NetEx/IP™

for UNIX Systems

Release 6.0

Software Reference Manual

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Revision Record

Revision	Description
01 (**08/2001**)	Manual released.
02 (**09/2002**)	• Added additional NetEx operator commands.
03 (**10/2003)**	• Added additional NetEx/IP operator commands. • Other minor revisions.

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Preface

This manual describes the NetEx/IP™ software for supported UNIX operating systems.

The supported UNIX operating systems and specific NetEx/IP™ products are:

- H320IP for HP-UX operating systems.
- H620IP for IBM RS/6000 AIX operating systems.
- H690IP for Solaris operating systems.
- H800IP for Red Hat Linux operating systems.

“Chapter 1: Introduction”, “Chapter 2: NetEx/IP and the ISO Model”, “Chapter 3: NetEx/IP Session Services”, and “Chapter 4: NetEx Request Block” are intended for all readers. “Chapter 5: C High Level Interface” describes the library of subroutines that are called by the C high-level language programs.

Please refer to the appropriate Memo-To-Users for your version of UNIX for installation prerequisites and procedures. These Memo-To-Users are intended for the systems programmer installing NetEx/IP.

“Appendix A: NRB Error Codes” includes a list and description of the error messages and codes issued by NetEx/IP.

Readers are not expected to be familiar with NetEx/IP before using this manual. However, an understanding of programming and using the host operating system is required.

Reference Material

The following manuals contain related information.

Number	Title and Description
460757	*"C" Configuration Manager and NETEX Alternate Path Retry (APR) User Guide*
460580	*NETEX Application Programmer's Interface Software Reference Manual*

Other vendor's manuals are listed below:

From StorageTek:

Number	Title and Description
460527	*HYPERchannel® Message Formats and Protocol Encapsulation*

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Red Hat, Inc.	**Red Hat**
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These references are made for informational purposes only.

The diagnostic tools and programs described in this manual are **not** part of the products described.

Notice to the Customer

Installation information contained in this document is intended for use by experienced System Programmers.

Document Conventions

The following notational conventions are used in this document.

Format	Description
`displayed information`	Information displayed on a CRT (or printed) is shown in `this font`.
`user entry`	*`This font`* is used to indicate the information to be entered by the user.
UPPERCASE	The exact form of a keyword that is not case-sensitive or is issued in uppercase.
MIXedcase	The exact form of a keyword that is not case-sensitive or is issued in uppercase, with the minimum spelling shown in uppercase.
bold	The exact form of a keyword that is case-sensitive and all or part of it must be issued in lowercase.
lowercase	A user-supplied name or string.
value	Underlined parameters or options are defaults.
<label>	The label of a key appearing on a keyboard. If "label" is in uppercase, it matches the label on the key (for example: <ENTER>). If "label" is in lowercase, it describes the label on the key (for example: <up-arrow>).
<key1><key2>	Two keys to be pressed simultaneously.
No delimiter	Required keyword/parameter.

Glossary

asynchronous: A class of data transmission service whereby all requests for service contend for a pool of dynamically allocated ring bandwidth and response time.

ASCII: Acronym for American National Standard Code for Information Interchange.

buffer: A contiguous block of memory allocated for temporary storage of information in performing I/O operations. Data is saved in a predetermined format. Data may be written into or read from the buffers.

code conversion: An optional feature in the adapter or host DX interface that dynamically converts the host data from one character set to another. An adapter configured with the code conversion has a special 1K RAM that is used for code conversion. This RAM can be loaded with any type of code (for example, ASCII, EBCDIC, et cetera).

Configuration Manager: A utility that parses a text NCT file into a PAM file.

Coprocessor NETwork EXecutive (CP NetEx): Resides on some types of Processor Interface (PI) boards and uses the processing and storage capacity of the board. This allows minicomputer users to use NetEx with minimal impact on host storage and processing.

Data Exchange Unit (DX unit or DXU): A chassis containing a nucleus processor, multiple customer-selectable interfaces, and/or coprocessors.

DX NetEx: A version of NetEx product specifically designed to operate from a DX unit, driven by software running on a host. DX NetEx resides on the P/NDNTx board.

Fiber Distributed Data Interface (FDDI): An American National Standards Institute (ANSI)-specified standard (X T9.5) for fiber optic links with data rates up to 100 Mbps. The standard specifies: multimode fiber; 50/125, 62.5/125, or 85/125 core-cladding specification; an LED or laser light source; and 2 kilometers for non-repeated data transmission at 40 Mbps.

header: A collection of control information transmitted at the beginning of a message, segment, datagram, packet, or block of data.

host: A data processing system that is connected to the network and with which devices on the network communicate. In the context of Internet Protocol (IP), a host is any addressable node on the network; an IP router has more than one host address.

Internet Protocol (IP): A protocol suite operating within the Internet as defined by the *Requests For Comment* (RFC). This may also refer to the network layer (level 3) of this protocol stack (the layer concerned with routing datagrams from network to network).

ISO: Acronym for International Standards Organization.

link: (1) A joining of any kind of DX networks. (2) The communications facility used to interconnect two trunks/busses on a network.

Network Configuration Table (NCT): An internal data structure that is used by the NETEX configuration manager program to store all the information describing the network.

Network Configuration Table Loader (NCTL): An interactive NetEx application program used for configuring local or remote DX NetEx boards, updating their NetEx configuration parameters and/or Network Control Table. The NCT Loader takes a pamfile created by the Configuration Manager and transfers it to the NetEx Coprocessor through a NetEx connection.

NETwork EXecutive (NetEx): A family of software designed to enable two or more application programs on heterogeneous host systems to communicate. NetEx is tailored to each supported operating system, but can communicate with any other supported NetEx, regardless of operating system.

NetEx can reside on the host, on a processor interface board (obsolete), in a DX unit (obsolete), or in a NESi-Gate adapter. The latter three cases use host-resident drivers as interfaces.

NetEx is a registered trademark of Network Executive Software.

Open Systems Interconnection (OSI): A seven-layer protocol stack defining a model for communications among components (computers, devices, people, etcetera) of a distributed network. OSI was defined by the ISO.

processor interface (PI): A PI interfaces a minicomputer with an adapter. The PI is a board(s) that contains a microprocessor and memory. The processor interface is generally installed in the host. Some types of PIs contain NetEx.

path: A route that can reach a specific host or group of devices.

TCP/IP: An acronym for Transmission Control Protocol/Internet Protocol. These communication protocols provide the mechanism for inter-network communications, especially on the Internet. The protocols are hardware-independent. They are described and updated through *Requests For Comment* (RFC). IP corresponds to the OSI network layer 3, TCP to layers 4 and 5.

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Chapter 1: Introduction

Network Executive Software's NetEx/IP™ allows two or more application programs (which may be on different host computers) to communicate with each other at multi-megabit speeds. The NetEx/IP family of software consists of different versions of NetEx/IP for use with different operating systems, such as the versions for use with the various UNIX operating system hosts. All of these versions provide a common high-level interface to simplify programming requirements. NetEx/IP utility programs are also available, such as the Bulk File Transfer (BFX™), Print File Transfer (PFX™), and USER-Access® utilities.

NetEx/IP Characteristics

NetEx/IP centralizes network considerations for networks such as HYPERchannel, FDDI or Ethernet, into a single piece of software. The following sections describe the characteristics of the NetEx/IP software.

- External interface
- Internal interaction
- NetEx/IP connections
- Design flow efficiency and flexibility
- Block segmenting
- Alternate Path Retry
- Basic I/O flow
- Remote operator interface

External Interface

The NetEx/IP external interface for the application programmer is common for all versions of NetEx/IP. NetEx/IP provides requests for use in the programs that call NetEx/IP. These calling programs may be written in C or other high-level languages. NetEx/IP programs written in high-level languages may be transported from one host to another, with some changes to account for different word sizes and other machine architecture variations.

NetEx/IP also provides an operator interface that monitors and controls certain NetEx/IP functions.

Internal Interaction

The internal operation of all supported versions of NetEx/IP are consistent and allow the different versions to interact freely. Thus, any program using NetEx/IP may communicate with any other program on the network that is also using NetEx/IP.

To facilitate communication between hosts of different manufacture, NetEx/IP supports code conversion. NetEx/IP can call on HYPERchannel adapters or DXEs to do code conversions and data assembly/disassembly, even if the sending adapter has that option installed. NetEx/IP software can perform code conversion, if HYPERchannel code conversion hardware is not installed.

NetEx/IP Connections

To communicate using NetEx/IP, two calling programs first form a connection using a handshake protocol. NetEx/IP then allows this pair of programs to communicate.

NetEx/IP can establish multiple connections at one time, and can allow one program to have multiple connections simultaneously.

NetEx/IP also supports communications within a single host. A calling program may connect to another calling program in the same host and exchange information just as if network communications were taking place.

Design Efficiency and Flexibility

The NetEx/IP design enables many applications on the same processor to share the use of the network facility. Programs calling NetEx/IP can be written without regard to the other programs calling NetEx/IP or other Network Executive Software device drivers.

Once NetEx/IP accepts data from the caller, NetEx/IP must deliver the data to its destination. The NetEx/IP subsystem on each host handles flow control, error recovery, and any other special considerations such as satellite links.

NetEx/IP optimizes data transfer throughput using a high degree of parallelism. That is, under normal circumstances, simultaneous adapter I/O, NetEx/IP buffer management, and user file I/O all take place concurrently. This means that the effective data transfer rate is as fast as possible (in the multi-megabit range).

Block Segmenting

NetEx/IP products provide block segmenting at the transport layer. NetEx/IP divides data into segments of a specified size for transmission across the network and reassembles the segments on the remote host before delivering the data to the session layer calling program on the remote NetEx/IP. This segmenting is transparent to the session user but provides control of the transmitted block segment size. This is especially useful for satellite communication.

Alternate Path Retry

Alternate Path Retry (APR) provides the capability for connections to automatically reroute on different network paths when a failure on a path is detected. This rerouting takes place with no loss of data. Alternate path retry is provided as part of the type 2 protocol supplied with current NetEx/IP versions. For more information on APR, refer to the *"C" Configuration Manager and NETEX Alternate Path Retry (APR) User Guide*.

Remote Operator Interface

This version of NetEx/IP provides a remote operator interface that allows users to issue NetEx/IP operator commands to other defined NetEx/IP hosts on the network. Other users may also be the remote operator for this NetEx/IP. See "REMOTE Command" for more information. Security features are provided.

New Features

NetEx/IP release 6.0 continues to provide support for standard IP networks that was introduced in Release 5.0. Release 6.0 enhances this support by introducing NetEx/IP protocol extensions (referred to as Type 4 protocol), that provide the ability for NetEx/IP to dynamically maximize the network performance, based on factors such as available bandwidth, distance, and workload on the network.

Basic I/O Flow

Figure 1 shows the basic I/O flow between two programs using host based NetEx/IP. The calling program communicates with NetEx/IP through the NetEx/IP user interface. NetEx/IP then uses the available network hardware to communicate with the calling program on the other processor.

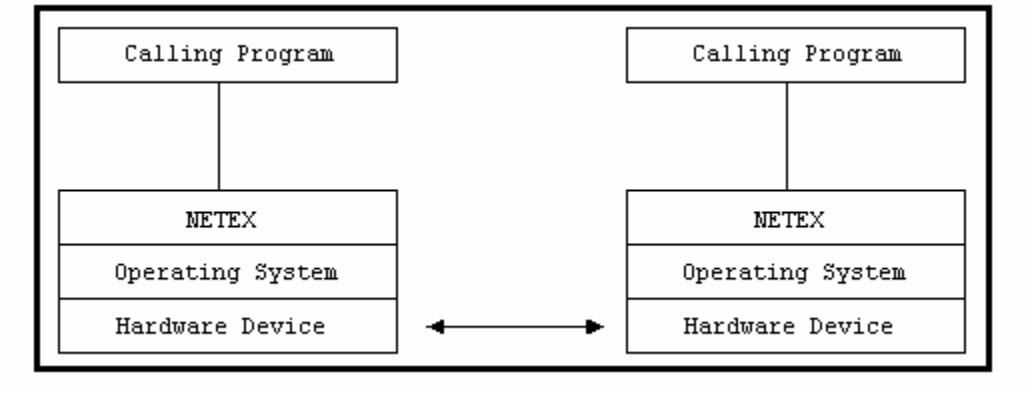


Figure 1. Basic I/O Flow

Host Based NetEx

Host based NetEx exists on the machine as a subsystem (a separate program residing in a machine that all other users in the machine can call on to perform services). User tasks produce a NetEx request that is delivered to the independent NetEx program using an inter-task communications facility provided by the host operating system. Data is moved so it is present in the NetEx program and the I/O is performed in the NetEx program.

Host based NetEx provides an administrative capability to the system programmers and system managers. Since all I/O is performed by the NetEx program, no data can be introduced on the network without first being checked by NetEx.

Host Based NetEx/IP

NetEx/IP release 6.0 provides support for communicating over standard IP networks. No changes are required to existing NetEx applications, since the Application Programming Interfaces (API's) have not been changed.

UNIX NetEx/IP software supports HYPERchannel networks in addition to IP networks. This means that migrating to a NetEx/IP network does not require all NetEx hosts and the network to be upgraded at the same time. One possible implementation scenario is to install NetEx/IP software on as many hosts as possible, but then continue using the HYPERchannel network. As subsequent schedules and requirements are defined, individual network segments can be staged for migration from HYPERchannel-based networks to IP-based networks in a planned manner.

DX NetEx

The DX NetEx product is similar to CP NetEx in that NetEx processing is removed from the host. The NetEx program resides on the PDNT3 Coprocessor board in the DX/E. Only the Hxx7 DX NetEx or Hxx7R NetEx

Requester user interface program resides on the host. In this implementation, H267x (and the Compaq OpenVMS TCP/IP product) or H367x (and the Compaq Guardian TCP/IP product) is used for transport of NetEx requests and buffers between H267x or H367x and the host and the DX/E.

NESiGate Offload NetEx/IP

This NetEx/IP product is similar to the DX NetEx product in that processing is removed from the host. The NetEx/IP program resides as either LAN Offload or Channel Offload software running in the NESiGate adapter. Only the Hxx7IP NetEx Requester user interface program resides on the host. In this implementation, H267IP the Compaq OpenVMS TCP/IP product, or H367IP the Compaq Guardian TCPIP product, is used for transport of NetEx requests and buffers between the H267IP (or H367IP) host and the NESiGate adapter.

Chapter 2: NetEx/IP and the ISO Model

In creating NetEx/IP, Network Executive Software followed the guidelines set by the International Standards Organization (ISO) for Open Systems Interconnection (OSI). Open Systems Interconnection refers to the exchange of information among terminal devices, computers, people, and networks, that are open to communication with one another.

The ISO model is composed of seven layers. Each layer interacts only with adjacent layers in the model (see Table 1). By using this modular structure, the internal function of each layer is self-contained and does not affect the functioning of other layers.

Table 1. ISO Model

Layer	Major Functions
Application	High level description of data to be transferred and the destination involved
Presentation	Select data formats and syntax
Session	Establish session connection, report exceptions, and select routing
Transport	Manage data transfer and provide NetEx/IP-to-NetEx/IP message delivery
Network	Point-to-point transfer, error detection, and error recovery
Data Link	Data link connection, error checking, and protocols
Physical	Mechanical and electrical protocols and interfaces

Although each layer physically interacts only with adjacent layers, each layer appears to communicate directly with the corresponding layer of the other model. Figure 2 illustrates this concept.

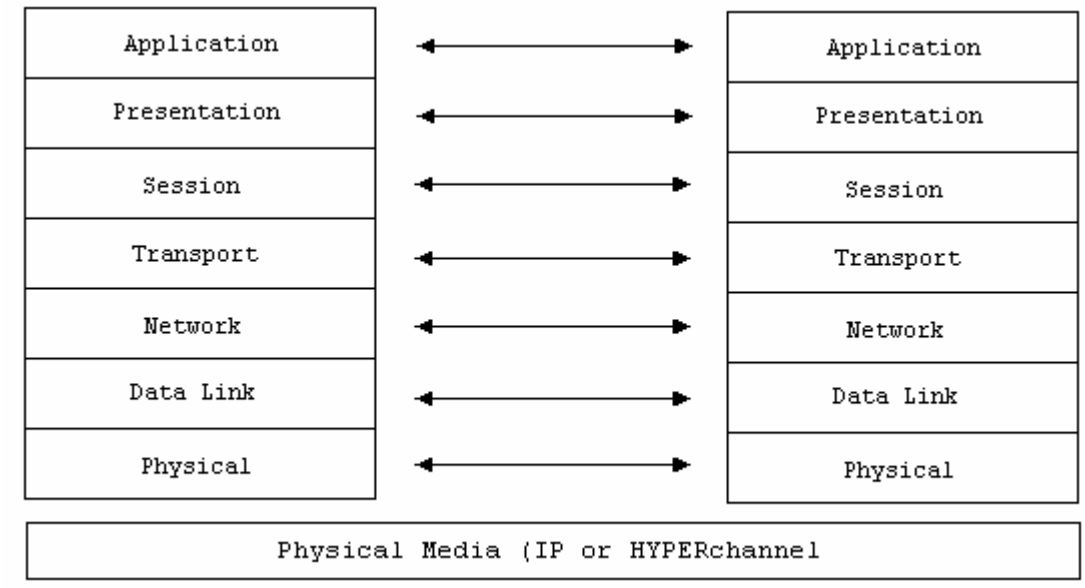


Figure 2. ISO Model Communication

Note: The corresponding layers appear to communicate directly as indicated by the lines with arrows, but actually they communicate only by progressing down through the layers of one model, through the physical media, and up through the layers of the other model.

Figure 3 shows that the hardware and firmware form the lower two layers. NetEx/IP and the driver comprise the next three layers. The NetEx/IP software provides complete session, transport, and network layer interfaces. This leaves the user free to write the application programs that use NetEx/IP or to use Network Executive Software utilities.

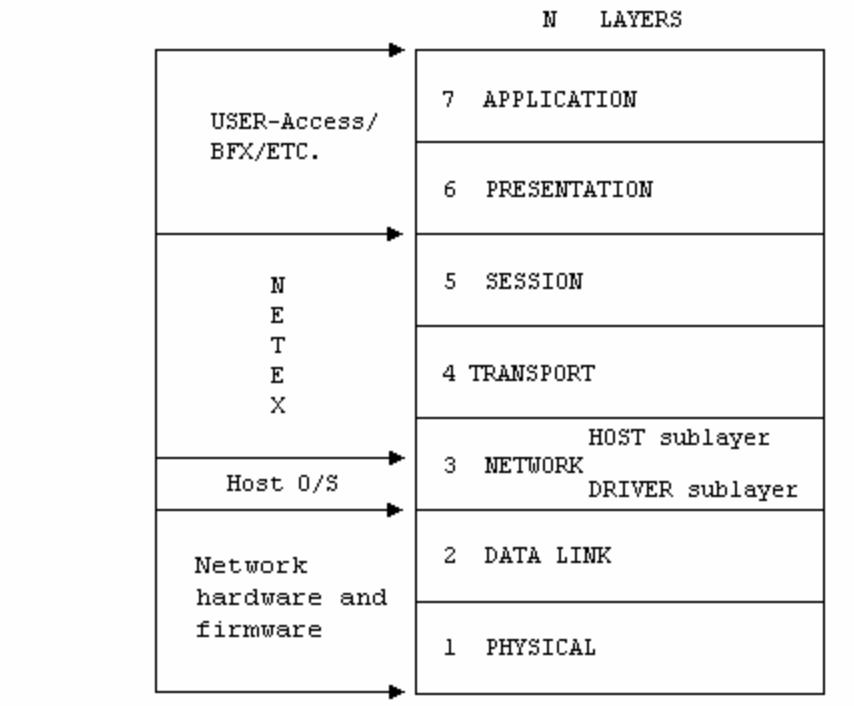


Figure 3. NetEx/IP and the ISO Model

Session Layer Services

As the highest layer within NetEx/IP (referring to the ISO model in Figure 3), the NetEx/IP session layer software provides the general interface to the user's application/utility program. The NetEx/IP session layer services include: program-to-program connection using the best available network path, reading data, writing data, disconnection, and statistics gathering. The user requests these services using a standard NetEx/IP Request Block (NRB) (containing parameters), and the NetEx/IP requests described in "NetEx/IP Session Services". The session layer software implements user requests by requesting services from the underlying transport layer.

Transport Layer Services

The transport layer provides the actual data movement services for NetEx/IP. This is an internal layer used only by the session service code, not the end user. It transmits and receives user data, along with internal protocol information, to provide fast, efficient communications over the network. The transport layer accom-

plishes its function by performing services for the session layer software above it and by requesting services of the network layer below it.

The transport software manages the network path chosen by the session software. The session user does not need to be concerned with the actual hardware and software used to transmit data, nor with NetEx/IP-to-NetEx/IP message delivery. The transport layer sets up hardware and software tables, provides buffering, and establishes linkages to manage the flow of information. Also, the protocol used by the transport layer software provides true full-duplex communications between subsystems, permitting asynchronous reads and writes. Because the transport layer provides a full-duplex operation, data can flow continuously, as long as it is being supplied by the user. This keeps the communications link as busy as possible and assures timely arrival of data to the user.

Network Layer Services

The network layer software provides link independence for the higher layers of NetEx/IP and assumes responsibility for keeping the network interfaces busy. This is an internal layer used only by the internal transport service, not the end user. The network layer formats the message proper to route the data through the network. If the protocol information overflows the HYPERchannel message proper, the network layer splits the data transmissions into two driver requests. The network layer also multiplexes network connections over common driver connections and manages those driver connections.

Driver Sublayer Services

The driver sublayer software is the interface between the network sublayer and the physical network device. The driver converts network sublayer I/O for a particular network path into a form which is understandable to the devices. The driver delivers and receives network messages and associated data to and from the network adapters. The driver also allows retry and error recovery for network adapters, supports assembly/disassembly, and code conversion options, if these are provided by the adapter type and requested by the user's data mode parameter.

Chapter 3: NetEx/IP Session Services

The user interface to NetEx/IP is a library that provides the user with access to the session and driver layer functions of NetEx/IP. Programming at the other levels of NetEx/IP (transport or network) is not supported.

To communicate using the session layer of NetEx/IP, the calling programs (that is, the programs that are calling NetEx/IP) must first establish a session connection. Once the session is established, data transfer may take place in a variety of ways, depending on the needs of the calling programs. One important feature of NetEx/IP is that the transport uses internal error checking and error recovery procedures. Once NetEx/IP accepts data, at the session or transport level, the user is assured of its delivery (with the possible exception of catastrophic failures – for example, a machine going down or a major problem with the communication line). Sessions may be terminated by either of the parties at any time, although this should be done by mutual agreement.

This chapter explains the concepts of session layer intertask communication using NetEx/IP. The following topics are discussed in this section:

- Session layer requests
- General concept of a session
- Establishing a session
- Data transfer process
- Terminating a session
- Handling multiple connections
- Satellite communication
- Error Recovery procedures
- Code Conversion

Session Layer Requests

There are eight requests used by programs to call NetEx/IP at the session level. These requests must be issued in a logical order according to rules described in the following paragraphs. These requests and a table called the NetEx Request Block (NRB) are the programmer's interface to NetEx/IP. The NRB is updated by the calling program when the program issues requests (either directly or via NetEx/IP), and it is updated by NetEx/IP when requests are completed by NetEx/IP. The NRB is described in the chapter "Chapter 4: NetEx Request Block".

