H3C MSR Router Series

Comware 5 Interface Configuration Guide

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Preface

This configuration guide describes configuration of various interfaces supported by the H3C MSR router series , including Ethernet, ATM, POS, Serial, CE1/CT1 interfaces, and so on.

This preface includes the following topics about the documentation:

- Audience.
- Conventions.
- Documentation feedback.

Audience

This documentation is intended for:

- Network planners.
- Field technical support and servicing engineers.
- Network administrators working with the routers.

Conventions

The following information describes the conventions used in the documentation.

Command conventions

<table>
<tr><th>Convention</th><th>Description</th></tr>
<tr><td>Boldface</td><td>Bold text represents commands and keywords that you enter literally as shown.</td></tr>
<tr><td>Italic</td><td>Italic text represents arguments that you replace with actual values.</td></tr>
<tr><td>[ ]</td><td>Square brackets enclose syntax choices (keywords or arguments) that are optional.</td></tr>
<tr><td>{ x | y | ... }</td><td>Braces enclose a set of required syntax choices separated by vertical bars, from which you select one.</td></tr>
<tr><td>[x | y | ...]</td><td>Square brackets enclose a set of optional syntax choices separated by vertical bars, from which you select one or none.</td></tr>
<tr><td>{ x | y | ... } *</td><td>Asterisk marked braces enclose a set of required syntax choices separated by vertical bars, from which you select a minimum of one.</td></tr>
<tr><td>[x | y | ...] *</td><td>Asterisk marked square brackets enclose optional syntax choices separated by vertical bars, from which you select one choice, multiple choices, or none.</td></tr>
<tr><td>&<1-n></td><td>The argument or keyword and argument combination before the ampersand (&) sign can be entered 1 to n times.</td></tr>
<tr><td>#</td><td>A line that starts with a pound (#) sign is comments.</td></tr>
</table>

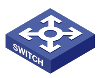
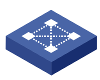
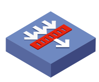
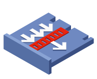
GUI conventions

Convention	Description
Boldface	Window names, button names, field names, and menu items are in Boldface. For example, the **New User** window opens; click **OK**.
>	Multi-level menus are separated by angle brackets. For example, **File** > **Create** > **Folder**.

Symbols

Convention	Description
⚠ WARNING!	An alert that calls attention to important information that if not understood or followed can result in personal injury.
△ CAUTION:	An alert that calls attention to important information that if not understood or followed can result in data loss, data corruption, or damage to hardware or software.
ⓘ IMPORTANT:	An alert that calls attention to essential information.
NOTE:	An alert that contains additional or supplementary information.
TIP:	An alert that provides helpful information.

Network topology icons

Convention	Description
	Represents a generic network device, such as a router, switch, or firewall.
	Represents a routing-capable device, such as a router or Layer 3 switch.
	Represents a generic switch, such as a Layer 2 or Layer 3 switch, or a router that supports Layer 2 forwarding and other Layer 2 features.
	Represents an access controller, a unified wired-WLAN module, or the access controller engine on a unified wired-WLAN switch.
	Represents an access point.
	Represents a wireless terminator unit.
	Represents a wireless terminator.
	Represents a mesh access point.
	Represents omnidirectional signals.
	Represents directional signals.
	Represents a security product, such as a firewall, UTM, multiservice security gateway, or load balancing device.
	Represents a security module, such as a firewall, load balancing, NetStream, SSL VPN, IPS, or ACG module.

Examples provided in this document

Examples in this document might use devices that differ from your device in hardware model, configuration, or software version. It is normal that the port numbers, sample output, screenshots, and other information in the examples differ from what you have on your device.

Documentation feedback

You can e-mail your comments about product documentation to info@h3c.com.

We appreciate your comments.

Contents

Configuring Ethernet interfaces

All configuration tasks in this chapter are independent and optional. You can perform these configuration tasks in any order.

Overview

Ethernet is the most widespread wired LAN technology due to its flexibility, simplicity, and easy implementation. Your device supports the following types of Ethernet interfaces:

- **Layer 2 Ethernet interfaces**—Physical Ethernet interfaces operating at the data link layer (Layer 2) to forward traffic within a subnet between hosts.
- **Layer 3 Ethernet interfaces**—Physical Ethernet interfaces operating at the network layer (Layer 3) to forward traffic between different subnets. You can assign an IP address to a Layer 3 Ethernet interface.
- **Layer-configurable Ethernet interfaces**—Physical Ethernet interfaces that can be configured to operate in bridge mode as Layer 2 Ethernet interfaces or in route-mode as Layer 3 Ethernet interfaces.
- **Layer 3 Ethernet subinterfaces**—Logical interfaces operating at the network layer. You can assign an IP address to a Layer 3 Ethernet subinterface. By creating subinterfaces on a Layer 3 Ethernet interface, you enable the interface to carry packets for multiple VLANs. For how a Layer 3 Ethernet subinterface sends and receives VLAN-tagged packets, see *Layer 2—LAN Switching Configuration Guide*.

Performing general configurations

This section describes the settings common to Layer 2 and Layer 3 Ethernet interfaces, and Layer 3 Ethernet subinterfaces. For more information about the settings specific to a type of Ethernet interfaces, see "Configuring a Layer 2 Ethernet interface" and "Configuring a Layer 3 Ethernet interface or subinterface."

Configuring a combo interface

The following matrix shows the feature and hardware compatibility:

Hardware	Feature compatibility
MSR800	Yes
MSR 900	No
MSR900-E	No
MSR 930	No
MSR 20-1X	No
MSR 20	No
MSR 30	Supported only on MSR 30-40 and MSR 30-60
MSR 50	Yes
MSR 2600	Yes
MSR3600-51F	No

A combo interface is a logical interface that comprises one fiber port and one copper port. The two ports share one forwarding channel and one interface view, so they cannot work simultaneously. When you enable one port, the other port is automatically disabled.

The LINK LED of a GE combo interface might be on when you insert or remove a transceiver module into or from the combo interface whose fiber combo port is active on an MSR 50 router, SIC-1GEC module, XMIM-16FSW module, or XMIM-24FSW module. To solve the problem, shut down the combo interface with the **shutdown** command and then bring it up with the **undo shutdown** command.

The fiber combo port and the copper combo port share one interface view, in which you can activate the fiber or copper combo port, and configure other port attributes such as the interface rate and duplex mode.

Configuration prerequisites

Before you configure combo interfaces, complete the following tasks:

- Determine the combo interfaces on your device by checking the product specifications and identify the two physical interfaces that compose each combo interface.
- Use the **display interface** command to determine whether the fiber port or copper port of the combo interface is active. If the current port is the copper port, the output includes "Media type is twisted pair, Port hardware type is 1000_BASE_T." If the current port is the fiber port, the output does not contain the information mentioned above. You can use the **display this** command in combo interface view to determine whether the fiber port or copper port of the combo interface is active. If the **combo enable fiber** command exists in the output, the fiber port is active. Otherwise, the copper port is active.

Changing the active port of a combo interface

Step	Command	Remarks
1. Enter system view.	**system-view**	N/A
2. Enter Ethernet interface view.	**interface** *interface-type interface-number*	N/A
3. Activate the copper combo port or fiber combo port.	**combo enable** { **copper** | **fiber** }	By default, the copper combo port is active.

Configuring basic settings of an Ethernet interface or subinterface

Configuring an Ethernet interface

You can set an Ethernet interface to operate in one of these duplex modes:

- **Full-duplex mode (full)**—Interfaces that operate in this mode can send and receive packets simultaneously.
- **Half-duplex mode (half)**—Interfaces that operate in this mode cannot send and receive packets simultaneously.
- **Auto-negotiation mode (auto)**—Interfaces that operate in this mode negotiate a duplex mode with their peers.

You can set the speed of an Ethernet interface or enable it to automatically negotiate a speed with its peer.

To configure an Ethernet interface:

Step		Command	Remarks
1.	Enter system view.	**system-view**	N/A
2.	Enter Ethernet interface view.	**interface** *interface-type interface-number*	N/A
3.	Set the interface description.	**description** *text*	Optional. By default, the description of an interface is in the format of *interface-name* **Interface**. For example, **Ethernet1/1 Interface**.
4.	Set the duplex mode of the interface.	**duplex** { **auto** | **full** | **half** }	Optional. By default, the duplex mode is **auto** for an Ethernet interface. Fiber ports do not support the **half** keyword.
5.	Set the port speed.	**speed** { **10** | **100** | **1000** | **auto** }	Optional.
6.	Set the intended bandwidth for the interface.	**bandwidth** *bandwidth-value*	Optional.
7.	Restore the default settings for the interface.	**default**	Optional.

Configuring an Ethernet subinterface

Step		Command	Remarks
1.	Enter system view.	**system-view**	N/A
2.	Create an Ethernet subinterface.	**interface** *interface-type interface-number.subnumber*	This command also leads you to Ethernet subinterface view.
3.	Set the interface description.	**description** *text*	Optional. By default, the description of an Ethernet subinterface is in the format of *interface-name* **Interface**. For example, **Ethernet1/1.1 Interface**.
4.	Set the intended bandwidth for the interface.	**bandwidth** *bandwidth-value*	Optional.
5.	Restore the default settings for the subinterface.	**default**	Optional.

You can configure IP-related settings on an Ethernet subinterface. For more information, see *Layer 3—IP Services Configuration Guide*.

Shutting down an Ethernet interface or subinterface

CAUTION:

Use this command with caution. After you manually shut down an Ethernet interface, the Ethernet interface cannot forward packets even if it is physically connected.

You might need to shut down and then bring up an Ethernet interface or subinterface to activate some configuration changes, for example, the speed or duplex mode changes.

To shut down an Ethernet interface or subinterface:

Step	Command	Remarks
1. Enter system view.	**system-view**	N/A
2. Enter Ethernet interface or subinterface view, or port group view.	• Enter Ethernet interface view: **interface** *interface-type interface-number* • Enter port group view: **port-group manual** *port-group-name* • Enter Ethernet subinterface view: **interface** *interface-type interface-number.subnumber*	Use one of the commands. To shut down an Ethernet interface or subinterface, enter Ethernet interface or subinterface view. To shut down all Ethernet interfaces in a port group, enter port group view.
3. Shut down the Ethernet interface or subinterface.	**shutdown**	By default, Ethernet interfaces and subinterfaces are up.

Configuring flow control on an Ethernet interface

To avoid packet drops on a link, you can enable flow control at both ends of the link. When traffic congestion occurs at the receiving end, the receiving end sends a flow control (Pause) frame to ask the sending end to suspend sending packets

With the **flow-control** command configured, an interface can both send and receive flow control frames: When congested, the interface sends a flow control frame to its peer. Upon receiving a flow control frame from the peer, the interface suspends sending packets.

To implement flow control on an Ethernet interface, the peer router must be able to process pause frames.

To enable flow control on an Ethernet interface:

Step	Command
1. Enter system view.	**system-view**
2. Enter Ethernet interface view.	**interface** *interface-type interface-number*
3. Enable flow control.	**flow-control**

Configuring physical state change suppression on an Ethernet interface

The following matrix shows the feature and hardware compatibility:

Hardware	Feature compatibility
MSR800	Supported only on Layer 3 GE interfaces
MSR 900	No
MSR900-E	Supported only on Layer 3 GE interfaces
MSR 930	Supported only on Layer 3 GE interfaces
MSR 20-1X	No
MSR 20	No

Hardware	Feature compatibility
MSR 30	Supported only on Layer 3 GE interfaces
MSR 50	Supported only on Layer 3 GE interfaces
MSR 2600	No
MSR3600-51F	Supported only on Layer 3 GE interfaces

The physical link state of an Ethernet interface is either up or down. Each time the physical link of a port goes up or comes down, the system immediately reports the change to the upper-layer protocol modules (such as routing and forwarding modules) for packet transmission, and automatically generates traps and logs, informing the user to take corresponding actions.

By default, an Ethernet interface detects the physical state change every 5 seconds. When a physical state change occurs, the Ethernet interface can detect the change within 0 to 5 seconds. To enable the system to report the physical state change as soon as the change occurs, you can set the suppression interval to 0 seconds (disable physical state change suppression).

To configure physical state change suppression on an Ethernet interface:

Step	Command	Remarks
1. Enter system view.	**system-view**	N/A
2. Enter Ethernet interface view.	**interface** *interface-type interface-number*	N/A
3. Set a physical state change suppression interval.	**link-delay** *delay-time*	Optional. By default, an Ethernet interface detects the physical state change every 5 seconds.

Configuring loopback testing on an Ethernet interface

If an Ethernet interface does not work correctly, you can enable loopback testing on it to identify the problem. An Ethernet interface in a loopback test does not forward data traffic.

Loopback testing has the following types:

- **Internal loopback testing**—Tests all on-chip functions related to Ethernet interfaces.
- **External loopback testing**—Tests hardware of Ethernet interfaces. To perform external loopback testing on an Ethernet interface, connect a loopback plug to the Ethernet interface. The device sends test packets out of the interface, which are expected to loop over the plug and back to the interface. If the interface fails to receive any test packets, the hardware of the interface is faulty.

Configuration restrictions and guidelines

- On an interface that is physically down, you can only perform internal loopback testing. On an interface administratively shut down, you cannot perform internal or external loopback testing.
- The **speed**, **duplex**, **mdi**, and **shutdown** commands are not available during loopback testing.
- During loopback testing, the Ethernet interface operates in full duplex mode. When you disable loopback testing, the port returns to its duplex setting.

Configuration procedure

To enable loopback testing on an Ethernet interface:

Step	Command	Remarks
1. Enter system view.	**system-view**	N/A
2. Enter Ethernet interface view.	**interface** *interface-type interface-number*	N/A
3. Enable loopback testing.	**loopback** { **external** | **internal** }	By default, loopback testing is disabled.

Configuring the link mode of an Ethernet interface

Depending on the hardware structure of interface cards, for a device, some interfaces can operate only as Layer 2 Ethernet interfaces (in bridge mode), some can operate only as Layer 3 Ethernet interfaces (in route mode), but others can operate either as Layer 2 or Layer 3 Ethernet interfaces (you can set the link mode to bridge or route).

You can configure the link mode in system view or in Ethernet interface view, which produces the same result. The link mode configuration in system view applies to multiple interfaces, and the link mode configuration in interface view applies only to the current interface.

Configuration restrictions and guidelines

- After you change the link mode of an Ethernet interface, all settings of the Ethernet interface are restored to their defaults under the new link mode.
- The link mode configuration for an Ethernet interface in system view and in interface view supersedes each other.

Configuration procedure

To change the link mode of the specified Ethernet interfaces in system view:

Step	Command
1. Enter system view.	**system-view**
2. Change the link mode of the specified Ethernet interfaces.	**port link-mode** { **bridge** | **route** } *interface-list*

To change the link mode of an Ethernet interface:

Step	Command
1. Enter system view.	**system-view**
2. Enter Ethernet interface view.	**interface** *interface-type interface-number*
3. Change the link mode of the Ethernet interface.	**port link-mode** { **bridge** | **route** }

Setting a statistics polling interval

You can configure an interface statistics polling interval. To display the interface statistics collected in the last polling interval, use the **display interface** or **display counters rate** command.

In global configuration mode (system view), you can configure an interface statistics polling interval for all Ethernet interfaces.

To set the statistics polling interval globally:

Step		Command	Remarks
1.	Enter system view.	**system-view**	N/A
2.	Set the statistics polling interval globally.	**flow-interval** *interval*	Optional.

Configuring a Layer 2 Ethernet interface

Configuring a port group

Some interfaces on your device might use the same set of settings. To configure these interfaces in bulk rather than one by one, you can assign them to a port group.

You create port groups manually. All settings made for a port group apply to all the member ports of the group. For example, you can configure a traffic suppression threshold (see "Configuring storm suppression for Ethernet interfaces") for multiple interfaces in bulk by assigning these interfaces to a port group.

Even though the settings are made on the port group, they are saved on each interface basis rather than on a port group basis. You can only view the settings in the view of each interface by using the **display current-configuration** or **display this** command.

To configure a manual port group:

Step		Command	Remarks
1.	Enter system view.	**system-view**	N/A
2.	Create a manual port group and enter manual port group view.	**port-group manual** *port-group-name*	N/A
3.	Assign Ethernet interfaces to the manual port group.	**group-member** *interface-list*	If you use the **group-member** *interface-type interface-start-number* **to** *interface-type interface-end-number* command to add multiple ports in batch to the specified port group, make sure that all these ports are of the same type and on the same interface card, and the *interface-end-number* argument must be greater than the *interface-start-number* argument.

Configuring storm suppression for Ethernet interfaces

You can use the storm suppression function to limit the size of a particular type of traffic (broadcast, multicast, or unknown unicast traffic) that can be received on a per-interface basis in Ethernet interface view or port group view. In interface or port group view, you set the maximum size of broadcast, multicast or unknown unicast traffic allowed to be received on an interface or each interface in a port group. When the broadcast, multicast, or unknown unicast traffic received on the interface exceeds this threshold, the system discards packets until the traffic drops below this threshold.

If you set a traffic suppression threshold for an Ethernet interface that belongs to a port group in both Ethernet interface view and port group view, the threshold configured last takes effect.

MSR800, MSR900-E, and MSR 930 routers do not support multicast storm suppression.

To set storm suppression thresholds on one or multiple Ethernet interfaces:

Step	Command	Remarks
1. Enter system view.	**system-view**	N/A
2. Enter Ethernet interface view or port group view.	• Enter Ethernet interface view: **interface** *interface-type interface-number* • Enter port group view: **port-group manual** *port-group-name*	Use one of the commands. To configure storm suppression on an Ethernet interface, enter Ethernet interface view. To configure storm suppression on a group of Ethernet interfaces, enter port group view.
3. Set the broadcast suppression threshold ratio.	**broadcast-suppression** { *ratio* | **pps** *max-pps* }	Optional. By default, broadcast traffic is allowed to pass through an interface.
4. Set the multicast suppression threshold ratio.	**multicast-suppression** { *ratio* | **pps** *max-pps* }	Optional. By default, multicast traffic is allowed to pass through an interface.
5. Set the unknown unicast suppression threshold ratio.	**unicast-suppression** { *ratio* | **pps** *max-pps* }	Optional. By default, unknown unicast traffic is allowed to pass through an interface.

Configuring jumbo frame support

An Ethernet interface might receive some frames larger than the standard Ethernet frame size (called "jumbo frames") during high-throughput data exchanges such as file transfers. Usually, an Ethernet interface discards jumbo frames. With jumbo frame support enabled, the interface can process frames larger than the standard Ethernet frame size yet within the specified range.

In global configuration mode (system view) or interface configuration mode (Ethernet interface view or port group view), you can set the length of jumbo frames that are allowed to pass through Ethernet interfaces, as follows:

- If you execute the command in system view, the configuration takes effect on all Layer 2 Ethernet interfaces.
- If you execute the command in Ethernet interface view, the configuration takes effect only on the interface.
- If you execute the command in port group view, the configuration takes effect on all ports in the port group.

A device supports either the global configuration mode or interface configuration mode, not both, depending on the device model.

To configure jumbo frame support in system view:

Step	Command	Remarks
1. Enter system view.	**system-view**	N/A
2. Configure jumbo frame support.	**jumboframe enable** [*value*]	By default, the device allows jumbo frames within the specified length to pass through all Layer 2 Ethernet interfaces. The maximum length of jumbo frames allowed to pass through depends on your device model. Support for the *value* argument depends

Step	Command	Remarks
		on your device model. If you set the *value* argument multiple times, the latest configuration takes effect.

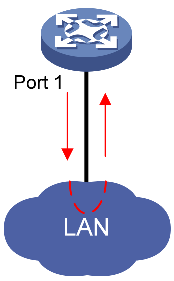
To configure jumbo frame support in interface view or port group view:

Step	Command	Remarks
1. Enter system view.	**system-view**	N/A
2. Configure jumbo frame support.	• (Method 1) In port group view: **a. port-group manual** *port-group-name* **b. jumboframe enable** [*value*] • (Method 2) In Ethernet interface view: **c. interface** interface-type interface-number **d. jumboframe enable** [*value*]	Use one of the methods. By default, the device allows jumbo frames within the specified length to pass through all Layer 2 Ethernet interfaces. The maximum length of jumbo frames allowed to pass through depends on your device model. Support for the *value* argument depends on your device model. If you set the *value* argument multiple times, the latest configuration takes effect.

Enabling loopback detection on an Ethernet interface

If a device receives a packet that it sent, a loop has occurred to the device. Loops might cause broadcast storms, which degrade network performance. You can use this feature to detect whether a loop has occurred. Single-port loopback occurs when an interface receives a packet that it sent and the receiving interface is the same as the sending interface, as shown in Figure 1.

Figure 1 Single-port loopback



You can enable loopback detection to detect loops on an interface and, if the interface supports the **loopback-detection action** command, configure the protective action to take on the receiving interface when a loop is detected, for example, to shut down the interface. When no protective action is configured, the device takes the actions in Table 1 to alleviate the impact of the loop condition.

Table 1 Actions to take upon detection of a loop condition

Port type	Actions when no protective action is configured
Access port	• Place the receiving interface in controlled mode. The interface discards all incoming packets, but still forwards outgoing packets. • Generate traps. • Delete all MAC address entries of the interface.
Hybrid or trunk port	• Generate traps. • If loopback detection control is enabled, place the receiving interface in

Port type	Actions when no protective action is configured
	controlled mode. The interface discards all incoming packets, but still forwards outgoing packets. • Delete all MAC address entries of the interface.

Configuration restrictions and guidelines

- To use loopback detection on an Ethernet interface, you must enable the function both globally and on the interface.
- To disable loopback detection on all interfaces, run the **undo loopback-detection enable** command in system view.
- To enable a hybrid or trunk port to take the administratively specified protective action, you must use the **loopback-detection control enable** command on the port.

Configuration procedure

To configure loopback detection:

Step	Command	Remarks
1. Enter system view.	**system-view**	N/A
2. Enable global loopback detection.	**loopback-detection enable**	By default, global loopback detection is disabled.
3. Set the loopback detection interval.	**loopback-detection interval-time** *time*	Optional. The default setting is 30 seconds.
4. Enter Ethernet interface view.	**interface** *interface-type interface-number*	N/A
5. Enable loopback detection on the interface.	**loopback-detection enable**	By default, loopback detection is disabled.
6. Enable loopback detection control on a trunk port or a hybrid port.	**loopback-detection control enable**	Optional. By default, loopback detection control is disabled.
7. Configure the action for loop protection on the Ethernet interface.	**loopback-detection action**	Optional. By default, the action for loop protection on an Ethernet interface is **block**.

Setting the MDI mode of an Ethernet interface

IMPORTANT:

Fiber ports do not support the MDI mode setting.

You can use both crossover and straight-through Ethernet cables to connect copper Ethernet interfaces. To accommodate these types of cables, a copper Ethernet interface can operate in one of the following Medium Dependent Interface (MDI) modes:

- Across mode
- Normal mode
- Auto mode

A copper Ethernet interface uses an RJ-45 connector, which comprises eight pins, each of which plays a dedicated role. For example, pins 1 and 2 transmit signals, and pins 3 and 6 receive signals. The pin role varies by the MDI modes as follows:

- In normal mode, pins 1 and 2 are transmit pins, and pins 3 and 6 are receive pins.
- In across mode, pins 1 and 2 are receive pins, and pins 3 and 6 are transmit pins.
- In auto mode, the interface negotiates pin roles with its peer.

To enable the interface to communicate with its peer, make sure that its transmit pins are connected to the remote receive pins. If the interface can detect the connection cable type, set the interface in auto MDI mode. If not, set its MDI mode by using the following guidelines:

- When a straight-through cable is used, set the interface to operate in the MDI mode different than its peer.
- When a crossover cable is used, set the interface to operate in the same MDI mode as its peer, or set either end to operate in auto mode.

