

LLC2 and SDLC Commands

LLC2 (IEEE 802.2) type 2 provides connection-oriented service and is widely used in LAN environments, particularly among IBM communication systems connected by Token Ring. Our router supports LLC2 connections over Ethernet, Token Ring, and 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)
- SDLLC SDLC/LLC2 Media Translation
- 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 wide-area network (WAN) links. SDLC defines two types of network nodes: primary and secondary. Primary nodes poll secondary nodes in a predetermined order. Secondaries then transmit 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 router 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 STUN enabled interfaces

Use the commands in this chapter to adjust the router's LLC2 and SDLC parameters. For LLC2 and SDLC parameter configuration information and examples, refer to the "Configuring LLC2 and SDLC Parameters" chapter in the *Router Products Configuration Guide*.

encapsulation sdlc-primary

Use the **encapsulation sdlc-primary** interface configuration command to configure the router as the primary SDLC station.

encapsulation sdlc-primary

Syntax Description

This command has no arguments or keywords.

Default

Disabled

Command Mode

Interface configuration

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 transmit 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, the router 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, the router takes the place of the EC, and must therefore be configured as a secondary SDLC station.

Example

The following example shows how to configure interface serial 0 on your router to have two SDLC secondary stations attached to it 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

encapsulation sdhc-secondary

sdhc address

show interfaces

encapsulation sdlc-secondary

Use the **encapsulation sdlc-secondary** interface configuration command to configure the router as a secondary SDLC station.

encapsulation sdlc-secondary

Syntax Description

This command has no arguments or keywords.

Default

Disabled

Command Mode

Interface configuration

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 transmit 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, the router 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, the router takes the place of the EC, and must therefore be configured as a secondary SDLC station.

Example

The following example shows the use of this command:

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

Related Commands

encapsulation sdlc-primary

sdlc address

show interfaces

llc2 ack-delay-time

Use the **llc2 ack-delay-time** interface configuration command to set the amount of time the router waits for an acknowledgment before sending the next set of information frames.

llc2 ack-delay-time *milliseconds*

Syntax Description

milliseconds

Number of milliseconds (ms) the router allows incoming information frames to stay unacknowledged. The minimum is 1 ms. The maximum is 60000 ms.

Default

3200 ms

Command Mode

Interface configuration

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 router can receive before sending an acknowledgment.

Example

In the following example, the router 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 router 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.

Related Commands

llc2 ack-max

show llc2

llc2 ack-max

Use the **llc2 ack-max** interface configuration command to control the maximum amount of information frames the router can receive before it must send an acknowledgment.

llc2 ack-max *packet-count*

Syntax Description

<i>packet-count</i>	Maximum number of packets the router will receive before sending an acknowledgment. The minimum is 1 packet. The maximum is 127 packets.
---------------------	--

Default

3 packets

Command Mode

Interface configuration

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.

Example

In the following example, the router 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

llc2 ack-delay-time

llc2 local-window

show llc2

llc2 idle-time

Use the **llc2 idle-time** interface configuration command to control the frequency of polls during periods of idle time (no traffic).

llc2 idle-time *milliseconds*

Syntax Description

milliseconds Number of milliseconds (ms) that can pass with no traffic before the LLC2 station sends a Receiver Ready frame. The minimum is 1 ms. The maximum is 60000 ms.

Default

10000 ms

Command Mode

Interface configuration

Usage Guidelines

Periodically, when no information frames are being transmitted 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.

Example

In the following example, the router waits 20000 ms before sending a Receiver Ready (“are you there”) frame:

```
! enter a global command, if you have not already
interface tokenring 0
! wait 20000 ms before sending receiver-ready frames
llc2 idle-time 20000
```

Related Commands

llc2 tbusy-time

llc2 tpf-time

show llc2

llc2 local-window

Use the **llc2 local-window** interface configuration command to control the maximum number of information frames the router sends before it waits for an acknowledgment.

llc2 local-window *packet-count*

Syntax Description

packet-count

Maximum number of packets that can be sent before the router must wait for an acknowledgment. The minimum is 1 packet. The maximum is 127 packets.

