



System i  
Networking  
Ethernet on iSeries

*Version 5 Release 4*







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Ethernet on iSeries

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**Note**

Before using this information and the product it supports, read the information in "Notices," on page 33.

**Sixth Edition (February 2006)**

This edition applies to version 5, release 4, modification 0 of IBM i5/OS (product number 5722-SS1) and to all subsequent releases and modifications until otherwise indicated in new editions. This version does not run on all reduced instruction set computer (RISC) models nor does it run on CISC models.

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## Ethernet

Ethernet on the System i™ platform supports TCP/IP, Advanced Peer-to-Peer Networking® (APPN), Advanced Program-to-Program Communication (APPC), retail, finance, host, and remote workstation.

You can use this information to configure and manage TCP/IP or Systems Network Architecture (SNA) over Ethernet on your System i platform.

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### What's new for V5R4



This topic highlights the changes and improvements made to Ethernet for V5R4.

| Support is added for 1 Gigabit Ethernet input/output adapters (IOAs) 5767 and 5768. These IOAs do not  
| require an input/output processor (IOP) to be installed in conjunction with the IOA. Instead, the IOA can  
| be plugged into a PCI-Express bus slot and the IOA is controlled by the main processor. The 5767 is a 2  
| port UTP (unshielded twisted pair) adapter which requires a minimum of CAT 5e cable and can transmit  
| to lengths of 100 meters. The 5768 is a 2 port 1 Gigabit SX adapter which uses multimode fiber (MMF)  
| and has duplex LC connectors. The 5768 can transmit to lengths of 500 meters. Both adapters support  
| TCP/IP, 9000-byte jumbo frames, and the IEEE 802.3ab (UTP adapter) and the IEEE 802.3z (SX-Fiber  
| adapter) standard.

| Also supported are the 181A and 181C pluggable ethernet modules. The 181A is a 2 port UTP module  
| which requires a minimum of CAT 5e cable and can transmit lengths of 100 meters. The 181C is a 4 port  
| UTP module which requires CAT 5e cabling and transmits to lengths of 100 meters. Both of these  
| modules support TCP/IP, 9000 byte jumbo frames, and the IEEE 802.3ab standard.

### How to see what's new or changed

To help you see where technical changes have been made, this information uses:

- The  image to mark where new or changed information begins.
- The  image to mark where new or changed information ends.

To find other information about what's new or changed this release, see the Memo to Users.

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### Printable PDF

Use this to view and print a PDF of this information.


To view or download the PDF version of this document, select Ethernet (about 463 KB).

### Saving PDF files

To save a PDF on your workstation for viewing or printing:

1. Right-click the PDF in your browser (right-click the link above).
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## Ethernet support

Many different factors influence the capabilities of Ethernet. Some of these influences can come from the cabling and adapter type you use.

Limiting factors can be the capabilities of the hub or switch that you connect to, the frame size you are able to transmit and receive, and the type of connection you use.

## Ethernet terminology

These terms are often used in reference to Ethernet networking.

Some of the terms defined can be used to represent multiple meanings. The terms and definitions used here are meant to specifically represent Ethernet networking technology, related information, and devices.

### Link partner

A device that the Ethernet adapter is connected to in an Ethernet connection. A link partner can be a switch, hub, router, or some other device that the adapter is connected to.

**Hub** A half-duplex device that sums all of its input and then broadcasts that sum on all output to the connected adapters. A hub has a large collision domain and shared media.

### Switch

A half-duplex or full-duplex device that detects which devices are attached at each port and passes only frames addressed to those devices on that port. A switch has a small collision domain.

## Ethernet capabilities

Ethernet capabilities, such as line speed and duplex mode, can enhance your system's performance.

System i products are capable of transmitting and receiving data at speeds from 10 megabits per second (10 Mbps) to 10 gigabits per second (10 Gbps or 10 000 Mbps). Functions such as full duplex also enhance the communication speeds and the overall performance of Ethernet.

### Line speed

The speed of data transfer is limited by the connection type, cabling, and maximum speeds that your system and link partner support.

- 1 The supported speeds can be 10 Mbps, 100 Mbps, 1000 Mbps (1 Gbps), or 10 000 Mbps (10 Gbps).

The cable type you use will directly limit what speed you can transmit and receive data. For more information about cabling types and their capabilities, see the Establishment of a physical connection to your network topic.

The maximum line speed of your system is also affected by the type of input/output adapter (IOA) that you are using. For more specific information about each supported IOA, see the Hardware requirements for Ethernet topic.

### Related concepts

"Gigabit and 10 Gigabit Ethernet" on page 3

System i products support Gigabit and 10 Gbps Ethernet, which requires the use of a 1 Gbps or 10 Gbps input/output adapter (IOA). The support for 10 Gbps Ethernet is limited to some models.



### Related reference

“Establishment of a physical connection to your network” on page 5

The first step to use Ethernet for System i is establishing a physical connection to your network. Having the correct settings and configurations for your system helps to ensure a successful connection.

“Hardware requirements for Ethernet” on page 7

System i products support many input/output adapters (IOAs). Find out what IOAs are supported and what capabilities each one has.

### Duplex mode

Depending on your system’s capabilities and the duplex mode of the link partner you are attaching to, you can use either full or half duplex.

Half duplex mode restricts the system to one-way communication; it cannot transmit and receive data at the same time. Full duplex allows your system to send and receive data simultaneously. You must match your system’s duplex mode to that of your link partner. If you do not, a duplex mismatch occurs.

#### Related concepts

“Auto-sensing” on page 5

If auto-negotiation fails, your system can match the line speed of its link partner.

### Gigabit and 10 Gigabit Ethernet

System i products support Gigabit and 10 Gbps Ethernet, which requires the use of a 1 Gbps or 10 Gbps input/output adapter (IOA). The support for 10 Gbps Ethernet is limited to some models.

The IOAs that can be used to run Gigabit Ethernet are as follows: the 2760, 5701, 5706, 5767 , 181A, and 181C Unshielded Twisted Pair (UTP) adapters, which use copper wire cabling, and the 2743, 5700, and 5707 Gigabit Ethernet cards, which use fiber optics. The fiber optic 573A and 576A IOAs support 10 Gbps Ethernet. All of the adapters support Transmission Control Protocol/Internet Protocol (TCP/IP), 9000-byte jumbo frames, and the IEEE 802.3 standard.

The i5/OS® operating system does not have integrated support for SNA over Gigabit or 10 Gbps Ethernet. Enterprise Extender or AnyNet® is required to run SNA over Gigabit or 10 Gbps Ethernet.

The UTP cards have the capability of running 10BASE-T/100BASE-TX/1000BASE-T in full or half duplex mode. The required minimum cabling type for use between these cards and their link partner is Category 5e, which has copper twisted pair wiring. All four pairs are used when running Gigabit Ethernet. The cable and connectors must also be wired to TIA/EIA 568-B standard. Crossover cables are not supported.

The Gigabit fiber optic cards only support 1000BASE-SX in full duplex mode. The 10 Gigabit fiber optic cards only support 10GBASE-LR and 10GBASE-SR in full duplex mode. The 2743 and 576A use duplex SC connectors while the 5700, 5707, 5768, and 573A use duplex LC connectors. The required fiber to use with the 2743, 5700, 5707, 5768, and 573A IOAs is 50 or 62.5 micron MMF (multi mode) fiber. 9 micron SMF (single mode) fiber is required for the 576A.

Table 1. Summary of IOA support by release

IOA	Earliest release supported
2743	V4R5
2760	V5R1
5700	V5R2
5701	V5R2
5706	V5R3
5707	V5R3

Table 1. Summary of IOA support by release (continued)

IOA	Earliest release supported
573A	V5R4
576A	V5R4
5767	V5R4
5768	V5R4
181A	V5R4
181C	V5R4

Ethernet frames can contain anywhere from 64 to 9000 bytes of information. All of these cards support the largest, 9000-byte jumbo frame size. The amount of work for the adapter to process each frame, regardless of size, is nearly the same. Therefore, you want to pack the most information possible into each frame. The final result will be to decrease processor utilization, leaving it more available for other application usage.

**Note:** Your system is limited by the switches, hubs, and devices that it connects to. Gigabit Ethernet, 10 Gigabit Ethernet, and jumbo frames can only be used if all devices support them.

**Related concepts**

“Line speed” on page 2

The speed of data transfer is limited by the connection type, cabling, and maximum speeds that your system and link partner support.

**Related reference**

“Establishment of a physical connection to your network” on page 5

The first step to use Ethernet for System i is establishing a physical connection to your network. Having the correct settings and configurations for your system helps to ensure a successful connection.

“Hardware requirements for Ethernet” on page 7

System i products support many input/output adapters (IOAs). Find out what IOAs are supported and what capabilities each one has.

**Auto-negotiation**

Auto-negotiation is the preferred method of configuring your system’s Ethernet connections.

