

dbs enable

To apply Dynamic Subscriber Bandwidth Selection (DBS) QoS parameters, use the **dbs enable** command in the appropriate configuration mode. To remove DBS QoS parameters, use the **no** form of this command.

dbs enable

no dbs enable

Syntax Description This command has no arguments or keywords.

Defaults DBS QoS parameters are not applied.

Command Modes

- ATM VC class configuration
- ATM VC configuration
- ATM PVC range configuration
- ATM PVC-in-range configuration

Command History	Release	Modification
	12.2(4)B	This command was introduced.
	12.2(13)T	This command was integrated into Cisco IOS Release 12.2(13)T.

Usage Guidelines The **no dbs enable** command configured in any configuration mode overrides the **dbs enable** command configured in any configuration mode. Both the **dbs enable** and **no dbs enable** commands are saved in the running configuration and appear, when configured, in the output of the **show running-config** command. The **default dbs enable** command does not appear in the output of the **show running-config** command when configured.

When you enter the **dbs enable** or **no dbs enable** command, existing sessions are not disconnected. If you have a session that has been configured for DBS and you configure the **no dbs enable** command on a VC, additional sessions that are configured will display DBS-configured QoS values until the first new session is up. After the first session is brought up, the VC has default and locally configured values. If you configure the **dbs enable** command after multiple sessions are already up on the VC, all sessions on that VC have DBS QoS parameters.

RADIUS QoS attributes are applied to PVCs when a new PPP over Ethernet (PPPoE) session has peak cell rate (PCR) and sustainable cell rate (SCR) values that are higher than existing PPPoE sessions. If a new PPPoE session with lower PCR and SCR values is added to a PVC, the RADIUS QoS attributes are not applied to the new session. If the user of the PPPoE session that has the higher PCR and SCR values logs out, the QoS attributes are set to those of the lower bandwidth user.

RADIUS QoS attributes override attributes on a PVC configured in ATM PVC-in-range or ATM PVC range configuration mode. If the RADIUS QoS attributes cannot be applied to a PVC, PPPoE and PPPoA sessions cannot be established.

When DBS is configured, normal ATM precedences apply. PVC configurations take precedence over VC class configurations. Thus, if DBS QoS parameters are applied on a VC class and disabled on one PVC in that VC class, DBS QoS parameters are not applied on the PVC. ATM PVC-in-range configurations take precedence over PVC range configurations.

When you configure DBS on a PVC, existing sessions on that PVC remain connected.

Examples

The following example configures DBS in ATM VC class configuration mode:

```
vc-class atm pppoe
  dba enable
```

The following example configures DBS in ATM VC configuration mode:

```
interface atm0/0/0.5 point-to-point
  ip address 10.0.0.0 255.255.255.0
  pvc 0/100
    dba enable
  protocol pppoe
```

The following example configures DBS in ATM PVC range configuration mode:

```
interface atm0/0/0.1 multipoint
  ip address 10.0.0.0 255.255.255.0
  range pvc 0/50 0/70
    dba enable
```

The following example configures DBS in ATM PVC-in-range configuration mode:

```
interface atm0/0/0.1 multipoint
  range pvc 0/50 0/70
    pvc-in-range 60
    dba enable
```

Related Commands

Command	Description
pvc	Creates or assigns a name to an ATM PVC, specifies the encapsulation type on an ATM PVC, or enters interface-ATM-VC configuration mode.
pvc-in-range	Configures an individual PVC within a PVC range.
range pvc	Defines a range of ATM PVCs.
show atm pvc dba	Displays all ATM PVCs on which DBS QoS parameters are applied.
vc-class atm	Configures a VC class for an ATM VC or interface.

de-bit

To set Frame Relay discard-eligible (DE) bit mapping for FRF.5 and FRF.8 network interworking, use the **de-bit** command in **FRF.5 connect configuration mode** or **FRF.8 connect configuration mode**. To disable or reset Frame Relay DE bit mapping, use the **no** form of this command.

de-bit {0 | 1 | map-clp}

no de-bit {0 | 1 | map-clp}

Syntax Description		
	0	Sets the DE field in the Frame Relay header to 0. This keyword may be used only for FRF.8.
	1	Sets the DE field in the Frame Relay header to 1. This keyword may be used only for FRF.8.
	map-clp	DE field in the Frame Relay header is set to 1 if one or more cells that belong to a frame have their cell loss priority (CLP) field set. This is the default setting. This keyword may be used for FRF.5 or FRF.8.
		Note The map-clp keyword is the only one available for FRF.5.

Defaults map-clp

Command Modes FRF.5 connect configuration
FRF.8 connect configuration

Command History	Release	Modification
	12.1(2)T	This command was introduced.
	12.2(8)YN	Enhanced QoS features were added for Cisco 1720, Cisco 1750, Cisco 1751, Cisco 1760, Cisco 2610XM-2651XM, Cisco 3640, Cisco 3640A, and Cisco 3660.
	12.2(13)T	This command was integrated into Cisco IOS Release 12.2(13)T.
	12.3(2)T	This command was integrated into Cisco IOS Release 12.3(2)T for the following platforms: Cisco 1721, Cisco 2610-2651, Cisco 2610XM-2651XM, Cisco 2691, Cisco 3620, and Cisco 3660.

Usage Guidelines In the default state, the DE bit in the Frame Relay header is set to 1 when one or more ATM cells that belong to a frame have their cell loss priority (CLP) field set to 1 or when the DE field of the Frame Relay service-specific convergence sublayer (FR-SSCS) protocol data unit (PDU) is set to 1.

When the **no de-bit** command and **map-clp** keyword are entered, the FR-SSCS PDU DE field is copied unchanged to the Q.922 core frame DE field, independently of CLP indications received at the ATM layer.

Examples

The following example creates a connection between the virtual circuit (VC) group named “friends” and ATM PVC 0/32 and configures FR DE field mapping to match the ATM CLP field:

```
Router(config)# vc-group friends
Router(config-vc-group)# serial1/0 16 16
Router(config-vc-group)# serial1/0 17 17
Router(config-vc-group)# serial1/0 18 18
Router(config-vc-group)# serial1/0 19 19
Router(config)# interface atm3/0
Router(config-if)# pvc 0/32
Router(config-if-atm-vc)# encapsulation aal5mux frame-relay
Router (config-if-atm-vc)# exit
Router (config-if)# exit
Router(config)# connect vc-group friends atm3/0 0/32
Router(config-frf5)# de-bit map-clp
```

Related Commands

Command	Description
clp-bit	Sets the ATM CLP field in the ATM cell header.
connect (FRF.5)	Configures an FRF.5 one-to-one connection or one-to-many connection between two Frame Relay end users over an intermediate ATM network.
connect (FRF.8)	Configures an FRF.8 one-to-one mapping between a Frame Relay DLCI and an ATM PVC.
vc-group	Assigns multiple Frame Relay DLCIs to a VC group.

de-bit map-clp

To set Frame Relay discard eligible (DE) bit mapping for FRF.5 network interworking, use the **de-bit map-clp** command in FRF.5 connect mode. To disable or reset Frame Relay DE bit mapping, use the **no** form of this command.

de-bit map-clp

no de-bit map-clp

Syntax Description This command has no arguments or keywords.

Defaults No default behavior or values

Command Modes FRF.5 connect configuration

Release	Modification
12.1(2)T	This command was introduced.

Usage Guidelines In the default state, the DE bit in the Frame Relay header is set to 1 when one or more ATM cells belonging to a frame have their cell loss priority (CLP) field set to 1, or when the DE field of the Frame Relay service specific convergence sublayer (FR-SSCS) protocol data unit (PDU) is set to 1.

When the **no de-bit map-clp** command is entered, the FR-SSCS PDU DE field is copied unchanged to the Q.922 core frame DE field, independent of CLP indications received at the ATM layer.

