frame-relay vif <dlci> ip ospf retransmit-interval <interval>

Sets the OSPF retransmit interval for the virtual interface of a Frame Relay serial interface.

Syntax

set interfaces serial *wanx* **frame-relay vif dlci ip ospf retransmit-interval** *interval*

delete interfaces serial *wanx* **frame-relay vif dlci ip ospf retransmit-interval**

show interfaces serial *wanx* **frame-relay vif dlci ip ospf retransmit-interval**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
    serial wan0..wan23 {
        frame-relay {
            vif 16-991 {
                ip {
                    ospf {
                        retransmit-interval: u32
                    }
                }
            }
        }
    }
}
```

Parameters

wanx	Mandatory. Multi-node. The identifier for the serial interface you are defining. This may be **wan0** to **wan23**, depending on what serial interfaces that are actually available on the system.
dlci	The identifier of the virtual interface. For Frame Relay interfaces, this is the DLCI number for the interface. The range is 16 to 991.
interval	Specifies the time in seconds to wait for an acknowledgement, after which the system retransmits an LSA packet to its neighbors. The range is 3 to 65535. The default is 5.

Default

Unacknowledged LSAs are retransmitted at 5-second intervals.

Usage Guidelines

Use this command to specify how long the virtual interface of a Frame Relay serial interface will wait for an acknowledgment of a link-state update before resending the update.

The link-state update packet is part of the exchange of topology databases between routers. When the initial database description (DD) packet is sent, it contains only the headers of the LSAs. If the receiving router determines that it requires that piece of the OSPF topology, it sends a link state request packet to request the complete LSA from the sending router.

After the update packet is sent, the sending router waits for an acknowledgement, either implicit or explicit, from the receiving router. In an explicit acknowledgement, the receiving router sends a link-state acknowledge (LS-Ack) packet to the router that sent the update. In an implicit acknowledgement, the router that sent the update receives an LSA from the receiving router that contains the update information.

If the retransmit interval passes with neither an explicit nor an implicit acknowledgement, the sending router will retransmit the link-state update packet.

Too high an interval slows network convergence. Too small an interval causes unnecessary retransmission.

Use the **set** form of this command to set the OSPF retransmit interval for the virtual interface of a Frame Relay serial interface.

Use the **delete** form of this command to restore the default retransmit interval.

Use the **show** form of this command to display retransmit interval configuration.

interfaces serial <wanx> frame-relay vif <dlci> ip ospf transmit-delay <delay>

Specifies the OSPF transmit delay for the virtual interface of a Frame Relay serial interface.

Syntax

set interfaces serial *wanx* **frame-relay vif dlci ip ospf transmit-delay** *delay*

delete interfaces serial *wanx* **frame-relay vif dlci ip ospf transmit-delay**

show interfaces serial *wanx* **frame-relay vif dlci ip ospf transmit-delay**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
   serial wan0..wan23 {
      frame-relay {
         vif 16-991 {
            ip {
               ospf {
                  transmit-delay: u32
               }
            }
         }
      }
   }
}
```

Parameters

wanx	Mandatory. Multi-node. The identifier for the serial interface you are defining. This may be **wan0** to **wan23**, depending on what serial interfaces that are actually available on the system.
dlci	The identifier of the virtual interface. For Frame Relay interfaces, this is the DLCI number for the interface. The range is 16 to 991.
delay	Mandatory. The delay, in seconds, between link-state transmits. This value must be the same for all nodes on the network. The range is 1 to 65535. The default is 1.

Default

Link-state transmits occur at 1-second intervals.

Usage Guidelines

Use this command to set the transmit delay for the virtual interface of a Frame Relay serial interface. This is the estimated time required to send a link-state update (LSU) packet.

This timer is used to accommodate transmission and propagation delays on the network, particularly on low-speed networks where delays may be significant. The router increments the age of link-state advertisements in LSU packets to account for these delays.

The value includes both the transmission time and the propagation delay across the network. The transmit delay is added to the age of the LSA packet before the LSA is transmitted The LSA age is used to help the network sequence LSAs, so that it can determine which of competing LSAs is the more recent and trustworthy.

LSAs are numbered in sequence, but the sequence numbers are finite, and so cannot be used as the sole determinant of the most recent LSA. Instead, OSPF also tracks the age of LSAs. Each time the LSA is forwarded to another router, its current age is incremented by the transmit delay. The packet's age, together with its sequence number, helps the receiving router to determine which version of a received LSA is more recent, and therefore to be used.

Use the **set** form of this command to set the transmit delay.

Use the **delete** form of this command to restore the default transmit delay.

Use the **show** form of this command to display transmit delay configuration.

Chapter 9: DSL Classical IPOA Interfaces

This chapter describes commands for configuring OSPF on DSL interfaces with Classical Internet Protocol over Asynchronous Transfer Mode (Classical IPOA) encapsulation.

This chapter presents the following topics:

- DSL Classical IPOA Interface OSPF Commands

DSL Classical IPOA Interface OSPF Commands

This chapter contains the following commands.

Configuration Commands	
interfaces adsl <adslx> pvc <pvc-id> classical-ipoa ip ospf	Enables OSPF on an ADSL PVC with Classical IPOA encapsulation.
interfaces adsl <adslx> pvc <pvc-id> classical-ipoa ip ospf authentication	Specifies the authentication method for OSPF on an ADSL PVC with Classical IPOA encapsulation.
interfaces adsl <adslx> pvc <pvc-id> classical-ipoa ip ospf bandwidth <bandwidth>	Specifies the bandwidth of an ADSL PVC with Classical IPOA encapsulation for calculating OSPF cost.
interfaces adsl <adslx> pvc <pvc-id> classical-ipoa ip ospf cost <cost>	Sets the routing cost for OSPF on an ADSL PVC with Classical IPOA encapsulation.
interfaces adsl <adslx> pvc <pvc-id> classical-ipoa ip ospf dead-interval <interval>	Sets the OSPF dead interval for an ADSL PVC with Classical IPOA encapsulation.
interfaces adsl <adslx> pvc <pvc-id> classical-ipoa ip ospf hello-interval <interval>	Sets the interval between OSPF hello packets on an ADSL PVC with Classical IPOA encapsulation.
interfaces adsl <adslx> pvc <pvc-id> classical-ipoa ip ospf mtu-ignore	Disables MTU mismatch detection for an ADSL PVC with Classical IPOA encapsulation.
interfaces adsl <adslx> pvc <pvc-id> classical-ipoa ip ospf network <type>	Specifies the OSPF network type for an ADSL PVC with Classical IPOA encapsulation.
interfaces adsl <adslx> pvc <pvc-id> classical-ipoa ip ospf priority <priority>	Sets the OSPF priority for an ADSL PVC with Classical IPOA encapsulation.
interfaces adsl <adslx> pvc <pvc-id> classical-ipoa ip ospf retransmit-interval <interval>	Sets the OSPF retransmit interval for an ADSL PVC with Classical IPOA encapsulation.
interfaces adsl <adslx> pvc <pvc-id> classical-ipoa ip ospf transmit-delay <delay>	Specifies the OSPF transmit delay for an ADSL PVC with Classical IPOA encapsulation.
Operational Commands	
None	

interfaces adsl <adslx> pvc <pvc-id> classical-ipoa ip ospf

Enables OSPF on an ADSL PVC with Classical IPOA encapsulation.

Syntax

set interfaces adsl *adslx* **pvc** *pvc-id* **classical-ipoa ip ospf**

delete interfaces adsl *adslx* **pvc** *pvc-id* **classical-ipoa ip ospf**

show interfaces adsl *adslx* **pvc** *pvc-id* **classical-ipoa ip ospf**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
   adsl adslx {
      pvc [0-255/0-65535|auto] {
         classical-ipoa {
            ip {
               ospf {
               }
            }
         }
      }
   }
}
```

Parameters

adslx	Mandatory. Multi-node. The identifier for the ADSL interface you are defining. This may be **adsl0** to **adsl***x*, depending on what physical ADSL ports are actually available on the system.
pvc-id	Mandatory. The identifier for the PVC. It can either be the *vpi*/*vci* pair or the keyword **auto**, where *vpi* is a Virtual Path Index from 0 to 255, *vci* is a Virtual Circuit Index from from 0 to 65535, and **auto** directs the system to detect the Virtual Path Index and Virtual Circuit Index automatically.

Default

None.

Usage Guidelines

Use this command to enable the Open Shortest Path First (OSPF) routing protocol on a PVC with Classical IP over Asynchronous Transfer ModeClassical IP over Asynchronous Transfer Mode (IPOA) encapsulation on an ADSL interface.

Use the **set** form of this command to enable OSPF on an interface.

Use the **delete** form of this command to remove all OSPF configuration and disable OSPF on an interface.

Use the **show** form of this command to display OSPF configuration.

interfaces adsl <adslx> pvc <pvc-id> classical-ipoa ip ospf authentication

Specifies the authentication method for OSPF on an ADSL PVC with Classical IPOA encapsulation.

Syntax

set interfaces adsl *adslx* **pvc** *pvc-id* **classical-ipoa ip ospf authentication** [**md5 key-id** *key-id* **md5-key** *md5-key* | **plaintext-password** *password*]

delete interfaces adsl *adslx* **pvc** *pvc-id* **classical-ipoa ip ospf authentication** [**md5 key-id** *key-id* **md5-key** | **plaintext-password**]

show interfaces adsl *adslx* **pvc** *pvc-id* **classical-ipoa ip ospf authentication** [**md5 key-id** *key-id* **md5-key** | **plaintext-password**]

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
    adsl adslx {
        pvc [0-255/0-65535|auto] {
            classical-ipoa {
                ip {
                    ospf {
                        authentication {
                            md5 {
                                key-id 1-255 {
                                    md5-key: text
                                }
                            }
                            plaintext-password: text
                        }
                    }
                }
            }
        }
    }
}
```

Parameters

adslx	Mandatory. Multi-node. The identifier for the ADSL interface you are defining. This may be **adsl0** to **adsl***x*, depending on what physical ADSL ports are actually available on the system.
pvc-id	Mandatory. The identifier for the PVC. It can either be the *vpi*/*vci* pair or the keyword **auto**, where *vpi* is a Virtual Path Index from 0 to 255, *vci* is a Virtual Circuit Index from from 0 to 65535, and **auto** directs the system to detect the Virtual Path Index and Virtual Circuit Index automatically.
key-id	Optional. The key used to identify the MD5 key. This must be the same on both the sending and receiving systems. The range is 1 to 255.
md5-key	Optional. A password-like MD5 key of up to 16 alphanumeric characters to be used as input to the MD5 hashing algorithm. The longer the key, the stronger the security. This must be the same on both the sending and receiving systems.
password	Optional. The password to use in plain-text authentication. This must be eight characters or less and the same on both the sending and receiving systems.

Default

None.

Usage Guidelines

Use this command to specify the authentication method to be used for OSPF on a PVC with Classical IP over Asynchronous Transfer Mode (IPOA) encapsulation on an ADSL interface. This authentication is independent of the authentication configured for the OSPF area.

In plain text authentication, passwords are sent through the network in plain text. In MD5 authentication, the system uses the Message Digest 5 (MD5) algorithm to compute a hash value from the contents of the OSPF packet and the password. The hash value and the MD5 key are included in the transmitted packet, and the receiving system (configured with the same password) calculates its own hash function, which must match.

The authentication parameters must be the same for all routers that are to establish two-way communication within a network. If two routers do not agree on these parameters, they will not consider establish adjacencies, and will disregard one another’s communications.

Use the **set** form of this command to set the authentication for a PVC with Classical IPOA encapsulation on an ADSL interface.

Use the **delete** form of this command to remove authentication configuration information.

Use the **show** form of this command to display authentication configuration information.

interfaces adsl <adslx> pvc <pvc-id> classical-ipoa ip ospf bandwidth <bandwidth>

Specifies the bandwidth of an ADSL PVC with Classical IPOA encapsulation for calculating OSPF cost.

Syntax

set interfaces adsl *adslx* **pvc** *pvc-id* **classical-ipoa ip ospf bandwidth** *bandwidth*

delete interfaces adsl *adslx* **pvc** *pvc-id* **classical-ipoa ip ospf bandwidth**

show interfaces adsl *adslx* **pvc** *pvc-id* **classical-ipoa ip ospf bandwidth**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
   adsl adslx {
      pvc [0-255/0-65535|auto] {
         classical-ipoa {
            ip {
               ospf {
                  bandwidth: u32
               }
            }
         }
      }
   }
}
```

Parameters

adslx	Mandatory. Multi-node. The identifier for the ADSL interface you are defining. This may be **adsl0** to **adsl***x*, depending on what physical ADSL ports are actually available on the system.
pvc-id	Mandatory. The identifier for the PVC. It can either be the *vpi*/*vci* pair or the keyword **auto**, where *vpi* is a Virtual Path Index from 0 to 255, *vci* is a Virtual Circuit Index from from 0 to 65535, and **auto** directs the system to detect the Virtual Path Index and Virtual Circuit Index automatically.

bandwidth	The bandwidth of the Ethernet interface in kilobits/sec. The range is 1 to 10000000.

Default

None.

Usage Guidelines

Use this command to specify the bandwidth of a PVC with Classical IP over Asynchronous Transfer Mode (IPOA) encapsulation on an ADSL interface for the purpose of computing OSPF cost.

Use the **set** form of this command to specify the bandwidth of the interface.

Use the **delete** form of this command to remove the bandwidth parameter.

Use the **show** form of this command to display the bandwidth configuration.

interfaces adsl <adslx> pvc <pvc-id> classical-ipoa ip ospf cost <cost>

Sets the routing cost for OSPF on an ADSL PVC with Classical IPOA encapsulation.

Syntax

set interfaces adsl *adslx* **pvc** *pvc-id* **classical-ipoa ip ospf cost** *cost*

delete interfaces adsl *adslx* **pvc** *pvc-id* **classical-ipoa ip ospf cost**

show interfaces adsl *adslx* **pvc** *pvc-id* **classical-ipoa ip ospf cost**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
   adsl adslx {
      pvc [0-255/0-65535|auto] {
         classical-ipoa {
            ip {
               ospf {
                  cost: u32
               }
            }
         }
      }
   }
}
```

Parameters

adslx	Mandatory. Multi-node. The identifier for the ADSL interface you are defining. This may be **adsl0** to **adsl***x*, depending on what physical ADSL ports are actually available on the system.
pvc-id	Mandatory. The identifier for the PVC. It can either be the *vpi*/*vci* pair or the keyword **auto**, where *vpi* is a Virtual Path Index from 0 to 255, *vci* is a Virtual Circuit Index from from 0 to 65535, and **auto** directs the system to detect the Virtual Path Index and Virtual Circuit Index automatically.

cost	The link-state metric (OSPF cost) to be advertised in the link-state advertisement (LSA) as the cost of sending packets over the ethernet interface. The range is 1 to 65535.

Default

For details on the default of OSPF cost, please see the Usage Guidelines.

Usage Guidelines

Use this command to manually override the default OSPF cost computed by the system for a PVC with Classical IP over Asynchronous Transfer Mode (IPOA) encapsulation on an ADSL interface. You can only assign one cost per interface.

By default, the metric associated with a link is computed as follows:

```
Cost = 108 / bandwidth
```

The cost of reaching any destination is the sum of the costs of the individual hops. Costs are always rounded to the nearest integer. Costs lower than 1 are rounded up to 1.

Table 9-1 shows the OSPF costs for some common media types.

Table 9-1 OSPF Costs for Common Media Types

Media Type	OSPF Cost
56 Kbps	1785
64 Kbps	1562
128 Kbps	781
256 Kbps	390
512 Kbps	195
768 Kbps	130
T1 (1.544 Mbps)	64
E1 (2.048 Mbps)	48
4 Mbps Token Ring	6
10 Mbps Ethernet	10
16 Mbps Token Ring	6
T3 (44.736 Mbps	2
100+ Mbps	1

The values in Table 9-1 show how OSPF fails to distinguish between interfaces faster than 100 Mbps, for example, between Fast Ethernet (100 Mbps) and Gigabit Ethernet (1000 Mbps) interfaces. If you want to distinguish interfaces equal to or greater than 100 Mbps, you must manually configure the cost of the interface using this command.

Use the **set** form of this command to specify the OSPF cost for the interface.

Use the **delete** form of this command to restore the default cost.

Use the **show** form of this command to display cost configuration.

interfaces adsl <adslx> pvc <pvc-id> classical-ipoa ip ospf dead-interval <interval>

Sets the OSPF dead interval for an ADSL PVC with Classical IPOA encapsulation.

Syntax

set interfaces adsl *adslx* **pvc** *pvc-id* **classical-ipoa ip ospf dead-interval** *interval*

delete interfaces adsl *adslx* **pvc** *pvc-id* **classical-ipoa ip ospf dead-interval**

show interfaces adsl *adslx* **pvc** *pvc-id* **classical-ipoa ip ospf dead-interval**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
   adsl adslx {
      pvc [0-255/0-65535|auto] {
         classical-ipoa {
            ip {
               ospf {
                  dead-interval: u32
               }
            }
         }
      }
   }
}
```

Parameters

adslx	Mandatory. Multi-node. The identifier for the ADSL interface you are defining. This may be **adsl0** to **adsl***x*, depending on what physical ADSL ports are actually available on the system.
pvc-id	Mandatory. The identifier for the PVC. It can either be the *vpi*/*vci* pair or the keyword **auto**, where *vpi* is a Virtual Path Index from 0 to 255, *vci* is a Virtual Circuit Index from from 0 to 65535, and **auto** directs the system to detect the Virtual Path Index and Virtual Circuit Index automatically.

interval	Specifies the time, in seconds, that this interface should wait to detect hello packets from neighboring routers before declaring the neighbor down. The range is 1 to 65535. The default is 4 times the hello interval.

Default

The dead interval is 4 times the hello interval.

Usage Guidelines

Use this command to specify the interval during which a PVC with Classical IP over Asynchronous Transfer Mode (IPOA) encapsulation on an ADSL interface should expect a hello packet from its neighbor.

If the dead interval passes without the interface receiving a hello packet from the neighbor, the neighbor's status is changed to out-of-service, and all associated state is cleared.

The dead interval must be the same for all routers that are to establish two-way communication within a network. If two routers do not agree on these parameters, they will not establish adjacencies and will disregard one another's communications.

Use the **set** form of this command to specify the dead interval.

Use the **delete** form of this command to restore the default dead interval.

Use the **show** form of this command to display dead interval configuration.

interfaces adsl <adslx> pvc <pvc-id> classical-ipoa ip ospf hello-interval <interval>

Sets the interval between OSPF hello packets on an ADSL PVC with Classical IPOA encapsulation.

Syntax

set interfaces adsl *adslx* **pvc** *pvc-id* **classical-ipoa ip ospf hello-interval** *interval*

delete interfaces adsl *adslx* **pvc** *pvc-id* **classical-ipoa ip ospf hello-interval**

show interfaces adsl *adslx* **pvc** *pvc-id* **classical-ipoa ip ospf hello-interval**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
   adsl adslx {
      pvc [0-255/0-65535|auto] {
         classical-ipoa {
            ip {
               ospf {
                  hello-interval: u32
               }
            }
         }
      }
   }
}
```

Parameters

adslx	Mandatory. Multi-node. The identifier for the ADSL interface you are defining. This may be **adsl0** to **adsl***x*, depending on what physical ADSL ports are actually available on the system.
pvc-id	Mandatory. The identifier for the PVC. It can either be the *vpi*/*vci* pair or the keyword **auto**, where *vpi* is a Virtual Path Index from 0 to 255, *vci* is a Virtual Circuit Index from from 0 to 65535, and **auto** directs the system to detect the Virtual Path Index and Virtual Circuit Index automatically.

interval	Mandatory. The interval, in seconds, between hello packets. This value must be the same for all nodes on the network.The range is 1 to 65535. The default is 10.

Default

Hello packets are sent every 10 seconds.

Usage Guidelines

Use this command to set the interval at which OSPF hello packets are sent for a PVC with Classical IP over Asynchronous Transfer Mode (IPOA) encapsulation on an ADSL interface.