To set the MDI mode of an Ethernet interface:

Step	Command	Remarks
1. Enter system view.	**system-view**	N/A
2. Enter Ethernet interface view.	**interface** *interface-type interface-number*	N/A
3. Set the MDI mode of the Ethernet interface.	**mdi** { **across** | **auto** | **normal** }	By default, a copper Ethernet interface operates in auto mode to negotiate pin roles with its peer.

Configuring a Layer 3 Ethernet interface or subinterface

Setting the MTU for an Ethernet interface or subinterface

The value of Maximum Transmission Unit (MTU) affects the fragmentation and re-assembly of IP packets.

To set the MTU for an Ethernet interface or subinterface:

Step	Command	Remarks
1. Enter system view.	**system-view**	N/A
2. Enter Ethernet interface or subinterface view.	**interface** *interface-type* { *interface-number* | *interface-number.subnumber* }	N/A
3. Set the MTU.	**mtu** *size*	The default setting is 1500.

Due to the QoS queue length limit (for example, the default length of an FIFO queue is 75), too small an MTU will result in too many fragments, which will be discarded from the QoS queue. You can increase MTU or QoS queue length correctly. In Ethernet interface view, you can use the **qos fifo queue-length** command to change the QoS queue length. For more information, see *ACL and QoS Configuration Guide*.

Configuring an Ethernet interface to operate in promiscuous mode

An Ethernet interface usually receives only packets with matched destination MAC addresses. After you configure an Ethernet interface to operate in promiscuous mode, however, the interface no longer checks the MAC addresses in received packets. Rather, it receives all Ethernet packets with correct format. You might need to configure a network listening port to operate in promiscuous mode.

To configure an Ethernet interface to operate in promiscuous mode:

Step	Command	Remarks
1. Enter system view.	**system-view**	N/A
2. Enter Ethernet interface view.	**interface** *interface-type interface-number*	N/A
3. Configure the Ethernet interface to operate in promiscuous mode.	**promiscuous**	By default, an Ethernet interface does not operate in promiscuous mode.

Configuring the MAC address of an Ethernet interface or subinterface

When a Layer 3 Ethernet subinterface is created, it uses the MAC address of its host interface by default. As a result, all Layer 3 Ethernet subinterfaces of a Layer 3 Ethernet interface share the same MAC address. To configure a different MAC address for a specific Layer 3 Ethernet subinterface, you can use the **mac-address** command.

H3C recommends not configuring a MAC address in the VRRP-reserved MAC address range for a Layer 3 Ethernet subinterface.

To configure the MAC address of an Ethernet interface or subinterface:

Step	Command	Remarks
1. Enter system view.	**system-view**	N/A
2. Enter Ethernet interface view.	**interface** *interface-type* { *interface-number* | *interface-number.subnumber* }	N/A
3. Configure the MAC address of the Ethernet interface or subinterface.	**mac-address** *mac-address*	The default setting depends on the router model. You can display the MAC address of a Layer 3 Ethernet interface by using the **display interface** command. The default MAC address of a Layer 3 Ethernet subinterface is the same as the MAC address of its main interface.

Configuring the QoS token function

IMPORTANT:

The **qmtoken** command can cause an Ethernet interface to automatically shut down and go up.

The following matrix shows the feature and hardware compatibility:

Hardware	Feature compatibility
MSR800	No
MSR 900	No

Hardware	Feature compatibility
MSR900-E	No
MSR 930	No
MSR 20-1X	Supported on MSR 20-1X routers except MSR 20-12
MSR 20	Yes
MSR 30	Yes
MSR 50	Yes
MSR 2600	No
MSR3600-51F	Yes

The QoS token function is a flow control mechanism for the bottom layer queue for an Ethernet interface. It uses tokens to set the maximum number of packets that the bottom layer queue can hold.

Custom queuing (CQ) or weight fair queuing (WFQ) takes effect when the bottom layer gets full. If the bottom layer queue size is large, CQ or WFQ might fail to take effect when the interface is transmitting data for TCP applications such as FTP, because TCP performs flow control. To resolve this problem, you can configure the QoS token function to reduce the maximum number of tokens.

To ensure data transmission efficiency, use the default setting in normal cases.

To configure the token limit on an Ethernet interface:

Step	Command	Remarks
1. Enter system view.	**system-view**	N/A
2. Enter Ethernet interface view.	**interface** *interface-type interface-number*	N/A
3. Set the maximum number of tokens for the interface.	**qmtoken** *token-number*	The default setting depends on the router model.

Displaying and maintaining an Ethernet interface or subinterface

Task	Command	Remarks
Display Ethernet interface or subinterface information.	**display interface** [*interface-type*] [**brief** [**down** | **description**]] [**|** { **begin** | **exclude** | **include** } *regular-expression*] **display interface** *interface-type* { *interface-number* | *interface-number.subnumber* } [**brief** [**description**]] [**|** { **begin** | **exclude** | **include** } *regular-expression*]	Available in any view.
Display traffic statistics for the specified interfaces.	**display counters** { **inbound** | **outbound** } **interface** [*interface-type*] [**|** { **begin** | **exclude** | **include** } *regular-expression*]	Available in any view.
Display traffic rate statistics over the last sampling interval.	**display counters rate** { **inbound** | **outbound** } **interface** [*interface-type*] [**|** { **begin** | **exclude** | **include** } *regular-expression*]	Available in any view.

Task	Command	Remarks
Display information about a manual port group or all manual port groups.	**display port-group manual** [**all** | **name** *port-group-name*] [**|** { **begin** | **exclude** | **include** } *regular-expression*]	Available in any view.
Display information about the loopback function.	**display loopback-detection** [**|** { **begin** | **exclude** | **include** } *regular-expression*]	Available in any view.
Clear the interface or subinterface statistics.	**reset counters interface** [*interface-type* [*interface-number* | *interface-number.subnumber*]]	Available in user view.

Configuring WAN interfaces

Overview

This chapter describes how to configure interfaces for connecting to WAN networks, including X.25, Frame Relay, ATM, and ISDN. Available WAN interfaces include:

- AM interface
- ATM interface
- AUX interface
- CE1/PRI interface
- CE3 interface
- CT1/PRI interface
- CT3 interface
- FCM interface
- ISDN BRI interface
- Synchronous/asynchronous serial interface
- USB interface
- 3G/4G modem interface

For more information about ATM interfaces, see "Configuring ATM and DSL interfaces."

Hardware compatibility with WAN interface

Hardware	Support for interfaces
CE3 and CT3 interface modules	The modules do not support subrate configuration if the module hardware version is earlier than Hardware 2.2.
MSR 30-11	The router does not support USB interfaces.
MSR800 series	Supports only the USB 3G/4G modem interfaces.
MSR 900 series	Supports only the AUX and USB 3G/4G modem interfaces.
MSR900-E series	Supports only the USB 3G/4G modem interfaces.
MSR 930 series	Supports the AUX and 3G/4G modem interfaces. The MSR 930-SA also supports serial interfaces.

Configuring an asynchronous serial interface

The following types of asynchronous serial interfaces are available:

- Synchronous/asynchronous serial interface operating in asynchronous mode, whose interface index begins with **Serial**.
- Dedicated asynchronous serial interface, whose interface index begins with **Async**.

You can connect a modem or ISDN terminal adapter to an asynchronous serial interface for dial-up connection.

An asynchronous serial interface can operate in flow mode or protocol mode. In protocol mode, the asynchronous serial interface supports PPP at the data link layer and IP at the network layer.

To configure an asynchronous serial interface:

Step	Command	Remarks
1. Enter system view.	**system-view**	N/A
2. Enter asynchronous serial interface view.	**interface async** *interface-number* or **interface serial** *interface-number*	N/A
3. Set the interface description.	**description** *text*	Optional. By default, the description of an asynchronous serial interface is *interface name* Interface, for example, Serial2/0 Interface.
4. Configure a synchronous or asynchronous serial interface to operate as an asynchronous serial interface.	**physical-mode async**	By default, a synchronous or asynchronous serial interface operates as a synchronous serial interface. This command is not available on AM interfaces. Skip this step if the interface is an Async interface.
5. Set the link layer protocol.	**link-protocol ppp**	Optional. The default is PPP.
6. Set the operating mode.	**async mode** { **flow** | **protocol** }	Optional. The default is the protocol mode.
7. Enable level detection.	**detect dsr-dtr**	Optional. Enabled by default. This command is not available to AM interfaces.
8. Enable local loopback.	**loopback**	Optional. Disabled by default.
9. Set the MTU.	**mtu** *size*	Optional. The default is 1500 bytes.
10. Set the keepalive transmission interval.	**timer hold** *seconds*	Optional. The default is 10 seconds.
11. Eliminate the pulses with a width less than 3.472 μs.	**eliminate-pulse**	Optional. Enabled by default.
12. Set the MRU for an interface operating in flow mode.	**phy-mru** *mrusize*	Optional. The default MRU is 1700 bytes.
13. Set the intended bandwidth for the asynchronous serial interface.	**bandwidth** *bandwidth-value*	Optional.
14. Restore the default settings for the asynchronous serial interface.	**default**	Optional.
15. Shut down the asynchronous	**shutdown**	Optional.

Step	Command	Remarks
serial interface.		An asynchronous serial interface is up by default.

NOTE:

- You can use the speed command in interface view to configure the baud rate for an asynchronous serial interface. For more information, see *Fundamentals Configuration Guide*.
- Configure PPP, DCC, IP address, firewall, and backup center for the asynchronous serial interface if the network requires.

Configuring an AUX interface

The AUX interface is fixed on your device. It can operate as a regular asynchronous serial interface at a speed up to 115200 bps. With this interface, you can perform functions such as remote device configuration and line backup.

To perform other AUX interface configurations (such as baud rate, stop bit, parity, and flow control), use the corresponding commands in user-interface view. For more information, see *Fundamentals Configuration Guide*.

Configuration procedure

To configure an AUX interface:

Step	Command	Remarks
1. Enter system view.	**system-view**	N/A
2. Enter AUX interface view.	**interface aux** *interface-number*	N/A
3. Set the interface description.	**description** *text*	Optional. By default, the description of an AUX interface is *interface name* Interface, for example, AUX0 Interface.
4. Set the operating mode.	**async mode** { **flow** | **protocol** }	The default is the flow mode.
5. Enable level detection.	**detect dsr-dtr**	Optional. Enabled by default.
6. Enable local loopback.	**loopback**	Optional. Disabled by default.
7. Set the link layer protocol.	**link-protocol ppp**	Optional. The default is PPP.
8. Set the polling interval.	**timer hold** *seconds*	Optional. The default is 10 seconds.
9. Set the MRU for the AUX interface operating in the flow mode.	**phy-mru** *mrusize*	Optional. 1700 bytes by default.
10. Set the intended bandwidth for the AUX interface.	**bandwidth** *bandwidth-value*	Optional.
11. Restore the default settings for the AUX interface.	**default**	Optional.

Step	Command	Remarks
12. Shut down the AUX interface.	**shutdown**	Optional. An AUX interface is up by default.

Displaying and maintaining AUX interfaces

Task	Command	Remarks
Display information about the specified AUX interfaces.	**display interface** [**aux**] [**brief** [**down** | **description**]] [**|** { **begin** | **exclude** | **include** } *regular-expression*] **display interface aux** *interface-number* [**brief** [**description**]] [**|** { **begin** | **exclude** | **include** } *regular-expression*]	Available in any view.
Clear statistics on a specified AUX interface.	**reset counters interface** [**aux** [*interface-number*]]	Available in user view.

Configuring a USB 3G/4G modem

Overview

3G/4G modem modules include USB 3G/4G modem modules and SIC-3G modem modules.

- A USB 3G/4G modem module is hot swappable. It uses Cellular 0/0 or Cellular-Ethernet 0/0 interface view for management, which is a fixed interface view. Even if no USB 3G/4G modem module is installed on the router, you can enter the interface view. The parameters configured in Cellular 0/0 or Cellular-Ethernet 0/0 interface view are not removed when the USB 3G/4G modem module is removed from the router.
- A SIC-3G modem module does not support hot swapping. When the SIC-3G modem module is installed on the router, the system creates a cellular interface view according to the slot number of the module. When the SIC-3G modem module is removed from the router, the cellular interface view is removed.

A 3G/4G modem module operates either in PPP mode or Ethernet mode, but not at the same time. When operating in PPP mode, the modem module is managed in Cellular 0/0 interface view. When operating in Ethernet mode, the modem module is managed in Cellular-Ethernet 0/0 interface view. You can set the operating mode of a 3G/4G modem module by using the **card-mode** command.

When a 3G/4G modem module operates in PPP mode, the link layer protocol is PPP and the network layer protocol is IP. When the 3G/4G modem module operates in Ethernet mode, the link layer protocol is Ethernet and the network layer protocol is IP.

Configuring a cellular interface

Follow these guidelines when you configure a cellular interface:

- The USB 3G/4G modem module can be installed only in slot USB 0.
- Do not remove the USB 3G/4G modem module when it is transmitting data. To do so, use the **shutdown** command to shut down the modem first.

To configure a cellular interface or cellular Ethernet interface:

Step	Command	Remarks
1. Enter system view.	**system-view**	N/A
2. Specify PPP or Ethernet encapsulation on the 3G/4G modem module.	**card-mode slot** *slot-num* { **ppp** | **ethernet** }	N/A
3. Enter interface view.	• Enter cellular interface view: **interface cellular** *interface-number* • Enter cellular Ethernet interface view: **interface cellular-ethernet** *interface-number*	Use the **interface cellular** command if PPP encapsulation is specified. Use the **interface cellular-ethernet** command if Ethernet encapsulation is specified.
4. Enable the interface to accept the IP address allocated by the peer through 4G modem negotiation.	**ip address cellular-allocated**	By default, an interface does not accept the IP address allocated by the peer through 4G modem negotiation.
5. Set the interface description.	**description** *text*	Optional. By default: • The description of a cellular interface is *interface name* Interface, for example, Cellular0/0 Interface. • The description of a cellular Ethernet interface is *interface name* Interface, for example, Cellular-Ethernet0/0 Interface.
6. Set the link layer protocol.	**link-protocol ppp**	Optional. The default is PPP. This setting is available when the modem operates in PPP mode.
7. Set the MTU.	**mtu** *size*	Optional. The default is 1500 bytes.
8. Set the polling interval.	**timer hold** *seconds*	Optional. The default is 10 seconds.
9. Enable cellular interface debugging.	**dm-port open**	Optional. Disabled by default. Supported only on SIC-3G interface modules.
10. Search for public land mobile networks (PLMNs).	**plmn search**	The configuration is automatically saved in a nonvolatile storage medium of the modem. Use the **display cellular** or **display cellular-ethernet** command to verify the configuration.
11. Configure PLMN searching mode.	**plmn select** { **auto** | **manual** *mcc mnc* }	Optional. The default searching mode is **auto**. The configuration is automatically saved in a nonvolatile storage

Step	Command	Remarks
		medium of the modem. Use the **display cellular** or **display cellular-ethernet** command to verify the configuration.
12. Create a parameter description profile for the USB 3G or 4G modem.	**profile create** *profile-number* { **dynamic** | **static** *apn* } **authentication-mode { none |** { **chap | pap | pap-chap**} [**user** *username*] [**password** *password*]	Optional. By default, this template does not exist. Repeat this step to create profiles. To specify two profiles as the primary and backup profiles, you must configure the same username and password for them.
13. Specify the primary and backup profiles.	**profile main** *profile-M-number* **backup** *profile-B-number*	Optional. By default, profile 1 is used for 3G or 4G modem dialup. For each dialup connection establishment, the 3G or 4G modem uses the backup profile only when it has failed to dial up using the primary profile. This command takes effect only on dialup connections initiated after the command is configured. It does not take effect on the dialup connection that has been established.
14. Select a CDMA network connection mode.	**mode cdma** { **1xrtt-only | evdo-only | hybrid | lte-only | auto** }	Optional.
15. Select a TD-SCDMA network connection mode.	**mode td-scdma** { **gsm-only | gsm-precedence | td-only | td-precedence | lte-only | auto** }	Optional.
16. Select a WCDMA network connection mode.	**mode wcdma** { **gsm-only | gsm-precedence | wcdma-only | wcdma-precedence | lte-only | auto** }	Optional.
17. Enable or disable PIN verification for the 3G/4G modem.	**pin verification** { **enable** | **disable** } [*pin*]	Optional.
18. Perform PIN verification for the 3G/4G modem.	**pin verify** [**simple** | **cipher**] *pin*	Optional. By default, no PIN is set for the SIM/UIM card installed on the 3G/4G modem.
19. Unlock the PIN.	**pin unlock** *puk new-pin*	N/A
20. Modify the PIN.	**pin modify** *current-pin new-pin*	N/A
21. Configure the RSSI thresholds.	**rssi** { **gsm** | **1xrtt** | **evdo** } { **low** *lowthreshold* | **medium** *mediumthreshold* }*	Optional. By default, the *lowthreshold* is –150, and the *mediumthreshold* is 0.
22. Set the intended bandwidth for the cellular interface.	**bandwidth** *bandwidth-value*	Optional.

Step	Command	Remarks
23. Manually reboot the 3G/4G modem.	**modem reboot**	Optional. A 3G/4G modem can automatically detect running errors and reboot. If the 3G/4G modem fails to reboot by itself, you can use this command to manually reboot it.
24. Bind the 3G/4G modem to the local IMSI.	**trust-imsi** *IMSI-string*	Optional. By default, a 3G/4G modem is not bound to the local IMSI.
25. Set the physical state change suppression time on the cellular interface.	**link-delay** *delay-time*	Optional. By default, physical state change suppression is disabled.
26. Restore the default settings for the cellular interface.	**default**	Optional.
27. Shut down the cellular interface.	**shutdown**	Optional. Up by default.
28. Bring up the cellular interface.	**undo shutdown**	Optional. Up by default.
29. Enable RSSI-based interface backup.	**standby rssi** *rssi-threshold* **interface** *interface-type interface-number* [**delay** *delay-time*]	Optional. By default, RSSI-based interface backup is disabled.
30. Enable GPS and set the GPS mode.	**gps mode** { *standalone* }	Optional. By default, GPS is disabled. This command is available only on the following routers: • MSR 930-LM. • MSR 930-W-LM. • MSR routers with the SIC-4G-LTE module.
31. Enable GPS NMEA stream state.	**gps nmea**	Optional. By default, GPS NMEA stream state is disabled. This command is available only on the following routers: • MSR 930-LM. • MSR 930-W-LM. • MSR routers with the SIC-4G-LTE module.
32. Specify an LTE band.	**lte band** *band-number*	Optional. By default, all supported LTE bands are available. This command is available only on the following routers: • MSR 930-LM. • MSR 930-W-LM. • MSR routers with the SIC-4G-LTE module.

Based on the network requirements, in PPP mode, configure PPP, DCC, IP address, firewall, and backup center on the cellular interface. In Ethernet mode, configure DCC, IP address, firewall, and backup center on the cellular Ethernet interface.

For more information about how to set the operating mode of an interface, see *Fundamentals Configuration Guide*.

Configuring automatic reboot

3G/4G modems might fail and cannot automatically dial up to the 3G/4G network when the 3G/4G network runs unstably or its running environment changes. MSR routers provide the auto-reset function to reduce manual resets of 3G/4G modems.

With 3G/4G modem auto-reset enabled, the system automatically resets the 3G/4G modem after consecutive dialup failures. By default, the system performs auto-reset if the 3G/4G modem has at least one successful dialup and then consecutive dialup failures. This prevents frequent resets of the 3G/4G modem caused by configuration errors that lead to dialup failures.

To configure 3G/4G modem auto-reset:

Step	Command	Remarks
1. Enter system view.	**system-view**	N/A
2. Specify PPP or Ethernet encapsulation on the 3G/4G modem module.	**card-mode slot** *slot-num* { **ppp** | **ethernet** }	N/A
3. Enter interface view.	• Enter cellular interface view: **interface cellular** *interface-number* • Enter cellular Ethernet interface view: **interface cellular-ethernet** *interface-number*	Use the **interface cellular** command if PPP encapsulation is specified. Use the **interface cellular-ethernet** command if Ethernet encapsulation is specified.
4. Enable 3G/4G modem auto-reset.	**modem auto-recovery enable**	Disabled by default.
5. Set the interval of waiting for the response from the 3G/4G modem after the system sends an AT command and the maximum times that the 3G/4G modem does not respond.	**modem response timer** *time* **auto-recovery** *threshold*	Optional. By default, the response interval is 10 seconds and auto-recovery threshold is 3.

Associating a cellular interface with a track entry and configuring auto-recovery parameters of 3G/4G modem

You can associate a cellular interface with the detection module through the track module. For example, the detection module uses NQA ICMP echo requests for tests and notifies the cellular interface of a negative event through the track module if the destination host is unreachable. When NQA detects link recovery, it notifies the cellular interface of a positive event through the track module.

With this function, the system determines whether a cellular interface has received a positive event after the interface receives a negative event.

- If yes, the 3G/4G modem automatically recovers. If the interface receives no positive event within the specified delay time, the 3G/4G modem recovers repeatedly.

- If not, it indicates that the 3G/4G modem fails possibly because of configuration errors. In this case, the system performs no action.

To associate a cellular interface with a track entry and configure auto-recovery parameters of a 3G/4G modem:

Step	Command	Remarks
1. Enter system view.	**system-view**	N/A
2. Specify PPP or Ethernet encapsulation on the 3G/4G modem module.	**card-mode slot** *slot-num* { **ppp** | **ethernet** }	N/A
3. Enter interface view.	• Enter cellular interface view: **interface cellular** *interface-number* • Enter cellular Ethernet interface view: **interface cellular-ethernet** *interface-number*	Use the **interface cellular** command if PPP encapsulation is specified. Use the **interface cellular-ethernet** command if Ethernet encapsulation is specified.
4. Associate the cellular interface with the track entry and configure auto-recovery parameters of 3G/4G modem.	**recovery track** *track-entry-number* **delay** *delay-time* **consecutive** *times*	By default, a cellular interface is not associated with a track entry.

Configuring the 3G modem to send, delete, and forward short messages

The 3G modem SMS function supports sending, receiving, deleting, displaying, and forwarding short messages.

The SIC-4G-LTE modem module does not support sending, deleting, or forwarding short messages.

To configure the 3G modem to send, delete, and forward short messages:

Step	Command	Remarks
1. Enter system view.	**system-view**	N/A
2. Specify PPP or Ethernet encapsulation on the 3G modem module.	**card-mode slot** *slot-num* { **ppp** | **ethernet** }	N/A
3. Enter interface view.	• Enter cellular interface view: **interface cellular** *interface-number* • Enter cellular Ethernet interface view: **interface cellular-ethernet** *interface-number*	Use the **interface cellular** command if PPP encapsulation is specified. Use the **interface cellular-ethernet** command if Ethernet encapsulation is specified.
4. Send a short message to the specified number.	**sms send** destination-number	Optional.
5. Delete the specified short messages or all short messages from the SIM card.	**sms delete** { **all** | **sms-id** *id* }	Optional.
6. Configure a short message forwarding rule.	**sms forward source-number** *source-number* **destination-number**	Optional. After you configure a short

Step	Command	Remarks
	destination-number	message forwarding rule, the system automatically forwards the short message from the specified source number to the specified destination number.

Deploying configuration on the device through SMS

If your device has a 3G modem, you can send short messages through the 3G network to deploy initial settings listed in Table 2 on the device. The operation procedure is as follows:

1. The administrator sends a deployment short message in the specified format (started with **dpl:**) to the device.
2. After receiving the short message, the device analyzes the short message content and completes the configuration.
3. The router sends a reply short message (started with **rsp:**) to the sender to report the deployment result.

