LINCS

Features

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Where to go for the information you seek.

Several books make up the 1174, 9300 and LINCS library, and include information to install, customize, operate, and maintain the 1174 and 9300 products. Following is a list and description of these manuals.

1174 Hardware Reference

The 1174 Hardware Description manual provides a description of the hardware found in several of the 1174 hardware platforms. These include the 1174-10R, 1174-10L, 1174-15X, 1174-20R, 1174-25X, 1174-60R, 1174-60C, 1174-65R, 1174-90R, and 1174-90T models. This manual includes installation planning considerations and front panel operations.

1174 Hardware Reference - 1174-65S/90S Communications Servers

The 1174 Hardware Description manual provides a description of the hardware found in the 1174-65S and 1174-90S hardware platforms. This manual includes installation planning considerations and front panel operations.

9300 Hardware Description

The 1174 Hardware Description manual provides a description of the hardware found in the 1174 hardware platforms. This manual includes installation planning consideration and front panel operations.

LINCS Product Description

The LINCS Product Description manual gives a brief description of the LINCS communications software capabilities. A reasonably complete list of the functions supported by LINCS is included.

LINCS Features

The LINCS Feature manual provides a much more detailed description of many of the LINCS features. Among those features described in detail are APPN Network Node, SNA PU Gateway support, IPX Routing, Host Connectivity, 3270 Server capabilities (IPX and TN3270), CUT Device features including Windowing, Keystroke Record/Playback, Entry Assist and Calculator, IP routing, IP Channel Bridge, ASCII Device and ASCII Host support, and NetView features.

LINCS Configuration

A Description of the LINCS Configuration process, as well as details of the configuration panels used to customize the LINCS software can be found in this manual.

LINCS Central Control

This manual contains information about the online Central Control panels. The Central Control mode provides a means to manage the LINCS software and the 1174 and 9300 hardware. A detailed description of their use is included in the manual.

LINCS Problem Determination

The LINCS Problem Determination manual aids the LINCS administrator by providing useful information about error codes and how to interpret them. Information is also included for running offline utilities.

Table of Contents

1. Overview

This document is organized into chapters based upon the major features supported by LINCS. The communications features: APPN NETWORK NODE, DSPU SUPPORT, IPX ROUTING, IP ROUTING, IP CHANNEL BRIDGE, HOST CONNECTIVITY, and 3270 SERVER FEATURES which are used to route data through the LINCS node or to end devices which are attached to the LINCS node are described first.

Subsequent sections discuss the CUT, Network Computer Terminal, and DFT end devices which are supported along with the device features, RPQs that have been implemented, and the Management tools which are available to configure and manage your LINCS node.

Three appendices: ASCII Keyboard Control Codes, ASCII Device Setup, and Keyboard Maps for 3270 Emulation provide information for users of ASCII hosts and devices.

Embedded throughout the document, there are sections titled **Configuration and Management**.

These sections are included to direct you to the appropriate Central Control utilities for configuring and managing a particular feature. Refer to the appropriate utilities in the *Configuration* and *Central Control* Manuals for further details.

2. APPN Network Node

Advanced Peer-to-Peer Networking (APPN) is an enhancement to SNA that supports peer to peer connections. APPN is appropriate for large SNA customers with multiple mainframes, those with existing AS/400 APPN based networks who are moving to multi-protocol networking, and those who wish to replace existing fixed predetermined point-to-point links with APPN's path selection scheme. The APPN architecture is an open technology, jointly developed in an industry consortium called the APPN Implementers' Workshop (AIW). MTX is a voting member of the AIW. LINCS' APPN Network node feature provides routing and network services to other adjacent Network Nodes, end nodes (EN) and low-entry networking (LEN) nodes with or without the presence of a local IBM mainframe. LINCS' APPN consists of the following services:

- Intermediate Session Routing (ISR)
- High Performance Routing (HPR)
- Dependent LU Requester (DLUR)
- Connectivity
- Network Management
- Route Selection:
  - Class of Service Definitions (COS)
  - Directory Services
  - Flexible Network Topology
  - Safe Store

LINCS APPN implementation is based on Data Connections Ltd's SNAP APPN, which was developed according to Version 2 of IBM's APPN specification, including many optional APPN function sets. By adhering to this standard, you can be certain that LINCS nodes will interconnect to End Nodes and Network Nodes from a wide array of vendors, whose interoperability is tested and proven at the APPN Implementers Workshop's Connectathon.

Connectivity

APPN utilizes LINCS' data link control objects for layer 2 connectivity to adjacent nodes. The APPN feature can be configured for predefined or dynamic connections to adjacent nodes. Dynamic connections are limited to LLC, and predefined connections can be any of the following protocols:

- LLC
- Channel/SNA
- Frame Relay
- SDLC SDLC/DAP
- TCP/IP
- X.25

Predefined circuits are *required* to support a LEN node.

Dynamic Connections

LINCS uses dynamic connections to find other APPN nodes. End nodes using a LINCS node as their server will dynamically connect, as will nodes on the connection network.

Predefined Circuits

Predefined Circuits are for nodes that cannot be located dynamically; Low Entry Nodes and Channel/SNA and SDLC links are examples however, links to End Nodes and adjacent NNs can be predefined. A user can specify the node type or allow LINCS to learn the node type of the node that initiates communications.

Connection Networks

A connection network increases session performance by allowing end nodes to communicate directly without the routing services of a network node. LINCS directs the end node to end node communication, but does not have to be a part of the connection network. To do this the transport facility must be a "Shared Access Transport Facility" which allows end nodes to communicate directly i.e. LLC or Frame Relay.

Route Selection

APPN's dynamic route selection eliminates the complex network definition required by other protocols. APPN's route selection separates the search phase from the route selection. First the requested resource (LU) is located, then a route to the resource is determined.

The path chosen by APPN is based on location, topology information, requested priority and class-of-service. APPN's chooses route selection using:

- Class of Service
- Directory Services
- Network Topology

Class of Service

COS routing defines how different types of data will be routed, using paths optimized for that specific type. All APPN nodes have several predefined classes of service. The COS used is determined by the mode name used at session establishment time. LINCS supports four standard mode names, plus the null or blank name. The four standard names correlate to identical COS names. A name of all blanks correlates to the #CONNECT COS name. The Mode Name is used to obtain a COS name and transmission priority requirements for the requested session. A COS name designates a set of definitions used for route selection. LINCS has five standard predefined COS names, and allows you to define additional COS names. Because COS names are data objects in LINCS, they may be copied to other LINCS nodes manually or via Central Site Change Management, a definite advantage for users needing to add COS names or modify the standard definitions.

Class of Service Definitions (COS)

For a particular COS, APPN determines the importance of eight values that are defined for every link within the APPN network. The values are:

- Propagation delay
- Cost per byte
- Cost for connect time
- Effective capacity
- Security
- Three optional user defined values

Each COS assigns a particular weight to these values. When an end node requests a route to a partner, the class-of-service requested is compared against the COSs available along the path. If the defined weights of a COS at each node meet or exceed the weights for the COS requested, then the path will be selected. If one node along the path cannot provide the COS requested (for example: SECURE), the request will be rejected. Configuration and Management

The "Display/Update APPN COS" utility on the Customization Data Menu is used to display or define your COS parameters. If you are not extremely knowledgeable about SNA and APPN route selection procedures, you should probably not define your own COSs. Default values will be used if no COS is defined.

Directory Services

APPN performs dynamic, automatic network definition capability. In an APPN network, end nodes and the resources they provide (LUs) need only be known by their serving network node.

A LEN's resources are defined during LINCS configuration. End nodes inform network nodes of their resources upon connecting. Directory services maintains a directory database of this information, plus information about resources outside its own domain as it learns of them. Aging algorithms remove inactive entrees from the "Safe Stored" directory database to keep it at a manageable size. LINCS' APPN supports standard directory services including:

- **Network node server** – LINCS registers its APPN end node's resources a local database. LENs and ENs use this service to locate remote LUs.
- **LU registration** – LEN LUs can be registered using LINCS' Central Control. This enables remote end nodes to find them.
- **Directed and broadcast services** – LINCS uses directed search requests to obtain domain path information from a central directory server, typically VTAM, and uses broadcast search requests when no central directory service is present.

Locating a Resource

APPN end nodes do not need partner definitions. Instead, an end node asks its network node server (for example LINCS) to find a partner, and to determine the best route to get there. Each end node tells its network node server which LUs reside in it. By combining all the information known by all the network nodes, the location of any LU can be determined. When an NN is requested to find an LU, it first looks within its own directory for the LU's location. If not

there, the NN sends the request to all of its adjacent network nodes. The send process is repeated by the adjacent nodes, until the LU is found. At that time, APPN caches the location of the found LU, so it will not have to go through the search phase if that LU is requested again. If more than one possible route is found, APPN selects the best path of those available which meet the requested requirements.

Network Topology

APPN allows any network topology. Each NN can be directly connected to every other NN, connected through a single routing hub, connected in a hierarchical network design, or any combination of these. LINCS APPN maintains information about all NNs and intermediate routing Transmission Groups (TG) within the network in a "Safe Stored" Topology Database. LINCS exchanges network information with other network nodes to maintain up-to-date topology information, which includes data about NNs, plus their connections to Virtual Routing Nodes and other NNs. Unlike TCP/IP, topology information is exchanged only when a topology change occurs, which reduces network management traffic significantly. Also, the topology data base contains information about network nodes only (Information about LEN and ENs is obtained from APPN's directory service) which reduces the size of the database.

Safe Store

All LINCS nodes are equipped with hard disks, so LINCS can save network information, which is known as the APPN Safe Store feature. Safe Stores occur only when updates to the directory or topology database have occurred. LINCS checks whether updates have occurred on heuristically determined 1 to 10 minute intervals. If LINCS APPN is stopped and restarted, only topology and directory updates that have occurred since the last Safe Store need to be obtained from the adjacent end node. This greatly reduces the amount of network management data traffic.

Intermediate Session Routing (ISR)

LINCS APPN supports networks using Intermediate Session Routing. ISR provides connection-oriented routing for LEN and EN sessions and for connection to adjacent NNs. Additionally ISR provides adaptive pacing and segmentation and reassembly of APPN network message units when required by partners. ISR routes session traffic at the Path Information Unit level.

High Performance Routing (HPR)

High Performance Routing (HPR) is an extension to APPN, which uses the same link types that base APPN supports. HPR adds reliability to the network, so link-level error recovery is only recommended on links with high error rates. HPR requires that LLC *does not* support link-level error recovery. HPR requires that X.25, Channel/SNA, SDLC, SDLC/DAP, *do* operate with link-level error recovery.

HPR provides dynamic rerouting for APPN, so sessions can survive link failures, while maintaining the deterministic stability and class-of-service associated with ISR. HPR can coexist and interoperate with all existing levels of APPN nodes. HPR nodes can distinguish between base APPN and HPR nodes and links. APPN nodes view HPR nodes and links as base APPN nodes and links. HPR uses the existing APPN route selection algorithm for route selection.

HPR provides end-to-end connections, thereby obtaining a significant throughput increase over ISR. HPR utilizes three new protocols to achieve additional throughput:

- Automatic Network Routing
- Rapid Transport Protocol
- Adaptive Rate Based congestion control

Automatic Network Routing (ANR)

ANR is a connectionless protocol that switches packets on a predetermined path. It improves switching speed, because of its reduced number of instructions compared to ISR. ANR also eliminates the 500-byte control block for each session, increasing the number of connections that the LINCS node can support, similar to Source-Route-Bridging. Labels that represent the full path between end node partners are carried in the header of each ANR packet. Because there is no limit to the number of labels in the header, ANR is not limited to 7 hops, like Source Route Bridging is. ANR selects the highest priority packet, gets the next link from and deletes the first label, then sends the packet out on the identified link.

Some important features the ANR offers are:

- **Fast packet switching** – ANR is much faster than base APPN's ISR. ANR operates at a lower layer than ISR. (ANR operates at Layer 2; ISR operates at Layer 3.) That minimizes the storage and processing required to route packets through intermediate nodes. ANR performs the traffic prioritization and packet forwarding functions found in ISR. Functions such as flow control, segmentation, link-level error recovery, and congestion control are NOT performed in the intermediate node (as in HPR). Instead, these functions are executed only at the endpoints of an RTP connection.

- **Source Routing** – ANR supports source routing. Each packet has a network layer header with routing information at the beginning of the packet. This routing information consists of a string of ANR labels. These labels describe the path of the packet through an HPR subnet. ANR labels are locally assigned by each HPR node. When a HPR node receives a packet, it:

  1. looks at the first ANR label in the packet

  2. selects the corresponding link over which to send the packet

  3. deletes this first ANR label from the packet

  4. forwards the packet out onto the selected link

- **No session awareness** – Intermediate HPR nodes have no knowledge of sessions. They simply route the session traffic based on the routing information. Therefore, intermediate nodes no longer have to store any session information (routing tables) for sessions that are routed across it, as in base APPN.

Rapid Transport Protocol (RTP)

RTP is designed for fast high quality networks. It is a connection-oriented transport protocol at OSI Layer 2. Before ANR takes place, RTP determines from the APPN topology and directory databases what the largest packet size is that can be supported at each node across an entire route. Before the first ANR hop, RTP segments packets to the minimum packet size, eliminating any requirement for segmenting and reassembly within the network. The last NN in the path reassembles and resequences the packets, if necessary. RTP retransmits only missing packets,

which is more efficient than algorithms that retransmit the missing packet and all following ones. This selective retransmit algorithm preserves packet order, and is the foundation for the Multiple Link Transmission Group (MLTG) support in HPR. RTP handles link failures by computing ANR labels for a new path that meets the class-of service requirements, and switching to it without notifying or disrupting higher protocol layers.

RTP establishes RTP connections to carry session traffic across a HPR subnet. These connections are "transport pipes" that connect two HPR nodes over a specific path in a HPR subnet. Multiple sessions may share the same RTP connection if they are using the same class of service. Intermediate HPR nodes have no knowledge of the RTP connection. They simply route the session traffic based on the ANR routing information.

RTP performs the following functions:

- Segmentation to the size needed for the smallest link
- Reassembly of segments Fast RTP connection setup and dissolution
- Selective retransmissions – RTP retransmits only missed or corrupted packets, instead of every packet since the error occurred.
- Sequence checking, in-order delivery
- End-to-end error recovery – HPR takes advantage of high-speed links. Since high-speed links are more reliable, they do not need the level of error recovery found in base APPN. RTP performs error recovery on an end-to-end basis, instead of requiring link-level error recovery on each intermediate link (as in base APPN). By only checking for errors at the endpoints of a RTP connection, the number of flows required for error recovery is reduced.
- Nondisruptive path switching – If a link or node goes down, RTP automatically reroutes the data without disrupting the traffic flow. RTP connections are reestablished over a new route that bypasses the failed link or node. Missed data is automatically recovered using end-to-end error recovery.

Adaptive rate-based flow/congestion control (ARB)

Base APPN performs adaptive session pacing at each node in the network. This method of flow control works well in networks with various link types operating at different speeds. Networks with high-speed links, however, can reduce the amount of processing done at each node by using adaptive rate-based congestion control (ARB) at the RTP endpoints. ARB attempts to predict when congestion will occur and reduce a node's sending rate before this happens. Each node samples the rate at which it receives and sends packets. When buffering limits are approached, ARB appends rate messages to data packets telling the end nodes to speed up or slow down, instead of waiting until after congestion develops and packets are discarded, requiring retransmission. ARB avoids congestion, instead of reacting to congestion, which yields higher link utilization.

HPR Configuration and Management

Configuration – HPR is configured for an APPN circuit by setting the **APPN HPR** field in the circuits Link Profile to the desired value.

Management – The **APPN Menu** in Central Control Mode contains the following utilities which have HPR specific information.

- The **Display/Update Circuit Status** utility contains an HPR support field.
- The **Display Node Topology** utility indicates whether or not HPR is supported on APPN nodes.
- The **Display RTP Connections** utility displays information about the RTP connections for which this node is an end point.

Dependent LU Requester (DLUR)

The Dependent LU Requester feature in a LINCS node will accept PU2.1 APPN traffic from a Dependent LU Server (DLUS), and convert it to PU2.0 traffic for processing by dependent LUs. This allows dependent LUs to benefit from APPN routing services that are traditionally unavailable to them.

Some advantages of DLUR over traditional Host and Gateway Circuits are:

- Dynamic routing and directory services without static user definitions.
- Transmission priority
- Class of service
- Reduced system definition
- Dependent LUs can be moved anywhere in the APPN network without problem management concerns and without changing VTAM definitions.
- Backup and recovery for links and nodes is available without additional definition and without requiring the user to switch to another logical terminal.
- The DLUR and DLUS do not have to be in the same APPN subnetwork, because LUs can be routed across subnetworks through border nodes.
- The DLUR/DLUS function supports SSCP takeover and giveback.
- The DLUR LINCS node can also route the Central Site Control Facility (CSCF) traffic to the DLUR host circuit or the DLUR gateway circuit.

The dependent LUs may reside in the LINCS node or on a downstream node. LUs residing within the LINCS node are referred to as Internal LUs, those residing in a DSPU are referred to as External LUs.

- **Internal LUs** - The dependent LUs will reside in the LINCS node, therefore a DLUR Host Circuit should be defined to accept the PU2.0 traffic. A DLUR Host Circuit provides dependent LU support for the following:
  - Direct and Network devices
  - TN3270 Clients
  - SAA Clients
  - DSPU using LU to PU Mapping and APPN mapping feature
  - Central Site Change Management (CSCM)
  - Local Format Storage U2.0 traffic.

Each DLUR host circuit and DLUR gateway circuit will be treated as an APPN predefined circuit, and so will be included in the maximum APPN circuits limit. These circuits are also counted as part of the maximum Host Circuits and maximum Gateway Circuits.

DLUR Configuration and Management

Configuration - In order to use DLUR, you must enable APPN as described in the Configuration and Management section. The panels which contain DLUR configuration items are:

- The SNA Options panel allows you to define the DLUS (Dependant LU Server).

- If APPN will be used to route data to dependent LUs associated with one or more PUs on the LINCS node (i.e., internal PUs), a DLUR Host Circuit should be defined for each such PU. DLUR host circuits are defined by setting both the **Line Options** and **Link Profile** panels to DLUR. Refer to the section titled "3270 Host Connectivity" for more information on defining Host Circuits.

- If APPN will be used to route data to dependent LUs associated with one or more PUs which are downstream from the LINCS node (i.e., external PUs), a DLUR Gateway Circuit should be defined for each such PU. DLUR gateway circuits are defined by setting both the **Line Options** and **Link Profile** panels for the Upstream connection to DLUR. Refer to the section titled "Gateway Circuits" for more information on defining Gateway Circuits.

Management - Central Control Mode contains the following utilities pertaining to DLUR circuits:

- The **Display/Update Circuit Status** utility on the APPN Menu in Central Control Mode includes information on your DLUR circuits, in addition to all other APPN dynamic and predefined circuits.

- The **Display/Update Gateway Circuits Status** utility on the Communications Menu shows the current status of your DLUR gateway circuits.

- The **Display/Update 3270 LU Connections** utility on the Device Menu shows the LUs that are active on your DLUR host circuits.

APPN Configuration and Management

Configuration - The following list defines the Configuration utilities used to define APPN Circuits. The "APPN Menu" in Configuration can also help guide you through these utilities:

- The **Line Options** utility defines the lines you will be using to access the APPN network, and enables the appropriate protocols for that line.

- A **Link Profile** should be defined for each protocol you will be using to access the APPN network. The profiles define link parameters, which may be shared by all of your APPN Circuits. Among these parameters are the APPN Transmission Group characteristics.

- The **SNA Options** panel contains some APPN Options. Among these are the Network Id and the APPN CP name, which are required when using APPN.

- The **APPN Dynamic Connections** utility defines parameters which are used to create APPN circuits dynamically. It also allows you to define APPN lines as a part of a Connection Network.

- The **APPN Predefined Circuits** utility predefines APPN circuits. This is required for some protocols, such as SDLC and Channel/SNA.

- The **APPN LEN LUs** utility defines LUs residing in Adjacent LEN nodes. You must define these LUs for LEN nodes, since a LEN's LUs cannot be located dynamically.

Management - The "APPN Menu" in Central Control Mode contains many utilities that help you determine the status of your APPN node, circuits, and sessions. There are also utilities that display the current APPN directory and topology, and even a utility to APING another APPN node. Refer to the APPN Menu in Central Control Mode for further details of the utilities available.

In addition to the Network Management Vector Transport (NMVT) facility and the SNMP agent available in all LINCS nodes, LINCS Central Control provides on-line management for APPN. From the Central Control APPN Menu, you can determine the status of the LINCS' APPN node and adjacent nodes and links. From the APPN Menu, you can use APING to determine the presence of and link status to end and network nodes, and select any of the following for current and historical information about the state of the network:

- **Node Status** - lists the number of configured and active adjacent nodes, intermediate sessions and directory entries; whether the node is congested, and the route additional resistance. From this panel, the APPN feature can be stopped and restarted.

- **Circuit Status** - lists all defined APPN circuits and their status. Links may be stopped and started from this panel.

- **ISR Sessions** - lists the sessions and provides information about the sessions for which this APPN node is providing intermediate session routing. This panel is used when contemplating stopping the node or determining the cause for congestion.

- **End Point Sessions** - provides information about the sessions for which this node is considered the end point.

- **RTP Connections** - this panel displays information about the RTP connections for which this node is an end point. From a subordinate panel a user can request that the current RTP Connection path-switch to a better route.

- **Directory** - lists all of the network resources this node knows about. This information is Safe Stored and recovered when the LINCS node is IMLed.

- **Node Topology** - displays information about network nodes within the network gathered from Topology Database Updates. This information is Safe Stored and recovered when the LINCS node is IML'd.

- **Transmission Group Topology** - similar to Node Topology, but about Transmission Groups. Class-of-Service data for each TG is shown on this panel.

- **Problems and Exceptions** - a chronological list of problems and exceptions that have occurred. A problem is a possibly perceptible anomalous event that degrades the system. An exception is anomalous event that degrades the system, but is not yet perceptible.

- **Audits** - a list of normal events that have occurred, such as when circuits are stopped or started, sessions activated and deactivated and CP-CP sessions are established.. Used for tracking activity and accounting.

3. DSPU Support

Gateway Circuits

PU Passthrough

This feature allows a LINCS node to act as a SNA gateway between Downstream Physical Units (DSPUs) and an upstream SNA host. Each host PU that is mapped to a DSPU is called a gateway circuit. SNA data for gateway circuits is passed through the LINCS node but the link layer connections to the host and the DSPU are maintained as separate logical links. LINCS does not tunnel any protocol and therefore is not susceptible to link level timeouts, retries, and lost sessions. All combinations of the upstream and downstream protocols listed below are supported.

Configuration and Management

Configuration - The following lists the Configuration utilities which are used to define Gateway Circuits. The "Gateway Menu" in Configuration will guide you through these configuration utilities.

- The Line Options utility should be used to define the lines you will be using for your upstream and downstream connections. The appropriate protocols should be enabled on the Line Options panels.
- A Link Profile should be defined for each protocol you will be using. The profiles are used to define link parameters which may be shared by any or all of your Gateway Circuits. A single profile may be assigned to links with the same protocol, thus eliminating the need to configure this link type information for each upstream and downstream connection.
- A Gateway Circuit panel must be defined for each connection to a DSPU. A line and link profile must be assigned to each upstream and downstream connection you define. These panels are used to define unique information for each connection, such as addressing information.

Management - The "Communications Menu" in Central Control Mode contains many utilities to help you determine the status of your Gateway Circuits. From this menu, you can determine the status of your communication lines or of individual Gateway Circuits. Also, depending upon the protocol(s) being used, you may access one of the protocol submenus (e.g., TCP/IP Menu, LLC Menu) to get more specific information, please refer to the Communication Menu in Central Control Mode for more information.

Upstream Protocols

Any of the following protocols can be used as an upstream protocol to connect a PU2.0 SNA DSPU to a 3270 host:

- Channel (Bus and Tag, or ESCON)
- Frame Relay/LLC
- LAN/LLC
- SDLC
- TCP/IP
- X.25
- APPN DLUR

Downstream Protocols

LINCS uses any of the following protocols to communicate with the DSPU:

- Frame Relay/LLC
- LAN/LLC
- SDLC/DAP
- TCP/IP
- X.25

SDLC/DAP

LINCS' SDLC/DAP feature expands the SNA gateway capabilities into the SDLC environment, by allowing the LINCS node to support DSPUs (PU type 2.0) over SDLC links. DSPUs are polled by the LINCS similar to the way a front end processor running NCP does. SNA traffic is passed through the LINCS node upstream to a host connection. This host connection can be through a channel attachment or through a LAN attachment, Token Ring or Ethernet.

Downstream device attachments are made using the standard SCC or HSC card of the LINCS node. Each card is capable of supporting up to 16 PUs downstream over one or more lines, running up to 64 Kbps each. Lines may be configured to support full-duplex or half-duplex operations, point-to-point or multidrop, NRZ or NRZI.

Segmentation

The maximum frame size sent to the host and to the DSPU is configured in the link profiles associated with each gateway circuit. LINCS will perform SNA segmentation in both directions as required.

Link Termination

LINCS will send a REQDISCONTACT to the host if the link to the DSPU is lost for any reason. The host is then responsible for the error recovery required to reactivate the link.

LU TO PU Mapping

Host logical unit (LU) to LAN physical unit (PU) mapping permits LU traffic destined for a LINCS node to be redirected to LLC connected LAN DSPUs. Using this feature, also known as a PU Concentration, the SNA host has access to DSPUs without requiring a separate PU at the host for each LAN device. To the host, the LINCS node appears to be a standard PU2.0 device, while to the DSPU, the LINCS node appears to be a PU passthrough gateway. This is achieved by redirecting the datastream for some of the LINCS node's LUs onto the LAN according to the configured LU-PU map.

This feature has the following benefits:

- By mapping LUs instead of PUs to the LAN clients, the number of PUs required on the host can be reduced.
- The mapped LUs can be pooled and made available to DSPUs on a first-come, first-served basis.

- LUs from multiple hosts may be mapped to the same DSPU.
- New LAN clients may be added without changing the GEN or reconfiguring the LINCS node.

Because a PC-Based DSN handles its own keyboard, LINCS functions such as Local Prints, Device-oriented alerts, and the Response Time Monitor are not supported from the Gateway.

The host LU to LAN PU feature works with any LINCS SNA host circuit.

Configuration and Management

Configuration - The following lists the Configuration utilities which are used to define the LUs and DSPUs which will be used by the LU to PU mapping feature. The "LU to PU Mapping" EMU in Configuration will guide you through these configuration utilities.

- You must define at least one SNA host circuit to receive traffic for the LUs which will be mapped to the DSPUs. Refer to the 3270 Host Connectivity section to information on how to configure your 3270 host circuits.
- The Line Options utility should be used to define the LLC lines which will be used to communicate to the DSPU(s).
- A LLC Link Profile must be defined with the link information to be used by the LLC link to the DSPU(s).
- LU to PU Mapping Profiles are used to associate Upstream LUs with Downstream PUs. Multiple DSPUs can share a LU to PU Mapping Profile, or if security is required a profile may be defined for each DSPU.

Management - The "Display/Update 3270 LU Connections" utility displays all configured 3270 LUs and indicates whether or not DSPUs currently own the LUs. If a DSPU owns a LU, the DSPU's LAN address will be displayed. The LUs may be disconnected using this utility.

4. IPX Routing

The LINCS IPX Router feature allows a LINCS node to act as an IPX router when attached to a NetWare internetwork via one or more LAN boards. IPX routing is supported between all LAN connections. The LANs can be any combination of Ethernet and/or Token Ring lines, or two different frame types on the same line.

To enable IPX routing, enable one of the following protocol combinations:

- one LAN board with multiple IPX/MAC layer protocols
- multiple LAN boards with one or more IPX/MAC layer protocols enabled
- one LAN boards with IPX SNA Server enabled

MAC Layer Protocol Conversion

Using IPX protocol, LINCS routes packets to and from various clients, servers, and routers in the internetwork to their final destination network. MAC layer protocol conversion is performed when packets are routed between network segments using differing MAC layer protocols. LINCS IPX Router feature uses the Routing Information Protocol (RIP) and Server Information Protocol (SAP) to maintain an internal database of network route and service information. MAC layer protocol conversion is done between different frame types. The following frame types are supported:

- Token Ring and Ethernet 802.2 LLC
- Token Ring and Ethernet SNAP
- Ethernet 802.3
- Ethernet Version 2

RIP Database

The RIP database is used by IPX to determine the best route to a destination network when routing IPX packets. The RIP application is used to broadcast internetwork route information to directly connected network segments, to keep other routers in the internetwork up to date on network configuration changes. This information is broadcast when network configuration changes are detected, and periodically during normal operations. The RIP application also responds to RIP routing information requests from other routers, clients, and servers in the internetwork. RIP uses an Aging process to remove networks from the network route database if no broadcasts are received periodically to indicate that a given network is still available.

SAP Database

The SAP database is used by Servers residing on the LINCS internal IPX network. The SAP application is used to broadcast internetwork service information to directly connected network segments, to keep other routers and servers in the internetwork up to date on network service changes. This information will be broadcast when network service changes are detected, and periodically during normal operations. The SAP application also responds to SAP service information requests from other routers and servers in the internetwork. SAP uses an Aging

process to remove services from the network services database if no broadcasts are received periodically to indicate that a given service is still available. SAP also interacts with RIP to determine if a path exists to a given service, before registering it in the Service Information Table. SAP also interacts with RIP to ensure that a path has not been lost to the service after it has been registered in the Service Information Table.

LINCS VS NOVELL

BENEFITS: IPX Routing at no cost: When LINCS IPX SNA Server is providing host access to clients on two separate networks, IPX packets are routed automatically. There is no configuration required or any additional expense.

DIFFERENCES: LINCS does not support:

• Routing directly through WAN connections. WAN internetworks can be accessed indirectly through a LINCS IPX Router when another IPX router on the internetwork is connected to the WAN network and the LINCS IPX Router has a direct or indirect LAN connection to that IPX router.

• Source Route Bridging. This is an optional feature by Novell's IPX Router software (Novell ROUTER.NLM).

• RIP and SAP filtering options, currently supported by Novell 4.01

Configuration and Management

Configuration: The following configuration panels are used to enable IPX Routing:

• **Line Options** – Enable IPX protocol on the desired lines. For each line with IPX enabled, the next panel is the IPX Line Options panel, where you can define additional parameters for IPX on that line.

• **IPX Options** – This panel defines global parameter for all IPX lines.

The IPX Router configuration **submenu** takes you through the configuration panels described above, or you can use the full menu. Additionally, there are several RPQs found on the RPS panels associated with the IPX feature.

Resource Requirements: IPX Feature Memory Requirements. If one or more LAN boards have IPX enabled (one LAN board with multiple IPX/MAC layer protocols enabled or multiple LAN boards with one or more IPX/MAC layer protocols enabled), or one LAN boards has IPX enabled and the IPX SNA Server is enabled (one or more IPX SNA Server LUs enabled), feature memory will be required for IPX Router support. This memory will be used for the RIP database and the SAP database as well, as other data areas needed by IPX, RIP, and SAP. See the Feature Memory panel in the Configuration document to see how much memory is required and how to specify it.

Management: The IPX Menu in Central Control is used to gather information and statistics about your IPX links.

5. Host Connectivity

LINCS supports connections to host systems of the following types:

- 3270
- Asynchronous
- TCP/IP (via TELNET)

Dynamic Host Connections

The Dynamic Host Connection (DHC) feature allows users to connect to host resources dynamically. This allows a LINCS node to have more device connections than the number of resources that are defined on the host, minimizing host configuration. Load Balancing is provided by allowing users who connect dynamically to specifying a wildcard host. If a connection is made to a wildcard host, LINCS will select the least busy SNA host for connection.

A device in session with a LINCS node can dynamically switch between 3270 hosts (SNA, BSC, or Non-SNA) and ASCII hosts (TELNET, or Asynchronous).

Host connections are made using the Connect panels, which are discussed later in this section.

Configuration and Management for Dynamic Host Connections

Configuration – The Host Classes utilities (3270, ASCII, IP) in Configuration can be used to define which host resources will be available for dynamic host connection. Host Classes are especially useful if you wish to limit access to particular host resources.

Displays are given the authority to dynamically connect to host resources on the Resource Authorization Matrix in a display's Device Profile. There you configure whether a display will connect to specific host classes, or any host resource.

The Device Profile's Host Assignments At Power On fields determine whether sessions on a device will pre-connect to a host, or use the connect panels. Pre-connection means host connection occurs automatically when the device powers on. The connect panels allow interactive host selection.

Management – Central Control Mode contains two utilities which are useful when using the Dynamic Host Connection feature:

- The Display/Update Host Connections utility displays all configured devices (Network and Direct Devices) and shows the host resources being used by those devices. You can also view the host resources currently being used by all LINCS devices, or disconnect host resources using this utility.

- The Display/Update 3270 LU Connections utility displays all configured 3270 LUs and shows the device which owns the LU. 3270 LUs may be owned by LINCS Devices (Network and Direct), Downstream Nodes using LU to PU Mapping, TN3270 Clients, or SAA Clients. This utility displays information indicating the device type which currently owns the LUs. The LUs may also be disconnected using this utility.

Host Classes

Host Classes are used to share a limited number of resources with a greater number of users. There are two types of host classes:

- 3270: SNA, BSC and Non-SNA hosts
- ASCII: IP and Asynchronous hosts

If you don't create host classes, you will have to assign individual sessions (LUs, host port addresses or IP addresses) to each device.

3270 Host Classes

3270 Host Classes allow sharing of or "pooling" LUs. This can be useful in the following situations:

- Pooling LUs allows a large number of workstations to gain occasional access to a limited number of LUs. A user may access the LU for a period of time, and then disconnect from the LU, thus making it available to other users.
- Creating LU pools is the simplest manner of making 3270 LUs available to TN3270 clients and LU to PU mapped DSPUs.
- 3270 Host Classes are required to make LUs available to IPX SNA clients.

3270 Host Classes can share a common class name, thereby collapsing LUs from multiple hosts into a single host class. This is useful when a user desires connection to one of several hosts, but doesn't necessarily care which host is chosen.

