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Networking
ATM on iSeries

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Contents

Part 1. ATM

Asynchronous transfer mode (ATM) provides a very fast and flexible network protocol. When used with LAN emulation, you can run token-ring and Ethernet on ATM to take advantage of ATM's superior speed, throughput, and flexibility. The information here shows you how to use ATM and LAN emulation with other LAN protocols and to configure and manage ATM support on your server.

ATM support on the server:

To use LAN emulation with traditional local area networks (LANs) and to configure and manage ATM support on your server see:
- Print this topic.
- Chapter 2, "ATM support" on page 5.
- Chapter 3, "Plan for ATM support" on page 17.
- Chapter 4, "Configure ATM on the iSeries server" on page 19.
- Chapter 5, "Manage the ATM network" on page 29.
- Chapter 6, "Tune SNA/LAN emulation performance" on page 33.
- Chapter 7, "Troubleshoot ATM on the iSeries server" on page 35.

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Chapter 1. Print this topic

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Chapter 2. ATM support

To understand and manage your system's ATM support and to know what commands are available, read:
- Read "ATM basics" for an overview of asynchronous transfer mode (ATM).
- Discover the ATM functions that your system supports. This information also discusses LAN emulation functions that your system supports.
- Learn how to diagnose ATM errors through tools that test your communications path or trace your communications between systems.
- Improve your ATM communication performance by learning what options are available to you.

ATM basics

No matter what your business — corporations, out sourcers, or service providers — asynchronous transfer mode (ATM) can save you money and move your networks into the future. ATM has advantages such as superior speed, throughput, flexibility, and LAN emulation (the ability to run other LAN protocols on ATM to take advantage of ATM's capabilities). For instance, you can use token-ring or Ethernet over ATM. ATM incorporates the following features:
- **Small, fixed-length cells:**

  ATM cells are the fundamental unit of the ATM transmission. Because of the cell's small size, the network can easily adjust the traffic flow. ATM can mix cells from many sources and route individual cells to different destinations.

  Each cell is 53 bytes that contains:
  - A 48-byte payload for data and voice traffic.
  - A 5-byte header that contains virtual circuit information that is used to route the cell to its proper destination.
- **Negotiated service connections:**

  The network negotiates requirements for each connection, which include traffic characteristics, peak and average cell rates, and quality of service.
- **Network switches:**

  ATM switch-based networks provide varying node access speeds, easy scalability, and dedicated bandwidth. Bandwidth refers to transmission capacity, utilization, or requirements.

If you need other information about ATM or frames that are dropped, see this information:
- "ATM medium access control address"
- "ATM switch and switching" on page 6
- "Bridges dropping frames" on page 6

If you want further information about ATM, see these topics:

- ATM Overview on the IBM Networking Web page .

- ATM Forum .

ATM medium access control address

An adapter attaches every system, controller, or personal computer to a LAN. A 6-byte medium access control (MAC) address identifies each adapter in the network. This address is also known as the adapter address, preset address, burned-in address, or universally-administered address.

Each adapter address must be unique within a LAN. Manufacturers assign each adapter a unique address. You can use the adapter address or assign an address yourself when you configure a LAN line description.

ATM switch and switching

ATM networks use switches to complete connections from one device to another. The ATM switch does not use the selector byte and passes it unchanged when the switch completes the connection to the called party. End systems use the selector byte to resolve multiple entries within a single adapter card.

The ATM Forum defines the Q.93B and Q.2931 signaling protocols to govern how this exchange takes place. The ATM Forum organization aims to promote ATM within the industry and the end-user community.

IBM is a member of the ATM Forum.

Bridges dropping frames

A remote bridge discards your frame if it does not support your frame size. Also, the network can discard your frame if it does not support your frame size.

In a token-ring environment, the bridge informs the system that originated the connection of the supported frame sizes. The system then automatically retries the connection with that 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.

To adjust your frame sizes, see "Adjust your LAN-frame size" on page 47.

iSeries server ATM support

Your server provides ATM support that you can use with other LAN protocols (token-ring and Ethernet) to take advantage of ATM's superior speed, throughput, and flexibility. The system uses LAN emulation to run other LAN types over ATM.

This information teaches you the ATM services that your server provides for you:
- To determine if your server can communicate with other ATM networks, read "ATM Compatibility" on page 7.
- "ATM Hardware, client, and protocol support" on page 7 shows you the possible ATM services that you can provide to your users.
- "iSeries server ATM services" on page 8 discusses ATM services, connection limitations, and discontinuation of direct connections.
- What is LAN emulation teaches you the basics of LAN emulation and how it works with other LAN protocols. It also points you to other sources that provide greater detail of LAN emulation.
- "ATM connection types" on page 10 discusses the supported ATM connection types. It also discusses how and when to use them with other LAN protocols.

ATM Compatibility

The ATM Forum is a worldwide organization that promotes ATM within the industry and within the end-user community. IBM is a member of the ATM Forum. Therefore, your system supports these standards of

interoperability as defined by the ATM Forum:
- User-to-network interface (UNI) 3.0
- UNI 3.1
- UNI 4.0

Both standards support switched virtual circuits (SVCs) and permanent virtual circuits (PVCs).

The signaling code and the interim (or integrated) local management interface (ILMI) code use these standards. For the signaling code, the standard specifies how the end systems and the switch create and manage calls. For the ILMI code, the standard specifies how the end systems register ATM addresses with the switch.

You may configure the system to use the same UNI standard as the switch. You also may configure the server to automatically detect the UNI version that is used by the switch. Your ATM NWI description specifies the UNI version (network type) to use (see "Create the ATM network interface description" on page 19).

ATM Standards of interoperability

Some organizations provide environments to test interoperability with equipment from many different vendors. The server licensed internal code (LIC) that is shown below is tested in such environments:
- Interim Local Management Interface (ILMI)
- ATM Adaptation Layer (QSAAL -- Q.2931)
- Signaling (Q.93B)
- Medium Access Control (MAC)
- "LAN emulation client" on page 9 and Logical Link Control (LLC)

ATM Hardware, client, and protocol support

The table below shows the ATM hardware and software capabilities of your server.

Table 1. ATM hardware and software capabilities

Category	Type	Description
Hardware	2809	PCI LAN/WAN/Workstation input-output processor (IOP)
	2810	High-speed Communications IOP
	2811	25 Mbps (UTP-3) input/output adapter (IOA), RJ-45 connector
	2812	45 Mbps (DS-3) IOA, coaxial cable, BNC connector
	2815	155 Mbps (UTP-5) IOA, RJ-45 connector
	2816	155 Mbps (Multi-mode fiber) IOA, duplex SC connectors
	2817	155 Mbps (Multi-mode fiber) IOA, duplex SC connectors
	2818	155 Mbps (Single-mode fiber) IOA, duplex SC connectors
	2819	34 Mbps (E-3) IOA, coaxial cable, BNC connector
LAN emulation client support	Lines	Server supports two lines* (1 Ethernet and 1 token-ring) per ATM card. Each line can support 256 LAN emulation clients.
	Controllers	Server supports 256 SNA controllers for each line description. The line description supports Transmission Control Protocol/Internet Protocol (TCP/IP) and SNA simultaneously.
	Connections	The server LEC supports SVCs or PVCs through a network switch.

Table 1. ATM hardware and software capabilities (continued)

Category	Type	Description
LAN protocols	Ethernet version 2	Both TCP/IP and APPC/APPN devices are supported.
	802.3	Both TCP/IP and APPC/APPN devices are supported.
	802.5	Both TCP/IP and APPC/APPN devices are supported.

*When multiple lines use the same IOA, they share its bandwidth (that is, the sum of each line's data rate may be less than or equal to the IOA's maximum data rate).

iSeries server ATM services

ATM supports one to two line descriptions on each NWI description. You can have one token-ring line description and one Ethernet line description. Each line description supports up to 256 stations.

Configuration object attachments:

You can make the attachments when creating the NWI description or the line description. During the creation of a network interface (NWI) or line description you can attach the one to the other. However, to change the attachment you must delete and recreate one of the descriptions as shown below:
* Delete the line description and specify another NWI description when you recreate it.
* Delete the NWI description and specify the new lines to attach when recreating the NWI description.

To create the NWI or line description, see configuring ATM.

Shared bandwidth:

When you use multiple lines on the same NWI description, the lines share the IOA's bandwidth. For example, on the 2815 IOA each line does not communicate at 155Mbps, but at slower speeds that combine to make 155 Mbps.

Direct connections discontinued:

ATM on the iSeries server does not support direct connections. Consequently, value *PVC replaces *DIRECT in the ATM access type (ACCTYPE) parameter. The CRTLINTRN and CRTLINETH commands use this parameter. If your existing line descriptions use the *DIRECT value, the installation process changes it to *PVC.

What is LAN emulation?

LAN emulation allows devices that are connected to an ATM network to use the network as if it was an Ethernet or token-ring LAN. It enables devices such as hosts, desktop computers, bridges, hubs, and routers with ATM interfaces to communicate through an ATM switch with existing LANs.

With LAN emulation you can migrate existing LANs to an ATM environment. Your applications on traditional LANs do not require any changes when using LAN emulation.

Each emulated LAN within an ATM network is a separate LAN emulation domain.

Note: The iSeries server supports ATM Forum-compliant LAN emulation Version 1.0 only (LANE 1.0). However, it does not support network management as defined by the ATM Forum LAN emulation client management specification.

For more information about what LAN emulation is and how it works, see:
* "LAN emulation client" on page 9
* "LAN emulation service" on page 9
* "LAN emulation security" on page 10

For an in-depth discussion of LAN emulation, you should read Campus ATM LAN Emulation and Classical

IP Implementation Guide. .

LAN emulation client

In an emulated LAN, a LAN emulation client (LEC) is the access point where devices on the emulated LAN use remote applications and data. For example, an emulated token-ring line description or an emulated Ethernet line description is a LEC.

A single LEC can serve as the ATM connection point for many devices or sessions. The LEC initiates the functions of the LAN protocol (either token-ring or Ethernet) over the ATM network.

The LEC can use the network as if it was a LAN, because the "LAN emulation server" on page 10 converts the remote LAN address to an "ATM address". The LEC then uses the remote ATM address to exchange information.

ATM address

An ATM address is a 20-digit hexadecimal number that uniquely identifies an end system in an ATM network. The server registers a unique ATM address for each IOA. To create the address, your system adds a 6-digit LAN MAC address and a 1-digit selector byte to the switch's 13-byte network prefix.

LAN emulation service

The LAN emulation service imitates the interface of a token-ring or Ethernet LAN and coordinates the connections between LAN emulation clients.

The LAN emulation service consists of three other services:
*   "LAN emulation configuration server"
*   "LAN emulation server" on page 10
*   "Broadcast and unknown server" on page 10

The server does not provide LAN emulation services (LECS, LES, and BUS). These services must reside in another device within the ATM network, such as an IBM 8260 network switch or an IBM 2210 Multi-protocol Switched Services (MSS) product.