Auto-negotiation should always be tried first. In auto-negotiation, your system sends out Ethernet link pulses seeking to transfer configuration data between your system and its link partner. Each link partner shares its supported values for line speed and duplex mode, and then finds the highest common value for each. The highest values common to both partners are selected, in the following order:

- 10 Gbps full duplex<sup>1</sup>
- 1 Gbps full duplex<sup>2</sup>
- 1 Gbps half duplex<sup>2</sup>
- 100 Mbps full duplex
- 100 Mbps half duplex
- 10 Mbps full duplex
- 10 Mbps half duplex

**Notes:**

1. The fiber optic 10 Gigabit Ethernet adapter can only run either 10 GBASE-LR (long range) or 10 GBASE-SR (short range), and full duplex. The fiber optic 10 Gigabit Ethernet adapter does allow auto-negotiation, but the only acceptable outcome is 10 Gbps, full duplex.

2. For Gigabit Ethernet, the line speed is negotiable only when using the UTP card, since this card has 10/100/1000BASE-T and full or half duplex capabilities. The fiber optic Gigabit Ethernet adapter can only run 1000BASE-SX and full duplex. The fiber optic Gigabit Ethernet adapter does allow auto-negotiation, but the only acceptable outcome from the auto-negotiation is 1000 Mbps, full duplex.

Auto-negotiation allows your system and its link partner to quickly establish a connection. However, both systems must support auto-negotiation. If the link partner is not configured to negotiate automatically, the system automatically senses a workable line speed, but not the duplex mode. The system uses the default setting of half-duplex. If this is not the correct duplex mode, a duplex mismatch occurs, at which point you must manually configure your system's duplex mode to match that of its link partner.

#### **Related concepts**

"Auto-sensing"

If auto-negotiation fails, your system can match the line speed of its link partner.

### **Auto-sensing**

If auto-negotiation fails, your system can match the line speed of its link partner.

However, the adapter cannot sense the duplex mode. The system will use the default setting of half duplex, which can result in a duplex mismatch.

### **Duplex mismatch**

Here is an example of duplex mismatch.

Your System i platform, configured for full duplex, is connecting to a hub configured for half duplex. Your system begins sending information to the hub, which is waiting to receive. When the receive line is clear, the hub then begins transmission back to your system. During this transmission, your system receives the incoming data and (if it has data ready) begins transmitting to the hub. Because the hub is half duplex, it sees this unexpected receipt of data and cancels the transmission in progress. This is called a *collision*. A duplex mismatch problem might be reported as a failure-to-connect error, or it might cause a more subtle performance problem due to intermittent canceled frames.

#### **Related concepts**

"Duplex mode" on page 3

Depending on your system's capabilities and the duplex mode of the link partner you are attaching to, you can use either full or half duplex.

"Auto-negotiation" on page 4

Auto-negotiation is the preferred method of configuring your system's Ethernet connections.

## **Establishment of a physical connection to your network**

The first step to use Ethernet for System i is establishing a physical connection to your network. Having the correct settings and configurations for your system helps to ensure a successful connection.

The physical link includes using the correct cabling and configuring the correct line speed and duplex mode to match the capabilities of the link partner you are connecting to.

### **UTP cable specifications**

The cabling that you use to connect to your link partner must be wired to the TIA/EIA 568-B standard (straight through, no cross-over). There are different categories of UTP cables and each one supports different speeds.

- Category 3: supports 10 Mbps
- Category 5: supports 10/100/1000 Mbps
- Category 5e: supports 10/100/1000 Mbps

- Category 6 or higher: supports 10/100/1000 Mbps

**Note:** Category 5e or higher is suitable if you are running Gigabit Ethernet. These cable types have tighter specifications that will help you achieve better quality connections.

Connecting your cables can be tedious work. The following list contains the pairs of wires inside the UTP cable and shows what order they are wired in the RJ-45 connector. It is crucial that the connector pins be in this order, or you will not be able to connect to your link partner. You will notice that the wires are different colors; some are solid colors and some are half solid and half white. Each half solid and half white wire is paired with the corresponding solid color wire, even though they might not sit adjacent to one another in the connector.

The pairs of wires are as follows:

- White/green, solid green
- White/orange, solid orange
- White/blue, solid blue
- White/brown, solid brown

The pins are numbered from left to right. (Hold the connector latch down and point the contacts away from you, so that pin 1 (White/Green) is on the left.) The following table shows how the wires appear in the connector and what pins they are set into.

Connector pin	Wire color
1	White/Green
2	Green
3	White/Orange
4	Blue
5	White/Blue
6	Orange
7	White/Brown
8	Brown

## Line speed and duplex mode configuration

If your link partner is capable of auto-negotiation, you can use `*AUTO` for both line speed and duplex mode, to negotiate automatically. If you are unsure of the link partner's capabilities, find out what line speed and duplex mode it is set to, so you can configure your system to match.

Here is an example where `*AUTO` cannot be used. If the hub or switch port is set to 100 Mbps and half duplex (not capable of auto-negotiation), in the Create Line Desc (Ethernet) (CRTLINETH) command, set your system's parameters to `LINESPEED equals 100M` and `DUPLEX equals *HALF`. Do not use `*AUTO` for either of these parameters, in this case.

Do not use any of the following line speed and duplex mode configurations:

- 10/\*AUTO
- 100/\*AUTO
- \*AUTO/Half
- \*AUTO/Full

These configurations might work, but you will have frequently unsuccessful and incorrect connections.

### Related concepts

“Gigabit and 10 Gigabit Ethernet” on page 3

System i products support Gigabit and 10 Gbps Ethernet, which requires the use of a 1 Gbps or 10 Gbps input/output adapter (IOA). The support for 10 Gbps Ethernet is limited to some models.

“Line speed” on page 2

The speed of data transfer is limited by the connection type, cabling, and maximum speeds that your system and link partner support.

**Related reference**

“Establishment of a physical connection to your network” on page 5

The first step to use Ethernet for System i is establishing a physical connection to your network. Having the correct settings and configurations for your system helps to ensure a successful connection.

“Hardware requirements for Ethernet”

System i products support many input/output adapters (IOAs). Find out what IOAs are supported and what capabilities each one has.

## Hardware requirements for Ethernet

System i products support many input/output adapters (IOAs). Find out what IOAs are supported and what capabilities each one has.

The Ethernet IOA types that System i products support are listed by custom card identification number (CCIN) in the following table.

*Table 2. Supported Ethernet adapters*

CCIN	Speed (Mbps)	Auto-negotiation supported	Jumbo frames supported	TCP/IP	i5/OS native SNA support	Duplex mode capability	
						Full	Half
576A <sup>2</sup>	10 000 (10 Gigabit)	Yes	Yes	Yes <sup>5</sup>	No	Yes	No
573A <sup>2</sup>	10 000 (10 Gigabit)	Yes	Yes	Yes <sup>5</sup>	No	Yes	No
5706 <sup>1,4</sup>	10/100/1000 (1 Gigabit)	Yes	Yes	Yes <sup>5</sup>	No	Yes	Yes
5767 <sup>1</sup>	10/100/1000 (1 Gigabit)	Yes	Yes	Yes <sup>5</sup>	No	Yes	Yes
181A <sup>1,4,7</sup>	10/100/1000 (1 Gigabit)	Yes	Yes	Yes <sup>5</sup>	No	Yes	No
181C <sup>1,4,7</sup>	10/100/1000 (1 Gigabit)	Yes	Yes	Yes <sup>5</sup>	No	Yes	No
5707 <sup>2,4</sup>	1000	Yes	Yes	Yes <sup>5</sup>	No	Yes	No
5768 <sup>2</sup>	1000	Yes	Yes	Yes <sup>5</sup>	No	Yes	No
2743 <sup>2</sup>	1000	Yes	Yes	Yes <sup>5</sup>	No	Yes	No
5700 <sup>2,6</sup>	1000	Yes	Yes	Yes <sup>5</sup>	No	Yes	No
2760 <sup>1</sup>	10/100/1000	Yes	Yes	Yes <sup>5</sup>	No	Yes	Yes
5701 <sup>1,6</sup>	10/100/1000	Yes	Yes	Yes <sup>5</sup>	No	Yes	Yes
2838 <sup>1,3,4</sup>	10/100	Yes	No	Yes	Yes	Yes	Yes
2849 <sup>1,3,4</sup>	10/100	Yes	No	Yes	Yes	Yes	Yes
6181 <sup>1</sup>	10	No	No	Yes	Yes	Yes	Yes
2723 <sup>1</sup>	10	No	No	Yes	Yes	Yes	Yes

Table 2. Supported Ethernet adapters (continued)

CCIN	Speed (Mbps)	Auto-negotiation supported	Jumbo frames supported	TCP/IP	i5/OS native SNA support	Duplex mode capability	
						Full	Half
<p><b>Notes:</b></p> <ol style="list-style-type: none"> <li>1. Unshielded Twisted Pair (UTP) card; uses copper wire cabling.</li> <li>2. Uses fiber optics.</li> <li>3. You can run SNA traffic with TCP/IP traffic on this IOP/IOA. TCP/IP traffic will run in the higher performance path along with SNA traffic.</li> <li>4. Supports Operations Console. To use Operations Console with 5706 and 5707 adapters, it is required to have V5R4 or later releases of the i5/OS operating system installed.</li> <li>5. Enterprise Extender or AnyNet is required to run SNA over 1 Gbps or 10 Gbps Ethernet. For more information, see the APPC, APPN, and HPR topic collection.</li> <li>6. These IOAs can be used with or without an IOP.</li> <li>7. On a partitioned system, the physical configuration (speed and duplex mode) of a port is managed by the Hardware Management Console (HMC) instead of by the partition configuration. The system ignores the line speed specified in the partition configuration and uses the settings configured by the HMC.</li> </ol>							

**Related concepts**

“Gigabit and 10 Gigabit Ethernet” on page 3  
 System i products support Gigabit and 10 Gbps Ethernet, which requires the use of a 1 Gbps or 10 Gbps input/output adapter (IOA). The support for 10 Gbps Ethernet is limited to some models.

