“C” Configuration Manager and NetEx® Alternate Path Retry (APR)

Release 5.2

Software Reference Manual

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Revision Record

Revision	Description
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Portions of text which have been changed or added at this revision are indicated by a bar (" | " in the margin. Minor editorial revisions are not indicated.

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Preface

This manual has two sections; the first, ""C" Configuration Manager" on page 1, describes the Network Executive Software "C" Configuration Manager. The second, "Alternate Path Retry (APR)" on page 25, provides information about the NetEx Alternate Path Retry facility. Alternate Path Retry is a feature based on route mapping and sorting performed by the Configuration Manager. The Configuration Manager section is intended only for users of the "C" version. However, the Alternate Path Retry section applies to all NetEx versions with this feature, including those with "C", PASCAL, or FORTRAN versions of the Configuration Manager.

"C" Configuration Manager

This section describes the "C" Configuration Manager and is most useful to those who are responsible for managing the NCT.

"Introduction" on page 3 introduces and briefly describes the Configuration Manager facility.

"Operation" on page 5 explains the Configuration Managers, the network configuration statements, configuration commands, and PAM (Physical Address Map) file structure.

"CM Configuration File Errors" on page 21 provides a listing and explanation of errors specific to the Network Configuration Table (NCT) File.

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

Alternate Path Retry (APR)

This section helps the NetEx user understand and use the Alternate Path Retry (APR) Facility. It supplements the NetEx software reference manuals, but does not replace them. This guide explains the interrelationship of NetEx commands when using Alternate Path Retry.

"Introduction" on page 27 introduces the Alternate Path Retry (APR) facility and provides definitions for terms used when discussing APR.

"Operation" on page 31 explains the path verification task, how internal paths work, and which commands automatically generate internal paths and path groups.

Reference Material

Refer to the Reference Manuals for active products by visiting our Support pages on our website at www.netex.com.

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

Notice to the Customer

The installation information supplied 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

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.

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

GNA: A NetEx Network Address, consisting of a combination of the NETADDR and SMGDREF parameters as specified on the ADAPTER statements in the NCT. For example, an ADAPTER defined with a NETADDR of A0 and a SMGDREF of 40 would have a GNA value of A040.

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.

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 EXecutive (NetEx): A family of software designed to the OSI model 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.

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

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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“C” Configuration Manager

Introduction

The Configuration Manager (CM) is a stand-alone program that is used to coordinate the management of configuration information for a NetEx network. There are two major components in CM: the NCT preprocessor and the PAM file generator. The NCT preprocessor reads as input a network configuration description file (text file). The network configuration describes the topology of the network. The preprocessor transforms this text file into an internal data structure called the Network Configuration Table (NCT). The second component creates a binary file based on user commands and the NCT. This binary file is made available and used by the NetEx routing mechanism.

User Interface

The user interface involves building the NCT data file used by the Configuration Manager. The data file consists of configuration statements describing the network. Once this text file is created, the user executes the Configuration Manager program. The program is interactive and various commands may be given to generate what the user desires. The output, a binary file, is ready for NetEx use upon completion of the program. The configuration statements, CM commands, and program output are described in detail in the following sections.

Operation

Network Configuration Statements

Network configuration statements are used during the installation process to describe the user's IP network configuration to NetEx. The network configuration statements are placed in a network configuration file, which is used to generate the Network Configuration Table (NCT).

Network Configuration Statement Syntax

The following syntax rules apply to the Network Configuration statements.

The entire 80 characters of each statement are scanned.

All references to identifiers must be identical to the identifier. The same combination of upper and lowercase must be used (for example, `T0=Beta` references the label 'Beta' not 'BETA', 'beta', or any other combination).

If a label is present, it must begin in the first character position of the statement, with no leading blanks. At least one space must separate the label from the statement type and the statement type from the parameters. If a label is missing, at least one blank must precede the statement type.

All labels must be unique. They must be distinct from each other and from any names used by the Configuration Manager. This includes all statement names, key words, and adapter types.

All host group names must also be distinct from labels or Configuration Manager names.

A comma (,) or blank is used to delimit the parameters of each statement.

Continuation statements are denoted by at least one blank preceding the statement.

If an asterisk is detected in the first character position of the statement, the entire statement is treated as a comment.

Network Configuration File

The configuration file contains the configuration manager statements that describe the user's network. Six different statement types are used to describe this, as follows.

VERSION - specifies the version of the network configuration. This value is recorded in the con-figuration record when the PAM file is built.

LOCALNET - describes all equipment that is interconnected via one or more networks. Statements describing the equipment on that network follow the LOCALNET statement.

TRUNK – For IP networks, TRUNK specifies a name used to identify connectivity to an IP network.

HOST - describes a host processor that has a connection to the network via one or more processor adapters.

ADAPTER - specifies the address and characteristics of the processor adapter that is attached to the HOST. This typically refers to the Network Interface port on the HOST.

END - specifies the end of the network configuration.

In the following specifications, the format used is as described in the preface of this manual. Note that the statement types and parameters can be in upper or lower case, but labels and identifiers are case specific, as mentioned above.

VERSION Statement

The VERSION statement defines a version number associated with this network description. It is purely for local version control and identification. The version should be incremented each time a significant change is made to the NCT. This allows confirmation that the PAM file being used corresponds to the NCT being examined, because the version number is recorded in the Configuration Record.

The VERSION statement has the following format.

Name	Statement	Parameters
[label]	VERSION	number

The following control words are used in the VERSION statement.

label

This optional name is ignored; it is allowed for commentary.

VERSION

This required string is the verb for this statement.

number

This required parameter specifies the version number of the NCT. The number is recorded in the configuration record and can be used to match the PAM file being used with the text NCT it came from. The number must be between 0 and 255.

LOCALNET Statement

The LOCALNET statement defines the name of the local network. The term 'local network' signifies Hosts, Adapters and Trunks sectioned into logical groups The first statement in the configuration file must be a LOCALNET statement. All TRUNK, HOST, and ADAPTER statements for that local network must follow the LOCALNET statement. The presence of a second LOCALNET statement, regardless of the label, will begin the description of a second local network. At least one LOCALNET statement must be present in any network configuration. Typically only one LOCALNET is defined, unless you want to define a common NCT with more than one Netex network. But hosts in one LOCALNET wouldn't be able to communicate with hosts in another LOCALNET. The TRUNK statements can be used to isolate one or more hosts (GNAs) from one or more hosts (GNAs) in the same LOCALNET.

The LOCALNET statement has the following format.

Name	Statement	Parameters
[label]	LOCALNET	TYPE = |HC |

The following control words are used in the LOCALNET statement.

label

This optional control word specifies the name of this local network. This label should be used to make the NCT more readable. The label may be any name desired by the user which is one to eight alpha-numeric characters long. It must be unique from all other labels in the network configuration. A typical label would be the site ID of the network which is referenced by remote sites.

LOCALNET

This required string is the verb for this statement.

TYPE

This required parameter specifies the type of local network to be described. It must be specified as HC. ***NetEx/IP networks must be defined as TYPE=HC.***

TRUNK Statement

For IP networks, the TRUNK statement identifies connectivity to an IP media. One trunk statement must be present for each unique IP network (or subnet) that is used by NetEx/IP. Adapters and/or servers connected to the IP Trunk are identified in subsequent HOST and ADAPTER statements. All rules regarding naming and placement of TRUNK statements are as follows.

All TRUNK statements in a NetEx local network must immediately follow the LOCALNET statement and precede all HOST statements that define the usage of the trunks. The range of a trunk is a single local network..