The SIC-4G-LTE modem module does not support deploying configuration on the device through SMS.

To configure the SMS-based configuration deployment feature:

Step	Command	Remarks
1. Enter system view.	**system-view**	N/A
2. Enable the SMS method of configuration deployment.	**autodeploy sms enable**	By default, this function is enabled.
3. Enable the device to send the content of incoming short messages in SNMP traps.	**snmp-agent trap enable sms**	Optional. By default, this function is enabled.
4. Enter cellular interface view.	**interface cellular** *interface-number*	N/A
5. Specify PPP or Ethernet encapsulation on the 3G modem module.	**card-mode slot** *slot-num* { **ppp** | **ethernet** }	N/A
6. Enter interface view.	• Enter cellular interface view: **interface cellular** *interface-number* • Enter cellular Ethernet interface view: **interface cellular-ethernet** *interface-number*	Use the **interface cellular** command if PPP encapsulation is specified. Use the **interface cellular-ethernet** command if Ethernet encapsulation is specified.
7. Enable SMS on the interface.	**sms sending-enable**	Optional. By default, SMS is disabled on cellular interfaces. The device cannot send any short messages except configuration deployment responses and forwarded short messages.

Table 2 Parameter template description

Parameter	Description
dpl:	Deployment SMS identifier.
pu:	PPP authentication username for which both CHAP authentication and PAP authentication can be configured. For more information, see *Layer 2—WAN Configuration Guide*.
cu:	PPP authentication username for which only CHAP authentication can be configured. For more information, see *Layer 2—WAN Configuration Guide*.
1u:	PPP authentication username for which only PAP authentication can be configured. For more information, see *Layer 2—WAN Configuration Guide*.
ps:	PPP authentication password. For more information, see *Layer 2—WAN Configuration Guide*.
dn:	PPP dial string. For more information, see *Layer 2—WAN Configuration Guide*.
an:	3G access point name, provided by ISP.
ac:	ACS URL. For more information, see *Network Management and Monitoring Configuration Guide*.
au:	ACS login username. For more information, see *Network Management and Monitoring Configuration Guide*.
as:	ACS login password. For more information, see *Network Management and Monitoring Configuration Guide*.
pc:	Preferred cipher suite of an SSL client policy. Options are: • **3s**—rsa_3des_ede_cbc_sha • **a1**—rsa_aes_128_cbc_sha • **a2**—rsa_aes_256_cbc_sha • **ds**—rsa_des_cbc_sha • **rm**—rsa_rc4_128_md5 • **rs**—rsa_rc4_128_sha For more information, see *Security Configuration Guide*.

A deployment short message must meet the following text format requirements:

- The message must start with **dpl:**.
- Separate the parameter name and value with a colon (:).
- Separate two parameters with a line break.
- The content is case sensitive.
- The message must not contain any parameters that are not in Table 2.
- You can deploy configuration in multiple messages, each of which must start with **dpl:**.
- The name and value of one parameter must be sent in one message.
- The **ps** parameter and one of the **pu**, **cu**, and **lu** parameters must be sent in one message.

The following is a sample deployment short message:

```
dpl:
pu:user001
```

```
ps:abc123
dn:*99#
an:3gnet
ac:http://www.acs.com:80/acs
au:admin
as:admin
pc:a1
```

Upgrading the 3G/4G modem firmware version

Task	Command	Remarks
Upgrade the 3G/4G modem firmware version.	**bootrom update file** *file_name* **slot** *slot_num*	No operation is allowed on the 3G/4G modem during the upgrading process. To display the upgraded 3G/4G modem firmware version, execute the **display cellular** or **cellular-ethernet all** command in any view.

Displaying and maintaining the 3G/4G modem

To display and maintain the 3G/4G modem in PPP mode:

Task	Command	Remarks
Display the call connection information of the 3G modem.	**display cellular** *interface-number* **all** [**|** { **begin** | **exclude** | **include** } *regular-expression*]	Available in any view.
Display information about a cellular interface.	**display interface** [**cellular**] [**brief** [**down** | **description**]] [**|** { **begin** | **exclude** | **include** } *regular-expression*] **display interface cellular** *interface-number* [**brief** [**description**]] [**|** { **begin** | **exclude** | **include** } *regular-expression*]	Available in any view.
Clear the statistics for interfaces.	**reset counters interface** [**cellular** [*interface-number*]]	Available in user view.
Display the SMS statistics.	**display sms interface interface-type** *interface-number* **statistics**	Available in any view. This command is not supported on SIC-4G-LTE modem-installed routers.
Display the summary or verbose information of SMSs.	**display sms interface interface-type** *interface-number* { **summary** | **verbose** [**sms-id** *id*] }	Available in any view. This command is not available for the SIC-4G-LTE module.
Display GPS information for a cellular interface.	**display gps interface cellular** *interface-number*	Available in any view. This command is available only on the following routers: • MSR 930-LM.

Task	Command	Remarks
		• MSR 930-W-LM. • MSR routers with the SIC-4G-LTE module.

To display and maintain the 3G/4G modem in Ethernet mode:

Task	Command	Remarks
Display the call connection information of the 4G modem.	**display cellular-ethernet** *interface-number* **all** [**|** { **begin** | **exclude** | **include** } *regular-expression*]	Available in any view.
Display information about a cellular Ethernet interface.	**display interface** [**cellular-ethernet**] [**brief** [**down** | **description**]] [**|** { **begin** | **exclude** | **include** } *regular-expression*] **display interface cellular-ethernet** *interface-number* [**brief** [**description**]] [**|** { **begin** | **exclude** | **include** } *regular-expression*]	Available in any view.
Clear the statistics for interfaces.	**reset counters interface** [**cellular-ethernet** [*interface-number*]]	Available in user view.
Display GPS information for a cellular Ethernet interface.	**display gps interface cellular-ethernet** *interface-number*	Available in any view. This command is available only on the following routers: • MSR 930-LM. • MSR 930-W-LM. • MSR routers with the SIC-4G-LTE module.

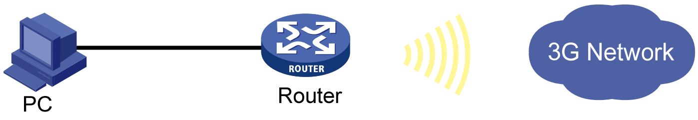
Cellular interface configuration example

Network requirements

As shown in Figure 2, the router provides a USB 3G/4G modem or SIC-3G modem, and the PC dials up to access a 3G network through Dial Control Center (DCC).

For more information about how DCC establishes dialup connections, see *Layer 2—WAN Configuration Guide*.

Figure 2 Network diagram



Configuration procedure

Configure a dial access control rule for dialer access group 1.

```
<Router> system-view
[Router] dialer-rule 1 ip permit
```

Assign an IP address to interface Cellular 0/0.

```
[Router] interface cellular 0/0
[Router-Cellular0/0] ip address 1.1.1.1 255.255.0.0
```

Enable circular DCC (C-DCC) on interface Cellular 0/0.

```
[Router-Cellular0/0] dialer enable-circular
```

Associate interface Cellular 0/0 with dialer access group 1.

```
[Router-Cellular0/0] dialer-group 1
```

Set the interval for DCC to make the next call attempt to five seconds.

```
[Router-Cellular0/0] dialer timer enable 5
```

Configure a dial string for calling a remote end.

```
[Router-Cellular0/0] dialer number 666666
[Router-Cellular0/0] quit
```

Enable modem dial-in and dial-out on User interface 1.

```
[Router] user-interface tty 1
[Router-ui-tty1] modem both
```

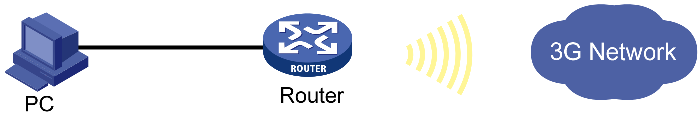
Cellular Ethernet interface configuration example

Network requirements

As shown in Figure 3, the router provides a USB 3G/4G module, and the PC dials up to access a 3G/4G network through Dial Control Center (DCC).

For more information about how DCC establishes dialup connections, see *Layer 2—WAN Configuration Guide*.

Figure 3 Network diagram



Configuration procedure

Configure a dial access control rule for dialer access group 1.

```
<Router> system-view
[Router] dialer-rule 1 ip permit
```

Assign an IP address to interface Cellular-Ethernet 0/0.

```
[Router] interface cellular-ethernet 0/0
[Router-Cellular-Ethernet0/0] ip address cellular-allocated
```

Enable circular DCC (C-DCC) on interface Cellular-Ethernet 0/0.

```
[Router-Cellular-Ethernet0/0] dialer enable-circular
```

Associate interface Cellular-Ethernet 0/0 with dialer access group 1.

```
[Router-Cellular-Ethernet0/0] dialer-group 1
```

Configure a dial string for calling a remote end.

```
[Router-Cellular-Ethernet0/0] dialer number *99#
```

Enable outbound NAT on interface Cellular-Ethernet 0/0.

```
[Router-Cellular-Ethernet0/0] nat outbound
[Router-Cellular-Ethernet0/0] quit
```

Configure a default route to interface Cellular-Ethernet 0/0, and enable dynamic domain name resolution.

```
[Router] ip route-static 0.0.0.0 0.0.0.0 Cellular-Ethernet0/0
[Router] dns resolve
[Router] dns proxy enable
```

RSSI-based interface backup configuration example

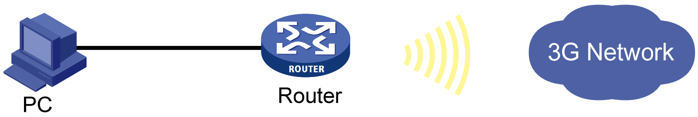
Network requirements

As shown in Figure 4, the router provides two 3G modem modules. They are managed in Cellular 1/0 (the master interface) view and Cellular 2/0 (the subordinate interface) view.

Configure the signal strength threshold as –90 dBm and the delay time as 60 minutes so that when the signal strength is below –90 dBm on the master interface, traffic is switched to the subordinate interface. When the signal strength is over –90 dBm on the master interface, traffic is switched back to the master interface.

Specify the destination address for NQA operation as 8.8.8.8, and set the number of consecutive probe failures to five so that when the number of consecutive probe failures exceeds five (included), the state of the track entry is changed to negative.

Figure 4 Network diagram



Configuration procedure

Configure an NQA operation with the administrator name **z** and operation tag **i** to check the connectivity of the link on the master interface.

```
<Router> system-view
[Router] nqa entry z i
[Router-nqa-z-i] type icmp-echo
[Router-nqa-z-i-icmp-echo] destination ip 8.8.8.8
[Router-nqa-z-i-icmp-echo] frequency 4000
[Router-nqa-z-i-icmp-echo] reaction 1 checked-element probe-fail threshold-type
consecutive 5 action-type trigger-only
[Router-nqa-z-i-icmp-echo] quit
[Router] nqa schedule z i start-time now lifetime forever
```

Configure PBR to make sure the probe packets are sent out of the master interface.

```
[Router] ip local policy-based-route pbr1
[Router] acl number 3000
[Router-acl-adv-3000] rule 0 permit icmp destination 8.8.8.8 0
[Router-acl-adv-3000] quit
[Router] policy-based-route pbr1 permit node 5
[Router-pbr-pbr1-5] if-match acl 3000
[Router-pbr-pbr1-5] apply output-interface Cellular1/0
[Router-pbr-pbr1-5] quit
```

Configure track entry 1, and associate it with reaction entry 1 of the NQA test group (with the administrator **z** and the operation tag **i**).

```
[Router] track 1 nqa entry z i reaction 1
```

Associate the subordinate interface with track entry 1.

```
[Router] interface Cellular2/0
[Router-Cellular2/0] standby track 1
[Router-Cellular2/0] quit
```

Enable signal strength-based interface backup on the master interface.

```
[Router] interface Cellular1/0
[Router-Cellular1/0] standby rssi -90 interface Cellular2/0 delay 60
[Router-Cellular1/0] quit
```

Configure two default routes, and assign a higher priority for the route with the output interface as the subordinate interface than the route with the output interface as the master interface.

```
[Router] ip route-static 0.0.0.0 0.0.0.0 Cellular1/0
[Router] ip route-static 0.0.0.0 0.0.0.0 Cellular2/0 preference 30
```

Configure the two 3G modem modules.

```
[Router] interface Cellular1/0
[Router-Cellular1/0] ppp ipcp dns request
[Router-Cellular1/0] ip address ppp-negotiate
[Router-Cellular1/0] dialer enable-circular
[Router-Cellular1/0] dialer-group 1
[Router-Cellular1/0] dialer timer autodial 5
[Router-Cellular1/0] dialer number *99# autodial
[Router-Cellular1/0] quit
[Router] interface Cellular2/0
[Router-Cellular2/0] ppp chap user card
[Router-Cellular2/0] ppp chap password cipher card
[Router-Cellular2/0] ppp ipcp dns request
[Router-Cellular2/0] ip address ppp-negotiate
[Router-Cellular2/0] dialer enable-circular
[Router-Cellular2/0] dialer-group 1
[Router-Cellular2/0] dialer timer autodial 5
[Router-Cellular2/0] dialer number #777 autodial
[Router-Cellular2/0] quit
[Router] dialer-rule 1 ip permit
[Router] user-interface tty 16
[Router-ui-tty16] modem both
[Router-ui-tty16] quit
[Router] user-interface tty 32
[Router-ui-tty32] modem both
[Router-ui-tty32] quit
```

Configuring a synchronous serial interface

A synchronous serial interface has the following features:

- Operates in either DTE or DCE mode. Usually, it serves as DTE to accept the clock provided by DCE.
- Connected by various types of cables, such as V.24, V.35, X.21, RS449, and RS530. Your device can automatically detect the type of connected cables and select electrical properties. In most cases, you do not need to configure them manually.

- Supports link layer protocols such as PPP, FR, link access procedure, balanced (LAPB), and X.25.
- Supports network layer protocols IP and IPX.
- Provides information about the connected cable type, operating mode (DTE or DCE), and so on after you run the **display interface serial** command.

To set the baud rate for a synchronous/asynchronous serial interface operating in asynchronous mode, use the **speed** command in user-interface view. For more information, see *Fundamentals Configuration Guide*.

Configure PPP/X.25/FR, DCC, IP address, firewall, and backup center for the synchronous serial interface if the network requires.

To configure a synchronous serial interface:

Step	Command	Remarks
1. Enter system view.	**system-view**	N/A
2. Enter synchronous serial interface view.	**interface serial** *interface-number*	N/A
3. Configure a synchronous or asynchronous serial interface to operate as a synchronous serial interface.	**physical-mode sync**	Optional. A synchronous or asynchronous serial interface operates as a synchronous serial interface. This command is not available on AM interfaces. Skip this step if the interface is an Async interface.
4. Set the interface description.	**description** *text*	Optional. By default, the description of a synchronous serial interface is *interface name* Interface, for example, Serial2/0 Interface.
5. Set the link layer protocol.	**link-protocol** { **fr** | **hdlc** | **lapb** | **ppp** | **sdlc** | **x25** }	Optional. The default is PPP.
6. Set the digital signal coding format.	**code** { **nrz** | **nrzi** }	Optional. The default is non-return-to-zero (NRZ).
7. Set the baud rate.	**baudrate** *baudrate* **virtualbaudrate** *virtualbaudrate*	Optional. The default is 64,000 bps. These commands are available to synchronous/asynchronous serial interface operating in asynchronous mode only.
8. Set the clock selection mode on the DTE side.	**clock** { **dteclk1** | **dteclk2** | **dteclk3** | **dteclk4** | **dteclk5** | **dteclkauto** }	Optional. The default is **dteclk1**.
9. Set transmit-clock or receive-clock signal inversion on the DTE side.	**invert** { **transmit-clock** | **receive-clock** }	Optional. Disabled by default.
10. Set the MTU.	**mtu** *size*	Optional. The default is 1500 bytes.
11. Set the CRC mode.	**crc** { **16** | **32** | **none** }	Optional.

Step	Command	Remarks
		The default is 16-bit CRC.
12. Set the number of interframe filling tags.	**itf number** *number*	Optional. 4 by default.
13. Enable level detection.	**detect dsr-dtr**	Optional. Enabled by default.
14. Enable data carrier detection (DCD).	**detect dcd**	Optional. Enabled by default.
15. Enable local loopback.	**loopback**	Optional. Disabled by default.
16. Configure the polling interval.	**timer hold** *seconds*	Optional. The default is 10 seconds.
17. Set line idle-mark to 0xFF.	**idle-mark**	Optional. The default is 0x7E.
18. Enable RTS signal reverse.	**reverse-rts**	Optional. Disabled by default.
19. Set the intended bandwidth for the synchronous serial interface.	**bandwidth** *bandwidth-value*	Optional.
20. Restore the default settings for the synchronous serial interface.	**default**	Optional.
21. Shut down the synchronous serial interface.	**shutdown**	Optional. A synchronous serial interface is up by default.
22. Start a loop test.	**looptest** [**-c** *count* | **-p** { *pattern* | **special** { **ascending** | **descending** | **random** } } | **-s** *packetsize* | **-t** *timeout*] * **interface** *type number*	Optional. This command is available only on synchronous serial interfaces created for E1, T1, E1-F, or T1-F.

Enabling subinterface rate statistics collection on a serial interface

After enabling subinterface rate statistics collection on a serial interface, the device periodically refreshes the rate statistics for the subinterfaces of the serial interface. You can use the **display interface** command to view the rate statistics.

Serial interfaces that support this feature include synchronous serial interfaces, synchronous/asynchronous serial interfaces, and sub-channel serial interfaces, but not dedicated asynchronous serial interfaces.

To enable subinterface rate statistics collection for a serial subinterface:

Step	Command	Remarks
1. Enter system view.	**system-view**	N/A
2. Enter serial interface view.	**interface** *interface-type interface-number*	N/A

Step	Command	Remarks
3. Enable subinterface rate statistics collection on the serial interface.	**sub-interface rate-statistic**	Optional. Disabled by default.

NOTE:

- Support for this feature varies with device models.
- Use this function with caution, because it is system resource demanding.

Displaying and maintaining serial interfaces

Task	Command	Remarks
Display information about the specified serial interfaces.	**display interface** [**serial**] [**brief** [**down** | **description**]] [**|** { **begin** | **exclude** | **include** } *regular-expression*] **display interface serial** *interface-number* [**brief** [**description**]] [**|** { **begin** | **exclude** | **include** } *regular-expression*]	Available in any view.
Clear statistics on a specified serial interface.	**reset counters interface** [**serial** [*interface-number*]]	Available in user view.

Configuring an AM interface

Overview

Analog modem (AM) interfaces bring services provided by asynchronous serial interfaces and analog modems together. Most of the configuration commands used on asynchronous serial interfaces and modems can be directly used on AM interfaces. When you configure an AM interface, you can treat it as a special asynchronous serial interface.

AM interfaces provide dial-in and dial-out services for analog dial-up users.

Theoretically, if the peer (usually an ISP) uses a digital modem, the AM interface can establish connection with the V.90 Modem standard to provide downstream rates up to 56 kbps and upstream rates up to 33.6 kbps. If the peer (usually a common user) uses an analog modem (or an AM interface), the AM interface can establish connection with the V.34 Modem standard to provide rates (both downstream and upstream) up to 33.6 kbps.

The real rate of an AM interface, however, may deviate somewhat depending on the line quality, PBX performance, connection protocol, and other elements.

Configuration procedure

To Configure an AM interface:

Step	Command	Remarks
1. Enter system view.	**system-view**	N/A
2. Enter AM interface view.	**interface analogmodem** *number*	N/A
3. Set the coding format of the modem.	**country-code** *area-name*	Optional.

Step	Command	Remarks
		united-states by default.
4. Set asynchronous interface properties.	See "Hardware compatibility with WAN interface."	Optional.

To set the baud rate for an AM interface, use the **speed** command in user-interface view. For more information, see *Fundamentals Configuration Guide*.

The configuration of AM interface is similar to that of asynchronous interface and modem, except that an AM interface does not support the **modem auto-answer** and the **baudrate** commands. For more information about modem configuration, see *Layer 2—WAN Configuration Guide*.

Configure PPP, DCC, IP address, firewall, and backup center on the AM interface if the network requires.

Displaying and maintaining AM interfaces

Task	Command	Remarks
Display information about the specified AM interfaces.	**display interface** [**analogmodem**] [**brief** [**down** | **description**]] [**|** { **begin** | **exclude** | **include** } *regular-expression*] **display interface analogmodem** *interface-number* [**brief** [**description**]] [**|** { **begin** | **exclude** | **include** } *regular-expression*]	Available in any view.
Clear statistics on a specified AM interface.	**reset counters interface** [**analogmodem** [*interface-number*]]	Available in user view.

Configuring an ISDN BRI interface

Overview

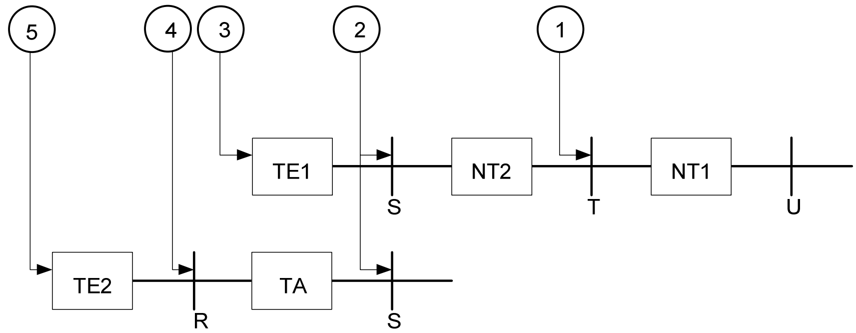
Integrated services digital network (ISDN) is a technology rising in 1970s. It provides all-digital terminal-to-terminal services and fulfills the full digitized delivery of services integrating voice, data, graphics, and video.

ISDN is different from the conventional PSTN network. In a conventional PSTN network, user information is transferred as analog signals over analog user loop to exchanges where these analog signals are converted into digital signals. These digital signals traverse the switched network and transmission network and are converted into the analog signals again upon reaching the destination. ISDN makes it possible to implement digital transmission on a user loop and achieves the end-to-end digitization. As a standardized digital interface, ISDN BRI interface can be used to forward digital and analog information. The standardization efforts that ITU-T made in provisioning the ISDN services make the implementation of ISDN possible. The provisions of the recommendations I.430, Q.921, and Q.931 allow all the devices meeting ITU-T ISDN provisions of unbarring ISDN network access.

The following is the provision standardizing the ISDN user-network interface.

ITU-T I.411 provides the referential ISDN user-network interface configuration as shown in Figure 5 on the basis of function group (a set of functions required for accessing an ISDN network) and reference point (a concept used to differentiate function groups).

Figure 5 Referential ISDN user-network interface configuration



Function groups include:

- Network terminal 1 (NT1) implements the functionality of the first layer in the OSI reference model, such as subscriber-line transmission, loop test, D-channel competition.
- Network terminal 2 (NT2), or named intelligent network terminal, implements the functionality of layers 1 through 3.
- Category-1 terminal equipment (TE1), or named ISDN standard terminal, is user equipment compliant with the ISDN interface provisions. Digital phone-set is such an example.
- Category-2 terminal equipment (TE2), or named non-ISDN standard terminal equipment, refers to the user equipment incompliant with the ISDN interface provisions.
- Terminal adapter (TA) implements the adaptation function so that TE2 can access a standard ISDN interface.

Reference points include:

- **R**—Point between a non-ISDN equipment and TA.
- **S**—Point between a user terminal and NT2.
- **T**—Point between NT1 and NT2.
- **U**—Point between NT1 and line terminal.