The NetEx/IP session requests, listed in the approximate order in which they are issued, are as follows.

SOFFER

This command makes a calling program using NetEx/IP available to another program on either a remote or local host.

SCONNECT

This command requests a session with a calling program that previously issued an SOFFER. The program may insert values defining characteristics of the upcoming session in the NRB when this re-

quest is issued. This request may also write data to the offering program provided this data does not exceed the maximum segment size specified on either the sending or receiving NetEx/IP.

SCONFIRM

This command is the last step to establish the session. The host which initially issued the SOFFER replies to a SCONNECT with the SCONFIRM request if the characteristics of the session (for example, data block size, etcetera) specified in the SCONNECT are accepted. This request may also write data to the connecting program provided this data does not exceed the maximum segment size specified on either the sending or receiving NetEx/IP.

SWRITE

This command sends data to the other program. The SWRITE request may only be used after a session has been properly established. The SWRITE request is an asynchronous service (the user is free to continue when NetEx/IP accepts the SWRITE). A datamode may be specified to invoke code conversion and data assembly or disassembly.

SREAD

This command receives data that has been written by another program. The SREAD request is also used to accept indicators such as SCONFIRM, and DISCONNECT. The SREAD request is an asynchronous service, so the user may continue when NetEx/IP accepts the SREAD Request.

SWAIT

This command is specified as part of a request or as a separate request, SWAIT suspends processing on the issuing program until NetEx/IP completes the specified request(s). For SWRITE, SCLOSE, SCONNECT, SCONFIRM, or SDISCONNECT requests, NetEx/IP accepts the request quickly and the issuing program can consider the request complete. For SREAD and SOFFER requests, the request does not complete until the other program issues a SWRITE, SCLOSE, SCONNECT, SCONFIRM, or SDISCONNECT request.

SCLOSE

This command is the last write operation for a connection. The SCLOSE request is issued to gracefully terminate a connection. It may contain data just like a WRITE request, but it also indicates that the sender is ready to terminate the connection. After the SCLOSE is issued, incoming data may continue to be read, but no other messages may be written. When the other party in the connection issues an SCLOSE, the session is terminated.

SDISCONNECT

This command immediately terminates a connected session. The SDISCONNECT request may be issued by either program at any time.

These request are used during the session as described in the following paragraphs.

General Concept of a Session

Before explaining in detail how each part of a session is programmed, the next paragraph explains the general concept of a simple NetEx/IP session.

Figure 4 shows a sample system configuration. Figure 5 is a simplified example of a session where one program reads data from another.

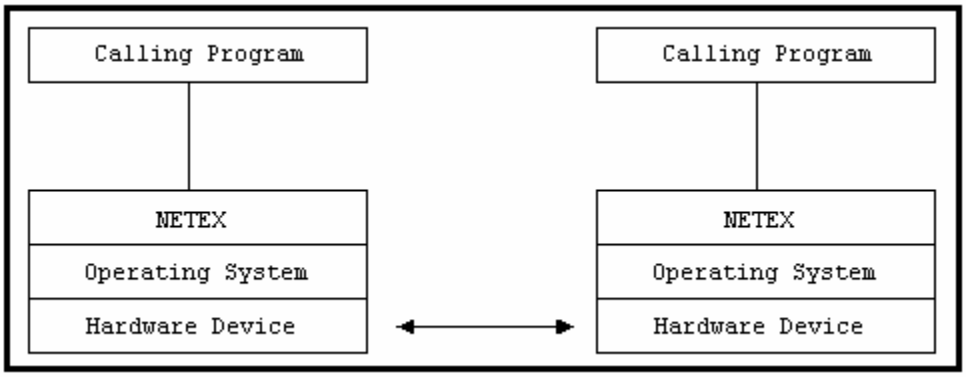


Figure 4. Sample System Configuration

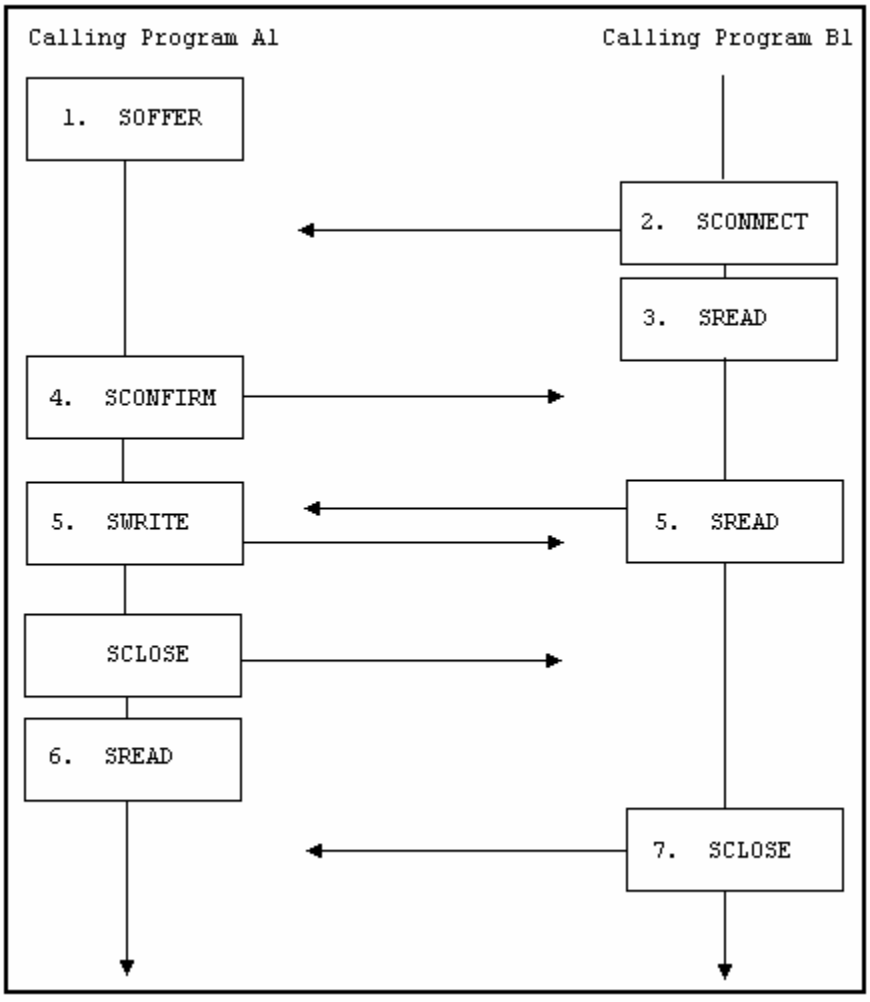


Figure 5. Simplified Session Example

The following text describes the session flow shown here in Figure 5:

1. Calling program A1 in host A issues an SOFFER indicating that it is available to service other calling programs.

2. Calling program B1 requires a file controlled by program A1. To initiate a data transfer session, program B1 issues an SCONNECT request. This request may contain data to be delivered to the offering program.
3. When the SCONNECT completes (is accepted by NetEx/IP), program B1 issues an SREAD to prepare to receive program A1's response to the SCONNECT. (Since the SCONNECT can also transport data, program B1 could issue an SDISCONNECT and terminate the session immediately. In that case, B1 would not know the status of the data transmitted.)
4. When the SCONNECT is received by the NetEx/IP in A1's host, the SOFFER completes with a Connect Indication and with B1's SCONNECT data in the buffer associated with A1's SOFFER. If program A1 finds the conditions associated with the SCONNECT acceptable, it responds by returning an SCONFIRM request.

   If the program A1 finds any conditions associated with the SCONNECT to be unacceptable, it would SDISCONNECT the session and may return data specifying the reason for the SDISCONNECT. For example, if one program determines the other program does not have the proper security code for data in that database, the session may be disconnected (SDISCONNECT).

   The SREAD that program B1 previously issued now indicated program A1's response. If program A1 issued an SCONFIRM, the SREAD will show a Confirm indication along with the data sent with the SCONFIRM. If program A1 issued an SDISCONNECT, the SREAD will complete with a Disconnect indication.
5. The programs may now begin the data transfer. Program B1 issues an SREAD to prepare to receive data from program A1. Program A1 writes data to program B1. The SWRITE command is used until the last data is written. An SCLOSE is used to write the last data. Since we are only issuing one write request in this example, the SCLOSE is used.
6. After completion of the last data transfer, program A1 issues an SREAD to detect program B1's next request.
7. Program B1 issues an SCLOSE and the session is terminated. Both programs may perform disconnect functions (for example, closing files, etcetera). Program A1 could then SOFFER itself as ready for another session.

This is a simplified example of a session. The following sections describe how to program NETEX by describing (in detail) establishing a session, data transfer and terminating a session.

Establishing a Session

Figure 6 is a flow chart showing how a connection is established using the session layer interface. Only steps which may occur in a normal process are shown in the figure. Other possibilities that are less likely to occur are discussed in the accompanying text.

Figure 6 refers to the NRB. The NRB (discussed in chapter 4, NetEx Request Block) is a block of parameters used to signal requests to NetEx/IP and to return status to programs.

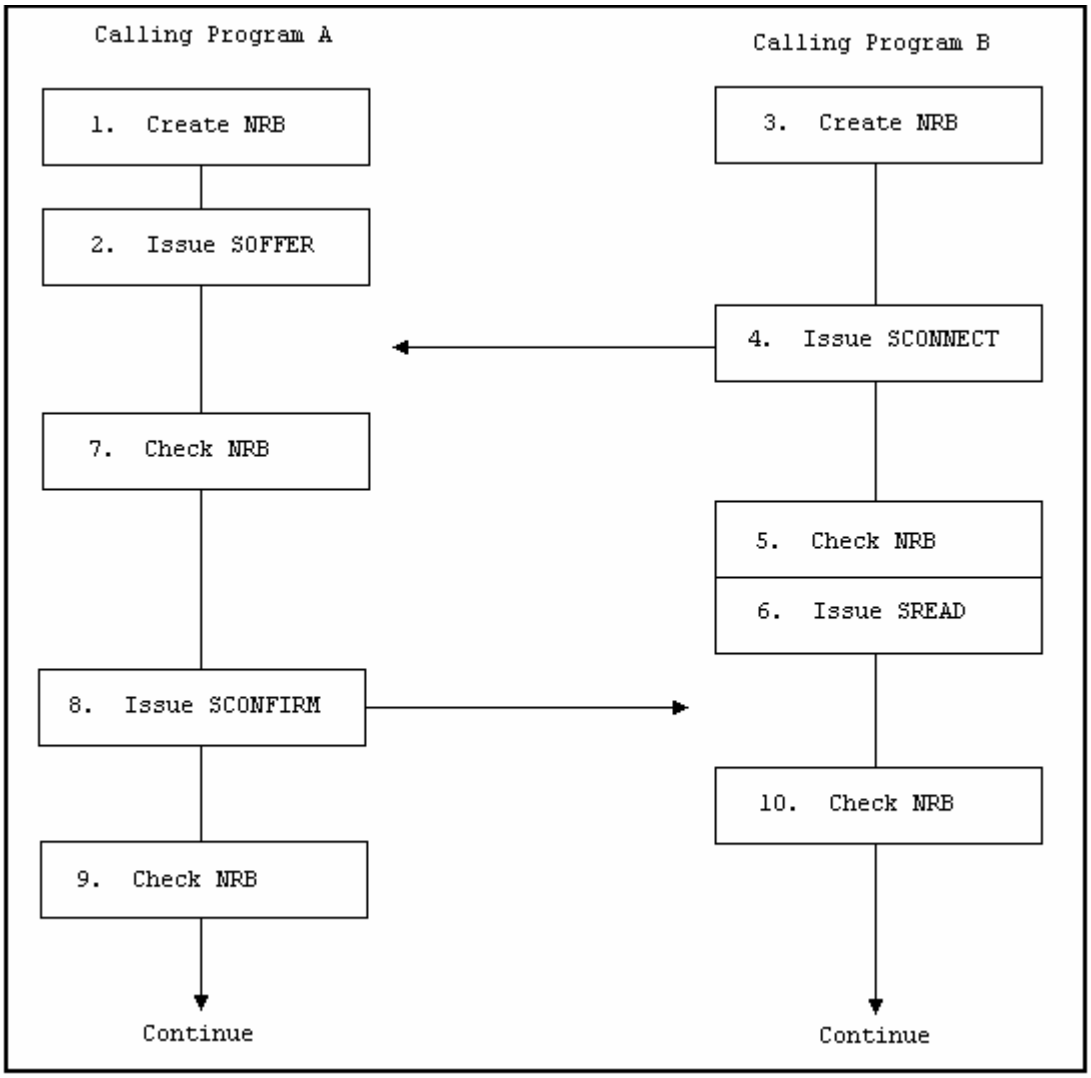


Figure 6. Establishing a Connection

The following numbered items refer to the steps in Figure 6. The steps are numbered to simplify the discussion and do not necessarily represent the exact order in which the events occur.

1. Program A prepares for the session by opening files and creating an NRB.
2. Program A issues an SOFFER to make it available to other NetEx/IP programs. The SOFFER may specify a data area for data associated with an upcoming SCONNECT.
3. Program B is a program that needs to establish a session with program A. Program B must first open files and create its own NRB.
4. Program B then issues an SCONNECT. The SCONNECT may contain such data as a password.
5. Program B then checks the NRB to determine the status of a request. The NRB indicates whether a request is in progress, whether a request has completed successfully, or whether the request has generated an error.

   Figure 6 continues assuming the NRB indicated normal completion. If the NRB indicates that a request is in progress, it would have to be rechecked after a short delay. If the NRB indicates an error, the error

code would be logged and the session would not be established. The calling program should then either try again to establish a session, or should act appropriately (such as closing files that were opened before the session was attempted).

6. Program B expects program A to respond to the SCONNECT with an SCONFIRM or an SDISCONNECT. Program B issues an SREAD which would detect program A's response.
7. Program A checks its NRB to see whether the SOFFER completes. The NRB indicates that program B has issued an SCONNECT.

   If the NRB indicates that an error occurred, program A would act appropriately (which could be disconnecting from this session and reissuing the SOFFER).

   A password may be required at this time. The password could be sent as data associated with the SCONNECT. After the SCONNECT is received, the password is examined. The password could be used to restrict access to certain files, restrict access by certain programs, or have other customized uses. If a program attempts to access restricted files or has an incorrect password, program A may issue an SDISCONNECT and terminate the session.
8. If all conditions associated with the SCONNECT are acceptable, program A issues an SCONFIRM to establish the session. The SCONFIRM may contain data.
9. Program A checks the NRB to make sure that the SCONFIRM was accepted by NetEx/IP. If it was, program A would continue with the session. If NetEx/IP did not accept the SCONFIRM, program A would either retry issuing the SCONFIRM or take other appropriate action.
10. Program B checks the NRB to determine if the SREAD has successfully completed and to see what call program A issued. If program A had responded with an SCONFIRM, program B would continue with the session. If program A had responded with an SDISCONNECT, program B would have to examine the reason code associated with the SDISCONNECT, and take the appropriate action.

The previous discussion outlines the rules to be followed when establishing a NetEx/IP session. It also introduces the concept of using the NRB for communication with NetEx/IP. After requests are issued, the NRB is examined to see when NetEx/IP completes the request. This may be done using the SWAIT request, or by periodically checking the NRB fields. The NRB fields are discussed in "Chapter 4: NetEx Request Block".

Data Transfer

Unlike rules for establishing a session, NetEx/IP provides a great deal of flexibility in how session requests are used for the data transfer process. The following paragraphs describe two methods for programming data transfer. The first method is a basic data transfer technique, the second uses the more advanced technique of concurrent SWRITE and SREAD requests.

Write/Read Data Transfer

The following paragraphs describe the session requests that are used to transfer data in a straight-forward way. In general, calling programs use the SREAD and SWRITE requests to perform the data transfer. Figure 7 shows how the calling programs perform the data transfer. SWRITE requests are issued by one program which must be received by an SREAD issued by the other program.

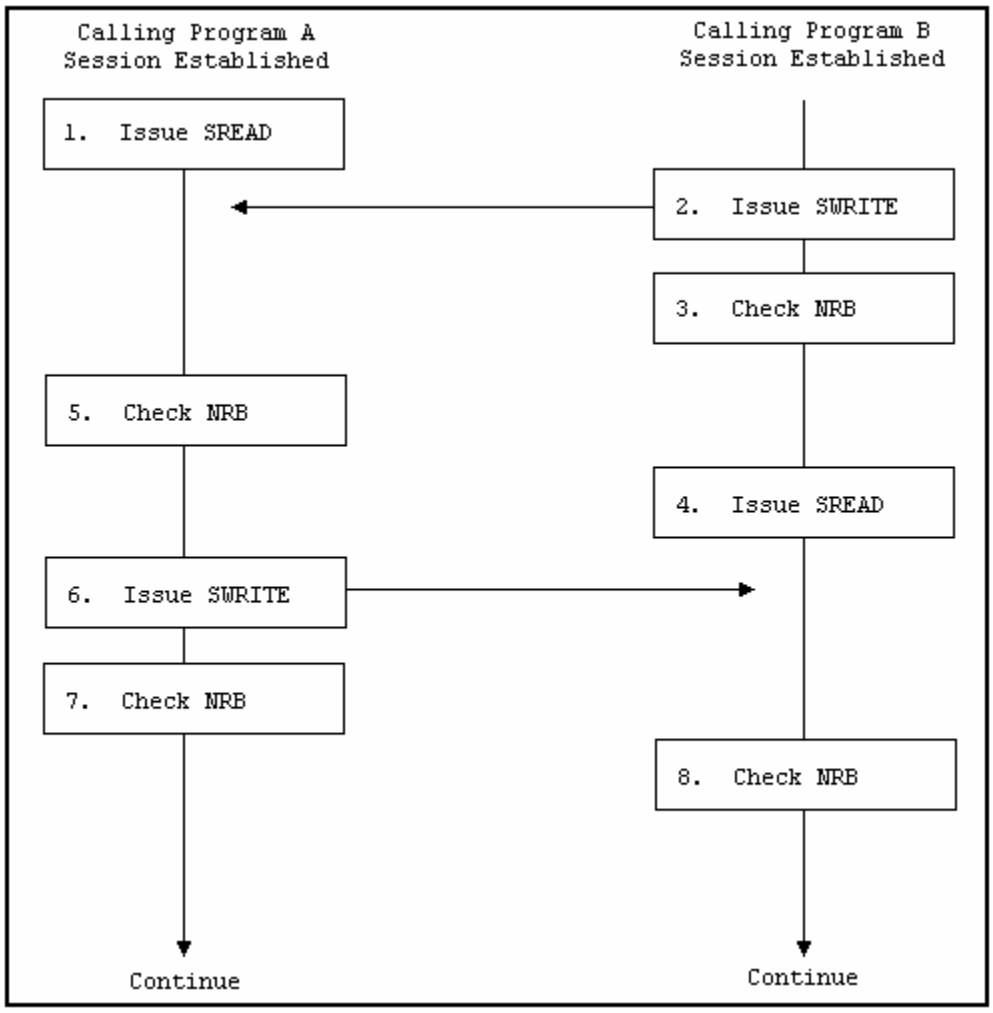


Figure 7. Write/Read Data Transfer

The following numbered items describe the steps in Figure 7. The steps are numbered to simplify the discussion and do not necessarily represent the exact order in which the events occur.

1. After a session has been established, program A issues an SREAD. The SREAD specifies the buffer for receiving data.
2. Program B issues an SWRITE. The SWRITE specifies where the data to be written is located and how long it is.
3. Program B checks the NRB to see if NetEx/IP accepted the SWRITE or indicated an error.

   Once NetEx/IP has accepted the data, it will deliver the data unless a catastrophic loss of connection occurs.
4. Program B issues an SREAD to detect program A's next request.
5. Program A received an updated NRB which indicates what program B has issued. In this case, program B has written data as program A expected. If the NRB word indicated an error, program A would act appropriately.

   If program B issued an SDISCONNECT, program A would check the reason for the SDISCONNECT and act appropriately.

6. Program A is programmed to SWRITE some data back to program B. Program A issues an SWRITE specifying the location of the data to be written.
7. Program A verifies that NetEx/IP accepted the SWRITE by checking the NRB. If the NRB indicates the SWRITE was not accepted, program A would act appropriately.
8. Program B checks the NRB and determines what program A issued.

   Both programs continue with the data transfer until they have completed their functions.

As when establishing a session, the SWAIT request may be used with other requests. Abnormal terminations are discussed later in this chapter.

Concurrent Write and Read Data Transfer

A more advanced method of data transfer uses read and write requests that are issued without expecting the other calling program to respond immediately. This type of technique is useful for long distance communications, but is also well-suited for local data transfer.

Because NetEx/IP will only accept one request using a specific NRB, two NRBs must be created by each program to perform concurrent read and writes. One NRB is used to establish the session, as previously described, and a second is created before data transfer begins. The second NRB must be created as a copy of the first to ensure that NetEx/IP internal words are preserved.

Figure 8 shows how the programs perform the data transfer. As an example of what work the program is doing, consider the following. Program A first requests data from Program B. Program B then writes data until program A writes an acknowledgement or another message. Notice that program A does not respond to every SWRITE issued by program B. When program A has received what it needs, it terminates the session using the termination procedure discussed later in this chapter.

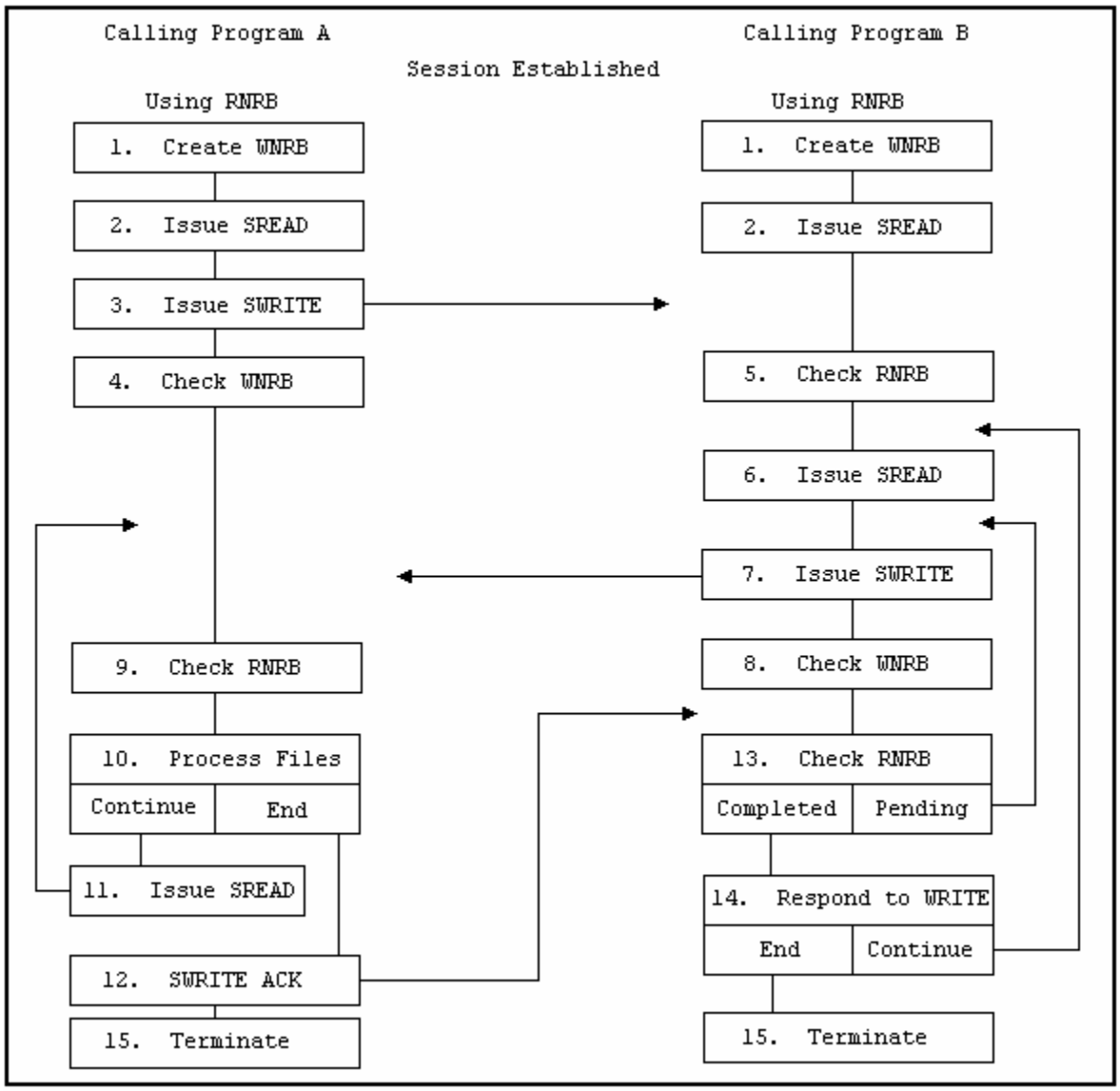


Figure 8. Concurrent SREAD and SWRITE Requests

The following numbered items describe the steps in Figure 8. The steps are numbered to simplify the discussion and do not necessarily represent the exact order which the event occur.