ASCII Host Classes

- ASCII host classes allow LINCS devices to share ports to ASCII hosts.
- IP host classes allow LINCS devices share TELNET connections to TCP/IP hosts.

Host Connection Menus

The Host Connection Menu lists the Host Connection panels which may be used to dynamically connect to a host resource.

```
Host Connection Menu

   Item    Connection Type

    1     3270
    2     ASCII
    3     TCP/IP
    4     LAT Class
    5     LAT Dynamic

Select Item:  _
```

The Host Connection Menu is displayed when a display powers on, if "Connect Menu" was chosen as the "Host Assignment At Power On" on the Device Profile Assignments panel during configuration. From the Host Connection Menu, you may select the desired Connection Type by entering the Item number in the "Select Item" field and pressing the enter key.

Once a Connection Type is chosen, the appropriate connect panel will be displayed. The following function keys are common to all of the Connect panels. Any additional key functionality will be discussed with the particular connection type in the sections which follow:

- **1–Menu** – Return to the Host Connection Menu.
- **2–Queue** – This function key is available if you attempt to connect to a host resource which is unavailable. Pressing this function key queues this session to connect to the host resource in the "Connect to:" field on the particular connect panel. When the resource becomes available, the session will automatically be connected.
- **4–Dequeue** – This function key is available if you previously queued as session to connect to a host resource. Pressing this function key removes the queued entry.
- **6–Reconnect** – Pressing this function key attempts to reestablish a connection to the host previously connected to.
- **9–Refresh** – Pressing this function key re-displays the Connection panel with the current values.

3270 Host Connect Panel

The 3270 Host Connection panel is displayed when 3270 is selected from the Host Connection Menu, or when "Connect Menu: 3270" is chosen as the "Host Assignment At Power On" in a display's Device Profile. From this panel, you may connect to an LU in a class, or to a specific LU. The panel shows an example of the message that is displayed if the Restricted Connection to Active LUs option is enabled and a user attempts connection to an inactive LU.

```
Connection Type:  3270

   _Class_      _Host_     Name____     _Total LUs    Connected     Available_
   _____      _____     _____     _____

      01          A        MOD2            64            40            24
      02          B        MOD5            32            11            21
      03          C        FINANCE         96            66            30


Connect to:  _
LU Not Active.  Press PF2 to connect when LU becomes active.

1 - Menu     2 - Queue     4 - Dequeue     6 - Reconnect     9 - Refresh
```

This panel's fields are described below:

- **Class** – The class numbers of all configured 3270 Host Classes.
- **Host** – The host letters of all configured 3270 Host Classes.
- **Name** – The class names.

- **Total LUs** – The number of LUs configured for the indicated class.
- **Connected** – The number of LUs in the indicated class already connected or in use.
- **Available** – The number of LUs in the indicated class available for connection. If the Restrict Connection to Active LUs feature is enabled for a host, then this number will only reflect those LUs that are currently active.

To connect to an LU in a 3270 class, enter the class name or class number in the "Connect to:" field on the panel and press <Enter>. If an LU is available, and the device is authorized to connect to the specified class, the connection will occur.

To connect to a specific LU, enter the specific host (host identifier or host letter) and LU number in hexadecimal in the "Connect to:" field. For example, enter a,02 for host "a, LU 02". If the LU is available, and the device is authorized for "Dynamic Access" to 3270 hosts, the connection will occur.

If you attempt to connect to class 01, but no LUs are active in Class 01, a message will appear as shown in the example. At this point you may press PF2 if you choose to queue to connect to a LU in the class when one becomes active. If you do so, then your session will automatically be connected to a LU in Class 01 when one becomes active.

Host sessions can disconnect from a 3270 LU in one of the following ways:

- Press the "Extended Select-D" key combination.
- Power off the Device. This will cause all sessions to be disconnected, if the "Power Off Action" field in the Device Profile specifies "Disconnect All Sessions".
- An authorized user can disconnect hosts using the "Display/Update Host Connections" utility, available in Central Control Mode.

Configuration and Management

Configuration – The Configuration and Management section under 3270 Host Connectivity describes the utilities needed to define 3270 Host Circuits.

Displays are given the ability to dynamically connect to 3270 hosts via the Resource Authorization Matrix in the display's Device Profile.

Management – Refer to the common Configuration and Management for Dynamic Host Connections.

ASCII Host Connect Panel

The following is an example ASCII Host Connection panel. This panel is displayed when "ASCII" is selected from the Host Connection Menu, or when "Connect Menu: ASCII" is chosen as the "Host Assignment At Power On" in a displays Device Profile. From this panel, you may connect to an ASCII host port in a class, or to a specific ASCII host port.

```
Connection Type:  ASCII

  _Class_    Name___                    ASCII Host Port availability
  -------    --------

                           AAAAAAAA    BBBBBBBB    CCCCCCCC    DDDDDDDD
                           01234567    01234567    01234567    01234567
       01    ss            A.......    ........    ........    ........
       02    bf            .A......    ........    ........    ........
       03    km            ..I.....    ........    ........    ........
       04    sg            ...I....    ........    ........    ........
       05    cs            ....A...    ........    ........    ........
       06    vax           .....I..    ........    ........    ........
       07    dh            ......A.    ........    ........    ........
       08    Vaxmail       .......I    ........    ........    ........
1 - Menu   2 - Queue   3 - Setup   4 - Dequeue   6 - Reconnect   9 - Refresh
```

The fields are described below:

- **Class** – The class numbers of all configured ASCII Host Classes.
- **Name** – The class name.
- **ASCII Host Port Availability** – A diagram showing the ASCII host ports which are currently available as follows.
  - **A** indicates that the port is available.
  - **I** indicates that the port is in use.
  - **.** indicates that the port is not a member of the class.
- **Profile** – This field selects an ASCII Session Profile for the host connection being attempted. It is an optional field. If not entered, the ASCII Session Profile will be assigned based on the setting of the "ASCII Session Profile Assignment" field on the ASCII Host Options panel in Configuration.

To connect to an ASCII host in a class, enter the class name or class number in the "Connect to:" field on the panel and press <Enter>. If a host is available, and the device is authorized to connect to the specified class, the connection will occur.

To connect to a specific ASCII host, enter the specific host (A0-D7) in the "Connect to:" field. If the host port is available, and the device is authorized for "Dynamic Access" to ASCII Hosts, the connection will occur.

The following function key is available in addition to those described in the section titled "Host Connection Menu".

3–Setup – This function key may or may not be available depending upon the setting of the "Setup Mode Access" field on the ASCII Host Options panel in Configuration. If authorized, you may enter Setup mode to change parameters for any ASCII port, or to disconnect an ASCII port. ASCII Host Setup Mode is described in detail in the "ASCII Host Features" section.

Configuration and Management for ASCII Host Connectivity

Configuration – The Configuration and Management section describes the utilities needed to define Asynchronous access to ASCII hosts.

Displays are given the ability to dynamically connect to ASCII hosts via the Resource Authorization Matrix in the display's Device Profile.

Management – Refer to the common Configuration and Management for Dynamic Host Connections

TCP/IP Host Connect Panel

The TCP/IP Host Connect panel is displayed when "TCP/IP" is selected from the Host Connection Menu, or when "Connect Menu: TCP/IP" is chosen as the "Host Assignment At Power On" in a displays Device Profile. From this panel, you can connect to an IP Host Class, or to a specific IP host or DNS name.

```
Connection Type:  TCP/IP                           Profile:  _

   _Class_        Name___        ___Users Connected___
   -------        -------        ----------------------

     01           M5                      10
     02           HAL                     20




1 - Menu   2 - Queue   3 - Ping   4 - Dequeue   6 - Reconnect   9 - Refresh
```

The fields are described below:

- **Class** – The class numbers of all configured IP Host Classes.
- **Name** – The class name.
- **Users Connected** – The number of active sessions associated with the class.
- **Profile** – This field selects an ASCII Session Profile for the host connection being attempted. It is an optional field. If not entered, the ASCII Session Profile will be assigned based upon the setting of the "ASCII Session Profile Assignment" field on the ASCII Host Options panel in Configuration.

You can connect to an IP Host by entering one of the following in the "Connect to:" field and pressing <Enter>:

- **class number or class name** – If a host in this class is available, and the device is authorized to connect to the specified class, the connection will occur.

- **DNS name** – This is a known and authorized TELNET host name in the TCP/IP network. The name may be up to 64 characters. If the host is available, and the device is authorized for "Dynamic Access" to IP Hosts in the Device Profile Assignments panel, the connection will occur. Full explicit names should end with a period, otherwise the configured Domain name value will be appended to the DNS name.

- **IP address** – This is a known TCP/IP host address. It is four octets with each octet separated by a dot. For example, 192.82.252.236 is an IP address in decimal format. If the host is available, and the device is authorized for "Dynamic Access" to IP Hosts in the Device Profile Assignments panel, the connection will occur.

When connecting to a specific IP Host using the DNS name or IP address, optional parameters are allowed as follows:

- **Line ID** – If TCP/IP is enabled on multiple lines, you can dynamically connect through a specific line by entering the line ID as the 2nd parameter. Otherwise, the first line configured for TCP/IP will be used for establishing the connection. For example, "192.82.252.236,TRC2" forces the TELNET host connection to be made through line TRC2. This is true only for DNS "Dynamic Access" to IP hosts, it is not true for classes.

- **TCP Port** – Normally, all connections will be made to TCP port 23, standard for TELNET. To select a TCP port, enter a specific TCP port as the 3rd parameter. For example, "192.82.252.236,TRC2,6000" forces the TELNET host connection to be made through line TRC2 using TCP Port 6000. If no specific line is entered as the 1st parameter, a TCP Port may still be entered by omitting the first parameter. For example, M5,6000 may be entered to force a connection for the class M5 using TCP port 6000. Two commas are needed if using a DNS name or an IP address. In this case, the default line ID would be used.

The following function key is available in addition to those described in the section titled "Host Connection Menu":

3-Ping – This function key provides access to the Ping feature panel. The Ping Function is described in more detail in the section titled "Ping Feature Panel".

TCP/IP Host Connectivity Configuration and Management

Configuration – The utilities needed to define TCP/IP (TELNET) Host Connections are described in under ASCII Host Protocols in this document.

Displays are given the ability to dynamically connect to IP hosts via the Resource Authorization Matrix in the display's Device Profile.

Management – Refer to the common Configuration and Management for Dynamic Host Connections.

Ping Feature Panel

```
Ping  (ICMP Echo Request)

      Response
      -------------------------------------
      Rsp from 192.84.252.253  seq.=255  time=xxxx  ms
      Timeout no response from 192.84.252.252


      -------------------------------------
      Average Response Time:  xxxx  ms

Ping:  192.84.252.253

      1 - Menu    3 - Return    4 - Clear               6 - Retry
```

Selecting "F3" from the TCP/IP Connect panel selects the Ping Feature Panel.

The Ping feature is a useful diagnostic tool if you fail to complete a TCP/IP connection. The ping command transmits an ICMP echo request and displays response data or error messages in the response column of the Ping panel. The response data or errors for up to twelve ping requests are displayed in the field labeled "Response". After the field is full, the response data will scrolled up each time a new response is received, to allow the latest response to appear in the last line of the field.

You can Ping an IP Host by entering one of the following items in the "Ping:" field and pressing <Enter>:

• **Class Number** or **Class name** may be entered if you wish to ping a specific class.

• **DNS name** – This is a known and authorized TELNET host name in the TCP/IP network, which may be up to 64 characters.

• **IP address** – This is a known TCP/IP host address. It is four octets with each octet separated by a dot. For example, 192.82.252.236 is an IP address in decimal format.

Optional parameters are allowed as described below.

• **Line ID** – If you are pinging a specific IP Host using the DNS name or IP address, you can the ping through a specific line by entering the line ID as the 2nd parameter. Otherwise, the first line configured for TCP/IP will be used.

• **Count** – If you wish to ping more than once, a decimal number in the range of 1 to 255 must be entered as the last parameter. When pinging a class, this will be the second parameter. When pinging a specific IP Host, this will be the third parameter. The number entered indicates how many times a echo request is transmitted.

Once all parameters are entered and <Enter> is pressed, the ping command will be sent to the selected host the number times indicated by the count, or until no response is received. You can request an abort of the ping command by pressing any key. However, the abort request will

not be recognized until a response is received, or until a time out occurs. If multiple ping requests are selected, the average response time is displayed in milliseconds. If there is no response, or only one ping request is selected, then N/A will displayed in the average response time field.

The function keys for the Ping panel are described below:

- **1–Menu** – Return to the Host Connection Menu.
- **3–Return** – Return to the TCP/IP Connect Panel.
- **4–Clear** – Clear the data in the Response field.
- **6–Retry** – This function key is available when the last ping command selected an IP Host using one of the IP Host Classes. If selected, LINCS will attempt the last ping command again.

ASCII Host Connectivity

ASCII Host connectivity is achieved using TCP/IP, or Asynchronous ASCII protocols. The following sections discuss how these protocols related to host connections, plus the features offered in ASCII host sessions.

ASCII Host Protocols

Asynchronous

Asynchronous ASCII hosts can be attached to a LINCS node using ASCII Device Adapters. All CUT-type devices can gain access to ASCII hosts.

Asynchronous Hosts Configuration and Management

Configuration – This section defines the Configuration utilities that define Asynchronous host connections. The Asynchronous Host Menu in Configuration (Submenu List) may also be used to guide you through these utilities.

The ASCII Port Options panel is displayed if any ASCII Ports are defined on the Product Definition panel, and is used to designate the desired Asynchronous ports as host ports.

The ASCII Host Classes utility groups ASCII Host ports into classes and assigns names to the classes. Defining classes provides a user-friendly and secure method of allowing dynamic connections to ASCII Hosts.

Refer to ASCII Host Connectivity under heading 1.2.7.1 for a description of other ASCII Host configuration utilities.

Management – The ASCII Event Log displays a list of the ASCII ports, along with summary counters of any errors that have occurred.

TCP/IP

TCP/IP host connections provide TELNET, TN3270, DNS, and LPD and TCP print servers attachment for CUT displays and direct attached printers. SNA may be encapsulated using the Switch-to-Switch Protocol (SSP) described in RFC 1434 for interoperability with IBM's 6611.

TCP/IP Configuration and Management

Configuration – This section defines the Configuration utilities used to define TCP/IP host connections. The TELNET Host Menu in Configuration (Submenu-list) also guides you through these utilities.

The Line Options utility is where you enable TCP/IP on a line. If TCP/IP is enabled, a TCP/IP Options panel will be displayed following the Line Options panel, to allow configuration of TELNET Host Connections, as well as other IP Host parameters.

The IP Host Classes utility is used to pre-define the IP Addresses, and to assign names to those addresses. Defining classes provides a simple and secure method of allowing dynamic connections to IP Hosts.

Refer to ASCII Host Connectivity for a description of other ASCII Host configuration utilities.

Management – TCP/IP menu in Central Control under the Communications menu allows you to examine TCP information, such as:

- **ARP table** – shows LINCS' mapping of IP addresses to LAN MAC addresses
- **TCP Socket status** – shows the TCP port, board port id, session and socket information
- **IP status** – examine and clear summary counters
- **DNS local cache** – examine and update the local name server data

You can also manage LPD queues using Central Control utilities. From the Device Menu, you can view and delete print jobs in LDP queues.

The Device Menu also provides panels to display host and 3270 LU connections information. There you can find out about TELNET and TN3270 sessions.

The SMS Server Data panel under the Network Management menu displays information about TELNET and TN3270 servers that LINCS has found.

The Gateway Circuit Status panel under the Communications menu gives you the status of gateway connections. You can check any gateway connection, including any IP lines.

The Event Logs menu lets you view log entries for gateway circuit and host events, which includes IP hosts and gateway circuits using IP lines.

DNS

The Domain Name Service is an application layer protocol that runs on top of TCP/IP. This naming service associates information (host names) with objects (Internet addresses). The main function of DNS is to retrieve and provide information about hosts on the Internet network by querying and answering queries. The feature allows you to establish a session with a TCP/IP host by entering a host name or Internet address, instead of the class name or class number on the TCP/IP Connect panel.

There are two basic components of DNS, the name resolver and the name server. LINCS will be acting as a client to the name server on the Internet network. LINCS will be running client software called a resolver. The name resolver's function is to resolve user queries. The resolver needs to know the address of at least one name server.

DNS names have a hierarchical organization, consisting of domains nested within one another. Names are written from bottom to top, with dots separating the levels.

The root of the tree is currently maintained by the Network Information Center. If you want to join the Internet you must contact the NIC to get the authority to be a member. NIC will grant you access and the root name server will be updated with this information. There is usually a name server at each node in the DNS structure tree. A name is defined by listing each label separated by dots all the way to the root label.

Labels must be 63 characters or less and domain names must be less than or equal to 255 bytes, however LINCS will limit the length of a DNS name in a query to 128 bytes. A canonical name response received from the name server that is greater than 128 bytes will be retransmitted fully in another query attempt. The label must start with a letter, end with a letter or digit, and have as interior characters only letters, digits, and hyphen.

LINCS is compliant with RFC1035 and RFC1034

TELNET

TELNET hosts on a TCP/IP network can be accessed from all authorized CUT-type devices on a LINCS node. Hosts can be attached locally or through a routed network. The TELNET feature on LINCS provides physical connection to an Ethernet or token ring network. LINCS can provide terminal server functionality for up to 256 TELNET sessions.

This allows a CUT terminal to "connect" to a TCP/IP host computer which supports TELNET applications. The devices attached to a LINCS node appear as a client to the host TELNET server application.

The TELNET session functionality is very similar to an ASCII session. The main difference is the LAN connection provides a much faster communication link between a host computer and a CUT terminal compared with the asynchronous ports on a LINCS node. Most ASCII features supported by LINCS are supported by the TELNET feature. This includes ASCII Concurrent Print and ECHO print.

LINCS allows configuration of up to 10 sessions per device. With the proper hardware installed, any of the 10 sessions can be TELNET sessions. This allows one device to support up to 10 TELNET sessions concurrently. Each TELNET session can connect to any one of several IP hosts concurrently. Up to 16 IP hosts classes are supported on each LINCS node. The session connections can be distributed among the 16 IP hosts in any manner.

During the session the CUT terminal will emulate IBM 3101, DEC VT2XX, VT1XX, VT52, DG210 and DG410 terminals. After connection, the interface to the user has the same look and feel of an ASCII session.

TELNET sessions use the same translate tables and keyboard interface defined for ASCII sessions. This enables the TELNET sessions to support all off-line and language features provided for ASCII host sessions.

To disconnect the terminal from the TELNET host, you can use either method available to an ASCII session. This includes EXSEL-D or disconnect via SETUP mode.

LINCS supports RFC854, RFC855, RFC856, RFC857, RFC860 and RFC1091.

TN3270 Client

An extension of the TELNET Host Connectivity feature, TN3270 host Connectivity provides all authorized CUT-type terminals access to TN3270 servers, such as another LINCS server. LINCS provides client emulation compliant with RFC1576.

To use this feature, the user will establish a TELNET connection to a TN3270 server. The connection process, from the user's perspective will be identical to any other TELNET Host Connection from the LINCS software. After a TELNET connection has been established, a TN3270 session is established by the client and server negotiating three TELNET options: BINARY transmission, TERMINAL-TYPE, and End of Record(EOR). Until all three options are successfully negotiated TELNET NVT ASCII data will be exchanged between the server and client. After the TN3270 session is created, however, 3270 data is passed between the server and the client.

Configuration and Management for TN3270 Client

Configuration – The configuration for connecting to a TN3270 Server is the same as for connecting to any TCP/IP Host. The only difference is the configuration of some TN3270 specific information in the ASCII Session Profile. Refer to the ASCII Session Profile description in the Central Control document for more details.

Management – same as for any other ASCII Host session over TCP/IP.

TCP Print Server

LINCS provides a TCP/IP raw socket print requester for sending LU1, LU3 and local print requests to printers attached to a TCP/IP network. This feature can help to consolidate costly print resources. The TCP server protocol is a client and server relationship that utilizes TCP/IP. The TCP print client will initiate a standard TCP connection to a specific IP address and TCP port, which identifies the printer to be used. The TCP port and IP address are normally configurable at the print server.

Multiple TCP/IP print servers may be defined for a single LINCS platform. Some or all of the servers may be TCP print servers. Each line with TCP/IP protocol enabled may be assigned one or more TCP print servers.

Each TCP print server must be assigned to one or more locally attached system printer sessions and allows multiple logical sessions to be supported on these printers. The TCP print server, also, may be assigned to coax host addressable printer sessions but not ASCII host addressable printer sessions. The TCP server cannot be assigned to any LAN printer sessions.

The TCP print server does not buffer or spool print data; it prints the data as it is received. TCP flow control is used to control data flow from the TCP print client.

Configuration for TCP Print Server

Configuration – This section describes the Configuration utilities which are used to define TCP/IP Print Servers. The TCP Print Server Menu in Configuration(Submenu List) may also be used to guide you through these utilities.

The Line Options utility is used to enable TCP/IP on the desired lines.

If TCP/IP is enabled on a line, a TCP/IP Options panel will be displayed next in configuration, which allows you to tailor additional TCP/IP Options.

The TCP/IP Print Server Classes defines the Print Server classes. These classes are assigned to printer sessions using the Device Profiles and/or the Device Profile Assignments utilities.

LPD Print Server

LINCS provides an RFC1179 compliant LPD print server that can direct network print requests to directly connected print resources. Prints can be spooled to either coax or ASYNC ASCII printers. This feature can help to consolidate costly print resources. The LPD protocol requires a client and server relationship that utilizes TCP/IP. The client is considered the LPR and the server provides the print services and is called the LPD. When the LPR requires print services it will initiate a TCP connection with the LPD.

LPD will allow users on a TCP/IP network to request ASCII print services and spooling functions on LINCS platform system printers. This allows LAN users to utilize existing print resources that also can be used to perform local, LU3, LU1 and host copy prints.

Multiple TCP/IP LAN print servers may be defined for a single LINCS platform. Some or all of the servers may be LPD servers. Each line with TCP/IP protocol enabled may be assigned one or more LPD servers. Each LPD server has a print queue name associated with it. Each LPD server is capable of serving multiple clients concurrently. The number of clients is limited by the maximum connections allowed. This value is configurable per queue name. The maximum number of connections is also limited to a maximum number of connections per line for all LAN devices.

Each LPD server print queue must be assigned to one or more directly attached system printer sessions and allows multiple logical sessions to be supported on these printers. The LPD server may also be assigned to coax host addressable printer sessions but not ASCII host addressable printer sessions. The LPD server print queue cannot be assigned to any LAN printers sessions.

The amount of memory allocated for LPD Server is limited only by the amount of memory in the LINCS device.

LPD Print Server Management

Management – The Display/Update LPD Queues utility on the Central Control utilities Device Menu manages the LPD print queues.

Central Control provides a utility that allows the system operator to view the status of each LPD print queue and to delete any print job.

ASCII Host Features

LINCS' ASCII Host feature enables you to integrate ASCII hosts, display stations, and printers into a 3270 environment. The feature utilizes ASCII ports on a LINCS node that can be designated as a host port. An ASCII port configured for ASCII host lets you use coax displays or ASCII displays to communicate with an ASCII host.

ASCII Host Prints

LINCS allows a printer, either ASCII or coax, to have ASCII host sessions. There can be up to ten sessions per device, with one or more being an ASCII host. When the printer powers on, LINCS will establish sessions with each of the hosts.

For ASCII printers, the host prints through LINCS unmodified, known as ASCII Passthrough. The ASCII host can send escape sequences through LINCS to modify the printer setup. LINCS can buffer the print data, to support different baud rates between the host and the printer.

For a coax printer, LINCS converts ASCII data to an SCS data stream. That means the coax printer must support SCS datastreams.

Flow Control

LINCS provides software flow control (XON/XOFF), or hardware flow control (RTS/CTS or DTR/DSR) for Asynchronous connections. If the printer is busy printing for another host, LINCS sends XOFFs to the host, and stores the host print data in a 256 byte buffer. If the host ignores the XOFFs, print data will be discarded when the buffer is full.

Connecting to an ASCII Host

How a device connects to an ASCII host depends upon the host connection method configured on the LINCS node. The device can connect directly to a specific host, or select a host from any available to the device. Choosing ASCII on the Host Connection menu presents the ASCII Host Connect panel from which an ASCII host class can be selected.

Disconnect Timer

LINCS provides an Inactivity Timeout timer, which is configurable in a ASCII Session Profile. If a display using that profile is inactive for the timer amount, it's host sessions are disconnected, and the host port is then available for other users.

The host may also be configured to send a disconnect sequence to the port at disconnect time. The disconnect sequence is typically used to update attached modems, or LOGOFF the user, so that other users do not get that host session. The disconnect sequence is configurable on the ASCII Session Profile panel.

A second type of LINCS timer can be used to allow a host to complete the LOGOFF sequence after an Inactivity Timeout. If the Disconnect Security Timer is enabled on the ASCII Host Options panel, the port will wait one minute after disconnect before allowing another user to connect to a port.

Setup Mode

ASCII Host Setup mode lets you modify parameters for the ASCII host session to which you are connected. If you have supervisor authority, you can modify the parameters for any ASCII host port. If you do not have supervisor authority, you can modify the parameters only for the ASCII host port to which you are currently connected.

On a coax display, the Erase EOF key toggles you in and out of ASCII Host Setup mode. For an ASCII terminal, the toggle key is defined by the Keyboard Definition Utility (KDU).

Dial Panels

The ASCII Dial panels provide a means for storing commonly used dial strings and modem initialization strings for ASCII hosts. The Dial panels also provide a way of entering dial strings and user IDs for use with the dialback security feature. All cursor keys, tab keys, and alphanumeric keys are active when the ASCII Dial panels are in use. In addition, a list of active PF keys is displayed at the bottom of the screen. Only the display terminal user with supervisor authority can modify data and toggle fields on these panels.

There are three different types of panels that are part of the ASCII Dial panels:

- **Modem Phone Number Panel:** Allows you to enter User IDs and host telephone numbers. You may also define a call back number, if the Call Back Security Feature is to be used. Up to 96 phone numbers can be entered. Each entry is identified as either a host number or a User ID number. (Be sure to end the dial string with a CR character if necessary or the string will not be sent.)

- **ASCII Modem Dial Panel:** Allows you to enter modem dial strings on a per port basis. The dial string will be sent just prior to a phone number when LINCS is dialing for you, either Host dial or Dial Back. An example of this is the ATDT string required by Hayes modems.

- **ASCII Modem Init Panel:** Allows you to enter another type of initialization string that is required of some modems when they power on. An example of this is if you wish to put the modem in auto answer mode. LINCS will send this string every time the modem powers on.

From an ASCII host session, you can access the Modem Phone Number panel by pressing the Dial Panel key (initially assigned to the Clear key). From a 3270 host session, you can access the Modem Phone Number panel by pressing the Extended Select key and then the Clear key.

With dialback, when the user ID and the password have been correctly entered, LINCS prompts the user to hang up or go "off hook". When DSR and CD drop on the modem, indicating that the user has hung up, LINCS waits eight seconds, then dials back the user based on the user ID, the telephone number, and the modem initialization string configured on the Dial panel. LINCS prompts again for the user ID, and the user enters the string again. If the string does not match the previous entry, access is denied and the port is made available for entry by another user.

If the modem attached to LINCS cannot get a dial tone, gets a busy signal, or if the call is not answered within five seconds, LINCS assumes the user has powered off the device, and makes the port available for access by another user.

ASCII Passthrough

ASCII Passthrough passes virtually all key sequences to and from an ASCII device to an ASCII host unmodified. Only two key sequences are not passed:

- Setup Mode key sequence, used to enter ASCII Setup Mode

- Session Switch Key, used to switch between configured sessions

Optional key sequences may also be defined, using the ADU, to provide the following functions:

- Dial Screen key sequence, used to access the Dial Screen

- Zoom key sequence, used to zoom in on a windowed session while in an ASCII session.

ASCII Passthrough also allows the device to operate at a different baud rate than the host's baud rate. LINCS also allows the device to emulate a different ASCII device. For example, a Wyse 50 can appear as a VT100 terminal to a DEC host.

Please observe the following cautions when switching to or from an ASCII Passthrough session:

- If an ASCII device supports Block Mode types of operation in passthrough mode, the device must exit Block Mode, and return to Character Mode before switching sessions.

- LINCS does not keep track of screen data in passthrough mode, so you will have to refresh the screen after switching back to an ASCII passthrough session. See ASCII Passthrough under ASCII Displays in the chapter on CUT Devices for additional information.

Cut and Send

The Cut and Send feature provides a means for integrating 3270 and ASCII applications. Data can be copied (cut) from a 3270 or ASCII source window and pasted (sent) into another 3270 or ASCII target window thereby passing data from one application to another.

Copying from One Window to Another

The CUT and SND keys described in KDU can be used to copy data from one window to another or use this procedure to copy data:

1. Press the ExSel key and then the WSC key to enter WSC mode.

2. Press the Copy key to enter Copy mode.

3. Press the Source key and Identify the data to be copied:

   - Select the profile and window from which the text is to be copied.

   - Position the cursor on the top left corner of the text to be copied.

   - Press the Cursor Sel (Cursor Select) key.

   - Position the cursor on the lower right corner of the text to be copied.

   - Press the Cursor Sel key again. As shown in Figure 10-15 on Page 10-52, the selected area will be indicated by lines enclosing the text. Note that the enclosing lines are not displayed over a nondisplay attribute.

4. Press the Target key and select the location to which the source data will be copied as follows:

   For 3270 target sessions:

   - Select the profile and window to which the text is to be copied. See "Selecting a Window from WSC Mode" for instructions on how to select a window.

   - Position the cursor on the top left corner of the area to which the text is to be copied.

   - Press the Cursor Sel key to define the target.

   For ASCII target sessions:

   - Select the profile and window to which the text is to be copied. See "Selecting a Window from WSC Mode" for instructions on how to select a window.

   - The cursor movement keys are not transmitted to the ASCII host while the display station is in WSC and an ASCII session. Complete all cursor movements for the target ASCII session before you enter WSC to initiate a Send operation.

   - To prevent you from mixing keyboard data with data being sent to the target ASCII session, the keyboard for the ASCII session is locked while the ASCII session is sending data. The keyboard is not locked for other sessions.

   - To suspend ASCII data transfer to the host, press the XOFF key. The LINCS stops releasing data to the transfer buffer until the transfer timeout counter expires or the XON key is pressed to resume data transfer.

5. Press the Enter key to perform the copy. The copied text transfer is initiated. If you press the Enter key while data is being transmitted to an ASCII session, the additional data is not transmitted. Note: When you copy text from one area to another, text that exists in the target area is overwritten. After you've pressed Enter to copy the text to the target, the source remains defined. If you press the Enter key to transfer data while other data is already being transferred to an ASCII session, the new data is not transferred.

6. You can select another target, copy the text to it, and repeat the procedure as many times as necessary, or press the Copy key or the WSC key to exit Copy mode.

Copying to an ASCII Host Session

Use the following format to transmit source data:

Initiator block string
Initiator line string
line1
Terminator line string
Initiator line string
line2
Terminator line string
.
.
Terminator block string

The following table describes how LINCS transmits data to an ASCII session:

Data to Transmit	Interpretation
Initiator block string	Empty string - nothing is transmitted.
Initiator line string	Empty string - nothing is transmitted.
Line 1 - Features	Eight characters transmitted - the leading and trailing spaces are not transmitted.
Terminator line string ^M	1 character transmitted (ASCII 0D).
Initiator line string	Empty string - nothing is transmitted.
Line 2 - <F2> Installation and Configuration	30 characters transmitted.
Terminator line string ^M	1 character transmitted (ASCII 0D).
Initiator line string	Empty string - nothing is transmitted.
Line 3 - Troubleshooting	15 characters transmitted.
Terminator line string ^M	1 character transmitted (ASCII 0D).
Terminator block string	Empty string - nothing is transmitted.

Character Changes

When you copy data from a 3270 session to an ASCII session, the following characters are changed, as shown.

Character in 3270 Session	Character in ASCII Session
Not Symbol	Circumflex
Broken Vertical Line	Solid Vertical Line
Cent Sign	Left Bracket

ADU

The ASCII Definition Utility is a Central Control utility that modifies:

- **Device Definition:** The ASCII Definition Utility (ADU) defines tables to customize up to seven display stations and plus some additional ASCII printer features that are not currently supported by the LINCS so that you can use them with a LINCS node.

- **Character Set:** Customization: ASCII devices communicate with LINCS through the use of ASCII data characters and ASCII control sequences. ASCII data characters are used to pass displayable data to and from LINCS. ASCII control sequences are used by ASCII terminals to request functions from LINCS. ASCII control sequences are used by LINCS to request presentation functions on the ASCII devices. You can modify or define new tables in LINCS that are used to translate ASCII host data to/from CUT type terminals and printers.

- **Printer Secondary Transparency Option:** LINCS can embed control sequences into the 3270 datastream for LU1 and LU3 prints, to control printer functions such as formatting.

Defining Unsupported Devices

There is no standard set of sequences that all ASCII devices can support. Each ASCII device type that LINCS supports has its own control sequence table allocated in memory that enables LINCS to communicate with it. The ADU feature allows you to customize these tables, so they support devices that LINCS does not currently support.

To use unsupported ASCII devices, you customize the following tables that provide information to the LINCS:

- Transmit sequence to perform 3270 function tables - These tables enable LINCS to know the transmit sequence to perform 3270 functions at the ASCII device.

- ASCII to 3270 keyboard function sequence tables - These tables enable LINCS to recognize which functions you want to perform with each keyboard control sequence you enter.

- Inbound and outbound character translate tables - These tables affect how data is interpreted from the device and how the data is displayed or printed at the device.

LINCS supports a maximum of 32 displays types. There are currently 25 predefined displays and the predefined displays cannot be changed.

Changes you make to user-defined displays are saved on disk and any previous entries are written over and not saved. Changes made to the user-defined printer parameters are also saved on disk and write over any previous entries.

Character Set Customization

There are two sets of EBCDIC to ASCII and ASCII to EBCDIC translate tables for displays, and two EBCDIC to ASCII translate tables for printers. The display set and the printer set have their respective default values which remain on disk. You can modify both sets and the modifications are saved to disk, but the original versions are still accessible by defaulting the tables during ADU. See LINCS Configuration for instructions on how to update these tables to customize ASCII devices.

