Critical Release Notice

Publication number: 297-8991-910
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The content of this customer NTP supports the SN08 (DMS) software release.

Bookmarks used in this NTP highlight the changes between the MMP15 baseline and the current release. The bookmarks provided are color-coded to identify release-specific content changes. NTP volumes that do not contain bookmarks indicate that the MMP15 baseline remains unchanged and is valid for the current release.

Bookmark Color Legend

Black: Applies to new or modified content for MMP15 that is valid through the current release.

Red: Applies to new or modified content for ISN04 (TDM) that is valid through the current release.

Blue: Applies to new or modified content for ISN05 (TDM) that is valid through the current release.

Green: Applies to new or modified content for ISN06 (TDM) that is valid through the current release.

Purple: Applies to new or modified content for ISN07 (TDM) that is valid through the current release.

Pink: Applies to new or modified content for ISN08 (TDM) that is valid through the current release.

Attention!
Adobe Acrobat Reader 5.0 or higher is required to view bookmarks in color.

Publication History

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References to Ethernet physical interface NT9X85BA removed by CR Q00949413.

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DMS-100 Family

Ethernet Interface Unit

User Guide

SN06 (DMS) Standard 04.01 September 2003

NORTEL
NORTHERN TELECOM

DMS-100 Family

Ethernet Interface Unit

User Guide

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SN06 (DMS) Standard release 04.01. Corrected load balancing information per CR Q00 425727.

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TELECOM12 Standard 03.01 Updated Chapter 2 and Appendix C in response to Feature 59010371, FTP Extended Functionality.

May 1999

TELECOM09Standard 02.02Implemented design comments.

March 1999

TL09 Standard 02.01 Updated table IPNETWRK with correct datafill Implemented design review comments.

TL08 Standard 02.01 References to file transport access manager (FTAM) deleted.

February 1998

TL07Standard 01.01First standard release of this document.

Contents

List of figures

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About this document

This document is a source of information for the Ethernet interface unit (EIU) product. The document provides the following information:

- hardware description
- protocol descriptions
- datafill requirements
- maintenance
- background information supporting the main chapters

When to use this document

Use this document for understanding the installation of the EIU, and for operating and maintaining the EIU.

How to check the version and issue of this document

The version and issue of the document are indicated by numbers, for example, 01.01.

The first two digits indicate the version. The version number increases each time the document is updated to support a new software release. For example, the first release of a document is 01.01. In the next software release cycle, the first release of the same document is 02.01.

The second two digits indicate the issue. The issue number increases each time the document is revised but rereleased in the same software release cycle. For example, the second release of a document in the same software release cycle is 01.02.

To determine which version of this document applies to the software in your office and how documentation for your product is organized, consult the release information in “Publication history” on page v of this document.

References in this document

The following documents can be consulted for additional information or are referred to in this document:

- *Commands Reference Manual*, 297-1001-822
- *DMS SuperNode DataSPAN Frame Relay Service Maintenance Guide*, 297-5111-501
- *DMS SuperNode SCP II Maintenance Guide*, 297-5131-541
- *Link Interface Unit (LIU7) Memory Calculation*, System Engineering Bulletin SEB 92-01-001
- *Link Interface Unit (LIU7) Memory Calculation for an End Office*, System Engineering Bulletin SEB 92-03-004
- *Link Interface Unit (LIU7) Memory Calculation for an Integrated Node*, System Engineering Bulletin SEB 92-03-005
- *LPP/ELPP/LIU7/DLIU Performance, Throughput, and Capacity*, System Engineering Bulletin SEB 92-12-001
- *DMS-100 Alarm Clearing and Performance Monitoring Procedures*, 297-xxxx-543
- *DMS-100 Card Replacement Procedures*, 297-xxxx-547
- *DMS-100 Log Reports Reference Manual*, 297-xxxx-840
- *DMS-100 Office Parameters Reference Manual*, 297-xxxx-855
- *DMS-100 Operational Measurements Reference Manual*, 297-xxxx-814
- *DMS-100 PM Software Release Document*, 297-8981-599
- *DMS-100 Recovery Procedures*, 297-xxxx-545
- *DMS-100 Routine Maintenance Procedures*, 297-xxxx-546
- *DMS-100 Translations Guide*, 297-xxxx-350
- *DMS-100 Trouble Locating Procedures*, 297-xxxx-544
- *Peripheral Modules Maintenance Guide*, 297-xxxx-592
- *Provisioning Rules for LPP, SSLPP, and SNSE LIS*, System Engineering Bulletin SEB 92-02-001
- *SuperNode Data Manager Simplex User Guide*, 297-5051-900

Internet request for comment documents

The following documents contain information related to Internet Protocol. These documents are available from the Internet Network Information Center servers.

- *An Ethernet Address Resolution Protocol*, RFC826
- *Bootstrap Protocol*, RFC951

- *Clarifications and Extensions for the Bootstrap Protocol*, RFC1542
- *File Transfer Protocol*, RFC959
- *Internet Control Message Protocol*, RCF792
- *Internet Protocol*, RFC791
- *OSPF Version 2*, RFC1583
- *Reverse Address Resolution Protocol*, RFC903
- *Routing Information Protocol*, RFC1058
- *Telnet Protocol Specifications*, RFC495
- *Transmission Control Protocol*, RFC793
- *User Datagram Protocol*, RFC768
- *Using ARP to Implement Transparent Subnet Gateways*, RFC1027

What precautionary messages mean

The types of precautionary messages used in Northern Telecom (Nortel) documents include attention boxes and danger, warning, and caution messages.

An attention box identifies information that is necessary for the proper performance of a procedure or task or the correct interpretation of information or data. Danger, warning, and caution messages indicate possible risks.

Examples of the precautionary messages follow.

ATTENTION Information needed to perform a task

ATTENTION
If the unused DS-3 ports are not deprovisioned before a DS-1/VT Mapper is installed, the DS-1 traffic will not be carried through the DS-1/VT Mapper, even though the DS-1/VT Mapper is properly provisioned.

CAUTION Possibility of service interruption or degradation

CAUTION
Possible loss of service
Before continuing, confirm that you are removing the card from the inactive unit of the peripheral module. Subscriber service will be lost if you remove a card from the active unit.

CAUTION Possibility of equipment damage

CAUTION
Damage to the backplane connector pins
Align the card before seating it, to avoid bending the backplane connector pins. Use light thumb pressure to align the card with the connectors. Next, use the levers on the card to seat the card into the connectors

CAUTION Possibility of static electricity damage

CAUTION
Static electricity damage
Wear a static discharge wrist strap connected to the wrist-strap grounding point of a frame supervisory panel (FSP) or a modular supervisory panel (MSP). This precaution protects the cards against damage caused by static electricity.

DANGER Possibility of personal injury

DANGER
Risk of personal injury
Handle the card by the edges only. Do not touch the components on the card. These components reach very high temperatures, and can burn causing personal injury.

DANGER Possibility of electrocution

DANGER
Risk of electrocution
Do not open the front panel of the inverter unless fuses F1, F2, and F3 have been removed. The inverter contains high voltage lines. Until the fuses are removed, the high voltage lines are active, and you risk being electrocuted.

How commands, parameters, and responses are represented

Commands, parameters, and responses in this document conform to the following conventions.

Input prompt (>)

An input prompt (>) indicates that the information that follows is a command:

```
>BSY
```

Commands and fixed parameters

Commands and fixed parameters that are entered at a MAP terminal are shown in uppercase letters:

```
>BSY  CTRL  ctrl_no
```

Variables

Variables are shown in lowercase letters:

```
>BSY  CTRL  ctrl_no
```

The letters or numbers that the variable represents must be entered. Each variable is explained in a list that follows the command string.

Responses

Responses correspond to the MAP display and are shown in a different typeface:

```
FP 3 Busy CTRL 0: Command request has been submitted.
FP 3 Busy CTRL 0: Command passed.
```

The following excerpt from a procedure shows the command syntax used in this document:

Step	Action

1	Start the FTP tool by typing
	>ftp nnn.nnn.nnn.nnn
	and pressing the Enter key.
	where
	nnn is the portion of the IP address that identifies the node
	Example:
	>ftp 47.187.112.215
	Example of a MAP response:
	`Allocated a Session ID Successfully 220 bcaryfc6 FTP server`
	`(Version $Revision: 1.21 $  $Date: 88/12/21 10:19:25 $) r`

Chapter 1: Introduction to the EIU

This chapter describes the Ethernet interface unit (EIU).

CAUTION
Possible loss of network security
Using the EIU and a telnet or file transfer protocol (FTP) session to establish a maintenance and administration position (MAP) session can introduce a security risk to both the DMS node and its subtending network.

When establishing and operating a MAP session in this way, there is limited security for clear text (user identification and passwords) and for Internet Protocol (IP) addresses for screening. This limited security makes an open local area network (LAN) vulnerable to entry by unauthorized persons.

Nortel recommends that the operating company, as a minimal precaution, integrate intermediate security servers with encryption to avoid unauthorized access to the switch. For alternative approaches, contact your Nortel representative to discuss state-of-the-art secure OA&M data communications equipment products.

By using the EIU, telnet, and FTP software, the operating company assumes any and all risks associated with the implementation and use of this hardware and software.

Topics in the chapter include the following:

- overview of the EIU
- system architecture
- hardware description
- limitations and restrictions
- feature packaging

- EIU provisioning requirements
- billing
- service orders
- user interface characteristics
- logs, alarms, and operational measurements (OM)

Overview of the EIU

The EIU is an application-specific unit (ASU) that supports Ethernet connectivity on the DMS-100 switch. You can configure the EIU as either an IP router or an OSI router. The EIU also supports host services.

The EIU is intended primarily as a high-speed interface that provides connectivity in a co-located environment such as that in a Central Office. However, if the EIU is deployed in a LAN extending beyond the co-located environment, you should observe the limitations and network security notes in the caution above.

The following list summarizes the router and host services that use dedicated EIUs. For general information on ASUs, refer to “Appendix G: ASU background information”.

Note: The following applications may not be available in all product lines or markets. For more information, consult with the specific Product Line Manager or contact Nortel Networks.

- **Automated directory assistance service (ADAS)**. ADAS provides assistance to an operator by automatically prompting subscribers for directory assistance information. ADAS uses the EIU to support messaging between an ADAS OA&M position and the DMS-100 switch.
- **Billing server**. Billing server allows the DMS-100 switch to forward billing and OM information from a DMS file processor (FP) to an external operating company billing processor. The OM data is sent to the downstream processor through a different EIU. The system throttles the billing server traffic at 36 kbyte/sec. Note that this application is only supported on DMS-250 or combinations with DMS-250 and GSM product lines.
- **Automatic file transfer (AFT)**. The AFT application lets the operating company use TCP/IP to transport billing and operational measurement (OM) data from the DMS-250 IOC (input/output controller) disks to the downstream processor over an Ethernet LAN. One EIU can support both billing and OMs. For this application, the recommended number of EIUs is two: one EIU is dedicated to billing data and the other is to OMs.

  AFT is also referred to as Madley AFT. Limited availability.

- **Cellular digital packet data (CDPD)**. The CDPD service transports datagrams between the mobile and private/public data networks.
- **Programmable service node (PSN)**. PSN is a flexible platform that lets operating companies rapidly deploy advanced services into their network. Deployment is achieved through a service control unit (SCU). The SCU is an external computing platform that controls the call processing on the switch using a high-speed data link.
- **Remote management system (RMS)**. RMS provides telnet and file transfer protocol (FTP) functionality to the DMS-250 switch. Telnet is a protocol for remote terminal access.
- **Intelligent Call Manager (ICM)**. ICM provides the protocol support for Computer Telephony Integration applications (for example, Symposium Call Center Server, SSCS) in accessing the DMS via TCP/IP protocols.

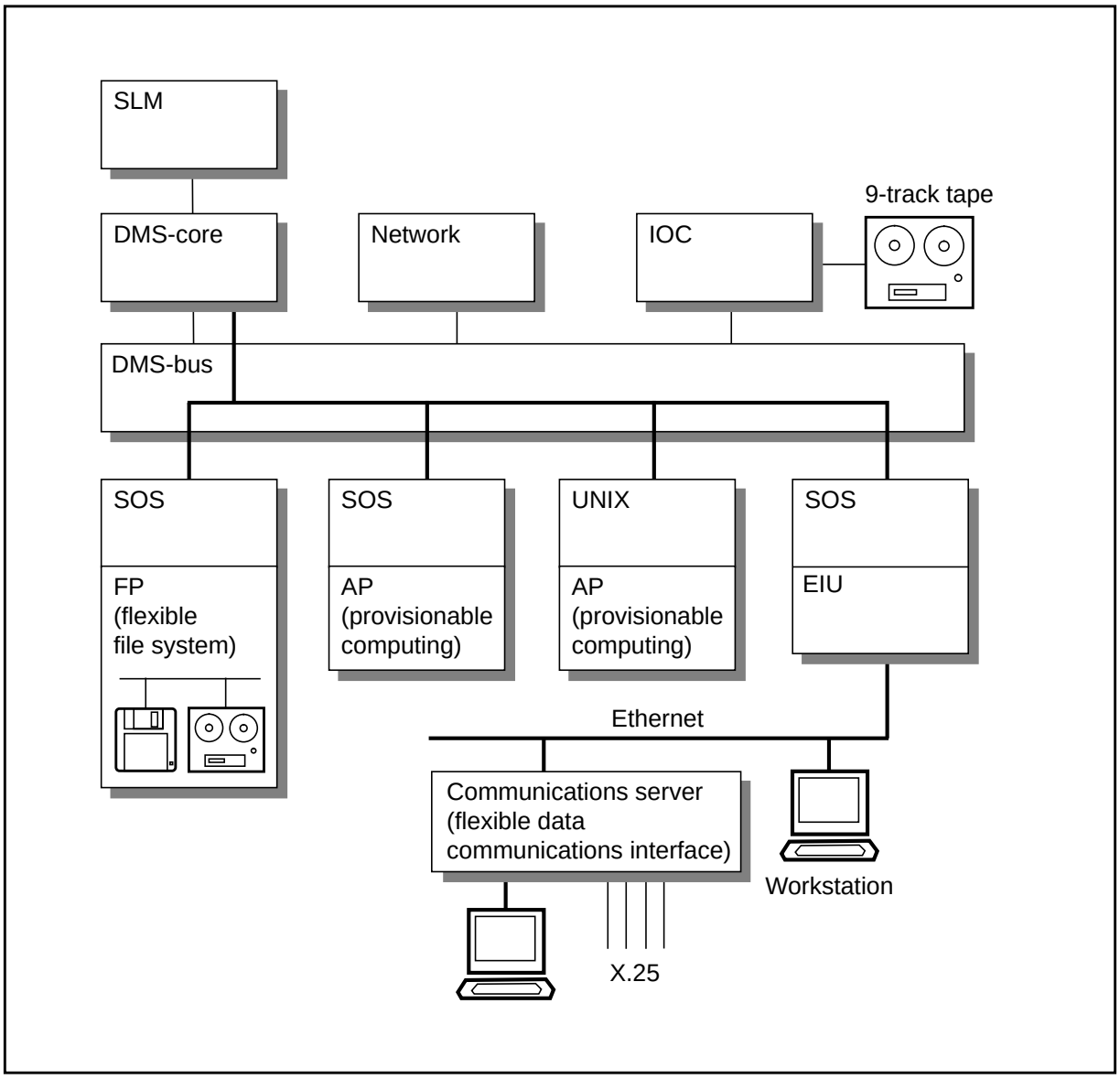
System architecture

The data communications environment supports data links that are not tied to the call processing network functions of the switch. These links do not use the DMS network or line access capabilities. This characteristic is important when supporting OAM links. These links must become functional in the early stages of switch initialization and remain functional through all but catastrophic failures, including call processing failures.

The EIU is a gateway between the DMS-bus and an Ethernet that supports user data links. The EIU is a concentration point between remote peripherals (workstations, terminals, and routers) and the DMS-bus. The remote peripherals are not terminated on the EIU, but on concentrators. These remote peripherals allow the network engineers to connect alternate link levels and asynchronous terminal equipment (MAP terminals, printers, and so on) to the system. The Ethernet also provides a link between the DMS-100 switch and the workstations used for processing.

Figure 1 shows an overview of the architecture of the enhanced SuperNode system.

Figure 1 Overall architecture of enhanced SuperNode system



DMS-bus interface and expansion

Two methods are used to interface processing engines to the DMS-bus. Direct links between the processors and the DMS-bus is the primary method for establishing this connection. A secondary method involves the LPP, which is used to fan out the message switch (MS). By having two methods, the DMS-100 switch has the flexibility for provisioning software functions to processors based on price, performance, and packaging criteria.

The LPP extends the MS fanout within a single cabinet. This fanout is accomplished by using a second-level MS pair to provide switching, and by extending the messaging capability through an extended messaging bus. These

second-level message switches are referred to as local message switches (LMS).

The frame transport bus (F-bus) is a 32-Mbit/s messaging bus that resembles the MS in its protocol. The use of a narrower data path allows access to two buses through a single backplane. This feature lets a single processor card connect to both planes of the LMS and to survive faults on one plane. Links interconnecting planes of the LMSs are provided to allow transparent message rerouting in the case of single faults.

Note: Because the interconnecting F-bus is a wire bus, it is limited to a single cabinet.

Inter-message switch links required with LPP

Inter-message switch links (IML) between the MS planes are also required to improve robustness. For example, two peripherals (such as an applications processor and an EIU) can lose communication with each other if they message through different planes of the MS. In this scenario, assume that one peripheral is messaging through plane 0 only because of a failure. If the second peripheral loses its link to plane 0, the two peripherals cannot communicate even though they can communicate to the DMS-core for maintenance purposes.

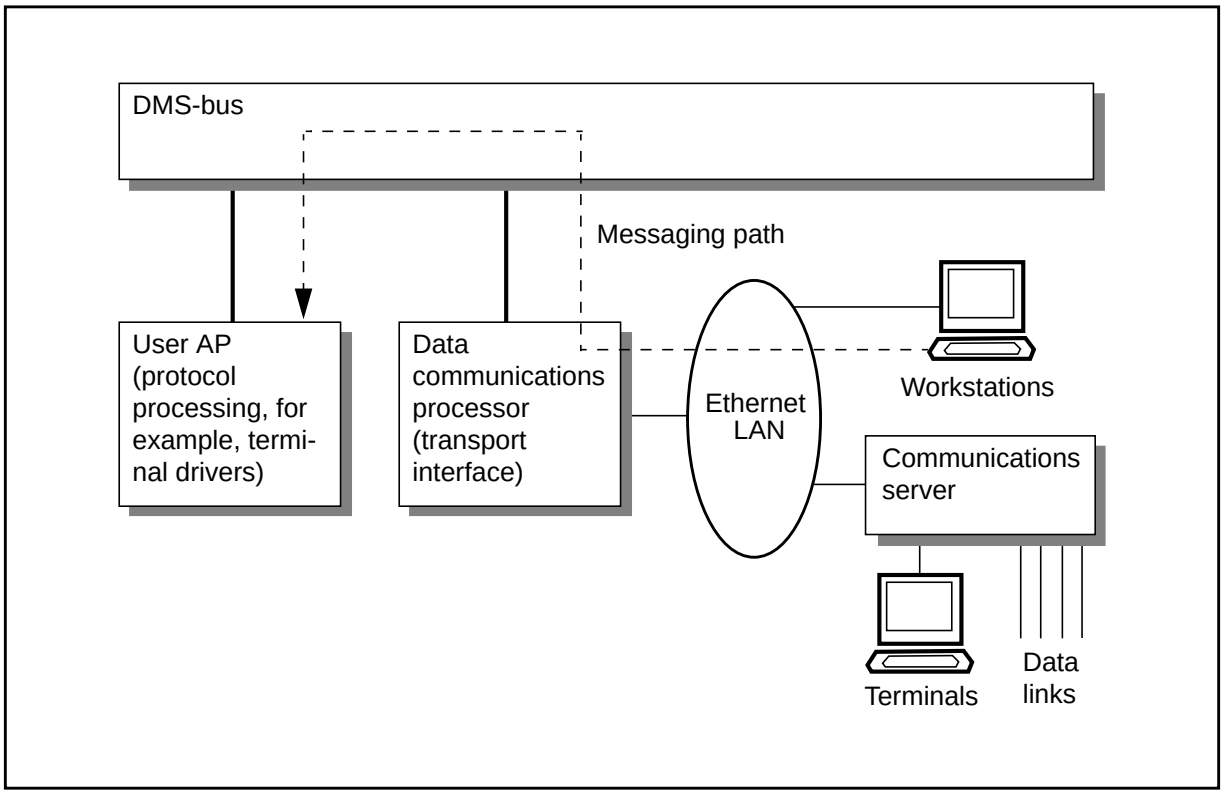
For this reason, there is a pair of IMLs in integrated service node (ISN) switches. These IMLs are DS512 links that operate at 1024 Kbit/s. Other improvements to the MS hardware are also required to conform with the ISN maintenance strategies.

Data communications interface architecture

The overall architecture of the data communications subsystem is based partially on the premise that the processing and the access method for these entities must be separate.

For this reason, application processors (AP) have the intelligence to drive the link protocols. This arrangement allows freedom to change access methods and allows flexibility in satisfying the processing requirements for each protocol. The emphasis is on providing locally attached, nonswitched connections primarily for OAM interfaces. An example of the overall data flow for the data communications environment is shown in figure 2.

Figure 2 Ethernet interface data flow



Given the cost of the SuperNode cabinet infrastructure, providing the standard hard connection interfaces in this mechanical environment is not possible. For this reason, interfaces are placed outside the boundaries of these cabinets. Engineering approaches to LANs also address a similar problem. In LANs, it is not economic to provide all types of data interfaces at each node on the LAN. The communications server provides a range of communications services to all users on the LAN and may be located anywhere on the LAN.

Another major functional requirement that the EIU satisfies is providing connectivity to commercially available workstations for value-added services. This requirement is provided through a standard interconnect media. The majority of these workstations support an Ethernet interface for local area networking. The EIU also supports this protocol.

The EIU supports packet communication into a LAN. The standards for its physical implementation are defined in IEEE 802.3. The EIU supports a 10 Mbit/s base band bus type of LAN for broadcast. The LAN uses a carrier sense multiple access with collision detection (CSMA/CD) method for arbitrating access to the communications channel.

Lastly, the EIU also provides a protocol gateway into the DMS-100 environment.

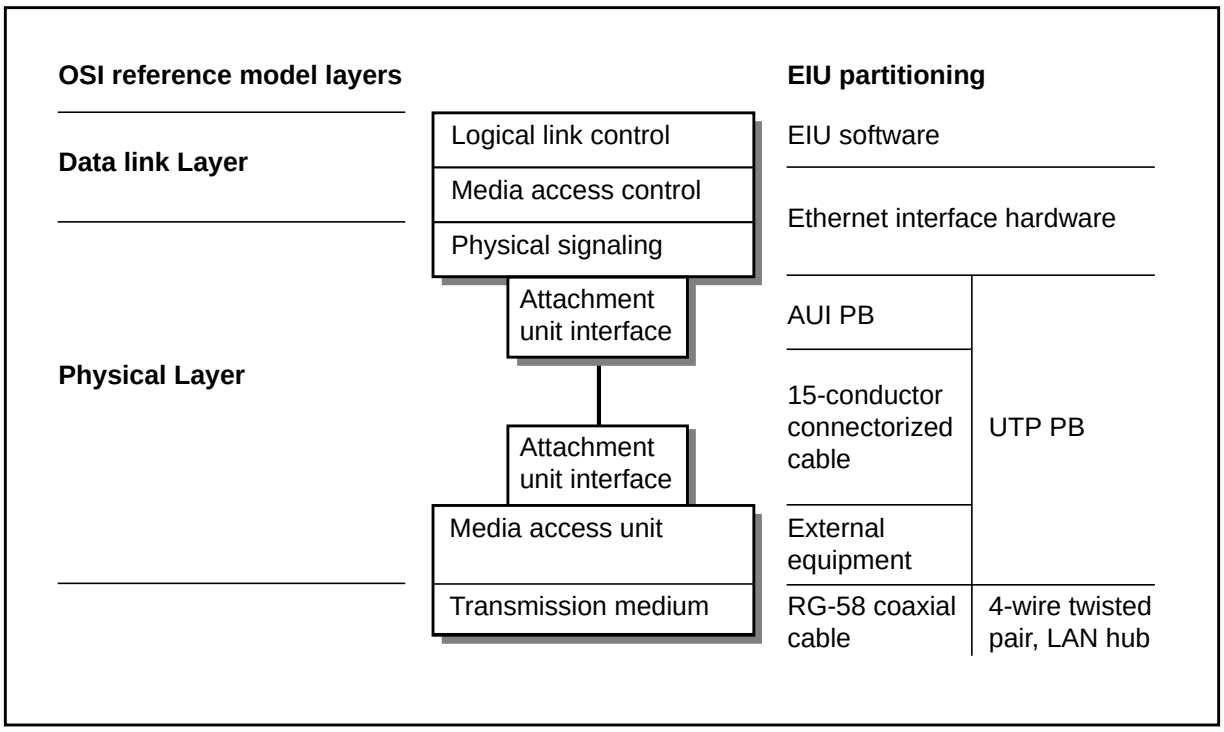
The Ethernet interface takes advantage of commercially supported peripherals and functions. These interface devices are selected and qualified for applications in the DMS-100 switch, with particular attention to hardware compliance, maintainability, and the protocol set provided. The following devices are commercially available:

- LAN repeaters to locally extend the range of the LAN
- LAN gateways to extend the range of the LAN to a metropolitan-area network (MAN) or a wide-area network (WAN)
- asynchronous terminals and printers through communications servers at up to 19.2 Kbit/s
- synchronous data links through communications servers at up to 56 Kbit/s
- IBM mainframe access through channel interconnect units
- workstations (for example, Sun, HP, IBM), Macintoshs, and PCs
- servers

The EIU is a simplex engine. A simplex engine is sufficient for the EIU because the facilities that are connected through the EIU are not critical to the operation of the switch (that is, for call processing). Sets of EIUs may be used with one or more EIUs available as a warm standby spare. The mapping of the EIU architecture to the OSI reference model is shown in figure 3 on page 28.

For more information on EIU sparing, refer to "EIU sparing and redundancy" on page 41.

Figure 3 EIU mapping to lower levels of the OSI communications model



Hardware description

The EIU is based on hardware originally developed for the signaling transfer point (STP). One of the main components of the STP is the LPP, which is a frame that can hold up to 36 two-slot ASUs. An LPP containing an EIU is deployed in a DMS SuperNode switch to establish Ethernet connectivity.

Figure 4 on page 29 shows where the EIU is provisionable on the link interface shelf (LIS). Figure 5 on page 30 shows where the EIU is provisionable on the single-shelf link peripheral processor (SSLPP).

The EIU consists of three cards provisioned in two slots, as shown in figure 4 and figure 5:

- NT9X84AA, Ethernet interface card (EIC). This processor board implements most of the media access control (MAC) layer on a single chip. It has 384 kbyte of high-speed buffer for holding Ethernet packets.
- NT9X85AA, Ethernet interface paddle board (EIP). This paddle board provides the physical link to the local area network (LAN). The paddle board implements an unshielded twisted-pair attachment unit interface (AUI).
- NTEX22BA/BB, Integrated processor and F-bus card (IPF). This processor board contains a Motorola M68020 processor and 8 Mbyte of

RAM. The NTEX22CA provides 32 Mbyte of RAM and higher throughput performance.

NTEX22 also contains a peripheral bus (P-bus) to F-bus interface. The P-bus to F-bus interface connects the processor bus with the frame bus, which in turn is connected to the local message switch (LMS) through the rate adaptor.

The IPF card is a common processor card used by almost all ASUs and runs the Support Operating System (SOS).

Figure 4 Link interface shelf, with 2-slot EIU locations

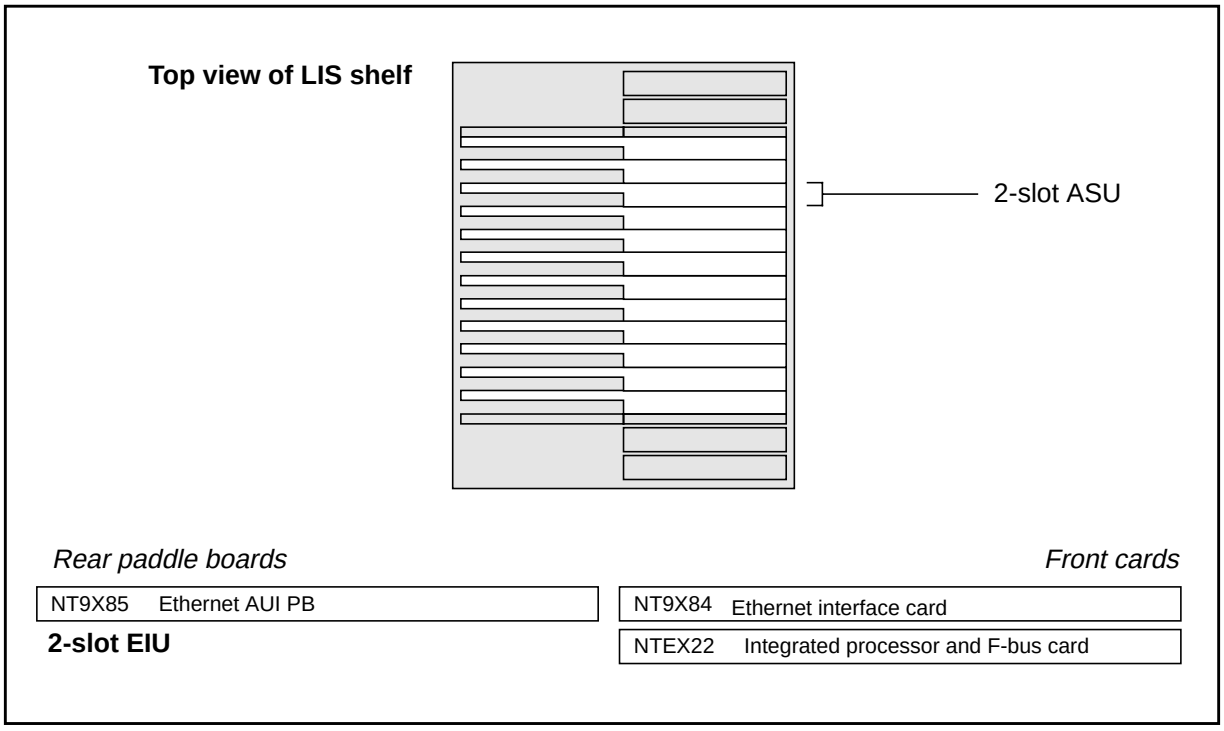


Figure 5 SSLPP, with 2-slot EIU locations

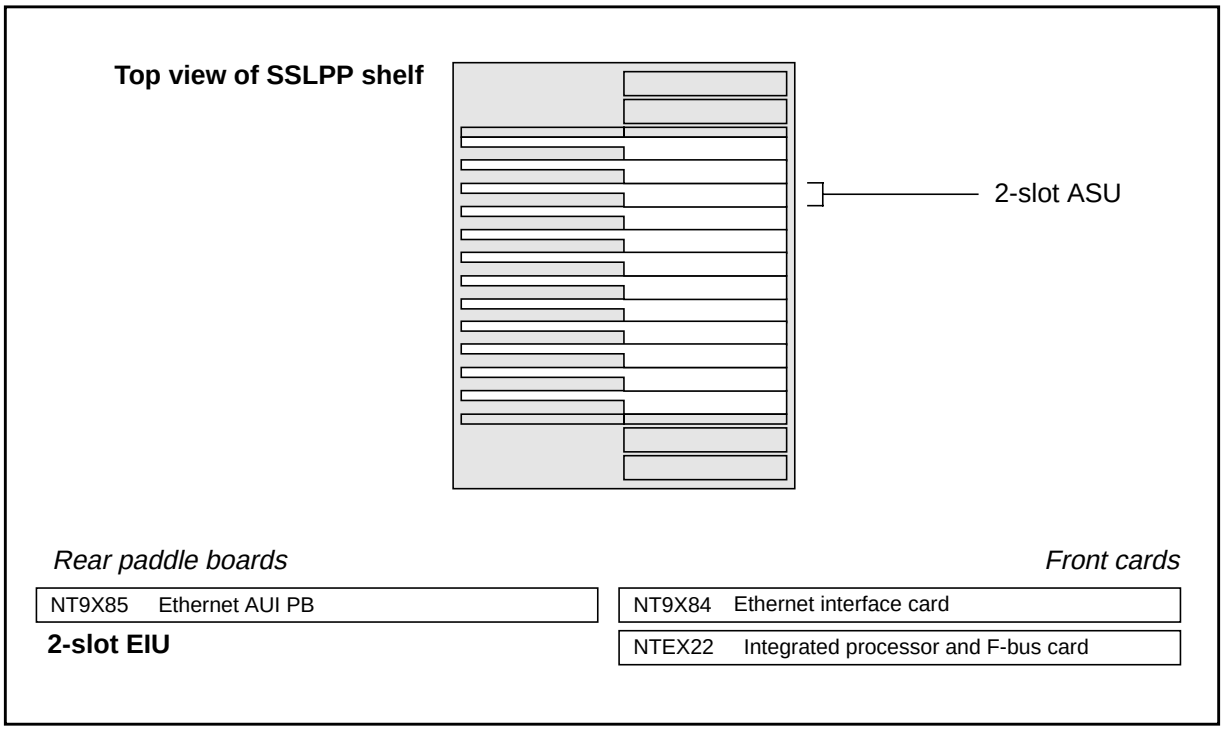


Figure 6 shows the placement of an LPP provisioned with an EIU on a DMS SuperNode switch.

Figure 6 DMS SuperNode switch LPP with an EIU

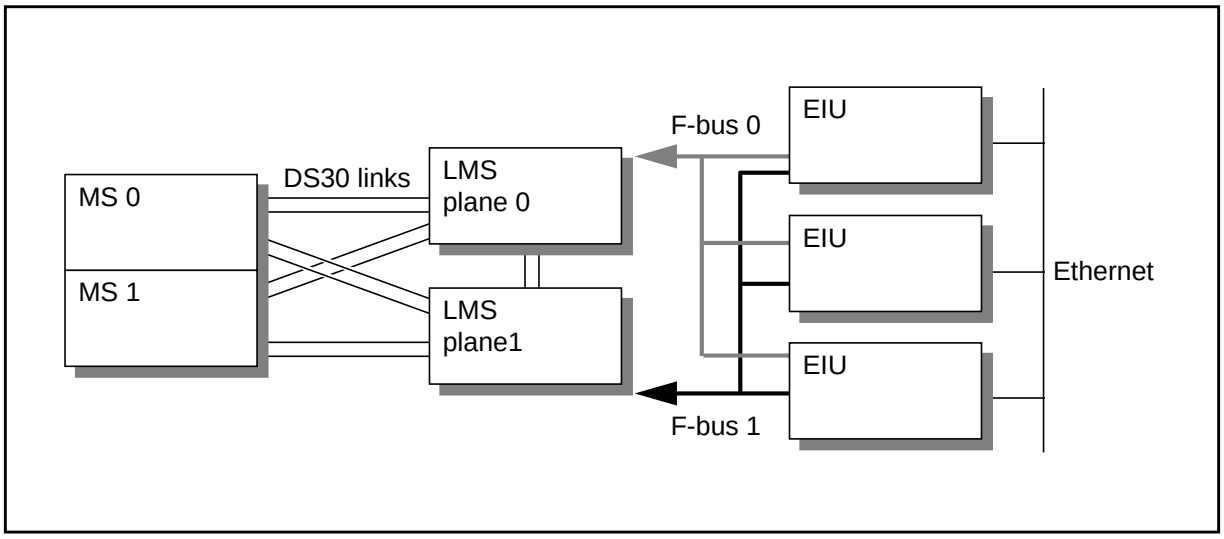
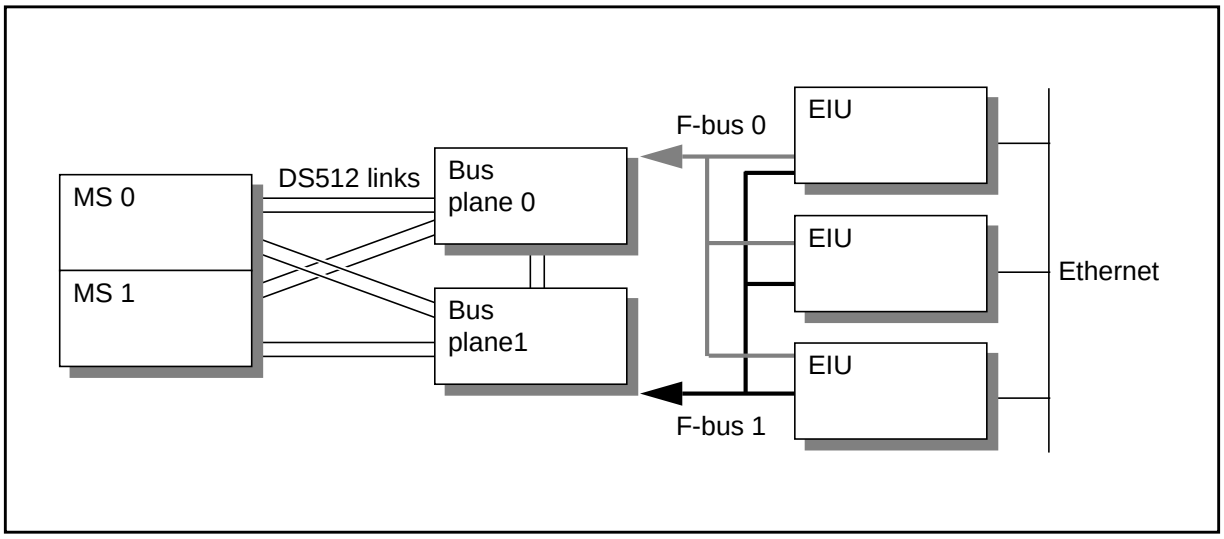


Figure 7 shows EIU links to the MS on the fiberized link interface shelf (FLIS).