Examples The following example creates a connection that connects the virtual circuit (VC) group named friends to ATM PVC 0/32 and configures FR DE field mapping to match the ATM CLP field:

```
Router(config)# vc-group friends
Router(config-vc-group)# serial0 16 16
Router(config-vc-group)# serial0 17 17
Router(config-vc-group)# serial0 18 18
Router(config-vc-group)# serial0 19 19
Router(config)# interface atm3/0
Router(config-if)# pvc 0/32
Router(config-if-atm-vc)# encapsulation aal5mux frame-relay
Router(config)# connect vc-group friends atm3/0 0/32
Router(config-frf5)# de-bit map-clp
```

Command	Description
clp-bit	Sets the ATM CLP field in the ATM cell header.
connect (FRF.5)	Connects a Frame Relay DLCI or VC group to an ATM PVC.
vc-group	Assigns multiple Frame Relay DLCIs to a VC group.

dscp (Frame Relay VC-bundle-member)

To configure the differentiated services code point (DSCP) levels for a Frame Relay permanent virtual circuit (PVC) bundle member, use the **dscp** command in Frame Relay VC-bundle-member configuration mode. To remove the DSCP level configuration from the PVC, use the **no** form of this command.

dscp {*level* | **other**}

no dscp *level*

Syntax Description	<i>level</i>	
		Specifies the DSCP level or levels for this Frame Relay PVC bundle member. The range is from 0 to 63. A PVC bundle member can be configured with a single DSCP level, multiple individual DSCP levels, a range of DSCP levels, multiple ranges of DSCP levels, or a combination of individual levels and level ranges. Examples are as follows: <ul style="list-style-type: none"> • 9 • 25,35,45 • 25-35,45-55 • 10,20,25-35,40,45-55,60
	other	Specifies that this Frame Relay PVC bundle member will handle all of the remaining DSCP levels that are not specified by other PVC bundle members.

Defaults DSCP levels are not configured.

Command Modes Frame Relay VC-bundle-member configuration

Command History	Release	Modification
	12.2(13)T	This command was introduced.

Usage Guidelines Assignment of DSCP levels to PVC bundle members allows you to create differentiated service because you can distribute the DSCP levels over the various PVC bundle members. You can map a single DSCP level or range of levels to each discrete PVC in the bundle, thereby enabling PVCs in the bundle to carry packets marked with different DSCP levels. Use the **dscp other** command to configure a PVC to carry traffic marked with DSCP levels not specifically configured on other PVCs. Only one PVC in the bundle can be configured with the **dscp other** command.

This command is available only when the match type for the PVC bundle is set to **dscp** using the **match dscp** command in Frame Relay VC-bundle configuration mode.

You can overwrite the DSCP level configuration on a PVC by reentering the **dscp** command with a new level value.

There is no default value for this command. When the PVC bundle is set to **dscp** using the **match dscp** command, all PVCs in the bundle are reset to remove any existing DSCP values. If one or more DSCP values are not specifically configured, the bundle will not come up.

Note, however, that a PVC may exist in a bundle but have no DSCP value associated with it. As long as all valid DSCP values are handled by one or more of the other PVCs in the bundle, the bundle can come up, but the PVC that has no DSCP value configured will not participate in it.

A DSCP level can be configured on one PVC-bundle member per bundle. If you configure the same DSCP level on more than one PVCs within a bundle, the following error warning appears on the console:

```
%Overlapping diff-serv code points
```

Examples

The following example assigns DSCP levels 0 through 9 to PVC bundle member 300 in a Frame Relay PVC bundle called “MP-3-static”:

```
interface serial 1/4
 frame-relay map ip 10.2.2.2 vc-bundle MP-3-static
 frame-relay vc-bundle MP-3-static
  pvc 300
    dscp 0-9
```

The following example changes the DSCP levels in the above example from 0 through 9 to 0, 9, and 20 through 29:

```
interface serial 1/4
 frame-relay map ip 10.2.2.2 vc-bundle MP-3-static
 frame-relay vc-bundle MP-3-static
  pvc 300
    dscp 0,9,20-29
```

Related Commands

Command	Description
exp	Configures MPLS EXP levels for a Frame Relay PVC bundle member.
frame-relay map	Defines mapping between a destination protocol address and the DLCI used to connect to the destination address.
frame-relay vc-bundle	Creates a Frame Relay PVC bundle and enters Frame Relay VC-bundle configuration mode.
match	Specifies which bits in the ToS octet to use for mapping packet service levels to Frame Relay PVC bundle members.
precedence (Frame Relay VC-bundle-member)	Configures the precedence levels for a Frame Relay PVC bundle member.
pvc (frame-relay vc-bundle)	Creates a PVC and PVC bundle member and enters Frame Relay VC-bundle-member configuration mode.

dsl enable-training-log

To enable the retrieval of the digital subscriber line (DSL) training log, use the **dsl enable-training-log** command in interface configuration mode. To disable retrieval of the DSL training log, use the **no** form of this command.

dsl enable-training-log

no dsl enable-training-log

Syntax Description This command has no arguments or keywords.

Defaults Retrieval of the DSL training log is disabled.

Command Modes Interface configuration

Command History	Release	Modification
	12.2(4)XM	This command was introduced.
	12.3	This command was integrated into Cisco IOS Release 12.3

Usage Guidelines The training log is a record of the events that occur when the router *trains*, or negotiates communication parameters, with the DSL access multiplexer (DSLAM) at the central office. Retrieving this log may add up to a few minutes to the training process, and retrieval is not always necessary after the router has successfully trained. Therefore, retrieval of the training log is disabled by default. To retrieve the log, enter the **dsl enable-training-log** command.

Examples The following example enables the retrieval of the training log:

```
Router(config-if)# dsl enable-training-log
```

dsl equipment-type

To configure the digital subscriber line (DSL) ATM interface to function as central office or customer premises equipment, use the **dsl equipment-type** command in interface configuration mode. To restore the default equipment type, use the **no** form of this command.

dsl equipment-type { **co** | **cpe** } **ignore-error-duration** *seconds*

no dsl equipment-type

Syntax Description	co	Configures the DSL ATM interface to function as central office equipment.
	cpe	Configures the DSL ATM interface to function as customer premises equipment.
	ignore-error-duration <i>seconds</i>	Sets the number of seconds for which errors are ignored. The valid range is from 15 to 30. The default is 0.

Defaults	cpe Seconds: 0
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Command Modes	Interface configuration
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Command History	Release	Modification
	12.2(4)XL	This command was integrated into Cisco IOS Release 12.2(4)XL on the G.SHDSL WIC on the Cisco 2600 series routers.
	12.2(8)T	This command was integrated into Cisco IOS Release 12.2(8)T on the G.SHDSL WAN interface card (WIC) on the Cisco 2600 series and Cisco 3600 series routers.
	12.2(13)T	The ignore-error-duration keyword was added to interoperate with metalink chipset digital subscriber line access multiplexers (DSLAMs).

Usage Guidelines This configuration command applies to a specific ATM interface. You must specify the ATM interface before you enter this command.

The ATM interface must be in the shutdown state before you enter this command.

Examples The following example shows how to configure DSL ATM interface 1/1 to function as central office equipment:

```
Router# configure terminal

Enter configuration commands, one per line. End with CNTL/Z.
Router(config)# interface atm 1/1
Router(config-if)# dsl equipment-type co ignore-error-duration 18''''
Router(config-if)# end
Router# clear interface atm 0/1
```

■ dsl equipment-type

Related Commands

Command	Description
dsl linerate	Specifies a line rate for the DSL ATM interface.
dsl operating-mode (G.SHDSL)	Specifies an operating mode of the DSL ATM interface.

dsl gain-setting rx-offset

To add an offset to the receive (Rx) gain in a modem, use the **dsl gain-setting rx-offset** command in global configuration mode.

dsl gain-setting rx-offset *decimal*

Syntax Description	<i>decimal</i>	Offset (in dB) to the Rx gain. The valid range is from -5 dB to 3 dB, with a granularity of 0.5 dB.
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Defaults	0 dB (no offset)
-----------------	------------------

Command Modes	Global configuration
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Command History	Release	Modification
	12.2(8)YN	This command was introduced.
12.3(2)T	This command was integrated into Cisco IOS Release 12.3(2)T.	