Preparing for making configuration

Before making configuration, you should:

- Verify the type of the interface provided by your telecom service provider, whether it is ISDN BRI U or ISDN BRI S/T. Despite that ITU-T I.411 has provided an ISDN user-network interface reference model, there are some arguments in the position of the user-network dividing point. Some nations adopt the U interface and some adopt the S/T interface depending on their needs. Identify the interface type provided by your service provider before making a router purchase decision.
- Request for digital service. As ISDN can provide integrated services including both digital and voice, you must request for an ISDN line allowing digital call service so that your router can make digital communications.
- Select connection type, which can be a point-to-point connection or a point-to-multipoint connection (optional). As ISDN supports semi-permanent connection, you can adopt the ISDN leased line in the event that you adopt ISDN only for connecting two fixed points. Otherwise, you must select a point-to-multipoint connection.
- Request for the delivery of Calling Line Identification (CLI) function (optional). With it, you can implement calling number filtering on your ISDN line to reject some users from accessing the local router and hence enhance the network security.

Configuration procedure

ISDN BRI interfaces are used for dialup purpose. For more information about ISBN BRI interface configuration, see *Layer 2—WAN Configuration Guide*.

To configure an ISDN BRI interface:

Step	Command	Remarks
1. Enter system view.	**system-view**	N/A
2. Enter ISDN BRI interface view.	**interface bri** *number*	N/A
3. Configure the interface description.	**description** *text*	Optional. By default, the description of an interface is *interface-name* Interface.
4. Enable external loopback on the ISDN BRI interface.	**loopback** { **b1** | **b2** | **both** }	Disabled by default.
5. Set the MTU for the BRI interface.	**mtu** *size*	Optional. 1500 bytes by default.
6. Set the intended bandwidth for the BRI interface.	**bandwidth** *bandwidth-value*	Optional.
7. Restore the default settings for the BRI interface.	**default**	Optional.
8. Shut down the BRI interface.	**shutdown**	Optional. A BRI interface is up by default.

Displaying and maintaining ISDN BRI interfaces

Task	Command	Remarks
Display information about the specified ISDN BRI interfaces.	**display interface** [**bri**] [**brief** [**down** | **description**]] [**|** { **begin** | **exclude** | **include** } *regular-expression*] **display interface bri** *interface-number* [**brief** [**description**]] [**|** { **begin** | **exclude** | **include** } *regular-expression*]	Available in any view.
Clear statistics on a specified ISDN BRI interface.	**reset counters interface** [**bri** [*interface-number*]]	Available in user view.

Configuring a CE1/PRI interface

Overview

In 1960s, the time division multiplexing (TDM) technology gained increasing popularity in data communications systems along with the introduction of pulse code modulation (PCM) technology. So far, there are two TDM systems in the data communications system:

- **E1 system**—Recommended by ITU-T and widely used in Europe and P.R. China.

- **T1 system**—Recommended by ANSI and widely used in North American and Japan. (Japan actually uses the J1 system. It is regarded as a T1 system due to the high level of similarity between them.)

A CE1/PRI interface can operate in either E1 mode (also called non-channelized mode) or CE1/PRI mode (also called channelized mode).

1. A CE1/PRI interface in E1 mode is an interface of 2.048 Mbps data bandwidth, on which no timeslots are divided. Its logical features are the same as those of a synchronous serial interface. It supports link layer protocols such as PPP, FR, LAPB, and X.25 and the network protocols such as IP and IPX.
2. A CE1/PRI interface in CE1/PRI mode is physically divided into 32 timeslots numbered 0 to 31. Timeslot 0 is used to transmit synchronizing information. This interface can be used as either a CE1 interface or a PRI interface.
   - When this interface is used as a CE1 interface, all the timeslots except timeslot 0 can be randomly divided into multiple channel sets and each set can be used as an interface upon timeslot bundling. Its logical features are the same as those of a synchronous serial interface. It supports link layer protocols such as PPP, HDLC, FR, LAPB, and X.25, and network protocols such as IP.
   - When the interface is used as a PRI interface, timeslot 16 will be used as a D channel to transmit signaling. Therefore, rather than selecting among all the timeslots, you are only allowed to make a random B channel selection among the timeslot sets except timeslots 0 and 16. The selected set of timeslots can be bundled together with timeslot 16 to form a PRI set that can be used as an interface. The logical features of this interface are the same as those of an ISDN PRI interface. It supports link layer protocols such as PPP, HDLC, FR, LAPB, and X.25, and network protocols such as IP.

Configuring a CE1/PRI interface in E1 mode

Step	Command	Remarks
1. Enter system view.	**system-view**	N/A
2. Enter CE1/PRI interface view.	**controller e1** *number*	N/A
3. Configure the interface to operate in E1 mode.	**using e1**	By default, a CE1/PRI interface operates in CE1/PRI mode.
4. Set other interface parameters.	See "Configuring other CE1/PRI interface parameters."	Optional.

After you configure the CE1/PRI interface to operate in E1 mode, the system automatically creates a serial interface numbered **serial** *interface-number*:**0**. This interface is logically equivalent to a synchronous serial interface where you can make other configurations such as:

- Parameters of data link protocol such as PPP, FR, LAPB, or X.25
- IP addressing
- Backup center settings if the interface is used as a primary or secondary interface for backup
- NAT and packet filtering if a firewall is to be set up

Configuring a CE1/PRI interface in CE1 mode

Step	Command	Remarks
1. Enter system view.	**system-view**	N/A
2. Enter CE1/PRI interface view.	**controller e1** *number*	N/A

Step	Command	Remarks
3. Configure the interface to operate in CE1/PRI mode.	**using ce1**	Optional. The default operating mode is CE1/PRI mode.
4. Bundle timeslots on the interface into a channel set.	**channel-set** *set-number* **timeslot-list** *list*	N/A
5. Enable RAI detection on the interface.	**alarm detect rai**	Optional. Enabled by default.
6. Set other interface parameters.	See "Configuring other CE1/PRI interface parameters."	Optional.

A CE1/PRI interface operating in CE1/PRI mode can be used as a CE1 interface where a serial interface is created upon creation of a channel set. You may bundle timeslots on a CE1/PRI interface into up to 31 channel sets.

For each channel set, the system automatically creates a serial interface numbered **serial** *interface-number*:*set-number*. This interface is logically equivalent to a synchronous serial interface where you can make other configurations such as:

- Data link protocol such as PPP, FR, LAPB, or X.25
- IP addressing
- Backup center settings if the interface is used as a primary or secondary interface for backup
- NAT and packet filtering if a firewall is to be set up

NOTE:

The timeslots on a CE1/PRI interface can be bundled into either channel sets or a PRI set, but not the both, at a time.

Configuring a CE1/PRI interface in PRI mode

Step	Command	Remarks
1. Enter system view.	**system-view**	N/A
2. Enter CE1/PRI interface view.	**controller e1** *number*	N/A
3. Configure the interface to operate in CE1/PRI mode.	**using ce1**	Optional. The default operating mode is CE1/PRI mode.
4. Bundle timeslots on the interface into a PRI set.	**pri-set** [**timeslot-list** *list*]	If no timeslot range is specified, all timeslots except timeslot 0 form a 30B + D ISDN PRI interface.
5. Set other interface parameters.	See "Configuring other CE1/PRI interface parameters."	Optional.

A CE1/PRI interface in CE1/PRI mode can be used as a PRI interface where only one PRI set can be created.

For the PRI set, the system automatically creates a serial interface numbered **serial** *interface-numbe***:15**. This interface is logically equivalent to an ISDN PRI interface where you can make other configurations such as:

- DCC

- PPP and PPP authentication
- IP addressing
- Backup center settings if the interface is to be used as a primary or secondary interface for backup
- Firewall

NOTE:

The timeslots on a CE1/PRI interface can be bundled into either channel sets or a PRI set, but not both at a time.

Configuring other CE1/PRI interface parameters

Step	Command	Remarks
1. Enter system view.	**system-view**	N/A
2. Enter CE1/PRI interface view.	**controller e1** *number*	N/A
3. Configure the interface description.	**description** *text*	Optional. By default, the description of an interface is *interface-name* Interface.
4. Set the line code format.	**code** { **ami** | **hdb3** }	Optional. The default is high density bipolar 3 (HDB3).
5. Configure to perform AIS (alarm indication signal) test.	**detect-ais**	Optional. By default, AIS test is performed. This command is available when the CE1/PRI interface is operating in E1 mode.
6. Set the cable type.	**cable** { **long** | **short** }	Optional. The default cable setting is long mode.
7. Set the clock mode.	**clock** { **master** | **slave** }	Optional. The default clock mode is **slave**, which is line clock.
8. Enable automatic clock mode change.	**clock-change auto**	Optional. Disabled by default.
9. Set the framing format.	**frame-format** { **crc4** | **no-crc4** }	Optional. The default is no-CRC4.
10. Set the line idle code type.	**idlecode** { **7e** | **ff** }	Optional. The default is 0x7E.
11. Set the type of interframe filling tag.	**itf type** { **7e** | **ff** }	Optional. The default is 0x7E.
12. Set the number of interframe filling tags.	**itf number** *number*	Optional. The default is 4.
13. Set the loopback mode.	**loopback** { **local** | **payload** | **remote** }	Optional. Loopback is disabled by default.

Step	Command	Remarks
14. Enable user data inversion.	**data-coding** { **inverted** | **normal** }	Optional. Disabled by default.
15. Set the intended bandwidth for the CE1/PRI interface.	**bandwidth** *bandwidth-value*	Optional.
16. Set the physical state change suppression interval for the CE1/PRI interface.	**link-delay** *delay-time*	Optional. By default, state change suppression is disabled.
17. Restore the default settings for the CE1/PRI interface.	**default**	Optional.
18. Shut down the CE1/PRI interface.	**shutdown**	Optional. Up by default.
19. Return to system view.	**quit**	N/A
20. Enter the view of the synchronous serial interface created on the CE1/PRI interface.	**interface serial** *interface-number:set-number* or **interface serial** *interface-number*:**15**	N/A
21. Set the CRC mode	**crc** { **16** | **32** | **none** }	Optional. By default, 16-bit CRC is adopted.

Configuring error packets diffusion restraint

The following matrix shows the feature and hardware compatibility:

Hardware	Feature compatibility
MSR800	No
MSR 900	No
MSR900-E	No
MSR 930	No
MSR 20-1X	No
MSR 20	No
MSR 30	Yes
MSR 50	Yes
MSR 2600	Yes
MSR3600-51F	Yes

Error packets diffusion refers to the situation when one timeslot receives a certain error packet. All the other timeslots are affected, and they also receive error packets.

You can restrain error packet diffusion by configuring three parameters: *detect-timer, renew-timer, threshold,* which function in the following way:

If, during the time specified by *detect-timer*, the ratio of error packets on an interface is greater than that specified by *threshold*, the interface is regarded as faulty and is shut down. After waiting for some time specified by *renew-timer,* the interface is brought up again.

To configure error packets diffusion restraint:

Step	Command	Remarks
1. Enter system view.	**system-view**	N/A
2. Enable error packets diffusion restraint.	**error-diffusion restraint enable**	N/A
3. Configure the parameters of error packets diffusion restraint.	**error-diffusion restraint config** *detect-timer renew-timer threshold*	Optional. By default, the value of *detect-timer* is 30 seconds, of *renew-timer* is 600 seconds; the *threshold* is 20%.
4. Restart the channel that is shut down for the sake of error packets restraint.	**error-diffusion restraint restart-channel serial** *interface-number*:*set-number*	Optional.

Displaying and maintaining CE1/PRI interfaces

Task	Command	Remarks
Display the status of a CE1/PRI interface.	**display controller e1** [*interface-number*] [**|** { **begin** | **exclude** | **include** } *regular-expression*]	Available in any view.
Display the status of a channel set or PRI set.	**display interface serial** *interface-number:set-number* [**|** { **begin** | **exclude** | **include** } *regular-expression*]	Available in any view.
Clear the controller counter for a CE1/PRI interface.	**reset counters controller e1** *interface-number*	Available in user view.

Configuring a CT1/PRI interface

Overview

A CT1/PRI interface can operate only in channelized mode. It can be used in the following ways:

- When it is operating as a CT1 interface, all the timeslots (numbered 1 to 24) can be randomly divided into groups. Each of these groups can form one channel set for which the system automatically creates an interface logically equivalent to a synchronous serial interface. This interface supports link layer protocols such as PPP, HDLC, FR, LAPB, and X.25, and network protocols such as IP and IPX.
- When it is operating as a PRI interface, timeslot 24 is used as a D channel for signaling transmission. Therefore, only a group of timeslots except timeslot 24 can be chosen as the B channel. This timeslot group is bundled together with timeslot 24 to form a PRI set. This PRI set will operate as an interface logically equivalent to an ISDN PRI interface where you can configure PPP, HDLC, FR, LAPB, or X.25 at the data link layer, IP at the network layer, DCC, and other configurations.

NOTE:

The timeslots on a CT1/PRI interface can be bundled into either channel sets or a PRI set at a time.

Configuring a CT1/PRI interface in CT1 mode

Step	Command	Remarks
1. Enter system view.	**system-view**	N/A
2. Enter CT1/PRI interface view.	**controller t1** *number*	N/A
3. Bundle timeslots on the interface into a channel set.	**channel-set** *set-number* **timeslot-list** *list* [**speed** { **56k** | **64k** }]	Up to 24 channel sets can be bundled. The default timeslot speed is 64 kbps.
4. Set other interface parameters.	See "Configuring other CT1/PRI interface parameters."	Optional.

For each channel set, the system automatically creates a serial interface numbered **serial** *number*:*set-number*. This interface is logically equivalent to a synchronous serial interface where you can make other configurations about:

- Data link protocol such as PPP, FR, LAPB, or X.25
- IP addressing
- Backup center settings if the interface is used as a primary or secondary interface for backup
- NAT and packet filtering if a firewall is to be set up

Configuring a CT1/PRI interface in PRI mode

Step	Command	Remarks
1. Enter system view.	**system-view**	N/A
2. Enter CT1/PRI interface view.	**controller t1** *number*	N/A
3. Bundle timeslots on the interface into a PRI set.	**pri-set** [**timeslot-list** *list*]	Only one PRI set can be created at a time.
4. Set other interface parameters.	See "Configuring other CT1/PRI interface parameters."	Optional.

For the PRI set, the system automatically creates a serial interface numbered **serial** *number*:**23**. This interface is logically equivalent to an ISDN PRI interface where you can make other configurations about:

- DCC
- PPP and PPP authentication
- IP addressing
- Backup center settings if the interface is to be used as a primary or secondary interface for backup
- Firewall, if any

Configuring other CT1/PRI interface parameters

To configure other CT1/PRI interface parameters:

Step	Command	Remarks
1. Enter system view.	**system-view**	N/A
2. Enter CT1/PRI interface view.	**controller t1** *number*	N/A
3. Configure the interface description.	**description** *text*	Optional. By default, the description of an interface is *interface-name* Interface.
4. Set the cable length and attenuation.	**cable long** { **0db** | **-7.5db** | **-15db** | **-22.5db** } **cable short** { **133ft** | **266ft** | **399ft** | **533ft** | **655ft** }	Optional. The **long 0db** keyword applies by default.
5. Set the line code format.	**code** { **ami** | **b8zs** }	Optional. The default is B8ZS[1].
6. Set the clock mode.	**clock** { **master** | **slave** }	Optional. The default is **slave**, which is line clock.
7. Set the framing format.	**frame-format** { **sf** | **esf** }	Optional. The default is ESF.
8. Enable RAI detection on the interface.	**alarm detect rai**	Optional. Enabled by default. This command is applicable when the framing format is ESF.
9. Enable user data inversion.	**data-coding** { **normal** | **inverted** }	Optional. Disabled by default.
10. Set the line idle code type.	**idlecode** { **7e** | **ff** }	Optional. The default is 0x7E.
11. Set the type of interframe filling tag.	**itf type** { **7e** | **ff** }	Optional. The default is 0x7E.
12. Set the number of interframe filling tags.	**itf number** *number*	Optional. The default is 4.
13. Set alarm thresholds.	**alarm-threshold** { **ais** { **level-1** | **level-2** } | **lfa** { **level-1** | **level-2** | **level-3** | **level-4** } | **los** { **pulse-detection** | **pulse-recovery** } *value* }	Optional. By default: • For LOS[3] alarm, the threshold of **pulse-detection** is 176 and the threshold of **pulse-recovery** is 22. If the number of the pulses detected during the total length of 176 pulse detection intervals is smaller than 22, the **pulse-recovery** threshold, a LOS alarm occurs. • Both AIS[4] alarm threshold and LFA[5] alarm threshold are level-1.
14. Set the behavior of the interface on the FDL in ESF framing.	**fdl** { **ansi** | **att** | **both** | **none** }	Optional. The default is none, meaning that

Step	Command	Remarks
		FDL is forbidden.
15. Enable loopback.	**loopback** { **local** | **payload** | **remote** }	Optional. Disabled by default.
16. Send remote loopback control code.	**sendloopcode** { **fdl-ansi-llb-down** | **fdl-ansi-llb-up** | **fdl-ansi-plb-down** | **fdl-ansi-plb-up** | **fdl-att-plb-down** | **fdl-att-plb-up** | **inband-llb-down** | **inband-llb-up** }	Optional. No remote loopback control code is sent by default.
17. Set the intended bandwidth for the CT1/PRI interface.	**bandwidth** *bandwidth-value*	Optional.
18. Set the physical state change suppression interval for the CT1/PRI interface.	**link-delay** *delay-time*	Optional. By default, state change suppression is disabled.
19. Restore the default settings for the CT1/PRI interface.	**default**	Optional.
20. Shut down the CT1/PRI interface.	**shutdown**	Optional. A CT1/PRI interface is up by default.
21. Return to system view.	**quit**	N/A
22. Enter the view of the synchronous serial interface created on the CT1/PRI interface.	**interface serial** *interface-number:set-number* or **interface serial** *interface-number*:**23**	N/A
23. Set the CRC mode.	**crc** { **16** | **32** | **none** }	Optional. By default, 16-bit CRC is adopted..
Note: 1. B8ZS = Bipolar 8 zero substitution; 2. ESF = Extended super frame; 3. LOS = Loss of signal; 4. AIS = Alarm indication signal; 5. LFA = Loss of frame align		

Starting/terminating a BERT test on a CT1/PRI interface

Bit error rate test (BERT) operates as follows:

The local end sends out a pattern, which is to be looped over somewhere on the line and back to the local end. The local end then checks the received pattern for the bit error rate, and by so doing helps you determine whether the condition of the line is good. To this end, you must configure loopback to allow the transmitted pattern to loop back from somewhere on the line, for example, from the far-end interface by placing the interface in far-end loopback.

You may view the state and result of the BERT test with the **display controller t1** command.

To start/terminate a BERT test on a CT1/PRI interface:

Step	Command	Remarks
1. Enter system view.	**system-view**	N/A

Step		Command	Remarks
2.	Enter CT1/PRI interface view.	**controller t1** *number*	N/A
3.	Start a BERT test.	**bert pattern** { **2^20** | **2^15** } **time** *minutes* [**unframed**]	By default, no BERT test is performed.

Configuring error packets diffusion restraint

The following matrix shows the feature and hardware compatibility:

Hardware	Feature compatibility
MSR800	No
MSR 900	No
MSR900-E	No
MSR 930	No
MSR 20-1X	No
MSR 20	No
MSR 30	Yes
MSR 50	Yes
MSR 2600	Yes
MSR3600-51F	Yes

Error packets diffusion refers to the situation when one timeslot receives a certain error packet, all the other timeslots are affected and also receive error packets.

You can restrain error packet diffusion by configuring three parameters: *detect-timer, renew-timer,* and *threshold,* which function in the following way:

If, during the time specified by *detect-timer*, the ratio of error packets on an interface is greater than that specified by *threshold*, the interface is regarded as faulty and is shut down. After waiting for some time specified by *renew-timer,* the interface is brought up again.

To configure error packets diffusion restraint:

Step		Command	Remarks
1.	Enter system view.	**system-view**	N/A
2.	Enable error packets diffusion restraint.	**error-diffusion restraint enable**	N/A
3.	Configure the parameters of error packets diffusion restraint.	**error-diffusion restraint config** *detect-timer renew-timer threshold*	Optional. By default, the values are 30 seconds for *detect-timer*, 600 seconds for *renew-timer* and 20% for the *threshold.*
4.	Restart the channel that is shut down for the sake of error packets restraint.	**error-diffusion restraint restart-channel serial** *interface-number*:*set-number*	Optional.

Displaying and maintaining CT1/PRI interfaces

Task	Command	Remarks
Display the status of a CT1/PRI interface.	**display controller t1** [*interface-number*] [**|** { **begin** | **exclude** | **include** } *regular-expression*]	Available in any view.
Display the status of a channel set or PRI set.	**display interface serial** *interface-number:set-number* [**|** { **begin** | **exclude** | **include** } *regular-expression*]	Available in any view.
Clear the controller counter for a CE1/PRI interface.	**reset counters controller t1** *interface-number*	Available in user view.

Configuring an E1-F interface

Overview

E1-F interfaces, which are fractional E1 interfaces, are simplified CE1/PRI interfaces. They are a cost-effective alternative to CE1/PRI interfaces where E1 access does not need multiple channel sets or ISDN PRI.

Compared with a CE1/PRI interface, an E1-F interface delivers these features:

- In framed mode, it can only bind timeslots into one channel set, but a CE1/PRI interface can group and bundle timeslots randomly into multiple channel sets.
- It does not support PRI mode.

An E1-F interface can operate in either framed (the default) or unframed mode.

When an E1-F interface is operating in unframed mode, it is a non-timeslot interface with 2048 kbps of data bandwidth. It is logically equivalent to a synchronous serial interface where you may configure PPP, HDLC, FR, LAPB or X.25 at the link layer and IP at the network layer.

When an E1-F interface is operating in framed mode, it is physically divided into 32 timeslots numbered 0 through 31. Except timeslot 0 used for transmitting synchronization information, all other timeslots can randomly form one channel set. The rate of the interface is n × 64 kbps and its logical features are the same as those of a synchronous serial interface where you can configure PPP, FR, LAPB and X.25 at the data link layer and IP or IPX at the network layer.

Configuring an E1-F interface in framed mode

Step	Command	Remarks
1. Enter system view.	**system-view**	N/A
2. Enter E1-F interface view.	**interface serial** *interface-number*	N/A
3. Configure the interface to operate in framed mode.	**undo fe1 unframed**	Optional. The default is framed mode.
4. Bundle timeslots on the interface.	**fe1 timeslot-list** *range*	Optional. If no timeslot range is specified, all timeslots are bundled by default.
5. Enable RAI detection on the interface.	**fe1 alarm detect rai**	Optional. Enabled by default.

Step	Command	Remarks
6. Set other interface parameters.	See "Configuring other E1-F interface parameters."	Optional.

Configuring an E1-F interface in unframed mode

Step	Command	Remarks
1. Enter system view.	**system-view**	N/A
2. Enter E1-F interface view.	**interface serial** *interface-number*	N/A
3. Configure the interface to operate in unframed mode.	**fe1 unframed**	The default is framed mode.
4. Set other interface parameters.	See "Configuring other E1-F interface parameters."	Optional.