1. After a session has been established, both programs create duplicate NRBs for the SWRITE requests. The NRBs created before the sessions were established are assumed to have been called RNRB, and will be used with SREAD requests. New NRBs called WNRB are duplicates of the RNRB that will be used with the SWRITE requests.
2. Both programs issue an SREAD request to prepare to receive request from the other program. The RNRB is specified in the SREADs as the place for NetEx/IP to respond to that request.
3. Program A issues an SWRITE to program B. The SWRITE contains a request for specific data from program B. The WNRB is specified in the SWRITE as the place for NetEx/IP to respond to that request.
4. Program A checks the WNRB to see if NetEx/IP accepted the SWRITE or indicated an error, and acts accordingly.

5. Program B, which has been checking the RNRB or waiting for it to complete, received the SWRITE from program A. This SWRITE contains parameters which program B will use to determine what data to send to program A.
6. Program B issues another SREAD that will be "floating" while processing continues.
7. Program B begins to SWRITE the data requested by program A. The WNRB is specified to monitor the SWRITE requests.
8. Program B checks the WNRB to make sure NetEx/IP accepted the SWRITE.
9. Program A checks its RNRB and discovers the SWRITE issued by program B.
10. Program A processes the files received. If program A has not yet received all the data it asked for in step 3 and wished to continue reading, it jumps to step 11. If program A wishes to respond to program B (to stop the transfer or to request other data), it jumps to step 12 and SWRITEs an appropriate message.
11. Program A issues an SREAD to continue receiving information from program B.
12. Program A SWRITEs an acknowledgement or a message to program B. Since program B has an SREAD floating, it will receive this SWRITE.
13. Program B checks the RNRB. If the SREAD has completed (meaning program A has written something), program B continues with step 14. If the SREAD is still pending (or floating), program B continues WRITING data to program A by jumping back to step 7.
14. Program B responds to program A's SWRITE. This response could include starting to transmit other data
15. The session is terminated normally when program A has received all the data it wanted, or by special request of one of the programs.

The previous example demonstrates the technique of using SREAD and SWRITE requests when using this technique.

One-Way Data Transfer

A typical use of NetEx/IP is a one-way data transfer. Figure 9 shows how a one-way data transfer could take place. Programs A and B establish a session as described earlier in this section. Program A, which will receive data, creates a single NRB. Program B, which will send data, creates an RNRB (for monitoring SREAD requests) and a duplicate WNRB (for monitoring SWRITE requests).

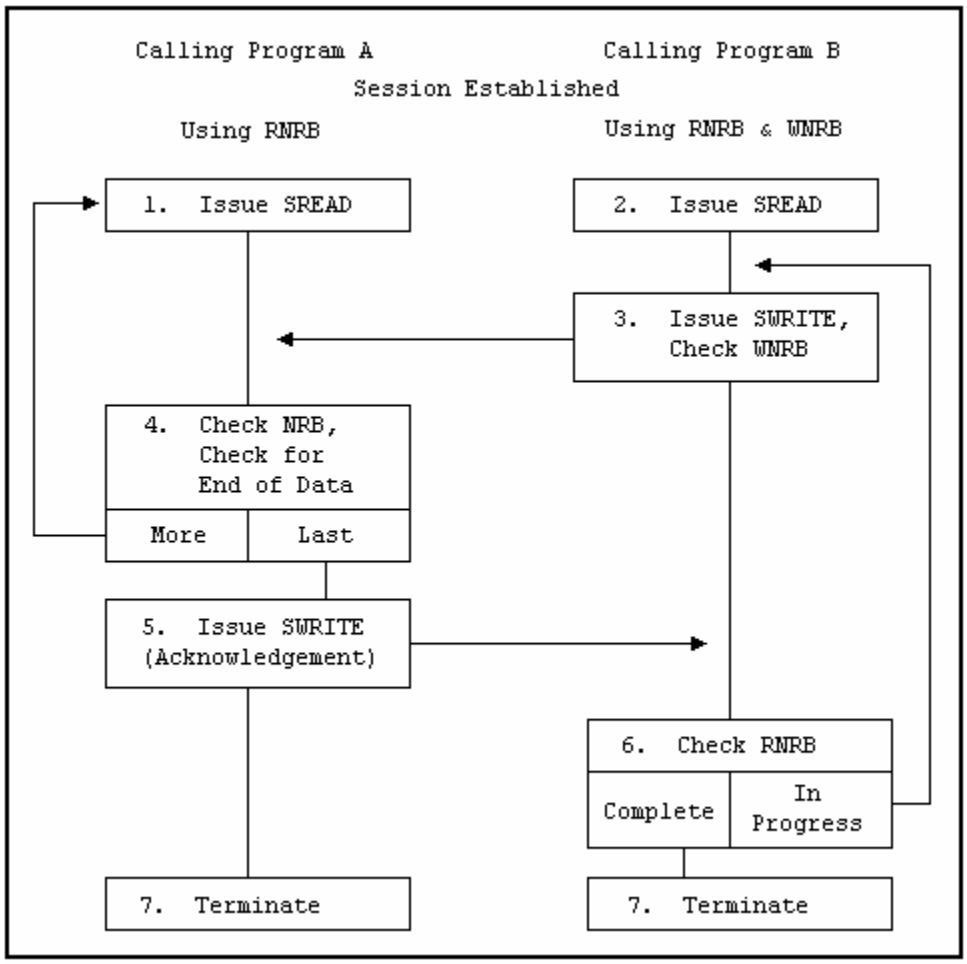


Figure 9. One-Way Data Transfer

The following numbered items describe the steps in Figure 9. The steps are numbered to simplify the discussion and do not necessarily represent the exact order in which the events occur.

1. Program A issues an SREAD request to prepare to receive data.
2. Program B issues an SREAD request to receive unexpected SWRITEs from program A. For example, if program A were unable to receive more data, it could notify program B using a previously determined set of indicators. Normally, this SREAD would not complete until all the information has been transferred.
3. Program B issues an SWRITE to transfer data to program A. An 'End of Data' indicator is placed in the data field with the last piece of information. Program B checks the WNRB to see if NetEx/IP accepted the SWRITE or indicated an error, and acts accordingly.
4. Program A checks the NRB to see if the SREAD completed. If it did not complete, program A continues to check it. When the SREAD completes, program A processes the incoming information, and checks for the 'End of Data' indicator. If there is more data coming (indicator not set), program A issues another SREAD (step 1). If this is the last piece of information, program A continues with step 5.
5. Program A issues an SWRITE acknowledging that all of the information has been received. (NetEx/IP has verified the integrity of the data.)
6. Program B checks the RNRB. If it is still in progress (because program A has not written anything), program B jumps back to step 3 and SWRITEs more data. If all data has been written, program B will issue

an SWAIT to suspend execution until program A returns a response. When the RNRB completes, program B checks the data written by program A. Normally, this would be an acknowledgement of the last piece of data. In that case, program B would continue with step 7. If a problem is encountered, program B acts accordingly.

7. Program B terminates the session.

In the previous example, SWAIT requests may be used freely by program A, but should generally be used only after SWRITE requests by program B. An SWAIT could be issued by program B to wait on the RNRB after all data has been written.

Terminating A Session

NetEx/IP sessions can terminate either normally or abnormally. A normal termination is planned by the programs involved. An abnormal termination is any unplanned termination of the session.

Normal Termination

Figure 10 shows the exchange of session calls associated with normal (planned) termination. The steps are numbered to simplify the discussion and do not necessarily represent the exact order in which the events occur.

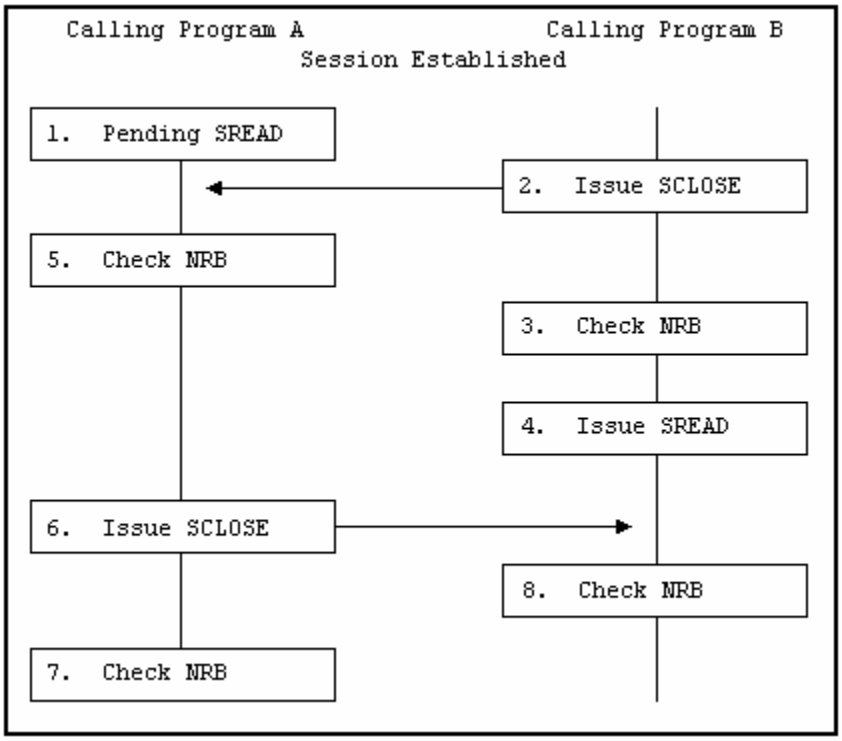


Figure 10. Normal Session Termination

The following numbered items refer to the steps in Figure 10.

1. Program A has a previously issued SREAD pending.
2. Program B issues an SCLOSE. The SCLOSE takes the same form as an SWRITE request.

3. Program B checks the NRB to verify that the SCLOSE was accepted by NetEx/IP. If it was accepted, program B may close output files or perform other termination processing. No other NetEx/IP write-type requests (except SDISCONNECT) may be issued by program B during this session. If the SCLOSE is not accepted, Program B must act appropriately (check if NetEx/IP is down or if the other application is not there).
4. Program B issues an SREAD. Program A may still write data to program B, or program A may issue an SCLOSE or an SDISCONNECT to terminate the session.
5. Program A detects the SCLOSE.
6. Program A issues an SCLOSE to terminate the session. Data may be associated with this request. Program A may issue any number of SWRITE requests before the SCLOSE.
7. Program A checks the NRB to make sure that the SCLOSE completed successfully. Program A closes files and performs other termination processing.
8. The SREAD issued by program B completes and the NRB indicates that the session has been terminated. Program B closes files and performs other termination processing.

Abnormal Session Termination

The program must be able to react to abnormal terminations. Sessions may be abnormally terminated by the other program or by NetEx/IP.

Sessions may be unexpectedly terminated by the other program for various reasons depending on how the program is written. Some typical reasons for immediate terminations are as follows:

- A program fails to provide the proper password or authorization for a session
- A program attempts to access data that it was not authorized to access.
- The program detected an internal failure such as a program check.
- A time limit was reached
- A program encountered problems issuing a request to NETEX.

Some of these problems may be overcome by reconnecting with the calling program.

NetEx/IP may terminate a session unexpectedly because of problems with the physical network or with a host computer. This type of error may not necessarily be solved by simply reconnecting with this host. Alternatives should be provided in the calling program.

Programming Notes

The following sections provide supplemental information intended to make programming NetEx/IP simpler:

- Handling Multiple Connections
- Service Wait Options
- Satellite Communication
- Error Recovery Procedures
- Code Conversion Options

Handling Multiple Connections

NetEx/IP provides the capability for a program to be simultaneously connected to more than one other calling program. Requests coming from different connections are identified using the NRBNREF word of the NRB. NRBNREF contains a unique number assigned to a connection when it is established. The capability to handle multiple connections enables the programmer to establish database server and requester programs.

Database server programs allow a network of hosts to use each other's databases. A database server program simply OFFERs itself to other hosts. When another host (requester) establishes a connection, the server SREADs or SWRITEs files to or from its database as specified by the requester.

Database server programs may issue multiple offers (SOFFER) by specifying a different NRB with each SOFFER. The offers (SOFFER) are completed in the order that they are issued. Many users on one machine may issue multiple OFFERs if each is generated as if it were an individual host.

Program B in the concurrent write/read example (Figure 8) is an example of a simple database server. Program B SWRITEs the files program A requests, and then waits for more instructions. More sophisticated database servers could allow themselves to connect to several requesters at one time.

Program A in Figure 8 is a simple example of a database requester.

Service WAIT Options

On each session call the user has the option to wait or not to wait for the request to complete. If the waiting is desired then the "W' form of the call should be used. The User Request Manager will issue the wait on the users' behalf and return control to the user when the NRB is posted.

The SWAIT request may be used to wait on a single NRB, a list of NRBs or may be used to wait on 0 NRBs. The way to use the wait request depends on the situation.

- If servicing a single connection where data moves logically in only one direction, use the wait option on the requests.
- If servicing multiple simultaneous connections, or a single connection where data flows both ways, use SWAIT(n) to wait on a list of NRBs.
- When servicing both NetEx/IP and real-time applications, use SWAIT(0) to wait on 0 NRBs, then check the real-time device. When issuing an SWAIT on 0 NRBs, check the NRBSTAT fields of the NRBs for the requests that you are interested in.
- NetEx/IP also needs to get control to update NRBs and send them back to the user through cross-memory services. Therefore, SWAIT(0) is important for host based NETEX.
- Another way to wait for any NRB to complete, without specifying each NRB on the call, is to use SWAIT(-1). This form of wait will return to the user only when an NRB has completed. This differs from SWAIT(0), which may return without an NRB completing.

The following points apply to waiting:

- A request cannot be marked complete until it is waited on.
- The NRB and the data buffer cannot be reused until the request is complete.

Satellite Communication

The standard NetEx/IP requests may be used when satellite communication facilities are a part of the network. NetEx/IP was designed and implemented with the capability to recover from errors and lost messages using protocols which make the solving of these problems transparent to the user.

IMPORTANT: Because of the long propagation delay inherent in the satellite subsystem (approximately 450ms round trip), the communications channel must be kept "full" of data. This is done by using concurrent SREADs and SWRITEs which transmit data in large amounts before having the writing application stop to wait for an acknowledgement from the reading application. In this way, data is transmitted rapidly and the propagation delay has less effect on performance. (This technique requires a large buffer area.)

For example, if the calling programs acknowledge every block written in one direction with a corresponding acknowledgement written in the other direction, the propagation delay would have major impact. But, if an entire file is transmitted before an acknowledgement is returned, the effect of the propagation delay is minimized.

Minimizing the effect of the delay in this manner must be balanced with the consideration that if there is a catastrophic failure of the link, NetEx/IP, or the other host, there is no way to know how much unacknowledged data was successfully received.

Determining the frequency of the checkpoint acknowledgements is an important consideration. This decision must be made by considering the needs of individual implementations.

NetEx/IP Error Recovery Procedures

Calling programs must be able to recover from errors identified by NetEx/IP. These errors will be returned when a NetEx/IP operation does not complete successfully. The following paragraphs describe the NetEx/IP error codes and some common error recovery procedures.

Error Codes

Whenever a NetEx/IP request is issued, the results of the request are returned in one or both of two NRB fields, NRBSTAT and NRBIND. These are located at the beginning of the NRB to make their subsequent examination by high level language programs a simple matter.

NRBSTAT indicates whether an operation is in progress and whether it completed successfully or not. NRBIND indicates the type of information that arrived as the result of a read-type command (SREAD or SOFFER).

When an operation is accepted by the NetEx/IP user interface, the value of NRBSTAT is set to the local value of –1. Thus, the sign of this word is an "operation in progress" flag for all implementations.

If an operation completed successfully, NRBSTAT will be returned as all zeroes. If a read-type command was issued, then an "indication" will be set in NRBIND when the SREAD completes.

If the operation did not complete successfully, the NRBSTAT will contain a standard error code. NRBSTAT is represented as a decimal number that is potentially as large as 2^{15} –1(32,767) The 2^{16} bit is not used so that it may remain an "in progress" flag for the 16 bit machines. The error codes are listed and described in appendix A.

Common Error Recovery Procedures

The following items are some commonly encountered errors and an explanation of how to recover from them.

- Other program not there – Operators or users must coordinate the running of the two NetEx/IP programs so that one has not timed out before the other has had a chance to establish a session.
- Other program busy – Retry NetEx/IP after a suitable delay.
- NetEx/IP requests out of sequence – Sessions must be completely established before write or read requests can be issued. Sessions are established using the offer, connect, and confirm requests in that order.

Code Conversion

NetEx/IP provides for common types of code conversion by using either StorageTek DXE hardware or NetEx/IP software facilities. The calling program uses the datamode (NRBDMODE) word of the NRB to specify either manual or automatic code conversion

If manual conversion is selected, the caller completely specifies which assembly/disassembly and code conversion functions will be used on both adapter output and adapter input. Then the caller must determine which assembly/disassembly modes and code conversion tables are meaningful to the adapters.

If automatic code conversion is selected, the caller simply specifies the source character set and the destination character set. NetEx/IP then uses any code conversion hardware that is available, and performs other code conversion using software when necessary.

Chapter 4: NetEx Request Block

The NetEx Request Block (NRB) is a block of parameters used to pass information between calling programs and NetEx/IP. The NRB is the means by which programs and NetEx/IP communicate with one another. The NRB is created by a calling program and may be updated by the program to pass information to NetEx/IP, or NetEx/IP may update the NRB to pass information to a program.

Each time a program makes a request to NetEx/IP, the program specifies an NRB to be associated with the request. NetEx/IP passes status information about that request back to the program via the NRB. Therefore, only one NetEx/IP request may use an NRB at one time. If concurrent read and write requests are used, or if a server program will be connected to more than one program at a time, several NRBs must be used.

The use of the NRB fields vary slightly between the different levels of programmer interface. Specific differences are described in the individual field descriptions that follow.

Rules for NRB Usage

The following principles are designed to make high level language usage of NetEx/IP somewhat transportable between machines.

- Before initiating a connection, the user must clear the NRB, including the OS dependent portion, to zeroes. When the connection is initiated, the user places whichever non-default values are needed in the user part of the NRB, and invokes NetEx/IP service. Once the connection is initiated, the user must not change the OS dependent part of the NRB between calls to NetEx/IP.
- If the calling program is using the connection in a full duplex manner, the user will need to make a copy of the NRB to produce a “read NRB” and a “write NRB.” This copying operation is the copying of all 40 words of the NRB to another area, at a time when the NRB being copied is not active. If a second request for the same connection is issued from the copied NRB, the user interface must detect the condition and handle the new part of the connection accordingly.
- Many NRB values are specified in addressable units. An addressable unit is the amount of information contained in one memory location for that machine. For example, a Unisys Computer Systems 2200 is 36 bits, IBM systems are generally eight bits, etc.
- For multi-threaded implementations, if a session is to be shared between threads, you must insure that each thread has its own copy(ies) of the NRB made while no NetEx/IP calls for that NRB are active. This rule may be broken only if you ‘gate’ the use of the NRB.
-

NRB Fields

Figure 11 shows the fields in the NRB. Most NRB fields are one long word (32 bits), or two words if the length is 16 bits. The NRB contains 40 fields.

Many of the NRB fields are, or could be, updated by either program or NetEx/IP with every request. However, the fields NRBCLASS, NRBMAXRT, NRBBLKI, NRBBLKO, NRBRSV, NRBOFFER, and NRBHOST are associated with the session negotiation process. Information in these fields is updated by NetEx/IP as their values change. These fields are initially specified during the OFFER and CONNECT re-

quests. When the SCONFIRM is sent, the negotiated values are set in the NRB associated with the read of the SCONFIRM information. Subsequent attempts to change these fields will have no effect.

NRB fields may be referenced by Assembler programs using the names shown in Figure 11 if the NTXNRB macro is used. Otherwise, the NRB fields must be referenced using the index numbers shown on the left side of Figure 11.

1	nrbstat	NetEx/IP request status returned to user
2	nrbind	Data type indication from OFFER/READ
3	nrblen	Length of data
4	nrbubit	Unused bit count
5	nrbreq	User request code
6	nrbnref	NetEx/IP reference number identifying connection
7	nrbbufa	Starting address of user's buffer
8	nrbbufl	Length of user's buffer
9	nrbdmode	Datamode for Write request
10	nrbtime	Request timeout in seconds
11	nrbclass	Class of service
12	nrbmaxrt	Maximum data rate permitted
13	nrbblki	Maximum buffer size for input requests
14	nrbblko	Maximum buffer size for output requests
15	nrbprota	Address of Odata
16	nrbprotl	Length of Odata
17	nrbresv1	Reserved
18	nrbresv2	Reserved
19	nrboffer	(Session Level) Offer name (8 bytes)
21	nrbhost	(Session Level) Remote hostname (8 bytes)
23	nrbresv3	Reserved
24	nrbuser	User field: not processed by NetEx/IP
25-40	nrbosd	Reserved (operating system dependent data)

Figure 11. NetEx Request Block (NRB) Words

The following paragraphs describe the fields in the NRB shown in Figure 11.

NRBSTAT

NRBSTAT contains a summary of the request issued by the user. If the request is currently in progress, the entire field contains a -1 (all ones). If the request completed successfully, the NRBSTAT is 0. If the request

was unsuccessful (NetEx/IP or the service routine detected an error), NRBSTAT contains a binary representation of a decimal error code. The meanings of the error codes are described in Appendix A.

The implementation user interface must be constructed so that a program polling NRBSTAT (to determine if the request as successful) proceeds to examine the error code if a positive value is found in NRBSTAT.