LAN emulation configuration server

The LAN emulation configuration server (LECS) provides configuration services to LAN emulation clients. The server's responsibilities include:
*   Providing LAN emulation clients with the address of their local server.
*   Creating a LAN domain.

Only one LAN emulation configuration server resides within the entire ATM network. The LECS is part of the "LAN emulation service".

The LAN emulation configuration server provides the clients with the ATM address of an appropriate LAN emulation server that the client uses to become part of an emulated LAN. As a result, the client does not require the ATM address of the server.

LAN emulation security:

The LAN emulation configuration server may also provide a measure of security within the emulated LAN by controlling which clients it will recognize and configure. The LAN emulation configuration server can refuse to configure the client, thereby preventing the client from joining an emulated LAN.

When to use a LAN emulation server:

An emulated LAN can function without a LAN configuration server. While the server makes configuration of LAN emulation clients easier, you can configure the LAN emulation client to contact the LAN emulation server directly. This function is useful if the LAN emulation configuration server meets any of the following conditions:
- It is not present in the ATM network.
- It is not functioning properly.
- It does not recognize the LAN emulation client.

LAN emulation server

The LAN emulation server (LES) provides ATM address resolution and control-related services to its clients. Each LES is associated with one LAN emulation domain and is part of the "LAN emulation service" on page 9. The LES recognizes the clients that are either connected to or defined in its domain. The LES translates LAN destinations to ATM addresses at the request of the clients. It also provides control services as a part of maintaining a LAN environment.

Membership in an emulated LAN does not depend on the physical location of each device. You determine membership in a domain by specifying which LAN emulation server to associate with your clients. These devices can connect at any point in the ATM network.

Broadcast and unknown server

The broadcast and unknown server (BUS) provides with its clients the necessary frame-forwarding and broadcast-related services. Each LAN emulation domain must contain a BUS. The BUS is part of the "LAN emulation service" on page 9.

LAN emulation security

ATM, when operating under either a token-ring or an Ethernet LAN, has the same security protections as a normal token-ring or Ethernet LAN. The ATM network has no standardized security protocols. Consequently, the security of the ATM network is analogous to an unencrypted wide area network (WAN) connection.

LAN emulation has no special protections or considerations, but through "LAN emulation service" on page 9 you can exclude clients from an emulated domain. Excluding the clients prevents them from accessing the network. Therefore, you need to consider this when you assess the overall security of your ATM network.

ATM connection types

ATM supports the connection types below:
- Switched
- Permanent

Since you can run token-ring and Ethernet over ATM, these protocols can also use the supported connection types. You define the connection type to use through the ATM access type (ACCTYPE) parameter that is in the line description. You define the ATM access type when creating the line description. To change your ATM access type, see "Change ATM-connection types" on page 31. To see your ATM access type, see "Commands for LAN configuration objects" on page 29 for a list of commands that display the parameters of your line description.

ATM switched virtual circuit

ATM on the iSeries server supports switched virtual circuits (SVCs). SVCs are created through a switch as needed and dropped when no longer required.

ATM permanent virtual circuit

A permanent virtual circuit (PVC) is a specifically defined connection, through an ATM switch that is always present. Therefore, LAN emulation does not require a switch to make PVC connections. PVCs require that you configure all physical paths to other LAN emulation clients into your ATM switch. This type of connection does not use a "LAN emulation server" or broadcast and unknown server, but it does use a "LAN emulation client" on page 9.

You use PVC only when the remote client is another server.

In PVC mode, your system cannot receive its own frames (that is, you cannot ping yourself).

ATM problem diagnosis

These tools can help you diagnose a problem and find solutions:
- Communications path tests verify the input/output adapters (IOAs) and communications links.
- LAN traces collect data to diagnose a communications problem.

You will also find information for locating error messages and how to use the tools above in Chapter 7, "Troubleshoot ATM on the iSeries server" on page 35. Also, for general troubleshooting information and tools to diagnose your server see getting started with server troubleshooting.

ATM communications-path test

The communications-path test allows you to verify that components and communication links are working properly. You can test the communications path to identify if the problem lies with the local system, the local switch, or the remote station. You can test these items:
- ATM IOA.
- Communications that is leaving the adapter.
- Communications path from the adapter to the local switch.
- Communications path from the adapter to the remote station.

To begin testing, see "Test the communications path" on page 41.

LAN communications trace

You can use the LAN communications trace to help debug networking problems. For example, if you cannot connect, a LAN trace shows what frames your system transmits and receives to help determine what the problem is. Only users with advanced knowledge of the communication protocols should view the data.

The communications trace collects data that are exchanged between your system and the remote system, controller, or personal computer. Once you have a trace, you can display it or print it to analyze the communication error.

You can perform two types of traces for ATM: an NWI trace and a line trace. The NWI trace shows all network activity (including the signaling and ILMI frames). The line trace is similar to the standard token-ring or Ethernet traces, but it also shows you the LAN emulation traffic. Line traces have the added advantage of filtering data. You can use trace filters to prevent unwanted data from appearing in a trace and to avoid filling up the trace buffer too fast.

To start tracing a communications path, see Communications trace in the Troubleshooting TCP/IP topic.

LAN Trace filters
The server communications trace provides dynamic filtering options to save trace buffer space and to exclude unwanted trace data. Filters are available only for line traces. That is, filters cannot be used with NWI descriptions. After the trace is done, you can apply additional filtering through the formatting options to limit the amount of displayed data.

Token-ring and Ethernet trace filters:

Trace data for token-ring and Ethernet line descriptions can be filtered to include only frames that are sent to or received from a specified:
- Controller
- Remote MAC (adapter) address

- Remote service access point (SAP)
- Local SAP
- IP protocol number
- Remote IP address data

ATM performance issues

You can increase your network's data throughput by adjusting parameters or by using another service that your service provider supports. To know what your options are for increasing throughput for your emulated LAN or SNA over ATM networks, see:
- "LAN emulation performance"
- "SNA over ATM timing issues" on page 13

LAN emulation performance

Your network's performance varies with the ATM network topology, applications that are used, system load and configuration, network speed, and numerous other variables. Generally, emulated LAN performance over an ATM network is faster than a LAN of the same type.

To maximize data throughput you should consider these items:

Connection speeds	Connection speeds between your LAN emulation clients and the network switch determine the fastest data rate. Faster connections, such as 155 Mbps connections, transfer more data in the same period of time than a slower connection, such as 25 Mbps connections.
	However, the maximum transfer rate within your communications path is limited by the slowest connection. For example, the fastest connection speed between a client using a 155 Mbps connection and a client using a 25 Mbps connection is 25 Mbps.
Larger frames	You can increase data transfer speeds by enlarging the frame sizes to reduce overhead processing time. Frame processing overhead time that is incurred by the ATM interface is effectively constant regardless of the amount of data in the frame. Therefore, less overhead time is incurred when transferring a 16 Kb frame, than transferring the same amount of data in 1.5 Kb frames.
	If the emulated LAN does not bridge to a traditional LAN, you can increase performance by using an emulated LAN topology with larger data units. For example, a 16 Mbps token-ring network uses a data frame size of 16 Kb. A 4 Mbps token-ring network uses a data frame size of 4 Kb. For Ethernet or 802.3, the data frame size is 1.5 Kb. If you want to increase your frame size, see "Increase data transfer speeds in emulated LANs" on page 34.
Smaller frames	When the network is overloaded or "saturated," devices may discard frames. As a result, the source sends duplicate frames that add to the overloaded condition.
	If the devices are discarding frames, you can decrease the frame size to help alleviate this problem. The communications line trace facility may be used to determine if the frames are being discarded. If you want to obtain a trace, see "Tracing LAN communications" on page 47. If you want to adjust frame sizes, see "Increase data transfer speeds in emulated LANs" on page 34.
Packet sizes (TCP/IP)	Frame sizes are limited by data packet size that must be large enough to contain the frame.
Larger record sizes (SNA)	Larger record sizes incur less processing overhead than smaller record sizes. Thus, using a larger record size improves throughput especially during large record transfers. For record sizes that are closer to the data packet size, the use of larger record sizes will have little or no effect.

Smaller networks	If a client has insufficient resources to maintain all required connections, it will drop connections to one client in order to connect to another. Setting up and releasing connections cause additional processing overhead.
	Typically, most clients do not drop connections because they have ample resources. However, if one client has more than 512 active clients, it will drop connections.

SNA over ATM timing issues

When using SNA over ATM, you can perform timing adjustments to improve ATM's performance. 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.

The table below shows the LAN parameters and their default values (see the *CALC column). You can view all parameter values with the Display Controller Description (DSPCTLD) command when the controller is varied on. You can find how a parameter affects your connection's performance by clicking on the link that is in the table below. To change these parameters, you should see "Adjust ATM connection performance" on page 33.

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

Parameter	Description	*CALC value
LANCNNTMR	(LAN connection timer) The time to wait between requests to connect.	7 seconds
LANCNNRTY	(LAN connection retry) The number of times to poll for request to connect.	10
LANRSPTMR	(LAN response timer) The time to wait before retransmitting a frame.	1 second
LANFRMRTY	(LAN frame retry) The number of times to retransmit a frame.	10
LANACKTMR	(LAN acknowledge timer) The time to wait before sending an acknowledgment.	0.1 seconds
LANACKFRQ	(LAN acknowledgment frequency) The number of frames to receive before sending an acknowledgment.	1
LANINACTMR	(LAN inactivity timer) The time to wait before requesting a response from the remote station.	10 seconds
LANMAXOUT	(LAN maximum outstanding) The number of outstanding frames allowed before requesting an acknowledgment from the remote station.	2
LANWDWSTP	(LAN window step) An alternative to LANMAXOUT. Use LANWDWSTP to help alleviate network congestion.	*NONE
LANACCPTY	(LAN access priority) The priority of the station. Stations with higher priority have greater access to the token. (Used for token-ring only.)	0

The LANCNNTMR and LANCNNRTY parameters

Your SNA controller description has two parameters: LAN connection timer (LANCNNTMR) and LAN connection retry (LANCNNRTY). They work together to define the frequency and persistence of polling the remote station to establish a connection. LANCNNTMR specifies how long to wait before polling again.

LANCNNRTY specifies how many times to poll. If the system receives no response from the remote station after polling LANCNNRTY times, the following 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 retry your connection inquiry, your system attempts to establish connection again.

Performance issues:

The default values of the parameters are designed for a single LAN and may cause a connection failure when you access a remote station through a remote bridge. The bridge may 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 LANCNNTMR and LANCNNRTY.

To change these parameters, see "Adjust ATM connection performance" on page 33.

The LANRSPTMR and LANFRMRTY parameters

In your SNA controller description, the LAN response timer (LANRSPTMR) and the LAN frame retry (LANFRMRTY) parameters work together to 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 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. (See LANACKTMR and LANACKFRQ for more information about the acknowledge timer).

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.

Performance issues:

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 may 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.