**Related tasks**

“Changing your line description” on page 20  
 To make changes to an existing line description, follow these steps.  
 “Assigning your line description to a TCP/IP interface” on page 20  
 To use your line description with TCP/IP, you must associate the line description with a new or existing TCP/IP interface.  
 “Configuring TCP/IP over Ethernet” on page 16  
 iSeries™ Navigator provides a configuration wizard for you to set up Ethernet support for TCP/IP.

**Related reference**

“Establishment of a physical connection to your network” on page 5  
 The first step to use Ethernet for System i is establishing a physical connection to your network. Having the correct settings and configurations for your system helps to ensure a successful connection.

**LAN IOA addresses**

The input/output adapter (IOA) has a preset address (also known as the burned-in address or the manufacturer-assigned address). You have the option of setting the address for each IOA to an address of your choice.

If you are using SNA, it is preferred that you use an address of your choice. For example, if you use the burned-in address of the adapter, you must configure this address into every device that communicates with the adapter. If, at a later point in time you replace the adapter, you must go back to each device and reconfigure them with the burned-in address of the new adapter. You cannot assign the burned-in address of the old adapter to the new adapter.

However, you can avoid the excess reconfiguration work by associating a locally administered address with the adapter. Because the other devices will already have the locally administered address configured, you will not need to reconfigure them when you replace the IOA. Instead, you can associate the existing locally administered address with the new adapter.

**Note:** No two adapters in the same network can have the same address.

## Ethernet frame format

While tracing LAN communications, you might need to look at the transmitted frames. To understand the data that is contained in the frame, you must know how it is formatted.

The following figures show the frame format of two Ethernet standards: IEEE 802.3 and Ethernet version 2.

The Frame Check Sequence (FCS) is a part of the frame put in place to verify that the information each frame contains is not damaged during transmission. If a frame is corrupted during transmission, the FCS on the frame will not match with the recipient's calculated FCS. Any frames that do not match the calculated FCS will be discarded.

### IEEE 802.3 frame format

Starting Delimiter (1 byte)	Destination Address (6 bytes)	Source Address (6 bytes)	Length (2 bytes)	LLC header and Information field (46 - 1500 bytes)	Frame Check Sequence (4 bytes)
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### Ethernet version 2 frame format

Starting Delimiter (1 byte)	Destination Address (6 bytes)	Source Address (6 bytes)	Type (2 bytes)	Information field (46 - 1500 bytes)	Frame Check Sequence (4 bytes)
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Ethernet version 2 supports SNA by placing the IEEE 802.2 LLC header and data into the information field. It also puts value X'80D5' into the Type field. This shows the frame format.

Starting Delimiter	Destination Address	Source Address	Type (80D5)	Information field (Length, Padding, LLC header, Data)	Frame Check Sequence
--------------------	---------------------	----------------	-------------	---	----------------------

**Note:** The i5/OS operating system does not have integrated support for SNA over Gigabit Ethernet or 10 Gbps Ethernet. Enterprise Extender or AnyNet is required to run SNA over 1 Gbps or 10 Gbps Ethernet.

#### Related information

APPC, APPN, and HPR

## Types of Ethernet frames sent

The Ethernet frame that your system receives and the Ethernet standard that you select in the line description govern the type of frame that your system sends.

In the line description, you select the standard through the Ethernet standard (ETHSTD) field. In an SNA environment, if you have the option to use Ethernet standard IEEE 802.3 or Ethernet version 2, use \*ALL.

The following table shows what Ethernet frame your system sends according to the frame type the system receives and the value of the ETHSTD field. As noted, your system will not send a frame in some cases.



Frame type received	ETHSTD value	Frame type sent
IEEE 802.3 with SNA or non-SNA data	*IEEE8023 <sup>1</sup>	IEEE 802.3
	*ETHV2 <sup>2</sup>	No frame sent
	*ALL <sup>3</sup>	IEEE 802.3
Ethernet version 2 with non-SNA data	*IEEE8023	No frame
	*ETHV2	Ethernet version 2
	*ALL	Ethernet version 2
Ethernet version 2 with SNA data	*IEEE8023	IEEE 802.3
	*ETHV2	Ethernet version 2, encapsulated SNA <sup>4</sup>
	*ALL	IEEE 802.3

**Notes:**

1. The network uses Ethernet standard IEEE 802.3.
2. The network uses Ethernet version 2. In an SNA environment, you use this protocol for only System i to System i communications.
3. The network uses both Ethernet standards (IEEE 802.3 and Ethernet version 2). All TCP/IP multicast packets are sent as 802.3 and Ethernet version 2 frames.
4. The type field of the Ethernet version 2 frame to indicate the information field contains the SNA data.

## Maximum Ethernet frame sizes

The largest frame size used during the connection process is controlled by the maximum frame size configurations of multiple items.

The maximum frame size for the connection is also influenced by exchange identifier negotiations and bridge considerations. Note that TCP/IP and SNA connections are limited by slightly different sets of items.

### TCP/IP connections

The maximum frame size is associated with:

- the Ethernet standard that you select
- the line description (Gigabit Ethernet only)
- each service access point (SAP)
- the TCP/IP interface

### SNA connections

The maximum frame size is associated with:

- the controller
- the Ethernet standard that you select
- each service access point (SAP)

During the connection process, your system selects the smallest common value of the maximum frame values. As previously stated, the actual maximum frame size used can become even smaller if the bridge cannot support the value selected by the system.

The following table shows the maximum frame sizes that are associated with the Ethernet standard that you select through the Ethernet standard (ETHSTD) field.



ETHSTD parameter value	Frame type used	Maximum frame size in bytes	
		SNA <sup>4</sup>	TCP/IP
*IEEE8023 <sup>1</sup>	IEEE 802.3	1496	8992 (1 Gbps/10 Gbps Ethernet) 1492 (all others)
*ETHV2 <sup>2</sup>	Ethernet version 2	1493	9000 8992 (1 Gbps/10 Gbps Ethernet) 1500 (all others)
*ALL <sup>3</sup>	IEEE 802.3	1496	8992 (1 Gbps/10 Gbps Ethernet) 1492 (all others)
	Ethernet version 2	1493	9000 8992 (1 Gbps/10 Gbps Ethernet) 1500 (all others)

**Notes:**

1. IEEE 802.3 standard.
2. Ethernet version 2 standard.
3. Network uses both Ethernet standards (IEEE 802.3 and Ethernet version 2).
4. For 1 Gbps and 10 Gbps cards, Enterprise Extender or AnyNet is required to use SNA. For more information, see the APPC, APPN, and HPR topic collection.

### Related reference

“SNA service access points” on page 14

Local SAPs are known as source service access points (SSAP). The remote SAPs are known as destination service access points (DSAPs). Your system sends data from an SSAP to a DSAP.

“Remote bridges dropping frames” on page 23

A remote bridge discards your frame if it does not support your frame size. The network can also discard your frame if it does not support your frame size.

“Improvement of Gigabit and 10 Gigabit Ethernet performance” on page 24

These tips show how to improve the performance of your system.

## Maximum LAN frame sizes

The larger your frame size, the more data your system can put into it. Hence, you can increase your data throughput.

Typically, you set the maximum frame size to the largest size that is supported by your input/output adapter (IOA). However, a device along the way will drop the frame if it cannot support the larger size. For example, if frames are being sent to a remote system on a different LAN, the frame must go through a bridge to be retransmitted to the remote LAN. If the bridge cannot support the frame size that your LAN is using, the frame will be dropped or discarded. In the Ethernet environment, no indication of the smaller frame size of the bridge is received. The problem will be detected when a connection with the remote system is established and a CPA57A1 message is sent to the configured message queue.

If you cannot configure the device to support your frame size, you must decrease your maximum frame size to a size that the device can support. You can change one or more of the following maximum frame size fields (location of the field in parentheses):

- SSAP maximum frame parameter (line description)
- Maximum frame size (line descriptions for token ring, Gigabit and 10 Gigabit Ethernet networks)
- Maximum frame size (controller description)

If any adjustments are made, it is preferred that the MAXFRAME value on the controller description be adjusted as well.

## LAN device connection

The correct line and controller descriptions help you achieve successful connections.

If you use SNA with a LAN protocol, this information can help you to successfully connect to a remote system. The correct relationship between a line description and a controller description helps to ensure connection establishment. A controller description determines which line descriptions your system uses. Therefore, you must ensure that the controller description refers to the correct line description.

