



LLC2 and SDLC Commands

Logical Link Control, type 2 (LLC2) protocol provides connection-oriented service and is widely used in LAN environments, particularly among IBM communication systems connected by Token Ring. The Cisco IOS software supports LLC2 connections over Ethernet, Token Ring, and Fiber Distributed Data Interface (FDDI).

The LLC2 commands provide operations that support the following features:

- Local acknowledgment in remote source-route bridging (RSRB)
- IBM LAN Network Manager (LNM) support used in source-route bridging (SRB)
- Synchronous Data Link Control (SDLC)/LLC2 Media Translation (SDLLC)
- ISO Connection-Mode Network Services (CMNS) running X.25 packets over LLC2

SDLC is used as the primary Systems Network Architecture (SNA) link-layer protocol for WAN links. SDLC defines two types of network nodes: primary and secondary. Primary nodes poll secondary nodes in a predetermined order. Secondaries then send if they have outgoing data. When configured as primary and secondary nodes, routers are established as SDLC stations.

The SDLC commands described in this chapter pertain to routers configured as SDLC stations. This is in contrast to a device configured for SDLC Transport where the router is not configured as an SDLC station, but acts as an intermediary, passing SDLC frames between two SDLC stations across a mixed-media, multiprotocol environment.

The SDLC commands support the following features:

- SDLLC SDLC/LLC2 media translation
- SDLC local acknowledgment for serial tunnel (STUN)-enabled interfaces

Use the commands in this chapter to adjust the LLC2 and SDLC parameters. For LLC2 and SDLC parameter configuration information and examples, refer to the “Configuring LLC2 and SDLC Parameters” chapter in the *Cisco IOS Bridging and IBM Networking Configuration Guide*.

encapsulation sdlc

To configure an SDLC interface, use the **encapsulation sdlc** interface configuration command. To deactivate the command, use the **no** form of this command.

encapsulation sdlc

no encapsulation sdlc

Syntax Description This command has no arguments or keywords.

Defaults Disabled

Command Modes Interface configuration

Command History	Release	Modification
	10.3	This command was introduced.

Usage Guidelines

The **encapsulation sdlc** command must be used to configure an SDLC interface if you plan to implement DLSw+ or Frame Relay access support.

SDLC defines two types of network nodes: primary and secondary. Primary nodes poll secondary nodes in a predetermined order. Secondaries then send if they have outgoing data. When configured as primary and secondary nodes, our routers are established as SDLC stations. Use the **sdlc role** interface configuration command to establish the role as primary or secondary.

In the IBM environment, a front-end processor (FEP) is the primary station and establishment controllers (ECs) are secondary stations. In a typical scenario, an EC may be connected to dumb terminals and to a Token Ring network at a local site. At the remote site, an IBM host connects to an IBM FEP, which can also have links to another Token Ring LAN. Typically, the two sites are connected through an SDLC leased line.

If a router is connected to an EC, it takes over the function of the FEP, and must therefore be configured as a primary SDLC station. If the router is connected to a FEP, it takes the place of the EC, and must therefore be configured as a secondary SDLC station.

Examples The following example configures an SDLC interface:

```
interface serial 2/6
 no ip address
 encapsulation sdlc
```

Related Commands	Command	Description
	sdlc role	Establishes the router to be either a primary or secondary SDLC station.

encapsulation sdlc-primary

To configure the router as the primary SDLC station if you plan to configure the SDLLC media translation feature, use the **encapsulation sdlc-primary** interface configuration command. To deactivate the command, use the **no** form of this command.

encapsulation sdlc-primary

no encapsulation sdlc-primary

Syntax Description This command has no arguments or keywords.

Defaults Disabled

Command Modes Interface configuration

Command History	Release	Modification
	10.0	This command was introduced.

Usage Guidelines The **encapsulation sdlc-primary** or **encapsulation sdlc-secondary** command must be used to configure an SDLC interface. To use the **encapsulation sdlc-primary** command, first select the interface on which you want to enable SDLC. Then establish the router as a primary station. Next, assign secondary station addresses to the primary station using the **sdlc address** command.

SDLC defines two types of network nodes: primary and secondary. Primary nodes poll secondary nodes in a predetermined order. Secondaries then send if they have outgoing data. When configured as primary and secondary nodes, our routers are established as SDLC stations.

In the IBM environment, a front-end processor (FEP) is the primary station and establishment controllers (ECs) are secondary stations. In a typical scenario, an EC may be connected to dumb terminals and to a Token Ring network at a local site. At the remote site, an IBM host connects to an IBM FEP, which can also have links to another Token Ring LAN. Typically, the two sites are connected through an SDLC leased line.

If a router is connected to an EC, it takes over the function of the FEP, and must therefore be configured as a primary SDLC station. If the router is connected to an FEP, it takes the place of the EC, and must therefore be configured as a secondary SDLC station.

Examples The following example shows configures serial interface 0 on your router to allow two SDLC secondary stations to attach through a modem-sharing device (MSD) with addresses C1 and C2:

```
! enter a global command if you have not already
interface serial 0
 encapsulation sdlc-primary
 sdlc address c1
 sdlc address c2
```

Related Commands	Command	Description
	encapsulation sdlc-secondary	Configures the router as a secondary SDLC station if you plan to configure the SDLLC media translation feature.
	sdlc address	Assigns a set of secondary stations attached to the serial link.
	show llc2	Displays the LLC2 connections active in the router.

encapsulation sdlc-secondary

To configure the router as a secondary SDLC station if you plan to configure the SDLLC media translation feature, use the **encapsulation sdlc-secondary** interface configuration command. To deactivate the command, use the **no** form of this command.

encapsulation sdlc-secondary

no encapsulation sdlc-secondary

Syntax Description This command has no arguments or keywords.

Defaults Disabled

Command Modes Interface configuration

Command History	Release	Modification
	10.0	This command was introduced.

Usage Guidelines

An **encapsulation sdlc-primary** or **encapsulation sdlc-secondary** command must be used to configure an SDLC interface. To use the **encapsulation sdlc-secondary** command, first select the interface on which you want to enable SDLC. Then establish the router as a secondary station. Next, assign secondary station addresses to the primary station using the **sdlc address** command.

SDLC defines two types of network nodes: primary and secondary. Primary nodes poll secondary nodes in a predetermined order. Secondaries then send if they have outgoing data. When configured as primary and secondary nodes, our devices are established as SDLC stations.

In the IBM environment, a front-end processor (FEP) is the primary station and establishment controllers (ECs) are secondary stations. In a typical scenario, an EC may be connected to dumb terminals and to a Token Ring network at a local site. At the remote site, an IBM host connects to an IBM FEP, which can also have links to another Token Ring LAN. Typically, the two sites are connected through an SDLC leased line.

If a router is connected to an EC, it takes over the function of the FEP, and must therefore be configured as a primary SDLC station. If the router is connected to a FEP, it takes the place of the EC, and must therefore be configured as a secondary SDLC station.

Examples The following example establishes the router as a secondary SDLC station:

```
interface serial 0
 encapsulation sdlc-secondary
```

Related Commands	Command	Description
	encapsulation sdlc-primary	Configures the router as the primary SDLC station if you plan to configure the SDLLC media translation feature.
	sdlc address	Assigns a set of secondary stations attached to the serial link.
	show llc2	Displays the LLC2 connections active in the router.

llc2 ack-delay-time

To set the amount of time the Cisco IOS software waits for an acknowledgment before sending the next set of information frames, use the **llc2 ack-delay-time** internal adapter configuration command. To revert to the default setting, use the **no** form of this command.

llc2 ack-delay-time *milliseconds*

no llc2 ack-delay-time *milliseconds*

Syntax Description	<i>milliseconds</i>	Number of milliseconds the software allows incoming information frames to stay unacknowledged. The minimum is 1 ms and the maximum is 60000 ms. The default is 100 ms.
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Defaults	100 ms
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Command Modes	Internal adapter configuration
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Command History	Release	Modification
	10.0	This command was introduced.

Usage Guidelines

Upon receiving an information frame, each LLC2 station starts a timer. If the timer expires, an acknowledgment will be sent for the frame, even if the **llc2 ack-max** number of received frames has not been reached. Experiment with the value of the **llc2 ack-delay-time** command to determine the configuration that balances acknowledgment network overhead and quick response time (by receipt of timely acknowledgments).

Use this command in conjunction with the **llc2 ack-max** command to determine the maximum number of information frames the Cisco IOS software can receive before sending an acknowledgment.

Examples

In the following example, the software allows a 100-ms delay before I-frames must be acknowledged:

```
! enter a global command, if you have not already
interface tokenring 0
! sample ack-max command
llc2 ack-max 3
! allow a 100 millisecond delay before I-frames must be acknowledged
llc2 ack-delay-time 100
```

At time 0, two information frames are received. The llc2 ack-max amount of three has not been reached, so no acknowledgment for these frames is sent. If a third frame, which would force the software to send an acknowledgment, is not received in 100 ms, an acknowledgment will be sent anyway, because the llc2 ack-delay timer expires. At this point, because all frames are acknowledged, the counter for the ack-max purposes will be reset to zero.

■ llc2 ack-delay-time

Related Commands	Command	Description
	llc2 ack-max	Controls the maximum amount of information frames the Cisco IOS software can receive before it must send an acknowledgment.
	show llc2	Displays the LLC2 connections active in the router.

llc2 ack-max

To control the maximum amount of information frames the Cisco IOS software can receive before it must send an acknowledgment, use the **llc2 ack-max** internal adapter configuration command. To revert to the default setting, use the **no** form of this command.

llc2 ack-max *packet-count*

no llc2 ack-max *packet-count*

Syntax Description	<i>packet-count</i>	Maximum number of packets the software will receive before sending an acknowledgment. The minimum is 1 packet and the maximum is 255 packets. The default is 3 packets.
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Defaults	3 packets
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Command Modes	Internal adapter configuration
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Command History	Release	Modification
	10.0	This command was introduced.