To change these parameters, see "Adjust ATM connection performance" on page 33.

The LANACKTMR and LANACKFRQ parameters

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.

Performance issues:

Large values for LANACKTMR and LANACKFRQ may 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 this 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.

To change these parameters, see "Adjust ATM connection performance" on page 33 and "Adjust outstanding LAN frames" on page 33.

The LANINACTMR parameter
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.

Performance issues:

Unnecessary traffic is created if the value that you specify for the LANINACTMR parameter is too small. This may lead to a performance throughput problem. If it is too large, your system may 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 may 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.

To change these parameters, you should see "Adjust ATM connection performance" on page 33.

The LANMAXOUT parameter
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.

Performance issues:

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.

If you want to change LANMAXOUT, see "Adjust outstanding LAN frames" on page 33.

The LANWDWSTP parameter

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.

Performance issues:

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

To change these parameters, see "Adjust ATM connection performance" on page 33.

The LANACCPTY parameter

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

Performance issues:

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.

To change these parameters, see "Adjust ATM connection performance" on page 33.

Chapter 3. Plan for ATM support

To simplify the configuration of your ATM support, consider these issues:
1. If you plan on running token ring or Ethernet over ATM, you will need LAN emulation.
2. You need the following information from your network administrator or telephone provider:
   * Your system can detect the ATM standard that is used by a network. If you do not want to do this, you must know what UNI version the network supports. For information about server supported networks, see "ATM Compatibility" on page 7.
   * Connection types that are supported by the network.
   * Connection speeds. See "ATM Hardware, client, and protocol support" on page 7 for supported connection speeds.
3. What kind of access security you need.
4. For detailed design guidelines on using ATM on a campus scale, see Campus ATM Design Guidelines

After obtaining the needed information, you are ready to configure ATM support on the iSeries server.

Chapter 4. Configure ATM on the iSeries server

If you are setting up ATM for the first time or are new to ATM on the server, read this information:
* "iSeries server ATM services" on page 8.
* Chapter 3, "Plan for ATM support" on page 17.
* "Configuration considerations unique to LAN emulation".

To configure your server ATM network, follow these steps:
1. "Create the ATM network interface description".
2. To use token ring or Ethernet over ATM, you must create a token-ring line description or create an Ethernet line description.
3. Controller descriptions and device descriptions for an ATM network are identical to those that are used in traditional Ethernet and token-ring networks. For configuration instructions, see creating advanced program-to-program communications (APPC) and Advanced Peer-to-Peer Networking (APPN) controller and device descriptions.

   For example APPC, APPN, and TCP/IP controllers and devices, see the token-ring configuration examples or the Ethernet configuration examples in OS/400 LAN, Frame-Relay, and ATM Support .
4. After configuring your objects, you can verify their configuration.
5. You can also refer to configuration examples for more help with configuring token-ring and Ethernet LAN emulation clients.

Configuration considerations unique to LAN emulation

ATM on the iSeries server uses LAN emulation to operate like a traditional local area network (LAN). Therefore, the basics of ATM configurations are the same as other server LAN configurations. However, you also need to consider the following before using your ATM network as an Ethernet or token-ring LAN:
* The NWI description contains information to configure the general aspects of the ATM network (everything that is common across the ATM physical interface). For example, UNI version, connection limitations, switched connections, and so forth.
* The line description defines a LAN emulation client (LEC) that uses the ATM IOAs. The LEC connects to other ATM devices by using switched virtual circuit (SVC) connections or permanent virtual circuit (PVC) connections.
* Controller descriptions and device descriptions for an ATM network are identical to those that are used in traditional Ethernet and token-ring networks. For information on configuring controllers and devices, see LAN, Frame-Relay, and ATM Support. .

Create the ATM network interface description

To create an ATM network interface (NWI) description, perform these steps:
1. "Identify the ATM IOA" on page 20 to associate with the NWI description.
2. Type **CRTNWIATM** on the command line, and press Enter.
3. For the `Network interface description` parameter, type a name for the NWI description.
4. For the `Resource Name` parameter, type the ATM resource name that you identified in step 1.
5. If you want the system to vary on this description after starting the operating system, do not change the `Online at IPL` parameter. Otherwise, select *NO to manually enable it (vary it on).
6. If you do not want the system to wait for your description to vary on, do not change the `Vary on wait` parameter. Otherwise, specify the number of minutes to wait.
7. For the `Network type` parameter, select the ATM network standard that the network uses. Use *AUTO to let your system detect the network type. Use *PVCONLY for permanent virtual circuits.

   To know what ATM standards your server supports, see "ATM Compatibility" on page 7.
8. (Optional) Enter some text to describe your NWI description.

9. If you do not want to attach the NWI description to your line descriptions at this time, skip to step 13.
10. You can attach line descriptions to your NWI description at this time. You can attach a maximum of two line descriptions (one token-ring and one Ethernet line description). To attach line descriptions, press F9 to see `Attached lines` parameter.
11. Type the name of your first line description.
12. To enter more than one line descriptions, type + on the next line, and press Enter.
13. If you change any of the parameter default values, you may want to see "ATM network interface parameter guidelines".
14. Press Enter to save your NWI description and exit the command.

    The system returns you to the command line and displays a message that you created the NWI description successfully.

For an example ATM NWI description, see "Example: Configure the NWI description" on page 25.

Next, you can create a line description or vary on your configuration objects:
- "Create a token-ring over ATM line description".
- "Create an Ethernet over ATM line description" on page 21.
- "Enable or disable configuration objects" on page 30.

Identify the ATM IOA

Before configuring your ATM network, you must identify the ATM IOA (port) to use with your NWI description. You can view a list of attached adapters and other communication resources in the Work with Communication Resources display by doing these steps:
1. Type **WRKHDWRSC** *CMN* on the command line, and press Enter.

   A list appears, showing the attached server communications resources, their type numbers, operational statuses, and descriptive text.
2. Locate an ATM IOA by looking for the phrase "ATM port" in the text column. Once found, record the resource's name that is under the resource column.

   See "ATM Hardware, client, and protocol support" on page 7 for a list of server supported IOAs.
3. Press F3 to exit the command.

ATM network interface parameter guidelines

You may want to consider these guidelines, if you do not use the default values of the parameters:

Maximum Point-to-Multipoint End Systems (MAXMPSYS)
   The maximum number of end systems that can attach to a multipoint connection. Do not use this field for LAN End Systems emulation.

Maximum Switched Virtual Connections (SVCCNN)
   The maximum number of connections that can be active at any time. If you plan to use more than two line descriptions with this network interface, you may want to increase this value by 258 for each additional line description over 2. Each line description supports a maximum of 256 clients (your system uses the extra two connections).

Network Switch Time-out (NETSWTOUT)
   The maximum time (in minutes) to make the initial connection with an ATM switch. If your system cannot contact the switch within this time, the network interface fails to vary on, and an error is posted.

Physical Layer Options (PHYLYROPT)
   Do not use this field unless directed by your server service provider. The physical layer options identify characteristics of a specific ATM network implementations.

Create a token-ring over ATM line description

To use token ring over ATM, you must create a token-ring line description.

Before you begin:

You must have an NWI description before creating the line description because the attachment to the NWI description cannot change after creating the line description. See create the ATM NWI description to create it.

Also, you may need to know what LEC frame sizes the LES supports. If the LES does not support your frame size, your line description will fail to vary on. Your network administrator or who ever handles LAN emulation should know the supported frame sizes.

Create the line description:

To create the line description, do these steps:

Note: You should use the default values when creating the line description. These values are good for most environments.

1. Type **CRTLINTRN** on the command line, and press Enter.
2. For the `Line description` parameter, type a descriptive name for the line description.
3. Press Enter.
4. For the `Resource name` parameter, type *NWID, and press Enter.
5. Reposition the cursor to the `NWI type` parameter.
6. Type *ATM, and press Enter.
7. If you want the system to vary on this description after starting the operating system, do not change the `Online at IPL` parameter. Otherwise, select *NO to manually enable it (vary on).
8. If you do not want the system to wait for your description to vary on, do not change the `Vary on wait` parameter. Otherwise, specify the number of minutes to wait.
9. Reposition your cursor to the `Attached NWI` parameter.
10. Specify the NWI description to use. Do not press Enter or precede the name with an asterisk.
11. Locate the `LEC frame size` parameter.

    If you are using PVCs, both the source and the destination LAN emulation clients should use the same frame sizes.

    If you are using SVCs, ensure that the LES supports your LEC frame size. If the LES does not support your frame size, your line description will fail to vary on. Typically, for token-ring LAN emulation this value will either be 4544 or 18190.

    If you change the `LEC frame size` parameter, you must ensure that it is at least 20 bytes larger than the `Maximum frame size` parameter.
12. If you use this line with a PVC, locate the `ATM access type` parameter, and specify *PVC.
13. Press F9 to show all parameters.
14. To have the system automatically create APPC controllers for incoming calls, specify *YES for the `Autocreate controller` parameter.
15. (Optional) You can view or change other parameters that affect ATM or LAN emulation.
16. Press Enter to create your line description, and exit the command.

The system returns you to the command line. To verify that you have created the line description, see the last message that is above the command line.

For an example, see "Example: Configure the token-ring line description for use with ATM" on page 27.

Next, you can do these tasks:
- "Create an Ethernet over ATM line description".
- Manually enable (vary on) your objects.

Create an Ethernet over ATM line description

To use Ethernet over ATM, you must create an Ethernet line description.

Before you begin:

You must have an NWI description before creating the line description because its attachment to the NWI description cannot change after creating the line description. See create the ATM NWI description to create it.

Create the line description:

To create the line description, do these steps:
1. Type **CRTLINETH** on the command line, and press Enter.
2. For the `Line description` parameter type a descriptive name for the line description.
3. Press Enter.
4. For the `Resource name` parameter, type *NWID, and press Enter.
5. If you want the system to vary on this description after you start the operating system, do not change the `Online at IPL` parameter. Otherwise, select *NO to manually enable it (vary on).
6. If you do not want the system to wait for your description to vary on, do not change the `Vary on wait` parameter. Otherwise, specify the number of minutes to wait.
7. For the `Attached NWI` parameter, specify the NWI description to use. Do not press Enter or precede the name with an asterisk.
8. For the `NWI type` parameter, type *ATM, and press Enter.
9. If you using this line for permanent connections, locate the `ATM access type` parameter, and specify *PVC.
10. Press F9 to show all parameters.
11. To have the system automatically create APPC controllers for incoming calls, specify *YES for the `Autocreate controller` parameter.
12. (Optional) You can view or change other parameters that affect ATM or LAN emulation.
13. Press Enter twice to create the line description, and exit the command.

For an example, see "Example: Configure an Ethernet line description for use with ATM" on page 27.

Your next step is to:
• Manually enable (vary on) your objects.

Line description parameters that affect ATM and LAN emulation connections

The table below shows other line description parameters that affect ATM and LAN emulation. To change these values, use the CHGLINTRN command for token ring or the CHGLINETH command for Ethernet.