Default

7 packets

Command Mode

Interface configuration

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.

Example

In the following example, the router will send as many as 30 information frames through the tokenring 1 interface before it must receive an acknowledgment:

```
! enter a global command, if you have not already
interface tokenring 1
llc2 local-window 30
```

Related Commands

llc2 ack-max

show llc2

llc2 n2

Use the **llc2 n2** interface configuration command to control the amount of times the router retries sending unacknowledged frames or repolls remote busy stations.

llc2 n2 *retry-count*

Syntax Description

retry-count Number of times the router retries operations. The minimum is 1 retry. The maximum is 255 retries.

Default

8 retries

Command Mode

Interface configuration

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 router is told that a remote station is busy, it will poll again based on the *retry-count* 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.

Example

In the following example, the router will resend a frame up to four times through interface tokenring 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:

```
! enter a global command, if you have not already
interface tokenring 1
! retry value of 8
llc2 n2 8
```

Related Commands

llc2 t1-time

llc2 tbusy-time

llc2 trej-time

show llc2

llc2 t1-time

Use the **llc2 t1-time** interface configuration command to control the amount of time the router will wait before resending unacknowledged information frames.

llc2 t1-time *milliseconds*

Syntax Description

milliseconds

Number of milliseconds (ms) the router waits before resending unacknowledged information frames. The minimum is 1 ms. The maximum is 60000 ms.

Default

1000 ms

Command Mode

Interface configuration

Usage Guidelines

Use 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.

Example

In the following example, the router will wait 4000 ms before resending an unacknowledged frame through tokenring 2:

```
! enter a global command, if you have not already
interface tokenring 2
! wait 4000 ms before retransmitting a frame through tokenring 2
llc2 t1-time 4000
```

Related Commands

llc2 n2

llc2 tpf-time

llc2 xid-retry-time

show llc2

llc2 tbusy-time

Use the **llc2 tbusy-time** interface configuration command to control the amount of time the router waits until repolling a busy remote station.

llc2 tbusy-time *milliseconds*

Syntax Description

milliseconds

Number of milliseconds (ms) the router waits before repolling a busy remote station. The minimum is 1 ms. The maximum is 60000 ms.

Default

9600 ms

Command Mode

Interface configuration

Usage Guidelines

An LLC2 station has the ability to tell others 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.

Example

In the following example, the router will wait up to 12000 ms before attempting to poll a remote station through tokenring 0 to learn the station's status:

```
! enter a global command, if you have not already
interface tokenring 0
! wait 12000 ms before polling a station through tokenring 0
llc2 tbusy-time 12000
```

Related Commands

llc2 n2

llc2 idle-time

show llc2

llc2 tpf-time

Use the **llc2 tpf-time** interface configuration command to set the amount of time the router waits for a final response to a poll frame before resending the poll frame.

llc2 tpf-time *milliseconds*

Syntax Description

milliseconds Number of milliseconds (ms) the router waits for a final response to a poll frame before resending the poll frame. The minimum is 1 ms. The maximum is 60000 ms.

Default

1000 ms

Command Mode

Interface configuration

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 router 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 router waits for receipt of an acknowledgment before sending the next set of frames.

Example

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 ms for an acknowledgment before resending I-frames
llc2 t1-time 1500
```

Related Commands

llc2 idle-time

llc2 n2

llc2 t1-time

show llc2

llc2 trej-time

Use the **llc2 trej-time** interface configuration command to control the amount of time a router waits for a correct frame after sending a reject (REJ) command to the remote LLC2 station.

llc2 trej-time *milliseconds*

Syntax Description

milliseconds

Number of milliseconds (ms) the router waits for a resend of a rejected frame before sending a reject command to the remote station. The minimum is 1 ms. The maximum is 60000 ms.

Default

3200 ms

Command Mode

Interface configuration

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.

Example

In the following example, the router will wait up to 1000 ms to receive a previously rejected frame before resending its reject message to the station that sent the frame:

```
! enter a global command, if you have not already
interface tokenring 0
! wait 1000 ms before resending a reject message through tokenring 0
llc2 trej-time 1000
```

Related Commands

llc2 n2

show llc2

llc2 xid-neg-val-time

Use the **llc2 xid-neg-val-time** interface configuration command to control the frequency of exchange of identification (XID) transmissions by the router.

llc2 xid-neg-val-time *milliseconds*

Syntax Description

milliseconds Number of milliseconds (ms) after which the router sends XID frames to other LLC2-speaking stations. The minimum is 0 ms. The maximum is 60000 ms.

Default

0 ms

Command Mode

Interface configuration

Usage Guidelines

Do not change the **llc2 xid-neg-val-time** parameter unless requested by your technical support representative.

LLC2-speaking stations can communicate exchange of identification (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.

Example

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

llc2 xid-retry-time
show llc2

llc2 xid-retry-time

Use the **llc2 xid-retry-time** interface configuration command to set the amount of time the router waits for a reply to exchange of identification (XID) frames before dropping the session.

llc2 xid-retry-time *milliseconds*

Syntax Description

milliseconds

Number of milliseconds (ms) the router waits for a reply to XID frame before dropping a session. The minimum is 1 ms. The maximum is 60000 ms.

Default

60000 ms

Command Mode

Interface configuration

Usage Guidelines

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

Example

The following example sets the router to wait up to 60000 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 ms for a reply to XID frames
llc2 xid-retry-time 60000
```

Related Commands

llc2 xid-neg-val-time

llc2 t1-time

show llc2

sdlc address

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

```
sdlc address hexbyte [echo]  
no sdlc address hexbyte
```

Syntax Description

<i>hexbyte</i>	Hexadecimal number (base 16) indicating the address of the serial link.
echo	(Optional) Treats nonecho and echo SDLC addresses as the same address.

Default

No secondary stations are assigned.

Command Mode

Interface configuration

Usage Guidelines

Before using this command, first select the interface on which you want to enable SDLC. Then establish the router as a primary station with the **encapsulation sdlc-primary** command. Next, assign secondary station addresses to the primary station using the **sdlc address** command. The addresses are given in hexadecimal (base 16) and are given one per line.

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

Example

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

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

Related Commands

```
encapsulation sdlc-primary  
encapsulation sdlc-secondary  
show interfaces
```

sdlc address ff ack-mode

Use the **sdlc address ff ack-mode** interface configuration command to configure the IBM reserved address FF as a valid local address.

sdlc address ff ack-mode

Syntax Description

This command has no arguments or keywords.

Default

Address FF is not configured as a valid local address.

Command Mode

Interface configuration

Usage Guidelines

The **sdlc address ff ack-mode** command is used to support applications that require local termination of 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.

Example

The following example enables local acknowledgment of SDLC address FF:

```
stun peer-name xxx.xxx.xxx.xxx
stun protocol-group 1 sdlc

interface serial 1
encapsulation stun
stun group 1
stun sdlc-role secondary
sdlc address C1
sdlc address FF ack-mode
stun route address C1 tcp yyy.yyy.yyy.yyy local-ack
stun route address FF tcp yyy.yyy.yyy.yyy local-ack
```

Related Command

A dagger (†) indicates that the command is documented in another chapter.

stun route address tcp †

sdlc cts-delay

Use the **sdlc cts-delay** interface configuration command to adjust the delay between the detection of RTS (request to send) and the assertion of CTS (clear to send).

sdlc cts-delay *unit*

Syntax Description

unit The delay in microseconds. The valid range is 1 to 64000. Each unit is approximately 5 microseconds.

Default

3 units (approximately 15 microseconds)

Command Mode

Interface configuration

Usage Guidelines

This timer is applicable only on an interface that is set to sdlc half-duplex mode and is acting as a data communication equipment (DCE).