A line description also governs the number of active controllers that can access it. By setting the MAXACT parameter number too small, you might prevent the controller from accessing the system over the specific line description. Therefore, you should set a large enough value to ensure the controller access to the line.

The descriptions must also contain the correct information to ensure connection establishment.

### Related tasks

“Creating the SNA controller description” on page 18

The controller description identifies the remote devices to which the system connects.

### Related reference

“Connection failure and controller descriptions” on page 30

Sometimes an incorrectly configured controller description can cause a connection failure. The problem source might involve the incorrect configuration of the adapter address, source service access point (SSAP), or destination service access point (DSAP) parameters.

## LAN device identification

Different types of verification are used during the LAN connection process.

To begin a connection, your system sends information to the remote device you are connecting to. The device identifies the system using this information. The device then sends information back to the system, which the system uses to identify the device. The system compares that information against the information that is contained in the line and controller descriptions. If a match occurs and other connection values are correct, the connection process continues. In the meantime, the remote device performs a similar process.

Your system and the remote device use two types of verification during the connection process. The first type (required) matches the line and controller description information with the connection information that the remote device sent. After the information has been verified, your system continues the process.

The remote device sends the following information:

- The MAC address associated with the input/output adapter (IOA) on the remote device (either preset or locally administered)
- The source service access point (SSAP) on the remote device
- The destination service access point (DSAP)

The other type of verification matches the SNA exchange identifier values. SNA hosts that use parallel connections require this verification. This verification is optional for Advanced Program-to-Program Communications (APPC).

### Related reference

“SNA service access points” on page 14

Local SAPs are known as source service access points (SSAP). The remote SAPs are known as destination service access points (DSAPs). Your system sends data from an SSAP to a DSAP.

“Connection failure and controller descriptions” on page 30

Sometimes an incorrectly configured controller description can cause a connection failure. The

problem source might involve the incorrect configuration of the adapter address, source service access point (SSAP), or destination service access point (DSAP) parameters.

## **SNA exchange identifiers**

To establish a connection, your system and the remote device both send an SNA exchange identifier (XID).

The exchange identifier is defined in the controller description for your system. SNA hosts that use parallel connections require the XIDs. Your system conducts an initial poll with NULL XIDs during the connection process to determine whether the remote device is active. If the device responds to the poll, your system and the remote device exchange XIDs and establish the connection.

The controller description for an SNA host names the XID value as the local exchange identifier. The APPC controller description names the XID value as the exchange identifier. Other controller types, such as CTRL, FNC, and RWS, also use the exchange identifier.

## **LAN device connection initiation**

In an SNA environment, you can determine which system initiates the connection request and which system waits for an incoming connection request.

To have your system initiate the connection, you can configure the controller description to dial the destination. If no connection is established, your controller description automatically switches to answer mode.

To have your system wait for incoming calls, you can configure the controller description to answer the incoming calls. You can specify the mode through the Initial connection (INLCNN) field of the controller description.

## **Dial mode (SNA)**

SNA controller descriptions use dial mode to send a connection request to a remote device.

Dial mode typically starts when varying on the controller description. However, if the DIALINIT parameter is set to \*DELAY, dial mode will not begin until an application opens a file that uses the connection. During the dialing process, the system polls the remote device to determine if the device is available. If the remote device is available, the connection process continues. Successful connection is still possible even if the local and remote devices dial each other simultaneously.

The following controller description fields set the frequency and duration of the poll:

- LAN connection retry (LANCNNRTY) determines the number of times your system polls the remote device.
- LAN connection timer (LANCNNTMR) determines the length of time between each poll.

If the remote device answers the poll within the time specified by the parameters, your system proceeds with establishing the connection. If not, your system sends an inquiry message (CPA58E0 or CPA57EF) to the configured message queue. This message indicates that a connection attempt failed and that the controller description is now in answer mode.

## **Answer mode (SNA)**

If you specify answer mode, the input/output adapter (IOA) does not originate connection requests, but responds to incoming connection requests. Systems with controller descriptions that are configured with dial mode initiate and accept connection requests. However, APPC controllers that are user owned (CTLOWN = \*USER) must be varied on before the system can respond to connection requests.

### **Related reference**

“LANCNTMR and LANCNNRTY” on page 25

The LAN connection timer (LANCNTMR) and LAN connection retry (LANCNNRTY) parameters of your controller description define the frequency and persistence of polling the remote station to establish a connection.

“Connection failure and controller descriptions” on page 30

Sometimes an incorrectly configured controller description can cause a connection failure. The problem source might involve the incorrect configuration of the adapter address, source service access point (SSAP), or destination service access point (DSAP) parameters.

## SNA connections to LAN protocols

The system can connect SNA to a LAN protocol by using service access points (SAPs). Multiple SAPs enable you to have multiple connections between SNA and a LAN protocol, thus permitting multiple communication paths between independent applications.

You or the system specifies which SAPs to use in the line and controller descriptions. For SNA, the system can automatically create one SAP value (the default value). You might want to change this value or have additional SAPs if any of the following conditions apply:

- The remote system does not use the default source service access point (SSAP)
- You want parallel station-to-station connections between adapters (This might be desirable if you link two applications that require different controller descriptions.)
- You want station-to-station connections to the same adapters (You might want to do this to configure multiple SAPs to test an application on a single system.)

### Related tasks

“Creating the SNA controller description” on page 18

The controller description identifies the remote devices to which the system connects.

## SNA service access points

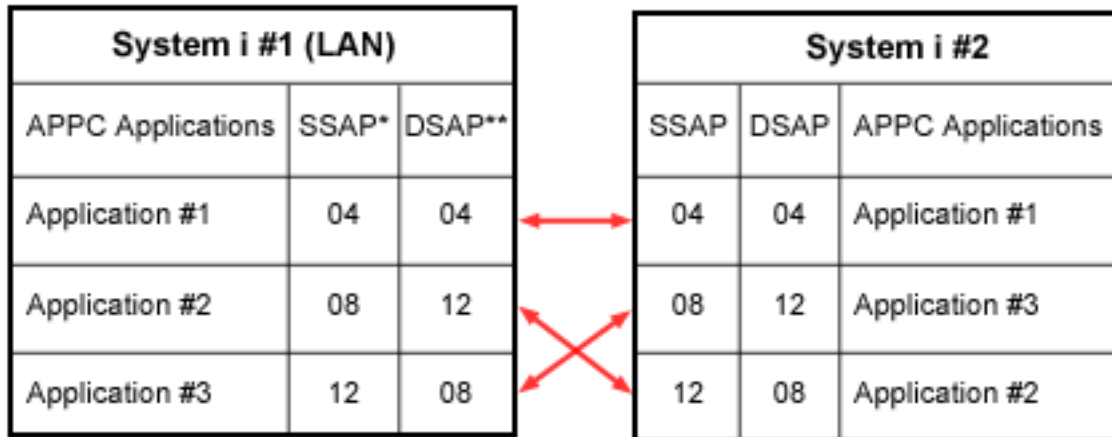
Local SAPs are known as source service access points (SSAP). The remote SAPs are known as destination service access points (DSAPs). Your system sends data from an SSAP to a DSAP.

If you decide to change the default service access points (SAPs) or add more SAPs, you must define them in the line and controller descriptions.

You can specify up to 24 SSAPs per line description when you define the SAPs. The SSAPs that your controller description uses must also be defined in the line description associated with the controller description. Your controller description also specifies the destination service access point (DSAP).

The following figure portrays the physical connection between the source service access points of your system and the destination service access points of the remote system. For example, on your system, the SSAP 08 will have a DSAP of 12. On the remote system, the SSAP is 12 and the DSAP is 08.

## Example of SSAP and DSAP Pairs



\* The LAN source service access point (SSAP) is the logical address that this system sends with any data to a remote system. This value must match the DSAP of the remote controller.

\*\*The LAN destination service access point (DSAP) is the logical address with which this controller communicates. This value must equal the LAN SSAP in the remote controller configuration.

For SNA, you must use certain SSAP values. You can find the help for selecting these values by pressing F1 (Help) while your cursor is on the SSAP list field of the line description.

### Related concepts

“LAN device identification” on page 12

Different types of verification are used during the LAN connection process.

### Related tasks

“Creating the SNA controller description” on page 18

The controller description identifies the remote devices to which the system connects.

“Changing your line description” on page 20

To make changes to an existing line description, follow these steps.

“Assigning your line description to a TCP/IP interface” on page 20

To use your line description with TCP/IP, you must associate the line description with a new or existing TCP/IP interface.

“Configuring TCP/IP over Ethernet” on page 16

iSeries Navigator provides a configuration wizard for you to set up Ethernet support for TCP/IP.

### Related reference

“Maximum Ethernet frame sizes” on page 10

The largest frame size used during the connection process is controlled by the maximum frame size configurations of multiple items.

### Related information

Match iSeries system line description parameters for a remote iSeries system

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## Configuring Ethernet support

The i5/OS operating system supports Ethernet connections with TCP/IP and SNA.