Typically you will define a single TRUNK for your NetEx network. However you could use multiple TRUNK statements if you wish to prevent the generation of NetEx/IP paths to a specific host (or GNA). For example, if there is no IP connectivity between 2 specific NetEx/IP hosts, they should not be defined on the same TRUNK.

Multiple TRUNKs can be defined on an ADAPTER to limit path generation in the following example:

> HOST1 to HOST2 (using TRUNKA); HOST1 to HOST3 (using TRUNKB). If there is no required connectivity between HOST2 and HOST3, they should be defined on different TRUNKs to prevent NetEx paths from being generated between HOST2 and HOST3; but both trunks should be defined on the HOST1 adapter(s) to get paths generated from HOST1.

Each of these trunks is given a label so that NetEx software can determine the NetEx paths used to communicate between NetEx/IP hosts on the network. Note that the label is required.

The TRUNK statement has the following format.

Name	Statement	Parameters
label	TRUNK	

The following control words are used in the TRUNK statement.

label

> This required control word specifies the name of this trunk. The label may be any name desired by the user which is from one to eight alphanumeric characters long. It must be unique from all other labels in the network configuration. Typical labels are ALPHA, BETA, etc.

TRUNK

> This required string is the verb for this statement.

HOST Statement

The HOST statement provides NetEx with information about a particular host in the network. One HOST statement is required for each host in the network.

The HOST statement must follow the LOCALNET and TRUNK statements for that local network. All ADAPTER statements describing the configuration of the host must immediately follow the HOST statement. Note that the label is required. The parameters TYPE, MODEL, and OS are for readability only and may be omitted. The parameters GROUP and PROTOCOL are used as needed and may be repeated within a single HOST statement.

The HOST statement has the following format.

Name	Statement	Parameters
label	HOST	[TYPE = manufacturer_product_line] [MODEL = model_number] [OS = operating_system_name] [GROUP = group_name] [VALDREF = xxxx] [OPTIONS = [ALTFIRST] [OPTIONS = [LONGMSG] [OPTIONS = [NOAPR] PROTOCOL = n [,PROTOCOL = n]

The following control words are used in the HOST statement.

label

This required control word specifies the logical name of the host. This label is to be the same name specified in the HNAME field of user connections. The label may be any name (one to eight characters long) chosen by the user. It must be unique from all other labels in the network configuration.

HOST

This required string is the verb for this statement.

TYPE

This optional parameter specifies the physical characteristics of the HOST by defining the trade name of the manufacturer's CPU product line. This parameter should be used to make the NCT more readable. The manufacturer_product_line may be an alphanumeric string from one to eight characters long.

MODEL

This optional parameter specifies the model number within the manufacturer's product line. This parameter should be used to make the NCT more readable. The model_number may be an alphanumeric string from one to eight characters long.

OS

This optional parameter specifies the operating system running on the machine. This parameter should be used to make the NCT more readable. The operating_system_name may be an alphanumeric string from one to eight characters long.

GROUP

This optional parameter specifies the logical name of a group of hosts that this HOST belongs to. If this HOST fits into more than one group, this parameter may be specified as many times as needed. The group_name may be an alphanumeric string from one to eight characters long. The GROUP parameter is used for Alternate Path Retry to a cluster of hosts (see the Introduction of "Alternate Path Retry (APR)").

The group_name must be distinct from all labels used in the configuration. It must also be distinct from all configuration manager reserved words, including all adapter identifiers.

VALDREF

This optional parameter specifies alternate drefs for valid communication with this host. This is primarily for documentation purposes.

OPTIONS

This optional parameter specifies several special options. The ALTFIRST option indicates that when this is the local host, the local NetEx should, if it supports it, rotate which alternate path it tries first on successive SCONNECT requests. This is currently only supported by a few NetExes. The LONGMSG option indicates that when this is the local host and the remote host also supports LONGMSG, the protocol will use a longer message length than older versions of NETEX. This is currently only supported by a few NetExes. The NOAPR option indicates that this host either cannot or wishes not to engage in APR. It instructs remote NetExes not to attempt APR to it.

PROTOCOL

This optional parameter specifies the protocol level of NetEx that will be used with this configuration. n may be specified as any decimal integer from 1 to 16. The number selected corresponds to the protocol level. When more than one level is acceptable, this parameter may be repeated, each time specifying a different level number. If a host is defined to belong to a GROUP, all the hosts in that group must have the same protocols selected.

Currently, this parameter must be specified as either PROTOCOL=2 or PROTOCOL=4. If it is not specified, PROTOCOL=2 is used as the default.

PROTOCOL=2 indicates that this NetEx/IP host supports the NetEx/IP Type-2 protocol. This protocol results in more static usage of network bandwidth, and is usually preferred in local environments (LAN), or in short-distance configurations (e.g. < 500 miles).

PROTOCOL=4 indicates that this NetEx/IP host supports the NetEx/IP Type-4 protocol. This protocol provides the ability for NetEx/IP to dynamically maximize the network performance, based on factors such as available bandwidth, distance, and workload on the network. To use Type-4 protocol on any given NetEx/IP connection, PROTOCOL=4 must be specified on the remote HOST definitions in the Configuration File, and optionally on the local HOST definition. If the local host NetEx/IP supports Type-4 protocol, it will be used on any connections to remote hosts for which PROTOCOL=4 is specified, regardless of how this parameter is specified, and also on any incoming Type-4 connections. Otherwise, Type-2 protocol is used.

ADAPTER Statement

The ADAPTER statement describes each adapter to NetEx. The ADAPTER statements for each adapter attached to a host must immediately follow the HOST statement.

The ADAPTER statement has the following format.

Name	Statement	Parameters
[label]	ADAPTER	MODEL = |nxxx| NETADDR = xx [SMGDREF = xx] [CHANADDR = [c]cud] [NUMADDRS = n] [DEVNAME = device_name] |T0 = label| |T1 = label| |T2 = label| |T3 = label|

The following control words are used in the ADAPTER statement.

label

This optional control word specifies a symbolic name for the processor adapter. The label may be any name desired by the user, which is from one to eight alphanumeric characters long. It must be unique from all other labels in the network configuration.

ADAPTER

This required string is the verb for this statement.

MODEL

This required parameter defines the type of adapter attached to the HOST. Only processor adapters may be specified. Use the following as a guide when defining ADAPTER models:

Adapter type	Model	Example NetEx
Channel-attached adapters (CA):		
NESiGate	N220	H210IP
LAN Offload adapters (LO):		
NESiGate	N130	H267IP,H297IP, H367IP
Host-NIC adapters:		
IP	N130	H140IP, H320IP, H620IP H690IP, H800IP; H820IP
IP	N220	H210IPZ, H300IPC

NETADDR

This required parameter defines the hexadecimal network address of the adapter on the local network. The operand xx consists of two hexadecimal digits that specify the eight-bit adapter address. It must be unique from all other NETADDRs in this specific LOCALNET with the exception of NETADDRs

that are defined for Requestor hosts using TNP feature of a host NetEx (i.e. H367IP). This operand is required in all ADAPTER definitions.

SMGDREF

This optional parameter specifies the sub-address for this host's session manager. This value corresponds to a specific task within the host. It consists of two hexadecimal integer digits. The default value is '00'. This operand need not be specified unless the user wishes to change the default; in that case, the SMGDREF must be defined on all ADAPTER statements referencing the host.

The SMGDREF assigned must be the complete dref for that adapter. For N220 adapters, this means adding in the offset of the two low-order hex digits from the CHANADDR (ex. CHANADDR=0240, if dref=01 then SMGDREF=41).

