3745 Communication Controller Models A and 170
3746 Nways Multiprotocol Controller
Models 900 and 950

# Overview

GA33-0180-12

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3746 Nways Multiprotocol Controller
Models 900 and 950

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**Note**

Before using this information and the product it supports, be sure to read the information under “Notices” on page xi.

**Thirteenth Edition (September 2000)**

This edition applies to the 3745 Communication Controller Models A and 170, and the 3746 Nways® Multiprotocol Controller Models 900 and 950.

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# About This Overview

This overview contains information about the following IBM communication controllers:

- IBM 3745 Model 170
- IBM 3745 Models 17A, 21A, 31A, 41A, and 61A (3745 Models A)
- IBM 3746 Nways® Multiprotocol Controller Model 900 (3746-900), functioning with the 3745 Models A as:
  - A Systems Network Architecture (SNA) subarea routing node, in conjunction with Network Control Program (NCP) running in the 3745
  - An Advanced Peer-to-Peer Networking (APPN®)/High Performance Routing (HPR) network node (NN)
  - An Internet Protocol (IP) high-end router
- IBM 3746 Nways Multiprotocol Controller Model 950 (3746-950) functioning as:
  - An APPN/HPR network node
  - An IP high-end router

This overview also explains how the networking technologies of the 3745 Models A, the 3746 Model 900, and the 3746 Model 950 can be deployed to match the evolution and growth of enterprise networks.

It also includes information on the Multiaccess Enclosure (MAE), an extension of the 3746 controllers, designed to provide a range of high-speed network interfaces, extensive support for routing protocols, and multiple networking functions.

## Conventions Used in This Overview

The following conventions are used in this overview:

| | |
|---|---|
| **3745-170** | IBM 3745 Model 170 |
| **3745 Models A** and **3745** | IBM 3745 Models 17A, 21A, 31A, 41A, and 61A (with or without an attached 3746 Expansion Unit Model A11, A12, L13, L14, L15, or 900) |
| **3746 Model 900** and **3746-900** | IBM 3746 Nways Multiprotocol Controller Model 900 |
| **3746 Model 950** and **3746-950** | IBM 3746 Nways Multiprotocol Controller Model 950 |
| **3746** | Both the 3746-900 and 3746-950. |

## Who Should Read This Overview

This overview is intended for:

- Information technology and network managers
- Network architects
- Network planners

You will find it useful to have an understanding of 3745 networking functions, and the channel connectivity of S/390® servers via Enterprise Systems Connection

Architecture® (ESCON®). For general information about ESCON, refer to *Introducing Enterprise Systems Connection*, GA23-0383.

Background knowledge of SNA, IP, APPN, HPR, distributed networking, and frame-relay concepts will also be very helpful in reading this overview.

## How This Overview Is Organized

Chapter 1, "General Information on 3745 and 3746 Controllers" on page 1-1, is an overview of the 3745, 3746-900, and 3746-950 line of products.

Chapter 2, "Functional Overview of the 3745 and 3746 Controllers" on page 2-1, describes the functions and components of the 3745, the 3746-900, and the 3746-950.

Chapter 3, "Functional Overview of the Multiaccess Enclosure" on page 3-1, gives information on the MAE and its networking capabilities.

Chapter 4, "Network Solutions" on page 4-1, describes the networking solutions that the 3745 and the 3746 can bring to your network. These solutions include:

- SNA environment
- APPN/HPR or mixed SNA and APPN/HPR environment
- Multiprotocol environment (IP, SNA, and/or APPN/HPR)
- Migration from an SNA to an APPN/HPR environment
- Migration from an SNA to a multiprotocol environment

Chapter 5, "Scalable Connectivity" on page 5-1, describes the advantages of the 3746 connectivity, and includes examples of three adapter types (communication line, ESCON, and token-ring adapters).

Chapter 6, "System Management" on page 6-1, describes how to manage the 3745 and the 3746, with an outline of problem management facilities, including:

- NetView® Performance Monitor (NPM)
- Controller Configuration and Management (CCM)
- Telnet
- Tivoli Management Environment (TME) 10 Remote Control[1]
- Java™ Console
- Remote Support Facility (RSF)

Chapter 7, "High Availability" on page 7-1, describes how the 3745 and the 3746 are high availability solutions in the design of your network.

Appendix A, "Configuration Options for the 3745 Model 170" on page A-1, describes the expansion features for the 3745-170.

Appendix B, "3745 Models A and 3746 Minimum Configurations and Upgrades" on page B-1, describes the minimum hardware requirements for running your controller.

[1] TME 10 Remote Control includes DCAF (see "Accessing the Service Processor Via TME 10 Remote Control" on page 6-11).

Appendix C, “Configuration Options for the 3746 (Base)” on page C-1, describes the expansion features of the 3746-900 and the 3746-950.

Appendix D, “Configuration Options for the 3746 (MAE)” on page D-1, describes the expansion features of the Multiaccess Enclosure (MAE).

Appendix E, “Connectivity and Performance of the 3746 APPN/HPR Network Node (NN)” on page E-1 describes the connectivity of the 3746 NN.

Appendix F, “Programming Support” on page F-1, describes the programs that are available for system and network support.

Appendix G, “The 3745 Models A and the 3746 Compared to Previous 3745 Models” on page G-1 describes the advantages of the 3745 Models A and 3746 as compared to 3745 Models xx0, the previous generation of 3745 controllers.

## What Is New in This Overview

This edition gives information on the latest developments of the 3746.

As a response to increased networking requirements for the Year 2000, the 3746 Extended Functions 5 (feature code 5812) delivers increased capacity and performance and enhanced network management.

This edition also describes the new Network Node Processor (NNP) Type 4, the new Service Processor (SP) Type 4, and associated benefits.

## New Functions in the 3746

### Network Node Processor Type 4

The Network Node Processor (NNP) Type 4 includes a Pentium® III 533-MHz processor for faster network restart times and 128-MB memory base for increased session capacity. An additional memory module enables the NNP4 to control up to 20 000 LU-LU sessions (out of 35 000 LU-LU sessions routed by the 3746) and up to 60 000 SSCP-LU sessions for the 3746 Dependent Logical Unit Requester (DLUR).

An upgrade is also available for improving the performance and connectivity of the previous NNP types to the level of performance and connectivity of the NNP Type 4.

For information about the processing capacity of the NNP Type 4, see “NNP Type 4 (NNP4)” on page 2-17.

### Service Processor (SP) Type 4

The Service Processor Type 4 includes a Pentium® III 533-MHz processor, 128-MB memory, and 133-Mhz bus for faster operator interventions.

An upgrade is also available for improving the performance of the previous SP types to the level of performance and connectivity of the SP Type 4.

For information about the processing capacity of the SP Type 4, see “Service Processor Type 4” on page 2-16.

### Increased Capacity and Performance

The 3746 Extended Functions 5 provides increased capacity and improved performance in the following areas:

- 60 000 SSCP-LU control sessions with Network Node Processor Type 3 (NNP3) and Network Node Processor Type 4 (NNP4), instead of 40 000
- 20 000 LU-LU data sessions controlled by NNP3 and NNP4, instead of 15 000, out of a total of 35 000 sessions routed through the 3746 Network Node
- 4 000 Physical Units (PUs) on Token-Ring Processor Type 3 (TRP3), instead of 3 000
- Faster network restart with NNP4 (533-Mhz processor)
- 10 000 IP routes on Controller Bus and Service Processor Type 3 (CBSP3), instead of 7 500
- 10 000 OSPF external routes on CBSP3, instead of 7 500
- Support of frame-relay lines carrying voice and data traffic
- Faster file transfers with increased IP throughput with the ESCON® Processor Type 3
- Faster recovery from network problems with dynamic windowing on TRP3

### Improved Network Management

The 3746 Extended Functions 5 provides improved network management in the following areas:

- Easier network definitions (such as discovery of Low Entry Networking (LEN) nodes)
- Ability to use a text editor (such as Windows or OS/2) to complete or update 3746 configuration definitions
- New RUNCMD commands to manage the 3746 from NetView
- Capability to dynamically tune the new dynamic windowing mechanism of NCP and NNP to more efficiently regulate traffic over TRP3 ports

### Improved Operator Productivity

The 3746 Multiprotocol Controller also provides the following functions that help to improve operator productivity:

- Faster operator interventions (response time reduced by a factor of up to five) with the SP4
- Improved response to end-user requests with multiple operator access

For more information, see “3746 Extended Functions 5” on page 2-4.

## Where to Find More Information

- *IBM 3746 APPN/HPR Implementation Guide*, SG24-2536
- *IBM 3746 IP Implementation Guide*, SG24-4845
- *The Integrated 3746 Multiaccess Enclosure*, SG24-5238
- *Introducing Enterprise Systems Connection*, GA23-0383

- *SNA Network to APPN Network Migration Experience*, SG24-4656
- *Using Tivoli NetView Performanc Monitor (NPM)*, SG24-5509
- "Customer Documentation for the 3746 Model 950" on page H-1
- "Customer Documentation for the 3745 (All Models), and 3746 (Model 900)" on page H-6
- "Additional Customer Documentation for the 3745 Models 130, 150, 160, 170, and 17A" on page H-12

## Additional Information on the Web

You can access the latest news and information about IBM network products, customer service and support at:

`http://www.ibm.com/networking`

More specific information can be found at:

`http://www.ibm.com/networking/3745`
`http://www.ibm.com/networking/3746`
`http://www.ibm.com/networking/ncp`

## Year 2000 Statement

This product is Year 2000 ready. When used in accordance with its associated documentation, it is capable of correctly processing, providing, and/or receiving date data within and between the 20th and 21st centuries, provided all other products (for example, software, hardware, and firmware) used with the product properly exchange accurate date data with it.

To be Year 2000 ready, the 3745 and 3746 controllers require a certain level of microcode. For more detailed information, access one of the URLs (3745 or 3746) listed above and click **Support**.

# Chapter 1. General Information on 3745 and 3746 Controllers

For nearly three decades, IBM's advanced line of communication controllers (3705, 3720, 3725, 3745, and 3746) have proved an effective solution for rapid changes in network technology. In particular, the 3745s and, more recently, the 3746-900 and the 3746-950, have proved cost effective for network evolution and adaptability to new functions.

IBM controllers include the following:

- 3745 Models 130[1], 150[1], 160[1], and 170
- 3745 Models 210[1], 310[1], 410[1], and 610[1]
- 3745 Models 17A, 21A[1], 31A, 41A[1], and 61A (3745 Models A)
- 3746 Model 900 (3746-900)
- 3746 Model 950 (3746-950)

These controllers were originally designed for the attributes and advantages of SNA. Later innovations in the same model line incorporated developments in APPN, HPR, and IP networking technologies:

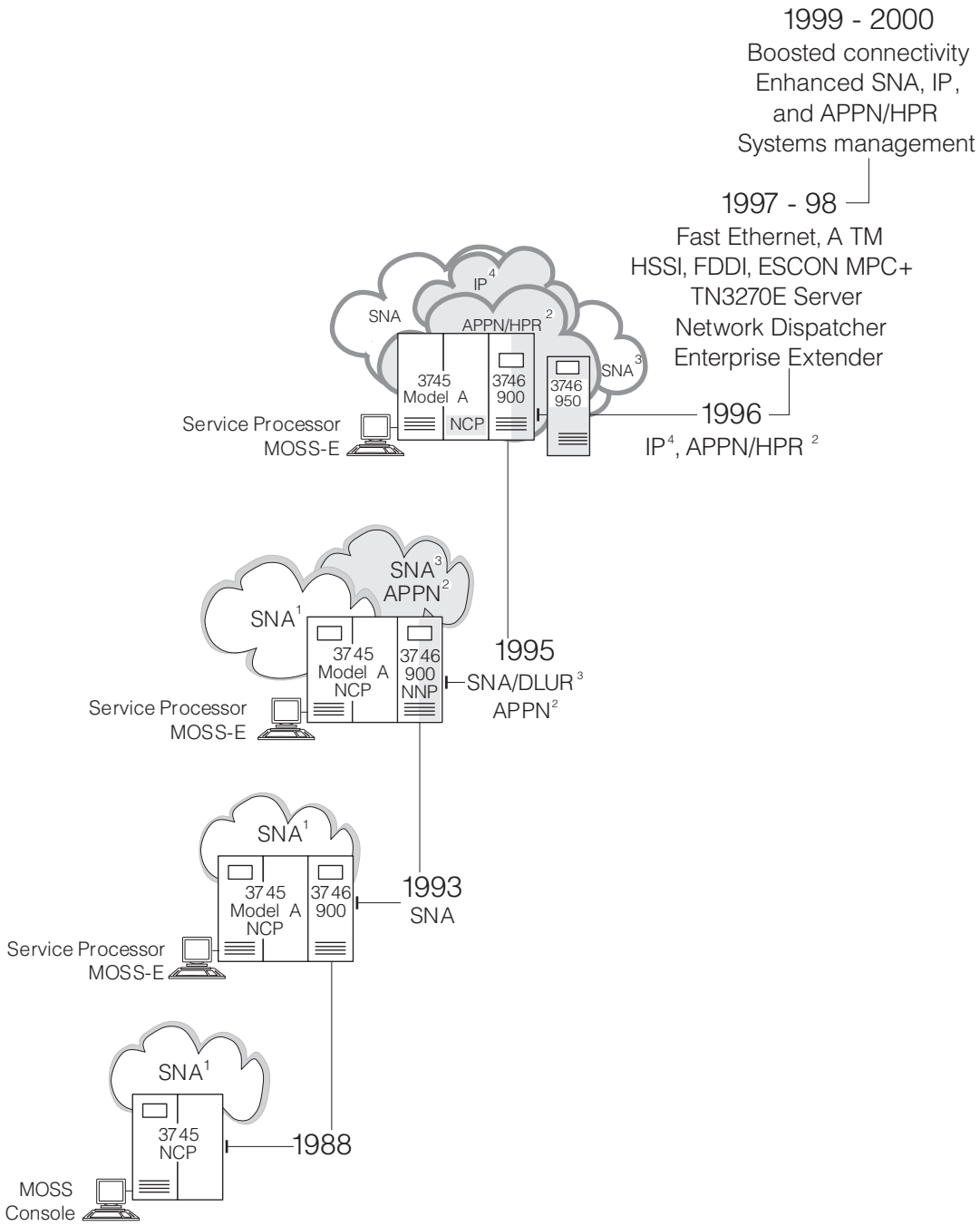
- The 3746-900 can operate simultaneously as an IP router, APPN/HPR NN, and an NCP-controlled SNA subarea node or APPN composite network node (CNN).
- The 3746-950 can operate simultaneously as an IP router and APPN/HPR Network Node (NN), independently of any 3745 running NCP.