Configuring other E1-F interface parameters

Step	Command	Remarks
1. Enter system view.	**system-view**	N/A
2. Enter E1-F interface view.	**interface serial** *serial-number*	N/A
3. Configure the interface description.	**description** *text*	Optional. By default, the description of an interface is *interface-name* Interface.
4. Set the line code format.	**fe1 code** { **ami** | **hdb3** }	Optional. The default is HDB3.
5. Set the clock mode.	**fe1 clock** { **master** | **slave** }	Optional. The default is **slave**, which is line clock.
6. Enable automatic clock mode change.	**clock-change auto**	Optional. Disabled by default.
7. Set the cable type.	**fe1 cable** { **long** | **short** }	Optional. The **long** keyword applies by default.
8. Configure the CRC mode.	**crc** { **16** | **32** | **none** }	Optional. 16-bit CRC by default.
9. Set the framing format.	**fe1 frame-format** { **crc4** | **no-crc4** }	Optional. The default is no-CRC4.
10. Set the line idle code type.	**fe1 idlecode** { **7e** | **ff** }	Optional. The default is 0x7E.
11. Set the interframe filling tag type.	**fe1 itf type** { **7e** | **ff** }	Optional. The default is 0x7E.
12. Set the number of interframe filling tags.	**fe1 itf number** *number*	Optional. The default is 4.

Step	Command	Remarks
13. Enable loopback and set the loopback mode.	**fe1 loopback** { **local** | **payload** | **remote** }	Optional. Loopback is disabled by default.
14. Enable user data reversion.	**fe1 data-coding** { **inverted** | **normal** }	Optional. Disabled by default.
15. Set the intended bandwidth for the E1-F interface.	**bandwidth** *bandwidth-value*	Optional.
16. Set the physical state change suppression interval for the E1-F interface.	**link-delay** *delay-time*	Optional. By default, state change suppression is disabled.
17. Restore the default settings for the E1-F interface.	**default**	Optional.
18. Shut down the E1-F interface.	**shutdown**	Optional. An E1-F interface is up by default.
19. Start a loop test.	**looptest** [**-c** *count* | **-p** { *pattern* | **special** { **ascending** | **descending** | **random** } } | **-s** *packetsize* | **-t** *timeout*] * **interface** *type number*	Optional. This command is available only on synchronous serial interfaces created for E1, T1, E1-F, or T1-F.

Displaying and maintaining E1-F interfaces

Task	Command	Remarks
Display the configuration and status of a specified or all E1-F interfaces.	**display fe1** [**serial** *interface-number*] [**|** { **begin** | **exclude** | **include** } *regular-expression*]	Available in any view.
Display the status of an E1-F interface.	**display interface serial** *interface-number* [**|** { **begin** | **exclude** | **include** } *regular-expression*]	Available in any view.

Configuring a T1-F interface

Overview

T1-F interfaces, fractional T1 interfaces, are simplified CT1/PRI interfaces. They are a cost-effective alternative to CT1/PRI interfaces where T1 access does not need multiple channel sets or ISDN PRI.

Compared with a CT1/PRI interface, a T1-F interface delivers these features:

- In framed mode, it can bind timeslots into only one channel set, but a CT1/PRI interface can group and bundle timeslots randomly into multiple channel sets.
- It does not support PRI mode.

A T1 line is multiplexed from 24 channels. A T1 primary group frame DS1 (digital signal level-1) comprises 24 DS0 (64 kbps) timeslots and 1 framing bit for synchronization, with each timeslot being 8 bits. Each primary group frame has 193 bits (24 × 8+1). As DS1 can transmit 8000 frames per second, its transmission speed is 1544 kbps (193 × 8 kbps).

A T1-F interface can only operate in framed mode. Timeslots 1 through 24 on it can randomly form a channel set. The rate of the interface is n × 64 kbps or n × 56 kbps and its logical features are the same as those of a synchronous serial interface where you can configure PPP, FR, LAPB and X.25 at the data link layer and IP at the network layer.

Configuration procedure

To Configure a T1-F interface:

Step	Command	Remarks
1. Enter system view.	**system-view**	N/A
2. Enter T1-F interface view.	**interface serial** *interface-number*	N/A
3. Configure the interface description.	**description** *text*	Optional. By default, the description of an interface is *interface-name* Interface.
4. Bundle timeslots on the interface into a channel set.	**ft1 timeslot-list** *range* [**speed** { **56k** | **64k** }]	If no timeslot range is specified, all timeslots are bundled into one channel set. The default timeslot speed is 64 kbps, and the default T1-F interface speed is 1536 kbps.
5. Set the cable length and attenuation.	**ft1 cable** { **long** *decibel* | **short** *length* }	Optional. The **long 0db** keyword applies by default.
6. Set the line code format.	**ft1 code** { **ami** | **b8zs** }	Optional. The default is B8ZS.
7. Set the clock mode.	**ft1 clock** { **master** | **slave** }	Optional. The default is **slave**, which is line clock.
8. Enable user data inversion.	**ft1 data-coding** { **inverted** | **normal** }	Optional. Disabled by default.
9. Set the behavior of the interface on the FDL in ESF framing.	**ft1 fdl** { **ansi** | **att** | **both** | **none** }	Optional. FDL is disabled by default.
10. Set the CRC mode.	**crc** { **16** | **32** | **none** }	Optional. 16-bit CRC by default.
11. Set the framing format.	**ft1 frame-format** { **esf** | **sf** }	Optional. The default is esf.
12. Enable RAI detection on the interface.	**ft1 alarm detect rai**	Optional. Enabled by default. This command is applicable when the framing format is ESF.
13. Set alarm thresholds.	**ft1 alarm-threshold** { **ais** { **level-1** | **level-2** } | **lfa** { **level-1** | **level-2** | **level-3** | **level-4** } | **los** { **pulse-detection** | **pulse-recovery** } *value* }	Optional. By default: • For LOS alarm, the threshold of **pulse-detection** is 176 and the threshold of **pulse-recovery** is 22. If the number of the pulses detected during the total length of 176 pulse detection

Step	Command	Remarks
		intervals is smaller than 22, the **pulse-recovery** threshold, a LOS alarm occurs. • Both AIS alarm threshold and LFA alarm threshold are level-1.
14. Set the type of line idle code.	**ft1 idlecode** { **7e** | **ff** }	Optional. The default is 0x7E.
15. Set the type of interframe filling tag.	**ft1 itf type** { **7e** | **ff** }	Optional. The default is 0x7E.
16. Set the number of interframe filling tags.	**ft1 itf number** *number*	Optional. The default is 4.
17. Enable loopback and set the loopback mode.	**ft1 loopback** { **local** | **remote** | **payload** }	Optional. Loopback is disabled by default.
18. Send remote control loopback code.	**ft1 sendloopcode** { **fdl-ansi-llb-down** | **fdl-ansi-llb-up** | **fdl-ansi-plb-down** | **fdl-ansi-plb-up** | **fdl-att-plb-down** | **fdl-att-plb-up** | **inband-llb-down** | **inband-llb-up** }	Optional. No remote control code is sent by default.
19. Set the intended bandwidth for the T1-F interface.	**bandwidth** *bandwidth-value*	Optional.
20. Set the physical state change suppression interval for the T1-F interface.	**link-delay** *delay-time*	Optional. By default, state change suppression is disabled.
21. Restore the default settings for the T1-F interface.	**default**	Optional.
22. Shut down the T1-F interface.	**shutdown**	Optional. A T1-F interface is up by default.
23. Start a loop test.	**looptest** [**-c** *count* | **-p** { *pattern* | **special** { **ascending** | **descending** | **random** } } | **-s** *packetsize* | **-t** *timeout*] * **interface** *type number*	Optional. This command is available only on synchronous serial interfaces created for E1, T1, E1-F, or T1-F.

Starting/terminating a BERT test on a T1-F interface

BERT is operating as follows:

The local end sends out a pattern, which is to be looped over somewhere on the line and back to the local end. The local end then checks the received pattern for the bit error rate, and by so doing helps you determine whether the condition of the line is good. To this end, you must configure loopback to allow the transmitted pattern to loop back from somewhere on the line, for example, from the far-end interface by placing the interface in far-end loopback.

You may view the state and result of the BERT test with the **display ft1 serial** command.

To start/terminate a BERT test on a T1-F interface:

Step		Command	Remarks
1.	Enter system view.	**system-view**	N/A
2.	Enter T1-F interface view.	**interface serial** *interface-number*	N/A
3.	Start a BERT test.	**ft1 bert pattern** { **2^20** | **2^15** } **time** *minutes* [**unframed**]	By default, no BERT test is performed.

Displaying and maintaining T1-F interfaces

Task	Command	Remarks
Display information about a specified or all T1-F interfaces.	**display ft1** [**serial** *interface-number*] [**|** { **begin** | **exclude** | **include** } *regular-expression*]	Available in any view.
Display the status of a specified T1-F interface.	**display interface serial** *serial-number* [**|** { **begin** | **exclude** | **include** } *regular-expression*]	Available in any view.

Configuring a CE3 interface

Overview

Like E1, E3 also belongs to the digital carrier system of ITU-T. It transmits data at 34.368 Mbps and adopts HDB3 as the line code format.

A CE3 interface can operate in either E3 or CE3 (the default) mode.

- A CE3 interface in E3 mode is an interface with 34.368 Mbps data bandwidth, on which, no timeslots are divided. The system automatically creates a serial interface numbered **serial** *number/line-number***/0:0** for it. This interface operates at 34.368 Mbps and is logically equivalent to a synchronous serial interface where you can make other configurations.
- A CE3 interface in CE3 mode can demultiplex 16 channels of E1 signals in compliance with ITU-T G.751 and G.742. Each E1 line can be divided into 32 timeslots numbered 0 to 31, of which timeslots 1 through 31 can be randomly bundled into N × 64 kbps logical channels. (Timeslot 0 for framing signal transmission must not participate in bundling operation.) Therefore, CE3 can be channelized into E1 lines or CE1 lines.

When an E1 line is operating in unframed (E1) mode, the system automatically creates a serial interface numbered **serial** *number*/*line-number***:0** for it. This interface operates at 2048 kbps and is logically equivalent to a synchronous serial interface where you can make other configurations.

When the E1 line is operating in framed (CE1) mode, you can bundle timeslots on it. The system automatically creates a serial interface numbered **serial** *number***/***line-number***:***set-number* for it. This interface operates at N × 64 kbps and is logically equivalent to a synchronous serial interface where you can make other configurations.

CE3 interfaces support link layer protocols PPP, HDLC, FR, LAPB, and X.25 and network protocol IP.

Configuring a CE3 interface in E3 mode

Step		Command	Remarks
1.	Enter system view.	**system-view**	N/A
2.	Enter CE3 interface view.	**controller e3** *interface-number*	N/A

Step	Command	Remarks
3. Configure the interface to operate in E3 mode.	**using e3**	The default operating mode is CE3 mode.
4. Configure the interface to operate in FE3 mode and set the DSU mode or the subrate.	**fe3** { **dsu-mode** { **0** | **1** } | **subrate** *number* }	Optional. By default, DSU mode 1 (the Kentrox mode) is adopted, and the subrate is 34010 kbps.
5. Set other interface parameters.	See "Configuring other CE3 interface parameters."	Optional.

Configure PPP, FR, and IP address for the CE3 interface if the network requires.

Configuring a CE3 interface in CE3 mode

Step	Command	Remarks
1. Enter system view.	**system-view**	N/A
2. Enter CE3 interface view.	**controller e3** *interface-number*	N/A
3. Configure the interface to operate in CE3 mode.	**using ce3**	Optional. The default operating mode is CE3 mode.
4. Set the operating mode of an E1 line on the CE3 interface to unframed mode or framed mode.	• Method 1: Set the operating mode to unframed (E1) mode: **e1** *line-number* **unframed** • Method 2: Set the operating mode to framed (CE1) mode and bundle timeslots on the CE1 interface: **a.** (Optional) **undo e1** *line-number* **unframed** **b.** **e1** *line-number* **channel-set** *set-number* **timeslot-list** *list*	By default: • In method 1, the operating mode is CE1. • In method 2, the operating mode is framed, and no channel sets are created.
5. Set other interface parameters.	See "Configuring other CE3 interface parameters."	Optional.

Configure PPP, FR, and IP address for the CE3 interface if the network requires.

Configuring other CE3 interface parameters

To configure other CE3 interface parameters:

Step	Command	Remarks
1. Enter system view.	**system-view**	N/A
2. Enter CE3 interface view.	**controller e3** *interface-number*	N/A
3. Configure the interface description.	**description** *text*	Optional. By default, the description of an interface is

Step	Command	Remarks
		interface-name Interface.
4. Configure the CE3 interface to perform BERT test, and configure the CE3 interface to perform BERT test on an E1 channel created on the interface.	**bert pattern** { **2^7** | **2^11** | **2^15** | **qrss** } **time** *number* [**unframed**] **e1** *line-number* **bert pattern** { **2^11** | **2^15** | **2^20** | **2^23** | **qrss** } **time** *number* [**unframed**]	Optional. By default, no BERT test is performed.
5. Set the clock mode.	• For the CE3 interface: **clock** { **master** | **slave** } • For an E1 line: **e1** *line-number* **set clock** { **master** | **slave** }	Optional. The default mode for both the CE3 interface and E1 line is **slave**, which is line clock.
6. Set the national bit.	**national-bit** { **0** | **1** }	Optional. The default is 1.
7. Enable loopback.	• For the CE3 interface: **loopback** { **local** | **payload** | **remote** } • For an E1 line: **e1** *line-number* **set loopback** { **local** | **remote** | **payload** }	Optional. Loopback is disabled by default.
8. Set E1 framing format on an E1 line.	**e1** *line-number* **set frame-format** { **crc4** | **no-crc4** }	Optional. The default is **no-crc4**.
9. Set the intended bandwidth for the CE3 interface.	**bandwidth** *bandwidth-value*	Optional.
10. Set the physical state change suppression interval for the CE3 interface.	**link-delay** *delay-time*	Optional. By default, state change suppression is disabled.
11. Restore the default settings for the CE3 interface.	**default**	Optional.
12. Return to system view.	**quit**	N/A
13. Enter synchronous serial interface view of an interface formed by a CE3 interface.	**interface serial** *number*/*line-number*:**0** or **interface serial** *number*/*line-number*:*set-number*	N/A
14. Set the CRC mode	**crc** { **16** | **32** | **none** }	Optional. By default, 16-bit CRC is adopted.

Displaying and maintaining CE3 interfaces

CAUTION:

Perform shutdown operations with caution, because once an interface is shut down, it stops operating.

Shutting down/bringing up a CE3 interface also shuts down/brings up the E1 lines demultiplexed from the CE3 interface, the serial interfaces formed by the E1 lines, and the serial interfaces created on E1 lines by means of timeslot bundling.

Shutting down/bringing up an E1 line also shuts down/brings up the serial interface formed by it and the serial interface created on it by means of timeslot bundling.

To shut down/bring up only a serial interface formed by E3 or E1 lines, or by timeslot bundling on an E1 line, run the **shutdown/undo shutdown** command in the view of the corresponding serial interface.

To display and maintain CE3 interfaces:

Task	Command	Remarks
Display the state information of a CE3 interface.	**display controller e3** [*interface-number*] [**|** { **begin** | **exclude** | **include** } *regular-expression*]	Available in any view.
Display the configuration and state of a serial interface formed on a CE3 interface.	**display interface serial** *interface-number* [**|** { **begin** | **exclude** | **include** } *regular-expression*]	Available in any view.
Clear the controller counter of a CE3 interface.	**reset counters controller e3** *interface-number*	Available in user view.
Shut down a CE3 interface.	**shutdown**	Available in CE3 interface view.
Bring up a CE3 interface.	**undo shutdown**	Available in CE3 interface view.
Shut down an E1 line.	**e1** *line-number* **shutdown**	Available in CE3 interface view.
Bring up an E1 line.	**undo e1** *line-number* **shutdown**	Available in CE3 interface view.

Configuring a CT3 interface

Overview

Both T3 and T1 belong to the T-carrier system promoted by ANSI. T3 uses the digital signal level DS-3 and operates at 44.736 Mbps.

CT3 interfaces support two operating modes: T3 (unchannelized) and CT3 (channelized).

- In T3 mode, a CT3 interface is a synchronous serial interface with 44.736 Mbps of data bandwidth, on which, no timeslots are divided.
- In CT3 mode, a CT3 interface can be demultiplexed into 28 channels of T1 signals. Each T1 line can be divided into 24 timeslots numbered 1 through 24. Different from E1, each line on a T1 interface can operate at either 64 kbps or 56 kbps. Therefore, the number of logical lines that can be created on a CT3 interface in CT3 mode is either M × 1.536 Mbps (where **M** ranges from 1 to 28) or N × 56 kbps or N x 64 kbps (where **N** ranges from 1 to 300).

When a T1 line is operating in unframed (T1) mode, the system automatically creates a serial interface numbered **serial** *number***/***line-number***:0** for it. This interface operates at 1544 kbps and is logically equivalent to a synchronous serial interface where you can make other configurations.

When the T1 line is operating in framed (CT1) mode, you can bundle timeslots on it. The system automatically creates a serial interface numbered **serial** *number***/***line-number***:***set-number* for it. This interface operates at N × 64 kbps or N × 56 kbps and is logically equivalent to a synchronous serial interface where you can make other configurations.

Configuring a CT3 interface in T3 mode

Step	Command	Remarks
1. Enter system view.	**system-view**	N/A
2. Enter CT3 interface view.	**controller t3** *interface-number*	N/A
3. Configure the interface to operate in T3 mode.	**using t3**	The default operating mode is CT3 mode.
4. Configure the interface to operate in the FT3 mode and set the DSU mode or the subrate.	**ft3** { **dsu-mode** { **0** | **1** | **2** | **3** | **4** } | **subrate** *number* }	Optional. By default, DSU mode 0 (the digital link mode) is adopted, and the subrate is 44210 kbps.
5. Set other interface parameters.	See "Configuring other CT3 interface parameters."	Optional.

Serial interfaces created on CT3 interfaces support PPP, HDLC, FR, LAPB, and X.25 at the data link layer, and IP at the network layer. Configure link layer protocols, and IP address for the CT3 interface if the network requires.

Configuring a CT3 interface in CT3 mode

Step	Command	Remarks
1. Enter system view.	**system-view**	N/A
2. Enter CT3 interface view.	**controller t3** *interface-number*	N/A
3. Configure the interface to operate in CT3 mode.	**using ct3**	Optional. The default operating mode is CT3 mode.
4. Set the operating mode of a T1 line on the CT3 interface to unframed mode or framed mode.	• Method 1: Set the operating mode to unframed (T1) mode: **t1** *line-number* **unframed** • Method 2: Set the operating mode to framed (CT1) mode and bundle timeslots on the CT1 interface: **a.** (Optional) **undo t1** *line-number* **unframed** **b.** **t1** *line-number* **channel-set** *set-number* **timeslot-list** *range* [**speed** { **56k** | **64k** }]	By default: • In method 1, the operating mode is CT1. • In method 2, the operating mode is framed, no channel sets are created, and the timeslot speed is 64 kbps.
5. Set other interface parameters.	See "Configuring other CT3 interface parameters."	Optional.

Serial interfaces created on CT3 interfaces support PPP, HDLC, FR, LAPB, and X.25 at the data link layer, and IP at the network layer. Configure link layer protocols, and IP addresses for the CT3 interfaces if the network requires.

Configuring other CT3 interface parameters

Step	Command	Remarks
1. Enter system view.	**system-view**	N/A
2. Enter CT3 interface view.	**controller t3** *interface-number*	N/A
3. Configure the interface description.	**description** *text*	Optional. By default, the description of an interface is *interface-name* Interface.
4. Set the clock mode.	• For the CT3 interface: **clock** { **master** | **slave** } • For a T1 line: **t1** *line-number* **set clock**.{ **master** | **slave** }	Optional. The default clock mode for both the CT3 interface and the T1 line is **slave**, which is line clock.
5. Set the cable length.	**cable** *feet*	Optional. The default is 14.9 meters (49 feet).
6. Set the loopback mode.	• On the CT3 interface: **loopback** { **local** | **payload** | **remote** } • On a T1 line: **t1** *line-number* **set loopback**.{ **local** | **payload** | **remote** }	Optional. Loopback is disabled by default.
7. Set the framing format.	• On the CT3 interface: **frame-format** { **c-bit** | **m23** } • On a T1 line: **t1** *line-number* **set frame-format** { **esf | sf** }	Optional. By default: • The framing format on the CT3 interface is C-bit. • The framing format on the T1 line is ESF.
8. Configure alarm signal detection/sending.	• On the CT3 interface: **alarm** { **detect** | **generate** { **ais** | **febe** | **idle** | **rai** } } • On a T1 line: **t1** *line-number* **alarm** { **detect | generate** { **ais** | **rai** } }	Optional. Alarm detection is enabled by default.
9. Start a BERT test.	• On the CT3 interface: **bert pattern** { **2^7** | **2^11** | **2^15** | **qrss** } **time** *number* [**unframed**] • On a T1 line: **t1** *line-number* **bert pattern** { **2^11** | **2^15** | **2^20** | **2^23** | **qrss** } **time** *number* [**unframed**]	Optional. BERT test is disabled by default.
10. Configure FEAC channel signal detection/sending on the CT3 interface.	• **feac detect** • **feac generate loopback** { **ds3-line** | **ds3-payload** } • **feac generate** { **ds3-los** | **ds3-ais** | **ds3-oof** | **ds3-idle** | **ds3-eqptfail** }	Optional. FEAC channel signal detection is enabled by default, but no FEAC signals are sent.
11. Configure MDL message	**mdl** { **data** { **eic** *string* | **fic** *string* |	Optional.

Step	Command	Remarks
detection/sending on the CT3 interface.	| **gen-no** *string* | **lic** *string* | **pfi** *string* | **port-no** *string* | **unit** *string* } | **detect** | **generate** { **idle-signal** | **path** | **test-signal** } }	By default, MDL message detection and sending are disabled and the default MDL message information applies.
12. Place a T1 line on the far-end CT3 interface in a loopback.	**t1** *line-number* **sendloopcode** { **fdl-ansi-line-up** | **fdl-ansi-payload-up** | **fdl-att-payload-up** | **inband-line-up** }	Optional.
13. Set the FDL format for a T1 channel.	**t1** *line-number* **set fdl** { **ansi** | **att** | **both** | **none** }	Optional. By default, FDL is disabled. This operation applies only to T1 channels that are formed on CT3 interfaces, operate in channelized mode, and use ESF as the T1 framing format.
14. Set the intended bandwidth for the CT3 interface.	**bandwidth** *bandwidth-value*	Optional.
15. Set the physical status suppression time for the CT3 interface.	**link-delay** *delay-time*	Optional By default, state change suppression is disabled.
16. Restore the default settings for the CT3 interface.	**default**	Optional.
17. Return to system view.	**quit**	N/A
18. Enter synchronous serial interface view of an interface formed by a CT3 interfaces.	**interface serial** *number/line-number*:**0** or **interface serial** *number/line-number*:*set-number*	N/A
19. Set the CRC mode.	**crc** { **16** | **32** | **none** }	Optional. By default, 16-bit CRC is adopted..
Note: FEAC = Far end and control signal; MDL = Maintenance data link; PPR = Periodical performance report		

Displaying and maintaining CT3 interfaces

CAUTION:

Perform shutdown operations with caution, because once an interface is shut down, it stops operating.

Shutting down/bringing up a CT3 interface also shuts down/brings up the T1 lines demultiplexed from the CT3 interface, the serial interfaces formed by the T1 lines, and the serial interfaces created on T1 lines by means of timeslot bundling.

Shutting down/bringing up a T1 line also shuts down/brings up the serial interface formed by it and the serial interface created on it by means of timeslot bundling.

To shut down/bring up only a serial interface formed by T3 or T1 lines, or by timeslot bundling on a T1 line, perform the **shutdown/undo shutdown** command in the view of the corresponding serial interface.