A hello packet is an OSPF packet used to detect and maintain relationships with neighbors on the same network (directly connected routers). The greater the interval between hello packets, the less router traffic occurs, but the longer it takes for topological changes to be detected.

The hello interval must be the same for all routers that are to establish two-way communication within a network. If two routers do not agree on these parameters, they will not establish adjacencies and will disregard one another’s communications.

Use the **set** form of this command to set the hello interval.

Use the **delete** form of this command to restore the default hello interval.

Use the **show** form of this command to display hello interval configuration.

interfaces adsl <adslx> pvc <pvc-id> classical-ipoa ip ospf mtu-ignore

Disables MTU mismatch detection for an ADSL PVC with Classical IPOA encapsulation.

Syntax

set interfaces adsl *adslx* **pvc** *pvc-id* **classical-ipoa ip ospf mtu-ignore**

delete interfaces adsl *adslx* **pvc** *pvc-id* **classical-ipoa ip ospf mtu-ignore**

show interfaces adsl *adslx* **pvc** *pvc-id* **classical-ipoa ip ospf**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
   adsl adslx {
      pvc [0-255/0-65535|auto] {
         classical-ipoa {
            ip {
               ospf {
                  mtu-ignore
               }
            }
         }
      }
   }
}
```

Parameters

adslx	Mandatory. Multi-node. The identifier for the ADSL interface you are defining. This may be **adsl0** to **adsl***x*, depending on what physical ADSL ports are actually available on the system.
pvc-id	Mandatory. The identifier for the PVC. It can either be the *vpi*/*vci* pair or the keyword **auto**, where *vpi* is a Virtual Path Index from 0 to 255, *vci* is a Virtual Circuit Index from from 0 to 65535, and **auto** directs the system to detect the Virtual Path Index and Virtual Circuit Index automatically.

Default

MTU mismatch detection is enabled by default.

Usage Guidelines

Use this command to disable MTU mismatch detection on an OSPF interface.

OSPF sends the MTU of the interface in a database description packet. If the MTUs of OSPF neighbors do not match, they cannot form an OSPF adjacency. MTU mismatch detection detects MTU mismatches and indicates them in the form of a debug message.

MTU mismatch is an important troubleshooting feature. If MTU mismatch is not enabled, MTU mismatches can only be detected by examining configuration for both interfaces.

There are some network setups where MTU mismatches are unavoidable, and even part of the normal set-up. It is for these cases only that MTU mismatch detection should be disabled, so that normal OSPF adjacencies can be formed.

Use the **set** form of this command to disable MTU mismatch detection.

Use the **delete** form of this command to re-enable MTU mismatch detection.

Use the **show** form of this command to display OSPF configuration.

interfaces adsl <adslx> pvc <pvc-id> classical-ipoa ip ospf network <type>

Specifies the OSPF network type for an ADSL PVC with Classical IPOA encapsulation.

Syntax

set interfaces adsl *adslx* **pvc** *pvc-id* **classical-ipoa ip ospf network** [**broadcast** | **non-broadcast** | **point-to-multipoint** | **point-to-point**]

delete interfaces adsl *adslx* **pvc** *pvc-id* **classical-ipoa ip ospf network**

show interfaces adsl *adslx* **pvc** *pvc-id* **classical-ipoa ip ospf network**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
   adsl adslx {
      pvc [0-255/0-65535|auto] {
         classical-ipoa {
            ip {
               ospf {
                  network: text
               }
            }
         }
      }
   }
}
```

Parameters

adslx	Mandatory. Multi-node. The identifier for the ADSL interface you are defining. This may be **adsl0** to **adsl***x*, depending on what physical ADSL ports are actually available on the system.
pvc-id	Mandatory. The identifier for the PVC. It can either be the *vpi*/*vci* pair or the keyword **auto**, where *vpi* is a Virtual Path Index from 0 to 255, *vci* is a Virtual Circuit Index from from 0 to 65535, and **auto** directs the system to detect the Virtual Path Index and Virtual Circuit Index automatically.

type	The network type for this interface. Supported values are as follows: **broadcast**: The interface supports broadcast mode, such as a LAN link. **non-broadcast**: The interface does not support broadcast mode. **point-to-point**: This interface supports point-to-point mode, such as an NBMA interface. **point-to-multipoint**: This interface supports point-to-multipoint mode, such as a PPP interface or a point-to-point logical interface on Frame Relay. The default is broadcast.

Default

Broadcast is supported.

Usage Guidelines

Use this command to configure and display the network type for the interface.

Use the **set** form of this command to specify the network type.

Use the **delete** form of this command to remove the network type.

Use the **show** form of this command to display the network type.

interfaces adsl <adslx> pvc <pvc-id> classical-ipoa ip ospf priority <priority>

Sets the OSPF priority for an ADSL PVC with Classical IPOA encapsulation.

Syntax

set interfaces adsl *adslx* **pvc** *pvc-id* **classical-ipoa ip ospf priority** *priority*

delete interfaces adsl *adslx* **pvc** *pvc-id* **classical-ipoa ip ospf priority**

show interfaces adsl *adslx* **pvc** *pvc-id* **classical-ipoa ip ospf priority**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
   adsl adslx {
      pvc [0-255/0-65535|auto] {
         classical-ipoa {
            ip {
               ospf {
                  priority: u32
               }
            }
         }
      }
   }
}
```

Parameters

adslx	Mandatory. Multi-node. The identifier for the ADSL interface you are defining. This may be **adsl0** to **adsl***x*, depending on what physical ADSL ports are actually available on the system.
pvc-id	Mandatory. The identifier for the PVC. It can either be the *vpi*/*vci* pair or the keyword **auto**, where *vpi* is a Virtual Path Index from 0 to 255, *vci* is a Virtual Circuit Index from from 0 to 65535, and **auto** directs the system to detect the Virtual Path Index and Virtual Circuit Index automatically.

priority	Specifies the OSPF router priority for this interface. The range is 0 to 255, where a router with priority 0 can never become the designated router. The default is 1.

Default

An OSPF interface has a priority of 1.

Usage Guidelines

Use this command to set the priority for a PVC with Classical IP over Asynchronous Transfer Mode (IPOA) encapsulation on an ADSL interface on the broadcast network to which the interface is connected. The priority determines which routers are selected as the area's Designated Router (DR) and Backup Designated Router (BDR).

The DR and BDR are used to reduce the amount of traffic on OSPF overhead on broadcast networks, by reducing the number of adjacent routers to which a router must flood its topological information. In broadcast networks (such as Ethernet), each router establishes an adjacency with only the DR and the BDR, rather than with every router in its area. The DR and the BDR then flood this information to all other routers on the network segment.

Priority can range from 0 to 255. In general, the router with the highest priority is elected as the DR, and the router with the second-highest priority is elected as the BDR. The higher the number, the higher the priority.

Routers with a priority of 0 are ineligible for election.

Use the **set** form of this command to specify the OSPF priority.

Use the **delete** form of this command to restore the default priority.

Use the **show** form of this command to display priority configuration.

interfaces adsl <adslx> pvc <pvc-id> classical-ipoa ip ospf retransmit-interval <interval>

Sets the OSPF retransmit interval for an ADSL PVC with Classical IPOA encapsulation.

Syntax

set interfaces adsl *adslx* **pvc** *pvc-id* **classical-ipoa ip ospf retransmit-interval** *interval*

delete interfaces adsl *adslx* **pvc** *pvc-id* **classical-ipoa ip ospf retransmit-interval**

show interfaces adsl *adslx* **pvc** *pvc-id* **classical-ipoa ip ospf retransmit-interval**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
   adsl adslx {
      pvc [0-255/0-65535|auto] {
         classical-ipoa {
            ip {
               ospf {
                  retransmit-interval: u32
               }
            }
         }
      }
   }
}
```

Parameters

adslx	Mandatory. Multi-node. The identifier for the ADSL interface you are defining. This may be **adsl0** to **adsl***x*, depending on what physical ADSL ports are actually available on the system.
pvc-id	Mandatory. The identifier for the PVC. It can either be the *vpi*/*vci* pair or the keyword **auto**, where *vpi* is a Virtual Path Index from 0 to 255, *vci* is a Virtual Circuit Index from from 0 to 65535, and **auto** directs the system to detect the Virtual Path Index and Virtual Circuit Index automatically.

interval	Specifies the time in seconds to wait for an acknowledgement, after which the system retransmits an LSA packet to its neighbors. The range is 3 to 65535. The default is 5.

Default

Unacknowledged LSAs are retransmitted at 5-second intervals.

Usage Guidelines

Use this command to specify how long a PVC with Classical IP over Asynchronous Transfer Mode (IPOA) encapsulation on an ADSL interface will wait for an acknowledgment of a link-state update before resending the update.

The link-state update packet is part of the exchange of topology databases between routers. When the initial database description (DD) packet is sent, it contains only the headers of the LSAs. If the receiving router determines that it requires that piece of the OSPF topology, it sends a link state request packet to request the complete LSA from the sending router.

After the update packet is sent, the sending router waits for an acknowledgement, either implicit or explicit, from the receiving router. In an explicit acknowledgement, the receiving router sends a link-state acknowledge (LS-Ack) packet to the router that sent the update. In an implicit acknowledgement, the router that sent the update receives an LSA from the receiving router that contains the update information.

If the retransmit interval passes with neither an explicit nor an implicit acknowledgement, the sending router will retransmit the link-state update packet.

Too high an interval slows network convergence. Too small an interval causes unnecessary retransmission.

Use the **set** form of this command to set the OSPF retransmit interval for a PVC with Classical IPOA encapsulation on an ADSL interface.

Use the **delete** form of this command to restore the default retransmit interval.

Use the **show** form of this command to display retransmit interval configuration.

interfaces adsl <adslx> pvc <pvc-id> classical-ipoa ip ospf transmit-delay <delay>

Specifies the OSPF transmit delay for an ADSL PVC with Classical IPOA encapsulation.

Syntax

set interfaces adsl *adslx* **pvc** *pvc-id* **classical-ipoa ip ospf transmit-delay** *delay*

delete interfaces adsl *adslx* **pvc** *pvc-id* **classical-ipoa ip ospf transmit-delay**

show interfaces adsl *adslx* **pvc** *pvc-id* **classical-ipoa ip ospf transmit-delay**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
   adsl adslx {
      pvc [0-255/0-65535|auto] {
         classical-ipoa {
            ip {
               ospf {
                  transmit-delay: u32
               }
            }
         }
      }
   }
}
```

Parameters

adslx	Mandatory. Multi-node. The identifier for the ADSL interface you are defining. This may be **adsl0** to **adsl***x*, depending on what physical ADSL ports are actually available on the system.
pvc-id	Mandatory. The identifier for the PVC. It can either be the *vpi*/*vci* pair or the keyword **auto**, where *vpi* is a Virtual Path Index from 0 to 255, *vci* is a Virtual Circuit Index from from 0 to 65535, and **auto** directs the system to detect the Virtual Path Index and Virtual Circuit Index automatically.

delay	Mandatory. The delay, in seconds, between link-state transmits. This value must be the same for all nodes on the network. The range is 1 to 65535. The default is 1.

Default

Link-state transmits occur at 1-second intervals.

Usage Guidelines

Use this command to set the transmit delay for a PVC with Classical IP over Asynchronous Transfer Mode (IPOA) encapsulation on an ADSL interface. This is the estimated time required to send a link-state update (LSU) packet.

This timer is used to accommodate transmission and propagation delays on the network, particularly on low-speed networks where delays may be significant. The router increments the age of link-state advertisements in LSU packets to account for these delays.

The value includes both the transmission time and the propagation delay across the network. The transmit delay is added to the age of the LSA packet before the LSA is transmitted The LSA age is used to help the network sequence LSAs, so that it can determine which of competing LSAs is the more recent and trustworthy.

LSAs are numbered in sequence, but the sequence numbers are finite, and so cannot be used as the sole determinant of the most recent LSA. Instead, OSPF also tracks the age of LSAs. Each time the LSA is forwarded to another router, its current age is incremented by the transmit delay. The packet’s age, together with its sequence number, helps the receiving router to determine which version of a received LSA is more recent, and therefore to be used.

Use the **set** form of this command to set the transmit delay.

Use the **delete** form of this command to restore the default transmit delay.

Use the **show** form of this command to display transmit delay configuration.

Chapter 10: DSL PPPoE Interfaces

This chapter describes commands for configuring OSPF on DSL interfaces with Point-to-Point Protocol over Ethernet (PPPoE) encapsulation.

This chapter presents the following topics:

- DSL PPPoE Interface OSPF Commands

DSL PPPoE Interface OSPF Commands

This chapter contains the following commands.

Configuration Commands	
interfaces adsl <adslx> pvc <pvc-id> pppoe <num> ip ospf	Enables OSPF on an ADSL PVC with PPPoE encapsulation.
interfaces adsl <adslx> pvc <pvc-id> pppoe <num> ip ospf authentication	Specifies the authentication method for OSPF on an ADSL PVC with PPPoE encapsulation.
interfaces adsl <adslx> pvc <pvc-id> pppoe <num> ip ospf bandwidth <bandwidth>	Specifies the bandwidth of an ADSL PVC with PPPoE encapsulation for calculating OSPF cost.
interfaces adsl <adslx> pvc <pvc-id> pppoe <num> ip ospf cost <cost>	Sets the routing cost for OSPF on an ADSL PVC with PPPoE encapsulation.
interfaces adsl <adslx> pvc <pvc-id> pppoe <num> ip ospf dead-interval <interval>	Sets the OSPF dead interval for an ADSL PVC with PPPoE encapsulation.
interfaces adsl <adslx> pvc <pvc-id> pppoe <num> ip ospf hello-interval <interval>	Sets the interval between OSPF hello packets on an ADSL PVC with PPPoE encapsulation.
interfaces adsl <adslx> pvc <pvc-id> pppoe <num> ip ospf mtu-ignore	Disables MTU mismatch detection for an ADSL PVC with PPPoE encapsulation.
interfaces adsl <adslx> pvc <pvc-id> pppoe <num> ip ospf network <type>	Specifies the OSPF network type for an ADSL PVC with PPPoE encapsulation.
interfaces adsl <adslx> pvc <pvc-id> pppoe <num> ip ospf priority <priority>	Sets the OSPF priority for an ADSL PVC with PPPoE encapsulation.
interfaces adsl <adslx> pvc <pvc-id> pppoe <num> ip ospf retransmit-interval <interval>	Sets the OSPF retransmit interval for an ADSL PVC with PPPoE encapsulation.
interfaces adsl <adslx> pvc <pvc-id> pppoe <num> ip ospf transmit-delay <delay>	Specifies the OSPF transmit delay for an ADSL PVC with PPPoE encapsulation.
Operational Commands	
None.	

interfaces adsl <adslx> pvc <pvc-id> pppoe <num> ip ospf

Enables OSPF on an ADSL PVC with PPPoE encapsulation.

Syntax

set interfaces adsl *adslx* **pvc** *pvc-id* **pppoe** *num* **ip ospf**

delete interfaces adsl *adslx* **pvc** *pvc-id* **pppoe** *num* **ip ospf**

show interfaces adsl *adslx* **pvc** *pvc-id* **pppoe** *num* **ip ospf**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
   adsl adslx {
      pvc [0-255/0-65535|auto] {
         pppoe 0-15 {
            ip {
               ospf {
               }
            }
         }
      }
   }
}
```

Parameters

adslx	Mandatory. Multi-node. The identifier for the ADSL interface you are defining. This may be **adsl0** to **adsl***x*, depending on what physical ADSL ports are actually available on the system.
pvc-id	Mandatory. The identifier for the PVC. It can either be the *vpi*/*vci* pair or the keyword **auto**, where *vpi* is a Virtual Path Index from 0 to 255, *vci* is a Virtual Circuit Index from from 0 to 65535, and **auto** directs the system to detect the Virtual Path Index and Virtual Circuit Index automatically.

num	Mandatory. The name of a defined PPPoE unit. The range of values is 0 to 15.

Default

None.

Usage Guidelines

Use this command to enable the Open Shortest Path First (OSPF) routing protocol on a PVC with Point-to-Point Protocol over Ethernet (PPPoE) encapsulation on an ADSL interface.

Use the **set** form of this command to enable OSPF on an interface.

Use the **delete** form of this command to remove all OSPF configuration and disable OSPF on an interface.

Use the **show** form of this command to display OSPF configuration.

interfaces adsl <adslx> pvc <pvc-id> pppoe <num> ip ospf authentication

Specifies the authentication method for OSPF on an ADSL PVC with PPPoE encapsulation.

Syntax

set interfaces adsl *adslx* **pvc** *pvc-id* **pppoe** *num* **ip ospf authentication** [**md5 key-id** *key-id* **md5-key** *md5-key* | **plaintext-password** *password*]

delete interfaces adsl *adslx* **pvc** *pvc-id* **pppoe** *num* **ip ospf authentication** [**md5 key-id** *key-id* **md5-key** | **plaintext-password**]

show interfaces adsl *adslx* **pvc** *pvc-id* **pppoe** *num* **ip ospf authentication** [**md5 key-id** *key-id* **md5-key** | **plaintext-password**]

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
    adsl adslx {
        pvc [0-255/0-65535|auto] {
            pppoe 0-15 {
                ip {
                    ospf {
                        authentication {
                            md5 {
                                key-id 1-255 {
                                    md5-key: text
                                }
                            }
                            plaintext-password: text
                        }
                    }
                }
            }
        }
    }
}
```

Parameters

adslx	Mandatory. Multi-node. The identifier for the ADSL interface you are defining. This may be **adsl0** to **adsl***x*, depending on what physical ADSL ports are actually available on the system.
pvc-id	Mandatory. The identifier for the PVC. It can either be the *vpi*/*vci* pair or the keyword **auto**, where *vpi* is a Virtual Path Index from 0 to 255, *vci* is a Virtual Circuit Index from from 0 to 65535, and **auto** directs the system to detect the Virtual Path Index and Virtual Circuit Index automatically.
num	Mandatory. The name of a defined PPPoE unit. The range of values is 0 to 15.
key-id	Optional. The key used to identify the MD5 key. This must be the same on both the sending and receiving systems. The range is 1 to 255.
md5-key	Optional. A password-like MD5 key of up to 16 alphanumeric characters to be used as input to the MD5 hashing algorithm. The longer the key, the stronger the security. This must be the same on both the sending and receiving systems.
password	Optional. The password to use in plain-text authentication. This must be eight characters or less and the same on both the sending and receiving systems.

Default

None.

Usage Guidelines

Use this command to specify the authentication method to be used for OSPF on a PVC with Point-to-Point Protocol over Ethernet (PPPoE) encapsulation on an ADSL interface. This authentication is independent of the authentication configured for the OSPF area.

In plain text authentication, passwords are sent through the network in plain text. In MD5 authentication, the system uses the Message Digest 5 (MD5) algorithm to compute a hash value from the contents of the OSPF packet and the password. The hash value and the MD5 key are included in the transmitted packet, and the receiving system (configured with the same password) calculates its own hash function, which must match.

The authentication parameters must be the same for all routers that are to establish two-way communication within a network. If two routers do not agree on these parameters, they will not consider establish adjacencies, and will disregard one another's communications.

Use the **set** form of this command to set the authentication for a PVC with PPPoE encapsulation on an ADSL interface.

Use the **delete** form of this command to remove authentication configuration information.

Use the **show** form of this command to display authentication configuration information.

interfaces adsl <adslx> pvc <pvc-id> pppoe <num> ip ospf bandwidth <bandwidth>

Specifies the bandwidth of an ADSL PVC with PPPoE encapsulation for calculating OSPF cost.

Syntax

set interfaces adsl *adslx* **pvc** *pvc-id* **pppoe** *num* **ip ospf bandwidth** *bandwidth*

delete interfaces adsl *adslx* **pvc** *pvc-id* **pppoe** *num* **ip ospf bandwidth**

show interfaces adsl *adslx* **pvc** *pvc-id* **pppoe** *num* **ip ospf bandwidth**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
   adsl adslx {
      pvc [0-255/0-65535|auto] {
         pppoe 0-15 {
            ip {
               ospf {
                  bandwidth: u32
               }
            }
         }
      }
   }
}
```

Parameters

adslx	Mandatory. Multi-node. The identifier for the ADSL interface you are defining. This may be **adsl0** to **adsl***x*, depending on what physical ADSL ports are actually available on the system.
pvc-id	Mandatory. The identifier for the PVC. It can either be the *vpi*/*vci* pair or the keyword **auto**, where *vpi* is a Virtual Path Index from 0 to 255, *vci* is a Virtual Circuit Index from from 0 to 65535, and **auto** directs the system to detect the Virtual Path Index and Virtual Circuit Index automatically.

num	Mandatory. The name of a defined PPPoE unit. The range of values is 0 to 15.
bandwidth	The bandwidth of the Ethernet interface in kilobits/sec. The range is 1 to 10000000.