A request is marked complete only after one of the following conditions is met:

- A WAIT option was integrated into the service call.
- An SWAIT request has been issued where one of the NRBs on the SWAIT list is the NRB specified.
- Any NetEx/IP service call is issued, and the NetEx/IP service finds that the request has completed recently.

NRBIND

NRBIND indicates the type of data received in response to a read, offer, or status request. If any of those read-type requests are issued, NRBIND will always receive a nonzero value.

The values returned in NRBIND are defined as follows:

INDCONNECT (1) – Connect indication

INDCONFIRM (2) – Confirm indication

INDDATA (3) – Normal data indication

INDEXPDATA (4) – Expedited data

INDCLOSE (5) – Close indication

INDDISCONNECT (6) – Disconnect indication

INDSTATUS (7) – Status Indication

If a write-type request (write, connect, confirm, close, or disconnect) is issued, the returned value of NRBIND is usually zero. If an error is returned to the write-type request, that means the connection is broken or was never established. If an error is returned to the write-type request, then a Disconnect Indication (6) is set in NRBSTAT.

If an operation did not complete successfully, then NRBSTAT will be set to a positive, nonzero value. If NRBSTAT is nonzero, then NRBIND will have one of the following values:

- If the error results in the loss of the connection or the connection not being established in the first place, then a Disconnect Indication (6) will be in NRBIND.
- If the error means that the request could not be processed but the connection remains in effect, then NRBIND will be set to zero.

NRBLEN and NRBUBIT

NRBLEN and NRBUBIT together define the amount of useful data for input and output. NRBLEN specifies the number of addressable units that are needed to contain the data. NRBUBIT specifies the number of bits in the last addressable unit that are not significant information. This allows information to be sent on the network on a logical bit basis without damaging the data.

For example, suppose a Unisys computer wished to send exactly 75 of its 36-bit words to an IBM processor and wished it returned at a later date. The Unisys user would specify NRBLEN=75 and NRBUBIT=0. Datamode would be bit stream. NetEx/IP would record 75*36=2700 bits of information was sent over the net-

work. The IBM user would receive the information with NRBLEN=338 (bytes) (8*338=2704 bits) and NRBUBIT=4 (bits). The IBM user could later specify the same length parameters on output and return precisely 75 words back to the Unisys system.

Note: Those programs that do not need the NRBUBIT can simply ignore its existence, knowing that simply handling the information specified by NRBLEN will ensure that all information sent by the other machine will be stored or processed.

Transmitting or receiving zero-length information is possible. Zero-length data is treated as a separate transmission and is received at the other end in chronological order (as is any other data). On both the transmit and receive sides, NRBLEN will be set to zero.

If NRBUBIT is none-zero, the unused bits are not set to zero or any other value by NetEx/IP. The calling program must handle any "garbage" that may be placed in the last word of the transfer.

NRBREQ

NRBREQ is the request code that will be given to NetEx/IP. This is a 16-bit binary value that contains the type of request (example: SREAD) that NetEx/IP is to perform.

NRBREQ has the following format:

Option Flags refers to optional processing that NetEx/IP will perform on the request. These flags are bit significant. The bits are assigned (represented as hexadecimal numbers) as follows:

0xxx - Normal processing. NetEx/IP will return control to the caller as soon as it has internally queued the request.

1xxx to 7xxx - Reserved

8xxx - WAIT. NetEx/IP or the NetEx/IP user interface is not to return control to the user program until the request is complete.

9xxx to Fxxx - Reserved

Service Level indicates whether the request is a SESSION, TRANSPORT, NETWORK, or DRIVER type of request. The values are assigned (in hexadecimal) as follows:

x0xx - Session request

x1xx - Transport request

x2xx - Network request

x3xx - Driver request

x4xx to xExx - Reserved

xFxx - Reserved (affects Function values)

Function indicates the specific type of request to be issued. The values are assigned (in hexadecimal) as follows:

xx01 - Connect (valid for S, T, N, and D levels)

xx02 - Confirm (valid for S, T, N, and D levels)

xx03 - Write (valid for S, T, N, and D levels)

xx04 - Reserved

xx05 - Close (valid for S and T levels)

xx06 - Disconnect (valid for S, T, N, and D levels)

xx07 to xx80 - Reserved

xx81 - Offer (valid for S, T, and N levels)

xx82 - Read

xx83 - Status

xx84 to xxFF - Reserved

The total request code is produced by combining the Option, Function, and Service Level. For example, consider SREAD with wait processing. Wait processing is 8xxx, SREAD is a x0xx Service Level plus a xx82 Function. This totals a 8082_{16} request code.

NRBNREF

NRBNREF is the 16-bit, internal NetEx/IP identifier that distinguishes this connection from all others maintained by this copy of NetEx/IP. When initial connect or offer requests are made at the Driver level, this field must be filled in by the caller. If issued at the Session level, this value is assigned by NetEx/IP when a connection is established.

NRBBUFA

NRBBUFA contains the start of the data buffer to be used for either input or output requests. The user must supply a valid buffer address before each input or output request. For a write request, the contents of this buffer must be left unchanged until the associated NetEx/IP write type request has completed. If a read request is issued, then the contents of the buffer should be examined when the read request completes successfully.

NRBBUFL

On input, NRBBUFL specifies the maximum size of the Pdata (ordinary data) that NetEx/IP can store in the buffer. This field is effectively ignored on output (NRBLEN and NRBUBIT are used to determine the actual length of output data). This usage difference allows a NetEx/IP user to associate an NRB with a single buffer and never change this field even if many READs and WRITEs are issued. NRBBUFL is specified in addressable units.

NRBDMODE

NRBDMODE is specified by the transmitting NetEx/IP program on any write-type request (connect, confirm, write, close, or disconnect) that is issued at the session, transport, network, or driver level. It is always specified as a 16-bit quantity. Datamode is forwarded through all layers of NetEx/IP. When the receiving entity received the data, the datamode specified by the transmitter (with possible modifications as described below) is inserted into the NRB associated with the receiving SREAD or SOFFER request.

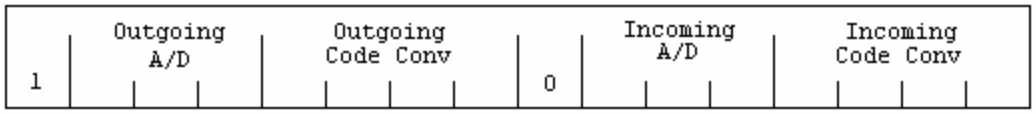
Datamode supports two basic modes: manual and auto datamode.

Manual Datamode

Manual datamode allows complete specification of the assembly/disassembly and code conversion functions on both adapter output and adapter input. In the manual datamode, the caller has total control over the adapter facilities. The user must determine which assembly/disassembly modes and code conversion tables are meaningful to the two adapters involved in the transfer. Refer to the Adapter reference manuals for the Adapter being used.

The datamode field is always in the "datamode" field of the drive protocol information to assist this incoming driver function. When the data is received, each driver calculates the amount of useful information received based on the incoming A/D mode specified and passes it up to the user read request. The read NRB will contain exactly the same datamode field as specified by the transmitter when the original message was sent.

Manual datamode has the following format:



'1' is the high order bit is the manual mode indicator

Outgoing A/D indicates the data assembly/disassembly to be performed on data as it goes out onto the network. This information is added to the "transmit data" function code when the user data goes over the network.

Outgoing Code Conv indicates the code conversion to be performed on data as it goes out onto the network. This information is added to the "transmit data" function code when the user data goes over the network.

'0' in the high order bit of the low order byte is the manual mode indicator.

Incoming A/D indicates the data assembly /disassembly to be performed on data as it goes from the network to the receiving program. This information is added to the "input data" function code when the receiving driver gets the message from the network.

Incoming Code Conv indicates the code conversion to be performed on data as it goes from the network to the receiving program. This information is added to the "input data" function code when the receiving driver gets the message from the network. This field will only be used if the receiving host-processor adapter supports code conversion.

Auto Datamode

Auto datamode is designed for all common NetEx/IP transfers. When auto datamode is selected, the user identifies the source and destination character sets, and NetEx/IP selects the appropriate assembly/disassembly and code conversion. NetEx/IP will perform code conversion only when the selected conversion is meaningful to the receiving machine. NetEx/IP uses hardware code conversion whenever possible.

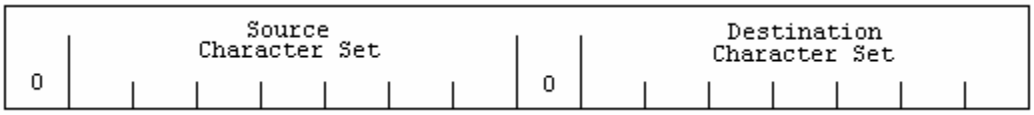
Auto datamode supports three conversion options.

Bit Stream where the bit pattern sent is precisely reproduced in the destination machine.

Octet where eight-bit binary quantities are sent from one machine to another, using an eight-bit byte representation appropriate to each machine.

Character where character information is sent from one machine to another with a full range of character assembly and code conversion options.

The conversion options are selected in the NRBDMODE field. The auto datamode has the following format in the NRBDMODE field:



'0' in the high order bit is the auto mode indicator.

Source Character Set indicates the conversion option of the data used in the write buffer of the transmitter.

'0' in the high bit of the low order byte is reserved.

Destination Character Set indicates the conversion option of the data going to the destination program. For example, a conversion from EBCDIC (3) to ASCII(2) would be entered as a hexadecimal value of 0302 or decimal value of 770.

Indicator	Conversion Option
0	Bit stream mode
1	Octet Mode
2	ASCII (8 bit)
3	EBCDIC
4	Reserved
5	BCD (Honeywell)
6	Field-data (Unisys)
7	Display code (CDC)

The processing rules for auto datamode are as follows:

- The transmitting driver examines the source character set specified. The character set implicitly specifies the method used to represent those characters on the transmitting machine. The driver selects an A/D mode so those characters will be each sent over the network as an eight-bit quantity. If the code conversion memory is installed, the transmitting driver will select a code conversion function to hardware convert the character set before the information is sent over the network. If code conversion is used, the transmitting driver sets the source character set to the value of the destination character set in the datamode field of the outgoing message proper.
- The receiving driver always reads a message proper in "octet" mode. By examining the datamode field and determining that character data is being sent, it selects an A/D mode to convert the eight-bit quantities coming over the network to the bit configuration used by the destination character set. If code conversion hardware is installed and the source character set does not equal the destination character set in the message proper then the data is code converted on input. Following such conversion, the source character set field in datamode is set to the destination character set value before the datamode is passed up to the receiving caller.
- If neither adapter has code conversion, and the character sets in the datamode field are still not equal, then software code conversion is performed and the two fields are set equal.
- If the incoming driver determines that the destination character set is not "meaningful" on it own host, then it treats the incoming character set as "octet mode" data and provides the user with the data along with an error code in NRBSTAT indicating that the data was "damaged."

- If the destination character set is a six-bit code, code conversion hardware is required on the adapter for the six-bit character machine.

NRBTIME

NRBTIME specifies the length of elapsed time that the associated read-type command is to remain in effect. If a time interval equal to the number of seconds in NRBTIME has elapsed, and no data or connection information has arrived to satisfy the READ or OFFER, then the request will end with an error.

If the value in NRBTIME is "0", then the request will wait indefinitely.

NRBCLASS

NRBCLASS is a connection-negotiation parameter that defines the class of service (the type of protocol that will be used by the connection service). The current definition of class is as follows:

0 Use class determined by the Network Configuration Table (NCT).

1 Use Version 1 NetEx/IP protocol. This protocol is no longer supported.

2 Use Version 2 NetEx/IP protocol. This protocol is used in Release 2 and above NetEx/IP products.

4 Use Version 4 NetEx/IP protocol. This protocol is supported by NetEx/IP Versions 6 and above.

All other values (or values that are not supported for a particular implementation) will return a "class not implemented" error.

When an offer or connect completes, the value of this field should contain the protocol version actually negotiated. If session services are requested, then the default returned may depend on the protocol desired by the remote host as determined in the local Network Configuration Table.

NRBMAXRT

NRBMAXRT (maximum rate) is a connection negotiation parameter that specifies the maximum data rate possible for the connection. NRBMAXRT is used for Session and Transport levels only. These levels are not discussed in this manual. This field is for informational purposes only on the session layer.

The NRBMAXRT value is based on the user's specification or the physical characteristics of the links between the two NetEx/IP calling programs. This field is designed for those applications that wish to make limited use of communications media between destinations.

The units of this field are expressed as a 16-bit positive quantity giving the speed of the link in 1000's of bits per second. Thus, a connection using a terrestrial link adapter whose line speed was generated as 230K bits per second would have 230 placed in this field.

> **Note:** The NRBMAXRT and the throttling concept only directly apply to the transmitting portion of a given connection. The other party in the connection may be working with completely different throttling parameters and the corresponding program will have no direct way of knowing the remote transmitter's data rate parameters.

On completion of the offer or confirm request, this field will have a nonzero value that contains the maximum throughput that is possible to the connection, based on the user's original request and the characteristics of the communications link between the two.

NRBBLKI and NRBBLKO

NRBBLKI and NRBBLKO are connection negotiation parameters that specify the maximum amount of data that the calling program expects to read or write at one time during the coming connection. This parameter should be provided with the connect or offer request. During the protocol negotiation process, the NRBBLKI of one program will be compared with the NRBBLKO (output maximum buffer size) specified at the other end, and the lesser of the two values will be returned in the two respective fields.

For the connecting program, the negotiated results will be returned in the NRB along with the confirm data read following the connect. The offering program will receive the negotiated values on completion of the offer and hence may decide if the negotiated values are acceptable for the work at hand.

The NetEx/IP installation systems programmer must supply two values controlling these buffer sizes. First, the default input and output block sizes to be used if these are not specified (left zero) by the caller. Secondly, the maximum input and output block sizes permitted by the installation.

As an example of the block negotiation process: Program A issues a connect with NRBBLKI=256 and NRBBLKO=4096. The offering program B to which A will connect specifies 64K for both, allowing the connector to set any reasonable value in these fields. When the offer completes, B sees NRBBLKO=256 and NRBBLKI=4096, the minimum of the two sets of values. When A's read following the connect completes, it will see NRBBLKI=256 and NRBBLKO=4096, which are the same values as B with the directions reversed.

If the connection established is a network or driver level connection then NRBBLKO and NRBBLKI may be adjusted to reflect the maximum size of data block that may be sent as a datagram on the path specified by the connect. If the application negotiated size is smaller than the maximum NPDU size, then the negotiated parameters will be unchanged. If the maximum NPDU size is smaller, then this maximum size will be returned in both NRBBLKI and NRBBLKO.

Two default options are available with these fields. If a zero is specified in either one of these fields, then the value used for negotiation will be an installation supplied default that is provided at NetEx/IP installation time. If the value in this field is the machine representation of –1, then the size used for negotiation will be the maximum size available for that installation, which is also a parameter specified at initialization time. Note that the values implied using zero or –1 will be used for negotiation of the connection block sizes. The actual size negotiated will be supplied in these fields on completion of the connect of offer.

NRBPROTA and NRBPROTL

The NRBPROTA and NRBPROTL are connection negotiation parameters that permit the application to provide Odata to the called layer of NetEx/IP. NRBPROTA specifies the address of the buffer containing the Odata, and NRBPROTL specifies the number of octets of Odata in that buffer.

When a write-type command is issued, the Odata provided (if any) will be added to the message, and eventually delivered as Odata to the receiving application's read type command. As a result, this is a second buffer that is handled in a similar way to the Pdata that is specified by NRBBUFA and NRBLEN/NRBUBIT. There are some distinct differences that are as follows:

Odata is always sent and received in "octet mode," which means it will be represented in the best way that the particular host can handle strings of eight-bit binary quantities, (for example, 1/byte, 4/36-bit word, etc).

The maximum amount of Odata that may be sent is limited. The maximum is installation dependent and may typically be 256 bytes or less. Each version of NetEx/IP will have a generated maximum on the number of bytes of Odata that it is prepared to accept in incoming messages. In the Session level, the maximum amount of Odata that may be sent or received will be the minimum of the Odata sizes generated on each host.

Users should be warned that sending excessive amounts of Odata with normal transmissions may result in a multiple network messages, which will increase network traffic and decrease network performance, often by a factor of two.

Note: Not all implementations of NetEx/IP support the use of Odata. No Network Executive Software utilities use Odata. Consult Network Executive Software personnel before using Odata to determine if it is available.

On a write-type operation, no Odata will be sent if NRBPROTL is zero. If a zero length is specified, then the Odata will be transmitted along with the Pdata, if present. When the read takes place, the Odata will be placed in the address specified by NRBPROTA and its incoming length will be set in NRBPROTL.

Always, NRBPROTL contains the length of the Odata in octets, not "addressable units."

The protocol field has special significance when used with Driver level requests, in that the Odata contains the network Message Proper, where the Pdata contains the Associated Data.

NRBRESV1 and NRBRESV2

NRBRESV1 and NRBRESV2 are reserved for possible future NetEx/IP enhancements.

NRBOFFER

This field is a session negotiation parameter that consists of two 16-bit fields. Used with a session level request, NRBOFFER specifies the offered name (the name of the process to be matched when the offer and connect requests meet). Names of all processes are uppercase alphanumeric data that are up to eight characters in length. Names less than eight characters long will be padded with blanks. Process names will be converted to the ASCII character set for transmission between hosts, so only those characters that are meaningful in ASCII should be used during the name matching process.

NRBHOST

This field is a session negotiation parameter that consists of two 16-bit fields. Used with a session level request, NRBHOST specifies the symbolic name of the host computer that will be addressed to match an offer request. Names of all hosts are specified by the installation systems programmer. All host names are uppercase alphanumeric data that are up to eight characters in length. Names less than eight characters long should be padded with blanks.

NRBRESV3

NRBRESV3 is reserved for possible future NetEx/IP enhancements. Programs should leave binary zeros in these fields.

NRBUSER

This field is reserved for users. Most typically it will be used to pass information to the User Exits that exist in host based NetEx/IP implementations. NetEx/IP will not process this field in any way.

NRBOSD

NRBOSD is reserved for internal use. NetEx/IP software uses this field to service and monitor the progress of NRB requests. The contents of these fields is maintained by NetEx/IP during a session.

If the NRBOSD field is altered by the calling program, the results are unpredictable.

Creating an NRB

single NRB should be created before a calling program OFFERs or CONNECTs to another program. The NRB is 40 fields long and should initially be zero-filled. Programs may create several NRBs initially.

If several NRBs are required to service a single connection, they should be duplicated from the initial NRB, as described in the following paragraphs.

Duplicating an NRB

Duplicating NRBs is necessary when using multiple NRBs within a session. By duplicating the NRB, the connection-negotiation parameters, the connection reference number and the internal NRBOSD information is preserved, allowing the duplicate NRB to be valid.

To duplicate an NRB, wait until the initial CONNECT or OFFER has completed successfully, then copy the entire "working" NRB (up to and including the NRBOSD field) to a blank NRB at a different location. The second NRB can now be used for NetEx/IP requests. The NRB should only be duplicated when it is not in use; that is, when NRBSTAT is 0.

Chapter 5: C High Level Interface

NETEX includes a library of subroutines that are designed to be called by the C high level object module. Also included is a library of copy files that may be included (#INCLUDE) into a C program and inserted at compile time. When the user makes a call to the user interface, the appropriate information is supplied in parameter format to pass to NETEX.

There are two components that are used to establish working communications through NETEX: one or more NETEX Request Blocks (NRBs) that must be supplied by the C caller, and the NETEX-provided subroutines that are used to invoke NETEX services. The NRB is described first, followed by the calls to the subroutines. The calls are presented in the approximate order in which they are used:

```
soffr       offer services
sconn       connect to an offered program
sconf       confirm acceptance of connect
sread       read incoming request or data
swrit       write data
sclos       write last data
swait       wait for previous request(s) to complete
sdisc       immediate disconnect
```

C NETEX Request Blocks

The C user builds an NRB by declaring it to be a structure of type nrb. Various fields of this structure will hold the information to be transferred to NETEX, and others will contain the information that is returned by NETEX. If more than one NRB will be required to service an application, one NRB type should be defined and several NRB variables should be declared to be of that type. Before these NRB structures are used for any NETEX request, Network Executive Software advises to zero all the members of the record. This will allow defaults for fields not explicitly used by the caller to take effect.

The NETEX C functions have the philosophy that arguments commonly passed to NETEX (such as a data buffer address) will be passed as parameters to the function. "Exotic" elements to be passed to NETEX, such as maximum input block size, will be supplied by storing the desired value in the proper member of the NRB structure. When the request completes, the C program directly accesses the desired members of the NRB structure to determine if the operation completed properly.

```
#define     INDCONNECT        1
#define     INDCONFIRM        2
#define     INDDATA           3
#define     INDEXPDATA        4
#define     INDCLOSE          5
#define     INDDISCONNECT     6
#define     INDSTATUS         7
```

Using these types the fields are as shown in the following table:

TYPE	FIELD	Function
long	nrbstat	Status or error code
long	nrbind	Indication
long	nrblen	Length of data
long	nrbubit	Unused bit count
long	nrbreq	Request code
long	nrbref	Reference number

TYPE	FIELD	Function
char	nrbbufa	Ponter to user's buffer
long	nrbbufl	Length of user's buffer
long	nrbdmode	Data mode of write request
long	nrbtime	Request timeout in seconds
long	nrbclass	Class of service
long	nrbmaxrt	Maximum transmission rate
long	nrbblki	Input buffer size
long	nrbblko	Output buffer size
char*	nrbbprota	Address of Odata
long	nrbprotl	Length of Odata
long	nrbresv1	PAM
long	nrbrref	Remote reference number
char	nrboffer[8]	Offer name
char	nrbhost[8]	Remote host name
long	nrbresv3	Reserved
long	nrbuser	Reserved for users
long	nrbosd[16]	OS Dependent

SOFFR C Function

The SOFFR (offer) function provides a means for a program desiring to accept a connection from a caller on the network to post the availability of the service. The SOFFR is actually a specialized form of read request. The SOFFR reads any data associated with the SCONN.

Before issuing an SOFFR function, the user must provide an NRB (described in chapter 4, NETEX Request Block) to be used by the user interface. Also, NETEX must be active in the system.

SOFFR Function Format

The SOFFR function has the following format:

Function (Select One)	Required Parameters
`soffr` `soffrw`	`(nrb, buffer, length, timeout, pname)`

SOFFR Parameters

The following parameters are used in the SOFFR function. The parameters must be specified in the order presented. All parameters are required.

soffr
soffrw

This is the verb for this function. SOFFRW specifies that the calling program must wait for the call to complete before processing is resumed.

nrb

This required parameter is a pointer to the NRB data area to be passed to NETEX.

buffer

This required parameter is a pointer to the buffer data area to receive data sent by the corresponding SCONNECT request.

length

This required parameter is the length of the buffer (in addressable units) that will hold the data sent by the corresponding SCONNECT. When called, *length* should contain the maximum size of the buffer. On return, the NRBLEN (NRB.length) field will contain the number of bytes of information actually sent to the offering application. The data type of length should be INT.

timeout

This required parameter is the number of seconds that the OFFER request should remain outstanding. If no application connects during this interval, then the OFFER will end abnormally. If *timeout* is specified as zero, the OFFER will remain outstanding indefinitely.

pname

This required parameter is the alphabetic name of the process to be offered to the corresponding calling program. The name offered is arbitrary, but must be known to the connecting program. This name may be provided as a packed array(.1..8.) of character or as a string in the CALL statement, if padded with blanks to eight characters in length.