Secondary Transparent Order

Secondary Transparent Print Order is a new print order supported by the ADU in LU1 and LU3 prints. It is used to embed escape sequences in the host datastream in a format commonly used by protocol converters currently on the market.

The character string selected for the Secondary Transparent Order are dedicated for use as an order and cannot be printed at any time. The table below compares the Secondary Transparent Order to SNA character string (SCS).

SCS Order (LU1 only)	Meaning	Secondary Transparent Order (LU1 and LU3)	Meaning
35	Hexadecimal value that indicates the start of transparent data.	xx*	Hexadecimal character (s) defined in ADU that indicates the start of transparent data.
Count	Defines the count of data bytes following the order. Data that follows the count byte is passed directly to the printer.	yy*	Hexadecimal character (s) defined in ADU that indicates the end of transparent data.

*XX can be the same as YY. The data between XX and YY is converted from EBCDIC to ASCII. Each EBCDIC character represents half of the ASCII character that is sent to the ASCII printer. The following example illustrates the conversion:

Secondary Transparent Order Translation

XX = 7C hex (EBCDIC @)

YY = 7C hex (EBCDIC @)

You create a printable datastream that looks like this:

@1B5B41424344@

LINCS receives an EBCDIC RU datastream that looks like this:

7C F1 C2 F5 C2 F4 F1 F4 F2 F4 F3 F4 F4 7C

The datastream is converted to the following ASCII datastream and sent to the ASCII printer:

1B 5B 41 42 43 44

Manual Clear Screen

To ensure that the LINCS can support any type of display defined in ADU, the clear screen sequence is not mandatory. Instead, LINCS manually clears the screen using a screen write of all spaces. Cursor positioning Escape sequences move the cursor to the Home position and spaces are sent to the ASCII display until the screen has been cleared.

Concurrent Print

The ASCII Concurrent Print feature allows data sent from an ASCII host to a CUT display to also be directed to the display's currently assigned printer. This essentially performs an automatic "Local Print" of all screens sent to the display, as long as the feature is enabled.

The Concurrent Print feature can be enabled in one of two ways:

• A Concurrent Print hot-key can be defined using the Keyboard Definition Utility. If defined, this key can be used to toggle the Concurrent Print feature on and off.

• The ASCII host can initiate concurrent printing by using an escape sequence. See Appendix A - ASCII Keyboard Codes for a description of the ASCII Concurrent Print escape code commands.

The display will release ownership of the printer if:

• the ACP Inactivity timer expires

• the escape sequence ESC[?4i (CSI?4i if 8 bit protocol) is encountered

• the display user toggles the ASCII Concurrent Print hot key

When the printer has finished printing, the display station starts processing data again.

Note: this feature is only available when the ASCII host session is in the VT100, VT200 or VT200 8 bit modes.

Depending upon the speed of the printer being used, the display station may be idle during an ASCII concurrent print while data is sent to the printer.

Keep in mind that ASCII Concurrent Print operates like any other local print. Refer to the section on Local Printing in the section titled CUT Device Features for more information on Local Printing and the status messages which may appear on the status line.

Configuration for ASCII Concurrent Print

Configuration – The ASCII Concurrent Print feature is enabled on the ASCII Host Options panel. Also, if you wish to manually enable and disable the feature while on-line, you must define a Concurrent Print hot key using the Keyboard Definition utility.

Configuration and Management for ASCII Host Connectivity

Configuration – In order to access the ASCII Host Configuration utilities, the TCP/IP and/or Asynchronous ASCII protocols must be enabled. The following sections (ASCII Host Protocols) discuss the configuration required for each protocol. This section discusses configuration details that are common to all ASCII Host Protocols.

The ASCII Host Options panel define some of the global parameters for ASCII Hosts. See Central Control and Configuration for details.

The ASCII Sessions profiles define the characteristics of a session connected to an ASCII host. When a session connects to an ASCII host using ASCII orTCP/IP, the Profile assigned to the class connected to will be used. With dynamic connections, you can change the ASCII Session profile on the Connection panel.

The Device Profiles and/or the Device Profile Assignments panels are used to assign the ASCII hosts and host classes to sessions on Network and Direct Devices. Using the pre-connect method provides a measure of security, when required. Alternately, displays may be authorized to connect to ASCII host resources dynamically using the Resource Authorization Matrix in the Device Profile. The section titled Dynamic Host Connection explains how to dynamically connect to ASCII Hosts.

Management – The Display/Update Host Connections utility displays all configured devices (Network and Direct Devices), and the host resources being used by those devices. This utility displays the host resources currently being used by all LINCS devices. Host connections may be also be disconnected using this utility.

Additional information about managing ASCII host connections is given in the following sections.

3270 Host Connectivity

3270 Host Connectivity is achieved using a wide range of link protocols carrying SNA, BSC, or non-SNA traffic. The various link protocols which may be used to communicate to a 3270 host are listed in the section titled 3270 Host Protocols. The features offered in 3270 Host Sessions are also discussed.

Sessions that LINCS has with 3270 hosts are called host circuits. A host circuit is a logical host connection on the physical line. Each physical unit (PU) address on a line corresponds to one host circuit. You must define a host circuit for every PU that is not gateway'd.

Host Protocols

This section describes the BSC, Channel/SNA, Channel/Non-SNA, Frame Relay, DLUR, LLC, SDLC , SNA, TCP/IP, SNA Encapsulation, TN3270 Client, and X.25 protocols that LINCS can use to communicate with a 3270 host.

BSC

BSC Host Circuits are supported only on SCC lines. To configure a BSC Host Circuit, set the Line Protocol to BSC on a Line Options panel, and define a BSC Link Profile.

Channel/SNA

Channel/SNA Host Circuits are supported on CHP lines. To configure a Channel/SNA Host Circuit, set the Line Protocol to Channel/SNA on a Line Options panel, and define a Channel/SNA Link Profile.

Channel/Non-SNA

Channel/SNA Host Circuits are supported on CHP lines. To configure a Channel/Non-SNA Host Circuit, set the Line Protocol to Channel/Non-SNA on a Line Options panel, and define a Channel/Non-SNA Link Profile.

Frame Relay

LINCS provides a direct native connection to Frame Relay networks on HSC lines. All data is packaged according to the formats described by RFC1490. When operating as a DSN, a LINCS node can provide access to any host connected to the Frame Relay network.

To configure a Frame Relay Host Circuit, define an HSC line with Frame Relay as the line protocol. Then define an LLC Link Profile, which will be assigned to the Frame Relay Host Circuit on the Host Circuit panels.

DLUR

DLUR Host Circuits provide APPN routing services to dependent LUs associated with PUs internal to the LINCS node. To configure a DLUR Host Circuit, enable APPN. Refer to the sections titled APPN and DLUR for more details.

LLC

LLC Host Circuits are supported on Ethernet, Token Ring, or Frame Relay lines. To configure an LLC Host Circuit, enable LLC on an Ethernet or Token Ring, or Frame Relay Line Options panel and define an LLC Link Profile (Note that if you define a Frame Relay line, then LLC is enabled by default).

SDLC

SDLC Host Circuits are supported on HSC and SCC Lines. To configure an SDLC Host Circuit, set the Line Protocol to SDLC on a Line Options panel, and define an SDLC Link Profile.

LINCS uses Synchronous Data Link Control (SDLC) to carry SNA data. Acting in the standard role of SDLC secondary, LINCS can simultaneously handle PU2.0 and PU2.1 SNA traffic for internal PUs, downstream PUs, and APPN. When configured for SDLC/DAP (Distribution Access Point) and using an HSC board, LINCS can act as SDLC primary. As the primary SDLC link station LINCS simulates the SDLC polling function of a FEP, polling other SDLC controllers, such as SDLC DSPUs or adjacent APPN nodes. Both link roles can be full or half duplex, and support single- or multi-drop configurations. Group Polling is also supported in both roles (except SDLC/DAP on the SCC board). Both NRZ and NRZI signaling schemes are supported, as well as permanent and controlled RTS modem handshaking.

Group Poll

The group poll feature allows the host to poll all PUs supported by the LINCS node via an SDLC group address, instead of polling each address individually. Group poll allows customers to configure the host to send a group poll to the LINCS node. LINCS will respond with data from any one of the configured internal PUs, Token Ring DSPU, Ethernet DSPU, or SDLC-attached DSPU (supported by the SDLC/DAP feature), that has inbound data pending. This feature significantly improves communication line throughput and end-user response time by reducing overall polling from the host and eliminating unproductive polls. Group poll is useful in a gateway or when LINCS is supporting multiple PUs.

For situations which require more than 254 LUs, LINCS supports multiple PUs (up to 16). This multiple PU support is useful in multi-domain environments where multiple hosts are interconnected via the FEP. In this case, each host system could have its own PU in the LINCS node.

Note: SDLC group poll functions only in half-duplex mode.

SNA

Systems Network Architecture (SNA) is a communications protocol that enables synchronous transmission of data between logical units (LUs) that transmit or receive data. An LU is a logical entity associated with an end-user, for example, a terminal connected to a LINCS node or a host application program.

During LINCS' sub-area SNA operation, communication occurs between a primary logical unit (PLU) and a secondary logical unit (SLU). The host contains the PLU, and the LINCS node contains the SLUs. The SLU can be associated with a display terminal or printer.

Outbound data is data transmitted from the host to the LINCS node. Inbound data is data transmitted from the LINCS node to the host. SNA Sessions

An SNA session is a logical connection between the host and the LINCS node. Three types of sessions exist within the LINCS node:

- SSCP-PU
- SSCP-SLU
- PLU-SLU (known as LU-LU)

The host access method (VTAM, VTAME, TCAM) provides the System Services Control Point (SSCP) facility that enables the host PLU to communicate with a LINCS' SLU.

An SSCP-PU session occurs between the access method and the LINCS node's physical unit (PU). Its purpose is to open the physical link between the LINCS node and the host.

The SSCP-SLU session occurs between the access method and an SLU contained within the LINCS node. Its purpose is to establish communication between the host and the SLU. The SSCP-PU session must precede this session.

The LU-LU session occurs between the host PLU and an SLU contained in the LINCS node. The SSCP-PU and SSCP-SLU sessions must precede this session. An LU-LU session is one of four types:

- Type 1 - The SLU's attached device is a printer whose datastream is an SNA character string (SCS), or is specified by the Datastream Profile (DSP) of a Function Management Header Type 1 (FMH-1).
- Type 2 - The SLU's attached device is a display terminal whose datastream is in 3270 datastream compatibility (DSC) mode format.
- Type 3 - The SLU's attached device is a printer whose datastream is in 3270 DSC mode format.
- Type 6.2 - This LU originally was used to support the Central Site Change Management feature. It now additionally is the native traffic scheme for APPN.

TCP/IP

TCP/IP Host Circuits are supported over Ethernet or Token Ring lines. To configure a TCP/IP Host Circuit, enable TCP/IP on an Ethernet or Token Ring Line Options panel, and define a TCP/IP Link Profile.

SNA Encapsulation

SNA may be encapsulated in TCP/IP using the Switch-to-Switch Protocol (SSP) described in RFC 1434 for interoperability with IBM's 6611 and other LINCS machines.

LINCS will connect any standard PU2.0 SNA DSPU to a TCP/IP-attached upstream node. LINCS can also use TCP/IP to connect TCP/IP DSPUs to SNA hosts.

TN3270 Client

An extension of the TELNET Host Connectivity feature, TN3270 host Connectivity provides all authorized CUT-type terminals access to TN3270 servers. LINCS provides client emulation compliant with RFC1576. To use this feature, a user establishes a TELNET connection to a TN3270 server. The connection process, from the user's perspective, is identical to any other TELNET Host Connection. After a TELNET connection is established, a TN3270 session is established by the client and server negotiating three TELNET options: BINARY transmission, TERMINAL-TYPE, and End of Record(EOR). Until all three options are successfully negotiated TELNET NVT ASCII data will be exchanged between the server and client. After the TN3270 session is created, however, 3270 data is passed between the server and the client.

X.25

LINCS uses the International Telegraph and Telephone Consultative Committee (CCITT) Recommendation X.25 communications protocol for packet-switched data transfer between the user and the host central processing unit.

The packet-switched method of data transfer breaks any data to be transferred into several pieces or packets. Each packet contains the data to be transferred and such additional information as is needed to route the packet to the proper location. This allows rapid multi-user communications over a network of different kinds of equipment.

The X.25 Dial Screen, which is available when connected to an X.25 Host, allows you to change, on a call-by-call basis, certain parameters that were set up during configuration.

X.25 Dial Screens

LINCS provides dial screens for establishing a Switched Virtual Circuit (SVC). Once one device attached to the LINCS node establishes the circuit to an X.25 host, then all devices with a single session assigned to that host will have access via that SVC. Dial screens can be restricted to only those users with supervisory authority, if necessary. The two X.25 dial screens are described in the LINCS Problem Guide.

X.25 Configuration

Configuration – X.25 Host Circuits are supported on HSC and SCC lines. To configure an X.25 Host Circuit, set the Line Profile to X.25 on an SCC or HSC Line Options panel, and define an X.25 Link Profile.

3270 Host Features

This section describes the features available with 3270 host support:

- Request Maintenance Statistics
- Vital Product Data (VPD)
- Extended LU Support
- DDDLU
- Extended Vital Product Data
- Local Format Storage
- Multiple Hosts

- TTU
- Response Time Monitor (RTM)
- Network Asset Manager
- SNA Alerts

Multiple Hosts

LINCS supports up to sixteen simultaneous host connections, which can be either logical or physical. For physical connections, additional host circuits can be added by adding additional lines (up to the maximum of 16). LINCS supports the concurrent use of different protocols; any combination of:

BSC, Local/SNA, Local/Non-SNA, Frame Relay, SDLC/SNA, Ethernet/SNA, Token Ring/SNA, TN3270 Client, X.25/SNA, Ethernet/TELNET, and Ethernet/LAT is supported.

For logical connections, up to sixteen multiple host circuits can be accessed on a single line. For example: sixteen BSC host circuits can be accessed on a single BSC line. This configuration supports up to 512 logical units, because each of the sixteen BSC host circuits supports only 32 logical units. This permits BSC to operate more effectively under MLS.

Devices attached to a LINCS node are able to jump between ten different host sessions by using the Multiple Logical Sessions (MLS) feature and the Jump key. The configuration procedure determines which sessions can be used for MLS host switching.

Example of a LINCS Node Configuration:
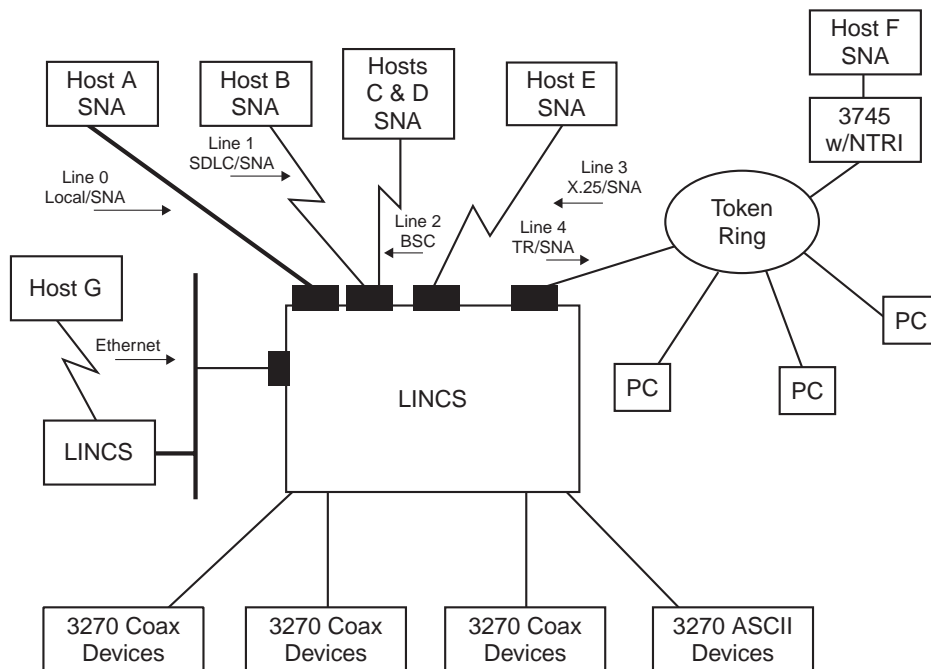
The example shows one of many possible configurations for a LINCS node. LINCS can support up to 16 hosts (Hosts A through P) on eight lines (Lines 0 through 7). Figure 2-3 shows the following support:

- Seven hosts connected to six lines
- One host attached to a Local/SNA line

- One host attached to an SDLC/SNA line
- Two logical host circuits attached to a BSC line
- One host attached to an X.25/SNA line
- One host attached to a Token Ring
- One host attached through Ethernet through a LINCS gateway
- 128 devices
- 96 3270 devices and/or LAN terminals
- 32 ASCII devices

Line 0 and Line 1 share an SCC board that has two-connector capability. X.25 uses an additional SCC board and must be the only line on the board. A TRC provides access to the Token Ring LAN. LINCS is operating as a gateway from Host A to the workstations on the ring. LINCS also functions as a downstream node from Host F on the ring.

Extended LU Support

LINCS supports up to 4048 (3270) LUs simultaneously. The maximum LU count is calculated as 253 LUs per host circuit on 16 host circuits. LUs can be assigned to TN3270 Clients, IPX SNA Clients, LU to PU mapped DSPUs, CUT Devices, and DFT devices in any combination. Configuration - 3270 LUs may be defined on any of the following Configuration panels:

- 3270 Host Classes define LUs to be members of classes. Note that 3270 Host Classes are required to define LUs that will be used by IPX SNA Clients.
- LU to PU Mapping Profiles specify LUs or classes to be used by DSPUs using the LU to PU Mapping feature.
- TN3270 Client Definitions specify LUs or classes to be used by TN3270 Clients.
- The Device Profiles and/or Device Profile Assignments panels specify LUs or classes to be used by CUT and DFT devices.

Feature memory may be required, depending upon the number of LUs which are defined. Refer to the Feature Memory utility in the Configuration and Central Control document for more information.

SNA Alerts

The SNA Alert feature is available on all SNA host circuits. LINCS generates alert messages that can be viewed on NetView's hardware monitor component. NetView or NPDA Version 3, Release 1 or later is required at the host.

If the SNA Alert feature is enabled, unsolicited Alert messages will be sent to the host which contain problem determination information about events or errors that have occurred within the LINCS node. The messages may also be user-defined if the Operator Messages are allowed in the configuration.

The following types of unsolicited Alert messages will be sent to the host:

- Machine checks (2nn, 3nn, 6nn event codes)
- Program checks (4nn, 7nn event codes)
- Communication checks (5nn event codes)

Alerts are queued within LINCS until the protocol allows them to be transmitted to the host. If an event occurs while LINCS already has an event queued, the priority of the new event is compared against the priority of the old event. If the second event has higher priority, the first Alert is lost. If the second event has equal or lower priority, the second Alert is lost.

LINCS is designed to transmit the maximum possible number of Alerts. NetView filtering determines which Alerts are significant.

Operator Initiated Alert Messages

Operator initiated Alert messages provide a means to report unusual events to the NetView operator. This function is supported on all control unit terminals (CUTs). Refer to the Configuration and Central Control manual for information about using Operator Initiated Alerts.

Configuration and Management for SNA Alerts

Configuration – The SNA Alert feature is enabled on the 3270 Host Profiles panel(s) under SNA Options. A 3270 Host Profile with SNA Alert enabled may be assigned to the desired host circuits on the 3270 Host Circuits panels.

Management – The Network Management Menu in Central Control Mode contains the "Operator Initiated Alert" utility which may be used by authorized users to send user-defined alert messages to an SNA host. This utility should be used to call attention to unusual situations.

Request Maintenance Statistics

A LINCS node supports the Request Maintenance Statistics (REQMS) command to SNA Host Circuits. This REQMS command requests summary error counts and configuration information from the Host Circuit and stores the data in NetView's Hardware Monitor data base. The NetView operator can then view the stored maintenance statistics.

When an SNA Host Circuit has received a REQMS command, a RECFMS (Record Formatted Maintenance Statistics) command is formatted with summary counters to send inbound to the host system. Four different RECFMS response types are supported:

- **Type 1** – Link Test Statistics – The link test statistics indicate the number of times the Test command has been received and transmitted.

- **Type 2** – Summary Counters – The summary counter statistics record the number of machine checks, communications checks, and program checks that have occurred on the Host Circuit.

- **Type 3** – Communication Adapter Data Error Counters – Type 3 statistics are kept for communication errors, such as overruns, underruns, command rejects, etc.

- **Type 5** – Configuration and Patch Information – Two different formats are supported for type 5:

  - **Format 1 – Configuration Information** – Upon receipt of this command, LINCS returns the current configuration information.

  - **Format 2 – RPQ and Patch Information** – This returns information about any RPQs or patches that are present. If none are present, nulls are returned.

Local Format Storage

The Local Format Storage feature enables the LINCS to store screen formats that can be invoked for display by host application software or by an operator. Use of Local Format Storage can increase network efficiency because the formats are stored in the LINCS node instead of in the 3270 host, causing less traffic on host lines when formats are displayed.

Configuration and Management for Local Format Storage

Configuration – The LFS feature is enabled by configuring memory for the feature in a 3270 Host Profile. Any host circuit assigned to a 3270 Host Profile with LFS memory configured will have that amount of memory available for storing formats. Refer to the LFS field on the 3270 Host Profile panel in the Configuration and Central Control manual for details on the amount of feature memory required for loading formats and format groups.

Management – The Display/Update Local Format Storage utility on the Network Management Menu in Central Control Mode can be used to view the formats that are currently loaded. It can also be used to delete the formats, if desired.

Creating Formats

To present formats using the LFS feature, you must first create them, then distribute them to the desired LINCS nodes. The host or operator may then present the formats as desired.

CICS, with standard Basic Mapping Support (BMS) commands, can create the 3270 data streams required by the LFS feature. These formats are stored on disk in the host, and retrieved to distribute them a LINCS node.

Distributing Formats

Once the formats are created, they may be received by a LINCS node on SNA Logical Unit (LU) with an address of 1. This LU address supports LU type 2 sessions, and expects to receive a subset of the 3270 data stream structured fields and commands necessary to support formats distribution.

To initiate the distribution of formats, LU address 1 must be defined as a display to NCP, VTAM, and CICS. When the LINCS node is IML'd, VTAM starts the LU. CICS, for automatic transaction initiation, simulates a logon from this LU to the format distribution transaction.

LINCS supports the following query replies that indicate to the host that the LU can participate in format loading or presentation.

- **Auxiliary Device** – This query reply is sent inbound from LU address 1. It tells the host that auxiliary devices are supported.
- **Format Storage Auxiliary Device** – This is also sent inbound from LU address 1. This tells the host that the Load Format Storage structured field can be used to load formats to this LU.
- **Format Presentation** – This query reply is sent inbound from LUs which are connected to CUT devices. It indicates to the host that the LU can support format presentation.

The following 3270 datastream structured fields are supported to accommodate format loading.

- **Destination/Origin**

- **Load Format Storage** – This structured field (SF) contains an operand that specifies one of the following actions.

  - Add a format – This SF contains a group name to which the format should be added, as well as a format name. If the specified group does not exist, then a new group is created. If the specified format name already exists, the old format is replaced with the new format. If the format is operator selectable, it also contains a local name that will be used by operators to retrieve the format. Keep in mind that names are case-sensitive and matching case must be used on retrieval.

  - Delete the specified format - When LINCS receives this SF, it deletes the specified format.

  - Delete the specified format group - When LINCS receives this SF, it deletes the specified format group and all formats within the group.

  - Reset format storage - This SF causes all format groups associated with the receiving host to be removed. Formats loaded on other hosts will remain intact.

  - Request summary status - When LINCS receives this SF. it returns an Exception/Status structured field containing the following information:

    - Number of groups loaded

    - Number of format loaded

    - Number of local names

    - Format storage space still available

- **Exception Status** – This structured field is sent inbound from the LINCS node to acknowledge each Load Format Storage structured field. It indicates if the LFS structured field was successful or unsuccessful.

The following diagram shows the typical sequence of events when a host is distributing formats to a LINCS node.

3270 Host		LINCS
	← Auxiliary Device and Format Storage Auxiliary Device Query Replies	
Destination/Origin structured field specifying the Format Storage auxiliary device →		
	← +rsp	
Local Format Storage structured field →		
	← +rsp	
	← Destination/Origin structured field identifying the Format storage auxiliary device and Exception/Status structured field with self-defining parameters set to indicate the success or failure of the operation	
Load Format Storage structured field - continue sending until all formats are loaded →		
	← Auxiliary Device and Format Storage Auxiliary Device Query Replies	
Destination/Origin structured field specifying the Format Storage auxiliary devies →		
	← +rsp	
Local Format Storage structured field →		
	← +rsp	
	← Destination/Origin structured field identifying the Format storage auxiliary device and Exception/Status structured field with self-defining parameters set to indicate the success or failure of the operation	
Load Format Storage structured field - continue sending until all formats are loaded →		

Presenting Formats

Once the formats are loaded from the host to the LINCS node, they can be presented to any CUT device seen as an LU defined to that host. The following structured fields can be used by the host to present formats:

- **Select Format Group** – This structured field specifies the group directory to be searched during the subsequent present format operation. This group remains selected until another format group is selected, format storage is reset, or the currently selected group is deleted.

- **Present Absolute/Relative Format** – This structured field contains a format name, a 3270 command byte, and a write control character. In addition, a relative format contains an offset value that is added to each 3270 order that contains a buffer address.

When this structured field is received, LINCS searches the current group directory for the format containing this name. When the format is located, LINCS applies the 3270 command and the WCC byte to the datastream, and presents the format to the LU. Multiple Present Absolute or Present Relative Format commands can be contained in a single datastream, and each is processed in sequence.

If a format is operator-selectable, you can request the format for presentation on CUT devices by entering the local name for the format and pressing the <Enter> key. The name must start at row 1 and column 1 of an unformatted screen. If the "Clear Aid Suppression" option is enabled in configuration, you can clear the screen without transmitting the Clear AID to the host by pressing the Clear key.

When you request a format, LINCS will search all loaded formats and display the format that has the local name you specified. The display screen is set to its default or alternate size, depending on the format screen size flag specified in the LFS structured field when the format was loaded. A default WCC will be used.

Response Time Monitor (RTM)

Response Time Monitor (RTM) is a network management tool that measures and records response times of inbound host attention operations from 3270 host sessions. The response times are recorded for all CUT devices, as well as DFT devices that support the feature.

For SNA host circuits, a host application program can be created to set the RTM configuration parameters and to gather RTM information from one or more LUs. This information can be displayed at a Network Communication Control Facility (NCCF) terminal.

For non-SNA host circuits, the statistics can be viewed in Central Control mode.

Configuration and Management for RTM

Configuration – RTM configuration parameters are defined on the second panel of a 3270 Host Profile.

Management – The Display/Update RTM logs utility, which is on the Network Management Menu in Central Control Mode, allows you to view and/or reset the RTM counters. The reset option is only available for Host Circuits that have the RTM Host Support option disabled. If Host Support is enabled, the host is in control of resetting the RTM logs.

RTM Statistics

The following statistics are kept when RTM is enabled.

- **LTTI** – The Last Transaction Time Indicator is the response time for the last host attention key. This indicator is displayed on CUT devices (if configured with display privileges in the RTM support field of the 3270 Host Profile) by pressing the LTTI key combination as follows:'

1. Press the Extended Select key.

2. Press the LTTI key:
   - On 122-key keyboards in Native mode and on 104-key keyboards, press PF19.
   - On 102-key keyboards, press F11.
   - On 88-key and 122-key keyboards in Emulation mode, press the hyphen key.

If your session is configured to display RTM data, one of the following is displayed on the status line:

⋮⌐⋮ : 9:26 means 9 minutes and 26 seconds

⋮⌐⋮ : 08.2 means 8 and 2 tenths seconds

If your display station is not authorized to display RTM data, the following symbol is displayed in the operator information area:

⋮⌐⋮

3. To clear the LTTI from your status line, press the LTTI key combination again.

- **Total Time** – The total response time is kept on a per-LU basis. If host support is enabled, this time is sent inbound to an SNA host requesting RTM data for an LU. It is cleared upon request from the host. If host support is NOT enabled, the total time may be reset from the Display/Update RTM logs utility.

- **Counters** – RTM counters are used to count the number of host transactions for which the response time was less than a configured boundary. Five counters are kept for every LU as shown in the following diagram. The boundaries are set in configuration or by the host if host support is enabled.
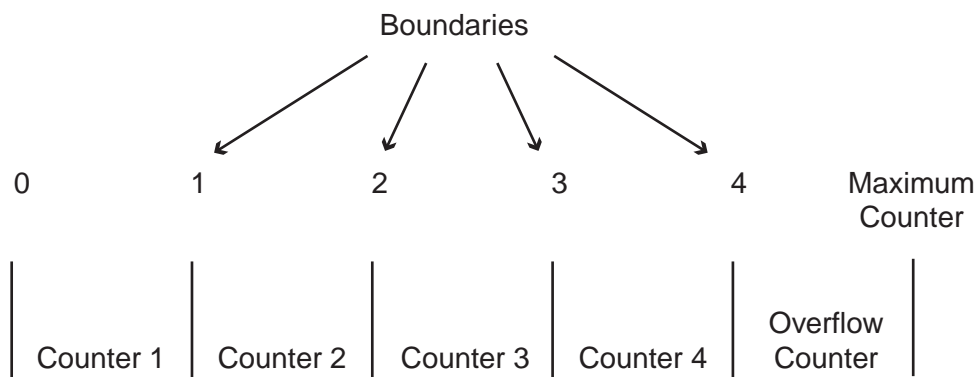
When a host transaction is ended, the response time is compared with the first boundary. If the response time is less than or equal to the boundary, then the first counter is incremented. If the response time is greater than the first boundary, the second boundary is checked, and so on until all boundaries have been checked. If the response time does not fit into any of the boundaries, the overflow counter is incremented to indicate that the response time was greater than the largest configured boundary.

If host support is enabled, the RTM counters are sent inbound to an SNA host requesting RTM data for an LU. They are cleared if:

- an RTM request is received with a request vector containing a reset indication.
- a host request is received that changes the RTM boundaries or definition for an LU.
- LINCS sent unsolicited RTM data to the host. For example, upon unbind or counter overflow.

If host support is NOT enabled, the counters may be viewed or reset from the Display/Update RTM logs utility.

Host Support for RTM

For SNA host circuits, host support is available to set RTM parameters, and to collect and display RTM information at a Network Communication Control Facility (NCCF) operator station.

An SNA application program can communicate with LINCS to solicit RTM information from one logical unit (LU), or from all LUs with non-zero RTM data. When the host requests non-zero RTM data from all LUs, only LUs with non-zero data respond, or if no LUs have collected data, the last configured LU responds.

LINCS can be configured to transmit unsolicited RTM information when an LU-LU session is unbound, or when an RTM counter overflows. Anytime an unsolicited RTM request is sent inbound from an LU, RTM data for that LU is reset.

Distributed Function Terminal (DFT) Interface

LINCS can enable distributed function terminals (DFTs) to support RTM. However, because DFTs perform their own keystroke and datastream processing, RTM support is also required within the DFT. Before you attempt to use RTM with a DFT within your network, check to see if RTM support is available within the device.

LINCS and an attached DFT communicate in the following manner to accomplish the RTM function:

- When the DFT is powered on (or the host changes RTM parameters), LINCS notifies the DFT of the RTM configuration parameters.

- When an AID key is pressed, the DFT tells LINCS to start the RTM timer.

- After the host has appropriately responded to the AID operation (based on the current RTM end of transaction definition), the DFT tells LINCS to stop the RTM timer.

- If it is authorized to do so, LINCS updates the RTM log and the LTTI for the device. If it is authorized to do so, the DFT displays the LTTI.

Network Asset Management

The Network Asset Management function provides product identification information for the LINCS node and its attached devices. This information may be returned to the host when the host solicits it using a Network Management Vector Transport (NMVT) request, called Request Product Set ID (PSID). It may also be sent to the host in an unsolicited manner if the host supports the Dynamic Definition of Dependent LUs (DDDLU).

The information which sent to the host is referred to as Vital Product Data (VPD) and Extended Vital Product Data (XVPD).

Vital Product Data (VPD)

Vital Product Data (VPD) is product identification information for the LINCS node and it's attached devices. This data includes information such as machine type, model number, sequence number, and plant of manufacture.

When a PSID request is received from the host, LINCS returns a PSID reply for the LINCS node, followed by a reply for each attached device. The reply for the attached devices includes information such as Primary LU address, port number, device type, model number, serial

number, and physical location. The request may also contain some Extended Vital Product Data if this feature is enabled as described in a subsequent section.

Not all devices support the Vital Product Data feature. Devices which support it report the VPD information to LINCS when the device powers on. This data is considered device-defined VPD because it is saved in the display station and provided to LINCS on request.

LINCS allows for the definition of user-defined VPD for devices which do not support the VPD feature. This data may be supplied by display operators and saved on the System disk. Note that user-defined VPD is assigned to a specific port. Since the data is not stored in the device, if the device is moved, the VPD does not move with it.

Configuration and Management for VPD

Configuration – No configuration is required for Vital Product Data Support.

Management – The following utilities are available on the Vital Product Data Menu in Central Control Mode.

- The Display/Update LINCS VPD utility displays vital data for the LINCS node. It also allows for the definition of a "Location" which will be sent to the host in a PSID reply if defined.

- The Display/Update Port VPD utility displays the vital data for devices attached to the LINCS node. This utility allows users to define their own vital data to be sent inbound in the PSID request in the event that the device does not supply it's own vital data.

Extended Vital Product Data

Extended Vital Product Data (Extended VPD) is information consisting of label and data fields. This information can be about any subject, such as building location and department number. The label fields are entered and saved during LINCS configuration. The data fields are entered by the user at a DFT and are saved in that display station along with the corresponding labels. The user can enter Extended VPD only for the display station being used.

Some display stations enable users to update Extended VPD in Setup mode for the display station. A LINCS Central Control utility provides Extended VPD panels that display and allow update of Extended VPD information for display stations that do not provide Extended VPD updating in Setup mode.