Default

None.

Usage Guidelines

Use this command to specify the bandwidth of a PVC with Point-to-Point Protocol over Ethernet (PPPoE) encapsulation on an ADSL interface for the purpose of computing OSPF cost.

Use the **set** form of this command to specify the bandwidth of the interface.

Use the **delete** form of this command to remove the bandwidth parameter.

Use the **show** form of this command to display the bandwidth configuration.

interfaces adsl <adslx> pvc <pvc-id> pppoe <num> ip ospf cost <cost>

Sets the routing cost for OSPF on an ADSL PVC with PPPoE encapsulation.

Syntax

set interfaces adsl *adslx* **pvc** *pvc-id* **pppoe** *num* **ip ospf cost** *cost*

delete interfaces adsl *adslx* **pvc** *pvc-id* **pppoe** *num* **ip ospf cost**

show interfaces adsl *adslx* **pvc** *pvc-id* **pppoe** *num* **ip ospf cost**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
   adsl adslx {
      pvc [0-255/0-65535|auto] {
         pppoe 0-15 {
            ip {
               ospf {
                  cost: u32
               }
            }
         }
      }
   }
}
```

Parameters

adslx	Mandatory. Multi-node. The identifier for the ADSL interface you are defining. This may be **adsl0** to **adsl***x*, depending on what physical ADSL ports are actually available on the system.
pvc-id	Mandatory. The identifier for the PVC. It can either be the *vpi*/*vci* pair or the keyword **auto**, where *vpi* is a Virtual Path Index from 0 to 255, *vci* is a Virtual Circuit Index from from 0 to 65535, and **auto** directs the system to detect the Virtual Path Index and Virtual Circuit Index automatically.

num	Mandatory. The name of a defined PPPoE unit. The range of values is 0 to 15.
cost	The link-state metric (OSPF cost) to be advertised in the link-state advertisement (LSA) as the cost of sending packets over the ethernet interface. The range is 1 to 65535.

Default

For details on the default of OSPF cost, please see the Usage Guidelines.

Usage Guidelines

Use this command to manually override the default OSPF cost computed by the system for a PVC with Point-to-Point Protocol over Ethernet (PPPoE) encapsulation on an ADSL interface. You can only assign one cost per interface.

By default, the metric associated with a link is computed as follows:

```
Cost = 108 / bandwidth
```

The cost of reaching any destination is the sum of the costs of the individual hops. Costs are always rounded to the nearest integer. Costs lower than 1 are rounded up to 1.

Table 10-1 shows the OSPF costs for some common media types.

Table 10-1 OSPF Costs for Common Media Types

Media Type	OSPF Cost
56 Kbps	1785
64 Kbps	1562
128 Kbps	781
256 Kbps	390
512 Kbps	195
768 Kbps	130
T1 (1.544 Mbps)	64
E1 (2.048 Mbps)	48
4 Mbps Token Ring	6
10 Mbps Ethernet	10
16 Mbps Token Ring	6

Table 10-1 OSPF Costs for Common Media Types

T3 (44.736 Mbps	2
100+ Mbps	1

The values in Table 10-1 show how OSPF fails to distinguish between interfaces faster than 100 Mbps, for example, between Fast Ethernet (100 Mbps) and Gigabit Ethernet (1000 Mbps) interfaces. If you want to distinguish interfaces equal to or greater than 100 Mbps, you must manually configure the cost of the interface using this command.

Use the **set** form of this command to specify the OSPF cost for the interface.

Use the **delete** form of this command to restore the default cost.

Use the **show** form of this command to display cost configuration.

interfaces adsl <adslx> pvc <pvc-id> pppoe <num> ip ospf dead-interval <interval>

Sets the OSPF dead interval for an ADSL PVC with PPPoE encapsulation.

Syntax

set interfaces adsl *adslx* **pvc** *pvc-id* **pppoe** *num* **ip ospf dead-interval** *interval*

delete interfaces adsl *adslx* **pvc** *pvc-id* **pppoe** *num* **ip ospf dead-interval**

show interfaces adsl *adslx* **pvc** *pvc-id* **pppoe** *num* **ip ospf dead-interval**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
   adsl adslx {
      pvc [0-255/0-65535|auto] {
         pppoe 0-15 {
            ip {
               ospf {
                  dead-interval: u32
               }
            }
         }
      }
   }
}
```

Parameters

adslx	Mandatory. Multi-node. The identifier for the ADSL interface you are defining. This may be **adsl0** to **adsl***x*, depending on what physical ADSL ports are actually available on the system.
pvc-id	Mandatory. The identifier for the PVC. It can either be the *vpi*/*vci* pair or the keyword **auto**, where *vpi* is a Virtual Path Index from 0 to 255, *vci* is a Virtual Circuit Index from from 0 to 65535, and **auto** directs the system to detect the Virtual Path Index and Virtual Circuit Index automatically.

num	Mandatory. The name of a defined PPPoE unit. The range of values is 0 to 15.
interval	Specifies the time, in seconds, that this interface should wait to detect hello packets from neighboring routers before declaring the neighbor down. The range is 1 to 65535. The default is 4 times the hello interval.

Default

The dead interval is 4 times the hello interval.

Usage Guidelines

Use this command to specify the interval during which a PVC with Point-to-Point Protocol over Ethernet (PPPoE) encapsulation on an ADSL interface should expect a hello packet from its neighbor.

If the dead interval passes without the interface receiving a hello packet from the neighbor, the neighbor's status is changed to out-of-service, and all associated state is cleared.

The dead interval must be the same for all routers that are to establish two-way communication within a network. If two routers do not agree on these parameters, they will not establish adjacencies and will disregard one another's communications.

Use the **set** form of this command to specify the dead interval.

Use the **delete** form of this command to restore the default dead interval.

Use the **show** form of this command to display dead interval configuration.

interfaces adsl <adslx> pvc <pvc-id> pppoe <num> ip ospf hello-interval <interval>

Sets the interval between OSPF hello packets on an ADSL PVC with PPPoE encapsulation.

Syntax

set interfaces adsl *adslx* **pvc** *pvc-id* **pppoe** *num* **ip ospf hello-interval** *interval*

delete interfaces adsl *adslx* **pvc** *pvc-id* **pppoe** *num* **ip ospf hello-interval**

show interfaces adsl *adslx* **pvc** *pvc-id* **pppoe** *num* **ip ospf hello-interval**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
   adsl adslx {
      pvc [0-255/0-65535|auto] {
         pppoe 0-15 {
            ip {
               ospf {
                  hello-interval: u32
               }
            }
         }
      }
   }
}
```

Parameters

adslx	Mandatory. Multi-node. The identifier for the ADSL interface you are defining. This may be **adsl0** to **adsl***x*, depending on what physical ADSL ports are actually available on the system.
pvc-id	Mandatory. The identifier for the PVC. It can either be the *vpi*/*vci* pair or the keyword **auto**, where *vpi* is a Virtual Path Index from 0 to 255, *vci* is a Virtual Circuit Index from from 0 to 65535, and **auto** directs the system to detect the Virtual Path Index and Virtual Circuit Index automatically.

num	Mandatory. The name of a defined PPPoE unit. The range of values is 0 to 15.
interval	Mandatory. The interval, in seconds, between hello packets. This value must be the same for all nodes on the network.The range is 1 to 65535. The default is 10.

Default

Hello packets are sent every 10 seconds.

Usage Guidelines

Use this command to set the interval at which OSPF hello packets are sent for a PVC with Point-to-Point Protocol over Ethernet (PPPoE) encapsulation on an ADSL interface.

A hello packet is an OSPF packet used to detect and maintain relationships with neighbors on the same network (directly connected routers). The greater the interval between hello packets, the less router traffic occurs, but the longer it takes for topological changes to be detected.

The hello interval must be the same for all routers that are to establish two-way communication within a network. If two routers do not agree on these parameters, they will not establish adjacencies and will disregard one another's communications.

Use the **set** form of this command to set the hello interval.

Use the **delete** form of this command to restore the default hello interval.

Use the **show** form of this command to display hello interval configuration.

interfaces adsl <adslx> pvc <pvc-id> pppoe <num> ip ospf mtu-ignore

Disables MTU mismatch detection for an ADSL PVC with PPPoE encapsulation.

Syntax

set interfaces adsl *adslx* **pvc** *pvc-id* **pppoe** *num* **ip ospf mtu-ignore**

delete interfaces adsl *adslx* **pvc** *pvc-id* **pppoe** *num* **ip ospf mtu-ignore**

show interfaces adsl *adslx* **pvc** *pvc-id* **pppoe** *num* **ip ospf**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
   adsl adslx {
      pvc [0-255/0-65535|auto] {
         pppoe 0-15 {
            ip {
               ospf {
                  mtu-ignore
               }
            }
         }
      }
   }
}
```

Parameters

adslx	Mandatory. Multi-node. The identifier for the ADSL interface you are defining. This may be **adsl0** to **adsl***x*, depending on what physical ADSL ports are actually available on the system.
pvc-id	Mandatory. The identifier for the PVC. It can either be the *vpi*/*vci* pair or the keyword **auto**, where *vpi* is a Virtual Path Index from 0 to 255, *vci* is a Virtual Circuit Index from from 0 to 65535, and **auto** directs the system to detect the Virtual Path Index and Virtual Circuit Index automatically.

num	Mandatory. The name of a defined PPPoE unit. The range of values is 0 to 15.

Default

MTU mismatch detection is enabled by default.

Usage Guidelines

Use this command to disable MTU mismatch detection on an OSPF interface.

OSPF sends the MTU of the interface in a database description packet. If the MTUs of OSPF neighbors do not match, they cannot form an OSPF adjacency. MTU mismatch detection detects MTU mismatches and indicates them in the form of a debug message.

MTU mismatch is an important troubleshooting feature. If MTU mismatch is not enabled, MTU mismatches can only be detected by examining configuration for both interfaces.

There are some network setups where MTU mismatches are unavoidable, and even part of the normal set-up. It is for these cases only that MTU mismatch detection should be disabled, so that normal OSPF adjacencies can be formed.

Use the **set** form of this command to disable MTU mismatch detection.

Use the **delete** form of this command to re-enable MTU mismatch detection.

Use the **show** form of this command to display OSPF configuration.

interfaces adsl <adslx> pvc <pvc-id> pppoe <num> ip ospf network <type>

Specifies the OSPF network type for an ADSL PVC with PPPoE encapsulation.

Syntax

set interfaces adsl *adslx* **pvc** *pvc-id* **pppoe** *num* **ip ospf network** [**broadcast** | **non-broadcast** | **point-to-multipoint** | **point-to-point**]

delete interfaces adsl *adslx* **pvc** *pvc-id* **pppoe** *num* **ip ospf network**

show interfaces adsl *adslx* **pvc** *pvc-id* **pppoe** *num* **ip ospf network**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
   adsl adslx {
      pvc [0-255/0-65535|auto] {
         pppoe 0-15 {
            ip {
               ospf {
                  network: text
               }
            }
         }
      }
   }
}
```

Parameters

adslx	Mandatory. Multi-node. The identifier for the ADSL interface you are defining. This may be **adsl0** to **adsl***x*, depending on what physical ADSL ports are actually available on the system.
pvc-id	Mandatory. The identifier for the PVC. It can either be the *vpi*/*vci* pair or the keyword **auto**, where *vpi* is a Virtual Path Index from 0 to 255, *vci* is a Virtual Circuit Index from from 0 to 65535, and **auto** directs the system to detect the Virtual Path Index and Virtual Circuit Index automatically.

num	Mandatory. The name of a defined PPPoE unit. The range of values is 0 to 15.
type	The network type for this interface. Supported values are as follows: **broadcast**: The interface supports broadcast mode, such as a LAN link. **non-broadcast**: The interface does not support broadcast mode. **point-to-point**: This interface supports point-to-point mode, such as an NBMA interface. **point-to-multipoint**: This interface supports point-to-multipoint mode, such as a PPP interface or a point-to-point logical interface on Frame Relay. The default is broadcast.

Default

Broadcast is supported.

Usage Guidelines

Use this command to configure and display the network type for the interface.

Use the **set** form of this command to specify the network type.

Use the **delete** form of this command to remove the network type.

Use the **show** form of this command to display the network type.

interfaces adsl <adslx> pvc <pvc-id> pppoe <num> ip ospf priority <priority>

Sets the OSPF priority for an ADSL PVC with PPPoE encapsulation.

Syntax

set interfaces adsl *adslx* **pvc** *pvc-id* **pppoe** *num* **ip ospf priority** *priority*

delete interfaces adsl *adslx* **pvc** *pvc-id* **pppoe** *num* **ip ospf priority**

show interfaces adsl *adslx* **pvc** *pvc-id* **pppoe** *num* **ip ospf priority**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
   adsl adslx {
      pvc [0-255/0-65535|auto] {
         pppoe 0-15 {
            ip {
               ospf {
                  priority: u32
               }
            }
         }
      }
   }
}
```

Parameters

adslx	Mandatory. Multi-node. The identifier for the ADSL interface you are defining. This may be **adsl0** to **adsl***x*, depending on what physical ADSL ports are actually available on the system.
pvc-id	Mandatory. The identifier for the PVC. It can either be the *vpi*/*vci* pair or the keyword **auto**, where *vpi* is a Virtual Path Index from 0 to 255, *vci* is a Virtual Circuit Index from from 0 to 65535, and **auto** directs the system to detect the Virtual Path Index and Virtual Circuit Index automatically.

num	Mandatory. The name of a defined PPPoE unit. The range of values is 0 to 15.
priority	Specifies the OSPF router priority for this interface. The range is 0 to 255, where a router with priority 0 can never become the designated router. The default is 1.

Default

An OSPF interface has a priority of 1.

Usage Guidelines

Use this command to set the priority for a PVC with Point-to-Point Protocol over Ethernet (PPPoE) encapsulation on an ADSL interface on the broadcast network to which the interface is connected. The priority determines which routers are selected as the area's Designated Router (DR) and Backup Designated Router (BDR).

The DR and BDR are used to reduce the amount of traffic on OSPF overhead on broadcast networks, by reducing the number of adjacent routers to which a router must flood its topological information. In broadcast networks (such as Ethernet), each router establishes an adjacency with only the DR and the BDR, rather than with every router in its area. The DR and the BDR then flood this information to all other routers on the network segment.

Priority can range from 0 to 255. In general, the router with the highest priority is elected as the DR, and the router with the second-highest priority is elected as the BDR. The higher the number, the higher the priority.

Routers with a priority of 0 are ineligible for election.

Use the **set** form of this command to specify the OSPF priority.

Use the **delete** form of this command to restore the default priority.

Use the **show** form of this command to display priority configuration.

interfaces adsl <adslx> pvc <pvc-id> pppoe <num> ip ospf retransmit-interval <interval>

Sets the OSPF retransmit interval for an ADSL PVC with PPPoE encapsulation.

Syntax

set interfaces adsl *adslx* **pvc** *pvc-id* **pppoe** *num* **ip ospf retransmit-interval** *interval*

delete interfaces adsl *adslx* **pvc** *pvc-id* **pppoe** *num* **ip ospf retransmit-interval**

show interfaces adsl *adslx* **pvc** *pvc-id* **pppoe** *num* **ip ospf retransmit-interval**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
   adsl adslx {
      pvc [0-255/0-65535|auto] {
         pppoe 0-15 {
            ip {
               ospf {
                  retransmit-interval: u32
               }
            }
         }
      }
   }
}
```

Parameters

adslx	Mandatory. Multi-node. The identifier for the ADSL interface you are defining. This may be **adsl0** to **adsl***x*, depending on what physical ADSL ports are actually available on the system.
pvc-id	Mandatory. The identifier for the PVC. It can either be the *vpi*/*vci* pair or the keyword **auto**, where *vpi* is a Virtual Path Index from 0 to 255, *vci* is a Virtual Circuit Index from from 0 to 65535, and **auto** directs the system to detect the Virtual Path Index and Virtual Circuit Index automatically.

num	Mandatory. The name of a defined PPPoE unit. The range of values is 0 to 15.
interval	Specifies the time in seconds to wait for an acknowledgement, after which the system retransmits an LSA packet to its neighbors. The range is 3 to 65535. The default is 5.

Default

Unacknowledged LSAs are retransmitted at 5-second intervals.

Usage Guidelines

Use this command to specify how long a PVC with Point-to-Point Protocol over Ethernet (PPPoE) encapsulation on an ADSL interface will wait for an acknowledgment of a link-state update before resending the update.

The link-state update packet is part of the exchange of topology databases between routers. When the initial database description (DD) packet is sent, it contains only the headers of the LSAs. If the receiving router determines that it requires that piece of the OSPF topology, it sends a link state request packet to request the complete LSA from the sending router.

After the update packet is sent, the sending router waits for an acknowledgement, either implicit or explicit, from the receiving router. In an explicit acknowledgement, the receiving router sends a link-state acknowledge (LS-Ack) packet to the router that sent the update. In an implicit acknowledgement, the router that sent the update receives an LSA from the receiving router that contains the update information.

If the retransmit interval passes with neither an explicit nor an implicit acknowledgement, the sending router will retransmit the link-state update packet.

Too high an interval slows network convergence. Too small an interval causes unnecessary retransmission.

Use the **set** form of this command to set the OSPF retransmit interval for a PVC with PPPoE encapsulation on an ADSL interface.

Use the **delete** form of this command to restore the default retransmit interval.

Use the **show** form of this command to display retransmit interval configuration.

interfaces adsl <adslx> pvc <pvc-id> pppoe <num> ip ospf transmit-delay <delay>

Specifies the OSPF transmit delay for an ADSL PVC with PPPoE encapsulation.

Syntax

set interfaces adsl *adslx* **pvc** *pvc-id* **pppoe** *num* **ip ospf transmit-delay** *delay*

delete interfaces adsl *adslx* **pvc** *pvc-id* **pppoe** *num* **ip ospf transmit-delay**

show interfaces adsl *adslx* **pvc** *pvc-id* **pppoe** *num* **ip ospf transmit-delay**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
   adsl adslx {
      pvc [0-255/0-65535|auto] {
         pppoe 0-15 {
            ip {
               ospf {
                  transmit-delay: u32
               }
            }
         }
      }
   }
}
```

Parameters

adslx	Mandatory. Multi-node. The identifier for the ADSL interface you are defining. This may be **adsl0** to **adsl***x*, depending on what physical ADSL ports are actually available on the system.
pvc-id	Mandatory. The identifier for the PVC. It can either be the *vpi*/*vci* pair or the keyword **auto**, where *vpi* is a Virtual Path Index from 0 to 255, *vci* is a Virtual Circuit Index from from 0 to 65535, and **auto** directs the system to detect the Virtual Path Index and Virtual Circuit Index automatically.

num	Mandatory. The name of a defined PPPoE unit. The range of values is 0 to 15.
delay	Mandatory. The delay, in seconds, between link-state transmits. This value must be the same for all nodes on the network. The range is 1 to 65535. The default is 1.

Default

Link-state transmits occur at 1-second intervals.