Usage Guidelines

An LLC2-speaking station can send only a predetermined number of frames before it must wait for an acknowledgment from the receiver. If the receiver waits until receiving a large number of frames before acknowledging any of them, and then acknowledges them all at once, it reduces overhead on the network.

For example, an acknowledgment for five frames can specify that all five have been received, as opposed to sending a separate acknowledgment for each frame. To keep network overhead low, make this parameter as large as possible.

However, some LLC2-speaking stations expect this to be a low number. Some NetBIOS-speaking stations expect an acknowledgment to every frame. Therefore, for these stations, this number is best set to 1. Experiment with this parameter to determine the best configuration.

Examples

In the following example, the software is configured to receive up to seven frames before it must send an acknowledgment. Seven frames is the maximum allowed by SNA before a reply must be received:

```
! enter a global command, if you have not already
interface tokenring 0
! receive up to seven frames before sending an acknowledgment
  llc2 ack-max 7
! sample delay-time command
  llc2 ack-delay-time 100
```

Related Commands	Command	Description
	llc2 ack-delay-time	Sets the amount of time the Cisco IOS software waits for an acknowledgment before sending the next set of information frames.
	llc2 local-window	Controls the maximum number of information frames the Cisco IOS software sends before it waits for an acknowledgment.
	show llc2	Displays the LLC2 connections active in the router.

llc2 idle-time

To control the frequency of polls during periods of idle time (no traffic), use the **llc2 idle-time** internal adapter configuration command. To revert to the default setting, use the **no** form of this command.

llc2 idle-time *milliseconds*

no llc2 idle-time *milliseconds*

Syntax Description	<i>milliseconds</i>	Number of ms that can pass with no traffic before the LLC2 station sends a Receiver Ready frame. The minimum is 1 ms and the maximum is 60000 ms. The default is 10000 ms.
Defaults	10000 ms	
Command Modes	Internal adapter configuration	
Command History	Release	Modification
	10.0	This command was introduced.
Usage Guidelines	Periodically, when no information frames are being sent during an LLC2 session, LLC2 stations are sent a Receiver Ready frame to indicate they are available. Set the value for this command low enough to ensure a timely discovery of available stations, but not too low, or you will create a network overhead with too many Receiver Ready frames.	
Examples	<p>In the following example, the Cisco IOS software waits 20,000 ms before sending a Receiver Ready (“are you there”) frame:</p> <pre>! enter a global command, if you have not already interface tokenring 0 ! wait 20000 milliseconds before sending receiver-ready frames llc2 idle-time 20000</pre>	
Related Commands	Command	Description
	llc2 tbusy-time	Controls the amount of time the Cisco IOS software waits until repolling a busy remote station.
	llc2 tpf-time	Sets the amount of time the Cisco IOS software waits for a final response to a poll frame before resending the poll frame.
	show llc2	Displays the LLC2 connections active in the router.

llc2 local-window

To control the maximum number of information frames the Cisco IOS software sends before it waits for an acknowledgment, use the **llc2 local-window** internal adapter configuration command. To revert to the default setting, use the **no** form of this command.

llc2 local-window *packet-count*

no llc2 local-window *packet-count*

Syntax Description	<i>packet-count</i>	Maximum number of packets that can be sent before the software must wait for an acknowledgment. The minimum is 1 packet and the maximum is 127 packets. The default is 7 packets.
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Defaults	7 packets
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Command Modes	Internal adapter configuration
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Command History	Release	Modification
	10.0	This command was introduced.

Usage Guidelines	An LLC2-speaking station can send only a predetermined number of frames before it must wait for an acknowledgment from the receiver. Set this number to the maximum value that can be supported by the stations with which the router communicates. Setting this value too large can cause frames to be lost, because the receiving station may not be able to receive all of them.
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Examples	In the following example, the software will send as many as 30 information frames through Token Ring interface 1 before it must receive an acknowledgment:
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```
! enter a global command, if you have not already
interface tokenring 1
 llc2 local-window 30
```

Related Commands	Command	Description
	llc2 ack-max	Controls the maximum amount of information frames the Cisco IOS software can receive before it must send an acknowledgment.
	show llc2	Displays the LLC2 connections active in the router.

llc2 n1

To specify the maximum size of an I-frame, use the **llc2 n1** internal adapter configuration command. To revert to the default setting, use the **no llc2 n1** form of this command.

llc2 n1 *bytes*

no llc2 n1

Syntax Description	<i>bytes</i>	Maximum size of an I-frame. The valid range is 1 to 4105 bytes. The default is 4105 bytes.
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Defaults	The default maximum I-frame size is 4105 bytes.
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Command Modes	Internal adapter configuration
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Command History	Release	Modification
	12.2	This command was introduced.

Usage Guidelines The following example sets the maximum I-frame size to 2057 bytes:

```
! enter a global command, if you have not already
interface tokenring 1
! maximum I-frame size of 2057 bytes
llc2 n1 2057
```

Related Commands	Command	Description
	show llc2	Displays the LLC2 connections active in the router.

llc2 n2

To control the amount of times the Cisco IOS software retries sending unacknowledged frames or repolls remote busy stations, use the **llc2 n2** internal adapter configuration command. To revert to the default setting, use the **no** form of this command.

llc2 n2 *retry-count*

no llc2 n2

Syntax Description	<i>retry-count</i>	Number of times the software retries operations. The minimum is 1 retry and the maximum is 255 retries. The default is 8 retries.
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Defaults	8 retries
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Command Modes	Internal adapter configuration
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Command History	Release	Modification
	10.0	This command was introduced.

Usage Guidelines	An LLC2 station must have some limit to the number of times it will resend a frame when the receiver of that frame has not acknowledged it. After the software is told that a remote station is busy, it will poll again based on the <i>retry-count</i> value. When this retry count is exceeded, the LLC2 station terminates its session with the other station. Set this parameter to a value that balances between frame checking and network performance.
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Examples	In the following example, the software will resend a frame up to four times through Token Ring interface 1 before it must receive an acknowledgment. Because you generally do not need to change the retry limit, this example shows you how to reset the limit to the default of 8.
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```
! enter a global command, if you have not already
interface tokenring 1
! retry value of 8
llc2 n2 8
```

Related Commands

Command	Description
llc2 t1-time	Controls the amount of time the Cisco IOS software will wait before resending unacknowledged information frames.
llc2 tbusy-time	Controls the amount of time the Cisco IOS software waits until repolling a busy remote station.
llc2 trej-time	Controls the amount of time the Cisco IOS software waits for a correct frame after sending a reject command to the remote LLC2 station.
show llc2	Displays the LLC2 connections active in the router.

llc2 nw

To increase the window size for consecutive good I-frames received, use the **llc2 nw** internal adapter configuration command. To revert to the default setting, use the **no** form of this command.

llc2 nw *window-size-increase*

no llc2 nw

Syntax Description	<i>window-size-increase</i> Number of frames to increase the window size for consecutive good I-frames received (0 is disabled). The allowed range is from 1 to 7. The default is 0.
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Defaults	0 (disabled)
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Command Modes	Internal adapter configuration
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Command History	Release	Modification
	11.0	This command was introduced.
	12.1	The allowed range was changed to from 0 to 31.

Examples In the following example, the window size for Token Ring interface 1 is increased by 1 frame when consecutive good I-frames are received:

```
! enter a global command, if you have not already
interface tokenring 1
! increase window size by 1
llc2 nw 1
```

Related Commands	Command	Description
	show llc2	Displays the LLC2 connections active in the router.
	llc2 rnr-activated	Invokes dynamic windowing logic for a link station when the router receives an RNR from the remote link station.

llc2 rcv-window

To control the number of frames in the receive window, use the **llc2 rcv-window** internal adapter configuration command. To revert to the default setting, use the **no** form of this command.

llc2 rcv-window *frame-count*

no llc2 rcv-window

Syntax Description	<i>frame-count</i>	Specifies the number of frames in the receive window. The default is 7.
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Defaults	7 frames
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Command Modes	Internal adapter configuration
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Command History	Release	Modification
	11.0	This command was introduced.

Examples In the following example, the receive window for Token Ring interface 1 contains 11 frames:

```
! enter a global command, if you have not already
interface tokenring 1
! 11 frames in the receive window
llc2 rcv-window 11
```

Related Commands	Command	Description
	show llc2	Displays the LLC2 connections active in the router.

llc2 rnr-activated

To invoke dynamic windowing logic for a link station when the router receives an RNR from the remote link station, use the **llc2 rnr-activated** internal adapter configuration command. To disable dynamic windowing logic, use the **no** form of this command.

llc2 rnr-activated

no llc2 rnr-activated

Syntax Description This command has no arguments or keywords.

Defaults Disabled

Command Modes Internal adapter configuration

Release	Modification
12.1	This command was introduced.

Usage Guidelines The **llc2 nw** command must be enabled before the **llc2 rnr-activated** command can be configured.