The 3746 Models 900 and 950 form the latest generation of controllers, the *3746 Nways Multiprotocol Controllers*. These controllers are the basis of efficient and reliable multiprotocol networks that support both SNA and TCP/IP applications.

By integrating the 3746-900 and the 3746-950 into your network, you can add the advantages of APPN/HPR and IP, while providing support for existing SNA configurations.

Figure 1-1 on page 1-2 illustrates the development of 3745 and 3746 controllers, in line with the evolution of networking technologies.

[1] These models are no longer manufactured.




1. This controller configuration supports SNA networking and the APPN CNN function along with NCP and VTAM.
2. APPN networking, using a network node processor (NNP), independent from NCP and VTAM.
3. Connectivity with SNA devices using DLUR support, and a VT AM with Dependent LU Server (DLUS).
4. IP networking using the NNP and 3746 IP routing features, independent from NCP , and TCP/IP MVS.

*Figure 1-1. The Networking Evolution of IBM 3745 and 3746 Controllers*

## The 3745/3746 Evolution from SNA to APPN/HPR and IP Routing

The extensions of SNA networking began in the 1980s with the introduction of Low Entry Networking (LEN). This development continued with APPN, HPR (an extension of APPN), and then IP routing.

APPN/HPR performs the following:

- Flexible, peer-to-peer connectivity for smaller system users (such as the IBM AS/400® server or the IBM Personal System/2).
- Simpler configuration and system definitions than earlier versions of SNA products.
- Dynamic reconfiguration and network changes without disrupting network operations, for greater network availability.
- An open network architecture that allows inter-operability between different vendor equipment.
- One hundred percent network availability, with non-disruptive session re-routing around network component failures.

Key characteristics of APPN/HPR include the following:

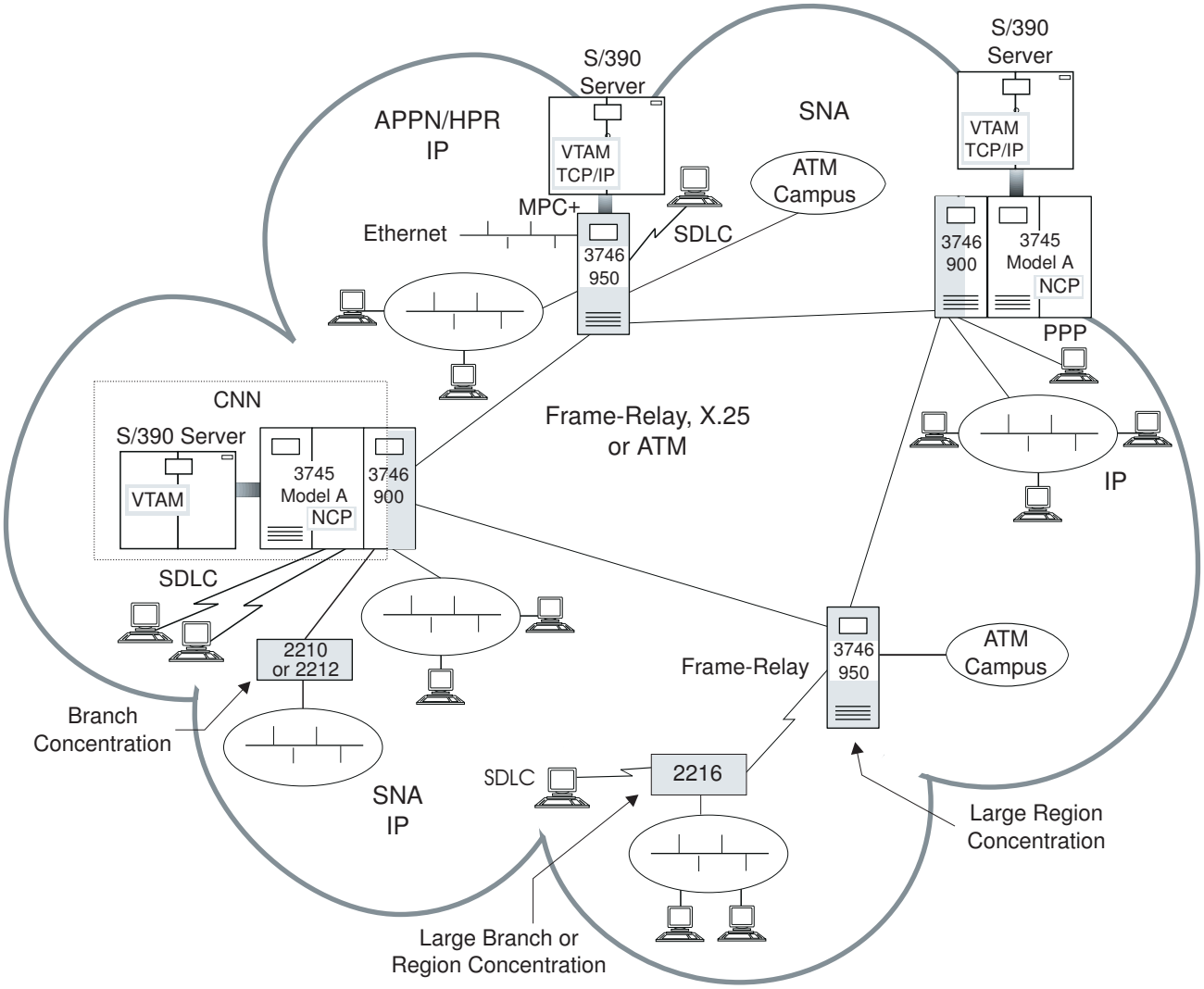
- Dynamic overview of the current network topology.
- Network management services, for example, automatic location of network end-system and intermediate-system resources.
- Dynamic selection of the best routes to remote users and applications.
- Ensuring transmission priority and traffic congestion control.
- Enabling high data throughput, in particular between S/390® servers and other servers in the network.

The 3746 IP router facilities include the following:

- Very rich set of IP routing functions.
- Concurrent IP, APPN/HPR, and SNA routing.
- Efficient access control to complement traditional filtering.
- High data throughput, in particular between S/390 servers running TCP/IP applications and other local or remote servers.
- Support for Simple Network Management Protocol (SNMP).

## 3745/3746 Network Environment

Figure 1-2 on page 1-4 shows 3745s and 3746s, using for example, a frame-relay, X.25, or ATM transport network.




**Legend**

| | |
|---|---|
| 2210 | IBM Nways Multiprotocol Router |
| 2212 | IBM Access Utility |
| 2216 | IBM Nways Multiaccess Connector |
| MPC+ | Multi-path Channel+ (ESCON) |

*Figure 1-2. 3745/3746 Network Environment*

# Chapter 2. Functional Overview of the 3745 and 3746 Controllers

Licensed Internal Code for 3745 Models A and 3746 Models 900 and 950 is delivered on CD-ROM only. This applies to new machines and functional upgrades for installed machines.

## Overview of the 3745

The 3745 is a high-performance communication controller for SNA-based networking. Network operations are performed by NCP running in the 3745 (NCP Version 7 Release 8 is the recommended version). The 3745 controls data communication exchange to the following devices:

- Line-attached control units and terminals (via modems or direct connection)
- Token-ring attached workstations
- Ethernet LAN-attached IP workstations
- Channel-attached or remotely connected processors 4341, 4361, 4381, 937x, 3090, ES/9000®, or S/390

Parallel channel support in the 3745 includes:

- Direct-Current Interlock (DCI) or High-Speed (HS) mode for attachment to byte multiplex, block multiplex, or selector channels.
- Data streaming mode for attachment to a block multiplex channel of IBM 937x, 3090, or ES/9000 servers.

### 3745 Model 170

Aimed at replacing older 3705, 3720, and 3725 controllers, the 3745-170 provides the ideal SNA networking solution for small-to-medium enterprise networks. With a 4 MB CCU (expandable to 8 MB) and a variety of network adapter options, the 3745-170 can support local and remotely attached devices via the following network interfaces:

- 112 communication lines at speeds of 500 bps to 256 kbps
- 2 CEPT lines with speeds up to 2.048 Mbps
- 2 token-rings at speeds of 4 Mbps, or 16 Mbps for LAN gateway to local or remote host applications
- 4 Ethernet V.2 and IEEE 802.3 LANs
- 4 parallel channel connections

For more information, see Appendix A, “Configuration Options for the 3745 Model 170” on page A-1.

### 3745 Models A (17A, 21A, 31A, 41A, 61A)

The 3745 Model A (17A, 21A,[1] 31A, 41A,[1] and 61A) forms the basis of 3745-based SNA or APPN/HPR networks under NCP control. In addition to features offered by earlier models, the 3745 Model A supports the following features:

[1] Models 21A and 41A are no longer manufactured.

- **NCP Support of the 3746-900**

  The 3745 Model A runs the NCP for SNA subarea control of the 3746-900.

- **Extended Memory**

  Up to 16 MB of storage per 3745 central control unit (CCU) for 3745 Models 31A and 61A.

- **Service Processor**

  The service processor runs the Maintenance and Operator Subsystem-Extended (MOSS-E) Licensed Internal Code.

### Basic Configuration for 3745 Models 31A and 61A

The 3745 Models 31A and 61A are shipped without basic features. Any Low-Speed Scanner (LSS), Line Interface Coupler (LIC), or LIC unit is optional. These lower cost 3745s make 3746-900 based solutions more attractive.

### Remote Control of the Service Processor Via an IP Connection

Java™ Console Support (FC 5801) provides the ability to control the service processor of the 3745 Models 17A, 21A, 31A, 41A, and 61A with any Web browser (with Java 1.1 enabled) installed on any platform. This support provides an alternative to the DCAF console support, and offers additional functions for ease of use. For more information, see "Java Console Support" on page 2-13.

### 3745 IP Connection to the 3746-900

The NCP IP program of the 3745 supports RIP V2 and can coexist with the IP router of the 3746-900. The Controller Bus Coupler (CBC) of the 3746-900 is used for the internal connection between the NCP IP router of the 3745 and the IP router of the 3746-900. This allows you to use the 3745 channel adapters, for example, to access non-ESCON hosts for 3746-900 IP router traffic.

**Note:** For high performance throughputs of the 3746 IP router, ESCON channel adapters are required.

For a description of the functions and adapters (channel adapters, low-speed scanners, high-speed scanners, token-ring adapters, line interface couplers, etc.) that are common to the 3745 Models A and other models, see the following:

- For 3745 Model 17A, see Appendix A, "Configuration Options for the 3745 Model 170" on page A-1, and *3745 Models 130, 150, 160, and 170: Introduction*, GA33-0138.
- For 3745 Models 21A, 31A, 41A, and 61A, refer to *3745 Models 210, 310, 410, and 610: Introduction*, GA33-0092.

## Overview of the 3746

The 3746 includes high-speed WAN/LAN connectivity, fast S/390 server access, and remote site concentration. High-speed connectivity options, together with scalability and high throughputs, offer high-end functions at a competitive cost. Combined with routing software, for example, Interactive Network Dispatcher and TN3270E Server, these features help reduce costs and increase network performance and operations efficiency.

## 3746 Models 900 and 950

The 3746 Nways Multiprotocol Controller Models 900 and 950 form the basis of manageable, reliable, and cost effective networks that can be readily adapted to meet the networking requirements of tomorrow.

## Flexibility in 3746 Options

3746 flexibility allows you to:

- Link your MVS/ESA™ server to an Intranet or Internet network with high speed native IP support.
- Use APPN/HPR to run high performance networks, with full availability of host-based SNA applications.
- Save costs by connecting to public or private frame-relay or X.25 networks.
- Extend your investment in both TCP/IP and SNA applications.
- Use ATM adapters for connectivity to ATM environments.
- Run high speed adapters for LAN and WAN networking.

## Broad Range of Networking Design Options

The IBM 3746 Models 900 and 950 offer a broad range of networking design options:

- SNA subarea routing under NCP control (3746-900).
- APPN/HPR routing, including DLUR support, to simplify network implementation and evolution.
- IP routing for high performance access to Internet or Intranet networks and website applications.
- Native routing (no protocol encapsulation) of multiple protocols (SNA, APPN/HPR, IP) over the same media, for example a wide area network (WAN) connection using frame-relay technology.
- Reduced network costs by using frame-relay technology to consolidate separate networks into a single, multiprotocol transport network.
- Network availability, with non-disruptive re-routing of user sessions around network component failure.
- HPR for enabling complete network availability, without network congestion. HPR utilizes the maximum amount of bandwidth available, end to end, between S/390 servers in a Parallel Sysplex® environment and network access nodes, for example:
  - IBM PS/2 with Communication Manager/2 (CM/2) or Communication Server for OS/2 WARP
  - IBM 2210 Nways Multiprotocol Router
  - IBM 2212 Access Utility
  - IBM 2216 Nways Multiaccess Connector
  - IBM 2217 Multiprotocol Concentrator
- Powerful network management tools, for example, NetView®, NetView Performance Monitor (NPM), and Nways Manager Suite or Nways Element Manager.