Usage Guidelines

Use this command to set the transmit delay for a PVC with Point-to-Point Protocol over Ethernet (PPPoE) encapsulation on an ADSL interface. This is the estimated time required to send a link-state update (LSU) packet.

This timer is used to accommodate transmission and propagation delays on the network, particularly on low-speed networks where delays may be significant. The router increments the age of link-state advertisements in LSU packets to account for these delays.

The value includes both the transmission time and the propagation delay across the network. The transmit delay is added to the age of the LSA packet before the LSA is transmitted The LSA age is used to help the network sequence LSAs, so that it can determine which of competing LSAs is the more recent and trustworthy.

LSAs are numbered in sequence, but the sequence numbers are finite, and so cannot be used as the sole determinant of the most recent LSA. Instead, OSPF also tracks the age of LSAs. Each time the LSA is forwarded to another router, its current age is incremented by the transmit delay. The packet’s age, together with its sequence number, helps the receiving router to determine which version of a received LSA is more recent, and therefore to be used.

Use the **set** form of this command to set the transmit delay.

Use the **delete** form of this command to restore the default transmit delay.

Use the **show** form of this command to display transmit delay configuration.

Chapter 11: DSL PPPoA Interfaces

This chapter describes commands for configuring OSPF on DSL interfaces with Point-to-Point Protocol over Asynchronous Transfer Mode (PPPoA) encapsulation.

This chapter presents the following topics:

- DSL PPPoA Interface OSPF Commands

DSL PPPoA Interface OSPF Commands

This chapter contains the following commands.

Configuration Commands	
interfaces adsl <adslx> pvc <pvc-id> pppoa <num> ip ospf	Enables OSPF on an ADSL PVC with PPPoA encapsulation.
interfaces adsl <adslx> pvc <pvc-id> pppoa <num> ip ospf authentication	Specifies the authentication method for OSPF on an ADSL PVC with PPPoA encapsulation.
interfaces adsl <adslx> pvc <pvc-id> pppoa <num> ip ospf bandwidth <bandwidth>	Specifies the bandwidth of an ADSL PVC with PPPoA encapsulation for calculating OSPF cost.
interfaces adsl <adslx> pvc <pvc-id> pppoa <num> ip ospf cost <cost>	Sets the routing cost for OSPF on an ADSL PVC with PPPoA encapsulation.
interfaces adsl <adslx> pvc <pvc-id> pppoa <num> ip ospf dead-interval <interval>	Sets the OSPF dead interval for an ADSL PVC with PPPoA encapsulation.
interfaces adsl <adslx> pvc <pvc-id> pppoa <num> ip ospf hello-interval <interval>	Sets the interval between OSPF hello packets on an ADSL PVC with PPPoA encapsulation.
interfaces adsl <adslx> pvc <pvc-id> pppoa <num> ip ospf mtu-ignore	Disables MTU mismatch detection for an ADSL PVC with PPPoA encapsulation.
interfaces adsl <adslx> pvc <pvc-id> pppoa <num> ip ospf network <type>	Specifies the OSPF network type for an ADSL PVC with PPPoA encapsulation.
interfaces adsl <adslx> pvc <pvc-id> pppoa <num> ip ospf priority <priority>	Sets the OSPF priority for an ADSL PVC with PPPoA encapsulation.
interfaces adsl <adslx> pvc <pvc-id> pppoa <num> ip ospf retransmit-interval <interval>	Sets the OSPF retransmit interval for an ADSL PVC with PPPoA encapsulation.
interfaces adsl <adslx> pvc <pvc-id> pppoa <num> ip ospf transmit-delay <delay>	Specifies the OSPF transmit delay for an ADSL PVC with PPPoA encapsulation.
Operational Commands	
None.	

interfaces adsl <adslx> pvc <pvc-id> pppoa <num> ip ospf

Enables OSPF on an ADSL PVC with PPPoA encapsulation.

Syntax

set interfaces adsl *adslx* **pvc** *pvc-id* **pppoa** *num* **ip ospf**

delete interfaces adsl *adslx* **pvc** *pvc-id* **pppoa** *num* **ip ospf**

show interfaces adsl *adslx* **pvc** *pvc-id* **pppoa** *num* **ip ospf**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
   adsl adslx {
      pvc [0-255/0-65535|auto] {
         pppoa 0-15 {
            ip {
               ospf {
               }
            }
         }
      }
   }
}
```

Parameters

adslx	Mandatory. Multi-node. The identifier for the ADSL interface you are defining. This may be **adsl0** to **adsl***x*, depending on what physical ADSL ports are actually available on the system.
pvc-id	Mandatory. The identifier for the PVC. It can either be the *vpi*/*vci* pair or the keyword **auto**, where *vpi* is a Virtual Path Index from 0 to 255, *vci* is a Virtual Circuit Index from from 0 to 65535, and **auto** directs the system to detect the Virtual Path Index and Virtual Circuit Index automatically.

num	Mandatory. The PPPoA unit number. This number must be unique across all PPPoA interfaces. In addition, only one PPPoA instance can be configured on a PVC. PPPoA units range from 0 to 15 and the resulting interfaces are named **pppoa0** to **pppoa15**.

Default

None.

Usage Guidelines

Use this command to enable the Open Shortest Path First (OSPF) routing protocol on a PVC with Point-to-Point Protocol over Asynchronous Transfer Mode (PPPoA) encapsulation on an ADSL interface.

Use the **set** form of this command to enable OSPF on an interface.

Use the **delete** form of this command to remove all OSPF configuration and disable OSPF on an interface.

Use the **show** form of this command to display OSPF configuration.

interfaces adsl <adslx> pvc <pvc-id> pppoa <num> ip ospf authentication

Specifies the authentication method for OSPF on an ADSL PVC with PPPoA encapsulation.

Syntax

set interfaces adsl *adslx* **pvc** *pvc-id* **pppoa** *num* **ip ospf authentication** [**md5 key-id** *key-id* **md5-key** *md5-key* | **plaintext-password** *password*]

delete interfaces adsl *adslx* **pvc** *pvc-id* **pppoa** *num* **ip ospf authentication** [**md5 key-id** *key-id* **md5-key** | **plaintext-password**]

show interfaces adsl *adslx* **pvc** *pvc-id* **pppoa** *num* **ip ospf authentication** [**md5 key-id** *key-id* **md5-key** | **plaintext-password**]

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
   adsl adslx {
      pvc [0-255/0-65535|auto] {
         pppoa 0-15 {
            ip {
               ospf {
                  authentication {
                     md5 {
                        key-id 1-255 {
                           md5-key: text
                        }
                     }
                     plaintext-password: text
                  }
               }
            }
         }
      }
   }
}
```

Parameters

adslx	Mandatory. Multi-node. The identifier for the ADSL interface you are defining. This may be **adsl0** to **adsl***x*, depending on what physical ADSL ports are actually available on the system.
pvc-id	Mandatory. The identifier for the PVC. It can either be the *vpi*/*vci* pair or the keyword **auto**, where *vpi* is a Virtual Path Index from 0 to 255, *vci* is a Virtual Circuit Index from from 0 to 65535, and **auto** directs the system to detect the Virtual Path Index and Virtual Circuit Index automatically.
num	Mandatory. The PPPoA unit number. This number must be unique across all PPPoA interfaces. In addition, only one PPPoA instance can be configured on a PVC. PPPoA units range from 0 to 15 and the resulting interfaces are named **pppoa0** to **pppoa15**.
key-id	Optional. The key used to identify the MD5 key. This must be the same on both the sending and receiving systems. The range is 1 to 255.
md5-key	Optional. A password-like MD5 key of up to 16 alphanumeric characters to be used as input to the MD5 hashing algorithm. The longer the key, the stronger the security. This must be the same on both the sending and receiving systems.
password	Optional. The password to use in plain-text authentication. This must be eight characters or less and the same on both the sending and receiving systems.

Default

None.

Usage Guidelines

Use this command to specify the authentication method to be used for OSPF on a PVC with Point-to-Point Protocol over Asynchronous Transfer Mode (PPPoA) encapsulation on an ADSL interface. This authentication is independent of the authentication configured for the OSPF area.

In plain text authentication, passwords are sent through the network in plain text. In MD5 authentication, the system uses the Message Digest 5 (MD5) algorithm to compute a hash value from the contents of the OSPF packet and the password. The hash value and the MD5 key are included in the transmitted packet, and the receiving system (configured with the same password) calculates its own hash function, which must match.

The authentication parameters must be the same for all routers that are to establish two-way communication within a network. If two routers do not agree on these parameters, they will not consider establish adjacencies, and will disregard one another's communications.

Use the **set** form of this command to set the authentication for a PVC with PPPoA encapsulation on an ADSL interface.

Use the **delete** form of this command to remove authentication configuration information.

Use the **show** form of this command to display authentication configuration information.

interfaces adsl <adslx> pvc <pvc-id> pppoa <num> ip ospf bandwidth <bandwidth>

Specifies the bandwidth of an ADSL PVC with PPPoA encapsulation for calculating OSPF cost.

Syntax

set interfaces adsl *adslx* **pvc** *pvc-id* **pppoa** *num* **ip ospf bandwidth** *bandwidth*

delete interfaces adsl *adslx* **pvc** *pvc-id* **pppoa** *num* **ip ospf bandwidth**

show interfaces adsl *adslx* **pvc** *pvc-id* **pppoa** *num* **ip ospf bandwidth**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
   adsl adslx {
      pvc [0-255/0-65535|auto] {
         pppoa 0-15 {
            ip {
               ospf {
                  bandwidth: u32
               }
            }
         }
      }
   }
}
```

Parameters

adslx	Mandatory. Multi-node. The identifier for the ADSL interface you are defining. This may be **adsl0** to **adsl***x*, depending on what physical ADSL ports are actually available on the system.
pvc-id	Mandatory. The identifier for the PVC. It can either be the *vpi*/*vci* pair or the keyword **auto**, where *vpi* is a Virtual Path Index from 0 to 255, *vci* is a Virtual Circuit Index from from 0 to 65535, and **auto** directs the system to detect the Virtual Path Index and Virtual Circuit Index automatically.

num	Mandatory. The PPPoA unit number. This number must be unique across all PPPoA interfaces. In addition, only one PPPoA instance can be configured on a PVC. PPPoA units range from 0 to 15 and the resulting interfaces are named **pppoa0** to **pppoa15**.
bandwidth	The bandwidth of the Ethernet interface in kilobits/sec. The range is 1 to 10000000.

Default

None.

Usage Guidelines

Use this command to specify the bandwidth of a PVC with Point-to-Point Protocol over Asynchronous Transfer Mode (PPPoA) encapsulation on an ADSL interface for the purpose of computing OSPF cost.

Use the **set** form of this command to specify the bandwidth of the interface.

Use the **delete** form of this command to remove the bandwidth parameter.

Use the **show** form of this command to display the bandwidth configuration.

interfaces adsl <adslx> pvc <pvc-id> pppoa <num> ip ospf cost <cost>

Sets the routing cost for OSPF on an ADSL PVC with PPPoA encapsulation.

Syntax

set interfaces adsl *adslx* **pvc** *pvc-id* **pppoa** *num* **ip ospf cost** *cost*

delete interfaces adsl *adslx* **pvc** *pvc-id* **pppoa** *num* **ip ospf cost**

show interfaces adsl *adslx* **pvc** *pvc-id* **pppoa** *num* **ip ospf cost**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
   adsl adslx {
      pvc [0-255/0-65535|auto] {
         pppoa 0-15 {
            ip {
               ospf {
                  cost: u32
               }
            }
         }
      }
   }
}
```

Parameters

adslx	Mandatory. Multi-node. The identifier for the ADSL interface you are defining. This may be **adsl0** to **adsl***x*, depending on what physical ADSL ports are actually available on the system.
pvc-id	Mandatory. The identifier for the PVC. It can either be the *vpi*/*vci* pair or the keyword **auto**, where *vpi* is a Virtual Path Index from 0 to 255, *vci* is a Virtual Circuit Index from from 0 to 65535, and **auto** directs the system to detect the Virtual Path Index and Virtual Circuit Index automatically.

num	Mandatory. The PPPoA unit number. This number must be unique across all PPPoA interfaces. In addition, only one PPPoA instance can be configured on a PVC. PPPoA units range from 0 to 15 and the resulting interfaces are named **pppoa0** to **pppoa15**.
cost	The link-state metric (OSPF cost) to be advertised in the link-state advertisement (LSA) as the cost of sending packets over the ethernet interface. The range is 1 to 65535.

Default

For details on the default of OSPF cost, please see the Usage Guidelines.

Usage Guidelines

Use this command to manually override the default OSPF cost computed by the system for a PVC with Point-to-Point Protocol over Asynchronous Transfer Mode (PPPoA) encapsulation on an ADSL interface. You can only assign one cost per interface.

By default, the metric associated with a link is computed as follows:

```
Cost = 108 / bandwidth
```

The cost of reaching any destination is the sum of the costs of the individual hops. Costs are always rounded to the nearest integer. Costs lower than 1 are rounded up to 1.

Table 11-1 shows the OSPF costs for some common media types.

Table 11-1 OSPF Costs for Common Media Types

Media Type	OSPF Cost
56 Kbps	1785
64 Kbps	1562
128 Kbps	781
256 Kbps	390
512 Kbps	195
768 Kbps	130
T1 (1.544 Mbps)	64
E1 (2.048 Mbps)	48
4 Mbps Token Ring	6
10 Mbps Ethernet	10

Table 11-1 OSPF Costs for Common Media Types

16 Mbps Token Ring	6
T3 (44.736 Mbps	2
100+ Mbps	1

The values in Table 11-1 show how OSPF fails to distinguish between interfaces faster than 100 Mbps, for example, between Fast Ethernet (100 Mbps) and Gigabit Ethernet (1000 Mbps) interfaces. If you want to distinguish interfaces equal to or greater than 100 Mbps, you must manually configure the cost of the interface using this command.

Use the **set** form of this command to specify the OSPF cost for the interface.

Use the **delete** form of this command to restore the default cost.

Use the **show** form of this command to display cost configuration.

interfaces adsl <adslx> pvc <pvc-id> pppoa <num> ip ospf dead-interval <interval>

Sets the OSPF dead interval for an ADSL PVC with PPPoA encapsulation.

Syntax

set interfaces adsl *adslx* **pvc** *pvc-id* **pppoa** *num* **ip ospf dead-interval** *interval*

delete interfaces adsl *adslx* **pvc** *pvc-id* **pppoa** *num* **ip ospf dead-interval**

show interfaces adsl *adslx* **pvc** *pvc-id* **pppoa** *num* **ip ospf dead-interval**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
    adsl adslx {
        pvc [0-255/0-65535|auto] {
            pppoa 0-15 {
                ip {
                    ospf {
                        dead-interval: u32
                    }
                }
            }
        }
    }
}
```

Parameters

adslx	Mandatory. Multi-node. The identifier for the ADSL interface you are defining. This may be **adsl0** to **adsl***x*, depending on what physical ADSL ports are actually available on the system.
pvc-id	Mandatory. The identifier for the PVC. It can either be the *vpi*/*vci* pair or the keyword **auto**, where *vpi* is a Virtual Path Index from 0 to 255, *vci* is a Virtual Circuit Index from from 0 to 65535, and **auto** directs the system to detect the Virtual Path Index and Virtual Circuit Index automatically.

num	Mandatory. The PPPoA unit number. This number must be unique across all PPPoA interfaces. In addition, only one PPPoA instance can be configured on a PVC. PPPoA units range from 0 to 15 and the resulting interfaces are named **pppoa0** to **pppoa15**.
interval	Specifies the time, in seconds, that this interface should wait to detect hello packets from neighboring routers before declaring the neighbor down. The range is 1 to 65535. The default is 4 times the hello interval.

Default

The dead interval is 4 times the hello interval.

Usage Guidelines

Use this command to specify the interval during which a PVC with Point-to-Point Protocol over Asynchronous Transfer Mode (PPPoA) encapsulation on an ADSL interface should expect a hello packet from its neighbor.

If the dead interval passes without the interface receiving a hello packet from the neighbor, the neighbor's status is changed to out-of-service, and all associated state is cleared.

The dead interval must be the same for all routers that are to establish two-way communication within a network. If two routers do not agree on these parameters, they will not establish adjacencies and will disregard one another's communications.

Use the **set** form of this command to specify the dead interval.

Use the **delete** form of this command to restore the default dead interval.

Use the **show** form of this command to display dead interval configuration.

interfaces adsl <adslx> pvc <pvc-id> pppoa <num> ip ospf hello-interval <interval>

Sets the interval between OSPF hello packets on an ADSL PVC with PPPoA encapsulation.

Syntax

set interfaces adsl *adslx* **pvc** *pvc-id* **pppoa** *num* **ip ospf hello-interval** *interval*

delete interfaces adsl *adslx* **pvc** *pvc-id* **pppoa** *num* **ip ospf hello-interval**

show interfaces adsl *adslx* **pvc** *pvc-id* **pppoa** *num* **ip ospf hello-interval**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
   adsl adslx {
      pvc [0-255/0-65535|auto] {
         pppoa 0-15 {
            ip {
               ospf {
                  hello-interval: u32
               }
            }
         }
      }
   }
}
```

Parameters

adslx	Mandatory. Multi-node. The identifier for the ADSL interface you are defining. This may be **adsl0** to **adsl***x*, depending on what physical ADSL ports are actually available on the system.
pvc-id	Mandatory. The identifier for the PVC. It can either be the *vpi*/*vci* pair or the keyword **auto**, where *vpi* is a Virtual Path Index from 0 to 255, *vci* is a Virtual Circuit Index from from 0 to 65535, and **auto** directs the system to detect the Virtual Path Index and Virtual Circuit Index automatically.

num	Mandatory. The PPPoA unit number. This number must be unique across all PPPoA interfaces. In addition, only one PPPoA instance can be configured on a PVC. PPPoA units range from 0 to 15 and the resulting interfaces are named **pppoa0** to **pppoa15**.
interval	Mandatory. The interval, in seconds, between hello packets. This value must be the same for all nodes on the network.The range is 1 to 65535. The default is 10.

Default

Hello packets are sent every 10 seconds.

Usage Guidelines

Use this command to set the interval at which OSPF hello packets are sent for a PVC with Point-to-Point Protocol over Asynchronous Transfer Mode (PPPoA) encapsulation on an ADSL interface.

A hello packet is an OSPF packet used to detect and maintain relationships with neighbors on the same network (directly connected routers). The greater the interval between hello packets, the less router traffic occurs, but the longer it takes for topological changes to be detected.

The hello interval must be the same for all routers that are to establish two-way communication within a network. If two routers do not agree on these parameters, they will not establish adjacencies and will disregard one another’s communications.

Use the **set** form of this command to set the hello interval.

Use the **delete** form of this command to restore the default hello interval.

Use the **show** form of this command to display hello interval configuration.

interfaces adsl <adslx> pvc <pvc-id> pppoa <num> ip ospf mtu-ignore

Disables MTU mismatch detection for an ADSL PVC with PPPoA encapsulation.