Usage Guidelines	In most cases this command does not need to be used because the default value should be adequate. If the service provider improves the line rates, as often happens, using this and other DSL commands will not improve the DSL performance.
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Examples	The following example shows how to add an offset of -2 to the receive (Rx) gain of the modem:
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```
dsl gain-setting rx-offset -2
```

Related Commands	Command	Description
	dsl gain-setting tx-offset	Adds an offset on the Tx gain in the modem and affects the DSP front end.
dsl max-tone-bits	Limits of the number of bits that are loaded into each upstream tone.	
dsl noise-margin	Adds an offset on the Rx target noise margin of the modem. The offset is added to the calculated target noise margin.	

dsl gain-setting tx-offset

To add an offset to the transmit gain in a modem, use the **dsl gain-setting tx-offset** command in global configuration mode.

dsl gain-setting tx-offset *decimal*

Syntax Description	<i>decimal</i>	Offset (in dB) to the transmit gain. The valid range is from -10 dB to 3 dB, with a granularity of 0.5 dB.
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Defaults	0 dB (no offset)
-----------------	------------------

Command Modes	Global configuration
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Command History	Release	Modification
	12.2(8)YN	This command was introduced.
12.3(2)T	This command was integrated into Cisco IOS Release 12.3(2)T.	

Usage Guidelines	In most cases this command does not need to be used because the default value should be adequate. If the service provider improves the line rates, as often happens, using this and other DSL commands will not improve the DSL performance.
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Examples	The following example shows how to add an offset of .5 to the transmit (Tx) gain of the modem:
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```
dsl gain-setting tx-offset .5
```

Related Commands	Command	Description
	dsl gain-setting rx-offset	Adds an offset on the Rx gain in the modem and affects the analog front end.
	dsl max-tone-bits	Limitsof the number of bits that are loaded into each upstream tone.
	dsl noise-margin	Adds an offset on the Rx target noise margin of the modem. The offset is added to the calculated target noise margin.

dsl linerate

To specify a line rate for the digital subscriber line (DSL) ATM interface, use the **dsl linerate** command in interface configuration mode. To restore the default line rate, use the **no** form of this command.

dsl linerate {*kbps* | **auto**}

no dsl linerate

Syntax Description	
<i>kbps</i>	Line rate, in kilobits per second, for the DSL ATM interface. Allowable entries are 72, 136, 200, 264, 392, 520, 776, 1032, 1160, 1544, 2056, and 2312 .
auto	Configures the DSL ATM interface to automatically train for an optimal line rate by negotiating with the far-end digital subscriber line access multiplexer (DSLAM) or WAN interface card (WIC).

Defaults The DSL ATM interface automatically synchronizes its line rate with the far-end DSLAM or WIC.

Command Modes Interface configuration

Command History	Release	Modification
	12.2(4)XL	This command was integrated into Cisco IOS Release 12.2(4)XL on the G.SHDSL WIC on the Cisco 2600 series routers.
	12.2(8)T	This command was integrated into Cisco IOS Release 12.2(8)T on the G.SHDSL WIC on the Cisco 2600 series and Cisco 3600 series routers.

Usage Guidelines This configuration command applies to a specific ATM interface. You must specify the ATM interface before you enter this command.

The ATM interface must be in the shutdown state before you enter this command.

Examples The following example shows how to configure DSL ATM interface 0/1 to operate at a line rate of 1040 kbps.

```
Router# configure terminal
```

```
Enter configuration commands, one per line. End with CNTL/Z.
```

```
Router(config)# interface atm 0/1
```

```
Router(config-if)# dsl linerate 1040
```

```
Router(config-if)# end
```

```
Router# clear interface atm 0/1
```

Related Commands	Command	Description
	dsl equipment-type	Configures the DSL ATM interface to function as CO equipment or CPE.
	dsl operating-mode (G.SHDSL)	Specifies an operating mode of the DSL ATM interface.

dsl max-tone-bits

To set a limit on the number of bits that are loaded into each upstream tone, use the **dsl max-tone-bits** command in global configuration mode.

dsl max-tone-bits *integer*

Syntax Description	<i>integer</i>	Number of bits that are loaded into each upstream tone. The valid range is from 2 to 14.
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Defaults	14 bits per tone, which is the ADSL maximum standard
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Command Modes	Global configuration
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Command History	Release	Modification
	12.2(8)YN	This command was introduced.
	12.3(2)T	This command was integrated into Cisco IOS Release 12.3(2)T.

Usage Guidelines	In most cases this command does not need to be used because the default value should be adequate. If the service provider improves the line rates, as often happens, using this and other DSL commands will not improve the DSL performance.
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Examples	The following example sets 10 as the maximum number of bits to be loaded into each upstream tone: <pre>dsl max-tone-bits 10</pre>
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Related Commands	Command	Description
	dsl gain-setting rx-offset	Adds an offset to the Rx gain in the modem and affects the analog front end.
	dsl gain-setting tx-offset	Adds an offset on the Tx gain in the modem and affects the DSP front end.
	dsl noise-margin	Adds an offset on the Rx target noise margin of the modem. The offset is added to the calculated target noise margin.

dsl noise-margin

To add an offset to the receive (Rx) target noise margin of a modem, use the **dsl noise-margin** command in global configuration mode.

dsl noise-margin *decimal*

Syntax Description	<i>decimal</i>	Offset (in dB) to the Rx target noise margin. The valid range is from -3 dB to 3 dB, with a granularity of 0.5 dB.
---------------------------	----------------	--

Defaults	0 dB (no offset)
-----------------	------------------

Command Modes	Global configuration
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Command History	Release	Modification
	12.2(8)YN	This command was introduced.
12.3(2)T	This command was integrated into Cisco IOS Release 12.3(2)T.	

Usage Guidelines	In most cases this command does not need to be used because the default value should be adequate. If the service provider improves the line rates, as often happens, using this and other digital subscriber line (DSL) commands will not improve the DSL performance.
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Examples	The following example shows how to add an offset of -.5 to the noise margin:
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```
dsl noise-margin -.5
```

Related Commands	Command	Description
	dsl gain-setting rx-offset	Adds an offset on the Rx gain in the modem and affects the analog front end.
	dsl gain-setting tx-offset	Adds an offset to the Tx gain in the modem and affects the DSP front end.
	dsl max-tone-bits	Limits the number of bits that are loaded into each upstream tone.

dsl operating-mode



Caution

This command is for testing or lab environments only. Using a configuration other than the default configuration for the digital subscriber line (DSL) operating mode can lead to unpredictable behavior on the asymmetric digital subscriber line (ADSL).

To modify the operating mode of the digital subscriber line for an ATM interface, use the **dsl operating-mode** command in interface configuration mode.

The following syntax is used with the Cisco WIC-1ADSL:

```
dsl operating-mode {auto | ansi-dmt | itu-dmt | splitterless}
```

```
no dsl operating-mode {auto | ansi-dmt | itu-dmt | splitterless}
```

The following syntax is used with the Cisco WIC-1ADSL-I-DG:

```
dsl operating-mode {auto | etsi | itu-dmt} [tone low]
```

```
no dsl operating-mode {auto | etsi | itu-dmt} [tone low]
```

Syntax Description

auto	Configure the ADSL line after automatic negotiation with the DSLAM located at the Central Office.
ansi-dmt	Configure the ADSL line to train in the ANSI T1.413 Issue 2 mode.
itu-dmt	Configure the ADSL line to train in the G.992.1 mode.
splitterless	Configure the ADSL line to train in the G.Lite mode.
etsi	Configure the ADSL line to train in the ETSI mode.
tone low	Enables the WIC-1ADSL-I-DG to use carrier tones 29 through 48. The absence of tone low tells the WIC-1ADSL-I-DG to use carrier tones 33 through 56. The latter tone set is used when the WIC is operating in accordance with Deutsche Telekom specification U-R2.

Defaults

The default DSL operating mode is **auto**.

Command Modes

Interface configuration

Command History

Release	Modification
12.1(3)XJ	This command was introduced on the Cisco 1700 series routers.
12.2(2)T	This command was integrated into Cisco IOS Release 12.2(2)T.
12.2(13)ZH	This command was modified to include the keyword splitterless for the Cisco WIC-1ADSL, and syntax (including tone low) for the Cisco WIC-1ADSL-I-DG.

Release	Modification
12.2(15)ZJ	The command changes made in Cisco IOS Release 12.2(13)ZH were integrated into Cisco IOS Release 12.2(15)ZJ.
12.3(4)T	The command changes made in Cisco IOS Release 12.2(13)ZJ were integrated into Cisco IOS Release 12.3(4)T.

Usage Guidelines



Caution

This command is for testing or lab environments only. Using a configuration other than the default configuration for the DSL operating mode can lead to unpredictable behavior on the ADSL line.

Examples

The following example shows how to configure the DSL operating mode for ATM interface 0:

```
Router# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)# interface atm 0
Router(config-if)# dsl operating-mode itu-dmt
Router(config-if)# end
Router#
```

Related Commands

Command	Description
show diag	Displays diagnostic information about the memory on an ADSL-WIC and the ADSL line training log.
show dsl interface atm	Displays information specific to the ADSL for a specified ATM interface.

dsl operating-mode (ADSL over ISDN)

To specify the operating mode of the digital subscriber line (DSL) for an ATM interface, use the **dsl operating-mode** command in interface configuration mode. To restore the default operating mode, use the **no** form of this command.