CHANADDR

This required parameter (required for N220 adapters only, optional for all others) specifies the lowest channel device address of a group of devices to be used by the NetEx software on an IBM or Unisys system. This channel unit address must be expressed as three or four hexadecimal digits (example: CHANADDR = 3C0, CHANADDR = 5100). Normally, NetEx is given a contiguous range of channel device addresses responded to by the N220 Processor Adapter. CHANADDR specifies the first.

NUMADDRS

This required parameter (required for N220 adapters only, optional for all others) specifies the maximum number of channel unit addresses that will be used by the IBM NetEx software. The number of addresses must be expressed as a decimal number (example: NUMADDRS = 32). The minimum required is 2. The maximum allowed is 64.

DEVNAME

This optional parameter specifies a logical device name for this adapter. The device name may be from one to eight alphanumeric characters.

T0, T1, T2, and T3

These required parameters define the IP media that are attached to the network adapter. At least ONE operand must be defined for each adapter. The associated labels specify the label of a preceding TRUNK statement. The referenced TRUNK must be defined in this LOCALNET.

END Statement

The END statement indicates the end of the Network Configuration statements. This must be the last network configuration statement.

The END statement has the following format.

Name	Statement	Parameters
	END	

The following control word is used in the END statement.

END

This required string is the verb for this statement.

Network Configuration Example

Figure 1 shows a possible network configuration. The associated statements needed to define the network are shown in Figure 2.

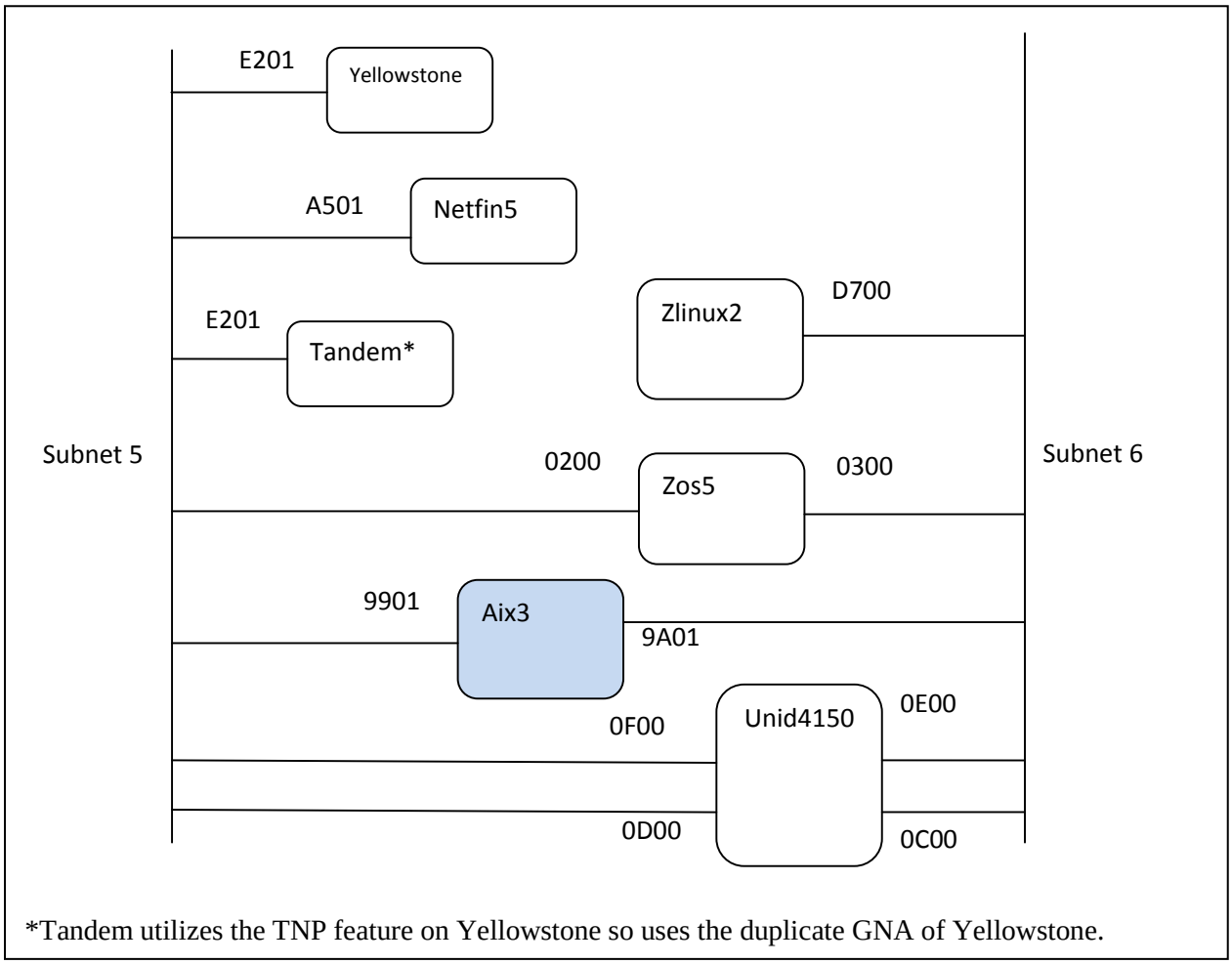


Figure 1. Sample Network Configuration

```
         VERSION    255
*************************************************
NESINET  LOCALNET   TYPE=HC
UDP_ETH5 TRUNK
UDP_ETH6 TRUNK
*************************************************************
*       Host YELLOWST (SuSE Linux)
*************************************************************
YELLOWST HOST     TYPE=LINUX    MODEL=SuSE
                  PROTOCOL=2    PROTOCOL=4
         ADAPTER  MODEL=N130    NETADDR=E2
                  T0=UDP_ETH5   SMGDREF=01
*************************************************************
*       Host NETFIN5 (NESiGate-LO)
*************************************************************
NETFIN5  HOST     TYPE=NESiGate MODEL=X346
                  GROUP=MINGE  GROUP=FLASHE
                  GROUP=TANDEMSE GROUP=DALE
                  PROTOCOL=2    PROTOCOL=4
         ADAPTER  MODEL=N130    NETADDR=A5
                  T0=UDP_ETH5   SMGDREF=01
*************************************************************
*       Requestor Hosts for use with H800IP/TNP
*  Tandem-s NonStop requestor connected to YELLOWSTONE
*************************************************************
TANYELL   HOST     TYPE=LINUX    MODEL=SuSE
                   PROTOCOL=2
          ADAPTER  MODEL=N130    NETADDR=E2
                   T0=UDP_ETH5   T1=UDP_ETH6
                   SMGDREF=01
*************************************************************
*  Host ZLINUX2
*************************************************************
ZLINUX2  HOST     TYPE=IBM      MODEL=Z9
                  PROTOCOL=2
         ADAPTER  MODEL=N130    NETADDR=D7
                  T1=UDP_ETH6
                  NUMADDRS=4    SMGDREF=00
*************************************************************
*       Host ZOS5 (Z/OS)
*************************************************************
ZOS5     HOST     TYPE=IBM      MODEL=Z9
                  PROTOCOL=2    PROTOCOL=4
         ADAPTER  MODEL=N220    NETADDR=02  CHANADDR=0200
                  T0=UDP_ETH5
                  NUMADDRS=4    SMGDREF=00
         ADAPTER  MODEL=N220    NETADDR=03  CHANADDR=0300
                  T0=UDP_ETH5   T1=UDP_ETH6
                  NUMADDRS=4    SMGDREF=00
*************************************************************
*       Host AIX3 (Power7)
*************************************************************
AIX3     HOST     TYPE=IBM_AIX  MODEL=POWER7
                  PROTOCOL=2
                  OPTIONS=LONGMSG ALTFIRST
         ADAPTER  MODEL=N130    NETADDR=99
                  T0=UDP_ETH5   SMGDREF=01
```

```
         ADAPTER  MODEL=N130    NETADDR=9A
                  T0=UDP_ETH6   SMGDREF=01
*********************************************************
*       Host Unisys
*********************************************************
UNID4150 HOST     TYPE=DORADO   MODEL=4150  GROUP=UNISYS
                  OPTIONS=ALTFIRST
                  OPTIONS=LONGMSG
          ADAPTER  MODEL=N220    NETADDR=0F  CHANADDR=0F00
                   T0=UDP_ETH5   NUMADDRS=4  SMGDREF=00
          ADAPTER  MODEL=N220    NETADDR=0E  CHANADDR=0E00
                   T0=UDP_ETH6   NUMADDRS=4  SMGDREF=00
          ADAPTER  MODEL=N220    NETADDR=0D  CHANADDR=0D00
                   T0=UDP_ETH5   NUMADDRS=4  SMGDREF=00
          ADAPTER  MODEL=N220    NETADDR=0C  CHANADDR=0C00
T0=UDP_ETH6   NUMADDRS=4  SMGDREF=00
          END
```