Syntax

set interfaces adsl *adslx* **pvc** *pvc-id* **pppoa** *num* **ip ospf mtu-ignore**

delete interfaces adsl *adslx* **pvc** *pvc-id* **pppoa** *num* **ip ospf mtu-ignore**

show interfaces adsl *adslx* **pvc** *pvc-id* **pppoa** *num* **ip ospf**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
   adsl adslx {
      pvc [0-255/0-65535|auto] {
         pppoa 0-15 {
            ip {
               ospf {
                  mtu-ignore
               }
            }
         }
      }
   }
}
```

Parameters

adslx	Mandatory. Multi-node. The identifier for the ADSL interface you are defining. This may be **adsl0** to **adsl***x*, depending on what physical ADSL ports are actually available on the system.
pvc-id	Mandatory. The identifier for the PVC. It can either be the *vpi*/*vci* pair or the keyword **auto**, where *vpi* is a Virtual Path Index from 0 to 255, *vci* is a Virtual Circuit Index from from 0 to 65535, and **auto** directs the system to detect the Virtual Path Index and Virtual Circuit Index automatically.

num	Mandatory. The PPPoA unit number. This number must be unique across all PPPoA interfaces. In addition, only one PPPoA instance can be configured on a PVC. PPPoA units range from 0 to 15 and the resulting interfaces are named **pppoa0** to **pppoa15**.

Default

MTU mismatch detection is enabled by default.

Usage Guidelines

Use this command to disable MTU mismatch detection on an ADSL interface with Point-to-Point Protocol over Asynchronous Transfer Mode (PPPoA) encapsulation running OSPF.

OSPF sends the MTU of the interface in a database description packet. If the MTUs of OSPF neighbors do not match, they cannot form an OSPF adjacency. MTU mismatch detection detects MTU mismatches and indicates them in the form of a debug message.

MTU mismatch is an important troubleshooting feature. If MTU mismatch is not enabled, MTU mismatches can only be detected by examining configuration for both interfaces.

There are some network setups where MTU mismatches are unavoidable, and even part of the normal set-up. It is for these cases only that MTU mismatch detection should be disabled, so that normal OSPF adjacencies can be formed.

Use the **set** form of this command to disable MTU mismatch detection.

Use the **delete** form of this command to re-enable MTU mismatch detection.

Use the **show** form of this command to display OSPF configuration.

interfaces adsl <adslx> pvc <pvc-id> pppoa <num> ip ospf network <type>

Specifies the OSPF network type for an ADSL PVC with PPPoA encapsulation.

Syntax

set interfaces adsl *adslx* **pvc** *pvc-id* **pppoa** *num* **ip ospf network** [**broadcast** | **non-broadcast** | **point-to-multipoint** | **point-to-point**]

delete interfaces adsl *adslx* **pvc** *pvc-id* **pppoa** *num* **ip ospf network**

show interfaces adsl *adslx* **pvc** *pvc-id* **pppoa** *num* **ip ospf network**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
   adsl adslx {
      pvc [0-255/0-65535|auto] {
         pppoa 0-15 {
            ip {
               ospf {
                  network: text
               }
            }
         }
      }
   }
}
```

Parameters

adslx	Mandatory. Multi-node. The identifier for the ADSL interface you are defining. This may be **adsl0** to **adsl***x*, depending on what physical ADSL ports are actually available on the system.
pvc-id	Mandatory. The identifier for the PVC. It can either be the *vpi*/*vci* pair or the keyword **auto**, where *vpi* is a Virtual Path Index from 0 to 255, *vci* is a Virtual Circuit Index from from 0 to 65535, and **auto** directs the system to detect the Virtual Path Index and Virtual Circuit Index automatically.

num	Mandatory. The PPPoA unit number. This number must be unique across all PPPoA interfaces. In addition, only one PPPoA instance can be configured on a PVC. PPPoA units range from 0 to 15 and the resulting interfaces are named **pppoa0** to **pppoa15**.
type	The network type for this interface. Supported values are as follows: **broadcast**: The interface supports broadcast mode, such as a LAN link. **non-broadcast**: The interface does not support broadcast mode. **point-to-point**: This interface supports point-to-point mode, such as an NBMA interface. **point-to-multipoint**: This interface supports point-to-multipoint mode, such as a PPP interface or a point-to-point logical interface on Frame Relay. The default is broadcast.

Default

Broadcast is supported.

Usage Guidelines

Use this command to configure and display the network type for an ADSL interface with Point-to-Point Protocol over Asynchronous Transfer Mode (PPPoA) encapsulation running OSPF.

Use the **set** form of this command to specify the network type.

Use the **delete** form of this command to remove the network type.

Use the **show** form of this command to display the network type.

interfaces adsl <adslx> pvc <pvc-id> pppoa <num> ip ospf priority <priority>

Sets the OSPF priority for an ADSL PVC with PPPoA encapsulation.

Syntax

set interfaces adsl *adslx* **pvc** *pvc-id* **pppoa** *num* **ip ospf priority** *priority*

delete interfaces adsl *adslx* **pvc** *pvc-id* **pppoa** *num* **ip ospf priority**

show interfaces adsl *adslx* **pvc** *pvc-id* **pppoa** *num* **ip ospf priority**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
   adsl adslx {
      pvc [0-255/0-65535|auto] {
         pppoa 0-15 {
            ip {
               ospf {
                  priority: u32
               }
            }
         }
      }
   }
}
```

Parameters

adslx	Mandatory. Multi-node. The identifier for the ADSL interface you are defining. This may be **adsl0** to **adsl***x*, depending on what physical ADSL ports are actually available on the system.
pvc-id	Mandatory. The identifier for the PVC. It can either be the *vpi*/*vci* pair or the keyword **auto**, where *vpi* is a Virtual Path Index from 0 to 255, *vci* is a Virtual Circuit Index from from 0 to 65535, and **auto** directs the system to detect the Virtual Path Index and Virtual Circuit Index automatically.

num	Mandatory. The PPPoA unit number. This number must be unique across all PPPoA interfaces. In addition, only one PPPoA instance can be configured on a PVC. PPPoA units range from 0 to 15 and the resulting interfaces are named **pppoa0** to **pppoa15**.
priority	Specifies the OSPF router priority for this interface. The range is 0 to 255, where a router with priority 0 can never become the designated router. The default is 1.

Default

An OSPF interface has a priority of 1.

Usage Guidelines

Use this command to set the priority for a PVC with PPPoA encapsulation on an ADSL interface on the broadcast network to which the interface is connected. The priority determines which routers are selected as the area's Designated Router (DR) and Backup Designated Router (BDR).

The DR and BDR are used to reduce the amount of traffic on OSPF overhead on broadcast networks, by reducing the number of adjacent routers to which a router must flood its topological information. In broadcast networks (such as Ethernet), each router establishes an adjacency with only the DR and the BDR, rather than with every router in its area. The DR and the BDR then flood this information to all other routers on the network segment.

Priority can range from 0 to 255. In general, the router with the highest priority is elected as the DR, and the router with the second-highest priority is elected as the BDR. The higher the number, the higher the priority.

Routers with a priority of 0 are ineligible for election.

Use the **set** form of this command to specify the OSPF priority.

Use the **delete** form of this command to restore the default priority.

Use the **show** form of this command to display priority configuration.

interfaces adsl <adslx> pvc <pvc-id> pppoa <num> ip ospf retransmit-interval <interval>

Sets the OSPF retransmit interval for an ADSL PVC with PPPoA encapsulation.

Syntax

set interfaces adsl *adslx* **pvc** *pvc-id* **pppoa** *num* **ip ospf retransmit-interval** *interval*

delete interfaces adsl *adslx* **pvc** *pvc-id* **pppoa** *num* **ip ospf retransmit-interval**

show interfaces adsl *adslx* **pvc** *pvc-id* **pppoa** *num* **ip ospf retransmit-interval**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
   adsl adslx {
      pvc [0-255/0-65535|auto] {
         pppoa 0-15 {
            ip {
               ospf {
                  retransmit-interval: u32
               }
            }
         }
      }
   }
}
```

Parameters

adslx	Mandatory. Multi-node. The identifier for the ADSL interface you are defining. This may be **adsl0** to **adsl***x*, depending on what physical ADSL ports are actually available on the system.
pvc-id	Mandatory. The identifier for the PVC. It can either be the *vpi*/*vci* pair or the keyword **auto**, where *vpi* is a Virtual Path Index from 0 to 255, *vci* is a Virtual Circuit Index from from 0 to 65535, and **auto** directs the system to detect the Virtual Path Index and Virtual Circuit Index automatically.

num	Mandatory. The PPPoA unit number. This number must be unique across all PPPoA interfaces. In addition, only one PPPoA instance can be configured on a PVC. PPPoA units range from 0 to 15 and the resulting interfaces are named **pppoa0** to **pppoa15**.
interval	Specifies the time in seconds to wait for an acknowledgement, after which the system retransmits an LSA packet to its neighbors. The range is 3 to 65535. The default is 5.

Default

Unacknowledged LSAs are retransmitted at 5-second intervals.

Usage Guidelines

Use this command to specify how long a PVC with PPPoA encapsulation on an ADSL interface will wait for an acknowledgment of a link-state update before resending the update.

The link-state update packet is part of the exchange of topology databases between routers. When the initial database description (DD) packet is sent, it contains only the headers of the LSAs. If the receiving router determines that it requires that piece of the OSPF topology, it sends a link state request packet to request the complete LSA from the sending router.

After the update packet is sent, the sending router waits for an acknowledgement, either implicit or explicit, from the receiving router. In an explicit acknowledgement, the receiving router sends a link-state acknowledge (LS-Ack) packet to the router that sent the update. In an implicit acknowledgement, the router that sent the update receives an LSA from the receiving router that contains the update information.

If the retransmit interval passes with neither an explicit nor an implicit acknowledgement, the sending router will retransmit the link-state update packet.

Too high an interval slows network convergence. Too small an interval causes unnecessary retransmission.

Use the **set** form of this command to set the OSPF retransmit interval for a PVC with PPPoA encapsulation on an ADSL interface.

Use the **delete** form of this command to restore the default retransmit interval.

Use the **show** form of this command to display retransmit interval configuration.

interfaces adsl <adslx> pvc <pvc-id> pppoa <num> ip ospf transmit-delay <delay>

Specifies the OSPF transmit delay for an ADSL PVC with PPPoA encapsulation.

Syntax

set interfaces adsl *adslx* **pvc** *pvc-id* **pppoa** *num* **ip ospf transmit-delay** *delay*

delete interfaces adsl *adslx* **pvc** *pvc-id* **pppoa** *num* **ip ospf transmit-delay**

show interfaces adsl *adslx* **pvc** *pvc-id* **pppoa** *num* **ip ospf transmit-delay**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
   adsl adslx {
      pvc [0-255/0-65535|auto] {
         pppoa 0-15 {
            ip {
               ospf {
                  transmit-delay: u32
               }
            }
         }
      }
   }
}
```

Parameters

adslx	Mandatory. Multi-node. The identifier for the ADSL interface you are defining. This may be **adsl0** to **adsl***x*, depending on what physical ADSL ports are actually available on the system.
pvc-id	Mandatory. The identifier for the PVC. It can either be the *vpi*/*vci* pair or the keyword **auto**, where *vpi* is a Virtual Path Index from 0 to 255, *vci* is a Virtual Circuit Index from from 0 to 65535, and **auto** directs the system to detect the Virtual Path Index and Virtual Circuit Index automatically.

num	Mandatory. The PPPoA unit number. This number must be unique across all PPPoA interfaces. In addition, only one PPPoA instance can be configured on a PVC. PPPoA units range from 0 to 15 and the resulting interfaces are named **pppoa0** to **pppoa15**.
delay	Mandatory. The delay, in seconds, between link-state transmits. This value must be the same for all nodes on the network. The range is 1 to 65535. The default is 1.

Default

Link-state transmits occur at 1-second intervals.

Usage Guidelines

Use this command to set the transmit delay for a PVC with PPPoA encapsulation on an ADSL interface. This is the estimated time required to send a link-state update (LSU) packet.

This timer is used to accommodate transmission and propagation delays on the network, particularly on low-speed networks where delays may be significant. The router increments the age of link-state advertisements in LSU packets to account for these delays.

The value includes both the transmission time and the propagation delay across the network. The transmit delay is added to the age of the LSA packet before the LSA is transmitted The LSA age is used to help the network sequence LSAs, so that it can determine which of competing LSAs is the more recent and trustworthy.

LSAs are numbered in sequence, but the sequence numbers are finite, and so cannot be used as the sole determinant of the most recent LSA. Instead, OSPF also tracks the age of LSAs. Each time the LSA is forwarded to another router, its current age is incremented by the transmit delay. The packet's age, together with its sequence number, helps the receiving router to determine which version of a received LSA is more recent, and therefore to be used.

Use the **set** form of this command to set the transmit delay.

Use the **delete** form of this command to restore the default transmit delay.

Use the **show** form of this command to display transmit delay configuration.

Chapter 12: DSL Bridged Ethernet Interfaces

This chapter describes commands for configuring OSPF on DSL interfaces with RFC 2684 bridged Ethernet encapsulation.

This chapter presents the following topics:

- DSL Bridged Ethernet Interface OSPF Commands

DSL Bridged Ethernet Interface OSPF Commands

This chapter contains the following commands.

Configuration Commands	
interfaces adsl <adslx> pvc <pvc-id> bridged-ethernet ip ospf	Enables OSPF on an ADSL PVC with Bridged Ethernet encapsulation.
interfaces adsl <adslx> pvc <pvc-id> bridged-ethernet ip ospf authentication	Specifies the authentication method for OSPF on an ADSL PVC with bridged-ethernet encapsulation.
interfaces adsl <adslx> pvc <pvc-id> bridged-ethernet ip ospf bandwidth <bandwidth>	Specifies the bandwidth of an ADSL PVC with Bridged Ethernet encapsulation for calculating OSPF cost.
interfaces adsl <adslx> pvc <pvc-id> bridged-ethernet ip ospf cost <cost>	Sets the routing cost for OSPF on an ADSL PVC with Bridged Ethernet encapsulation.
interfaces adsl <adslx> pvc <pvc-id> bridged-ethernet ip ospf dead-interval <interval>	Sets the OSPF dead interval for an ADSL PVC with Bridged Ethernet encapsulation.
interfaces adsl <adslx> pvc <pvc-id> bridged-ethernet ip ospf hello-interval <interval>	Sets the interval between OSPF hello packets on an ADSL PVC with Bridged Ethernet encapsulation.
interfaces adsl <adslx> pvc <pvc-id> bridged-ethernet ip ospf mtu-ignore	Disables MTU mismatch detection for an ADSL PVC with Bridged Ethernet encapsulation.
interfaces adsl <adslx> pvc <pvc-id> bridged-ethernet ip ospf network <type>	Specifies the OSPF network type for an ADSL PVC with Bridged Ethernet encapsulation.
interfaces adsl <adslx> pvc <pvc-id> bridged-ethernet ip ospf priority <priority>	Sets the OSPF priority for an ADSL PVC with Bridged Ethernet encapsulation.
interfaces adsl <adslx> pvc <pvc-id> bridged-ethernet ip ospf retransmit-interval <interval>	Sets the OSPF retransmit interval for an ADSL PVC with Bridged Ethernet encapsulation.
interfaces adsl <adslx> pvc <pvc-id> bridged-ethernet ip ospf transmit-delay <delay>	Specifies the OSPF transmit delay for an ADSL PVC with Bridged Ethernet encapsulation.
Operational Commands	
None.	

interfaces adsl <adslx> pvc <pvc-id> bridged-ethernet ip ospf

Enables OSPF on an ADSL PVC with Bridged Ethernet encapsulation.

Syntax

set interfaces adsl *adslx* **pvc** *pvc-id* **bridged-ethernet ip ospf**

delete interfaces adsl *adslx* **pvc** *pvc-id* **bridged-ethernet ip ospf**

show interfaces adsl *adslx* **pvc** *pvc-id* **bridged-ethernet ip ospf**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
   adsl adslx {
      pvc [0-255/0-65535|auto] {
         bridged-ethernet {
            ip {
               ospf {
               }
            }
         }
      }
   }
}
```

Parameters

adslx	Mandatory. Multi-node. The identifier for the ADSL interface you are defining. This may be **adsl0** to **adsl***x*, depending on what physical ADSL ports are actually available on the system.
pvc-id	Mandatory. The identifier for the PVC. It can either be the *vpi*/*vci* pair or the keyword **auto**, where *vpi* is a Virtual Path Index from 0 to 255, *vci* is a Virtual Circuit Index from from 0 to 65535, and **auto** directs the system to detect the Virtual Path Index and Virtual Circuit Index automatically.

Default

None.

Usage Guidelines

Use this command to enable the Open Shortest Path First (OSPF) routing protocol on a PVC with Bridged Ethernet encapsulation on an ADSL interface.

Use the **set** form of this command to enable OSPF on an interface.

Use the **delete** form of this command to remove all OSPF configuration and disable OSPF on an interface.

Use the **show** form of this command to display OSPF configuration.

interfaces adsl <adslx> pvc <pvc-id> bridged-ethernet ip ospf authentication

Specifies the authentication method for OSPF on an ADSL PVC with bridged-ethernet encapsulation.

Syntax

set interfaces adsl *adslx* **pvc** *pvc-id* **bridged-ethernet ip ospf authentication** [**md5 key-id** *key-id* **md5-key** *md5-key* | **plaintext-password** *password*]

delete interfaces adsl *adslx* **pvc** *pvc-id* **bridged-ethernet ip ospf authentication** [**md5 key-id** *key-id* **md5-key** | **plaintext-password**]

show interfaces adsl *adslx* **pvc** *pvc-id* **bridged-ethernet ip ospf authentication** [**md5 key-id** *key-id* **md5-key** | **plaintext-password**]

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
   adsl adslx {
      pvc [0-255/0-65535|auto] {
         bridged-ethernet {
            ip {
               ospf {
                  authentication {
                     md5 {
                        key-id 1-255 {
                           md5-key text
                        }
                     }
                     plaintext-password text
                  }
               }
            }
         }
      }
   }
}
```

Parameters

adslx	Mandatory. Multi-node. The identifier for the ADSL interface you are defining. This may be **adsl0** to **adsl***x*, depending on what physical ADSL ports are actually available on the system.
pvc-id	Mandatory. The identifier for the PVC. It can either be the *vpi*/*vci* pair or the keyword **auto**, where *vpi* is a Virtual Path Index from 0 to 255, *vci* is a Virtual Circuit Index from from 0 to 65535, and **auto** directs the system to detect the Virtual Path Index and Virtual Circuit Index automatically.
key-id	Optional. The key used to identify the MD5 key. This must be the same on both the sending and receiving systems. The range is 1 to 255.
md5-key	Optional. A password-like MD5 key of up to 16 alphanumeric characters to be used as input to the MD5 hashing algorithm. The longer the key, the stronger the security. This must be the same on both the sending and receiving systems.
password	Optional. The password to use in plain-text authentication. This must be eight characters or less and the same on both the sending and receiving systems.

Default

None.

Usage Guidelines

Use this command to specify the authentication method to be used for OSPF on a PVC with Bridged Ethernet encapsulation on an ADSL interface. This authentication is independent of the authentication configured for the OSPF area.

In plain text authentication, passwords are sent through the network in plain text. In MD5 authentication, the system uses the Message Digest 5 (MD5) algorithm to compute a hash value from the contents of the OSPF packet and the password. The hash value and the MD5 key are included in the transmitted packet, and the receiving system (configured with the same password) calculates its own hash function, which must match.

The authentication parameters must be the same for all routers that are to establish two-way communication within a network. If two routers do not agree on these parameters, they will not consider establish adjacencies, and will disregard one another's communications.

Use the **set** form of this command to set the authentication for a PVC with Bridged Ethernet encapsulation on an ADSL interface.

Use the **delete** form of this command to remove authentication configuration information.

Use the **show** form of this command to display authentication configuration information.

interfaces adsl <adslx> pvc <pvc-id> bridged-ethernet ip ospf bandwidth <bandwidth>

Specifies the bandwidth of an ADSL PVC with Bridged Ethernet encapsulation for calculating OSPF cost.

Syntax

set interfaces adsl *adslx* **pvc** *pvc-id* **bridged-ethernet ip ospf bandwidth** *bandwidth*

delete interfaces adsl *adslx* **pvc** *pvc-id* **bridged-ethernet ip ospf bandwidth**

show interfaces adsl *adslx* **pvc** *pvc-id* **bridged-ethernet ip ospf bandwidth**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
    adsl adslx {
        pvc [0-255/0-65535|auto] {
            bridged-ethernet {
                ip {
                    ospf {
                        bandwidth u32
                    }
                }
            }
        }
    }
}
```

Parameters

adslx	Mandatory. Multi-node. The identifier for the ADSL interface you are defining. This may be **adsl0** to **adsl***x*, depending on what physical ADSL ports are actually available on the system.
pvc-id	Mandatory. The identifier for the PVC. It can either be the *vpi*/*vci* pair or the keyword **auto**, where *vpi* is a Virtual Path Index from 0 to 255, *vci* is a Virtual Circuit Index from from 0 to 65535, and **auto** directs the system to detect the Virtual Path Index and Virtual Circuit Index automatically.

bandwidth	The bandwidth of the Ethernet interface in kilobits/sec. The range is 1 to 10000000.