## Configuring TCP/IP over Ethernet

iSeries Navigator provides a configuration wizard for you to set up Ethernet support for TCP/IP.

To configure your system, complete the following steps:

1. Install iSeries Navigator. (If this has previously been installed, skip to step 2.)
2. In the iSeries Navigator window, expand the system that will provide Ethernet support for TCP/IP. Log onto the system if you are prompted to do so.
3. To configure a new TCP/IP interface that will be used with Ethernet, follow these steps:
  - a. Expand **Network** → **TCP/IP Configuration** → **IPv4** or **IPv6**.
  - b. Right-click **Interface**.
  - c. Select **New Interface** → **Local Area Network**. This will take you to the New Interface Wizard.

**Remember:** You can choose to use an existing line description or have a new one created by iSeries Navigator.

4. If you did not choose to turn on the TCP/IP interface, you can do so now. Follow the instructions in “Starting the TCP/IP interface” on page 21.

### Related tasks

“Changing your line description” on page 20

To make changes to an existing line description, follow these steps.

### Related reference

“Hardware requirements for Ethernet” on page 7

System i products support many input/output adapters (IOAs). Find out what IOAs are supported and what capabilities each one has.

“SNA service access points” on page 14

Local SAPs are known as source service access points (SSAP). The remote SAPs are known as destination service access points (DSAPs). Your system sends data from an SSAP to a DSAP.

### Related information

TCP/IP setup

## Configuring SNA over Ethernet

To configure Ethernet support for SNA, complete the following tasks from an interactive job.

### Selecting a LAN IOA and creating the Ethernet line description

To configure SNA over Ethernet, you need to select a LAN input/output adapter (IOA) and create the Ethernet line description using an interactive job .

**Note:** The following steps describe only the fields that require additional information. If you need help with the fields that are not discussed here, press F1 (Help) when your cursor is on the field in question.

1. Type `WRKHDWRSC *CMN` and press Enter. A list will appear that shows the attached i5/OS communications resources, and their type numbers, operational statuses, and descriptive text.
2. Locate an IOA by looking in the descriptive text column for a phrase that describes the port for your LAN type. For example, if you use Ethernet, look for “Ethernet Port.”
3. After you find an IOA, move your cursor to its **Opt** field.
4. Type 5 (Work with configuration descriptions) and press Enter.
5. Type 1 (Create) and press Enter.  
You are now in the Create Line Description (Ethernet) (CRTLINETH) screen.



**Note:** The system enters the IOA you selected into the **Resource** name field.

To move from field to field, move your cursor or press the tab key. Do not press Enter while you are in this screen unless instructed to do so; otherwise you will exit the command.

6. Type a name for your line description into the **Line description** field.
7. Indicate the address to use with the IOA in the **Local adapter** address field. You can use either the preset address or a locally administered address. If you are unsure which address to use, see the LAN IOA addresses topic.

To use the preset address, accept the default value of **\*ADPT**. To specify a locally administered address, enter a valid address into the field. For guidelines on creating a valid address, move your cursor to the address field and press F1 (Help).

8. If the system uses this line description to communicate with an SNA host through a parallel connection, specify a value other than **\*LIND** in the **SNA Exchange identifier** field.
9. In the **Ethernet standard** field, specify the standard to use. If you can use SNA over IEEE 802.3 or Ethernet version 2, use the **\*ALL** value on the **ETHSTD** parameter.  
For information about how the selected standard influences the type of Ethernet frame your system sends, see the Types of Ethernet frames sent topic.

**Note:** You cannot change this field after exiting the command.

10. In the **Line speed** field, indicate the line speed to use. If you do not know the capabilities of the IOA, see the Hardware requirements for Ethernet topic.

**Note:** Line speed automatic negotiation occurs when you specify **\*AUTO**.

11. Select the duplex mode to use with your IOA. If you do not know the capabilities of the IOA, see the Hardware requirements for Ethernet topic.

**Note:** Duplex mode automatic negotiation occurs when you specify **\*AUTO**. Remember that your Ethernet switch or hub must support automatic negotiation before you can successfully use this function. If the device does not support it, a duplex mismatch can occur, causing connection problems. For more information see the Auto-sensing topic.

12. Press F10 (Additional fields).
13. List all the source service access points (SSAP) that your controller description can use in the **SSAP** field. Accept the default value **\*SYSGEN** or specify your SSAPs. To define the SSAP values, move your cursor to the field and press F1 (Help) for help to determine what values to use. For more information about whether you or the system should define the service access points (SAPs), see SNA connections to LAN protocols.
14. Leave the **SSAP maximum frame** field blank.
15. Optional: In the **Autocreate controller** field, specify **\*YES** if you use APPN and want the system to create a controller description. (The system will create the description when a call comes in.) If you specified **\*YES**, you do not need to create a device description.
16. Press Enter to create the line description. Your line description will appear at the bottom of the list.
17. Press Enter twice.

#### **Related concepts**

“LAN IOA addresses” on page 8

The input/output adapter (IOA) has a preset address (also known as the burned-in address or the manufacturer-assigned address). You have the option of setting the address for each IOA to an address of your choice.

“SNA connections to LAN protocols” on page 14

The system can connect SNA to a LAN protocol by using service access points (SAPs). Multiple SAPs enable you to have multiple connections between SNA and a LAN protocol, thus permitting multiple communication paths between independent applications.

“Auto-sensing” on page 5

If auto-negotiation fails, your system can match the line speed of its link partner.

#### **Related reference**

“SNA service access points” on page 14

Local SAPs are known as source service access points (SSAP). The remote SAPs are known as destination service access points (DSAPs). Your system sends data from an SSAP to a DSAP.

“Types of Ethernet frames sent” on page 9

The Ethernet frame that your system receives and the Ethernet standard that you select in the line description govern the type of frame that your system sends.

“Hardware requirements for Ethernet” on page 7

System i products support many input/output adapters (IOAs). Find out what IOAs are supported and what capabilities each one has.

## **Creating the SNA controller description**

The controller description identifies the remote devices to which the system connects.

**Note:** If you are running Advanced Peer-to-Peer Networking (APPN), your system can automatically create the controller description (this is the suggested method) or you can create it manually. Autocreate cannot be used with Advanced Program-to-Program Communication (APPC).

To create a controller description to use with your LAN adapter, complete the following steps:

- | 1. Optional: Type G0 CMDCTL to find a list of controller creation commands.
- | 2. Type the name of the command to use and press F4 (Prompt).
- | 3. Type the name of the controller description into the **Controller description** field.
- | 4. Specify \*LAN in the **Link Type** field.
- | 5. Press Enter three times. The system displays more fields that might require the following information:
  - | • **Switched line list:** It specifies one or more line descriptions that your controller description can use. Enter the name of your Ethernet Line Description.
  - | • **Initial connection:** It determines whether the controller description initiates connection requests (\*DIAL), or waits for incoming connection requests (\*ANS).  
If you specify \*DIAL and want to adjust the polling duration or frequency, you can change the **LAN connection retry** (LANCNNRPTY) or **LAN connection timer** (LANCNNNTMR) field.
  - | • **LAN remote adapter address:** It contains the address of the remote input/output adapter (IOA). To locate this address, see the Viewing the LAN IOA address topic. If you are using the preset address of the adapter, consider using your own LAN IOA addresses to minimize your reconfiguration work.
  - | • **LAN DSAP:** It contains the source service access point (SSAP) value from the controller description that is for the remote device.
  - | • **LAN SSAP:** It contains a value from the SSAP listing of the line description that is associated with this controller description.
- | 6. Fill in all of the required fields. Press Enter until you reach a required field.
- | 7. Press Enter again to create the description.

#### **Related concepts**

“LAN device connection” on page 12

The correct line and controller descriptions help you achieve successful connections.

“SNA connections to LAN protocols” on page 14

The system can connect SNA to a LAN protocol by using service access points (SAPs). Multiple SAPs enable you to have multiple connections between SNA and a LAN protocol, thus permitting multiple communication paths between independent applications.

#### **Related tasks**



“Viewing the LAN IOA address” on page 22

When configuring a controller description, you must specify the address of the remote input/output adapter (IOA).

#### **Related reference**

“SNA service access points” on page 14

Local SAPs are known as source service access points (SSAP). The remote SAPs are known as destination service access points (DSAPs). Your system sends data from an SSAP to a DSAP.

“LANCNTMR and LANCNNRTY” on page 25

The LAN connection timer (LANCNTMR) and LAN connection retry (LANCNNRTY) parameters of your controller description define the frequency and persistence of polling the remote station to establish a connection.

#### **Related information**



Communications Configuration (on the V5R1 Supplemental Manuals Web site)

Configure APPC, APPN, and HPR

## **Creating the SNA device description**

The device description identifies the communications device that is used by the remote device.

There are no LAN-specific parameters in the device description. To create the SNA device description, complete the following steps:

1. Find the create command to use. Use the GO CMDDEV command to view of list of available commands.
2. Type the name of the command and press F4 (Prompt).
3. Type the name of the device description into the corresponding field.