Figure 2. Sample Network Description

Commands

The NCT preprocessor is the major component of the configuration preprocessor. This program accepts NCT data files and builds files of PAM lists. It is designed to work from an input data file. This can be either the user's terminal or a disk file.

The preprocessor program is started by the user as a task. It prompts the user for commands, then responds accordingly. The commands are listed and explained as follows.

nct *ifilename*

This command tells the preprocessor to read new NCT data. The data is read from the file whose name is given. This file must have 64-character fixed length records. Any existing tables are thrown away, and the new file is read. The internal representation for the network is built from the NCT data in the file, and then the validity of the structure is verified. This command is required before any makepam commands.

select *hostname hostname hostname …*
select *

This command is used to select which hosts should be used as destinations in generating the PAM List file. The makepam command clears the list of selected hosts. A `select *` statement selects all hosts.At least 1 host must be selected before a makepam command is issued. The host the pam is being made for is always selected.

deselect *hostname hostname hostname ...*

deselect *

This command is used to de-select hosts , all hosts, or group names that should not be used as destinations. The most common use of this command would be after the `select *` command, to take a few hosts out of the list that was selected. The makepam command will take out of the select list those hosts in the deselect list. It will clear the list of deselected hosts after building the file.

makepam *hostname ofilename*

This command tells the preprocessor to generate a PAM List file from the current network data structure read in by the last NCT command and hosts selected by the select command . Hence, an NCT command and at least 1 select command must have been given, before this command is legal. The preprocessor first builds the host configuration entry for the specified host. Then it builds the PAM Lists for the paths from the specified host to all selected hosts on the network and writes all this information to a file. If no select statements have been given, then all hosts on the network are selected. The file is written under the given filename. This command implicitly clears the list of selected hosts when it has finished writing the file.

[connapr | fullapr]

The connapr and fullapr parameters have been deprecated. All paths are available for path retry.

exit

This command tells the preprocessor to stop.

quit

This command tells the preprocessor to stop.

show

This command will display the components of the NCT. The names of the LOCALNETs and the adapter models in each LOCALNET are displayed. Also displayed are the names of all the trunks, hosts, and groups.

list

This command will display the names of the hosts and groups that have been selected. Those hosts/groups that have been deselected will still appear in the list because they are not deleted from the select list until the makepam command is given.

help

This command will display the help file.

Sample Configuration Manager Interface

This is an example of the user interface to Configuration Manager (CM). User input follows the symbol '>'. It specifies a configuration text file named 'sample.conf' and selects the host name 'NTXDEV' as a destination. The next command specifies 'UNIX' as the local host name and 'ntx_pam' as the place to store the output. If there had been any error in processing, the user would have seen a message displayed and the prompt 'Config>' would be repeated. Specify full path names of where to find the NCT file and where the PAM files is to be stored. The default is in the current directory. The cm program is assumed to be in the user's path statement.

```
Config> nct Example.nct
Non-matching options (8000 vs c000) on adapters at same NETADDR(e2)!
The NCT is valid.
Config> select *
Selected 'YELLOWST'
Selected 'NETFIN5 '
Selected 'TANYELL '
Selected 'ZOS5    '
Selected 'AIX3    '
Selected 'UNID4150'
Selected 'ZLINUX2 '
Selected 'UNISYS  '
Selected 'DALE    '
Selected 'TANDEMSE'
Selected 'FLASHE  '

Config> makepam aix3 aix3.pam
Path exists from host     AIX3 to host  NETFIN5
Path exists from host     AIX3 to host  NETFIN5
Path exists from host     AIX3 to host  NETFIN5
Path exists from host     AIX3 to host  NETFIN5
Path exists from host     AIX3 to host UNID4150
Path exists from host     AIX3 to host  ZLINUX2
Path exists from host     AIX3 to host UNID4150
Path exists from host     AIX3 to host     AIX3
Path exists from host     AIX3 to host     ZOS5
Path exists from host     AIX3 to host  TANYELL
Path exists from host     AIX3 to host  NETFIN5
Path exists from host     AIX3 to host YELLOWST
Host selections cleared.
Config> q >
```

Figure 3. Configuration Manager Commands to Build PAM

PAM File Structure

The data file, which is used, for communication between the NCT Preprocessor and the NetEx sub-routines has a very specific binary format. The file is treated by the processing routines as a random file of octets. Low level I/O routines map these requests into block I/O requests and ensure that necessary alignment constraints are met.