```
dsl operating-mode { annexb-ur2 | etsi | auto }
```

```
no dsl operating-mode { annexb-ur2 | etsi | auto }
```

Syntax Description

annexb-ur2	Specifies the Deutsche Telekom U-R2 (interface) mode, which transmits and receives ADSL signals according to the ITU-T G.992.1 Annex B standard. This mode supports upstream bins (analog modems) numbered 33 to 53 and downstream bins numbered 64 to 255.
etsi	Specifies Alcatel proprietary ETSI mode, which supports upstream bins numbered 29 to 48 and downstream bins numbered 64 to 255.
auto	Configures a modem to switch between etsi mode and annexb-ur2 mode for connection, following the sequence described in the “Usage Guidelines” section.

Defaults

Mode: **etsi**

Command Modes

Interface configuration

Command History

Release	Modification
12.2(4)YA	This command was introduced.
12.2(15)T	This command was implemented on the Cisco 820 series and the Cisco SOHO 70, 76, 77, and 77H platforms.

Usage Guidelines

In auto mode, a modem first tries to connect using **etsi** mode. If the connection fails, the modem retries a set number of times. If the modem fails to connect after several retries using **etsi** mode, the modem automatically switches to **annexb-ur2** mode and tries several times to connect using **annexb-ur2** mode. If the modem fails to connect after several retries using **annexb-ur2** mode, the modem automatically switches back to **etsi** mode and tries to connect.

The modem continues switching between modes, in sequence as described, until the modem reaches the state SHOWTIME (which signifies that the connection attempt was successful) and connects using one of the modes. This switching process is designed specifically for expediting DSL modem performance.

Examples

The following example shows how to configure the DSL to operate in **etsi** mode:

```
Router# configure terminal
```

Enter configuration commands, one per line. End with CNTL/Z.

■ dsl operating-mode (ADSL over ISDN)

```
Router(config)# interface atm 0
Router(config-if)# dsl operating-mode etsi
Router(config-if)# end
```

Related Commands

Command	Description
show dsl interface atm	Displays information specific to the ADSL for a specified ATM interface.

dsl-mode shdsl symmetric annex

To configure a DSL controller to operate in SHDSL multirate, high-speed symmetric mode, and to set regional operating parameters, use the **dsl-mode shdsl symmetric annex** command in controller configuration mode.

dsl-mode shdsl symmetric annex {A | B | A-B | A-B-ANFP | B-ANFP}

Syntax Description		
A	Sets the Annex A operating parameter of the G.991.2 standard for North America. This is the default.	
B	Sets the Annex B operating parameter of the G.991.2 standard for Europe.	
A-B	Supports Annex A or B. For CPE mode only. Not supported in central office (CO) mode. Selected when the line trains.	
A-B-ANFP	Supports Annex A or B-ANFP. For CPE mode only. Not supported in CO mode. Selected when the line trains.	
B-ANFP	Supports Annex B-ANFP.	

Defaults The default regional operating parameter is A for North America.

Command Modes Controller configuration

Command History	Release	Modification
	12.3(4)XD	This command was introduced on Cisco 2600 series and Cisco 3700 series routers.
	12.3(4)XG	This command was integrated into the Cisco IOS Release 12.3(4)XG on the Cisco 1700 series routers.
	12.3(7)T	This command was integrated into Cisco IOS Release 12.3(7)T on Cisco 2600 series, Cisco 3631, and Cisco 3700 series routers
	12.3(11)T	Support for the following annex parameters was integrated into Cisco IOS Release 12.3(11)T for Cisco 2600, Cisco 2800, Cisco 3700, and Cisco 3800 series routers: <ul style="list-style-type: none"> • A-B • A-B-ANFP • B-ANFP

Usage Guidelines Use this command to configure the DSL controller interface to operate in SHDSL multirate, high-speed symmetric mode, and to set regional operating parameters to either North America or Europe, per ITU G.991.2.

Examples

The following example shows a typical configuration and (when messaging is enabled) the messages seen for a DSL controller on the CO side of the network. This example uses the **dsl-mode shdsl symmetric annex a** command to configure the controller for SHDSL North American multirate, high-speed symmetric mode.

```
Router# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.

Router(config)# controller dsl 0/0
Router(config-controller)# mode atm
Router(config-controller)# line-term co
Router(config-controller)# line-mode 4-wire
Router(config-controller)# dsl-mode shdsl symmetric annex a
Router(config-controller)# line-rate 4608
00:22:07: %CONTROLLER-5-UPDOWN: Controller DSL 0/0, changed state to down
00:23:25: %CONTROLLER-5-UPDOWN: Controller DSL 0/0, changed state to up
00:23:31: %LINK-3-UPDOWN: Interface ATM0/0, changed state to up
00:23:32: %LINEPROTO-5-UPDOWN: Line protocol on Interface ATM0/0, changed state to up
```

Related Commands

Command	Description
controller dsl	Configures the DSL controller.
line-mode	Configures a DSL controller to operate in four-wire mode.
line-rate	Specifies a line rate for the DSL controller.
line-term	Specifies termination for a DSL line.
mode atm	Sets the DSL controller into ATM mode and creates an ATM interface.

dsl power-cutback

To set the maximum noise margin that can occur on a digital subscriber line (DSL) before a power cutback happens, use the **dsl power-cutback** command in interface configuration mode. To reset the maximum noise margin to the default value of 31, use the **no** form of this command.

dsl power-cutback *dB*

no dsl power-cutback

Syntax Description	<i>dB</i>	Maximum noise margin in decibels. Range is 1 to 30.
---------------------------	-----------	---

Command Default	The maximum noise margin is 31.	
------------------------	---------------------------------	--

Command Modes	Interface configuration	
----------------------	-------------------------	--

Command History	Release	Modification
	12.2T	This command was introduced.

Usage Guidelines	<p>This command is available on ATM interfaces.</p> <p>Anytime the maximum noise margin is changed by entering the dsl power-cutback command, the line will retrain.</p>
-------------------------	---

Examples	The following example specifies a maximum noise margin of 10 decibels on ATM interface 0:
-----------------	---

```
interface ATM 0
  no ip address
  no ip route-cache
  no ip mroute-cache
  load-interval 30
  no atm ilmi-keepalive
  dsl operating-mode auto
  dsl power-cutback 10
```

dxi map

To map a protocol address to a given virtual path identifier (VPI) and virtual channel identifier (VCI), use the **dxi map** command in interface configuration mode. To remove the mapping for that protocol and protocol address, use the **no** form of this command.

dxi map *protocol protocol-address vpi vci* [**broadcast**]

no dxi map *protocol protocol-address*

Syntax Description

<i>protocol</i>	One of the following bridging or protocol keywords: appletalk , bridge , clns , decnet , ip , or novell .
<i>protocol-address</i>	Protocol-specific address.
<i>vpi</i>	Virtual path identifier in the range from 0 to 15.
<i>vci</i>	Virtual circuit identifier in the range from 0 to 63.
broadcast	(Optional) Address to which broadcasts should be forwarded.

Defaults

No map definition is established.

Command Modes

Interface configuration

Command History

Release	Modification
10.3	This command was introduced.
12.2(13)T	The apollo , vines , and xns arguments were removed because Apollo Domain, Banyan VINES, and Xerox Network Systems are no longer supported in the Cisco IOS software.

Usage Guidelines

This command is used in configurations where the router is intended to communicate with an ATM network through an ATM data service unit (ADSU). Given the circuit identifier parameters (VPI and VCI) for the ATM permanent virtual circuit (PVC), the router computes and uses the DXI frame address (DFA) that is used for communication between the router and the ADSU.

The **dxi map** command can be used only on a serial interface or HSSI configured for ATM-DXI encapsulation.

Examples

The following example converts all IP packets intended for the host with IP address 172.21.170.49 into ATM cells identified with a VPI of 2 (binary 0000 0010) and a VCI of 46 (binary 0000 0000 0010 1110) by the ADSU:

```
interface serial 0
 dxi map ip 172.21.170.49 2 46 broadcast
```

Using the mapping defined in Annex A of the ATM DXI Specification, the router uses the VPI and VCI information in this example to compute a DFA of 558 (binary 1000101110). The ADSU will use the DFA of the incoming frame to extract the VPI and VCI information when formulating ATM cells.

Related Commands

Command	Description
dxi pvc	Configures multiprotocol or single-protocol ATM-DXI encapsulation.
encapsulation atm-dxi	Enables ATM-DXI encapsulation.

dxi pvc

To configure multiprotocol or single protocol ATM-Data Exchange Interface (DXI) encapsulation, use the **dxi pvc** command in interface configuration mode. To disable multiprotocol ATM-DXI encapsulation, use the **no** form of this command.

dxi pvc *vpi vci* [**snap** | **nlpid** | **mux**]

no dxi pvc *vpi vci* [**snap** | **nlpid** | **mux**]

Syntax Description

<i>vpi</i>	ATM network virtual path identifier (VPI) of this permanent virtual circuit (PVC), in the range from 0 to 15. The VPI is a 4-bit field in the header of the ATM DXI frame. The VPI value is unique only on a single interface, not throughout the ATM network, because it has local significance only. Both <i>vpi</i> and <i>vci</i> cannot be specified as 0; if one is 0, the other cannot be 0.
<i>vci</i>	ATM network virtual channel identifier (VCI) of this PVC, in the range from 0 to 63. The VCI is a 6-bit field in the header of the ATM DXI frame. The VCI value is unique only on a single interface, not throughout the ATM network, because it has local significance only. Both <i>vpi</i> and <i>vci</i> cannot be specified as 0; if one is 0, the other cannot be 0.
snap	(Optional) LLC/SNAP encapsulation based on the protocol used in the packet. This keyword defines a PVC that can carry multiple network protocols. This is the default.
nlpid	(Optional) RFC 1294/1490 encapsulation. This option is provided for backward compatibility with the default encapsulation in earlier versions of the Cisco IOS software.
mux	(Optional) MUX encapsulation; the carried protocol is defined by the dxi map command when the PVC is set up. This keyword defines a PVC that carries only one network protocol.

Defaults

LLC/SNAP encapsulation

Command Modes

Interface configuration

Command History

Release	Modification
10.3	This command was introduced.

Usage Guidelines

This command can be used only on a serial interface or HSSI that is configured with ATM-DXI encapsulation.

Select the **nlpid** option if you are using the default encapsulation for software releases earlier than Cisco IOS Release 10.3.

Examples

The following example configures ATM-DXI MUX encapsulation on serial interface 1. The PVC identified by a VPI of 10 and a VCI of 10 can carry a single protocol. Then the protocol to be carried on this PVC is defined by the **dxi map** command.

```
interface serial 1
  dxi pvc 10 10 mux
  dxi map ip 172.21.176.45 10 10 broadcast
```

The following example configures ATM-DXI NLPID encapsulation on serial interface 1. The PVC identified by a VPI of 11 and a VCI of 12 can carry multiprotocol traffic that is encapsulated with a header described in RFC 1294/1490.

```
interface serial 1
  dxi pvc 11 12 nlpid
```

Related Commands

Command	Description
class-int	Maps a protocol address to a given VPI and VCI.
encapsulation atm-dxi	Enables ATM-DXI encapsulation.
show dxi pvc	Displays the PVC statistics for a serial interface.

efci-bit

To set the explicit forward congestion indication (EFCI) bit field in the ATM cell header for FRF.8 service interworking, use the **efci-bit** command in FRF.8 connect mode. To disable or reset this bit, use the **no** form of this command.

efci-bit {0 / map-fecn}

no efci-bit {0 / map-fecn}

Syntax Description	0	The EFCI field in the ATM cell header is set to 0.
	map-fecn	The EFCI field in the ATM cell header is set to 1 when the forward explicit congestion notification (FECN) field in the Frame Relay header is set.

Defaults The default is **0**.

Command Modes FRF.8 connect configuration

Command History	Release	Modification
	12.1(2)T	This command was introduced.

Usage Guidelines This command maps from Frame Relay to ATM.

Examples The following example creates a connection that connects Frame Relay DLCI 100 to ATM PVC 0/32, and sets the EFCI field in the ATM cell header to 1 when the FECN field in the Frame Relay header is set:

```
Router(config)# interface atm1/0
Router(config-if)# pvc 0/32
Router(config-if)# encapsulation aal5mux fr-atm-srv
Router(config)# connect serial0 100 atm1/0 0/32 service-interworking
Router(config-frf8)# efci-bit map-fecn
```

Related Commands	Command	Description
	clp-bit	Sets the ATM CLP field in the ATM cell header.
	connect (FRF.8)	Connects a Frame Relay DLCI to an ATM PVC.
	connect (FRF.5)	Sets the Frame Relay DE bit field in the Frame Relay cell header.
	service translation	Allows mapping between encapsulated ATM PDUs and encapsulated Frame Relay PDUs.

encapsulation (ATM)

To configure the ATM adaptation layer (AAL) and encapsulation type for an ATM virtual circuit (VC), VC class, VC, bundle, or permanent virtual circuit (PVC) range, use the **encapsulation** command in the appropriate mode. To remove an encapsulation type, use the **no** form of this command.

```
encapsulation { aal2 | aal5auto | aal5autopp virtual-template number [group group-name] | aal5ciscoppp virtual-template number | aal5mux protocol | aal5nlpid | aal5snap }
```