Examples In the following example, the **llc2n rnr-activated** command is enabled on Adapter 0 4000.cafe.0000:

```
interface Channel4/2
max-llc2-rcvbufs 750
lan TokenRing 12
source-bridge 16 1 500
adapter 0 4000.cafe.0000
  llc2 Nw 31
  llc2 rnr-activated
adapter 1 4000.cafe.0001
```

Command	Description
llc2 nw	Increases the window size for consecutive good I-frames received.
max-llc2-rcvbufs	Configures the number of receive DMA buffers that are used by the LLC2 stack on the CIP/XCPA.

llc2 send-window

To control the number of frames in the send window, use the **llc2 send-window** internal adapter configuration command. To revert to the default setting, use the **no** form of this command.

llc2 send-window *frame-count*

no llc2 send-window

Syntax Description	<i>frame-count</i>	Specifies the number of frames in the send window. The default is 7.
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Defaults	7 frames
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Command Modes	Internal adapter configuration
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Command History	Release	Modification
	11.0	This command was introduced.

Examples In the following example, the send window for Token Ring interface 1 contains 11 frames:

```
! enter a global command, if you have not already
interface tokenring 1
! 11 frames in the send window
llc2 send-window 11
```

Related Commands	Command	Description
	show llc2	Displays the LLC2 connections active in the router.

llc2 t1-time

To control the amount of time the Cisco IOS software will wait before resending unacknowledged information frames, use the **llc2 t1-time** internal adapter configuration command. To revert to the default setting, use the **no** form of this command.

llc2 t1-time *milliseconds*

no llc2 t1-time *milliseconds*

Syntax Description	<i>milliseconds</i>	Number of milliseconds the software waits before resending unacknowledged information frames. The minimum is 1 ms and the maximum is 60000 ms. The default is 1000 ms.
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Defaults	1000 ms
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Command Modes	Internal adapter configuration
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Command History	Release	Modification
	10.0	This command was introduced.

Usage Guidelines	Use this command in conjunction with the llc2 n2 command to provide a balance of network monitoring and performance. Ensure that enough time is allowed to account for the round trip between the router and its LLC2-speaking stations under heavy network loading conditions.
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Examples	In the following example, the software will wait 4000 ms before resending an unacknowledged frame through Token Ring interface 2:
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```
! enter a global command, if you have not already
interface tokenring 2
! wait 4000 milliseconds before retransmitting a frame through tokenring 2
llc2 t1-time 4000
```

Related Commands	Command	Description
	llc2 n2	Controls the number of times the Cisco IOS software retries sending unacknowledged frames or repolls remote busy stations.
	llc2 tpf-time	Sets the amount of time the Cisco IOS software waits for a final response to a poll frame before resending the poll frame.
	llc2 xid-retry-time	Sets the amount of time the Cisco IOS software waits for a reply to XID frames before dropping the session.
	show llc2	Displays the LLC2 connections active in the router.

llc2 tbusy-time

To control the amount of time the Cisco IOS software waits until repolling a busy remote station, use the **llc2 tbusy-time** internal adapter configuration command. To revert to the default setting, use the **no** form of this command.

llc2 tbusy-time *milliseconds*

no llc2 tbusy-time *milliseconds*

Syntax Description	<i>milliseconds</i>	Number of ms the software waits before repolling a busy remote station. The minimum is 1 ms and the maximum is 60000 ms. The default is 9600 ms.
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Defaults	9600 ms
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Command Modes	Internal adapter configuration
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Command History	Release	Modification
	10.0	This command was introduced.

Usage Guidelines	An LLC2 station has the ability to notify other stations that it is temporarily busy, so the other stations will not attempt to send any new information frames. The frames sent to indicate this are called Receiver Not Ready (RNR) frames. Change the value of this parameter only to increase the value for LLC2-speaking stations that have unusually long busy periods before they clear their busy status. Increasing the value will prevent the stations from timing out.
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Examples	In the following example, the software will wait up to 12,000 ms before attempting to poll a remote station through Token Ring interface 0 to learn the station's status:
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```
! enter a global command, if you have not already
interface tokenring 0
! wait 12000 milliseconds before polling a station through tokenring 0
llc2 tbusy-time 12000
```

Related Commands	Command	Description
	llc2 n2	Controls the number of times the Cisco IOS software retries sending unacknowledged frames or repolls remote busy stations.
	llc2 idle-time	Controls the frequency of polls during periods of idle time (no traffic).
	show llc2	Displays the LLC2 connections active in the router.

llc2 tpf-time

To set the amount of time the Cisco IOS software waits for a final response to a poll frame before resending the poll frame, use the **llc2 tpf-time** internal adapter configuration command. To revert to the default setting, use the **no** form of this command.

llc2 tpf-time *milliseconds*

no llc2 tpf-time *milliseconds*

Syntax Description	<i>milliseconds</i>	Number of ms the software waits for a final response to a poll frame before resending the poll frame. The minimum is 1 ms and the maximum is 60000 ms. The default is 1000 ms.
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Defaults	1000 ms
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Command Modes	Internal adapter configuration
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Command History	Release	Modification
	10.0	This command was introduced.

Usage Guidelines

When sending a command that must receive a response, a poll bit is sent in the frame. This is the receiving station's clue that the sender is expecting some response from it, be it an acknowledgment of information frames or an acknowledgment of more administrative tasks, such as starting and stopping the session. Once a sender gives out the poll bit, it cannot send any other frame with the poll bit set until the receiver replies with a frame containing a final bit set. If the receiver is faulty, it may never return the final bit to the sender. Therefore, the sender could be waiting for a reply that will never come. To avoid this problem, when a poll-bit-set frame is sent, a transmit-poll-frame (TPF) timer is started. If this timer expires, the software assumes that it can send another frame with a poll bit.

Usually, you will not want to change this value. If you do, the value should be larger than the T1 time, set with the **llc2 t1-time** command. The T1 time determines how long the software waits for receipt of an acknowledgment before sending the next set of frames.

Examples

While you generally will not want to change the transmit-poll-frame time, this example sets the TPF time to 3000 ms. Because the TPF time should be larger than the LLC2 T1 time, this example shows the TPF time as double the LLC2 T1 time.

```
! enter a global command, if you have not already
interface tokenring 0
! send a poll bit set through tokenring 0 after a 3000 ms delay
llc2 tpf-time 3000
! wait 1500 milliseconds for an acknowledgment before resending I-frames
llc2 t1-time 1500
```

Related Commands	Command	Description
	llc2 idle-time	Controls the frequency of polls during periods of idle time (no traffic).
	llc2 n2	Controls the number of times the Cisco IOS software retries sending unacknowledged frames or repolls remote busy stations.
	llc2 t1-time	Controls the amount of time the Cisco IOS software will wait before resending unacknowledged information frames.
	show llc2	Displays the LLC2 connections active in the router.

llc2 trej-time

To control the amount of time the Cisco IOS software waits for a correct frame after sending a reject command to the remote LLC2 station, use the **llc2 trej-time** internal adapter configuration command. To revert to the default setting, use the **no** form of this command.

llc2 trej-time *milliseconds*

no llc2 trej-time *milliseconds*

Syntax Description	<i>milliseconds</i>	Number of milliseconds the software waits for a resend of a rejected frame before sending a reject command to the remote station. The minimum is 1 ms and the maximum is 60000 ms. The default is 3200 ms.
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Defaults	3200 ms
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Command Modes	Internal adapter configuration
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Command History	Release	Modification
	10.0	This command was introduced.

Usage Guidelines	When an LLC2 station sends an information frame, a sequence number is included in the frame. The LLC2 station that receives these frames will expect to receive them in order. If it does not, it can reject a frame and indicate which frame it is expecting to receive instead. Upon sending a reject, the LLC2 station starts a reject timer. If the frames are not received before this timer expires, the session is disconnected.
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Examples	In the following example, the software will wait up to 1000 ms to receive a previously rejected frame before resending its reject message to the station that sent the frame:
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```
! enter a global command, if you have not already
interface tokenring 0
! wait 1000 milliseconds before resending a reject message through tokenring 0
llc2 trej-time 1000
```

Related Commands	Command	Description
	llc2 n2	Controls the number of times the Cisco IOS software retries sending unacknowledged frames or repolls remote busy stations.
	show llc2	Displays the LLC2 connections active in the router.

llc2 xid-neg-val-time

To control the frequency of exchange of identification (XID) transmissions by the Cisco IOS software, use the **llc2 xid-neg-val-tim** internal adapter configuration command. To revert to the default setting, use the **no** form of this command.

llc2 xid-neg-val-time *milliseconds*

no llc2 xid-neg-val-time *milliseconds*

Syntax Description	<i>milliseconds</i>	Number of ms after which the software sends XID frames to other LLC2-speaking stations. The minimum is 0 ms and the maximum is 60000 ms. The default is 0 ms.
---------------------------	---------------------	---

Defaults	0 ms
-----------------	------

Command Modes	Internal adapter configuration
----------------------	--------------------------------

Command History	Release	Modification
	10.0	This command was introduced.

Usage Guidelines	<p>Do not change the llc2 xid-neg-val-time parameter unless requested by your technical support representative.</p> <p>LLC2-speaking stations can communicate XID frames to each other. These frames identify the stations at a higher level than the MAC address and also can contain information about the configuration of the station. These frames are typically sent only during setup and configuration periods when it is deemed that sending them is useful. The greatest frequency at which this information is transferred is controlled by this timer.</p>
-------------------------	---

Examples	The following example shows how to reset the frequency of XID transmissions to the default of 0 ms:
-----------------	---