Default

None.

Usage Guidelines

Use this command to specify the bandwidth of a PVC with Bridged Ethernet encapsulation on an ADSL interface for the purpose of computing OSPF cost.

Use the **set** form of this command to specify the bandwidth of the interface.

Use the **delete** form of this command to remove the bandwidth parameter.

Use the **show** form of this command to display the bandwidth configuration.

interfaces adsl <adslx> pvc <pvc-id> bridged-ethernet ip ospf cost <cost>

Sets the routing cost for OSPF on an ADSL PVC with Bridged Ethernet encapsulation.

Syntax

set interfaces adsl *adslx* **pvc** *pvc-id* **bridged-ethernet ip ospf cost** *cost*

delete interfaces adsl *adslx* **pvc** *pvc-id* **bridged-ethernet ip ospf cost**

show interfaces adsl *adslx* **pvc** *pvc-id* **bridged-ethernet ip ospf cost**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
   adsl adslx {
      pvc [0-255/0-65535|auto] {
         bridged-ethernet {
            ip {
               ospf {
                  cost u32
               }
            }
         }
      }
   }
}
```

Parameters

adslx	Mandatory. Multi-node. The identifier for the ADSL interface you are defining. This may be **adsl0** to **adsl***x*, depending on what physical ADSL ports are actually available on the system.
pvc-id	Mandatory. The identifier for the PVC. It can either be the *vpi*/*vci* pair or the keyword **auto**, where *vpi* is a Virtual Path Index from 0 to 255, *vci* is a Virtual Circuit Index from from 0 to 65535, and **auto** directs the system to detect the Virtual Path Index and Virtual Circuit Index automatically.

cost	The link-state metric (OSPF cost) to be advertised in the link-state advertisement (LSA) as the cost of sending packets over the interface. The range is 1 to 65535.

Default

For details on the default of OSPF cost, please see the Usage Guidelines.

Usage Guidelines

Use this command to manually override the default OSPF cost computed by the system for a PVC with Bridged Ethernet encapsulation on an ADSL interface. You can only assign one cost per interface.

By default, the metric associated with a link is computed as follows:

```
Cost = 108 / bandwidth
```

The cost of reaching any destination is the sum of the costs of the individual hops. Costs are always rounded to the nearest integer. Costs lower than 1 are rounded up to 1.

Table 12-1 shows the OSPF costs for some common media types.

Table 12-1 OSPF Costs for Common Media Types

Media Type	OSPF Cost
56 Kbps	1785
64 Kbps	1562
128 Kbps	781
256 Kbps	390
512 Kbps	195
768 Kbps	130
T1 (1.544 Mbps)	64
E1 (2.048 Mbps)	48
4 Mbps Token Ring	6
10 Mbps Ethernet	10
16 Mbps Token Ring	6
T3 (44.736 Mbps	2
100+ Mbps	1

The values in Table 12-1 show how OSPF fails to distinguish between interfaces faster than 100 Mbps, for example, between Fast Ethernet (100 Mbps) and Gigabit Ethernet (1000 Mbps) interfaces. If you want to distinguish interfaces equal to or greater than 100 Mbps, you must manually configure the cost of the interface using this command.

Use the **set** form of this command to specify the OSPF cost for the interface.

Use the **delete** form of this command to restore the default cost.

Use the **show** form of this command to display cost configuration.

interfaces adsl <adslx> pvc <pvc-id> bridged-ethernet ip ospf dead-interval <interval>

Sets the OSPF dead interval for an ADSL PVC with Bridged Ethernet encapsulation.

Syntax

set interfaces adsl *adslx* **pvc** *pvc-id* **bridged-ethernet ip ospf dead-interval** *interval*

delete interfaces adsl *adslx* **pvc** *pvc-id* **bridged-ethernet ip ospf dead-interval**

show interfaces adsl *adslx* **pvc** *pvc-id* **bridged-ethernet ip ospf dead-interval**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
   adsl adslx {
      pvc [0-255/0-65535|auto] {
         bridged-ethernet {
            ip {
               ospf {
                  dead-interval u32
               }
            }
         }
      }
   }
}
```

Parameters

adslx	Mandatory. Multi-node. The identifier for the ADSL interface you are defining. This may be **adsl0** to **adsl***x*, depending on what physical ADSL ports are actually available on the system.
pvc-id	Mandatory. The identifier for the PVC. It can either be the *vpi*/*vci* pair or the keyword **auto**, where *vpi* is a Virtual Path Index from 0 to 255, *vci* is a Virtual Circuit Index from from 0 to 65535, and **auto** directs the system to detect the Virtual Path Index and Virtual Circuit Index automatically.

interval	Specifies the time, in seconds, that this interface should wait to detect hello packets from neighboring routers before declaring the neighbor down. The range is 1 to 65535. The default is 4 times the hello interval.

Default

The dead interval is 4 times the hello interval.

Usage Guidelines

Use this command to specify the interval during which a PVC with Bridged Ethernet encapsulation on an ADSL interface should expect a hello packet from its neighbor.

If the dead interval passes without the interface receiving a hello packet from the neighbor, the neighbor's status is changed to out-of-service, and all associated state is cleared.

The dead interval must be the same for all routers that are to establish two-way communication within a network. If two routers do not agree on these parameters, they will not establish adjacencies and will disregard one another's communications.

Use the **set** form of this command to specify the dead interval.

Use the **delete** form of this command to restore the default dead interval.

Use the **show** form of this command to display dead interval configuration.

interfaces adsl <adslx> pvc <pvc-id> bridged-ethernet ip ospf hello-interval <interval>

Sets the interval between OSPF hello packets on an ADSL PVC with Bridged Ethernet encapsulation.

Syntax

set interfaces adsl *adslx* **pvc** *pvc-id* **bridged-ethernet ip ospf hello-interval** *interval*

delete interfaces adsl *adslx* **pvc** *pvc-id* **bridged-ethernet ip ospf hello-interval**

show interfaces adsl *adslx* **pvc** *pvc-id* **bridged-ethernet ip ospf hello-interval**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
   adsl adslx {
      pvc [0-255/0-65535|auto] {
         bridged-ethernet {
            ip {
               ospf {
                  hello-interval u32
               }
            }
         }
      }
   }
}
```

Parameters

adslx	Mandatory. Multi-node. The identifier for the ADSL interface you are defining. This may be **adsl0** to **adsl***x*, depending on what physical ADSL ports are actually available on the system.
pvc-id	Mandatory. The identifier for the PVC. It can either be the *vpi*/*vci* pair or the keyword **auto**, where *vpi* is a Virtual Path Index from 0 to 255, *vci* is a Virtual Circuit Index from from 0 to 65535, and **auto** directs the system to detect the Virtual Path Index and Virtual Circuit Index automatically.

interval	Mandatory. The interval, in seconds, between hello packets. This value must be the same for all nodes on the network.The range is 1 to 65535. The default is 10.

Default

Hello packets are sent every 10 seconds.

Usage Guidelines

Use this command to set the interval at which OSPF hello packets are sent for a PVC with Bridged Ethernet encapsulation on an ADSL interface.

A hello packet is an OSPF packet used to detect and maintain relationships with neighbors on the same network (directly connected routers). The greater the interval between hello packets, the less router traffic occurs, but the longer it takes for topological changes to be detected.

The hello interval must be the same for all routers that are to establish two-way communication within a network. If two routers do not agree on these parameters, they will not establish adjacencies and will disregard one another's communications.

Use the **set** form of this command to set the hello interval.

Use the **delete** form of this command to restore the default hello interval.

Use the **show** form of this command to display hello interval configuration.

interfaces adsl <adslx> pvc <pvc-id> bridged-ethernet ip ospf mtu-ignore

Disables MTU mismatch detection for an ADSL PVC with Bridged Ethernet encapsulation.

Syntax

set interfaces adsl *adslx* **pvc** *pvc-id* **bridged-ethernet ip ospf mtu-ignore**

delete interfaces adsl *adslx* **pvc** *pvc-id* **bridged-ethernet ip ospf mtu-ignore**

show interfaces adsl *adslx* **pvc** *pvc-id* **bridged-ethernet ip ospf**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
   adsl adslx {
      pvc [0-255/0-65535|auto] {
         bridged-ethernet {
            ip {
               ospf {
                  mtu-ignore
               }
            }
         }
      }
   }
}
```

Parameters

adslx	Mandatory. Multi-node. The identifier for the ADSL interface you are defining. This may be **adsl0** to **adsl***x*, depending on what physical ADSL ports are actually available on the system.
pvc-id	Mandatory. The identifier for the PVC. It can either be the *vpi*/*vci* pair or the keyword **auto**, where *vpi* is a Virtual Path Index from 0 to 255, *vci* is a Virtual Circuit Index from from 0 to 65535, and **auto** directs the system to detect the Virtual Path Index and Virtual Circuit Index automatically.

Default

MTU mismatch detection is enabled by default.

Usage Guidelines

Use this command to disable MTU mismatch detection on an OSPF interface.

OSPF sends the MTU of the interface in a database description packet. If the MTUs of OSPF neighbors do not match, they cannot form an OSPF adjacency. MTU mismatch detection detects MTU mismatches and indicates them in the form of a debug message.

MTU mismatch is an important troubleshooting feature. If MTU mismatch is not enabled, MTU mismatches can only be detected by examining configuration for both interfaces.

There are some network setups where MTU mismatches are unavoidable, and even part of the normal set-up. It is for these cases only that MTU mismatch detection should be disabled, so that normal OSPF adjacencies can be formed.

Use the **set** form of this command to disable MTU mismatch detection.

Use the **delete** form of this command to re-enable MTU mismatch detection.

Use the **show** form of this command to display OSPF configuration.

interfaces adsl <adslx> pvc <pvc-id> bridged-ethernet ip ospf network <type>

Specifies the OSPF network type for an ADSL PVC with Bridged Ethernet encapsulation.

Syntax

set interfaces adsl *adslx* **pvc** *pvc-id* **bridged-ethernet ip ospf network** [**broadcast** | **non-broadcast** | **point-to-multipoint** | **point-to-point**]

delete interfaces adsl *adslx* **pvc** *pvc-id* **bridged-ethernet ip ospf network**

show interfaces adsl *adslx* **pvc** *pvc-id* **bridged-ethernet ip ospf network**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
   adsl adslx {
      pvc [0-255/0-65535|auto] {
         bridged-ethernet {
            ip {
               ospf {
                  network text
               }
            }
         }
      }
   }
}
```

Parameters

adslx	Mandatory. Multi-node. The identifier for the ADSL interface you are defining. This may be **adsl0** to **adsl***x*, depending on what physical ADSL ports are actually available on the system.
pvc-id	Mandatory. The identifier for the PVC. It can either be the *vpi*/*vci* pair or the keyword **auto**, where *vpi* is a Virtual Path Index from 0 to 255, *vci* is a Virtual Circuit Index from from 0 to 65535, and **auto** directs the system to detect the Virtual Path Index and Virtual Circuit Index automatically.

type	The network type for this interface. Supported values are as follows: **broadcast**: The interface supports broadcast mode, such as a LAN link. **non-broadcast**: The interface does not support broadcast mode. **point-to-point**: This interface supports point-to-point mode, such as an NBMA interface. **point-to-multipoint**: This interface supports point-to-multipoint mode, such as a PPP interface or a point-to-point logical interface on Frame Relay. The default is broadcast.

Default

Broadcast is supported.

Usage Guidelines

Use this command to configure and display the network type for the interface.

Use the **set** form of this command to specify the network type.

Use the **delete** form of this command to remove the network type.

Use the **show** form of this command to display the network type.

interfaces adsl <adslx> pvc <pvc-id> bridged-ethernet ip ospf priority <priority>

Sets the OSPF priority for an ADSL PVC with Bridged Ethernet encapsulation.

Syntax

set interfaces adsl *adslx* **pvc** *pvc-id* **bridged-ethernet ip ospf priority** *priority*

delete interfaces adsl *adslx* **pvc** *pvc-id* **bridged-ethernet ip ospf priority**

show interfaces adsl *adslx* **pvc** *pvc-id* **bridged-ethernet ip ospf priority**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
   adsl adslx {
      pvc [0-255/0-65535|auto] {
         bridged-ethernet {
            ip {
               ospf {
                  priority u32
               }
            }
         }
      }
   }
}
```

Parameters

adslx	Mandatory. Multi-node. The identifier for the ADSL interface you are defining. This may be **adsl0** to **adsl***x*, depending on what physical ADSL ports are actually available on the system.
pvc-id	Mandatory. The identifier for the PVC. It can either be the *vpi*/*vci* pair or the keyword **auto**, where *vpi* is a Virtual Path Index from 0 to 255, *vci* is a Virtual Circuit Index from from 0 to 65535, and **auto** directs the system to detect the Virtual Path Index and Virtual Circuit Index automatically.

priority	Specifies the OSPF router priority for this interface. The range is 0 to 255, where a router with priority 0 can never become the designated router. The default is 1.

Default

An OSPF interface has a priority of 1.

Usage Guidelines

Use this command to set the priority for a PVC with Bridged Ethernet encapsulation on an ADSL interface on the broadcast network to which the interface is connected. The priority determines which routers are selected as the area's Designated Router (DR) and Backup Designated Router (BDR).

The DR and BDR are used to reduce the amount of traffic on OSPF overhead on broadcast networks, by reducing the number of adjacent routers to which a router must flood its topological information. In broadcast networks (such as Ethernet), each router establishes an adjacency with only the DR and the BDR, rather than with every router in its area. The DR and the BDR then flood this information to all other routers on the network segment.

Priority can range from 0 to 255. In general, the router with the highest priority is elected as the DR, and the router with the second-highest priority is elected as the BDR. The higher the number, the higher the priority.

Routers with a priority of 0 are ineligible for election.

Use the **set** form of this command to specify the OSPF priority.

Use the **delete** form of this command to restore the default priority.

Use the **show** form of this command to display priority configuration.

interfaces adsl <adslx> pvc <pvc-id> bridged-ethernet ip ospf retransmit-interval <interval>

Sets the OSPF retransmit interval for an ADSL PVC with Bridged Ethernet encapsulation.

Syntax

set interfaces adsl *adslx* **pvc** *pvc-id* **bridged-ethernet ip ospf retransmit-interval** *interval*

delete interfaces adsl *adslx* **pvc** *pvc-id* **bridged-ethernet ip ospf retransmit-interval**

show interfaces adsl *adslx* **pvc** *pvc-id* **bridged-ethernet ip ospf retransmit-interval**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
   adsl adslx {
      pvc [0-255/0-65535|auto] {
         bridged-ethernet {
            ip {
               ospf {
                  retransmit-interval u32
               }
            }
         }
      }
   }
}
```

Parameters

adslx	Mandatory. Multi-node. The identifier for the ADSL interface you are defining. This may be **adsl0** to **adsl***x*, depending on what physical ADSL ports are actually available on the system.
pvc-id	Mandatory. The identifier for the PVC. It can either be the *vpi*/*vci* pair or the keyword **auto**, where *vpi* is a Virtual Path Index from 0 to 255, *vci* is a Virtual Circuit Index from from 0 to 65535, and **auto** directs the system to detect the Virtual Path Index and Virtual Circuit Index automatically.

interval	Specifies the time in seconds to wait for an acknowledgement, after which the system retransmits an LSA packet to its neighbors. The range is 3 to 65535. The default is 5.

Default

Unacknowledged LSAs are retransmitted at 5-second intervals.

Usage Guidelines

Use this command to specify how long a PVC with Bridged Ethernet encapsulation on an ADSL interface will wait for an acknowledgment of a link-state update before resending the update.

The link-state update packet is part of the exchange of topology databases between routers. When the initial database description (DD) packet is sent, it contains only the headers of the LSAs. If the receiving router determines that it requires that piece of the OSPF topology, it sends a link state request packet to request the complete LSA from the sending router.

After the update packet is sent, the sending router waits for an acknowledgement, either implicit or explicit, from the receiving router. In an explicit acknowledgement, the receiving router sends a link-state acknowledge (LS-Ack) packet to the router that sent the update. In an implicit acknowledgement, the router that sent the update receives an LSA from the receiving router that contains the update information.

If the retransmit interval passes with neither an explicit nor an implicit acknowledgement, the sending router will retransmit the link-state update packet.

Too high an interval slows network convergence. Too small an interval causes unnecessary retransmission.

Use the **set** form of this command to set the OSPF retransmit interval for a PVC with Bridged Ethernet encapsulation on an ADSL interface.

Use the **delete** form of this command to restore the default retransmit interval.

Use the **show** form of this command to display retransmit interval configuration.

interfaces adsl <adslx> pvc <pvc-id> bridged-ethernet ip ospf transmit-delay <delay>

Specifies the OSPF transmit delay for an ADSL PVC with Bridged Ethernet encapsulation.

Syntax

set interfaces adsl *adslx* **pvc** *pvc-id* **bridged-ethernet ip ospf transmit-delay** *delay*

delete interfaces adsl *adslx* **pvc** *pvc-id* **bridged-ethernet ip ospf transmit-delay**

show interfaces adsl *adslx* **pvc** *pvc-id* **bridged-ethernet ip ospf transmit-delay**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
   adsl adslx {
      pvc [0-255/0-65535|auto] {
         bridged-ethernet {
            ip {
               ospf {
                  transmit-delay u32
               }
            }
         }
      }
   }
}
```

Parameters

adslx	Mandatory. Multi-node. The identifier for the ADSL interface you are defining. This may be **adsl0** to **adsl***x*, depending on what physical ADSL ports are actually available on the system.
pvc-id	Mandatory. The identifier for the PVC. It can either be the *vpi*/*vci* pair or the keyword **auto**, where *vpi* is a Virtual Path Index from 0 to 255, *vci* is a Virtual Circuit Index from from 0 to 65535, and **auto** directs the system to detect the Virtual Path Index and Virtual Circuit Index automatically.

delay	Mandatory. The delay, in seconds, between link-state transmits. This value must be the same for all nodes on the network. The range is 1 to 65535. The default is 1.

Default

Link-state transmits occur at one-second intervals.

Usage Guidelines

Use this command to set the transmit delay for a PVC with Bridged Ethernet encapsulation on an ADSL interface. This is the estimated time required to send a link-state update (LSU) packet.

This timer is used to accommodate transmission and propagation delays on the network, particularly on low-speed networks where delays may be significant. The router increments the age of link-state advertisements in LSU packets to account for these delays.

The value includes both the transmission time and the propagation delay across the network. The transmit delay is added to the age of the LSA packet before the LSA is transmitted The LSA age is used to help the network sequence LSAs, so that it can determine which of competing LSAs is the more recent and trustworthy.

LSAs are numbered in sequence, but the sequence numbers are finite, and so cannot be used as the sole determinant of the most recent LSA. Instead, OSPF also tracks the age of LSAs. Each time the LSA is forwarded to another router, its current age is incremented by the transmit delay. The packet's age, together with its sequence number, helps the receiving router to determine which version of a received LSA is more recent, and therefore to be used.

Use the **set** form of this command to set the transmit delay.

Use the **delete** form of this command to restore the default transmit delay.

Use the **show** form of this command to display transmit delay configuration.

Chapter 13: Multilink Interfaces

This chapter describes commands for configuring OSPF on multilink interfaces.

This chapter presents the following topics:

- Multilink Interface OSPF Commands

Multilink Interface OSPF Commands

This chapter contains the following commands.