```
no encapsulation { aal2 | aal5auto | aal5autopp virtual-template number [group group-name] | aal5ciscoppp virtual-template number | aal5mux protocol | aal5nlpid | aal5snap }
```

Syntax Description	
aal2	AAL and encapsulation type for PVCs dedicated to AAL2 Voice over ATM.
aal5auto	AAL and encapsulation type for PPP over ATM (PPPoA) switched virtual circuits (SVCs). Enables an ATM SVC to use either aal5snap or aal5mux encapsulation options.
aal5autopp	Enables PPPoA/PPPoE autosense. PPPoA/PPPoE autosense enables a router to distinguish between incoming PPPoA and PPP over Ethernet (PPPoE) sessions and create virtual access for both PPP types based on demand.
virtual-template <i>number</i>	Number used to identify the virtual template.
group	(Optional) Specifies that a PPPoE profile will be used by PPPoE sessions on the interface.
<i>group-name</i>	(Optional) Name of the PPPoE profile to be used by PPPoE sessions on the interface.
aal5ciscoppp	AAL and encapsulation type for Cisco PPP over ATM. Supported on ATM PVCs only.
aal5mux	AAL and encapsulation type for multiplex (MUX)-type VCs. A protocol must be specified when using this encapsulation type.
<i>protocol</i>	Protocol type being used by the MUX-encapsulated VC. Possible values for the <i>protocol</i> argument are as follows: <ul style="list-style-type: none"> • appletalk—AppleTalk protocol. • decnet—DECnet protocol. • frame-relay—Frame Relay-ATM Network Interworking (FRF.5) on the Cisco MC3810. • fr-atm-srv—Frame Relay-ATM Service Interworking (FRF.8) on the Cisco MC3810. • ip—IP protocol. • ipx—IPX protocol. • ppp virtual-template <i>number</i>—Internet Engineering Task Force (IETF)-compliant PPP over ATM. Use the virtual-template <i>number</i> options to identify the virtual template. Supported on ATM PVCs only. • voice—Voice over ATM.

aal5nlpid	AAL and encapsulation type that allows ATM interfaces to interoperate with High-Speed Serial Interfaces (HSSIs) that are using an ATM data service unit (ADSU) and running ATM-Data Exchange Interface (DXI). Supported on ATM PVCs only.
aal5snap	AAL and encapsulation type that supports Inverse ARP. Logical Link Control/Subnetwork Access Protocol (LLC/SNAP) precedes the protocol datagram.

Defaults

The global default encapsulation option is **aal5snap**. See the “Usage Guidelines” section for other default characteristics.

Command Modes

ATM VC configuration (for an ATM PVC or SVC)
 VC-class configuration (for a VC class)
 Bundle configuration (for a VC bundle)
 PVC range configuration (for an ATM PVC range)
 PVC-in-range configuration (for an individual PVC within a PVC range)

Command History

Release	Modification
11.3 T	This command was introduced.
12.0(3)T	This command was enhanced to provide encapsulation configuration for ATM VC bundles. The aal5mux frame and aal5mux voice keywords were added for the Cisco MC3810 series router.
12.0(7)XK	Support for the aal5mux voice option was added to Cisco 3600 series routers.
12.0(7)T	The aal5mux fr-atm-srv option was added for the Cisco MC3810 router. The aal5mux frame option was changed to aal5mux frame-relay .
12.1(1)XA	Support for the aal2 option was added to the Cisco MC3810 router.
12.1(3)T	The aal5auto option was added to provide encapsulation configuration for PPP over ATM SVCs.
12.1(5)XM	Support for the aal2 option was added to the Cisco AS5300 access server and Cisco 3600 multiservice platforms.
12.1(5)T	The aal5ciscoPPP , aal5mux , and aal5snap options were made available in PVC range and PVC-in-range configuration modes.
12.2(2)T	This command was integrated into Cisco IOS Release 12.2(2)T.
12.1(1)DC1	The aal5autoppP option was introduced on the Cisco 6400 universal access concentrator.
12.2(4)T	The aal5autoppP option was implemented in Cisco IOS Release 12.2(4)T.
12.2(13)T	The apollo , vines , and xns values were removed as options for the <i>protocol</i> argument because Apollo Domain, Banyan VINES, and Xerox Network Systems are no longer supported in the Cisco IOS software.
12.2(15)T	The group option was added.

Usage Guidelines

**Note**

To configure Integrated Local Management Interface (ILMI), QSAAL, or Switched Multimegabit Data Service (SMDS) encapsulations for an ATM PVC, use the **pvc** command.

Use the **aal5mux** encapsulation option to dedicate the specified PVC to a single protocol; use the **aal5snap** encapsulation option to multiplex two or more protocols over the same PVC. Whether you select **aal5mux** or **aal5snap** encapsulation might depend on practical considerations, such as the type of network and the pricing offered by the network. If the pricing of the network depends on the number of PVCs set up, **aal5snap** might be the appropriate choice. If pricing depends on the number of bytes transmitted, **aal5mux** might be the appropriate choice because it has slightly less overhead.

Encapsulation for PPPoA

When configuring Cisco PPP over ATM, use the **aal5ciscopp** keyword and specify the virtual template number.

It is possible to implicitly create a virtual template when configuring Cisco PPP over ATM. In other words, if the parameters of the virtual template are not explicitly defined before you configure the ATM PVC, the PPP interface will be brought up using default values from the virtual template identified. However, some parameters (such as an IP address) take effect only if they are specified before the PPP interface comes up. Therefore, we recommend that you explicitly create and configure the virtual template before configuring the ATM PVC to ensure that such parameters take effect.

If you specify virtual template parameters after the ATM PVC is configured, you should enter a **shutdown** command followed by a **no shutdown** command on the ATM subinterface to restart the interface, causing the newly configured parameters (such as an IP address) to take effect.

Configuring PPPoA/PPPoE Autosense

Use the **encapsulation aal5autopp virtual-template *template-number*** command to configure PPPoA/PPPoE autosense. PPPoA/PPPoE autosense enables a router to distinguish between incoming PPPoA and PPPoE sessions and create virtual access for both PPP types based on demand.

If a PPPoE profile is not specified by using the **group *group-name*** option, PPPoE sessions will be established using parameters from the global PPPoE profile. PPPoE profiles must be configured using the **bba-group pppoe** command.

**Note**

Do not use this command on a router that initiates PPPoA sessions.

Entering the **no encapsulation aal5autopp virtual-template** command will terminate the PPPoA or PPPoE session and detach the virtual-access interface from the PVC.

Configuring Encapsulation for VC Bundles

Before using this command to configure a VC bundle, enter the **bundle** subinterface configuration command to create a new bundle or modify an existing one and to enter bundle configuration mode.

A VC bundle can have only one encapsulation configured for it: either **aal5snap** or **aal5mux**.

Encapsulation Rules of Precedence

If the **encapsulation** command is not explicitly configured on an ATM PVC, SVC, or VC bundle, the VC inherits the following default configuration (listed in order of precedence from lowest to highest):

- Configuration of the **encapsulation** command in a VC class assigned to the PVC, PVC bundle, or SVC itself.

- Configuration of the **encapsulation** command in a VC class assigned to the ATM subinterface of the PVC, SVC, or VC bundle.
- Configuration of the **encapsulation** command in a VC class assigned to the ATM main interface of the PVC, SVC, or VC bundle.
- Global encapsulation option default: **aal5snap**

**Note**

When a VC is a member of a VC bundle, configuration using the **encapsulation** command in VC-class mode no longer applies to the VC. Bundle configuration takes precedence.

Configuring Encapsulation for a PVC Range

When a PVC range or an individual PVC within a PVC range is being configured, the following options are available:

- **encapsulation aal5ciscoppp**
- **encapsulation aal5mux**
- **encapsulation aal5snap**

Examples**MUX-Type Encapsulation on a VC Example**

The following example configures an ATM PVC with VPI 0 and VCI 33 for a MUX-type encapsulation using IP:

```
interface atm 1/0
  pvc 0/33
    encapsulation aal5mux ip
```

SNAP Encapsulation Example

The following example configures a bundle called “chicago” for **aal5snap** encapsulation:

```
bundle chicago
  encapsulation aal5snap
```

PPP over ATM SVCs Example

The following example configures an ATM SVC called “chicago” with the encapsulation type **aal5auto**. Encapsulation type **aal5auto** enables the SVC to use PPP and either **aal5snap** or **aal5mux** encapsulation.

```
interface ATM 2/0/0
  svc chicago
  encapsulation aal5auto
```

PPPoA/PPPoE Autosense Example

The following example enables PPPoA/PPPoE autosense on PVC 30/33. PPPoA sessions will use virtual template 1, and PPPoE sessions will use the global PPPoE profile.

```
interface ATM 0/0/0.33 multipoint
  pvc 30/33
    encapsulation aal5autopp virtual-template 1
  !
  bba-group pppoe global
  virtual-template 1
  sessions max limit 8000
  sessions per-vc limit 8
  sessions per-mac limit 2
```

AAL2 Voice over ATM Example

The following example configures a PVC to support AAL2 encapsulation for Voice over ATM:

```
interface ATM0.2 point-to-point
  pvc 2/200
    vbr-rt 760 760 100
    encapsulation aal2
```

Related Commands

Command	Description
bba-group pppoe	Creates a PPPoE profile.
broadcast	Configures broadcast packet duplication and transmission for an ATM VC class, PVC, SVC, or VC bundle.
class-vc	Assigns a VC class to an ATM PVC, SVC, or VC bundle member.
debug pppoe	Displays debugging information for PPPoE sessions.
inarp	Configures the Inverse ARP time period for an ATM PVC, VC class, or VC bundle.
oam retry	Configures parameters related to OAM management for an ATM PVC, SVC, VC class, or VC bundle.
protocol (ATM)	Configures a static map for an ATM PVC, SVC, VC class, or VC bundle and enables Inverse ARP or Inverse ARP broadcasts on an ATM PVC.

encapsulation (Frame Relay VC-bundle)

To override the encapsulation for a point-to-point subinterface and configure Frame Relay encapsulation for an individual Frame Relay permanent virtual circuit (PVC) bundle, use the **encapsulation** command in Frame Relay VC-bundle configuration mode. To disable the encapsulation for the individual PVC bundle and revert to the encapsulation for the point-to-point subinterface, use the **no** form of this command.

encapsulation [**cisco** | **ietf**]

no encapsulation [**cisco** | **ietf**]

Syntax Description	Parameter	Description
	cisco	(Optional) Uses Cisco proprietary encapsulation, which is a four-byte header, with two bytes to identify the data-link connection identifier (DLCI) and two bytes to identify the packet type
	ietf	(Optional) Sets the encapsulation method to comply with the Internet Engineering Task Force (IETF) standard (RFC 1490 and RFC 2427). Use this keyword when connecting to another vendor's equipment across a Frame Relay network on point-to-point interfaces.

Defaults Encapsulation type that is configured on the main interface

Command Modes Frame Relay VC-bundle configuration

Command History	Release	Modification
	12.2(13)T	This command was introduced.

Usage Guidelines Use this command to override the encapsulation at a point-to-point subinterface for an individual Frame Relay PVC bundle. This command is available for point-to-point subinterfaces only; it cannot be used on multipoint interfaces.

Examples The following example configures RFC 1490 encapsulation for the Frame Relay PVC bundle named "P2P-5":