SOFFER Entry Parameters

The following NRB fields are used by SOFFR on entry.

NRBBUFA Address for incoming Pdata

NRBBUFL Length of buffer to hold Pdata

NRBPROTA Address for incoming Odata

NRBPROTL Length of buffer to hold Odata

NRBTIME Number of seconds offer outstanding

NRBBLKO Maximum transmission size acceptable

NRBBLKI Maximum reception size acceptable

NRBMXRAT Limit on transmission speed

NRBOFFER Application name to offer

SOFFR Results

The following NRB fields are updated when SOFFR completes.

NRBSTAT Success/failure code

NRBIND Contains Connect Indication

NRBLEN Length of incoming Pdata

NRBUBIT Unused bit count of Pdata

NRBPROTL Length of Odata received

NRBNREF S-ref assigned this connection

NRBBLKO Maximum transmission Pdata Size

NRBBLKI Maximum reception Pdata size

NRBMXRAT Maximum transmission speed of path

NRBHOST Name of host where SCONN originated

SCONN C Function

The SCONN (connect) function provides a means for a program to request a session with a program that has issued an SOFFR. The SCONN is a specialized form of a write request. The SCONN initiates the session and may optionally write data to the offerer at the same time, provided this data does not exceed the maximum segment size specified on either the sending or receiving NETEX.

Before issuing the SCONN, an NRB must be provided for use by the user interface.

SCONN Function Format

The SCONN function has the following format:

Function (Select One)	Required Parameters
`sconn` `sconnw`	`(nrb, buffer, length, datamd, pname, hname)`

SCONN Parameters

The following parameters are used in the SCONN function. The parameters must be specified in the order presented. All parameters are required.

sconn
sconnw
This is the verb for this function. SCONNW specifies that the calling program must wait for the call to complete before processing is resumed.

nrb
This required parameter is a pointer to the NRB data area to be passed to NETEX.

buffer
This required parameter is a pointer to the buffer data area that holds the user data to be sent to the corresponding application

length
This required parameter is the length of the data (in addressable units) to be sent to the corresponding application, to be presented with the completion of the corresponding application's OFFER request. If no data needs to be sent to the other application, the length may be set to zero. The data type of *length* should be INT.

datamd
This required parameter is the datamode to be used to send the connect data to the corresponding application. The data type of *datamd* should be INTEGER. Refer to NRBDMODE in chapter 4 for a discussion of the datamode parameter.

pname
This required parameter is the alphabetic name of the process offered (SOFFR) by the corresponding calling program. The name offered is determined by the other calling program. This name may be provided as a packed array(.1..8.) of character or as a string in the call invocation, if padded with blanks to eight characters in length.

hname

This required parameter is the alphabetic name of the host computer to be accessed to determine if the correct SOFFR is available. The "names" of the host computers in the network are determined by the NETEX installation systems programmer. This may be provided as a packed array(.1..8.) of character or provided as a string in the call invocation, if padded with blanks to eight characters in length.

SCONN Entry Parameters

The following NRB fields are used by SCONN on entry.

NRBBUFA	Address of outgoing Pdata
NRBLEN	Length of outgoing Pdata
NRBUBIT	Pdata unused bit count
NRBDMODE	datamode of Pdata
NRBPROTA	Address of outgoing Odata
NRBPROTL	Length of outgoing Odata
NRBBLKO	Maximum transmission size acceptable
NRBBLKI	Maximum reception size acceptable
NRBMXRAT	Limit on transmission speed
NRBHOST	Alphanumeric "host" name
NRBOFFER	Alphanumeric "application" name

SCONN Results

The following NRB fields are updated when SCONN completes.

NRBSTAT	Success/failure code
NRBIND	Set to zero
NRBNREF	S-ref (Session ID) assigned
NRBBLKO	Maximum transmission Pdata size
NRBBLKI	Maximum reception Pdata size
NRBMXRAT	Maximum transmission speed of path

SCONF C Function

The SCONF (confirm) function provides a means for an offering program to confirm (to the connector) that the connection has been successfully completed. A negative response to an SCONN would be an SDISC.

The SCONF is a specialized form of write request. Data may optionally be written during the confirm process with this command, provided this data does not exceed the maximum segment size specified on either the sending or receiving NETEX.

Before issuing the SCONF call, an SOFFR must have completed successfully by receiving an SCONN response. The calling program must provide a NRB with an NRBNREF relating to this session.

SCONF Function Format

The SCONF function has the following format:

Function (Select One)	Required Parameters
`sconf` `sconfw`	`(nrb, buffer, length, datamd)`

SCONF Parameters

The following parameters are used in the SCONF function. The parameters must be specified in the order presented. All parameters are required.

sconf
sconfw
This is the verb for this function. SCONFW specifies that the calling program must wait for the call to complete before processing is resumed.

nrb
This required parameter is a pointer to the NRB data area to be passed to NETEX.

buffer
This required parameter is a pointer to the buffer data area that holds the user data to be sent to the corresponding application.

length
This required parameter is the length of the data (in addressable units) to be sent to the corresponding application, to be presented with the completion of the corresponding application's SREAD request. If no data needs to be sent to the other application, the length may be set to zero. The data type of *length* should be INT.

datamd
This required parameter is the datamode to be used to send the connect data to the corresponding application. The data type of *datamd* should be INTEGER. Refer to NRBDMODE in chapter 4 for a discussion of the datamode parameter.

SCONF Entry Parameters

The following NRB fields are used by SCONF on entry.

NRBBUFA Address of outgoing Pdata (move mode)

NRBLEN	Length of outgoing Pdata
NRBUBIT	Pdata unused bit count
NRBDMODE	datamode of Pdata
NRBPROTA	Address of outgoing Odata
NRBPROTL	Length of outgoing Odata

SCONF Results

The following NRB fields are updated when SCONF completes

NRBSTAT	Success/failure code
NRBIND	Set to zero

SREAD C Function

The SREAD function provides a means for a program to receive data from another host or an indication from NETEX of an abnormal condition with the connection.

Before an SREAD can be issued, a connection must be established. The NRB specified must have been used for a previous NETEX request for the particular connection, or a copy of another NRB that has been used to service the desired connection.

IMPORTANT: Keep an SREAD request outstanding to receive incoming data. NETEX will automatically terminate a connection if a request is waiting to be read for too long. This read-timeout value is set at installation time.

Defaults for unspecified parameters are assumed to be the parameters existing in the NRB. Thus, after *buffer* and *length* are agreed on during the connection process, these parameters can be omitted.

SREAD Function Format

The SREAD function has the following format:

Function (Select One)	Required Parameters
`sread` `sreadw`	`(nrb, buffer, length, timeout)`

SREAD Parameters

The following parameters are used in the SREAD function. The parameters must be specified in the order presented. All parameters are required.

sread
sreadw
This is the verb for this function. SREADW specifies that the calling program must wait for the call to complete before processing is resumed.

nrb
This required parameter is a pointer to the NRB data area to be passed to NETEX.

buffer
This required parameter is a pointer to the buffer data area to receive the data sent by the corresponding application's SWRITE or SCONF request.

length
This required parameter is the length of the buffer (in addressable units) to hold the data sent by the corresponding SWRITE. When called, *length* should contain the maximum size of the buffer. On return, the actual length will be in NRBLEN. Programs that wish to work with the Unused Bit Count on input should examine the NRBUBIT field. The data type of *length* should be INT.

timeout
This required parameter is the number of seconds that the READ request should remain outstanding. If the corresponding application does not send data during this interval, then the read will end abnormally. If *timeout* is specified as zero, the READ will remain outstanding indefinitely.

SREAD Entry Parameters

The following NRB Fields are used by SREAD on entry.

NRBBUFA Address for incoming Pdata (move mode)

NRBBUFL Length of buffer to hold Pdata

NRBPROTA Address for incoming Odata

NRBPROTL Length of buffer to hold Odata

NRBTIME Number of seconds offer outstanding

SREAD Results

The following NRB fields are updated when SREAD completes.

NRBSTAT Success/failure code

NRBIND Contains Connect Indication

NRBLEN Length of incoming Pdata

NRBUBIT Unused bit count of Pdata

NRBPROTL Length of Odata received

NRBBLKO Maximum transmission Pdata size (On Read of Confirm only)

NRBBLKI Maximum reception Pdata size (On Read of Confirm only)

SWRIT C Function

The SWRIT (write) function provides a means for a program to transmit data to another calling program.

Before an SWRIT can be issued, a connection must be established.

SWRIT Function Format

The SWRIT function has the following format:

Function (Select One)	Required Parameters
`swrit` `swritw`	`(nrb, buffer, length, datamd)`

SWRIT Parameters

The following parameters are used in the SWRIT function. The parameters must be specified in the order presented. All parameters are required.

swrite
swritw
This is the verb for this function. SWRITW specifies that the calling program must wait for the call to complete before processing is resumed.

nrb
This required parameter is a pointer to the NRB data area to be passed to NETEX

buffer
This required parameter is a pointer to the buffer data area that holds the user data to be sent to the corresponding application.

length
This required parameters is the length of the data (in addressable units) to be sent to the corresponding application. The length may be set to zero. The data type of *length* should be INT.

datamd
This required parameter is the datamode to be used to send the connect data to the corresponding application. The data type of *datamd* should be INT. Refer to NRBDMODE in chapter 4 for a discussion of the datamode parameter.

SWRIT Entry Parameters

The following NRB fields are used by SWRIT on entry.

NRBBUFA Address of outgoing Pdata

NRBLEN Length of outgoing Pdata

NRBUBIT Pdata unused bit count

NRBDMODE Datamode of Pdata

NRBPROTA Address of outgoing Odata

NRBPROTL Length of outgoing Odata

SWRIT Results

The following NRB fields are updated when SWRIT completes.

NRBSTAT Success/failure code

NRBIND Set to zero

SCLOS C Function

The SCLOS (close) function provides a way for a program to transmit data to another corresponding calling program and indicate that this is the last data to be sent. The data must be received by a read request in the other program.

After a program has issued an SCLOS, no other data may be written by that program. If the other program had previously issued an SCLOS, the data is written and then the connection is disconnected. If the other program has not issued an SCLOS, it is still free to write data to the program that did issue the SCLOS.

Before issuing the SCLOS, a connection must be fully established.

SCLOS Function Format

The SCLOS function has the following format:

Function (Select One)	Required Parameters
`sclos` `sclosw`	`(nrb, buffer, length, datamd)`

SCLOS Parameters

The following parameters are used in the SCLOS function. The parameters must be specified in the order presented. All parameters are required.

sclos
sclosw
This is the verb for this function. SCLOSW specifies that the calling program must wait for the call to complete before processing is resumed.

nrb
This required parameter is a pointer to the NRB data area to be passed to NETEX.

buffer
This required parameter is a pointer to the buffer data area that holds the user data to be sent to the corresponding application.

length
This required parameter is the length of the data (in addressable units) to be sent to the corresponding application. The length may be set to zero. The data type of *length* should be INT.

datamd
This required parameter is the datamode to be used to send the connect data to the corresponding application. The data type of *datamd* should be INT. Refer to NRBDMODE in chapter 4 for a discussion of the datamode parameter.

SCLOS Entry Parameters

The following NRB fields are used by SCLOS on entry.

NRBBUFA Address of outgoing Pdata

NRBLEN Length of outgoing Pdata

NRBUBIT	Pdata unused bit count
NRBDMODE	Datamode of Pdata
NRBPROTA	Address of outgoing Odata
NRBPROTL	Length of outgoing Odata

SCLOS Results

The following NRB fields are updated when SCLOS completes

NRBSTAT	Success/failure code
NRBIND	Set to zero
NRBBUFA	Contains zero (if ptr mode selected)

SWAIT C Function

The SWAIT function provides the means to wait for the completion of requests that have not been previously waited for. Control will be returned to the SWAIT caller when any one of the NRBs specified no longer has the "in progress" flag set. Return from the subroutine will be immediate if any one of the NRBs has completed before the SWAIT call. By waiting on 0 NRBs, the NETEX subroutine library will take control and update all NRBs.

SWAIT(0) will return after checking all of the NRBs that are pending. It may return before any NRB has completed. Therefore, Network Executive Software advises to check the NRBSTAT after an SWAIT(0) and send another SWAIT(0) if the status is –1. This behavior is true whether SWAIT(0) is used in a single or multi-threaded application.

When SWAIT(-1) is called, NETEX takes control and checks all NRBs, just as SWAIT(0) does. SWAIT(-1) will only return to the user when at least one NRB has completed.

Note: In a multi-threaded application, the NRB which completed may not belong to the thread making the swait(-1) call. If your thread has no NRBs active, you may end up waiting for another thread's NRB to complete! Think globally for this form of the call and use with caution!

In a multi-threaded environment, `swait(nrbnum, nrb, nrb …)` works as you would expect. This form of the call is recommended over the `swait(-1)` form.

After control is returned, the calling program must determine which of the NRBs in the list has completed. This can be done by examining the NRBSTAT field of each of the NRBs.

See "ntxteat.c" and "ntxtgen.c" in the "tests" subdirectory of your NetEx installed distribution for a sample server/client multi-threaded application. It also contains samples of all 3 forms of the 'swait' call. The sample of the swait(-1) call is not foolproof!

C SWAIT Examples

Figure 12 shows an example of an SWAIT (0).

```
(program)
.
.
swrit (nrba,buffa,len,dmode);
swrit (nrbb,buffb,len,dmode);
i=0;
while (i<5&&
       nrba.nrbstat<0&&
       nrbb.nrbstat<0) {

       delay(1);
       swait(0);
}
if (nrba.nrbstat>=0) {
   /*process nrba */
}
else {
   /*process nrbb */
}
```

Figure 12. SWAIT(0) Example

Figure 13 shows an example of an SWAIT(-1).

```
(program)
.
.
swrit (nrba,buffa,len,dmode);
swrit (nrbb,buffb,len,dmode);
swait(-1);
if (nrba.nrbstat>=0) {
   /*process nrba */
}
else {
   /*process nrbb */
}
```

Figure 13. SWAIT(-1) Example

SWAIT Function Format

The SWAIT function has the following format:

Function	Required Parameters
`swait`	`(nrbnum, nrb, nrb, ...)`

SWAIT Parameters

The following parameters are used in the SWAIT function. The parameters must be specified in the order presented. All parameters are required.

swait

This is the verb for this function.

nrbnum

This required parameter is the number of NRBs to wait for. Control will be returned after the completion of any calls/NRBs specified. If 0 is specified, the NetEx subroutine library will take control and update NRBs or perform other functions.

nrb

This required parameter is a pointer to one or more NRBs (the number of NRBs specified in nrbnum) associated with the request to be waited for. An *nrb* is required for each NRB specified in *nrbnum*.

SDISC C Function

The SDISC (disconnect) function provides the means for any connected program to terminate a session. The request is immediate and any data currently in transport may not be delivered. If data delivery is required, the program must wait for confirmation of previous SREAD or SWRIT functions before issuing the SDISC.

When an SDISC is issued, an outstanding SREAD in the other program will terminate with an error in NRBSTAT.

NETEX does not ensure that data written with an SDISC macro will actually be received by the other program.

SDISC Function Format

The SDISC function has the following format

Function (Select One)	Required Parameters
sdisc sdiscw	(nrb, buffer, length, datamd)

SDISC Parameters

The following parameters are used in the SDISC function. The parameters must be specified in the order presented. All parameters are required.

sdisc
sdiscw

This is the verb for this function. SDISCW specifies that the calling program must wait for the call to complete before processing is resumed.

nrb

This required parameter is a pointer to the NRB data area to be passed to NETEX.

buffer

This required parameter is a pointer to the buffer data area that holds the user data to be sent to the corresponding application.

Note: For SDISC, delivery of DISCONNECT data is **not** reliable, although the actual disconnection will always occur.

length

This required parameter is the length of the data (in addressable units) to be sent to the corresponding application, to be presented with the completion of the corresponding application's SREAD request. If no data needs to be sent to the other application, the length may be set to zero. The data type of *length* should be INT.

datamd

This required parameter is the datamode to be used to send the disconnect data to the corresponding application. The data type of *datamd* should be INT. Refer to NRBDMODE in chapter 4 for a discussion of the datamode parameter.

On completion of the SDISC, the connection will no longer exist; new commands against that connection will be rejected. An SOFFR or SCONN must be issued to establish a new connection.

SDISC Entry Parameters

The following NRB fields are used by SDISC on entry.

NRBBUFA Address of outgoing Pdata

NRBLEN Length of outgoing Pdata

NRBUBIT Pdata unused bit count

NRBDMODE Datamode of Pdata

NRBPROTA Address of outgoing Odata

NRBPROTL Length of outgoing Odata

SDISC Results

The following NRB fields are updated when SDISC completes.

NRBSTAT Success/failure code

NRBIND Set to zero

C Program Examples

The following figures are examples of C language offer and connect programs designed for the transfer of computer generated data.

To compile these programs use:

```
cc –o nsef001 nsef001.c –lntxc
cc –o nsef002 nsef002.c –lntxc
```

To run the programs:

```
nsef001  [datamode]
nsef002  hostname [datamode]
```

datamode

The default is 0, if the datamode is not specified.

To run intra-host:

```
nsef001 &
nsef002  localhostname
```

Figure 14 follows.

```
/*
 *This is the offering side of a connection, the basic sequence is
 *    offer with data verification
 *    confirm
 *    read and write to remote with data verification
 *    read disconnect
 * the session is terminated if there are any errors
*/

#include<netex.h>
#define SUCCESS 0

nrb n;
short buf[500], verf[500]
int step, i, mode;
int bytes=2;
char *job[]={"offer", "connect", "confirm", "read", "write", "disc", "wait"};
main(argc,argv) /* nsef001 [datamode] */
  int argc;
  char *argv[];
{
   memset(&n,'0',sizeof(n));
   memset(buf,'\0',sizeof(buf));
   step=0;
   printf("this is the start of nsef001\n");
   if(argc<2)
        mode=0;
   else
        sscanf(argv[1],"%x",&mode);
   verf[0] =1234;

   /*offer,check for success, verify data*/
```

```
soffrw(&n,buf,4,300,"NSEF0011");
if(n.nrbstat !=SUCCESS || n.nrbind !=INDCONNECT)
     terminate(0);
if(buf[0] !=verf[0]
     terminate(1);
buf[0] =1234;
buf[1] =5678;

/*confirm the connection */
step = 2;
sconfw(&n,buf,8,mode);
if(n.nrbstat !=SUCCESS)
     terminate(0);

/*read and verify data */
step = 3;
sreadw(&n,buf,400*bytes,120);
for(i=0;i<400;i++) {
     verf[i] = i +1
     if(buf[i] !=verf[i])
          terminate(i+1);
}
if(n.nrbstat !=SUCCESS || n.nrbind !=INDDATA ||
   n.nrblen !=400*bytes)
     terminate(0);
printf(" first read in nsef001 has completed and verified data\n");
for(i=0;i<420; i++)
     buf[i] =i+1;

*/ write to remote */
step =4;
swritw(&n,buf,420*bytes,mode);
if(n.nrbstat !=SUCCESS)
     terminate(0);

/*read and verify data */
step = 3
sreadw(&n,buf,40*bytes,120);
for(i=0<40;i++){
     if(buf[i] != verf[i])
          terminate(i+1);
}
if(n.nrbstat !=SUCCESS || n.nrbind !=INDDATA ||
   n.nrblen !=40*bytes
     terminate(0);
printf(" second read in nsef001 has completed and verified data\n");
for(i=0;i<420;i++)
     buf[i] =i+1

/*write to remote */
step=4;
swritw(&n,buf,420*bytes, mode);
if(n.nrbstat !=SUCCESS)
     terminate(0);

/*read the disconnect */
```

```
   step=3
   sreadw(&n,buf,1,30);
   /* verify disconnect */
   if(n.nrbstat !=SUCCESS || n.nrbind !=INDDISCONNECT)
        terminate(0);
   printf(" reading disconnect in nsef001 completed\n");
   printf(" this test completed successfully nsef001\n");
   }

   /*
    * terminate the session on error condition
    * verify>0 indicates a data verification error.
    */
   terminate(verify)
   int verify;
   {
        if(verify--)
             printf(" data miscompared at n=%d, buf=%d, mode=%d\n",
                    verify,buf[verify],verf[verify]);
        printf(" **%s**nrbstat=%d, nrbind=%d,nrblen=%d,mode=%d\n",
               job[step],n.nrbstat,n.nrbind,n.nrblen,n.nrbdmode);
        sdiscw(&n,buf,1,mode);
        if(n.nrbstat !=SUCCESS || n.nrbind !=INDDISCONNECT)
             printf("**disc stat = %d**,nrbind =%d,nrblen =%d\n",
                    n.nrbstat,n.nrbind,n.nrblen);
   exit(-1);



/*
 * this is the connecting side of the connection, the basic sequence is
 *  connect to remote
 *  read confirm with data verification
 *  write to and read from remote host with data verification
 *  disconnect
 */
#include<netex.h>
#define SUCCESS 0

nrb n;
short buf[500],verf[500];
int step,i,mode;
int bytes =2;
char *job[]={ "offer","connect","confirm","read","write","disc","wait"};
char host[9]'

main(argc,argv) /* nsef002 host [datamode] */
  int  argc;
  char *argv[];
{
   memset(&n,'0',sizeof(n)); /* zero out nrb */
   memset(buf,'\0',sizeof(buf));
   printf(" this is the start of nsef002\n");
   if(argc==2)
        mode=0;
   else if(argc==3)
```

```
        sscanf(argv[2], "%x",&mode);
   else {
        printf(" nsef002: wrong arg count\n");
        exit(1);
   }
   memset(host,' ` ,sizeof(host)-1);
   memcpy(host,argv[1],strlen(argv[1]));
   verf[0] =1234;
   verf[1] = 5678;
   buf[0] =1234;

   /* connect to remote */
   step =1;
   sconnw(&n,buf,4,mode,"NSEF0011", host);
   if(n.nrbstat !=SUCCESS)
        terminate(0);
   step = 3;


/* read confirm, verify data */
   sreadw(&n,buf,8,120);
   for(i=0; i<2; i++)
        if(buf[i] !=verf[i]
             terminate(i+1);
   if(n.nrbstat !=SUCCESS || n.nrbind !=INDCONFIRM)
        terminate(0);
   printf(" reading the sconf completed successfully");
   for(i=0; i<400;i++)
        buf[i] =i+1;

/* write to remote */
   step=4
   printf(" this is the mode before write %d, nrbdmode=%d\n",
          mode,n.nrbdmode);
   swritw(&n,buf,400*bytes, mode);
   printf(" this is the mode after swrite %d, nrbmode=%d\n",
          mode, n.nrbdmode);
   if(n.nrbstat !=SUCCESS)
         teminate(0);

/* read from remote, verify data */
   step = 3;
   sreadw(&n,buf,420*bytes,30);
   for(i=0;i<420;i++)
        if(buf[i] != (verf[i] = i+1))
             terminate(i+1);
   if(n.nrbstat !=SUCCESS || n.nrbind !=INDDATA ||
      n.nrblen !=420*bytes)
        terminate(0);
   printf(" second read in nsef002 completed with data verified\n");

*/ write to remote */
   step=4;
   for(i=0; i<40;i++)
        buf[i] =i+1;
   swritw(&n,buf,40*bytes,mode);
   if(n.nrbstat !=SUCCESS)
```

```
        terminate(0);

/* read from remote, verify data */
   step = 3;
   sreadw(&n,buf,420*bytes,120);
   for(i=0; i<420;i++)
        if(buf[i] ! = verf [i]
             terminate(i+1);
   if(n.nrbstat !=SUCCESS || n.nrbind !=INDDATA ||
      n.nrblen !=420*bytes)

{

/* disconnect */
   step = 5;
   sdiscw(&n,buf, 1,0);
   if(n.nrbsta !=SUCCESS || n.nrbind !=0) {
        printf(" ***disconnect*** nrbstat=%d,nrbind=%d\n",
               n.nrbstat,n.nrbind);
   exit(-1);
   }
   printf(" this test completed successfully nsef002\n");
}

/*
 * terminated the session because of an error
 * verify>0 indicates data verification error
 */
   terminate(verify --)
   int verify;
   {
        if(verify)
             printf(" data miscompared at n=%d, buf=%d, verf=%d\n",
                    verify,buf[verify],verf[verify]);
        printf(" **%s** nrbstat=%d,nrbind=%d,nrblen=%d, mode=%d\n",
               job[step],n.nrbstat,n.nrbind,n.nrblen,n.nrbdmode);
        sdiscw(&n,buf,1,mode);
        if(n.nrbstat !=SUCCESS || n.nrbind !=INDDISCONNECT)
             printf("**disc stat = %d**,nrbind=%d,nrblen=%d\n",
                    n.nrbstat,n.nrbind,n.nrblen);
        exit(-1);
```

Figure 14. C Program Example

Chapter 6: Installation

Please refer to the appropriate Memo To Users document for installation and OS specific information for your operating system.