Figure 7 DMS SuperNode FLIS with an EIU



Ethernet interface card (NT9X84)

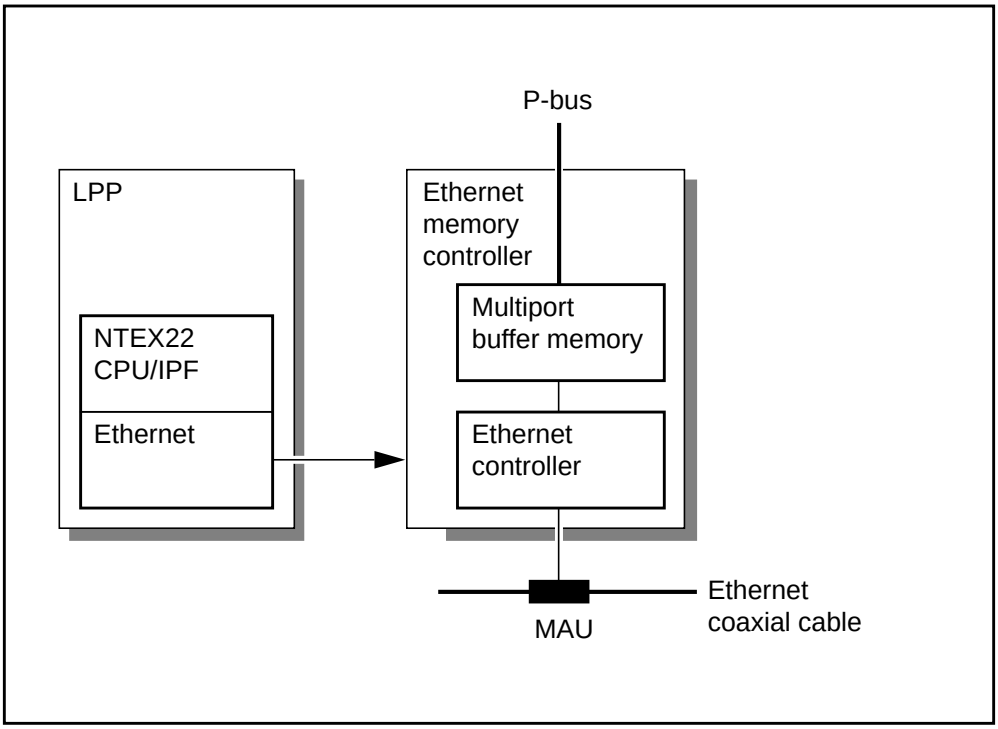
The EIC is based on commercial Ethernet interface chips. It supports one Ethernet communications link and processes all of the level 1 and part of the level 2 protocols for the Ethernet in hardware.

The card consists of a common message buffer that is accessed by both the processor and the Ethernet interface chip. On the Ethernet side, an independent controller uses memory-based data structures to locate and transmit and receive data from the links. The controller chip is an Advanced Micro Devices AM7990 LANCE device (a LAN controller for Ethernet) with support devices.

The buffer memory is organized as 192 kilowords x 16 bits (384 kbyte) with parity, and is directly accessible by the processor. Both byte and word access is supported. The processor and the Ethernet control chip contend for access to this memory. The architecture of the memory controller ensures that sufficient memory access bandwidth is allocated to the Ethernet controller, so that underrun or overrun conditions do not occur during transmission or reception of a message.

Figure 8 illustrates the memory and buffer architecture.

Figure 8 Ethernet interface architecture



Ethernet physical interface

The physical interface to the Ethernet system is defined by the paddle board located behind the EIC. The interface available is described in the following section.

Attachment unit interface—NT9X85AA

This card is a 15-pin D-type connector that provides the interface between the Ethernet controller and the media access unit (MAU). This is the most generic interface and supported as an industry standard (IEEE 802.3 10Base5 implementation).

> ***Note:*** This interface is compatible with all implementations of Ethernet through external equipment.

The MAU is different depending on the implementation of the LAN.

For a 10Base5 coax LAN, the MAU has coaxial connections on either side using field installed N-type connectors. The AUI connection is on an adjacent side. The coax cable is about 0.5 in. in diameter and has a bending radius of 0.5 m and the minimum amount of cable between transceivers is 2.5 m. These physical restrictions must be taken into account when installing the MAU. MAUs have a range of 500 m per bus segment which may be bridged together to form a LAN that is a maximum of 2500 m long. The disadvantages of this implementation are installation and difficulty of maintenance.

For a 10BaseT twisted-pair LAN, the AUI connection is usually on one side with an RJ-11 telephone jack on the other. Typically, standard office four-wire circuits are used to connect the MAU to the hub. The hub is an electronic replacement for the multiple access properties of the coaxial cable. It generates the broadcast function for each message received. It is usually an AC-powered unit mounted in a 19-in rack. The hub has either RJ-11 telephone jacks or a specialized interconnect through a punch-block distribution system.

Typical unshielded twisted-pair (UTP) systems offer a LAN radius of 100 m, allow cascading of hubs, and may allow the use of other types of interconnect (fiber or standard coax) to increase the radius. The star configuration, in combination with the centralized electronic implementation of the LAN function, allows fault location and isolation capabilities that are more in line with standard DMS-100 maintenance practices.

Grounding requirements

Isolated system ground (ISG) is not mandatory. The EIU will operate properly in both ISG and non-ISG environments. This section provides information on grounding for equipment and facilities associated with the EIU.

ISG issues are most prevalent in the area of Ethernet peripherals. Because these devices are AC powered, they may violate the ISG requirements. Devices can be powered from a protected AC source to isolate the frame and logic grounds and to provide continued service in the event of a commercial AC power failure.

In addition, the implementation of the AUI is not compliant with the IEEE 802.3 specification. In particular, the shield of the AUI cable is not connected to logic ground. Instead, the cable is connected to frame ground to satisfy the ISG requirement. The Ethernet interface is further transformer-isolated in the transceiver (the MAU) and the shield ground is capacitively coupled to the case of the unit.

Capabilities, limitations, and restrictions

This section describes the known limitations and restrictions for the EIU.

The operating company can install the EIU only on SuperNode shelves, including the LPP (but not the 24-slot LPP), FLIS, and SuperNode SE link

interface shelf (SNSE LIS). Nortel has tested the EIU for installation, operation, administration, and maintenance on each of these platforms.

EIU hardware capabilities and limitations

The following points describe EIU-specific limitations:

- An Ethernet message is 1518 bytes long, including 128 transmit and 128 receive buffers.
- The EIP (NT9X85AA) implements the unshielded twisted-pair AUI interface, which provides the physical link to the LAN. The EIC (NT9X84AA) implements most of the MAC layer.
- Only the 2-card EIU, based on the IPF (NTEX22BA/BB), is supported.
- The 4-Mbyte EIU (NTEX22AA) is not supported.
- The 8-Mbyte EIU, based on the IPF NTEX22BB, is now standard. All customer sites must upgrade.
- The EIU and the TCP/IP protocols are suitable for connecting low- to medium-speed peripherals, such as terminal servers and workstations, to the SuperNode switch.

  The EIU acts as an IP router for IP capable nodes such as the DMS-core, file processors (FP) and application processors (AP). The EIU can perform this function subject to the limitations identified in this document. The TCP/IP protocols allow interworking with a very large number of third party vendor's equipment.
- The EIU, unlike equipment from many other major manufacturers, can withstand a broadcast storm[1] or a babbling node. This capability is possible because of the overload control feature. This capability follows the standard DMS-100 maintenance philosophy, which states that a node must be maintainable even under overload conditions.

  In a lab environment, it has been demonstrated that a moderately heavily loaded LAN with broadcast messages caused workstations and a router to lock up, while the EIU remained functional. The workstations were overloaded to the point that all activity within the operating system stopped:

  — the on-screen clock stopped ticking

  — the cursor did not respond to mouse movements

  — keystrokes were ignored

  — outgoing LAN activity stopped

1. A broadcast message is issued from a single node and is received and processed by all nodes on the network. A broadcast storm occurs when a faulty node broadcasts a message to all other nodes for which it expects a reply. For each reply, the node may in turn issue another broadcast message causing the number of messages to multiply rapidly until the network is congested.

— programs were not aware that a period of time had elapsed

— The router stopped routing packets.

The EIU remained fully functional throughout the broadcast storm test. Although traffic from the EIU stopped, this stoppage was due to all other components on the LAN being nonfunctional and there was nothing left for the EIU to communicate with. The test demonstrated that maintenance personnel could remote login to the EIU, start a CI process, look at some OMs, and remote logout. The EIU could also successfully complete an in-service test and could be manual busied, then returned to service after successfully completing the out-of-service test.

- IP throttling was introduced to address customer concerns on co-residency of EIUs with other ASUs in an LPP frame. The IP throttling feature provides partial protection for the DS30 links at the expense of EIU throughput. Similarly, throttling has been implemented for EIUs on FLIS and SNSE LIS to protect the links between the MS and EIU from overloading.

  When deployed, fiber SR128 links through the MS will provide enhanced capacity to alleviate link capacity overload.

- The SNSE LIS and LPP have been product integrity tested with up to eight EIUs. Capacity engineering rules restrict the number of EIUs supported per platform to less than eight. Refer to *Provisioning Rules for LPP, SSLPP, and SNSE LIS*, System Engineering Bulletin SEB 92-02-001.

- The DMS-100 switch supports a maximum of eight EIUs per switch. Each of the eight EIUs can be configured on a separate LAN. However, EIUs configured on the same LAN can provide simple load balancing of IP traffic between EIUs, and tolerance to failure of a single EIU. For more information on redundancy and sparing, refer to “EIU sparing and redundancy” on page 41.

- The EIU can screen IP packets whereby only IP packets from a specified list of source IP address are accepted into the SuperNode switch and others rejected. This list of IP addresses is bound in by and is the responsibility of user applications (for example, EXNDINV).

- OSI and TCP/IP protocols cannot co-exist on the EIU.

- Theoretically, the EIU is capable of routing approximately 350 kbyte/s with 1536 kbyte packets at the IP level. That measurement equals about 2.5 Mbit/s. This performance measurement is the rate at which the EIU routes to the F-bus. However, throttling values limit throughput. Refer to *Provisioning Rules for LPP, SSLPP, and SNSE LIS*, System Engineering Bulletin SEB 92-02-001.

System-wide limitations

The EIU is collocated in an LPP shelf with other ASUs such as the link interface unit (LIU7) and frame relay interface unit (FRIU). The exact configuration of ASU-type units depends on the applications. The LPP is connected to the DMS-bus through eight DS30 links in a load-sharing arrangement.

Each DS30 has a transfer capacity of approximately 256 Kbyte/s. A single EIU can route long messages (1518 bytes) from the LAN to the DMS-bus at a rate that can overload the DS30 and cause the link to fail (SysB state). This link failure causes traffic to switch to an alternate DS30 link. If the system maintains the level of traffic that caused the initial failure, each DS30 link topples one by one until the LPP is isolated from the DMS-bus. Further, as each DS30 link overloads, all pending messages on that link are lost, including SS7 messages.

> ***Note:*** When deployed, fiber SR128 links through the MS will provide enhanced capacity to alleviate link capacity overload.

The IP throttling feature throttles IP messages to and from the EIU to provide a measure of protection against DS30 link overload. Application groups can engineer throttling to permit them to override the defaults. Complete protection is still not guaranteed due to other message sources, such as SIPC, MTS, logs, and OMs. Further, multiple EIUs on the same LPP can still simultaneously send a large message on the same link which, when combined with other messages in the LMS RX FIFO queue, can still cause an overload.

IP throttling has also been implemented to protect the links between the MS and EIUs that are on FLIS or SNSE LIS.

A problem common to all ASU types is that the F-bus receive buffers can be overloaded. If this happens too many times within a certain time interval, the rate adaptor detects the error and fails the link. Engineering rules are required to ensure any ASU type is not overloaded. Refer to *Provisioning Rules for LPP, SSLPP, and SNSE LIS*, System Engineering Bulletin SEB 92-02-001.

Limitations associated with maintenance

The operating company can datafill a maximum of eight EIUs in the LIUINV table. That is, the maximum number of EIUs on a switch is eight. As a further limitation, each LPP can have a maximum of four EIUs. The FLIS can have up to eight EIUs.

These limitations are not only a datafill issue. Other factors must be studied before these values can be increased, such as traffic load through an LPP or FLIS, EMI emissions, and routing issues. Currently, with 8 EIUs and 28 LIU7s in a 36 processor LPP configuration, the emissions are just within allowable limits.

The Ethernet address in the LIUINV table has the format of the Nortel SuperNode family range of addresses: *X*000075F*xxxxx*, where *X* is hexadecimal notation and *x* is a variable. For more information on MAC addresses, refer to “Appendix I: Obtaining a MAC address”.

Diagnostics for the EIU test only the Ethernet interface card (EIC) and the Ethernet interface paddle board (EIP). These diagnostics do not test the AUI cable. The AUI cable attaches to the paddle board and to a connector in the bulkhead. An extension of the AUI then runs from the bulkhead to the MAU.

Diagnostics also test the MAU. EIU diagnostics test the EIU’s connectivity to the AUI and the MAU up to the HUB.

Lastly, the *record start* command cannot be initiated during a telnet session on the connected device.

Limitations associated with protocols

Trailers are not supported. Trailers are the field on the data packet in which the system places the “headers”, which normally precede the data, after the data. Trailers can be negotiated between cooperating systems in an attempt to improve efficiency.

In the DMS-core, the protocol stack runs in the SuperNode IP (SNIP) scheduler class. This includes the IP receive processes and timer functions for TCP. In all other nodes, the protocol stack runs in CP class. The initial allocation for SNIP class is 3 percent and an interface is provided that allows an application to modify this value.

The following sections describe specific limitations associated with protocols.

Routing information protocol

The size of the dynamic routing table is limited to 436 entries. This limitation is imposed by the current implementation of and the current number of buffer management system (BMS) buffers reserved for routing information protocol (RIP) broadcasts. If the routing table overflows the routes at the end of the RIP, the system ignores the messages. This situation can lead to unpredictable routing behavior, such that routes may appear and disappear every 30 s. There is no warning log to notify the operating company that this errant behavior is occurring.

RIP Version 1.0 does not support variable-length subnetting. This limitation means that all subnets that use RIP to exchange routing information must use the same number of bits in their IP address to identify their subnet. If a subnet does not adhere to this rule, unpredictable and intermittent loss-of-connectivity behavior may be experienced on the EIU. RIP-II, which supports variable-length subnetting, is not implemented on the EIU.

TCP

Each TCP connection has its own state machine. For the number of allowed connections, refer to Table 5, *TCP connection limits by Supernode subsystem* in this document. There are also SOS limitations in that applications that require hundreds or thousands of connections are not supported.

Internet Protocol and Internet Control Message Protocol

When an EIU goes ManB or SysB, any qualifying EIU that is available takes over. The first EIU that failed broadcasts reverse-RIP messages advertising its loss-of-connectivity to the network. In this way, the routers on the LAN that are immediately notified of the second EIU takeover.

However, there is a worse case scenario in which the reverse-RIP messages are lost on the LAN. As a result, the entry for the first EIU must time-out in the routing table in each router before these routers start sending datagrams to the second EIU. This time-out can take up to 3 min. This limitation is imposed by the RIP implementation on the EIU. A possible option is to configure the routers on the LAN to use only address resolution protocol (ARP) and not RIP to communicate with the DMS-100 switch. However, the ARP-cache time-out on the router must be set to a low value (1 min is the recommended time).

All subnet size combinations are permitted in table IPNETWRK. However, the subnet size in the DMS-100 switch must be the same as the subnet size of the LAN to which the DMS-100 switch is connected. This requirement is a result of the limitation of the RIP version 1.0 implementation in the EIU. The IP subnet must be allocated for each DMS-100 switch. Refer to “Addressing” on page 50.

Feature packaging

Feature packaging applies to software loaded on the DMS-core. In general, these packages provide the central maintenance functionality for the new remote processors and the protocol software.

Prior to CSP02, the feature packages for the software resident in the DMS-core are summarized in table 1.

Table 1 DMS-Core feature packages

Package	Title	Description
NTXF05AA	Ethernet interface unit	The is the basic package needed to datafill and maintain the EIU. No protocol software is included in this package.
(Sheet 1 of 2)		

Table 1 DMS-Core feature packages

Package	Title	Description
NTXF19AA	TCP/IP	This package is the protocol software from the transport layer down to the link layer. NTXF19AA uses NTXF05AA.
NTXS11AA	FTP	This package is the standard FTP client and server software. NTXS11AA uses NTXF19AA.
NTX70AA	Telnet/RMAP	This package is the standard telnet server for remote MAP (RMAP) access.
(Sheet 2 of 2)		

Software for peripheral processors is controlled through package lists that define the entities for a specific load. The EIU may have several loads depending upon the applications resident on it.

As of CSP02, the EIU-related software is packaged in LANCOMM. Software is available with TL_ALL LCF. EIU-related software is provided as part of order code TEL00001.

EIU provisioning requirements

The provisioning rules for the total numbers of EIUs depend on the following requirements:

- the applications running on the EIUs
- the total application capacity required for all EIUs on the switch
- the level of redundancy required by these applications

The provisioning requirements are subject to the maximum limit of eight EIUs per switch.

The following sections describe the provisioning limits for the new components.

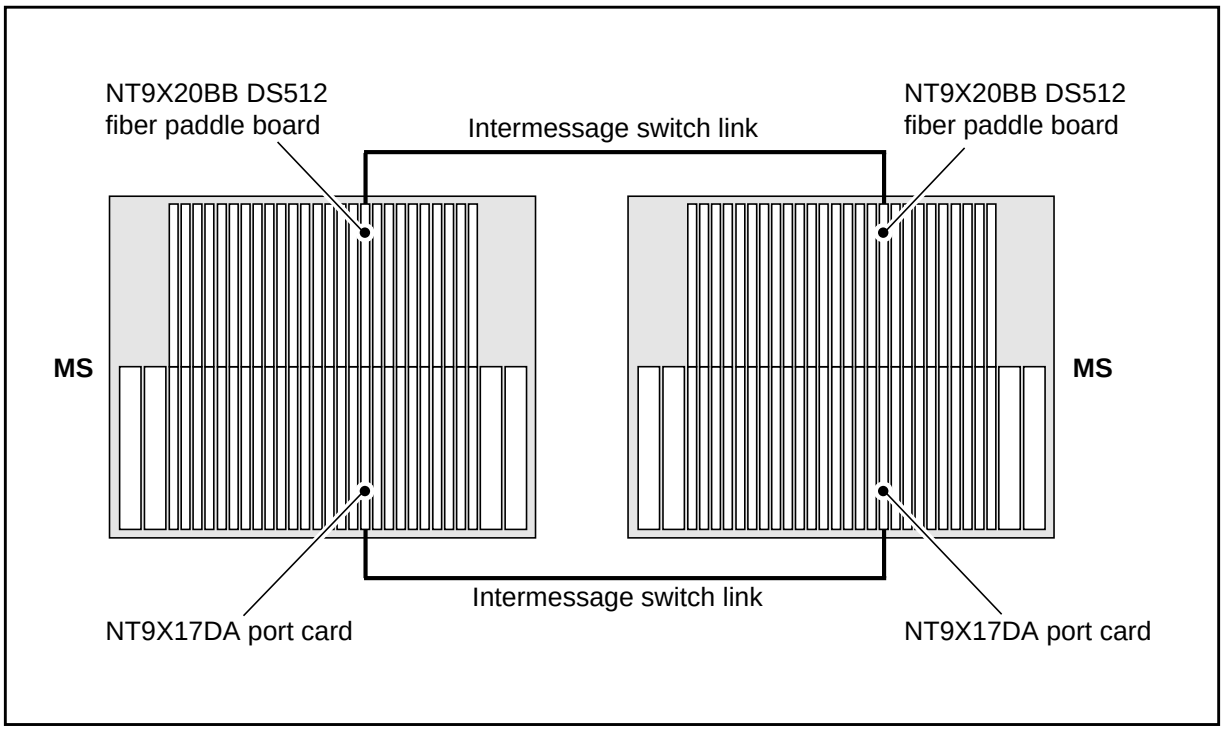
DMS-bus inter-MS provisioning

Each message switch in an IML requires an NT9X17DA port card and an NT9X20BB DS512 fiber paddle board.

Card position is not restricted. However, the cards associated with a link must use the same slots in each MS. For example, if the cards in one MS are provisioned in slot 21 (that is, the NT9X17DA is in 21F and the NT9X20BB

is in 21R), the cards in the MS at the other end of the link must also be provisioned in slot 21. This example is shown in figure 9.

Figure 9 Example of DMS-bus intermessage switch configuration



The following cards must also be provisioned on each switch:

- a minimum of 16 Mbyte of memory using one of the following card configurations:
  - — one NT9X13DB CPU card and one NT9X14DB memory card
  - — one NT9X13NA CPU card
- one NT9X49CB MS tracer card

DMS-bus external MS provisioning

Just as the SuperNode core requires access to the DMS-bus, so do peripherals. Therefore, DMS-bus port engineering is required.

The information in table 2 defines the port requirements for EIU installation.

Table 2 DMS-bus port engineering requirements for peripherals

Peripheral	Message Switch			Comments
	links per plane	Port Card	Paddle Board	
LPP (DS-30)	4	NT9X17AA	NT9X23BA	1 LPP requires 1 MS port card

EIU provisioning

Provisioning of EIUs is application dependent. The number of EIUs required and their configuration is determined by a combination of product and software criteria. EIUs are not provisioned on a switch unless required by the application.

Where possible, provision two or more EIUs connecting to a single LAN to improve reliability. This redundancy may not be required if duplication is provided at a higher system level (for example, duplicate LANs).

Observe the following provisioning rules:

- although the maximum number of EIUs in a switch is limited to eight (limitation imposed by software), the actual number that you can provision per platform is determined by engineering rules (refer to *Provisioning Rules for LPP, SSLPP, and SNSE LIS*, System Engineering Bulletin SEB 92-02-001
- each EIU requires one LIU position (two slots) in a 36-position LPP
- each EIU has a fixed memory capacity; the NTEX22BB contains 8 Mbyte of RAM, and the NTEX22CA contains 32 Mbyte of RAM

For more information on datafill, refer to “Chapter 3: EIU datafill”. For more information on maintenance impact on spares, refer to “EIU sparing requirements” on page 101.

EIU sparing and redundancy

The DMS switch and the EIU support load balanced routing. Characteristics related to provisioning and options are described in the following points:

- In table IPNETWRK, one EIU is defined as the default for the CM.
- In table IPROUTER, all EIUs are defined.
- Maintenance software ensured that all EIUs are aware of the states of all other EIUs. States are known for the following:
  - — links between the EIU and the LAN-side subnet
  - — links between the EIU and the SuperNode-side subnet

— the EIU state

- During normal operation, the default EIU routes all messages to the CM. If there is a problem with the default EIU or its links, the following occurs:
  - — the default EIU advertises to the network that it is no longer available (or in the event of a LAN-side link failure, the neighboring routers cannot reach the default EIU)
  - — another provisioned EIU advertises that it is the router (net hop) to the SuperNode-side subnet and the CM
- During normal operations, if there is a problem with the non-default EIU or its links, there is no impact on service unless the default EIU experiences problems, in which case the SuperNode subnet is isolated from the LAN-side subnet until one of more EIUs are brought back into service.

Applications running on the EIUs must have sparing defined at the application level.

Billing

EIUs do not directly affect billing functions.

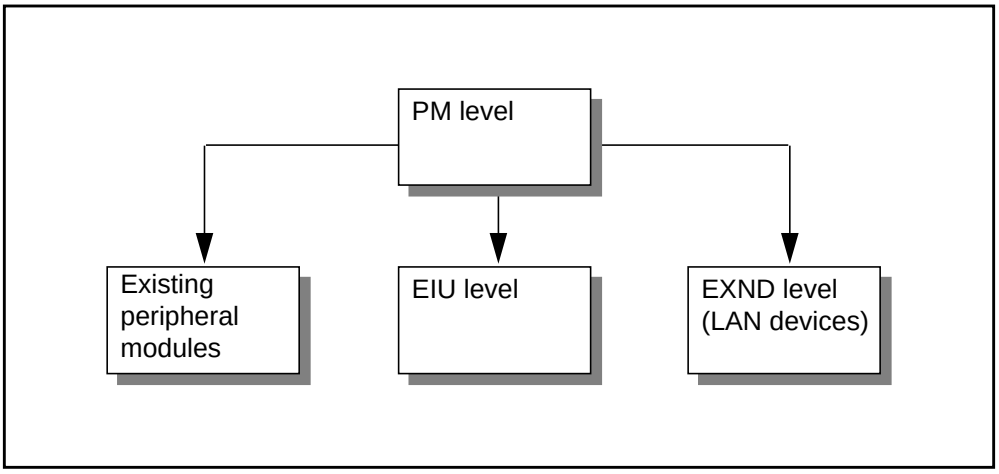
Service orders

The EIU does not affect service order functions.

User interface characteristics

The EIU uses the existing peripheral user interface (UI) based on the DMS MAPCI. The MAPCI includes additions to the PM level of the MAP display to include the new hardware components. Figure 10 shows the hierarchical relationship for the MAP levels used for the components.

Figure 10 MAP display level hierarchy



Logs, alarms, and OMs

In general, the subsystems that generate logs, alarms, and OMs do not have significant changes apart from the standard DMS-100 reporting sub-systems.

CAUTION
Possible loss of information
If a telnet session drops, logs and OMs may be lost.

Log reports

All logs from the EIU conform to the DMS OAM infrastructure. Log messages are formatted in the DMS-core for display using the standard DMS log system.

Alarms

The EIU uses the DMS alarm system to report faults. Alarms are raised by major maintenance state changes (usually brought on by hardware problems or overload conditions). In addition, the MAP interface displays a composite alarm banner across the top of the screen. This banner displays alarms with the most urgent priority; as maintenance personnel clear the highest priority alarms, next in priority display for each subsystem. In a healthy DMS-100 switch (that is, operations are normal), there are few alarms occurring.

Operational measurements

The EIU uses the DMS OM collection system to collect and distribute operational measurements. The DMS OM subsystem also generates simple reports. OMs can be transferred to “down-stream” processors for more detailed analysis.

In general, operational measurements can be used to determine performance and capacity in operational components. General types of operational measurements gathered by the switch include the following:

- error counts
- I/O counts (operations completed)
- CPU occupancy

Chapter 2: EIU messaging protocols

This chapter describes the Ethernet interface unit (EIU) software architecture:

- SuperNode software architecture
- protocol engineering
- Internet Protocol (IP) throttling

CAUTION
Possible loss of network security
Using the Ethernet interface unit (EIU) and a telnet or file transfer protocol (FTP) session to establish a maintenance and administration position (MAP) session can introduce a security risk to both the DMS node and its subtending network.

When establishing and operating a MAP session in this way, there is limited security for clear text (user identification and passwords) and for Internet Protocol (IP) addresses for screening. This limited security makes an open local area network (LAN) vulnerable to entry by unauthorized persons.

Nortel recommends that the operating company, as a minimal precaution, integrate intermediate security servers with encryption to avoid unauthorized access to the switch. For alternative approaches, contact your Nortel representative to discuss state-of-the-art secure OA&M data communications equipment products.

By using the EIU, telnet, and FTP software, the operating company assumes any and all risks associated with the implementation and use of this hardware and software.

Software architecture

The protocol stack supported on the DMS-core includes the following:

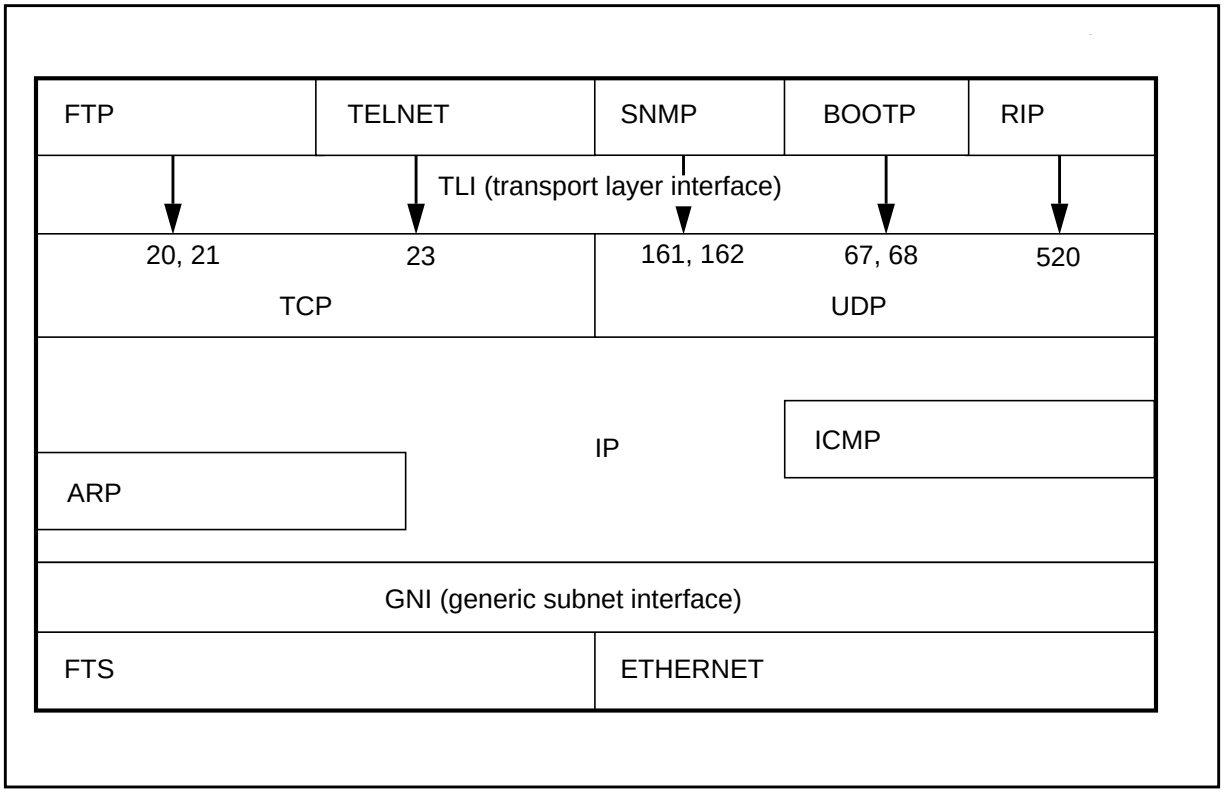
- bootstrap protocol (BOOTP)
- file transfer protocol (FTP)
- IP
- telnet
- transmission control protocol (TCP)
- user datagram protocol (UDP)
- simple network management protocol (SNMP)

Software architecture also includes key protocols such as address resolution protocol (ARP), Internet control message protocol (ICMP) and routing information protocol (RIP)[1].

Figure 11 shows the structure of the DMS-100 switch EIU protocol stack.

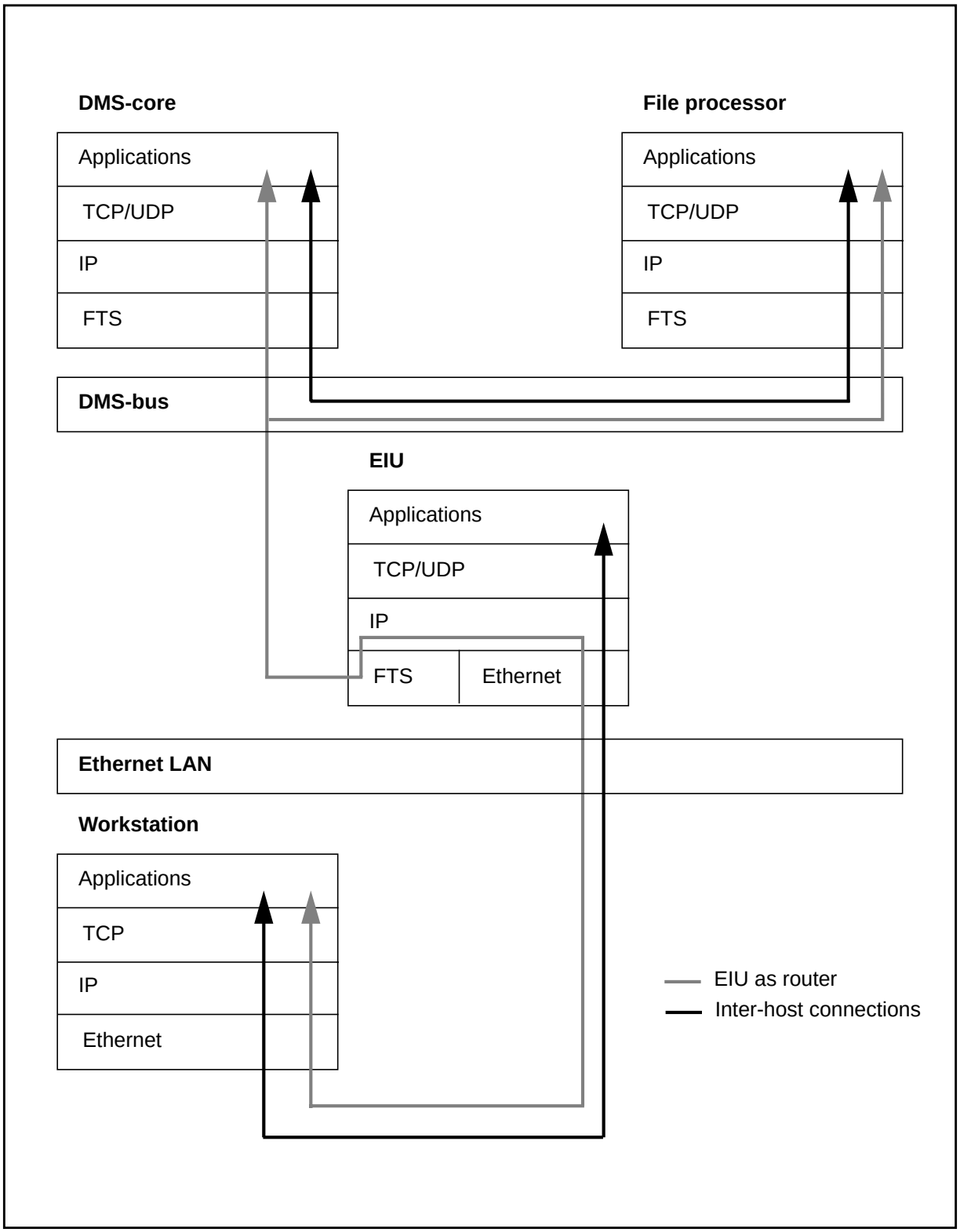
1. EIU only.

Figure 11 SuperNode TCP/ IP protocol stack



The message flow between SuperNode nodes, and between SuperNode nodes and external Ethernet LAN, is shown in figure 12 in this section.

Figure 12 SuperNode TCP/IP message flow



Supported protocols

The EIU software is designed such that the EIU can be configured to run as one of the following:

- Internet host: EIU is involved only in supporting applications such as Message Detail Recording for SS7 (MDR7)
- Internet router: EIU is involved only in forwarding IP packets between SuperNode and Ethernet LAN
- Internet host and Internet router: EIU forwards IP packets between SuperNode and Ethernet LAN, as well as supporting a local application such as MDR7 on the EIU
- Interface: EIU is similar to an internet router. The difference is that the Supernode can be configured on an existing Ethernet subnet

Appendix F, “EIU supported configurations” in this document contains diagrams of these configurations.

The following sections describe the protocols supported by the DMS-100 switch.

Boot protocol

Boot protocol (BOOTP) is a UDP/IP bootstrap protocol that allows a client machine to discover its own IP address, the address of a server host, and the name of a file to be loaded into memory and executed. A BOOTP server has been implemented for the CM, a BOOTP relay agent for EIUs and a BOOTP client for FPs (FEAT.AR1295).

BOOTP can be used to configure three types of IP hosts:

- Nodes that reside on the DMS FPs. Once table IPNETWRK is datafilled, each FP that does not already have an IP address sends a BOOTP request to the CM. The latter allocates an address for the FP, adds a tuple in table IPHOST with 20 TCP endpoints, 4 FTP client sessions, and 4 FTP server sessions, and sends a BOOTP reply back to the FP. Refer to “TCP” on page 36.
- Nodes that are part of the DMS product but not connected to the DMS-100 switch can be configured on an Ethernet LAN using EIUs. Such nodes must be on the same subnet as the LAN side of the EIUs to be configured through the BOOTP server on the CM, except if the maximum hops count accepted by the relay agent and server is increased. The internal database for BOOTP on the CM must be populated with information about such nodes, for example by putting the required information in table EXNDINV. The relay agents on EIUs forward relays requests and replies between the clients on the LAN and the BOOTP server on the CM.
- Nodes that are part of the DMS product, but that are connected to the DMS-100 switch through an Ethernet LAN directly to the CM (that is, the CM

has an Ethernet card). Such nodes have to be on the same subnet as the CM to be configured through the BOOTP server on the CM, except if the maximum hops count accepted by the server is increased.