Example

The following example sets the delay between the detection of RTS and the assertion of CTS to 10 (approximately 50 microseconds):

```
sdlc cts-delay 10
```

Related Commands

sdlc hdx

sdlc rts-timeout

sdlc dte-timeout

Use the **sdlc dte-timeout** interface configuration command to adjust the amount of time a data terminal equipment (DTE) interface waits for the DCE to assert a clear to send (CTS) before dropping a request to send (RTS).

sdlc dte-timeout *unit*

Syntax Description

unit Timeout wait interval in microseconds. The valid range is 10 to 64000. Each unit is approximately 5 microseconds.

Default

10 units (approximately 50 microseconds).

Command Mode

Interface configuration

Usage Guidelines

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

Example

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

```
sdlc dte-timeout 100
```

Related Commands

sdlc cts-delay

sdlc hdx

sdlc rts timeout

sdlc frmr-disable

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

```
sdlc frmr-disable  
no sdlc framer-disable
```

Syntax Description

This command has no arguments or keywords.

Default

Support of FRMRs or error indications

Command Mode

Interface configuration

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 router receives an error, it drops the line by sending a disconnect request to the remote station.

Example

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

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

Related Command

show interfaces

sdlc hdx

Use the **sdlc hdx** interface configuration command to configure an interface for half-duplex mode. Use the **no** form of this command to reset the interface for full-duplex mode.

sdlc hdx
no sdlc hdx

Syntax Description

This command has no arguments or keywords.

Default

Disabled

Command Mode

Interface configuration

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 router receives an error, it drops the line by sending a disconnect request to the remote station.

Example

In the following example, an SDLC interface has been configured for half-duplex mode:

```
encapsulation sdlc-primary  
sdlc hdx
```

Related Commands

sdlc cts-delay
sdlc rts-timeout

sdlc holdq

Use the **sdlc holdq** interface configuration command to control the maximum number of packets that can be held in a buffer before being transmitted to a remote SDLC station.

sdlc holdq *address queue-size*

Syntax Description

<i>address</i>	SDLC address for which you are specifying a queue size.
<i>queue-size</i>	Router's local send window size. The minimum is 1 packet. No maximum value has been established.

Default

12 packets

Command Mode

Interface configuration

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 awaiting transmission on the serial link. This command is specified for each SDLC address, and therefore, for each SDLC secondary station on the serial link.

Example

The following example shows how to change the output hold queue length to 30 frames on an SDLC station of address c1 off serial 0:

```
! enter a global command, if you have not already
interface serial 0
! use SDLC encapsulation
encapsulation sdlc-primary
! establish address of SDLC station off serial 0 as c1
sdlc address c1
! change the output hold queue length to 30 frames on the SDLC station
sdlc holdq c1 30
```

Related Command

show interfaces

sdlc k

Use the **sdlc k** interface configuration command to set the window size in order to control the maximum number of information frames a router receives before sending an acknowledgment.

sdlc k *window-size*

Syntax Description

window-size Router's local send window size. The minimum is 1 frame. The maximum is 7 frames.

Default

7 frames

Command Mode

Interface configuration

Usage Guidelines

When the router is communicating with SDLC, it must have a parameter that controls the maximum number of information frames it will receive before the other end 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.

Example

In the following example, the router 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

sdlc n1

show interfaces

sdlc line-speed

Use the **sdlc line-speed** interface configuration command to enable adaptive SDLC T1.

sdlc line-speed *rate*
no sdlc line-speed *rate*

Syntax Description

rate Clockrate in bits per second

Default

No default rate

Command Mode

Interface configuration

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 DCE, this should be equal to the clockrate on the interface. For DTE, it should be equal to the clockrate on the DCE device to which the DTE is connected.

Example

In the following example, the sdlc line-speed rate is set to *rate*:

```
sdlc line-speed rate
```

Related Commands

sdlc n2
sdlc t1

sdlc n1

Use the **sdlc n1** interface configuration command to control the maximum size of an incoming frame.

sdlc n1 *bit-count*

Syntax Description

bit-count

Number indicating bit size. Frames that exceed this size are rejected. The minimum is 1 bit. The maximum is 12000 bits.