```
! enter a global command, if you have not already
interface tokenring 0
! set the frequency of XID transmissions to 0
llc2 xid-neg-val-time 0
```

Related Commands	Command	Description
	llc2 xid-retry-time	Sets the amount of time the Cisco IOS software waits for a reply to XID frames before dropping the session.
	show llc2	Displays the LLC2 connections active in the router.

llc2 xid-retry-time

To set the amount of time the Cisco IOS software waits for a reply to exchange of identification (XID) frames before dropping the session, use the **llc2 xid-retry-time** internal adapter configuration command. To revert to the default setting, use the **no** form of this command.

llc2 xid-retry-time *milliseconds*

no llc2 xid-retry-time *milliseconds*

Syntax Description	<i>milliseconds</i>	Number of ms the software waits for a reply to XID frames before dropping a session. The minimum is 1 ms and the maximum is 60000 ms. The default is 60000 ms.
---------------------------	---------------------	--

Defaults	60000 ms
-----------------	----------

Command Modes	Internal adapter configuration
----------------------	--------------------------------

Command History	Release	Modification
	10.0	This command was introduced.

Usage Guidelines	Set this value greater than the value of the T1 time, or the time the software waits for an acknowledgment before dropping the session. T1 time is set with the llc2 t1-time command.
-------------------------	--

Examples	The following example sets the software to wait up to 60,000 ms for a reply to XID frames it sent to remote stations (which resets the value to its default):
-----------------	---

```
! enter a global command, if you have not already
interface tokenring 0
! wait 60000 milliseconds for a reply to XID frames
llc2 xid-retry-time 60000
```

Related Commands	Command	Description
	llc2 t1-time	Controls the amount of time the Cisco IOS software will wait before resending unacknowledged information frames.
	llc2 xid-neg-val-time	Controls the frequency of XID transmissions by the Cisco IOS software.
	show llc2	Displays the LLC2 connections active in the router.

max-llc2-rcvbufs

To configure the number of receive DMA buffers that are used by the LLC2 stack on the CIP/XCPA, use the **max-llc2-rcvbufs** internal adapter configuration command. Use the **no** form of this command to revert to the default setting.

max-llc2-rcvbufs *buffers*

no max-llc2-rcvbufs *buffers*

Syntax Description	<i>buffers</i>	The number of receive DMA buffers that are used by the LLC2 stack on the CIP/XCPA. The allowed range is from 500 to 1250 in multiples of 50. The default is 500.						
Defaults	500 buffers							
Command Modes	Virtual interface configuration							
Command History	<table border="1"> <thead> <tr> <th>Release</th> <th>Modification</th> </tr> </thead> <tbody> <tr> <td>12.1</td> <td>This command was introduced.</td> </tr> </tbody> </table>	Release	Modification	12.1	This command was introduced.			
Release	Modification							
12.1	This command was introduced.							
Examples	<p>The following example configures the max-llc2-rcvbufs for 750 buffers on Channel interface 4/2:</p> <pre>interface Channel4/2 max-llc2-rcvbufs 750 lan TokenRing 12 source-bridge 16 1 500 adapter 0 4000.cafe.0000 llc2 Nw 31 llc2 rnr-activated adapter 1 4000.cafe.0001</pre>							
Related Commands	<table border="1"> <thead> <tr> <th>Command</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>llc2 nw</td> <td>Increases the window size for consecutive good I-frames received.</td> </tr> <tr> <td>llc2 rnr-activated</td> <td>Invokes dynamic windowing logic for a link station when the router receives an RNR from the remote link station.</td> </tr> </tbody> </table>	Command	Description	llc2 nw	Increases the window size for consecutive good I-frames received.	llc2 rnr-activated	Invokes dynamic windowing logic for a link station when the router receives an RNR from the remote link station.	
Command	Description							
llc2 nw	Increases the window size for consecutive good I-frames received.							
llc2 rnr-activated	Invokes dynamic windowing logic for a link station when the router receives an RNR from the remote link station.							

sdlc address

To assign a set of secondary stations attached to the serial link, use the **sdlc address** interface configuration command. To remove an assigned secondary station use the **no** form of this command.

To assign the IBM reserved address ff as a non-broadcast valid local address, configure the **sdlc address** interface configuration command with a hexbyte value of *ff* and specify the **ack-mode** option. To deactivate, use the **no** form of this command.

sdlc address *hexbyte* [**echo**] [**ack-mode**] [**xid-poll**] [**switched**] [**seonly**] [**xid-passthru**] [**passive**]
[**K number**]

no sdlc address *hexbyte* [**echo**] [**ack-mode**] [**xid-poll**] [**switched**] [**seonly**] [**xid-passthru**]
[**passive**] [**K number**]

Syntax Description

<i>hexbyte</i>	Hexadecimal number (base 16) that indicates the address of the serial link. The range is 1 to ff. If ff is configured, the ack-mode option must be specified.
echo	(Optional) Treats non-echo and echo SDLC addresses as the same address.
ack-mode	(Optional) Supports applications that require local termination of an SDLC connection with address FF. This option should be used only if you use the SDLC address ff as a regular (not a broadcast) address.
xid-poll	(Optional) Configures the router to send a null XID to the Token Ring-attached host device. This tells the host device to start the session.
switched	(Optional) Configures the router to send an exchange identification (XID) to an SDLC attached device. When the device answers, then a proxy XID is sent to the peer.
seonly	(Optional) Eliminates the need for counting PU4 lines on the Network Control Program (NCP) to determine the correct poll address. Since the router is always secondary, when seonly is coded, the polling address will be determined by the router.
xid-passthru	(Optional) Allows the router to pass the (XID) through the interface in both the host and end device's direction.
passive	(Optional) Causes the router to wait before sending a SNRM until it receives an XID from the host. This keyword is valid only when the role is primary, and it requires the sdlc partner command with keyword inbound specified.
K number	(Optional) Specifies the maximum number of information frames (I-frames) that a router can send before it expects an acknowledgment from the end device. The minimum window-size is 1 and the maximum size is 7. The default is 7.

Defaults

No secondary stations are assigned.

Command Modes

Interface configuration

Command History	Release	Modification
	10.0	This command was introduced.
	11.0	The SDLC address ack-mode option was introduced.
	11.3	The command was modified to include the switched , passive , xid-poll , and xid-passthru options.
	11.3(T)	The command was modified to include the seonly option.
	12.1(5)T	The sdlc address and sdlc address ff ack-mode commands were combined. The K option was added.

Usage Guidelines

Before you can use this command, you must first specify the encapsulation on the interface on which you want to enable SDLC; then, establish the router link station role. Next, assign secondary station addresses using the **sdlc address** command. The addresses are given one per line in hexadecimal (base 16).

The **sdlc address ff ack-mode** command is used to support applications that require local termination on an SDLC connection with address ff. This command should be used only if you use the SDLC address ff as a regular (not a broadcast) address.

The optional keyword **echo** is valid only for TG interfaces. When you use the **echo** keyword, *hexbyte* is the non-echo SDLC address.

The optional keyword **passive** is valid only when the role is primary. When you use the **passive** keyword, the **sdlc partner** command is required with keyword **inbound** specified.

Examples

The following example shows how to configure serial interface 0 with two SDLC secondary stations attached to it through a modem-sharing device with addresses C1 and C2:

```
interface serial 0
 encapsulation sdlc
 sdlc role primary
 sdlc address c1
 sdlc address c2
```

Related Commands

Command	Description
encapsulation sdlc	Configures an SDLC interface.
encapsulation sdlc-primary	Configures the router as the primary SDLC station if you plan to configure the SDLLC media translation feature.
encapsulation sdlc-secondary	Configures the router as a secondary SDLC station if you plan to configure the SDLLC media translation feature.
show llc2	Displays the LLC2 connections active in the router.
stun route address tcp	Specifies TCP encapsulation and optionally establishes SDLC local acknowledgment (SDLC transport) for STUN.
sdlc role	Establishes a router to be either a primary or secondary SDLC station.

sdlc dte-timeout

To adjust the amount of time a data terminal equipment (DTE) interface waits for the data circuit-terminating equipment (DCE) to assert a Clear To Send (CTS) signal before dropping a Request To Send (RTS), use the **sdlc dte-timeout** interface configuration command. To revert to the default setting, use the **no** form of this command.

sdlc dte-timeout *unit*

no sdlc dte-timeout *unit*

Syntax Description	<i>unit</i>	Timeout wait interval in microseconds. The valid range is 10 to 64000. Each unit is approximately 5 microseconds. The default is 10 units (approximately 50 microseconds).
---------------------------	-------------	--

Defaults	10 units (approximately 50 microseconds)
-----------------	--

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

Command History	Release	Modification
	10.0	This command was introduced.

Usage Guidelines	Use this command on an interface that is in half-duplex mode and that has been configured for DTE.
-------------------------	--

Examples	The following example sets the amount of time that the DTE waits for the DCE to assert a CTS to 100 units (approximately 500 microseconds):
-----------------	---

```
sdlc dte-timeout 100
```

Related Commands	Command	Description
	half-duplex	Specifies half-duplex mode on an SDLC interface or on the FDDI full-duplex, single-mode port adapter and FDDI full-duplex, multimode port adapter on the Cisco 7200 series and Cisco 7500 series routers.
	half-duplex timer	Tunes half-duplex timers.

sdlc frmr-disable

To indicate that secondary stations on a particular serial link do not support Frame Rejects (FRMRs) or error indications, use the **sdlc frmr-disable** interface configuration command. To specify that the secondary station does support FRMRs, use the **no** form of this command.

sdlc frmr-disable

no sdlc frmr-disable

Syntax Description This command has no arguments or keywords.

Defaults Support of FRMRs or error indications

Command Modes Interface configuration

Command History	Release	Modification
	10.0	This command was introduced.

Usage Guidelines FRMRs are error indications that can be sent to an SDLC station indicating that a protocol error has occurred. Not all SDLC stations support FRMRs. If this command is enabled, when the Cisco IOS software receives an error, it drops the line by sending a disconnect request to the remote station.

Examples In the following example, the software is set to drop the serial line when it receives a protocol error:

```
interface serial 0
 sdlc frmr-disable
```

Related Commands	Command	Description
	show llc2	Displays the LLC2 connections active in the router.

sdhc holdq

To control the maximum number of packets that can be held in a buffer before being sent to a remote SDLC station, use the **sdhc holdq** interface configuration command. To revert to the default setting, use the **no** form of this command.

sdhc holdq *address queue-size*

no sdhc holdq *address queue-size*

Syntax Description	Parameter	Description
	<i>address</i>	SDLC address for which you are specifying a queue size.
	<i>queue-size</i>	Local send window size. The minimum is 1 packet. No maximum value has been established. The default is 200 packets.

Defaults 200 packets

Command Modes Interface configuration

Command History	Release	Modification
	10.0	This command was introduced.

Usage Guidelines This command is particularly useful with the SDLLC feature that allows an LLC2-speaking SNA station on a Token Ring to communicate with an SDLC-speaking SNA station on a serial link. Frame sizes and window sizes on Token Rings are often much larger than those acceptable for serial links. The fact that serial links are often much slower than Token Rings often makes this problem worse. Therefore, temporary backlogs can exist in periods of high data transfer from the Token Ring station to the serial station. A buffer creates a holding place for backlogged frames waiting to be sent on the serial link. This command is specified for each SDLC address, and therefore, for each SDLC secondary station on the serial link.

Examples The following example shows how to change the output hold queue length to 30 frames on an SDLC station of address C1 off serial interface 0:

```
interface serial 0
 encapsulation sdhc-primary
 sdhc address c1
 sdhc holdq c1 30
```

Related Commands	Command	Description
	show llc2	Displays the LLC2 connections active in the router.

sdlc k

To set the window size in order to control the maximum number of information frames the Cisco IOS software sends before it must stop sending and wait for an acknowledgment from the receiving router, use the **sdlc k** interface configuration command. To revert to the default setting, use the **no** form of this command.

sdlc k *window-size*

no sdlc k *window-size*

Syntax Description	<i>window-size</i>	Local send window size. The minimum is 1 frame. The maximum is 7 frames, which is the default.
---------------------------	--------------------	--

Defaults	7 frames
-----------------	----------

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

Command History	Release	Modification
	10.0	This command was introduced.

Usage Guidelines	When the Cisco IOS software is communicating with SDLC, it must have a parameter that controls the maximum number of information frames it will send before it must stop sending and wait for an acknowledgment. The k parameter controls this window of acceptable frames. Use this command in conjunction with the sdlc n1 command to create a balance between frame checking and network performance.
-------------------------	--

Examples	In the following example, the software can send up to five frames before it must receive an acknowledgment:
-----------------	---

```
! enter a global command, if you have not already
interface tokenring 0
!send up to 5 frames, then wait for acknowledgment
sdlc k 5
```

Related Commands	Command	Description
	sdlc n1	Controls the maximum size of an incoming frame.
	show llc2	Displays the LLC2 connections active in the router.

sdhc line-speed

To enable adaptive SDLC T1, use the **sdhc line-speed** interface configuration command. To deactivate the command, use the **no** form of this command.

sdhc line-speed *rate*

no sdhc line-speed *rate*

Syntax Description	<i>rate</i>	Clock rate in bits per second.
---------------------------	-------------	--------------------------------

Defaults	No default rate
-----------------	-----------------

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

Command History	Release	Modification
	10.0	This command was introduced.

Usage Guidelines	This feature is used to calculate the adjusted SDLC T1 value. The adjusted T1 is used to compensate for the delay between the time the system software passes a packet to the microcode, and the time the packet is actually sent out on the line. For a DCE device, this should be equal to the clock rate on the interface. For a DTE device, it should be equal to the clock rate on the DCE device to which the DTE is connected.
-------------------------	---

Examples	In the following example, the SDLC line-speed rate is set to <i>rate</i> :
-----------------	--

```
sdhc line-speed rate
```

Related Commands	Command	Description
	sdhc n2	Determines the number of times that the Cisco IOS software resends a frame before terminating the SDLC session.
	sdhc t1	Controls the amount of time the Cisco IOS software waits for an acknowledgment to a frame or sequence of frames.

sdlc n1

To control the maximum size of an incoming frame, use the **sdlc n1** interface configuration command. To revert to the default setting, use the **no** form of this command.

sdlc n1 *bit-count*

no sdlc n1 *bit-count*

Syntax Description	<i>bit-count</i>	Number indicating bit size. Frames that exceed this size are rejected. The minimum is 1 bit. The maximum value depends on the configured maximum MTU value for the interface.
---------------------------	------------------	---

Defaults	12000 bits
-----------------	------------

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

Command History	Release	Modification
	10.0	This command was introduced.

Usage Guidelines	<p>Use with the sdlc k command to reduce network overhead while continuing to check the sending of frames.</p> <p>The formula for determining the maximum allowed value for the <i>bit-count</i> argument is the maximum MTU value of the interface + 2 bytes (for the SDLC header) multiplied by 8 (to convert from bytes to bits). For example, if the maximum MTU of the interface is 1500 bytes, then the largest value for the <i>bit-count</i> argument is $(1500+2)*8=12016$ bits. Usually, the default maximum MTU size is 1500 bytes, but it can be configured as high as 18000 bytes.</p>
-------------------------	---

Examples In the following example, the Cisco IOS software rejects frames larger than 10,000 bits:

```
interface serial 0
  sdlc n1 10000
```

Related Commands	Command	Description
	sdlc k	Sets the window size in order to control the maximum number of information frames the Cisco IOS software sends before it must stop sending and wait for an acknowledgment from the receiving router
	show llc2	Displays the LLC2 connections active in the router.

sdhc n2

To determine the number of times that the Cisco IOS software resends a frame before terminating the SDLC session, use the **sdhc n2** interface configuration command. To revert to the default setting, use the **no** form of this command.

sdhc n2 *retry-count*

no sdhc n2 *retry-count*

Syntax Description	<i>retry-count</i>	Number of retry attempts. When this number is exceeded, the SDLC station terminates its session with the other station. The minimum is 1 and the maximum is 255. The default is 20 retries.
---------------------------	--------------------	---

Defaults	20 retries
-----------------	------------

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

Command History	Release	Modification
	10.0	This command was introduced.

Usage Guidelines	Use with the sdhc t1 command to reduce network overhead while continuing to check the sending of data.
-------------------------	---

Examples	In the following example, the software is set to drop an SDLC station after five unsuccessful attempts to receive an acknowledgment for a frame:
-----------------	--

```
interface serial 0
  sdhc n2 5
```

Related Commands	Command	Description
	sdhc t1	Controls the amount of time the Cisco IOS software waits for an acknowledgment to a frame or sequence of frames.
	show llc2	Displays the LLC2 connections active in the router.

sdlc partner

To specify the destination address with which an LLC session is established for the SDLC station, use the **sdlc partner** interface configuration command. To cancel the configuration, use the **no** form of this command.

sdlc partner *mac-address sdlc-address* { **inbound** | **outbound** }

no sdlc partner *mac-address sdlc-address* { **inbound** | **outbound** }

Syntax Description	
<i>mac-address</i>	The 48-bit Media Access Control (MAC) address of the Token Ring host.
<i>sdlc-address</i>	SDLC address of the serial device that will communicate with the Token Ring host. The valid range is 1 to FE.
inbound	Prevents the router from sending proxy XIDs to the remote end station on behalf of the station specified. The remote end station must initiate the connection. When the router is configured for SDLC role secondary, the default is inbound (the router does not send proxy XIDs until it is polled). The inbound keyword is required if you want the router to wait before sending an SNRM until it receives an XID from the host. See the passive keyword on the sdlc address command for more details.
outbound	Causes the router to send proxy XIDs to the partner end station. If the remote end station responds, then (for PU 2.1 local devices) a NULL XID is sent on the SDLC line. The default behavior for SDLC role primary is outbound, and for SDLC role secondary is inbound.

Defaults No partner is defined.

Command Modes Interface configuration

Command History	Release	Modification
	11.0	This command was introduced.
	11.2	The following keywords were added: <ul style="list-style-type: none"> • inbound • outbound

Usage Guidelines The **inbound** keyword prevents unwanted messages on the host operator console from inbound XID's to inactive VTAM Switched Major Nodes. It directs SDLC to not send Test or XID frames to the host, FEP, or 3172 even after the connection to a downstream PU2 is complete. The **inbound** keyword is required for System88 support.

Examples

The following example establishes the correspondence between an SDLC and QLLC connection:

```
sdhc partner 1000.5aed.1f53 d2 inbound outbound
```

Related Commands

Command	Description
encapsulation sdhc	Configures an SDLC interface.
sdhc address	Assigns a set of secondary stations attached to the serial link.
sdhc dlsw	Attaches SDLC addresses to DLSw+.
sdhc vmac	Configures a MAC address for the serial interface.

sdlc poll-limit-value

To control how many times a single secondary station can be polled for input before the next station must be polled, use the **sdlc poll-limit-value** interface configuration command. To revert to the default setting, use the **no** form of this command.

sdlc poll-limit-value *count*

no sdlc poll-limit-value *count*

Syntax Description	<i>count</i>	Number of times the Cisco IOS software can poll one secondary station before proceeding to the next station. The valid range is 1 through 10. The default is 1.
---------------------------	--------------	---

Defaults	1 time
-----------------	--------

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

Command History	Release	Modification
	10.0	This command was introduced.

Usage Guidelines

As is typical for the primary station of an SDLC connection, if a secondary station sends its full possible window of input to the primary router or access server, the Cisco IOS software immediately will re-poll the same secondary for more data in an attempt to capture the complete transaction at one time. The **sdlc poll-limit-value** command indicates how many times this can happen before the next station in the poll loop must be polled.

Increasing the value allows for smoother transaction processing but can delay polling of other stations or giving output to other stations.

Examples

The following example specifies that the router can be polled two times before the next station in the poll list must be polled:

```
! enter a global command, if you have not already
interface serial 4
  no ip address
! use stun encapsulation
encapsulation stun
! establish stun group 4 on interface serial 4
  stun group 4
  stun sdlc-role primary
! poll the router up to two times before polling the next station
  sdlc poll-limit-value 2
```

■ `sdlc poll-limit-value`

Related Commands	Command	Description
	<code>sdlc poll-pause-timer</code>	Controls how long the Cisco IOS software pauses between sending each poll frame to secondary stations on a single serial interface.
	<code>show llc2</code>	Displays the LLC2 connections active in the router.

sdhc poll-pause-timer

To control how long the Cisco IOS software pauses between sending each poll frame to secondary stations on a single serial interface, use the **sdhc poll-pause-timer** interface configuration command. To revert to the default setting, use the **no** form of this command.

sdhc poll-pause-timer *milliseconds*

no sdhc poll-pause-timer *milliseconds*

Syntax Description	<i>milliseconds</i>	Number of ms that the software waits before sending the poll frame to a single serial interface. This is a number in the range 1 to 10000. The default is 10 ms.
---------------------------	---------------------	--

Defaults	10 ms
-----------------	-------

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

Command History	Release	Modification
	10.0	This command was introduced.

Usage Guidelines As is typical for the primary station of an SDLC connection, the software generates polls periodically to each of the secondary stations to solicit their input. After polling each station on a single serial interface, the software will pause before beginning to poll the next station.

Because the secondaries cannot send data until they are polled, increasing this timer can increase response time to the users. However, making this parameter too small can flood the serial link with unneeded polls and require the secondary stations to spend wasted CPU time processing them.

Examples In the following example, the software pauses 2000 ms before sending a series of poll frames through serial interface 4:

```
! enter a global command, if you have not already
interface serial 4
no ip address
! use STUN encapsulation
encapsulation stun
! establish stun group 4 on interface serial 4
stun group 4
!
stun sdhc-role primary
! wait 2000 milliseconds before sending each series of poll frames
sdhc poll-pause-timer 2000
```

Related Commands	Command	Description
	<code>sdlc poll-limit-value</code>	Controls how many times a single secondary station can be polled for input before the next station must be polled.
	<code>show llc2</code>	Displays the LLC2 connections active in the router.

sdlc poll-wait-timeout

To specify the interval the Cisco IOS software will wait for polls from a primary node before timing out that connection when the router has been configured for local acknowledgment and some form of SDLC communication (SDLLC or STUN, for example), use the **sdlc poll-wait-timeout** interface configuration command. To revert to the default setting, use the **no** form of this command.

sdlc poll-wait-timeout *milliseconds*

no sdlc poll-wait-timeout *milliseconds*

Syntax Description	<i>milliseconds</i>	Number of milliseconds the software will wait for a poll from the primary station before timing out the connection to the primary station. The minimum is 10 ms and the maximum is 64000 ms. The default is 10000 ms.
---------------------------	---------------------	---

Defaults	10000 ms
-----------------	----------

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

Command History	Release	Modification
	10.0	This command was introduced.

Usage Guidelines	<p>This command can be used on an interface that has been configured as a secondary node, but is not to be used on an interface that has been configured as a primary node.</p> <p>In a locally acknowledged multidrop environment, the polls the primary node sends to the router can be delayed because the primary node is busy polling other secondary nodes. In such situations, this command can be used to extend the timeout, thus reducing the likelihood the Cisco IOS software times out the connection to the primary node.</p>
-------------------------	---

Examples	<p>The following example specifies that the local software will wait an interval of 63,000 ms for a poll from a primary station before timing out:</p>
-----------------	--

```
! sample stun peer-name global command
stun peer-name 150.136.134.86
! sample protocol-group command
stun protocol-group 4 sdlc
!
interface serial 0
! sample ip address command
no ip address
! sample encapsulation stun command
encapsulation stun
! place interface serial0 in previously defined STUN group 4
```

■ **sdlc poll-wait-timeout**

```

stun group 4
! must enter the next command to use the sdlc poll-wait-timeout command
stun sdlc-role secondary
! set timeout period for polls from primary station to 63000 milliseconds.
sdhc poll-wait-timeout 63000
! list the addresses of the sdlc stations on the link
sdhc address C1
sdhc address C2
! provide stun route command
stun route address C2 tcp 150.136.134.58
stun route address C1 tcp 150.136.134.58

```

Related Commands

Command	Description
sdhc poll-limit-value	Controls how many times a single secondary station can be polled for input before the next station must be polled.
sdhc poll-pause-timer	Controls how long the Cisco IOS software pauses between sending each poll frame to secondary stations on a single serial interface.

sdlc qlc-prtnr

To establish correspondence between an SDLC and QLLC connection, use the **sdlc qlc-prtnr** interface configuration command. To deactivate the command, use the **no** form of this command.

sdlc qlc-prtnr *virtual-mac-address* *sdlc-address*

no sdlc qlc-prtnr *virtual-mac-address* *sdlc-address*

Syntax Description		
	<i>virtual-mac-address</i>	The virtual Media Access Control (MAC) address in the form <i>h.h.h</i> .
	<i>sdlc-address</i>	SDLC address in hexadecimal. The valid range is 1 to FE.

Defaults No correspondence is defined.

Command Modes Interface configuration

Command History	Release	Modification
	10.3	This command was introduced.

Examples The following example establishes the correspondence between an SDLC and QLLC connection:

```
sdlc qlc-prtnr 4000.0122.0001 c1
```

Related Commands	Command	Description
	show llc2	Displays the LLC2 connections active in the router.

sdlc role

To establish the router to be either a primary or secondary SDLC station, use the **sdlc role** interface configuration command. To cancel the designation, use the **no** form of this command.

sdlc role { **none** | **primary** | **secondary** | **prim-xid-poll** }

no sdlc role { **none** | **primary** | **secondary** | **prim-xid-poll** }

Syntax Description

none	Establishes the router as either a primary or secondary station, depending on the end stations.
primary	Establishes the router as a primary station.
secondary	Establishes the router as a secondary station.
prim-xid-poll	Establishes the router as a primary station when the end station is configured as a secondary NT2.1.

Defaults

No default role is assigned.

Command Modes

Interface configuration

Command History

Release	Modification
10.3	This command was introduced.

Usage Guidelines

If the role is **none**, the router can be either primary or secondary, depending on the end stations. The SDLC end station must be configured as negotiable or primary NT2.1. When the end stations are configured as physical unit type 2 (PU 2), you can set the role of the interface to **primary** or **secondary**. When the end station is configured as secondary NT2.1, you must set the role of the interface to **prim-xid-poll**.

To configure an SDLC multidrop line (downstream), configure the SDLC role as follows:

- **primary** if all SDLC devices are type PU 2.0 or mixed PU 2.0 and 2.1
- **prim-xid-poll** if all devices are type PU 2.1

Examples

The following example configures the router as a primary SDLC station:

```
interface serial 2/6
no ip address
encapsulation sdlc
fras map sdlc c1 serial 2/0 frame-relay 32 4 4
sdlc role primary
sdlc address c1
sdlc xid c1 01700001
```

Related Commands	Command	Description
	encapsulation sdlc	Configures an SDLC interface.

sdhc saps

To configure SDLC-to-LLC sessions with respect to the SSAP and DSAP on the LLC, use the **sdhc saps** interface configuration command. To return to the default setting, use the **no** form of this command.

sdhc saps *address ssap dsap*

no sdhc saps *address ssap dsap*

Syntax Description

<i>address</i>	Address of the SDLC station that will communicate with the router. Valid range is 1 to FF.
<i>ssap</i>	Source service access point (SSAP) of the partner. Valid range is 1 to FF.
<i>dsap</i>	Destination service access point (DSAP) of the partner. Valid range is 1 to FF.

Defaults

The default value for both the *ssap* and *dsap* arguments is 04.

Command Modes

Interface configuration

Command History

Release	Modification
10.3	This command was introduced.

Examples

The following example configures SDLC address 01, SSAP 08, and DSAP 08.

```
sdhc saps 01 08 08
```

sdhc sdhc-largest-frame

To indicate the largest information frame (I-frame) size that can be sent or received by the designated SDLC station, use the **sdhc sdhc-largest-frame** interface configuration command. To return to the default value, use the **no** form of this command.

sdhc sdhc-largest-frame *address size*

no sdhc sdhc-largest-frame *address size*

Syntax Description	<i>address</i>	Address of the SDLC station that will communicate with the router.
	<i>size</i>	Largest frame size that can be sent or received. The default is 265 bytes.

Defaults The default size for the largest I-frame is 265 bytes.

Command Modes Interface configuration

Command History	Release	Modification
	10.3	This command was introduced.

Examples In the following example, the Cisco IOS software can send or receive a frame as large as 265 bytes (the default) from the SDLC station at address C6. Any frames larger will be fragmented by the software.