File transfer protocol

File transfer protocol has been implemented on all the SuperNode-based nodes including CM.

FTP implementation contains client as well as server software. The client software lets the user application connect to a remote FTP server. The server can be on any node within the SuperNode switch or a node external to the SuperNode switch. The communication with the external node is through the EIU. At least one EIU must be in-service in order to connect to an external node. The SuperNode FTP server software listens to the incoming requests for connection from a client FTP.

An FTP client has been implemented for launching manual FTP client sessions from any SuperNode-based node to any node external or internal to the SuperNode switch. The manual FTP can be invoked by issuing the following command:

```
> ftp '<nnn.nnn.nnn.nnn>' [x]
```

where

nnn.nnn.nnn.nnn	is the IP address of the FTP server
x	x is an optional port number

Observe that the IP address is enclosed within single quotes. For manual FTP, a path name in lower case must be enclosed within single quotes. If the path name is not enclosed within quotes and starts with a slash character(/), the path name must be prefixed by a colon character (:). These restrictions are specific to SuperNode CI.

There are three separate file systems supported by FTP:

- SFDEV (on all nodes)
- SLM volumes on CM

Also, access to the IOC is available. SLM volumes and SFDEV are record-oriented file systems, whereas FTFS volumes are byte-stream oriented. Therefore, take extra care to identify the record lengths while transferring files to a record-oriented file system.

For example, LOAD68K files require 256-byte fixed-length records. UnIPLed images are stored as 512-byte fixed-length records. IPLed images need 1020-byte fixed-length records. The record length can be set either automatically or manually. If the file extension is in a prescribed form, the system automatically

detects and sets the record length. To manually set the record length, use the LRECL command. This command changes the record length locally at the client site and sends the command to the server. The command is applied locally, regardless of the server response (negative or positive). Both the automatic record length detection process and the manual process require that the file transfer type (ASCII or BINARY) be manually set to the required value before transferring the file.

ASCII files can also be transferred to the record-oriented file systems. If the transfer mode is binary, FTP switches automatically to FIXED length records. If the file size of the file being transferred to the SuperNode switch in binary mode is not a multiple of the current record length, the last record is padded with spaces. This is a file system restriction and has nothing to do with FTP implementation. This restriction can be eliminated by providing a separate QUOTE command for FTP which toggles the record type (FIXED/VAR) in binary mode. For files that do not meet the above criteria, the QUOTE command can be issued to switch to VAR record length for binary transfer mode.

Volume listing is available via any FTP connection to the DMS-100 switch. To list the available volumes when connected to the DMS FTP server, type the following command:

```
ws>ls /
```

The system automatically capitalizes filenames when it is connected to a DMS FTP server. The DMS SuperNode filename convention is to use an uppercase format for all files even though it provides for lower case. Therefore, any filenames included with commands sent to the DMS FTP server are automatically capitalized. If a filename needs to be lowercase, enclose the filename in single quotation marks to prevent automatic capitalization of the filename.

Since the DMS SuperNode system does not have a global security concept, the FTP server implementation contains a security mechanism. This mechanism relies on the applications to inform about the potential userIDs and passwords for valid FTP logins from remote FTP clients. The applications reserve a number of FTP server sessions and provide a set of valid userIDs and passwords. This information is kept as a database and is compared with the userID-password combination whenever a remote client tries to login.

The activation and deactivation of the FTP layer on a node is controlled by the datafill in table IPHOST. The tuple for a particular node contains the number of server and client sessions allowed on that node. These numbers map correspondingly into simultaneous FTP server and client processes.

Internet Protocol

The IP control software supports the IP logic, which provides a connectionless datagram service between hosts. The IP software is designed such that the same modules provide IP host and IP router functionality. The IP layer interfaces with the following:

- transport layer protocols like TCP and user datagram protocol (UDP) for providing data flow between transport layer and data link layer
- address resolution protocol (ARP) for resolving IP address to subnet address
- Internet control message protocol (ICMP) for handling IP control messages to and from other IP nodes

The IP routing table is maintained through static datafill in IP tables in DMS-core and through dynamic routing information available either through Routing Information Protocol (RIP) or ICMP redirect message.

The IP throttling process is responsible for transmitting queued IP datagrams to destination nodes, based on the IP throttling configuration in the IP tables in DMS-core.

Telnet

Telnet is an application protocol for remote terminal access. Telnet software is implemented in two parts:

- a server that resides on the accessed (host) computer
- a client that resides on the accessing (remote) computer

The server program listens at a known port for connection from clients. After a connection is established, the client redirects all keyboard input to the server, which passes it on to the accessed program. The server intercepts all program output, and redirects it to the client which prints it on the client machine screen.

The DMS-100 telnet server implementation has the following features:

- remote access to the DMS-100 switch through telnet
- increased maximum number of simultaneous telnet sessions supported on the DMS-100 switch
- logs that report on the telnet software
- dynamic assignment of telnet sessions

Telnet functionality has been implemented in the DMS-100 switch to provide access to the CI and the MAPCI, which are running on a DMS-core (CM), from a workstation or other FTP-capable devices on an Ethernet LAN.

The MAPCI supports asynchronous output to both the scroll area and a “full screen” area. The input, however, is buffered in a line-by-line mode. This combination of features requires that the telnet client perform echoing of input characters.

The telnet server translates MAP display updates into VT100 character strings and sends them to the telnet client at the remote end. Telnet clients must directly connect to the CM using the CM address.

Transmission control protocol

TCP is a reliable transport layer protocol that provides communications services to various applications like telnet, FTP, and so on. TCP can reside on all the nodes capable of running Internet software. SuperNode TCP implementation is able to interoperate with most of the industry-standard TCP implementations.

User datagram protocol

UDP protocol provides connectionless transport protocol services unlike TCP, which provides connection-oriented transport services. The original SuperNode application for UDP is routing information protocol (RIP) on an EIU. The IP route path display tool is also using UDP for intra-SuperNode messaging between processes on different nodes. The UDP is designed such that it can use IP fragmentation and reassembly functions to support UDP datagram size of up to 4 kbyte.

Address resolution protocol

The address resolution protocol (ARP) protocol implements the address resolution protocol, which provides dynamic binding between IP address and a physical hardware address. ARP resolves IP address-to-Ethernet or MAC address translation through ARP protocol running on an EIU. The IP address to frame transport address (FTA) translation is done in ARP through simple static table lookup.

Internet control message protocol

The ICMP software provides the IP status and error-reporting mechanism, which is very closely coupled to IP. The ICMP messages handling in SuperNode is limited to a few specific messages. The ICMP echo and response messages are handled to provide ping capability. The ICMP redirect is handled to provide routing table updates to SuperNode hosts from the dynamic routing information on the EIU. TCP is notified of ICMP source quench messages.

Routing information protocol

The industry standard RIP is implemented for an EIU to enable it to participate in the exchange of dynamic routing information with other IP routers on the Ethernet LAN. The dynamic routing information is required on the SuperNode to be able to route datagrams to hosts on distant LANs.

Upon receiving RIP update from either another EIU or IP router on the LAN, the RIP software updates internal IP routing table. According to RFC1058, RIP response messages are transmitted every 30 s to Ethernet LAN.

Addressing

Within a single SuperNode switch, multiple hosts and multiple applications within a single host may simultaneously request TCP/IP services. To provide for application address uniqueness across the network, the following TCP/IP address allocation scheme is used:

- TCP/UDP provides individual PORT numbers to distinguish between applications in the same host.
- Each host processor in the Internet SuperNode switch is assigned a unique IP address. This is a logical address, and when concatenated with TCP port number, forms a unique network end-point or “socket”.
- A unique IP address is required per hardware device.
- Within the network, each node is physically identified by its own unique physical hardware address. The logical IP address is translated to a physical hardware address prior to datagram delivery to the destination node.
- Within a SuperNode switch, each node such as DMS-core, FP, and EIU has a unique FTA, which is the physical hardware address on the SuperNode subnet. The EIU also has a media access control (MAC) address, which uniquely identifies it on the Ethernet LAN.
- IP broadcast is not supported on the SuperNode subnet since the physical layer does not support this.

MAC addresses

A unique media access control (MAC) address is assigned to each EIU through table control datafill in table LIUINV. The norm within the industry is that the MAC addresses are hard-coded in ROM. The EIU is different from industry norm in this case. There is a flexibility of assigning the MAC address to the EIU and at the same time the flexibility can result in problems if the addresses are not assigned uniquely to the EIUs.

Only 48-bit MAC addresses are supported by the SuperNode switch.

For more information on MAC addresses, refer to “Appendix I: Obtaining a MAC address”.

Internet addresses

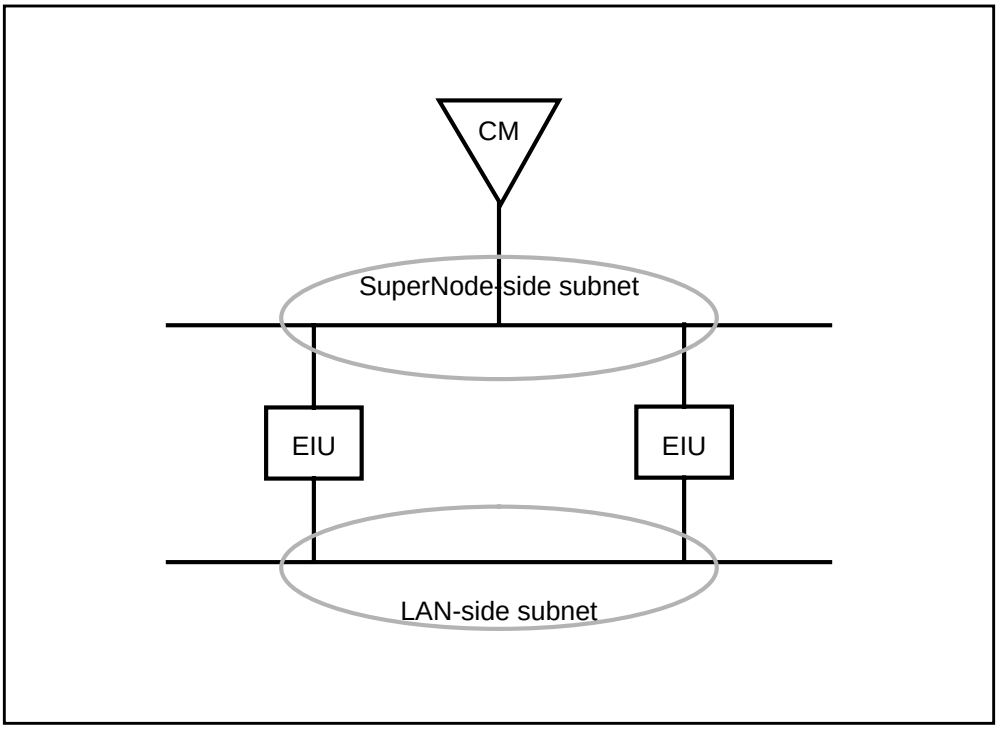
The logical Internet address is analogous to physical or subnet addressing in which each host is assigned unique integer address called the Internet address or IP address. The Internet address integers are not assigned randomly, but are assigned to nodes in such a way that Internet routing is more efficient. Refer to

"Appendix E: Understanding IP and IP addressing" for more information on Internet addressing.

The IP address features and restrictions within the SuperNode switch are as follows:

- The Class A, B, and C address schemes are supported. The Class D and E schemes are not supported.
- The IP addresses for all SuperNode hosts are assigned through DMS table control (tables IPNETWRK, IPROUTER, and IPHOST).
- The IP addresses for all SuperNode hosts are on a single subnet.
- The EIU is assigned two IP addresses: one to address the SuperNode side subnet and other to address Ethernet LAN side subnet. Both EIU addresses cannot be assigned on same subnet number. Refer to figure 13 in this chapter.
- The EIU Ethernet side IP address MUST be the same class and network as the SuperNode side.
- The SuperNode node IP address can be changed at any time. However, UDP/TCP applications are affected.
- The EIU host application is addressed from within the SuperNode switch or from external LAN workstations by addressing the EIU SuperNode side IP address. The exception is the routing information protocol, which uses the LAN side IP address.

Figure 13 Typical configuration for LAN and SuperNode subnets



For more information on IP addresses, refer to “Appendix H: IP network number requests” and “Appendix E: Understanding IP and IP addressing”.

How to get IP addresses for SuperNode

To ensure that the network portion of an IP address is unique, all IP addresses are assigned by a central authority, the Network Information Center (NIC). The central authority assigns the network portion of the IP address and delegates responsibility for assigning host addresses to the requesting organization.

It is essential for the NIC to assign IP addresses for networks that are attached to the connected Internet. An individual organization may assign arbitrary IP addresses without contacting NIC, but only if their network is not connected to the public Internet. However, experience has shown that it is unwise to apply this kind of arbitrary addressing scheme. Arbitrary schemes prevent future interoperability and may cause significant problems and down time when converting to NIC-assigned addresses in future. It is strongly recommended that the operating company obtain official Internet addresses from the NIC.

What is the SuperNode network topology?

The network consists of a SuperNode switch and other third-party equipment such as HUBs and workstations. Third party routers may be required for distant LANs or for fault tolerant network architecture. Based on network topology, following information may be required:

- the IP address class
- the IP address subnet size based on number of subnets and the maximum number of hosts per subnet (also, consider future expansion of the network)
- the IP addresses for HUBs and routers
- the dynamic routing strategy (only RIP is supported on the EIU)
- network security (if the network is connected to public network such as the Internet, security consideration is vital)

Routing

The IP is a network layer protocol using the ISO seven-layer model. One of the key responsibilities of the network layer protocol is to route messages from the source node to destination nodes. The SuperNode IP works in a somewhat complex inter-networking environment where the routing decision is not always simple.

The IP routing algorithm must route messages from SuperNode hosts to the following:

- internal SuperNode SOS and UNIX-based hosts
- external-to-SuperNode hosts such as workstations

When the destination host is not attached to the SuperNode network[2], IP must route messages to a neighboring IP router. In this way, IP forwards route messages toward the final destination. SuperNode connectivity to external hosts is possible through EIUs. The EIU, in this context, is referred to as an IP router. Generally, IP routers have more than one network interface (the network interface is defined as the node's connectivity to the underlying network, whether it is Ethernet or FTS), to allow IP messages to pass from one network to another. The IP router may also provide connectivity to networks with distinct architectures. The EIU is one such IP router.

The EIU acts as the IP router between the SuperNode hosts (through the FTS network interface) and the Ethernet LAN (through the Ethernet interface). The EIU receives and forwards messages between the Ethernet LAN and the SuperNode hosts. Some unique characteristics of SuperNode IP routing are as follows:

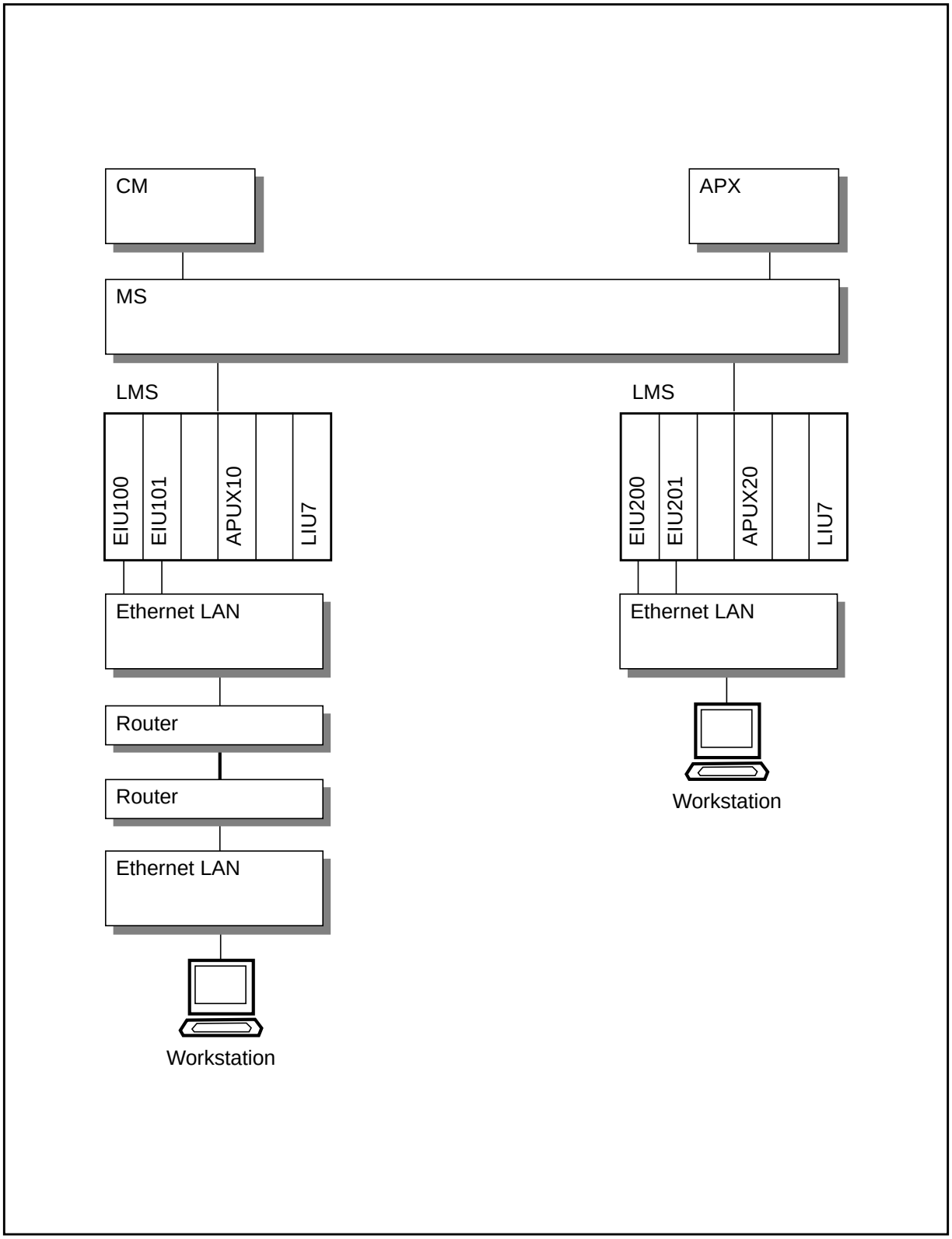
- IP messages destined from one SuperNode host to another SuperNode host within same SuperNode are sent directly without any intermediate nodes as routers or gateways.
- IP messages destined to hosts on the LAN are sent through one of the available (in service) EIU IP routers connected to that LAN.

2. A SuperNode network is the network of SuperNode hosts reachable through FTS.

- Upon failure of any one EIU IP router, the traffic is switched over to another available (in service) EIU IP router on the same LAN.
- IP routing handles a mix of EIU IP routers and EIU hosts on the same LAN.
- A simple load balancing scheme between multiple EIU IP routers is provided. The load balancing scheme sets specific EIUs as primary routers for the outgoing data. Incoming data is load balanced by specific EIUs that proxy for host nodes within the SuperNode subnet. As host nodes are provisioned in table IPHOST, the load balancing scheme is updated. Load balancing is also updated when nodes go in and out of service.
- The EIU does not route messages between nodes on the same or distinct LANs. The purpose of an EIU is to provide SuperNode connectivity to the LAN. It is not intended to act as a router between two Ethernet LANs. The EIU, however, routes messages to another EIU SuperNode host address if the other EIU is configured as a host and is connected to a different Ethernet LAN subnet.
- The IP routing software is identical on all SuperNode nodes, including an EIU.
- The optional RIP (version 1) is implemented on the EIU to participate in dynamic routing information exchange. RIP allows the SuperNode switch to route messages to hosts on distant LANs (nodes not directly connected on the LAN where EIUs are connected).
- EIUs use proxy ARP for other SuperNode IP hosts and for host EIUs on other Ethernet LANs.
- When an EIU is ISTb (NA), it is still connected to the Ethernet LAN and responds to packets received over the LAN. The EIU is aware that the connection to the SuperNode switch is not available. Awareness is achieved through the EIU by issuing a reverse RIP to neighboring routers to indicate that the EIU can no longer route to the SuperNode subnet.

A typical SuperNode network topology that is currently supported is shown in figure 14 in this chapter.

Figure 14 An example SuperNode Ethernet



Routing tables

The IP routing table structure is briefly explained here. The knowledge of IP routing tables is critical in understanding SuperNode IP routing issues.

The SuperNode IP routing information is organized locally on all hosts in two separate tables. One table determines a routeset from a given destination IP address. An example of this table is shown in table 3. A second table is used to determine the actual next hop IP address from the routeset derived from the first table. An example of this table is shown in table 4.

Table 3 IP routing table

Destination	Subnet Mask	Routeset	Type of Route	Subnet
47.12.0.0	255.255.240.0	{1, 0, 0, 0, 0}	Gateway	SuperNode
47.148.0.0	255.255.240.0	{2, 0, 0, 0, 0}	Gateway	SuperNode
0.0.0.0	0.0.0.0	{2, 1, 0, 0, 0}	Default	SuperNode

These two tables are not datafilled through table control, rather they are derived from control datafill in tables IPNETWRK, IPROUTER, and IPHOST. Further, these two tables may contain entries from dynamically learned routes either from RIP on the EIU or from ICMP redirect messages on other nodes.

Table 4 IP route list table

Index	Type of route list	Node	Status	Address
1	Router	EIU 132 * Primary	InSv	47.64.64.4
2	Router-Host	EIU 131	OutSv	47.64.64.2
		EIU 133	InSv	47.64.64.5
		EIU 205 * Primary	InSv	47.64.64.3

Each routing-table entry (see table 3) contains a destination IP address, IP address subnet mask, list of route lists (routeset) that reach the destination IP, and other fields that indicate type of route and subnet type. The IP routing algorithm is used to determine the routeset that can reach the destination IP address.

Each route list table entry (see table 4) contains one route list. The route list is composed of a list of routers that share common router characteristics. For instance, all EIU IP routers configured on the same LAN are grouped in one route list. The primary router is determined in each route list entry. For a given host node, the primary router is the EIU that packets are sent to. The primary

router is determined based on the simple load balancing rules and the status of the router.

IP Screening

Packets destined for the Supernode can be screened at the IP level. If the source of the packet is determined to be invalid, the packet is dropped by the EIU. For more information, refer to data schema table EXNDINV in this document.

Protocol engineering

This section provides information on engineering rules and data for each of the protocol layers. It also contains discussions on the maintenance of the protocol stack and its performance.

IP throttling

IP throttle engineering is required to control congestion in the DS30 links. If the IP throttle is not properly engineered, the robustness of the LMS on which EIUs are located is compromised. This situation occurs because of the potentially large number of datagrams transferred between EIUs and SuperNode nodes across LMS.

IP (as a network layer protocol that transfers datagrams between EIUs and the SuperNode nodes) does not have built-in flow control mechanism to provide throttling. As a result, manual control is required. Table IPTHRON asserts manual control over IP throttling of datagrams transmitted over DS30 links.

For information on table IPTHRON, refer to “Chapter 3: EIU datafill”. For more information on IP throttling, refer to “IP throttling” on page 65.

For information on EIU provisioning rules for LPP, SSLPP, and SNSE-LIS, refer to *Provisioning Rules for LPP, SSLPP, and SNSE LIS*, System Engineering Bulletin number 92-02-001, version 01.09.

TCP connection management

The TCP layer provides reliable delivery of the data to its remote peer through well-defined connections. The connection management for SuperNode TCP is handled through datafill in table IPHOST. Table IPHOST permits the operating company to vary the number of TCP connections on a per node basis.When changing this value, note the following points:

- decreasing the allowed number of connections causes all connections to be dropped
- existing connections are maintained when you increase the number of connections

Maximums are defined for the number of TCP connections allowed on a node, as shown in table 5. UDP connection maximums are shown in table 6 on page 62.

Table 5 TCP connection limits by SuperNode subsystem

Subsystem	Maximum TCP connections
computing module	64
function processor	32
EIU	32
APU	1

Table 6 UDP connection limits by SuperNode subsystem

Subsystem	Maximum UDP connections
computing module	32
function processor	32
EIU	32
APU	32

The parameter TCP_CONN controls the number of TCP connections for the node. The value for this parameter can be changed at any time regardless of the status of the node. The new value is immediately propagated to the node concerned, provided the node is in service.

If TCP was in service before the value of TCP_CONN is decreased, the existing TCP connections are dropped immediately and the users are notified accordingly. TCP remains out of service until it can reallocate its resources (control blocks, buffers, and timers) to accommodate the new number of allowed TCP connections.

If the new value is zero, TCP remains out of service until a nonzero value number is datafilled for that node.

The DMS-100 switch responds in the same way when the IP address of the node is modified while the node is in service. In this case, if the number of TCP connections remains the same or is increased, the reallocation is not required. If both the IP address and the number of TCP connections are modified, the consequences are similar to the situation in which only the number of TCP connections is decreased. The system generates a log for each connection dropped. This functionality must be exercised very cautiously, since it may

cause TCP to drop the existing connections, which could cause a temporary outage of all TCP applications.

FTP session control

Similar to the concept of TCP numbers, FTP sessions (client and server) on each node are managed by the parameters FTPSVCON and FTPCLCON in table IPHOST. These parameters control the number of FTP server and client sessions allowed on a particular node.

There is no maximum limit defined for these numbers, but they are governed by the number of TCP connections allowed on the node. Since each FTP session consumes two TCP connections (control and data), the total number of FTP client and server sessions taken together cannot exceed half the number of TCP connections allowed on that node. This restriction obviously does not take into account other TCP applications on the node. The operating company must ensure that the values in datafill are adequate for all other TCP applications (telnet, MDR7, ROSP, and so on).

The number of FTP server and client sessions are tightly coupled with the number of server and client processes respectively. Each server and client process manages one FTP server/client session. The number of FTP server sessions also restricts the number of server processes that can be reserved by the applications for security reasons. The total number of servers that can be reserved by different applications cannot exceed the number of servers allowed on the node.

If the number of client and server sessions for a node in table IPHOST is modified, the existing sessions are dropped immediately and the FTP client users are duly notified. FTP layer remains out of service until all the resources are reallocated to conform to the new datafill. If the number of FTP server and client sessions is datafilled as zero, FTP cannot provide its services.

This functionality must be exercised cautiously since it causes FTP to drop the existing sessions, which could cause a temporary outage of all FTP clients and servers. Similar consequences are observed if the IP address of the node is modified while the node is in service. Reducing the number of FTP servers removes defined owner and userID information as necessary. It is up to the user or application to restore the information when the number of sessions is increased.

Protocol buffer engineering

The buffer engineering for receiving and transmitting IP packets is a critical part of the buffer management for the protocol stack. A default number of buffers is allocated for IP receive and transmit purposes. The buffers are divided into three categories:

- small (128 bytes)

- medium (1024 bytes)
- large (1600 bytes)

When the IP layer comes into service, the number of buffers allocated by default is 10 for the small buffer size and 5 each for the medium and large buffer sizes. These values are load and application dependent.

When the TCP layer comes into service, it allocates its own pool of transmit buffers and adds buffers to the common pool of receive buffers. The common pool of buffers is used for receiving IP and TCP packets.

The transmit pool owned by TCP is used for transmission of TCP segments. The TCP transmission mechanism does not consume buffers from the common pool. The allocation of TCP transmit and receive buffers depends on the datafill for the number of TCP connections on the node. For each TCP connection, TCP allocates 3 small, 2 medium, and 1 large buffer for the transmit side. It adds as many buffers to the common pool of buffers owned by ICBM for receiving TCP segments.

For example, assume that the number of TCP connections for the node is 10. Therefore, the total number of transmit buffers allocated is 30, 20, and 10 for small, medium, and large sizes, respectively. The same number of buffers for all three sizes are added to the existing common pool owned by ICBM. If the TCP layer is brought out of service, all the transmit buffers owned by TCP, as well as receive buffers that are added by TCP to the common pool (owned by ICBM), are deallocated. Initial allocation of the buffers in the common pool is a static allocation regardless of the service state of IP layer. For every two endpoints reserved, TCP allocates a 4-kbyte buffer for compaction.

Buffer allocation is summarized in table 7.

Table 7 Buffer allocation per end point

Protocol	Buffer type	Number of buffers	Size (in bytes)
TCP	Receive	1	1518
	ICBM common pool	2	1024
		3	128
	Transmit	1	1518
	TCP own	2	1024
		3	128
UDP	Receive	1	1518
(Sheet 1 of 2)			

Table 7 Buffer allocation per end point (continued)

Protocol	Buffer type	Number of buffers	Size (in bytes)
	ICBM common pool	10	128
	Transmit (application must allocate the number of buffers and size)	0	0
(Sheet 2 of 2)			

IP throttling

IP throttle engineering is required to control congestion in the DS30 links. LPPs, SSLPPs, and SNSE-LISs have different throttling requirements, as described in the following sections.

For more information on datafill for IP throttling, refer to “Chapter 3: EIU datafill”.

IP throttling for LPP

The LPP incorporates additional throttling control for TCP/IP traffic sent over DS30s between the MS and LPP. Throttling protects against incorrectly engineered LANs from overloading DS30s with errant TCP/IP traffic.

Table 8 shows the recommended traffic values for entry into table IPTHRON. Adherence to these values ensures adequate bandwidth for the IP router application and protect against DS30 overload. Refer to “Chapter 3: EIU datafill” for additional information on table IPTHRON.

Table 8 IP throttling values for LPP

Approved BCS	**BCS36**											
Approved CSP	**CSP02**			**CSP04/05**			**CSP04**			**CSP04**		
Approved S/W							**TOPS**			**IEC04**		
IP router application	**EIU**		**CM**	**EIU**		**CM**	**EIU**		**CM**	**EIU**		**CM**
	Tx	**Rx**	**Tx**	**Tx**	**Rx**	**Tx**	**Tx**	**Rx**	**Tx**	**Tx**	**Rx**	**Tx**
ADAS	10	40	40				10	40	25			
CDPD	5	5										
RMS										10	10	
PSN										12	25	
(Sheet 1 of 2)												

Table 8 IP throttling values for LPP (continued)

Approved BCS	**BCS36**											
Approved CSP	**CSP02**			**CSP04/05**			**CSP04**			**CSP04**		
Approved S/W							**TOPS**			**IEC04**		
IP router application	**EIU**		**CM**	**EIU**		**CM**	**EIU**		**CM**	**EIU**		**CM**
	Tx	**Rx**	**Tx**	**Tx**	**Rx**	**Tx**	**Tx**	**Rx**	**Tx**	**Tx**	**Rx**	**Tx**
Note 1: Values for DS30 in kbyte/s ***Note 2:*** EIU = LMS node ***Note 3:*** CM = SuperNode												
(Sheet 2 of 2)												

IP throttling for SSLPP

The SSLPP incorporates additional throttling control for TCP/IP traffic sent over SR256 between the MS and SSLPP.

Table 8 shows the recommended traffic values for entry into table IPTHRON. Adherence to these values ensures adequate bandwidth for the IP router application and protect against overload. Refer to “Chapter 3: EIU datafill” for additional information on table IPTHRON.

Table 9 IP throttling values for SSLPP

Approved BCS						
Approved CSP	**CSP04/05**			**CSP04**		
Approved S/W				**IEC04**		
IP router application	**EIU**		**CM**	**EIU**		**CM**
	Tx	**Rx**	**Tx**	**Tx**	**Rx**	**Tx**
ADAS						
CDPD						
RMS				10	10	
PSN				12	25	
Note 1: Values for DS30 in kbyte/s ***Note 2:*** EIU = LMS node ***Note 3:*** CM = SuperNode						

Chapter 3: EIU datafill

This chapter describes the datafill requirements for installing and maintaining Ethernet interface units (EIU) in an Ethernet network. There are seven data schema tables required to provision the EIU. The purpose of each table is summarized in table 10.

Table 10 Summary of data schema tables required for EIU provisioning

Table	Description
LIUINV	Table LIUINV is the main inventory table for configuring EIUs, and includes card product engineering codes (PEC), shelf location, default load name, Ethernet MAC address, and a flag to enable local area network (LAN) heartbeat checking.
IPNETWRK	Table IPNETWRK defines the SuperNode subnetwork (IP address class, DMS-core host address, subnetwork mask, and default EIU). The SuperNode subnet is derived from the subnet mask and the DMS-core host address.
IPROUTER	Table IPROUTER defines the routing functions of the EIUs (SuperNode side and LAN side IP addresses, and flags to enable address resolution protocol (ARP) and proxy ARP protocols).
IPHOST	Table IPHOST defines IP addresses for all IP hosts in the switch. Hosts include computing module (CM), application processors (AP), file processors (FP), application processors for UNIX (APUX), and the EIU.
IPPROTO	Table IPPROTO defines timers for ARP refresh.
IPTHRON	Table IPTHRON defines IP throttling data in kbyte/s for the EIUs and APUs. Table entries allow favoring of the CM, APs, and FPs. This table protects the DS30 links in the LPP from traffic overflow, and is needed for messaging.
ENSITES	Table ENSITES contains a complete list of all sites referenced in table EXNDINV.
ENTYPES	Table ENTYPES contains a complete list of all external node types referenced in table EXNDINV.
EXNDINV	Table EXNDINV lets the maintenance and administration position (MAP) operator monitor and control nodes that are either attached to SuperNode switches by EIU, or attached to SuperNode or NT40 switches by an input/output controller (IOC) X.25 card.

The following sections describe these tables as they apply to EIU provisioning. For complete information on data schema, refer to *DMS-100 Translations Guide,* 297-8xxx-350.

Interdependency and auto-configuration

Tables IPROUTER and IPHOST are interdependent on each other, as well as on table IPNETWRK. Whenever a tuple in table IPROUTER is modified, the corresponding tuple, if any (with the same EIU), in table IPHOST is also modified and auto-configured. For example, if either the SuperNode side or the LAN-side IP address changes for an EIU in table IPROUTER table, the corresponding entry in table IPHOST is configured to reflect the changes made in table IPROUTER. The changes in the tables are propagated immediately to all in-service nodes.

Changes made to the IP address component in table IPNETWRK also force auto-configuration of the IP address components of all the nodes listed in tables IPROUTER and IPHPOST. The auto-reconfiguration routine validates the changes made in table IPNETWRK against the current entries in tables IPROUTER and IPHOST. If the new parameters of IPNETWRK table do not conform with all the current entries in the other two tables, auto-configuration is not performed and the reasons are displayed.

The validation routine for auto-configuration validates the host IDs of all the nodes in tables IPHOST and IPROUTER with the new host ID size being proposed in table IPNETWRK. The changes cannot be made to table IPNETWRK if the validation for auto-configuration fails. If the changes are validated for auto-configuration, the modified data in table IPNETWRK is propagated to all nodes along with the modified data (as a result of auto-configuration) of tables IPROUTER and IPHOST.

Boot protocol (BOOTP) may automatically datafill the FPs in table IPHOST even though EIUs are datafilled automatically.

Table LIUINV

Table LIUINV describes the hardware configuration for application-specific units (ASU). EIU hardware information is datafilled in this table.

Currently, the system allows a maximum of eight EIUs per switch. EIUs can be on a single link peripheral processor (LPP) or in multiple LPPs (according to the limitations imposed by product integrity testing of the engineering rules in *Provisioning Rules for LPP, SSLPP, and SNSE LIS*, System Engineering Bulletin SEB 92-02-001. The location of an EIU on an LPP or on a particular shelf of the LPP must be carefully considered with respect to LPP engineering rules. For more information on engineering, refer to “Chapter 1: Introduction to the EIU”.

Datafill sequence and implications

The following tables must be datafilled before table LIUINV:

- PMLOADS
- LIMINV
- CARRMTC
- SUSHELF
- LIMPTINV (LIM-based LIU)
- MSCDINV (MS-based LIU)

You must datafill the EIU in table LIUINV before datafilling it in table IPHOST.

Table LIUINV datafill

Table 11 lists the fields and value ranges used to datafill an EIU in table LIUINV.

CAUTION
Possible loss of service
Table LIUINV requires that you datafill a unique media access control (MAC) address for each EIU. Obtain these MAC addresses from Nortel. Using an arbitrary address for an EIU may result in loss of connectivity with the Ethernet network.

While table 11 provides all the information you need to datafill for EIUs, complete information on table LIUINV is in *DMS-100 Translations Guide*, 297-xxxx-350.

Table 11 Field descriptions for table LIUINV for EIU datafill

Field	Subfield or refinement	Entry	Explanation and action
LIUNAME		see subfields	*Link interface unit name* This is the key field, which consists of subfields LIUTYPE and LIUNO. This field uniquely identifies the EIU.
	LIUTYPE	EIU	*Link interface unit type* The Ethernet interface unit (EIU) replaces the data communication processor (DCP).
(Sheet 1 of 4)			

Table 11 Field descriptions for table LIUINV for EIU datafill (continued)

Field	Subfield or refinement	Entry	Explanation and action
	LIUNO	0 to 511	*Link interface unit number* Enter the number assigned to the EIU.
LOCATION			The actual physical location of the EIU. This field identifies the shelf and slot number where the EIU is located
LOCATION		see subfields	*Location* Enter the location of the EIU on the host link interface module. This field consists of subfields CTRL, SHELFNUM, and LIUSLOT.
	CTRL	see subfield	*Control information* This field consists of subfield CONTROL.
	CONTROL	LIM or MS	*Controlling host entity* Enter MS if the host is a message switch and datafill subfields MSCARD and MSPORT. Enter LIM if the controlling host is a link interface module and datafill field LIMNUM.
	MSCARD	5 to 23	*Message switch card* If the entry in field CONTROL is MS, enter the message switch card number. Any entries outside the range indicated for this field are invalid.
	MSPORT	0 to 3	*Message switch port* If the entry in field CONTROL is MS, enter the message switch port number.
	LIMNUM	0 to 16	*Link interface module number* If the entry in field CONTROL is LIM, enter the host LIM number on which the LIU resides. Otherwise, leave this field blank.
	SHELFNUM	0 to 3	*Shelf number* Enter the shelf number, at the host LIM, on which the EIU is located.