```
interface serial 1/4.2 point-to-point
 ip address 10.1.1.1 255.0.0.0
 frame-relay vc-bundle P2P-5
 encapsulation ietf
```

Related Commands	Command	Description
	encapsulation frame-relay	Enables Frame Relay encapsulation on an interface.

encapsulation (L2TP)

To specify the Layer 2 data encapsulation method to be used for tunneling IP traffic over a pseudowire, use the **encapsulation** (L2TP) command in pseudowire class configuration mode. To remove the specified Layer 2 encapsulation method, use the **no** form of this command.

encapsulation {**l2tpv2** | **l2tpv3** [**manual**] | **mpls**}

no encapsulation {**l2tpv2** | **l2tpv3** [**manual**] | **mpls**}

Syntax Description

l2tpv2	Uses Layer 2 Tunneling Protocol (L2TP) as the tunneling method to encapsulate data in the pseudowire.
l2tpv3	Uses Layer 2 Tunneling Protocol Version 3 (L2TPv3) as the tunneling method to encapsulate data in the pseudowire.
manual	(Optional) No signaling is to be used in the L2TPv3 control channel.
mpls	Uses Multiprotocol Label Switching (MPLS) as the tunneling method to encapsulate data in the pseudowire.

Defaults

No encapsulation method is specified.

Command Modes

Pseudowire class configuration

Command History

Release	Modification
12.0(23)S	This command was introduced.
12.3(2)T	The l2tpv2 keyword was added and this command was integrated into Cisco IOS Release 12.3(2)T.

Usage Guidelines

This command must be configured if the pseudowire class will be referenced from an xconnect or pseudowire configured to forward Layer 2 traffic.

Examples

The following example shows how to configure L2TPv3 as the data encapsulation method for the pseudowire class named "ether-pw":

```
Router(config)# pseudowire-class ether-pw
Router(config-pw)# encapsulation l2tpv3
```

Related Commands

Command	Description
pseudowire-class	Specifies the name of an L2TP pseudowire class and enters pseudowire class configuration mode.

encapsulation atm-dxi

To enable ATM-Data Exchange Interface (DXI) encapsulation, use the **encapsulation atm-dxi** command in interface configuration mode. To disable ATM-DXI, use the **no** form of this command.

encapsulation atm-dxi

no encapsulation atm-dxi

Syntax Description This command has no arguments or keywords.

Defaults When ATM-DXI encapsulation is not configured, HDLC is the default encapsulation.

Command Modes Interface configuration

Command History	Release	Modification
	10.0	This command was introduced.

Examples The following example configures ATM-DXI encapsulation on serial interface 1:

```
interface serial 1
 encapsulation atm-dxi
```

Related Commands	Command	Description
	class-int	Maps a protocol address to a given VPI and VCI.

encapsulation frame-relay

To enable Frame Relay encapsulation, use the **encapsulation frame-relay** command in interface configuration mode. To disable Frame Relay encapsulation, use the **no** form of this command.

encapsulation frame-relay [**cisco** | **ietf**]

no encapsulation frame-relay [**ietf**]

Syntax Description	Parameter	Description
	cisco	(Optional) Uses Cisco's own encapsulation, which is a 4-byte header, with 2 bytes to identify the data-link connection identifier (DLCI) and 2 bytes to identify the packet type.
	ietf	(Optional) Sets the encapsulation method to comply with the Internet Engineering Task Force (IETF) standard (RFC 1490). Use this keyword when connecting to another vendor's equipment across a Frame Relay network.

Defaults The default is **cisco** encapsulation.

Command Modes Interface configuration

Command History	Release	Modification
	10.0	This command was introduced.

Usage Guidelines Use this command with no keywords to restore the default Cisco encapsulation, which is a 4-byte header with 2 bytes for the DLCI and 2 bytes to identify the packet type.

You should shut down the interface prior to changing encapsulation types. Although this is not required, shutting down the interface ensures that the interface is reset for the new encapsulation.

Examples The following example configures Cisco Frame Relay encapsulation on interface serial 1:

```
interface serial 1
 encapsulation frame-relay
```

Use the **ietf** keyword if your router or access server is connected to another vendor's equipment across a Frame Relay network to conform with RFC 1490:

```
interface serial 1
 encapsulation frame-relay ietf
```

encapsulation frame-relay mfr

To create a multilink Frame Relay bundle link and associate the link with a bundle, use the **encapsulation frame-relay mfr** command in interface configuration mode. To remove the bundle link from the bundle, use the **no** form of this command.

encapsulation frame-relay mfr *number* [*name*]

Syntax Description

<i>number</i>	Interface number of the multilink Frame Relay bundle with which this bundle link will be associated.
<i>name</i>	(Optional) Bundle link identification (LID) name. The name can be up to 49 characters long.

Defaults

The default LID is the name of the physical interface.

Command Modes

Interface configuration

Command History

Release	Modification
12.0(17)S	This command was introduced on the Cisco 12000 series routers.
12.2(8)T	This command was integrated into Cisco IOS Release 12.2(8)T.
12.0(24)S	This command was implemented on VIP-enabled Cisco 7500 series routers.
12.3(4)T	Support for this command on VIP-enabled Cisco 7500 series routers was integrated into Cisco IOS Release 12.3(4)T.

Usage Guidelines

Use the *name* argument to assign a LID name to a bundle link. This name will be used to identify the bundle link to peer devices and to enable the devices to determine which bundle links are associated with which bundles. The LID name can also be assigned or changed by using the **frame-relay multilink lid** command on the bundle link interface. If the LID name is not assigned, the default name is the name of the physical interface.



Tip

To minimize latency that results from the arrival order of packets, we recommend bundling physical links of the same line speed in one bundle.

To remove a bundle link from a bundle, use the **no encapsulation frame-relay mfr** command or configure a new type of encapsulation on the interface by using the **encapsulation** command.

Examples

The following example shows serial interface 0 being associated as a bundle link with bundle interface “mfr0”. The bundle link identification name is “BL1”.

```
interface mfr0
```

```
!  
interface serial 0  
  encapsulation frame-relay mfr0 BL1
```

Related Commands

Command	Description
debug frame-relay multilink	Displays debug messages for multilink Frame Relay bundles and bundle links.
frame-relay multilink lid	Assigns a LID name to a multilink Frame Relay bundle link.
show frame-relay multilink	Displays configuration information and statistics about multilink Frame Relay bundles and bundle links.

encapsulation lapb

To exchange datagrams over a serial interface using Link Access Procedure, Balanced (LAPB) encapsulation, use the **encapsulation lapb** command in interface configuration mode.

encapsulation lapb [**dte** | **dce**] [**multi** | *protocol*]

Syntax Description	
dte	(Optional) Specifies operation as a data terminal equipment (DTE) device. This is the default LAPB mode.
dce	(Optional) Specifies operation as a data communications equipment (DCE) device.
multi	(Optional) Specifies use of multiple LAN protocols to be carried on the LAPB line.
<i>protocol</i>	(Optional) A single protocol to be carried on the LAPB line. A single protocol can be one of the following: appletalk , clns (ISO CLNS), decnet , ip , and ipx (Novell IPX). IP is the default protocol.

Defaults The default serial encapsulation is High-Level Data Link Control (HDLC). You must explicitly configure a LAPB encapsulation method.

DTE operation is the default LAPB mode. IP is the default protocol.

Command Modes Interface configuration

Command History	Release	Modification
	10.0	This command was introduced.
	10.3	The following keywords and argument were introduced: dte , dce , multi , <i>protocol</i> .
	12.2(13)T	The apollo , vines , and xns arguments were removed because support for Apollo Domain, Banyan VINES, and Xerox Network Systems is no longer available in the Cisco IOS software.

Usage Guidelines LAPB encapsulations are appropriate only for private connections, where you have complete control over both ends of the link. Connections to X.25 networks should use an X.25 encapsulation configuration, which operates the X.25 Layer 3 protocol above a LAPB Layer 2.

One end of the link must be a logical DCE device, and the other end a logical DTE device. (This assignment is independent of the interface's hardware DTE or DCE identity.)

Both ends of the LAPB link must specify the same protocol encapsulation.

LAPB encapsulation is supported on serial lines configured for dial-on-demand routing (DDR). It can be configured on DDR synchronous serial and ISDN interfaces and on DDR dialer rotary groups. It is not supported on asynchronous dialer interfaces.

A single-protocol LAPB encapsulation exchanges datagrams of the given protocol, each in a separate LAPB information frame. You must configure the interface with the protocol-specific parameters needed—for example, a link that carries IP traffic will have an IP address defined for the interface.

A multiprotocol LAPB encapsulation can exchange any or all of the protocols allowed for a LAPB interface. It exchanges datagrams, each in a separate LAPB information frame. Two bytes of protocol identification data precede the protocol data. You need to configure the interface with all the protocol-specific parameters needed for each protocol carried.

Multiprotocol LAPB encapsulation supports transparent bridging. This feature requires use of the **encapsulation lapb multi** command followed by the **bridge-group** command, which identifies the bridge group associated with multiprotocol LAPB encapsulation. This feature does *not* support use of the **encapsulation lapb protocol** command with a **bridge** keyword.

LAPB encapsulation supports the priority and custom queueing features.

Examples

The following example sets the operating mode as DTE and specifies that AppleTalk protocol traffic will be carried on the LAPB line:

```
interface serial 1
 encapsulation lapb dte appletalk
```

Related Commands

Command	Description
bridge-group	Assigns each network interface to a bridge group.

encapsulation smds

To enable Switched Multimegabit Data Service (SMDS) on the desired interface, use the **encapsulation smds** interface configuration command.

encapsulation smds

Syntax Description This command has no arguments or keywords.

Defaults Disabled

Command Modes Interface configuration

Command History	Release	Modification
	10.0	This command was introduced.

Usage Guidelines The interface to which this command applies must be a serial interface. All subsequent SMDS configuration commands apply only to an interface with encapsulation SMDS.



Note

The maximum packet size allowed in the SMDS specifications (TA-772) is 9188. This is larger than the packet size used by servers with most media. The Cisco default maximum transmission unit (MTU) size is 1500 bytes to be consistent with Ethernet. However, on the High Speed Serial Interface (HSSI), the default MTU size is 4470 bytes. If a larger MTU is used, the **mtu** command must be entered before the **encapsulation smds** command.



Caution

The Cisco MCI card has buffer limitations that prevent setting the MTU size higher than 2048, and the HSSI card has buffer limitations that prevent setting the MTU size higher than 4500. Configuring higher settings can cause inconsistencies and performance problems.

Examples The following example shows how to configure the SMDS service on serial interface 0:

```
interface serial 0
 encapsulation smds
```

Related Commands	Command	Description
	mtu	Adjusts the maximum packet size or MTU size.

encapsulation x25

To specify a serial interface's operation as an X.25 device, use the **encapsulation x25** command in interface configuration mode. To remove the specification, use the **no** form of this command.

encapsulation x25 [dte | dce] [ddn | bfe | ietf]

no encapsulation x25 [dte | dce] [ddn | bfe | ietf]

Syntax Description	
dte	(Optional) Specifies operation as a data terminal equipment (DTE). This is the default X.25 mode.
dce	(Optional) Specifies operation as a data communications equipment (DCE).
ddn	(Optional) Specifies Defense Data Network (DDN) encapsulation on an interface using DDN X.25 Standard Service.
bfe	(Optional) Specifies Blacker Front End (BFE) encapsulation on an interface attached to a BFE device.
ietf	(Optional) Specifies that the interface's datagram encapsulation defaults to use of the Internet Engineering Task Force (IETF) standard method, as defined by RFC 1356.

Defaults

The default serial encapsulation is High-Level Data Link Control (HDLC). You must explicitly configure an X.25 encapsulation method.

DTE operation is the default X.25 mode. Cisco's traditional X.25 encapsulation method is the default.

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.
10.3	The following keywords were added: <ul style="list-style-type: none"> • dte • dce • ddn • bfe • ietf

Usage Guidelines

One end of an X.25 link must be a logical DCE device and the other end a logical DTE device. (This assignment is independent of the interface's hardware DTE or DCE identity.) Typically, when connecting to a public data network (PDN), the customer equipment acts as the DTE device and the PDN attachment acts as the DCE.

Cisco has long supported the encapsulation of a number of datagram protocols, using a standard means when available and a proprietary means when necessary. The IETF adopted a standard, RFC 1356, for encapsulating most types of datagram traffic over X.25. X.25 interfaces use Cisco's traditional method unless explicitly configured for IETF operation; if the **ietf** keyword is specified, that standard is used unless Cisco's traditional method is explicitly configured. For details see the **x25 map** command.

You can configure a router attaching to the DDN or to a BFE device to use their respective algorithms to convert between IP and X.121 addresses by using the **ddn** or **bfe** option, respectively. An IP address must be assigned to the interface, from which the algorithm will generate the interface's X.121 address. For proper operation, this X.121 address must not be modified.

A router DDN attachment can operate as either a DTE or a DCE device. A BFE attachment can operate only as a DTE device. The **ietf** option is not available if either the **ddn** or **bfe** option is selected.

Examples

The following example configures the interface for connection to a BFE device:

```
interface serial 0
 encapsulation x25 bfe
```

Related Commands

Command	Description
x25 map	Sets up the LAN protocols-to-remote host mapping.

exp

To configure Multiprotocol Label Switching (MPLS) experimental (EXP) levels for a Frame Relay permanent virtual circuit (PVC) bundle member, use the **exp** command in Frame Relay VC-bundle-member configuration mode. To remove the EXP level configuration from the PVC, use the **no** form of this command.

```
exp { level | other }
```

```
no exp
```

Syntax Description	<i>level</i>	
		Specifies the MPLS EXP level or levels for this Frame Relay PVC bundle member. The range is from 0 to 7. A PVC bundle member can be configured with a single MPLS EXP level, multiple individual MPLS EXP levels, a range of MPLS EXP levels, multiple ranges of MPLS EXP levels, or a combination of individual levels and level ranges. Examples are as follows: <ul style="list-style-type: none"> • 0 • 0,2,3 • 0-2,4-5 • 0,1,2-4,7
	other	Specifies that this Frame Relay PVC bundle member will handle all of the remaining MPLS EXP levels that are not explicitly configured on any other bundle member PVCs.

Defaults EXP levels are not configured.

Command Modes Frame Relay VC-bundle-member configuration

Command History	Release	Modification
	12.2(13)T	This command was introduced.

Usage Guidelines Assignment of MPLS EXP levels to Frame Relay PVC bundle members allows you to create differentiated service because you can distribute the levels over the various PVC bundle members. You can map a single level or a range of levels to each discrete PVC in the bundle, thereby enabling PVCs in the bundle to carry packets marked with different levels. Use the **exp other** command to indicate that a PVC can carry traffic marked with EXP levels not specifically configured for other PVCs. Only one PVC in the bundle can be configured using the **exp other** command.

All EXP levels must be accounted for in the PVC bundle configuration, or the bundle will not come up. Note, however, that a PVC may be a bundle member but have no EXP level associated with it. As long as all valid EXP levels are handled by other PVCs in the bundle, the bundle can come up, but the PVC that has no EXP level configured will not participate in it.

The **exp** command is available only when tag-switching is configured on the interface with the **tag-switching ip** command.

You can overwrite the EXP level configuration on a PVC by reentering the **exp** command with a new value.

The MPLS experimental bits are a bit-by-bit copy of the IP precedence bits. When Frame Relay PVC bundles are configured for IP precedence and tag-switching is enabled, the **precedence** command is replaced by the **exp** command. When tag-switching is disabled, the **exp** command is replaced by the **precedence** command.

Examples

The following example shows the configuration of four Frame Relay PVC bundle members in PVC bundle “bundle1” configured with MPLS EXP level support:

```
interface serial 0.1 point-to-point
 encapsulation frame-relay
 ip address 10.1.1.1
 tag-switching ip
 frame-relay vc-bundle bundle1
  pvc 100 ny-control
   class control
   exp 7
   protect vc
  pvc 101 ny-premium
   class premium
   exp 6-5
   protect group
   no bump traffic
   bump explicit 7
  pvc 102 my-priority
   class priority
   exp 4-2
   protect group
  pvc 103 ny-basic
   class basic
   exp other
   protect group
```

Related Commands

Command	Description
bump	Configures the bumping rules for a specific PVC member of a bundle.
class	Associates a map class with a specified DLCI.
dscp (Frame Relay VC-bundle-member)	Configures the DSCP value or values for a Frame Relay PVC bundle member.
match	Specifies which bits of the IP header to use for mapping packet service levels to Frame Relay PVC bundle members.
precedence (Frame Relay VC-bundle-member)	Configures the precedence levels for a Frame Relay PVC bundle member.
protect	Configures a Frame Relay PVC bundle member with protected group or protected PVC status.
tag-switching ip	Enables label switching of IPv4 packets on an interface.