Chapter 7: Operator Interface

The NETEX operator interface (NTXOPER) provides a set of commands that allow you to control and display NETEX resources. This chapter details the following information on NTXOPER.

- Executing Operator commands
- Enabling the Remote Operator interface
- Operator command descriptions

Executing Commands

You can execute NETEX operator commands in either command line or interactive mode.

Command Line Mode

When you execute operator commands in command line mode, you initiate the NTXOPER program for each command and provide the command parameters as arguments to the program. To execute an operator command in command line mode, use the following general format:

```
ntxoper  operator_command parameters
```

Replace `operator_command` with a valid operator command; replace `parameters` with the parameters for the operator command. For example, to execute the DISPLAY HOST command, enter the following:

```
ntxoper display host
```

You can also execute an operator command in command line mode on a remote host using the following general format:

```
ntxoper : host_name  operator_command  parameters
```

Replace `host_name` with the name of the host on which you want to execute the command; replace `operator_command` with a valid operator command; replace `parameters` with parameters for the command. For more information on executing operator commands on a remote host, refer to Command Descriptions later in this chapter.

Interactive Mode

When you execute operator commands interactively, you first start an operator interface session using the NTXOPER command. During an NTXOPER session, all valid operator commands are available. you can also use these additional commands:

Interactive Operator Command	**Description**
`. (period)`	Repeats the previous command
`rmt hostname operator_command`	Executes the specified operator command using the remote NTXOPER interface.
`crmt hostname operator_command`	Executes the specified operator command using the remote NTXCONS interface.
`QUIT`	Terminates NTXOPER. You can also terminate NTXOPER by entering EXIT, BYE, or STOP.

Enabling the Remote Operator Service

The NETEX remote operator service allows you to request a NETEX operator display from other hosts on the network. You can request the display from any NETEX that has the remote operator display feature enabled.

To enable the remote operator service, use the SET NTXOPER operator command. For example, to enable remote operator service on your local host, enter:

```
ntxoper set ntxoper on
```

You can define the class of commands available to remote operators with the SET ROPCLASS operator command. For example, to allow remote operators to execute all commands, enter the following:

```
ntxoper set ropclass a
```

To allow remote operators to use only general display commands, enter the following:

```
ntxoper set ropclass g
```

When the remote operator service is enabled, you can execute NTXOPER operator commands on a remote system either in command line or interactive mode (refer to Executing Commands earlier in this chapter). Any display you request is shown in the format defined by the remote program. For example, if you request a display from a NETEX for VAX/VMS, use a NETEX for VAX/VMS command and the system returns a NETEX for VAX/VMS display.

Operator Command Descriptions

This section details all the NETEX operator interface commands. The following table briefly summarizes each command.

Operator Command	Description
CLEAR LOG	Clears the NETEX log file
CLEAR IPROUTE	Clear IP routing table entries
DISPLAY HOST	Displays host(s) defined to NETEX
DISPLAY IPROUTE	Displays routing table entries
DISPLAY LOG	Displays the last 100 lines of the NetEx/IP log
DISPLAY MEMORY	Displays the current memory allocations for various internal control blocks and data buffers. (Same as the DISPLAY MEMORY command.)
DISPLAY NETWORK	Lists network connections currently pending or in progress
DISPLAY PARMS	Displays parameter values controlled by SET commands
DISPLAY SESSION	Lists sessions currently pending or in progress
DISPLAY TRANSPORT	Lists the current state of transport connections
DISPLAY USAGE	(*See* DISPLAY MEMORY *command*)
DISPLAY VERSION	Displays the current version level of the NetEx/IP component.
DRAIN HOST	Prevents new connections with a specific host
DRAIN NETEX	Prevents any new connections from starting
HALT SREF	Immediately stops a NetEx session
HELP	Provide NetEx/IP help information.
KILL NETEX	Immediately stops all NETEX resources
LOAD NCT	Transfers a pamfile created by the Configuration Manager to NETEX
SET CONTIME	Specifies the connect attempt timeout value
SET DBGDATA	Specifies number of data bytes to trace
SET DBGMSG	Enable/disable NETEX message tracing
SET DBGREQ	Enable/disable user request tracing
SET DBGRET	Enable/disable user response tracing
SET DEADTIME	Specifies time to wait until disconnecting a connection due to lack of traffic
SET DEFBI	Specifies the default maximum input buffer size for sessions
SET DEFBO	Specifies the default maximum output buffer size for sessions
SET HOST	The logical name of this NETEX host

Operator Command	Description
SET IDLETIME	Specifies time between idle messages to verify the continued existence of the other end of the connection
SET IPROUTE	Set an IP routing table address entry
SET MAXBI	Specifies the maximum input buffer size a user may request on a SCONN or SOFFR
SET MAXBO	Specifies the maximum output buffer size a user may request on a SCONN or SOFFR
SET MAXKBS	Specifies the maximum rate at which NetEx/IP will deliver data to the network for each network connection.
SET MSGLVL	Specifies the level of messages to display
SET NTXOPER	Enables and disables the remote operator service
SET PREFPROT	Specifies the default preferred protocol type to use when connecting to hosts that support multiple NetEx/IP protocol types.
SET READTIME	Time that NETEX will retain incoming data waiting for a user read request
SET ROPCLASS	Class of operator commands that the remote operator may issue
SET SESMAXIMUM	Number of concurrent session offers and active connections allowed
SET WDOGINT	Time between NETEX internal checks for timed events
START NETEX	Reverses the effect of DRAIN NETEX
START HOST	Reverses the effect of DRAIN HOST
SWLOG	Saves the current 'ntxlog' file as 'ntxlog.n' (where *n* is an integer greater than or equal to 1), and starts using a new 'ntxlog' file.

Figure 15 NETEX Operator Commands

CLEAR LOG

Description

Clears the NETEX log file while NETEX is running.

Format

```
Clear LOG
```

CLEAR IPROUTE

Description

Clear all or a selected IP routing table entry. Use caution using the "`clear ipr all`" – it is useful only if you plan to do a "`load nct`" right afterwards or to manually re-enter all entries.

Format

```
Clear  IProute  uuss | ALL
```

Parameters

uuss
The NCT defined NETADDR and SMGDREF of a host adapter.

ALL
Clear all table entries

DISPLAY ADAPTER

Description

The operator may display a list of halted adapters.

Format

```
Display HALTED
```

DISPLAY HOST

Description

Lists the hosts defined on the network. By specifying a host name, you can limit the display to only the specified host and receive more detailed information for that host.

Format

```
Display Host [hostname]
```

Parameters

hostname

Specifies the name of the host to be displayed. By default, information on all hosts is displayed.

Display Examples

The following figure shows a sample DISPLAY HOST display when the hostname parameter is omitted:

```
13:12:41          Host ULTRA5H         Current Routes
Dest Host   Proto   Routes   State          Dest Host   Proto   Routes   State
---------   -----   ------   ------         ---------   -----   ------   ------
 NTXLCL      2       3                       NTXLCL00    2       1
 DALE        2       4                       TANDEMH     2       4
 TANDEMSH    2       4                       DXU20       2       2
 MINGH       2       4                       FLASHH      2       4
 DXUB3       2       2                       HP          2       5
 STRATUS     2       5                       RIOS4       2       4
 SOLSRVR     2       5                       ULTRA5      2       3
 UNISYS      2       7                       ZARKHOV     2       4
 ZARKGWH     2       1                       ZARKHOVE    2       1
 UNISYSE     2       2                       UNISYSH     2       2
 ULTRA5H     2       1                       SOLGWH      2       1
 SOLSRVRF    2       1                       SOLSRVRH    2       1
 RIOS4F      2       1                       RIOS4H      2       1
 STRATUSH    2       1                       AIX1GWE     2       1
 AIX1F       2       1                       AIX1H       2       1
 OS390E2     2       1                       OS390H      2       2
 NETFIN5     2       1                       NETFIN3     2       2
 HPE         2       1                       HPF         2       1
 HPH         2       1                       DXUB3GWH    2       1
 DXU20H      2       1
```

Figure 16 Display Hosts Command Output, No HostName specified.

The columns in the display are as follows:

Dest Host

The name of each host or group on the network. The names correspond to the names used on the NCT data file HOST statement.

Proto

Type of protocol supported by the destination host, as defined in the NCT data file HOST statement.

Routes

The number of routes defined by the Configuration Manager to reach the destination host.

If a host is currently drained, DRAINED appears on the right side of the display for that host.

The following display is an example of the DISPLAY HOST command when a host name is supplied:

```
13:18:59         Host ULTRA5H        Routes to os390h
 pam header - len= 14 segsize= fffb
          maxrate=    0 delay=    0
 pam entries --
    pam entry   1 ->  6  1 80 88 db  0
    pam entry   2 ->  6  1 40 88 cb 40
-------------------------------------
 pam header - len= 14 segsize= fffb
          maxrate=    0 delay=    0
 pam entries --
    pam entry   1 ->  6  1 80 88 db  0
    pam entry   2 ->  6  1 40 88 20 80
-------------------------------------
```

Figure 17 Display Host Command, HostName specified

The fields in the display are as follows:

Host

This field shows the NETEX name of the local host.

Routes to

This field shows the NETEX name of the destination host.

len

This field shows the length of the PAM for this route.

segsize

This field shows the maximum segment size supported on this route.

maxrate

This field shows the maximum rate of transmission on this route, specified in 1000s of bits per second.

delay

This field shows the amount of time to wait between successive transmissions on this route. Time is specified in milliseconds.

pam entry

This field shows the PAM route component entry for each adapter in the route (length, type code, flag, trunk mask, dref [two bytes]).

DISPLAY IPROUTE

Description

Display all or a selected IP routing table entry.

Format

```
Display  IProute  [ uuss | ALL ]
```

Parameters

uuss

The NCT defined NETADDR and SMGDREF of a host adapter.

ALL

Display all table entries. All is assumed if no uuss is given.

Display Examples

The following figure shows a sample DISPLAY IPROUTE display when the uuss parameter is omitted:

```
11:42:34         Host STEVE1        Current GNA to IP Maping Table:
GNA      IP Adr           Source         GNA      IP Adr           Source
-------- ---------------  -------        -------- ---------------  -------
00002000       10.1.2.25  Local          00002080       10.1.2.25  Local
00002480         5.5.5.5  Oper           00002400       10.1.2.25  Local
00003401         0.0.0.0  Unknown        00005181         6.6.6.6  Oper
00005101         0.0.0.0  Unknown        00005201         0.0.0.0  Unknown
00005501         0.0.0.0  Unknown        00005701       10.1.5.26  Local
00005801         0.0.0.0  Unknown        00005901         0.0.0.0  Unknown
00006100       10.1.2.27  Local          0000a101      10.1.100.5  Local
0000a201   192.168.100.4  Local          0000a401       10.1.2.25  Local
0000a501       10.1.5.26  Local          0000a600       10.1.2.27  Local
0000a801       10.1.2.29  Local          0000a901       10.1.5.28  Local
0000ab01       10.1.5.17  Local          0000ac01       10.1.2.10  Local
0000ad01        10.1.2.5  Local          0000ae01        10.1.2.3  Local
0000af01        10.1.2.1  Local          0000b3b0         0.0.0.0  Unknown
0000b5c0       10.1.2.25  Local          0000b801       10.1.5.38  Local
0000b901       10.1.5.39  Local          0000ba01       10.1.2.24  Local
0000c6c0       10.1.5.27  Local          0000cb40       10.1.2.25  Local
0000d805         0.0.0.0  Unknown        0000d905       10.1.2.25  Local
```

Figure 18 Display IP Route Command

The columns in the display are as follows:

GNA

The network address mapped by this entry. Currently there will always be 4 leading zero's.

IP Adr

The IP address associated with this entry, or 0.0.0.0 for none.

Source

The source of this entry. Currently it may be Local (for a successful DNS lookup), Oper (for an operator entry), or Unknown (for DNS lookup failed).

DISPLAY LOG

Description

Displays the last 100 lines from the NetEx/IP log file.

Format

```
Display Log
```

DISPLAY MEMORY

Description

Displays the current memory allocations for various internal control blocks and data buffers.

Format

```
Display MEMory
```

Display Examples

The following figure shows a sample DISPLAY MEMORY command output:

```
NtxOper> display memory

14:23:42          Host NETFIN10         Memory
ctlbufs=        6 ctlmbufs=       0 ctlnrb=         22 ctlpam=        17
ctlmsg=         6 ctlodata=      15 ctlquehead=     15
ctlquesub=      2 ctlquetub=      3 ctlquenub=       3 ctlquedcb=      1
ctlquebcb=      6 ctlquendb=      0 ctlquetdb=       3


ctlbufs -         # of buffers (of length segment size) currently in use
ctlmbufs -        # of dynamically allocated buffers (number of mallocs)
ctlnrb -          # of nrb control blocks currently allocated
ctlpam -          # of pams currently allocated for active sessions
ctlmsg -          # of message propers currently allocated
ctlodata -        # of odata buffers currently allocated
ctlquehead -      # of queue headers currently allocated
ctlquesub -       # of session user blocks currently allocated
ctlquetub -       # of transport user blocks currently allocated
ctlquenub -       # of network user blocks currently allocated
ctlquedcb -       # of device blocks currently allocated
ctlquebcb -       # of data buffers currently allocated
ctlquendb -       # of network data control blocks currently allocated
ctlquetdb -       # of transport data control blocks currently allocated
```

Figure 19 Display Memory Command

DISPLAY NETWORK

Description

Lists the network connections that are currently pending or in progress on the operator's host. By specifying an NREF, the operator may limit the display to only the specified network connection and receive more detailed information.

Format

```
Display Network [nref]
```

Parameters

nref

Specifies a NREF for the command. By default, information for all NREFs is displayed.

Display Examples

The following shows a sample DISPLAY NETWORK command output:

```
13:29:52          Host ULTRA5H         Active Network Connections
Nref   User     Tref   State     RNref  Prot Type
----- -------- ----- ---------- -----  ---------
  143 PFXU2200   162 DATA          31      2
  145 NTXOPER    164 DATA          60      2
   -1 SESSMGR2   165 OFFERED               2
```

Figure 20 Display Network Command

The following shows a DISPLAY NETWORK command output when an Nref is specified:

```
09:56:04          Host ULTRA5H         Nref    65
Name=  root       Pid=   21587008  State=data
Writes=      11   Reads=       10  Nubblki=  32768  Nubblko=  32768
Readto=      80

Physical Address Map (PAM)
 pam header --
    len=14 segsize=fffb maxrate=   0 delay=   0
 pam entries --
   pam entry   1-> 6  1 80 88 db  0
   pam entry   2-> 6  1 40 88 df  1
 end of pam
```

Figure 21 Display Network Command, NREF specified

The following describes the fields in the display:

Nref

This field shows the unique identifier that distinguishes this network connection from all other active network connections to this NETEX. This reference identifier must be used in operator commands that modify a network connection, and may be used with this command to get detailed information about this network connection.

Name

This field shows the name of the process requesting network services.

State

This field shows the current status of the network connection. This is useful for tracking the progress of a connection, particularly for finding hung connections. The possible states are as follows:

closing	A close has been issued by the user. No additional data may be sent, but additional data may be received.
confirm	CONNECT message received, waiting for the confirm call.
data	Connection completed and user may exchange data.
connect	Connect request issued by user, waiting for confirm.
disconnect	Disconnect detected, but not yet complete.
offered	Offer has been issued by user, waiting for connect.
smgr conn	A user is in the process of connecting to a remote session manager. This process is internal to NETEX. The user's connect is in progress.
assigning	A user is in the process of being identified as a network user. This state is internal to NETEX. The user's offer or connect is in progress.
Rnref	This field shows the destination (or remote) host's Nref for this network connection. If a connection does not currently exist, this column will be blank.
Reads	This field shows the number of user messages received during this session.
Writes	This field shows the number of user messages transmitted during this session.
Nubblki	Maximum input blocksize.
Nubblko	Maximum output blocksize.
Read to	Read timeout.

DISPLAY PARMS

Description

Displays most parameter values controlled by the SET command and initialization parameters.

Format

```
Display Parms
```

Display Examples

The following figure shows a sample DISPLAY PARMS command output:

```
10:09:45          Host ULTRA5H         Parameters
contime=   25  deadtime=   60  idletime=    6  readtime=  300
maxbi=  65536  maxbo=   65536  defbi=   32768  defbo=   32768
maxseg= 64000  wdogint=     2  msglvl=immediate
max ses=  110  max tran=    0  max net=     0  dreadque=    6
cur ses=    3  cur tran=    4  cur net=     4  status=NORMAL
RmtOper=   ON  Class=       G
prefprot=   4  mxkbs=       0
```

Figure 22 Display Parms Command

The following describes the fields:

contime
: This field shows the maximum number of seconds that NETEX will wait for a transport connect message to generate a response from the remote host. This parameter may be changed using the SET CONTIME operator command or the CONTIME initialization statement.

deadtime
: This field shows the maximum number of seconds that NETEX will wait before it disconnects a transport connection (or attempts an alternate path) because there was no response from a remote host. This parameter may be changed using the SET DEADTIME operator command or the DEADTIME initialization statement.

idletime
: This field shows the maximum number of seconds that NETEX will wait before sending an idle message to verify the continued existence of a party at the other end of a logical connection. This parameter may be changed using the SET IDLETIME operator command or the IDLETIME initialization statement.

readtime
: This field shows the maximum number of seconds that NETEX will wait before sending an idle message to verify the continued existence of a party at the other end of a logical connection. This parameter may be changed using the SET IDLETIME operator command or the IDLETIME initialization statement.

maxbi
: This field shows the maximum buffer input size (in bytes) that a user may specify for data coming in to his host in a single message. This parameter may be changed using the SET MAXBI operator command or the MAXBI initialization statement.

maxbo

This field shows the maximum buffer output size (in bytes) that a user may specify for data leaving his host in a single message. This parameter may be changed using the SET MAXBO operator command or the MAXBO initialization statement.

defbi

This field shows the default buffer input size (in bytes) that a user may specify for data coming in to his host in a single message. This parameter may be changed using the SET DEFBI operator command or the DEFBI initialization statement.

defbo

This field shows the default buffer output size (in bytes) that a user may specify for data leaving his host in a single message. This parameter may be changed using the SET DEFBO operator command or the DEFBO initialization statement.

maxseg

This field shows the maximum segment size that will ever be used for any connection from this host. This parameter may be changed using the SET MAXSEG operator command or the MAXSEG initialization statement.

wdogint

This field shows the number of seconds that the watchdog timer waits before checking NRB timeout values. The parameter may be set using the SET WDOGINT operator command.

msglvl

This field shows the minimum level of severity necessary to display a message to the operator. This parameter can be set using the SET MSGLVL command.

max ses

This field shows the number of session connections or OFFERs permitted at one time. This parameter may be changed using the SET SESMAX operator command or the SESMAX initialization statement. It can never exceed the value specified for SESLIM.

max tran

This field shows the number of direct transport connections or OFFERs permitted at one time. This parameter is always 0 because direct transport connections are not supported at this time.

max net

This field shows the number of direct network connections or OFFERs permitted at one time. This parameter is always 0 because direct network connections are not supported at this time.

dreadque

This field shows the number of reads queued up for each driver connection.

cur ses

This field shows the number of session connections in progress or being OFFERed.

cur tran

This field shows the number of transport connections in progress or OFFERed.

cur net

This field shows the number of network connections in progress of being OFFERed.

status

This field shows the current status of NETEX. Status can be one of the following:

DRAINED A DRAIN command has been issued and no sessions are active.

DRAINING A DRAIN command has been issued, but some sessions are still active.

NORMAL All sessions are active.

RmtOper

This field shows whether the remote operator service is ON or OFF. The remote operator status may be changed with the SET NTXOPER command.

Class

This field shows the privilege class of remote operator service (may be changed by the SET ROPCLASS command). The classes are as follows:

A indicates that all commands are allowed.

G indicates that only display commands are allowed.

prefprot

This field shows the default preferred protocol type to use when connecting to hosts that support multiple NetEx/IP protocol types.

mxkbs

This field shows the maximum rate at which NetEx/IP will deliver data to the network for each network connection. If zero is specified, data will be delivered with no internal throttling. This value is only used for connections to hosts that do not have a 'rate' value specified in the PAM. This value is specified in Kbits per second. For example, a value of 50 means 50Kbs; a value of 50000 means 50Mbs (i.e. 50,000 Kbs).

DISPLAY SESSION

Description

Lists the sessions that are currently pending or in progress on the operator's host. By specifying an Sref, you can limit the display to the specified session and receive more detailed information for the session.

Format

```
Display Session [sref]
```

Parameters

sref

Specifies the Sref to be displayed. By default, all sessions for all Srefs are displayed.

Display Examples

The following shows a sample DISPLAY SESSION command output:

```
12:45:32          Host ULTRA5H         Active Sessions
 Sref   User     Pid     State       Name      Host    Rnref Msg In Msg Out
----- -------- ----- ---------- -------- -------- ----- ------ -------
   56 NTXOPER     -2 offered    NTXOPER
   65 root     87008 data       ROOT     SOLSRVRH   133       7       8
   66 root     00208 offered    NTXEFT
```

Figure 23 Display Session, no SREF specified

The following shows a sample DISPLAY SESSION command output when an Sref is specified:

```
12:49:40          Host ULTRA5H         Sref    65
Name =  root       State=data         Dest =SOLSRVRH  Rnref=       133
Mxbi =     16384  Mxbo =     16384  Class=          2  Rate =         0
Reads=         7  Writes=         8  Pid  =  21587008
```

Figure 24 Display Session, SREF specified

The following describes the fields in the display:

Sref

This field shows the unique identifier that distinguishes this session from all other active session connections to this NETEX. This reference identifier must be used in operator commands that modify a session, and may be used with this command to get detailed information about this session.