(Sheet 2 of 4)

Table 11 Field descriptions for table LIUINV for EIU datafill (continued)

Field	Subfield or refinement	Entry	Explanation and action
	LIUSLOT	8 to 31	*Link interface slot* Enter the slot number, at the host LIM, on which the EIU resides. The EIU occupies two card slots. The left-most card represents the logical location of the card. All the shelves that are datafilled on a particular controller must be of the same type (two-slot shelves).
LOAD		alphanumeric (vector of up to 8 characters)	*Software load name* Enter the table software load name applicable to the EIU. This load is found in table PMLOADS.
PROCINFO		see subfield	*Processor information* This field specifies the product engineering code (PEC) of the processors used in the LIU. This field consists of subfield PROCPEC.
	PROCPEC	NTEX22BA or NTEX22BB NTEX22CA	*Processor product engineering code* Enter the PEC of the processor card used in the EIU as follows: • NTEX22BA and NTEX22BB are the PECs for the 8-Mbyte integrated processor and F-bus interface cards. The difference between the NTEX22BA and NTEX22BB cards is in firmware only, the hardware is identical. • NTEX22CA has a 32-Mbyte integrated processor and F-bus interface card.
CARDINFO			This field identifies the PEC of EIU circuit packs. The EIC PEC code is NT9X84AA and the Ethernet interface paddle board (EIP) PEC code is NT9X85AA.

(Sheet 3 of 4)

Table 11 Field descriptions for table LIUINV for EIU datafill (continued)

Field	Subfield or refinement	Entry	Explanation and action
CARDINFO		see subfields	*Card information* This field specifies the card data and consists of subfield APPLPEC.
	APPLPEC	NT9X84AA	*Application product engineering code* Enter the PEC of the application card. Card NT9X84AA is used with EIU applications. This field consists of subfields PBPED, HEARTBEAT, and MAC_ADDRESS.
	PBPEC	NT9X85AA	*Paddle board product engineering code* Enter one of the PECs. Enter NT9X85AA for EIU coax applications.
	HEARTBEAT	YES or NO	*Heartbeat* Enter YES if the EIU expects a heartbeat indication signal from the media access unit (MAU) connected to it; otherwise, enter NO. Yes is allowed only if the MAU supports heartbeat of signal quality error (SQE)
	MAC_ ADDRESS	000075F00000 to 000075FFFFFF	*Media access control address* Enter a 12-character hex string representing the MAC address. The MAC address is represented in hexadecimal without any spaces between digits. The MAC_ADDRESS must be of the form 000075Fxxxxx. MAC addresses for EIUs are defined by Nortel. Refer to "Appendix I: Obtaining a MAC address" for more information on MAC addresses.
(Sheet 4 of 4)			

EIU MAC addresses

By industry convention, MAC addresses for networking devices are unique worldwide. In typical networking devices, the MAC address is burned into a PROM on the circuit pack. However, for EIUs on the DMS-100 switch, the

MAC address is datafilled. The operating company obtains the MAC address from Nortel, and Nortel in turn controls the distribution of the addresses so that all addresses remain unique. The operating company must ensure that this address is datafilled correctly for each EIU.

For details on MAC addresses, refer to “Appendix I: Obtaining a MAC address”.

IP addresses

By industry convention, IP addresses must also be unique. This address is used at a network level to route information to nodes in a LAN or WAN environment. IP addresses are regulated by the Network Information Center (NIC).

For details on IP addresses, refer to “Appendix H: IP network number requests” and “Appendix E: Understanding IP and IP addressing”.

Sample datafill for table LIUINV

Figure 15 shows sample datafill for table LIUINV for an EIU.

Figure 15 Datafill example for table LIUINV

```
 LIUNAME      LOCATION     LOAD          PROCINFO
                                                        CARDINFO
-------------------------------------------------------------------
 EIU 117   LIM  1 3 12 ETC0TBM                          NTEX22BB
                             NT9X84AA NT9X85AA YES 000075F4C117
```

Table IPNETWRK

Table IPNETWRK contains information relating to the SuperNode subnetwork (IP address class, DMS-core host address, subnetwork mask, and default EIU). The SuperNode subnet is derived from the subnet mask and the DMS-core host address.

Table IPNETWRK also contains the provisioning information for interface EIUs.

Table IPNETWRK is part of the implementation of transmission control protocol/Internet Protocol (TCP/IP) protocols on the DMS SuperNode. This implementation provides the following functionality:

- third-party compatibility with host machines for connection setup and data exchange is added

- routing tables and algorithms are added to the IP as part of its addressing function
- the capability to datafill and distribute configurable information that is associated with the TCP/IP protocols using table control and the distributed data manager is added

Datafill sequence and implications

Before datafilling table IPNETWRK, the following prerequisites must be in place:

- the EIU must be datafilled in LIUINV table
- Nortel Networks recommends to place the default EIU in the off-line state
- table IPROUTER must be empty

Note: Table IPROUTER is not required for interface EIUs.

If these conditions are not met, the system generates an error message that indicates which conditions have not been met.

Datafill for table IPNETWRK

Table 12 lists the fields and value ranges used to datafill an EIU in table IPNETWRK.

While table 12 provides all the information you need to datafill for EIUs, complete information on table IPNETWRK is in *DMS-100 Translations Guide,* 297-xxxx-350.

Table 12 Field descriptions for table IPNETWRK for EIU datafill

Field	Subfield or refinement	Entry	Explanation and action
KEYREF		refer to subfield	*Key reference.* This field consists of subfield TAB_KEY.
	TAB_KEY	0 to 15	*Table key.* Enter data in the network interfaces. You can enter a maximum of 16 entries.
CMIPADDR		IP address with four numbers from 0 to 255	*Computing module Internet Protocol. address.* Enter the Internet Protocol (IP) address of the CM. Separate each number in the address with a single space. For example, 47 2 86 122 is equivalent to an IP address of 47.2.86.122.
SUBNET		1 to 23	*Internet Protocol network subnet range.* Enter the range of the IP network subnet mask bit width. Entries outside the range indicated for this field are invalid.
OPTION		refer to subfields	*Option.* This field consists of subfields WORD_EIU and EIU_RNG. You can enter up to a maximum of two options. If you enter less than two options, end the entry with a $. This field defines the default EIU used for routing.
	WORD_EIU	EIU or EXTERNAL_ ROUTER	*Ethernet interface unit.* Enter EIU (Ethernet interface unit) or EXTERNAL_ROUTER.
	EIU_RNG	0 to 750	*Ethernet interface unit range.* Enter the number that is assigned to the EIU.
PARMAREA		refer to subfields	*Parameter area.* This optional field consists of subfield PARM. You can enter a maximum of 12 multiples of this field. If you enter less than 12 multiples, end the list of entries with a $.

(Sheet 1 of 3)

Table 12 Field descriptions for table IPNETWRK for EIU datafill (continued)

Field	Subfield or refinement	Entry	Explanation and action
	PARM	SCRNFLAG	*Parameter.* If a screening flag is a requirement, enter SCRNGLAG. Enter refinement SCRNFLAG.
		EIU_INTERFACE	To specify an EIU interface as the LAN interface for the CM, enter refinements for WORD_EIU and EIU_RNG.
		DFLT_GTWY_IP ADDR	If a default gateway IP address for the network is a requirement, enter refinement GTWY_IPADDR.
		IOM_ INTERFACE	To specify an IOM interface as the LAN interface for the network, enter refinements IOMNUM and PORT.
		IOP_INTERFACE	To specify an XA-Core IOP interface as the LAN interface fo rthe network, enter refinements IOMNUM, PACKLET and PORT.
	DFLT_ INTERFACE	Y or N	To specify the default interface for the CM, enter Y. To not specify the default interface for the CM, enter N.
		NULLPARM	Enter NULLPARM for a null parameter. This parameter is reserved for internal use.
(Sheet 2 of 3)			

Table 12 Field descriptions for table IPNETWRK for EIU datafill (continued)

Field	Subfield or refinement	Entry	Explanation and action
	SCRNFLAG	Y or N	*Screen flag.* If the entry in subfield PARM is SCRNFLAG, datafill this refinement. To activate IP screening, enter Y. To deactivate IP screening, enter N. Refer to data schema table EXNDINV in this document for IP screening capability.
	GTWY_IPADDR	IP address with four numbers from 0 to 255	If the entry in subfield PARM is DFLT_GTWY_IPADDR, enter the default gateway IP address. Separate each number in the address with a single space. For example, 47 2 11 109 is equivalent to an IP address of 47.2.11.109.
	IOM_NUM	0 to 255	Enter the IOM number.
	PORT	0 to 255	Enter the associated IOM port number.
	PACKLET	0 to 255	Enter the associated packlet number.
(Sheet 3 of 3)			

Sample datafill for table IPNETWRK

Figure 16 shows sample datafill for table IPNETWRK for an EIU.

Figure 16 Datafill examples for table IPNETWRK

```
KEYREF        CMIPADDR SUBNET                                        OPTION
                                                                     PARMAREA
-------------------------------------------------------------------------------
    0    47 209 192 11 12   (       EIU 117)                            $
                                                          (SCRNFLAG N)$
    1   47 209 192 10 12$ (EIU_INTERFACE EIU 117)  (DFLT_INTERFACE y)
                                    (DFLT_GTWY_IPPADDR 47 209 192 15)$
```

Supplementary information

The TRANSLATE command in the NETMAN tool can be used to convert an IP address into network parameters and vice versa.

Observe the following criteria required for the subnet:

- the subnet size must be the same as the subnet size used on the LAN-side of the EIU
- the subnet must be in the range 2 to 22 and is further validated based on the class of network
- a Class A network (first octet of IP address is within the range 1 to 127) can have a subnet size from 2 to 22
- a Class B network (first octet of IP address is within the range 128 to 191) can have a subnet size from 2 to 14
- a Class C network (first octet of IP address is within the range 192 to 223) can have a subnet size from 2 to 6

This secondary validation is not performed until the table is committed, at wh1 47 209 192 11 12ich point it fails with an error message DATA CONSISTENCY ERROR if this criteria is not met.

For examples on addressing, refer to “Appendix F: EIU addressing examples”.

Table IPROUTER

Table IPROUTER is part of the implementation of TCP/IP protocols on the SuperNode switch. This table provides the following functionality:

- provides compatibility with third-party host machines for connection setup and data exchange
- adds routing tables and algorithms to the IP as part of its addressing function
- defines and distributes configurable information that is associated with the TCP/IP using table control and the distributed data manager

Table IPROUTER stores Internet-specific information from each of the EIU, or routers, in the SuperNode switch.

IPROUTER table contains the list of EIUs and their corresponding parameters, as described in table 13. This table is required to configure an EIU as an Internet node.

Note: Table IPROUTER is not required for interface EIUs.

Datafill sequence and implications

The following tables must be datafilled before table IPROUTER:

- PMLOADS
- LIUINV
- IPNETWRK

Before entering data in table IPROUTER, Nortel Networks recommends to place the default EIU in the off-line state.

Datafill

Table 13 lists the fields and value ranges used to datafill an EIU in table IPROUTER.

While table 13 provides all the information you need to datafill for EIUs, complete information on table IPROUTER is in *DMS-100 Translations Guide*, 297-xxxx-350.

Table 13 Field descriptions for table IPROUTER for EIU datafill

Field	Subfield or refinement	Entry	Explanation and action
RKEY		0 to 63	*Router key* Enter the identification number of the IP router. This is the key into the table.
ROUTER		see subfields	*Router* This field consists of subfields WORD_EIU and EIU_RNG.
	WORD_EIU	EIU	*Ethernet interface unit* Enter EIU (Ethernet interface unit). Entries outside this range are invalid.
	EIU_RNG	0 to 750	*Ethernet interface unit range* Enter the specific EIU to be accessed for the router index.
SNIPADR		table of 4 digits (0 to 255)	*Supernode-side Internet Protocol address* Enter the SuperNode-side IP address.
ETHIPADR		table of 4 digits (0 to 255)	*Ethernet-side Internet Protocol address* Enter the Ethernet-side IP address.

(Sheet 1 of 2)

Table 13 Field descriptions for table IPROUTER for EIU datafill (continued)

Field	Subfield or refinement	Entry	Explanation and action
ETHARP		YES or NO	*Ethernet address resolution protocol* Enter YES if the EIU is to engage in address resolution protocol (ARP) activity within the Ethernet subnet. Otherwise, enter NO. The default value for this field is YES.
ETHPARP		YES or NO	*Ethernet proxy address resolution protocol* Enter YES if EIU is to engage in proxy ARP activity on behalf of the SuperNode hosts within the Ethernet. Otherwise, enter NO. The default value for this field is YES.
(Sheet 2 of 2)			

Sample datafill for table IPROUTER

Figure 17 shows sample datafill for table IPROUTER for an EIU.

Figure 17 Datafill example for table IPROUTER

```
RKEY              ROUTER         SNIPADR        ETHIPADR ETHARP ETHPARP
-------------------------------------------------------------------------
   0              EIU 117  47 209 192 117  47  59 132 241    YES    YES
```

Table IPHOST

Table IPHOST assigns the IP addresses to SuperNode end hosts. SuperNode end hosts can have one or two addresses, depending on the entry in field NODENAME.

Table IPHOST activates the TCP layer and its applications on those nodes.

> ***Note:*** If the TCPCONN field in table IPHOST is set to 0, communication in related applications stops.

Table IPHOST also supports application processor (AP) and file processor (FP) datafill for both Support Operating System (SOS) nodes and for SOS SuperNode UNIX (SNIX) nodes for which two IP addresses are needed.

Datafill sequence and implications

The following tables must be datafilled before table IPHOST:

- IPNETWRK
- Inventory tables for nodes that are datafilled in field nodename in table IPHOST

Before entering data into table IPROUTER, Nortel Networks recommends placing the corresponding EIUs referred to in the datafill in the OFFL state..

Note: In the assignment of IP addresses, the LAN side and the workstation need to be on different subnets from the DMS peripheral module (PM).

Datafill

Table 14 lists the fields and value ranges used to datafill an EIU in table IPHOST.

While table 14 provides all the information you need to datafill for EIUs, complete information on table IPHOST is in *DMS-100 Translations Guide*, 297-xxxx-350.

Table 14 Field descriptions for table IPHOST for EIU datafill

Field	Subfield or refinement	Entry	Explana tion and action
INDEX		refer to subfield	*Index* This field consists of subfield NODEIDX.
	NODEIDX	0 to 63	*Node index* Enter the node index number.
(Sheet 1 of 2)			

Table 14 Field descriptions for table IPHOST for EIU datafill (continued)

Field	Subfield or refinement	Entry	Explana tion and action
NODENAME		AP, APU, CM , EIU, ELIU, FP,MS	*Node name* Enter the node name: • AP (application processor) • APU (application processor UNIX) • CM (computing module) • EIU (Ethernet interface unit) • FP (file processor) • MS (message switch) ***Note:*** You can enter AP and FP to support the Supernode Unix (SNIX) versions of the nodes. You can enter IP addresses for both the software operating system and the SNIX sides of the nodes. You must enter the nodes in table APINV. The IP address for an AP or FP can be the software operating side only or the software operating side and SNIX side. You can enter one or two IP addresses for an AP or FP node. The application on the node determines the number addresses to enter. A node AP requires two IP addresses for the node.
NODE		refer to subfields	*Node* This field contains subfields for the entries in field NODENAME.
(Sheet 2 of 2)			

NODENAME = AP

If the entry in field NODENAME is AP, enter the data in the following refinements:

- SMNINDEX
- SNADDR
- TCPCONN
- FTPCLCON
- FTPSVCON
- UNIXADDR

The datafill appears in the following table.

Table 15 Field descriptions for conditional datafill for NODENAME = AP

Field	Subfield or refinement	Entry	Explanation and action
	SMNINDEX	0 to 99	*File processor index* Enter the FP index number.
	SNADDR	table of 4 (0 to 255)	*Internet porotocol address SuperNode* Enter the address of the SuperNode side.
	TCPCONN	(0 TO 20)	*Transmission control Protocol connections* Enter the transmission control protocol (TCP) connections number..
	FTCLCONN	0 to 10	*File transfer protocol connections.* Enter the file transfer proctocol (FTP) connections number.
	FTSVCON	0 to 10	*File transfer protocol server connections* Enter the FTP server number.
	UNIXADDR	table of 4 (0 to 255)	*Unix address* Enter the UNIX side IP address fo the node..

NODENAME = APU

If the entry in field NODENAME is APU, enter the data in the following refinements:

- APUINDEX
- SOSADDR
- UNIXADDR
- TCPCONN
- FTPCLCON
- FTPSVCON

The datafill appears in the following table.

Table 16 Field descriptions for conditional datafill for NODENAME = APU

Field	Subfield or refinement	Entry	Explanation and action
	APUINDEX	0 to 1	*Application processor UNIX index* Enter the APU index number.
	SOSADDR	table of 4 (0 to 255)	*Support Operating Switch* Enter the support operating switch address.
	UNIXADDR	table of 4 (0 to 255)	*Internet protocol host identification for APU* Enter the support operating switch.
	TCPCONN	0 to 1	*Transmission control protocol connections* Enter the TCP connections number.
	FTPCLCON	0	*File transfer protocol connections* Enter the FTP connections number.
	FTPSVCON	0	*File transfer protocol server connections* Enter the FTP server number.

NODENAME = CM

If the entry in field NODENAME is CM, enter the data in the following refinements.

- CMINDEX
- TCPCONN
- FTPCLCON
- FTPSVCON

The datafill appears in the following table.

Table 17 Field descriptions for conditional data for NODENAME = CM

Field	Subfield or refinement	Entry	Explanation and action
	CMINDEX	0 to 1	*Computing module index* Enter the CM index number.
	TCPCONN	0 to 96	*Transmission control protocol connections* Enter the TCP connections number.
	FTPCLCON	0 to 48	*File transfer protocol connections* Enter the maximum number of FTP client sessions.
	FTPSVCON	0 to 48	*File transfer protocol server connections* Enter the maximum number of FTP server sessions.

NODENAME = EIU

If the entry in field NODENAME is EIU, enter data in the following refinements:

- EIUINDEX
- SNADDR
- LANADDR
- TCPCONN
- FTPCLCON
- FTPSVCON

The datafill appears in the following table.

Table 18 Field descriptions for conditional datafill for NODENAME = EIU

Field	Subfield or refinement	Entry	Explanation and action
	EIUINDEX	0 to 750	*Ethernet interface unit index* Enter the EIU number.
	SNADDR	table of 4 (0 to 255)	*Internet protocol address for node* Enter the IP address of the SuperNode side of the node.
	LANADDR	table of 4 (0 to 255)	*Second IP address for EIU host* Enter the second IP address fo the EIU host.
	TCPCONN	0 to 32	*Transmission control protocol connections* Enter the TCP connections number.
	FTPCLCON	0 to 16	*File transfer protocol connections* Enter the file transfer protocol connections number.
	FTPSVCON	0 to 16	*File transfer protocol server connections* Enter the file transfer protocol serer number.

NODENAME = ELIU

If the entry in field NODENAME is ELIU, enter the data in the following refinements:

- ELIUINDEX
- SNADDR
- LANADDR
- TCPCONN

The datafill appears in the following table.

Table 19 Field descriptions for conditional datafill for NODENAME = ELIU

Field	Subfield or refinement	Entry	Explanation and action
	ELIUINDEX	0 to 750	*Ethernet interface unit index* Enter the ELIU number.
	SNADDR	table of 4 (0 to 255)	*Internet protocol address for node* Enter the IP address of the SuperNode side of the node.
	LANADDR	table of 4 (0 to 255)	*Second IP address for ELIU host* Enter the second IP address for the ELIU host.
	TCPCONN	2	*Transmission control protocol connections* Correct entry is 2.

NODENAME = FP

If the entry in field NODENAME is FP, enter data in the following refinements.

- SMNINDEX
- SNADDR
- TCPCONN
- FTPCLCON
- FTPSVCON
- UNIXADDR

The datafill appears in the following table.

Table 20 Field descriptions for conditional datafill for NODENAME = FP

Field	Subfield or refinement	Entry	Explanation and action
	SMNINDEX	0 to 99	*File processor index* Enter the file processor index number.
	SNADDR	table of 4 (0 to 255)	*Internet Protocol address for node* Enter the IP address of the SuperNode side of the node.
	TCPCONN	0 to 32	*Transmission control protocol connections* Enter the transmission control protocol connections number.
	FTPCLCON	0 to 16	*File transfer protocol connections* Enter the file transfer protocol connections number.
	FTPSVCON	0 to 16	*File transfer protocol server connections* Enter the FTP server number.
	UNIXADDR	table of 4 (0 to 255)	*Internet Protocol host identification for APUX* Enter the UNIX IP identification for the APUX.

NODENAME = MS

If the entry in field NODENAME is MS, enter the data in the following refinements.

- MSINDEX
- SNADDR
- TCPCONN
- FTPCLCON
- FTPSVCON

The datafill appears in the following table.

Table 21 Field descriptions for conditional datafill for NODENAME = MS

Field	Subfield or refinement	Entry	Explanation and action
	MSINDEX	0 to 1	*Message switch index* Enter the MS index.
	SNADDR	table of 4 (0 to 255)	*Internet Protocol address for node* Enter the IP address of the SuperNode side of the node.
	TCPCONN	0	*Transmission control protocol connections* Enter the TCP connections number.
	FTPCLCON	0	*File transfer protocol connections* Enter the FTP connections number.
	FTPSVCON	0	*File transfer protocol server connections* Enter the FTP server number.

Sample datafill for table IPHOST

Figure 18 shows sample datafill for table IPHOST for an EIU.

Figure 18 Datafill example for table IPHOST

```
INDEX NODENAME                                                  NODEINFO
-----------------------------------------------------------------------
    0       CM  0                                32    1    1
    1      EIU 117  47 209 192 117
                            47  59 132 241    8    0    0
```

Table IPTHRON

Table IPTHRON contains the IP throttling numbers that control congestion. The IP datagram flow from SuperNode hosts requires throttling to control congestion in the shared communication resources between the local message switch (LMS) and the message switch (MS). The IP throttling values in this table indicate the level of throttling in kbyte/s imposed by each IP SuperNode host.

The following are general rules for datafilling table IPTHRON:

- The LMS node name and number are key to each tuple.

- The first two fields for the tuple are numbers between 0 (zero) and 32 767 that represents the maximum IP transmit-and-receive rate in kbyte/s to and from the node that is datafilled as a key.
- The IP throttling numbers default to zero (100% throttling) for all EIUs datafilled in table LIUINV. This means that if the throttling capacity numbers are not modified to numbers more than zero in this table, the EIU cannot communicate to nodes across DS30 links. The APU datafill is optional in this table. If APU is not datafilled in this table, it defaults to 0% throttling. The 0% throttling means that IP traffic to and from the APU is not throttled.
- There are eight optional fields for each tuple.
- Each optional field contains the following:
  - SuperNode node name, such as CM, file processor (FP), application processor (AP), EIU, or APU
  - node index
  - transmit capacity in kbytes/s
- Each optional field indicates the IP transmission rate from the node in the optional field to either the EIU or the APU that is datafilled as a key for the tuple.
- The node name and index in the optional field must be datafilled first in its appropriate inventory table. However, table IPTHRON does not validate the information in the optional field. For example, FPs datafilled in the IPTHRON tuple optional fields must be datafilled first in table APINV. The tuple in IPTHRON is accepted even if the FPs are not datafilled in table APINV.
- For one tuple, the total transmit capacity of all of the nodes in the optional fields cannot exceed the total receive capacity of the LMS node.
- For one tuple, the same node and node number must not appear more than once in the optional fields.
- No other verification is performed for a tuple. For example, maintenance personnel must ensure that EIUs and APUs that appear in the optional fields are not located on the same LIM as the LMS node.
- The table entries can be added, modified, or deleted without taking the node off-line. The node must be datafilled in table LIUINV before it is allowed in table IPTHRON. As a special case, EIUs are automatically datafilled in this table with default values (transmit capacity of zero and receive capacity of zero) when they are added in table LIUINV. The EIU is also automatically deleted from IPTHRON when it is deleted from table LIUINV. Adding and deleting EIU directly from table IPTHRON is not allowed.
- The table does not directly depend on the other tables.

For more information on throttling, refer to"IP throttling" on page 61 and to the *Provisioning Rules for LPP, SSLPP, and SNSE LIS*, System Engineering Bulletin number 92-02-001, version 01.09.

Datafill sequence and implications

The following tables must be datafilled before table IPTHRON:

- inventory tables for nodes that are datafilled in field SNNODE in table IPTHRON

Datafill

Table 22 on page 91 lists the fields and value ranges used to datafill an EIU in table IPHOST.

While table 22 provides all the information you need to datafill for EIUs, complete information on table IPHOST is in *DMS-100 Translations Guide*, 297-xxxx-350.

Table 22 Field descriptions for table IPTHRON for EIU datafill

Field	Subfield or refinement	Entry	Explanation and action
LMSNODE		see subfields	*Local message switch node* This is the first and key field of the table and consists of subfields LIUNAME and LIUNO.
	LIUNAME	APU or EIU	*Link interface unit name* Enter the link interface unit (LIU) name. This field indicates an IP capable node connected to the local message switch. The node datafilled here must first be datafilled in table LIUINV. Enter APU for application processor unit. Enter EIU for Ethernet interface unit.
	LIUNO	0 to 750	*Link interface unit number* Enter the node index.
TXCAPCT		0 to 32767	*Transmit capacity* Enter the IP transmission rate in kbyte/s from the node to all other SuperNode IP nodes.
RXCAPCT		0 to 32767	*Receive capacity* Enter the IP receive rate in kbyte/s from all other SuperNode nodes to the node.

(Sheet 1 of 3)

Table 22 Field descriptions for table IPTHRON for EIU datafill (continued)

Field	Subfield or refinement	Entry	Explanation and action
OPTION		see subfield	*Option* This field consists of subfield SNNODE.
	SNNODE	AP, APU, CM, EIU, ELIU, FP, or MS	*SuperNode node* Enter the name of the SuperNode node. The node must first be datafilled in its inventory table. For example, FP must be datafilled in table APINV. Up to eight nodes can be entered. If less than eight are required, end the list with a $ (dollar sign). Enter AP (application processor) and datafill refinement SMNINDEX. Enter APU and datafill refinement APUINDEX. Enter CM and go to refinement TXCAPCT. Enter EIU and datafill refinement EIUINDEX. Enter ELIU and datafill refinement ELIUINDEX. Enter FP (file processor) and datafill refinement SMNINDEX. Enter MS (message switch) and datafill refinement MSINDEX.
	SMNINDEX	0 to 99	*Synchronized and matched node index* If the entry in field SNNODE is AP or FP, enter the synchronized and matched node (SMN) index. Go to refinement TXCAPCT.
	APUINDEX	0 to 750	*Application processor unit index* If the entry in field SNNODE is APU, enter the APU index. Go to refinement TXCAPCT.

(Sheet 2 of 3)

Table 22 Field descriptions for table IPTHRON for EIU datafill (continued)

Field	Subfield or refinement	Entry	Explanation and action
	EIUINDEX	0 to 750	*Ethernet interface unit index* If the entry in field SNNODE is EIU, enter the EIU index. Go to refinement TXCAPCT.
	ELIUINDEX	0 to 750	*Ethernet link interface unit index* If the entry in field SNNODE is ELIU, enter the ELIU index. Go to refinement TXCAPCT.
	MSINDEX	0 to 1	*Message switch index* If the entry in field SNNODE is MS, enter the MS index. Go to refinement TXCAPCT.
	TXCAPCT	0 to 32767	*Transmit capacity* Enter the IP transmission rate in kilobits per second from node to node. The node name and number are specified as a key to this tuple.
(Sheet 3 of 3)			

Sample datafill for table IPTHRON

Figure 19 shows sample datafill for table IPTHRON for an EIU.

Figure 19 Datafill example for table IPTHRON

```
LMSNODE TXCAPCT RXCAPCT
                                                                        OPTION
-------------------------------------------------------------------------------
EIU 117   15    15                                                        $
```

Table IPPROTO

Table IPPROTO is rarely used and normally does not need to be datafilled.

If there is a serious performance problem, typically on very slow networks, modification of this table may be considered to increase timeout values.

Datafill sequence and implications

There are no datafill sequence and implications.

Datafill

Table 23 lists the fields and value ranges used to datafill an EIU in table IPPROTO.

Table 23 Field descriptions for table IPPROTO for EIU datafill

Field	Subfield or refinement	Entry	Explanation and action
IPRSMTMO		1 to 100 (seconds)	The IP reassembly time-out. This field sets the time when IP reassembly gives up reassembling a packet. By default the IP reassembly time-out is 10 seconds. The time-out can be modified to improve performance in extreme network conditions. On extremely slow networks this may be increased to give reassembly a better chance to reassemble before the time-out occurs.
ARPRFTMO		1 to 720 (seconds)	ARP cache time-out. On slow networks, the ARP cache time-out can be increased from the default of 1minute. Increasing the time-out too much can cause an excessively large ARP cache, thereby reducing the network performance.

Sample datafill for table IPPROTO

Figure 20 shows sample datafill for table IPPROTO.

Figure 20 Datafill example for table IPPROTO

```
IPPKEY IPRSMTMO ARPRFTMO
-----------------------
     0       20        2
```

Table ENSITES

Table ENSITES contains a complete list of all sites referenced in table EXNDINV.

Datafill sequence and implications

There are no datafill sequence and implications.

Datafill

Table 24 lists the fields and value ranges used to datafill an EIU in table ENSITES.

While table 24 provides all the information you need to datafill for EIUs, complete information on table ENSITES is in *DMS-100 Translations Guide*, 297-xxxx-350.

Table 24 Field descriptions for table ENSITES for EIU datafill

Field	Subfield or refinement	Entry	Explanation and action
ENSITE		alphanumeric (1 to 12 characters)	*External node site* Enter the name of the node site.

Sample datafill for table ENSITES

Figure 21 shows sample datafill for table ENSITES for an EIU.

Figure 21 Datafill example for table ENSITES

```
ENSITE
-----------------------------------------------------------------------
MER_5
```

Table ENTYPES

Table ENTYPES contains a complete list of all external node types referenced in table EXNDINV.

Datafill sequence and implications

There are no datafill sequence and implications.

Datafill

Table 25 on page 96 lists the fields and value ranges used to datafill an EIU in table ENTYPES.

While table 25 provides all the information you need to datafill for EIUs, complete information on table ENTYPES is in *DMS-100 Translations Guide*, 297-xxxx-350.

Table 25 Field descriptions for table ENTYPE for EIU datafill

Field	Subfield or refinement	Entry	Explanation and action
ENTYPE		alphanumeric (1 to 12 characters)	*External node type* Enter the type of external node (for example, SUN or HP).

Sample datafill for table ENTYPES

Figure 22 shows sample datafill for table ENTYPES for an EIU.

Figure 22 Datafill example for table ENTYPES

```
ENTYPE
------------------------
HP
XTERM
SUN
```

Table EXNDINV

Table EXNDINV provides the MAP operator with the capability of monitoring and controlling nodes that are either attached to SuperNode switches by EIU, or attached to SuperNode or NT40 switches by an input/output controller (IOC) X.25 card.

Each node is referred to as an external node. An external node is any piece of hardware that has an address and responds to a standard communications protocol. For example, an Ethernet node has an IP address and responds to Internet control message protocol (ICMP). Examples of external nodes are UNIX workstations such as SUN and HP, communication servers, and mainframes.

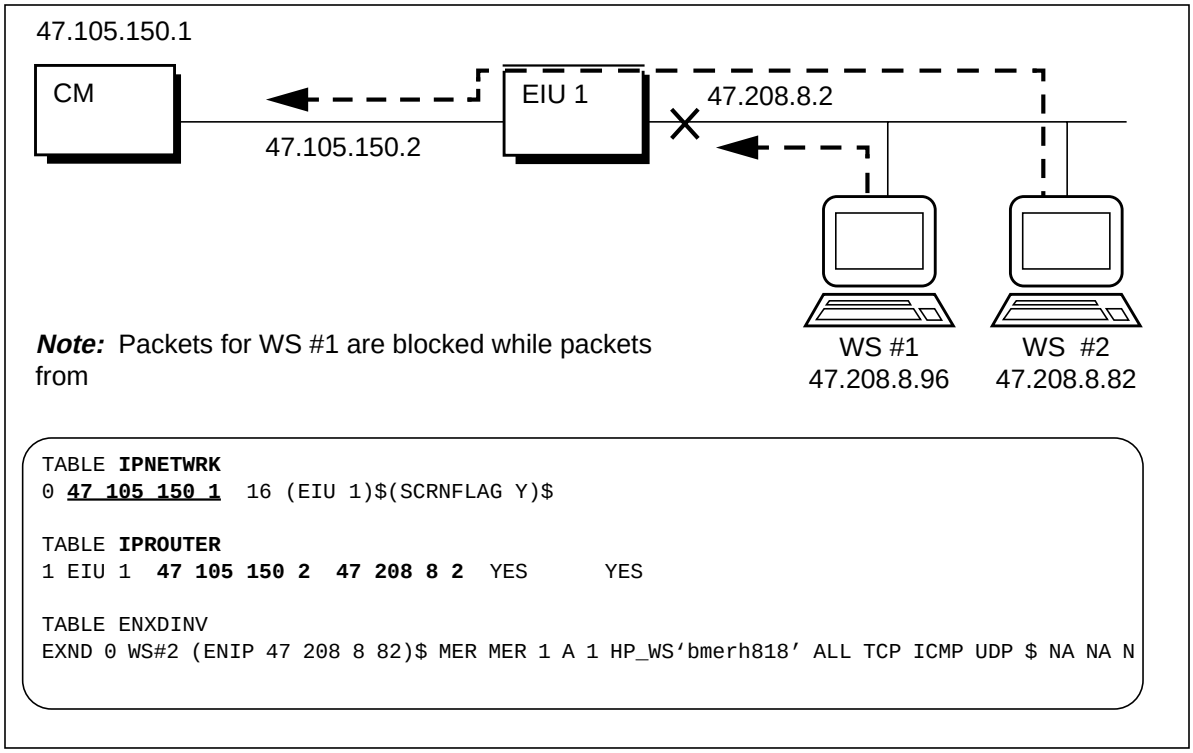
Another example of a standard communications protocol is X.25, which is also supported.

Table EXNDINV contains information about external nodes that are either connected to the DMS SuperNode switch by an EIU, or connected to the DMS SuperNode or NT40 switch by an IOC X.25 card. Each tuple in the table contains the node name, address, protocol, and other information about the external node.

Table EXNDINV filters IP packets. Only packets with a specified source IP address can access DMS IP nodes. The SCRNFLG option in table IPNETWRK enables this functionality

Figure 23 shows table EXNDINV filtering IP packets

Figure 23 Table EXNDINV filters IP packets




```
TABLE IPNETWRK
0 47 105 150 1  16 (EIU 1)$(SCRNFLAG Y)$

TABLE IPROUTER
1 EIU 1  47 105 150 2  47 208 8 2  YES      YES

TABLE ENXDINV
EXND 0 WS#2 (ENIP 47 208 8 82)$ MER MER 1 A 1 HP_WS‘bmerh818’ ALL TCP ICMP UDP $ NA NA N
```

Datafill sequence and implications

For external nodes that communicate using ICMP, the following tables must be datafilled before table EXNDINV:

- PMLOADS
- LIUINV (specifies EIU hardware)
- IPNETWRK (specifies SuperNode network addresses)
- IPROUTER (specifies EIUs as Ethernet routers)
- ENSITES (specifies external node and service peripheral module [SPM] sites)
- ENTYPES (specifies external node types)

Note: Table IPROUTER is not required for interface EIUs.

Datafill

Table 26 lists the fields and value ranges used to datafill an EIU in table EXNDINV.

While table 26 provides all the information you need to datafill for EIUs, complete information on table EXNDINV is in *DMS-100 Translations Guide*, 297-xxxx-350.

Table 26 Field descriptions for table EXNDINV for EIU datafill

Field	Subfield or refinement	Entry	Explanation and action
EXNDKEY		see subfields	*External node key* This key field consists of subfields ENPMTYPE and ENNODENO.
	ENPMTYPE	EXND	*External node peripheral module type* Enter the PM type as follows: • EXND (external node) ***Note:*** These nodes are defined for all products. A product may define additional types of nodes that are valid only for that product.
	ENNODENO	0 to 31	*External node number* Enter a number to identify the external node number of the external node PM type.
ENNAME		alphanumeric (vector of up to 12 characters)	*External node name* Enter an external node name. If the external node runs the UNIX operating system, a suggested value for the field is the UNIX host name of the node, however, this is not enforced.
ENADDR		vector of up to 2 elements	*External node address* This field is a vector of addresses for the external node. Each element of the vector contains an address type and an address. For EIUs, the address is IPADDRESS
	ADDRTYPE	ENIP	*Address type* If the external node is an Ethernet node that has an IP address and responds to ICMP.