- Transport of data over leased connections using frame relay, Synchronous Data Link Control (SDLC), Point-to-Point Protocol (PPP), switched circuits using SDLC, and carrier networks providing frame-relay, X.25 or Integrated System Digital Network (ISDN) services.
- High speed Type 3 processors, fully compatible with, and upgradeable from other processor types.

## Advanced Networking Technologies (MAE)

The Multiaccess Enclosure (MAE) supports advanced networking technologies for server access, and high-speed LAN, WAN, and ESCON adapters. Support includes:

- ATM adapters for 155 Mbps operation over single-mode or multimode optical fibers, supporting high-speed LAN and WAN networking.
- Fast Ethernet and Fiber Distributed Data Interface (FDDI) support for high-bandwidth and high-capacity access to campus backbones and servers.
- High Speed Serial Interface (HSSI) support for high-speed (T3/E3) connectivity between two sites, or for cost-effective concentration into a data center of many sites connected over a frame-relay network.
- ESCON and Parallel Channel High Performance Data Transfer (HPDT) Multi-Path Channel+ (MPC+) support for HPR, TCP/IP and User Datagram Protocol (UDP) applications.
- ISDN and Channelized T1/E1 support.
- Flexible TN3270E server support for IP access to SNA applications.
- Interactive Network Dispatcher for scalable implementation of Internet and Intranet web server sites, with load distribution between IBM S/390 servers and other servers, allowing non-disruptive addition or interruption of servers.
- Enterprise Extender support for transporting SNA APPN/HPR application traffic over IP backbone networks.
- Data Link Switching (DLSw) for SNA messages translation into IP packets.

## 3746 Extended Functions 5

The 3746 Extended Functions 5 (FC 5812) complement the 3746 and MAE Extended Functions 4 (FC 5810, FC 5811).

The 3746 Extended Functions 5 include the following new functions.

## Increased Capacity and Performance

The 3746 Extended Functions 5 enable users to achieve more connectivity and more throughput on Type 3 and Type 4 processors. Older processors can be upgraded on site to Type 3 (CBSP, ESCP, TRP, CLP) or Type 4 (NNP, SP) processors.

These enhancements apply mainly for SNA, APPN, HPR, and IP routing, with a 3746 equipped with the NNP. Some enhancements also apply to SNA subarea routing (NCP). Specific enhancements include:

- Up to 35 000 LU-LU data sessions on NNP Type 3 or Type 4

The total number of LU-LU sessions (APPN or DLUR) routed by the 3746 Network Node is increased from 30 000 to 35 000. Up to 20 000 of these LU-LU sessions can be established by the NNP, an increase of 33% compared to the previous maximum of 15 000 sessions. The other LU-LU sessions (up to 35 000 maximum) are intermediate sessions established by other network nodes.

- Up to 60 000 SSCP-LU control session capacity on NNP Type 3 or Type 4

  The SSCP-LU control session capacity is increased by 50%, from 40 000 to 60 000 sessions. This allows migration from NCPs with a large number of defined LUs.

- Up to 4000 token-ring PUs on TRP Type 3 (FC 5623)

  TRP3 can now connect 4000 physical units (PUs). Previously, the maximum was 3000 PUs. The TRP Type 2 can connect up to 2000 PUs. The increased TRP3 connectivity applies to PUs activated by NCP and PUs activated by the NNP, in any combination up to 4000. This enables an increase in the number of end users supported on existing token-ring processors.

- Dynamic Windowing on Token-Ring Processor Type 3 (FC 5623)

  A new algorithm allows the NNP and NCP to more efficiently regulate traffic over token-ring ports. The benefits of this mechanism are:

  – More effective utilization of WAN network bandwidth after detection of frame loss (network problem)

  – Faster recovery after detection of LAN station congestion

- Up to 10 000 IP routes and 10 000 OSPF external routes on CBSP Type 3 (FC 5123 or FC 9023)

  The maximum number of IP routes is increased from 7500 to 10 000. The maximum number of OSPF external routes is increased from 7500 to 10 000.

- IP Throughput on ESCON Processor Type 3 (FC 5523)

  The Maximum Transmission Unit (MTU) size for IP traffic over ESCON channels is increased from 4 KB to 7 KB to enable higher channel throughputs. This allows faster file transfers, ESCON to ESCON, or token-ring to or from ESCON, for example 2 MB/sec for a single ESCON-to-ESCON session.

  For user interactive traffic where the response from the application is larger than 4092 bytes, MTUs larger than 4 KB increase the transaction rate, for example by 70% for responses of 5000 bytes.

- Voice traffic on Communication Line Processor Type 3 (FC 5203)

  Frame relay lines carrying voice traffic (voice over IP or voice over frame relay) or voice and data traffic (SNA, IP, and so on), can be connected to the CLP3. This support, available for lines activated by either NCP or the NNP, enables voice and data consolidation over an existing network infrastructure: frame relay connections and SDLC leased lines (redefined as frame relay lines) can be used between 3746 sites to save the costs of separate leased lines dedicated to voice traffic.

## X.25 QLLC on Communication Line Processor Type 3 (FC 5203)

The 3746 X.25 support (FC 5030), which allows NCP to control X.25 QLLC traffic without the need of X.25 NCP Packet Switching Interface (NPSI), is now available for DDX-P lines connected to the Communication Line Processor Type 3. Compared to NPSI support, the X.25 support feature of the 3746 allows users to very significantly reduce the 3745 processor (CCU) utilization and increase the volume of data traffic and end-user transactions. The X.25 support for DDX-P lines includes two new options, NetType3=Yes and Packet Level Piggybacking=No.

## Controller Configuration and Management (CCM) Enhancements

- Dynamic discovery of Low Entry Networking (LEN) nodes and Network Nodes (NN) without control sessions.

  These nodes are automatically discovered without any PU definition in CCM. The node-initiated sessions do not require any LU definition in CCM. Only the VTAM-initiated sessions require the corresponding node LUs to be defined in CCM.

- Dynamic change of maximum number of PUs per TIC3 port

  Up to now, the operator had to stop the port to change the maximum number of incoming calls per TIC3 port. With this improvement, the users already connected are not affected by a change of the maximum number of PUs per TIC3 port.

  In a multi-3746 installation, this allows the operator to non-disruptively adjust the total number of PUs per 3746/NNP, depending on the number of operational 3746/NNPs. As an example, a data center with two 3746s and 5000 PUs would be defined in such a way that a maximum of 2500 PUs are accepted per 3746. In normal operations, this allows the connections to be evenly spread between the two 3746s, even if the 3746s started one after the other. If one 3746 is not available, the operator can dynamically change the TIC3 definition of the active 3746 to increase the total number of PUs to 5000.

- More dynamic capabilities for Multiaccess Enclosure (MAE) users

  IP definitions apply to the 3746, the MAE, or both the 3746 and MAE (shared parameters). If the IP configuration changes do not affect the MAE, the MAE is no longer restarted. As a result, the users connected to the MAE are not impacted by changes related to ports not pertaining to the MAE.

- Editing of CCM configuration files (CCM Remote)

  For APPN/HPR/DLUR definitions, this method allows very easy replication of parameter definitions and can be much faster than the standard CCM graphical interface. Using File Transfer Program (FTP) or Distributed Control Access Facility (DCAF) on a workstation running OS/2, the user can download CCM configuration files from the Service Processor of the 3746, and then extract the APPN configuration files and convert them into ASCII files. A text editor can be used, either locally on the OS/2 workstation or on another workstation (Windows, OS/2, and so on), to complete or update the APPN ASCII configuration files. The OS/2 workstation is finally used to convert the ASCII files back to CCM file format and then to upload them to the Service Processor via FTP or DCAF.

## Network Management from NetView for OS/390

The following RUNCMDs are added or enhanced for 3746 control from NetView:

- Activate/deactivate IP resources
- Display the 3746/NNP counters of PUs and sessions (LU-LU, SSCP-LU)
- List all ports sorted by name
- List all stations sorted by name
- List a summary of the APPN sessions per alias name
- List a summary of the topology per APPN Network Node
- List all the topology data for a given APPN Network Node
- List a summary of the directory per APPN Network Node
- List all the directory data for a given APPN Network Node
- Request the APPN control program dump
- Monitor the APPN control program dump request completion

## Operations Management

- Four concurrent operators using Java consoles

  Up to four operators may have concurrent access to the 3745 or 3746 via Java consoles. The first one is provided with a full access privilege. The other three may have either a full access privilege or a view-only access privilege. With this multiple operator access, a help desk can rapidly respond to end-user requests.

- Customizable user login for Java console access over switched network

  This allows users to choose a single or existing login to access all the 3745s and 3746s in the network, instead of having to use a different predefined login for each machine being called.

- Flexible password definition for Telnet access and CCM

  The Telnet access and CCM password is no longer restricted to a fixed length of 8 characters. This allows 3746 users to extend the existing Telnet password to 3746 CCM/Telnet and have a single password for all routers in the network.

## Prerequisites

- 3746 and MAE Extended Functions 4 (FC 5810, FC 5811)
- Service Processor Type 3, Service Processor Type 4, Upgrade to Service Processor Type 3, or Upgrade to Service Processor Type 4
- Network Node Processor Type 3, Network Node Processor Type 4, Upgrade to Network Node Processor Type 3, or Upgrade to Network Node Processor Type 4
- Processor Type 3 (CBSP3, ESCP3, TRP3, CLP3) depending on functions to be operated (see description)

## 3746 and MAE Extended Functions 4

The 3746 and MAE Extended Functions 4 consolidates functions that were previously available under five separate Extended Functions features, plus new 3746 and MAE (FC 3001) functions. The aim is to reduce complexity, simplify ordering, and improve the useability of the 3746. Extended Functions 4 combines the functions previously available in the following features:

- 3746 Extended Functions 1 (FC 5800)
- 3746 Extended Functions 3 (FC 5801)
- MAE Extended Functions 1 (FC 5804)
- MAE Extended Functions 2 (FC 5805)
- MAE Extended Functions 3 (FC 5807)

Extended Functions 4 (FC 5810) is for 3746 users who have not acquired either FC 5800 or FC 5804 from IBM. Extended Functions 4 (FC 5811) offers the same support but is available as an upgrade option for 3746 users who have already acquired at least the 3746 Extended Functions 1 (FC 5800) or the MAE Extended Functions 1 (FC 5804).

The Extended Functions 4 includes:

## Increased Connectivity

The Extended Functions 4 enables more connectivity and throughput for token-ring and ESCON Type 3 processors. Existing Type 1 or 2 processors can be upgraded to Type 3 processors, or additional Type 3 processors installed. These enhancements apply to NCP and Network Node Processor environments (APPN/HPR and IP) of the 3746. Specific enhancements include the following:

### ESCON Processors in the 3746

For the ESCON Processor Type 3 (FC 5523), connectivity is increased from 16 to 32 logical connections ('subchannels'), effectively a 100% increase in connections to the S/390. The increased number of connections reflects the maximum number of logical paths to different instances of VTAM and TCP/IP running in S/390 logical partitions (LPARs). This increased number of channel connections enables access to more partitions of S/390 servers, particularly important in the S/390 Parallel Sysplex environment.

### Token-Ring Processors in the 3746

For the Token-Ring Processor Type 3 (FC 5623), connectivity is increased up to 3000 physical units (PUs), effectively a 50% increase. Increased connectivity enables an expansion in the number of end users supported on existing token-ring processors.

## Improved Performance through Connection Balancing

As many users are exploiting the connection balancing facilities on token-ring or frame-relay ports of the 3745, this facility is now extended to the adapters of the 3746. This facility provides connection balancing across adapters and 3745/3746 controllers, and applies to connections controlled by NCP or the Network Node Processor (APPN/HPR). These connections include the following:

### Token-Ring Processors in the 3746

Token-ring connection balancing for the 3746 Token-Ring Processor Type 3 (FC 5623), enabling the user to increase throughput by balancing the physical unit (PU) connections and workload among multiple token-ring processors.

### Communication Line Processors in the 3746

Frame-relay Boundary Access Node (BAN) connection balancing for the 3746 Communication Line Processor Type 3 (FC 5203). This enables users of frame-relay (BAN) traffic to increase throughput by balancing the physical unit (PU) connections and workload among multiple communication line adapters.

## Extended SNA and IP Protocols Support

Many users need to transport SNA traffic over an IP backbone, and use TN3270E for this purpose. Extended Functions 4 provides a significant increase in the number of sessions supported by the 3746 TN3270E server. Enhanced TN3720E functions and new IP capabilities for the 3746 include the following:

### TN3270E Server

- An increase of TN3270E sessions in the 3746 from 4000 to 15 000, effectively an almost 300% improvement. This increased number of TN3270E sessions is supported through the hardware integration feature[2] of the MAE, FC 3001. To enable increased session support for TN3270E, additional memory on the MAE is required (up to 512 MB). For more information, see “MAE Memory Expansion” on page 3-2.
- New TN3270E functions include multiple LU pools, IP address to LU name mapping, and dynamic definition of dependent LUs.

**Note:** These require the MAE 3001.

### ESCON and Parallel Channel Adapters

- Support for OSPF Version 2 over the ESCON interface of the ESCON Processor Type 3 (FC 5523) on the base 3746, and the ESCON and parallel channel adapters of the MAE 3001. (For more information, see “MAE Channel Adapters” on page D-4.) OSPF V2 is already supported over LAN and WAN adapters.
- A new TCP/IP Passthrough capability over ESCON and parallel channel adapters of the MAE 3001. This function enables IBM 3172 controllers to be easily replaced in the data center.

In addition to the TN3270E sessions supported by the TN3270E server of the 3746, additional session support can be obtained by externally attaching the 3746 controller to an IBM Network Utility through a LAN.