For detailed information about all the parameters and their dependencies, see the chapter about communications device descriptions in Communications Configuration.

4. Press Enter twice to create the description.

#### **Related information**



Communications Configuration (on the V5R1 Supplemental Manuals Web site)

## **Varying on configuration objects for SNA**

The Work with Configuration Status (WRKCFGSTS) command enables you to vary on the configuration objects.

1. Type WRKCFGSTS \*LIN and press Enter.
2. Locate your line description.
3. Move your cursor to the **Opt** field of the line description, type 1 (Vary on), and press Enter.
4. If the line description does not vary on successfully, press F3 (Exit). Read Display message queues to solve communication problems to understand how to view the error messages and to find possible solutions.
5. Press F3 (Exit).

If the line description varied on successfully, you should do the same for the controller description if you created one. Vary on the description by using the same instructions for varying on the line description. Instead of specifying \*LIN for the WRKCFGSTS command, you must specify \*CTL.

---

## **Managing Ethernet support**

After configuring Ethernet support, you can change many things, such as line descriptions and Ethernet performance.

## Using existing line descriptions with iSeries Navigator

To use an existing Ethernet line description with iSeries Navigator, you need to change the description with an interactive job.

However, you should ensure that all configuration objects (for example, TCP/IP interfaces) that currently use the line description are still able to work with it after you have changed it.

Use the Change Line Description (Ethernet) (CHGLINETH) command to change your line description. Then use iSeries Navigator to assign your line description to a TCP/IP interface.

### Changing your line description

To make changes to an existing line description, follow these steps.

1. Vary off the line description:
  - a. Type WRKLIND and press Enter.
  - b. Locate your line description, and place your cursor in its **Opt** field.
  - c. Type 8 (Work with status) and press Enter.
  - d. Type 2 (Vary off) and press Enter. If your line description does not vary off, place your cursor on the error message and press F1 (Help) to view more information about the error. If you need help with the error, see Troubleshooting.
  - e. Press Enter.
2. Type CHGLINETH description\_name (where **description\_name** is the line description being changed) and press F4 (Prompt).
3. Specify the correct values for the **Line speed** field and the **Duplex** field. If you are not familiar with the input/output adapter (IOA), see Hardware requirements for Ethernet.
4. If you are using this line description with TCP/IP, ensure that source service access point (SSAP) X'AA' and its associated information are in the **SSAP list** field.
5. If you want to use the larger frame sizes of Gigabit or 10 Gigabit Ethernet, ensure that all the nodes along the communications path can support the frame sizes.
6. Press Enter to save your changes.

#### Related tasks

“Configuring TCP/IP over Ethernet” on page 16

iSeries Navigator provides a configuration wizard for you to set up Ethernet support for TCP/IP.

#### Related reference

“Hardware requirements for Ethernet” on page 7

System i products support many input/output adapters (IOAs). Find out what IOAs are supported and what capabilities each one has.

“SNA service access points” on page 14

Local SAPs are known as source service access points (SSAP). The remote SAPs are known as destination service access points (DSAPs). Your system sends data from an SSAP to a DSAP.

### Assigning your line description to a TCP/IP interface

To use your line description with TCP/IP, you must associate the line description with a new or existing TCP/IP interface.

- | You can use the Change TCP/IP Interface (CHGTCPIFC) CL command to assign a line description to a  
| TCP/IP interface. Use the Internet Address (INTNETADR) keyword to specify the internet address of the  
| TCP/IP interface you want to configure. The internet address is specified in the form *nnn.nnn.nnn.nnn*,  
| where *nnn* is a decimal number ranging from 0 through 255. Use the Line Description (LIND) keyword to  
| specify the name of the line description to be associated with the TCP/IP interface. The following  
| example illustrates how to assign the line description ETH0 to the TCP/IP interface 10.1.1.1 with the  
| CHGTCPIFC command:

| CHGTCPIFC INTNETADR('10.1.1.1') LIND(ETH0)

| **Related reference**

“Hardware requirements for Ethernet” on page 7

System i products support many input/output adapters (IOAs). Find out what IOAs are supported and what capabilities each one has.

“SNA service access points” on page 14

Local SAPs are known as source service access points (SSAP). The remote SAPs are known as destination service access points (DSAPs). Your system sends data from an SSAP to a DSAP.

**Related information**

TCP/IP setup

Change TCP/IP Interface (CHGTCPIFC) command

## Enabling objects to accept connections

After configuring LAN support, you are ready to enable your configuration objects to accept connections. For SNA, vary on the line and controller descriptions. For TCP/IP, start the interface.

### Varying on configuration objects for SNA

The Work with Configuration Status (WRKCFGSTS) command enables you to vary on the configuration objects.

1. Type WRKCFGSTS \*LIN and press Enter.
2. Locate your line description.
3. Move your cursor to the **Opt** field of the line description, type 1 (Vary on), and press Enter.
4. If the line description does not vary on successfully, press F3 (Exit). Read Display message queues to solve communication problems to understand how to view the error messages and to find possible solutions.
5. Press F3 (Exit).

If the line description varied on successfully, you should do the same for the controller description if you created one. Vary on the description by using the same instructions for varying on the line description. Instead of specifying \*LIN for the WRKCFGSTS command, you must specify \*CTL.

### Starting the TCP/IP interface

You can use iSeries Navigator to enable the TCP/IP interface.

- | 1. In iSeries Navigator, expand the system that contains the TCP/IP interface to start.
- | 2. Expand **Network** → **TCP/IP Configuration** → **IPv4** or **IPv6**.
- | 3. Click **Interface**.
- | 4. Start the interface now, or every time TCP/IP starts.
- | To start the interface now, follow these steps:
- | a. Right-click an inactive interface.
- | b. Select **Start**.
- | c. Click **OK** to close the window.
- | To start the interface every time TCP/IP starts, follow these steps:
- | a. Double-click an interface to display its **Properties** window.
- | b. On the **Advanced** tab, check **Start interface when TCP/IP is started**.
- | c. Click **OK** to save the settings.

**Related information**

TCP/IP setup

## Viewing the LAN IOA address

When configuring a controller description, you must specify the address of the remote input/output adapter (IOA).

### Viewing the locally administered address

1. Type DSPLIND `description_name` (where **description\_name** is the name of the description to be displayed) and press Enter.
2. Locate the **Local adapter address** field to view the address of the adapter.
3. Press F3 (Exit).

### Viewing the preset address

1. Locate a line description that uses the IOA. This description must specify \*ADPT in the **Adapter address** field. If you cannot find such a line description, create it, and then return here to continue the steps.
2. Use the Work with Configuration Status (WRKCFGSTS) command to vary on the line description:
  - a. Type WRKCFGSTS \*LIN and press Enter.
  - b. Locate your line description and look for a status of varied on or active.
  - c. If it is varied on or active, press F3 (Exit) and skip to step 3.
  - d. If it is not varied on or active, place your cursor on the **Opt** field of the line description, type 1 (Vary on), and press Enter.
  - e. If your line description does not vary on, place your cursor on the error message and press F1 (Help) to view more information about the error. If you need help to understand the error message or to resolve it, see Troubleshooting.
  - f. Press F3 (Exit).
3. Type DSPLIND `description_name` (where **description\_name** is the name of your line description), and press Enter.
4. Locate the **Local adapter address** field to view the preset address of the adapter.
5. Press Enter.

## Configuration object commands

Configuration object commands are commands that affect your line, controller, or device descriptions. You can view and use these commands by using the GO command.

To view a subset of the commands, use the following GO commands:

- To view line description commands, type GO CMDLIND and press Enter.
- To view controller description commands, type GO CMDCTLD and press Enter.
- To view device description commands, type GO CMDDEVD and press Enter.

To view a more complete list of commands, use the following GO commands:

- To view line description commands, type GO CMDLIN and press Enter.
- To view controller description commands, type GO CMDCTL and press Enter.
- To view device description commands, type GO CMDDEV and press Enter.

The following list shows other related commands that you can use with your descriptions. To use one of these commands, type the name of the command (shown in parentheses) and press F4 (Prompt):

- Retrieve Configuration Status (RTVCFGSTS)
- Vary Configuration (VRYCFG)
- Save Configuration (SAVCFG)
- Restore Configuration (RSTCFG)

- Work with Configuration Status (WRKCFGSTS)

## Tuning Ethernet performance

You can tune an Ethernet network's performance by adjusting the parameters that control its behavior.

### Related information



System i Performance Capabilities Reference PDF

Improve local area network performance

## Adjusting your LAN-frame size

Changing the LAN-frame size influences the performance of Ethernet.

Ethernet networks break data up into many little chunks called frames. These frames are sent individually across the network and reconstructed by the receiving computer. Changing the size of the frames can alter the behavior of the network. Changing the frame size is possible for both TCP/IP over Ethernet networks and SNA over Ethernet networks.

Your frame size might need adjusting if the remote bridge drops your frames.