(Sheet 1 of 5)

Table 26 Field descriptions for table EXNDINV for EIU datafill (continued)

Field	Subfield or refinement	Entry	Explanation and action
	IPADDRESS	0 to 255 (table of 4)	*Internet Protocol address* If the entry in field ADDRTYPE is equal to ENIP, enter the IP address of the node. An IP address consists of 4 bytes, each with a value in the range 0 to 255. The IP address is usually expressed in the form 255.255.255.255.
	MACADDRESS	table of 12 hex digits	*Machine address* If the entry in the field ADDRTYPE is equal to ENMAC, enter the MAC address that is associated with the Ethernet interface. This subfield consists of a machine address and an indication as to whether the DMS-100 switch provides boot protocol (BOOTP) capability to the node. The MAC address consists of 12 bytes, each with a hex digit value in the range of {0, 1, 2, 3, 4, 5, 6, 7, 8, 9, a, b, c, d, e, f}.
	DMSBOOTP	no, yes	*DMS boot protocol* The DMSBOOTP support is limited to providing an IP address to the external node. It does not provide full BOOTP protocol support.
ENFNAME		alphanumeric (vector of up to 8 characters)	*External node load file name* Enter the default load file name used for the command LOADPM. See table PMLOADS. Enter $ (dollar sign).
ENSITE		alphanumeric (vector of up to 12 characters)	*External node site* Enter the name of the site (usually a building) in which the node is housed. This value must first be datafilled in table ENSITES.
ENLOCN		see subfields	*External node location* This field defines the location of the node within a building and consists of subfields FLOOR, ROW, and POSITION.

(Sheet 2 of 5)

Table 26 Field descriptions for table EXNDINV for EIU datafill (continued)

Field	Subfield or refinement	Entry	Explanation and action
	FLOOR	0 to 99	*Floor number* Enter the number of the floor on which the node is located.
	ROW	A to Z or AA to ZZ (excluding I, O, II, and OO)	*Row* Enter the row on the floor in which the node is located.
	POSITION	0 to 99	*Bay position* Enter the position of the bay in the row where the node is located.
ENTYPE		alphanumeric (vector of up to 12 characters)	*External node type* Enter the type of the node, for example, SUN or HP. This value must first be datafilled in table ENTYPES.
ENINFO		alphanumeric (table of up to 20 characters)	*External node information* Enter a string containing any additional information about the node. Character strings that contain blank characters must be entered with three single quotation marks at the start of the string and three single quotation marks at the end of the string.
ENPROCSR		ALL CORE EIU NONE	*External node processor class* Enter the set of SuperNode processor types with which the external node is allowed to communicate. Table control provides the user with the capability of entering ALL or NONE. If ALL is entered, values CORE and EIU are automatically datafilled by table control.
ENPROTCL		ALL ICMP TCP UDP NONE	*External node protocol* Enter the set of protocols with which the external node can communicate with the SuperNode. Table control provides the user with the capability of entering ALL or NONE. If ALL is entered, values ICMP, UDP, and TCP are automatically datafilled by table control.

(Sheet 3 of 5)

Table 26 Field descriptions for table EXNDINV for EIU datafill (continued)

Field	Subfield or refinement	Entry	Explanation and action
EN0LKALM		CR MJ MN NA	*External node no-link alarm* Enter the type of alarm to be raised if no links are available to the external node: • CR (critical alarm) • MJ (major alarm) • MN (minor alarm) • NA (no alarm)
EN1LKALM		CR MJ MN NA	*External node one-link alarm* Enter the type of alarm to be raised if only one link is available to the external node.
ENALMSPT		Y or N	*External node alarm scan points* This is a vector of up to two multiples. Enter Y (yes) if scan points are to be assigned to the node for alarm purposes and datafill refinements SCTMTYPE, SCTMNO, SCTMCTNO, CRITSCPT, MAJSCPT, MINSCPT, and SCCARDCD. Otherwise, enter N (no). No further datafill is required.
	SCTMTYPE	MTM or OAU	*Scan circuit trunk module type* Enter MTM if the scan circuit resides on the maintenance trunk module (MTM). Enter OAU if the scan circuit resides on the office alarm unit (OAU).
	SCTMNO	0 to 2047	*Scan circuit trunk module number* Enter the trunk module (TM) of the MTM where the scan circuit resides.
	SCTMCTNO	0 to 29	*Scan circuit trunk module circuit number* Enter the circuit number on the MTM of the scan circuit.
	CRITSCPT	0 to 6	*Critical alarm scan point* Enter the scan point associated with the critical alarm for the node.

(Sheet 4 of 5)

Table 26 Field descriptions for table EXNDINV for EIU datafill (continued)

Field	Subfield or refinement	Entry	Explanation and action
	MAJSCPT	0 to 6	*Major alarm scan point* Enter the scan point associated with the major alarm for the node.
	MINSCPT	0 to 6	*Minor alarm scan point* Enter the scan point associated with the minor alarm for the node.
(Sheet 5 of 5)			

Sample datafill for table EXNDINV

Figure 24 shows sample datafill for table EXNDINV for an EIU.

Figure 24 Datafill example for table EXNDINV

```
EXNDKEY ENNAME ENADDR ENFNAME ENSITE ENLOCN ENTYPE ENINFO ENPROCSR ENPROTCL
EN0LKALM EN1LKALM ENALMSPT
-------------------------------------------------------------------------
EXND 0 EXNODMTC (ENIP 47 73 5 95) (ENIP 47 73 5 93) $ $ CAR 1 A 1 XTERM
'COOP7W32' ALL TCP ICMP UDP $ MN NA N
```

Chapter 4: EIU maintenance

This chapter provides information on Ethernet interface unit (EIU) maintenance.

CAUTION
Possible loss of network security
Using the Ethernet interface unit (EIU) and a telnet or file transfer protocol (FTP) session to establish a maintenance and administration position (MAP) session can introduce a security risk to both the DMS node and its subtending network.

When establishing and operating a MAP session in this way, there is limited security for clear text (user identification and passwords) and for Internet Protocol (IP) addresses for screening. This limited security makes an open local area network (LAN) vulnerable to entry by unauthorized persons.

Nortel recommends that the operating company, as a minimal precaution, integrate intermediate security servers with encryption to avoid unauthorized access to the switch. For alternative approaches, contact your Nortel representative to discuss state-of-the-art secure OA&M data communications equipment products.

By using the EIU, telnet, and FTP software, the operating company assumes any and all risks associated with the implementation and use of this hardware and software.

EIU maintenance is limited to hardware diagnostics for the Ethernet interface card (EIC) and the Ethernet interface paddle board (EIP). The maintenance procedures do not include detection or isolation of hardware faults for LAN equipment beyond the EIP, such as a media access unit (MAU) or hub. However, the DMS-100 switch can detect some local area network (LAN) faults, which it reports using EIU in-service trouble alarms and logs.

EIU MAP level

EIU information is available on the maintenance and administration position command interface (MAPCI) display under the PM level. The command to access the EIU MAP display is as follows:

```
>MAPCI;MTC;PM;POST  EIU  n|ALL
```

where
n is the EIU index

The maintenance actions implemented for an EIU are similar to those required for any other application-specific unit (ASU) on the LPP.

Manual busy state

The EIU can be set to the manual busy state from the following states:

- Offl, the off-line state
- InSv, the in-service state
- IsTb, the in-service trouble state

On the MAP display, manual busy is shown as ManB.

The EIU software load can be downloaded to the EIU processor only in the ManB state through the LOADPM command. When the EIU is in either the ManB or the Offl states, it is not actively transmitting messages on the Ethernet LAN. However, in a ManB state, if the EIU contains the correct IP address information database, it may communicate to other SuperNode nodes, such as function processor (FP) or computing module (CM).

In-service state

The EIU can be set to the InSv state only from ManB state. When the EIU is returned to service, the IP address database along with other IP throttling and engineering data is downloaded to the EIU. When the EIU is in the InSv or IsTb state, it can actively communicate to both the Ethernet LAN and the frame transport bus (F-bus).

EIU diagnostics

EIU diagnostics run in the background. This section describes the diagnostics provided for the EIU.

Out-of-service diagnostics

A complete set of EIU out-of-service diagnostics are executed during the ManB to InSv state transition. The EIU is not allowed to return to service if any one part of the diagnostics fail. The faulty card-list does not appear on the MAP display and the system generates PM logs that can help isolate the faulty card. The components level isolation of the fault is not available through logs

or the MAP display. The TST command in MAPCI also executes the same diagnostics when the EIU is ManB.

In-service diagnostics

The EIU changes its state to SysB state from InSv or IsTb if a serious hardware fault is detected by the in-service audit process. The in-service audits periodically run diagnostics on some critical EIU hardware components. The audits run every minute, each time checking one quarter of the hardware components.

In-service diagnostics also include an idler class audit, which runs continuously. The idler class runs whenever there are no other useful processes running. The idler class audit tests the EIC shared RAM. The idler class audit detects the missing Ethernet interface card (EIC) card almost instantly. The EIU goes SysB immediately when EIC is pulled out. The missing EIC causes EIC memory fault, which causes the idler process to TRAP.

In-service leaky bucket audit

Several LAN errors can be detected by the EIC diagnostics software. However, these errors are not severe or fatal enough to be reported on every occurrence of the error. Most of these errors occur when the Ethernet LAN is carrying above average traffic. These errors are transient and therefore do not require the EIU to take any action. However, if these errors occur frequently, relative to the Ethernet traffic, it may be indicative of a faulty component on the LAN. The leaky bucket algorithm is applied to such errors before reporting them through in-service trouble alarm and PM logs.

The leaky bucket algorithm measures errors against relative traffic and therefore allows the EIU to report faults only when a preset error count threshold is exceeded. The algorithm is controlled by five parameters:

- leaky bucket size
- fault detection threshold mark. The fault is reported when the bucket level exceeds this value.
- fault clear threshold mark. The fault reported previously, is cleared when the bucket level is lower than this value.
- error event factor. This value is added to the bucket level when an error event occurs.
- good event factor. This value is subtracted from the bucket level when a good event occurs.

Table 27 summarizes the preset bucket parameters for reported LAN faults.

Table 27 EIU LAN fault leaky bucket parameters

Bucket name	Bucket size	Threshold set level	Threshold clear level	Error event count value	Good event count value
Receive framing error	3000	3000	2970	1000	1
Receiver overflow	3000	3000	2970	1000	1
Receive CRC	3000	3000	2970	1000	1
Transmit Deferred	60	30	15	1	1
Loss of carrier	30000	30000	29940	10000	1
Late collision	300	300	270	10	1
Transmit retries exceeded	300	300	270	10	1

EIU overload control

In an overload situation, the EIU overload control discards packets at the interrupt level rather than at the process level.

The feedback scheme is devised such that packets received either from the Ethernet interface or F-bus interface are discarded when the EIU resources reach critical condition. The EIU can withstand a broadcast storm or a babbling node due to overload controls that have been implemented. This level of robustness follows standard DMS maintenance philosophy: a node must be maintainable even under overload conditions.

Lab tests show that a moderately loaded LAN with broadcast messages resulted in the workstation and the router locking up while the EIU remained functional. The workstations were overloaded to the point that all activity within the operating system stopped:

- the on-screen clock stopped ticking
- the cursor did not respond to mouse movements
- keystrokes were ignored
- outgoing LAN activity stopped
- programs were not aware that a period of time had elapsed
- the router stopped routing packets

The EIU remained fully functional throughout the test. Although traffic from the EIU stopped, the stoppage was due to all other components on the LAN being non-functional and there was nothing left for the EIU to communicate with.

These test also showed that maintenance personnel could remote login to the EIU, start a CI process, look at OMs, and finally remote logout. The EIU could also successfully complete an in-service test and could be manual busied, then returned to service after successfully completing the out-of-service test.

EIU sparing requirements

The EIU is a variation on the CCS7 link interface unit 7 (LIU7) that Nortel developed for the DMS signaling transfer point (STP). The central maintenance software for the EIU is based on the generic software developed for the LIU7. The local maintenance software for the EIC, the EIP, and the routing software are particular to the EIU.

EIUs are simplex entities and therefore require a sparing strategy to handle the following situations:

- hardware failure of an EIU
- batch change supplement (BCS) software upgrade on an EIU
- manual maintenance actions on an EIU

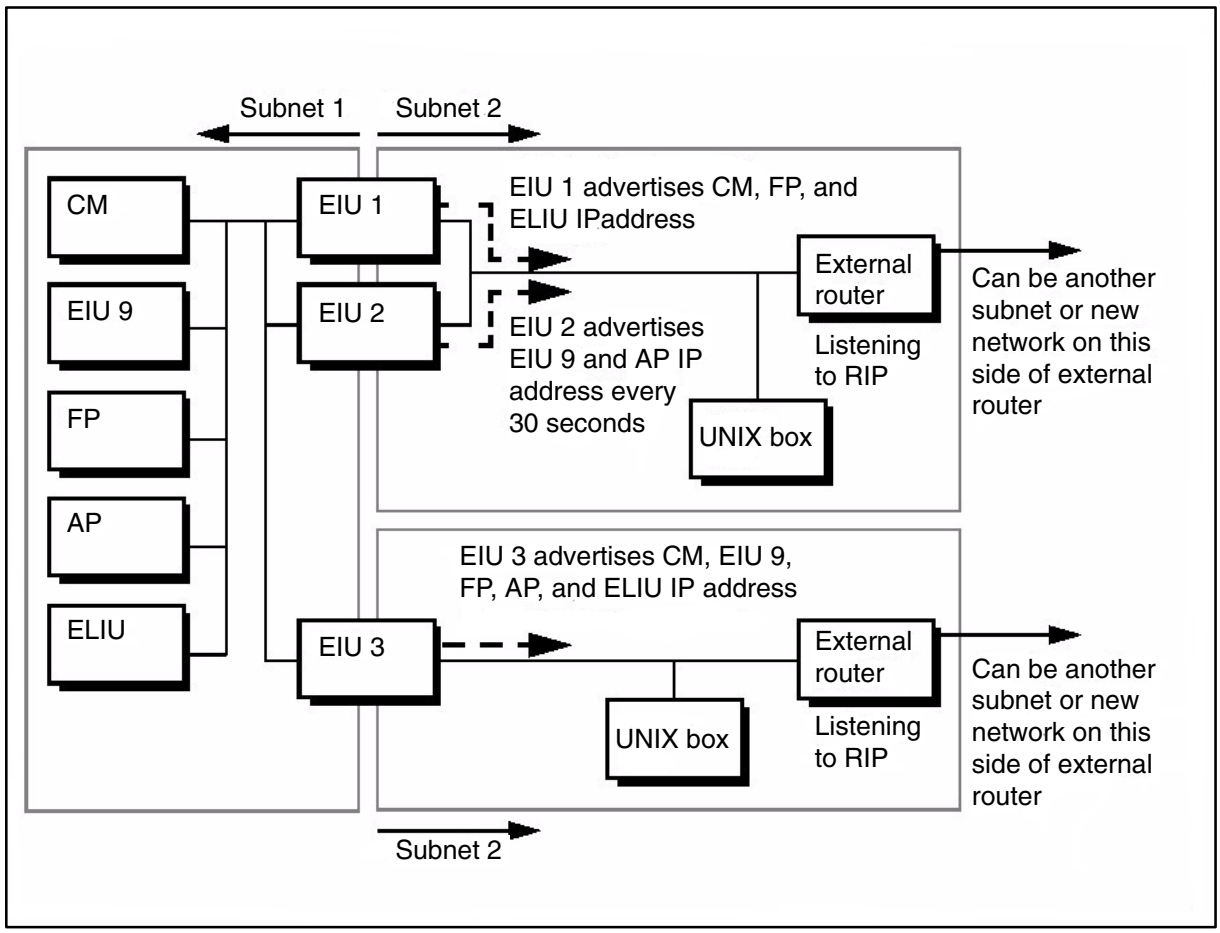
EIU sparing is established and operates as follows:

- The EIUs are organized in sets and lists based on routing information. All EIUs on a single LAN are a set. Multiple sets support multiple LANs.
- All SuperNode hosts (CM, FP, and application processor unit [APU]) have one list of EIUs from a set of lists. The EIUs on this list are configured to reach a specific subnet.
- If one of the EIUs in the list fails, the DMS-100 switch selects the next standby EIU in the list. If all EIUs in the list fail, the DMS-100 switch uses an alternate list if one is available.
- The TCP reliable transport protocol recovers from all but the most severe forms of failure. Most EIU failures are transparent to the end applications that is using the EIU as a router. Any applications fail if the EIU on which they reside fails.
- All EIUs are routers, hosts, or both. The sparing strategy allows only other routers as spares. An EIU as a host and router can be used if all other routers have failed. This sparing strategy has an impact on the host application performance. Applications running on the EIU itself require application level sparing to recover.
- All definitions for the sparing strategy are controlled with datafill.

A simple form of load balancing is used such that multiple end-hosts in the DMS switch have one active EIU while the other is a spare backup. If the first EIU fails, the second takes over.

For more information on EIU redundancy and sparing, refer to "EIU sparing and redundancy" on page 39.

Figure 25 EIU rendundant configuration



Automated system maintenance

The EIU hardware is automatically maintained using a variety of techniques common to all DMS products. These techniques fall into the following categories:

- checks on hardware integrity during normal operations (that is, parity or error detection and correction on memory arrays, cyclic reduncancy checks [CRC] on data in transit, and erroneous state detection). These

indicators drive “fault thresholds” that trigger maintenance actions when exceeded.

- periodic functional audits to ensure that the hardware still functions
- out-of-band resets that the DMS-100 switch initiates when detecting a severe problem. An out-of-band reset is a hardware reset that is propagated outside of the normal message processing and protocol paths.

The EIU hardware diagnostics do not extend beyond the EIP (NT9X85). Any faults in the AUI, MAU, or network are not necessarily detected by EIU diagnostics.

Manual system maintenance

Maintenance personnel and engineers can manually maintain the EIU and related hardware in the same way that they maintain all DMS-100 and SuperNode hardware:

- commands are used to put the node into a variety of states (for example, OFFL and MBSY
- problems on the node trigger automatic maintenance actions and raise alarms that notify maintenance personnel that a problem exists

Maintenance activities includes the following:

- Alarm clearing. Alarms are displayed along the top of the MAPCI hierarchy. For information and procedures, refer to *Alarm Clearing and Performance Monitoring Procedures*, 297-xxxx-543.
- Troubleshooting. Maintenance personnel carry out troubleshooting procedure to try and isolate intermittent or difficult to trace problems. For information and procedures, refer to *Trouble Locating Procedures*, 297-xxxx-544.
- Recovery. Maintenance personnel and engineers undertake recovery procedures after a component, sub-system, or system-wide failure. For information and procedures, refer to *Recovery Procedures*, 297-xxxx-545.
- Routine maintenance. Maintenance personnel use routine maintenance procedures to perform specific sets of tasks that the DMS-100 switch requires as a minimum to maintain operations. For information and procedures on routine maintenance, refer to *Routine Maintenance Procedures*, 297-xxxx-546.
- Card replacement. Maintenance personnel use card replacement procedures in two situations:
  - — as part of other maintenance procedures, required as a response to alarms or to complete trouble locating
  - — during routine card replacement

For information and procedures, refer to *Card Replacement Procedures*, 297-xxxx-547.

Logs relevant to EIU OA&M

The following logs are relevant to EIU operations, administration, and maintenance:

- TELN
- ITN

Note: For more information on these logs, refer to the *DMS 100 Logs Reports Reference Manual*, 297-xxxx-840.

OMs relevant to EIU OA&M

The following operational measurements (OM) are relevant to EIU operations, administration, and maintenance:

- EIUETHER

Note: For more information on these OMs, refer to the *DMS 100 Operational Measurements Reference Manual*, 297-xxxx-814.

Appendix A: EIU installation checklist

This appendix provides a checklist of activities that the operating company follows to install Ethernet interface units (EIU) in a DMS-100 switch.

CAUTION
Possible loss of network security
Using the Ethernet interface unit (EIU) and a telnet or file transfer protocol (FTP) session to establish a maintenance and administration position (MAP) session can introduce a security risk to both the DMS node and its subtending network.

When establishing and operating a MAP session in this way, there is limited security for clear text (user identification and passwords) and for Internet Protocol (IP) addresses for screening. This limited security makes an open local area network (LAN) vulnerable to entry by unauthorized persons.

Nortel recommends that the operating company, as a minimal precaution, integrate intermediate security servers with encryption to avoid unauthorized access to the switch. For alternative approaches, contact your Nortel representative to discuss state-of-the-art secure OA&M data communications equipment products.

By using the EIU, telnet, and FTP software, the operating company assumes any and all risks associated with the implementation and use of this hardware and software.

Use the list in table 28 as a checklist to ensure that you meet all installation requirements for hardware, software, and datafill.

Table 28 EIU installation checklist

Item description	Contact	Check
Hardware		
EIU hardware (NTEX22, NT9X84, NT9X85) circuit packs (one each per EIU)	Nortel	
EIU attachment unit interface (AUI) cable, NTNX36PY	Nortel	
Media access unit (MAU)	HP recommended MAU with LEDs and SQE switch and sufficient shielding	
Software		
Former DMS-core software packages: • NTXF05AA - EIU • NTXF19AA - transmission control protocol/Internet Protocol (TCP/IP) software • NTXS11AA - file transport protocol (FTP) software • NTX70AA - TELNET/ RMAP software Effective CSP02, these software packages are integrated with the telecom layer software.	Nortel	
EIU software load: • - ETC - Ethernet IP router customer load Consult the *DMS-100 PM Software Release Document*, 297-8981-599	Nortel	
Datafill		
EIU media access control (MAC) address Note: Refer to Appendix I Obtaining a MAC address	Nortel	
SuperNode and EIU IP addresses	Nortel customer and Network Information Center (NIC)	
Tables LIUINV, IPTHRON, IPNETWRK, IPROUTER, IPHOST, ENSITES, ENTYPES, and EXNDINV	Nortel customer	

Appendix B: EIU troubleshooting

This appendix provides information on tools that are commonly used in troubleshooting problems with the Ethernet interface unit (EIU). The appendix also provides a summary of common problems and possible causes.

CAUTION
Possible loss of network security
Using the Ethernet interface unit (EIU) and a telnet or file transfer protocol (FTP) session to establish a maintenance and administration position (MAP) session can introduce a security risk to both the DMS node and its subtending network.

When establishing and operating a MAP session in this way, there is limited security for clear text (user identification and passwords) and for Internet Protocol (IP) addresses for screening. This limited security makes an open local area network (LAN) vulnerable to entry by unauthorized persons.

Nortel recommends that the operating company, as a minimal precaution, integrate intermediate security servers with encryption to avoid unauthorized access to the switch. For alternative approaches, contact your Nortel representative to discuss state-of-the-art secure OA&M data communications equipment products.

By using the EIU, telnet, and FTP software, the operating company assumes any and all risks associated with the implementation and use of this hardware and software.

Tools

Table 29 summarizes the tools available for troubleshooting the EIU.

Table 29 Tools for EIU troubleshooting

Tool name	Resident	Description
IPOMSCI	Y	monitors internal operational measurements (OM) generated by the different layers of Internet Protocol stack (for example • transmission control protocol (TCP) • Internet Protocol (IP) • Internet control message protocol (ICMP) • address resolution protocol (ARP) • SuperNode access protocol (SNAP)
IPRTRACE	Y	monitors and displays the intermediate paths taken by the IP packets (generated by SuperNode) to their destinations.
NETMAN	Y	displays information on TCP and user datagram protocol (UDP) connections
SNPINGCI	Y	use to ping remote IP nodes for checking serviceability of these remote nodes

For more information on these tools, refer to *Commands Reference Manual*, 297-1001-822.

Troubleshooting checklist

Much of the troubleshooting required for the EIU is handled at the frame, shelf, and software load levels. There are, however, some problems that operating company personnel can troubleshoot at the EIU level.

Table 30 lists the problems that the operating company and customers can encounter. The table also lists probable causes, referenced to the list at the end of the table.

Table 30 EIU troubleshooting checklist

Problem	Probable cause
Cannot ping any SuperNode-based node from an external node or vice versa	1, 2, 3, 4, 5
Can ping to a SuperNode-based node, but cannot set up a TCP connection	4
(Sheet 1 of 2)	

Table 30 EIU troubleshooting checklist (continued)

Problem	Probable cause
Cannot set up an FTP session between a SuperNode-based node and an external node	4, 8
Cannot ping between two SuperNode-based nodes	4, 5
Cannot set up an TCP connection between two SuperNode-based nodes	4, 5, 6
Cannot log in as the admin user	7, 8
Cannot setup an FTP session between two SuperNode-based nodes	4
Can ping EIU, but cannot ping the computing module (CM)	4

1 There are no EIUs in service.

2 Table IPNETWRK is not datafilled.

3 Table IPROUTER is not datafilled or does not contain the in-service EIU as one of its entries.

4 Table IPHOST for the node in question is not datafilled with non-zero values.

5 Table IPTHRON contains zero values.

6 Someone else is logged on to the server with the same userID.

7 The system permits only one FTP session at a time for the admin user.

8 There are no TCP resources.

(Sheet 2 of 2)

Appendix C: Using FTP

This appendix provides information on using file transfer protocol (FTP) with the Ethernet interface unit (EIU). FTP is an internationally accepted protocol for exchanging files between computing devices. Exchanged files can be in many formats. Further, computing devices can be hosts with different and even incompatible file systems.

CAUTION
Possible loss of network security
Using the Ethernet interface unit (EIU) and a telnet or file transfer protocol (FTP) session to establish a maintenance and administration position (MAP) session can introduce a security risk to both the DMS node and its subtending network.

When establishing and operating a MAP session in this way, there is limited security for clear text (user identification and passwords) and for Internet Protocol (IP) addresses for screening. This limited security makes an open local area network (LAN) vulnerable to entry by unauthorized persons.

Nortel recommends that the operating company, as a minimal precaution, integrate intermediate security servers with encryption to avoid unauthorized access to the switch. For alternative approaches, contact your Nortel representative to discuss state-of-the-art secure OA&M data communications equipment products.

By using the EIU, telnet, and FTP software, the operating company assumes any and all risks associated with the implementation and use of this hardware and software.

What is FTP?

FTP is a session-oriented tool, which means that you establish a session, through login, before the file exchange takes place. The login requires a secure userID and password. Create the secure userID and password via the FTP level or the FTP MIB using SNMP.

FTP on the DMS-100 switch conforms to industry standards regulating FTP. As a result, users can exchange files between the computing module (CM), file processors (FP), UNIX workstations or PCs, mainframes, and other computing platforms that have an industry-standard implementation of FTP.

In an established session, each FTP implementation on the connected platforms works either as the server or the client, such that you can transfer files to or from a host.

FTP on the DMS-100 switch provides the following functionalities:

- automatically detects the file type and logical record length based on the filename extension
- lists available active disk volumes
- automatically capitalizes filenames

Automatic Record Length Detection

The FTP application automatically detects and sets the record length for files with acceptable file extensions. The system defaults to the automatic record length detection option.

When the automatic record length detection option is active, the system recognizes the following two file formats:

- filename extensions made up of a shortened form of the transfer type and record length such as the extension .bin256
- filename extensions that are the same as a defined set of common extensions

  Note: Before the transfer takes place, issue the BINARY or ASCII command.

Before the transfer, the FTP application attempts to determine the file type and record length by parsing the extension of the file. The FTP application identifies files with extensions made up of a shortened form of the transfer type and record length. These files are in the following format:

```
<filename>.<bin/txt><record length>
```

where

`<bin/txt>` is the transfer type, txt for ASCII or bin for BINARY

`<record length>` the logical record length is a number from 1 to 32767

This file format is shown in table 31.

Table 31 Examples of filenames with record length in their extension

File type	Filename before transfer to the DMS	Format	DMS filename after transfer to the DMS
XPM software	file1.bin1024	binary, lrecl 1024	FILE1
XPM software	file1e.txt54	ascii, lrecl 54	FILE1
MS software	file1.bin138	binary, lrecl 138	FILE1
Series III	file1.bin1020	binary, lrecl 1020	FILE1
MS Firmware	file1.bin138	binary, lrecl 138	FILE1
LCM	file1.bin55	binary, lrecl 55	FILE1
OM	file1.bin2048	binary, lrecl 2048	FILE1
DCH	file1.bin1024	binary, lrecl 1024	FILE1

If the filename extension is not as described in table 31, the system attempts to identify the extension with a common set of filename extensions. Common filename extensions recognized by the FTP application are shown in table 32.

Table 32 Examples of filenames without record length in their extension

File type	Extension	Filename before transfer to the DMS	Format	DMS filename after transfer to the DMS
Patches	.patch .ptchm68p .ptchm88p .ptchisnp	file1.patch file1.ptchm68p file1.ptchm88p file1.ptchisnp	binary, lrecl 128	FILE1$PATCH
CM modules	.loadbr2 .load68k .loadppc	file1.loadbr2 file1.load68k file1.loadppc	binary, lrecl 256	FILE1$LD
XREF	.xref	file1.xref	ascii, lrecl80	FILE1

Before the file transfer takes place, set file type to BINARY or ASCII. For example, use the BINARY command to change the file type to binary for filenames in the following format:

```
filename.patch
```

If the file format is not recognized by the FTP application, the system aborts the file transfer and issues one of the following error messages.

Example of an error message:

```
‘503 TYPE must be Binary.’

‘503 TYPE must be ASCII.’
```

Volume listing

The FTP application provides the ability to determine available volumes on the DMS-100 switch. Use the command ls / or to list the available active disk volumes on the DMS-100 switch.

Example of command:

```
WS>ls /
```

FTP cookbook

This section provides a primer on FTP on the DMS-100 switch, including the following:

- a description of the FTP implementation on the DMS-100 switch
- command summary

FTP on the DMS-100 switch

The implementation of FTP on the DMS-100 switch conforms to industry standards defined in RFC959. There are some differences between the DMS implementation and others.

FTP software resides on many nodes within the DMS-100 switch. It resides on all FPs and on the CM as well. Users can FTP directly to the CM, the FP, or any other nodes that have FTP software installed. In this document, the CM is used for illustration, although FTP exists in other nodes as well.

FTP has limited resources and should be considered as a shared resource. Although FTP sessions time-out and deallocate within 10 minutes of idling, users are advised to manually terminate their sessions as soon as their work is done.

File name conventions

This section gives a number of guidelines to help you choose proper file names while working with FTP on the DMS-100 switch:

- If you have a client session on the DMS-100 switch, full path names must start with a slash (/).

Example:

```
DMS>get source ‘/a/b/filename’
DMS>put ‘/a/b/filename’ destination
```

- If you have a client session on the DMS-100 switch, destination and source file names on the local host can be in lowercase or uppercase. But since the DMS CI tries to convert every letter on the command line to uppercase, you must take care and place single quotes around path names that are in lowercase. Also, use single quotes when using a forward slash in a pathname or filename.

  Example:

  ```
  DMS>get ‘dmopro.exec’ ‘/S00DTEMP/DMOPRO’
  DMS>put ‘/S00DTEMP/RECORDFILE’ ‘recordfile’
  ```

  Note: The CI on the DMS-100 switch converts all letters to uppercase if they are not enclosed in single quotes.

- When FTPing to the DMS-100 switch (the DMS is the server), filenames are converted to uppercase unless enclosed by single quotes.

DMS FTP client commands

This section lists the commands that the client implements. FTP clients are slightly different from one implementation to another. Some clients have more commands than others. The DMS client has a small command list but it has the quote command feature which allows it to send any command “as is”. This makes it flexible.

Note: Some commands are not available in field loads.

FTP commands are summarized in table 33.

Table 33 FTP commands on the DMS-100 switch

Command	Description
ADDUSERINFO	add user-related information
ASCII	change file transfer to ASCII type
AUTOLRECL	enable or disable automatic record length detection
BINARY	change the file transfer to binary type
CD	change the working directory
COMMANDMASK	set the command mask for ADDUSERINFO
COMMANDTIMEOUT	set the command idle time for ADDUSERINFO
DELETE	delete the file specified in the path name
(Sheet 1 of 2)	

Table 33 FTP commands on the DMS-100 switch (continued)

Command	Description
DELUSERINFO	delete user-related information
DIR	list the directory
FTPCLOSE	close the connection with the remote host
FTPDEBUG	set the debug messages on or off
FTPOPEN	establish a connection to the remote host
FTPQUERY	print the file attributes
FTPQUIT	close the connection
GET	get the file from the remote server
HELP	get information on commands
LCD	change the local working directory
LRECL	send the SITE LRECL command
LS	list the directory
MKDIR	create a directory
NOOP	send a NOOP command
PASS	set your password
PUT	send a file to a remote host
PWD	print the working directory
QUIT	close the connection and quit CI
QUOTE	send arguments as typed to remote host
RENAME	rename a file
RMDIR	remove a directory
SHOWSVUSERS	show user-related information
STATUS	display remote status
SVRESERVE	reserve one or more server sessions
SVUNRESERVE	remove one or more server session reservations
USER	login as another user under a different userID
(Sheet 2 of 2)	

Obtaining the IP address of the SuperNode host

If you need to find out the IP address of a SuperNode host, refer to the following tables:

- table IPNETWRK for address of the CM
- table IPHOST for addresses of all other SuperNode hosts

Tutorial: basic FTP operations

This section provides a set of procedures for using FTP on the DMS-100 switch to transfer files to and from the DMS-100 switch. Use these procedures as either reference or as a tutorial.

The procedures do not exercise all of the FTP commands available on the DMS client. The purpose of the procedures, as they are presented here, is to introduce you to common operations and commands.

> ***Note:*** The procedures assume that you are at the CI level, and using the DMS-100 switch as the FTP client. The purpose of the session with the host is to transfer files between the host and a DMS-100 switch.

Procedure 1 Establishing an FTP session

Step	Action

1	Start the FTP tool by typing
	> ftp ‘nnn.nnn.nnn.nnn’
	and pressing the Enter key.
	where
	nnn is the portion of the IP address that identified the node
	Example:
	> ftp ‘47.208.11.210’
	Example of a MAP response:
	`Allocated a Session ID Sucessfully`
	`220 bmerh538 FTP server (Version 1.7.212.2 Tue Apr 21 12:14:46 GMT 1998) ready`

2	Enter the host userID **ftp> user_id** and pressing the Enter key. *where* user_id is a valid userID for that host
3	Enter the host password **ftp> passwd** and pressing the Enter key.

where

passwd — is a valid user password for the userID that you are using

You are placed in the default directory.

Example of a MAP response:

```
230 User johnh logged in.
```

4 You have completed this procedure.

Procedure 2 Determining your directory location

Step	Action

1 Establish an FTP session as described in procedure 1 in this appendix.

2 Request the current directory path by typing

ftp> pwd

and pressing the Enter key.

Example of a MAP response:

```
257 "/tmp_mnt/home/users/johnh" is current directory.
```

3 You have completed this procedure.

Procedure 3 Listing files and changing to another directory

1 Establish an FTP session and determine your location as described in procedure 1 in this appendix.

2 List the files names in brief in the directory by typing

ftp> ls

and pressing the Enter key.

Example of a MAP response:

```
200 Type set to A.
```

```
News
PERSONAL
.Xresources
Windows
WSFILE
dmsplpermdir
dmspltempdir
226 Transfer complete.
200 Type set to A.
```

3 List the files names and their attributes in the directory by typing

ftp> dir

and pressing the Enter key.

Example of a MAP response:

```
total 57512
drwx------   2 paulg snopc 512 Jan 26 08:05 News
drwx------   2 paulg snopc 512 Feb  2 07:55 PERSONAL
-rw-r--r--   1 paulg gtest 397 Jan  4  1995 .Xresources
drwxr-xr-x   4 paulg snopc 512 Nov 30 13:22 Windows
-rw-r-----   1 paulg snopc 557879 Feb  1 09:08 WSFILE
drwxr-x---   2 paulg snopc 512 Jan 22 15:50 dmsplpermdir
drwxr-x---   3 paulg snopc 4608 Feb 1 11:08 dmspltempdir
226 Transfer complete.
```

4 Change to another directory on the remote host by typing

ftp> cd path_name

and pressing the Enter key.

where
path_name is a valid directory path

Example:

ftp> cd ‘/team/bin’

Example of a MAP response:

```
250 CWD command successful.
```

5 Change to another directory on the local host by typing

ftp> lcd path_name

and pressing the Enter key.

where
path_name is a valid directory path

Example:

ftp> lcd ‘/S00DTEMP’

Example of a MAP response:

```
FTP: Local directory changed.
```

6 You have completed this procedure.

Procedure 4 Quitting an FTP session

1 Quit the FTP session from the prompt by typing

ftp> quit

and pressing the Enter key.

Example of a MAP response:

```
221 Goodbye.
FTP: Session ID deallocated.
```

2 You have completed this procedure.

Tutorial: moving files

This section provides a set of procedures to move files between a remote host and the DMS-100 switch which is the local host. It describes the command lines for the following FTP operations:

- setting file type to ASCII
- moving an ASCII file from the remote host to local host
- moving an ASCII file from the local host to remote host
- setting file type to binary
- moving a binary file from remote host to local host

Procedure 5 Copying ASCII files to and from the remote host

Step Action

1 Establish an FTP session and determine your location as described in procedure 1 in this appendix.

2 Determine the next step.

If the file	Do
is not on the current remote directory	step 3
is on the current remote directory	step 4

3 Change directory on the remote host by typing

ftp> cd path_name

and pressing the Enter key.

where
path_name is a valid directory path

Example:

ftp> cd '/team/bin'

Example of a MAP response:

```
250 CWD command successful.
```

4 Set the file type to ASCII by typing

ftp> ascii

and pressing the Enter key.