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[2] For more information on the hardware connection between the MAE 3001 and the 3746, see “MAE with Direct Attachment to the 3746” on page 3-5.

### Routing Tables

The number of IP routes supported by the 3746 is extended from 5000 to 7500. In OSPF environments, the number of autonomous system external routes supported by the 3746 is extended from 5000 to 7500.

## Enhanced APPN/DLUR Support

Enhanced APPN/DLUR support applies to the following in the 3746 and the MAE:

### APPN in the 3746 and the MAE

- Support for 15 000 APPN/DLUR sessions in the MAE 3001, an increase of over 10 000 sessions[3] .

  **Note:** To enable increased session support for APPN/DLUR, additional memory in the MAE is required (up to 512 MB). For more information, see “MAE Memory Expansion” on page 3-2.

- APPN standard option set 1116 is now fully implemented, allowing the 3746 to automatically register the dependent LUs of DLUR end nodes. Prior to this, the user had to pre-define the LUs in the 3746.

## Enhanced Network Management for APPN/HPR Environments

Many S/390 users are implementing the S/390 Parallel Sysplex system, which uses APPN/HPR to achieve 100% availability and workload balancing among S/390 servers. A solution for achieving 100% availability outside the S/390 data center is to move APPN/HPR out into the network. Extended Functions 4 facilitates the implementation of APPN/HPR, and provides many network management facilities, similar to functions available in an NCP subarea environment. Additional management facilities allow measurement of the 3746 system resources (NNP utilization, for example) and enhance remote configuration support. These network management facilities include the following:

**CCM Remote Configuration ("CCM Batch")**

This new configuration facility, also referenced as "CCM batch", allows an AIX workstation user to remotely access any 3746 in the network, download CCM files (3746 configurations), update the corresponding ASCII files with a text editor, and after an automatic syntax validity checking, upload the resulting configuration files and activate them. TCP/IP communication is used for downloading or uploading CCM files between the AIX workstation and the Service Processor of the 3746.

The above actions can be automated. Commands can be placed in a file and executed by CCM batch running in the AIX workstation. AIX support allows users to schedule this execution at a specific time and date.

Any 3746 can be managed via this remote configuration facility. For 3746s equipped with the MAE (FC 3001), network administrators can use their AIX workstation and text editor to configure their 3746 with all its base adapters, upload the CCM file to the 3746, and then complete the configuration with the MAE definitions. This last step can be performed remotely, for example by using Java Console or DCAF support to access CCM in the 3746.

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[3] The TN3270E and MAE APPN/DLUR maxima are an aggregate number, providing a maximum of 15 000 sessions.

**NetView (RUNCMD)**

Management requests for the 3746 Network Node and 3746 APPN/HPR resources controlled by the NNP may be issued from NetView by using RUNCMD commands (for example, to perform status display, activation, deactivation).

**NetView Performance Monitor (NPM)**

For the token-ring interface, the number of active stations (PUs) per TIC3 is reported to NPM. The counter includes the PUs activated by NCP and the PUs activated by the NNP of the 3746.

**APPN Topology Safestore**

Topology Safestore (APPN standard option set 1202) periodically saves the APPN topology on disk, to enable faster restart of 3746 and APPN networks.

**Network Node Processor**

- Information on NNP utilization (up to 5 days of CPU load and memory occupancy) can be graphically displayed at the service processor.
- Counters of PUs and sessions controlled by the NNP (active PUs, active SSCP-PU sessions, active SSCP-LU sessions, and active LU-LU sessions) can be displayed at the service processor (CCM monitoring function).

# 3746 Extended Functions 3

The functions provided by the Extended Functions 3, FC 5801, are now included in Extended Functions 4, FC 5810 and 5811. These functions are the following:

## WAN Support (240 Lines)

The network node processor (NNP) can control more than 120 and up to 240 lines for IP or APPN/HPR traffic.

## APPN/DLUR Support (30 000 LU-LU Sessions)

The Network Node Processor Type 2 (NNP2) (FC 5122), equipped with a 64 Mbytes Memory Expansion (FC 5037) and the NNP Type 3 (FC 5423) support up to 30 000 LU-LU (data) sessions. Out of these 30 000 sessions, 15 000 sessions can be established by the NNP2 or NNP3 acting as the Network Node (NN) server of the attached PUs (PU2s, APPN End Nodes, LENs). The remaining sessions are established by other Network Node Servers (2210, 2212, 2216, CS/2, Network Utility) for their LUs and downstream PUs. This support requires the CBSP Type 3.

In addition, the number of HPR/Automatic Network Routing (ANR) sessions is unlimited.

**Prerequisites:** The CBSP Type 3 Upgrade, FC 5123, or the CBSP Type 3, FC 9023.

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[4] The NNP 3, with an additional memory module (FC 5047), can support up to 40 000 SSCP-LU control sessions. For more information on session support in the NNP3 as compared to the NNP 2, see Table E-5 on page E-6.

## RIP Version 2 Support on 3746 Base and MAE Adapters

RIP V2 provides enhancements to the RIP protocol, to support autonomous systems, IGP/EGP interactions, subnetting, and authentication. RIP V2 allows full interoperability with other routing protocols, such as OSPF, with no constraints on network design. RIP V2 adds the following features:

- Route tags to propagate EGP information
- Subnet masks to support variable subnet masks
- Next hop addresses to support optimization of routes
- Authentication for a password passing
- Multicasting, so that multicast can be used instead of broadcast

RIP V2 is now available on the 3746 base adapters (CLP, CLP3, TRP2, TRP3, ESCP2, ESCP3) and also on the Multiaccess Enclosure (MAE FC 3001) ports.

**Prerequisites:** 3746 Extended Functions 1, FC 5800, or MAE Extended Functions 1, FC 5804.

## Interactive Network Dispatcher Enhancement for Server Support

The Interactive Network Dispatcher function is enhanced to add support for servers connected to any adapter of the 3746 base (CLP, CLP3, TRP2, TRP3, ESCP2, ESCP3). Interactive Network Dispatcher balances Web access and TCP/IP connections across multiple servers. Prior to this enhancement, Interactive Network Dispatcher supported servers connected only to MAE ports.

**Prerequisites:** MAE with Direct Attachment, FC 3001.

## IP Routing Enhancements

- Route Filtering can be enabled to define which routes are used for packets forwarding and which routes are excluded from the route table.
- RIP metrics make it possible to define a different metric for inbound and outbound traffic, so that traffic can take different paths, for example, in and out of a server. This will enable high throughput traffic to use multiple paths. Applications such as FTP on the S/390, which have high throughput requirements, can benefit from the performance enhancements that this function will bring.

## 3746 Model 900 Enhancements for NCP Traffic

The following enhancements are supported in conjunction with NCP Version 7 Release 7.

**Frame-relay CIR Support**

The Committed Information Rate (CIR) is the subscriber data throughput that the networks commit to supporting under normal network conditions. The CIR procedures provide bandwidth management on frame-relay links such that the data are transmitted to the destination at the committed information rate.

Prior to this enhancement, a Communication Rate (COMRATE) bandwidth management algorithm was provided for frame-relay lines controlled by NCP. CIR was supported only for the 3746 frame-relay lines controlled by the NNP. Now, both CIR and COMRATE bandwidth management algorithms are provided for a 3746 frame-relay line controlled by NCP. This allows you to choose the optimum bandwidth management algorithm for your environment.

**Frame-Relay Protocol over Switched Lines**

Support for switched frame relay on the NCP controlled 3746 Model 900 physical interfaces is now available. The support on 3745 physical interfaces was already available with NCP V7R6 for SNA traffic (peripheral and subarea) including remote load for subarea connections.

This function allows devices, such as IBM 2210 and 2216 routers, to backup frame-relay peripheral and subarea connections to an NCP when the primary connection is unavailable or failing.

**Routing Information Field (RIF) Change Notification**

NTuneMON provides information about bridges and LAN segments that a token-ring connection uses. For 3746-900 token-ring connections, this routing information is provided by the token-ring processor (TRP) at connection establishment. This new function allows the 3746 to notify NTuneMON (via NCP) of a token-ring station routing change in case of re-routing due to a failure of the initial route.

## Java Console Support

Java Console is platform-independent and can be run on IBM OS/2®, Windows® 95, Windows 98, Windows NT®, AIX®, UNIX®, or Macintosh. The only requirement is a Web browser with Java 1.1 or later enabled. Java Console provides the same facilities as the current DCAF remote console support for 3745 Models A and 3746 Models 900 and 950.

**Note:** Java Console provides remote access via TCP/IP connection.

There are three options for accessing a 3745/3746 service processor from a Java Console workstation:

**Remote access via the user network**

The network must provide IP access to the service processor, via a router or a bridge connected to the service ring of the 3745/3746. If the 3746 is the router providing this connection (via TIC3 port), it must run IP Routing (FC 5033).

**Remote access via switched network**

The operator can connect the Java Console workstation by dialing the telephone number of the service processor port equipped with the Remote Support Facility (RSF) modem. PPP is used for the TCP/IP communication with the service processor.

**Local access via the service ring**

The Java Console workstation is directly connected to the service ring for TCP/IP communication with the service processor.

The operator can establish a connection to one 3745/3746 service processor and then use this connection to access other service processors. These service processors can be accessed via the service ring and IP network, provided there is IP connectivity, bridged or routed, between the first service processor and the other service processors.

***Customers with SNA-only Networks:*** Java Console support works in an IP environment. If the network is SNA based, and there is no IP connectivity to the service ring, DCAF should be retained. Another option is to use Java Console to directly access the service processor via a switched PPP connection.

***Customers using DCAF:*** The Licensed Internal Code which provides support for the new Java Console, continues to provide the current DCAF support. The choice of console type, Java or DCAF, is made at installation time.

**Note:** Customers selecting DCAF console support can connect to the service processor using their already available DCAF console.

***Migration from DCAF to Java Console:*** The migration from DCAF to Java Console is performed by installing the new Licensed Internal Code and by selecting the Java Console support during the code installation.

***Security Over Switched Line:*** The PPP connection between the workstation and the service processor is secured through the Cryptographic Handshake Authentication Protocol (CHAP). The user defines two sets of passwords in the service processor, one for the operator connections and another one for the remote maintenance connections (RSF).

### Java Console File Transfer

Downloading the Java Console support code from the 3746 service processor on to a remote workstation enables a file transfer function. This function can be used for uploading files (for example, CCM configuration files) from the remote workstation to the service processor.

### CCM Enhancements

**3746 Dynamic Change Update enhancement**

Resources that are added or modified on 3746 base adapters can be automatically activated by the user selecting **Automatic activation** in CCM. Prior to this enhancement, manual activation was required after the resource modification. This enhancement does not apply to the MAE resources.

**Improved Search Command**

A search can be performed on all columns of the **Port Management**, **Station Management**, or **Session Management** panel. This allows a global search in all columns of a management panel, for example, a search with the string "active" will provide, as a result, a display of all active resources.

## 3746 Extended Functions 2

The 3746 Extended Functions 2 feature provides Session Services Extensions (SSE) support for the base adapters of the 3746. It also includes the APPN option set 087 (Enhanced Topology Garbage Collection). This implementation of SSE and Topology Garbage Collection does not require the MAE.

These functions (SSE, Topology Garbage Collection) have been available for the adapters of the Multiaccess Enclosure (FC 3001), as part of the MAE Extended Functions 3 (FC 5807).

**Session Services Extensions**

Session Services Extensions (APPN Option sets 1061, 1063, and 1118) allows the 3746 Models 900 and 950 to connect to a VTAM Border Node in another APPN network. This means that users who are migrating SNA networks to APPN are now able to fully migrate their SNI links. This function is especially important for Service Providers who offer VTAM APPN Border Node connectivity because it means that their

customers do not have to implement a Border Node themselves. The user will connect to the Service Provider using a 3746 Model 900 or 950 with the SSE functions, and get the equivalent function to SNI links today.

SSE also allows the 3746 Models 900 and 950 to fully act as APPN Network Node Server for VTAM End Nodes.

**Enhanced Topology Garbage Collection**

Enhanced Topology Garbage Collection (APPN option set 087) allows APPN resources removed from the network (network nodes, transmission groups between network nodes) to be deleted from the network topology data base in a coordinated manner between the 3746 and the other APPN Network Nodes implementing the same option. This automatic deletion of removed/unusable resources from the network topology data base simplifies the displayed network topology and makes it easier to exploit, while saving operator-driven topology maintenances.

Prior to this implementation, the 3746 relied only on basic APPN mechanisms (timers), internal to the 3746, to decide that a resource had been removed from the network, and to delete it from its network topology database. With the new support, the 3746 is also able to notify other APPN network nodes about a resource deletion, and to update its topology database when it receives notification from another network node. In addition, this synchronization allows operator-initiated deletions to be immediately reflected in the topology data base of the 3746 and other network nodes, like VTAM and the IBM 2210, 2212 and 2216, which implement the enhanced topology garbage collection.

## 3746 Extended Functions 1

The functions provided by 3746 Extended Functions 1, FC 5800[5], are now included in Extended Functions 4, FC 5810 or 5811. These include the following:

- Internal IP routing between the 3746 IP router and the 3745 (NCP V7R6 or above is required).
- Dynamic windowing enhancement for frame relay and LIC16[6] ISDN (NCP V7R6 or above is required).
- X.25 traffic controlled by the NNP (independent of NCP).
- MLTG support for HPR traffic over token-ring, Ethernet, SDLC, frame relay, and X.25.
- Bandwidth Reservation System (BRS) for IP traffic over 3746 PPP lines
- Frame-relay switching (FRFH) for 3746 lines controlled by the NNP.
- Frame-relay CIR (and BRS at DLCI level) for lines controlled by the NNP.
- Euro-ISDN PRI enhancements (LIC16[6]):
  - Automatic backup of frame-relay links over ISDN (non-disruptive for NCP operations).