LINCS requests the Extended VPD from each display station when the display station powers on. When Extended VPD is updated using the Central Control Update Extended VPD utility, LINCS provides the updated information to the display station. If the display station is moved to another port the Extended VPD moves with the display station. If the display station is moved to another node that uses different labels, the Extended VPD should be updated. All non concurrent Extended VPD is indicated in the On-line test with an asterisk (*) in front of each data field with a label that does not match.

Extended VPD is included in the LINCS reply to a PSID request if the Extended VPD feature is enabled and if Extended VPD is present on a device. One subvector is sent for each Extended VPD label.

Configuration and Management for Extended VPD

- **Configuration** – No configuration is required for Vital Product Data Support.
- **Management** – Extended VPD can be displayed and updated for each device using the Extended VPD menu, available from the VPD Utility under LINCS Central Control.

DDDLU

The Dynamic Definition of Dependent LUs (DDDLU) feature allows logical units (LUs) to be dynamically defined by a host. If the host sends an ACTPU indicating support for unsolicited NMVTs for PSID, a PSID will be sent to the host from every powered-on device connected to 3270 LUs owned by the requesting host. The PSID will contain the device's port number, a list of LUs connected to the device, and a device description. The host will use the LU list and device description to build its LU tables.

If a device is not powered-on at the time the ACTPU is received, a PSID will be sent to the host if and when the device powers on. If a device powers off and back on, a new PSID will be sent to the host and the host can dynamically redefine the associated LUs. If a session on a device is using the Dynamic Host Connection feature to dynamically connect to 3270 LUs, a PSID for the LU will be sent at the time the LU is connected rather than at device power-on time.

TTU

The Translate Table Utility (TTU) defines the EBCDIC-to-REGEN tables, which translate communications character set data from a 3270 host to device character set data. Each LINCS node is allowed to have two sets of Translate Tables for 3270 Host Support. By default, the translate tables are defined based upon the primary and secondary languages which you define. Using TTU, you may define the primary and secondary translate tables as desired. You may then configure each of your 3270 host circuits to use either the primary or secondary translate tables.

Configuration and Management for TTU

Configuration – The Translate Table Utility is accessed from the Customization Data Menu in Central Control Mode. It allows you to define up to two sets of translate tables referred to as "User-Defined 1" and "User-Defined 2"

The User-Defined tables are associated with the primary or secondary language on the Language Options panel in Configuration.

The 3270 Host Profile allows you to select either the primary or secondary translate tables. Note that primary or secondary doesn't necessarily refer to the primary or secondary language, since you may define your user-defined translate tables starting with the base language of your choice.

The 3270 Host Profile is assigned to a 3270 Host Circuit on the 3270 Host Circuits panels.

Configuration and Management for 3270 Host Connectivity

Configuration – The following list defines the Configuration utilities used to define 3270 Host Circuits. The 3270 Host Menu in Configuration(Submenu List) may be used to guide you through these configuration utilities.

- The Line Options utility defines the lines you will be using to access your 3270 hosts. The appropriate protocols should be enabled on the Line Options panels.

- A Link Profile should be defined for each protocol you will be using to access your 3270 hosts. Link profiles are used to define link parameters that may be shared by any or all of your Host Circuits. A single profile may be assigned to all host circuits with the same protocol, thus eliminating the need to configure this link type information for each host.

- 3270 Host Profiles define characteristics of the 3270 Host Sessions. In most cases, a single profile may be assigned to all host circuits, eliminating the need to configure this host type information for each host.

- A 3270 Host Circuit must be defined for each 3270 Host you will be accessing. A line, link profile, and host profile will be assigned to each host circuit you define. The Host Circuit panel is also used to define unique information for each host such as addressing information.

- 3270 Host Classes may be defined, if desired. Classes provide a mechanism for "pooling" LUs. This is especially useful when the number of available LUs is limited, or when pools of LUs are needed by IPX SNA Clients and TN3270 Clients. Defining classes also provides a user-friendly and secure method of allowing dynamic connections to 3270 Hosts. Multiple 3270 Host Classes can share a common class name thereby collapsing LUs from multiple hosts into a single host class. This is useful when a user desires connection to one of several 3270 hosts, but doesn't necessarily care which 3270 host is chosen.

- The Device Profiles and/or the Device Profile Assignments panels assign 3270 Hosts and 3270 LUs to sessions on LINCS Network and Direct Devices.

Refer to the following sections if LUs will be assigned to devices other than LINCS Network and Direct devices.

- LU to PU Mapping – LUs may be assigned to DSPUs.
- IPX SNA Server – LUs may be assigned to IPX SNA Clients
- TN3270 Server – LUs may be assigned to TN3270 Clients.
- TN3287 Server – LUs may be assigned to TN3287 Clients.

Management – The Display/Update 3270 LU Connections utility displays all configured 3270 LUs, and shows the device that owns the LU. 3270 LUs may be owned by LINCS Devices (Network and Direct), Downstream Nodes using LU to PU Mapping, TN3270 Clients, or SAA Clients. This utility displays appropriate information to indicate the particular device type which currently owns the LUs. The LUs may also be disconnected using this utility.

The Event Log Menu is used to determine if abnormal events have occurred for a particular host or LU.

6. 3270 Server Features

IPX SNA Server

LINCS IPX SNA Server feature provides SNA IBM mainframe connectivity to LAN-attached workstations running NetWare for SAA compatible 3270 terminal emulation products. The mainframe may be attached by any means currently available to LINCS, for example: SDLC, Local Channel, Token Ring, or Ethernet. The LAN workstations may be attached through any LAN board supporting the IPX protocol. Multiple LAN boards are supported in one LINCS node.

The client workstation must be running a Netware for SAA compatible 3270 terminal emulator.

The workstation connection to LINCS can be Token Ring or Ethernet. The clients will appear to the SNA host as Type PU 2.0 devices, and can establish type LU1, LU2 and LU3 type sessions with an SNA or APPN host.

Competitive Analysis

LINCS Advantages: The advantages of LINCS IPX SNA Server over PC-based NetWare for SAA Server are:

- LINCS runs on hardware that is generally more robust than PC hardware.
- LINCS provides a greater range of host connectivity than a PC running NetWare for SAA
- A LINCS node supports more client sessions, and more host connections than a NetWare for SAA Server.
- Adding IPX SNA Server to LINCS is simpler and less time consuming than installing Novell SAA Server.

Differences from NetWare for SAA: LINCS does not support the following :

- PU2.1 host connection
- LU0, LU6.2
- TCP/IP or AppleTalk
- NetWare Communication Services Manager
- User names or passwords

IPX SNA Server Configuration and Management

Configuration - The following Configuration utilities enable the IPX SNA Server feature. The "IPX SNA Server Menu" on the Configuration(Submenu list) may be used to guide you through these configuration utilities.

- **3270 Host Circuits:** Host Circuits must be defined to use the IPX SNA Server feature. Refer to the Configuration and Management section for 3270 Host Connectivity for details on configuring Host Circuits.
- **Line Options:** Use the Line Options utility to enable the IPX Protocol on the line(s) that will be used to communicate with the IPX SAA Clients.

- **IPX Options:** This utility contains global IPX SAA Server Options that must be defined for the IPX SNA Server feature.

Management - The following Central Control Mode utilities are available:

- The IPX Menu contains utilities that are helpful in determining the status of your IPX network.

- The "Display/Update 3270 LU Connections" utility on the Device Menu displays all the configured 3270 LUs, and indicates whether or not the LUs are owned by the IPX SNA Clients. The LUs may be disconnected using this utility.

Configuring the SNA Server's Client

The following list explains the configuration options of the DOS and Windows versions of Novell's emulator products as they apply to this feature. Other emulator packages may have slightly different formats for supplying the necessary configuration information.

- **User Name/ID** - The user name/ID field will be ignored. Any value may be entered.

- **User Password** - The user password field will be ignored. Any value may be entered.

- **Server Name** - The server name must match the Netware Comm Server name configured in LINCS. Note that the server name is case sensitive.

- **Service Name** - The service name must either match a 3270 Host ID or be wildcarded by specifying an asterisk. If the service name is wildcarded, the LU may be allocated from any 3270 host.

- **LU Category** - The LU category should be set to:

  - An **LU Pool Name** - When the LU category is pooled, the pool name should match that of a 3270 Host Class configured in LINCS. If Pooled is selected, a LU will be chosen from the least busy SNA host in the indicated class.

  - A **LU Dedicated Name** - When the LU category is dedicated, the dedicated LU name should specified as a decimal value. Note that the specified LU must either be assigned to a device or belong to a 3270 Host Class. If the Service Name is a 3270 Host ID, the LU will be chosen from the indicated host. If the service name wildcarded, the LU will be chosen from the least busy SNA host with the LU available.

  - **Any** - Either dedicated or pooled.

- Session Screen Size - The Session Screen Size (MOD 2, 3, 4 or 5) should match the screen type configured for the LU (pooled or dedicated). Since LINCS is not configured with information regarding screen size, there is no means for verifying the screen size specified.

IPX LU Nickname File

The nickname.sys file is an ASCII text file that can be created for the purpose of mapping resources named by the customer to named resources that LINCS can recognize. The nickname.sys file also supports the TN3270 Server feature. For specifics about its usage in conjunction with TN3270, refer to the section entitled TN3270 LU Nickname File.

User-defined names can be associated with LINCS LU resources with this file, allowing the client to be configured with meaningful resource names. For example, the named resource may be chosen to match the VTAM LU name, found in the host gen. The name is passed to LINCS as the resource name whenever the client is configured for Dedicated LUs or Pooled (Group) LUs.

The Nickname file is not required to provide specific LU assignments, but may be used to provide a means to this end.

LINCS accepts as the Nickname file, a file by the name of: nickname.sys

This file can placed on a floppy diskette residing in the floppy drive, or may be located in the SYSTEM subdirectory on the hard drive. LINCS will search the available drives for the nickname.sys file in the order of drives c, d, a, b. Although it may be useful to create the nickname.sys file and test it on a diskette, you will normally want to copy it to the hard drive using Media Management for normal operations.

The nickname.sys file is read into memory at IML time. You may also invoke changes on the fly by copying a new nickname.sys file to the hard drive, then invoking Central Control Mode utility 3/5. This will cause the new nickname file to be read into LINCS memory, and all new connections will use the new file.

Syntax for the nickname.sys file is as follows:

    nickname1=host,lu1

    nickname2=host,lu2

    or

    nickname3=class_name

    or

    nickname4=LUnn

where each nickname must be a unique string of up to 16 characters consisting of alphanumeric characters and/or the characters space, !, ", #, $, %, &, ', (,), *, +, ,, ., -, /, :, ;, <;, =, >;, ?, {, |, }, and ~. Do not use [, \,], ^, or _.

All entries into the file should be on consecutive lines, with each line terminated with a carriage return. There is to be one entry per line, with no white space to the left of the carriage return other than as part of the nickname itself.

LINCS is not case sensitive for the nicknames. When using the format of nickname=LUnn, however, the characters "LU" must be in capitals.

Each host,lu in the nickname file should be in the form of a single letter corresponding to the host letter assigned by LINCS for the host connection, separated by a comma from a two digit LU number (in hex!). Do not use the Host ID name from configuration.

If a class_name is used, this corresponds to the LINCS Class Name for a 3270 host. LINCS is not case-sensitive for the class_name parameter.

When using the format LUnn, the letters LU must be in capital letters, and the nn is the hex value of the desired LU. The client must also send the appropriate Service Name that is LINCS-compatible to let LINCS know which PU that the LU is on.

TN3270E Server

LINCS provides TN3270 and TN3270E Clients access to all types of 3270 hosts. Clients can connect to a LINCS node to communicate with SNA, Non-SNA and Bisync hosts on a session basis. LINCS provides server capabilities for TN3270 clients as defined in RFC1576, and

TN3270E clients per RFC 1647. The TN3270E server software feature, for LINCS with the appropriate software expansion FAD, consists of an extension of the current TELNET feature to allow a TELNET client attached via Ethernet or Token Ring to receive 3270 data. LINCS acts as a TN3270E server and the terminal is the TN3270 client.

When an incoming TELNET connection is established certain TELNET options can be negotiated to cause the connection to transition to a TN3270 type 3270 session. Subsequent data from LINCS (TN3270 server) to the terminal (TN3270 client) is 3270 data to be processed by a 3270 emulator running on the client. This allows the client to connect to a 3270 host computer as a DFT type terminal without requiring an ASCII emulation/translation on the server. The TN3270 client must be a TELNET client attached to the LINCS TELNET server via Ethernet/Token Ring or be routed across a Frame Relay connection.

Client emulation must be consistent with the 3270 LU type configured on the host. The server allows you to associate a specific LU with the client, but you must make sure that the client emulator supports all functionality associated with that LU. The server passes all RU's to the client unmodified, including Write Structured Field (WSF) commands (including queries) and orders containing a 12/14/16 bit address field. The only exception is that a non-extended type client will not receive Write Structured Field commands. If the WSF is a query, the server replies with a null query response on behalf of any non-extended type client. The following client terminal types are supported:

IBM-3179-2	IBM-3180-2
IBM-3278-2	IBM-3278-3
IBM-3278-4	IBM-3278-5
IBM-3278-2-E	IBM-3278-3-E
IBM-3278-4-E	IBM-3278-5-E
IBM-3279-2	IBM-3279-3
IBM-3279-2-E	IBM-3279-3-E
IBM-3279-4-E	IBM-3279-5-E

LINCS assumes that the TN3270 client is capable of receiving an NVT ASCII data stream, the default mode for an incoming TELNET connection. The server can be configured to send NVT data to display a user prompt panel when the client connects.

When a TELNET client connects to the server, TELNET communication parameters are negotiated to establish the client-server interface. The negotiated session parameters determine whether or not this TELNET connection is a TN3270 type connection. Specifically, the End - Of-Record and Transmit Binary TELNET options must be supported by the client and server, and the client must negotiate IBM 32XX type terminal support using the Terminal Type TELNET option. The server usually initiates negotiation of these options at connect time, although either side may negotiate any option at any time. Note that the obsolete TELNET Regime option will be refused by the server.

TN3270 and (Async) TELNET connections must use different TCP Ports on LINCS. If TN3270/TN3270E client connections are configured and a client connects on a TCP port configured for TN3270/TN3270E client connections, the server will attempt to negotiate the client as a TN3270E client first (if configured) then as a TN3270 client if the client refuses TN3270E. To connect the client as a TN3270 device, the TELNET options mentioned above will be negotiated.

At this point it is assumed that the client is a TN3270 client. If the client refuses one or more of the options, the server closes the TCP connection. If a client attempts to connect on a TCP port not configured for TN3270 client connections, the server will not attempt to negotiate TN3270 options.

TN3270 LU Nickname File

The Nickname file is used to provide an alias table to LINCS for TN3270 and TN3270E clients. User-defined names can be associated with LINCS LU resources with this file, allowing the client to be configured with meaningful resource names. For example, the named resource may be chosen to match the VTAM LU name, found in the host gen.

The Nickname file is not required to provide specific LU assignments, but may be used to provide a means to this end.

LINCS accepts as the Nickname file, a file by the name of: nickname.sys

This file can reside on a floppy diskette residing in the floppy drive, or may be located in the SYSTEM subdirectory on the hard drive. LINCS will search the available drives for the nickname.sys file in the order of drives c, d, a, b. Although it may be useful to create the nickname.sys file and test it on a diskette, you will normally want to copy it to the hard drive using media management for normal operations.

The nickname file is read from the nickname.sys file into LINCS memory at IML time. Changes to the nickname.sys file can be made and the file replaced at any time. You must however, use the Refresh LU Nickname File utility on the Media Management menu to force LINCS to refresh the file that it is using while online. When the nickname file is changed while online, LINCS will allow all active connections to continue. New users attempting to connect will use the rules dictated by the new file.

Syntax for the nickname.sys file is as follows:

    nickname1=host,lu1

    nickname2=host,lu2

    or

    nickname3=class_name

where each nickname must be a unique string of up to 16 characters consisting of alphanumeric characters and/or the characters space, !, ", #, $, %, &, ', (,), *, +, ,, ., -, /, :, ;, <, =, >;, ?, {, |, }, and ~. Do not use [, \,], ^, or _. Caution should be taken when using a string that is a substring of another string. For example, the string fg@671 is a substring of dfg@671. A substring will be matched to the first occurrence found in the list.

All entries into the file should be on consecutive lines, with each line terminated with a carriage return. There is to be one entry per line, with no white space to the left of the carriage return (unless the space is part of the nickname itself).

LINCS is not case sensitive for the nicknames.

Each host,lu in the nickname file should be in the form of a single letter corresponding to the host letter assigned by LINCS for the host connection, separated by a comma from a two digit LU number (in hex!).

If a class_name is used, this corresponds to the LINCS Class Name for a 3270 host. LINCS is not case-sensitive for the class_name parameter.

Session Management System

Some of the problems associated with moving 3270 client platforms to a LAN environment include:

- Less dependable server platforms than traditional coax controllers

- Training users on how to connect to multiple TN3270 servers so that when one is unavailable due to the host link down, server down, or all sessions in use, another server can be accessed.

- Balancing the work load across multiple servers to get the best overall performance

- Knowing when a preferred host connection is available again after an outage

The Session Management System (SMS) of the LINCS/Gen C platform addresses these issues.

The LINCS SMS feature provides a system which manages TN3270 (and TELNET) client connections to a pool of servers. SMS provides two main functions. One is to automatically select which one of a pool of TN3270 servers will be approached with a session connection based on the available number of sessions and connections at each server. The other function is to provide redundancy. For example, if a particular server is down, SMS will select another server to which the client can connect.

The SMS feature provides these functions by implementing a primitive Domain Name Server which will provide domain name-to-IP address resolution for the TN3270 and TELNET clients. Instead of a domain name representing one server, many servers will be represented by a single domain name. The SMS domain server will return the IP address of the server which has the most available sessions and connections and is operational. To determine session and connection availability the SMS server will periodically poll, via TCP connections, a configured list of servers.

Each SMS server, maintains contact with each of the TN3270 server platforms to keep information on session availability up to date. Clients request the IP address of a TN3270 server using a configured domain name for the session that they desire. The primary SMS server provides the IP address of the server with the most available active sessions to give. The backup SMS server is approached only if the primary SMS server is unavailable.

Once the client is given an IP address to contact, it will attempt to establish a session with the TN3270 server.

The SMS feature can be used along with the an existing DNS server or can be used in environments where DNS is not already in use. When used in conjunction with an existing DNS server, the SMS server is configured to control a sub-domain of the existing DNS. TN3270 clients are configured with the DNS server's IP address, and the IP address of the back-up DNS server, along with the fully-qualified domain name of the required TN3270 service. The existing DNS server (and back-up DNS server) is configured to direct any requests to the new sub-domain over to the SMS server. The SMS server responds back to the DNS server with a resolved IP address. The DNS server in turn responds back to the requesting client. The DNS server is not allowed to cache the resolved name, forcing the DNS server to always pass new requests on to SMS.

When there are no DNS servers in the network, the SMS server's IP address is configured into the client's platforms as if it were the DNS server. A second SMS server is recommended for fault-tolerance reasons. With no real DNS server available, the SMS server will resolve the DNS request for the TN3270 session directly back to the requesting client.

Once a TN3270 service domain name has been resolved to the client, the client will attempt to make a connection to the TN3270 server. All subsequent traffic is handled by the TN3270 server. Thus, user performance is not affected by use of the SMS feature, and the only observable impact may be at connection time.

The SMS server polls the list of TN3270 servers (SMS clients) identified by the list of IP addresses in all of the SMS Server Definitions panels my making a TCP connection to port 5000 on each of the TN3270 servers. The TN3270 servers will respond by sending the session and connection availability data over the TCP connection. The rate at which the servers are polled is configurable. Port 5000 must not be configured for any other use on the LINCS platform, in order to make use of SMS.

TN3270E Server Configuration and Management

Configuration - The following Configuration utilities enable the TN3270E Server feature. The "TN3270 Server Menu" in Configuration(Submenu List) may be used to guide you through these configuration utilities.

- **3270 Host Circuits** must be defined to use the TN3270 Server feature. Refer to the Configuration and Management section for 3270 Host Connectivity for details of configuring Host Circuits.

- **Line Options** - Use the Line Options utility to enable the TCP/IP protocol on the line(s) that will communicate with the TN3270 Clients. If enabled, a "TCP/IP Line Options" panel will be displayed, to define your TN3270 Client Connections along with other TCP/IP line parameters.

- **TCP/IP Options** - This utility contains global TN3270 Server Options, including the option that determines whether LINCS will act as a TN3270E or a TN3270 server.

- **TN3270 Client Definitions** - This utility defines specific information about your TN3270 Clients and the LUs which they will be using. This panel also determines which TCP ports, LINCS will be listening on for TN3270 clients. Both, specific and pooled LU resources are assigned to TN3270 clients on this panel.

Management - The following Central Control Mode utilities are available:

- The TCP/IP Menu contains utilities useful in determining the status of your TCP/IP lines.

- The Display/Update 3270 LU Connections utility on the Device Menu displays all configured 3270 LUs, and indicates whether or not the LUs are owned by TN3270 Clients. The LUs may be disconnected using this utility.

- The Refresh LU nickname file utility on the Media Management menu allows you to change the LU Nickname file while online, allowing you to modify which users have access to which resources.

- The SMS Server Data panel allows you to monitor the number of TN3270 users and the number of available TN3270 sessions, when you have the SMS feature enabled.

TN3287 Server

An extension of TN3270 Client Support, TN3287 Client Support provides access for printers attached over a TCP/IP network. LINCS provides LU1 and LU3 printing, compliant with RFC1646, using LU name and printer selection. The TN3287 server software feature, for LINCS with the TN3270 software expansion FAD, consists of an extension of the current TN3270 server feature to allow a TELNET client attached via Ethernet or Token Ring to receive LU1/LU3 print data.

This feature will operate similarly to the TN3270 server feature with the following differences:

Additions:

- An additional TELNET terminal type, IBM-3287-1, will be accepted by the server.
- The terminal type response may include an optional alphanumeric string specifying a host class or host and LU.
- The protocol assumes that the client supports LU1 and LU3 data streams, and requires the server to identify each outbound RU (or LU1 chain) as LU1 or LU3 data.
- The protocol requires the server to notify the client when End Bracket has occurred.
- The client will be required to return status information to the server.

Constraints:

- The client is responsible for ensuring that it is requesting an LU "genned" as a printer. The server will allow it to claim any available LU. The bind will be rejected if it is inappropriate.
- There are no configuration changes required, but currently allowed TN client definitions will be interpreted slightly differently for a TN3287 connection.
- This feature fully supports TN3270 Extensions for LU name and Printer. The TN3287 client must be a TELNET client attached to the LINCS TELNET server via Ethernet/Token Ring.

TN3278 Configuration and Management

The information for configuring and managing TN3287 Server is the same as for the TN3270 Server. The only difference is that the LUs must be configured for printers on the host.

7. CUT Device Support

A Control Unit Terminal (CUT) device is one that relies on LINCS to process it's keystrokes and host data streams. Since LINCS is in charge of all the datastream and keystroke processing, a wide range of features is available for these CUT devices. CUT devices include Network Devices which may be LAN attached to the LINCS node, as well as Direct Devices which may be coax or asynchronously attached.

CUT devices may be connected to either 3270 or ASCII hosts, or to no host at all. The full range of 3270 and ASCII Host Connectivity features which were described in previous sections is available to all CUT devices. Also, since all keystroke information from CUT devices is forwarded to LINCS, many other features are available as described in a subsequent section titled "CUT Device Features".

Configuration and Management

This section outlines the Configuration and Management which is common to both Network and Direct Devices. Subsequent sections will discuss any Configuration which is specific to the device type.

Configuration

- The Device Options utilities define global parameters which are valid for all devices attached to the LINCS node.
- The Device Profiles define characteristics for "groups" of devices. All devices may use the same Device Profile if desired, thus eliminating the need to configure this information for each device.
- Device Profile Assignments assign Device Profiles and specific host assignments to all configured devices.
- Printer Assignments assign local printers to devices. Refer to the section titled "Local Printing" for more details.

Management

The Device Menu in Central Control Mode contains utilities that are useful in managing devices attached to your LINCS node. Please refer to this Menu in the Central Control document for further details.

Network Devices

Workstations and printers attached to LINCS by a LAN are termed Network Devices. A workstation can be a PC running terminal emulation software, such as LANSYS , or a DECnet LAT display, or a TELNET terminal. Supported printers include LPD and TCP.

LANSYS

LANSYS lets Token Ring and Ethernet attached PCs emulate CUT-mode terminals. All LINCS CUT features are available to the LANSYS clients including the popular 1472-style emulation. LANSYS can be used in place of other commercially available 3270 emulation packages that

require the PC to act as a DSN controller. LANSYS provides the bottom 5 layers of the OSI reference model and will work with 16/4 Mbps Token Ring or Ethernet. LANSYS support may be added in increments of 8, up to the maximum quantity. LANSYS feature software performs the following tasks:

- Locates each Token Ring LAN terminal and uses configuration information to establish a circuit with the terminal over the LAN
- Emulates coax functions using a proprietary MTX protocol
- Provides all features that are available to a CUT mode coax display

LAT Display

LAN-attached LAT Client support emulates directly attached ASCII devices, enabling the clients to access any type of host connected to LINCS. LINCS can provide LAT clients (workstations) with 3270 sessions by being a named LAT service on the network. All the features available to CUT-type devices are available to the LAT client.

TELNET Display

TELNET clients can connect to a LINCS node, enabling users to access any type of host connected to LINCS. All features available to CUT-type devices are available to the ASCII display.

LINCS supports RFC854, RFC855, RFC856, RFC857, RFC859, RFC860, RFC885, RFC1091, RFC1116 and RFC1700.

LPD Printer

LINCS provides an RFC1179 compliant print requester for sending LU1, LU3 and local print requests to printers which are attached to a TCP/IP network. This feature can help to consolidate costly print resources. The LPD protocol requires a client and server relationship that utilizes TCP/IP. The client is considered the LPR. The server provides the print services and is called the LPD. When the LPR requires print services, it will initiate a TCP connection with the LPD.

Configuration and Management

Configuration - LINCS LPR client needs to know what remote LPD printers are available for printing. You must define a TCP/IP line to the LAN that has the LDP printers, and define the LDP printers to LINCS on the Network Device Definition panel(s) during configuration.

TCP Printer

LINCS provides a TCP/IP raw socket print server that can direct network print requests to directly connected print resources. Prints can be directed to either coax or ASYNC ASCII printers. This feature can help to consolidate costly print resources. Multiple LAN devices on each LAN line are supported, all or some of which may be TCP printers. The number of TCP printers that can be configured is also limited by the maximum number of LAN connections per line. Each TCP Printer will be assigned an IP address and a TCP Port, in order to assign its TCP print server.

Configuration and Management

Configuration - A TCP printer supports multiple logical sessions. Host and LU assignments to a TCP printer are made in the same manner as any other device. A TCP printer has the same characteristics of as any other ASCII printer, thus, the device profiles do not require any changes to describe a TCP printer. Assigning device profiles to TCP printers will be done in the same manner as any other device.

Direct Devices

Direct Devices are CUT or DFT devices that are directly attached to the LINCS node. The devices may be coax attached, or asynchronously attached displays and printers. LINCS supports the following direct devices:

Coax Devices

An MCC (Multiplexed Coax controller) card is required for coax device attachment. MCC cards may be installed in an 1174 for a total of up to 128 coax devices depending upon the model. The coax attached devices can be any combination of 3270 CUT displays, printers, or Distributed Function Terminals (DFTs). See the section "CUT Device Features" for details about support for CUT devices. DFT device support is further described in a separate section titled "DFT Device Support".

Configuration and Management

Configuration - The following configuration utilities define coax devices. The "Direct Device Menu" in Configuration may be used to guide you through these utilities.

• The **Product Definition** panel defines the number of Coax ports present.

• The **Coax Multiplexing** panel defines special connectors for MCC boards, and enables Dynamic Multiplexing.

• Refer to the Configuration and Management section under "CUT Device Support" for configuration utilities common to all LINCS devices.

Management - The **Device Menu** in Central Control mode help manage your LINCS devices.

Dynamic Multiplexing

The dynamic multiplexing feature allows a coax mux to be attached to any coax port, on the MCC or on any CDA board installed in your LINCS node. The physical port may be assigned from zero to eight logical ports on the Dynamic Multiplexing Assignments panel in configuration. This allows for greater flexibility of distribution of devices within the work area.

Asynchronous (ASCII) Devices

An AIC (ASCII Interface Controller) plus ADAs (ASCII Device Adapters) are required for ASCII device attachment. Depending on the model and hardware configuration, a total of up to 32 ASCII devices can be defined. The ASCII device ports may be configured for ASCII display, printer, or host attachment in any combination.

Configuration and Management

Configuration - The following Configuration utilities define ASCII devices. The "Direct Device Menu" in Configuration may be used to guide you through these utilities.

- The **Product Definition** panel defines the number of ASCII ports present.

- The **ASCII Port Options** panel designates ASCII ports as being Display or Printer device ports.

- Refer to the Configuration and Management section under "CUT Device Support" for configuration utilities common to all LINCS devices.

Management - The Device Menu in Central Control mode helps manage your LINCS devices.

ASCII Displays

Asynchronous ASCII displays can be attached to a LINCS node using ASCII Device Adapters, enabling access to any type of host connected to LINCS. All features available to CUT-type devices are available to ASCII displays. LINCS provides protocol conversion or ASCII passthrough for ASCII display stations.

LINCS provides security for ASCII displays, by limiting access, and providing modem dial-back. You can also define new ASCII display types, if you are using one that is not predefined to LINCS.

Protocol Conversion

3270 Emulation: Protocol Conversion enables an ASCII display station or an ASCII printer to access a 3270 host. 3270 emulation occurs when an ASCII display station or printer accesses a 3270 host, and the ASCII Device Support software gives the device a 3270 personality. LINCS' ASCII feature supports the ASCII display stations listed in the "Supported ASCII Devices" section below.

ASCII Emulation: Protocol Conversion also enables a coax display to access an ASCII host port. ASCII emulation occurs when a coax display accesses an ASCII host port, and the ASCII Host Support software gives the display an ASCII personality. Supported ASCII terminal emulation functions can be emulated by a coax display. The ASCII character set supported is a subset of ANSI X3.64-1977.

ASCII Passthrough

In ASCII Passthrough mode, LINCS transmits data between an ASCII display station and an ASCII host without modification. When the display station is operating in Passthrough mode, it acts like an ASCII device accessing an ASCII host application. LINCS acts as a conduit for the data, and does not perform any translation on the data.

Because no data translation is done, LINCS keeps no buffers. That means the Passthrough sessions' screen image is not saved when you jump to another session and then back to the Passthrough session. However, some ASCII hosts support a Refresh key that can restore the screen when LINCS cannot. Consult the ASCII host's operator's manual to determine if your ASCII host supports this feature.

ASCII Passthrough with Emulation enables an ASCII display not normally supported by an ASCII host to communicate with that host by providing the display with a supported ASCII terminal emulation personality. When using emulation on an ASCII display, LINCS keeps

track of scrolling regions and other dynamic setup values. If the operator exits emulation, those values will not be set up in the display itself. If windowing is being used, emulation is automatically turned on.

Also see *ASCII Passthrough* under *ASCII Host Features* in the chapter on *Host Connectivity* for additional information.

Supported ASCII Devices

The following ASCII display stations and features are supported:

	Base Color	EAB Color	status line	line drawing support	Non display	Intensify	Extended highlighting (3)	Mod 5 Support/ 132 col
ADDS								
Viewpoint A2					✓			
Viewpoint 78			✓	✓	✓			
DEC								
VT 52				✓	✓			
VT1XX				✓	✓	✓	✓	✓(1)
VT2XX (7-bit)				✓	✓	✓	✓	✓(1)
VT2XX (8-bit)				✓	✓	✓	✓	✓(1)
VT320 (8-bit)			✓	✓	✓	✓	✓	
Data General								✓(1)
Esprit 10/78			✓		✓	✓		
Hazeltine 1500					✓			
HP 2621B					✓			
IBM								
3101					✓			
3161, 3162				✓	✓	✓	✓	
3163				✓	✓	✓		✓(2)
3151			✓	✓	✓	✓	✓	✓(2)
3164	✓	✓	✓	✓	✓	✓	✓	
FTTERM Color	✓	✓	✓	✓	✓	✓		
FTTERM Monochrome			✓	✓	✓	✓		
Lear Siegler								
ADM 3A, ADM 5					✓			
ADM 11			✓		✓	✓		
ADM 12			✓	✓	✓	✓	✓	
ADM 1178			✓		✓	✓		
TeleVideo								
912					✓			
950			✓	✓	✓	✓		
970			✓	✓	✓	✓	✓	✓(1)
Wyse								
50				✓	✓			✓(2)
60				✓	✓			✓(2)

(1) 132 column support is provided using the sequences in the predefined device. The only ADU change required is for Mod size.

(2) 132 column support requires modification to all cursor positioning and status line positioning sequences in addition to the Mod size change. Some terminals may not be able to support 27 or 28 rows, and may result in undesired results.

(3) **Extended Highlighting** includes: blink, reverse video, and underscore

Defining Unsupported ASCII Devices

ASCII devices which are not listed above can be supported by defining them to LINCS with the ASCII Definition Utility (ADU). See the section about ADU for more information.

Security

LINCS can maintain a list of authorized users who are required to enter password and userid information to gain access to system resources.

LINCS can provide call-back capabilities in order to reverse charges, as well as protecting against unauthorized dial in users. This dialback feature provides security for lines attached through a modem to switched phone lines. To enable this feature, simply add a telephone number next to the userID and password on the dial panel. See *Dial Panels* in Chapter 5, for additional information about using ASCII terminals to dial out over a modem attached to LINCS.

ASCII Printers

All display stations attached to LINCS can perform local screen prints to a printer attached to either an IBM 3472-type (ASCII) display station or to another ASCII printer, if allowed by the Device Profile used by the display. LINCS uses the session configured on that device's profile.