To display and maintain CT3 interfaces:

Task	Command	Remarks
Display the state information of CT3 interface.	**display controller t3** [*interface-number*] [**|** { **begin** | **exclude** | **include** } *regular-expression*]	Available in any view.
Display the configuration and state of a serial interface formed on a CT3 interface.	**display interface serial** *interface-number* [**|** { **begin** | **exclude** | **include** } *regular-expression*]	Available in any view.
Clear the controller counter of a CT3 interface.	**reset counters controller t3** *interface-number*	Available in user view.
Display the state of a T1 line.	**t1** *line-number* **show**	Available in CT3 interface view.
Shut down a CT3 interface.	**shutdown**	Available in CT3 interface view.
Bring up a CT3 interface.	**undo shutdown**	Available in CT3 interface view.
Shut down a T1 line.	**t1** *line-number* **shutdown**	Available in CT3 interface view.
Bring up a T1 line.	**undo t1** *line-number* **shutdown**	Available in CT3 interface view.

Configuring ATM and DSL interfaces

ATM and DSL interface

ATM and DSL

Asynchronous Transfer Mode (ATM) is a backbone network technology for transmission of audio, video, and data. By virtue of its flexibility and support for multimedia services, ATM is regarded as a core technology for implementing broadband communications.

Digital Subscriber Line (DSL) is a technology providing high-speed data transmission over copper wires. It includes Asymmetric Digital Subscriber Line (ADSL), High-bit-rate Digital Subscriber Line (HDSL), Very High-rate Digital Subscriber Line (VDSL), single-pair high-speed DSL defined in ITU-T Standard G.991.2 (G.SHDSL), and Symmetric Digital Subscriber Line (SDSL). These DSL technologies are different in signal transmission speed and distance and uplink/downlink rate symmetric mode (whether uplink and downlink rates are the same).

The ATM physical layer lies at the bottom of the ATM reference model. Though it involves specific transmission media, its functionality does not rely on the transmission mechanism and speed of a specific medium. Rather, it primarily delivers valid cells and the associated timing signals between the upper layer and transmission medium. The speeds of physical access media are defined in international standards such as ATM OC-3c/STM-1, ATM E3/T3, and IMA-E1/T1. Most DSL applications are ATM-based, combining the advantages of ATM with the low transmission cost feature of DSL. So far, DSL technologies have been widely adopted for broadband access.

ATM interfaces available on the low-end and mid-range routers

The low-end and mid-range routers provide the following ATM interfaces:

- IMA-E1/T1
- ATM E3/T3
- ATM 25.6 Mbps
- ATM OC-3c/STM-1 based on SONET/SDH
- ATM ADSL based on the ADSL technology
- ATM G.SHDSL based on the G.SHDSL technology

These interfaces support IPoA, IPoEoA, PPPoA, and PPPoEoA. For more information about them, see *Layer 2—WAN Configuration Guide*.

ATM interface features

The ATM interfaces of low-end and middle-range routers support:

- Nonreal-time variable bit rate (nrt_VBR)
- Real-time variable bit rate (rt_VBR)
- Constant bit rate (CBR)
- Unspecified bit rate (UBR)
- Permanent virtual circuit (PVC)
- Per-VC traffic shaping

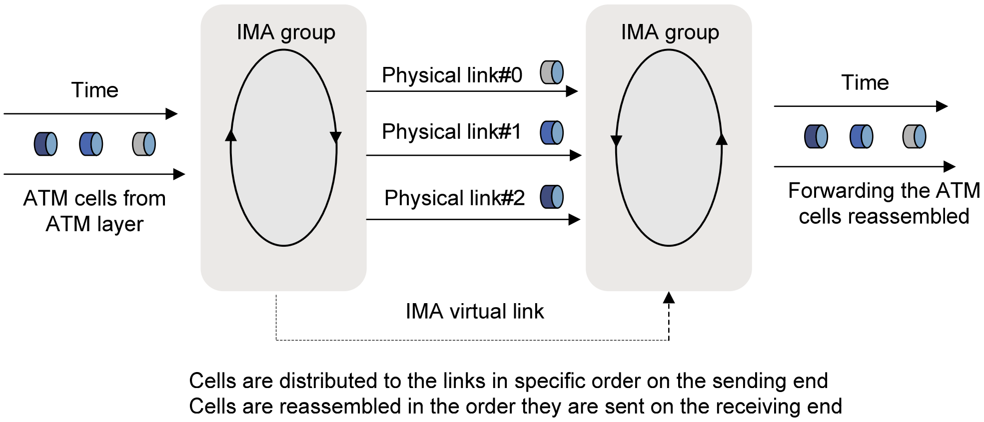
- User-to-network Interface (UNI)
- *RFC1483, Multiprotocol Encapsulation over ATM Adaptation Layer 5*
- RFC2225, *Classical IP and ARP over ATM*
- RFC2390, *Inverse Address Resolution Protocol*
- F5 end to end loopback OAM
- ATM adaptation layer 5 (AAL5)

IMA

Overview

The Inverse Multiplexing for ATM (IMA) technology distributes an ATM cell stream across multiple low-speed links and reassembles the cells into the original stream at the far end. When the ATM cell stream is distributed, a round robin mechanism is invoked. Each of the low-speed links is fed with the ATM cells in a specific order. The ATM cells sent in each round forms an IMA frame. In addition, the IMA interface sends ICP cells (IMA control protocol cells) periodically to identify the IMA frames and for the receiving end to reassemble the distributed ATM cells received. Before reassembling the ATM cells received of an IMA frame, the receiving end adjusts the differential delay of the link and eliminates the cell delay variation (CDV) using the ICP cells received. Because the IMA frames are aligned on the sending end before they are distributed to the low-speed links, the differential delays among the low-speed links can be detected on the receiving end according to the time when the cells transmitted along the low-speed links arrive. IMA requires that cells be sent continuously. If no ATM cells are to be sent between two successive ICP cells, filler cells are inserted, which are simply dropped on the receiving end.

Figure 6 An IMA implementation



IMA is achieved through IMA groups. An IMA group is a collection of physical links grouped to form a higher-bandwidth logical link. The rate of the IMA group is approximately the sum of the individual link rates. IMA provides you a cheap way to transmit high-speed ATM cell streams over low-speed links multiplexed together while allowing for great flexibility.

Configuring an IMA group

Step	Command	Remarks
1. Enter system view	**system-view**	N/A
2. Enter ATM E1/T1 interface view.	**interface atm** *interface-number*	N/A

Step	Command	Remarks
3. Add the current interface to an IMA group.	**ima ima-group** *group-number*	If the IMA group identified by the *group-number* argument does not exist, this command creates the IMA group first.
4. Enter IMA group interface view.	**interface ima-group** *group-interface-number*	N/A
5. Assign an IP address to the IMA group interface.	**ip address** *ip-address address-mask*	By default, an IMA group interface has no IP address.
6. Set the number of the cells an IMA frame contains.	**frame-length** { **32** | **64** | **128** | **256** }	Optional. The default setting is 128.
7. Set the clock mode for the IMA group.	**ima-clock** { **ctc** [**link-number** *number*] | **itc** }	Optional. The default setting is common transmit clock.
8. Set the standard to be used by the IMA group.	**ima-standard** { **alternate-v10** | **normal** | **standard-v10** | **standard-v11** }	Optional. The default setting is **normal**.
9. Set the minimum number of links required for bringing up the IMA group.	**min-active-links** *number*	Optional. The default setting is 1.
10. Set the maximum differential delay allowed between the links.	**differential-delay** *milliseconds*	Optional. The default setting is 25 ms.
11. Enable IMA link test on a link and specify the test pattern.	**ima-test** [**link-number** *number*] [**pattern-id** *id*]	Optional. By default, link test is disabled. If no link is specified, this command enables IMA link test on the first link added to the IMA group. The default test pattern is 0xAA.
12. Set the power backoff (PBO) value, which reduces the transmit power.	**shdsl pbo** { *value* | **auto** }	Optional. The default setting is **auto**.
13. Set the intended bandwidth for the IMA group interface	**bandwidth** *bandwidth-value*	Optional.
14. Restore the default settings for the IMA group interface	**default**	Optional.

Configuring an IMA-E1/T1 interface

The following matrix shows the IMA-E1/T1 interface and hardware compatibility:

Hardware	Interface compatibility
MSR800	No
MSR 900	No

Hardware	Interface compatibility
MSR900-E	No
MSR 930	No
MSR 20-1X	No
MSR 20	No
MSR 30	Yes
MSR 50	Yes
MSR 2600	No
MSR3600-51F	Yes

Overview

The IMA-E1/T1 interface configuration includes two parts: physical parameters of ATM E1/T1 interfaces and IMA features. If no IMA group is configured for transmitting ATM cell streams, the cells are distributed directly over E1/T1 links. You can, however, assign multiple IMA-E1/T1 interfaces to an IMA group to form a higher-speed IMA interface link for ATM cell transmission.

For both IMA groups and the E1/T1 links outside the groups, you can create PVCs, specify service types, and configure the related parameters. For more information (including the configuration of PVCs), see *Layer 2—WAN Configuration Guide*.

Configuration procedure

To configure an IMA E1/T1 interface:

Step	Command	Remarks
1. Enter system view.	**system-view**	N/A
2. Enter ATM E1/T1 interface view.	**interface atm** *interface-number*	N/A
3. Set the clock mode.	**clock** { **master** | **slave** }	Optional. The default setting is **slave**.
4. Enable automatic clock mode change.	**clock-change auto**	Optional. This function is disabled by default.
5. Set the framing format.	• On an E1 interface: **frame-format** { **crc4-adm** | **no-crc4-adm** } • On a T1 interface: **frame-format** { **esf-adm** | **sf-adm** }	Optional. By default, the framing format for an E1 interface is CRC4 ADM and that for an T1 interface is ESF ADM.
6. Set the line coding format.	• On an E1 interface: **code** { **ami** | **hdb3** } • On a T1 interface: **code** { **ami** | **b8zs** }	Optional. The default line coding format for an E1 interface is HDB3 and for a T1 interface is B8ZS.
7. Enable scrambling.	**scramble**	Optional. Scrambling is enabled by default.
8. Set the cable mode for the	**cable** { **long** | **short** }	Optional.

Step	Command	Remarks
ATM E1 interface.		The default cable mode is long. In this mode, the system automatically adapts the cable mode to the cable actually connected.
9. Set the cable mode for the ATM T1 interface.	**cable** { **long** { **0db** | **-7.5db** | **-15db** | **-22.5db** } | **short** { **133ft** | **266ft** | **399ft** | **533ft** | **655ft** } }	Optional. The default setting is **long 0db**.
10. Set the intended bandwidth for the ATM E1/T1 interface.	**bandwidth** *bandwidth-value*	Optional.
11. Restore the default settings for the ATM E1/T1 interface.	**default**	Optional.
12. Configure an IMA group.	See "Configuring an IMA group."	N/A

NOTE:

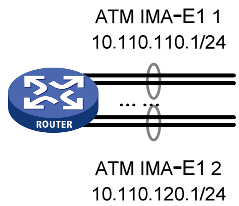
- E1 configurations are supported on the IMA (E1) interface module and T1 configurations on the IMA (T1) interface module.
- The line coding formats for IMA-E1 interfaces and IMA-T1 interfaces are fixed to high-density bipolar 3 (HDB3) and bipolar 8-zero substitution (B8ZS).

ATM IMA-E1/T1 interface configuration example

Network requirements

As shown in Figure 7, on the IMA-8E1 interface module of the router, create two IMA groups, each of which is assigned two links; create two PVCs, setting their peer IP address to 10.10.10.10/24; and configure them to support pseudo broadcast.

Figure 7 Network diagram



Configuration procedure

Assign two links to IMA group 1.

```
<Sysname> system-view
[Sysname] interface atm 1/0
[Sysname-Atm1/0] undo ip address
[Sysname-Atm1/0] ima ima-group 1
[Sysname-Atm1/0] interface atm 1/2
[Sysname-Atm1/2] undo ip address
[Sysname-Atm1/2] ima ima-group 1
[Sysname-Atm1/2] quit
```

Assign another two links to IMA group 2.

```
[Sysname] interface atm 1/3
```

```
[Sysname-Atm1/3] undo ip address
[Sysname-Atm1/3] ima ima-group 2
[Sysname-Atm1/3] interface atm 1/4
[Sysname-Atm1/4] undo ip address
[Sysname-Atm1/4] ima ima-group 2
[Sysname-Atm1/4] quit
```

Create PVCs and assign IP addresses to the IMA groups.

```
[Sysname] interface ima-group 1/1
[Sysname-Ima-group1/1] ip address 10.110.110.1 255.255.255.0
[Sysname-Ima-group1/1] pvc aaa 1/42
[Sysname-atm-pvc-Ima-group1/1-1/42-aaa] map ip 10.10.10.10 broadcast
[Sysname-atm-pvc-Ima-group1/1-1/42-aaa] quit
[Sysname-atm-pvc-Ima-group1/1] quit
[Sysname] interface ima-group 1/2
[Sysname-Ima-group1/2] ip address 10.110.120.1 255.255.255.0
[Sysname-Ima-group1/2] pvc bbb 1/92
[Sysname-atm-pvc-Ima-group1/2-1/92-bbb] map ip 10.10.10.10 broadcast
```

Troubleshooting ATM IMA-E1/T1 interfaces

You can start troubleshooting an ATM interface by testing network connectivity using the **ping** command or the extended **ping** command. In an extended **ping** command, specify some options in the IP header. For more information about the **ping** command, see *Network Management and Monitoring Configuration Guide*.

If the interface cannot be pinged, check whether:

- The interface is down.
- The AAL5 encapsulation type of the PVC is incorrect.

Configuring an ATM E3/T3 interface

The following matrix shows the ATM E3/T3 interface and hardware compatibility:

Hardware	Interface compatibility
MSR800	No
MSR 900	No
MSR900-E	No
MSR 930	No
MSR 20-1X	No
MSR 20	No
MSR 30	Yes
MSR 50	Yes
MSR 2600	No
MSR3600-51F	Yes

Overview

This section covers only the physical configurations of the ATM E3/T3 interface. For more information about how to configure ATM (including PVCs), see *Layer 2—WAN Configuration Guide*.

Configuration procedure

To configure an ATM E3/T3 interface:

Step	Command	Remarks
1. Enter system view.	**system-view**	N/A
2. Enter ATM E3/T3 interface view.	**interface atm** *interface-number*	N/A
3. Set the clock mode.	**clock** { **master** | **slave** }	Optional. The default setting is **slave**.
4. Set the framing format.	• On an ATM E3 interface: **frame-format** { **g751-adm** | **g751-plcp** | **g832-adm** } • On an ATM T3 interface: **frame-format** { **cbit-adm** | **cbit-plcp** | **m23-adm** | **m23-plcp** }	Optional. The framing format for an ATM E3 interface is G.751 PLCP and for an ATM T3 interface is C-bit PLCP.
5. Set the cable mode.	**cable** { **long** | **short** }	Optional. The default setting is short haul.
6. Enable scrambling.	**scramble**	Optional. Scrambling is enabled by default.
7. Set the loopback mode.	**loopback** { **cell** | **local** | **payload** | **remote** }	Optional. Loopback is disabled by default.
8. Set the intended bandwidth for the ATM E3/T3 interface.	**bandwidth** *bandwidth-value*	Optional.
9. Restore the default settings for the ATM E3/T3 interface.	**default**	Optional.

NOTE:

E3 configurations are supported on the ATM (E3) interface module and T3 configurations on the ATM (T3) interface module.

Configuring an ATM OC-3c/STM-1 interface

The following matrix shows the ATM OC-3c/STM-1 interface and hardware compatibility:

Hardware	Interface compatibility
MSR800	No
MSR 900	No
MSR900-E	No
MSR 930	No

Hardware	Interface compatibility
MSR 20-1X	No
MSR 20	No
MSR 30	Yes
MSR 50	Yes
MSR 2600	No
MSR3600-51F	Yes

Overview

This section covers only the physical configurations of the interface. For more information about how to configure ATM (including PVCs), see *Layer 2—WAN Configuration Guide*.

Configuration procedure

To configure an ATM OC-3c/STM-1 interface:

Step	Command	Remarks
1. Enter system view.	**system-view**	N/A
2. Enter ATM OC-3c/STM-1 interface view.	**interface atm** *interface-number*	N/A
3. Set the clock mode.	**clock** { **master** | **slave** }	Optional. The default setting is **slave**.
4. Set the framing format.	**frame-format** { **sdh** | **sonet** }	Optional. The default setting is SDH STM-1.
5. Enable scrambling.	**scramble**	Optional. Scrambling is enabled by default.
6. Configure the overhead bytes.	**flag c2** *flag-value* **flag** { **j0 | j1** } { **sdh | sonet** } *flag-value*	Optional. The default is hexadecimal 13 for C2. By default, SDH framing applies. In SDH framing, the defaults are null for both J0 and J1.
7. Set the loopback mode.	**loopback** { **cell** | **local** | **remote** }	Optional. Loopback is disabled by default.
8. Set the intended bandwidth for the ATM OC-3c/STM-1 interface.	**bandwidth** *bandwidth-value*	Optional.
9. Restore the default settings for the ATM OC-3c/STM-1 interface.	**default**	Optional.

Configuring an ADSL interface

The following matrix shows the ATM ADSL2+ interface and hardware compatibility:

Hardware	Interface compatibility
MSR800	No
MSR 900	No
MSR900-E	No
MSR 930	No
MSR 20-1X	Supported only on MSR20-15, which supports the ADSL2+ protocol
MSR 20	Yes
MSR 30	Yes
MSR 50	Yes
MSR 2600	Yes
MSR3600-51F	Yes

Overview

ADSL technologies

Asymmetric Digital Subscriber Line (ADSL) is an asymmetric transmission technology that implements high-speed data transmission over twisted-pair copper wire by using unused high frequency ranges in the regular telephone line with a different modulation method. With standard ADSL, the band from 26 kHz to 138 kHz is used for upstream communication, while 138 kHz to 1.104 MHz is used for downstream communication. Theoretically, the upstream rate is up to 640 kbps, and the downstream rate is up to 8 Mbps.

Some latest ADSL technologies, however, can provide faster transmission rates by improving modulation rate, coding gain, initialization state machine, by reducing frame head overhead, and by using enhanced signal processing methods. For example, given the same bands, ADSL2 can provide the upstream transmission rate up to 1024 kbps and downstream transmission rate up to 12 Mbps. By expanding the downstream band from 1.104 MHz to 2.208 MHz, ADSL2+ can even provide a downstream rate as fast as 24 Mbps.

The transmission rate of ADSL is susceptible to the transmission distance and line quality. An increased transmission distance means decreased line quality and transmission rate, and a decreased transmission distance means the contrary. When setting up a link, ADSL can automatically tune the rate taking into consideration actual line conditions such as distance and noise.

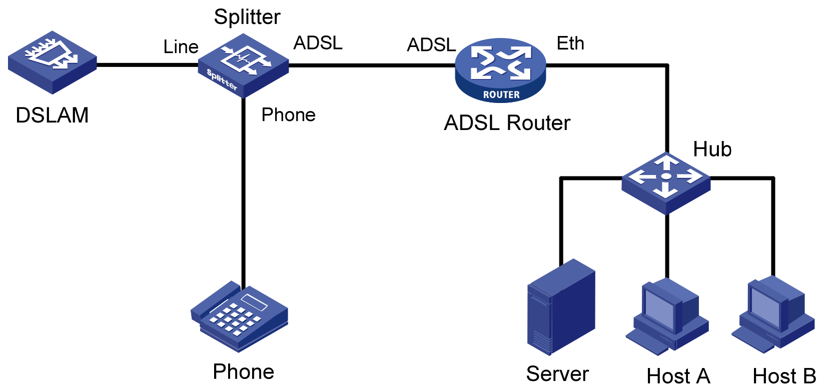
Two types of ADSL modules/cards are available: ADSL over POTS and ADSL over ISDN (ADSL-I).

Typical network topology for ADSL routers

Figure 8 shows a typical network topology for routers with ADSL interfaces, where:

- DSLAM at the central office end works as the central office (CO) equipment.
- The router works as the Customer Premises Equipment (CPE).

Figure 8 Network diagram



Line activation and deactivation

Before transmitting traffic, the CPE must activate the line. This is done through handshake training and information exchange between the CO equipment and the CPE.

A typical activation process lasts 30 seconds, beginning with line negotiation until the line comes up. During this process, the two parties examine line distance and conditions against the line configuration template (which defines the ADSL criteria, channel mode, upstream and downstream speeds, and noise tolerance) and attempts to reach an agreement. If the activation succeeds, a communication connection is set up between the two parties. When negotiating connection parameters during the line activation, the CO equipment provide and decide values for most parameters, while the CPE accept them.

Contrary to activation, deactivation tears down the communication connection between the two parties. The router tests the performance of the line regularly. Once it finds out that the line performance is deteriorating, it automatically deactivates, retrains, and reactivates the line.

IMPORTANT:

Make sure regular twisted pairs are used and the cables are well connected when connecting ADSL interfaces, because the ADSL transmission rate is susceptible to the transmission distance and line quality.

This section covers only the physical configurations of the ADSL interface. For more information about how to configure ATM (including PVCs), see *Layer 2—WAN Configuration Guide*.

Configuration procedure

To configure an ADSL interface:

Step	Command	Remarks
1. Enter system view.	**system-view**	N/A
2. Enter ATM interface view.	**interface atm** *interface-number*	N/A
3. Activate the ADSL interface.	**activate**	Optional. The interface is active by default.
4. Configure the ADSL interface standard.	**adsl standard** { **auto** | **g9923** | **g9925** | **gdmt** | **glite** | **t1413** }	Optional. The default setting is auto sensing.
5. Set the transmit power attenuation value.	**adsl tx-attenuation** *attenuation*	Optional. The default value is 1.

Step	Command	Remarks
6. Set the intended bandwidth for the ADSL interface.	**bandwidth** *bandwidth-value*	Optional.
7. Restore the default settings for the ADSL interface.	**default**	Optional.

NOTE:

To have the **adsl standard** command configuration take effect on an interface, you need to re-activate the interface either by executing the **shutdown** and **undo shutdown** commands or the **activate** and **undo activate** commands.

Upgrading ADSL2+ card software

The upgradeable software includes BootROM and card software. You first need to load the new software by FTP or some other means to the flash memory or the CF card on your device. Before performing an upgrade, you need to shut down the interface with the **shutdown** command if the interface is up. After completing the upgrade, you need to bring the interface up with the **undo shutdown** command.

To upgrade ADSL2+ card software:

Step	Command	Remarks
1. Enter system view.	**system-view**	N/A
2. Enter ATM interface view.	**interface atm** *interface-number*	N/A
3. Shut down the interface.	**shutdown**	Optional. Skip this step if the interface is already down.
4. Return to system view.	**quit**	N/A
5. Return to user view.	**quit**	N/A
6. Upgrade software.	**bootrom update file** *file-url* [**slot** *slot-no-list*] [**all** | **part**]	N/A
7. Enter system view.	**system-view**	N/A
8. Enter ATM interface view.	**interface atm** *interface-number*	N/A
9. Bring the interface up.	**undo shutdown**	N/A

NOTE:

When executing the **bootrom update file** command, do not use the **all** keyword unless absolutely necessary; use the **part** keyword instead. If you use the **all** keyword, you will find it hard to roll back to the old version once the upgrade fails.