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5 No longer available.

6 No longer manufactured. ISDN adapters are available with the MAE. For more information, see Appendix D, “Configuration Options for the 3746 (MAE)” on page D-1.

– Support of LIC16 for NPM (NPM V2R3 and PTFs).

## MAE Extended Functions 1, 2, and 3

The functions provided by the MAE Extended Functions 1 (FC 5804), 2 (FC 5805), and 3 (FC 5807), are now included in the Extended Functions 4, FCs 5810 and 5811. For more information on these MAE Extended Functions, see “MAE Extended Functions 1” on page 3-13, “MAE Extended Functions 2” on page 3-11, and “MAE Extended Functions 3” on page 3-9.

## 3746 Processors

The 3746-900 and the 3746-950 include the following processors:

- Service processor
- Network node processor
- Adapter processors
- MAE, functioning as a multi-adapter processor, independent of NCP control

## Service Processor

The service processor runs the MOSS-E program of the 3745 and 3746 and the CCM program of the 3746 Network Node and IP router.

### Service Processors Type 2 and Type 3

The Service Processors Type 2[7] and Type 3[7] are equipped with a CD-ROM drive, and support recent enhancements of the 3746, including the Multiaccess Enclosure (MAE) (see Chapter 3, “Functional Overview of the Multiaccess Enclosure” on page 3-1). For more technical specifications, see “Service Processor Type 2 - FC 5052” on page C-12, and “Service Processor Type 3 - FC 5053” on page C-12.

### Service Processor Type 4

The Service Processor Type 4 (SP4) with its 533 MHz processor, 128 MB memory, and 133 MHz bus enables much faster operator interventions with a response time reduced by an estimated factor[8] of up to five, compared to older versions of the service processor.

### Service Processor Upgrade to Type 4

Upgrades a service processor 5020[7] or 5021[7] to a Service Processor Type 4.

For more technical information, see “Service Processor Upgrade to Type 3 - FC 5050” on page C-12.

7 No longer manufactured.

8 Actual performance depends on multiple environment factors, which may include products present in the network, user parameter settings, and user traffic characteristics.

## Network Node Processor

The Network Node Processor (NNP) runs the APPN/HPR control point and IP management (SNMP agent) of the 3746. As an HPR intermediate routing node, the 3746 supports any number of sessions.

### NNP Type 1 (NNP1)

The NNP Type 1[7], with memory expansion, supports up to 5000 physical units (PUs), 30 000 SSCP-LU sessions and 15 000 APPN/Dependent LU-LU sessions.[9]

### NNP Type 2 (NNP2)

The NNP Type 2[7], with memory expansion, supports up to 5000 PUs, 30 000 SSCP-LU sessions and 30 000 APPN/Dependent LU-LU sessions.[9] Out of these 30 000 sessions, up to 15 000 can be established by the NNP2, the remaining sessions being established by other APPN Network Nodes and routed through the 3746 Network Node.

### NNP Type 3 (NNP3)

The Network Node Processor Type 3[7], with its 128 MB base memory, supports up to 5000 PUs, 30 000 SSCP-LU sessions (3746 DLUR) and 30 000 APPN/Dependent LU-LU sessions[9]. An additional memory module allows the NNP3 to support up to 35 000 LU-LU sessions (up to 20 000 sessions established by the NNP3) and 60 000 SSCP-LU control sessions for DLUR in the 3746. For more information, see “NNP Type 3 and NNP Type 4 Memory Expansion.”

### NNP Type 4 (NNP4)

The NNP4 provides a faster network restart with its 533 MHz processor, 256 MB memory, and 133 MHz bus, compared with the 90 MHz processor for NNP Type 1 (128 MB), 200 MHz for NNP Type 2 (128 MB), and 350/450 MHz for NNP Type 3 (160 MB). An additional memory module allows the NNP4 to support up to 35 000 LU-LU sessions (up to 20 000 sessions established by the NNP4) and 60 000 SSCP-LU control sessions for DLUR in the 3746. As an example, a configuration of 750 PUs, 30 000 SSCP-LU control sessions and 10 000 LU-LU data sessions could be activated in 19 minutes by a 3746 using an NNP Type 1 (128 MB) versus 11 minutes for a 3746 using an NNP Type 4 (128 MB), a reduction factor[10] of 1.75. Upgrading an NNP Type 2 (128 MB) to an NNP Type 4 (128 MB) could result in a reduction factor[10] of 1.5 for the same configuration (NNP Type 2 restart time=16.5 minutes).

**Prerequisites:** The NNP4 requires a Service Processor Type 4, Type 3 or Type 2.

### NNP Type 3 and NNP Type 4 Memory Expansion

32-MB memory expansion (NNP Type 3) or 128-MB memory expansion (NNP Type 4) can be added to the 128-MB base memory. This memory expansion is designed for DLUR in the NNP to support up to 60 000 SSCP-LU sessions, versus 30 000 for the NNP1, NNP2, base NNP3 or base NNP4. The additional memory also supports 35 000 LU-LU sessions versus 30 000 for the NNP1, NNP2, base NNP3 or base NNP4. Through this increase in control sessions, the user can define many more

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9 For more information on PU and session support, depending on NNP type, see Table E-5 on page E-6.

10 Actual performance depends on multiple environment factors, which may include: products present on the network, user parameter settings, and user traffic characteristics.

LUs (each one requiring an SSCP-LU session), although only a subset of these LUs actually require a LU-LU (data) session.

For more information on the maximum number of PUs, LUs, and sessions supported by the different NNP types, see Table E-5 on page E-6.

### Network Node Processor Upgrade to Type 4

Designed to upgrade an installed NNP Type 1 (FC 5022), or NNP Type 2 (FC 5122) or NNP Type 3 (FC 5423) to an NNP Type 4 with equivalent performance and connectivity.

## 3746 Adapter Processors

Each adapter[11] of the 3746 consists of a processor and one or several couplers. The processor performs the data link control and APPN, HPR, and IP routing. The couplers connect the communication media (WAN link, token-ring LAN, or ESCON channel fibers).

Significant improvements have been made to the processors of the 3746 to increase throughput, connectivity, and functionality. The processors Type 3 include the Communication Line Processor (CLP3), token-ring processor (TRP3), ESCON Processor (ESCP3), and Controller Bus and Service Processor (CBSP3).

Compared to a processor Type 2, a processor Type 3 can improve the adapter throughput by up to one hundred percent, and adapter connectivity (number of physical units, user sessions, etc.) by a factor of up to three.

### CLP Type 3

CLP Type 3[12] supports up to:

- 3000[13] PUs (1000 PUs over SDLC, and 2000[13] PUs over frame relay, X.25, and ISDN) or about 12 000 APPN/Dependent LU sessions controlled by the 3746 NN.
- 2000[13] frame-relay virtual circuits (DLCIs).

### TRP Type 3

TRP Type 3[12] supports up to 4000 PUs or approximately 14 000 APPN/Dependent LU sessions controlled by the 3746 NN.

### ESCP Type 3

ESCP Type 3[12] supports up to 32 logical connections with S/390 server partitions running VTAM or TCP/IP, or approximately 14 000 APPN/Dependent LU sessions controlled by the 3746 NN.

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11 This does not apply to the adapters of the MAE.

12 For more information on PU and session support, see Table E-1 on page E-2.

13 For the 3746-900s running only NCP traffic over the CLP/CLP3s, the maximum is 4000 PUs (1000 PUs over SDLC lines, and 3000 PUs over frame-relay, X.25 and ISDN lines) and 3000 DLCIs.

### CBSP Type 2 or Type 3

CBSP Type 2 or Type 3[12] runs the IP router protocols (RIP V1 and V2, OSPF V2, BGP V4). The CBSP Type 2[7] supports a total of up to 5000 IP routes and, in OSPF environments, 5000 autonomous system external routes. The CBSP Type 3 supports a total of up to 10 000 IP routes and, in OSPF environments, 10 000 autonomous system external routes. The CBSP3, the most powerful version of the CBSP, is required for the 3746 NNs supporting more than 15 000 APPN/Dependent LU sessions.

### Processor Upgrades

Type 1 and Type 2 processors can be upgraded to Type 3 processors. The CLP, TRP2, ESCP2, and CBSP2 processors[7] support NCP, APPN/HPR, and IP traffic, but with lower connectivity and throughput. The TRP, ESCP, and CBSP (processors Type 1[7]) support NCP traffic only.

## Multiaccess Enclosure (MAE)

Functioning as a multi-adapter processor, independent of NCP control, the MAE provides multiple types of network interfaces. The MAE houses eight adapter slots with up to eight ports per adapter. Routing and support functions in the MAE include the following:

- Support for SDLC, PPP, frame-relay, X.25 WAN, and OSPF protocols
- Routing for TCP/IP, SNA/DLUR, APPN, and HPR traffic
- Bridging for SNA (NCP) traffic
- Connectivity to ESCON and parallel channels

For more information on the MAE, see Chapter 3, “Functional Overview of the Multiaccess Enclosure” on page 3-1.

# Chapter 3. Functional Overview of the Multiaccess Enclosure

Licensed Internal Code for the 3746, including Multiaccess Enclosure (MAE) functions, is delivered on CD-ROM only. This applies to new machines and functional upgrades for installed machines.

## Overview of the Multiaccess Enclosure

The PowerPC based MAE enclosure provides adapters for high-speed WAN/LAN connectivity, fast S/390 server access, and remote site concentration. Licensed Internal Code residing in the MAE includes TN3270E Server, Interactive Network Dispatcher, Enterprise Extender, and DLSw. With comprehensive support for IP, SNA, and APPN/HPR routing protocols, and a wide selection of network adapters, the MAE provides a powerful and flexible solution for increasing network throughput, response time, and operations efficiency.

The MAE adds ATM, ISDN PRI, HSSI (T3/E3 speeds), FDDI, 10/100-Mbps Ethernet, parallel channel, and high-throughput ESCON channel connectivity to the 3746.

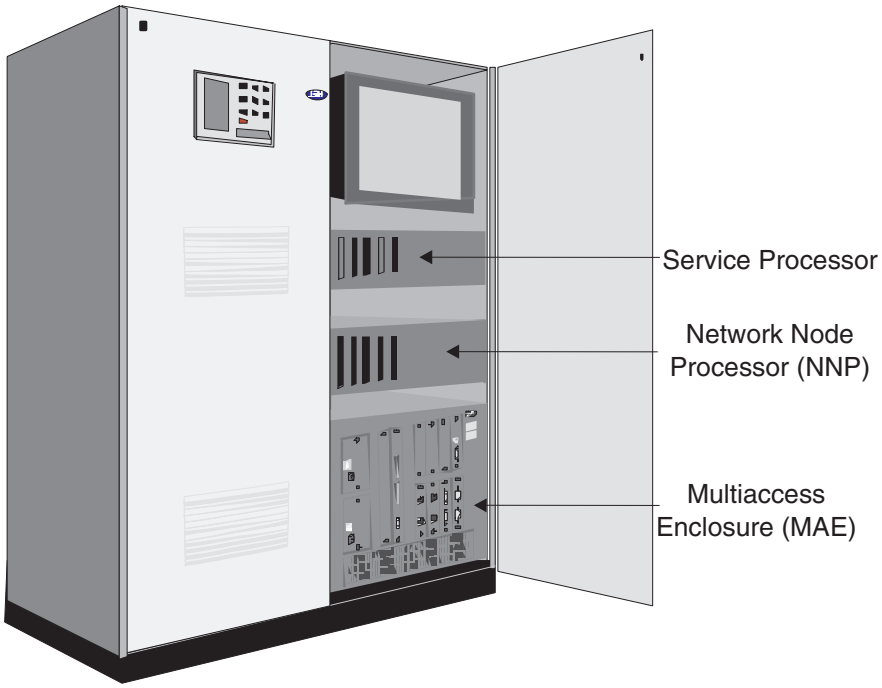


*Figure 3-1. IBM 3746 Controller with a Multiaccess Enclosure (MAE)*

The MAE supports the following network design options:

- SNA and IP transport over a single network infrastructure.
- Flexible TN3270E server support for IP access to SNA applications.
- Interactive Network Dispatcher for scalable implementation of Internet and Intranet web server sites, with load distribution between IBM S/390 servers and other servers, allowing non-disruptive addition or interruption of servers.

- ESCON High Performance Data Transfer (HPDT) Multi-Path Channel+ (MPC+) support for HPR, TCP/IP and UDP applications.
- Enterprise Extender support for transporting SNA applications over IP backbone networks.
- Data Link Switching (DLSw).

# MAE Components

## Basic Functions in the MAE

The MAE base (FC 3000[1] or FC 3001[1]) includes the following hardware:

- Power supply
- Cooling fan
- System card containing:
  - PowerPC microprocessor (200 MHz)
  - 64 MB DRAM (expandable to 512 MB)
  - PCMCIA token-ring card and cable (to connect the MAE to the 3746 service ring)
- Eight adapter slots
- One of the following connections to the 3746 controller:
  - MAE FC 3001[1]: a direct attachment to the controller switch (see "MAE with Direct Attachment to the 3746" on page 3-5), and optional internal token-ring attachments.
  - MAE FC 3000[1]: with one or two token-ring internal attachments.

Licensed Internal Code (LIC) for operating the MAE is pre-loaded before shipping.

**Prerequisites (MAE FC 3001):**

- NNP Type 2, NNP Type 3, or NNP Type 4
- Service Processor Type 2, Service Processor Type 3, or Service Processor Type 4
- IP routing (FC 5033)
- Controller expansion[3]

Extended Functions 4

## MAE Memory Expansion

The MAE system card has two slots for DIMM memory cards. The basic MAE configuration includes a 64 MB DIMM. When two cards are configured, they must have the same memory size. If a 128 MB or 256 MB DIMM is configured, this card replaces the basic 64 MB DIMM. In the case of the MAE upgrade with DIMM card(s) that have larger memory capacity than the installed DIMM cards, the existing card(s) are replaced by the new card(s).