The following ASCII display stations support a printer for both local screen printing and host addressable printing:

- ADDs Viewpoint A2, 78
- DEC VT100, VT200, VT300, VT52
- IBM 3151, 3161, 3162, 3163, 3101, 3151 and 3164
- IBM File Transfer and Terminal Emulator Program (FTTERM), color and monochrome
- Lear Siegler ADM 11, ADM 12, 1178, 3A
- TeleVideo 970, 912, 950
- Wyse 60, 50
- Hazeltine 1500
- Esprit 1078

Note: If a printer is connected to an ASCII display station, and the printer is turned off, no print operation is performed. LINCS does not send a message to the display station requesting a local screen print to tell you that the printer is turned off.

LU1 Protocol Enveloping

The LU1 Protocol Enveloping feature allows LINCS to exchange data between a 3270 host and an ASCII device configured as a printer.

LU1 Outbound 3270 host data: The outbound LU1 data stream from a 3270 host is translated from EBCDIC to ASCII and sent to the ASCII printer. When the session is in protocol enveloping

mode, very little processing is done, depending on the additional configuration options. Two options are available to modify the rate data is sent to the printer:

- **Enveloping Delay after Carriage Return** option defines the number of DEL characters, X'7F', to be sent after carriage return(CR) or horizontal tab (HT), to allow the print head to be repositioned before sending more data.

- **Enveloping Delay after Form Feed** option defines the number of DEL characters, X'7F', to be sent when the host data contains form feed(FF) or vertical tab (VT).

LU1 Inbound ASCII Printer data: The inbound data from the ASCII printer (Keyboard printer) is translated from ASCII to EBCDIC and sent to the 3270 host while the session is in send state. All the inbound data is ignored while the session is not in the send state. As printer data is processed from the receive queue one character at time, it is stored into the printer device buffer(SIB). The printer data is sent to the host when either the device buffer is full or the line turnaround character carriage return (CR) is received. For LU1 Protocol enveloping inbound data translation, the NRC/MCS ASCII display tables will be used depending on the printer configuration.

CUT Device Features

LINCS provides these additional functions to CUT mode type devices:

- ASCII Definition Utility (ADU)
- Dual Language Selection
- Calculator
- Time of Day
- Entry Assist
- Host Addressable Print
- File Transfer
- Typeahead
- Host Identifier
- Keyboard Definition Utility (KDU)
- Local Print
- Windowing
- Null-Space Conversion
- Record/Playback of keystroke sequences

Calculator

LINCS provides a four-function nonscientific calculator to any directly attached CUT mode display station. The calculator performs quick and accurate calculations without affecting your host session. The calculator performs operations in decimal, hexadecimal or octal mode. The calculator requires Feature Memory to be allocated, which is calculated while determining the Presentation Space Storage.

To enter Calculator mode, press the Extended Select (Ex Sel) key, then the alphabetic character C key (122-key keyboard). On 88/102-key keyboards, simultaneously press the Alt and Erase

EOF keys, then the alphabetic character C key. When you activate the calculator, LINCS allocates memory for your display station. This means that you own the calculator session until you either perform a Quit and Clear exit, or you power off your terminal.

A sample Calculator panel is shown below. When the panel is displayed, the cursor keys move the calculator window. The calculator window position is maintained by LINCS. If the calculator window placement is beyond the border of the lowest model size recognized by LINCS configuration, the window is relocated to a default position on the display. This keeps the calculator window within the screen boundaries of the lowest screen size model used.

```
┌─ Calc ─────────────┐
│                    │
│ PF1   Auto         │
│ PF2   2            │
│ PF3   10           │
│ PF4   Exit         │
│                    │
│    Memory          │
│         0.00       │
│                    │
│                    │
│    Input           │
│         0.00  0.00 │
│                    │
│ Press PF8 to Exit CALCULATOR │
│                    │
└────────────────────┘
```

Calculator Options and Functions

The PF function keys (PF1 through PF8) either select calculator options or perform the special calculator functions described below. In this document , references to decimal point apply to the period character or to the comma character, depending on the Numeric Delimiter option you selected during configuration.

Selecting a Decimal Mode

The calculator provides an Auto or Fixed mode for decimal point placement. The PF1 key toggles between the two modes. In Auto mode, decimal point placement is automatically set for a predefined format that contains from 0 to 7 decimal places. Pressing the decimal key has no effect. In Fixed mode, you use the decimal point key to enter a decimal point for each number.

Selecting Decimal Places

The PF2 key cycles through the available decimal point placement formats. This function operates only if the Auto Decimal mode operation is selected with the PF1 key. With Fixed mode selected, the decimal place function is ignored.

Decimal places from 0 to 7 can be selected by pressing the PF3 key. The decimal places' field selection cycles from 0 through 7 digits, incrementing each time the PF3 key is pressed. All data fields assume the decimal place format is selected, with all values truncated when cycling from 7 to 0. The default is 2 decimal places.

Changing Base Modes

Press the PF3 key to select 10 (decimal), 16 (hexadecimal), or 8 (octal). When the operating base mode is changed, the Input, Result, and Memory fields are converted to the new base. When converting from decimal (base 10), only the integer part (digits to the left of the decimal point) is converted to the new base. All fractional values are lost. The decimal point operates only in Decimal mode. In Hexadecimal mode (base 16), alphabetic keys A through F are valid characters.

Pasting the Result

Press the PF5 key to paste the Result field into the foreground-most edit buffer at the session's cursor position. To paste successfully, there must be a minimum of 13 character positions available to receive the Result field, and the cursor must be positioned at least 13 characters before the end of the line. The paste operation does not move the session's cursor position.

Storing the Result

Press the PF6 key to store the current Result field into the calculator Memory field. As long as the memory is not cleared with a Quit and Clear or power-off, the data in the Memory field is retained.

Recalling the Result

Press the PF7 key to recall the data in the Memory field, and to place it into the Input field. Calculations resume as normal.

Selecting Exit Modes

Press the PF4 key to select an exit mode for the calculator. Three options are available: Exit, Exit with Paste, and Quit/Clear.

- **Exit mode** erases the calculator window, and returns you to your active session. All data is retained in the calculator fields.

- **Exit with Paste mode** automatically pastes the Result field into the session's current cursor position before exiting. All data is retained in the calculator fields.

- **Quit and Clear mode** erases the calculator window, and clears all calculator data areas (deallocates memory) so other devices can then use the calculator session.

- All exit modes restore your device to its state before calculator was invoked.

Exiting Calculator

Press the PF8 key to exit the calculator function. If the calculator is exited without clearing memory (Quit/Clear), the window position and values in the data fields are retained by LINCS and owned (memory allocated) by the terminal user. Other users cannot access the particular calculator session.

Calculator Operation

You can add, subtract, multiply, and divide with the calculator. First, enter the value, then select the function to be performed. Use either the numeric keypad or the normal keypad to make entries or select functions.

The following keys select the mathematical functions:

Math Function	Key
Addition	+ or Enter
Subtraction	-
Multiplication	* or Tab
Division	/ or Space Bar

The following table describes the keys used for field entry:

Key	Description
Del	Deletes last character entered
0 - 9	Decimal Characters
A - F	Hexadecimal characters or , Numeric Delimiter or decimal point depending upon configuration
PA1 or Clear	Clear input and result fields
PA 2 or Erase Input	Clears Input Field

Dual Language

The Dual Language feature allows two languages (Primary and Secondary) to be accessible without reconfiguring LINCS. Use of a Primary language is mandatory, but the Secondary language is optional. The default Primary language is (01) US English. If the default Secondary language is Disabled. The Primary and Secondary languages can be configured to be the same language, enabling you to define twice the number of keys on the Keyboard Definition Utility (KDU) or ASCII Definition Utility (ADU) layouts. Both primary and secondary languages fully support all language functions, such as the Keyboard Definition Utility (KDU), and Dual Mode keyboards, such as APL.

Supported Languages

The following languages can be either the primary language or the secondary language. The default primary language is US English. The default secondary language is Disabled.

Languages followed by an asterisk (*) are supported by both 3270 hosts and ASCII hosts. Languages that are not followed by an asterisk are supported only by 3270 hosts.

US English*	US English (ASCII)	Austrian/German*
Belgian*	Brazilian	French Canadian*
Danish*	Finnish*	International
Italian*	Japanese English	Spanish*
Spanish speaking*	UK English*	Norwegian*
Swedish*	EBCDIC WT	Portuguese
Canadian Bilingual	French AZERTY*	US ASCII/International

US ASCII-8	Cyrillic	Greek
Icelandic	ROECE Latin	Turkish
Yugoslav	New Swiss French*	New Swiss German*
New Belgian	Thai	Netherlands*
Latin/Cyrillic	Latin/Greek	Latin/Thai
Belgian French*		

Software Requirements

The following languages have their own character generators. To correctly display all the characters in a particular language, that language's character generator must be installed in the display station.

Languages followed by an asterisk (*) are supported by both 3270 hosts and ASCII hosts. Languages that are not followed by an asterisk are supported only by 3270 hosts.

Cyrillic	Greek
Icelandic	ROECE Latin
Spanish*	Thai
Turkish	Yugoslav

All other languages use the Base character generator.

If two languages are configured that have different character generators, one of the languages may not display characters correctly. For example, if German and Icelandic are configured and the terminal has only a Base character generator, the Icelandic characters that differ from the characters on the Base character generator will not display correctly.

Using the Dual Language Feature

Before you can use the Dual Language feature, you must configure a primary and a secondary language. See the *LINCS Configuration and Central Control* document for instructions on how to configure the Dual Language feature.

The status line displays PR for primary language or SE for secondary language at location 36. If the Dual Language feature has not been configured, PR or SE is not displayed.

Host Default Language

During configuration, you can select either of the two configured languages, the primary language or the secondary language, to be the default language for a host. The code page for the host default language is used at all times for that host. When the device is powered on, each session's keyboard language is set to the default language for the corresponding host.

Greek, Cyrillic, and Thai

If you select Greek, Cyrillic, or Thai as either language during configuration, no language toggling is possible unless the Keyboard Definition Utility (KDU) is used during configuration to add a language toggle key.

If you select Greek as the primary language, you can select Latin/Greek as the secondary language. If you select Cyrillic as the primary language, you can select Latin/Cyrillic as the secondary language. If you select Thai as the primary language, you can select Latin/Thai as the secondary language. Each of these secondary languages, Latin/Greek, Latin/Cyrillic, and Latin/Thai, is a special version of Latin that is specific to the primary language, Greek, Cyrillic, and Thai.

You do not have to select Latin as the secondary language for Greek, Cyrillic, or Thai. You can select any of the supported languages as a secondary language, or you can select no secondary language.

Note: You can select Latin/Greek, Latin/Cyrillic, or Latin/Thai as the secondary language and, if you want to, Greek, Cyrillic, or Thai as the primary language.

Switching Sessions and the Dual Language Feature

To switch from one configured language keyboard to the other, either press the Language Toggle key, or press the Primary key (to switch from the secondary language to the primary language) or the Secondary key (to switch from the primary language to the secondary language). If you press the Primary key from the primary language or the Secondary key from the secondary language, nothing happens. Each time you change languages, the keyboard layout switches from one configured language to the other. When the keyboard layout switches, the up, down, and alt shift states remain the same.

- **Toggle Key** - For 3270 or ASCII displays, use ExSel then L. For ASCII displays only, you can also use Esc, then Control + F.

- **Primary Key** - For ASCII keyboards, use the Escape, then Control + D key sequence for the Primary key. For coax keyboards, use the Keyboard Definition Utility (KDU) during configuration.

- **Secondary Key** - For ASCII keyboards, use the Escape, then Control + E key sequence for the Secondary key. For coax keyboards, use the Keyboard Definition Utility (KDU) during configuration.

Examples of Switching Sessions

When you switch sessions, the keyboard layout switches to the layout for the language of the new session. The code page used for the new session always corresponds to the default language for the host. The following two examples illustrate what happens when you switch sessions.

- **Switching Sessions, Keyboard Layouts, and Code Pages**

  1. Session 1 is active, and its host is configured for German as the default language. German is the current keyboard layout.

  2. You switch to Session 2. The host for Session 2 has Spanish as the default language.

  3. The new code page and keyboard layout are Spanish.

- **Switching Sessions and Code Pages, but not Keyboard Layouts**

  1. Session 1 is active, and its host is configured for German as the default language. Spanish is the current keyboard layout.

  2. You switch to Session 2. The host for Session 2 has Spanish as the default language.

  3. The new code page is Spanish and the keyboard layout remains Spanish.

KDU and the Dual Language Feature

You can use the Keyboard Definition Utility (KDU) to modify both primary and secondary language keyboards.

The appropriate configured language is displayed on the keyboard's layouts to be modified. The following mnemonics are used for the Dual Language keys:

Mnemonics	Key
PRI	Primary Key
SEC	Secondary key
LTK	Language Toggle Key

Modifications for each code page must be made from that particular language's code page. For example, German modifications can't be taken from the Spanish code page.

Printing

There are two types of prints: LU1 (SCS) and LU3. When an LU3 print is sent to a printer, the printer uses the code page corresponding to the default language for the host associated with the current printer session. An LU1 (SCS) print is not affected by the Dual Language feature, because the printer performs the translation for SCS prints. Local prints from a DFT are LU1 prints.

The following languages have their own character generators. To correctly print all the characters in a language, you must install that language's character generator. Languages followed by an asterisk (*) are supported by both 3270 and ASCII hosts. Languages that are not followed by an asterisk are supported by only 3270 hosts.

Cyrillic	Greek
Icelandic	ROECE Latin
Spanish *	Thai
Turkish	Yugoslav

All other languages use the Base character generator.

Connecting to a Dynamic LU

When a session connects to a dynamic LU, the keyboard language is set to the default language that has been configured for that host.

Entry Assist

LINCS' Entry Assist feature makes it easier to enter, format, and edit data on attached display terminals. When you activate Entry Assist on your display station, formatting, editing, and data entry functions remain active while the display station is in Document mode, but they cannot be used out of Document mode. Data formatted during Document mode remains

formatted when the display station is switched out of Document mode. You can transmit the data to the host CPU with the format intact. The following functions are available in document mode:

- Screen margins
- Tabbing
- Audible alarm indicating the approach of the end of the line
- Cursor position display
- Word wrap (automatically moving an unfinished word to the next line when the word would extend beyond the right margin)
- Autorepeat word-forward and word-reverse cursor movement
- Autorepeat character deletion
- Autorepeat character-deleting backspace in Insert mode
- Word deletion

Entry Assist Requirements

Entry Assist can be used on any ASCII display or Control Unit Terminal (CUT) display supported by LINCS, if the active terminal session occupies 80 columns or less.

LINCS disables Entry Assist if:

- A Create Partition, which changes the display to more than 80 columns, is received.
- The display terminal is capable of Mod 5 operation, and the session is set to its Mod 5 screen size.

Entry Assist is designed for use with several IBM full-screen editing programs. These programs are used to handle text for correspondence, publications, programs, job control language (JCL), and other material. Entry Assist enhances the ability of the editing programs to format text for these types of material.

Entering Document Mode

Document mode is the mode in which Entry Assist functions are enabled. The display station is not placed in Document mode when it is first powered on. To put most display stations in Document mode, press the Doc Mode key. Press the Doc Mode key again to take the display station out of Document mode. When in Document mode, the display station displays DOC on the operator status row until the display station is taken out of Document mode.

Cursor Movement and Editing Functions

Cursor movement and editing functions are active whenever the display station is in Document mode. These functions are subject to the limitations imposed by the format parameters currently set on the format scale. The following cursor movement and editing functions are available in Document mode:

- Word wrap
- Autorepeat cursor movement to next word
- Autorepeat cursor movement to previous word
- Delete word to the right
- Autorepeat deletion of character to the right

- Tab function
- Backtab function
- Backspacing with deletion
- New line function observing left margin
- Cursor position indicator

File Transfer

The File Transfer feature allows LINCS to successfully support file transfer programs such as IND$FILE and FFTERM. As long as file transfer is enabled, LINCS will retrieve screen data from the terminal when host attention keys are pressed. This allows the file transfer programs to format the screen as desired prior to generating a host attention key.

A device may enter or exit file transfer using the Alt-X key combination. If a device is configured for the Windowing feature, the device must be using Windowing Profile 0 in order to enter file transfer mode.

When File Transfer is enabled, FX will appear at column 66 on the status line. Note that if the "Time of Day" feature is enabled, the time will not be displayed on devices which have file transfer enabled since some file transfer programs are sensitive to the data which appears on the status line.

Configuration and Management

Configuration - File Transfer may be enabled in a displays Device Profile by setting the "PC File transfer" field to Enable. This field governs the status of File Transfer upon IML of the LINCS node.

Devices which are not using special file transfer programs should not enable the PC File Transfer option. Unnecessary use of this feature may reduce performance.

Management - This feature is controlled by display operators by using the file transfer key combination. If users are unnecessarily entering file transfer mode, you may disable or redefine the file transfer key using the KDU or ADU utility.

Host Addressable Print

The Host Addressable Print feature allows host access to printers which are locally attached to CUT displays which supports the HAP feature. To the host, the printer appears as any other printer which is directly attached to the LINCS node. In addition to the host access, displays may also access the HAP printers when using the Local Print feature.

3472-type coax displays support the attachment of a host addressable printer. Refer to the appropriate 3472 documentation for information on how to enable the HAP support on the display. Refer to the table in the section "ASCII Printers" to see which ASCII displays support attachment of a host addressable printer.

Configuration and Management

Configuration - HAP is enabled by defining a HAP Profile in a displays Device Profile. The HAP profile defines the printer characteristics to be used by the displays printer session. Note

that the Host assignments in the HAP profile are ignored by displays supporting the HAP feature. The Host Assignment for your HAP session should be defined in the displays device profile.

The "HAP Session" and "HAP Status at IML" fields are also available in the displays device profile to further define your HAP parameters.

Management - The "Display/Update HAP Session Status" utility is available on the Device Menu in Central Control Mode. This utility allows you to change the status of your HAP Session between a display and a printer.

Host ID

The Host Identifier is displayed on the status line of sessions connected to a host. The host identifier is displayed as follows.

- **3270 Host** - If a session is connected to a 3270 Host, then the Host Identifier will be displayed, along the LU number. Whether the LU number is displayed in hex or decimal is set in the General Options panel.

- **ASCII Host** - If a session is connected to an ASCII Host Class, then the Class Name is the Host Identifier. If the session is connected to a specific ASCII Port (A0-D7), then the Host Identifier is Host_XX where XX represents the ASCII host which the session is connected to (A0-D7).

- **IP Host** - If a session is connected to an IP Host Class, then the Class Name is the Host Identifier. Otherwise, the data entered at the "Connect To" prompt on the TCP/IP Connection panel will be displayed as the Host Identifier. For example, if a DNS name was entered at the "Connect To" prompt to connect to a TCP/IP host, then the DNS name (truncated to 16 characters) will be displayed as the Host Identifier.

- **LAT Host** - The Host Identifier is the LAT Class to which the session is connected.

Configuration and Management

Configuration - Display Host ID must be enabled on the Device Profile for Displays panel for the host identifier to be displayed.

Local Printing

The Local Print feature allows you to print a screen image from any authorized CUT device to any network, Direct, or HAP printer which is defined as a Local or Shared Printer. The local print can be initiated by an operator or by the host as described below.

- **Operator Initiated Local Print** - This type of print is initiated by pressing the Print key on a display attached to the LINCS node.

- **Host Initiated Local Print** - For SNA host circuits, a local print is initiated through a write type command to a display with the WCC print bit set to 1. For BSC host circuits, the BSC copy command can be used to transfer data from a display to a printer.

- For ASCII hosts, the ASCII Concurrent Print feature can be used to send data simultaneously to a CUT display and a printer.

For either type of local print, the print will be directed to the printer currently assigned to the display (displayed in column 62 on the status line). If the print cannot start immediately, one of the following will be displayed in the Input Inhibit field on the status line.

Symbol	Meaning
X ☐—☐ ⟨⟩	Printer Busy
X ☐—☐ ⟨⟩⟨⟩	Printer Very Busy
X ☐—◁	Printer Not Working
X ⚥ X	Operator Unauthorized

If the print can start immediately, the status line's Printer Status field will display the "Printer Printing" symbol and will show the full 8 digits port ID of the printer port which is executing the print. The following describes other symbols which may be displayed in the Printer Status field.

Symbol	Name	Meaning
☐—☐ **nn**	Printer Authorized	The indicated printer (or printer class) is currently assigned to your display, but no print request is in progress.
☐—■ **nn**	Print in Progress	A print request from your display is currently being printed on the indicated printer port ID.
☐—◢ **nn**	Printer Failure	The indicated printer port has failed. If the failure is corrected, any prints queued to the printer will continue to print.

Configuration and Management

Configuration -

- Defining Local Printers - The Local Print feature is enabled by setting the "Printer Mode" in one or more Printer Device Profiles to "Local" or "Shared". Devices are defined as local printers by assigning the printer Device Profiles to the desired printers on the Device Profile Assignments panels. Note that if a printer will be used as a "local only" printer (ie, no host access is required), then you can should set the printers "Host Assignment at Power On" to "Connect Menu". This will allow a session on the printer to be available for local prints without tying up any Host Resources.

- Defining Printer Classes - The printer Device Profiles allow for the definition of printer classes. A given device profile may specify membership in one or more printer classes. Any printer assigned to the device profile may then be a member of the printer class(es). Local Printer classes can be useful if one or more printer devices share similar characteristics. You may want to print to one of a group of printers, but you don't necessarily care which printer is used. You may group printers according to their print quality, location, color capabilities, or any other characteristic that would be useful in your particular situation. If printer classes are defined, displays may be given the authority to print to these classes via the Resource Authorization Matrix in the displays Device Profile. Thus, it would be useful to define printer classes if you wish to limit access to a particular printer, or group of printers.

- Assigning Printers to Displays - If any local printer devices are defined, the Printer Assignments panel is available to assign default printers, or printer classes, to display devices. These printer assignments can be modified while online in one of 2 ways.

- The configured printer assignments may be changed, saved to disk, and then applied immediately by specifying "Immediate" for the Printer Assignment field on the "Apply Configuration Changes panel. If this option is chosen, the operation will appear as if all devices entered Printer Ident Mode and changed their assigned printer.

- The configured printer assignments may be overridden by individual operators by entering Printer Identification mode and specifying the desired printer. This operation is described in a later section.

Management - Local Printing is managed internally within LINCS by keeping track of the printer states and assuring that local prints do not become intermixed with host prints. If local prints are attempted while the assigned printer is busy with a host print, a "Printer Very Busy" inhibit will be reported on the status line and the print will resume once the host has released the printer. If host prints are attempted to a printer while it is busy performing local prints, the host print will be rejected. The host will be notified when the local print operation is complete so that the host may re-attempt the host print.

Printer Identification (PID)

The PID function is available for users who need to override their configured printer assignment. A displays configured printer assignment is displayed in column 62 on the status line. If future prints should be directed to a different printer, the PID function allows one to specify any authorized printer class or a specific printer.

PID mode is entered by pressing the "Ident" key (the alt of the print key on most 3270 keyboards). While in PID mode, the PID field will occupy columns 59-69 on the status line to allow for the entry of an 8 digit port ID. The currently assigned PID will be displayed when you initially enter PID mode, but will disappear when you begin entering the new PID. Following is an example of the status line indicators in PID mode. Note that the ">>>" indicator precedes the PID field to let the user know that the session is in PID mode.

When initially entering PID mode: >>>C01_____

When you start entering a new PID: >>>C_____

The acceptable formats for entering a new Printer Identification are the same as for the Printer field on the Printer Assignment panel in configuration. The acceptable formats for the PID field are described below.

- Class numbers may be specified by entering C_#_# or Class _#_# referring to the printer classes assigned in the Printer Device Profiles. Valid class numbers are C01 to C16. A display must be authorized to access the desired printer class in the Resource Authorization Matrix in the Display's Device Profile.

- Port IDs may be specified by entering the full 8 character port-ID of the desired printers (ex, TRC1.002, MCC1.016, ADAB.007..). In order to access a specific printer port, the display must have Dynamic Access to printers, or the printer must be a member of a printer class that the display is authorized to connect to.

- ASYNC printer port-IDs may be entered in a shorthand form by entering a "0" prior to the identifier (ex, 0A7 may be entered instead of ADAA.007).

- The assignment which is configured on the Printer Assignment panel may be reestablished by pressing the <RESET> or <CLEAR> key while in Printer Ident mode.

The PID being entered will be checked after 3 digits are entered to determine if a valid 3 digit PID has been entered. If so, PID mode will be exited at that point. Otherwise, PID mode will remain active until the user has entered all available 8 characters, or has pressed the ENTER key.

The following keys perform special functions during PID mode.

- ENTER is used to indicate that the operator has finished entering his PID data. This is useful when the number of PID characters to be entered is less than the full PID field. ENTER triggers LINCS to go ahead and set the newly entered PID.

- CLEAR and RESET will reestablish the printer ident to the printer that is assigned on the Printer Assignment panel in configuration, and exit printer ident mode.

- The Ident key can be used to gracefully exit PID mode and ignore any data which had been entered, thus setting the PID back to what it was prior to entering PID mode.

- The Cursor Left and Backspace keys can be used to erase the previously entered PID character.

- The Er Inp, Erase EOF, New Line, Back Tab, and Cursor Home keys can be used to "start over" with the PID entry.

Upon exiting PID mode, 8 character port-IDs will be truncated to the 3 digits following the "." in the port-ID. This is necessary so that the status line symbols normally occupying columns 66-69 on the status line may be displayed. During "printer printing" and "printer broke" conditions, the PID field will return to the 8 column format so that the user will know the specific printer which is being used. Also, remember that a user may see the full 8 character PID by entering PID mode.

Print Buffering

The Print Buffering feature allows local print requests to be buffered in LINCS feature memory while a printer is busy with other local print requests. Without print buffering, your display station will be in an input inhibit condition (Printer Busy symbol) if a local print is attempted while your assigned printer is busy with some other local print request.

If the Print Buffering feature is enabled when you attempt a local print to a busy printer, your displays screen image will be saved in LINCS feature memory and will be printed when the printer becomes available. This feature allows you to continue data entry while your preserved screen image is waiting to be printed.

If your display has prints queued, the status line will indicate how many screens are currently queued to be printed. Locations 53 to 57 of the status line are used as the "Queued Prints" status area. This area will display "Q nnn" where nnn = number prints queued from your display.

Configuration and Management
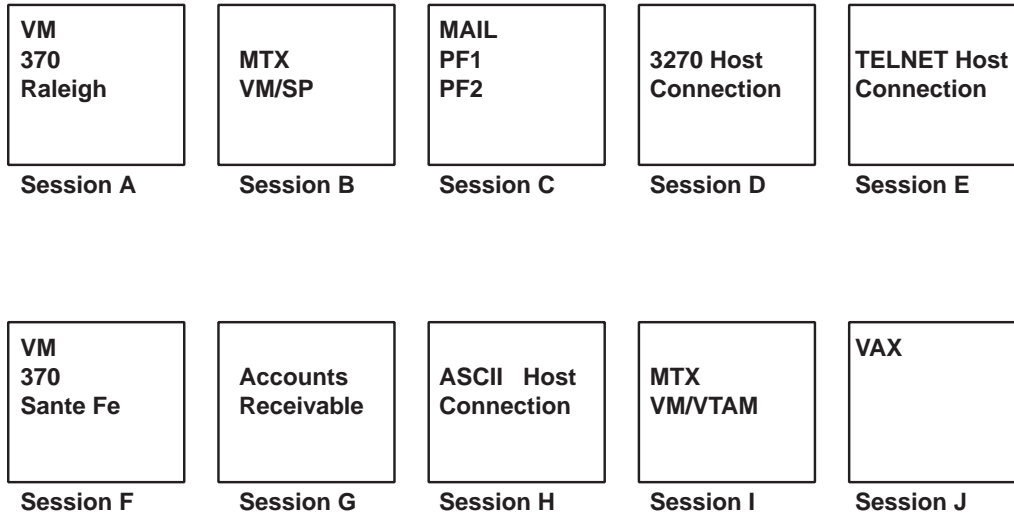
Configuration - Print Buffering is enabled in a printer device profile by setting the "Print Buffering" field to Enable. If print buffering is enabled, the feature memory used to buffer prints will be taken from the "Presentation Space Storage" memory. Refer to the Presentation Space Storage feature memory description in Configuration for more details on the amount of memory required.

Management - The "Display/Update Buffered Prints" utility on the Device Menu in Central Control mode can be used to display all prints which are currently buffered and/or to delete the buffered prints.

Multiple Logical Sessions

The Multiple Logical Sessions (MLS) features allows CUT devices to access up to 10 sessions on a single device. Each session may be connected to the same host, or all sessions may be connected to different hosts. All sessions are active at the same time from the perspective of the host.

VM 370 Raleigh	MTX VM/SP	MAIL PF1 PF2	3270 Host Connection	TELNET Host Connection
Session A	**Session B**	**Session C**	**Session D**	**Session E**

VM 370 Sante Fe	Accounts Receivable	ASCII Host Connection	MTX VM/VTAM	VAX
Session F	**Session G**	**Session H**	**Session I**	**Session J**

Configuration and Management

Configuration - MLS is configured by assigning more than one session to a device in the Device Profile or the Device Profile Assignments panels. Feature memory is required in order to successfully use the MLS feature. Refer to the Presentation Space Storage feature memory description in the Configuration document for details about the memory requirements.

Management - The following utilities are available on the Device Menu in Central Control Mode.

- The "Display/Update Host Connections" utility can be used to view the current Host Connections for all sessions on all devices.
- The "Display Device Status" utility can be used to get a little more detail about the status of the sessions, such as if the session is currently selected or in bracket.

MLS on Displays

The session which you see on your display screen at any given time is referred to as the foreground session. The sessions which are not visible are referred to as the background sessions. Note that when the Windowing feature is enabled, portions of the background sessions may be visible. Refer to the Windowing feature for more details.

You may jump from your foreground session to the next logical session by pressing the <Alt-Insert> key combination, or you may go directly to the desired session by pressing <Alt-session> where session is the desired session letter a - j. For example, you can press

Alt-b to jump to session b. When you change sessions, your old foreground session will remain intact and still be active from the perspective of the host.

This is very useful when you have started a host transaction and are waiting for a response. You can jump to another session and start some other transaction while you are waiting for your response.

Session identifiers are displayed at column 5 on the status line to help you keep track of which session is in the foreground at a given point in time. The session identifier is the session letter, a through j.
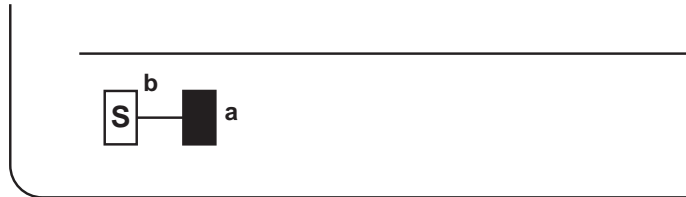
The Status line is also used to alert you when a background session has been updated. When this occurs, an arrow followed by the background session identifier will be displayed at columns 6 and 7 on the status line. If multiple background sessions are updated, the session which is closest to your foreground session will be displayed. For example, if session a were the foreground session, and sessions b and d were updated, the status line would display >b.

MLS on Printers

Printers can be assigned up to ten sessions, but unlike displays, only one of the sessions can be "busy for host" at a given point in time. The session that is currently "busy for host" will be referred to as the foreground session. A printer session is automatically changed to the foreground session when it becomes "busy for host".

The term "busy for host" is slightly different for the various host types as described below.

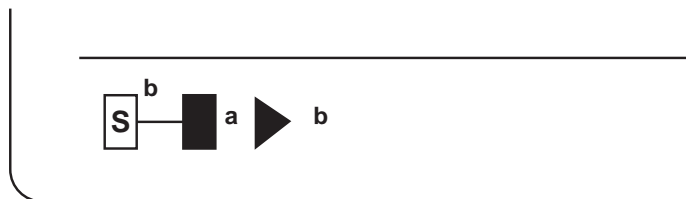- SNA Host Circuit - If configured for between bracket printer sharing, a printer is "busy for host" when one of its sessions is in bracket. If no between bracket sharing is allowed, the printer is "busy for host" when one of its sessions is bound (that is, in an LU-LU session).

- BSC Host Circuit - When using the BSC protocol, the printer is "busy for host" when one of its sessions is selected or when data has been written to the printer but has not yet been printed. If the BSC host selects and writes to the printer without printing the data, the printer will remain busy for host" until the BSC host selects the printer and prints the data.

- ASCII Host - Once an ASCII host has written data to a printer, the printer remains "busy for host" until the inactivity timeout timer that is configured for the ASCII host port expires.

If a host tries to access a printer session while another session on the printer if "busy for host", LINCS responds in the same manner as if the printer were busy doing a local print (no sense

codes are defined to indicate that another printer session is busy for host). This situation is handled for the various host protocols as follows:

- SNA - SNA behaves differently depending on whether or not the printer is configured for between bracket printer sharing.

    - **Between bracket sharing allowed** - If a printer session is busy for host when an SNA host tries to begin a bracket with the printer, LINCS returns a sense code "0814" (bracket bid reject - RTR to follow). When the printer becomes available, SNA sends RTR (ready to receive) inbound to the PLU (primary logical unit) indicating that the host can now begin a bracket with this printer session.

    - **No between bracket sharing allowed** - If a printer session is busy for host when an SNA host tries to BIND the printer, the BIND response is withheld by LINCS until the printer becomes available. This could take some time since the host which is accessing the printer may keep the printer busy for an indefinite amount of time. When the printer becomes available, the BIND response will be sent inbound to the SNA host.

- BSC - If a printer is busy for host when a BSC host attempts to select the printer, LINCS rejects the select with an RVI response. LINCS then sets the status and sense conditions for that printer to IR (intervention required). The status and sense conditions are updated to DE (device end) when the printer becomes available.

- ASCII - If an ASCII host writes data to a printer while the printer is already busy for host, the data is held in the receive queue until the printer becomes available. If the receive queue becomes full, the host is XOFFed.

Null-Space Conversion

The Null-Space Conversion feature is available for all 3270 Host Sessions on any CUT device. It is used to convert nulls to spaces on a 3270 screens. The benefit of this feature is that null characters on the screen will be converted to spaces and will be transmitted to the 3270 host, thus maintaining the visible format of the data.

When the Null-Space Conversion feature is not used, null characters on the screen are not transmitted to a 3270 host. Thus, if you enter data and use the cursor move keys (arrows) rather than the space bar to separate your words, the words would become concatenated when sent inbound to the 3270 host.