User

This field shows the username and process id requesting session services.

Pid

This field shows the process id of the user of this session. If pid = -2, this is the remote operator's session.

state

This field shows the current status of the session connection. This is useful for tracking the progress of a connection, particularly for finding hung connections. The possible states are as follows:

closing	A close has been issued by the user. No additional data may be sent, but additional data may be received.
confirm	CONNECT message received, waiting for the confirm call.
data	Connection completed and user may exchange data.
connect	Connect request issued by user, waiting for confirm.
disconnect	Disconnect detected, but not yet complete.
offered	Offer has been issued by user, waiting for connect.
smgr conn	A user is in the process of connecting to a remote session manager. This process is internal to NETEX. The user's connect is in progress.
assigning	A user is in the process of being identified as a network user. This state is internal to NETEX. The user's offer or connect is in progress.

Rnref

This field shows the destination (or remote) host's network reference number for this session connection. If a connection does not currently exist, this column will be blank. If the connection is a type 1 connection, this number represents the destination host's session reference number.

Reads

This field shows the number of user messages received during this session.

Writes

This field shows the number of user messages transmitted during this session.

DISPLAY TRANSPORT

Description

Displays the current state and progress of all transport services requested directly by user processes (not yet implemented) and indirectly by user requests of session services. By specifying a Tref, the operator limits the display to the specified transport and receives detailed information from the Transport User Block (TUB).

Format

```
Display Transport [tref]
```

Parameters

tref

Specifies the Tref of a transport service to be displayed. By default, the services for all Trefs are displayed.

Display Examples

The following shows a sample DISPLAY TRANSPORT command output:

```
13:41:07         Host ULTRA5H        Active Transport Connections
 tref username segsz    state    rnref blksin duprecv blkout rexmit
----- -------- ----- ---------- ------ -------------- -------------
   56 NTXOPER  64000 offered
   65 root     32768 data         133      7       0      8      0
   66 root     64000 offered
65535 SESSMGR  64000 offered
```

Figure 25 Display Transport, no TREF specified

The following show sample DISPLAY TRANSPORT output, with a TREF specified:

```
13:41:26         Host ULTRA5H        Tref    65
Name =  root      User =  21587008  State=data        RmtNref=     133
AckQ =         0  InQ  =         0  OutQ =         0  DataQ=         0
Maxtblok=      5  Mblko=     16384  Trate=        na  Segsize=   32768
Maxrblok=      5  Mblki=     16384  Reads=         7  Writes=        8
Transmitter:      Tlrn =         8  Clrn =        12  Tpbn =         8
                  Rexmt=         0  Tack =         0  Tpbna=         0
                  Curtb=  21601680  Tto  =         6  Ackcr=         2
Receiver:         Plrn =         8  Rlrn =        13  Rpbn =         7
                  Rpbnr=         7  Rack =         0  Rpbnl=         8
                  Currb=  21601424  Rto  =         6  Ackcr=         2
```

Figure 26 Display Transport, TREF specified

The following describes the fields in the displays:

Tref

This is the NETEX transport reference identifier.

TUB

This is the memory location of the Transport User Block associated with this tref.

Name

This field indicates the name of the process requesting transport services.

State

This field shows the current status of the connection. This is useful for tracking the progress of a connection, particularly for finding "hung" connections. The possible states are as follows:

closing	A close has been issued by the user. No additional data may be sent, but additional data may be received.
confirm	CONNECT message received, waiting for the confirm call.
data	Connection completed and user may exchange data.
connect	Connect request issued by user, waiting for confirm.
disconnect	Disconnect detected, but not yet complete.
rdconnect	Offer has been issued by user, waiting for connect.
smgr conn	A user is in the process of connecting to a remote session manager. This process is internal to NETEX. The user's connect is in progress.
assigning	A user is in the process of being identified as a network user. This state is internal to NETEX. The user's offer or connect is in progress.

RmtNref

This field indicates the remote network reference number.

OutSuspQ

This field indicates the number of internal writes waiting for completion.

AckQ

This field shows the number of blocks queued waiting for acknowledgement.

InQ

This field shows the number of segments waiting to go on the DataQ

OutQ

This field indicates the number of segments waiting to be written.

DataQ

This field shows the number of blocks queued waiting for read requests.

Maxtblok

This field shows the maximum number of transmitting buffers.

Mblko

This field indicates the maximum output block size (bytes).

TRate

This field indicates the maximum transmission rate.

Segsize

This field indicates the transport layer segmentation size.

Maxrblok

This field shows the maximum number of receiving buffers.

Mblki

This field shows the maximum input block size (bytes).

TPL@
This field indicates the memory address of the Transport PAM List.

CurPAM@
This field indicates the memory address of the current PAM within the TPL (Transport level Pam List) being used.

Altpathrem
This field indicates the number of alternate paths remaining.

Routes
This field indicates the number of routes (paths) to the remote host.

Pam Rate
This field indicates the rate in Megabits found in PAM.

Pamdelay
This field indicates the delay in Milliseconds found in PAM.

Inputlost
This field indicates the number of incoming data which was lost, NAK'ed and required re-transmission.

OutofOrder
This field shows the number of blocks received out of order.

Rexmit
This field shows the number of blocks retransmitted.

Transmitter:

Writes
This shows the number of TWRITEs completed.

WrBytes
This indicates the number of bytes written.

Werrors
This field shows the number of write errors.

Tlrn
This is the last LRN (Logical Record Number) assigned.

Clrn
This is the last transmitter credit received.

Tpbn
This is the last PBM (Physical Block Number) assigned.

Rexmt
This is the number of re-transmissions.

Tack
This indicates that the ACK/NAK information, bit signal received.

Tpbna
This is the last PBN returned in an ACK.

Tto

This is the transmit timeout (idle time).

Acker
This is the outgoing ACK credit (number of messages before an idle ACK).

Receiver:

Reads
This is the number of TREADs completed.

RBytes
This is the number of bytes read.

Rerrors
This is the number of read errors.

Plrn
This is the next LRN given to the user.

Rlrn
This is the most recent credit sent.

Rpbn
This is the last PBN received.

Rpbnr
This is the last PBN reported as sent in an ACK.

Rack
This is the ACK/NAK information, bit signal to be sent.

Rto
This is the receive timeout (communications lost).

Acker
This is the incoming ACK credit.

DISPLAY USAGE

Description

See the DISPLAY MEMORY command on page xx.

DISPLAY VERSION

Description

Displays the current version level of the NetEx/IP component.

Format

```
Display Version
```

Display Example

The following shows the output from a DISPLAY VERSION command:

```
NtxOper> d version

14:21:19         Host NETFIN10        Version
Hxxx LINUX NETEX Rel 6.5.6 2002/03
```

Figure 27 Display Version Command

DRAIN NETEX

Description

Prevents new sessions from being established. This command gracefully terminates all NETEX activity. When all sessions have completed, a message appears indicating that NETEX is drained. NETEX will await a START command to resume normal operation.

Connections in progress are not affected. Offers are taken down with a 3522. Local users attempting to establish a connection receive a 3505 NRBSTAT code. Remote users attempting to establish a connection receive a 3523 NRBSTAT code.

Format

```
DRAIN NETEX
```

DRAIN HOST

Description

Prevents users from establishing a connection with a host. When a user attempts to establish a connection, they receive a 3507 NRBSTAT code.

Format

```
DRAIN HOST rmthost
```

Parameters

rmthost
Specifies the remote host to be drained.

HALT ADAPTER

Description

When a local adapter is halted, NetEx/IP immediately stops writing to or reading from the halted adapter. This is true regardless of the state of connections using that adapter. If a remote host attempts to establish a new connection on a route through a halted adapter, the local NetEx/IP will ignore those messages sent by the remote host.

Non-local adapters are adapters that are not attached to the host on which this NetEx/IP is running. After non-local adapters are halted, all new connections are established using routes through other adapters.

Once a session connection is established through a remote adapter that session continues to completion even after a HALT command has been entered for it.

Link or gateway adapters may not be halted at this time.

Format

```
HALT Adapter <uuss>
```

Parameters

uuss

The four HEX character network address (DREF) of the adapter to be halted.

HALT SREF

Description

Immediately terminates a session. Local users with an active read receive a 3422 NRBSTAT code or a 3100 code on the next write request. An outstanding OFFER is terminated with a 3422 NRBSTAT code.

Format

```
Halt SRef n
```

Parameters

n

Specifies the SREF for the session to be halted. To determine the SREF number, use the DISPLAY SESSION command.

HELP

Description

Provides a list of NetEx/IP commands and command formats.

Format

```
HELP
```

or

```
?
```

Parameters

None.

Comments

This command can be entered as either ‘help’ or ‘?’. However, the ‘?’ format may be required from various remote NTXOPER sources, since several implementations of NTXOPER use ‘HELP’ to provide local NTXOPER help information.

KILL NETEX

Description

Immediately stops NETEX resources and terminates all NETEX activity. Connections in progress are terminated and a 0512 return code is inserted into all active NRBs.

Format

```
KILL NETEX
```

LOAD NCT

Description

Transfers PAM files (data structures describing paths to remote hosts) created by the configuration manager to NETEX. Local adapter information can not be changed by using this command.

The operator must first modify the NCT data file containing the configuration statements and run the CM utility to create the PAM file (refer to "Step 6: Build an NCT" in the appropriate appendix for your system). The filename given on the MAKEPAM statement must be the same name given on the LOAD command. Also, the local hostname specified on the MAKEPAM statement must be the same as the local host in NETEX (the local parameter in the ntx_default file). If the message "file not in PAMFILE format" is returned, check to see if your host name matches the NETEX local hostname.

Format

```
Load NCt filename
```

Parameters

filename

Specifies the name of the PAM file to be loaded.

SET CONTIME

Description

Specifies the maximum number of seconds that NETEX will wait for a transport connect message to generate a response from the destination host. If this time is exceeded, the transport will assume the destination host is down and return appropriate status to the user. The transport connect message is resent every IDLETIME seconds until CONTIME seconds have passed.

Format

```
SET Contime seconds
```

Parameters

seconds

Specifies the number of seconds that NETEX waits to generate a response to a transport connection message.

SET DBGDATA

Description

Specifies the maximum number of data bytes to trace for any associated data block.

Format

```
SET DBGDATA byte_count
```

Parameters

byte_count

Specifies an integer to indicate the maximum number of data bytes to trace for any associated data block. The default is 0, which indicates that debug tracing is disabled.

SET DBGMSG

Description

Enables or disables the tracing of HYPERchannel messages between NETEX and the network.

Format

```
SET DBGMSG value
```

Parameters

value

Specifies whether debug tracing is enabled or disabled. Specify 0 to disable tracing; specify any other value to enable tracing. The default is 0.

SET DBGREQ

Description

Enables or disables the tracing of user requests arriving at the NETEX protocol stack. When tracing is enabled, the user's NRB is traced.

Format

```
SET DBGREQ value
```

Parameters

value

Specifies a value to indicate whether user requests are traced. Specify 0 to disable tracing; specify any other value to enable tracing. The default is 0.

SET DBGRET

Description

Enables or disables the tracing of user responses returned from the NETEX protocol stack. When tracing is enabled, the state of the user's final NRB is traced.

Format

```
SET DBGRET value
```

Parameters

value

Specifies a value to indicate whether user responses are traced. Specify 0 to disable tracing; specify any other value to enable tracing. The default is 0.

SET DEADTIME

Description

Specifies the amount of time transport waits until it disconnects a connection because there was no response from the remote host. The remote host normally generates an idle message every IDLETIME seconds based on its own IDLETIME parameter. Receipt of any message from the remote host keeps the DEADTIME timer from expiring.

Format

```
SET DEadtime seconds
```

Parameters

seconds

Specifies the number of seconds that NETEX waits until it disconnects a connection due to no response from the remote host.

SET DEFBI

Description

Specifies the default input buffer size for a connection. This default value is used if the user does not specify a maximum input buffer size in the CONNECT or OFFER request.

Format

```
SET DEFBI size
```

Parameters

size

Specifies the default input buffer size in bytes. DEFBI can be from 64 bytes to the MAXBI value.

SET DEFBO

Description

Specifies the default output buffer size for a connection. This default value is used if the user does not specify a maximum output buffer size in the CONNECT or OFFER request.

Format

```
SET DEFBO size
```

Parameters

size

Specifies the default output buffer size in bytes. DEFBO can be from 64 bytes to the MAXBO value.

SET HOST

Description

Specifies the logical name of the host under which this copy of NETEX is running. The logical name must have been previously defined in the NCT table through a HOST statement in the network configuration file.

Format

```
SET HOST name
```

Parameters

name

Specifies the logical NCT name assigned to the host.

SET IDLETIME

Description

Specifies the amount of time that transport will wait before sending an idle message to verify the continued existence of a party at the other end of a logical connection. The transmission of any message resets the timer.

Format

```
SET Idletime seconds
```

Parameters

seconds

Specifies the number of seconds NETEX waits before sending an idle message to the remote host.

SET IPROUTE

Description

Create an IP routing table entry.

Format

```
SET IProute uuss ipaddr
```

Parameters

uuss
The NCT defined NETADDR and SMGDREF of a host adapter.

ipaddr
Normal dotted decimal IP address format: xxx.xxx.xxx.xxx

Notes

Please note that all IP routing table updates made with this command are valid only as long as NetEx/IP is running. These changes will be lost should NetEx/IP be recycled. If the operator command 'LOAD NCT' is issued, the operator entered entry will only be replaced if there is a successful DNS lookup for that GNA.

SET MAXBI

Description

Specifies the maximum input buffer size that a user may specify on a CONNECT or OFFER call. This parameter sets a system wide maximum user buffer size. Its value and the size of the user buffer region determine possible fragmentation of the region and the maximum number of connections that can be supported.

Format

```
SET MAXBI size
```

Parameters

size

Specifies the maximum input buffer size (in bytes) that users can specify on a CONNECT or OFFER call. Size may be from 64 to 32768 bytes, but must be greater than or equal to the default block-in value.

SET MAXBO

Description

Specifies the maximum output buffer size that a user may specify on a CONNECT or OFFER call. This parameter sets a system wide maximum user buffer size. Its value and the size of the user buffer region determine possible fragmentation of the region and the maximum number of connections that can be supported.

Format

```
SET MAXBO size
```

Parameters

size

Specifies the maximum output buffer size (in bytes) that users can specify on a CONNECT or OFFER call. Size may be from 64 to 32768 bytes, but must be greater than or equal to the default block-out value.

SET MAXKBS

Description

Sets the maximum rate at which NetEx/IP will deliver data to the network for each network connection. If zero is specified, data will be delivered with no internal throttling. This value is only used for connections to hosts that do not have a 'rate' value specified in the PAM.

Format

```
SET MAXKBS n
```

Parameters

n

Specifies the maximum rate in Kbits per second. For example, a value of 50 means 50 Kbs; a value of 50000 means 50 Mbs (50,000 Kbs).

SET MSGLVL

Description

Controls the severity of messages printed on the operator's console. The operator messages are grouped from 0-15. All messages with the specified level of severity or greater are displayed.

Format

```
SET MSGLvl level
```

Parameters

level

Specifies a keyword to indicate the level of messages to be displayed on the operator's console. Specify one of the following:

immediate Messages that require immediate action by the operator. Example: NETEX termination.

important Messages that are of great interest to the operator and may require operator action. Examples: notification of all set drain, start, and clear commands; remote operator messages.

interesting Messages regarding events that are of interest in closely monitored environments.

blither Messages that are intended for diagnostic or debugging purposes. These messages are generally only of interest when a system programmer is attempting to diagnose a NETEX problem.

SET NTXOPER

Description

Specifies whether the remote operator service is enabled or disabled.

Format

```
SET NTXOPer value
```

Parameters

value

Specifies whether the remote operator service is enabled or disabled. Specify ON to enable the remote operator service; specify OFF to disable the remote operator service. The default is ON.

SET PREFPROT

Description

Sets the default preferred protocol type to use when connecting to hosts that support multiple NetEx/IP protocol types.

Format

```
SET PREFPROT n
```

Parameters

n

Specifies the default preferred protocol type. Specify 2 to use type-2 as the default protocol; specify 4 to use type-4 as the default protocol.

SET READTIME

Description

Specifies the number of seconds NETEX transport retains user data waiting for the receiver to issue a READ request. When this timer expires a disconnect will be flagged and sent to the remote process connected. The local process will be sent a disconnect message for READTIME seconds, if there is not already one there. When a disconnect times out, the transport connection will be cleared out and the Tref will become invalid for future user requests.

Format

```
SET REAdtime seconds
```

Parameter

seconds

Specifies the number of seconds NETEX transport retains user data waiting for a READ to be issed from the receiver.

SET ROPCLASS

Description

Specifies the class of operator commands that the remote operators will be allowed to issue.

Format

```
SET ROPClass class
```

Parameters

class

Specifies a value to indicate the class of remote operator commands to be available to remote hosts as follows:

A indicates that all commands are allowed.

G indicates that only display commands are allowed.

SET SESMAX

Description

Controls the number of session connections or OFFERs permitted at one time. If the current number of sessions is greater than the new value specified, the command will not affect sessions in progress but will deny any new requests until sessions are disconnected. If the current number of sessions is less than the new value, then there will be no immediate effect.

Format

```
SET SESMax number
```

Parameters

number

Specifies the number of connections and OFFERs to allow at one time (from 2 to the SESLIM value).

SET WDOGINT

Description

Specifies the number of seconds that elapse between NETEX's checking for timed-out conditions in the NRB requests. If a READ has a timeout value specified as 10 seconds, and the WDOGINT is also 10 seconds, the READ will actually timeout in the range 10-20 seconds.

Format

```
SET WDogint seconds
```

Parameters

seconds

Specifies the number of seconds that NETEX uses as a base unit for checking time out values.

START NETEX

Description

Restarts NETEX after it has been drained using the DRAIN NETEX command.

Format

```
START NETEX
```

START ADAPTER

Description

Start a HALTED adapter.

Format

```
STart Adapter <uuss>
```

Parameters

uuss

The four HEX character network address (DREF) of the adapter to be started.

START HOST

Description

Starts a remote host which had been drained.

Format

```
START HOST rmthost
```

Parameters

rmthost
Specifies the name of the remote host to be started.

SWLOG

Description

Saves the current ‘ntxlog’ file as ‘ntxlog.n’, and starts using a new ‘ntxlog’ file. When this command is entered, the current ‘ntxlog’ file becomes ‘ntxlog.1’, the previous ‘ntxlog.1’ file becomes ‘ntxlog.2’, etc. The number of ‘ntxlog’ files that are saved is determined by the value of the ‘numlogs’ initialization statement contained in the ‘ntx_default’ file. When the archive name of an old ‘ntxlog’ file equals the ‘numlogs’ specification, the file is deleted.

For example, if ‘numlogs’ is specified as 5, the following ‘ntxlog’ files will exist after the ‘swlog’ command is entered 4 times:

ntxlog	current file
ntxlog.1	current-1 file
ntxlog.2	current-2 file
ntxlog.3	current-3 file
ntxlog.4	current-4 file

Entering another ‘swlog’ command results in the following:

ntxlog.4 is deleted

ntxlog.3 is renamed to ntxlog.4

ntxlog.2 is renamed to ntxlog.3

ntxlog.1 is renamed to ntxlog.2

ntxlog is renamed to ntxlog.1

A new ‘ntxlog’ is created

Format

SWLOG

Parameters

None

Chapter 8: HCM Statistics

The UNIX NETEX/IP release contains the `hcmstat` command, which provides current HCM interface statistics. The command is located in the following file:

```
(netex base directory)/hcmd/hcmstat
```

The `hcmstat` command reports on the status of HCM interface counters, as well as routing statistics.

Status of Device Counters

Several counters are maintained for each HCM interface. Normally, the Physical Point of Attachment (PPA) 0 corresponds to */dev/hcm1*, PPA 1 corresponds to */dev/hcm2*, and so on. (The PPA to device configuration can be changed when HCMD is started.) Here is a sample status of the counters returned for PPA 0:

```
******* STATUS for PPA 0

              5637 Notification messages sent
             42032 Notification messages received
                 0 Network messages dropped, no acceptor
                 0 Duplicate Acceptors discovered
                 0 Notification skipped, buffer not available
                 0 Notification skipped, ring down
                 0 Notification message ignored, bad format
                 0 Routing message ignored, off domain/network
                 0 Dropped for flow control
                 0 Dropped_because no user wanted it
                 0 packets returned from DLPI
                 2 Partial buffers dropped at reassembly timeout
```

Figure 28 HCMSTAT Command

The following list describes the counter values returned:

Notification messages sent
Indicates the number of Address Resolution Protocol (ARP) messages sent by this interface.

Notification message received
Indicates the number of ARP messages received from other DXEs or simulated DXEs. If this value remains 0 after one to two minutes of operation, it indicates no communication is taking place.

Network messages dropped, no acceptor
Indicates the number HYPERchannel messages generated by NETEX or a user addressed to a DXE for which no addressing information is available.

Duplicate Acceptors discovered
Indicates the number of times two different DXEs advertised being the designation for the same message. This can result from a network reconfiguration.

Notification skipped, buffer not available
Indicates the number of times HCM was unable to send an ARP notification due to a low buffer condition.

Notification message skipped, ring down

Indicates the number of times HCM was unable to send an ARP notification due to the FDDI ring being unavailable. This counter is currently not used.

Notification message ignored, bad format
Indicates the number of APR messages received with a bad format.

Routing message ignored, off domain/network
Indicates the number of times routing information was received from a DXE not on the current domain or network.

Dropped for flow control
Indicates the number of times an incoming message was dropped because the destination application NETEX or user driver-level service was unable to receive it.

Dropped because no user wanted it
Indicates the number of messages arriving for an address without a user. For example, a message arriving before NETEX is up.

Route Statistics

Route statistics are returned for Each HCM device. Here is a sample of route statistics returned for PPA 0:

```
******* ROUTES for PPA 0

        DESTINATION GNA         FDDI MAC ADDRESS        NUCLEUS GNA

        0101DB00                08 00 20 B9 5A 54       0101DBFF
        010120**                00 00 A9 02 2B 38       010120F0
        010121**                00 00 A9 02 2B 38       010120F0
        010122**                00 00 A9 02 2B 38       010120F0
        010123**                00 00 A9 02 2B 38       010120F0
        010124**                00 00 A9 02 2B 38       010120F0
        010125**                00 00 A9 02 2B 38       010120F0
```

Figure 29 Route Statistics Output

The following list describes the current routing information:

DESTINATION GNA
Indicates the Global Network Address (GNA) of the destination adapter. It is made up of the DOMAIN (01), NETWORK (01), UNIT (DB in this example), and the logical address (00 or **). For a local adapter, the logical address is 00. For any other adapters, the logical address is **. This specifies that the adapter applies to all logical addresses on this unit.

FDDI MAC ADDRESS
Indicates the hardware MAC address to receive the GNA.

NUCLEUS GNA
Indicates the GNA of the nucleus for this DXE or virtual DXE.

HCMSTAT

HCMSTAT has been modified to report three new pieces of information: partial packets, messages returned by the lower levels of the operating system, and addresses for multiple units claiming that they have to handle traffic for some adapter. The messages are:

0 packets returned from DLPI

This is a count of the packets returned to the driver because the ring was down or there was a memory restriction.