To change your frame size, follow these steps:

1. Determine the new frame size. If you do not know what your frame size should be, you might find that the frame size is contained within the QSYSOPR message queue in message CPF 5908.
2. Determine which configuration object and MAXFRAME parameter to change. See "Remote bridges dropping frames" for information about which configuration object to change.
3. To change the parameter, perform one of the following tasks:
  - Change the line description using the CHGLINETH CL command.
  - Change the controller description. Type GO CMDCTL and press Enter to display a list of commands. Select the appropriate command for your controller type.
4. Press F9 to show all parameters.
5. Locate the MAXFRAME parameter that you chose in step 2.
6. Specify the value that you found in step 1.
7. Press Enter to save your changes and exit the command.

### Related tasks

"Viewing QSYSOPR or other message queues" on page 29

The QSYSOPR and other message queues might contain messages that describe an error and might contain possible solutions for the error. These messages are typically a good place to begin troubleshooting with. You can use the Display Messages (DSPMSG) command to view these messages.

### Related reference

"Remote bridges dropping frames"

A remote bridge discards your frame if it does not support your frame size. The network can also discard your frame if it does not support your frame size.

## Remote bridges dropping frames

A remote bridge discards your frame if it does not support your frame size. The network can also discard your frame if it does not support your frame size.

If you cannot configure the bridge to support your frame size or a larger frame size, adjust the MAXFRAME parameter to a value that is acceptable to the bridge. The system has these MAXFRAME parameters that are shown in order of precedence:

1. The source service access point (SSAP) MAXFRAME parameter in the line description.
2. The MAXFRAME parameter in the line description (except Ethernet line descriptions).

3. The MAXFRAME parameter in the controller description.

The SSAP MAXFRAME parameter affects only one device. That is, only that device will use a frame size of SSAP MAXFRAME.

The MAXFRAME parameter that is in the line description affects all devices that use that description.

The MAXFRAME parameter that is in the controller description affects all lines and devices that use that description.

You set the precedence when specifying a MAXFRAME value. If you define a value for the first parameter (SSAP MAXFRAME) and then the second parameter, your system uses the value of the first parameter. To use the value of the second parameter, you should not specify a value for the first parameter.

**Related tasks**

“Adjusting your LAN-frame size” on page 23

Changing the LAN-frame size influences the performance of Ethernet.

**Related reference**

“Maximum Ethernet frame sizes” on page 10

The largest frame size used during the connection process is controlled by the maximum frame size configurations of multiple items.

**Related information**

Match iSeries system line description parameters for a remote iSeries system

| **Improvement of Gigabit and 10 Gigabit Ethernet performance**

| These tips show how to improve the performance of your system.

- | • Increase your maximum frame size. You must ensure that all devices along the communications path support the frame size. For more information about frame sizes, see Maximum Ethernet frame sizes.
- | • Monitor the performance of your LAN by using the monitors feature of iSeries Navigator. See Track performance in the Performance topic collection for more information.
- | • See the communication performance chapter in the System i Performance Capabilities Reference.

| **Related reference**

| “Maximum Ethernet frame sizes” on page 10

| The largest frame size used during the connection process is controlled by the maximum frame size configurations of multiple items.

| **Related information**

| Tracking performance



| System i Performance Capabilities Reference PDF

**SNA over Ethernet timing parameters**

SNA over Ethernet networks have parameters that control timing. You can make the adjustments through the parameters of the SNA controller description.

SNA controller descriptions (Advanced Program-to-Program Communications (APPC), SNA host, remote workstation, finance, and retail) have parameters that describe the behavior of the station. The parameters can be used with all LAN protocols. The names of these parameters begin with the letters LAN.

See the following LAN parameters to find how they affect your connection’s performance. You can view all parameter values with the Display Controller Description (DSPCTLD) command when the controller is varied on.

**Note:** Reducing a parameter's value gives you quicker error detection, but it also reduces the time for error recovery.

#### **LANCNTMR and LANCNNRTY:**

The LAN connection timer (LANCNTMR) and LAN connection retry (LANCANNRTY) parameters of your controller description define the frequency and persistence of polling the remote station to establish a connection.

LANCNTMR specifies how long to wait before polling again. LANCANNRTY specifies how many times to poll. If the system receives no response from the remote station after polling LANCANNRTY times, the following situation occurs:

- The user is notified that contact with the station was unsuccessful.
- The system places the controller description in answer mode.
- If the remote station signals your system to do a retry of your connection inquiry, your system attempts to establish connection again.

The default \*CALC value for LANCNTMR is 7 seconds. The default \*CALC value for LANCANNRTY is 10.

#### **Performance considerations**

The default values of the parameters are designed for a single LAN and might cause a connection failure when you access a remote station through a remote bridge. The bridge might slow data traffic enough that the connection timer expires before the remote station's response reaches you. If this is the case, you should increase the values of LANCNTMR and LANCANNRTY.

##### **Related concepts**

"LAN device connection initiation" on page 13

In an SNA environment, you can determine which system initiates the connection request and which system waits for an incoming connection request.

##### **Related tasks**

"Creating the SNA controller description" on page 18

The controller description identifies the remote devices to which the system connects.

"Changing timing parameters" on page 28

To change the LAN timing parameters in your controller description, follow these steps.

#### **LANRSPTMR and LANFRMRTY:**

The LAN response timer (LANRSPTMR) and the LAN frame retry (LANFRMRTY) parameters in your controller description determine how soon and how often the system retransmits a frame.

LANRSPTMR defines how long to wait before retransmitting a frame to the remote station. LANFRMRTY specifies how many times to retransmit a frame. A system retransmits a frame when one of the following situation occurs:

- A frame was lost or damaged.
- The remote station does not respond because it is busy.
- The remote station is waiting to acknowledge the frame with an information frame of its own.

After your system retransmits a frame a number of times (based on the number that is indicated by the LANFRMRTY parameter), the system notifies the user that an error occurred and disconnects itself from the remote station.

The default \*CALC value for LANRSPTMR is 1 second. The default \*CALC value for LANFRMRTY is 10.



## Performance considerations

The default values of the parameters are designed for a single LAN and can cause too many frame retransmissions when accessing a remote station through a remote bridge. The bridge might slow data traffic enough that your retransmit timer expires before the remote station's acknowledgment reaches you. Eventually, your system will automatically disconnect itself because it retransmitted a frame too many times. If this is the case, you should increase the values of LANRSPTMR and LANFRMRTY.

**Note:** If you make the parameter values too large, your connection failure notices can be delayed.

### Related tasks

"Changing timing parameters" on page 28

To change the LAN timing parameters in your controller description, follow these steps.

## LANACKTMR and LANACKFRQ:

Your SNA controller description includes the LAN acknowledgment timer (LANACKTMR) and the LAN acknowledgment frequency (LANACKFRQ) parameters. They work together to determine how often to send an acknowledgment to the remote station.

LANACKTMR specifies how long the system waits before sending an acknowledgment for the frames that it received. LANACKFRQ specifies the maximum number of frames that your system receives before sending an acknowledgment to the remote station (independent of timers or having data to send). Your system has a greater chance of sending the acknowledgment in a data frame (rather than the acknowledgment by itself) if the LANACKFRQ value is large.

The default \*CALC value for LANACKTMR is 0.1 second. The default \*CALC value for LANACKFRQ is 1.

## Performance issues

Large values for LANACKTMR and LANACKFRQ might be desirable because smaller values can cause unnecessary acknowledgments and contribute to heavier LAN traffic. If you are connected to a network with traffic problems, you can increase the values of either parameters or both parameters.

However, in most cases where LAN traffic is not a problem and data tends to flow one way, large parameter values can cause these to happen:

- Introduce unnecessary delays when sending acknowledgments.
- Slow response times.

## LANACKTMR considerations

You should choose values for the LANACKTMR parameter by carefully considering the remote station's response timer (LANRSPTMR) and maximum outstanding frame count (LANMAXOUT).

For example, assume that your system cannot send an acknowledgment before the remote station's response timer expires. The remote station will retransmit its frame because it did not receive your acknowledgment. To solve this problem, you must either shorten your system's timer or lengthen the remote system's timer.

## LANACKFRQ considerations

Similarly, you should choose values for LANACKFRQ by carefully considering the remote station's maximum outstanding frame count (LANMAXOUT). If you do not correctly adjust the counters, your system will wait for more frames. However, the remote station will not transmit them because it is waiting for an acknowledgment from your system.



### **Related tasks**

“Changing timing parameters” on page 28

To change the LAN timing parameters in your controller description, follow these steps.

### **LANINACTMR:**

The LAN inactivity timer (LANINACTMR) parameter of your SNA controller description determines how long your system waits before requesting a response from the remote station. Your system uses the request to test if the remote station is still accessible.

The default \*CALC value for LANINACTMR is 10 seconds.

### **Performance considerations**

Unnecessary traffic is created if the value that you specify for the LANINACTMR parameter is too small. This might lead to a performance throughput problem. If it is too large, your system might not find out as quickly that the remote station is inaccessible.

LANINACTMR is sensitive to whether the remote station is on the same LAN or not. If the station is across a bridge, you might need to increase this value. If the value is 0 (no time out), you will not be informed if the connection fails until your system attempts a data transfer.

### **Related tasks**

“Changing timing parameters” on page 28

To change the LAN timing parameters in your controller description, follow these steps.