A name entered as   John Dan Smith

may be sent to the host as   JohnDanSmith

When the Null-Space Conversion feature is enabled, the leading and embedded nulls in a field will be converted to spaces and will be sent inbound to the 3270 host in the proper format.

The initial status of the Null-Space Conversion feature is determined by Configuration. Once the LINCS node is IMLed, any operator may enable or disable the Null-Space Conversion feature by pressing the <Ex-Sel N> key combination. When the feature is enabled, an indicator (N->) is displayed at column 66 on the status line. This status line location is shared with the Entry Assist feature as described in the following table.

Symbol	Description
DOC	Entry Assist is on
N->	Null/Space Conversion is on
D->	Both are on

When the Null-Space Conversion feature is enabled, any nulls in the current field on the screen (ie, the field that the cursor is in) are converted to spaces. While the feature is on, null characters in any field which gets updated are converted to spaces. Nulls in fields that are not updated while the feature is enabled are not converted.

Configuration and Management

Configuration - The Null-Space Conversion feature is enabled on the Device Options/General panel in configuration. If enabled, all devices will initially be in Null-Space Conversion mode. Keep in mind that any operator may enabled this feature in a 3270 session by pressing the <Ex-Sel N> key combination.

Management - If users are unnecessarily or mistakenly entering Null-Space conversion mode by pressing the <Ex-Sel N> key combination, you may disable or redefine the Null-Space conversion key using the KDU or ADU utility.

Record Playback

With the Record/Playback feature, you can store a series of typed keystrokes and assign them to a function key. When a display is in Playback mode, the keystrokes will be executed when you press that function key. The Record/Playback feature reduces typing errors and saves time.

LINCS provides keystroke record/playback functionality for any CUT device. Up to 24 local sequences may be recorded and saved by any authorized user. Up to 24 globally available sequences can also be defined using supervisor password. Only your display station has access your local playback sequences. If you record a local playback sequence on a key that already has a global sequence assigned on it, the local sequence takes precedence over the global sequence. The assignment of sequences to global keys is controlled by use of a password and selectively authorizing users to access the keys.

To record key sequences, select the Playback Sequence item on the Customization Data menu. A port number can be specified as an input parameter. If none is specified, the utility defaults to the current port's Playback Sequence panel. To modify Global sequences or the Record Playback (RPB) Sequence ID, the update parameter must be entered. User-defined sequences and global sequences are saved on an RPB subdirectory on the hard drive. Sequences are loaded into memory at IML.

Recorded sequences are lost when the display station disconnects from the port unless they are saved to disk. Saved sequences, both local and global, can be shared by sharing the disks on which they are stored, and the disk data is microcode upgradable.

Record/Playback Keys

The Record/Playback keys are device-dependent and may be different on your keyboard. You can change the keys that support the Record/Playback functions with the Keyboard Definition

Utility (KDU). Refer to the LINCS Central Control and Configuration document for instructions on using the KDU.

Function	Key Sequence	KDU Symbol Equivalent
Record	Exsel + E	REC
Playback	Exsel + P	PLA
Pause	Alt + Space	PAU

Recording Key Functions

To record a key sequence, follow these steps:

1. Press the Record key. The R? symbol is displayed on the status row.

2. Press the PF key to which you want to assign the key sequence. If no playback sequence is already stored on this PF key, R is displayed on the operator status row. If a playback sequence is already stored on this PF key, R?+ is displayed and an alarm sounds.

3. If the PF key already has a key sequence stored on it, press the Record key to terminate the record operation without changing the sequence already recorded on this PF key or press the new key sequence to overwrite the old sequence with the new sequence.

4. If the PF key does not have a key sequence stored on it, enter the key sequence to be stored.

5. Press the Record key to end the record session. The **R** is no longer displayed on the status row.

Note: The Extended Select key cannot be recorded as the last function in a recorded sequence. This prevents you from recording sequences that terminate the record operation and leave the display station in Extended Select mode.

Timing Considerations

Recording sequences that contain AID keys, such as the Enter key or a PF key, may cause timing problems between the host and the LINCS node. The Record/Playback feature attempts to compensate for these problems by watching for an indication of when the host is ready to receive data. The host displays a clock symbol on the status row to warn you that you must wait before recording additional keystrokes. When the clock or clocks are removed, you can resume recording keystrokes.

Because systems vary, the clock symbol may be posted and removed a number of times during a transaction. The Record/Playback feature works effectively in environments where the host updates occur a fixed number of times. When the clock is displayed at random or variable intervals, or when the host accepts keys between clocks, the played back sequences that contain AID keys may not perform as expected. This usually happens because the host updates are not consistent with the number of clock events that occur. When this happens, press the Pause key during record to suspend playback and give the host time to process the AID key function.

Pausing During Record Operation

You can press the Pause key to temporarily stop the record operation. The pause symbol is displayed. The playback operation will pause when the Pause key is played back. During the pause, you can enter keys from the keyboard that are not included in the record operation. To return to the record operation, press the Pause key again.

Record Error Conditions

The following error conditions abnormally terminate the record operation:

- The device is powered off and on (POR) during a record operation - All keystroke sequences entered during the record operation are lost and the PF key is unassigned. If keystrokes were previously assigned to this key, they are unassigned to the key.

- The record operation exhausts the allocated feature memory - The keystroke sequences recorded up to the point of failure are saved and assigned to the PF key.

- The user enters an illegal record sequence - The keystroke sequences recorded up to the point of failure are saved and assigned to the PF key.

When a Record/Playback error condition occurs, X-? and one of the following error messages are displayed on the operator status row:

Error Condition	Error Message
POR	*none*
Feature memory exhausted	ERP1
Playback attempted during record operation	

Record Status Line Symbols

The following symbols are displayed on the operator status row during the record operation:

Status Line Symbol	Meaning
R?	Record key pressed. User must press PF key.
R?+	PF key pressed already has a playback sequence.
R	Record operation in progress.
R[Block]	Record operation is paused.
X-?	Error condition occurred.

Playing Back Key Functions

Key functions processed during playback are subject to the same requirements as keys input from the keyboard. For example, data keys entered in protected fields or on attributes, whether entered directly or through a playback operation, cause an inhibit condition.

The Caps Lock state during playback must be the same as the Caps Lock state during record.

Note: Caps Lock keys within the recorded string may cause the display station to inherit a different Caps Lock state after Playback is completed.

A playback sequence can be a local playback sequence or a global sequence. A local playback sequence is a recorded sequence that your define for your own use. A global playback sequence is a recorded sequence that the system manager defines for all users. A local sequence has precedence over a global sequence assigned to the same PF key.

To playback a key sequence, follow these steps:

1. Press the Playback key. **P?** is displayed on the operator status row.

2. Press the PF key to which the key sequence is assigned.

3. If the PF key does not have a key sequence assigned to it, **X-F** is displayed on the operator status row.

4. If the PF key has a key sequence assigned to it, the sequence plays back and P is displayed in the operator status row. Which keys or key combinations play back depends on the keyboard type. Some keyboard types require a series of keystrokes to perform a particular function. If the keyboard on which the key functions were recorded is a different type from the keyboard on which the keystrokes are playing back, the played back key sequence may differ from the recorded key sequence, but the keystroke functions remain the same. For example, if you record the PF13 key on a 122-key keyboard and play back the function on a 102-key keyboard, the Shift-PF1 key combination is played back.

5. When the stored key sequence has finished playing back, the **P** is no longer displayed on the status row.

Note: Many of the Extended Select functions can operate in Playback mode only if the playback keyboard device type is the same type as the record keyboard device type because several of the Extended Select functions require different activation sequences on different keyboard types.

Pausing During Playback

If you recorded a pause during the record operation, the playback operation pauses to give the host time to respond to a played back AID key. The pause symbol, P[block] is displayed during the playback pause. You can also use the pause to enter keys from the keyboard that were not included in the record operation. To return to the record operation, press the Pause key.

Playback Error Conditions

The following error conditions abnormally terminate the playback operation:

• The device is powered off (POFF) during playback.

• Device transmission errors occur.

• The user presses the Reset key.

When a playback error condition occurs, **X-?** is displayed on the operator status row.

Error Condition	Error Message
POFF	*none*

Playback Status Line Symbols

The following symbols are displayed on the operator status row during the record operation:

Status Line Symbol	Meaning
P?	Playback key pressed. User must press PF key.
P	Playback operation in progress.
R[block]	Playback operation is paused.
X - F	Playback attempted for key not loaded or defined.
X - ?	Error condition occurred.

Displaying Record/Playback Information

You can display information about the playback operation, such as the PF keys to which key sequences have already been assigned, the playback name of the recorded sequence, and whether the sequence is local or global, by displaying the Display/Update Playback Sequences panel.

Configuration and Management

Configuration - To use the Record/Playback feature, the display station must be configured for Record/Playback.

Time of Day

When the Time of Day feature is enabled, the current time will be displayed at location 53 on the status line. The time is displayed as HH:MM (HH is hours and MM is minutes) and is updated once per minute.

Both a 12 hour and a 24 hour format are allowed. The format is specified in configuration.

Note that if the "File Transfer" feature is enabled on a device, the time will not be displayed since some file transfer programs are sensitive to the data which appears on the status line.

The "Time of Day" field on the status line is shared by the "Buffered Prints" field. While prints are buffered from a device, the Time of Day will not be displayed.

Configuration and Management

Configuration - The Time of Day feature is enabled on the Device Options/General panel in Configuration. If it is enabled, then all CUT devices will display the Time of Day on the status line.

Typeahead

The Typeahead feature allows you to queue keystrokes during certain input inhibit conditions. The keystrokes are subsequently processed when the inhibit condition is cleared. Up to 64 keystrokes may be queued for later processing.

The following lists the inhibit conditions which allow the queuing of keystroke

- X-clock - This symbol appears in 3270 host sessions

- X-system - This symbol appears in 3270 host sessions.

- Printer busy (**X** ▭—▭ ⟳) - This symbol appears if you attempt a local print to a printer that is already busy doing some other local print.

- Printer Very Busy (**X** ▭—▭ ⟳⟳) - This symbol appears if you attempt a local print to a printer that is busy doing a host print.

While one of the indicated symbols is displayed on your status line, your session is in "typeahead mode" and may queue up to 64 keystrokes, including AID keys which may cause the session to become inhibited again. If desired, you may purge the keys which you have queued by pressing the Reset key. When the inhibit condition is cleared, any keystrokes which are queued will be processed.

While you are in typeahead mode, you may jump to another session if you have Multiple Logical Sessions. The jump key will not be queued in the typeahead queue. In your new session, your keys will be processed normally. If your original session is still inhibited when you return back to it, your keystrokes will continue to be queued.

Configuration and Management

The Typeahead feature is enabled in a display's Device Profile. If it is enabled, then all CUT devices assigned to the Device Profile will have access to the feature.

Windowing

The Windowing Feature allows CUT devices to display up to five of their Multiple Logical Sessions simultaneously. This is accomplished by creating windows for the desired sessions. You can size, move, add, delete, and zoom windows, and you can copy data from one window to another.

The following shows how display station may appear when the windowing feature is enabled.
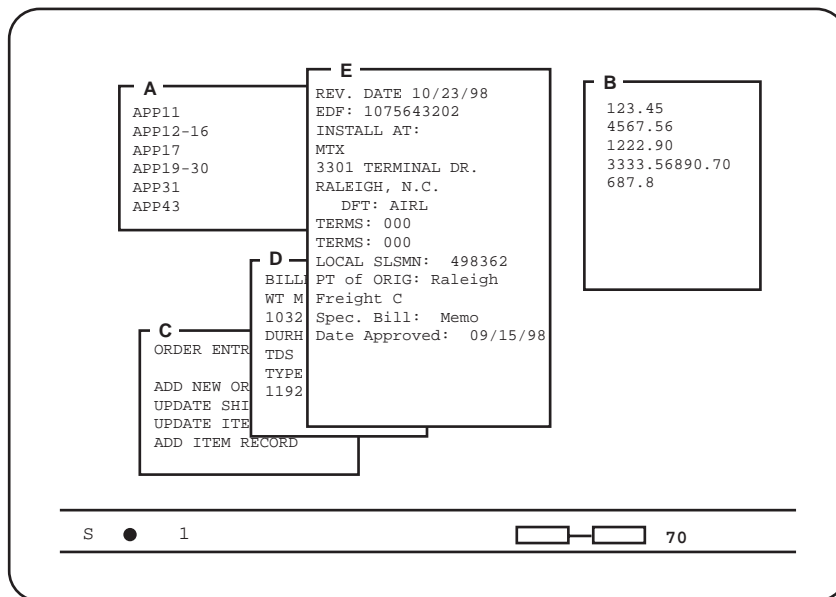
A single arrangement of up to five windows is referred to as a Windowing Profile. Each display operator can use "Work Station Control Mode" to define up to 3 Windowing Profiles, referred to as User Profiles 1, 2 and 3. Also, a global set of Windowing Profiles can be defined and accessed by all devices. This global set of Windowing Profiles is referred to as the System Profiles.

Profile 0 is used to refer to the windowing arrangement when all windows are the full screen size. A "0" will be displayed at column 7 on your status line when you are using this default profile. When in Profile 0, you may use the jump keys to jump to all of your configured sessions as described in the section titled "Multiple Logical Sessions".

Once Windowing Profiles have been defined using "Work Station Control Mode", the following keys can be used. Refer to the section "Windowing Keys" for the location of these keys.

• Change Profile- Pressing the Change Profile key will switch the display to the next defined windowing profile. If you have only one profile defined, then this key will take the display between the user-defined profile and profile 0.

Note that if the File Transfer feature is enabled, the Change Profile key will be ignored. Windowing Profile 0 is the only profile that can be used in conjunction with the File Transfer feature.

- Jump - The jump key will take you through the sessions (up to 5) that are defined in your current profile. In profile 0, the jump key takes you through all of your configured sessions.

- Zoom - The Zoom key can be used to view your foreground sessions data on a full screen. While displaying a Windowing Profile other than profile 0, you will only see a portion of the data from each windows session. When you want to see the full screen of data on a particular session, you can jump to that session and use the Zoom key to display the data on a full screen. Pressing the Zoom key again will re-display the original Windowing Profile.

A display's status line will show the current windowing profile in column 7. This can be helpful if you have multiple profiles defined.

Configuration and Management

Configuration - Windowing is enabled in a display's Device Profile. If it is enabled, then all CUT devices assigned to the Device Profile will have access to the feature.

Management - The "Display/Update Windowing Setup" utility which is on the Customization Data Menu is Central Control Mode can be used to define System Profiles, or to copy System Profiles to your User Profiles. It also allows you to name your profiles and sessions.

Work Station Control Mode

Work Station Control (WSC) Mode is the mode you must enter in order to define your windowing profiles. To enter WSC mode, press the <Ex-Sel WSC> key combination. Refer to the Windowing Keys table for the location of these keys. Note that while you are in WSC mode, your host sessions remain active and will continue to display data that the host may send.

When you enter WSC mode, your cursor will disappear and the status line will be used to display Work Station Control Mode information. The following is an example of the WSC status line.

```
-------------------------------------------------------------------------------------------------
WSCTRL   SETUP    SIZE     WINDOW= A      PROFILE= 0       MSG=   MOD 2
-------------------------------------------------------------------------------------------------
```

- WSCTRL - Indicates that the device is in Work Station Control mode.

- SETUP - This field displays the current mode. Valid modes are SETUP, BROWSE, and COPY. SETUP mode is used to size, move, delete, save and restore windows.

- SIZE - This field displays the current SETUP mode function. It may display either SIZE or MOVE.

- Window = A - Shows the current window. In this example, session a is the current window, or foreground session.

- Profile = 0 - Shows the currently selected profile. In this example, profile 0 is the current profile.

- MSG=xxxx - Used to display a Windowing Error (WE) message or an informational message.

- MOD 2 - Indicates the MOD size of the current profile.

The following topics detail capabilities which are available in WSC mode:

- Defining a Profile - You can define up to 3 User Profiles. Remember that Profile 0 is the default profile and is always defined. To define a profile, simply press the profile number (1, 2, or 3) of the profile you wish to define.

  If your device is a Mod 3, 4, or 5 device, you may press the Enter key to toggle to the desired Mod Size. The new Mod size will be displayed on the status line as shown in the WSC Status Line example . Note that you can change the Profile Mod size only if no windows are defined for the profile.

- Creating a Window - Once a profile has been created, you can create up to five windows in the profile. To add a window to a user-profile, press a session letter (a-j) to correspond to the session you wish to add. The window will be added to the current profile and data from the indicated session will be copied into the window.

  Once one or more windows have been added to a profile, the windows can be sized and moved within the profile as desired.

- Sizing a Window - You can change the size of any window in a user-profile. To enter "size" mode, press the <setup> and then the <size> key. To size a window, select the desired session (a-j) and use the cursor move keys described below to size the window as desired.

  - Cursor Up - controls the top border.
  - Cursor Down - controls the bottom border.
  - Cursor Left - controls the left border.
  - Cursor Right - controls the right border.

  The cursor movement keys are used to "enlarge" the window by moving the indicated border in the indicated direction. If the Alt key is held down while the cursor movement key is pressed, then the window size will be reduced by moving the border in the opposite direction.

  Once all windows are sized as desired, you can exit SIZE mode by pressing the <size> key. Exit SETUP mode by pressing the <setup> key.

- Moving a Window - You may need to move windows within a profile to obtain the desired window arrangement. To enter "move" mode, press the <setup> and then the <move> key. To move a window, select the desired session (a-j) and use the cursor move keys described below to move the window as desired.

  - Cursor Up - moves the window up.
  - Cursor Down - moves the window down.
  - Cursor Left - moves the window to the left.
  - Cursor Right - moves the window to the right.

  Once all windows are moved as desired, you can exit MOVE mode by pressing the <move> key. Exit SETUP mode by pressing the <setup> key.

- Deleting a Window - You can delete a window from a user-profile by pressing the <setup> key followed by the <Win Del> key. The current window will be removed and the next window in the will become the foreground window. To remove a user-profile, you can delete all windows which are in the profile.

- Saving Profiles - You can save your user-defined profiles at any time by entering WSC mode and pressing the <setup> and <save> key combination. The profiles will be saved to

the System Disk and PFSV will be displayed in the MSG area on the status line. The profiles which are saved will be restored to the device upon subsequent IML of the LINCS node.

- Restoring Profiles - You may restore your previously saved profiles by pressing the <setup> and <restore> key combination. Keep in mind that your saved profiles will be restored upon IML of the LINCS node. Using the restore function is useful if you have modified your profiles and wish to restore them as they were last saved. If your profiles are successfully restored, you will be PFRS in the MSG area on the status line.

  Keep in mind that a profile cannot be restored if any of the following statements are true.

  - The saved profile mod size is not compatible with the mod size of the currently attached display station.

  - The display station has fewer sessions than the saved profile.

- Changing Profiles - The <Chg Profile> key allows you to switch to the next defined profile. When the key is pressed, the PROFILE= field on the status line will display the new profile number and the screen will be updated to display the windows in the new profile.

- Selecting Windows - Use the jump function to select a window. You can select a window from Application mode or WSC mode.

  - Selecting a Window from Application Mode - Press the <jump> key. The next window that is set up in the current profile becomes the active window. When a window is selected, its border (if displayed) changes to foreground border colors and/or symbols, and the status line is updated to show the selected windows name. The previously selected window's border shows background symbols and/or colors. Keep pressing the <jump> key to advance the active window through windows A, B, C, D and E if they are defined. After the last window is selected the next depression of the <jump> key makes window A the active window. If you know the letter designation of the window you want to select, press the ALT key + character key for that window (A, B, C, D, E, F, G, H, I, or J). The window is selected.

  - Selecting a Window from WSC Mode - Press the character key (A, B, C, D, E, F, G, H, I, or J) that corresponds to the window you want to select, or press the <jump> key as described above.

- Zooming a Window - While in WSC mode, you may want to view a sessions data on a full screen. You can do this by pressing the <zoom> key, which is basically the same as switching to profile 0. You can press the Zoom key again to return to the original Windowing Profile.

- Browsing Windows - The Browse function allows you to move data vertically or horizontally within a window so that you can see session data that exists beyond the window's borders.

  To browse, press the <Browse> key and then use the cursor movement keys to browse the data in the desired direction. The data in the current window will be shifted as the cursor movement keys are pressed. To browse data in another window, press the desired session letter (a-j), or jump to the desired session using the <jump> key. You can exit browse mode by pressing <Browse> again.

- Copying Data - With the Copy function you can copy data from a 3270 session or an ASCII session in one window to a 3270 session or an ASCII session in another window. You can also copy from one location in a window to another location within the same window.

  Note: You can use the Keyboard Definition utility (KDU) to define Copy and Send keys. Refer to the Configuration and Central Control manual for instructions on how to use the KDU.

The following limits on copying apply:

- Data cannot be copied to protected screens or protected fields.
- The area to receive the data must be large enough to accept the copied input.
- All nondisplay field attribute characters in the source session are translated to spaces in the target session.
- Intensified field attributes in the source session are ignored.
- Field attribute positions in the source session are converted to spaces in the target session.

For ASCII sessions, you must first allocate memory for cut and send. Allocating Feature Memory in Configuration and Central Control tells you how to allocate memory. The following limitations apply only when copying to an ASCII session:

- Color character attributes in the source session are not supported.
- Extended highlighting in the source session, such as underline, blink, and reverse video, is not supported.

- Copying from One Window to Another - Use this procedure to copy data:

    A. Press the ExSel key and then the WSC key to enter WSC mode.

    B. Press the Copy key to enter Copy mode.

    C. Press the Source key.

    Identify the data to be copied:

    1. Select the profile and window from which the text is to be copied.

    2. Position the cursor on the top left corner of the text to be copied.

    3. Press the Cursr Sel (Cursor Select) key.

    4. Position the cursor on the lower right corner of the text to be copied.

    5. Press the Cursr Sel key again. The selected area will be indicated by lines enclosing the text. Note that the enclosing lines are not displayed over a nondisplay attribute.

    D. Press the Target key to begin selecting the location to which the source data will be copied. Select the target to which the text will be copied as follows:

    For 3270 target sessions:

    a) Select the profile and window to which the text is to be copied. See *Selecting a Window from WSC Mode* for instructions on how to select a window.

    b) Position the cursor on the top left corner of the area to which the text is to be copied.

    c) Press the Cursr Sel key to define the target.

    For ASCII target sessions:

    Select the profile and window to which the text is to be copied. See *Selecting a Window from WSC Mode* for instructions on how to select a window.

    The cursor movement keys are not transmitted to the ASCII host while the display station is in WSC and an ASCII session. Complete all cursor movements for the target ASCII session before you enter WSC to initiate a Send operation.

    To prevent you from mixing keyboard data with data being sent to the target ASCII session, the keyboard for the ASCII session is locked while the ASCII session is sending data. The keyboard is not locked for other sessions.

To suspend ASCII data transfer to the host, press the XOFF key. The Communications Server stops releasing data to the transfer buffer until the transfer timeout counter expires or the XON key is pressed to resume data transfer.

E. Press the Enter key to perform the copy. The copied text transfer is initiated. If you press the Enter key while data is being transmitted to an ASCII session, the additional data is not transmitted.

Note: When you copy text from one area to another, text that exists in the target area is overwritten.

After you've pressed Enter to copy the text to the target, the source remains defined. If you press the Enter key to transfer data while other data is already being transferred to an ASCII session, the new data is not transferred.

F. You can select another target, copy the text to it, and repeat the procedure as many times as necessary, or press the Copy key or the WSC key to exit Copy mode.

- Copying to an ASCII Host Session - Use the following format to transmit source data:

Initiator block string
 Initiator line string
  line1
 Terminator line string
 Initiator line string
  line2
 Terminator line string
    .
    .
Terminator block string

The following table describes how the Communications Server transmits data to an ASCII session. Refer to the figures below for an illustration of the source and target sessions.

Data to Transmit	Interpretation
Initiator block string	Empty string - nothing is transmitted.
Initiator line string	Empty string - nothing is transmitted.
Line 1 - **Features**	Eight characters transmitted - the leading and trailing spaces are not transmitted.
Terminator line string **^M**	1 character transmitted (ASCII 0D).
Initiator line string	Empty string - nothing is transmitted.
Line 2 - **Installation and Configuration**	30 characters transmitted.
Terminator line string **^M**	1 character transmitted (ASCII 0D).
Initiator line string	Empty string - nothing is transmitted.
Line 3 - **Troubleshooting**	15 characters transmitted.
Terminator line string **^M**	1 character transmitted (ASCII 0D).
Terminator block string	Empty string - nothing is transmitted.

Source →

A
```
Other Manuals are
|Features                    |
 Installation and Configuration
|Troubleshooting             |
```

B
☐

C
☐

WSCTRL   COPY   SOURCE   WINDOW=A   PROFILE=2   MSG=   MDD2

Copy Data Source Panel

A
```
Other Manuals are
|Features                  |
 Installation and Configuration
|Troubleshooting           |
```

B
☐

C
```
Other Manuals are
Features
Installation and Configuration
Troubleshooting
```
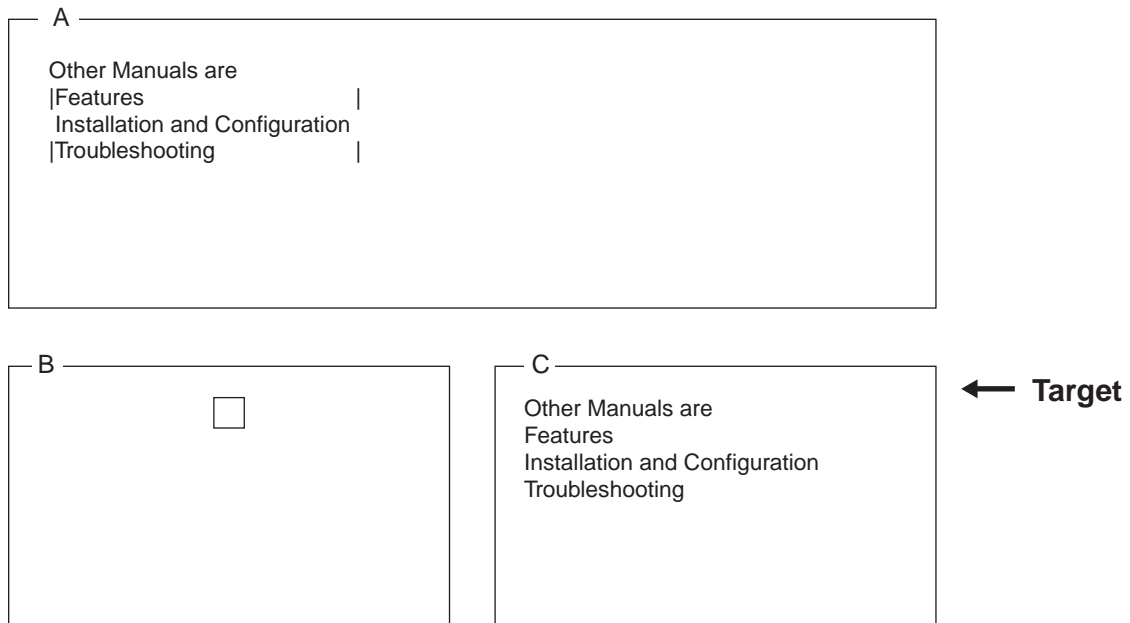
← **Target**

WSCTRL   COPY   SOURCE   WINDOW=A   PROFILE=2   MSG=   MDD2

Copy Data Target Panel

Character Changes - When you copy data from a 3270 session to an ASCII session, the following characters are changed, as shown.

Character in 3270 Session	Character in ASCII Session
(not symbol)	(circumflex)
(broken vertical line)	| (solid vertical line)
(cent sign)	[(left bracket)

• Changing the ASCII Host Transfer Configuration

When you send data to an ASCII session, the data is sent to the ASCII host in a continuous stream. Control characters embedded in the stream format the data when it reaches the ASCII session. You can select control characters and formats on the Update ASCII Cut and Send Parameters panel. The table describes the fields on the Update ASCII Cut and Send Parameters panel.

You can change the ASCII host transfer configuration from Port 0. Use the Update ASCII Cut and Send Parameters panel. Press the ExSel key and then the S key to display the Update ASCII Cut and Send Parameters panel.

Use the PF7 and PF8 keys to scroll backward and forward through the Update ASCII Cut and Send Parameters panel to display all the classes. Use the cursor movement, Tab, and Backtab keys to move through the fields on the screen. When you finish changing the configuration, press the PF10 key to save the changes and leave the configuration screen. Saving changes is allowed only on Port 0.

Update ASCII Cut and Send Parameters

01 VAX/VMS NULLS

to spaces   **APL/TEXT to spaces**

Remove leading spaces   **Remove trailing spaces**

Initiator block string

Terminator block string

Initiator line string

Terminator line string   ^M

Transfer timeout (sec)   05   **Block transfer size 16**

02 UNIX Host

NULLS to spaces   **APL/TEXT to spaces**

Remove leading spaces   **Remove trailing spaces**

Initiator block string

Terminator block string

Initiator line string

Terminator line string   ^M

Transfer timeout (sec)   05   **Block transfer size 16**

PF1-Exit   PF7-Back   PF8-Forw   PF10-Save and exit

Update Parameters Panel

Update ASCII Cut and Send Parameters Panel Fields. Each field on the Update ASCII Cut and Send Parameters panel is limited to 29 characters.

Field	Description
nn	The ASCII class number, followed by the ASCII class name.
Nulls to spaces/Nulls transmitted	Use the Enter key to toggle between changing nulls to spaces and transmitting nulls.
APL/TEXT to spaces/Transmit APL/TEXT base	Use the Enter key to toggle between transmitting APL text as spaces and transmitting APL text as a base character.
Remove leading spaces/Do not remove leading spaces	Use the Enter key to toggle between removing leading spaces before transmitting data, and transmitting data with the leading spaces.
Remove trailing spaces/Do not remove trailing spaces	Use the Enter key to toggle between removing trailing spaces before transmitting data, and transmitting data with the trailing spaces.
Initiator block string	Enter the initiator block string character (for example, ^B).
Terminator block string	Enter the terminator block string character (for example, ^Z).
Initiator line string	Enter the initiator line string character (for example, ^I).
Terminator line string	Enter the terminator line string. The default is ^M.
Transfer timeout (sec)	Enter the number of seconds of inactivity after which the transfer is terminated. The default is 5.
Block transfer size	Enter the block transfer size. The default is 16. **Block Transfer Size** / **Approximater Transfer Rate (char/sec)** 1 — 20 (160 baud) 2 — 40 16 — 320 (EVE recommended) 60 — 1200 (9600 baud) 96 — 1200 (9600 baud)

Note: Nulls (ASCII 0) are not inserted if the line or block string is empty.

- Getting Help

  The Help panel appears on the right side of the screen and displays information regarding windows and profiles as well as active keys for the current operating mode. Help panel information changes for each windowing mode.

  The Help panel can be displayed only while the display station is in WSC mode.

  To display the Help panel:
  - Press the ExSel key.
  - Press the WSC key.
  - Press the Help key.

  The Help panel appears and remains on until the Help key or the WSC key is pressed again.

- System Profiles

  A System profile is an arrangement of windows that can be accessed by any compatibly sized and configured display terminal in the Communications Server's network. A system administrator can define and later modify up to three system profiles that are available to all of the display stations attached to the 1174.

  System profiles allow a system administrator to create an arrangement of windows that meets the requirements of a specific group of users. For example, an accounting department might use the window arrangement in Profile 1, while an MIS department would use the window arrangement in Profile 2.

  The system administrator defines the System profiles by accessing Test mode and giving the password defined during configuration. Once a System profile is defined, users can copy the profile into their User profile area, and then modify the profile as needed.

  The sections that follow show procedures for defining and accessing system profiles.

- Defining System Profiles

  To set up a system profile, follow these steps:

  1. Press the ExSel key and then the WSC key to enter WSC mode.

  2. Add, size, and move windows as necessary to create window arrangements for the System profiles.

  3. Save the profiles by pressing the Save Profiles key in Setup mode. At this point, you have defined user profiles.

  4. Press the WSC key to exit WSC mode.

  Refer to the 1174 Communications Servers Operations Manual for instructions on how to copy user profiles to the system profiles.

You can also copy system profiles to your own user profiles. Refer to the 1174 Communications Servers Operations Manual for instructions on how to copy system profiles to user profiles.

Windowing Keys

Key	122-Key and 104-Key Keyboards	88-Key Keyboard	102-Key Keyboard
↑	↑	↑	↑
↓	↓	↓	↓
←	←	←	←
→	→	↑	↑
Profile 0	0	0	0
Profile 1	1	1	1
Profile 2	2	2	2
Profile 3	3	3	3
Window A	A	A	A
Alt	Alt	Alt	Alt
Window B	B	B	B
Bottom In	Alt + ↓	Alt + ↓	Alt + ↓
Browse	PF2	4	4
Window C	C	C	C
Chg Profile	Alt + `	Alt + `	Alt + `
Copy	PF8	-	-
Cursr Sel	Cursr Sel	Cursr Sel	Alt + PF9
Window D	D	D	D
Enter	Enter	Enter	Enter
Ex Sel	Ex Sel	Ex Sel	Ex Sel
Window E	E	E	E
Window F	F	F	F
Window G	G	G	G
Help	PF1	Grave	Grave
Window H	H	H	H
Window I	I	I	I
Jump	Alt + â (insert)	Alt + â (insert)	Alt + Insert
Window J	J	J	J
Left In	Alt + ←	Alt + ←	Alt + ←
Move	PF4	6	6
Reset	Reset	Reset	Reset
Restore	PF7	9	9
Right In	Alt + →	Alt + →	Alt + →
Save	PF6	8	8
Setup	PF3	5	5
Size	PF5	7	7
Source	PF9	=	=
Target	PF10	← (Backspace)	← (Backspace)
Top In	Alt + ↑	Alt + ↑	Alt + ↑
Win Del	⍉	⍉	⍉
Enter/Exit WSC	PF16, w or W	w or W	PF16, w or W
Zoom	Alt + Tab	Alt + Tab	Alt + Tab

Windowing Errors

Error Code	Meaning
WE1	Copy not allowed; an attempt was made to copy into a protected area.
WE2	Cannot move window further.
WE3	Cannot size window while it is enlarged.
WE4	Copy not allowed; source and target are not defined.
WE5	Cannot leave WSC; no windows are defined in the current profile.
WE6	Cannot change screen profiles; the only profile defined is Profile 0.
WE7	Cannot jump to the requested window; that session not available.
WE8	Incorrect key entered.
WE9	Cannot delete window in Profile 0.
WE10	Cannot shrink window further.
WE11	Cannot expand window further.
WE12	Cannot delete window; no windows are defined.
WE13	Cannot browse further in the current direction.
WE14	Cannot move window while enlarged or while in Profile 0.
WE15	Cannot jump; no other windows defined.
WE16	Cannot size windows while zoomed or while in Profile 0.
WE17	Source field undefined.
WE18	Target field undefined.
WE19	Warning: source and target fields overlap.
WE20	Warning: target field smaller than source field.
WE21	Cannot save profiles; none defined.
WE22	Cannot restore profiles; none defined.
WE23	Profiles saved were altered and must be created again.
WE24	Cannot copy to session that has its input inhibited.
WE26	Cannot restore profiles except while in Profile 0.
WE27	Restore warning; some profiles are illegal.
WE28	Cannot size; no windows defined.
WE29	Cannot browse windows while zoomed or while in Profile 0.
WE30	Mod of window has changed; auto resized.
WE31	File error on a profile command.
WE32	Cannot change profile in File Transfer mode.
WE33	The window cannot be sized to Expanded mode.
WE37	Attempt to define more than five sessions in a profile.