Parameter	Description
ATM Access Type (ACCTYPE)	The line's connection type. This may be a client entity that is using switched virtual circuits (*SVC), or permanent virtual circuit (*PVC). Use PVC only when connecting to another server.
Emulated LAN Name (EMLLANNAME)	This specifies the emulated LAN name. If the connection type is *SVC, this is the name of the emulated LAN to join. Specify a maximum of 32 characters. Specify *NONE if you do not want the emulated LAN name to be used. **Note:** This field is case sensitive, and values can be uppercase, lowercase, or mixed case. However, you must put lowercase or mixed-case values within single quotes. If they are not, the values are converted to uppercase. Values contained within single quotes are passed unchanged to the server. Therefore, the emulated LAN name must match the server's name. If you use *NONE, the server does not include an emulated LAN name when requesting to join an emulated LAN.
Last Contacted LAN Emulation Server (LSTCONTLES)	If the client (line description) is currently varied on, this is the address of the LAN emulation server the client currently connects to. If the client is not varied on, this is the address of the LAN emulation server the client last connected to. This parameter is a display-only field.

Parameter	Description
LEC Disconnect Time Out (LECDSCTIMO)	The number of minutes, from 1-30, a LAN emulation client waits before disconnecting an idle virtual circuit connection. Specifying *NOMAX causes the LEC to wait indefinitely (it does not disconnect).
LEC Frame Size (LECFRAME)	The LAN emulation client (LEC) frame size to be transmitted and received on this line description. This value should match the frame size parameter of the LAN emulation server that this line will connect to. This parameter affects only token-ring line descriptions. **Note:** This value must be at least 20 bytes more than the value specified in `Maximum frame size`.
LES ATM Address (LESATMADR)	The address of the LAN emulation server that the client contacts to join an emulated LAN. Specifying an address of zero is equivalent to specifying *NONE. See also `USELECS`. **Note:** A value of *NONE requires that the `USELECS` parameter is defined as *YES. **Network prefix** This is the switch's network prefix that the remote server is attached to. To determine the network prefix, you should refer either to the configuration of the LAN emulation server that is used or to the configuration of the switch that the LAN emulation server is attached to. This is 26 hexadecimal characters in length. **End system identifier** Refer to the configuration of the LAN emulation server that you use to determine the end system identifier. This is 12 hexadecimal characters in length. **Selector byte** To determine the selector byte, you may refer to the configuration of the LAN emulation server that you use. This is 2 hexadecimal characters in length.
Local Adapter Address (ADPTADR)	The line description's LAN medium access control (MAC) address. It is also used as the 12 hexadecimal-digit end-system identifier (ESID) in the local ATM address. Each adapter is assigned a unique, preset address when it is manufactured. Use the preset address or assign an address when you configure the line description. To change the `Local ATM address` parameter, you must change the local adapter address. For Ethernet, the valid range is 020000000000-7EFFFFFFFFFF. For token-ring, the range is 400000000000-7FFFFFFFFFFF. **Note:** See LAN, Frame-Relay and ATM Support for additional information on LAN MAC addresses and for specific requirements for Ethernet and token-ring local-area networks.

Parameter	Description
Local ATM Address (LCLATMADR)	The local ATM address is specified in the description for the entity. This is the ATM address of the client's connection.
	Network prefix
	You interrogate the switch to obtain network prefix. Typically, each switch has a unique network prefix. This is 26 hexadecimal characters in length and is a display-only field.
	End system identifier
	The end system identifier is the same as the local adapter address. This is 12 hexadecimal characters in length and is a display-only field.
	Selector byte
	The selector byte identifies the unique ATM address of each entity that resides within one resource. It is 2 hexadecimal characters in length and is a display-only field. **Note:** For server token-ring LAN emulation clients, the selector byte value is always a hexadecimal ″13″. Ethernet clients have a value of hexadecimal ″03″.
Maximum Address Resolution Protocol Entries (MAXARPENT)	The maximum number of ARP entries the client maintains concurrently. It is a display-only field.
Maximum Frame Size (MAXFRAME)	The maximum frame size for this line. Typically, this value is 4060 for a LEC frame size of 4544, and 16393 for a LEC frame size of 18190. **Note:** This value must be at least 20 bytes less than the value specified in `LEC frame size`.
Network Interface Type (NWITYPE)	The network interface type is *ATM to attach the line description to an ATM network interface
Reported Emulated LAN Name (DSPLIND)	The emulated LAN name that is returned by the LAN emulation server. This is a display-only parameter.
Use LECS Address (USELECS)	If *YES, this client attempts to contact the LAN emulation configuration server to obtain the LAN emulation server address. If *NO, the client uses `LES ATM address` to identify the appropriate LAN emulation server. **Note:** If `Use LECS address` is *YES and an error occurs when the server client attempts to connect to the LECS, the client uses `Last Contacted LES Address` to reattempt a connection to the LAN emulation server. If there is no value for `Last Contacted LES Address`, the client reattempts to connect with the LAN emulation server that is specified in the `LES ATM Address` parameter before reporting a failure.

Verify your configurations

To verify that your configuration objects are working properly, see this information:
- Vary them on by using the commands that are shown in "Enable or disable configuration objects" on page 30.
- Check their values and attachments by using the WRKCFGSTS command.
- Test the communications path to verify proper connection and configuration.

Examples: Configure support for ATM

Here you will find various configuration examples for NWI and line descriptions.
- Configuring the NWI description.
- Configuring an ATM permanent connection.
- Configuring a token-ring line description for use with ATM.
- Configuring an Ethernet line description for use with ATM.

Example: Configure the NWI description

This configuration example creates an ATM LAN emulation client (LEC) that conforms to the specifications below:
- The system automatically varies on the NWI description.
- The LEC attaches to a UNI 3.0 ATM switch.
- The LEC uses SVC connections.
- The ATM switch is located outside the building, but within the campus of this company. Therefore, the connection latency to the switch should be minimal.

Note: These parameters are for illustrative purposes only. Your NWI description may vary, depending on the unique characteristics of your network.

To define the ATM NWI description, do the steps below:
1. "Identify the ATM IOA" on page 20.
2. Type **CRTNWIATM** on the command line, and press Enter.
3. Enter an NWI description name into the `Network interface description` parameter. For this example, type BACKBONE.
4. Enter the ATM resource name that you recorded in step 1 into the `Resource name` parameter.
5. Leave the `Online at IPL` parameter as *YES. We want the system to automatically vary on the line description after you start the operating system.
6. Type *UNI30 into the `Network type` parameter.
7. Press F9 to show all parameters.
8. Accept the default value of zero for the `Maximum PMP end systems` parameter.
9. Accept the default value of 516 for the `switched virtual connections` parameter. The extra 4 connections are used by LAN emulation.
10. Accept the default value of 2 minutes for the `Network switch timeout` parameter.
11. Accept the default value of *NONE for the `Physical layer options` parameter.
12. Press Page Down to see the next panel.
13. Accept the defaults for the Recovery limits and Authority parameters.
14. Press Enter.

    A message appears that verifies that you created the NWI description properly.

Example: Configure an ATM permanent connection

This example shows how to configure an Ethernet LAN emulation client that uses permanent connections. The LAN emulation client allows your server to exchange data with any other LAN emulation client that is in the emulated LAN as if it was a device in an Ethernet LAN. The configuration objects are created according to these specifications:
- After the operating system is turned on, ATM should function without intervention.
- Attach to an ATM switch, but use permanent virtual circuits (PVCs).
- The emulated LAN will have a maximum of 2 stations (or clients).
- The ATM switch is on the premises of the service provider.
- Use Ethernet LAN emulation that supports both Ethernet version 2 and IEEE 802.3.
- The LAN emulation configuration server (LECS) is not required for PVC connections.
- The ATM network connects only two clients. Therefore, this client should maintain any inactive connections.

To create the configuration objects for this example, do these tasks:
1. Configuring the NWI description.
2. Creating the line description.
3. Displaying the configuration objects.

NWI description for ATM PVC connection example

The example below shows how to configure your NWI description to use a permanent virtual circuit (PVC):
1. To determine the correct resource name for the ATM port, type **WRKHDWRSC** *CMN* on the command line, and press Enter.

2. Press F3 to exit the command.
3. To begin creation of the NWI description, type **CRTNWIATM** on the command line, and press Enter.
4. Enter an appropriate network interface description name.
5. Enter an the ATM resource name that you found in step 1 on page 25.
6. Accept the default for the `Online at IPL` parameter.
7. Specify *PVCONLY for the `Network type` parameter.
8. Press F10 for additional parameters.
9. Specify 0 for the `Maximum PMP end systems` parameter.
10. Set the `Switched virtual connections` parameter to 16 (the lowest value for this parameter).
11. For a network type of *PVCONLY, the `Network switch timeout` parameter serves no function.
12. Leave the value for the `Physical layer options` parameter as *NONE.
13. Page down to see the remaining fields.
14. The Recovery limits and Authority parameters can be left unchanged
15. Press Enter to create the NWI description and exit the command. A message appears on the server Main Menu display that verifies the successful creation of the description.
16. Create the Ethernet line description next.

Example: Configure an Ethernet line description for use with ATM

Next, you create the line description to define the LAN emulation client.
1. Type **CRTLINETH** on the command line, and press Enter to begin the creation of the Ethernet line description.
2. Enter an appropriate name for the line description.
3. Specify *NWID for the `Resource name` parameter, and press Enter.
4. Accept the default value for the `Online at IPL` parameter.
5. Attach this line description to the NWI description that you just created, by entering its name into the `Attached NWI` parameter.
6. Specify *ATM for the `NWI type` parameter.
7. Press Enter to display additional parameters.
8. Accept the default value of *ADPT for the `Local adapter address` to use the adapter's burned-in address.
9. Accept the default for the `Ethernet standard` parameter.
10. Specify *PVC for the `ATM access type` parameter. This causes the line to use permanent virtual circuits to connect with other devices. Permanent virtual circuits require that someone specifies each path through the network by configuring each traversed network switch.
11. Press Enter to show additional parameters. Press page down to see the next panel.
12. For the `PVC identifiers` parameter, enter the virtual path identifier (VPI) and virtual circuit identifier (VCI) for this PVC connection. The VPI and VCI are determined as a result of configuring the network switch that this iSeries attaches to.
13. Press F10 to show the remaining parameters.
14. The default values are acceptable for the remaining parameters.
15. Press Enter to create the line description, and exit the command.
16. Next, you can display the objects you created to verify your object's configuration.

Display the configuration object

You can display the network interface and line descriptions by using the Display Network Interface Description (DSPNWID) and Display Line Description (DSPLIND) commands.
1. To display your NWI description, type **DSPNWID** on the command line, and press Enter.
2. Type the name of your description, and press Enter.

   The system displays your description.
3. Press F3 to exit the command.
4. To display your line description, type **DSPLIND** on the command line, and press Enter.
5. Type the name of your description, and press Enter.