```
interface serial 4
sdhc sdhc-largest-frame c6 265
```

sdlc simultaneous

To enable an interface configured as a primary SDLC station to operate in two-way simultaneous mode, use the **sdlc simultaneous** interface configuration command. To revert to the default setting, use the **no** form of this command.

sdlc simultaneous [**full-datamode** | **half-datamode**]

no sdlc simultaneous [**full-datamode** | **half-datamode**]

Syntax Description

full-datamode	(Optional) Enables the primary station to send data to and receive data from the polled secondary station.
half-datamode	(Optional) Prohibits the primary station from sending data to the polled secondary station.

Defaults

Two-way simultaneous mode is disabled.

Command Modes

Interface configuration

Command History

Release	Modification
10.3	This command was introduced.

Usage Guidelines

By default, the SDLC driver supports alternative mode. This means that in a multidrop environment, the primary station cannot send data to another secondary station until it receives a response (F bit) from the secondary station with which it is currently communicating.

In contrast, two-way simultaneous mode enables the interface configured as a primary SDLC station to send data to a second secondary station, even when it is receiving data from another secondary station. This capability improves utilization of a full-duplex serial line.

Examples

The following example enables all primary stations to send and receive data at the same time:

```
sdlc simultaneous full-datamode
```

The following example enables all secondary stations to send or receive data at the same time:

```
sdlc simultaneous half-datamode
```

Related Commands

Command	Description
encapsulation sdlc-primary	Configures the router as the primary SDLC station if you plan to configure the SDLLC media translation feature.
show llc2	Displays the LLC2 connections active in the router.

sdlc slow-poll

To enable the slow-poll capability of the router as a primary SDLC station, use the **sdlc slow-poll** interface configuration command. To disable slow-poll capability, use the **no** form of this command.

sdlc slow-poll *seconds*

no sdlc slow-poll

Syntax Description	<i>seconds</i>	Amount of time in seconds. The default is 10 seconds.
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Defaults	10 seconds
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Command Modes	Interface configuration
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Command History	Release	Modification
	10.0	This command was introduced.

Usage Guidelines

You can use this command to improve the performance of a multidropped SDLC configuration when one or more of the secondary stations are inactive.

When slow-poll is enabled, if the router acting as a primary station detects that a secondary SDLC station is not responding, it polls that secondary SDLC station less frequently. The router spends less time waiting for the inactive secondary station to respond, thereby minimizing the performance degradation on the active secondary SDLC stations on the multidropped line.

Examples

The following example enables the slow-poll capability:

```
interface serial 0
 sdlc slow-poll
```

Related Commands	Command	Description
	sdlc poll-limit-value	Controls how many times a single secondary station can be polled for input before the next station must be polled.
	sdlc poll-pause-timer	Controls how long the Cisco IOS software pauses between sending each poll frame to secondary stations on a single serial interface.
	show llc2	Displays the LLC2 connections active in the router.

sdhc snrm-timer

To specify a SNRM timer that is different from the T1 response time, set the SDLC SNRM timer using the **sdhc snrm-timer** command in interface configuration mode. To deactivate, use the **no** form of this command.

sdhc snrm-timer *number*

no sdhc snrm-timer *number*

Syntax Description	<i>number</i>	Specifies the time to wait for a reply to a SNRM frame in milliseconds, and is enabled only if the station role is primary. Range is 1 to 64000 ms, and default is the no form of the command.
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Defaults	No default behavior or values.
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Command Modes	Interface configuration
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Command History	Release	Modification
	12.1(5)T	This command was introduced.

Usage Guidelines	Use the SNRM Timer only if you want to have a unique timeout period to wait for a reply to a SNRM. The sdhc snrm-timer command is used to specify the time to wait for a reply to a SNRM frame in milliseconds. This parameter is enabled only if the station role is primary.
-------------------------	---

Examples	The following configuration defines serial interface 0 as the primary SDLC station with two SDLC secondary stations, C1 and C2, attached to it through a modem-sharing device. SDLC simultaneous half-datatmode is enabled, and the time to wait for a reply to a SNRM frame is 2500 ms.
-----------------	--

```
interface serial 0
 encapsulation sdhc
 sdhc role primary
 sdhc address c1
 sdhc address c2
 sdhc simultaneous half-datatmode
 sdhc snrm-timer 2500
```

Related Commands

Command	Description
encapsulation sdlc	Configures an SDLC interface.
sdlc n2	Sets the number of times the Cisco IOS software will retry an operation that has timed out.
sdlc role primary	Establishes the router as a primary SDLC station.
sdlc simultaneous	Enables an interface configured as a primary SDLC station to operate in two-way simultaneous mode.
sdlc t1	Controls the amount of time the Cisco IOS software waits for a reply.

sdlc t1

To control the amount of time the Cisco IOS software waits for an acknowledgment to a frame or sequence of frames, use the **sdlc t1** interface configuration command. To revert to the default setting, use the **no** form of this command.

sdlc t1 *milliseconds*

no sdlc t1 *milliseconds*

Syntax Description	<i>milliseconds</i>	Number of milliseconds that the software waits. The minimum is 1 ms and the maximum is 64000 ms. The default is 3000 ms.
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Defaults	3000 ms
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Command Modes	Interface configuration
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Command History	Release	Modification
	10.0	This command was introduced.

Usage Guidelines	When an SDLC station sends a frame, it waits for an acknowledgment from the receiver that the frame has been received. The sending station cannot wait indefinitely for a response. When the frame is sent, a timer is started. To be consistent with the original specification of SDLC, this timer is called the T1 timer and is controlled by this parameter. If this timer reaches its limit before the acknowledgment is received, the software will try again and resend the frame.
-------------------------	---

Examples	In the following example, the software waits up to 4000 ms for a reply to a frame or sequence of frames:
-----------------	--

```
! enter a global command, if you have not already
interface tokenring 0
  sdlc t1 4000
```

Related Commands	Command	Description
	sdlc n2	Determines the number of times that the Cisco IOS software resends a frame before terminating the SDLC session.
	show llc2	Displays the LLC2 connections active in the router.

sdlc test serial

To determine the status of end stations, use the **sdlc test serial EXEC** command. To halt the sending of the test frames, use the **sdlc test serial** command with the **stop** keyword.

sdlc test serial *number address [iterations | continuous | stop | string string]*

Syntax Description		
<i>number</i>		Serial interface on which the test frame is to be sent out.
<i>address</i>		SDLC address (in hexadecimal) of the end station to receive the test frame.
<i>iterations</i>		(Optional) Number of test frames to be sent. The valid range is 1 to 25 frames. The default is 10 frames.
continuous		(Optional) Sends frames continuously until the sdlc test serial command is issued with the stop keyword.
stop		(Optional) Halts the sending of test frames.
string string		(Optional) Specifies a string of characters as data within the test frame. If this option is not specified, the default test string is ABCDEFGHIJKLMNOPQRSTUVWXYZ.

Defaults

The **sdlc test serial** command is not active.

The default number of test frames sent is 10.

The default test string is "ABCDEFGHIJKLMNOPQRSTUVWXYZ."

Command Modes

EXEC

Command History

Release	Modification
11.2	This command was introduced.

Usage Guidelines

The command will pre-check for correct interface and SDLC address. The results of the test frames sent can be viewed after the frames have been sent or an **sdlc test serial** command with the **stop** keyword has been issued.

There is not a **no** form for this command.

Examples

The following are variations of the **sdlc test serial** command, followed by the response for each:

```
Router# sdlc test serial 0 c1
SDLC Test for address C1 completed
Frames sent=10 Frames received=10
```

```
Router# sdlc test serial 0 c1 255
SDLC Test for address C1 completed
Frames sent=255 Frames received=255
```

■ **sdlc test serial**

```
Router# sdlc test serial 0 C1 stop  
SDLC Test for address C1 completed  
Frames sent=44 Frames received=44
```

```
Router# sdlc test serial 0 c1 string Thestuffofdreams  
SDLC Test for address C1 completed  
Frames sent=10 Frames received=10
```

Related Commands

Command	Description
show llc2	Displays the LLC2 connections active in the router.

sdlc vmac

To configure a MAC address for the serial interface, use the **sdlc vmac** interface configuration command. To disable the configuration, use the **no** form of this command.

sdlc vmac *mac-address*

no sdlc vmac *mac-address*

Syntax Description	<i>mac-address</i>	48-bit MAC address of the Token Ring host.
Defaults	Disabled	
Command Modes	Interface configuration	
Command History	Release	Modification
	11.0	This command was introduced.
Usage Guidelines	This command must be configured if you plan to configure DLSw+. The last byte of the address must be 00.	
Examples	The following example specifies a MAC address for the serial interface: <pre>sdlc vmac 1234.3174.0000</pre>	
Related Commands	Command	Description
	encapsulation sdlc	Configures an SDLC interface.
	sdlc dlsw	Attaches SDLC addresses to DLSw+.

sdhc xid

To specify an XID value appropriate for the designated SDLC station associated with this serial interface, use the **sdhc xid** interface configuration command. To disable XID processing for this address, use the **no** form of this command.

sdhc xid *address xid*

no sdhc xid *address xid*

Syntax Description	Parameter	Description
	<i>address</i>	Address of the SDLC station associated with this interface.
	<i>xid</i>	XID the Cisco IOS software will use to respond to XID requests the router receives. This value must be 4 bytes (8 digits) in length and is specified with hexadecimal digits.

Defaults Disabled

Command Modes Interface configuration

Command History	Release	Modification
	10.3	This command was introduced.

Usage Guidelines XID requests and responses are usually exchanged before sessions are started. Be sure that the XID value configured in the Cisco IOS software matches the IDBLK and IDNUM parameters configured on the host. The XID response to an XID request will contain the information you configured in the **sdhc xid** command. The host will check the XID response it receives with the IDBLK and IDNUM parameters (that are configured in the VTAM). If they match, the host will initiate a session with the router. If they do not match, the host will not initiate a session.

Examples The following example specifies an XID value of 01720002 at address C2:

```
interface serial 0
  sdhc xid c2 01720002
```

Related Commands	Command	Description
	encapsulation sdhc	Configures an SDLC interface.

sdlc xid-pause-timer

To control the frequency of XID retries between a router and an upstream VTAM, use the **sdlc xid-pause-timer** interface configuration command. To restore the default timer value, use the **no** form of this command.

sdlc xid-pause-timer *time*

no sdlc xid-pause-timer *time*

Syntax Description	<i>time</i>	Length of time the router is to wait, in seconds, before sending the next retry XID. The valid range is 10 to 300 seconds. The default is 10 seconds.
---------------------------	-------------	---

Defaults The default XID pause timer value is 10 seconds.

Command Modes Interface configuration

Command History	Release	Modification
	12.2	This command was introduced.

Usage Guidelines When a router attempts to send an XID upstream to VTAM, and the switched major node is down, the router continues to send retry XIDs at 10 second intervals. If many other routers are also attempting to send retry XIDs to VTAM, the resulting XID flood can cause problems. The **sdlc xid-pause-timer** command enables you to control the interval between router XID retries.

Examples The following example specifies an XID pause timer value of 60 seconds:

```
interface serial 0
  sdlc xid-pause-timer 60
```

show llc2

To display the LLC2 connections active in the router, use the **show llc2** privileged EXEC command.

show llc2

Syntax Description This command has no arguments or keywords.

Command Modes Privileged EXEC

Command History	Release	Modification
	10.0	This command was introduced.

Examples The following is sample output from the **show llc2** command:

```
Router# show llc2

TokenRing0 DTE=1000.5A59.04F9,400022224444 SAP=04/04, State=NORMAL
V(S)=5, V(R)=5, Last N(R)=5, Local window=7, Remote Window=127
ack-max=3, n2=8, Next timer in 7768
xid-retry timer 0/60000 ack timer 0/1000
p timer 0/1000 idle timer 7768/10000
rej timer 0/3200 busy timer 0/9600
ack-delay timer 0/3200
CMNS Connections to:
Address 1000.5A59.04F9 via Ethernet2
Protocol is up
Interface type X25-DCE RESTARTS 0/1
Timers: T10 1 T11 1 T12 1 T13 1
```

The display includes a CMNS addendum, indicating LLC2 is running with CMNS. When LLC2 is not running with CMNS, the **show llc2** command does not display a CMNS addendum.

Table 42 describes significant fields shown in the display.

Table 42 *show llc2* Field Descriptions

Field	Description
TokenRing0	Name of interface on which the session is established.
DTE=1000.5A59.04F9, 400022224444	Address of the station to which the router is talking on this session. (The address is the MAC address of the interface on which the connection is established, except when Local Acknowledgment or SDLLC is used, in which case the address used by the Cisco IOS software is shown as in this example, following the DTE address and separated by a comma.)
SAP=04/04	Other station's and the router's (remote/local) service access point (SAP) for this connection. The SAP is analogous to a "port number" on the router and allows for multiple sessions between the same two stations.

Table 42 *show llc2 Field Descriptions (continued)*

Field	Description
State=NORMAL	<p>Current state of the LLC2 session. The possible values are:</p> <ul style="list-style-type: none"> • ADM—Asynchronous Disconnect Mode—A connection is not established, and either end can begin one. • SETUP—Request to begin a connection has been sent to the remote station, and this station is waiting for a response to that request. • RESET—A previously open connection has been reset because of some error by this station, and this station is waiting for a response to that reset command. • D_CONN—This station has requested a normal, expected, end of communications with the remote, and is waiting for a response to that disconnect request. • ERROR—This station has detected an error in communications and has told the other station of this. This station is waiting for a reply to its posting of this error. • NORMAL—Connection between the two sides is fully established, and normal communication is occurring. • BUSY—Normal communication state exists, except busy conditions on this station make it such that this station cannot receive information frames from the other station at this time. • REJECT—Out-of-sequence frame has been detected on this station, and this station has requested that the other resend this information. • AWAIT—Normal communication exists, but this station has had a timer expire, and is trying to recover from it (usually by resending the frame that started the timer). • AWAIT_BUSY—A combination of the AWAIT and BUSY states. • AWAIT_REJ—A combination of the AWAIT and REJECT states.
V(S)=5	Sequence number of the next information frame this station will send.
V(R)=5	Sequence number of the next information frame this station expects to receive from the other station.
Last N (R)=5	Last sequence number of this station's sent frames acknowledged by the remote station.
Local Window=7	Number of frames this station may send before requiring an acknowledgment from the remote station.
Remote Window=127	Number of frames this station can accept from the remote.
ack-max=3	Maximum number of packets to receive before sending an acknowledgment.
n2=8	Number of times to retry operations.
Next timer in 7768	Number of milliseconds before the next timer, for any reason, goes off.

Table 42 show llc2 Field Descriptions (continued)

Field	Description
xid-retry timer 0/60000	Number of milliseconds to wait for a reply to XID frames before dropping a session. This timer value is in the form of next-time/time-between, where “next-time” is the next time, in milliseconds, that the timer will wake, and “time-between” is the time, in milliseconds, between each timer wakeup. A “next-time” of zero indicates that the timer is not enabled, and will never wake.
ack timer 0/1000	Number of milliseconds to wait before sending an acknowledgment. This timer value is in the form of next-time/time-between, where “next-time” is the next time, in milliseconds, that the timer will wake, and “time-between” is the time, in milliseconds, between each timer wakeup. A “next-time” of zero indicates that the timer is not enabled, and will never wake.
p timer 0/1000	Number of milliseconds to wait for a final response to a poll frame before resending the poll frame. This timer value is in the form of next-time/time-between, where “next-time” is the next time, in milliseconds, that the timer will wake, and “time-between” is the time, in milliseconds, between each timer wakeup. A “next-time” of zero indicates that the timer is not enabled, and will never wake.
idle timer 7768/10000	Number of milliseconds that can pass with no traffic before the LLC2 station sends a Receiver Ready frame. This timer value is in the form of next-time/time-between, where “next-time” is the next time, in milliseconds, that the timer will wake, and “time-between” is the time, in milliseconds, between each timer wakeup. A “next-time” of zero indicates that the timer is not enabled, and will never wake.
rej timer 0/3200	Number of milliseconds to wait for a resend of a rejected frame before sending a reject command to the remote station. This timer value is in the form of next-time/time-between, where “next-time” is the next time, in milliseconds, that the timer will wake, and “time-between” is the time, in milliseconds, between each timer wakeup. A “next-time” of zero indicates that the timer is not enabled, and will never wake.
busy timer 0/9600	Number of milliseconds to wait before repolling a busy remote station. This timer value is in the form of next-time/time-between, where “next-time” is the next time, in milliseconds, that the timer will wake, and “time-between” is the time, in milliseconds, between each timer wakeup. A “next-time” of zero indicates that the timer is not enabled, and will never wake.
ack-delay timer 0/3200	Number of milliseconds to allow incoming information frames to stay unacknowledged. This timer value is in the form of next-time/time-between, where “next-time” is the next time, in milliseconds, that the timer will wake, and “time-between” is the time, in milliseconds, between each timer wakeup. A “next-time” of zero indicates that the timer is not enabled, and will never wake.
CMNS Connections to:	List of values that affect the interface if CMNS is enabled.
Address 1000.5A59.04F9 via Ethernet2	MAC address of remote station.
Protocol is up	Up indicates the LLC2 and X.25 protocols are in a state where incoming and outgoing Call Requests can be made on this LLC2 connection.

Table 42 *show llc2 Field Descriptions (continued)*

Field	Description
Interface type X25-DCE	One of X25-DCE, X25-DTE, or X25-DXE (both DTE and DCE).
RESTARTS 0/1	Restarts sent/received on this LLC2 connection.
Timers:	T10, T11, T12, T13 (or T20, T21, T22, T23 for DTE); these are Request packet timers. These are similar in function to X.25 parameters of the same name.

Related Commands

Command	Description
llc2 ack-delay-time	Sets the amount of time the Cisco IOS software waits for an acknowledgment before sending the next set of information frames.
llc2 ack-max	Controls the maximum amount of information frames the Cisco IOS software can receive before it must send an acknowledgment.
llc2 idle-time	Controls the frequency of polls during periods of idle time (no traffic).
llc2 local-window	Controls the maximum number of information frames the Cisco IOS software sends before it waits for an acknowledgment.
llc2 n2	Controls the number of times the Cisco IOS software retries sending unacknowledged frames or repolls remote busy stations.
llc2 t1-time	Controls the amount of time the Cisco IOS software will wait before resending unacknowledged information frames.
llc2 tbusy-time	Controls the amount of time the Cisco IOS software waits until repolling a busy remote station.
llc2 tpf-time	Sets the amount of time the Cisco IOS software waits for a final response to a poll frame before resending the poll frame.
llc2 trej-time	Controls the amount of time the Cisco IOS software waits for a correct frame after sending a reject command to the remote LLC2 station.
llc2 xid-neg-val-time	Controls the frequency of XID transmissions by the Cisco IOS software.
llc2 xid-retry-time	Sets the amount of time the Cisco IOS software waits for a reply to XID frames before dropping the session.

■ show llc2