PRTPAM and DUMPPAM

The contents of the PAM file may be summarized and viewed through the PRTPAM and DUMPPAM programs. These programs allow the person responsible for setting up the Configuration Manager and managing the NCT to verify the PAM file contents from outside of NetEx. PRTPAM provides a summary of PAM file information (see Figure 4 on page 20), while DUMPPAM describes the components of the PAM file more specifically and is primarily used by NESi support personnel and therefore is not described here.

```
admin$  prtpam aix3.pam
Dump of PAM file aix3.pam:
Local  host AIX3     CM version   1 NCT version 255 Hosts  15
  N130 Adapter 9a Port 01
  N130 Adapter 99 Port 01
Remote host NTXLCL   (length 64 (d)) Routes       2 Session manager nref ffff
  NTXLCL    Segsize   524256 bits     Rate     0 kbps     Delay     0 msec
            HYPERchannel      Adapter 9a Port 01 Trunk 88 Flags 80
            HYPERchannel      Adapter 9a Port 01 Trunk 88 Flags 40
  NTXLCL    Segsize   524256 bits     Rate     0 kbps     Delay     0 msec
            HYPERchannel      Adapter 99 Port 01 Trunk 88 Flags 80
            HYPERchannel      Adapter 99 Port 01 Trunk 88 Flags 40
Remote host NTXLCL00 (length 44 (d)) Routes       1 Session manager nref ffff
  NTXLCL00  Segsize   524256 bits     Rate     0 kbps     Delay     0 msec
            HYPERchannel      Adapter 9a Port 01 Trunk 88 Flags 80
            HYPERchannel      Adapter 9a Port 01 Trunk 88 Flags 40
Remote host NTXLCL01 (length 44 (d)) Routes       1 Session manager nref ffff
  NTXLCL01  Segsize   524256 bits     Rate     0 kbps     Delay     0 msec
            HYPERchannel      Adapter 99 Port 01 Trunk 88 Flags 80
            HYPERchannel      Adapter 99 Port 01 Trunk 88 Flags 40
Remote host MINGE    (length 44 (d)) Routes       1 Session manager nref ffff
  NETFIN5   Segsize   524256 bits     Rate     0 kbps     Delay     0 msec
            HYPERchannel      Adapter 99 Port 01 Trunk 88 Flags 80
            HYPERchannel      Adapter a5 Port 01 Trunk 88 Flags 40
Remote host FLASHE   (length 44 (d)) Routes       1 Session manager nref ffff
  NETFIN5   Segsize   524256 bits     Rate     0 kbps     Delay     0 msec
            HYPERchannel      Adapter 99 Port 01 Trunk 88 Flags 80
            HYPERchannel      Adapter a5 Port 01 Trunk 88 Flags 40
Remote host TANDEMSE (length 44 (d)) Routes       1 Session manager nref ffff
  NETFIN5   Segsize   524256 bits     Rate     0 kbps     Delay     0 msec
            HYPERchannel      Adapter 99 Port 01 Trunk 88 Flags 80
            HYPERchannel      Adapter a5 Port 01 Trunk 88 Flags 40
Remote host DALE     (length 44 (d)) Routes       1 Session manager nref ffff
  NETFIN5   Segsize   524256 bits     Rate     0 kbps     Delay     0 msec
            HYPERchannel      Adapter 99 Port 01 Trunk 88 Flags 80
            HYPERchannel      Adapter a5 Port 01 Trunk 88 Flags 40
Remote host UNISYS   (length 104 (d)) Routes       4 Session manager nref ffff
  UNID4150  Segsize   524256 bits     Rate     0 kbps     Delay     0 msec
            HYPERchannel      Adapter 9a Port 01 Trunk 88 Flags 80
            HYPERchannel      Adapter 0e Port 00 Trunk 88 Flags 40
   UNID4150  Segsize   524256 bits     Rate     0 kbps     Delay     0 msec
            HYPERchannel      Adapter 9a Port 01 Trunk 88 Flags 80
            HYPERchannel      Adapter 0c Port 00 Trunk 88 Flags 40
  UNID4150  Segsize   524256 bits     Rate     0 kbps     Delay     0 msec
```

```
            HYPERchannel      Adapter 99 Port 01 Trunk 88 Flags 80
            HYPERchannel      Adapter 0f Port 00 Trunk 88 Flags 40
  UNID4150  Segsize   524256 bits     Rate     0 kbps     Delay     0 msec
            HYPERchannel      Adapter 99 Port 01 Trunk 88 Flags 80
            HYPERchannel      Adapter 0d Port 00 Trunk 88 Flags 40
Remote host ZLINUX2  (length 44 (d)) Routes       1 Session manager nref ffff
  ZLINUX2   Segsize   524256 bits     Rate     0 kbps     Delay     0 msec
            HYPERchannel      Adapter 9a Port 01 Trunk 48 Flags 80
            HYPERchannel      Adapter d7 Port 00 Trunk 84 Flags 40
Remote host UNID4150 (length 104 (d)) Routes       4 Session manager nref ffff
  UNID4150  Segsize   524256 bits     Rate     0 kbps     Delay     0 msec
            HYPERchannel      Adapter 9a Port 01 Trunk 88 Flags 80
            HYPERchannel      Adapter 0e Port 00 Trunk 88 Flags 40

  UNID4150  Segsize   524256 bits     Rate     0 kbps     Delay     0 msec
            HYPERchannel      Adapter 9a Port 01 Trunk 88 Flags 80
            HYPERchannel      Adapter 0c Port 00 Trunk 88 Flags 40
  UNID4150  Segsize   524256 bits     Rate     0 kbps     Delay     0 msec
            HYPERchannel      Adapter 99 Port 01 Trunk 88 Flags 80
            HYPERchannel      Adapter 0f Port 00 Trunk 88 Flags 40
  UNID4150  Segsize   524256 bits     Rate     0 kbps     Delay     0 msec
            HYPERchannel      Adapter 99 Port 01 Trunk 88 Flags 80
            HYPERchannel      Adapter 0d Port 00 Trunk 88 Flags 40
Remote host AIX3     (length 38 (d)) Routes       1 Session manager nref ffff
  AIX3      Segsize   524256 bits     Rate     0 kbps     Delay     0 msec
            Loopback          Adapter 9a Port 01          Flags c0
Remote host ZOS5     (length 84 (d)) Routes       3 Session manager nref ffff
  ZOS5      Segsize   524256 bits     Rate     0 kbps     Delay     0 msec
            HYPERchannel      Adapter 9a Port 01 Trunk 48 Flags 80
            HYPERchannel      Adapter 03 Port 00 Trunk 84 Flags 40
  ZOS5      Segsize   524256 bits     Rate     0 kbps     Delay     0 msec
            HYPERchannel      Adapter 99 Port 01 Trunk 88 Flags 80
            HYPERchannel      Adapter 02 Port 00 Trunk 88 Flags 40
  ZOS5      Segsize   524256 bits     Rate     0 kbps     Delay     0 msec
            HYPERchannel      Adapter 99 Port 01 Trunk 88 Flags 80
            HYPERchannel      Adapter 03 Port 00 Trunk 88 Flags 40
Remote host TANYELL  (length 64 (d)) Routes       2 Session manager nref ffff
  TANYELL   Segsize   524256 bits     Rate     0 kbps     Delay     0 msec
            HYPERchannel      Adapter 9a Port 01 Trunk 48 Flags 80
            HYPERchannel      Adapter e2 Port 01 Trunk 84 Flags 40
  TANYELL   Segsize   524256 bits     Rate     0 kbps     Delay     0 msec
            HYPERchannel      Adapter 99 Port 01 Trunk 88 Flags 80
            HYPERchannel      Adapter e2 Port 01 Trunk 88 Flags 40
Remote host NETFIN5  (length 44 (d)) Routes       1 Session manager nref ffff
  NETFIN5   Segsize   524256 bits     Rate     0 kbps     Delay     0 msec
            HYPERchannel      Adapter 99 Port 01 Trunk 88 Flags 80
            HYPERchannel      Adapter a5 Port 01 Trunk 88 Flags 40
Remote host YELLOWST (length 44 (d)) Routes       1 Session manager nref ffff
  YELLOWST  Segsize   524256 bits     Rate     0 kbps     Delay     0 msec
            HYPERchannel      Adapter 99 Port 01 Trunk 88 Flags 80
            HYPERchannel      Adapter e2 Port 01 Trunk 88 Flags 40
End of PAM file dump
```

Figure 4. Output From PRTPAM Program

CM Configuration File Errors

This section lists error messages that are specific to the NCT file. If an error is not listed here, it is probably considered a Configuration Manager error; these errors should be self-explanatory. Error messages are generally listed alphabetically within this category. However, some messages begin with a user-defined symbol or label and cannot be listed alphabetically. The general form of each of those errors is listed at the end of this section, in no particular order.

A label is required on HOST statements.

Explanation: The hostname is specified by its label. All HOST statements must include a label.

Bad NETADDR string.

Explanation: A value greater than hex FF was specified for NETADDR on an ADAPTER statement.

Bad protocol 'string' (must be 1 or 2).

Explanation: Protocol for a HOST statement must be specified as either 1 or 2. See the description of the Configuration File statements for additional information.

build_glob: Unknown class.