   The system displays your description.
6. Press F3 to exit the command.

Example: Configure the token-ring line description for use with ATM

This configuration example creates a token-ring LEC line description for ATM according the specifications below:

- The system uses this description as a test bench for new technology, so ATM should not be operational after you start the operating system, unless you have it manually varied on.
- Attach to an ATM switch by using the UNI 3.1 standard.
- Use switched virtual connections.
- Join a token-ring emulated LAN.
- Consider performance an important aspect of the planned testing. This means that the largest frame size possible should be used.
- The emulated LAN has a minimum number of clients. However, since the test network has ample resources, there is no need to limit the number of clients.
- The ATM test network is relatively small, so minimum delays are expected between the system and the switch. Such a simple network does not require the services of a LECS.
- Use locally administered addresses to prevent confusion with production network addresses.
- Since this ATM network testing causes no contention for resources, an average amount of time should be allowed before the LEC drops the inactive connections to other clients.

1. Type **CRTLINTRN** on the command line,, and press Enter.
2. Enter a line description name into the `Line description` parameter. Type BACKBONETR for this example.
3. Specify*NWID for the `Resource name` parameter, and press Enter. This identifies the hardware the description represents.
4. Specify *ATM for the `NWI type` parameter, and press Enter.
5. Specify the maximum number of controllers your line supports. This value must be equal to or greater than the sum of controllers that currently are active on this line and controllers that you will attach to in the near future. In this example, specify 256 for the `Maximum controllers` parameter. This is the largest value allowed.
6. Enter the name of the NWI description to which this line description attaches into the `Attached NWI` parameter. Type BACKBONE for this example.
7. Specify this line's `Maximum frame size`. See your network administrator for this value. For maximum throughput, enter the largest value allowed (16393).

   Note: This value must be at least 20 bytes less than the specified LEC frame size.
8. Enter the LEC frame size. In this example, set the LEC frame size to the largest value allowed (18190).
9. For testing purposes, specify 4000000000FF for the Local adapter address parameter.
10. Specify *SVC as the `ATM access type`.

    Press the F9 to show all parameters.
11. (Optional) You can view or change other parameters that affect ATM or LAN emulation.
12. Press Enter to create the line description, and exit the command

Example: Configure an Ethernet line description for use with ATM

This configuration example creates an ATM LAN emulation client (LEC) that conforms to the following specifications:

- The system automatically varies on the line description.
- The ATM LEC does not use locally-administered addresses.
- The ATM LEC should join an Ethernet emulated LAN that uses both Ethernet version 2 and IEEE 802.3 and has the name of ETHERNET1.
- The ATM LEC should use the LAN emulation configuration server (LECS) to find the proper LAN emulation server (LES).
- The ATM network demonstrates occasional congestion and contains several emulated LANs. Therefore, inactive connections to other clients should be dropped to free resources in the network.

To define an Ethernet LAN emulation client to use with ATM, perform these steps:

1. Type **CRTLINETH** on the command line, and press Enter.

2. Type a line description name into the `Line description` parameter. Type BACKBONEET for this example.
3. Specify *NWID for the `Resource name` parameter, and press Enter. This identifies the hardware that the description represents.
4. Specify *YES for the `Online at IPL` parameter to have your system automatically vary on the description. Specifying *NO requires you to manually enable (vary on) the line description after you start the operating system.
5. Enter the name NWI description to attach to this line description. For this example, it is BACKBONE.
6. Specify *ATM for the `NWI type` parameter, and press Enter.
7. For the `Local adapter address` parameter, specify *ADPT to use the adapter's preset address. To use a locally administered address, enter your own address (020000000000 through

   7EFFFFFFFFFF). See LAN, Frame-Relay, and ATM Support for additional information on LAN adapter addresses.
8. Specify *ALL as the `Ethernet standard` to use for this line.
9. Specify *SVC as the `ATM access type`. This line uses SVC to connect with other devices. *PVC is also a valid choice for Ethernet line descriptions.

   Press F9 to show all parameters.
10. Specify *YES for the `Use LECS address` parameter. The client uses the LAN emulation configuration server to obtain the appropriate LAN emulation server's ATM address. However, this requires the services of a LAN emulation configuration server to be available somewhere within the ATM network.

    Press Page Down to show the next panel.
11. No LES ATM address is required when you specify *YES for the `Use LECS address` parameter. In this example, the LES ATM address is *NONE.
12. Type ETHERNET1 into the `Emulated LAN name` parameter. The LAN emulation client uses this value to request a connection to the emulated LAN. If the LAN emulation configuration server cannot find an emulated LAN by this name, it will attempt to determine a suitable substitute. The LECS will then direct the LEC to that LAN emulation server.
13. Specify 5 minutes for the `LEC disconnect time out` parameter and allow the LEC to free inactive connections after that period.
14. Press Enter to create the line description, and exit the command.

Chapter 5. Manage the ATM network

To find out what commands are available to you, how to add security, and so forth, see this information:
- "Commands for LAN configuration objects"
- "Change ATM NWI or line description attachments" on page 30
- "Change ATM-connection types" on page 31

Commands for LAN configuration objects

To see what commands are available to you to manage your configuration objects, see this information:
- "ATM NWI description commands"
- "Token-ring line description commands"
- "Ethernet line description commands" on page 30
- "Enable or disable configuration objects" on page 30

ATM NWI description commands

You can create, change, delete, and display your network interface (NWI) description.
- To create your ATM NWI description, see "Create the ATM network interface description" on page 19
- To change your description:
  1. Type **CHGNWIATM** on the command line, and press Enter.
  2. Type in the name of your NWI description, and press Enter.
  3. Make your changes.
  4. Press Enter to save your changes, and exit the command.
- To delete your NWI description, use the Delete Network Interface Description (DLTNWID) command. Type the statement below on the command line, and press Enter:

  ```
  DLTNWID (description)
  ```

  Where description is the name of your description.
- To display your NWI description, use the Display Network Interface Description (DSPNWID) command. Type the statement below on the command line, and press Enter:

  ```
  DSPNWID (description)
  ```

  Where description is the name of your description.

Token-ring line description commands

You can create, change, delete, and display your token-ring line description.
- To create your line description, see "Create a token-ring over ATM line description" on page 20.
- To change or view your line description:
  1. Type **CHGLINTRN** on the command line, and press Enter.
  2. Type in the name of your description, and press Enter.
  3. Make your changes.
  4. Press Enter to save your changes, and exit the command.
- To delete your description use the Delete Line Description (DLTLIND) command. Type the statement below on the command line, and press Enter:

  ```
  DLTLIND (description)
  ```

  Where description is the name of your description.
- To display your line description, type the statement below on the command line, and press Enter:

  ```
  DSPLIND LIND(description)
  ```

  Where description is the name of your description.

Ethernet line description commands

You can create, change, delete, and display your Ethernet line description.
- To create your description, see "Create an Ethernet over ATM line description" on page 21.
- To change or view your description:
    1. Type **CHGLINETH** on the command line, and press Enter.
    2. Type in the name of your description, and press Enter.
    3. Make your changes.
    4. Press Enter to save your changes, and exit the command.
- To delete your description, type the statement below on the command line, and press Enter:

    ```
    DLTLIND (description)
    ```

    Where description is the name of your description.
- To display your line description, type the statement below on the command line, and press Enter:

    ```
    DSPLIND LIND(description)
    ```

    Where description is the name of your description.

Enable or disable configuration objects

To enable or disable an object you ″vary on″ or ″vary off″ the object. You can also vary (on or off) other objects that are attached to the object. If you want more help information, press F1 for each parameter.

Vary on the object:

To vary on your NWI description and all attached line descriptions, type the statement below on the command line, and press Enter:

```
VRYCFG CFGOBJ(description) CFGTYPE(*NWI) STATUS(*ON) RANGE(*NET)
```

Where description is the name of your NWI description.

Vary off the object:

To vary off your NWI description and all attached line descriptions, type the statement below on the command line, and press Enter:

```
VRYCFG CFGOBJ(description) CFGTYPE(*NWI) STATUS(*OFF) RANGE(*NET)
```

Where description is the name of your NWI description.

Change ATM NWI or line description attachments

You form attachments between an NWI description and a line description during the description's creation. To change the attachment, you must first delete the NWI or line description.

Change an NWI's attachments:
1. Record the non-default values of your NWI description.
2. Delete the line description by typing the statement below, and pressing Enter:

    ```
    DLTNWID (description)
    ```

    Where description is the name of your NWI description.
3. Attach the NWI description to the line description while recreating your NWI description.

    You should set the non-default values into your NWI description during its recreation.

Change a line description's attachments:
1. Record the non-default values of your line description.
2. Type **DLTLIND** *(description)*, and press Enter to delete the line description.

Where description is the name of your description.

3. Attach the NWI description to the line description while recreating the line description. See "Create a token-ring over ATM line description" on page 20 or "Create an Ethernet over ATM line description" on page 21.

    You should set the non-default values into your line description during its recreation.

Change ATM-connection types

During the creation of the line description, you define your connection type. To change it:

1. Record your line description's non-default values. You use the change line description commands to view your line description values (see "Token-ring line description commands" on page 29 or "Ethernet line description commands" on page 30).

2. Either delete your line descriptions or create a new line description. To delete the line description, enter **DLTLIND** *(description)*

    Where description is the name of your line description.

3. To create a new line description (see "Create a token-ring over ATM line description" on page 20 or "Create an Ethernet over ATM line description" on page 21).

    While creating your line description, locate the ACCTYPE parameter and select:
    • *SVC (for switched)
    • *PVC (for permanent connections)

4. Press Enter to save your line description and exit the command.

See "ATM connection types" on page 10 for more information about connection types.

Chapter 6. Tune SNA/LAN emulation performance

You can increase your system's performance when using System Network Architecture (SNA) over asynchronous transfer mode (ATM) by adjusting timers and the number of outstanding frames.

Also, you can increase your "LAN emulation performance" on page 12 by increasing data transfer speeds through enlarging your frame size.

Adjust ATM connection performance

When running SNA over ATM, you can increase ATM's speed by adjusting the timing and counter parameters. To find out why and how these parameters affect your system's performance, see "SNA over ATM timing issues" on page 13. To adjust the parameters, do these steps:
1. Identify the parameters to adjust. See "SNA over ATM timing issues" on page 13 for a list of parameters.

    Note: If you are connecting two servers together, you should consider this guideline for the LANACKFRQ and LANMAXOUT parameters. Your system's LANACKFRQ value should be less than or equal to the LANMAXOUT value of the remote station. If you do this, you should set LANMAXOUT to a value that is evenly divisible by LANACKFRQ.

    Note: Both LANACKTMR and LANACKFRQ must either be zero or non-zero.
2. Find the command to change your SNA controller description.
3. Press F9 to show all parameters.
4. Locate and change the parameters that you identified in step 1.

    Note: You should press F1 for the parameters that you are changing to determine if your values are appropriate.
5. Press Enter to save your changes and exit the command.