Configuring a G.SHDSL interface

The following matrix shows the G.SHDSL interface and hardware compatibility:

Hardware	Interface compatibility
MSR800	No

Hardware	Interface compatibility
MSR 900	No
MSR900-E	No
MSR 930	No
MSR 20-1X	No
MSR 20	No
MSR 30	Supported only on MIM-1SHL-4W and MIM-1G.SHDSL modules
MSR 50	Supported only on FIC-1SHL-4W and FIC-1G.SHDSL modules
MSR 2600	No
MSR3600-51F	Supported only on MIM-1SHL-4W and MIM-1G.SHDSL modules

The following matrix shows the G.SHDSL.BIS interface and hardware compatibility:

Hardware	Interface compatibility
MSR800	No
MSR 900	No
MSR900-E	No
MSR 930	No
MSR 20-1X	Supported only on MSR 20-13 and DSIC-1SHDSL-8W modules
MSR 20	Supported only on DSIC-1SHDSL-8W modules
MSR 30	Supported only on DSIC-1SHDSL-8W modules
MSR 50	Supported only on DSIC-1SHDSL-8W modules
MSR 2600	No
MSR3600-51F	Supported only on DSIC-1SHDSL-8W modules

Overview

G. single-pair high-speed digital subscriber line (G.SHDSL) is a symmetric transmission technology that implements high-speed data transmission over the twisted-pair copper wire by making use of the unused high frequency ranges with different modulation methods. So far, two types of G.SHDSL are supported: two-wire and four-wire. Two-wire G.SHDSL can provide transmission rates up to 2.312 Mbps while four-wire G.SHDSL can provide transmission rates up to 4.624 Mbps.

The transmission speed of G.SHDSL is susceptible to transmission distance and line quality. An increased transmission distance means decreased line quality and transmission rate, and decreased transmission distance means the contrary. When setting up a link, G. SHDSL can automatically tune the speed taking into consideration the actual line conditions such as distance and noise.

For a typical network topology for routers with G.SHDSL interfaces, see Figure 8. Unlike ADSL, G.SHDSL does not use the splitter.

This section covers only the physical configurations of the G.SHDSL interface. For information about configuring ATM (including PVCs), see *Layer 2—WAN Configuration Guide*.

Configuration procedure

> **IMPORTANT:**
> Shut down the idle G.SHDSL interfaces to prevent their lines from consuming system resources.

To configure a G.SHDSL interface:

Step	Command	Remarks
1. Enter system view.	**system-view**	N/A
2. Enter ATM interface view.	**interface atm** *interface-number*	N/A
3. Activate the G.SHDSL interface.	**activate**	Optional. The G.SHDSL interface is active by default.
4. Specify the G.SHDSL interface standard.	**shdsl annex** { **a** | **b** }	Optional. The default setting is annex B.
5. Set the wiring mode.	**shdsl wire** { **2** | **4-auto-enhanced** | **4-enhanced** | **4-standard** | **6** | **8** | **auto** }	Optional. The default setting is: • **4-enhanced** mode for the four-wire G.SHDSL interface. • **4-standard** for the four-wire G.SHDSL.bis interface. • **8** for the eight-wire G.SHDSL.bis interface. This command is available only if the interface supports four-wire and eight-wire G.SHDSL.
6. Set the interface operating mode.	**shdsl mode** { **co** | **cpe** }	Optional. The default setting is CPE.
7. Set the single-pair rate.	**shdsl rate** { **auto** | *rate* }	Optional. The default is auto-negotiation mode for the two-wire G.SHDSL interface, 2.312 Mbps for the four-wire G.SHDSL interface (four-wire G.SHDSL interface rate is 4.624 Mbps), and auto-negotiation for two-wire and four-wire G.SHDSL.bis interfaces.
8. Set the target SNR margin.	**shdsl snr-margin** [**current** *current-margin-value*] [**snext** *snext-margin-value*]	Optional. By default, *current-margin-value* is set to 2, and *snext-margin-value* is set to 0.
9. Set the power spectral density (PSD) mode.	**shdsl psd** { **asymmetry** | **symmetry** }	Optional. The default setting is symmetry.
10. Set the power back-off (PBO) value, which reduces the transmit power.	**shdsl pbo** { *value* | **auto** }	Optional. The default setting is **auto**.
11. Specify the capability type.	**shdsl capability** { **auto** | **g-shdsl** | **g-shdsl-bis** }	Optional. • When the interface operates in CPE mode, all three

Step	Command	Remarks
		keywords are supported, and the **auto** keyword applies by default. • When the interface operates in CO mode, only the **g-shdsl** and **g-shdsl-bis** keywords are supported, and the **g-shdsl-bis** keyword applies by default.
12. Set the pulse amplitude modulation (PAM) constellation.	**shdsl pam** { **16** | **32** | **auto** }	Optional. The default setting is **auto**.
13. Enable SHDSL line probing.	**shdsl line-probing enable**	Optional. SHDSL line probing is enabled by default.
14. Set the intended bandwidth for the G.SHDSL interface.	**bandwidth** *bandwidth-value*	Optional.
15. Restore the default settings for the G.SHDSL interface.	**default**	Optional.

Configuring an EFM interface

The following matrix shows the command and hardware compatibility:

Hardware	Command compatibility
MSR800	No
MSR 900	No
MSR900-E	No
MSR 930	No
MSR 20-1X	Supported only on MSR 20-13
MSR 20	Yes
MSR 30	Yes
MSR 50	Yes
MSR 2600	No
MSR3600-51F	Yes

Ethernet First Mile (EFM) interfaces receive and transmit Ethernet frames over ATM physical links and use the Ethernet protocol suite. They can transmit Ethernet frames over legacy DSL lines and thus achieve all-Ethernet access. By encapsulating Ethernet packets and achieving stable and high speed data transmission over telephone lines, EFM extends the transmission distance of Ethernet from 100 meters to 1500 meters, greatly popularizing Ethernet applications. With EFM interfaces, the already popular Ethernet technologies can be deployed on the access networks of telecom users, greatly improving the network performance as well as lowering the device and operation costs.

Configuration procedure

To configure an EFM interface:

Step	Command	Remarks
1. Enter system view.	**system-view**	N/A
2. Enter EFM interface view.	**interface efm** *interface-number*	N/A
3. Set the intended bandwidth for the EFM interface.	**bandwidth** *bandwidth-value*	Optional.
4. Restore the default settings for the EFM interface.	**default**	Optional.

NOTE:

Configure ARP, DHCP, IP address, and firewall on an EFM interface as needed.

Configuring the working mode of an interface card

No dedicated but multi-purpose EFM cards are available. Switch the working mode of an interface card as needed. For more information about the working modes of an interface card, see *Fundamentals Configuration Guide*.

Displaying and maintaining ATM and DSL interfaces

Task	Command	Remarks
Display information about a specified or all ATM or DSL interfaces.	**display interface** [**atm**] [**brief** [**down** | **description**]] [**|** { **begin** | **exclude** | **include** } *regular-expression*] **display interface atm** *interface-number* [**brief** [**description**]] [**|** { **begin** | **exclude** | **include** } *regular-expression*]	Available in any view.
Display the actual configuration of a DSL line.	**display dsl configuration interface atm** *interface-number* [**|** { **begin** | **exclude** | **include** } *regular-expression*]	Available in any view.
Display the state information of a DSL line.	**display dsl status interface atm** *interface-number* [**|** { **begin** | **exclude** | **include** } *regular-expression*]	Available in any view.
Display DSL version information and available capabilities.	**display dsl version interface atm** *interface-number* [**|** { **begin** | **exclude** | **include** } *regular-expression*]	Available in any view.
Display information about a specified or all IMA group interfaces.	**display interface** [**ima-group**] [**brief** [**down** | **description**]] [**|** { **begin** | **exclude** | **include** } *regular-expression*] **display interface ima-group** *group-interface-number* [**brief** [**description**]] [**|** { **begin** | **exclude** | **include** } *regular-expression*]	Available in any view.
Clear the statistics on all PVCs on a specified ATM interface.	**reset atm interface** [**atm** [*interface-number*]]	Available in user view.
Clear the statistics on an ATM	**reset counters interface** [**atm**	Available in user view.

Task	Command	Remarks
interface.	[*interface-number*]]	

NOTE:

For those physical interfaces that are not connected to cables, shut down them using the **shutdown** command to avoid anomalies resulted from interference.

Troubleshooting

Troubleshooting ATM interfaces

When diagnosing ATM interface problems, first test the interface with the **ping** command or the extended **ping** command.

The **ping** command can test network connectivity. Extended **ping** command can be used to specify some options in the IP header in addition to that function. For more information about the **ping** command, see *Network Management and Monitoring Configuration Guide*.

If the interface cannot be pinged, check whether:

- The interface is down, which causes missing of its route in the routing table.
- The AAL5 encapsulation of the PVC is incorrect (for 155 Mbps ATM interfaces only).

Troubleshooting DSL interfaces

Improper line operation is one of the faults that you might encounter in DSL applications. Such a fault is likely to occur on whichever devices or nodes in the hierarchical broadband network architecture. It is probably caused by the CPE device, copper wire, splitter, DSL port on DSLAM, or even the broadband access server. For this reason, you should segment the network to locate the problem. DSLAM provides you with abundant fault isolation methods and a complete guide, which are however, beyond the scope of this document.

On the CPE, you may do the following when the problem occurs:

1. Read the LEDs for the DSL interface card.

   When the DSL line is training, the LINK LED blinks. After the activation succeeds, the LINK LED which should otherwise be OFF lights and stays ON. The Activity LED blinks when data is being transmitted on the line.
2. Display the DSL state information with the **display dsl status** command.

   The **State of driver/chipsets** field provides information on interface and transceiver states.

   Common interface states include Activating, Active, Startupping, Deactive, and Test Mode.

   Common transceiver states include Idle, Data Mode, HandShaking, and Training.
3. Perform the **debugging physical** command to view details about activation, such as sending of the **activate** command, activation timeout, training process, and activation success.
4. If line activation attempts always fail, verify that the line is securely connected and functioning correctly.
5. If bit error rate is high or interference occurs too often, shut down and then bring up the interface by using the **shutdown** and **undo shutdown** commands or reboot the device and reconnect the line. If the problem persists, make an overall line condition and environment check.

Configuring POS interfaces

This chapter describes how to configure physical parameters for POS interfaces. You must perform the tasks in this chapter before you configure other settings on the interface, including the link and network layer parameters, interface backup, and packet filtering.

Overview

SONET and SDH

Synchronous Optical Network (SONET), a synchronous transmission system defined by the ANSI, is an international standard transmission protocol. It adopts optical transmission.

ITU-T Synchronous Digital Hierarchy (SDH) uses a SONET rate subset. SDH adopts synchronous multiplexing and allows for flexible mapping structure. It can add or drop low-speed tributary signals to or from SDH signals without a large amount of multiplexing/demultiplexing devices. This reduces signal attenuation and investment in devices.

POS

Packet over SONET/SDH (POS) is a technology widely used on WAN and MAN. It supports data packets, such as IP packets.

POS maps length-variable packets directly to SONET synchronous payloads and uses the SONET physical layer transmission standard. It offers high-speed, reliable, and point-to-point data connectivity.

The POS interfaces on your device support PPP, Frame Relay, and HDLC at the data link layer and IP at the network layer. Depending on your device model, the transmission rate of POS interfaces can be STM-1, STM-4, and STM-16, each four times the immediate lower level.

Hardware compatibility with POS interface

Hardware	Feature compatibility
MSR800	No
MSR 900	No
MSR900-E	No
MSR 930	No
MSR 20-1X	No
MSR 20	No
MSR 30	Yes
MSR 50	Yes
MSR 2600	No
MSR3600-51F	Yes

Configuring physical parameters on a POS interface

Step	Command	Remarks
1. Enter system view.	**system-view**	N/A
2. Enter POS interface view.	**interface pos** *interface-number*	N/A
3. Set the interface description.	**description** *text*	Optional. By default, the description of a POS interface is *interface name* Interface, for example, Pos2/0 **Interface**.
4. Set the clock mode.	**clock** { **master** | **slave** }	Optional. The default is slave.
5. Set the CRC length.	**crc** { **16** | **32** }	Optional. The default is 32 bits.
6. Set the loopback mode.	**loopback** { **local** | **remote** }	Optional. Loopback is disabled by default.
7. Configure the overhead bytes.	• **flag c2** *flag-value* • **flag** { **j0** | **j1** } { **sdh** | **sonet** } *flag-value*	Optional. By default: • The C2 overhead byte is hexadecimal 16. • SDH framing applies. In SDH framing, both J0 and J1 overhead bytes are null. In SONET framing, the J0 overhead byte is 0x01 and J1 overhead byte is null.
8. Set the framing format.	**frame-format** { **sdh** | **sonet** }	Optional. The default is SDH.
9. Configure scrambling.	**scramble**	Optional. Scrambling is enabled by default.
10. Set the link type.	**link-protocol** { **fr** [**ietf** | **mfr** *interface-number* | **nonstandard**] | **hdlc** | **ppp** }	Optional. The default is PPP.
11. Set the interface MTU.	**mtu** *size*	Optional. By default, the MTU is in the range of 128 to 1650 bytes.
12. Set the intended bandwidth for the POS interface.	**bandwidth** bandwidth-value	Optional.
13. Restore the default settings for the POS interface.	**default**	Optional.
14. Shut down and bring up the POS interface.	**shutdown** **undo shutdown**	Optional. By default, a POS interface is up. For the settings to take effect, you must perform this step. If no cable is connected to the interface, shut down the interface

Step	Command	Remarks
		to prevent interface exceptions.

Configuring the operating mode of a POS interface card

Some POS interface cards support multiple operating modes. You can change their operating mode by using the **card-mode** command. For more information about the operating modes of interface cards, see *Fundamentals Configuration Guide*.

Displaying and maintaining POS interfaces

Task	Command	Remarks
Display information about POS interfaces.	**display interface** [**pos**] [**brief** [**down** | **description**]] [**|** { **begin** | **exclude** | **include** } *regular-expression*] **display interface pos** *interface-number* [**brief** [**description**]] [**|** { **begin** | **exclude** | **include** } *regular-expression*]	Available in any view.
Clear statistics for POS interfaces.	**reset counters interface** [**pos** [*interface-number*]]	Available in user view.

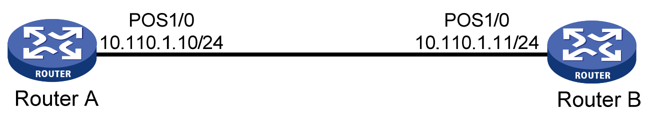
POS interface configuration examples

Directly connecting routers through POS interfaces

Network requirements

As shown in Figure 9, POS interfaces on Router A and Router B are connected through a pair of single-mode optical fibers for data transmission.

Figure 9 Network diagram



Configuration procedure

1. Configure POS 1/0 on Router A.

   # Assign an IP address to the interface.

   ```
   <RouterA> system-view
   [RouterA] interface pos 1/0
   [RouterA-Pos1/0] ip address 10.110.1.10 255.255.255.0
   ```

   # Configure the data link layer protocol and MTU for the interface.

   ```
   [RouterA-Pos1/0] link-protocol ppp
   [RouterA-Pos1/0] mtu 1500
   [RouterA-Pos1/0] shutdown
   ```

```
[RouterA-Pos1/0] undo shutdown
```

2. Configure POS 1/0 on Router B:

   # Set the clock mode to **master** for the interface.

```
<RouterB> system-view
[RouterB] interface pos 1/0
[RouterB-Pos1/0] clock master
```

   # Assign an IP address to the interface.

```
[RouterB-Pos1/0] ip address 10.110.1.11 255.255.255.0
```

   # Configure the data link layer protocol and MTU for the interface.

```
[RouterB-Pos1/0] link-protocol ppp
[RouterB-Pos1/0] mtu 1500
[RouterB-Pos1/0] shutdown
[RouterB-Pos1/0] undo shutdown
```

Verifying the configuration

Verify the POS interface settings, for example, on Router A.

```
<RouterA> display interface pos
```

Verify that Router A and Router B can ping each other at the POS interfaces. (Details not shown.)

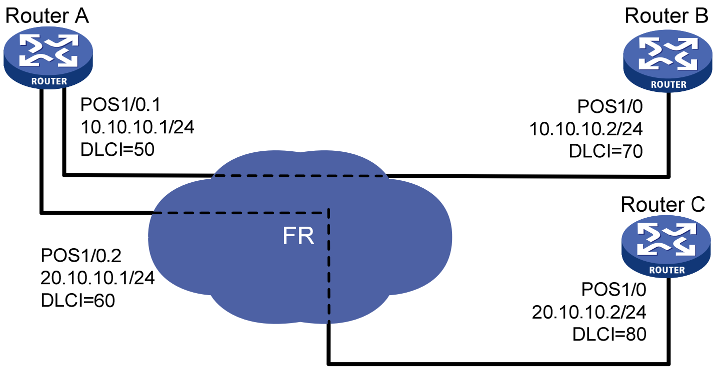
Connecting routers through POS interfaces across Frame Relay

Network requirements

As shown in Figure 10:

- Routers A, B, and C are DTEs on a Frame Relay network.
- Router A uses Frame Relay sub-interfaces to connect Router B and Router C in different network segments.

Figure 10 Network diagram



Configuration procedure

1. Configure Router A:

   # Set the clock mode to **slave** on POS interface 1/0.

```
<RouterA> system-view
[RouterA] interface pos 1/0
[RouterA-Pos1/0] clock slave
```

   # Enable Frame Relay on the interface.

```
[RouterA-Pos1/0] link-protocol fr
[RouterA-Pos1/0] fr interface-type dte
[RouterA-Pos1/0] quit
```

Create sub-interface 1 on the interface.

```
[RouterA] interface pos 1/0.1
[RouterA-Pos1/0.1] ip address 10.10.10.1 255.255.255.0
[RouterA-Pos1/0.1] fr map ip 10.10.10.2 50
[RouterA-Pos1/0.1] mtu 1500
[RouterA-Pos1/0.1] quit
```

Create sub-interface 2 on the interface.

```
[RouterA] interface pos 1/0.2
[RouterA-Pos1/0.2] ip address 20.10.10.1 255.255.255.0
[RouterA-Pos1/0.2] fr map ip 20.10.10.2 60
[RouterA-Pos1/0.2] mtu 1500
[RouterA-Pos1/0.2] quit
```

2. Configure Router B:

   # Set the clock mode to **slave** on POS 1/0.

```
[RouterB] interface pos 1/0
[RouterB-Pos1/0] clock slave
```

   # Configure Frame Relay encapsulation on the interface.

```
[RouterB-Pos1/0] link-protocol fr
[RouterB-Pos1/0] fr interface-type dte
[RouterB-Pos1/0] ip address 10.10.10.2 255.255.255.0
[RouterB-Pos1/0] fr map ip 10.10.10.1 70
[RouterB-Pos1/0] mtu 1500
```

3. Configure Router C in the same way Router B is configured. (Details not shown.)

Verifying the configuration

Verify the POS interface settings.

```
<RouterA> display interface pos
```

Verify that Router A and Router B can ping each other. (Details not shown.)

Verify that Router A and Router C can ping each other. (Details not shown.)

Troubleshooting POS interfaces

Symptom 1

The physical state of the POS interface is down.

Solution

To resolve the problem:

- Verify that the POS interface is connected correctly to the remote port.
  - The transmit connector at one end must be connected to the receive connector at the other end.
  - The transmit and receive connectors of the POS interface must not be connected by the same fiber. If they are connected by the same fiber, the **display interface** command displays the "**loopback detected**" message, whether or not the loopback detection feature is enabled.

- If the two POS interfaces are directly connected, verify that the two ends use different clock mode settings.
- If the problem persists, contact H3C Support.

Symptom 2

The physical layer is up, but the link is down.

Solution

To resolve the problem:

- Verify that the two ends have matching clock mode, scrambling setting, and physical parameters.
- Verify that the two ends have the same link layer protocol.
- Verify that the two ends are assigned IP addresses.
- If the problem persists, contact H3C Support.

Symptom 3

A great amount of IP packets are dropped.

Solution

To resolve the problem:

- Verify that the correct clock mode is configured on the POS interface.
  Incorrect clock mode setting can incur a large amount of CRC errors.
- Verify that the two ends have the same MTU setting.
- If the problem persists, contact H3C Support.

Configuring CPOS interfaces

Overview

SONET and SDH

Synchronous Optical Network (SONET) adopts optical transmission. It is a synchronous transmission system defined by the ANSI and is an international standard transmission protocol.

ITU-T Synchronous Digital Hierarchy (SDH) uses synchronous multiplexing and a flexible mapping structure. It can add or drop low-speed tributary signals to or from SDH signals without a large number of multiplexing/demultiplexing devices. This reduces signal attenuation and decreases device investments.

CPOS

The low-speed tributary signals multiplexed to form an SDH signal are called channels. The channelized POS (CPOS) interface makes full use of SDH to provide precise bandwidth division, reduce the number of low-speed physical interfaces on devices, enhance their aggregation capacity, and improve the access capacity of leased lines.

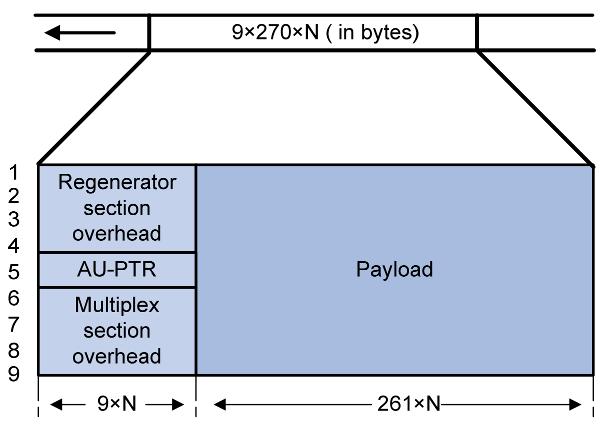
The CPOS interface operates at the rate of STM-1 or STM-16.

SDH frame structure

To understand the benefits of CPOS, understand the frame structure of SDH signal STM-N first.

Low-speed tributary signals should distribute in one frame regularly and evenly for the convenience of adding them to or dropping them from high-speed signals. The ITU-T stipulates that STM-N frames adopt the structure of rectangle blocks in bytes, as illustrated in Figure 11.

Figure 11 STM-N frame structure



STM-N is a rectangle-block frame structure of 9 rows x 270 x N columns, where the N in STM-N equals the N columns. N takes the value 1, 4, 16, and so on, indicating the number of STM-1 signals that form SDH signal.

The STM-N frame structure consists of three parts: the section overhead (SOH), which includes the regenerator section overhead (RSOH) and the multiplex section overhead (MSOH); the administration unit pointer (AU-PTR); and payload. AU-PTR is the pointer that indicates the location of the first byte of the payload in an STM-N frame so that the receiving end can correctly extract the payload.

Terms

- **Multiplex unit**—A basic SDH multiplex unit includes multiple containers (C-n), virtual containers (VC-n), tributary units (TU-n), tributary unit groups (TUG-n), administrative units (AU-n) and administrative unit groups (AUG-n), where n is the hierarchical sequence number of unit level.
- **Container**—Information structure unit that carries service signals at different rates. G.709 defines the criteria for five standard containers C-11, C-12, C-2, C-3 and C-4.
- **Virtual container (VC)**—Information structure unit supporting channel layer connection of SDH. It terminates an SDH channel. VC is divided into lower-order and higher-order VCs. VC-4 and VC-3 in AU-3 are higher-order virtual containers.
- **Tributary unit (TU) and tributary unit group (TUG)**—TU is the information structure that provides adaptation between higher-order and lower-order channel layers. TUG is a set of one or more TUs whose location is fixed in higher-order VC payload.
- **Administrative unit (AU) and administrative unit group (AUG)**—AU is the information structure that provides adaptation between higher-order channel layer and multiplex section layer. AUG is a set of one or more AUs whose locations are fixed in the payload of STM-N.