Explanation: Some statement appeared to have a valid form but was interpretable. If the NCT appears correct, contact an SE for assistance.

CHANADDR out of range: 'string'.

Explanation: Value given for CHANADDR ('string') on an ADAPTER statement outside of allowable range.

Distinct trunks required on each interface.

Explanation: The same trunk name was specified for more than one of the adapter's trunks. Each trunk interface on an adapter must be connected to a different trunk. However, it is not necessary that every trunk interface be used or connected to a trunk.

Duplicate VERSION statement near line 'number' ignored.

Explanation: A second VERSION statement was found in the NCT near the listed line. The second VERSION statement is ignored, and processing continues.

Error(s) on ADAPTER statement 'label', near line 'number'.

Explanation: One or more errors, listed elsewhere, were detected in an ADAPTER statement. The statement label will appear if given. The line number is usually the last line of the ADAPTER statement.

Error(s) on HOST statement: 'hostname', near line 'number'.

Explanation: Errors were detected in the HOST statement labeled 'hostname'. The line number is usually the last line of the HOST statement.

Hash: Pointer corruption suspected.

Explanation: This message indicates an internal error within the CM. Retry the operation before reporting to Network Executive Software.

Host names are limited to eight characters: 'string'.

Explanation: A host name (or label on a HOST statement) was encountered which exceeded eight characters in length. The maximum host name length is eight characters.

Missing parameter value for 'string'.

Explanation: The parameter 'string' does not have a value associated with it.

Must specify a HOST before an ADAPTER.

Explanation: A HOST statement must be specified before an ADAPTER statement. All adapters (other than links) belong to some host and must appear immediately following the host definition or statement.

Must specify a LOCALNET before an ADAPTER.

Explanation: A LOCALNET statement must precede any ADAPTER statements.

Must specify a LOCALNET before a HOST.

Explanation: A LOCALNET statement must be defined before a HOST statement.

Must specify a LOCALNET before a TRUNK.

Explanation: A LOCALNET statement must precede any TRUNK statements.

Must specify MODEL on ADAPTER statement.

Explanation: The required keyword MODEL was omitted on an ADAPTER statement.

Must specify NETADDR on ADAPTER statement.

Explanation: The required keyword NETADDR was omitted from an ADAPTER statement.

N220 ADAPTERS need a CHANADDR.

Explanation: The required keyword CHANADDR was omitted from an ADAPTER statement.

N220 ADAPTERS need a NUMADDRS.

Explanation: The required keyword NUMADDRS was omitted from an ADAPTER statement.

NXXX ADAPTERS need at least one trunk.

Explanation: At least one trunk must be specified on all l adapters.

Non-matching adapters at same NETADDR.

Explanation: Two adapters with the same NETADDR but with other differing characteristics have been detected. This is probably an error in the definition of different ports on the same adapter in the Configuration File.

Non-matching trunks on adapters at same ADDR.

Explanation: The same adapter has been specified more than once in the text NCT file, probably with different ports, but the specified trunks are not the same.

NUMADDRS out of range: 'string'.

Explanation: The NUMADDR specified on an ADAPTER statement is outside the allowed range.

Numeric CHANADDR required: 'string'.

Explanation: The CHANADDR specified on a HOST statement was not a number.

Numeric Dref required: 'string'.

Explanation: The DREF on an ADAPTER statement was not a hex valued 'string'.

Numeric Netaddr required: 'string'.

Explanation: The NETADDR on a LINK or ADAPTER statement was not a hex valued 'string'.

Numeric NUMADDRS required: 'string'.

Explanation: The NUMADDRS specified on an ADAPTER statement was not numeric.

Numeric VALDREF required: 'string'.

Explanation: The value specified for VALDREF was not numeric.

Out of memory.

Explanation: The CM attempted to allocate additional memory for required internal table space and was unable to do so. Retry the operation before reporting the problem to Network Executive Software.

Premature EOF.

Explanation: In parsing an NCT text file, an end of file was detected prior to reading an END statement. An END statement should appear once in each NCT text file.

PROTOCOL must be numeric (1 or 2): 'string'.

Explanation: The PROTOCOL value on a HOST statement was not a number.

SMGDREF out of range: 'string'.

Explanation: The hex value of 'string' is not between 0 and 255 on an ADAPTER statement.

Syntax error near line 'number': Label 'string' with no statement - or -
Syntax error near line 'number': At statement labeled 'string', 'string' unknown. - or -
Syntax error near line 'number': 'string' unknown statement.

Explanation: An invalid statement type was encountered. Any label present, the line number where the problem was encountered, and the unrecognized word, are all presented to help the user find the problem.

The NCT is not valid.

Explanation: One or more fatal errors occurred while parsing the NCT text file. As a result, the NCT is considered invalid. The errors detected should already have been displayed.

The NCT is valid.

Explanation: Though several miscellaneous error messages may have been printed, the CM was able to parse a valid NCT for a PAM file may be generated. If any fatal errors are detected, the message "The NCT is not valid." would have been displayed instead, in response to the NCT command.

TRUNK is not defined. - or -
TRUNK is not declared.

Explanation: The value for the TRUNK= parameter on an ADAPTER was not a previously declared TRUNK.

TRUNK statement needs label.

Explanation: A TRUNK statement was found which did not have a label. All TRUNK statements must be labeled, so they may be referenced by ADAPTER statements.

TYPE not specified on LOCALNET statement.

Explanation: The type of a local network, HC or HB, was not specified on the LOCALNET.

Unknown keyword: 'string'. - or -
Unknown keyword 'string'. Ignored.

Explanation: The keyword 'string' is not a valid keyword, or not a valid keyword on the specified statement. It is ignored.

Unknown model 'string'.

Explanation: An invalid model type 'string' was specified.

Unknown parameter name 'string'.

Explanation: An invalid parameter 'string' was detected.

Unknown TYPE 'string'. Default to HC.

Explanation: An invalid LOCALNET type of 'string' has been specified. Only HC is valid.

Unrecognized CHANADDR: 'string'. - or -
Unrecognized DEVNAME: 'string'. - or -
Unrecognized MODE710: 'string'. - or -
Unrecognized OPTIONS: 'string'.

Explanation: Invalid or non-hex value specified or value outside of allowable range.

VALDREF out of range: ‘string’.

Explanation: The value specified for VALDREF is outside the allowable range.

Value required on version statement, ignored. Near line ‘number’.

Explanation: A VERSION statement with no version number was found and was ignored.

Version must be between 0 and 255, ‘string’ ignored (near line ‘number’).

Explanation: The number specified on a VERSION statement was out of range and ignored.

The general form of the NCT file errors which begin with a user-defined symbol or label follow here. They are listed in order by the first word after the user information.

‘hostname’ has no adapters.

Explanation: The specified host ‘hostname’ has no adapters connected to it. There is no path for communication with the named host.

‘label’ has no object pointer.

Explanation: The label ‘label’ does not label anything. There is no valid, corresponding NCT statement for the specified label.

‘label’ is not defined.

Explanation: The specified label was referenced, but never defined.

‘label’ Redeclared, ‘statement’ statement ignored. - or -
‘label’ Redeclared on ‘statement’ statement.

Explanation: The specified label ‘label’ has been previously declared. LOCALNETs with duplicate definitions are ignored, all others are fatal. All labels must be unique across the NCT.

Alternate Path Retry (APR)

Introduction

Network Executive Software's Alternate Path Retry (APR) is a feature found in NetEx software. APR is derived from the NetEx Model and provides two approaches to retrying a transfer connection. The first approach is handled by the Session layer of NetEx, and the second is handled by the Transport layer. The two approaches function as follows.