Default

12000 bits

Command Mode

Interface configuration

Usage Guidelines

Use with the **sdlc k** command to reduce network overhead while continuing to check frame transmission.

Example

In the following example, the router rejects frames larger than 10000 bits:

```
! enter a global command, if you have not already
interface tokenring 0
! reject frames larger than 10000 bits
sdlc n1 10000
```

Related Commands

sdlc k

show interfaces

sdlc n2

Use the **sdlc n2** interface configuration command to determine the number of times that a router resends a frame before terminating the SDLC session.

sdlc n2 *retry-count*

Syntax Description

retry-count

Number of retry attempts. When this number is exceeded, the SDLC station terminates its session with the other station. The minimum is 1. The maximum is 255.

Default

20 retries

Command Mode

Interface configuration

Usage Guidelines

Use with the **sdlc t1** command to reduce network overhead while continuing to check transmission.

Example

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

```
interface serial 0
sdlc n2 5
```

Related Commands

sdlc t1

show interfaces

sdlc poll-limit-value

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

```
sdlc poll-limit-value count  
no sdlc poll-limit-value count
```

Syntax Description

<i>count</i>	Number of times the router can poll one secondary station before proceeding to the next station. The minimum is 1 time. The maximum is 10 times.
--------------	--

Default

1 time

Command Mode

Interface configuration

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, the router immediately will repoll 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.

Example

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
```

Related Commands

```
sdlc poll-pause-timer  
show interfaces
```

sdlc poll-pause-timer

Use the **sdlc poll-pause-timer** interface configuration command to control the length of time the router pauses before sending each poll frame to secondary stations on a single serial interface. Use the **no** form of this command to retrieve the default value.

```
sdlc poll-pause-timer milliseconds  
no sdlc poll-pause-timer milliseconds
```

Syntax Description

<i>milliseconds</i>	Number of milliseconds (ms) that the router waits before sending the poll frame to a single serial interface. This value can be a number in the range 1 to 10000. The default is 10 milliseconds.
---------------------	---

Default

10 milliseconds

Command Mode

Interface configuration

Usage Guidelines

As is typical for the primary station of an SDLC connection, the router generates polls periodically to each secondary station to solicit its input. After polling each station on a single serial interface, the router pauses before beginning to poll the next station.

Because the secondaries cannot transmit data until they are polled, increasing this timer value 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 valuable CPU time processing them.

Example

In the following example, the router pauses 2000 ms before sending a series of poll frames through interface serial 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 sdlc-role primary  
! wait 2000 ms before sending each series of poll frames  
sdlc poll-pause-timer 2000
```

Related Commands

sdhc poll-limit-value

show interfaces



sdlc poll-wait-timeout

Use the **sdlc poll-wait-timeout** interface configuration command when the router has been configured for Local Acknowledgment and some form of SDLC communication (SDLLC or STUN, for example), to specify the interval the router will wait for polls from a primary node before timing out that connection.

sdlc poll-wait-timeout *milliseconds*

Syntax

milliseconds

Number of milliseconds (ms) the router will wait for a poll from the primary station before timing out the connection to the primary station. The minimum is 10 ms. The maximum is 64000 ms.

Default

10000 ms

Command Mode

Interface configuration

Usage Guidelines

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.

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 router times out the connection to the primary node.

Example

The following example specifies that the local router will wait an interval of 63000 ms for a poll from a primary station before timing out:

```
! sample stun peer-name global command
stun peer-name 150.136.134.86
! sample protocol-group command
stun protocol-group 4 sdhc
!
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
stun group 4
! must enter the next command to use the sdhc poll-wait-timeout command
stun sdhc-role secondary
! set timeout period for polls from primary station to 63000 ms.
sdhc poll-wait-timeout 63000
! list the addresses of the sdhc 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

sdhc poll-limit-value

sdhc poll-pause-time

sdlc qlc-prtnr

To establish correspondence between an SDLC and QLLC connection, use the **sdlc qlc-prtnr** interface configuration command.