Configuration Commands	
interfaces multilink <mlx> ip ospf	Enables OSPF on a multilink interface.
interfaces multilink <mlx> ip ospf	Specifies the authentication method for OSPF on a multilink interface.
interfaces multilink <mlx> ip ospf bandwidth <bandwidth>	Specifies the bandwidth of a multilink interface for calculating OSPF cost.
interfaces multilink <mlx> ip ospf cost <cost>	Sets the routing cost for OSPF on a multilink interface.
interfaces multilink <mlx> ip ospf dead-interval <interval>	Sets the dead interval for OSPF on a multilink interface.
interfaces multilink <mlx> ip ospf hello-interval <interval>	Sets the interval between OSPF hello packets on a multilink interface.
interfaces multilink <mlx> ip ospf mtu-ignore	Disables MTU mismatch detection for OSPF on a multilink interface.
interfaces multilink <mlx> ip ospf network <type>	Specifies the network type for OSPF on a multilink interface.
interfaces multilink <mlx> ip ospf priority <priority>	Sets the priority for OSPF on a multilink interface.
interfaces multilink <mlx> ip ospf retransmit-interval <interval>	Sets the retransmit interval for OSPF on a multilink interface.
interfaces multilink <mlx> ip ospf transmit-delay <delay>	Specifies the transmit delay for OSPF on a multilink interface.
Operational Commands	
None.	

interfaces multilink <mlx> ip ospf

Enables OSPF on a multilink interface.

Syntax

set interfaces multilink *mlx* **ip ospf**

delete interfaces multilink *mlx* **ip ospf**

show interfaces multilink *mlx* **ip ospf**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
    multilink ml0..ml23 {
        ip {
            ospf {
            }
        }
    }
}
```

Parameters

mlx	Mandatory. The identifier of the multilink bundle. You can create up to two multilink bundles. Supported values are **ml0** (“em ell zero”) through **ml23** (“em ell twenty-three”).

Default

None.

Usage Guidelines

Use this command to enable the Open Shortest Path First (OSPF) routing protocol on a multilink interface.

Use the **set** form of this command to enable OSPF on a multilink interface.

Use the **delete** form of this command to remove all OSPF configuration and disable OSPF on a multilink interface.

Use the **show** form of this command to display OSPF configuration.

interfaces multilink <mlx> ip ospf authentication

Specifies the authentication method for OSPF on a multilink interface.

Syntax

set interfaces multilink *mlx* **ip ospf authentication** [**md5 key-id** *key-id* **md5-key** *md5-key* | **plaintext-password** *password*]

delete interfaces multilink *mlx* **ip ospf authentication** [**md5 key-id** *key-id* **md5-key** | **plaintext-password**]

show interfaces multilink *mlx* **ip ospf authentication** [**md5 key-id** *key-id* **md5-key** | **plaintext-password**]

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
   multilink ml0..ml23 {
      ip {
         ospf {
            authentication {
               md5 {
                  key-id 1-255 {
                     md5-key: text
                  }
               }
               plaintext-password: text
            }
         }
      }
   }
}
```

Parameters

mlx	Mandatory. The identifier of the multilink bundle. You can create up to two multilink bundles. Supported values are **ml0** (“em ell zero”) through **ml23** (“em ell twenty-three”).

key-id	Optional. The key used to identify the MD5 key. This must be the same on both the sending and receiving systems. The range is 1 to 255.
md5-key	Optional. A password-like MD5 key of up to 16 alphanumeric characters to be used as input to the MD5 hashing algorithm. The longer the key, the stronger the security. This must be the same on both the sending and receiving systems.
password	Optional. The password to use in plain-text authentication. This must be eight characters or less and the same on both the sending and receiving systems.

Default

None.

Usage Guidelines

Use this command to specify the authentication method to be used for OSPF on a multilink interface. This authentication is independent of the authentication configured for the OSPF area.

In plain text authentication, passwords are sent through the network in plain text. In MD5 authentication, the system uses the Message Digest 5 (MD5) algorithm to compute a hash value from the contents of the OSPF packet and the password. The hash value and the MD5 key are included in the transmitted packet, and the receiving system (configured with the same password) calculates its own hash function, which must match.

The authentication parameters must be the same for all routers that are to establish two-way communication within a network. If two routers do not agree on these parameters, they will not consider establish adjacencies, and will disregard one another’s communications.

Use the **set** form of this command to set the authentication for a multilink interface.

Use the **delete** form of this command to remove multilink interface authentication configuration information.

Use the **show** form of this command to display multilink interface authentication configuration information.

interfaces multilink <mlx> ip ospf bandwidth <bandwidth>

Specifies the bandwidth of a multilink interface for calculating OSPF cost.

Syntax

set interfaces multilink *mlx* **ip ospf bandwidth** *bandwidth*

delete interfaces multilink *mlx* **ip ospf bandwidth**

show interfaces multilink *mlx* **ip ospf bandwidth**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
   multilink ml0..ml23 {
      ip {
         ospf {
            bandwidth: u32
         }
      }
   }
}
```

Parameters

mlx	Mandatory. The identifier of the multilink bundle. You can create up to two multilink bundles. Supported values are **ml0** (“em ell zero”) through **ml23** (“em ell twenty-three”).
bandwidth	The bandwidth of the Ethernet interface in kilobits/sec. The range is 1 to 10000000.

Default

None.

Usage Guidelines

Use this command to specify the bandwidth of the multiulink interface for the purpose of computing OSPF cost.

Use the **set** form of this command to specify the bandwidth of the multiulink interface.

Use the **delete** form of this command to remove the bandwidth parameter.

Use the **show** form of this command to display the bandwidth configuration.

interfaces multilink <mlx> ip ospf cost <cost>

Sets the routing cost for OSPF on a multilink interface.

Syntax

set interfaces multilink *mlx* **ip ospf cost** *cost*

delete interfaces multilink *mlx* **ip ospf cost**

show interfaces multilink *mlx* **ip ospf cost**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
   multilink ml0..ml23 {
      ip {
         ospf {
            cost: u32
         }
      }
   }
}
```

Parameters

mlx	Mandatory. The identifier of the multilink bundle. You can create up to two multilink bundles. Supported values are **ml0** (“em ell zero”) through **ml23** (“em ell twenty-three”).
cost	The link-state metric (OSPF cost) to be advertised in the link-state advertisement (LSA) as the cost of sending packets over the ethernet interface. The range is 1 to 65535.

Default

For details on the default of OSPF cost, please see the Usage Guidelines.

Usage Guidelines

Use this command to manually override the default OSPF cost computed by the system for OSPF run on a multilink interface. You can only assign one cost per interface.

By default, the metric associated with a link is computed as follows:

```
Cost = 108 / bandwidth
```

The cost of reaching any destination is the sum of the costs of the individual hops. Costs are always rounded to the nearest integer. Costs lower than 1 are rounded up to 1.

Table 13-1 shows the OSPF costs for some common media types.

Table 13-1 OSPF Costs for Common Media Types

Media Type	OSPF Cost
56 Kbps	1785
64 Kbps	1562
128 Kbps	781
256 Kbps	390
512 Kbps	195
768 Kbps	130
T1 (1.544 Mbps)	64
E1 (2.048 Mbps)	48
4 Mbps Token Ring	6
10 Mbps Ethernet	10
16 Mbps Token Ring	6
T3 (44.736 Mbps	2
100+ Mbps	1

The values in Table 13-1 show how OSPF fails to distinguish between interfaces faster than 100 Mbps, for example, between Fast Ethernet (100 Mbps) and Gigabit Ethernet (1000 Mbps) interfaces. If you want to distinguish interfaces equal to or greater than 100 Mbps, you must manually configure the cost of the interface using this command.

Use the **set** form of this command to specify the OSPF cost for the multilink interface.

Use the **delete** form of this command to restore the default cost.

Use the **show** form of this command to display cost configuration.

interfaces multilink <mlx> ip ospf dead-interval <interval>

Sets the dead interval for OSPF on a multilink interface.

Syntax

set interfaces multilink *mlx* **ip ospf dead-interval** *interval*

delete interfaces multilink *mlx* **ip ospf dead-interval**

show interfaces multilink *mlx* **ip ospf dead-interval**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
   multilink ml0..ml23 {
      ip {
         ospf {
            dead-interval: u32
         }
      }
   }
}
```

Parameters

mlx	Mandatory. The identifier of the multilink bundle. You can create up to two multilink bundles. Supported values are **ml0** (“em ell zero”) through **ml23** (“em ell twenty-three”).
interval	Specifies the time, in seconds, that this interface should wait to detect hello packets from neighboring routers before declaring the neighbor down. The range is 1 to 65535. The default is 4 times the hello interval.

Default

The dead interval is 4 times the hello interval (40 seconds).

Usage Guidelines

Use this command to specify the interval during which a multilink interface should expect an OSPF hello packet from its neighbor.

If the dead interval passes without the interface receiving a hello packet from the neighbor, the neighbor's status is changed to out-of-service, and all associated state is cleared.

The dead interval must be the same for all routers that are to establish two-way communication within a network. If two routers do not agree on these parameters, they will not establish adjacencies and will disregard one another's communications.

Use the **set** form of this command to specify the dead interval.

Use the **delete** form of this command to restore the default dead interval.

Use the **show** form of this command to display dead interval configuration.

interfaces multilink <mlx> ip ospf hello-interval <interval>

Sets the interval between OSPF hello packets on a multilink interface.

Syntax

set interfaces multilink *mlx* **ip ospf hello-interval** *interval*

delete interfaces multilink *mlx* **ip ospf hello-interval**

show interfaces multilink *mlx* **ip ospf hello-interval**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
   multilink ml0..ml23 {
      ip {
         ospf {
            hello-interval: u32
         }
      }
   }
}
```

Parameters

mlx	Mandatory. The identifier of the multilink bundle. You can create up to two multilink bundles. Supported values are **ml0** (“em ell zero”) through **ml23** (“em ell twenty-three”).
interval	Mandatory. The interval, in seconds, between hello packets. This value must be the same for all nodes on the network.The range is 1 to 65535. The default is 10.

Default

Hello packets are sent every 10 seconds.

Usage Guidelines

Use this command to set the interval at which OSPF hello packets are sent for a multilink interface.

A hello packet is an OSPF packet used to detect and maintain relationships with neighbors on the same network (directly connected routers). The greater the interval between hello packets, the less router traffic occurs, but the longer it takes for topological changes to be detected.

The hello interval must be the same for all routers that are to establish two-way communication within a network. If two routers do not agree on these parameters, they will not establish adjacencies and will disregard one another's communications.

Use the **set** form of this command to set the hello interval.

Use the **delete** form of this command to restore the default hello interval.

Use the **show** form of this command to display hello interval configuration.

interfaces multilink <mlx> ip ospf mtu-ignore

Disables MTU mismatch detection for OSPF on a multilink interface.

Syntax

set interfaces multilink *mlx* **ip ospf mtu-ignore**

delete interfaces multilink *mlx* **ip ospf mtu-ignore**

show interfaces multilink *mlx* **ip ospf**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
   multilink ml0..ml23 {
      ip {
         ospf {
            mtu-ignore
         }
      }
   }
}
```

Parameters

mlx	Mandatory. The identifier of the multilink bundle. You can create up to two multilink bundles. Supported values are **ml0** (“em ell zero”) through **ml23** (“em ell twenty-three”).

Default

MTU mismatch detection is enabled by default.

Usage Guidelines

Use this command to disable MTU mismatch detection on a multilink OSPF interface.

OSPF sends the MTU of the interface in a database description packet. If the MTUs of OSPF neighbors do not match, they cannot form an OSPF adjacency. MTU mismatch detection detects MTU mismatches and indicates them in the form of a debug message.

MTU mismatch is an important troubleshooting feature. If MTU mismatch is not enabled, MTU mismatches can only be detected by examining configuration for both interfaces.

There are some network setups where MTU mismatches are unavoidable, and even part of the normal set-up. It is for these cases only that MTU mismatch detection should be disabled, so that normal OSPF adjacencies can be formed.

Use the **set** form of this command to disable MTU mismatch detection.

Use the **delete** form of this command to re-enable MTU mismatch detection.

Use the **show** form of this command to display OSPF configuration.

interfaces multilink <mlx> ip ospf network <type>

Specifies the network type for OSPF on a multilink interface.

Syntax

set interfaces multilink *mlx* **ip ospf network** [**broadcast** | **non-broadcast** | **point-to-multipoint** | **point-to-point**]

delete interfaces multilink *mlx* **ip ospf network**

show interfaces multilink *mlx* **ip ospf network**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
   multilink ml0..ml23 {
      ip {
         ospf {
            network: text
         }
      }
   }
}
```

Parameters

mlx	Mandatory. The identifier of the multilink bundle. You can create up to two multilink bundles. Supported values are **ml0** (“em ell zero”) through **ml23** (“em ell twenty-three”).
type	The network type for this interface. Supported values are as follows: **broadcast**: The interface supports broadcast mode, such as a LAN link. **non-broadcast**: The interface does not support broadcast mode. **point-to-point**: This interface supports point-to-point mode, such as an NBMA interface. **point-to-multipoint**: This interface supports point-to-multipoint mode, such as a PPP interface or a point-to-point logical interface on Frame Relay.

Default

The default is **broadcast**.

Usage Guidelines

Use this command to configure and display the OSPF network type for a multipoint interface.

Use the **set** form of this command to specify the network type.

Use the **delete** form of this command to remove the network type.

Use the **show** form of this command to display the network type.

interfaces multilink <mlx> ip ospf priority <priority>

Sets the priority for OSPF on a multilink interface.

Syntax

set interfaces multilink *mlx* **ip ospf priority** *priority*

delete interfaces multilink *mlx* **ip ospf priority**

show interfaces multilink *mlx* **ip ospf priority**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
   multilink ml0..ml23 {
      ip {
         ospf {
            priority: u32
         }
      }
   }
}
```

Parameters

mlx	Mandatory. The identifier of the multilink bundle. You can create up to two multilink bundles. Supported values are **ml0** (“em ell zero”) through **ml23** (“em ell twenty-three”).
priority	Specifies the OSPF router priority for this interface. The range is 0 to 255, where a router with priority 0 can never become the designated router. The default is 1.

Default

An OSPF interface has a priority of 1.

Usage Guidelines

Use this command to set the OSPF priority for a multilink interface on the broadcast network to which the interface is connected. The priority determines which routers are selected as the area's Designated Router (DR) and Backup Designated Router (BDR).

The DR and BDR are used to reduce the amount of traffic on OSPF overhead on broadcast networks, by reducing the number of adjacent routers to which a router must flood its topological information. In broadcast networks (such as Ethernet), each router establishes an adjacency with only the DR and the BDR, rather than with every router in its area. The DR and the BDR then flood this information to all other routers on the network segment.

Priority can range from 0 to 255. In general, the router with the highest priority is elected as the DR, and the router with the second-highest priority is elected as the BDR. The higher the number, the higher the priority.

Routers with a priority of 0 are ineligible for election.

Use the **set** form of this command to specify the OSPF priority.

Use the **delete** form of this command to restore the default priority.

Use the **show** form of this command to display priority configuration.

interfaces multilink <mlx> ip ospf retransmit-interval <interval>

Sets the retransmit interval for OSPF on a multilink interface.

Syntax

set interfaces multilink *mlx* **ip ospf retransmit-interval** *interval*

delete interfaces multilink *mlx* **ip ospf retransmit-interval**

show interfaces multilink *mlx* **ip ospf retransmit-interval**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
   multilink ml0..ml23 {
      ip {
         ospf {
            retransmit-interval: u32
         }
      }
   }
}
```

Parameters

mlx	Mandatory. The identifier of the multilink bundle. You can create up to two multilink bundles. Supported values are **ml0** (“em ell zero”) through **ml23** (“em ell twenty-three”).
interval	Specifies the time in seconds to wait for an acknowledgement, after which the system retransmits an LSA packet to its neighbors. The range is 3 to 65535. The default is 5.

Default

Unacknowledged LSAs are retransmitted at 5-second intervals.

Usage Guidelines

Use this command to specify how long a multilink interface will wait for an acknowledgment of a link-state update before resending the update.

The link-state update packet is part of the exchange of topology databases between routers. When the initial database description (DD) packet is sent, it contains only the headers of the LSAs. If the receiving router determines that it requires that piece of the OSPF topology, it sends a link state request packet to request the complete LSA from the sending router.

After the update packet is sent, the sending router waits for an acknowledgement, either implicit or explicit, from the receiving router. In an explicit acknowledgement, the receiving router sends a link-state acknowledge (LS-Ack) packet to the router that sent the update. In an implicit acknowledgement, the router that sent the update receives an LSA from the receiving router that contains the update information.

If the retransmit interval passes with neither an explicit nor an implicit acknowledgement, the sending router will retransmit the link-state update packet.

Too high an interval slows network convergence. Too small an interval causes unnecessary retransmission.

Use the **set** form of this command to set the OSPF retransmit interval for a multilink interface.

Use the **delete** form of this command to restore the default retransmit interval.

Use the **show** form of this command to display retransmit interval configuration.

interfaces multilink <mlx> ip ospf transmit-delay <delay>

Specifies the transmit delay for OSPF on a multilink interface.

Syntax

set interfaces multilink *mlx* **ip ospf transmit-delay** *delay*

delete interfaces multilink *mlx* **ip ospf transmit-delay**

show interfaces multilink *mlx* **ip ospf transmit-delay**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
   multilink ml0..ml23 {
      ip {
         ospf {
            transmit-delay: u32
         }
      }
   }
}
```

Parameters

mlx	Mandatory. The identifier of the multilink bundle. You can create up to two multilink bundles. Supported values are **ml0** (“em ell zero”) through **ml23** (“em ell twenty-three”).
delay	Mandatory. The delay, in seconds, between link-state transmits. This value must be the same for all nodes on the network. The range is 1 to 65535. The default is 1.

Default

Link-state transmits occur at 1-second intervals.

Usage Guidelines

Use this command to set the transmit delay for a multilink interface. This is the estimated time required to send a link-state update (LSU) packet.

This timer is used to accommodate transmission and propagation delays on the network, particularly on low-speed networks where delays may be significant. The router increments the age of link-state advertisements in LSU packets to account for these delays.

The value includes both the transmission time and the propagation delay across the network. The transmit delay is added to the age of the LSA packet before the LSA is transmitted The LSA age is used to help the network sequence LSAs, so that it can determine which of competing LSAs is the more recent and trustworthy.

LSAs are numbered in sequence, but the sequence numbers are finite, and so cannot be used as the sole determinant of the most recent LSA. Instead, OSPF also tracks the age of LSAs. Each time the LSA is forwarded to another router, its current age is incremented by the transmit delay. The packet’s age, together with its sequence number, helps the receiving router to determine which version of a received LSA is more recent, and therefore to be used.

Use the **set** form of this command to set the transmit delay.

Use the **delete** form of this command to restore the default transmit delay.

Use the **show** form of this command to display transmit delay configuration.

Chapter 14: Tunnel Interfaces

This chapter describes commands for configuring OSPF on tunnel interfaces.

This chapter presents the following topics:

- Tunnel Interface OSPF Commands

Tunnel Interface OSPF Commands

This chapter contains the following commands.

Configuration Commands	
interfaces tunnel <tunx> ip ospf	Enables OSPF on a tunnel interface.
interfaces tunnel <tunx> ip ospf authentication	Specifies the authentication method for OSPF on an Ethernet interface.
interfaces tunnel <tunx> ip ospf bandwidth <bandwidth>	Specifies the bandwidth of a tunnel interface for calculating OSPF cost.
interfaces tunnel <tunx> ip ospf cost <cost>	Sets the routing cost for OSPF on a tunnel interface.
interfaces tunnel <tunx> ip ospf dead-interval <interval>	Sets the OSPF dead interval for a tunnel interface.
interfaces tunnel <tunx> ip ospf hello-interval <interval>	Sets the interval between OSPF hello packets on a tunnel interface.
interfaces tunnel <tunx> ip ospf mtu-ignore	Disables MTU mismatch detection for a tunnel interface.
interfaces tunnel <tunx> ip ospf network <type>	Specifies the OSPF network type for a tunnel interface.
interfaces tunnel <tunx> ip ospf priority <priority>	Sets the OSPF priority for a tunnel interface.
interfaces tunnel <tunx> ip ospf retransmit-interval <interval>	Sets the OSPF retransmit interval for a tunnel interface.
interfaces tunnel <tunx> ip ospf transmit-delay <delay>	Specifies the OSPF transmit delay for a tunnel interface.
Operational Commands	
None.	

interfaces tunnel <tunx> ip ospf

Enables OSPF on a tunnel interface.

Syntax

set interfaces tunnel *tunx* **ip ospf**

delete interfaces tunnel *tunx* **ip ospf**

show interfaces tunnel *tunx* **ip ospf**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
    tunnel tun0..tun9 {
        ip {
            ospf
        }
    }
}
```

Parameters

tunx	Mandatory. The name of the tunnel interface you are configuring. The range is **tun0** to **tun9**.