When a session connection is being established, the local NETEX attempts to contact the Session Manager on the remote host. If the remote NETEX is down, or if the desired application is not offered on that particular host, APR allows retries to alternate host(s).

> The list of alternate hosts is established by Session management. The HOST statement in Network Configuration can establish a host "group" or a list of hosts identified by a single name (see "HOST Statement"). Each time a connection is established, the hosts in the group are tried in sequence. Attempts to S-Connect to each host in the group continue until an active NetEx and the desired application S-Offered is found, or the list is exhausted.

At the Transport Level, APR allows NETEX to detect a failure on a network path to a remote host, switch activity to an alternate path (providing one is available), and maintain the connection be-tween the hosts. The rest of this section primarily addresses this level of APR.

Definitions

The following terms are used when discussing APR:

1. The **path** is the combination of Host adapters that provides a connection between two hosts.
2. Multiple paths are generated from the NCT (Network Configuration Table) for a given source/destination pair if one of the following is true.

   a. There is more than one adapter on the source host that can reach the destination host.

   b. There is more than one adapter on the destination host that can be reached by the source host.

   In summary, multiple paths are generated in the PAM if there are multiple routes from the source to the destination.
3. The primary path is the path that occurs first in the list of paths passed to NetEx.
4. The secondary path is the next path in the list of paths. Paths are tried (when APR is invoked) in the order they appear in the list of paths. NetEx will attempt connection on all the paths in the list before reporting a "Connect Failure", 3500 error, back to the application.

   Before the list of paths is passed to NetEx, it is sorted by a subroutine of the Configuration Manager, appropriately named the "Sort PAM" Routine.

   In all but the Unisys Configuration Manager, the source adapters are scanned in the reverse order given, while the destination adapters are scanned in the opposite order. This is done so that if there are connections in both directions, the load will somewhat balance.
5. The following timers affect APR as indicated.

   CONTO Connect time out. If this interval expires on a "Connect," the next path will be attempted.

   DEADTO Dead time out. This is the allowed interval for switching to a new path for an established connection.

   IDLETO Idle time out. This is the interval at which "keepalive" messages are sent between the source and destination ends of the connection. Note that if data (or a confirm) is sent by the local (source side) within the IDLETO, the idle timer is reset. When the IDLETO is reset by transmission of a message/data, no "keepalive" message is sent. IDLETO should be much less than either DEADTO or CONTO.

   TMSGTTO Transmit message termination time out. The length of time the offerer will wait while not receiving any messages, data, or idle; before terminating the connection.

   The timer interval (TMSGTTO - Transport Message Termination Time Out) is calculated as follows:

   ```
   TMSGTTO=DEADTO+(npaths*CONTO).
   ```

   The timer intervals (TMSGITO/TMSGTTO - Transport Message Idle/Termination Time Out) are passed in the initial connection protocol exchanged between the source and destination. The offerer (source) then uses the requestor (destination) timer interval.
6. **Physical Address Map - PAM.** This is a binary representation of a route from one host to another through the network. This map is built by the Configuration Manager using the NCT.
7. **Transport PAM List - TPL.** The Transport PAM List is a list of PAMs that describe all routes from the connecting host to a particular destination host.

8. **Session PAM List - SPL.** The Session PAM List is a list of TPLs that describe all routes from the connecting host to a destination host or group of destination hosts.

Operation

Overview

Note: In the following discussion, the T (T-xxx where xxx is a function such as Connect, etc.) refers to Transport Layer, N to Network Layer, and S to Session Layer. The error responses are also coded according to which layer issues them. Error codes of 1xxx are Driver layer, 4xxx are Network, 2xxx are Transport and 3xxx are Session.

The NetEx Transport layer provides the capability to transparently redirect traffic over a totally independent network connection without causing a loss of service to the transport user.

When a T-Connect request is issued, the addressing information contains a list of the primary and all selected alternate routes to the destination. Transport then issues an N-Connect (establish path) for the primary path. The connection or normal data transfer proceeds. However, if Transport detects that all communications have ceased on the existing network connection (detected by timers expiring without data or messages being received), it N-Disconnects the failing connection and attempts to N-Connect using the next alternate route provided in the list of PAMs passed to it at T-Connect time.

If the N-Connection succeeds, the transport connection continues as normal. If it does not, the timers are rezeroed, and the next PAM is tried until the list of PAMs is exhausted. If the list of PAMs is exhausted without a successful connection, a Disconnect indication is returned to the Transport user indicating the connection has been lost/did not succeed.

Detail

Transport

APR is the responsibility of the Transport entity that initiated the connection by accepting a T-Connect request from a user. A list of PAMs, describing paths between the source and destination NetExes, is passed to Transport along with the T-Connect request. The PAMs were sorted by the Configuration Manager, before being passed to the Transport layer.

It is the responsibility of the source (local/connecting) Transport entity to try all possible network connections to the destination (remote) Transport process. It is the responsibility of the destination remote/offering Transport process to simply wait until sufficient time has elapsed for all paths to be tried, or until input arrives from the connecting (source) Transport. This is accomplished by setting READTIME sufficiently high so that all routes between the local and remote sides may be tried.

Offering Side

If a Transport process began with a T-Offer, it will continue to transmit Idle (keepalive) messages every TMSGITO (Transport Message Idle Time Out) seconds, if it is not sending data messages. The offering side will take no other action until TMSGTTO (Transport Message Transmit Time Out) seconds expire with no response of any kind from the connecting side. At that time, the connection has been lost, and the Transport layer informs its user by returning the NRB with a 2400 (Dead Time Out) NRB Error Status.

If a network message containing a Connect indication does arrive within the TMSGTTO, Transport considers the connection, or reconnection to have succeeded. It then sends a Transport message (either an Idle or data) using the N-Confirm service. Transport will continue to send N-Confirm responses until a message with a normal data indication arrives. At that point Transport will N-Write all subsequent messages.

Connecting Side

The connecting Transport service will continue to send Idle messages every TMSGITO (Transport Message Idle Time Out) seconds and will take no further action until DEADTO (Dead Time Out) seconds have elapsed with no response whatsoever from the destination Transport service. Transport will then N-Disconnect the original network path and attempt to N-Connect on the next PAM entry. The N-Connect will contain a Transport idle message and possibly data.

Once the new path is selected, the Transport process will continue to try this path by sending N-Connect requests every IDLETO seconds until CONTO (Connect Time Out) seconds have expired. During the whole CONTO time period, Transport will leave an N-Read outstanding. If data containing an N-Confirm arrives before CONTO seconds, the new path is considered to be good, and Transport will consider this path the primary path until subsequent DEADTO seconds have elapsed without a network message arriving from the offering side.

If no data are received on the new path within CONTO seconds, the next path in the list of PAMs is selected. The process is repeated (with N-Disconnect and N-Connect being issued) until either CONTO seconds expire or an N-Confirm is received. Transport will continue to try new paths until all paths in the PAM list originally provided with the T-Connect have been tried with no response from any. In this case an NRB status of 2500 (Connect Time Out) would be returned to the Transport service user.

DISPLAY HOST Command

The NetEx user can determine which paths have been generated by either dumping the PAMFILE, or by using NetEx operator commands.