---

1 The MAE FC 3000 and 3001 are no longer manufactured. Any functional upgrade (hardware, LIC software) of the MAE 3000, as well as most of the other 3746 functional upgrades require the MAE 3000 to be upgraded to the MAE 3001. This MAE upgrade remains available by ordering the RPQ 7L1345.

2 No longer manufactured.

3 The cable for the MAE direct attachment is 9 m (29.5 ft); this means that the controller expansion should not be installed more than 6 m (18.7 ft) from the 3746 controller.

### MAE 64-MB Memory Expansion (FC 3520)

An optional 64-MB memory expansion[2] is available in the MAE for additional session support in APPN/DLUR, APPN/HPR, DLSw, or TN3270E environments. This provides the MAE with a total of 128 MB memory.

### MAE 128-MB Memory Card (FC 3521)

Features a 128-MB DIMM memory card in the MAE 3001, designed for additional TN3270E and APPN/DLUR session support. Two cards can be configured for a total of 256 MB memory.

### MAE 256-MB Memory Card (FC 3522)

Features a 256-MB DIMM memory card in the MAE 3001, designed for additional TN3270E and APPN/DLUR session support. The MAE equipped with two 256-MB cards can support up to 15 000 TN3270E and APPN/DLUR LU-LU sessions (on aggregate).

## MAE Adapters

The MAE provides support for the following adapters[4]:

### ESCON

Supporting the following channel protocols:

- Multi-Path Channel+ (MPC+)
- LAN Channel Station (LCS)
- Link Services Architecture (LSA)

### Parallel Channel

Supporting parallel channel connections[2] to S/390 and S/370™ servers, using the following channel protocols:

- Multi-Path Channel+ (MPC+)
- LAN Channel Station (LCS)
- Link Services Architecture (LSA)

### Multiport ISDN Primary Rate Interface

Multiport ISDN Primary Rate Interface[2] supports T1/J1 (non-European lines) connections with speeds of 1.544 Mbps, or E1 (European lines) with speeds of 2.048 Mbps. An optional daughter card increases the number of adapter ports from 4 to 8. Supported link protocols include frame relay and PPP.

### ISDN Primary Rate Interface (One Port)

The ISDN Primary Rate Interface (One Port) adapter[2] supports frame relay and PPP.

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[4] For more information on MAE adapters, see Appendix D, “Configuration Options for the 3746 (MAE)” on page D-1.

### Fast Ethernet
Supporting one interface per adapter with speeds of either 10 or 100 Mbps.

### HSSI
Supporting one HSSI interface per adapter with speeds up to 52 Mbps.

### FDDI
Supporting one FDDI[2] interface per adapter, operating either as a Dual Attach Station (DAS) or Single Attach Station (SAS), using multi-mode fiber (MMF).

### 155-Mbps Asynchronous Transfer Mode (ATM)
ATM forum-compliant, supporting LAN Emulation client, Classical IP routing, and native HPR with the following fiber optic options:

- MMF fiber optic cable with an ATM support chip for segmentation and reassembly (SAR), and SONET OC-3c framing
- Single-mode fiber (SMF)[2], fiber optic cable with an ATM support chip for SAR, and SONET OC-3c framing

MAE Extended Functions 3 (FC 5807) and 3746 and MAE Extended Functions 4 (FC 5810 and FC 5811) include support for ATM adapters as point-to-point token-ring connections, with line speeds of 155 Mbps. For more information on FasTR[5], see "MAE Extended Functions 3" on page 3-9.

### Ethernet
The Ethernet adapter[2] supports Ethernet 2.0, IEEE 802.3, and ISO 8802.3 (10 Mbps).

### Token-Ring
Supporting IEEE 802.5 and ISO 88025.5.

### V.35 and V.36
The V.35/V.36 adapter supports line speeds for a modem attachment and line speeds for direct attachment. (V.35 direct-attachment cables and V.36 cables are no longer available from IBM.)

### X.21
Supporting line speeds for a modem attachment and line speeds for a direct attachment. (Direct attachment cables are no longer available from IBM.)

### V.24/EIA 232
Supporting line speeds for a modem attachment and line speeds for a direct attachment. (Direct attachment cables are no longer available from IBM.)

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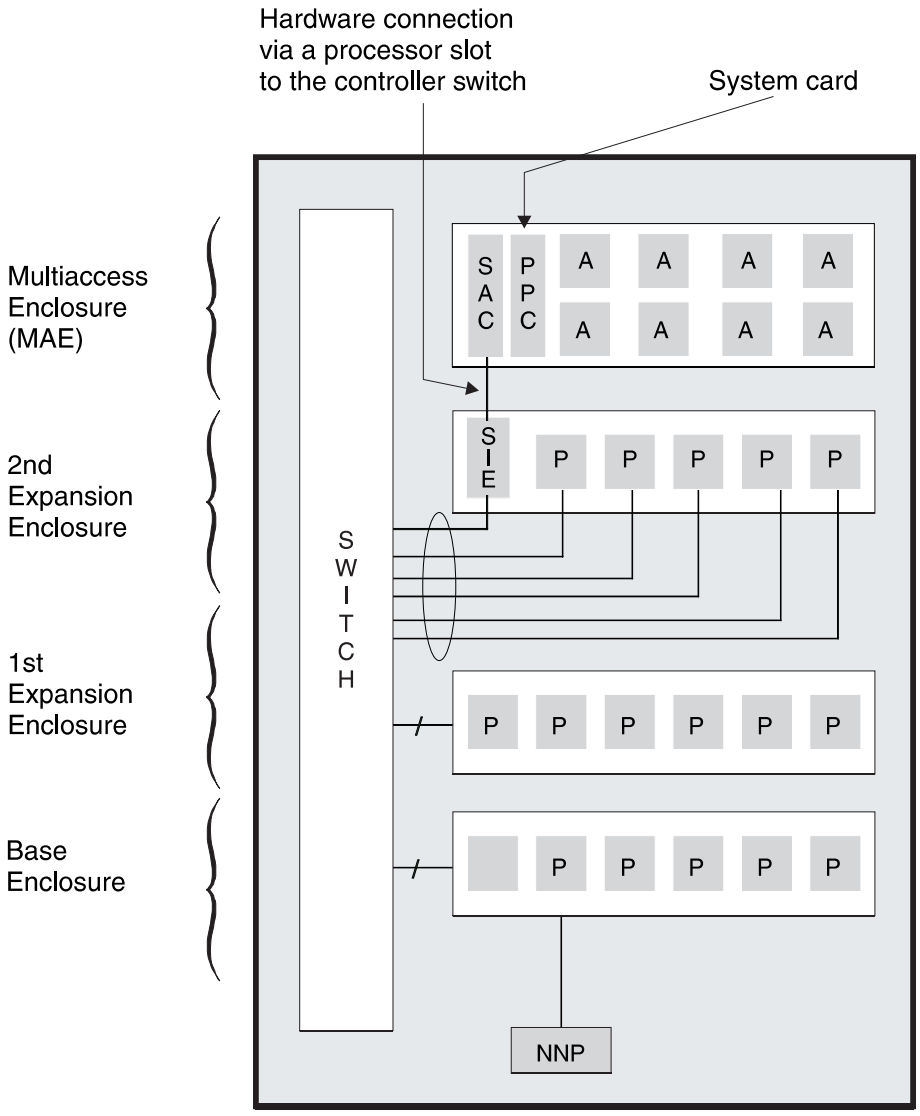
5 Configuration support for Fast Token-Ring (FasTR) over ATM adapters is included in MAE Extended Functions 3, FC 5807, and Extended Functions 4 FC 5810 or 5811.

## MAE with Direct Attachment to the 3746

The MAE with direct attachment to the 3746 controller switch, FC 3001[2], includes a switch adapter card installed into the MAE and a switch interface extension installed into a 3746 processor slot (see Figure 3-2).

The CBSP Type 2 or Type 3, where the service processor routing tables reside, functions as the single IP control point for all the 3746 processors, including the MAE. This single IP control point allows you to configure both the base adapters and the MAE adapters, through the CCM program.




**Legend**:

| | |
|---|---|
| A | Adapter |
| NNP | Network Node Processor |
| P | Processor |
| PPC | PowerPC |
| SAC | Switch Access Card |

*Figure 3-2. MAE Hardware Connection to the 3746 Connectivity Switch for IP Traffic*

Compared to the MAE FC 3000, the MAE FC 3001 provides multiple additional capabilities which mainly address IP network environments:

## Greater Functionality

**Extended Functions 4, FC 5810 or 5811, provides the following:**

- OSPF V2 over ESCON and parallel channel adapters.
- TCP/IP Passthrough for ESCON and parallel channel adapters of the MAE, enabling 3172 controllers to be replaced as IP server gateways.
- TN3270E enhancements, including increased session support (up to 15 000).
- Up to 15 000 APPN/DLUR LU-LU sessions through the MAE.
- Additional 256 and 512 MB memory modules for increased session support (maximum 15 000).
- Compatibility with the other 3746 functions provided by the Extended Functions 4 (for a detailed description, see “3746 and MAE Extended Functions 4” on page 2-8).

**MAE Extended Functions 3**[6]

- Secure Virtual Private Network (VPN) connections with the following:
  - Layer 2 Tunneling Protocol (L2TP)
  - IP Security (IPSec)
  - AAA security.
- Virtual Router Redundancy Protocol and Network Address Translation (NAT/NAPT).
- TN3270E server support for subarea SNA connections to the SNA host.
- APPN/HPR Extended Border Node (EBN) and Session Services Extensions (SSE).
- Fast Token-Ring (FasTR) over ATM adapters.
- Parallel channel adapter support.
- ISDN primary rate adapters (4-ports adapter and 4-ports daughter card) support.
- MAE processor utilization reporting.

For a detailed description of these functions, see “MAE Extended Functions 3” on page 3-9.

**3746 Extended Functions 3**[6]

The MAE 3001 is compatible with the MAE and 3746 functions provided by the 3746 Extended Functions 3, FC 5801[6]:

- RIP Version 2
- Interactive Network Dispatcher enhancements
- IP route filtering
- IP route metrics (RIP)
- Frame-relay enhancements for NCP traffic
- Java Console support
- CCM enhancements

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6 This feature and the related functions are now integrated in the Extended Functions 4, FC 5810 or 5811.

For a detailed description, see “3746 Extended Functions 3” on page 2-11.

### Higher Performance

A high-speed full-duplex (2 x 50 Mbps) attachment to the switch of the 3746 enables IP routing between the MAE adapters and the base adapters of the 3746. With the MAE FC 3000 all the IP, APPN/DLUR/HPR and subarea SNA (NCP) traffic is routed through two token-ring connections (2 x 16 Mbps). With the MAE 3001, the IP throughput between the MAE and the base adapters is multiplied by a factor of up to three, while the bandwidth of the token-ring connections is freed for APPN/DLUR/HPR and/or SNA (NCP) traffic.

The IP, SNA, or APPN/HPR traffic throughput between adapters of the MAE, for example between LAN adapters and ESCON adapters, is equivalent to that of an IBM 2216 Multiaccess Connector configured with the same adapters.

In APPN/HPR environments, the MAE operates as a network node, independently from the 3746 network node. This provides alternate path capability and increased session capacity.

### Easier Management

A single IP router image facilitates configuration, management, network operations, and maintenance. This is an advance from the MAE FC 3000, where the 3746 base and the MAE operated as two IP routers.

In the APPN/HPR topology, the 3746 (with its NNP) and the MAE (with its own control point) appear as two network nodes.

**Upgrade from MAE 3000 to MAE 3001**

If you have a MAE already installed (FC 3000), an upgrade provides the high-speed direct attachment to the 3746 connectivity switch.

## TN3270E Server (MAE)

TN3270E server (FC 5806) in the MAE provides a TN3270 gateway function for downstream clients, enabling access to SNA applications on S/390 servers. Clients make a TCP connection to a server, which is then mapped to a corresponding SNA LU-LU session that the TN3270 server maintains with the S/390.

TN3270E server supports the capabilities described in RFCs 1576, 1646, and 1647.

The connection between the TN3270E server and the S/390 can be made via SNA subarea, APPN, or APPN/HPR protocols, and DLUR in the MAE. The 3746 can be local to or remote from the S/390 server, while using any of the interfaces that support APPN.

Together with Enterprise Extender[7], TN3270E servers can be distributed in the network within an IP infrastructure. This means that TN3270E servers running on

[7] Fully supported in the Extended Functions 4.

IBM 2210, IBM 2212, IBM 2216, and IBM 3746 platforms can be placed in locations that provide the best scalability and availability.

### New TN3270E Functions

New TN3270E functions include LU pools, IP address to LU mapping, and dynamic definition of dependent LUs. With additional memory modules (128 MB and 256 MB), the MAE FC 3001 can support up to 15 000 TN3270E sessions and APPN/DLUR LU-LU sessions, an increase of more than 10 000 sessions.

For more information, see “TN3270E Server” on page 2-9.

### TN3270E Server Enhancement

An enhancement to TN3270E in the MAE Extended Functions 3[6] (FC 5807), this provides support for subarea SNA connections to the SNA host. For more information, see "TN3270E Server Enhancements" on page 3-10.

## 3746 MAE Extended Functions 4

The Extended Functions 4 consolidates the functions that were previously available under five separate Extended Functions features, plus new 3746 and MAE functions. The aim is to reduce complexity, simplify ordering, and improve the useability of the 3746.