Default

None.

Usage Guidelines

Use this command to enable the Open Shortest Path First (OSPF) routing protocol on a tunnel interface.

Use the **set** form of this command to enable OSPF on an interface.

Use the **delete** form of this command to remove all OSPF configuration and disable OSPF on an interface.

Use the **show** form of this command to display OSPF configuration.

interfaces tunnel <tunx> ip ospf authentication

Specifies the authentication method for OSPF on an Ethernet interface.

Syntax

set interfaces tunnel *tunx* **ip ospf authentication** [**md5 key-id** *key-id* **md5-key** *md5-key* | **plaintext-password** *password*]

delete interfaces tunnel *tunx* **ip ospf authentication** [**md5 key-id** *key-id* **md5-key** | **plaintext-password**]

show interfaces tunnel *tunx* **ip ospf authentication** [**md5 key-id** *key-id* **md5-key** | **plaintext-password**]

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
    tunnel tun0..tun9 {
        ip {
            ospf {
                authentication {
                    md5 {
                        key-id 1-255 {
                            md5-key: text
                        }
                    }
                    plaintext-password: text
                }
            }
        }
    }
}
```

Parameters

tunx	Mandatory. The name of the tunnel interface you are configuring. The range is **tun0** to **tun9**.
key-id	Optional. The key used to identify the MD5 key. This must be the same on both the sending and receiving systems. The range is 1 to 255.

md5-key	Optional. A password-like MD5 key of up to 16 alphanumeric characters to be used as input to the MD5 hashing algorithm. The longer the key, the stronger the security. This must be the same on both the sending and receiving systems.
password	Optional. The password to use in plain-text authentication. This must be eight characters or less and the same on both the sending and receiving systems.

Default

None.

Usage Guidelines

Use this command to specify the authentication method to be used for OSPF on a tunnel interface. This authentication is independent of the authentication configured for the OSPF area.

In plain text authentication, passwords are sent through the network in plain text. In MD5 authentication, the system uses the Message Digest 5 (MD5) algorithm to compute a hash value from the contents of the OSPF packet and the password. The hash value and the MD5 key are included in the transmitted packet, and the receiving system (configured with the same password) calculates its own hash function, which must match.

The authentication parameters must be the same for all routers that are to establish two-way communication within a network. If two routers do not agree on these parameters, they will not consider establish adjacencies, and will disregard one another's communications.

Use the **set** form of this command to set the authentication for a tunnel interface.

Use the **delete** form of this command to remove interface authentication configuration information.

Use the **show** form of this command to display interface authentication configuration information.

interfaces tunnel <tunx> ip ospf bandwidth <bandwidth>

Specifies the bandwidth of a tunnel interface for calculating OSPF cost.

Syntax

set interfaces tunnel *tunx* **ip ospf bandwidth** *bandwidth*

delete interfaces tunnel *tunx* **ip ospf bandwidth**

show interfaces tunnel *tunx* **ip ospf bandwidth**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
   tunnel tun0..tun9 {
      ip {
         ospf {
            bandwidth: u32
         }
      }
   }
}
```

Parameters

tunx	Mandatory. The name of the tunnel interface you are configuring. The range is **tun0** to **tun9**.
bandwidth	The bandwidth of the Ethernet interface in kilobits/sec. The range is 1 to 10000000.

Default

None.

Usage Guidelines

Use this command to specify the bandwidth of the tunnel interface for the purpose of computing OSPF cost.

Use the **set** form of this command to specify the bandwidth of the interface.

Use the **delete** form of this command to remove the bandwidth parameter.

Use the **show** form of this command to display the bandwidth configuration.

interfaces tunnel <tunx> ip ospf cost <cost>

Sets the routing cost for OSPF on a tunnel interface.

Syntax

set interfaces tunnel *tunx* **ip ospf cost** *cost*

delete interfaces tunnel *tunx* **ip ospf cost**

show interfaces tunnel *tunx* **ip ospf cost**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
   tunnel tun0..tun9 {
      ip {
         ospf {
            cost: u32
         }
      }
   }
}
```

Parameters

tunx	Mandatory. The name of the tunnel interface you are configuring. The range is **tun0** to **tun9**.
cost	The link-state metric (OSPF cost) to be advertised in the link-state advertisement (LSA) as the cost of sending packets over the ethernet interface. The range is 1 to 65535.

Default

For details on the default of OSPF cost, please see the Usage Guidelines.

Usage Guidelines

Use this command to manually override the default OSPF cost computed by the system for a tunnel interface. You can only assign one cost per interface.

By default, the metric associated with a link is computed as follows:

```
Cost = 108 / bandwidth
```

The cost of reaching any destination is the sum of the costs of the individual hops. Costs are always rounded to the nearest integer. Costs lower than 1 are rounded up to 1.

Table 14-1 shows the OSPF costs for some common media types.

Table 14-1 OSPF Costs for Common Media Types

Media Type	OSPF Cost
56 Kbps	1785
64 Kbps	1562
128 Kbps	781
256 Kbps	390
512 Kbps	195
768 Kbps	130
T1 (1.544 Mbps)	64
E1 (2.048 Mbps)	48
4 Mbps Token Ring	6
10 Mbps Ethernet	10
16 Mbps Token Ring	6
T3 (44.736 Mbps	2
100+ Mbps	1

The values in Table 14-1 show how OSPF fails to distinguish between interfaces faster than 100 Mbps, for example, between Fast Ethernet (100 Mbps) and Gigabit Ethernet (1000 Mbps) interfaces. If you want to distinguish interfaces equal to or greater than 100 Mbps, you must manually configure the cost of the interface using this command.

Use the **set** form of this command to specify the OSPF cost for the interface.

Use the **delete** form of this command to restore the default cost.

Use the **show** form of this command to display cost configuration.

interfaces tunnel <tunx> ip ospf dead-interval <interval>

Sets the OSPF dead interval for a tunnel interface.

Syntax

set interfaces tunnel *tunx* **ip ospf dead-interval** *interval*

delete interfaces tunnel *tunx* **ip ospf dead-interval**

show interfaces tunnel *tunx* **ip ospf dead-interval**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
   tunnel tun0..tun9 {
      ip {
         ospf {
            dead-interval: u32
         }
      }
   }
}
```

Parameters

tunx	Mandatory. The name of the tunnel interface you are configuring. The range is **tun0** to **tun9**.
interval	Specifies the time, in seconds, that this interface should wait to detect hello packets from neighboring routers before declaring the neighbor down. The range is 1 to 65535. The default is 4 times the hello interval.

Default

The dead interval is 4 times the hello interval.

Usage Guidelines

Use this command to specify the interval during which a tunnel interface should expect a hello packet from its neighbor.

If the dead interval passes without the interface receiving a hello packet from the neighbor, the neighbor's status is changed to out-of-service, and all associated state is cleared.

The dead interval must be the same for all routers that are to establish two-way communication within a network. If two routers do not agree on these parameters, they will not establish adjacencies and will disregard one another's communications.

Use the **set** form of this command to specify the dead interval.

Use the **delete** form of this command to restore the default dead interval.

Use the **show** form of this command to display dead interval configuration.

interfaces tunnel <tunx> ip ospf hello-interval <interval>

Sets the interval between OSPF hello packets on a tunnel interface.

Syntax

set interfaces tunnel *tunx* **ip ospf hello-interval** *interval*

delete interfaces tunnel *tunx* **ip ospf hello-interval**

show interfaces tunnel *tunx* **ip ospf hello-interval**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
   tunnel tun0..tun9 {
      ip {
         ospf {
            hello-interval: u32
         }
      }
   }
}
```

Parameters

tunx	Mandatory. The name of the tunnel interface you are configuring. The range is **tun0** to **tun9**.
interval	Mandatory. The interval, in seconds, between hello packets. This value must be the same for all nodes on the network.The range is 1 to 65535. The default is 10.

Default

Hello packets are sent every 10 seconds.

Usage Guidelines

Use this command to set the interval at which OSPF hello packets are sent for a tunnel interface.

A hello packet is an OSPF packet used to detect and maintain relationships with neighbors on the same network (directly connected routers). The greater the interval between hello packets, the less router traffic occurs, but the longer it takes for topological changes to be detected.

The hello interval must be the same for all routers that are to establish two-way communication within a network. If two routers do not agree on these parameters, they will not establish adjacencies and will disregard one another’s communications.

Use the **set** form of this command to set the hello interval.

Use the **delete** form of this command to restore the default hello interval.

Use the **show** form of this command to display hello interval configuration.

interfaces tunnel <tunx> ip ospf mtu-ignore

Disables MTU mismatch detection for a tunnel interface.

Syntax

set interfaces tunnel *tunx* **ip ospf mtu-ignore**

delete interfaces tunnel *tunx* **ip ospf mtu-ignore**

show interfaces tunnel *tunx* **ip ospf**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
    tunnel tun0..tun9 {
        ip {
            ospf {
                mtu-ignore
            }
        }
    }
}
```

Parameters

tunx	Mandatory. The name of the tunnel interface you are configuring. The range is **tun0** to **tun9**.

Default

MTU mismatch detection is enabled by default.

Usage Guidelines

Use this command to disable MTU mismatch detection on an OSPF interface.

OSPF sends the MTU of the interface in a database description packet. If the MTUs of OSPF neighbors do not match, they cannot form an OSPF adjacency. MTU mismatch detection detects MTU mismatches and indicates them in the form of a debug message.

MTU mismatch is an important troubleshooting feature. If MTU mismatch is not enabled, MTU mismatches can only be detected by examining configuration for both interfaces.

There are some network setups where MTU mismatches are unavoidable, and even part of the normal set-up. It is for these cases only that MTU mismatch detection should be disabled, so that normal OSPF adjacencies can be formed.

Use the **set** form of this command to disable MTU mismatch detection.

Use the **delete** form of this command to re-enable MTU mismatch detection.

Use the **show** form of this command to display OSPF configuration.

interfaces tunnel <tunx> ip ospf network <type>

Specifies the OSPF network type for a tunnel interface.

Syntax

set interfaces tunnel *tunx* **ip ospf network** [**broadcast** | **non-broadcast** | **point-to-multipoint** | **point-to-point**]

delete interfaces tunnel *tunx* **ip ospf network**

show interfaces tunnel *tunx* **ip ospf network**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
   tunnel tun0..tun9 {
      ip {
         ospf {
            network: text
         }
      }
   }
}
```

Parameters

tunx	Mandatory. The name of the tunnel interface you are configuring. The range is **tun0** to **tun9**.
type	The network type for this interface. Supported values are as follows: **broadcast**: The interface supports broadcast mode, such as a LAN link. **non-broadcast**: The interface does not support broadcast mode. **point-to-point**: This interface supports point-to-point mode, such as an NBMA interface. **point-to-multipoint**: This interface supports point-to-multipoint mode, such as a PPP interface or a point-to-point logical interface on Frame Relay. The default is broadcast.

Default

Broadcast is supported.

Usage Guidelines

Use this command to configure and display the network type for the interface.

Use the **set** form of this command to specify the network type.

Use the **delete** form of this command to remove the network type.

Use the **show** form of this command to display the network type.

interfaces tunnel <tunx> ip ospf priority <priority>

Sets the OSPF priority for a tunnel interface.

Syntax

set interfaces tunnel *tunx* **ip ospf priority** *priority*

delete interfaces tunnel *tunx* **ip ospf priority**

show interfaces tunnel *tunx* **ip ospf priority**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
    tunnel tun0..tun9 {
        ip {
            ospf {
                priority: u32
            }
        }
    }
}
```

Parameters

tunx	Mandatory. The name of the tunnel interface you are configuring. The range is **tun0** to **tun9**.
priority	Specifies the OSPF router priority for this interface. The range is 0 to 255, where a router with priority 0 can never become the designated router. The default is 1.

Default

An OSPF interface has a priority of 1.

Usage Guidelines

Use this command to set the priority for a tunnel interface on the broadcast network to which the interface is connected. The priority determines which routers are selected as the area's Designated Router (DR) and Backup Designated Router (BDR).

The DR and BDR are used to reduce the amount of traffic on OSPF overhead on broadcast networks, by reducing the number of adjacent routers to which a router must flood its topological information. In broadcast networks (such as Ethernet), each router establishes an adjacency with only the DR and the BDR, rather than with every router in its area. The DR and the BDR then flood this information to all other routers on the network segment.

Priority can range from 0 to 255. In general, the router with the highest priority is elected as the DR, and the router with the second-highest priority is elected as the BDR. The higher the number, the higher the priority.

Routers with a priority of 0 are ineligible for election.

Use the **set** form of this command to specify the OSPF priority.

Use the **delete** form of this command to restore the default priority.

Use the **show** form of this command to display priority configuration.

interfaces tunnel <tunx> ip ospf retransmit-interval <interval>

Sets the OSPF retransmit interval for a tunnel interface.

Syntax

set interfaces tunnel *tunx* **ip ospf retransmit-interval** *interval*

delete interfaces tunnel *tunx* **ip ospf retransmit-interval**

show interfaces tunnel *tunx* **ip ospf retransmit-interval**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
   tunnel tun0..tun9 {
      ip {
         ospf {
            retransmit-interval: u32
         }
      }
   }
}
```

Parameters

tunx	Mandatory. The name of the tunnel interface you are configuring. The range is **tun0** to **tun9**.
interval	Specifies the time in seconds to wait for an acknowledgement, after which the system retransmits an LSA packet to its neighbors. The range is 3 to 65535. The default is 5.

Default

Unacknowledged LSAs are retransmitted at 5-second intervals.

Usage Guidelines

Use this command to specify how long a tunnel interface will wait for an acknowledgment of a link-state update before resending the update.

The link-state update packet is part of the exchange of topology databases between routers. When the initial database description (DD) packet is sent, it contains only the headers of the LSAs. If the receiving router determines that it requires that piece of the OSPF topology, it sends a link state request packet to request the complete LSA from the sending router.

After the update packet is sent, the sending router waits for an acknowledgement, either implicit or explicit, from the receiving router. In an explicit acknowledgement, the receiving router sends a link-state acknowledge (LS-Ack) packet to the router that sent the update. In an implicit acknowledgement, the router that sent the update receives an LSA from the receiving router that contains the update information.

If the retransmit interval passes with neither an explicit nor an implicit acknowledgement, the sending router will retransmit the link-state update packet.

Too high an interval slows network convergence. Too small an interval causes unnecessary retransmission.

Use the **set** form of this command to set the OSPF retransmit interval for a tunnel interface.

Use the **delete** form of this command to restore the default retransmit interval.

Use the **show** form of this command to display retransmit interval configuration.

interfaces tunnel <tunx> ip ospf transmit-delay <delay>

Specifies the OSPF transmit delay for a tunnel interface.

Syntax

set interfaces tunnel *tunx* **ip ospf transmit-delay** *delay*

delete interfaces tunnel *tunx* **ip ospf transmit-delay**

show interfaces tunnel *tunx* **ip ospf transmit-delay**

Command Mode

Configuration mode.

Configuration Statement

```
interfaces {
    tunnel tun0..tun9 {
        ip {
            ospf {
                transmit-delay: u32
            }
        }
    }
}
```

Parameters

tunx	Mandatory. The name of the tunnel interface you are configuring. The range is **tun0** to **tun9**.
delay	Mandatory. The delay, in seconds, between link-state transmits. This value must be the same for all nodes on the network. The range is 1 to 65535. The default is 1.

Default

Link-state transmits occur at 1-second intervals.

Usage Guidelines

Use this command to set the transmit delay for a tunnel interface. This is the estimated time required to send a link-state update (LSU) packet.

This timer is used to accommodate transmission and propagation delays on the network, particularly on low-speed networks where delays may be significant. The router increments the age of link-state advertisements in LSU packets to account for these delays.

The value includes both the transmission time and the propagation delay across the network. The transmit delay is added to the age of the LSA packet before the LSA is transmitted The LSA age is used to help the network sequence LSAs, so that it can determine which of competing LSAs is the more recent and trustworthy.

LSAs are numbered in sequence, but the sequence numbers are finite, and so cannot be used as the sole determinant of the most recent LSA. Instead, OSPF also tracks the age of LSAs. Each time the LSA is forwarded to another router, its current age is incremented by the transmit delay. The packet’s age, together with its sequence number, helps the receiving router to determine which version of a received LSA is more recent, and therefore to be used.

Use the **set** form of this command to set the transmit delay.

Use the **delete** form of this command to restore the default transmit delay.

Use the **show** form of this command to display transmit delay configuration.

Glossary of Acronyms

ACL	access control list
ADSL	Asymmetric Digital Subscriber Line
AS	autonomous system
ARP	Address Resolution Protocol
BGP	Border Gateway Protocol
BIOS	Basic Input Output System
BPDU	Bridge Protocol Data Unit
CA	certificate authority
CHAP	Challenge Handshake Authentication Protocol
CLI	command-line interface
DDNS	dynamic DNS
DHCP	Dynamic Host Configuration Protocol
DLCI	data-link connection identifier
DMI	desktop management interface
DMZ	demilitarized zone
DNS	Domain Name System
DSCP	Differentiated Services Code Point
DSL	Digital Subscriber Line
eBGP	external BGP
EGP	Exterior Gateway Protocol

ECMP	equal-cost multipath
ESP	Encapsulating Security Payload
FIB	Forwarding Information Base
FTP	File Transfer Protocol
GRE	Generic Routing Encapsulation
HDLC	High-Level Data Link Control
I/O	Input/Ouput
ICMP	Internet Control Message Protocol
IDS	Intrusion Detection System
IEEE	Institute of Electrical and Electronics Engineers
IGP	Interior Gateway Protocol
IPS	Intrusion Protection System
IKE	Internet Key Exchange
IP	Internet Protocol
IPOA	IP over ATM
IPsec	IP security
IPv4	IP Version 4
IPv6	IP Version 6
ISP	Internet Service Provider
L2TP	Layer 2 Tunneling Protocol
LACP	Link Aggregation Control Protocol
LAN	local area network
MAC	medium access control
MIB	Management Information Base
MLPPP	multilink PPP
MRRU	maximum received reconstructed unit
MTU	maximum transmission unit

NAT	Network Address Translation
ND	Neighbor Discovery
NIC	network interface card
NTP	Network Time Protocol
OSPF	Open Shortest Path First
OSPFv2	OSPF Version 2
OSPFv3	OSPF Version 3
PAM	Pluggable Authentication Module
PAP	Password Authentication Protocol
PCI	peripheral component interconnect
PKI	Public Key Infrastructure
PPP	Point-to-Point Protocol
PPPoA	PPP over ATM
PPPoE	PPP over Ethernet
PPTP	Point-to-Point Tunneling Protocol
PVC	permanent virtual circuit
QoS	quality of service
RADIUS	Remote Authentication Dial-In User Service
RIB	Routing Information Base
RIP	Routing Information Protocol
RIPng	RIP next generation
Rx	receive
SNMP	Simple Network Management Protocol
SONET	Synchronous Optical Network
SSH	Secure Shell
STP	Spanning Tree Protocol
TACACS+	Terminal Access Controller Access Control System Plus

TCP	Transmission Control Protocol
ToS	Type of Service
Tx	transmit
UDP	User Datagram Protocol
vif	virtual interface
VLAN	virtual LAN
VPN	Virtual Private Network
VRRP	Virtual Router Redundancy Protocol
WAN	wide area network