Example of a MAP response:

```
200 Type set to A.
```

5 Determine the next step.

If the file	Do
is not stored the current local directory	step 6
is stored on the current local directory	step 7

6 Change directory on the local host (DMS-100 switch) by typing

ftp> lcd path_name

and pressing the Enter key.

where
path_name is a valid directory path

Example:

ftp> lcd '/S00DTEMP'

Example of a MAP response

```
FTP: Local directory changed.
```

7 Determine the next step.

If the filename	Do
has an extension that CANNOT have the record length automatically detected. Refer to the section "Automatic record length detection in this appendix".	step 8
has an extension that can have the record length automatically detected	step 10

8 Set the record length of the file by typing

ftp> lrecl rec_length

and pressing the Enter key.

where
rec_length is the record length required for the file

Example:

ftp> lrecl 256

This example sets the default record length on the DMS-100 switch to 256.

9 Get an ASCII file from the remote host by typing

ftp>get file_name1

and pressing the Enter key.

where
file_name1 is the name of the file on the remote directory

Example:

ftp> get 'file1.dmo'

This example gets a file named file1.dmo from the remote host and renames it to FILE1 on the DMS-100 switch.

Example of a MAP response:

```
226 Transfer complete.
35334bytes transferred in 0 hrs. 0 mins. 12 secs. 42 ms.
(3282 Bps)
```

Go to step 11.

10 Get an ASCII file from the remote host by typing

ftp>get file_name1

and pressing the Enter key.

where
file_name1 is the name of the file on the remote directory

Example:

ftp> get 'file1.txt54'

This example gets a file named file1.txt54 from the remote host and renames it to FILE1 on the DMS-100 switch.

Example of a MAP response:

```
226 Transfer complete.
35334bytes transferred in 0 hrs. 0 mins. 12 secs. 42 ms.
(3282 Bps)
```

11 Put an ASCII file on the remote host by typing

ftp>put file_name1 file_name2

and pressing the Enter key.

where
file_name1 is the name of the file on the local host directory
file_name2 is the name of the file on the remote host directory

Example:

ftp> put 'RECORDFILE' 'jan18.log'

This example takes the file RECORDFILE from the DMS-100 switch, renames it jan18.log and puts it on the remote host.

Example of a MAP response:

```
226 Transfer complete.
12365 bytes transferred in 0 hrs. 0 mins. 4 secs. 110 ms.
(3008 Bps)
```

12 You have completed this procedure.

Procedure 6 Copying a binary file from the remote host

Step Action

1 Establish an FTP session and determine your location as described in procedure 1 in this appendix.

2 Determine the next step

If the file	Do
is not on the current remote directory	step 3
is on the current remote directory	step 4

3 Change directory on the remote host by typing

ftp> cd path_name

and pressing the Enter key.

where
path_name is a valid directory path

Example:

ftp> cd ‘ /team/bin’

Example of a MAP response:

```
250 CWD command successful.
```

4 Set the file type to binary by typing

ftp> binary

and pressing the Enter key.

Example of a MAP response:

```
200 Type set to I.
```

5 Determine the next step.

If the file	Do
is not stored on the current local directory	step 6
is stored on the current local directory	step 7

6 Change directory on the local host (DMS-100 switch) by typing

ftp> lcd path_name

and pressing the Enter key.

where
path_name is a valid directory path

Example:

ftp> lcd '/S00DTEMP'

7 Determine the next step.

If the filename	Do
has an extension that CANNOT have the record length automatically detected. Refer to the section "Automatic record length detection is this appendix".	step 8
has an extension that can have the record length automatically detected	step 10

8 Set the record length of the file by typing

ftp> lrecl rec_length

and pressing the Enter key.

where
rec_length is the record length required for the file

Example:

ftp> lrecl 256

This example sets the default record length on the DMS-100 switch to 256.

9 Get the file from the remote host by typing

ftp> get file_name1

and pressing the Enter key.

where
file_name1 is the name of the file on the remote directory

Example:

ftp> get 'file1.bin'

This example gets a file called file1.bin from the remote host and renames it to FILE1 on the DMS-100 switch.

Go to step 11.

10 Get the file from the remote host by typing

ftp> get file_name1

and pressing the Enter key.

where
file_name1 is the name of the file on the remote directory

Example:

ftp> get 'file1.bin1020'

This example gets a file called file1.bin1020 from the remote host and renames it to FILE1 on the DMS-100 switch.

11 You have completed this procedure.

Tutorial: advanced operations

This section provides a set of procedures that demonstrate how to add FTP users on the DMS-100 switch.

Procedure 7 Showing the status of server sessions

Use this procedure to determine why an FTP session cannot be established.

Step Action

1 Start the FTP tool without connecting to a host by typing

ftp> ftp

and pressing the Enter key.

2 Obtain information on current and reserved FTP sessions by typing

ftp> showsvusers

and pressing the Enter key.

Example of a MAP response:

```
1. Sessions reserved -> 1 Sessions active -> 1
USERNAME: admin DEFAULTDIR:/SFDEV ACTIVE SESSIONS:1
ABSOLUTEPATHNAME:yes COMMAND TIMEOUT: forever
```

The sample MAP response indicates that there is one server session reserved with a userID of admin and this session is presently active (that is, someone has established an FTP session).

3 You have completed this procedure.

Procedure 8 Reserving a server session and adding a server userID

You can reserve server sessions on a DMS node and attach some user information to these server sessions, such as a different default directory. The number of sessions that can be reserved depends on the number of FTP connections datafilled for that node in table IPHOST. This number equals the sum of all server sessions allowed for this node.

Find out how many server sessions the node can support. Use procedure 7 to find out how many sessions have been reserved. The remaining sessions can be reserved for use by a designated user.

Step Action

1 Start the FTP tool without connecting to a host by typing

ftp> ftp

and pressing the Enter key.

2 Reserve a session by typing

ftp> svreserve 1

and pressing the Enter key.

Example:

ftp> svreserve 1

Example of a MAP response:

```
1 SERVER SESSION RESERVED
TOTAL NUMBER OF SERVER SESSIONS RESERVED -> 1
```

3 Add user information associated with the reserved sessions by typing

ftp> adduserinfo user_id passwd default_dir privilege

and pressing the Enter key.

where

user_id	is the userID
passwd	is the password for this userID
default_dir	is the default directory on the host
privilege	is permission to access absolute path names: *y* gives permissions, *n* denies permissions

Example:

ftp>adduserinfo 'johnh' 'johnh' '/S00DTEMP' y

Example of a MAP response:

```
BIND USERINFO PASSED
```

This userID can now FTP to this node and login using the userID and password johnh johnh.

4 You have completed this procedure.

Procedure 9 Remove a server userID and unreserve a session

Use this procedure to disallow a userID to FTP to this node and to free up a server session.

Step Action

1 Start the FTP tool without connecting to a host by typing

ftp> ftp

and pressing the Enter key.

2 Delete user information by typing

ftp> deluserinfo user_id

and pressing the Enter key.

where
user_id is the userID

Example:

ftp>deluserinfo 'johnh'

Example of a MAP response:

```
DELETE USERINFO PASSED
```

This userID can no longer FTP to this node and login using the userID and password of johnh johnh.

3 Unreserve a session by typing

ftp> svunreserve 1

and pressing the Enter key.

Example:

ftp>svunreserve 1

Example of a MAP response:

```
0 SERVER SESSIONS STILL RESERVED.
```

4 You have completed this procedure.

Procedure 10 Adding a userID with limited set of commands

Use this procedure to add a userID with a limited set of commands.

Step Action

1 Start the FTP tool without connecting to a host by typing

ftp> ftp

and pressing the Enter key.

2 Reset the command mask to allow all commands by typing

ftp> commandmask clear

and pressing the Enter key.

Example:

ftp>commandmask clear

Example of a MAP response:

```
Command mask has been cleared.
```

3 Set the command mask to disallow userID from using a command by typing

ftp> commandmask command mask_state

and pressing the Enter key.

where
command is a specific command
mask_state is permission to use the command: clear gives permission, set denies permissions

Example:

ftp> commandmask mkdir set

Example of a MAP response:

```
Command mask for the mkdir command has been set
```

4 Add user information associated with this command mask by typing

ftp> adduserinfo user_id passwd default_dir privilege

and pressing the Enter key.

where

user_id	is the user_ID
passwd	is the password for this userID
default_dir	is the default working directory
privilege	is permission to access absolute path names: *y* gives permissions, *n*denies permissions

Example:

ftp>adduserinfo 'johnh' 'johnh' '/S00DTEMP' y

Example of a MAP response:

```
BIND USERINFO PASSED
```

This userID can now FTP to this node and login using the userID and password of johnh johnh but does not have permission to use the mkdir command.

The following commands can be masked:
- cd
- get
- put
- putu
-rename
- delete
- rmdir
- mkdir
- pwd
- ls
- dir
- noop

5 You have completed this procedure.

Procedure 11 Adding a userID with a new command timeout

Use this procedure to add a userID wih a command idle time of forever.

Step Action

1 Start the FTP tool without connecting to a host by typing

ftp> ftp

and pressing the Enter key.

2 Determine the current default command timeout value by typing

ftp> commandtimeout

and pressing the Enter key.

Example:

ftp>commandtimeout

```
Default command timout value is 10 mins.
```

3 Set the default command timeout value to forever by typing

ftp> commandtimeout value

and pressing the Enter key.

where

value	is a time value in minutes. A value of 0 means forever.

Example:

ftp>commandmask 0

Example of a MAP response:

```
Default command timeout value has been changed to forever.
```

4 Add user information associated with this command mask by typing

ftp> adduserinfo user_id passwd default_dir privilege

and pressing the Enter key.

where

user_id	is the user_ID
passwd	is the password for this userID
default_dir	is the default working directory
privilege	is permission to access absolute path names: *y* gives permissions, *n* denies permissions

Example:

ftp>adduserinfo 'johnh' 'johnh' '/S00DTEMP' y

Example of a MAP response:

```
BIND USERINFO PASSED
```

This userID can now FTP to this node and login using the userID and password of johnh johnh. The session will remain established until the user manually terminate the session.

5 You have completed this procedure.

FTP operations reference

This section provides a quick reference for FTP operations to and from the DMS-100 switch.

Table 34 shows FTP operations for sessions started on a workstation for connection to a DMS-100 switch. In this scenario, the DMS-100 switch is the remote host and the workstation is the local host.

Table 34 FTP operations reference: workstation to DMS

Action	Command sequence
FTP login	**WS> ftp IP_address** where IP_address is the address of the remote host. Enter a valid FTP userID and password to complete login.
Display the working directory of the DMS	**WS> pwd**
Change directories on the remote host (DMS)	**WS> cd /path_name** where path_name is a valid path from the current working directory i.e. cd /PATH_NAME
Change the working directory on the local host (workstation)	**WS> lcd /directory** where directory is a valid path from the current working directory
List the directory contents on the remote host (DMS)	**WS> ls**
Turn off automatic record length detection	**WS>site autolrecl off**
Turn on automatic record length detection	**WS>site autolrecl on**
List available active disk volumes	**WS>ls /**
(Sheet 1 of 3)	

Table 34 FTP operations reference: workstation to DMS

Action	Command sequence
Get an ASCII file from the DMS	**WS> ascii** **WS> get file_name** where file_name is the name of the file on the DMS that you want to get. If the file name is in lowercase, use single quotation marks around the name (including forward slashes). The above command sequence • sets the transfer type to ASCII • gets the file from the current directory on the DMS Because the workstation has no concept of record length, the logical record length does not have to be set.
Send an ASCII file to the DMS	**WS> ascii** **WS> site LRECL 132** **WS> put file_name NEW_FILE_NAME** where file_name is the name of the file on the host node. NEW_FILE_NAME is the target file name on the DMS. If file_name is in uppercase, new_file_name is optional **WS>put FILE_NAME**. The above command sequence • sets the transfer type to ASCII • sets the logical record length to 132 bytes • puts the file in the current directory of the DMS
Send a LOAD68K file to the DMS	**WS> binary** **WS> put file_name.load68k** where file_name is the name of the file on the host node. FILE_NAME$LD is the name of the target file on the DMS. The above command sequence • sets the transfer type to binary • puts the file in the current directory of the DMS
(Sheet 2 of 3)	

Table 34 FTP operations reference: workstation to DMS

Action	Command sequence
Send an image file to the DMS	**WS> binary** **WS> site lrecl 1020** **WS>put file_name.image FILE_NAME** where file_name is the name of the file on the workstation and FILE_NAME is the target file name, in uppercase, on the DMS.
Send an unIPLed load to the DMS	**WS> binary** **WS> site lrecl 512** **WS> put file_name.sosimage FILE_NAME_UNIPL** where file_name is the name of the file on the workstation and FILE_NAME_UNIPL is the target file name, in uppercase, on the DMS.
(Sheet 3 of 3)	

Table 35 shows FTP operations for sessions started on a DMS-100 switch for connection to a workstation. In this scenario, the DMS-100 switch is the local host and the workstation is the remote host.

Table 35 FTP operations reference: DMS to workstation

Action	Command sequence
FTP login	**CM> FTP** **CM> FTPOPEN 'IP_address'** where IP_address is the address of the remote node. Enter a valid userID and password to complete login.
FTP login (alternative steps)	**CM> FTP 'IP_address'** where IP_address is the address of the remote node. Enter a valid userID and password to complete login.
Display the working directory of the workstation	**CM> pwd**
(Sheet 1 of 3)	

Table 35 FTP operations reference: DMS to workstation

Action	Command sequence
Change the working directory on the workstation	**CM> cd ‘path_name’** where path_name is a valid path from the current working directory on the workstation Use single quotation marks only if the directory name is in lowercase.
Change the working directory on the DMS	**CM> lcd ‘/PATH_NAME’** where path_name is a valid path from the current working directory
Display the working directory on the DMS	**CM> lcd**
List the directory contents on the workstation	**CM> ls**
Turn off automatic record length detection	**CM>autolrecl off**
Turn on automatic record length detection	**CM>autolrecl on**
Get an ASCII file from the workstation	**CM> ascii** **CM> get ‘file_name1.txt132’** where filename is the name of the file on the workstation If filename is in lowercase, use single quotation marks around the name. The above command sequence • sets the transfer type to ASCII • puts the file in the current directory of the DMS
(Sheet 2 of 3)	

Table 35 FTP operations reference: DMS to workstation

Action	Command sequence
Send an ASCII file to the workstation	**CM> ascii** **CM> put file_name** where file_name is the name of the target file on the workstation. If the file name is in lowercase or contains forward slashes, use single quotation marks around the name. The above command sequence • sets the transfer type to ASCII • puts the file in the current directory of the workstation. Because the workstation has no concept of record length, the logical record length does not have to be set.
Get a LOAD68K file from the workstation	**CM> binary** **CM> get 'filename.load68k'** where filename is the name of the file on the workstation If the filename is in lowercase or contains forward slashes, use single quotation marks around the name.
Get an image (ISN) from the workstation	**CM> binary** **CM> get 'filename.bin1020'** where filename is the name of the file on the workstation If the filename is in lowercase or contains forward slashes, use single quotation marks around the name.
Get an unIPLed (ISN) load from the workstation	**CM> binary** **CM> get 'filename.bin512'** where filename is the name of the file on the workstation If the filename is in lowercase or contains forward slashes, use single quotation marks around the name.
Send an image on unIPLed (ISN) load to the workstation	**CM> binary** **CM> put FILE_NAME1 'file_name2.sosimage'** where file_name is the name of the file on the DMS file_name2.sosimage is the name of the target file on the remote host. If the file_name1 is in lowercase or contains forward slashes, use single quotation marks around the name.
(Sheet 3 of 3)	

Appendix D: Using telnet

This appendix provides procedures for establishing telnet sessions on the DMS-100 switch.

CAUTION
Possible loss of network security
Using the Ethernet interface unit (EIU) and a telnet or file transfer protocol (FTP) session to establish a maintenance and administration position (MAP) session can introduce a security risk to both the DMS node and its subtending network.

When establishing and operating a MAP session in this way, there is limited security for clear text (user identification and passwords) and for Internet Protocol (IP) addresses for screening. This limited security makes an open local area network (LAN) vulnerable to entry by unauthorized persons.

Nortel recommends that the operating company, as a minimal precaution, integrate intermediate security servers with encryption to avoid unauthorized access to the switch. For alternative approaches, contact your Nortel representative to discuss state-of-the-art secure OA&M data communications equipment products.

By using the EIU, telnet, and FTP software, the operating company assumes any and all risks associated with the implementation and use of this hardware and software.

Telnet access to a switch

CAUTION
Possible loss of service
To avoid reliability problems, establish telnet sessions on the DMS switch only with CSP05 software and above. If you encounter problems, contact your next level of support.

Procedure 12 Telnetting into a switch for MAP session access (pre-CSP05)

Step	Action
1	Go to the CI level of the MAP display.
2	Open table IPHOST by typing **>table IPHOST** and pressing the Enter key.
3	List available EIUs by typing **>list all** and pressing the Enter key.
4	Locate the EIU in the list and determine a. the EIU IP address on the SuperNode side b. that there are enough available connections on the CM and the EIU
5	Close table IPHOST by typing **>quit** and pressing the Enter key.
6	Open table RMCONFIG by typing **>table RMCONFIG** and pressing the Enter key.
7	Determine that there are enough MAP and telnet sessions.
8	Close table RMCONFIG by typing **>quit** and pressing the Enter key.
9	Open an xterm window.
10	Telnet into the EIU by typing **>telnet ip_addr** and pressing the Enter key. *where* ip_addr is IP address that you found at step 4
11	You have completed this procedure.

Procedure 13 Telnetting into a switch for MAP session access (CSP05 and up)

Step	Action
1	Go to the CI level of the MAP display.
2	Open table IPNETWRK by typing **>table IPNETWRK** and pressing the Enter key.
3	Determine the IP address for the CM.
4	Close table IPNETWRK by typing **>quit** and pressing the Enter key.
5	Open table IPHOST by typing **>table IPHOST** and pressing the Enter key.
6	Determine that there are enough TCP connections for the CM.
7	Close table IPHOST by typing **>quit** and pressing the Enter key.
8	Open an xterm window.
9	Telnet into the CM by typing **>telnet ip_addr** and pressing the Enter key. *where* ip_addr is IP address for the CM that you found at step 3
10	You have completed this procedure.

Appendix E: Understanding IP and IP addressing

This chapter is a primer on internetworking, Internet Protocol (IP), addressing, and IP-related protocols.

For examples on IP addressing and configurations, refer to “Appendix F: EIU addressing examples”.

What is internetworking?

Internetworking began as a method of connecting stand-alone local area networks (LAN) to allow sharing of information between different parts of an enterprise (corporation, campus, and so on). These “islands of automation” were originally installed to satisfy the communications requirements of a particular community of interest.

When members of a particular community of interest required access to applications on different networks, the network administrator often installed a second or third LAN access. This addition was unnecessarily expensive due to the duplication of resources. Adding to the problem was the incompatibility of older host-based architectures, such as the IBM System Network Architecture (SNA), with the newer LAN-based architectures, such as transmission control protocol/Internet Protocol (TCP/IP) and Novell Internet packet exchange (IPX).

In the early days of computing (1960s), data entry was performed in isolation from the computer. Programmers entered their code on paper tape or punched or marked cards, which were sent through the mail to a central computer site. The program was run (or it crashed) and the resulting output was printed locally and shipped to the user, again through the mail. Response time was measured in terms of days or even weeks.

With the advent of low-speed modems, multiplexors, and block-mode data transfer protocols in the early 1970s, users could now be “on-line” to the computer to enter program code. It was thought at this time that the communications duties could be handled by the application program residing in the host computer. This approach was fine as long as there was only one

application that the user needed to access. Otherwise, the user required a separate line and terminal device for each application.

As the number of communications duties grew (such as addressing, route selection, and error detection and correction), there came a point where the applications had to be uncoupled from the communications "network." Specialized computers were created to take over the communications duties. Termed front-end processors, these computers were actually communications switches designed to convert the fast bus speeds of the host processor to slower network link speeds. By the mid-1980s, most networks followed this paradigm. It was about this time that various types of stand-alone LANs sprang up to satisfy local requirements, but these LANs were rarely integrated with the central host networks.

The majority of an enterprise's networks are now interconnected into one internetwork. The internetwork typically consists of a physical topology of multiprotocol routers connected together using a wide assortment of LAN and wide-area network (WAN) technologies. Multiple logical topologies are overlaid on the physical topology to create the multiprotocol Internetwork. TCP/IP is one of the more popular logical topologies.

What made Internetworking possible was the widespread acceptance of connectionless network layer protocols. A connectionless datagram or packet is a stand-alone protocol data unit (PDU) incorporating the information required to route it through the internetwork from source to destination. There is a fair amount of overhead associated with connectionless datagrams, but it is a small trade-off considering the benefits over connection-oriented network layer protocols.

What is routing?

Routing is the process of directing packet traffic between networks according to predetermined criteria. The goal of routing is to make the most efficient use of network resources. It does this by eliminating unnecessary packet copies and forwarding packet data using the optimum path. The device that carries out this process is called a router. The most common forwarding criterion is the packet destination address. A router either discards or passes a packet, based on whether the destination is on a known network (that is, a network that is connected to, or reachable by, another port on the router).

In general, a router discards a packet if the packet protocol is not supported by the router. For example, if a non-IP packet were introduced on an IP network, an IP router on that network discards the packet rather than forward it.

Routing and routed protocols

Each internetworking architecture (for example, TCP/IP) includes at least one routed protocol and one routing protocol.

The routed protocol of the architecture (usually the network-layer protocol) creates connectionless datagrams or packets. The address information contained in the datagram header enables each encountered router to make a routing decision for the datagram. The routed protocol of the TCP/IP architecture is the IP.

The routing protocol distributes information on the availability or reachability of networks or subnetworks (also loosely referred to as wires). To choose the optimum path, the routing protocol uses a metric to rank the paths to the destination network. This information is compiled into a routing table or database. There are two main routing protocols found in TCP/IP networks: routing information protocol (RIP) and open shortest path first (OSPF). These protocols, along with other methods of defining routes are briefly described in "Protocols related to Internet Protocol" on page 160.

Planning overview

Integrating a SuperNode into the Ethernet network structure requires some planning. The process for this planning stage is summarized in the following steps:

1. Map the networks to which the SuperNode connects through the EIU.
2. Choose the IP addresses for the EIUs. Determine the optimum subnetwork masks, if necessary.
3. Identify special requirements for the networks.

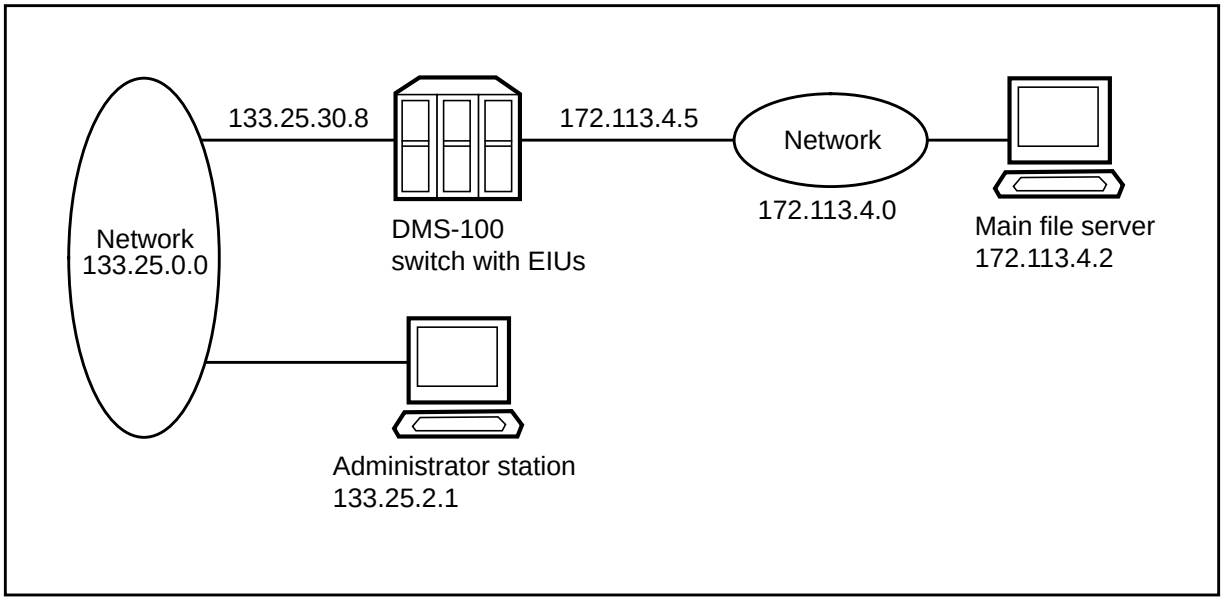
If there is only one EIU in the network, the planning stage is complete. However, if there are other routers, of any manufacture, included in the plans, three additional steps are needed:

1. Select a routing protocol. In cases where the EIU is to be integrated into an existing network, choose the routing protocol to conform or interoperate with the existing network.
2. Gather relevant information about the networks involved, including server addresses and special needs.
3. If the network connects to other networks that are not under the control of the operating company, plan security firewalls to prevent unauthorized access to the network.

Mapping the network

It is very important to have a usable representation of the network before installing the EIU. If IP is already in use in the network, it may be a simple matter of a rough diagram showing the network numbers needed and the IP addresses assigned to the ports. Figure 26 on page 148 illustrates a simple network map.

Figure 26 Simple network map

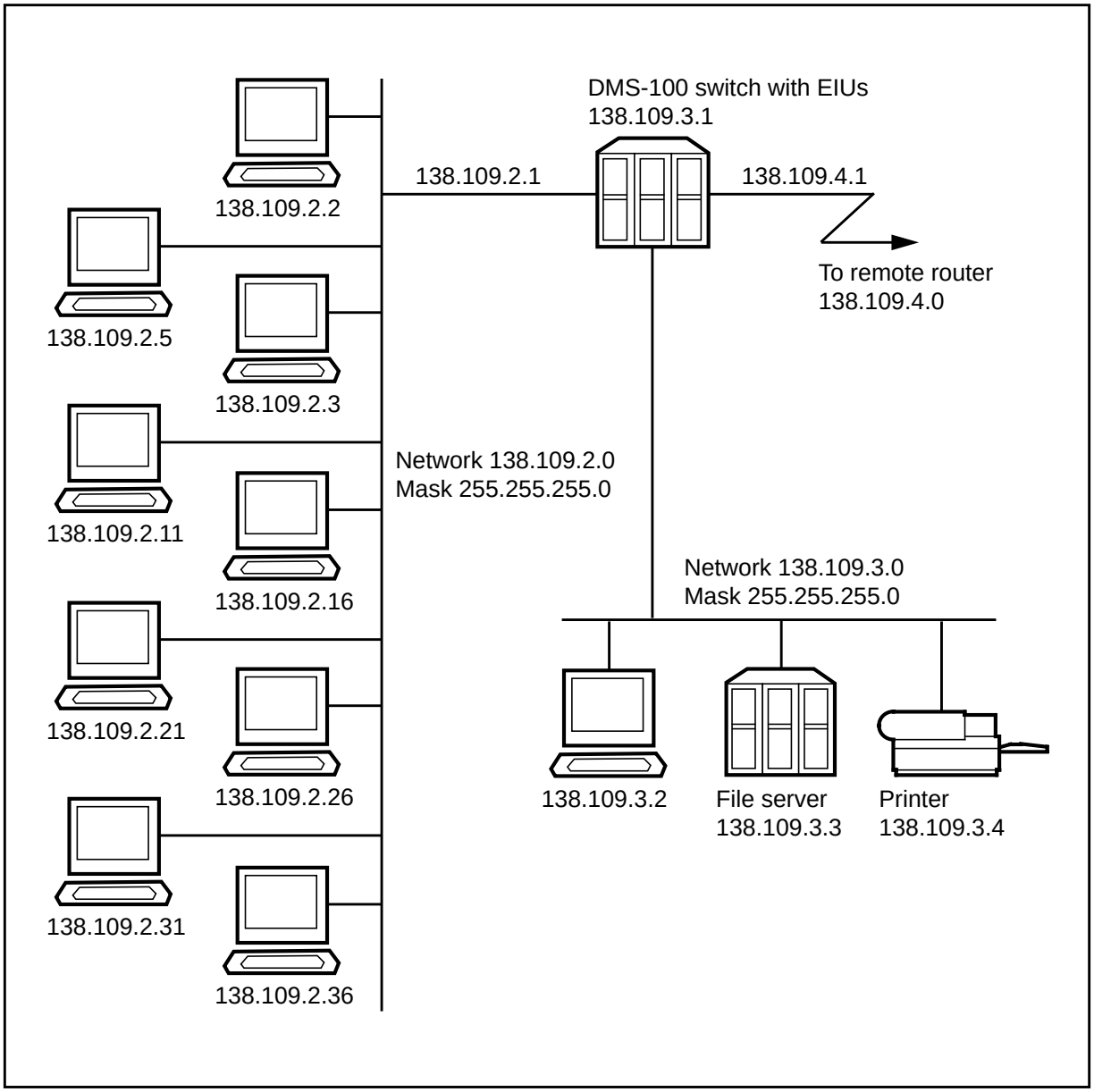


The networks shown in figure 26 are established and only need to be joined to the EIUs. Consequently, the installers and administrators need only understand the network addresses for the ports and the routing protocol currently in use.

Each connected segment must have a unique network or subnetwork number. In the case of Ethernet/IEEE 802.3 LAN, any number of intermediate bridges can extend these networks across a campus as necessary. If they have a single network number for all of the bridged cables, they are a single network from the IP point of view.

However, if the operating company is introducing IP concurrently with installing the EIU in the SuperNode, a map has the benefit of showing each node and its IP address. For large LANs or for geographically dispersed networks, these maps can require several sheets. Figure 27 on page 149 is an example of one page of such a network map.

Figure 27 Detailed network diagram



Choosing IP addresses

IP was originally developed to allow large numbers of diverse institutions to interconnect their local hosts and networks into a larger network (an Internetwork). In time, a larger entity connecting many networks and nodes evolved—the Internet. IP addresses on the Internet are administered so that the network number assigned to an institution is unique. Upon application to the Network Information Center (NIC), each institution is assigned a network number for its own use. If a network is not connected to a public network, it can use an arbitrary network number. However, the use of arbitrary numbers is

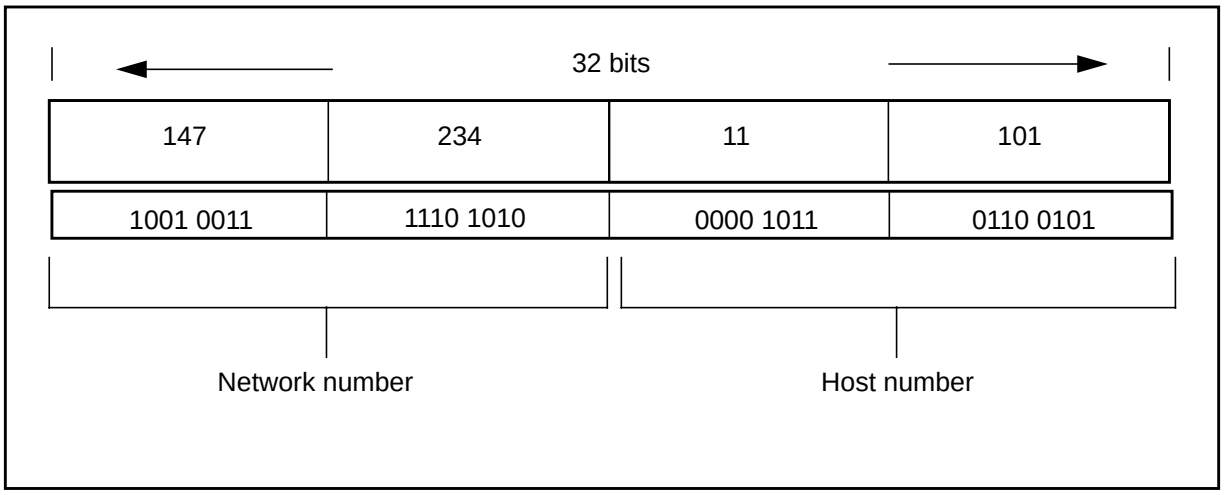
not recommended. If connection to public networks is needed later, all the addressing work must be repeated.

IP addresses

IP uses a 32-bit address, which consists of four sets of eight-bit numbers, normally expressed in decimal notation. For example, 147.234.011.101 is a valid IP address format.

IP addresses can be divided into a network number and a host number, as shown in figure 28.

Figure 28 IP address structure



The addresses are assigned in one of three unicast classes—A, B, or C—depending on the number of host addresses the institution can reasonably expect to use. These ranges are identified by the first eight bits of the address and are made up of the first one-to-three octets of the address. Each range reserves less of the whole address for host numbers than the previous range. Table 36 describes the ranges and uses of class A, B, and C addresses.

Table 36 IP address classes

Class	Range	Description
A	1 to 126	This is used for networks that can have a very large number of nodes (hosts)—up to 16 581 373—such as government agencies and major university systems (for example, 111.0.0.0).
B	128 to 191	This is used for networks that can have up to 65 023 nodes, such as large corporations (for example, 129.191.0.0).

Table 36 IP address classes

Class	Range	Description
C	192 to 223	This is used for smaller networks having fewer than 255 nodes, such as smaller colleges and businesses (for example, 195.10.107.0).

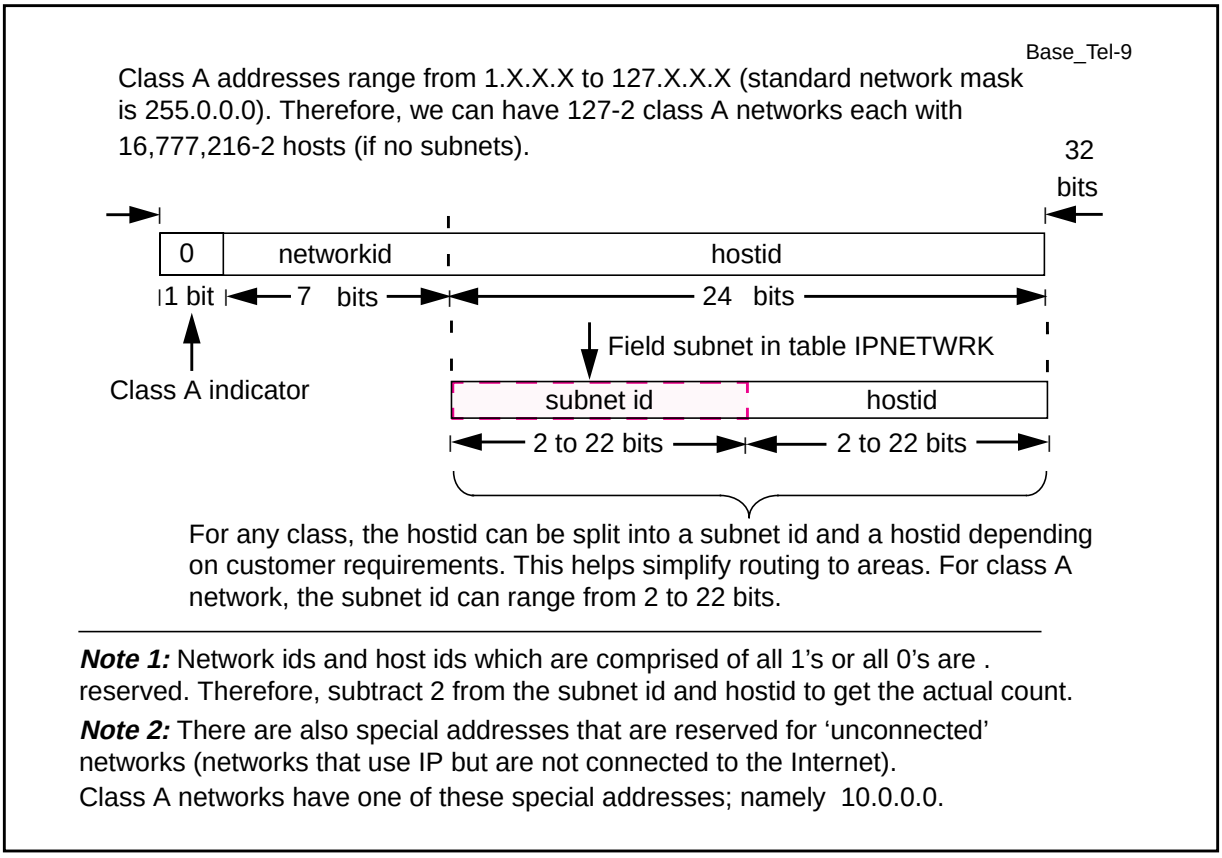
Two additional address classes exist. Class D addresses support IP multicasting, which is used to transmit packets to multiple IP addresses. Class E addresses are reserved for Internet engineering task force experimental use.

Network address 127 is not a valid network number. It is used for testing purposes only.

The EIU supports Ethernet connectivity to class A, B or C networks.

The following diagrams show addressing and subnet mask examples of Network classes.

Figure 29 IP addressing: class A



Note 1: Network ids and host ids which are comprised of all 1's or all 0's are . reserved. Therefore, subtract 2 from the subnet id and hostid to get the actual count.

Note 2: There are also special addresses that are reserved for 'unconnected' networks (networks that use IP but are not connected to the Internet).
Class A networks have one of these special addresses; namely 10.0.0.0.