### **LANMAXOUT:**

The Maximum outstanding data frames (LANMAXOUT) parameter of your SNA controller description specifies how many frames your system sends before waiting to receive an acknowledgment.

This parameter is highly sensitive to the remote station’s speed to copy and acknowledge frames (speed is based on buffering capabilities and processing resource).

**Note:** The LAN window step (LANWDWSTP) parameter can influence the number of outstanding frames.

The default \*CALC value for LANMAXOUT is 2.

### **Performance considerations**

For optimal performance, you must choose appropriate values for the LANMAXOUT and LANACKFRQ parameters on both the sending and receiving stations.

These variables affect which LANMAXOUT and LANACKFRQ values provide the best performance:

- The characteristics of the application.
- The amount of data sent.
- The rate that the application can present and accept data.
- The data blocking characteristics.
- The LAN adapter type.
- The processing unit model.
- The utilization of the line, the adapter, and the processing unit.
- The internal buffering capabilities.

In most environments, the default value (\*CALC) for LANACKFRQ and LANMAXOUT offer the best performance. However, for some environments, changing the values can improve performance significantly.

#### **Related tasks**

“Changing timing parameters”

To change the LAN timing parameters in your controller description, follow these steps.

#### **LANWDWSTP:**

The LAN window step (LANWDWSTP) parameter of your SNA controller description determines whether the number of outstanding frames are reduced during network congestion.

Parameter LANMAXOUT determines the initial value for the number of outstanding frames.

The default \*CALC value for LANWDWSTP is \*NONE.

#### **Performance considerations**

If the value for LANWDWSTP parameter is too small or is \*NONE, the network congestion takes longer to subside. For more information about network congestion, see the discussion of the dynamic window algorithm in book *Token-Ring Network Architecture Reference* (SC30–3374).

#### **Related tasks**

“Changing timing parameters”

To change the LAN timing parameters in your controller description, follow these steps.

#### **LANACCPTY:**

The LAN access priority (LANACCPTY) parameter of your SNA controller description determines a token’s priority.

The larger the number the higher the priority. (Used for token-ring only).

The default \*CALC value for LANACCPTY is 0.

#### **Performance considerations**

The higher the priority, the greater the chances are that the remote station will quickly receive the token. The greater the access priority value, the more tokens the remote station receives. The greater value also increases your system’s chances for sending its frame. These considerations are important if your system accesses a heavily used ring (not many free tokens available) and your application program needs priority treatment.

#### **Related tasks**

“Changing timing parameters”

To change the LAN timing parameters in your controller description, follow these steps.

#### **Changing timing parameters:**

To change the LAN timing parameters in your controller description, follow these steps.

1. To view a list of commands that can change your controller description, type GO CMDCHG and press Enter.
2. From the displayed list of commands, choose a command to change your SNA controller description.
3. Type the command and press Enter.
4. Change the LAN parameters that you have chosen.

5. Press Enter to save your changes.

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## Troubleshooting Ethernet

This information might help you solve problems with your system and connections. You can find out why connections might fail, why frames are dropped, or why PCs cannot connect to your system.

### Viewing QSYSOPR or other message queues

The QSYSOPR and other message queues might contain messages that describe an error and might contain possible solutions for the error. These messages are typically a good place to begin troubleshooting with. You can use the Display Messages (DSPMSG) command to view these messages.

To view the message queues, follow these steps:

1. Type DSPMSG MSGQ(message\_queue) on the command line and press Enter. **message\_queue** is QSYSOPR or the configured message queue name. For example, DSPMSG MSQ(QSYSOPR).
2. Locate the error messages created around the time the error occurred.
3. Move your cursor to the error message of interest and press F1. The system displays more information about the error.
4. Note the cause code, the error's description, and possible solutions. Also, record any message IDs, error codes, reference codes, or reason codes.

#### Related tasks

"Adjusting your LAN-frame size" on page 23

Changing the LAN-frame size influences the performance of Ethernet.

#### Related information

Display Messages (DSPMSG) command

## Troubleshooting LANs

The i5/OS tools can help you quickly find the problem and possible solutions.

For an overview of the tools of your system and instructions about how to use them, see System i troubleshooting.

#### Related information

Troubleshooting

Communications trace

## Physical network problems

If your adapter cannot make a connection to the network, and the product activity log points to a physical network problem, check these problem areas.

### Cabling problems

- Check that your cable type is appropriate for the line speed you are using. For example, category 3 cable cannot be used for 100 Mbps.
- Is the cable wired correctly?
- Do all cables, patch cables, and patch panels between the system and the network, switch, or hub support your line speed? For example, if the line speed is configured at 100 Mbps, the cable must be category 5 to support the speed.

### Possible solutions

- If the cables have been excessively bent or stretched, the wiring inside the cable might have been untwisted, damaged, or even broken. Try reseating the cable or temporarily replacing it with a functional one.

- Make sure that you are not using crossover cable.
- Route the cable away from electrically noisy devices, such as fluorescent lights, printers, copiers, or electric motors. These items can cause interference with data transmissions.
- Try plugging the cable into a different switch or hub port.
- Check that the switch or hub has the latest software from the vendor.
- You might want to add lightning protection to your network cabling and switch or hub power lines, if you live in a lightning prone area. A direct strike can cause a large power surge, which can severely damage your networking equipment and cabling.

## Configuration problem checks and solutions

- Check that the line speed and duplex mode chosen in CRTLINETH are the same as the parameters programmed into the switch or hub port. One frequent cause of problems is a duplex or line speed mismatch.

**Note:** To use the \*AUTO configuration for line speed or duplex mode, you must configure both of the parameters to \*AUTO. Do not use line speed and duplex configurations of 10/AUTO, 100/AUTO, AUTO/Half, or AUTO/Full. These configurations might work, but you will have frequently unsuccessful and incorrect connections.

- Try varying the line off and then on again with \*RESET. Do not use \*RESET if an MFIOP is the IOP. This might shut down the entire machine because other devices that share the MFIOP will not be able to access the line.
- If you suspect the adapter might be faulty, run VFYCMN with an external wrap plug attached. If this test is passed, the adapter is not likely to be the problem.
- Connect a LAN analyzer to verify that the actual line speed and duplex mode being used on the link between the server and the hub, or between the server and the switch is accurate.

## Connection failure and controller descriptions

Sometimes an incorrectly configured controller description can cause a connection failure. The problem source might involve the incorrect configuration of the adapter address, source service access point (SSAP), or destination service access point (DSAP) parameters.

For more information about how these parameters influence a successful connection, see LAN device identification. For other causes of a connection failure, see LAN device connection initiation.

### The remote system does not connect

If your controller description uses dial mode, your system might receive message CPA58E0 (Controller not replying) or CPA57EF (Contact not successful). Remote systems or controller descriptions that do not vary on can cause one of these messages to appear.

### Your system does not connect

If your controller description uses answer mode, you might receive the message CPI591A (Controller is varied off or not recognized by local system). The following situations can cause this message to appear:

- The connection requested by the remote system does not exist on the local system. The local system searches for this connection (that is indicated by combining the local adapter address, the DSAP, and the SSAP) in all varied on controller descriptions.
- The controller description does not refer to the line description that can answer the call.

## Solutions

- On either side of the connection, verify that the controller description has the correct combination of adapter address, SSAP, and DSAP.

- In the **Switched line list** field of the controller description, enter the line description that can accept the incoming call.
- Vary on the correct controller description (use the Work with Configuration Status (WRKCFGSTS) command to vary on the controller).
- Verify that the local and remote adapters are wired into the network correctly.

#### **Related concepts**

“LAN device identification” on page 12

Different types of verification are used during the LAN connection process.

“LAN device connection initiation” on page 13

In an SNA environment, you can determine which system initiates the connection request and which system waits for an incoming connection request.

“LAN device connection” on page 12

The correct line and controller descriptions help you achieve successful connections.

## **Remote system connection failure**

If a remote system cannot connect to your system, you need to check several areas.

If the remote device is polling your system, but the system operator message queue does not contain a message regarding your system being polled, check the Product Activity Log for messages regarding line descriptions and system reference code AF06.



A connection failure can occur if the remote system uses a destination service access point (DSAP) that your line description does not refer to. Another possible cause might be that the line description that contains the correct DSAP is not in the **Switched line list** field of the correct controller description. If the AF06 system reference code is absent, the error might still have occurred. Verify that the adapter address, SSAP, and DSAP values for both your system and the remote system are correct.

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## **Related information for Ethernet**

Listed here are the product manuals and IBM® Redbooks™ (in PDF format), Web sites, and information center topics that relate to the Ethernet topic. You can view or print any of the PDFs.

### **Manuals**

- See the *Communications Configuration* manual on the V5R1 Supplemental Manuals  Web site.
- System i Performance Capabilities Reference PDF  (977 KB)

### **Other information**

- AnyNet communications for the iSeries system
- Communications Trace
- Configure APPC, APPN, and HPR
- Display message queues to solve communication problems
- Display the Product Activity Log to solve communication problems
- Improve local area network performance
- Troubleshooting
- Tracking performance


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