Extended Functions 4 combines the functions previously available in the following features:

- 3746 Extended Functions 1 (FC 5800)
- 3746 Extended Functions 3 (FC 5801)
- MAE Extended Functions 1 (FC 5804)
- MAE Extended Functions 2 (FC 5805)
- MAE Extended Functions 3 (FC 5807)

Extended Functions 4 (FC 5810) is for 3746 users who have not acquired either FC 5800 or FC 5804 from IBM. Extended Functions 4 (FC 5811) offers the same support but is available as an upgrade option for 3746 users who have already acquired at least the 3746 Extended Functions 1 (FC 5800) or the MAE Extended Functions 1 (FC 5804).

For a description of the new MAE functions, see “3746 and MAE Extended Functions 4” on page 2-8.

## Upgrade from Extended Functions to Extended Functions 4 (FC 5811)

This feature provides an upgrade from installed Extended Functions to the level of the new Extended Functions 4. This upgrade applies to the following:

- 3746 Extended Functions 1 (FC 5800), and 3 (FC 5801) (see “3746 Extended Functions 1” on page 2-15 and “3746 Extended Functions 3” on page 2-11 respectively)
- MAE Extended Functions 1 (FC 5804), 2 (FC 5805), and 3 (FC 5807)

The installed 3746 configuration must include feature 5800 or 5804 at minimum. (for the MAE FC 3001

## MAE Extended Functions 3

The MAE Extended Functions 3 (FC 5807[6]) provides a comprehensive set of multiprotocol routing protocols and transport software. Support includes:

**Parallel Channel**

Support for the parallel channel adapter (FC 3299) to include LCS (TCP/IP), LSA (APPN/HPR, SNA), and MPC+ (HPR and TCP/IP).

**ISDN Primary Rate Access**

Support for multiport ISDN Primary Rate Access adapters (FCs 3297[2] and 3298). These channelized T1/E1/J1 adapters extend ISDN PRI support to include frame relay and PPP over individual or groups of DS0s. This support, previously available for a 1-port ISDN PRI adapter (FC 3283), is now extended to 4/8 port adapters.

Single or multiple connections can be configured on the same physical attachment. Each attachment is set as a multiple of 64 kbps, up to the maximum speed of 24x64 for T1 (1.544 Mbps), or 31x64 for E1 (2.048 Mbps). The time-slots for the combined DS0s need not be contiguous.

**IPSec**

Part of the development of a new set of protocols, IPSec ensures the secure exchange of data packets over an IP network.

IPSec is primarily used in building a virtual private network (VPN).

**Note:** The 3746 and the MAE do not support any encryption function.

**Network Address Translation (NAT)**

As an Internet standard, NAT enables a LAN to use one set of IP addresses for internal use, and another set for external use outside the LAN. NAT resides at the point of connection between the LAN and any given network to ensure the translation of IP addresses. The advantages to NAT are as follows:

- Provides a type of fire-wall by hiding enterprise IP addresses.
- Allows complete access to the Internet, even for IP addresses that are not globally unique.
- Combines multiple ISDN connections into a single Internet connection.

Also, Network Address and Port Translation (NAPT) can combine the TCP and UDP connections of multiple private devices into a single public IP address.

**Authentication, Authorization and Accounting via TACACS+/RADIUS**

Many Internet service providers (ISPs) use TACACS+ and RADIUS servers to authenticate PPP connections. The MAE Extended Functions 3 enables TACACS+ or RADIUS servers to also authorize the network resources available for the user (including tunneled PPP connections), and perform accounting on any services used.

**Layer 2 Tunneling Protocol (L2TP)**

A combination of point-to-point tunnelling protocol (PPTP) and layer two forwarding (L2F) protocol, L2TP allows ISPs to build and operate VPNs on the Internet. This means that users can dial-in to their enterprise network via the Internet. Remote users dial a local L2TP Access Concentrator (LAC) (for example, an IBM 2210). The connection is tunneled from the LAC to the MAE, acting as the L2TP Network Server

(LNS). As the terminating point for tunneled PPP connections, the MAE provides access to virtual private network (VPN) resources.

**Virtual Router Redundancy Protocol (VRRP)**

VRRP is an Internet Engineering Task Force (IETF) standard as cited in RFC 2338. VRRP is an election protocol that dynamically allows a set of routers running VRRP to serve as backups for each other on a LAN.

For example, several IBM 3746s and IBM 2216s can utilize the same IP address, effectively creating a virtual router. One 3746 is designated as a 'master', with the other 3746s and 2216s acting as backup in case the 'master' 3746 fails. VRRP eliminates the need for an active routing protocol over the network, and establishes a single default gateway without the possibility of a single point of failure.

**IP, IPX, and AppleTalk Enhanced Support**

This enhancement supports bridging and routing functions for IP and IPX protocols, and AppleTalk, the Macintosh LAN-based architecture. Support includes:

- IP can be bridged and routed on the same interface.
- No communication is required between routed and bridged interfaces (except for IP).
- IP packets can be routed between a bridged network and a routed network.

**Note:** Prior to this enhancement, if a protocol was routed on any interface, it could not be bridged.

**Performance of IP routing increased to 150 kpps**

The MAE supports 150 000 packets per second (pps) for 64-byte packets.

**APPN Extended Border Node (EBN)**

Extended Border Nodes (EBNs) are used to subdivide an APPN network into smaller sub-networks (with different network IDs), or to connect multiple enterprise networks with different network IDs. Defined by the AIW specification for allowing users to run HPR sessions that can span the border node, EBN enables multi-subnet sessions to benefit from the better performance and non-disruptive path switching of HPR.

EBN is supported over MAE adapters only and includes support for EBN MIB.

**Session Services Extensions (SSE)**

SSE enables the MAE to connect to a VTAM Border Node in another APPN network. This means that in migrating an SNA network to APPN, SNA Network Interconnection (SNI) links can be migrated as well. For Service Providers with APPN Border Node access points, users do not have to implement any Border Nodes themselves. The user can connect to the access point with a 3746 running SSE.

Extended Functions 4 extends SSE support to all the adapters of the 3746.

**TN3270E Server Enhancements**

TN3270E Server (FC 5806) requires APPN for any connection to the SNA host. This enhancement provides the following:

- Supports subarea SNA connections from the TN3270E server to the SNA host
- Eliminates the need for APPN in the data center
- First-phase support for TN3270E Base MIB and TN3270E Response Time MIB

Subarea SNA connections are supported by VTAM release level 3.4 (and higher) at the SNA host.

Subarea SNA connections are supported over the following MAE ports:

- Parallel and ESCON channels (XCA MAJNODES in VTAM)
- LANs
- ATM LANE
- Frame relay

Subarea connections cannot be transported over the IP network via DLSw or Enterprise Extender.

**Note:** This TN3270E enhancement requires TN3270E Server (FC 5806).

**Fast Token-Ring (FasTR) over ATM adapters**

FasTR is a configuration option for the ATM adapters of the MAE, which enable point-to-point 155-Mbps Token-Ring connections. FasTR enables high-speed connections between the following:

- 3746 with an MAE and a 8270-800[8].
- 3746 with an MAE and a 8260[8], with a Multiprotocol Switched Services (MSS) Client Universal Feature Card (UFC) installed on a 8272 blade.

**MAE Processor Report Facility**

From the Telnet Console command line, the user can monitor the percentage (0-100) of processor utilization versus idle time. Utilization data is captured in a simple SNMP MIB table. Users can collect this data to determine the following:

- Daily load trends
- Capacity planning
- Network bottlenecks

## MAE Extended Functions 2

The MAE Extended Functions 2 (feature code 5805[6]) includes the following protocols and routing software:

**HPDT UDP**

High Performance Data Transfer (HPDT) Multi-Path Channel+ (MPC+), includes IP support over MAE ESCON channels. HPDT reduces S/390 server cycle consumption and achieves a more efficient transfer of data. HPDT UDP was initially targeted for communications between DB2® on OS/39 (V2R4) and SAP R/3 application servers. Other UNIX System Services applications using UDP, such as NFS and DCE, can also

8 Part of the IBM family of token-ring Switches.

transparently take advantage of HPDT UDP services over MAE ESCON channels.

**HPDT TCP**

HPDT TCP/IP extends the efficiencies of HPDT services to IP applications using OS/390 (V2R5). HPDT reduces S/390 server cycle consumption and achieves a more efficient transfer of data. It is supported over 3746 MAE ESCON channels.

**Enterprise Extender**

Enterprise Extender provides a simple set of extensions in APPN/HPR for integrating SNA into IP backbone networks. To HPR, the IP backbone network appears as a logical link; to IP, SNA traffic appears as UDP datagrams with no session awareness.

Enterprise Extender extends the support of Parallel SYSPLEX features to IP backbone networks (previously only available for native HPR networks).

By reducing the demand on data center routing platforms, Enterprise Extender provides a more cost-effective solution compared to other integration technologies. Enterprise Extender seamlessly routes packets through network protocol "edges", eliminating costly protocol translation and the store-and-forward associated with transport-layer functions.

Enterprise Extender provides many of the traffic control features that SNA users rely on. Using Class of Service (COS), SNA applications specify a required service from the network (for example, interactive, batch, etc.). Enterprise Extender supports SNA priority in IP environments by mapping the SNA COS priority to UDP port numbers, which can then be easily ordered using BRS.

**X.25 scalability of the Multiaccess Enclosure**

This extends the X.25 capacity from a limit of 239 VCs to 400 PVCs, and a limit that is memory dependent for SVCs and capable of supporting more than 1000 VCs.

**Channelized T1/E1 Support**

This support allows the ISDN PRI adapter to be configured as a channelized T1 or E1 instead of using it for ISDN PRI. Support is provided for frame relay and PPP over individual or groups of DS0s (64 kbps transmission rate). One or multiple connections are supported on the same physical interface. The bandwidth of each connection will be either 56 kbps, 64 kbps, or a multiple of 64 kbps up to the maximum speed of 24x64 for T1 or 31x64 for E1. Depending on tariffs, this can offer a significant savings versus multiple physical interfaces. The time-slots for the combined DS0s need not be contiguous.

**Dial-in support for SDLC PU Type 2 devices**

Switched dial-in is the capability for SDLC PU Type 2 devices to dial into the MAE through a switched network. The support is provided through DLSw. It provides HDX and FDX support as well as NRZ and NRZI. Call answering is supported but not a dial-out facility.

**Adapter Support**

FDDI, Fast Ethernet, and HSSI.

## MAE Extended Functions 1

The MAE Extended Functions 1 (feature code 5804[6]) includes the following:

## Interactive Network Dispatcher

Interactive Network Dispatcher supports scalable implementation of Internet and Intranet web server sites, with load distribution between IBM S/390 servers and other servers, allowing non-disruptive addition or interruption of servers.

Interactive Network Dispatcher is transparent to the user, and increases the efficiency of e-mail servers, Web servers, distributed parallel databases, and other TCP/IP applications.

A router running Interactive Network Dispatcher performs load balancing among adjacent IP servers. The load-balancing mechanism determines the most appropriate server to receive each new connection. Subsequent traffic for that connection is then routed to the same server, while remaining transparent to users and other applications. The load information is obtained from a set of weights based on the following:

- Number of connections active per server.
- Number of new connections since the last interval.
- Feedback from response times of individual HTTP, FTP, and Secure Sockets Layer (SSL) servers.
- Configurable policy information.

As Interactive Network Dispatcher registers only incoming packets from the client to the server, without needing to see outgoing packets, this significantly reduces the overheads of load balancing. Packets are forwarded to the chosen server exactly as created.

## RIP Version 2

MAE adapters support RIP Version 2, enabling, for example, the MAE ESCON adapter to reduce loads on the host by using an IP multicast address to broadcast periodic RIP (Version 2) messages. RIP Version 2 has the following features:

- Route tags for propagating EGP information.
- Support for variable subnet masks.
- Next hop addresses to support optimization of routes.
- Password authentication.
- Multicasting (instead of broadcasting).

## MAE 64-MB Memory Expansion

An optional 64-MB memory expansion (feature code 3520) is available in the MAE for memory intensive applications such as APPN/DLUR, APPN/HPR, DLSw, or TN3270E environments.

## ATM

ATM[5] enhancements include the following:

**High performance ATM Adapters**

Support for the following:

- 1-port 155 Mbps MMF (feature code 3294 - LIC294)
- 1-port 155 Mbps SMF (feature code 3295 - LIC295).

These provide improved performance compared to LIC284 and LIC293 respectively.

**Native APPN/HPR over ATM**
As specified by the APPN Implementers Workshop (AIW) specification 8192. The 3746 can attach to an ATM network through SVC and PVC connections without LAN emulation or encapsulation. This support includes ATM signaling of bandwidth, QoS, ATM addressing, connection network support for SVCs, route selection extensions for ATM characteristics, mapping between ARB and ATM characteristics, and HPR over ATM Management Information Base (MIB) extensions.

**Native ATM bridging**
Allows routers to connect frame-relay/ATM interworking switches to devices on either PVCs or SVCs which do not support LAN emulation connections.

**Configurable Quality of Service (QoS)**
Allows LAN emulation networks to take advantage of ATM QoS capabilities.

**Backup gateway**
For added failure recovery, a backup gateway for end stations on LAN emulation can now be configured with default gateway IP addresses. If the primary gateway fails, the backup gateway automatically passes packets from the end station to other subnets. Also, the user can configure ARP servers as primary or backup.

**Server Cache Synchronization Protocol (SCSP)**
Distributes ARP servers to eliminate a single point of failure.

All the supported routed protocols and native ATM bridging can be multiplexed onto a single ATM permanent virtual circuit.