Figure 30 Subnet mask: class A

CLASS A subnet masks

Base_Tel-10

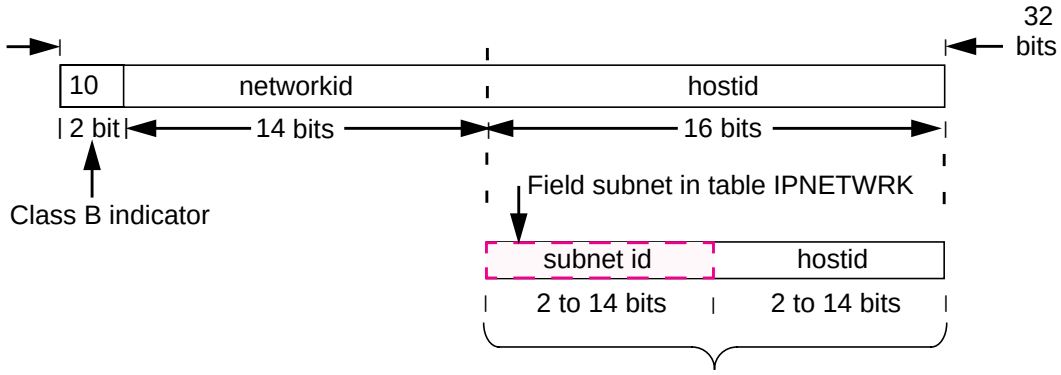
No. subnets	No. hosts	netmask	Netmask in binary format	IPNETWRK subnet size
2	4194302	255.192.0.0	(11111111.11000000.00000000.00000000)	2
6	2097150	255.224.0.0	(11111111.11100000.00000000.00000000)	3
14	1048574	255.240.0.0	(11111111.11110000.00000000.00000000)	4
30	524286	255.248.0.0	(11111111.11111000.00000000.00000000)	5
62	262142	255.252.0.0	(11111111.11111100.00000000.00000000)	6
126	131070	255.254.0.0	(11111111.11111110.00000000.00000000)	7
254	65534	255.255.0.0	(11111111.11111111.00000000.00000000)	8
510	32766	255.255.128.0	(11111111.11111111.10000000.00000000)	9
1022	16382	255.255.192.0	(11111111.11111111.11000000.00000000)	10
2046	8190	255.255.224.0	(11111111.11111111.11100000.00000000)	11
4094	4094	255.255.240.0	(11111111.11111111.11110000.00000000)	12
8190	2046	255.255.248.0	(11111111.11111111.11111000.00000000)	13
16382	1022	255.255.252.0	(11111111.11111111.11111100.00000000)	14
32766	510	255.255.254.0	(11111111.11111111.11111110.00000000)	15
65534	254	255.255.255.0	(11111111.11111111.11111111.00000000)	16
131070	126	255.255.255.128	(11111111.11111111.11111111.10000000)	17
262142	62	255.255.255.192	(11111111.11111111.11111111.11000000)	18
524286	30	255.255.255.224	(11111111.11111111.11111111.11100000)	19
1048574	14	255.255.255.240	(11111111.11111111.11111111.11110000)	20
2097150	6	255.255.255.248	(11111111.11111111.11111111.11111000)	21
4194302	2	255.255.255.252	(11111111.11111111.11111111.11111100)	22
		Host/Router		DMS

Note: The CORWAN (Nortel LAN network 47.XX.XX.XX) is a class A network with a 12 bit subnet.

Figure 31 IP addressing: class B

Base_Tel-11

Class B addresses range from 128.0.X.X to 191.255.X.X (standard network mask is 255.255.0.0), therefore, we can have 16384-2 class B networks each with 65536-2 hosts (if no subnets).



For any class, the hostid can be split into a subnet id and a hostid depending on customer requirements. This helps simplify routing to areas. For class B network, the subnet id can range from 2 to 14 bits.

Note 1: Network ids and host ids which are comprised of all 1's or all 0's are reserved, therefore, subtract 2 from the subnet id and hostid to get the actual count.

Note 2: There are also special addresses that are reserved for 'unconnected' networks (networks that use IP but are not connected to the Internet). Class B networks have 16 of these special addresses ranging from 172.16.0.0 to 172.31.0.0.

Figure 32 Subnet mask: class B

CLASS B subnet masks

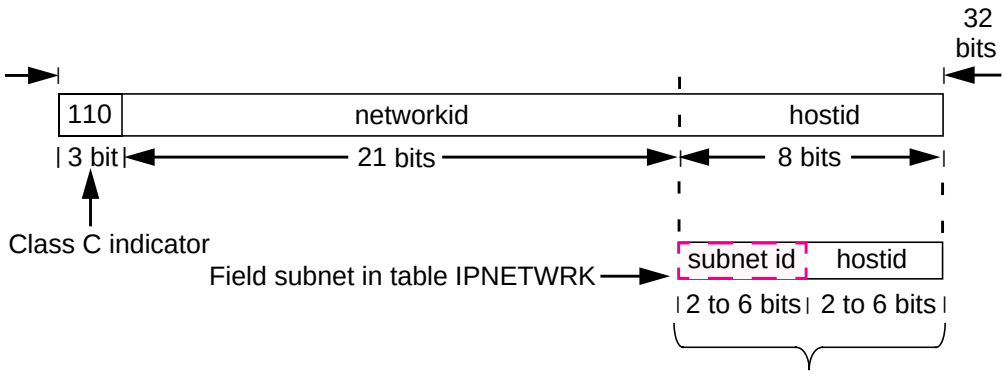
Base_Tel-12

No. subnets	No. hosts	netmask	Netmask in binary format	IPNETWRK subnet size
2	16382	255.255.192.0	(11111111.11111111.11000000.00000000)	2
6	8190	255.255.224.0	(11111111.11111111.11100000.00000000)	3
14	4090	255.255.240.0	(11111111.11111111.11110000.00000000)	4
30	2046	255.255.248.0	(11111111.11111111.11111000.00000000)	5
62	1022	255.255.252.0	(11111111.11111111.11111100.00000000)	6
126	510	255.255.254.0	(11111111.11111111.11111110.00000000)	7
254	254	255.255.255.0	(11111111.11111111.11111111.00000000)	8
510	126	255.255.255.128	(11111111.11111111.11111111.10000000)	9
1022	62	255.255.255.192	(11111111.11111111.11111111.11000000)	10
2046	30	255.255.255.224	(11111111.11111111.11111111.11100000)	11
4094	14	255.255.255.240	(11111111.11111111.11111111.11110000)	12
8190	6	255.255.255.248	(11111111.11111111.11111111.11111000)	13
16382	2	255.255.255.252	(11111111.11111111.11111111.11111100)	14
		Host/Router		DMS

Figure 33 IP addressing: class C

Base_Tel-13

Class C addresses range from 192.0.0.X to 223.255.255.X (standard network mask is 255.255.255.0), therefore, we can have 16384-2 class C networks each with 65536-2 hosts (if no subnets).



For any class, the hostid can be split into a subnet id and a hostid depending on customer requirements. This helps simplify routing to areas. For class C network, the subnet id can range from 2 to 6 bits.

Note 1: Network ids and host ids which are comprised of all 1's or all 0's are reserved, therefore, subtract 2 from the subnet id and hostid to get the actual count.

Note 2: There are also special addresses that are reserved for 'unconnected' networks (networks that use IP but are not connected to the Internet). Class C networks have 256 of these special addresses ranging from 192.168.0.0 to 192.168.255.0.

Figure 34 Subnet mask: class C

CLASS C subnet masks

Base_Tel-14

No. subnets	No. hosts	netmask	Netmask in binary format	IPNETWRK subnet size
2	62	255.255.255.192	(11111111.11111111.11111111.11000000)	2
6	30	255.255.255.224	(11111111.11111111.11111111.11100000)	3
14	14	255.255.255.240	(11111111.11111111.11111111.11110000)	4
30	6	255.255.255.248	(11111111.11111111.11111111.11111000)	5
62	2	255.255.255.252	(11111111.11111111.11111111.11111100)	6
		Host/Router		DMS

Figure 35 IP addressing: class D

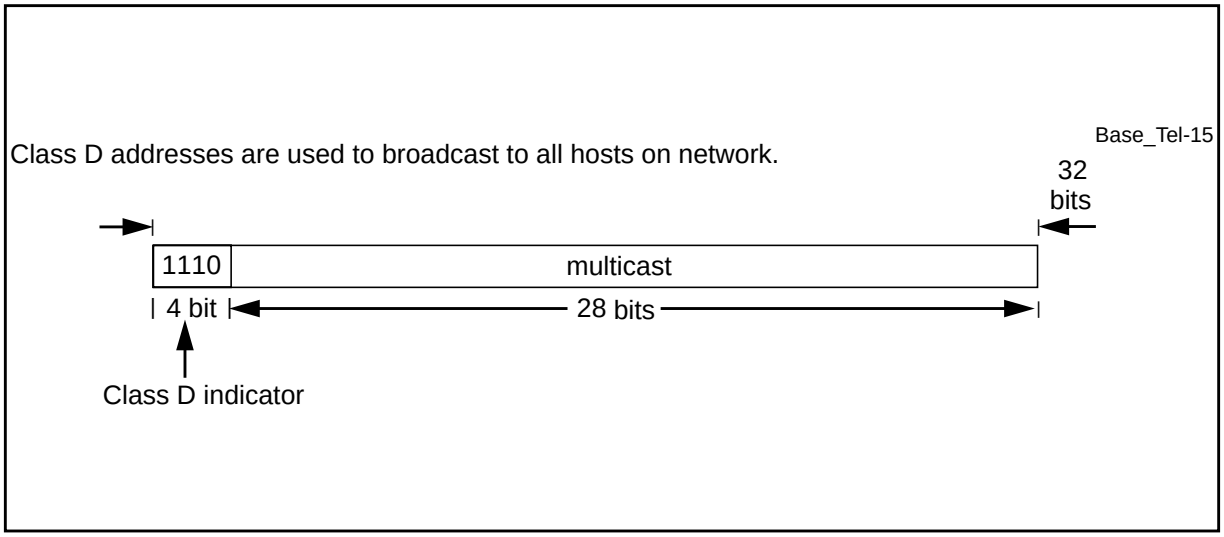
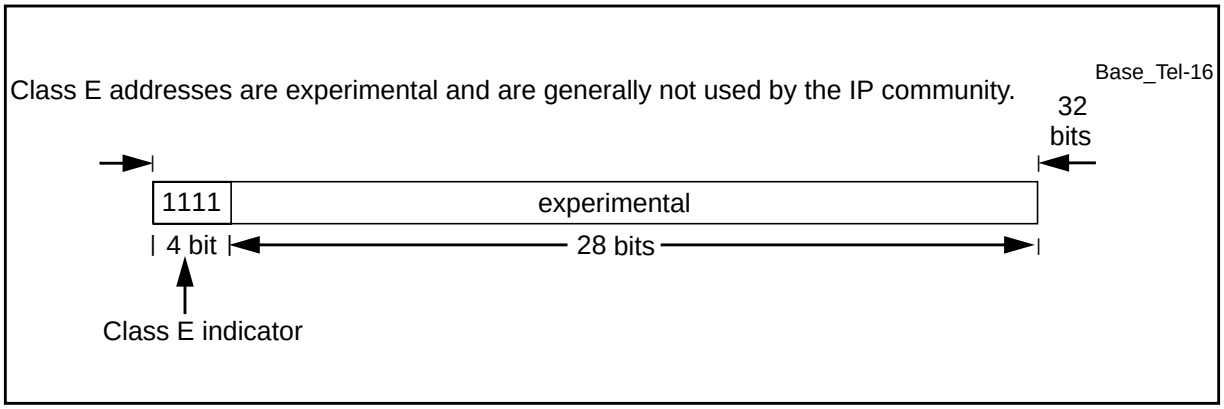


Figure 36 IP addressing: class E



Address masks

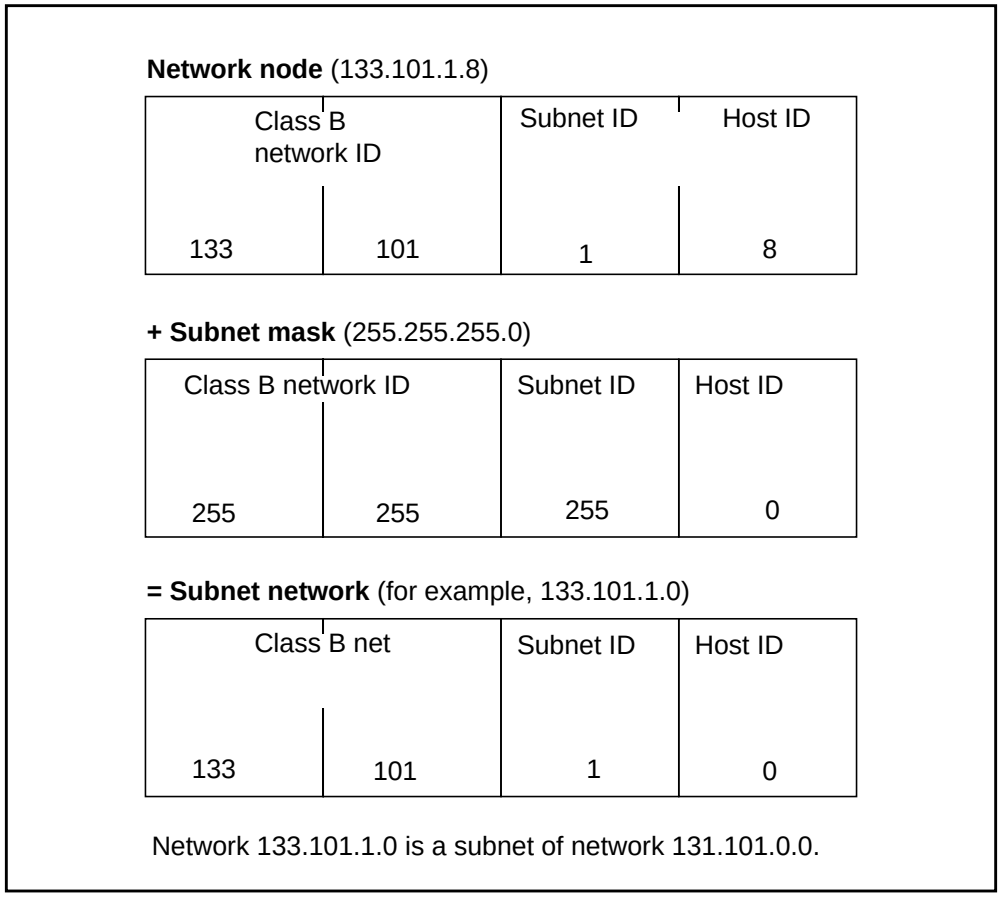
For administrative or procedural reasons, a network number can be subdivided into subnetworks using a subnetwork mask, also called a subnet or address mask. A network mask is a set of values that masks, or causes the router to ignore, portions of a packet address. This technique allows the administrator to subdivide the networks at levels below the Internet address defined range.

A subnetwork mask identifies to IP the portion of the whole address that identifies the network and subnetwork. Subnetwork masks are represented in decimal values. For example, to indicate that the first two bytes of an address are the network and subnetwork parts and the last two bytes are reserved for hosts, the subnetwork mask is 255.255.0.0.

For instance, assume that IP address 133.101.0.0 has been assigned to a company. Without a subnetwork mask, the last two fields of the address identify individual hosts. In this case, assume the company has five major

departments. Each department expects to use fewer than 254 host addresses, so the entire third byte of the address is chosen for the subnetwork number. To reserve the third byte for the subnetwork number, they use subnetwork mask 255.255.255.0. Figure 37 on page 158 illustrates this point.

Figure 37 Address mask example

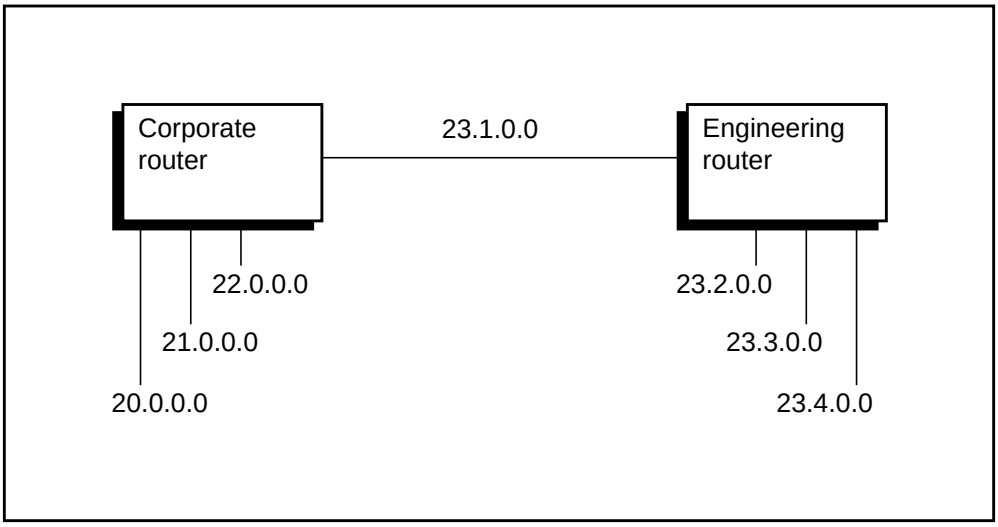


There is no official requirement that the subnet mask consist only of contiguous bits. However, in the presence of variable width subnetworks, non-contiguous masks can lead to ambiguous routing when subnet masks partially overlap (such as 255.255.255.0 and 255.255.0.255).

Network numbering example

Figure 38 on page 159 illustrates an example of a simple network numbering scheme for an organization that performs all networking internally. Since, for security reasons, they never expect to attach to the outside world, they use their own set of network numbers. The network has two routers: one for the Corporate Networking group to interconnect non-engineering users, and a second for a large, computer-intensive department, such as Engineering.

Figure 38 Simple network numbering



The Corporate Networking group assigns a class A address to each of its departments. The three Ethernet networks on 20.0, 21.0, and 20.0.22.0 are sufficient to interconnect most of the organization. The Corporate Networking group reserves network 20.0.0.0 for its own use to interconnect the corporate computers. Each of these departments has more than 16 million IP addresses available for its personal computers, workstations, and hosts.

A fourth Ethernet goes to the Engineering group, which is assigned network number 23. Since this group has multiple networks, they use subnetworking to allocate their own Ethernet networks. They use the entire second octet in the IP address to designate the subnetwork. They use subnetworks 23.1.0.0 through 23.4.0.0. This requires a subnet mask of 255.255.0.0.

The Ethernet linking the two routers (23.1.0.0) is a backbone between the two group routers. Other addresses are used for individual workstations.

In this case, the administrators of both routers have to be aware of the subnetworking strategy chosen by the Engineering group. The Corporate Networking group router has to be aware that anything for 23.1.x should be forwarded on its Ethernet, and that 23.2.x, 23.3.x, and 23.4.x addresses should be directed to the other router for distribution and forwarding using 23.1.0.0.

Firewalls and network security

An important consideration when planning a network is security. There are many ways security can be compromised, the most important being access across an internetwork, from beyond the network borders.

Nortel recommends that the operating company, as a minimal precaution, integrate intermediate security servers with encryption to avoid unauthorized access to the switch. For alternative approaches, contact a Nortel

representative to discuss state-of-the-art secure data communications equipment products.

Variable-width subnetworks

When subnetworks were first invented, they were intended to be used in a star topology, with the major router at the port of entry connected to all subnetworks. All subnetworks were supposed to have address ranges of the same size. Later IP implementations have retained the expectation that the width of the subnet mask is uniform throughout all the subranges of the top level (class A or B) network number.

With the current increased emphasis on conservation of IP addresses, it is often desirable to allocate subnet ranges of "just the right size". To allocate ranges consistently, all protocol exchanges that communicate a network address range must include the associated subnet mask. OSPF performs this, and future releases of other route information protocols (for example, RIP Version 2) allow this too. On the other hand, some protocols do not carry this information, since knowledge of subnet structure is contained within a routing domain, and is invisible outside of a routing domain.

It is important to realize that support for variable-width subnetworks does not allow for subnetworking subnetworks. For example, an IP port can have the class B address 129.191.14.1 with subnet mask 255.255.255.0. IP address 129.191.0.0 is the network, and IP address 129.191.14.0 is the subnet. You cannot further subnet the 129.191.14.0 subnet—for example, 129.191.14.128 with mask 255.255.255.128. However, a new subnet can be created with a longer mask, such as 129.191.15.128 with mask 255.255.255.128.

Protocols related to Internet Protocol

This section provides brief descriptions on the constituent protocols of TCP/IP.

Internet Protocol

IP is a connectionless datagram service that provides the following benefits:

- best-effort delivery
- internetwork-wide addressing
- fragmentation and reassembly
- time-to-live control of datagrams
- checksum verification of header contents

IP is defined in RFC791.

Internet control message protocol

The Internet control message protocol (ICMP) provides feedback from an IP router or gateway to a source host. ICMP messages are sent in several situations—for example, to report resource or routing problems or to report a shorter available route to a destination. The DMS-100 switch uses ICMP echoes and echo replies to verify the reachability of routers or end systems. ICMP supports redirect messages to provide routine table updates.

ICMP is defined in RFC792.

Transmission control protocol

Transmission control protocol (TCP) is a connection-oriented transport-layer protocol. It provides reliable, robust, and adaptable data transfer between end-system upper layer protocols. TCP assumes that simple, potentially unreliable, datagram services are available from lower-level protocols.

TCP is defined in RFC793.

User datagram protocol

User datagram protocol (UDP) defines the use of unacknowledged datagrams. UDP packets are often used for very low-priority data or on very high-reliability networks. UDP is also used when an application already provides an integrity function and does not need to duplicate that function by using TCP.

UDP is defined in RFC768.

Address resolution protocol

The address resolution protocol (ARP) is a mechanism for mapping 32-bit IP addresses to 48-bit Ethernet hardware addresses. The hardware address is a concatenation, or joining, of two numbers:

- a vendor ID number, centrally assigned by the IEEE
- a unique serial number, the media access control (MAC) address, is assigned by the hardware vendor (see “Appendix I: Obtaining a MAC address”).

The MAC address usually has significance only on the local LAN wire.

The EIU implementation of ARP supports the following features:

- removal of out-of-date ARP cache data
- configurable cache data time-out
- encapsulation between Ethernet and IEEE 802.3 networks

ARP is supported on Ethernet, FDDI, token ring and frame relay media.

Included in the family of address resolution protocols are reverse address resolution protocol (RARP), proxy address resolution protocol (proxy ARP), and inverse address resolution protocol (InARP).

ARP is defined in RFC826.

Reverse ARP

RARP is used to determine or assign a particular station IP address when only the station LAN MAC address is known.

There are many reasons why an end system does not already have an IP address. The end-system could be a diskless workstation homed off a server. Or, it could be a portable computer belonging to an itinerant user, sharing a pool of IP addresses with other itinerant users.

RFC903 defines RARP.

Proxy ARP

The proxy ARP is used to help an IP device locate a destination device, when the destination device is on a remote IP network or wire. When a source station broadcasts an ARP request on the local wire, and there is no station matching the destination IP address on the wire, the source does not receive an ARP response from the actual destination. Instead, the router derives the destination IP wire address and searches for a match in its IP routing table.

If the destination IP wire address is present in the routing table, the router responds with its MAC address. This tells the source that the MAC address for the router is the MAC address for the destination station. The source IP station has no idea that the destination is on another wire.

Proxy ARP is defined in RFC1027.

Inverse ARP

The inverse address resolution protocol (InARP) determines the IP address for a remote router on a particular frame relay data link connection identifier (DLCI). This IP address is the local frame relay address of a permanent virtual circuit (PVC) to a remote router.

Inverse ARP is defined in RFC2390.

Bootstrap Protocol

The bootstrap protocol (BOOTP) is a UDP/IP-based protocol that permits a booting host to configure itself dynamically and without user supervision.

BOOTP provides a means to notify a host of the following:

- its assigned IP address

- the IP address of a boot server host
- the name of a file to be loaded into memory and executed
- the local subnet mask
- the local time offset
- the addresses of default routers
- the addresses of various Internet servers

The EIU supports the BOOTP relay agent functionality described in RFC951 and RFC1542.

File transfer protocol

FTP provides a robust file transfer mechanism for data transfer between IP hosts. FTP is used to transfer files between the DMS-100 file system and a server or workstation. Once a connection is established, the EIU node requests the appropriate account information (including security information) before establishing a session.

FTP is defined in RFC959.

Open shortest path first

Open shortest path first (OSPF) is a link-state-based routing protocol. It defines a preferred route, which is the shortest available path between a source and a destination. The length of a path is determined by its metric, a measure that can be adjusted by network administrators to favor one path over another.

OSPF is defined in RFC1583.

Routing information protocol

The routing information protocol (RIP) is a distance-vector routing protocol. RIP ranks paths in terms of hops. Each router in a path is a hop. For historical reasons, many applications use the term seconds in place of hops.

RIP is defined in RFC1058.

Telnet

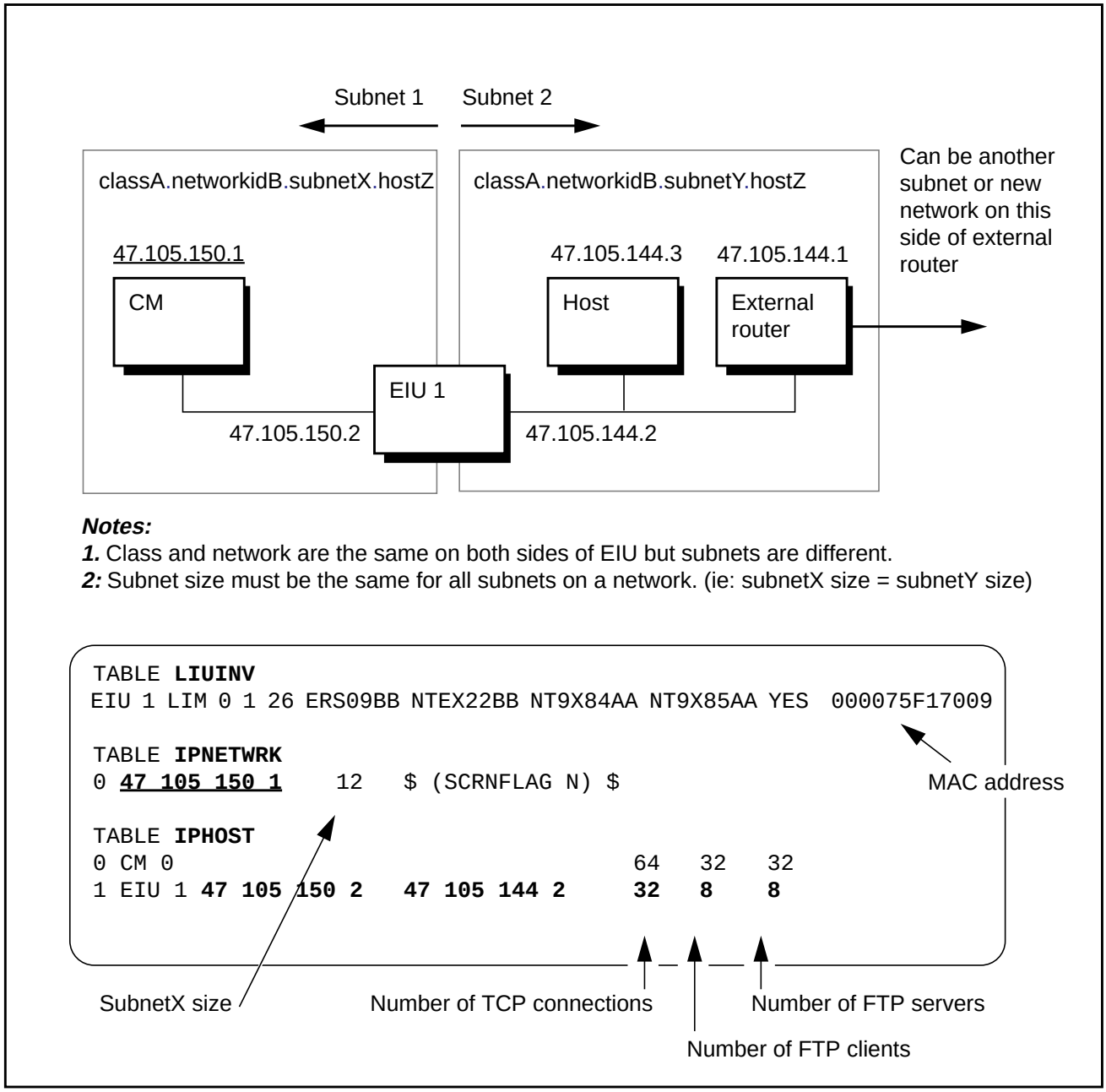
Telnet is a virtual terminal system for IP. It allows a valid user access to a terminal or command process on a remote system.

Telnet is defined in RFC495.

Appendix F: EIU supported configurations

This appendix provides examples of EIU supported configurations.

Figure 39 Host configuration



Notes:
1. Class and network are the same on both sides of EIU but subnets are different.
2: Subnet size must be the same for all subnets on a network. (ie: subnetX size = subnetY size)