Find controller description change commands

To find the command to change your SNA controller description, do these steps:
1. With the cursor on an empty command line, press F4.
2. Select Verb Commands.
3. Select Change Commands.
4. Page down until you see the change controller commands.
5. Select a command to change your SNA controller description (advanced program-to-program communications (APPC), SNA host, remote workstation, finance, or retail).
6. Enter the name of your existing controller, and press Enter.

Adjust outstanding LAN frames

When running SNA over ATM, you can experiment with different parameter values for LANMAXOUT and LANACKFRQ to see if performance improves. If your values do not noticeably improve performance, you should change the values back to *CALC. To adjust these parameters, do these steps:
1. Find the command to change your SNA controller description.
2. Press F9 to show all parameters.
3. Locate the LANACKFRQ or LANMAXOUT parameter and use the guidelines to find a good starting value for the parameter.
4. Press Enter to save your changes and exit the command.
5. If the new value did not increase your system's performance, you can increase the parameter's value.
6. If your new values do not cause any noticeable performance improvement, you should change the value back to *CALC.

Guidelines for the LANACKFRQ and LANMAXOUT starting values:

Use these guidelines to find starting values for parameters LANACKFRQ and LANMAXOUT:
- For large transfer environments where the frame size is:
  - 1994 bytes or less, set LANACKFRQ to 4 and LANMAXOUT to 8.
  - Between 1994 and 8156 bytes, set LANACKFRQ to 2 and LANMAXOUT to 4.
- For mixed environments follow the guidelines for large transfer environments (see previous bullet), but set LANACKFRQ to *CALC. Mixed environments have interactive and large transfer activity.
- When communicating with a PS/2 Model 50 or above, follow the guidelines for large transfer environments but set LANACKFRQ to *CALC.
- If you decide to not use *CALC for LANACKFRQ and LANMAXOUT, here are some guidelines for determining new values:
  - LANACKFRQ should be about half the size of LANMAXOUT.
  - LANACKFRQ should be the same on the sending and receiving systems.
  - LANMAXOUT should be the same on the sending and receiving systems.

Increase data transfer speeds in emulated LANs

Increase data transfer speeds for emulated local area networks (LANs) by enlarging your frame size:
1. Open your line description by using either the **CHGLINTRN** or the **CHGLINETH** command.
2. Type the name of your line description, and press Enter.
3. Find the `Maximum frame size` parameter.
4. Specify your frame size.

> **Note:** Your maximum frame size value is 20 bytes less than the value that is given to you by your network administrator.

To see how frame sizes affect your system's performance, see "LAN emulation performance" on page 12.

Chapter 7. Troubleshoot ATM on the iSeries server

To find and resolve errors on a server ATM network, do these tasks:
- Find ATM errors by using error messages to locate the problem and solutions.
- Test the communications path to find out what part of the path is causing the problem.
- Trace your LAN communications to locate a problem.
- Adjust your frame sizes if the remote bridge drops your frames.

For more general troubleshooting information and tools, see troubleshooting on the server.

Find ATM errors

You can use one or more of the resources below to help you find an error and possible solutions:
- "View QSYSOPR or other message queues". This information discusses how to locate error messages in the message queues.
- "View print error log". This information discusses another method of finding error messages.
- "ATM network cause codes" on page 36. This information describes the ATM cause codes that are found in the error message.

To understand how these tools work together to locate a problem and find possible solutions, see "Example: Locate ATM errors" on page 41.

View QSYSOPR or other message queues

QSYSOPR and other message queues contain messages that describe the error and may contain possible solutions for the error. These messages are usually a good place to begin your troubleshooting. To view these messages, do these tasks:
1. Type **DSPMSG** *MSGQ(message_queue)* on the command line and press Enter.

   Where message_queue is QSYSOPR or the configured message queue.
2. Locate the error messages that are associated with one or more of these items:
   - The ATM resource that was used.
   - 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. If the message contains an ATM cause code, you should note the cause code, the error's description, and possible solutions. Also, record any message IDs, error codes, reference codes, or reason codes.

View print error log

The Print Error Log (PRTERRLOG) command displays errors according to the date and time. To view the print error log, do these tasks:
1. Type **PRTERRLOG** on the command line, and press F4.
2. Type *ANZLOG, and press Enter.
3. Press Enter to display more fields.
4. (Optional) Specify the date and time the error occurred. Doing this limits the number of displayed messages. If you do not specify a date and time, you will see all the messages that were created in the last 24 hours.
5. Press Enter to print the log to a file, and exit the command.
6. Use the Work with Spooled Files (WRKSPLF) command to display the messages. Type **WRKSPLF** on the command line, and press Enter.
7. Locate your log file, move your cursor to the log, type 5, and press Enter to display the log.
8. Locate a line that describes the error.
9. Continue to page down until you find a detailed description of the error.
10. To view more information, press F19 or F20 to move the log to the left or to the right.

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Note: At the end of your log is some help that explains the report's format.

ATM network cause codes

The LAN emulation software reports network errors by using ATM cause codes. The cause codes become a part of your error logs, error messages, or job logs. You should not confuse ATM cause codes with error codes. Your messages will indicate if it has an error code or an ATM cause code. For a description of the ATM cause codes, see this information:
- "UNI 3.0 cause code description"
- "UNI 3.1 and UNI 4.0 cause code description" on page 38

UNI 3.0 cause code description

The table below shows the UNI 3.0 cause code, its meaning, and possible causes.

Cause Code (Dec)	Cause Code (Hex)	Meaning	Technical Description
1	1	Unallocated (unassigned) number	Although the number's format is valid, the called party cannot be reached because it is not currently assigned (allocated).
2	2	No route to specified transit network	The equipment sending this cause code received a request to route the call through a transit network that it does not recognize. The equipment does not recognize the transit network because either: • It does not exist. • It exists, but does not serve the equipment that sent the cause code. This cause code is supported on a network-dependent basis.
3	3	No route to destination	The called party cannot be reached, because the network the call was routed through does not serve the destination.
10	0A	VPCI/VCI unacceptable	The virtual channel most recently identified is not acceptable to the sending entity.
17	11	User busy	The called party cannot accept another call because a user busy condition was encountered. This cause code may be generated by the called user or by the network.
18	12	No user responding	The called party did not respond to a call establishment message with a connect indication within the prescribed time.
21	15	Call rejected	The equipment sending this cause code did not accept this call, although it could have. Even if the equipment sending this cause code is neither busy nor incompatible.
22	16	Number changed	The called party number is not assigned. The new called party number may be included in the diagnostic field. If a network does not support this capability, cause code 1 ″unassigned (unallocated) number″, should be sent.
23	17	User rejects all calls with calling line identification restriction (CLIR)	The called party returns this cause code. The call contains no calling party number information, but the called party requires this information.
27	1B	Destination out of order	Cannot reach the destination, specified by the user, because the interface to the destination is not functioning correctly. Or in otherwords, the signaling message was not delivered to the remote user. For example, a physical layer, of SAAL, fails at the remote user because the user's equipment is off-line.
28	1C	Invalid number format (address incomplete)	The called user cannot be reached because the called party number has an invalid format or is not complete.
30	1E	Response to STATUS ENQUIRY	This cause code is included in the STATUS message because a STATUS ENQUIRY message was previously received.
31	1F	Normal, unspecified	This cause code reports a normal event only when no other cause code in the normal class applies.

Cause Code (Dec)	Cause Code (Hex)	Meaning	Technical Description
35	23	Requested VPCI/VCI not available	The requested VPCI/VCI is not available.
38	26	Network out of order (not used in UNI 3.0)	The network is not functioning correctly and is likely to last for a long time. If you reattempt the call immediately, it will not succeed.
41	29	Temporary failure	The network is not functioning correctly and is not likely to last for a long time. The user succeed if the call is re-attempted immediately.
43	2B	Access information discarded	The network cannot deliver one or more of the access information (as indicated in the diagnostic) to the remote user as requested. Examples include: • Asynchronous Transfer Mode (ATM) adaptation layer parameters • Broadband low layer information • Broadband high layer information • Sub-address
45	2D	No VPCI/VCI available	There are no appropriate VPCI/VCI presently available to handle the call.
47	2F	Resource unavailable, unspecified	This cause code reports a resource unavailable event only when no other cause code in the resource unavailable class applies.
49	31	Quality of Service unavailable	This cause code reports that the requested Quality of Service cannot be provided.
51	33	User cell rate not available	This cause code reports that the requested ATM User Cell Rate is unobtainable.
57	39	Bearer capability not authorized.	The equipment, sending this cause code, supports the requested bearer capability, but the user is not authorized to use it.
58	3A	Bearer capability not presently available	The user requested a bearer capability that is supported by the equipment, that generated the cause code, but is not available at the time.
63	3F	Service of option not available, unspecified	This cause code reports a service or option not available event only when no other cause code in the service or option not available class applies.
65	41	Bearer capability not implemented	The equipment sending this cause code does not support the requested bearer capability.
73	49	Unsupported combination of traffic parameters	The combination of traffic parameters contained in the ATM user cell rate information element is not supported.
81	51	Invalid call reference value	The equipment sending this cause code received a message with a call reference that is not supported by the user-network interface.
82	52	Identified channel does not exist	The equipment sending this cause code received a request to use an inactivated channel.
88	58	Incompatible destination	The equipment sending this cause code received a request to establish a call with a compatibility attribute that cannot be accommodated. The attribute can be: • Broadband low layer information • Broadband high layer information • Other compatibility attributes
89	59	Invalid endpoint reference	The equipment sending this cause code received a message with an endpoint reference that is not currently used on the user-network interface.
91	5B	Invalid transit network selection	A transit network identification has an incorrect format (as defined in Annex D).

Cause Code (Dec)	Cause Code (Hex)	Meaning	Technical Description
92	5C	Too many pending add party requests	The calling party sent an add party message, but the network rejected it because its queues are full. This is a temporary condition.
93	5D	AAL parameters cannot be supported	The equipment sending this cause code received a request to establish a call, containing ATM adaptation layer parameters that it cannot accommodate.
96	60	Mandatory information element is missing	The equipment, sending this cause code, cannot process a received message because the message is missing an information element.
97	61	Message type non-existent or not implemented	The equipment, sending this cause code, cannot recognize a received message because the message is either not defined or defined, but not implemented by the equipment.
99	63	Information element non-existent or not implemented	The equipment, sending this cause code, received a message that includes information elements. These elements are not recognized because the information element identifiers are either not defined or are defined, but not implemented by the equipment. The unrecognized information elements are discarded, because the equipment can process the message without them.
100	64	Invalid information element contents	The equipment, sending this cause code, received an information element that it implements; however, one or more of the element's fields are coded in a way that is not supported by the equipment.
101	65	Message not compatible with call state	A message was received that is incompatible with the call state.
102	66	Recovery on timer expiry	A procedure was initiated by the expiry of a timer in association with error handling procedures.
104	68	incorrect message length	This cause code reports inconsistent message length.
111	6F	Protocol error, unspecified	This cause code reports a protocol error event only when no other cause code in the protocol error class applies.