0 Partial buffers dropped at reassembly timeout

This is a count of partial buffers. The final message is made up of several separate buffers. The driver reassembles these buffers and sends the final message up to NetEx or the driver level user. If any of these smaller messages are lost, the buffer is dropped after reassembly timeout.

More than one entity requested to receive messages for unit XX

One NUCLEUS GNA was unit/logical UULL with mac addr xx xx xx

The other NUCLEUS GNA was unit/logical UULL with mac addr xx xx xx

There should only be one route for each address

Please check your configuration.

This message indicates that there are two hosts or DX units that indicate that they are the unit to receive messages for unit XX. This can come from duplicate CONF file information, or ROUTE statements. There should be only one path for each unit.

New Utilities

There are several new utilities shipped in /usr/nsc/hcmd. The ‘hcmclear’ utility clears the status table that the ‘hcmstat’ reports. Use it to clear the information after the ‘More than one entity...’ problem is corrected. The ‘hdebug’ utility can be used to turn on system traces without rebuilding the system.

Appendix A: NRB Error Codes

When a NETEX request is issued, the results of the request are returned in one or both of two NRB fields, NRBSTAT and NRBIND. These fields are located at the beginning of the NRB to make their subsequent examination by high level language programs a simpler matter.

NRBSTAT is designed to indicate if an operation is in progress and whether it completed successfully. NRBIND is designed to indicate the type of information that arrived as the result of a read type command (OFFER or READ).

When the operation is accepted by the NETEX user interface, the value of NRBSTAT is set to a –1. Thus, the sign of this word is an "operation in progress" flag for all implementations.

If an operation completed successfully, NRBSTAT is returned as all zeroes. If a read–type command was issued, then an "indication" is set in NRBIND. The termination of a session is always indicated by a disconnect indication in NRBIND regardless of the request type.

If the operation did not complete successfully, then NRBSTAT contains a standard error code. NRBSTAT is represented as four decimal digits. The thousands digit denotes the origin of the error; the low order three digits identify the error type. The codes for error origin are as follows.

Code	Description
0xxx	NETEX general. Errors detected by the user interface that prohibit proper process of the command.
1xxx	Driver level errors.
2xxx	Transport level errors.
3xxx	Session level errors.
4xxx	Network level errors.
5xxx-8xxx	Reserved for future NETEX functions
90xx	Reserved for errors returned by user exits on the local host
91xx	Reserved for errors returned by user exits on the remote host during the connection process.
9200-32767	Reserved for future NETEX functions.

Table 2 Origin of NRB Error Codes

0xxx and 90xx errors can be returned to any user program that access any level of NETEX services. Normally, an application that accesses services at say, transport level receive only those errors (2xxx) related to transport services. However, the principle within NETEX is that if a level elects to abort the user's request based on an error returned by a lower level of software, then the error code should be "rippled up" to the user rather than summarized at the higher level. For example, driver might report a "power off" or "not operation" status to transport if there is an adapter failure. If transport decided that this error type should cause loss of communications, then the 1xxx error is returned to the user along with a Disconnect Indication in NRBIND when the next user read command was issued.

Following that, the second digit places the errors in categories:

Digit	Category
x0xx	NETEX general or inconsistent NRB formats
x1xx	Specification errors in parameters passed to a particular protocol level
x2xx	Hardware errors
x3xx	Request out of sequence and read timeouts
x4xx	NETEX Initiated disconnect errors
x5xx	Errors during connection

Table 3 Origin of NRB Error Codes, Part 2

Note the following when using these codes:

The error codes at each level are as common as possible. Thus, a 2103 error in transport would have substantially the same meaning as a 3103 error in session, and a 1361 error would not be defined at (for example) the Driver level if a 3361 error meant something entirely different at the Session level.

Some errors cause the loss of the connection or result in a connection not being established. Any status code that implies that the connection is no longer useful has a 6 (Disconnect Indication) returned in NRBSTAT. Any attempts to issue further requests to that connection have a x100 (no Nref) error returned to it.

All errors that result in the loss of the connection and a Disconnect Indication in NRBIND are indicated by an asterisk (*) following the error code number.

Note: A 0000 in field NRBSTAT means successful completion of the NETEX request. A -1 means that the request is still in progress.

The following sections describe the errors in numerical order starting with general NETEX error, followed by driver, transport, and session level errors.

General Errors

The following errors are general NETEX errors.

0000	Successful completion
0001	A read type operation completed normally within NETEX, but the Pdata buffer provided by the user was not large enough to hold the data. NRBLEN and NRBUBIT reflect the amount of data the other party intended to send. However, the amount of data moved to the user's program was only the amount of addressable units specified in NRBBUFL. NRBIND specifies the type of data sent to the user. Requests affected: OFFER, READ. The status of the connection is not affected.
0002	NRBBUFL and NRBBUFA do not specify a block of storage that fits entirely within the user's addressable memory. The operation is suppressed. All requests are affected. The status of the connection is unaffected.
0003	On a write type operation, the unused bit count(NRBUBIT) specifies a larger number of bits than are in the machine's word (addressable unit size). The operation is suppressed; the status of the connection is not affected.

0004	The request code(NRBREQ) is not valid. The operation is ignored, and the status of the connection specified by NRBNREF is not affected
0005	The buffer size specified (in NRBBUFL for read and NRBLEN for write) exceeds an implementation defined NETEX maximum. The operation is suppressed. The status of the connection is not affected.
0011	A read-type operation completed normally within NETEX, but the Odata buffer provided by the user was not large enough to hold the data. NRBPROTL reflects the amount of data the other party intended to send; however, the amount of data moved to the user's program was only the amount of addressable units originally specified in NRBPROTL. NRBIND specifies the type of data sent to the user. Requests affected: OFFER, READ. The status of the connection is not affected
0012	NRBPROTL and NRBPROTA do not specify a block of storage that fits entirely within the user's addressable memory. The operation is suppressed. All requests are affected. The status of the connection is unaffected.
0021	A read-type operation completed normally within NETEX, but BOTH the Odata and Pdata buffers were too small to hold the incoming data. NRBLEN/NRBUBIT and NRBPROTL reflect the amount of data the other party intended to send; however, the amount of data moved to the user's program was only the amount of addressable units originally specified in NRBLEN and NRBPROTL. NRBIND specifies the type of data sent to the user. Request affected: OFFER, READ. The status of the connection is not affected.
0100*	The user interface detected that the NRBNREF in the NRB does not refer to a connection currently in use by the application program. Probable cause is a bad CONNECT, OFFER, or ASSIGN or failure to handle an incoming Disconnect.
0310	The user has attempted to re-use an NRB before a previous request issued with that NRB has completed. The request will be rejected. When the original request issued with that NRB completes, then the NRB will be once more updated with the status of that request.
0500*	NETEX is not currently running on the local computer. Intervention by the local computer operator will be required to start NETEX. This code is issued by the NETEX user interface when it is determined that NETEX is unavailable.
0503*	An OFFER, CONNECT, or ASSIGN request has resulted in the number of connections outstanding for the caller exceeding an implementation defined maximum. The new connection request is rejected.
0504*	The user program is not authorized to use the user interface facilities needed to communicated with NETEX. No use of NETEX is possible until the user gains the appropriate authorization
0505*	NETEX is currently being drained by the computer operator in preparation for a NETEX shutdown. No new OFFER, CONNECT, or ASSIGN requests will be accepted. The request is rejected. The status of already existing connections is not affected.
0511*	A CONNECT or ASSIGN request would exceed the total number of driver service level connections to NETEX. The new connection request is rejected.

0512*	The NETEX program is aborting execution due either to internal NETEX software problems or cancellation by the computer operator. No further traffic with NETEX will be possible. This error will be issued to complete a request that was issued when NETEX was running normally.

Table 4 General NRB Error Codes

Host Specific Errors

0913	The number of concurrent NETEX requests has exceeded the number of available NETEX NRBs. The request can be retried at a later time.

Table 5 Host Specific NRB Error Codes

Driver Service Errors

1005	The length of data on a DWRITE is greater than a host-specified maximum. The request is rejected.
1006	The length of data received on a DREAD is greater than a host-specified maximum. The request is rejected.
1100*	The Dref specified by the NRBNREF is not in use or is not owned by this application program. The request is rejected. The status of the other connections owned by this application remain unchanged.
1101	The DATAMODE field of a NETEX format network message is not valid for this particular host; or, the message is routed through the driver (intra-host) and Assembly/Disassembly cannot be performed.
1102	The specified value of the Associated Data bit in the hardware message area does not match the presence or absence of associated data as specified in NRBLEN. DWRITW is affected. The driver assignment remains in effect. Both NETEX format and arbitrary format network messages are affected.
1103	The specified length of the message proper does not fit, it is not between 8 to 64 bytes inclusive. Only writes (DWRITE) may obtain this response. The driver assignment remains in effect. Both NETEX format and arbitrary format network messages are affected.
1200	“Power off”, “not operational”, or a similar indication of local adapter unavailability was discovered when physical I/O was issued. The status of the assignment is not affected, but it is unlikely that driver communications can continue without operator intervention.
1201	The network adapter has reported an error in processing the DREAD or DWRITE request. The adapter model dependent detailed status may be obtained by issuing a DSTATUS function.
1300	A DREAD or DCONNECT request timed-out before any data was received on the network. The time value used for the timeout was in NRBTIME. No data was received. The status of the driver connection is not affected.

1304	The number of DWRITE requests outstanding against a single connection exceeds an implementation defined maximum. The DWRITE request is rejected. The status of the connection and the previous DWRITE requests remains unchanged.
1305	The number of DREAD requests outstanding against a single connection exceeds an implementation defined maximum. The DREAD request is rejected. The status of the connection and the previous DREAD requests remains unchanged.
1306	A DREAD or a DWRITE was detected when the connection was in disconnect mode.
1310	The device service was forced to discard the Associated Data segment of a message because no DREAD was issued within a sufficient time of the arrival of the network message. The message proper is returned to the user. Also, a DWRITE will receive this error if an intra-host DWRITE cannot be matched with an outstanding DREAD by another driver user. In that case, the message proper will be queued and associated data discarded.
1311	Message propers have been lost because of excess demand for the Driver service's resources. One or more messages that arrived before the current message were totally discarded by the driver service. This will be provided as a DREAD error or an intra-host DWRITE.
1312	A request for a privileged service such as diagnostic mode has been issued to the driver. The request is rejected as the user does not have sufficient implementation dependent privileges. This error applies to both DREAD requests and intra-host writes (DWRITE).
1501*	A specific Dref requested by the DCONNECT is already in use. If a nonspecific request was made, all driver paths are in use.
1503*	The number of user driver attaches permitted by NETEX has been exceeded. Driver service can not be offered at this time. The DCONNECT is rejected.
1504*	Driver service is not directly available to applications programs. This service can only be made available by the installation systems programmer.
1505*	NETEX is currently being "drained" by the computer operator. No new driver service (DCONNECT) requests are being accepted.
1506*	The specific Dref (adapter address) requested by a DCONNECT does not exist on this local host.
1507*	The specific Dref (adapter address) exists on the local host, but the NETEX operator has drained that adapter so no new requests for driver service (DCONNECT requests) can be accepted on that adapter.
1509*	The specified value of NRBBLKO exceeds an installation or implementation defined maximum. The DCONNECT request is rejected.
1510*	The specified value of NRBBLKI exceeds an installation or implementation defined maximum. The DCONNECT request is rejected.
1601	Hardware error – lost interrupt.
1605	Driver initialization failed.
1606	NTX minor device in use.
1612	Cannot attach to shared memory.
1614	NRB not in shared memory.

1628	Driver is out of buffer space.

Table 6 Driver Service NRB Error Codes

Transport Service Errors

2005	During a WRITE operation, the length of the buffer as specified by NRBLEN exceeds the maximum buffer size found in NRBBLKO. The WRITE operation is rejected. The connection remains outstanding.
2008	During a segmented write, NRBLEN exceeds the segment size.
2100*	The Tref specified by NRBNREF is not in use or is not owned by this application program. The request is rejected. The status of the other connections owned by this application remain unchanged.
2101	The DATAMODE field in the NRB is not valid for the local host. The write operation (SWRITE, TWRITE, SCONNECT, TCONNECT, SCLOSE, TCLOSE) is suppressed. The connection (if previously established) remains in effect.
2103	The quantity of Odata provided exceeds an implementation defined maximum. The request is rejected.
2300	The timeout value associated with a TREAD request resulted in a request timing out before any data or other indication was received from the corresponding application.
2301	TCONNECT, TOFFER, or TCONFIRM has been issued for a connection that is already fully established. The request is rejected. The status of the connection remains unchanged. Some implementations may return a 2301 code for any “out of sequence” series of request to Transport.
2302	A connect indication was received by a preceding offer, and a request other than TCONFIRM or TDISCONNECT was issued. The request is rejected. NETEX will continue to wait for the confirm or disconnect request.
2303	A TCONNECT request was previously issued, then a request other than a TREAD to read the Confirm of Disconnect indication was issued. The request is rejected. NETEX will continue to wait for the TREAD request.
2304	The number of TWRITE requests outstanding against a single connection exceeds an implementation defined maximum (usually one). The TWRITE request is rejected. The status of the connection and the previous TWRITE requests remains unchanged.
2305	The number of TREAD requests outstanding against a single connection exceeds an implementation defined maximum (usually one). The TREAD request is rejected. The status of the connection and the previous TREAD requests remains unchanged.
2306	A TWRITE request has been issued to a transport connection that is in the process of servicing a remote caller or NETEX initiated Disconnect. A Disconnect Indication is pending from NETEX.
2307	A TREAD request has been issued to a transport connection that is in the process of servicing a remote caller or NETEX initiated Disconnect. A Disconnect Indication is pending from NETEX.
2308	A write type request (TWRITE or another TCLOSE) has been issued against a connection that has accepted a previous TCLOSE.

2400*	No response has been received from the remote NETEX for a period of elapsed time (DEADTO) specified by the installation systems programmer. The connection is terminated. A Disconnect Indication will be found in the NRBIND.
2402*	The remote application has failed to issue a TREAD request for a period of elapsed time (READTO) specified by the installation systems programmer on the remote host. The connection is terminated. A Disconnect Indication will be found in NRBIND.
2403	The remote application exited without issuing an explicit Disconnect back to the local application. The connection is terminated. A Disconnect Indication will be found in NRBIND.
2500*	A connect message was repeatedly sent to the remote host in response to a previous TCONNECT request, but no response was received for a period of elapsed time (CONTO) specified by the installation systems programmer.
2503*	The number of transport connections permitted by NETEX has been exceeded. Transport service can not be offered at this time. The TCONNECT or TOFFER is rejected.
2504*	Transport service is not directly available to applications programs. This service can only be made available by the installation systems programmer.
2505*	NETEX is currently being "drained" by the computer operator. No new request for Transport services (TCONNECT of TOFFER requests) are being accepted.
2506*	The Physical Address Map passed to Transport for a connection is not valid. If this message was returned from a SCONNECT request, the Network Configuration list was incorrectly generated.
2509	The specified value of NRBBLKO exceeds an installation or implementation defined maximum. The connection request is rejected.
2510*	The specified value of NRBBLKI exceeds an installation or implementation defined maximum. The connection request is rejected.
2511*	The specified Class of Service is not implemented.

Table 7 Transport Service NRB Error Codes

Session Service Errors

3005	During a WRITE operation, the length of the buffer as specified by NRBLEN exceeds the maximum buffer size found in NRBBLKO. The WRITE operation is rejected. The connection remains outstanding.
3006	The length of PDATA sent on a CONNECT, CONFIRM, or DISCONNECT is greater than the maximum allowed. The request is rejected.
3008	During a WRITE, NRBLEN exceeds segment size.
3100*	The Sref specified by NRBNREF is not in use or is not owned by this applications program. The request is rejected. The status of other connections owned by this application remain unchanged.
3101	On an SWRITE request for intra-host communications, a DATAMODE was specified that is not supported for internal communications.

3103	The quantity of Odata provided exceeds an implementation defined maximum. The request is rejected.
3300	An SREAD or SOFFER request timed-out before a response was received on the network. If the timed request is an SREAD, the status of the connection was not affected. If an SOFFER timed out, then the connection will not have taken place.
3301	SCONNECT, SOFFER, or SCONFIRM has been issued for a connection that is already fully established. The request is rejected. The status of the connections remains unchanged.
3302	A connect indication was received by a preceding SOFFER, and a request other than SCONFIRM or SDISCONNECT was issued. The request is rejected. NETEX will continue to wait for the confirm or disconnect request.
3303	A SCONNECT request was previously issued, then a request other than an SREAD or SDISCONNECT was issued. The request is rejected. NETEX will continue to wait for the SREAD or SDISCONNECT request.
3304	The number of SWRITE requests outstanding against a single connection exceeds an implementation defined maximum (usually one). The SWRITE request is rejected. The status of the connection and the previous SWRITE requests remains unchanged.
3305	The number of SREAD requests outstanding against a single connection exceeds an implementation defined maximum (usually one). The SREAD request is rejected. The status of the connection and the previous SREAD requests remains unchanged.
3306	A SWRITE has been issued to a session connection that is in the process of servicing a remote caller or NETEX initiated Disconnect. A Disconnect Indication is pending from NETEX.
3307	A SREAD request has been issued to a session connection that is in the process of servicing a remote caller or NETEX initiated Disconnect. A Disconnect Indication is pending from NETEX.
3308	A write type request (SWRITE or another SCLOSE) has been issued against a connection that has accepted a previous SCLOSE.
3402*	The remote application has failed to issue an SREAD request for a period of elapsed time (READTO) specified by the installation systems programmer on the remote host. The connection is terminated. A Disconnect Indication will be found in NRBIND.
3403*	The remote application exited without issuing an explicit Disconnect back to the local application. The connection is terminated. A Disconnect Indication will be found in NRBIND
3422	HALT SREF was issued by operator.
3500*	A connect message was repeatedly sent to the remote host in response to a previous TCONNECT request, but no response was received for a period of elapsed time (CONTO) specified by the installation systems programmer. Probable cause is the absence of the NETEX software on the remote host. The SCONNECT terminates with a Disconnect Indication in NRBIND.
3501*	The PNAME specified is not OFFERed on the HOST specified during the SCONNECT. The SCONNECT terminates with a Disconnect Indication in NRBIND.

3502*	The PNAME specified was not OFFERed on the HOST specified during the SCONNECT. However, a session that was previously established by OFFERing the requested PNAME is now in progress on the remote machine. If the remote application elects to re-OFFER the connection in the future the service might be available at that time. (In other words, the remote application is "busy.")
3503*	The number of user session connections permitted by NETEX has been exceeded. Session service can not be offered at this time. The SCONNECT or SOFFER is rejected.
3504*	Session service is not directly available to applications programs. This service can only be made available by the installation systems programmer.
3505*	NETEX is currently being "drained" by the computer operator. No new requests for Session services (SCONNECT and SOFFER) are being accepted.
3506*	The HOST specified in an SCONNECT request does not exist anywhere on the network generated by the installation systems programmer. The SDISCONNECT terminates with a Disconnect Indication in NRBIND.
3507*	The HOST specified exists on the installation generated network configuration, but the local computer operator has specified that no session level connections take place with that particular host. The SCONNECT terminates with a Disconnect Indication in NRBIND.
3508*	The HOST specified exists on the installation generated network configuration, but no communications path exists between the local host and the specified remote host. The SCONNECT terminates with a Disconnect Indication in NRBIND.
3509*	The specified value of NRBBLKO exceeds an installation or implementation defined maximum. The connection request is rejected.
3510*	The specified value of NRBBLKI exceeds an installation or implementation defined maximum. The connection request is rejected.
3511*	The Class of Service request is not currently implemented.
3522*	NETEX was drained while this outstanding OFFER was not complete.
3523*	NETEX was DRAINed when a connect was received. This error is returned by the Session Manager to the connector.
3550*	The local host specified on an SOFFER or SCONNECT does not exist in the NETEX Administrator's NCT. The request is rejected at the Administrator.
3552*	The local host specified on an SOFFER or SCONNECT request in not in the NETEX Administrator's domain. The request is rejected.
3553*	The Physical Address Map (PAM) sent along with an OFFER or CONNECT request to the Administrator does not match any PAM that the Administrator can generate. The request is rejected.

Table 8 Session Service NRB Error Codes

Network Service Errors

4100*	The Nref specified by NRBNREF is not in use or is not owned by this application program. The request is rejected. The status of other connections owned by this application remain unchanged.
4101	In a Network connection that is intra-host (causing no network adapter traffic) a DATAMODE was requested on the NWRITE that is not supported for intra-host communications. The block will be sent to the destination process using bit stream (DATAMODE 0) transmission.
4104	Checksum on an incoming driver level message is not correct. The message and data received will be returned to the DREAD caller along with the error code but the data should, of course, be considered suspect. The status of the driver assignment is not affected.
4105	The length of the Pdata was less than or substantially different from the specified length in the message proper. This comparison is performed after adjustment for incoming A/D modes. Sufficient slop in this comparison will be done to accommodate those machines that must send information in multiples of the word size.
4300	The timeout value associated with an NREAD request resulted in a request timing out before any data or other indication was received from the corresponding application.
4301	NCONNECT or NOFFER has been issued for a connection that is already fully established. The request is rejected. The status of the connection remains unchanged. Some implementations may return a 4301 code for any "out of sequence" series of requests to Network Service.
4304	The number of NWRITE requests outstanding against a single connection exceeds an implementation defined maximum (usually one). The NWRITE request is rejected. The status of the connection and the previous NWRITE requests remains unchanged.
4305	The number of NREAD requests outstanding against a single connection exceeds an implementation defined maximum (usually one). The NREAD request is rejected. The status of the connection and the previous NREAD requests remains unchanged.
4306	A NWRITE has been issued to a transport connection that is in the process of servicing a NETEX initiated Disconnect. A Disconnect Indication is pending from NETEX.
4307	A NREAD request has been issued to a transport connection that is in the process of servicing a NETEX initiated Disconnect. A Disconnect Indication is pending from NETEX.
4403*	When processing an NWRITE request, Network Service found that a network Virtual Circuit between two Network applications no longer exists. The Network connection is terminated.
4501*	A specific Nref requested by the NCONNECT or NOFFER is already in use.
4503*	The number of user Network connections permitted by NETEX has been exceeded. Network service can not be offered at this time. The NCONNECT or NOFFER is rejected.
4504*	Network service is not directly available to applications programs. This service can only be made available by the installation systems programmer.
4505*	NETEX is currently being "drained" by the computer operator. No new requests for Network services (NCONNECT or NOFFER requests) are being accepted.

4506*	The Physical Address Map passed to Network for a connection is not valid. If this message was returned from an SCONNECT request the Network Configuration list was incorrectly generated.
4509*	The specified value of NRBBLKO exceeds an installation or implementation defined maximum. The connection request is rejected.
4510*	The specified value of NRBBLKI exceeds an installation or implementation defined maximum. The connection request is rejected
4511*	The specified Class of Service is not implemented.
4512*	During an attempt to establish a virtual circuit on HYPERbus or other equipment, a component of the network physically did not respond. The circuit cannot be established.
4513*	During an attempt to establish a virtual circuit on HYPERbus or other equipment, a component of the network could not honor the request because all its circuit facilities were "busy." The circuit cannot be established at the current time.
4514*	During an attempt to establish a virtual circuit on HYPERbus or other equipment, a component of the network could not honor the request because of an equipment failure.
9001	User exit rejected request (Completion). The request has been failed by the user interface because NETEX has completed processing.

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