ADU

The ASCII Definition Utility (ADU) enables you to customize ASCII device parameters, enabling the definition of new ASCII display types, and to configure items such as printer parameters and translate tables, which enable you to tailor the ASCII datastream to your needs. ADU is a Central Control utility that can be used for:

- Device Definition: You can define new ASCII devices not currently supported by LINCS, or add or change features to existing ASCII device definitions.

- Character Set Customization: You can modify or define new tables in LINCS that are used to translate ASCII host data to/from CUT type terminals and printers.

- Printer Secondary Transparency Option: LINCS can embed control sequences into the 3270 datastream for LU1 and LU3 prints, to control printer functions such as formatting.

The complete description of ADU can be found in the ASCII Host Features Section.

Configuration and Management

Configuration -The ASCII Definition Utility is accessed from the Customization Data Menu in Central Control Mode.

KDU

The Keyboard Definition Utility (KDU) allows you to define the function of the keys for coax display stations attached to the LINCS node. The KDU's main menu lets you specify the type of keyboard or keypad you want to modify. A series of diagrams of the keyboard will then be displayed. To customize the keyboard, type the new function of each key directly on the diagram. Details are provided in the LINCS Configuration and Central Control manual.

Configuration and Management

Configuration - The Keyboard Definition Utility is accessed from the Customization Data Menu in Central Control Mode.

8. DFT Devices

A DFT is a coax device that processes its own data stream and performs some of the protocol functions. Since these devices also process their own keystrokes, some of the LINCS features normally available to CUT devices are not supported by DFTs.

DFTs can have up to five DFT host sessions. In a BSC or nonSNA channel environment, all DFT sessions must be on the same host. In a SNA environment, all five DFT sessions may be on the same or different hosts.

DFT-E

DFT-E devices are extended DFTs which can simultaneously support a CUT session in addition to five DFT sessions.

The CUT session may be assigned any type of LINCS host session including both ASCII and 3270 hosts. This session will support most features of a standard non-EAB MOD 2 CUT device, except for windowing and CUT-type printer functions. A local DFT printer is supported when configured as a DFT LU.

DFT-E Configuration

Configuration - Sessions A through E are configured as standard DFT sessions. Session F will be treated as the CUT session, even if fewer than 5 DFT sessions are configured.

Downstream Loadable (DSL) Devices

DSL devices are DFTs that load their control program from a LINCS disk. A floppy disk that contains the DSL control program must be obtained from the manufacturer of DSL device. The DSL files may optionally be merged to the LINCS hard disk using the DSL merge procedure. The IBM 3179G, 3192G, 3193, 3290, 3472G, and PS/2 are examples of DSL devices.

RTM

LINCS supports RTM on DFTs. However, because DFTs perform their own keystroke and datastream processing, RTM support is also required within the DFT. Before you attempt to use RTM with a DFT, you should verify that RTM support is available within the device.

A LINCS node and an attached DFT communicate in the following manner to provide RTM support:

- When the DFT is powered on (or the host changes RTM parameters), LINCS notifies the DFT of the RTM configuration parameters.
- The DFT asks LINCS to start the RTM timer when an AID key is pressed.
- After the host has responded to the AID (based on the current RTM end of transaction definition), the DFT asks LINCS to stop the RTM timer.
- If authorized, LINCS then updates the RTM log and the LTTI for the device. If authorized, the DFT displays the LTTI.

9. RPQs

RPQs are proprietary features that have been developed based upon particular customer needs. The RPQs listed are available to all LINCS node users.

- **5550 Printer Sharing** - routes IBM 5550 device prints to other 5550 devices.
- **ASCII Backspace/Delete key** - when enabled LINCS bypasses the checks for DOC and INSERT modes and always does the backspace with delete.
- **ASCII Display Time Clock** - allows ASCII displays attached to LINCS to operate similar to TWX type devices (as an IBM 3708 replacement).
- **ASCII Shift Lock** - Makes the Caps Lock key on an ASCII keyboard act as a Shift Lock function on a 3270 keyboard. Caps lock forces all alphabet characters to shift to upper case. Shift Lock forces all keys to use the shifted characters and symbols.
- **Attached Processor Feature** - allows an ASCII host to send a command sequence that will initiate a recorded RPB sequence the same as if the user had initiated the sequence from the keyboard.
- **Coax poll rate** - the Coax Poll Rate RPQ increases the coax poll rate to accommodate certain non-compliant devices.
- **Deferred Keyboard Restore** - Enables sessions connected to a 3270 host to remain inhibited (X clock) until an end bracket or change direction is received, even if a keyboard restore is received while in receive state.
- **Device Based Shift Status** - the shift key status affects all sessions vs. only the foreground session.
- **DFT Frame Sequencing** - when enabled, this RPQ will disallow interspersing of frames from multiple LUs when communicating to a DFT. That is, all frames with the same sequence number (segmented frames) will be sent to the DFT before a frame for a different LU is sent. This RPQ is needed for certain Irma clients.
- **Do not map DFT LUs** - causes LINCS to pass the host LU defined entry to the DFT instead of automatically mapping LU beginning with LU 02, to the coax DFTs.
- **Filter IPX Packet Type 20** - enabling this RPQ will cause LINCS to defer from propagating IPX broadcast type 20 packets. This can greatly reduce traffic in Windows NT environments.
- **Ignore DNS cache** - DNS resolutions are not cached when this RPQ is enabled. This forces every request for use of a DNS name to go to the DNS name server.
- **IPX SAP Filter (save comm server entries only)** - allows LINCS to filter out all IPX SAP frames except for those received from a comm server, resulting in only comm server entries in the SAP table.
- **LANSYS Delay** - enables slower client workstations or workstations with slow protocol stacks to execute LANSYS.
- **Local SNA DE/CU On-line Status Display** - slows return of DE/UC when initializing the PU for VSE environments.
- **Make Hard Disk priority higher** - the hard disk priority is bumped up to the same priority as the communications priority. This RPQ should be used when LINCS is configured to function as a print server, especially if the print server feature appears to be hanging.
- **Map "ANY" LUs to "PUBLIC" LUs** - causes an IPX 3270 request for "ANY" LU to be treated as a request for an LU from a Host Class by the name of "PUBLIC".

- **Map LU 0FFh for all SNA Hosts (hex, disable=00)** - allows you to map LU 'FF' to a different LU as defined by the hex value entered. For example, if a hex value of '55' is entered, then LU 'FF' in the data stream would be treated as LU '55' in the LINCS configuration. A value of '00' for this RPQ indicates that LU 'FF' will be treated as an invalid LU.
- **MAP "PUBLIC" LUs to "ANY" LUs** - will treat an IPX 3270 request for a "PUBLIC" LU as if it were a request to receive any LU configured for the requested service name.
- **Maximize User Disk Space** - enabling this RPQ will cause LINCS to limit the amount of hard disk space set aside for the LINCS operating system to 15 MB, making available the other 5 MB for features such as LPD Print Serving and Central Site Customization. This RPQ is normally invoked on older LINCS platforms that have only a 20 MB hard drive installed.
- **Multiple LFS LUs per host** - enhances Local Format Storage to allow multiple LFS LUs on a single host.
- **NetView RPQ1** - Machine Type - allows alerts generated by a LINCS nodes to be interpreted the same as the would be if generated by an IBM 3174.
- **NetView RPQ2** - Product Class - allows alerts generated by a LINCS nodes to be distinguished from similar alerts generated by an IBM 3174.
- **Pass Write Structured Fields to LU3 TN3287 Client** - when enabled, LINCS will pass Write Structured Fields to an LU3 TN3287 client if the client indicates that extended data streams are supported. If not enabled, LINCS will not forward the Write Structured field.
- **Presentation Space Update in File Transfer Mode** - the PCs screen buffer is used instead of LINCS' for PCs executing file transfer programs such as IND$File and FFTERM.
- **Prevent TN3270 Connect Panel if Host is Disabled** - this option prevents the painting of the connect panel on the client's screen unless the host connection is functional.
- **Restrict TN3270 LU Requests to those Configured** - when enabled, this RPQ protects a Host and LU entry in the TN3270 Client Definition panel from being used by another client other than the one with the IP address specified by the entry. When not enabled, other clients may obtain the resource by merely requesting it. Tab/Backtab keys stop at colons and tabs - when enabled, the cursor will stop at a colon in addition to a space after a field attribute when the Tab and Backtab keys are pressed.
- **UNBIND before NOTIFY power-off sequence** - when a LAN-based client disconnects from LINCS, forcing an UNBIND and a NOTIFY to be sent, the UNBIND will be sent first if the RPQ is enabled, and NOTIFY will be sent first if the RPQ is disabled.
- **Upper Case Translate of all data keys** - all keys are converted to upper case. Use device model size to validate.
- **Bind** - accepts or rejects the session bind based on the device POR information vs. Extended Function Features capabilities.
- **Use scan codes in WSC mode** - transmit key scan code vs. key position.

RPQ Configuration and Management

Configuration - RPQs are enabled or disabled from the RPQs menu in Configuration. The RPQs Menu is manually entered from the Configuration menu. It will not automatically appear as you are paging through the Configuration Panels.

10. Management Features

LINCS Central Control mode provides many utilities for configuring and managing your LINCS node. The following devices may access the Central Control Utility:

- Any CUT device (Network or Direct)
- Limited Access Devices (TELNET or Serial Port Access)
- Netview's Central Site Control Facility

Central Control access is available anytime the LINCS node is operational. Communications remain active for all sessions except the one that is actually accessing the Central Control Utilities. Any CUT session may access the Central Control utility although for security reasons, some of the utilities require Supervisor Authority and/or a password.

The *Configuration* and *Central Control* Manuals list all of the utilities which are available and describes them in detail.

Configuration

The Configuration utility is available in Central Control Mode, and allows you to reconfigure your LINCS node without affecting normal operations. Once the configuration changes are saved, the Apply Configuration Changes panel is available, where you can apply the changes in one of the following manners.

- You may apply all of the changes immediately, by setting the IML Option to "IML Now".
- You may apply all of the changes at a scheduled time, by setting the IML Option to "IML Later", and specifying a data and time to IML.
- You may apply some changes immediately "without" IMLing, by selecting "Immediate" for the options which are listed on the "Apply Configuration Changes" panel.

Refer to the *Configuration* and *Central Control* Manuals for details on the Configuration procedures.

Communication Status and Statistics

Central Control provides utilities to:

- Monitor the status of circuits and sessions for all protocols
- View or reset sessions host connections
- View IPX RIP and SAP tables
- View and reset LAN card statistics
- Monitor APPN problems and exceptions
- Monitor and capture SNA traffic
- View the status of all devices attached to the LINCS node
- View the Event logs which record errors and events which have occurred within the LINCS node and its attached devices.

Media Management

The Media Management utilities allow you to view, copy, and delete data objects on your hard and floppy disks. When a new level of software is received, the "Copy Data Objects" utility is used to copy the System Microcode from the SYSTEM floppies to your hard disk. This operation can be performed without disrupting normal operation of your LINCS node.

Other Media Management utilities allow you to copy your data objects, or an entire disk, for backup purposes. Please refer to the Configuration and Central Control Manual for details on the available Media Management utilities.

IML Utility

The IML utility on the Supervisor Functions Menu allows you to IML the LINCS node without manually pressing the IML key. The IML can be scheduled to occur immediately, or for a later, more convenient time.

When the LINCS node is IML'd from the Central Control utility, the configuration currently on the hard disk is examined to see if a "Quick IML" can be executed. If the configuration on the hard disk is not significantly different from the configuration which is currently loaded, then a Quick IML will be executed, and only the customization data objects will be reloaded. If the configuration has changed significantly enough such that additional files and features need to be loaded from the hard disk, a full IML will be done.

Central Control Facility

The Central Site Control Facility provides remote operation for LINCS. A full screen interface enables the NetView operator to execute LINCS tests using the same commands and screens as are used locally at the LINCS node. Operators can perform such functions as checking the configuration, displaying the Central Site Change Management catalog, and soliciting and updating vital product data information.

The following diagram shows the NetView user and a LINCS node in the network:
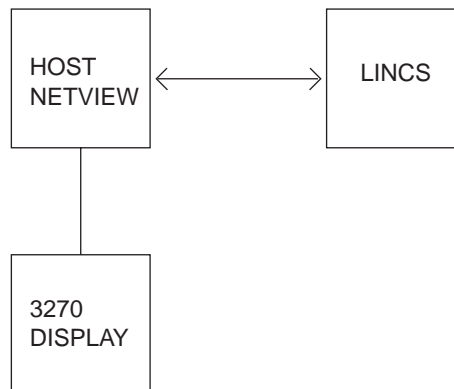
Using Central Site Control Facility

To use the Central Site Control Facility (CSCF) in the network, the destination LINCS node must be configured for CSCF. Refer to the Configuration and Central Control Manual for details on configuring for CSCF and the feature memory requirements.

The NetView user invokes CSCF by typing "CSCF PU=<puname>" where <puname> is the PU name defined by VTAM. This command starts a transaction with a LINCS node in the network. LINCS performs the test, and sends the screen data inbound.

The screen data consists of some fixed data and some variable data. The fixed data is referred to as a template. The Communications Server first sends the template name and then variable data to the NetView.

If the template does not exist in the VSAM database, then NetView asks LINCS to send the template. LINCS responds with a template definition. NetView first stores that template definition in its VSAM database, then it fits the variable data sent earlier into that template and displays the resultant screen to the user. This way the template is sent only once to the host. The next time the test is executed, only the variable data needs to be sent, thus making data transmission more efficient.

With NetView you can perform most of the on-line Test mode tests on your LINCS node in the same way as you would have performed those tests locally. Any differences in using Test mode from the CSCF are noted in a help screen, which is accessed from the Main menu by pressing PF1. The help screen is shown below. You can terminate the transaction by pressing PF2.

```
MTLXHELP              LINCS CSCF HELP              9300/L08PU40

The Central Control Utility invoked from the Central Site Control
Facility (CSCF) is slightly different from the Central Control
Utility performed locally.

The upper left corner of a panel shows the CSCF panel name, and the
upper right corner shows the PU name.  Since the PU name is prefixed
by "9300", the panel title which is centered on row 1 will be
prefixed by "LINCS" to indicate that the destination is a 9300.

Unlike the Local Central Control Utility, selections may be entered
from a test panel that is not a menu panel. In this case, the
selection is processed from the Main Menu.

For a toggle field, enter a "+" to toggle forwards, or a "-" to
toggle backwards, and then press PF11. You may toggle multiple
fields by pressing PF11 once.

CMD===>>

PF: 1-Main  2-END  3-PREV        6-ROLL        12-RETRIEVE
```

CSCF Commands

CSCF requires that the NetView Central Site Control Facility feature be installed on the NetView system. CSCF is supported by NetView Release 3 when running on the MVS/XA and VM operating systems.

The CSCF commands are as follows:

• CSCF PU=<puname>

  This command invokes CSCF on the LINCS node in the network. LINCS in turn sends the Test mode Main menu to NetView. The Netview operator can now enter any valid commands (for example, /1/1) to display configuration panels.

- CSCF PU=<puname>, OP=(/7/1)

  This command not only invokes CSCF, but also specifies the utility to be performed. LINCS executes the utility, and the results are sent inbound to NetView. In this example, the event log data is sent inbound.

- CSCF PURGE ALL

  This command purges all the templates stored at the host VSAM database. This command is used occasionally to free up the space taken by the unused templates.

For further information on these commands, please refer to the NetView Operations Manual.

Utilities Supported by Central Site Control Facility

For a complete list of all the Central Control Utilities supported by LINCS, please refer to the LINCS *Configuration and Central Control manual*.

The following tests are not supported by CSCF:

- Display/Update HAP Session Status
- Extended Attributes Demo
- Operator Initiated Alert
- Update Extended Vital Product Data

Central Site Customization

Central Site Customization (CSC) provides a way to store multiple configurations on a Library disk. The configurations for all LINCS nodes in a network can be configured and maintained at a Central Site. The configurations can then be copied to floppies for manual distribution to the Network Sites, or they can be electronically distributed to the Network Sites using the Central Site Change Management feature.

Another way to use the Central Site Customization utility is to backup your configurations. You may want to modify your configuration without losing your current working configuration. You can use the CSC utility to Retrieve your System Disk configuration and save this configuration in your CSC library. You may then modify your System disk configuration as desired. If you need to retrieve your previous configuration, you can do so by using the CSC Create System Disk function to copy the saved configuration back to your System disk.

The *Configuration* and *Central Control* Manuals describe the CSC feature and all of the functions that are available.

Configuration and Management

Configuration - Central Site Customization is enabled on the General Options panel in Configuration. When IMLing with default customization data objects (i.e., by pressing Config at state 500 or when no configuration is stored on the hard disk), CSC will be enabled by default. That provides a way to save multiple configurations even when your normal configuration doesn't provide enough feature memory for CSC operations.

Management - Refer to the Configuration and Central Control Manual for details on how to use the Central Site Customization Utility.

Central Site Management

Central Site Change Management (CSCM), in conjunction with NetView DM, provides the ability to electronically distribute microcode and customization data to LINCS nodes in an SNA network. The distribution of data is controlled from NetView DM. NetView DM Version 1, Release 2 or higher, may be installed on any IBM processor capable of operating with MVS, ACF/VTAM, or ACF/TCAM.

When using CSCM to distribute data objects, a single LINCS node in the Network should be designated as the Central Site. The Central Site node uses the Central Site Customization feature to maintain the configuration data objects for other nodes in the network. Using the NetView DM functions, microcode and customization data is retrieved from the Central Site, stored in the NetView DM resource repository, and then distributed from the resource repository to the Network Sites.

Configuration and Management

Configuration - The following Configuration utilities enable the Central Site Change Management feature:

- An SNA Host Circuit must be defined, in order to use the Central Site Change Management feature. Refer to the Configuration and Management section for 3270 Host Connectivity for details of configuring Host Circuits.

- The SNA Options is used to configure a Network ID and LU Name, which are required for the CSCM feature. Refer to the Central Site Options panel for further details.

- A LINCS node is designated as a Central Site by enabling the Central Site Customization (CSC) feature on the General Options panel. If CSC is not enabled, the node will be treated as a Network Site.

Management - The Display/Update Disk Information utility on the Media Management Menu in Central Control Mode lists the data object canonical names for all data objects residing on LINCS disks. This is useful when writing NetView DM transmission plans to retrieve the objects.

During CSCM processing status codes may be reported in a variety of ways:

- Informational messages will be displayed on the operator control panel. These messages are formatted as:

  CSCM f obj

  where "f" is the CSCM function:

  R = read

  W = write

  D = delete/remove

  I = install

  A = accept

  and "obj" represents the data object the function is being performed on.

  For example, SYS for System Microcode, CFG for Configuration

- 400 series events will be logged in the Event Logs, indicating the status of Change Management functions. These events are documented in the *LINCS Problem Determination* manual.

- SNA sense codes may appear on an SNA negative response, in a function management header type 7 (FMH-7), in an inbound unbind request, or in a Sense Data MS common subvector. The SNA sense codes are documented in the *LINCS Problem Determination* manual.

Preparing for CSCM Function

Before using CSCM to distribute LINCS Gen-C microcode and customization data, all LINCS nodes which will be receiving the data should be running LINCS C1.0 or greater. LINCS nodes running Gen-B are not capable of receiving Gen-C data objects electronically.

The CSCM functions are implemented using NetView DM commands on an LU type 6.2 session. NetView DM Version 1, Release 2 or higher, may be installed on any IBM processor capable of operating with MVS, ACF/VTAM, or ACF/TCAM.

LU address 01 on the CSCM host in a LINCS node will support the LU6.2 protocol. This LU will have to be defined to ACF/VTAM for each LINCS node that will support CSCM. The LUNAMES defined to ACF/VTAM should match the LUNAMES defined at the LINCS nodes. Refer to the NetView DM Installation Manual for details on how to define the Logical Unit and the Logon mode.

Data Objects and Canonical Names

The various types of microcode and customization data distributed by CSCM are referred to as data objects. There are two types of data objects, Microcode data objects and Customization data objects. The following sections further describe each type of data object.

Each data object is uniquely identified by a structured name which is known as the data object's canonical name. This is the name which must be supplied to NetView DM in order to distribute the data objects.

A canonical name consists of several tokens (or fields) separated by a period. The content of a token varies depending on the data object. The sections which follow give the canonical name format for the LINCS microcode and customization data objects.

Microcode Data Objects

Microcode data objects contain the microcode which controls the operation of the LINCS nodes and its attached devices. These data objects are provided on diskettes. The canonical names are built as follows:

- Token 1 must always be MCODE for Microcode data objects.

- Token 2 is used to identify the product such as 9300 or 1174.

- Token 3 is not used and must always be NA.

- Token 4 identifies the type of release as follows:

  - FUNCTEC identifies a new functional release of LINCS microcode. A whole number release such as C3.0 contains major new functions and features while a decimal number release such as C3.1 contains smaller features.

- MAINTEC is used to identify a maintenance release of microcode. These releases are done to correct specific customer problems. The microcode integration level (IL) is incremented with each MAINTEC release.

- FEATURE is only valid for DSL microcode data objects. It is used to identify a feature release of DSL microcode.

- Token 5 normally contains the microcode release level of a data object. It is a five character field with the following format:

  gffss where g indicates Generation level,

  ff is a 2-digit functional release level, and

  ss is a 2-digit suffix release level.

  Example: C0300 indicates Generation C, Release 3.0.

- Token 6 identifies the type of microcode such as SYSTEM or DSL.

- Token 7 varies depending upon the type of data object as follows.

  - For FUNCTEC levels of System Microcode, Token 7 is left blank.

  - For MAINTEC levels of System Microcode, Token 7 is the integration level.

  - For DSL microcode, Token 7 is the specific DSL device, such as 1192.

- Token 8 is only used for FEATURE DSL microcode. It contains the RPQ number of the DSL feature.

The types of microcode data objects are listed and explained next.

System Microcode Data Objects

The System Microcode data object contains all the files necessary to load the LINCS node and bring it on-line. You receive system microcode from MTX on diskette. Information about naming and managing this object are detailed in the list below:

- **Data Object Canonical Name** - The System data object canonical name is based upon the type of release and the integration level (il) of the System disk. The following canonical name formats are supported.

  - MCODE.9300.NA.FUNCTEC.rlvl.SYSTEM - This name refers to a new release of system microcode.

  - MCODE.9300.NA.MAINTEC.rlvl.SYSTEM.il - This canonical name refers to a maintenance level of System microcode.

- **Data Object Source** - The System Microcode data object is provided on LINCS system diskettes. The microcode can be copied to the hard disk using the Copy Data Object" utility in Media Management or by using the software merge utility (accessible by pressing <CLEAR> on the operator control panel at state 500).

- **Data Object Destination** - The destination of the System Microcode data object is a System disk at the receiving LINCS node.

- **Distributing the Data Object** - Use the following steps to distribute a new level of System Microcode to your LINCS nodes:

  1. Merge the new microcode onto the hard disk of the Central Site node, and IML with the new microcode.

2. If the new microcode contains new functions which you want to configure for the Network Sites, use the Central Site Customization utility to re-configure as desired and save the modified configuration back to the library disk. Note that is it not necessary to re-configure the library members unless you want to enable any new features. The configurations which are already at the Network Sites will automatically be upgraded to the new level during the IML process when LINCS detects that the configuration is at a lower level than the System Microcode.

3. Build a NetView DM transmission plan to distribute the new System Microcode to the desired Network Sites. If you reconfigured any of your library members, the transmission plan should include statements to distribute the changed library members.

Downstream Load Microcode

Downstream Load Microcode is microcode required by downstream devices, in order for them to work properly. An example is IBM's 3290 display, which requires microcode from LINCS when the display is powered on. Information about naming and managing this object are detailed in the list below:

- **Data Object Description** - A Downstream Load (DSL) data object contains the microcode necessary to load a single type of DSL device.

- **Data Object Canonical Name** - The DSL data object canonical name is built based upon the type of device the DSL microcode supports. The following formats are supported.

  - MCODE.9300.NA.FUNCTECT.rlvl.DSL.nnnn - This canonical name format is used to distribute DSL microcode for a specific DSL device. The DSL device number (for example, 1192) is specified in Token 7.

  - MCODE.1174.NA.FEATURE.rlvl.DSL.nnnn.rpqnumbr - This canonical name indicates a release of DSL microcode that contains RPQ microcode. The RPQ microcode contained in the DSL microcode is identified by the RPQ number.

- **Data Object Source** - The DSL data object is provided on the DSL diskette that was received when the DSL device was purchased. Prior to distributing the DSL Microcode, it must be merged onto LINCS hard disk. The "Copy Disk" or "Copy Data Objects" utility in Media Management may be used to copy the DSL microcode to the system hard disk.

- **Data Object Destination** - The destination of the DSL data object is a DSL disk at the receiving LINCS node.

- **Distributing the Data Object** - Use the following steps to distribute the DSL microcode.

  1. Merge the DSL microcode onto the hard disk of the Central Site node.

  2. Build a NetView DM transmission plan to distribute the DSL data object.

Customization Data Objects

Customization data objects contain data which defines a particular feature. These data objects are normally defined using customization utilities on the Customization Data Menu in Central Control mode. The canonical names are built as follows:

- Token 1 must always be MCUST for Customization data objects.

- Token 2 is used to identify the project, such as 9300 or 1174.

- Token 3 is not used and must always be NA.

- Token 4 is NA (not applicable) for all customization data objects except for Configuration (CFG). For CFG data objects, token 4 is the Network ID defined during Configuration.

- Token 5 is NA (not applicable) for all customization data objects except for CFG. For CFG data objects, token 5 is the CSCM LU Name defined during Configuration.

- Token 6 contains an acronym identifying the type of customization data.

- Token 7 varies depending upon the type of data object:

  - For a CFG data object, token 7 is the name given to the library member when saving the CFG using Central Site Customization. If the Configuration data object is modified using the Configuration utility, token 7 contains LOCALCHG to indicate that a local change has been performed.

  - For other customization data objects, token 7 contains the ID given to the data object when it was defined. The utilities for defining these data objects provide a field for uniquely identifying the data.

- Token 8 is only used for the Configuration data object. It is the version number assigned to the data object when it was saved using Central Site Customization. When Token 7 contains LOCALCHG, Token 8 contains the 4-digit integration level of the System microcode used to save the configuration.

Configuration Customization

The Configuration (CFG) data object contains the data that uniquely defines the operation of a particular LINCS node. Information about naming and managing this object are detailed in the list below:

- **Data Object Canonical Name** - The Configuration data object canonical name is built using the NETID and LUNAME, which are defined during configuration. The library member name and version number are defined by the Central Site Customization utility. The following canonical name formats are supported for the Configuration Data object:

  - MCUST.9300.NA.netid.luname.CFG.libmname.vernum - This canonical name identifies a Configuration data object which has been defined using the Central Site Customization utility.

  - MCUST.1174.NA netid.luname.CFG.LOCALCHG.il - This canonical name identifies a Configuration Data object, that has been changed locally using the Configuration Utility. Token 7 is set to LOCALCHG to indicate that the data object no longer matches the Configuration stored in the Resource Repository. Token 8 is the Integration Level of the System Microcode used to save the configuration data.

- **Data Object Source** - The Configuration data object for Network Sites is usually created using the Central Site Customization utility, although any LINCS node can reconfigure using the Configuration utility.

  The CFG data object is retrieved from a Library disk at the Central Site node by default. If the CFG is not found on a library disk of the source node, LINCS will search the System disk for the CFG.

- **Data Object Destination** - The destination of the CFG data object is a System disk installed at the receiving node.

- **Distributing the Data Object** - The Configuration data object should be distributed when the administrator of the Central Site node makes a Configuration Change for a Network

node. The System Microcode at the Network Node must be at a level equal to or greater than the changed Configuration data.

Use the following steps to upgrade the Configuration for a Network Site:

1. Modify the library member as desired, using the Central Site Customization utility.

2. Build a NetView DM transmission plan to distribute the updated library member to the Network Site. If the System Microcode at the Network Site is at a lower level than the System Microcode at the Central Site, the transmission plan should also include statements to distribute the System Microcode.

APPN Class of Service Customization

The Class of Service (COS) Customization data object provides flexibility for session characteristics and route selection in an APPN network. If not defined, LINCS will provide a default COS data object to be used for APPN route selection. Information about naming and managing this object are detailed in the list below:

*   **Data Object Canonical Name** - The COS data object canonical name is built based on the Data Object Name assigned when saving the COS data object. It has the following format:

    MCUST.9300.NA.NA.NA.COS.dobjname - It is recommended that a meaningful data object name be defined, especially for networks in which multiple versions of the COS data object will be used.

*   **Data Object Source** - This data object is defined and saved to the System disk using the APPN COS utility, which is on the Customization Data Menu in Central Control Mode.

*   **Data Object Destination** - The destination of the COS data object is a System disk at the receiving node.

*   **Distributing the Data Object** - Use the following steps to distribute the COS data object to other LINCS nodes.

    1. Use the Display/Update APPN COS utility to define a COS data object and save it to the System disk. Identify the data object by assigning a unique data object ID.

    2. Build a NetView DM transmission plan to distribute the COS data object to the desired Network nodes.

    3. If any Network nodes require a different COS, redefine the COS at the Central Site and build a NetView DM transmission plan to distribute the modified COS to the desired Network nodes. If desired, you may save the original COS to a floppy using the "Copy Data Objects" utility prior to redefining it.

Keyboard Definition Utility Customization

The Keyboard Definition Utility (KDU) Customization data object redefines the default keyboard table layouts for coax devices. If the keyboard tables are not redefined, the standard keyboard table layouts are used. The Keyboard Definition Utility (KDU) is available from the Customization Data Menu in Central Control Mode. Information about naming and managing this object are detailed in the list below:

*   **Data Object Canonical Name** - The KDU data object canonical name is built using the Data Object Name assigned when saving the KDU data object. It has the following format:

    MCUST.1174.NA.NA.NA.KDU.dobjname - We recommend you use a meaningful data object name, especially for networks in which multiple versions of the KDU data object will be used.

- **Data Object Source** - This data object is defined and saved on the System disk using the Keyboard Definition Utility.

- **Data Object Destination** - The destination of the KDU data object is a System disk at the receiving node.

- **Distributing the Data Object** - Use the following steps to distribute the KDU data object to other LINCS nodes:

  1. Use the "Display/Update Keyboard Definition utility to define a KDU data object, and save it to the System disk. Identify the data object by assigning a unique data object ID.

  2. Build a NetView DM transmission plan to distribute the KDU data object to the desired Network nodes.

  3. If any Network nodes require a different KDU, redefine the KDU at the Central Site and build a NetView DM transmission plan to distribute the modified KDU to the desired Network nodes. If desired, you may save the original KDU to a floppy using the "Copy Data Objects" utility prior to redefining it.

ASCII Definition Utility Customization

The ASCII Definition Utility (ADU) Customization data object is used to modify the default keyboard and translate table layouts for ASCII devices and ASCII host sessions. The ADU is available from the Customization Data Menu in Central Control Mode. Information about naming and managing this object are detailed in the list below:

- **Data Object Canonical Name** - The ADU data object canonical name is built based on the Data Object Name assigned when saving the ADU data object. It has the following format:

  MCUST.1174.NA.NA.NA.ADU.dobjname - It is recommended that a meaningful data object name be defined, especially for networks in which multiple versions of the ADU data object will be used.

- Data Object Source - This data object is defined and saved on system disk using the ASCII Definition Utility.

- Data Object Destination - The destination of the ADU data object is a System disk at the receiving node.

- Distributing the Data Object - Use the following steps to distribute the ADU data object to other LINCS nodes.

  1. Use the "Display/Update ASCII Definition utility to define an ADU data object and save it to the System disk. Identify the data object by assigning a unique data object ID.

  2. Build a NetView DM transmission plan to distribute the ADU data object to the desired Network nodes.

  3. If any Network nodes require a different ADU, redefine the ADU at the Central Site and build a NetView DM transmission plan to distribute the modified ADU to the desired Network nodes. If desired, you may save the original ADU to a floppy using the "Copy Data Objects" utility prior to redefining it.

Translate Table Utility Customization

The Translate Table Utility (TTU) Customization data object is used to modify the translate tables for 3270 host sessions. The Translate Table utility is available on the Customization

Data Menu in Central Control Mode. Information about naming and managing this object are detailed in the list below:

- **Data Object Canonical Name** - The TTU data object canonical name is based on the Data Object Name assigned when saving the TTU data object. It has the following format:

   MCUST.9300.NA.NA.NA.TTU.dobjname - We recommend that you use a meaningful data object name, especially for networks in which multiple versions of the TTU data object will be used.

- **Data Object Source** - This data object is defined and saved using the Translate Table utility.

- **Data Object Destination** - The destination of the TTU data object is a System disk at the receiving node.

- **Distributing the Data Object** - Use the following steps to distribute the TTU data object to other LINCS nodes:

   1. Use the Display/Update Translate Table utility to define a TTU data object and save it to the System disk. Identify the data object by assigning a unique data object ID.