```
sdlc qlc-prtnr virtual-mac-address sdlc-address
```

Syntax Description

virtual-mac-address

The virtual MAC address in the form H.H.H.

sdlc-address

SDLC address in hex. The valid range is 1 through FE.

Default

No correspondence is defined

Command Mode

Interface configuration

Example

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

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

Related Command

A dagger (†) indicates that the command is documented in another chapter.

show interfaces †

sdlc rts-timeout

Use the **sdlc rts-timeout** interface configuration command to adjust the amount of time the interface waits for the DCE to assert clear to send (CTS) before dropping a request to send (RTS).

sdlc rts-timeout *unit*

Syntax Description

unit The amount of time in microseconds. The valid range is 10 to 64000. Each unit is approximately 5 microseconds.

Default

10 units (approximately 50 microseconds)

Command Mode

Interface configuration

Usage Guidelines

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

Example

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

```
sdlc rts-timeout 100
```

Related Commands

sdlc cts-delay

sdlc hdx

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.

```
sdlc simultaneous [full-datmode | half-datmode]
```

Syntax Description

full-datmode	Enables the primary station to send data to and receive data from the polled secondary station.
half-datmode	Prohibits the primary station from sending data to the polled secondary station.

Default

Two-way simultaneous mode is disabled.

Command Mode

Interface configuration

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.

Example

To enable all secondary stations to send and receive data at the same time, issue the following command:

```
sdlc simultaneous full-datmode
```

To enable all secondary stations to either send or receive data at one time, issue the following command:

```
sdlc simultaneous half-datmode
```

Related Commands

A dagger (†) indicates that the command is documented in another chapter.

encapsulation sdlc-primary
show interfaces †

sdlc slow-poll

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

sdlc slow-poll *seconds*
no sdlc slow-poll

Syntax Description

seconds Amount of time in seconds

Default

10 seconds

Command Mode

Interface configuration

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.

Example

In the following example, the slow-poll capability is enabled for the router:

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

Related Commands

sdlc poll-limit-value
sdlc poll-pause-timer
show interfaces

sdlc t1

Use the **sdlc t1** interface configuration command to control the amount of time the router waits for an acknowledgment to a frame or sequence of frames.

sdlc t1 *milliseconds*

Syntax Description

milliseconds

Number of milliseconds (ms) that the router waits. The minimum is 1 ms. The maximum is 64000 ms.

Default

3000 ms

Command Mode

Interface configuration

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 router will try again and resend the frame.

Example

In the following example, the router 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

sdlc n2

show interfaces

show interfaces

Use the **show interfaces** privileged EXEC command to display the SDLC information for a given SDLC interface.

show interfaces

Syntax Description

This command has no arguments or keywords.

Command Mode

Privileged EXEC

Sample Display with SDLC Connections

The following is sample output from the **show interfaces** command for an SDLC primary interface supporting the SDLLC function:

```
router# show interfaces

Serial 0 is up, line protocol is up
Hardware is MCI Serial
MTU 1500 bytes, BW 1544 Kbit, DLY 20000 usec, rely 255/255, load 1/255
Encapsulation SDLC-PRIMARY, loopback not set
  Timers (msec): poll pause 100 fair poll 500. Poll limit 1
  [T1 3000, N1 12016, N2 20, K 7] timer: 56608 Last polled device: none
  SDLLC [ma: 0000.0C01.14--, ring: 7 bridge: 1, target ring: 10
    largest token ring frame 2052]
SDLC addr C1 state is CONNECT
  VS 6, VR 3, RCNT 0, Remote VR 6, Current retransmit count 0
  Hold queue: 0/12 IFRAMEs 77/22 RNRs 0/0 SNRMs 1/0 DISCs 0/0
  Poll: clear, Poll count: 0, chain: p: C1 n: C1
  SDLLC [largest SDLC frame: 265, XID: disabled]
Last input 00:00:02, output 00:00:01, output hang never
Output queue 0/40, 0 drops; input queue 0/75, 0 drops
Five minute input rate 517 bits/sec, 30 packets/sec
Five minute output rate 672 bits/sec, 20 packets/sec
  357 packets input, 28382 bytes, 0 no buffer
  Received 0 broadcasts, 0 runts, 0 giants
  0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
  926 packets output, 77274 bytes, 0 underruns
  0 output errors, 0 collisions, 0 interface resets, 0 restarts
  2 carrier transitions
```

Table 24-1 shows the timer fields relevant to all SDLC connections.

Table 24-1 Timer Fields and Descriptions when SDLC is Enabled

Field	Description
Timers (msec):	Lists the timers and their current values.
poll pause, fair poll, Poll limit	Current values of these timers, as described in the individual command sections in this chapter.
T1, N1, N2, K	Current values for these timers, as described in the individual command sections in this chapter.

Table 24-2 shows other data given for each SDLC secondary station configured to be attached to this interface.

Table 24-2 SDLC Field Descriptions

Field	Description
addr	Address of this secondary SDLC station.
state is	Current state of this connection. The possible values are: <ul style="list-style-type: none"> • DISCONNECT—No communication is being attempted to this secondary. • CONNECT—A normal connect state exists between this router and this secondary. • DISCSENT—This router has sent a disconnect request to this secondary and is awaiting its response. • SNRMSENT—This router has sent a connect request (SNRM) to this secondary and is awaiting its response. • THEMBUSY—This secondary has told this router that it is temporarily unable to receive any more information frames. • USBUSY—This router has told this secondary that it is temporarily unable to receive any more information frames. • BOTHBUSY—Both sides have told each other that they are temporarily unable to receive any more information frames. • ERROR—This router has detected an error, and is waiting for a response from the secondary acknowledging this.
VS	Sequence number of the next information frame this station sends.
VR	Sequence number of the next information frame from this secondary that this station expects to receive.
Remote VR	Last frame transmitted by this station that has been acknowledged by the other station.
Current retransmit count	Number of times the current I-frame or sequence of I-frames has been retransmitted.
Hold queue:	Number of frames in hold queue/Maximum size of hold queue.
IFRAMEs, RNRs, SNRMs, DISCs	Sent/received count for these frames.
Poll:	“Set” if this router has a poll outstanding to the secondary; “clear” if it does not.
Poll count:	Number of polls, in a row, given to this secondary station at this time.
chain:	Shows the previous (p) and next (n) secondary address on this interface in the round robin loop of polled devices.

Related Commands

- encapsulation sdhc-primary**
- encapsulation sdhc-secondary**
- sdhc frmr-disable**
- sdhc holdq**
- sdhc n1**
- sdhc n2**
- sdhc poll-limit-value**
- sdhc poll-pause-timer**

show llc2

Use the **show llc2** privileged EXEC command to display the LLC2 connections active in the router.

```
show llc2
```

Syntax Description

This command has no arguments or keywords.

Command Mode

Privileged EXEC

Sample Display

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 24-3 describes significant fields shown in the display.

Table 24-3 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 router's 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 router is shown as in this example, following the DTE address and separated by a comma.)
SAP=04/04	The other station's and the router's (remote/local) Service Access Point for this connection. The SAP is analogous to a "port number" on the router and allows for multiple sessions between the same two stations.

Field	Description
State=NORMAL	<p>The 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 transmitted 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, n2=8	Value of these parameters, as given in the previous configuration section.
Next timer in 7768	Number of milliseconds before the next timer, for any reason, goes off.
xid-retry timer 0/60000....	A series of timer values 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 given 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.

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

llc2 ack-delay-time
llc2 ack-max
llc2 idle-time
llc2 local window
llc2 n2
llc2 t1-time
llc2 tbusy-time
llc2 tpf-time
llc2 trej-time
llc2 xid-neg-val-time
llc2 xid-retry-time