Multiplexing E1/T1 channels to form STM-1

In the SDH multiplexing recommended by G.709, more than one path is available for a valid payload to be multiplexed to form STM-N. Figure 12 illustrate the multiplexing processes from E1 and T1 to STM-1.

Figure 12 Process of multiplexing E1 channels to form STM-1

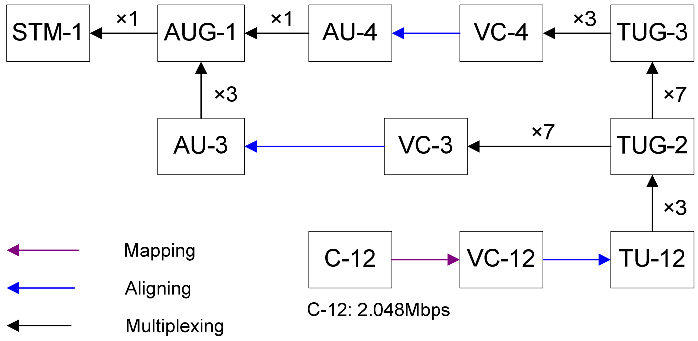
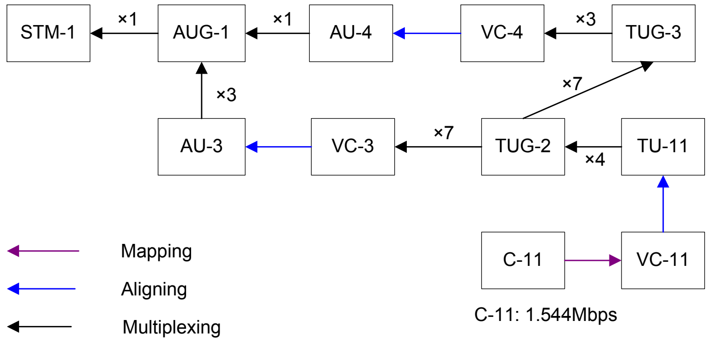


Figure 13 Process of multiplexing T1 channels to form STM-1



In actual applications, different countries and regions might adopt different multiplexing structures. To ensure interoperability, the **multiplex mode** command is provided on CPOS interfaces. This allows you to select the AU-3 or AU-4 multiplexing structure.

Calculating E1/T1 channel sequence numbers

Since CPOS interfaces adopt the byte interleaved multiplexing mode, the lower-order VCs are not arranged in order in a higher-order VC. To understand how TU numbers are calculated, see the following example where E1 channels are multiplexed to form STM-1 through the AU-4.

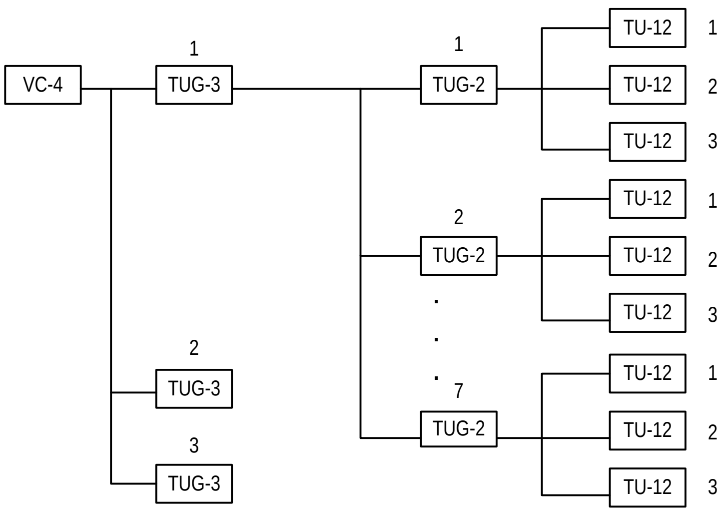
As shown in Figure 12, when the AU-4 path is used, the multiplexing structure for 2 Mbps is 3-7-3. The formula for calculating the TU-12 sequence numbers of different locations in the same VC-4 is as follows:

Sequence number of TU-12 = TUG-3 number + (TUG-2 number – 1) x 3 + (TU-12 Number – 1) x 21

The two TU-12s are adjacent to each other if they have the same TUG-3 number and TUG-2 number but different TU-12 numbers with a difference of 1.

The numbers in the formula mentioned refer to the location numbers in a VC-4 frame. TUG-3 can be numbered in the range of 1 to 3; TUG-2 in the range of 1 to 7 and TU-12 in the range of 1 to 3. TU-12 numbers indicate the order (E1 channel number) in which the 63 TU-12s in a VC-4 frame are multiplexed.

Figure 14 Order of TUG-3s, TUG-2s, and TU-12s in a VC-4 frame



You can calculate TU-12 numbers in the same way when the AU-3 path is used.

When 63 E1 channels or 84 T1 channels are configured on a CPOS interface, you can reference E1 or T1 channels by referencing the numbers in the range of 1 to 63 or 1 to 84. When connecting your device to channelized STM-1 interfaces on devices of other vendors, you should consider the possible numbering differences due to different channel referencing methods.

Overhead bytes

SDH provides layered monitoring and management of precise division.

It provides monitoring at section and channel levels, where sections are subdivided into regenerator and multiplex sections, and channels are subdivided into higher-order and lower-order paths. These monitoring functions are implemented using overhead bytes.

SDH provides a variety of overhead bytes, but only those involved in CPOS configuration are discussed in this section.

SOH

The section overhead (SOH) is further classified into the regenerator section overhead (RSOH) and the multiplex section overhead (MSOH).

The regeneration section trace message J0 is included in RSOH to repeatedly send the section access point identifier, based on which the receiver can make sure that it is in continuous connection with the sender. This byte can be any character in the network of the same operator. If the networks of two operators are involved, the sending and receiving devices at network borders must use the same J0 byte. With the J0 byte, operators can detect and troubleshoot faults in advance or use less time to recover networks.

POH

The payload of an STM-N frame includes the path overhead (POH), which monitors low-speed tributary signals.

The SOH monitors the section layer, and the POH monitors the path layer. The POH is divided into the higher-order path overhead and the lower-order path overhead.

Higher-order path overhead monitors paths at the VC-4/VC-3 level.

Similar to the J0 byte, the higher-order VC-N path trace byte J1 is included in the higher-order path overhead to repeatedly send the higher-order path access point identifier, based on which the receiving end of the path can make sure that it is in continuous connection with the specified sender. The sender and the recipient must use the same J1 byte.

In addition, the path signal label byte C2 is included in the higher-order path overhead to indicate the multiplexing structure of VC frames and the properties of payload such as whether the path is carrying traffic, what type of traffic are carried, and how they are mapped. The sender and receiver must use the same C2 byte.

CPOS interface application scenario

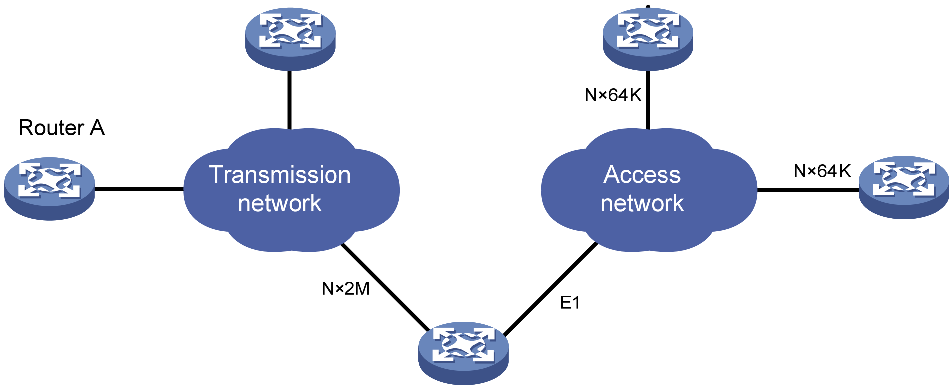
CPOS is used to enhance the capability of a device in low-speed access redistribution. STM-1 CPOS is especially suitable for aggregating E1/T1 channels.

Some government agencies and enterprises use low-end and mid-range devices to access transmission networks through E1/T1 leased lines. Users who require bandwidth between E1 and T3 (44 Mbps), for a data center for example, lease multiple E1/T1 lines.

The bandwidth of all these users is aggregated to one or more CPOS interfaces through a transmission network, and then connected to a high-end device where the low-end devices are uniquely identified by timeslots.

In actual applications, the connection between these low-end devices and the CPOS interfaces might span more than one transmission network and as such, might require relay. This is similar to the scenario where low-end devices are connected to a high-end device through one or multiple E1/T1 leased lines.

Figure 15 Network diagram for a CPOS application



Hardware compatibility with CPOS interface

Hardware	Feature compatibility
MSR800	No
MSR 900	No
MSR900-E	No
MSR 930	No
MSR 20-1X	No
MSR 20	No
MSR 30	Yes
MSR 50	Yes
MSR 2600	No
MSR3600-51F	Yes

E1-related commands are available for CPOS (E) interface modules. T1-related commands are available for CPOS (T) interface modules.

Configuring a CPOS interface

Follow these guidelines when you configure a CPOS interface:

- E1 configuration is supported on the CPOS(E) interface module but T1 configuration is supported on the CPOS (T) interface module.
- If no cable is connected to a physical interface, shut down the interface with the **shutdown** command to prevent anomalies caused by interference.
- Use the **shutdown** command with caution, because once an interface is shut down, it stops operating.

To configure a CPOS interface:

Step	Command	Remarks
1. Enter system view.	**system-view**	N/A

Step	Command	Remarks
2. Enter CPOS interface view.	**controller cpos** *cpos-number*	N/A
3. Set the interface description.	**description** *text*	Optional. By default, the description of a CPOS interface is *interface name* Interface, for example, Cpos2/0 Interface.
4. Set the framing format.	**frame-format** { **sdh** | **sonet** }	Optional. SDH by default.
5. Set the clock mode.	**clock** { **master** | **slave** }	Optional. Slave by default.
6. Set the loopback mode.	**loopback** { **local** | **remote** }	Optional. Disabled by default.
7. Configure the AUG multiplexing mode.	**multiplex mode** { **au-3** | **au-4** }	Optional. Available only in SDH framing. AU-4 by default.
8. Configure the SOH and higher-order path overhead bytes	**flag c2** *path-number c2-value* **flag** { **j0** | **j1** *path-number* } { **sdh** | **sonet** } *flag-value*	Optional.
9. Set the intended bandwidth for the CPOS interface.	**bandwidth** *bandwidth-value*	Optional.
10. Restore the default settings for the CPOS interface.	**default**	Optional.
11. Shut down the CPOS interface.	**shutdown**	Optional. Up by default.
12. Configure E1/T1 channel attributes.	• See "Configuring an E1 channel." • See "Configuring a T1 channel."	Optional.

Configuring an E1 channel

Step	Command	Remarks
1. Enter system view.	**system-view**	N/A
2. Enter CPOS interface view.	**controller cpos** *cpos-number*	N/A
3. Set the framing format for E1.	**e1** *e1-number* **set frame-format** { **crc4** | **no-crc4** }	Optional. no-CRC4 by default.
4. Set the clock mode for E1.	**e1** *e1-number* **set clock** { **master** | **slave** }	Optional. Slave by default.
5. Set the loopback mode for E1.	**e1** *e1-number* **set loopback** { **local** | **payload** | **remote** }	Optional. Disabled by default.
6. Set the overhead bytes for E1.	**e1** *e1-number* **set flag c2** *c2-value* **e1** *e1-number* **set flag j2** { **sdh** |	Optional. By default, C2 is set to hexadecimal **02** and J2 is cyclic

Step	Command	Remarks
	sonet } *j2-string*	null.
7. Configure the E1 operating mode.	• Method 1: Configure E1 to operate in unframed mode: **e1** *e1-number* **unframed** • Method 2: Configure E1 to operate in framed mode and set timeslot bundling: **a.** (Optional) **undo e1** *e1-number* **unframed** **b.** **e1** *e1-number* **channel-set** *set-number* **timeslot-list** *range*	Use either method. The default setting is: • E1 operates in framed mode. • An E1 channel is not channelized.
8. Shut down the specified E1 channel.	**e1** *e1-number* **shutdown**	Optional. Up by default.

NOTE:

E1 configuration is supported on the CPOS (E) interface module.

Configuring a T1 channel

Step	Command	Remarks
1. Enter system view.	**system-view**	N/A
2. Enter CPOS interface view.	**controller cpos** *cpos-number*	N/A
3. Set the framing format for T1.	**t1** *t1-number* **set frame-format** { **esf** | **sf** }	Optional. ESF by default.
4. Set the clock mode for T1.	**t1** *t1-number* **set clock** { **master** | **slave** }	Optional. Slave by default.
5. Set the loopback mode for T1.	**t1** *t1-number* **set loopback** { **local** | **payload** | **remote** }	Optional. Disabled by default.
6. Set the overhead bytes for T1.	**t1** *t1-number* **set flag c2** *c2-value* **t1** *t1-number* **set flag j2** { **sdh** | **sonet** } *j2-string*	Optional. By default, C2 is set to hexadecimal **02** and J2 is cyclic null.
7. Configure the T1 operating mode.	• Method 1: Configure T1 to operate in unframed mode: **t1** *t1-number* **unframed** • Method 2: Configure T1 to operate in framed mode, and set timeslot bundling: **a.** (Optional) **undo t1** *t1-number* **unframed** **b.** **t1** *t1-number* **channel-set** *set-number* **timeslot-list** *range* [**speed** { **56k** | **64k** }]	Use either method. By default: • T1 operates in framed mode. • A T1 channel is not channelized.

Step	Command	Remarks
8. Shut down the specified T1 channel.	**t1** *t1-number* **shutdown**	Optional. By default, a T1 channel is up.

NOTE:

T1 configuration is supported on the CPOS (T) interface module.

Configuring the operating mode of an interface card

Some CPOS cards can be used to provide E1 or T1 lines. You can change their operating mode by using the **card-mode** command. For more information about configuring the operating mode of an interface card, see *Fundamentals Configuration Guide*.

Displaying and maintaining CPOS interfaces

Task	Command	Remarks
Display information about channels on a specified or all CPOS interfaces.	**display controller cpos** [*cpos-number*] [**|** { **begin** | **exclude** | **include** } *regular-expression*]	Available in any view.
Display information about a specified E1 channel on a CPOS interface.	**display controller cpos** *cpos-number* **e1** *e1-number* [**|** { **begin** | **exclude** | **include** } *regular-expression*]	Available in any view.
Display information about a specified T1 channel on a CPOS interface.	**display controller cpos** *cpos-number* **t1** *t1-number* [**|** { **begin** | **exclude** | **include** } *regular-expression*]	Available in any view.
Display information about an E1/T1 serial interface.	**display interface serial** *interface-number/channel-number:set-number* [**|** { **begin** | **exclude** | **include** } *regular-expression*]	Available in any view.
Clear the controller counter of a CPOS interface.	**reset counters** *controller* **cpos** *interface-number*	Available in user view.

For more information about the **display interface serial** command, see *Interface Command Reference*.

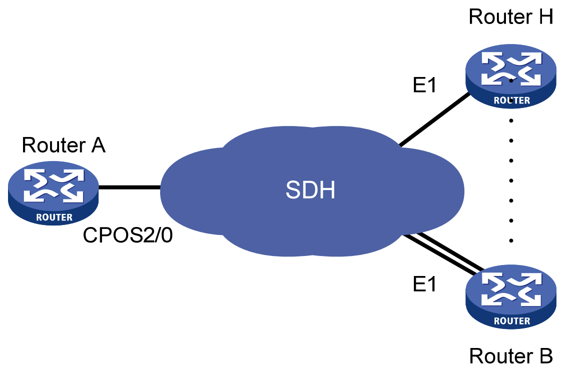
CPOS-E1 interface configuration example

Network requirements

As shown in Figure 16, branch nodes Router B through Router H are uplinked to the central node Router A through E1 links. Router A aggregate these E1 links with a CPOS interface.

Add one more E1 link on Router B to expand its capacity. In addition, bind the two E1 links through an MP-group interface.

Figure 16 Network diagram



Configuration procedure

> **IMPORTANT:**
>
> For correct network synchronization, make sure the master clock mode is configured on the SONET/SDH devices connected to the routers.

1. Configure Router A:

   # Configure E1 channels 1 and 2 of CPOS 2/0 to operate in unframed mode.

   ```
   <RouterA> system-view
   [RouterA] controller cpos 2/0
   [RouterA-Cpos2/0] e1 1 unframed
   [RouterA-Cpos2/0] e1 2 unframed
   ```

   # Create MP-group 1 and assign an IP address to it.

   ```
   [RouterA] interface mp-group 1
   [RouterA-Mp-group1] ip address 10.1.1.1 24
   [RouterA-Mp-group1] quit
   ```

   # Assign Serial 2/0/1:0 to MP-group 1.

   ```
   [RouterA] interface serial2/0/1:0
   [RouterA-Serial2/0/1:0] ppp mp mp-group 1
   [RouterA-Serial2/0/1:0] quit
   ```

   # Assign Serial 2/0/2:0 to MP-group 1.

   ```
   [RouterA] interface serial2/0/2:0
   [RouterA-Serial2/0/2:0] ppp mp mp-group 1
   [RouterA-Serial2/0/2:0] quit
   ```

2. Configure Router B:

   # Configure E1 2/1 to operate in E1 mode.

   ```
   <RouterB> system-view
   [RouterB] controller e1 2/1
   [RouterB-E1 2/1] using e1
   [RouterB-E1 2/1] quit
   ```

   # Configure E1 2/2 to operate in E1 mode.

   ```
   [RouterB] controller e1 2/2
   [RouterB-E1 2/2] using e1
   [RouterB-E1 2/2] quit
   ```

Create MP-group 1 and assign an IP address to it.

```
[RouterB] interface mp-group 1
[RouterB-Mp-group1] ip address 10.1.1.2 24
[RouterB-Mp-group1] quit
```

Assign Serial 2/0/1:0 to MP-group 1.

```
[RouterB] interface serial2/0/1:0
[RouterB-Serial2/0/1:0] ppp mp mp-group 1
[RouterB-Serial2/0/1:0] quit
```

Assign Serial 2/0/2:0 to MP-group 1.

```
[RouterB] interface serial2/0/2:0
[RouterB-Serial2/0/2:0] ppp mp mp-group 1
[RouterB-Serial2/0/2:0] quit
```

3. Configure other branch nodes in the same way Router B is configured. (Details not shown.)

Verifying the configuration

Verify the serial interface configuration and state, for example, on Router B.

```
<RouterB> display interface serial 2/0/1:0
```

Verify the MP interface, and MP bundle configuration and state, for example, on Router B.

```
<RouterB> display interface mp-group 1
<RouterB> display interface display ppp mp
```

Verify that the routers can ping one another. (Details not shown.)

Troubleshooting CPOS interfaces

Interface physical status is UP, link protocol status is down, and loopback is detected

Symptom

The H3C router is connected to another vendor's router through E1 channels on CPOS interfaces across an SDH network. PPP is used on the serial interface created for the E1 channel set.

The output from the **display interface serial** command shows the following errors:

- The physical state of the interface is UP, but the link protocol is DOWN.
- The serial interface is in a looped condition, even though loopback detection is not configured on the interface.

Solution

The symptom might occur when the router and its directly connected SDH device have different multiplex paths for the E1 channels. Multiplex path inconsistency can cause PPP negotiation failure because the SDH device transmits signals from the router in incorrect timeslots to the remote end. If the SDH device incorrectly maps a signal to an idle timeslot in a looped condition, the router can detect a loop on the serial interface.

To resolve the problem:

1. Identify the multiplex path for the E1 channels on the router.

```
<H3C> display controller cpos e1
```

2. Verify that the router and its directly connected SDH device have the same multiplex path for E1 channels. (Details not shown.)

3. Debug the loop condition.

```
<H3C> debugging ppp lcp error
```

4. If the problem persists, contact H3C Support.

Configuring loopback and null interfaces

Configuring a loopback interface

Introduction

A loopback interface is a virtual interface. The physical layer state and link layer protocols of a loopback interface are always up unless the loopback interface is manually shut down. A loopback interface is widely used in the following scenarios:

- A loopback interface address can be configured as the source address of the IP packets that the device generates. Because loopback interface addresses are stable unicast addresses, they are usually used as device identifications.
  - When you configure a rule on an authentication or security server to permit or deny packets that a device generates, you can simplify the rule by configuring it to permit or deny packets carrying the loopback interface address that identifies the device.
  - When you use a loopback interface address as the source address of IP packets, make sure the peer is reachable through routes by performing routing configuration. All data packets sent to the loopback interface are considered as packets sent to the device itself, so the device does not forward these packets.
- A loopback interface is often used in dynamic routing protocols. For example, if no router ID is configured for a dynamic routing protocol, the highest loopback interface IP address is selected as the router ID. In BGP, to avoid BGP sessions being interrupted by physical port failure, you can use a loopback interface as the source interface of BGP packets.

Configuration procedure

To configure a loopback interface:

Step	Command	Remarks
1. Enter system view.	**system-view**	N/A
2. Create a loopback interface and enter loopback interface view.	**interface loopback** *interface-number*	N/A
3. Set the interface description.	**description** *text*	Optional. By default, the description of a loopback interface is *interface name* Interface.
4. Shut down the loopback interface.	**shutdown**	Optional. By default, a loopback interface is up.
5. Set the intended bandwidth for the loopback interface.	**bandwidth** *bandwidth-value*	Optional.
6. Restore the default settings for the loopback interface.	**default**	Optional.

You can configure settings such as IP addresses and IP routes on loopback interfaces. For more information, see *Layer 3—IP Services Configuration Guide* and *Layer 3—IP Routing Configuration Guide*.

Configuring the null interface

Introduction

A null interface is a completely software-based logical interface, and is always up. However, you cannot use it to forward data packets or configure an IP address or link layer protocol on it. With a null interface specified as the next hop of a static route to a specific network segment, any packets routed to the network segment are dropped. The null interface provides a simpler way to filter packets than ACL. You can filter uninteresting traffic by transmitting it to a null interface instead of applying an ACL.

For example, by executing the **ip route-static 92.101.0.0 255.255.0.0 null 0** command (which configures a static route leading to null interface 0), you can have all the packets destined to the network segment 92.101.0.0/16 discarded.

Only one null interface, Null 0, is supported on your device. You cannot remove or create a null interface.

Configuration procedure

To enter null interface view:

Step	Command	Remarks
1. Enter system view.	**system-view**	N/A
2. Enter null interface view.	**interface null 0**	The Null 0 interface is the default null interface on your device. It cannot be manually created or removed.
3. Set the interface description.	**description** *text*	Optional. By default, the description of a null interface is *interface name* Interface.
4. Set the intended bandwidth for the null interface.	**bandwidth** *bandwidth-value*	Optional.
5. Restore the default settings for the null interface.	**default**	Optional.

Displaying and maintaining loopback and null interfaces

Task	Command	Remarks
Display information about loopback interfaces.	**display interface** [**loopback**] [**brief** [**down** | **description**]] [**|** { **begin** | **exclude** | **include** } *regular-expression*] **display interface loopback** *interface-number* [**brief** [**description**]] [**|** { **begin** | **exclude** | **include** } *regular-expression*]	Available in any view.
Display information about the null	**display interface** [**null**] [**brief** [**down**	Available in any view.

Task	Command	Remarks
interface.	| **description**]] [**|** { **begin** | **exclude** | **include** } *regular-expression*] **display interface null 0** [**brief** [**description**]] [**|** { **begin** | **exclude** | **include** } *regular-expression*]	
Clear the statistics on a loopback interface.	**reset counters interface** [**loopback** [*interface-number*]]	Available in user view.
Clear the statistics on the null interface.	**reset counters interface** [**null** [**0**]]	Available in user view.

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A C D H I O P T