The NetEx Operator command, DISPLAY HOST, is used to display the various hosts that have been described to NetEx in the NCT. Enter the command as shown below.

```
DISPLAY HOST
```

Figure 5 on page 32 is the actual output of the DISPLAY HOST command from a NetEx host using the sample NCT in Figure 2 on page 16:

```
NtxOper v2.0, Copyright (C) 1999-2013, Network Executive Software, Inc.
15:50:33         Host AIX3        Current Routes
DestHost  Pr  Rts  State    Fl  PmOf
--------  --  ---  -------  --  -----
NTXLCL     2    2           02      0
NTXLCL00   2    1           02      0
NTXLCL01   2    1           02      0
FLASHE     6    1           00      0
TANDEMSE   6    1           00      0
DALE       6    1           00      0
UNISYS     2    4           22      0
ZLINUX2    2    1           00      0
UNID4150   2    4           22      0
AIX3       2    1           02      0
ZOS5       6    3           20      0
TANYELL    2    2           00      0
NETFIN5    6    1           00      0
YELLOWST   6    1           00      0
NtxOper v2.0, Terminating
```

Figure 5. NetEx Display Host Output

Select a host from the list that is defined to NetEx, such as host **UNID4150**, and enter the DISPLAY HOST command as shown below.

```
DISPLAY HOST UNID4150
```

This command will produce the output shown in Figure 6.

```
NtxOper v2.0, Copyright (C) 1999-2013, Network Executive Software, Inc.
17:36:44         Host AIX3        Routes to unid4150
 pam header - len=14 segsize=fffc
        maxrate=000000 delay=0000
 pam entries –
    pam entry   1 -> 06 01 80 88 9a 01
    pam entry   2 -> 06 01 40 88 0e 00
-------------------------------------
 pam header - len=14 segsize=fffc
        maxrate=000000 delay=0000
 pam entries –
    pam entry   1 -> 06 01 80 88 9a 01
    pam entry   2 -> 06 01 40 88 0c 00
-------------------------------------
 pam header - len=14 segsize=fffc
        maxrate=000000 delay=0000
 pam entries –
    pam entry   1 -> 06 01 80 88 99 01
    pam entry   2 -> 06 01 40 88 0f 00
-------------------------------------
 pam header - len=14 segsize=fffc
        maxrate=000000 delay=0000
 pam entries –
    pam entry   1 -> 06 01 80 88 99 01
    pam entry   2 -> 06 01 40 88 0d 00
-------------------------------------


NtxOper v2.0, Terminating
```

Figure 6. NetEx Display Host Unisys Output

Note: For a complete description of the NetEx operator commands, including syntax and output examples, consult the appropriate NetEx reference manual. For example, if you are using H210 NetEx, refer to the H210IPZ NetEx for IBM zOS Operator Reference Manual for more information. See “Reference Material” for a list of related manuals.

The capability of determining which PAM (path) is currently in use is not generally available in all NetExes. Check the individual NetEx reference manual to determine if the feature is available.

Connect Failure

NetEx will try all paths. If Connection Failure (NRBSTAT 3500) is reported back to the user, then all paths between the source and destination have been attempted, unsuccessfully.

If APR is invoked, and a connection is successfully made on an alternate path; then that alternate path is used for the duration of the connection. If the alternate path would fail, the retry process would continue with the next PAM entry until the list wrapped back to the current failing entry.

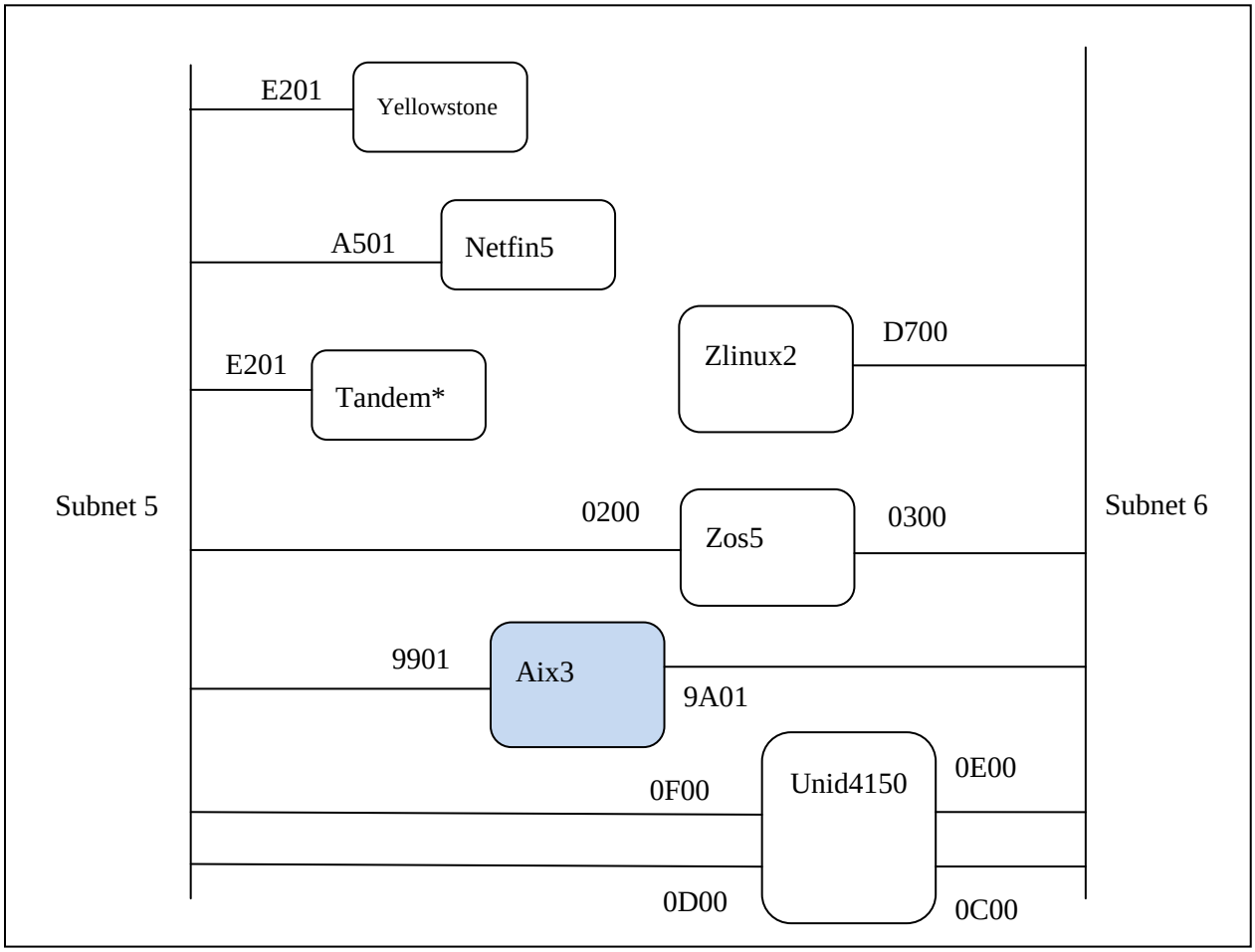
Once a Session has completed and a new Session is being established, the PAM list would be passed to the Transport layer as before and the list of PAMs attempted beginning with the first entry.

Sample Network Definition

Sample Network Topology

Figure 7 is a sample network used to illustrate alternate path configurations.

Note: The job used to create the sample PAM, operator commands, and NetEx output were run on an IBM Power 7 AIX , using H620IP NetEx, Release 7.0.1.



*Tandem utilizes the TNP feature on Yellowstone so uses the duplicate GNA of Yellowstone.

Figure 7. Sample Network Configuration

Configuration Manager Commands

The NCT commands, as shown in Figure 2 on page 16, would be used to describe this network.

Configuration Manager Job Output

Figure 4 is actual job output from running the Configuration Manager against the sample NCT file in Figure 2 on page 16.

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