UNI 3.1 and UNI 4.0 cause code description

The table below shows the UNI 3.1 and UNI 4.0 cause code, its meaning, and possible causes.

Cause Code (Dec)	Cause Code (Hex)	Meaning	Technical Description
1	1	Unallocated (unassigned) number	Although the number's format is valid, the called party cannot be reached because it is not currently assigned (allocated).
2	2	No route to specified transit network	The equipment, sending this cause code, received a request to route the call through an unrecognizable transit network. The equipment cannot recognize the network because either: • It does not exist. • It exists, but does not serve the equipment. This cause is supported on a network-dependent basis.
3	3	No route to destination	The called party cannot be reached, because the network the call was routed through does not serve the destination.
10	0A	VPCI/VCI unacceptable	The virtual channel most recently identified is not acceptable to the sending entity.
16	10	Normal call clearing	The call was cleared because one of the users involved in the call requested that the call be cleared.

Cause Code (Dec)	Cause Code (Hex)	Meaning	Technical Description
17	11	User busy	The called party cannot accept another call because a user busy condition was encountered. This cause code may be generated by the called user or by the network.
18	12	No user responding	The called party did not respond to a call establishment message with a connect indication within the prescribed time.
21	15	Call rejected	The equipment sending this cause code did not accept this call, although it could have. Even if the equipment is neither busy nor incompatible.
22	16	Number changed	The called party number is not assigned. The called party number may be included in the diagnostic field. If a network does not support this capability, cause code 1, ″unassigned (unallocated) number″, should be sent.
23	17	User rejects all calls with calling line identification restriction (CLIR)	The called party returns this cause code. The call contains no calling party number information, even though the called party requires this information.
27	1B	Destination out of order	Cannot reach the destination, specified by the user, because the interface to the destination is not functioning correctly. Or in otherwords, the signaling message was not delivered to the remote user. For example, a physical layer, of SAAL, fails at the remote user because the user's equipment is off-line.
28	1C	Invalid number format (address incomplete)	The called user cannot be reached because the called party number has an invalid format or is not complete.
30	1E	Response to STATUS ENQUIRY	This cause code is included in the STATUS message because a STATUS ENQUIRY message was previously received.
31	1F	Normal, unspecified	This cause code reports a normal event only when no other cause in the normal class applies.
35	23	Requested VPCI/VCI not available	The requested VPCI/VCI is not available.
38	26	Network out of order (not used in UNI 3.0)	The network is not functioning correctly and is likely to last for a long time. If you reattempt the call immediately, it will not succeed.
41	29	Temporary failure	The network is not functioning correctly and is not likely to last for a long time. The user may succeed if the call is re-attempted immediately.
43	2B	Access information discarded	The network cannot deliver one or more of the access information to the remote user as requested. Examples include: - ATM adaptation layer parameters - Broadband low layer information - Broadband high layer information - Sub-address (as indicated in the diagnostic)
45	2D	No VPCI/VCI available	There is no appropriate VPCI/VCI presently available to handle the call.
47	2F	Resource unavailable, unspecified	This cause code reports a resource unavailable event only when no other cause in the resource unavailable class applies.
49	31	Quality of Service unavailable	This cause code reports that the requested Quality of Service cannot be provided.
51	33	User cell rate not available	This cause code reports that the requested ATM User Cell Rate is unobtainable.
57	39	Bearer capability not authorized.	The equipment, sending this cause code, supports the requested bearer capability, but the user is not authorized to use it.
58	3A	Bearer capability not presently available	The user requested a supported bearer capability, but it is not available at the time.

Cause Code (Dec)	Cause Code (Hex)	Meaning	Technical Description
63	3F	Service of option not available, unspecified	This cause code reports a service or option not available event only when no other cause code in the service or option not available class applies.
65	41	Bearer capability not implemented	The equipment, sending this cause code, does not support the requested bearer capability.
73	49	Unsupported combination of traffic parameters	The combination of traffic parameters in the ATM user cell rate information element is not supported.
81	51	Invalid call reference value	The equipment, sending this cause code, received a message with a call reference that is not currently in use on the user-network interface.
82	52	Identified channel does not exist	The equipment, sending this cause code, received a request to use an inactivated channel.
88	58	Incompatible destination	The equipment, sending this cause code, received a request to establish a call with a compatibility attribute that cannot be accommodated. The attribute can be: • Broadband low layer information • Broadband high layer information • Other compatibility attributes
89	59	Invalid endpoint reference	The equipment, sending this cause, received a message with an endpoint reference that is not currently used on the user-network interface.
91	5B	Invalid transit network selection	A transit network identification has an incorrect format (as defined in Annex D).
92	5C	Too many pending add party requests	The calling party sent an add party message, but the network rejected it because its queues are full. This is a temporary condition.
93	5D	AAL parameters cannot be supported	The equipment, sending this cause code, received a request to establish a call containing ATM adaptation layer parameters that it cannot accommodate.
96	60	Mandatory information element is missing	The equipment, sending this cause code, cannot process a received message, because the message is missing an information element.
97	61	Message type non-existent or not implemented	The equipment, sending this cause code, cannot recognize a received message, because the message is either not defined or defined, but not implemented by the equipment.
99	63	Information element non-existent or not implemented	The equipment, sending this cause code, received a message that includes information elements. These elements are not recognized, because the information element identifiers are either not defined or are defined, but not implemented by the equipment. The unrecognized information elements are discarded, because the equipment can process the message without them.
100	64	Invalid information element contents	The equipment, sending this cause code, received an information element that it implements; however, one or more of the element's fields are coded in a way that is not supported by the equipment.
101	65	Message not compatible with call state	A message was received that is incompatible with the call state.
102	66	Recovery on timer expiry	A procedure was initiated by the expiry of a timer in association with error handling procedures.
104	68	Incorrect message length	This cause code reports an inconsistent message length.
111	6F	Protocol error, unspecified	This cause code reports a protocol error event only when no other cause in the protocol error class applies.

Example: Locate ATM errors

The example here shows you how to use the message to identify the error. Typically, error messages contain an eight-character hexadecimal error code that indicates the problem. In this example, a line has failed. Follow the steps below to find the error and its cause:

1. First use the Work with Configuration Status (WRKCFGSTS) command to check the status of all the descriptions. To do this, type **WRKCFGSTS** *CFGTYPE(*NWI)* on the command line.

   If a description has a suspicious status, note its name. In this case, one of the line descriptions has a status of Rcypnd (Recovery pending).

2. Next, find out what error occurred. View the system error log to find any error messages that relate to the description that was noted in the previous step. In this scenario, all the messages are directed to the system message queue QSYSOPR. To view the messages, enter this on the command line **DSPMSG QSYSOPR**.

3. Now locate a message that says something about the suspicious description.

4. After finding an error message that relates to the description, place your cursor on the message and press F1 to expand the message. The message may give possible causes and options to recover from the error.

5. If the message contains an ATM cause code, record the value and then look at "ATM network cause codes" on page 36 for more information about possible causes and maybe solutions.

6. Continue to look for other messages and possible causes and solutions.

7. From the gathered information, you can fix the error. If not, contact your next level of support: your support provider or IBM support.

Test the communications path

You can perform tests on certain parts of your communications path or on the whole path:
- If the error messages indicate that you need to check your communications path.
- You need more diagnostic information.
- For other reasons.

Testing your communications path can identify if the problem lies with the local system, the local switch, or the remote station. To perform these tests, see this information:
- "Test the ATM IOA"
- "Test IOA communications" on page 42
- "Test local switch path" on page 43
- "Test communications path to remote station" on page 44

If you are not sure where the problem is, divide the problem area in half by testing the path to the local switch. If the test fails, the problem area includes the input/output adapter (IOA), the local switch, and whatever is between them. If the test succeeds, the problem area is between the local switch and the remote site. To narrow the problem area even further, you can continue with additional testing to divide the problem area in half until you find your problem.

If any of the tests fail, see test failures.

Test the ATM IOA

The ATM IOA internal test verifies that the IOA is operational. You can perform this test if you experience any problems after installing the IOA hardware and software. To do test the IOA, use the Start System Service Tools (STRSST) command.

Do these steps:
1. Type **STRSST** on the command line, and press Enter.
2. Select ″Start a service tool.″
3. Select ″Hardware service manager.″
4. Select ″Logical hardware resources.″
5. Select ″System bus resources.″

6. Locate the ATM IOP that is associated with the IOA that you want to test.

   See "ATM Hardware, client, and protocol support" on page 7 for a list of the supported ATM IOPs.
7. Move your cursor to the input/output processor (IOP), and enter a 9 (Resources associated with IOP), and press Enter.
8. Locate the ATM IOA.

   See "ATM Hardware, client, and protocol support" on page 7 for a list of supported ATM IOAs.
9. Move your cursor to the IOA, enter a 7 (Verify,) and press Enter.
10. Read the instructions on the panel, and press Enter.
11. Select Adapter internal test and, press Enter.
12. Press Enter to run the test once.
13. Wait for the test to complete and for the results message to display, then press Enter.
14. If the test fails, see test failures.
15. You have now completed the internal verification tests. Press Enter to continue.

Test IOA communications

The ATM IOA external wrap test verifies that the installed ATM IOA, drivers, and receivers are operational.

To start the external wrap test, do these steps:
1. Ensure that you have the proper card wrap plug. If you do not have one, obtain one through its "ATM card wrap plug" part number.
2. Type **STRSST** on the command line, and press Enter.
3. Select ″Start a service tool.″
4. Select ″Hardware service manager.″
5. Select ″Logical hardware resources .″
6. Select ″System bus resources.″
7. Locate the ATM IOP that is associated with the IOA that you want to test.

   See "ATM Hardware, client, and protocol support" on page 7 for a list of the supported ATM IOPs.
8. Move your cursor to the IOP, type a 9 (Resources associated with IOP), and press Enter.
9. Locate the ATM IOA.

   See "ATM Hardware, client, and protocol support" on page 7 for a list of the supported ATM IOAs.
10. Move your cursor to the IOA, type a 7 (Verify), and press Enter.
11. Read the instructions on the panel, and press Enter.
12. Select Adapter wrap test.
13. Press Enter to run the test once.
14. Follow the instructions on the panel, and press Enter.

    For card wrap plug part numbers, see "ATM card wrap plug".
15. After the test completes, a message appears that indicates that the test failed, or that the test completed successfully. Press Enter to continue.
16. The external wrap test is complete. Remove the wrap plug and reattach any cables that were removed to perform the testing. Then press Enter to continue.
17. Press F3 repeatedly until the Exit System Service Tools screen displays.
18. Press Enter to confirm and exit.
19. If the test fails, see test failures.