Figure 40 Router configurations

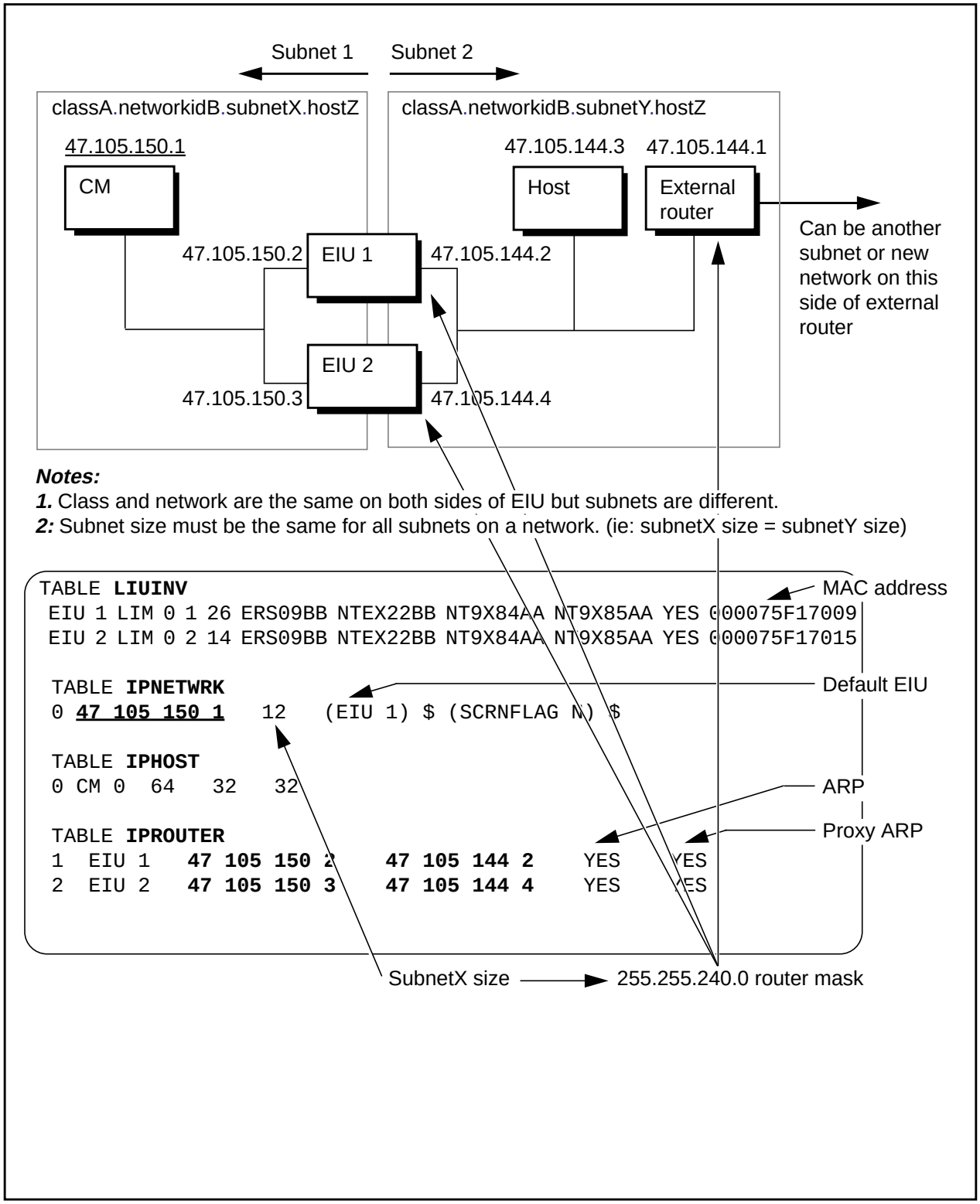


Figure 41 Host and router configuration

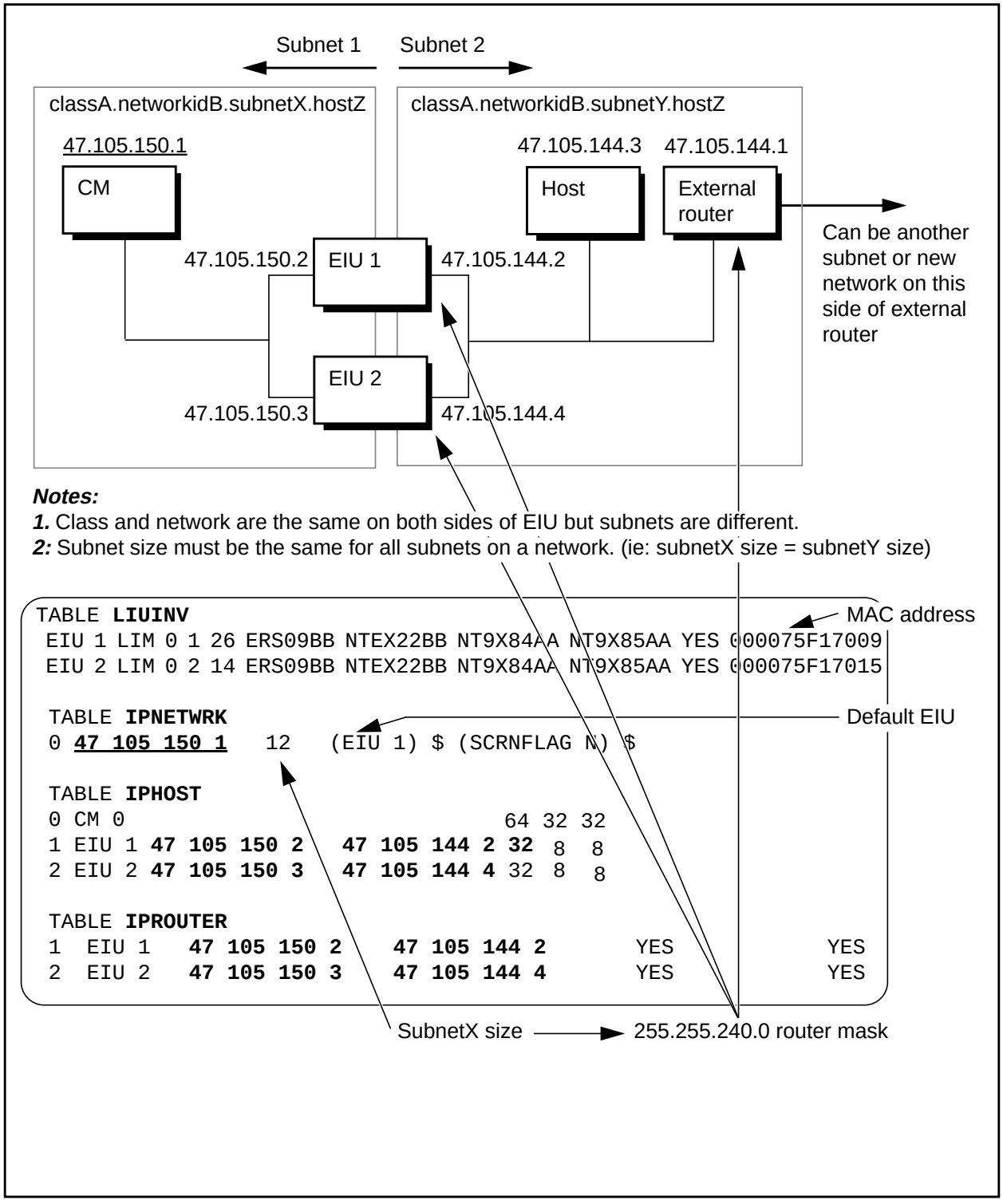


Figure 42 Interface configuration part 1

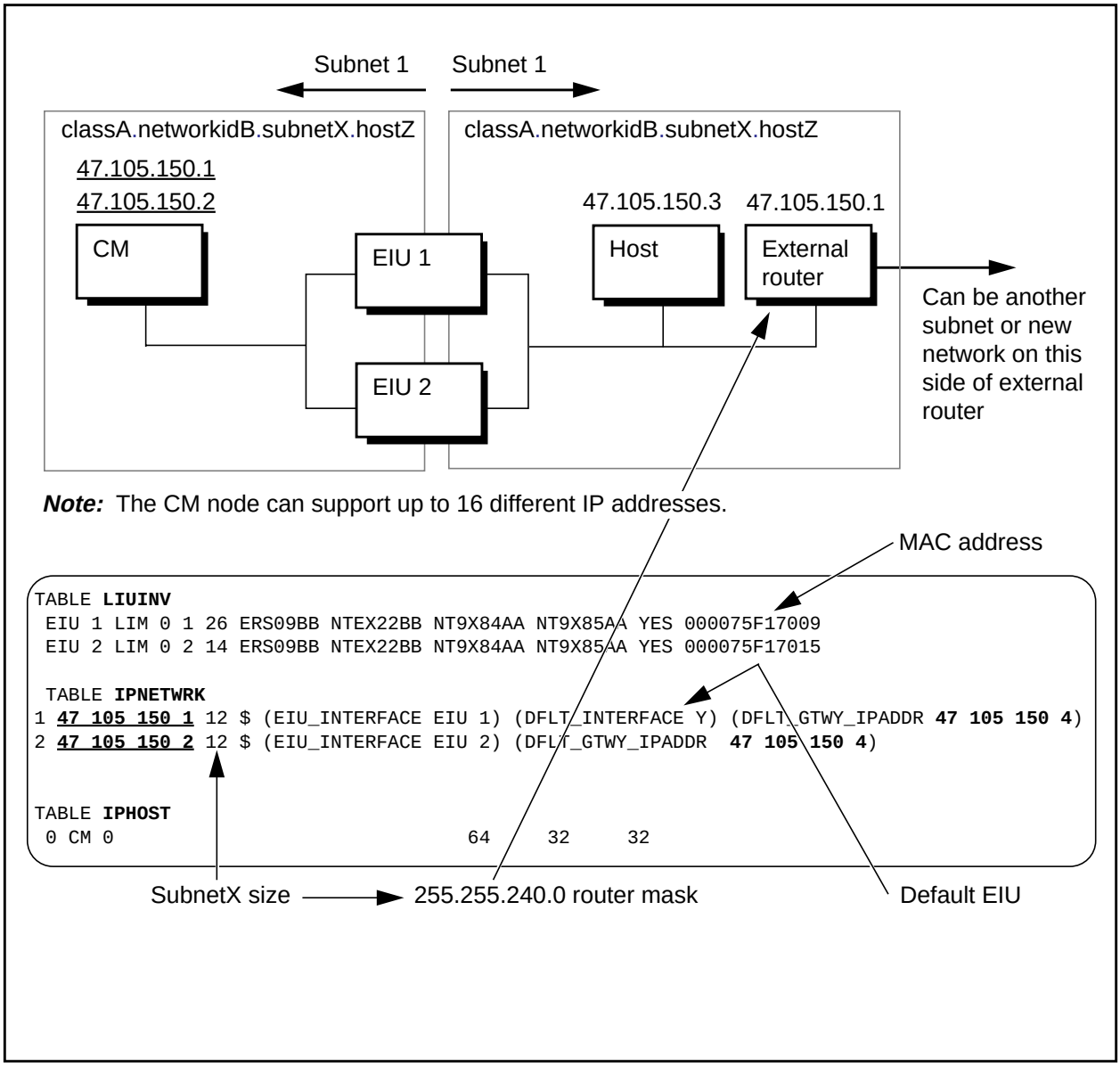
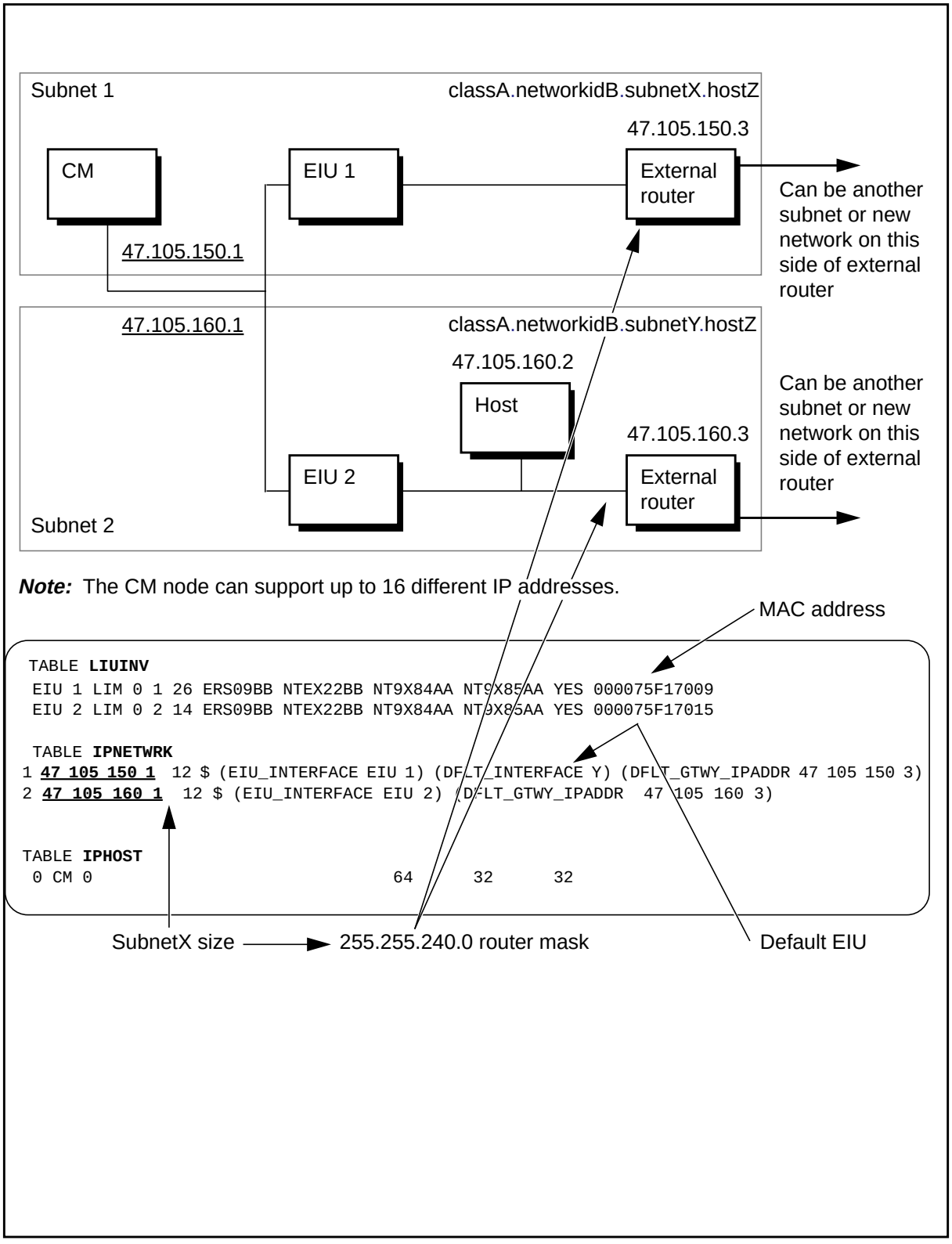


Figure 43 Interface Configuration part 2



Appendix G: IP network number requests

This appendix provides information on obtaining an Internet Protocol (IP) address from the Network Information Center (NIC), including information on the type of addresses available and the form required to obtain the address.

Overview

NIC is the formal organization that regulates and assigns all IP addresses recognized on the Internet. NIC ensures that the network portion of an IP address is unique. NIC assigns the network portion of the IP address to the requesting organization, and delegates responsibility for assigning host addresses to that organization.

While NIC assigns IP addresses for networks that are attached to the connected Internet, it is not concerned with isolated networks that do not access the Internet. As a result, an organization with an isolated network may choose to assign arbitrary addresses to the nodes within that network, without regulation through NIC. However, experience across the Internetworking industry shows that the unregulated address structures result in the following limitations:

- prevent future interoperability of the corporate network with the Internet
- may cause significant problems and downtime when converting the corporate network to assigned addresses in the future

It is strongly recommended that an organization obtain official Internet addresses from the NIC.

Considerations for obtaining IP addresses

Consider the following characteristics of the network when assigning IP addresses to hosts within the network:

- SuperNode network topology
- the dynamic routing strategy (only routing information protocol [RIP] is supported on the Ethernet interface unit [EIU])
- network security

The network topology consists of the SuperNode and other third-party equipment, such as hubs and workstations. Some third-party routers may be required for distant LANs or for fault-tolerant network architecture. Based on network topology, the following information may be required:

- IP address class
- IP address subnet size, based on the number of subnets, the maximum number of hosts per subnet, and the projected expansion of the network
- number of IP addresses needed for hubs and routers

If the network is connected to a public network, such as the Internet, security considerations are vital.

NIC IP network number request form

You must complete the form in table 37 as part of the application process for obtaining an IP network number.

Table 37 NIC IP address request form

IP address request form
To obtain an Internet number, please provide the following information on-line, by way of electronic mail, to HOSTMASTER@NIC.DDN.MIL. If electronic mail is not available to you, please mail hard copy to: DDN Network Information Center 14200 Park Meadow Dr., Suite 200 Chantilly, VA 22021 Once the NIC receives your completed application we will send you an acknowledgment, by way of electronic or postal mail. PLEASE ALLOW AT LEAST 8 WORKING DAYS FOR PROCESSING YOUR REQUEST. ***NOTE***: This application is solely for obtaining a legitimate IP network number assignment. If you're interested in officially registering a domain please complete the domain application found in netinfo/domain-template.txt. If FTP is not available to you, please contact HOSTMASTER@NIC.DDN.MIL or phone the NIC at (800) 365-3642 for further assistance. NOTE: European network applications should use the European template (netinfo/european-ip-template.txt). Please follow their instructions for submission. YOUR APPLICATION MUST BE TYPED.
(Sheet 1 of 4)

Table 37 NIC IP address request form

IP address request form (continued)
1) If the network will be connected to the Internet, you must provide the name of the governmental sponsoring organization, and the name, title, mailing address, phone number, net mailbox, and NIC handle (if any) of the contact person (POC) at that organization who has authorized the network connection. This person will serve as the POC for administrative and policy questions about authorization to be a part of the Internet. Examples of such sponsoring organizations are: DISA DNSO, the National Science Foundation (NSF), or similar military or government sponsors. NOTE: If the network will NOT be connected to the Internet, you do not need to provide this information. 1a. Sponsoring organization: 1b. Contact name (Last name, First name): 1c. Contact title: 1d. Mail address: 1e. Phone: 1f. Net mailbox: 1g. NIC handle (if known):
2) Provide the name, title, mailing address, phone number, and organization of the technical POC. The on-line mailbox and NIC handle (if any) of the technical POC should also be included. This is the POC for resolving technical problems associated with the network and for updating information about the network. The technical POC may also be responsible for hosts attached to this network. 2a. NIC handle (if known): 2b. Technical POC name (Last name, First name): 2c. Technical POC title: 2d. Mail address: 2e. Phone: 2f. Net mailbox:
(Sheet 2 of 4)

Table 37 NIC IP address request form

IP address request form (continued)
3) Supply the short mnemonic name for the network (up to 12 characters). This is the name that will be used as an identifier in Internet name and address tables. 3a. Network name:
4) Identify the network geographic location and the responsible organization establishing the network. 4a. Postal address for main/headquarters network site: 4b. Name of organization:
5) Question #5 is for MILITARY or DOD requests, ONLY. If you require that this connected network be announced to the NSFNET please answer questions 5a, 5b, and 5c. 5a. Do you want MILNET to announce your network to the NSFNET? (Y/N): 5b. Do you have an alternate connection, other than MILNET, to the NSFNET? (Y/N): 5c. Please state an alternate connection if the answer to 5b answer is “yes”: 5d. If you answered “yes” to 5b, would you like the MILNET connection as a backup path to the NSFNET? (Y/N):
6) Estimate the number of hosts that will be on the network within the following time periods: 6a. Initially: 6b. Within one year: 6c. Within two years: 6d. Within five years:
(Sheet 3 of 4)

Table 37 NIC IP address request form

IP address request form (continued)
7) Unless a strong and convincing reason is presented, the network (if it qualifies at all) will be assigned a class C network number. If a class C network number is not acceptable for your purposes state why. Note: If there are plans for more than a few local networks, and more than 100 hosts, you are strongly urged to consider subnetting. See RFC 950. 7a. Reason for class A or B address:
8) Networks are characterized as being either Research, Defense, Government - Non Defense, or Commercial, and the network address space is shared between these four areas. Which type is this network? 8a. Type of network:
9) What is the purpose of the network? 9a. Purpose of network:
PLEASE ALLOW AT LEAST 8 WORKING DAYS FOR PROCESSING THIS APPLICATION For further information contact the DDN Network Information Center (NIC): by way of electronic mail: HOSTMASTER@NIC.DDN.MIL Telephone: (800) 365-3642 Postal mail: DDN Network Information Center 14200 Park Meadow Dr., Suite 200 Chantilly, VA 22021
(Sheet 4 of 4)

Appendix H: ASU background information

This appendix provides background information on application-specific units (ASU) and the SuperNode platforms that support these ASUs.

Application-specific units and supported services

The following ASUs are described in this section:

- link interface unit (LIU7)
- Ethernet interface unit (EIU)
- frame relay interface unit (FRIU)
- X.25/X.75 link interface unit (XLIU)
- network interface unit (NIU)
- voice processing unit (VPU)
- application processor unit (APU)

Link interface unit

The link interface unit (LIU7) provides an interface for common channel signaling 7 (CCS7). CCS7 supports a variety of services, including the following:

- integrated user services part (ISUP) and connectionless (TCAP) -based services
- enhanced 800 services (E800)
- automated calling card system (ACCS)
- custom local area signaling service (CLASS)
- advanced intelligent network (AIN) services

Ethernet interface unit

The Ethernet interface unit (EIU) supports Ethernet connectivity on the DMS-100 switch. The operating company can configure the EIU as either an IP or

OSI router or support host services. The current list of router and host services that use dedicated EIUs include:

- automated directory assistance service (ADAS)
- billing server
- cellular digital packet data (CDPD)
- programmable service node (PSN)
- automatic file transfer (AFT)
- remote management system (RMS)
- internet central buffer manager (ICM)

Additional applications supported by EIUs are updated in *Provisioning Rules for LPP, SSLPP, and SNSE LIS*, System Engineering Bulletin SEB 92-02-001.

EIUs are supported on the following platforms:

- link peripheral processor (LPP)
- single-shelf link peripheral processor (SSLPP)
- SuperNode SE link interface shelf (SNSE LIS)

Frame relay interface unit

DataSPAN is the Nortel frame relay service (FRS) offering. DataSPAN is a high-performance connection-oriented packet switching data service. DataSPAN is implemented using the frame relay interface unit (FRIU). The data transfer services are applicable to a variety of data communications, including the following:

- OSI connectionless networking
- IBM system network architecture (SNA)
- transmission control protocol/Internet Protocol (TCP/IP)

X.25/X.75 link interface unit

The DMS packet handler allows ISDN basic rate service access for both B- and D-channels to the X.25 packet network. It is implemented using the X.25/X.75 link interface unit (XLIU). The XLIU allows interconnectivity to other ISDN nodes and public packet switched networks provided by operating companies or inter-exchange carriers (IEC).

For CDPD applications, the XLIU along with the EIU and the network interface unit (NIU) provides functionality to transport datagrams between mobiles, and private and public data networks.

Network interface unit

The NIU provides direct network connectivity for the link peripheral processor (LPP), the single-shelf LPP (SSLPP), or the SuperNode SE link interface shelf (SNSE LIS). The NIU gives some ASUs and services access to DS1 or PCM30 trunking without using channel banks or multiplexer equipment. Prior to the availability of the NIU, physical connections were limited to DS0 or V.35 located on paddle boards of the LIU7 ASU. The NIU offers no service functionality by itself and must be engineered with an LIU7, XLIU, or voice processing unit (VPU).

For CDPD applications, the NIU provides management and maintenance functions.

Voice processor unit and ADAS

ADAS is supported on the VPU, the application processing unit (APU), and the EIU. ADAS provides voice processing capabilities for operator directory assistance calls and allows for improved operator efficiencies and customer service.

For ADAS, there are three types of ASUs that provide support for application functionality and OAM functions:

- ADAS APUs support service-specific application software and off-load the demands placed on the DMS-core. APUs can be configured for use by any application with the appropriate software.
- ADAS VPUs support voice processing capabilities to store and playback prompts, tones, and caller responses, as well as to detect dual-tone multifrequency (DTMF) tones.
- ADAS EIUs support a link to an Ethernet local area network (LAN) for communications with an ADAS OAM workstation.

ASUs and Cellular digital packet data

CDPD service transports datagrams between the mobile-end systems, and private and public data networks.

There are three types of ASUs that provide support for CDPD service:

- CDPD EIU provides communication between the DMS-100 switch supporting mobile-end systems and private and public data networks by providing a link to the Ethernet. There are two types of functions supported by EIUs for CDPD:
  - — IP-EIU routes IP traffic between mobiles and private and public data networks
  - — CNLP EIU exchanges networking information (such as registering of visiting mobiles) and forwarding of data with other mobile-end systems

- CDPD XLIU terminates various protocols, such as LAPB and MDLP. XLIUs also store accounting information for data services.
- CDPD NIU stores and maintains subscriber routing and mobility information on the NIU software. The NIU contains the software that interfaces with the computing module (CM) for maintenance functions. The NIU also gives the XLIU channelized access to the DMS-100 switch network.

External routers

External routers allows the message transfer part (MTP) routing functionality to reside in the dedicated LIU7s instead of in the digital trunk controller 7 (DTC7). This configuration eliminates the necessity for the DTC7s to be informed of routing changes and thus significantly reduces the volume of messaging to the DTC7s.

Platforms

ASUs are supported on the following platforms:

- link peripheral processor (LPP)
- single-shelf link peripheral processor (SSLPP)
- SuperNode SE link interface shelf (SNSE LIS)

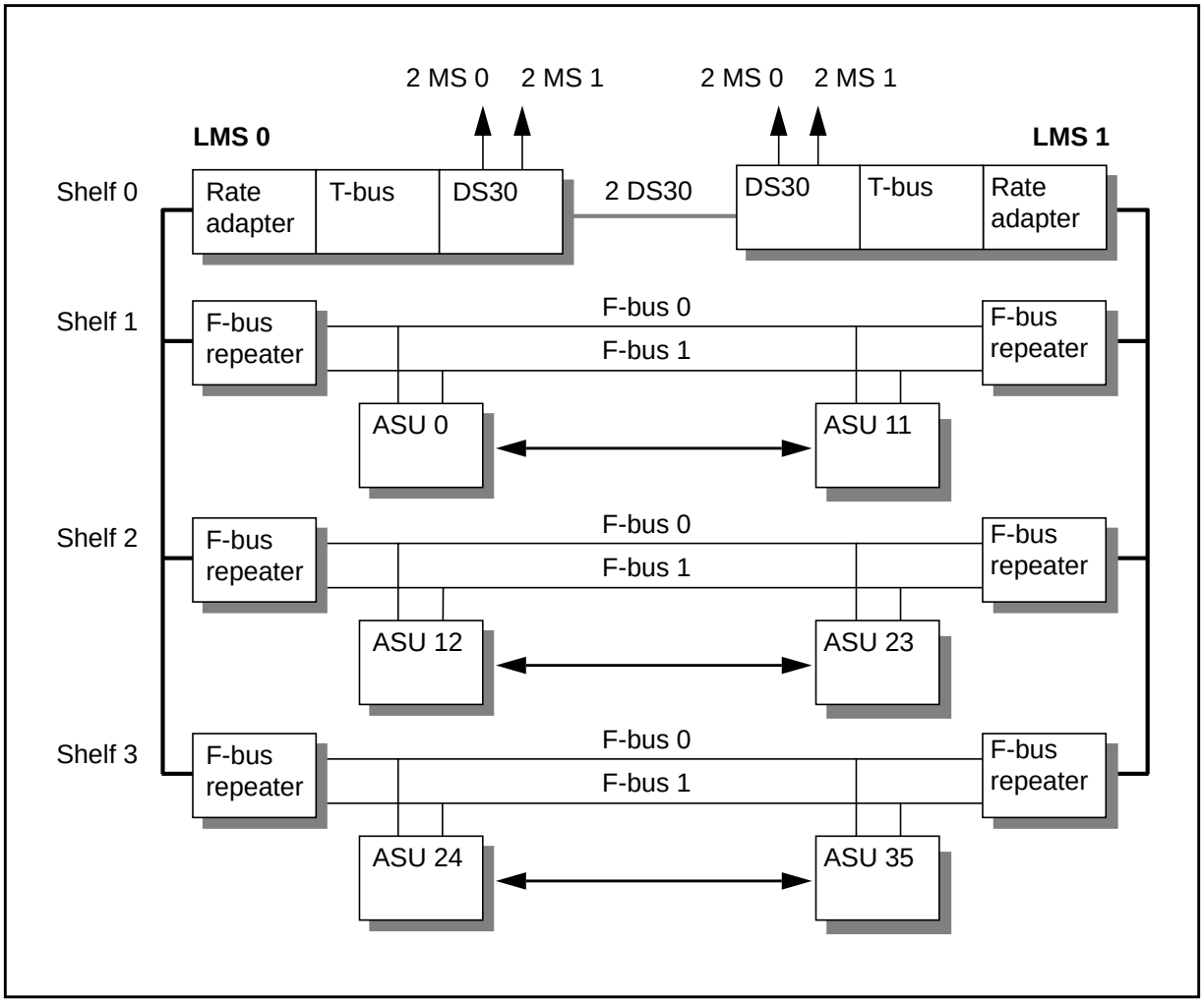
Link peripheral processor

LPPs with a maximum of either 24 or 36 ASUs exist. However multi-application deployment is only supported on the 36-ASU version of the LPP. EIUs are not supported on the 24-slot LPP.

The LPP consists of two basic subsystems: the individual ASUs (LIU7s, EIUs, and so on) and the local message switch (LMS). Figure 44 shows a block diagram of the LPP. This figure illustrates the ASU-LMS interconnection through a duplicated frame transport bus (F-bus) and the DS30 interconnections between the independent planes of the LMS and the corresponding planes of the DMS-bus. Each ASU consists of two circuit packs and a single paddle board.

The duplicated F-bus is eight bits wide and runs at a clock rate of 4.096 MHz. Each of the ASUs and services has access to the duplicated F-bus through its ASU F-bus interface. The F-bus terminator and repeater electrically terminates the F-bus and provides a signal repeater function between the ASU shelves within a single LPP. These circuit packs occupy the extreme left and right slot positions in each shelf. Each circuit pack serves one of the duplicated F-bus paths on a single ASU shelf backplane.

Figure 44 LPP architecture



The LMS represents the first level of the two-level message switching hierarchy. The LMS provides the interface between the F-bus seen by individual ASUs and services and non-channelized DS30 links to the DMS-bus. The LMS is duplicated: LMS0 interfaces to F-bus0 and LMS1 to F-bus1. Each ASU has access to either F-bus0 or F-bus1. Messages are sent or received on either F-bus. Each LMS plane connects to each side of the DMS-bus in a fully redundant manner.

Each LMS plane consists of a maximum of 13 circuit packs and paddle boards, and occupies one-half of the top shelf of the LPP. The majority of the printed circuit boards are identical to those employed in the DMS-bus. These circuit packs constitute the transport bus (T-bus). The T-bus is a 32-bit-wide parallel bus that also operates at a clock rate of 4.096 MHz. The T-bus resides between the rate adapter and the DS30 interface circuits that connect the LPP to the

DMS-bus. While the rate adapter is responsible for mediating traffic flow between the F-bus and T-bus, the T-bus provides the following functionality:

- T-bus for inter- and intra-LPP messaging (inter-LPP messaging is carried on DS30 links)
- access to mapper hardware for logical-to-physical addressing
- supports the LMS central processing unit (CPU), which is responsible for LPP diagnostics, maintenance, and maintaining configuration specific data in its memory

Single-shelf link peripheral processor

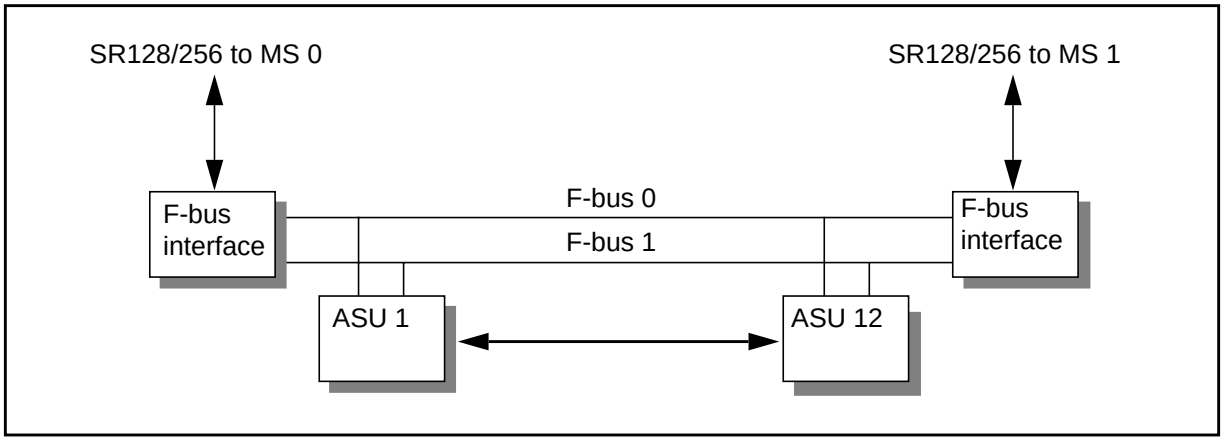
The SSLPP is a cost-competitive alternative for offices that do not need the number of slots offered by the LPP. The operating company can provision a maximum of 12 ASUs on the SSLPP.

The SSLPP allows the F-bus from a single link interface shelf (LIS) to connect directly to the DMS-bus with a fiber optic cable. The functions of the LMS are assumed by the DMS-bus. The shelf assembly is identical to that used in the LPP, with the major difference being the method used to connect it to the message switch (MS).

In the SSLPP, the F-bus interface circuit pack is replaced with an F-bus controller circuit pack, which handles the messaging to and from the ASUs and services and provides shelf control. The F-bus extender paddle board is replaced with a fiber interface paddle board, which interfaces to the fiber optic link and provides the system clock and out-of-band reset reception. Each F-bus controller connects to one of the two F-buses for the shelf and provides a connection to an MS. This arrangement provides the same minimum level of redundancy as in the LPP (where each F-bus is connected to only one of the two LMSs). In a single office, a maximum of two SSLPPs can be connected to the MS. The fiberized interface allows a selectable number of channels for future requirements (128 and 256 channels).

Figure 45 on page 183 provides an overview of the SSLPP configuration.

Figure 45 SSLPP architecture

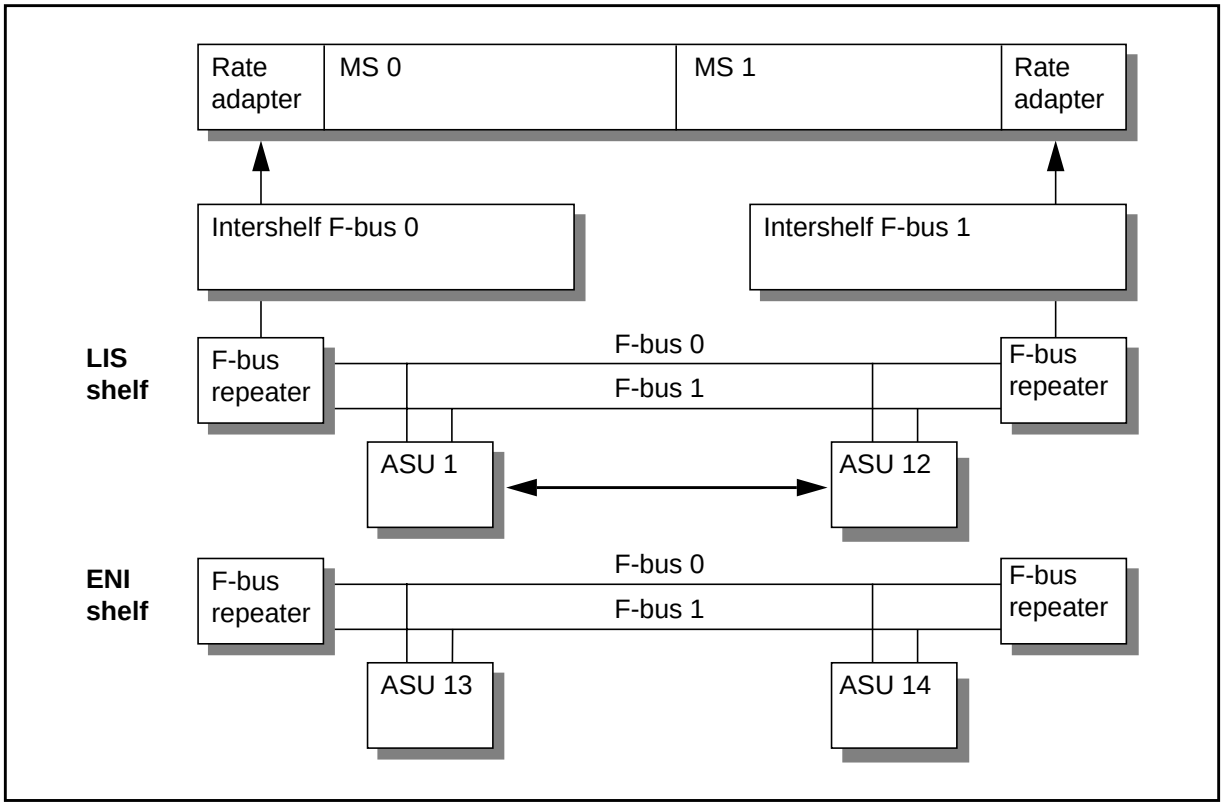


SuperNode SE link interface shelf

The SNSE LIS is part of the SuperNode SE configuration. In this arrangement, the SNSE LIS is collocated with a DMS-bus (MS), 16kbyte ENET, CM, and SLM hardware in a single frame. By virtue of the proximity to the MS, there is no need to provide a fiber or DS30 interface with the SNSE LIS. The F-bus interface hardware (rate adapter) is integrated into the MS. The SNSE LIS shelf supports a maximum of 14 ASUs and services. To provision beyond this maximum, either a separate SSLPP or LPP must be added to the office.

Figure 46 on page 184 provides an overview of the SNSE LIS configuration with its inter-shelf F-bus connection to the MS.

Figure 46 SNSE-LIS architecture



Appendix I: Obtaining a MAC address

This appendix provides information on media access control (MAC) addresses[1], and on obtaining a MAC address for the Ethernet interface unit (EIU).

Overview

The standard among manufacturers of Internetworking hardware is that the MAC address is hard-coded in read-only memory (ROM) on each device. The address becomes a unique identifier, and this standard ensures that no two devices have the same identifier.

The EIU departs from this standard in that, while Nortel controls the MAC address and the address is still unique, the operating company is responsible for recording this address in datafill. While there is flexibility in assigning the MAC address to EIU, this flexibility can cause problems if MAC addresses are not unique across the network or the Internetwork. The operating company must ensure that the datafilled address is correct, or addressing conflicts can occur.

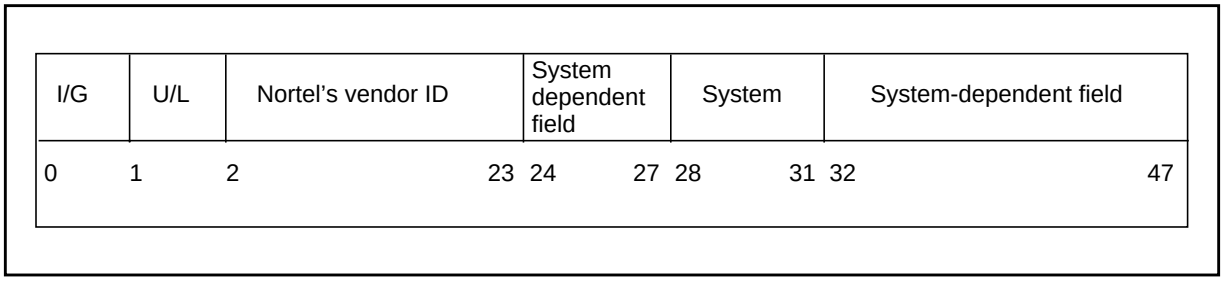
Administrative personnel assign a unique MAC address to each EIU using table control datafill in table LIUINV.

MAC address format

As defined by IEEE Standard 802.3, a MAC address is either 16 or 48 bits long. SuperNode supports 48-bit addresses. The 48-bit MAC address structure is shown in figure 47.

1. The MAC address is also known as an Ethernet address. In this document, the industry - standard term MAC address is used.

Figure 47 EIU MAC address format



The format of the MAC address is defined as follows:

- Nortel sets the two bits for the I/G and U/L fields according to the IEEE definition of the MAC address.
- For the vendor identifier, Nortel uses the 22-bit identifier that the IEEE assigns (*00 0000 0000 0000 1010 1110*). The convention used to represent addresses in hexadecimal is to flip the bits in each byte end-for-end. Therefore, the first three bytes of a single-station globally administered address for an Nortel product in hex is *00 00 75*.
- Nortel uses the *System* field to identify the type of product to which the address applies. The hexadecimal value F identifies SuperNode systems.
- Nortel assigns in sequence the remaining 20 bits for the system-dependent fields.

In summary, the first 24 bits of the address are defined by IEEE standards and regulations. The remaining 24 bits are partitioned internally by Nortel to define MAC addresses for its range of products.

EIUs are assigned 20 bits (greater than 1 million addresses) out of this range. By convention, EIUs are datafilled with MAC addresses in a block of 16 addresses. This block must be unique among all SuperNodes deployed with EIUs (65 384 unique values). The remaining four bits are also uniquely defined to provide unique addresses within each SuperNode. Uniqueness is enforced only within a SuperNode, not between SuperNodes even on the same network.

How to get the MAC address for an EIU

Nortel is responsible for assigning blocks of MAC addresses to its customers.

CAUTION
Possible loss of service
Do not assign an arbitrary MAC address to either EIUs or other SuperNode equipment. Duplicate MAC addresses can cause protocol conflicts at the Open Systems Interconnect (OSI) data link or equivalent layer, making equipment unaccessible to the network.

To obtain MAC addresses, contact your Nortel Engineering support group by using the internal Nortel email address, MAC ADDRESS2. This process is documented in ECM620 and is provisioned by Nortel personnel.

List of terms

ACCS automated calling card system

ADAS automated directory assistance service

AIN advanced intelligent network

ALP application layer program

APU application processor unit

APUX application processor for Unix

ARP address resolution protocol

ASU application-specific unit

ATF automatic file transfer

AUI attachment unit interface

BCS batch change supplement

BMS buffer management system

BMSM BMS manager

BOOTP boot protocol

CCS7 common channel signaling for SS7

CLASS custom local area signaling service

CSMA/CD carrier sense multiple access with collision detection

CDPD cellular digital packet data

CI command interpreter

CM computing module

CPU central processing unit

DATAS DMS Accounting and Traffic Analysis System

DCP data communication processor (now EIU)

DMS Digital Multiplex System

DTMF dual-tone multifrequency

E800 enhanced 800 services

EIC Ethernet interface card

EIP Ethernet interface paddle board

EIU Ethernet interface unit

EMI electromagnetic interference

F-Bus frame transport bus

FIFO first in, first out

FLIS fiberized link interface shelf

FP file processor

FRIU frame relay interface unit

FRS frame relay service

FTA frame transport address

FTP file transfer protocol

FTS Frame Transport System

GMP global messaging process

IEEE Institute of Electrical and Electronics Engineers, Inc.

ICBM Internet central buffer manager

ICMP Internet control message protocol

IEC inter-exchange carriers

IML inter-message switch links

InARP inverse address resolution protocol

IOC input/output controller

IP Internet Protocol

IPF integrated processor and F-bus

IPX Internet packet exchange

ISDN integrated services data network

ISG isolated system ground

ISN integrated service node

ISUP integrated user services part

Kbyte kilobyte

Kbyte/s kilobyte per second

Kbit kilobit

Kbit/s kilobit per second

LAN local area network

LAPB link access protocol - balanced

LIS link interface shelf

LIU link interface unit

LIU7 LIU for CCS7

LLC line load control

LMS local message switch

LPP link peripheral processor

MAC media access control

MAN metropolitan-area network

MAU media access unit

MAP maintenance and administration position

Mbyte megabyte

Mbyte/s megabytes per second

Mbit megabits

Mbit/s megabits per second

MDLP mobile data link protocol

MDR7 message detail recording for CSS7

MS message switch

MTP message transfer part

NIC Network Information Center

NFS network file system

OM operational measurement

OSPF open shortest path first

OSI open systems interconnect

P-Bus peripheral bus

PDU protocol data unit

RARP reverse address resolution protocol

RFC Request For Comment

RIP routing information protocol

RMS remote management system

RPC remote procedure call

RTS return to service

RX receive

SCP service control point

SCU service control unit

SDM SuperNode Data Manager

SEB software engineering bulletin

SLM system load module

SMP simple management protocol

SNA system network architecture

SNAP SuperNode access protocol

SNSE LIS SuperNode SE link interface shelf

SNIP SuperNode IP scheduler class

SNIX SuperNode UNIX

SNMP simple network management protocol

SOS Support Operating System

SPM service peripheral module

SQE signal quality error

SS7 signalling system #7

SSLPP single-shelf link peripheral processor

STP signaling transfer point

SwAct switch of activity

SysB system busy

T-bus transport bus

TCAP transaction capabilities application part

TCP transmission control protocol

TCP/IP transmission control protocol/Internet Protocol

TFTP trivial file transfer protocol

TOS type of service

TRMS Transaction Record Management System

UDP user datagram protocol

ULP upper layer protocol

UTP unshielded twisted-pair

VPU voice processor unit

WAN wide area network

WS workstation

XDR external data representation

XLIU X.25/X.75 link interface unit

DMS-100 Family

Ethernet Interface Unit

User Guide

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