   2. Build a NetView DM transmission plan to distribute the TTU data object to the desired Network nodes.

   3. If any Network nodes require a different TTU, redefine the TTU at the Central Site and build a NetView DM transmission plan to distribute the modified TTU to the desired Network nodes. If desired, you may save the original TTU to a floppy using the Copy Data Objects utility prior to redefining it.

Record Playback Customization

The Record Playback (RPB) Customization data object records common key sequences. Function keys can then be used to playback these sequences. Information about naming and managing this object are detailed in the list below:

- **Data Object Canonical Name** - The RPB data object canonical name is based on the "RPQ Sequences ID" assigned when saving global playback sequences. It has the following format:

   MCUST.9300.NA.NA.NA.RPB.dobjname

- **Data Object Source** - This data object is defined and stored on the Record Playback disk using the Display/Update Playback Sequences, which is on the Customization Data Menu in Central Control Mode.

- **Data Object Destination** - The destination of the RPB data object is an RPB disk at the receiving node.

- **Distributing the Data Object** - Use the following steps to distribute global key sequences to other LINCS nodes:

   1. Record the desired key sequences as described in the section titled Record Playback.

   2. Use the Display/Update Playback Sequences utility in Central Control Mode to save the sequences to the RPB disk.

   3. Build a NetView DM transmission plan to distribute the RPB data object to the desired Network nodes.

Vital Product Data Customization

The VPD Customization Data object contains user-defined node and port Vital Product Data. The information which is defined is used to build a Product Set Identification which is transmitted to a 3270 host upon request. Information about naming and managing this object are detailed in the list below:

- **Data Object Canonical Name** - The VPD data object canonical name is built using the VPD ID defined using the Vital Product Data utilities in Central Control mode. The canonical name has the following format:

    MCUST.1174.NA.NA.NA.VPD.dobjname

- **Data Object Source** - This data object is defined and stored on the System disk using the Display/Update LINCS VPD and/or the Display/Update Port VPD utilities, which are on the Vital Product Data Menu in Central Control mode.

- **Data Object Destination** - The destination of the VPD data object is a System disk at the receiving node.

- **Distributing the Data Object** - It usually is not necessary to distribute the VPD data object, since the information in the data object is specific to the location of the LINCS node and it's devices. If you wish to control this type of information at a Central Site, then you can distribute the VPD data object(s) as follows:

    1. Use the Display/Update LINCS VPD and or the Display/Update Port VPD utilities to define Vital Product data for a LINCS node and it's attached devices.

    2. Build a NetView DM transmission plan to distribute the VPD data object to a Network Site.

    3. If distributing VPD data to more than one site, copy the VPD data object to a floppy (for backup purposes) and repeat steps 1 and 2 as many times as necessary to define the VPD for all Network sites.

Windowing Customization

The Windowing (WIN) data object contains data that defines windowing profiles. For more details, refer to the section titled Windowing. Also, refer to the Display/Update Windowing Setup utility, which is on the Customization Data Menu in Central Control mode. Information about naming and managing this object are detailed in the list below:

Data Object Canonical Name - The Windowing data object canonical name is based on the Windowing ID defined using the Windowing Setup utility in Central Control mode. It has the following format:

    MCUST.1174.NA.NA.NA.WIN.dobjname

- **Data Object Source** - This data object is defined using Work Station Control mode to define and save windowing profiles for your port. An authorized user may then use the Windowing Setup utility to create System Profiles. The windowing data is saved to the System disk.

- **Data Object Destination** - The destination of the WIN data object the a System disk at the receiving node.

- **Distributing the Data Object** - The windowing data object may be distributed if you wish to create and maintain the profiles for all users locally. This would make sense if most of

your sites use common screen formats. You could create System Profiles and distribute them to the desired network sites. Use the following steps to distribute the WIN data object:

1. Use Work Station Control Mode to create the desired windowing profiles for your port.

2. Use the Windowing Setup Utility in Central Control Mode to copy the desired user profiles to system profiles.

3. Build a NetView DM transmission plan to distribute the WIN data object to the desired Network Sites.

Canonical Name Summary Table

The following table shows the canonical names supported by LINCS. The tokens in uppercase must appear as shown. Lowercase tokens may vary.

NetView DM and CSCM allow the usage of partial canonical names. This means that certain tokens may be replaced by an asterisk and further qualified in the MATCHIND (matching indicators) parameter when defining NetView DM functions. Tokens which may be defined by MATCHIND are shown in brackets.

The "NetView DM Overview" section describes the NetView DM functions for which partial naming is valid.

Data Object Canonical Names Supported by LINCS

TOKEN	1	2	3	4	5	6	7	8
	MCODE	9300	[NA]	[FUNCTEC]	[rlvl]	SYSTEM		
	MCODE	9300	[NA]	[MAINTEC]	[rlvl]	SYSTEM	[il]	
	MCODE	9300	[NA]	[FUNCTEC]	[rlvl]	DSL	nnnn	
	MCODE	9300	[NA]	[FEATURE]	[rlvl]	DSL	nnnn	[rpqnumbr]
	MCUST	9300	[NA]	[netid]	[luname]	CFG	[libmname]	[vernum]
	MCUST	9300	[NA]	[netid]	[luname]	CFG	[LOCALCHG]	[il]
	MCUST	9300	[NA]	[NA]	[NA]	KDU	[dobjname]	
	MCUST	9300	[NA]	[NA]	[NA]	ADU	[dobjname]	
	MCUST	9300	[NA]	[NA]	[NA]	WIN	[dobjname]	
	MCUST	9300	[NA]	[NA]	[NA]	VPD	[dobjname]	
	MCUST	9300	[NA]	[NA]	[NA]	RPB	[dobjname]	
	MCUST	9300	[NA]	[NA]	[NA]	COS	[dobjname]	
	MCUST	9300	[NA]	[NA]	[NA]	TTU	[dobjname]	

LEGEND:

dobjname   Data object name defined during customization

il4   digit integration level

luname   defined in configuration

libmname   library member name

netid	network ID defined in configuration
nnnn	DSL device type (for example, 1192)
rlvl	5-character release level (for example, C0300)
rpqnumbr	8-character RPQ number
vernum	version number given library member

Data Object States

A data object can be in one of four possible states:

1.   Sent
2.   On-Trial
3.   Production (either removable or nonremovable)
4.   Back-Level

Each state is described below. Refer to the NetView DM Overview section for an explanation of the NetView DM functions mentioned here.

*   **Sent** - This state is entered when a data object is sent using the NetView DM SEND function, or when using the INSTALL function with SEND = yes (in which case the object would only be in the Sent state until the INSTALL function completed).

    Data objects in the Sent state cannot be accessed by LINCS for an electronic ACTIVATE function or a manual IML.

*   **On-Trial** - This state is entered when a data object is INSTALLED with ACTUSE = trial.

    Data objects in the On-Trial state can be accessed for an electronic ACTIVATE function or a manual IML.

*   **Production** - This state is entered in one of three ways:

    *   A data object enters the Production state when INSTALLED with ACTUSE = production.

    *   When a Production level data object is removed, the corresponding Back-Level data object (if present) is put into the Production state.

    *   If a data object is defined using a customization utility instead of NetView DM, the data object will be installed in Production.

    Data objects in the Production state may be removable or not, depending upon the setting of the REMOVABILITY parameter when the INSTALL function is performed. If REMOVABILITY = yes, the original Production level data object is moved to the Back-Level state. If REMOVABILITY = no, the original Production level data object is deleted and no Back-Level copy of the data object exists.

*   **Back-Level** - This state is entered when a new data object is INSTALLED with REMOVABILITY = yes and ACTUSE = production. The new data object enters the Production state and the original data object enters the Back-Level state.

A maximum of two states of the same data object type can exist on disk at any point in time. The NetView DM functions can be used to REMOVE or DELETE existing data objects so that new data objects may be INSTALLED.

NetView DM Overview

The electronic distribution of LINCS Microcode and Customization data objects must be initiated and controlled from NetView DM. NetView DM, Version 1, Release 2 or higher, is an IBM licensed program product that helps manage and control the distribution of software, microcode, and data in an SNA network.

Retrieving data from and distributing data to LINCS in a network is accomplished by building NetView DM transmission plans to retrieve, send, and install data objects. Once retrieved, the data objects are stored in the NetView DM resource repository. The repository is used to maintain multiple versions of a data object. It is recommended that the most recent version of all data objects be stored at the Central Site LINCS node, and that earlier versions be maintained in the resource repository.

NetView DM transmission plans contain the details for distributing a data object. They identify the data object canonical name as well as the source and destination for the data object. As plans are executed, NetView DM collects completion data, and then logs the status of plan completion by function.

The following NetView DM functions are supported by LINCS: NetView DM Functions,

- Retrieve Microcode
- Send Microcode
- Delete Microcode
- Install Microcode
- Remove Microcode
- Accept Microcode
- Activate Node

These functions are described in the following sections.

Retrieve Microcode

The RETRIEVE function is used to request a LINCS node (Central Site or Network Site) to return a copy of the requested data object(s) to the host application for storage in the NetView DM resource repository. The data object must exist in the repository before it can be SENT to the Network Site LINCS nodes.

To retrieve a data object from the Central Site Library disk, it must have a canonical name associated with it. Library members that are not configured for CSCM will not have canonical names associated with them, therefore these members cannot be accessed by NetView DM.

The MATCHIND Data object retrieving, parameter available with the RETRIEVE function is used to further define tokens which may have been replaced by an asterisk in the canonical name of the data object to retrieve. Options which may be selected are:

- H Select highest.
- L Select lowest.

Refer to the Canonical Name Summary Table to see which tokens may be replaced.

Send Microcode

The SEND function is used to distribute one or more data objects from the NetView DM resource repository to one or more LINCS nodes in the network. The receiving LINCS node may be a Central Site or Network Site controller.

When sending and installing a single data object, an INSTALL function with SEND = yes would normally be used to accomplish both the SEND and INSTALL functions in one step. The SEND function is used when multiple data objects need to be sent prior to installation. For example, when installing a new FUNCTEC level of System microcode and CFG data object, the CFG data objects may be sent using SEND prior to installing the System data object.

The MATCHIND parameter is available with the SEND MICROCODE function to further define tokens which may have been replaced by an asterisk in the canonical name of the data object to send. NetView DM will locate the data object to send by searching for the one which most closely matches the canonical name specified.

It is important to remember that only two states of a given data object can be present on disk at the same time. For this reason, the following optional parameters may be used with the SEND function:

* **DESTRUCTION** This parameter specifies whether or not a previously sent data object of the same type will be deleted. Only data objects in the Sent state may be deleted using this parameter. The name of the data object to delete will be specified in the DELNAME parameter.

* **DELNAME** This parameter is used when the DESTRUCTION parameter is set to "allowed." It specifies the canonical name of the data object to be deleted.

* **DELMATCHIND** This parameter specifies a list of matching indicators to further define tokens which may have been replaced by an asterisk in the canonical name of the data object to delete. It is only valid when DESTRUCTION = allowed.

If the distribution is successful, the data object is in the Sent state at the receiving LINCS node.

Delete Microcode

The DELETE function is used to delete data objects that are no longer required, or that must be deleted to allow updated data objects to be sent.

The MATCHIND parameter is available with the DELETE MICROCODE function to further define tokens which may have been replaced by an asterisk in the canonical name of the data object to delete. Care should be taken when using partial naming with the DELETE function. If used carelessly, the incorrect data object could be deleted.

Any data object that is in the Sent state can be deleted (that is, the data object has not been installed). In addition, non critical data objects may be deleted when they are in the Production Non-Removable state. The only LINCS data object that is critical is the system microcode. All others may be deleted if desired.

The DELETE function cannot be used to delete data objects in the On-Trial, Production Removable and Back-Level states. To delete On-Trial and Production Removably data objects,

the REMOVE function must be used. Back-Level data objects are only deleted when the ACCEPT function is used on the corresponding Production level data object.

Install Microcode

The INSTALL function must be executed before a LINCS node can access data objects that have been sent. If the data object has not yet been sent, the INSTALL function can be specified with SEND = yes. After a successful INSTALL operation, a data object will end up in one of the following states:

- Installed in Production Removably
- Installed in Production Non-Removably
- Installed On-Trial

The following parameters are available with the INSTALL function. The setting of these parameters determines the resulting state of new and original data objects. INSTALL function parameters:

- SEND - Answering yes or no to this parameter determines whether or not the data object should be sent prior to being installed.

- MATCHIND - This parameter is valid only when SEND = yes. It is used to further define tokens which were replaced by asterisks in the data object canonical name. Refer to the Canonical Name Summary Table to see which tokens may be replaced.

- REMOVABILITY - This specifies whether or not the data object that is being installed can be removed with the REMOVE function. The states of the new and original data objects are determined based on this parameter in conjunction with the ACTUSE parameter as follows:

  - If REMOVABILITY = no, then ACTUSE must be production. The new data object will be installed in Production Non-Removably and the original data object will be deleted.

  - If REMOVABILITY = yes and ACTUSE = trial, the new data object will be in the On-Trial state and the state of the original data object will be unaffected.

  - If REMOVABILITY = yes and ACTUSE = production, the new data object will be installed in Production Removably and the original data object will be put in the Back-Level state.

- AUTOREMOVAL – This specifies whether or not the data object should be removed automatically if the installation fails.

- PRETEST - This parameter specifies whether a data object should be tested prior to installation. If PRETEST = yes, LINCS will verify that the data object is compatible with other data objects and hardware installed at the site.

- AUTOACCEPT - Answering yes to this parameter instructs LINCS to automatically ACCEPT the data object if the installation is successful. The original Production level data object will be removed, and the new data object will be put into the installed in Production Non-Removably state.

  Using this parameter eliminates the need to use a separate ACCEPT function.

- COREQUISITES - This parameter specifies a group of data objects that should be installed as corequisites of the data object specified in the INSTALL function. It is assumed that the other data objects were previously sent using the SEND function.

A common use of the INSTALL with COREQUISITES would be to install a new level of the System Microcode data object with the CFG data object specified as a COREQUISITE. The CFG data object should be sent to the site using the SEND function prior to specifying it as a COREQUISITE.

- ACTUSE - This parameter specifies which type of activation (IML from Trial or Production) may access the installed data object. It may be specified as ACTUSE = trial or ACTUSE = production.

- DESTRUCTION – This parameter specifies whether or not the original data object may be erased if the receiving LINCS node does not have enough disk space to receive the new data object and keep a copy of the original data object. This parameter is valid only when SEND = yes.

- DELNAME – This parameter specifies the canonical name of the data object to be deleted if DESTRUCTION = allowed.

- DELMATCHIND – This parameter is valid only if DESTRUCTION = allowed. It is used to further define tokens which were replaced by asterisks in canonical name of the data object to delete. Refer to the Canonical Name Summary Table to see which tokens may be replaced.

Remove Microcode

The REMOVE function is used to remove one or more data objects installed in Production Removably or On-Trial. The corresponding Back-Level data object (if present) is changed to the Production Non-Removably state.

If a data object has corequisite data object(s), the REMOVE function causes that data object and its corequisites to be removed.

Partial naming is not allowed on the REMOVE function.

Accept Microcode

The ACCEPT function is used to move a data object from the Production Removably state to the Production Non-Removably state. The Back-Level data object will be erased if the ACCEPT is successful.

If the data object was originally installed with corequisite data objects, the ACCEPT function will change the corequisites to the Production Non-Removably state as well.

Partial naming is not allowed on the ACCEPT function.

Activate Node

The ACTIVATE function is used to electronically IML a LINCS node. Data objects installed On-Trial will be used for the IML if they exist; otherwise, Production level data objects will be used.

An optional parameter with the ACTIVATE function specifies whether or not the activation will occur if host sessions are active. Setting FORCE = yes will cause an IML to occur regardless of whether or not sessions are active. Setting FORCE = no will cause the ACTIVATE to fail if any session on any host circuit is active.

Media Management Considerations for CSCM Functions

Drive Search Order

The drive search order for all CSCM functions will be as follows:

1. Hard drive C
2. Hard drive D
3. Diskette drive A
4. Diskette drive B

This search order is unaffected by any drive choices made during the IML process.

When searching for a particular logical disk, such as when trying to find a place to store a data object being received because of a SEND function, the first logical disk of the correct type encountered will be used. However, when searching for a data object (for example, during a RETRIEVE function), the search will continue until either the data object is found or all logical disks capable of containing the data object have been searched.

TCP/IP Management

The following sections discuss management features LINCS offers for connections using TCP/IP.

SMS

The Session Management System (SMS) is a load balancing feature used in conjunction with the TN3270 server and TELNET server features. Using DNS, it provides TELNET and TN3270 clients a way to evenly load LINCS' and system resources.

SNMP

The Simple Network Management Protocol (SNMP) helps network managers locate, identify, and isolate problems in a TCP/IP Internet. There are two parts to implementing SNMP- the network management stations, which perform the SNMP client function, and the network elements, which perform the SNMP agent function. The SNMP client executes management applications that monitor and control the SNMP agent(s). The LINCS implementation provides the SNMP agent function.

The current network management framework for TCP/IP-based internetworks consists of:

- Structure and Identification of Management Information (SMI) for TCP/IP-based Internetworks, which describes how managed objects contained in the MIB are defined.

- Management Information Base (MIB) for Network Management of TCP/IP-based Internetworks, which describes the managed objects contained in the MIB.

- Simple Network Management Protocol (SNMP), which defines the protocol used to manage these objects.

Several changes have been introduced to the MIB structure, resulting in the MIB II definition. Both MIB versions are supported on a LINCS node.

Network elements (the SNMP agent) may inform the network management station (the SNMP client) of asynchronous events (such as a link going down or coming up) that occur by issuing a "trap".

MIB Support

LINCS supports the following MIB object groups:

- System
- Interfaces - includes the CHP, SCC, HSC, ETH, and TRC boards
- Address Translation (AT)
- Internet Protocol (IP)
- Internal Control Message Protocol (ICMP)
- Transmission Control Protocol (TCP)
- User Datagram Protocol (UDP)

LINCS does not support the following MIB object groups:

- Transmission
- Exterior Gateway Protocol (EGP)

There are three methods for MIB implementations. First there are single stack, single interface data bases. Second there are single stack, multiple interface methods used by TCP/IP hosts that accept traffic from multiple segments of the same network. Third there are multiple interface, multiple stack methods used by most router type boxes. The method used by the LINCS platform is most similar to the router implementation. To some SNMP managers with automatic discovery, a two-interface machine may appear as 2 two-interface machines. System administrators should take this into account when designing a network topology that includes a LINCS device with two TCP/IP interfaces on the same network.

LINCS provides support from a single interface MIB to a machine specific, multiple interface MIB. The MIB II will include all other interfaces installed in the machine. In addition, the LINCS provides SNMP agents that contain no enterprise or private MIBs. SNMP MIB II support on a LINCS device is available if TCP/IP is configured on at least one line. Trap support is enabled if the SNMP Trap IP Address is configured for at least one line.

The MIB II feature provides machine-wide SNMP support for all interfaces in a LINCS platform. No configuration information will be required, however it should be noted that only one interface is necessary to support an IP trap address, because traps will now be sent for machine-wide events.

SNMP Traps

The following SNMP traps (asynchronous) are supported:

- **authentication** - Authentication traps will be sent when an SNMP manager fails to utilize appropriate authentication for community names. An authentication trap will be sent from the board that detected the failure if an IP trap address is configured on that board, otherwise no trap will be sent.
- **cold start** - ColdStart traps will be sent at completion of IML. One coldStart trap will be sent from each board with a Trap IP address configured.

- **link down** - LinkDown traps will be sent following a link activity transition to inactive. A linkDown trap will be sent from each board with a Trap IP address configured. The following outlines what are considered as link inactive transitions:

Board	linkDown transition
CHP	when the channel interface transitions from online to offline *
SCC	when DSR transitions from active to inactive
HSC	when DSR transitions from active to inactive
ETH	when the adapter transitions from open to closed
TRC	when the adapter transitions from open to closed

* Channel transitions to offline include a system reset or taking the channel physically offline. Once one event has occurred a second event will not generate a trap unless the channel has gone online in between.

- **link up** - LinkUp traps will be sent following a link activity transition to active. A linkUp trap will be sent from each board with a Trap IP address configured. The following table outlines what are considered as link active transitions:

Board	linkUp transition
CHP	when the channel interface transitions from offline to online *
SCC	when DSR transitions from inactive to active
HSC	when DSR transitions from inactive to active
ETH	when the adapter transitions from closed to open
TRC	when the adapter transitions from closed to open

* Channel transitions to online represent receiving a valid channel command following an offline event

Configuration and Management

There are configuration strings required for system identification and parameters required for authentication and trap reporting. These configurations are based on both a controller basis and on a board basis. The strings are defined on the SNMP Options panel and the TCP/IP line options panel.

FTP Server

LINCS provides the FTP Server function as a means to provide microcode and customization management. The FTP Server is available through any LAN line configured for TCP/IP or through the HSC card if configured for IP over Frame Relay and may be accessed using any RFC 959 compliant FTP client. It is even possible to make use of a Limited Access Telnet disk to provide the necessary TCP/IP addressing information to LINCS. Note, some clients may require that you specify the server's operating system type. If so, select UNIX.

Features supported as of LINCS release (4.1) include:

- Replacing System files
- Creating a "backup" copy of the System files

- Restoring a previously backed up copy of the System files
- Retrieving a Dump disk
- Retrieving a configuration from a LINCS platform
- Sending a new configuration to a LINCS platform
- Distribution of 1683 microcode
- IML the LINCS platform

In the current release of the FTP Server feature, LINCS does not support a directory service similar to DOS, so it is necessary to logon with various names to access different subdirectories. The following user names may be used when logging on.

- SYSTEM - allows access system microcode directory.
- MERGE - allows user to store new microcode for microcode upgrade.
- DUMP - allows user to retrieve DUMP disks files.
- BACKUP - allows user to access microcode backup directory.
- RPB - provides access to the Record/Playback directory
- 1683 - allows access to the 1683 microcode distribution directory.

For logging onto the FTP Server feature, it is advisable that a password be used for the sake of security. The password used for all directories except the 1683 directory is the LINCS supervisor password configured on the General Options panel. If no supervisor password is configured, then any string will be accepted.

The password used to access the 1683 directory is 1683.

In early versions of LINCS 4.0, logon names and passwords must be given in upper case, which is no longer necessary.

A list of FTP commands that LINCS supports can be obtained by submitting a request for help to the server. This can be requested by using the FTP "quote" command ("quote help"). Following is a list of commands that LINCS does and does not support.

Access Control Commands

- USER - User Name is supported.
- PASS - Password is supported.
- ACCT - Account is not implemented.
- CWD - Change working directory does not allow access.
- CDUP - Change to parent directory does not allow access.
- SMNT - Structure Mount is not implemented.
- REIN - Reinitialize is supported.
- QUIT - Logout is supported.

Transfer Parameter Commands

- PORT - Data Port is supported.
- PASV - Passive is supported.
- TYPE - Representation Type is supported with the following parameters.

- A - ASCII non-print
- E - EBCDIC is not supported
- I - Image is supported
- L - local byte size is not supported
- STRU - File Structure is supported. File Structure types as supported as follows.
- F - File structure is supported
- R - Record structure is not supported
- P - Page structure is not supported.
- MODE - Transfer mode is supported. The mode parameters is supported as follows.
- S - Stream is supported.
- B - is not supported.
- C - Compressed is not supported.
- FTP Service Commands
- RETR- Retrieve is supported.
- STOR - Store is supported.
- STOU - Store unique does not allow access.
- APPE - Append does not allow access.
- ALLOC - Allocate is not supported.
- REST- Restart is not supported.
- RNFR - Rename from does not allow access.
- RNTO - Rename to does not allow access.
- ABOR - Abort is supported.
- DELE - Delete is supported.
- RMD - Remove Directory does not allow access.
- MKD - Make Directory does not allow access.
- PWD - Print working directory is supported.
- LIST - Directory Listing is supported.
- NLST - Directory file list is supported.
- SITE - System Service command is supported. The parameters supported are as follows.
- MERGE - copies system microcode data object to system directory.
- BACKUPSYS copies all system files on the system directory to backup directory.
- RESTORESYS copies all file on backup directory to system directory.
- IML forces LINCS to perform an IML. A response of Command OK is sent back to client prior to the actual IML.
- SYST - System type is supported.
- STAT - Status is supported.
- HELP - Help is supported.
- NOOP - No operation is supported.

Two methods can be used to upgrade the microcode level of LINCS. One method is to copy LINCS microcode from an existing machine onto your FTP client, then distribute it to another LINCS platform. A second method is to load microcode directly onto your FTP client, then distribute it to another LINCS platform. In each case it is recommended that you upgrade from a lower microcode level to a higher level.

Before copying the new files to LINCS it is recommended that you use the backup instruction for making a backup copy of your current LINCS configuration, just in case you have a problem resulting in an incomplete transfer.

LINCS Backup Procedure

To backup all system microcode and configuration files do the following steps

1. Use your FTP client to connect and logon to the LINCS FTP server using the "BACKUP" user name and the supervisor password.

2. Issue the FTP client's SITE command with the parameter "BACKUPSYS" in order to copy the system files to the backup directory. This command will take approximately three minutes to complete. Take notice if the command completed successfully (response of: "command ok"). From a Windows 95 FTP client, the command is "quote site backupsys".

3. Quit and disconnect from the FTP server.

Transferring New Microcode to LINCS

1. Create a new subdirectory on your FTP client's hard drive, and copy the 3 System disks into this directory (System 1, System 2, and System 3 disks). If you obtain them in zipped format, remember to extract the files into your directory. If you copy the zipped files into the directory, you should remove the original zipped files after extraction, before continuing.

2. Use your FTP client to connect and logon to the LINCS FTP server using the "MERGE" user name and the supervisor password.

3. Use the appropriate FTP client command to select "IMAGE" data type, "FILE" file structure and "STREAM" transfer mode. (This usually done by selecting "binary" file transfer.)

4. Use the appropriate FTP client commands to transfer all the files contained in your FTP subdirectory to the current working directory of the LINCS FTP server.

5. If all files were transferred successfully, then issue the FTP client's SITE command with the parameter "MERGE" in order to transfer the microcode from the current directory to the main system directory ("quote site merge"). This command will take approximately two minutes to complete. Take notice if the command completed successfully ("command ok" response).

At this point, if the SITE command completed successfully, the merge process is complete. It is necessary to IML the LINCS platform before the microcode can be put into use. You may choose to IML the LINCS platform using any one of the following methods:

• Issue the Site IML command ("quote site iml") to LINCS.

• Have somebody manually press the IML button on the front of the LINCS platform.

• Using Telnet or some other method, force an IML from Central Control Mode, using the proper utility behind the Supervisor Functions Menu.

Restoring a Previously Backed Up Copy of LINCS

To restore all system microcode and configuration files to what they were prior to a microcode upgrade, do the following steps. Be aware that if you attempt to restore the system and it has not been previously backed up successfully as described above you may destroy the current system microcode and configuration. It should be noted also that the restore procedure will restore LINCS to the existence at the time of the backup, and that any changes made between the original backup of LINCS and the restore will be lost.

1. Use your FTP client to connect and logon to the LINCS FTP server using the "BACKUP" user name and the supervisor password.

2. Issue the FTP client's SITE command with the parameter "RESTORESYS" in order to copy the backup system files to the system directory ("quote site restoresys"). This command will take approximately three minutes to complete. Take notice if the command completed successfully ("command ok").

3. Logoff and disconnect from the FTP server.

11. IP Routing

The LINCS IP Router feature allows a LINCS node to function as an IP router when attached to a TCP/IP internetwork via one or more LAN boards or through a Frame Relay connection. IP routing is supported between all LAN and Frame Relay connections. The LANs can be any combination of Ethernet and/or Token Ring lines.

To enable IP routing, enable IP protocol for the desired LAN/WAN cards in configuration. This will cause a Line Options, TCP/IP Options panel to appear.

You must configure the IP address, IP subnet mask, and enable one of the router options.

You may optionally choose to configure a default router. The default router is where LINCS will forward a packet to, if no other entry in the routing table exists to match the packet to a destination.

You can configure IP Routing in addition to any other feature supported by LINCS. You can configure IP Routing for any LAN/HSC card (except for one that is configured for the IP Channel Bridge feature).

LINCS supports the following types of IP Routing in Release 4.1:
*   Static Routing
*   Static and Dynamic
*   RIP Version 1
*   RIP Version 2
*   Addressing

In order to operate correctly in your network, the IP addressing selected for the LAN cards on the LINCS platform must be suitable. All nodes expected to use the LINCS platform to route traffic for them must be addressed to be on the same subnet as LINCS. It is extremely important that the subnet mask is selected correctly and entered correctly into the LINCS configuration. If a Default Router is configured in the LINCS configuration for the purpose of forwarding packets to (when no other destination is found in the LINCS table), it must also be on the same subnet as the LINCS LAN card's address implies.

Mixed Router Environment

LINCS can be interfaced into a network where routers from other vendors are installed. If the other routers support RIP, you can configure LINCS as a RIP router (version 1 or version 2) and LINCS should update routing tables based on the RIP packets received. If the other routers in the network do not support RIP, and another routing protocol is being used, it may be necessary to enter a static route (to LINCS) into the nearest router's configuration for any routes that can only be reached through the LINCS platform. You will also need to put one or more entries into LINCS' configuration to communicate through the existing network. The simplest entry to add to LINCS would be to define the nearest non-LINCS router as the default router for LINCS to send packets to. Thus any packets received for subnets other than the ones connected to LINCS will be forwarded to the other router for determining the ultimate path to the destination.

You can also put specific entries into LINCS' Static IP Routing panel to inform LINCS of where to forward packets to, when configuring a single default router is not the preferred solution.

Routing over Point-to-Point Lines

It is not necessary to run WAN connections over a real Frame Relay network, in order for LINCS to support IP traffic. LINCS allows you to route over point-to-point lines by configuring a LINCS platform on one end of the link to emulate a Frame Relay switch and the other end of the link as a normal Frame Relay user. LINCS will use Frame Relay as the transport protocol for both IP and SNA traffic. When configured for point-to-point connections, you can use standard modems, and whatever link speed that you have.

When configuring for this scenario, you must match LMI methods and DLCI numbers on both ends of the link.

Configuration and Management

Configuration: The following configuration panels are used to enable IP Routing:

- Line Options - Enable IP protocol on the desired lines. For each line with IP enabled, the next panel to configure is the Line Options - TCP/IP Options panel, where you can define additional parameters for IP on that line.
- Static IP Routing - allows you to define static entries into the routing table.

Resource Requirements: The IP Routing feature of LINCS does not require any additional feature memory or hardware beyond what is in the hardware platform. If you wish to set up a WAN connection for IP Routing, you will need to use the HSC card to provide the synchronous serial connection, and you will need to have the Frame Relay feature activation diskette installed, even if you are configuring a point-to-point line, since LINCS uses the Frame Relay protocol to move IP data over the wide area.

Management: The IP Menu in Central Control Mode is used to gather information and statistics about your IP links. An IP Routing submenu reached through the IP Menu allows you to reset the IP Router if needed, and to view the IP routing tables.

12. Network Computing Terminal Support

LINCS provides support for Network Computing Terminals (NCTs) via direct coax attachment. A feature within LINCS by the name of Coax to Ethernet Bridge provides a means to interface NCTs onto Ethernet networks to access servers, gateways, and the Internet/intranet.

What is a Network Computing Terminal?

A Network Computing Terminal, as defined by MTX is a desktop workstation that combines the best traits of a Network Computer and a Fixed Function Terminal. Among these traits are:

- Solid state design (no moving parts such as disk drives, fans, etc.) providing the ultimate in reliability
- Integrated mainframe terminal emulation (3270 coax, TN3270)
- Integrated ASCII Terminal Emulation (VT220, Wyse 50)
- Integrated AS/400 terminal emulation (TN5250)
- Integrated Internet Browser
- E-Mail Support (pop 3 server client)
- Integrated ICA client (for accessing multi-user Windows NT applications)
- LPR/LPD printing capabilities
- Flash memory upgrade
- Resident IP protocol stack
- Integrated Ethernet interface
- Optional Coax interface
- Integrated operating system

13. IP Channel Bridge

The IP Channel Bridge feature provides a means to pass IP traffic between the channel and one or more LAN interfaces. IP traffic is bridged, other protocols are filtered out.

All protocols that ride on IP are passed between the LAN and the host. The channel and LAN adapters that are used by this feature are the same as those used by other features, but must be dedicated to the IP Channel Bridge feature when configured for it. Other protocols and features will not be allowed on the same cards with the exception of the Coax/Ethernet Bridge feature.

The IP channel feature interfaces to the IP stacks running on the host. These may belong to IBM, Interlink, Connectivity Solutions or possibly some other vendor.

LINCS uses a standard 3088 (CTC) emulation on the host channel.

Up to four LAN adapters can be dedicated to the same channel interface. Any or all of the channel interfaces can be configured to support the IP traffic. No two channel interfaces can be configured to bridge to the same LAN card.

IP Channel Bridge Applications

Prime applications for the IP Channel Bridge feature include:
- Providing data transfers between Unix and mainframe environments.
- Allow FTP file transfers between PC-based clients and the host.
- Support for TN3270 clients to TN3270 Server that runs on the host IP stack
- Provide access to Internet users

Configuration and Management

The IP Channel Bridge feature requires the IP Channel Bridge Feature Activation Disk on the 1174 product line or the IP Channel Bridge personality on the 9300 product line.

All channel and LAN cards used by the IP Channel Bridge feature are dedicated to this feature and are not used for any other LINCS feature, with one exception. One Ethernet card can be configured to support both the IP Channel Bridge feature and the Coax to Ethernet Bridge feature.

No additional memory or processors are required.

Configuration of the IP Channel Bridge feature is accomplished by setting the protocol for the channel to CTC and the protocol of the LAN card to IP Bridge. A pair of gateway circuits are defined to pair the channel interface to the LAN interface.

It is possible to reduce the amount of traffic onto the channel by configuring an ARP filter. The purpose of the ARP filter is to filter out all ARPs that are not directed to the host. You must configure the IP address of the host into this ARP filter to inform LINCS which address to pass. This configuration is on the Gateway Circuits panel.