ATM card wrap plug
You must use the proper plug for the ATM IOA that you are testing. Below is a list of IBM ATM IOAs and their associated IBM wrap plug part numbers (speed, cabling, and type are in parenthesis):

2811 IOA (25 Mbps, RJ-45)
    Wrap plug number 42H0540

2812 IOA (45 Mbps, coaxial cable)
    Wrap plug number 21H3548

2815 IOA (155 Mbps, UTP-3)
    Wrap plug number 21H0540

2816 IOA (155 Mbps, multi-mode fiber)
Wrap plug number 21H3547

2817 IOA (155 Mbps, multi-mode fiber)
Wrap plug number 04P9438

2818 IOA (155 Mbps, single-mode fiber)
Wrap plug number 21H3547

2819 IOA (34 Mbps, coaxial cable)
Wrap plug number 21H3548

Test local switch path

You can test the local communications path between your IOA and the local switch. The test verifies that the following items are operational and configured properly:
- Input/output processor (IOP)
- Input/output adapter (IOA)
- Licensed internal code (LIC)
- Cabling
- Local network switch

To start the test, do these steps:
1. Verify that the NWI description attaches to the proper IOA.
2. Verify that the proper line description attaches to the NWI description and that both are varied on.

   To verify this, enter **WRKCFGSTS** *CFGTYPE(*NWI)* on the command line.
3. Press F3 to exit the command.
4. Use the Verify Communications (VFYCMN) command to verify the communications path. Type **VFYCMN** on the command line, and press Enter.
5. Select Network Interface Description.
6. Specify the desired ATM network interface description, and press Enter.
7. Ignore the ″Problem Analysis″ screen, and press Enter.
8. Press Enter to specify a line description.
9. Specify a line description, and press Enter.
10. Specify the controller description, and press Enter.
11. Verify that the information is correct, and press Enter.
12. If the displayed panel shows that the source service access point (SSAP) was found, the link test is successful. If SSAP has no value, the link test failed.

    For a brief description of the values, you must press F1. For a detailed description, you should see "Link test completion codes".

If the test fails, see test failures. You may also want to test the local IOA or its communications port to further narrow the problem area. If the test succeeds, you may want to test the remote site's communications path.

Link test completion codes
The link test provides a set of hexadecimal completion codes to indicate whether the remote adapter and SAP are reachable by your server. The table below lists the completion codes, their meanings, and possible recoveries:

Code	Meaning	Recovery
00000000	Parameter value was found and is valid	None

Code	Meaning	Recovery
????????	Link test timed out. The parameter cannot be reached using the supplied values. Possible causes include the following: 1. Remote adapter address is incorrect.	Possible recoveries include the following. Verify the values specified for the link test and change the values as indicated. Then run the link test again. 1. Verify the values specified for the link test and change the values as needed. Then run the link test again. 2. Verify the remote adapter address (controller description ADPTADR parameter). To open your controller description, see "Find controller description change commands" on page 33.
	2. Destination service access point (DSAP) value is incorrect.	2. Verify the remote SAP (controller description DSAP parameter).
	3. Both LANCNNTMR and LANCNNRTY or either parameter values are not large enough.	3. Increase the values of either or both parameters.
	4. Remote adapter is not attached to the network or is attached to a network other than that represented by the line description.	4. Verify that the remote adapter is attached to the same network as the line description..
	5. Bridges between the server and the remote adapter are unable to transmit the test frame.	5. Check the bridge and network configurations.
FFFFFFFF	Parameter value was not found. This completion code may indicate that the local SAP (SSAP parameter in the controller description) is not included in the SSAP list for the associated line description.	Change the value specified and run the link test again.
Any other values	Link test did not run.	No recovery available. Record the completion code for the next level of support (your support provider or IBM support).

Test communications path to remote station

This test assumes that your local communications path (your adapter, cables, and local switch) are functioning properly. If you do not know this, see "Test local switch path" on page 43.

Before you begin:

You will need the information below if you do not plan to retrieve it from an existing controller:
- LAN remote adapter address
- LAN destination service access point
- LAN source service access point

Also, you must determine the proper address and whether you need to convert the remote adapter address.

To start the test, do these steps:
1. Vary on the line description that is used to communicate with the remote station by entering this on the command line:
   ```
   VRYCFG CFGOBJ(description) CFGTYPE(*LIN) STATUS(*ON)
   ```

   Where description is the name of your line description.
2. Vary on the controller description, if any, that is used to communicate with the remote station by entering this on the command line:

```
VRYCFG CFGOBJ(description) CFGTYPE(*CTL) STATUS(*ON)
```

   Where description is the name of your controller description.
3. Type **VFYCMN** on the command line, and press Enter.
4. Select Network Interface Description, and press Enter.
5. Specify an ATM network interface description to test, and press Enter.
6. Ignore the Problem analysis screen, and press Enter.
7. Press Enter to select a line description.
8. Select a line description, and press Enter.
9. The next step is to determine where to get the values for the fields below:
   - LAN remote adapter address.
   - LAN destination service access point.
   - LAN source service access point.

   To retrieve the information from an existing controller, type the controller's name, and press Enter; otherwise, type *NONE and press Enter to specify the values yourself.

   The Verify Controller Information screen appears.
10. Specify or verify the needed information for the fields below:
    - LAN remote adapter address (See "Remote LAN-adapter address considerations" to verify that the address has the proper bit order).
    - LAN destination service access point.
    - LAN source service access point.
    - LAN connection timer.
    - LAN connection retry.
11. Verify the information that was entered, and press Enter.
12. Check your completion codes against the information in "Link test completion codes" on page 43.

Remote LAN-adapter address considerations

You should consider the following when specifying the remote adapter address for the communications link test:
- Do not use broadcast addresses.
- Convert remote adapter addresses when accessing the remote adapter through bridges that are between the Ethernet and token-ring networks.

You must convert a remote adapter's address if you retrieve its address through a network type that is not used by the remote adapter. For example, the remote adapter is on a token-ring network, and you retrieve its address while on an Ethernet network. You must convert the address before using it with the communications link test. The same is true if the remote adapter is on an Ethernet network, and you retrieve the information through a token-ring network.

Token-ring/Ethernet address conversion:

Compared to each other, the bit order of the token-ring and the Ethernet addresses are reversed at the byte boundaries. Therefore, you must reverse the bits in each address byte before using it.

To reverse the address, you can use the procedure and table below. For an example address conversion, see "Address conversion example" on page 46.
1. Separate the remote adapter's 12-hexadecimal-digit MAC address into pairs.
2. Starting from the first hex pair (the left-most pair) of the address, locate its corresponding inverted pair in the table. The first character of your hex pair represents the table's row coordinate and the second character represents the table's column coordinate.

   Write down the converted value. This value is the first byte of the converted address.
3. Continue the conversion process until you convert all 6 pairs.
4. Combine the converted 6 pairs from left to right into a 12-hexadecimal-digit MAC address.

2nd Char (column) → 1st Char (row) ↓	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0	00	80	40	C0	20	A0	60	E0	10	90	50	D0	30	B0	70	F0
1	08	88	48	C8	28	A8	68	E8	18	98	58	D8	38	B8	78	F8
2	04	84	44	C4	24	A4	64	E4	14	94	54	D4	34	B4	74	F4
3	0C	8C	4C	CC	2C	AC	6C	EC	1C	9C	5C	DC	3C	BC	7C	FC
4	02	82	42	C2	22	A2	62	E2	12	92	52	D2	32	B2	72	F2
5	0A	8A	4A	CA	2A	AA	6A	EA	1A	9A	5A	DA	3A	BA	7A	FA
6	06	86	46	C6	26	A6	66	E6	16	96	56	D6	36	B6	76	F6
7	0E	8E	4E	CE	2E	AE	6E	EE	1E	9E	5E	DE	3E	BE	7E	FE
8	01	81	41	C1	21	A1	61	E1	11	91	51	D1	31	B1	71	F1
9	09	89	49	C9	29	A9	69	E9	19	99	59	D9	39	B9	79	F9
A	05	85	45	C5	25	A5	65	E5	15	95	55	D5	35	B5	75	F5
B	0D	8D	4D	CD	2D	AD	6D	ED	1D	9D	5D	DD	3D	BD	7D	FD
C	03	83	43	C3	23	A3	63	E3	13	93	53	D3	33	B3	73	F3
D	0B	8B	4B	CB	2B	AB	6B	EB	1B	9B	5B	DB	3B	BB	7B	FB
E	07	87	47	C7	27	A7	67	E7	17	97	57	D7	37	B7	77	F7
F	0F	8F	4F	CF	2F	AF	6F	EF	1F	9F	5F	DF	3F	BF	7F	FF

Address conversion example

The figure below shows how to convert a token-ring address of 10005A4DBC96 into an Ethernet address of 08005AB23D69.

```
10   00   5A   4D   BC   96
```

Conversion Table

```
08   00   5A   B2   3D   69
```
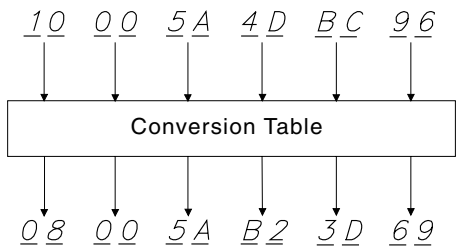
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Communications-path-test failures

A number of problems can cause failures during the communications path test. The "LAN emulation configuration server" on page 9, ATM network switch, or "LAN emulation server" on page 10 may be in one of these states:

- Configured improperly
- Not operational
- Not reachable

The possible causes for the above conditions may be:

- A cable may be unplugged, reversed, or broken.
- The server configuration may be incorrect or incomplete.
- The server IOP or IOA may have failed.
- An internal code failure may have occurred.

For additional information on diagnosing such problems, see "Find ATM errors" on page 35 and "Tracing LAN communications". If you want to test the path to the local switch, see "Test local switch path" on page 43.

Tracing LAN communications

Note: Since virtual permanent circuits (using *PVCONLY for parameter NETTYPE in your ATM NWI description) does not use the signaling protocols, problems such as disconnected cables will not be detected.

See Communications trace in the *Troubleshooting TCP/IP* topic. You can use communications trace to solve problems that occur with your system.

Adjust your LAN-frame size

Your frame size may need adjusting if the remote bridge drops your frames. To change your frame size:
1. Determine the new frame size.

    The network administrator should know what your frame size should be. You may also find that the frame size is contained in message CPF 5908. The message will be in "View QSYSOPR or other message queues" on page 35.
2. Determine which configuration object and MAXFRAME parameter to change. To determine this, see "Bridges dropping frames" on page 6.
3. To change the parameter, see this information to determine which command to use:
    *   **Change line description commands:**
        –   Use the **CHGLINTRN** command for token-ring line descriptions.
        –   Use the **CHGLINETH** command for Ethernet line descriptions.
    *   **Change controller description commands:**
        –   On an empty command line, type GO CMDCTL, and press Enter.
        –   Enter the appropriate command into the command line, and press Enter.
        –   Type the name of your controller, and press Enter.

    See "Token-ring line description commands" on page 29 or "Ethernet line description commands" on page 30 for instructions on how to use the change line description commands.
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.

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