## Frame relay, PPP, ISDN, and WAN

Frame-relay, PPP, ISDN, and WAN enhancements include the following:

**Frame-relay dial circuit interface**
Configurable on a V.25bis interface type.

**Frame-relay data compression (mode-1 FRF.9)**
Configurable per PVC running over a frame-relay interface. Support for congestion management includes the following:

- Consolidated Link Layer Management (CLLM) messages. For example, SNMP traps sent on receipt of CLLM, Forward Explicit Congestion Notification (FECN), or Backward Explicit Congestion Notification (BECN) frames.
- Throttling transmission on receipt of FECN.
- FECN source notification.

**PPP Bandwidth Allocation Protocol/Bandwidth Allocation Control Protocol (BAP/BACP)**
For dynamically adding or dropping links over ISDN B channels. Authentication servers replace the need for creating names and passwords for each router.

**ISDN I.430 and I.431**
Support enables interconnection to lease-line service from NTT.

**Ethernet locally-administered MAC address**

Can be configured to override the default burned-in address.

**WAN support for BRS**

For assigning TCP/IP packets to a BRS class and priority based on the packet's UDP or TCP port number. A backup frame-relay, PPP, or X.25 link can be specified for IP over frame relay when the traffic rate reaches a specified threshold. A single operator console can enable or disable adapters without disrupting interface(s) configured for WAN re-route.

## APPN and DLSw

APPN and DLSw enhancements include:

- Native HPR over ATM (see "Native HPR over ATM" on page 3-14), supporting an implicit focal point and up to eight backups, enabling the router to initiate a management session with NetView.
- DLSw, supporting a range of source/destination SAPs and MAC addresses that can be configured to override circuit priority.
- DLSw Switch-to-Switch Protocol, allowing the exchange of MAC address lists between partners.
- NetBIOS session alive spoofing, for eliminating session alive frames on a dial-on-demand link.

# Chapter 4. Network Solutions

## 3746 Nways Multiprotocol Controllers

This chapter describes networking solutions that the 3745 and the 3746 can bring to your network. As these solutions depend on the environment of your network, the following examples illustrates how the 3745 and 3746 can be applied to each particular environment:

- Multiprotocol networking, in which a 3746 routes SNA, APPN/HPR and IP protocols.
- SNA subarea networking, in which a 3745 with a 3746-900 operates with NCP in a VTAM dependent network.
- Mixed SNA and APPN/HPR networking, in which a 3746-900 operates both as an SNA subarea node under NCP control and as an APPN/HPR node independent from NCP control.
- APPN/HPR networking, in which a 3746-950 and/or a 3746-900 operate independently from NCP in a distributed network.

## 3746 Nways Controller Operating in a Multiprotocol Environment

The IBM 3746 operates as an IP router and APPN/HPR Network Node, enabling separate networks to be consolidated over a single multiprotocol transport network which can carry SNA traffic.

## 3746 Internet Protocol (IP) Routing

The 3746 performs channel-attached IP routing and supports a complete set of TCP/IP functions, including RIP V2[1], OSPF V2[1], and BGP V4. To enable common IP routing functionality across the network, the 3746 shares a code base with the 2210 Nways Multiprotocol Router, the 2212 Access Utility, the 2216 Nways Multiaccess Connector, and the Network Utility product.

The 3746 IP router allows routing of IP traffic over token-ring and Ethernet LANs, ESCON channels, frame-relay and X.25 networks, and leased lines (using frame-relay or PPP protocol).

With the Multiaccess Enclosure (MAE), the 3746 supports the routing of IP traffic over the following additional interfaces:

- ESCON channels using MPC+ or LCS channel protocol
- Parallel channels using MPC+ or LCS channel protocol
- ATM
- FDDI
- Fast Ethernet
- HSSI
- ISDN

[1] RIP V2 and OSPF V2 are fully supported in the Extended Functions 4, FC 5810.

As IP routers, the 3746-900 and 3746-950 can connect the following:

- Multiple networks to form an Intranet.
- Dissimilar networks for routing data from one network to another.

## 3746 IP Protocol Support

The 3746 IP support includes the following router protocols:

**RIP V2**

A method for routers to exchange topology information with other routers on the Internet or an Intranet. RIP arranges information on a router's database to be sent to other connected routers.

RIP Version 2 is fully supported in the 3746 base and MAE adapters with the new Extended Functions 4.

**OSPF Version 2**

Supports different kinds of networks, for example PPP and broadcast (Ethernet or token-ring). OSPF is the recommended topology exchange protocol for the Internet.

OSPF V2 is supported over the following channel interfaces:

- ESCON Processor Type 3 in the 3746
- ESCON and parallel channel adapters in the MAE, FC 3001

**BGP Version 4**

Supports non-hierarchical topologies, and functions as a dynamic routing protocol for running two or more autonomous systems. BGP filters information on path attributes as a method for selecting the best route.

## 3746 IP Router Characteristics

IP packets are forwarded by the 3746 processors (ESCON, token-ring, communication line, and MAE), either port-to-port within the processor, or processor-to-processor.

The NNP of the 3746 performs configuration and management functions for both the IP router and the APPN/HPR NN. The 3746 with IP Routing (FC 5033) performs the following:

- Standard SNMP support for network management via NetView for AIX[2] or other platforms.
- Concurrent IP, APPN/HPR, and SNA (NCP) routing over the same adapters and ports.
- Efficient control of access and filtering.
- High data throughput between S/390 servers and the network, allowing consolidation of S/390 front-end equipment (SNA and IP).
- Single front-end equipment access to TCP/IP MVS and VTAM (SNA) applications (simplifying the installation of S/390 servers).
- Cost reduction of network ownership by consolidating IP and SNA networks over a single multiprotocol transport network, using frame relay or ATM as the protocol for data link control.
- Native routing of IP, APPN/HPR and SNA (controlled by NCP) traffic over base adapters (ESCON, token-ring, and communication line processors). Native

[2] After NetView for AIX V 4.0, the product name is Tivoli NetView.

routing, versus encapsulation, preserves the advantages of each individual protocol.

**Note:** The MAE ports of the 3746-900 (ATM, FDDI, HSSI, Fast Ethernet, ESCON, or others) are not controlled by NCP.

## 3745 and 3746-900 Evolution to Multiprotocol Environment

As an example, a multiprotocol frame-relay backbone network can be designed to consolidate controller-based and router-based networks. All frame-relay nodes, controllers and routers, can be fully interoperable, using frame-relay RFC 1490.

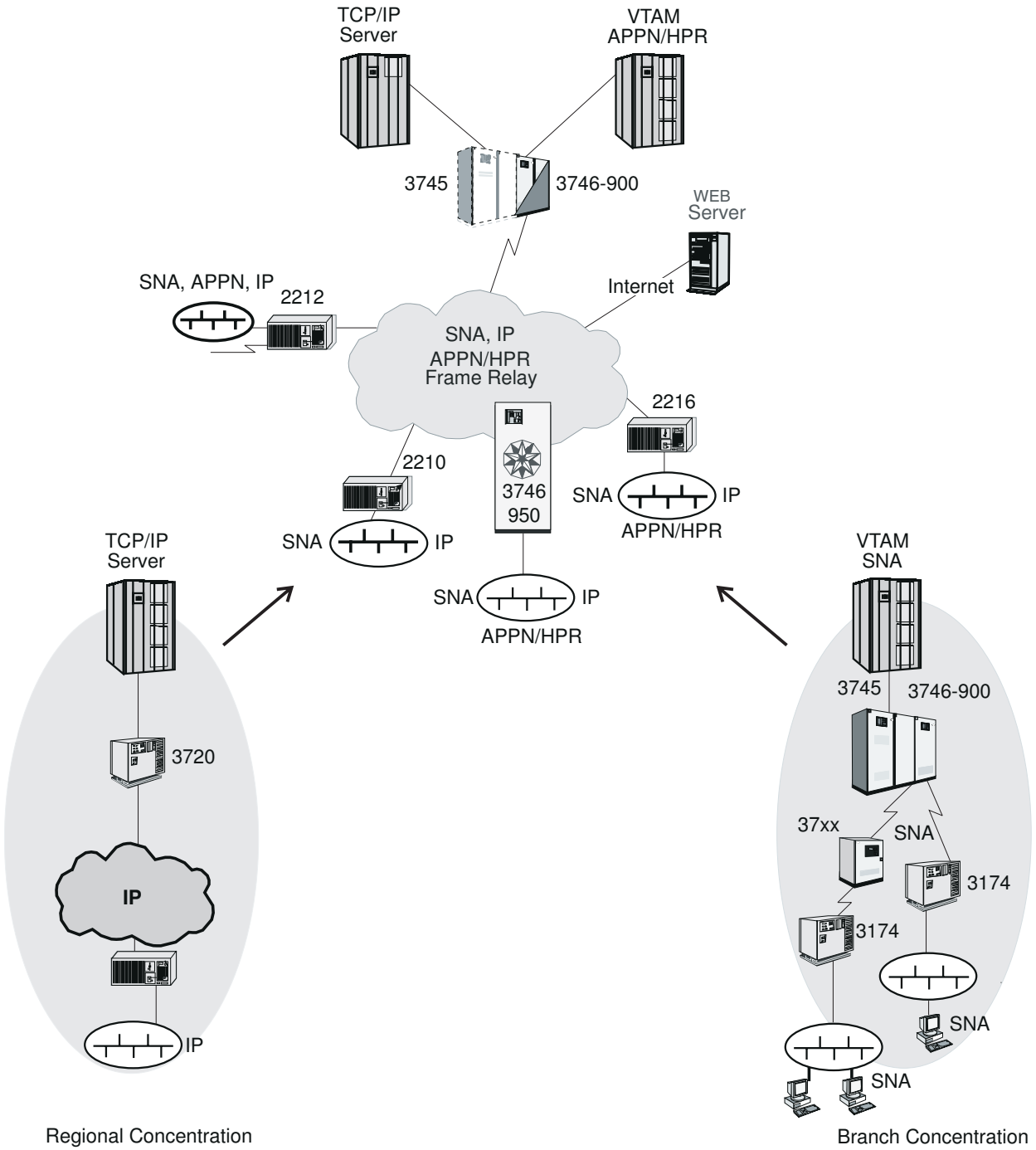


*Figure 4-1. Communication Controller Evolution to Multiprotocol Environment*

Branch concentration, usually through SNA equipment (for example, a 3174) and a separate IP router, can be replaced by a single concentrator, routing multiple protocols over a frame-relay connection. The concentrator could be any of the following:

- 2210 Nways Multiprotocol Router
- 2212 Access Utility
- 2216 Nways Multiaccess Connector
- 2217 Nways Multiprotocol Concentrator
- 2218 Frame-Relay Access Device (FRAD)

Regional concentration and access to the backbone network (for example, through a 3720 or 3725 and a separate IP router) can be replaced by a single 2216 Nways Multiaccess Connector or, for large sites, by a 3746-950.

Access to servers running VTAM SNA applications (for example, through a 3725 or a 3745 possibly connected to a 3746-900) and TCP/IP applications can be performed by a 3746-950, or a 3746-900 attached to a 3745. Any installed 3746-900 can be upgraded for IP routing and APPN/HPR, or converted to a 3746-950.

Consolidating networks with 3746 Nways Controllers has the following advantages:

- Reduction of circuit costs (single link for multiple protocols).
- Reduction of network management costs, network complexity, and personal skill requirements (only one network infrastructure).
- Lower bandwidth costs by utilizing these solutions:
  - Native routing of SNA, IP, APPN, and HPR to lower the overhead of protocol encapsulation into a single network protocol.
  - Bandwidth management, using COMRATE or Committed Information Rate (CIR) and for traffic under the control of the NNP, Bandwidth Reservation System (BRS).
- Direct communication, using frame-relay BAN, between the 3746 in the data center and remote routers, without the need for an intermediate router locally connected to the 3746.
- Flexibility in network attachment, network topology, and server location.

## Network Control Program (NCP) and Internet Protocol (IP)

NCP (NCP V7R4 and above) supports native IP routing over the following:

- Frame-relay lines connected to the 3745
- Token-ring and Ethernet LANs attached to the 3745
- Parallel channel adapters of the 3745
- ESCON channel adapters of the 3746-900

A single frame-relay DLCI can support both IP and SNA traffic (for example BAN traffic) for an RFC 1490 compliant frame-relay device. Using separate DLCIs allows the line bandwidth to be allocated differently for SNA and IP traffic.

NCP (Version 7 Release 6 and higher) supports internal IP routing (via the CBC) between NCP in the 3745 and the IP router of the attached 3746-900. For example, the parallel channel of the 3745 can carry IP traffic for the 3746 IP router.

**Note:** The 3745/NCP performance for IP traffic is relatively low. For high throughputs, the 3746 IP Routing (FC 5033) should be used.

## 3745 and 3746-900 in an SNA Network (NCP Controlled)

The 3746-900 supports the Advanced Communication Function (ACF)/NCP running in the 3745, called SNA PU type 4 support. Among multiple other functions, this includes:

- Multi-Link Transmission Group (MLTG) support.
- Connectivity to X.25 networks along with one of the following:
  - X.25 NCP Packet Switching Interface (NPSI) program running in the 3745.
  - ACF/NCP supporting SNA Qualified Logical Link Control (QLLC) connections.
- Primary Rate Interface (PRI[3]) to ISDN networks (Euro-ISDN) for SNA traffic.
- Frame-relay networking, including boundary network node (BNN) and boundary access node (BAN) functions.

## Multi-Link Transmission Group (MLTG) Support

An MLTG is a logical group of physical links for SNA traffic between two 3745/3746-900s. An MLTG can include various transmission media using different data link protocols (frame relay, SDLC, ISDN B-channel) and token-ring LANs. The traffic is automatically distributed over the physical links of the MLTG. If a physical link fails, MLTG provides automatic and non-disruptive data re-routing over other links of the MLTG.

## Connectivity to X.25 Networks

### NPSI Support (SNA and Non-SNA Traffic)

A CLP supports ITU-T X.25 protocol along with the X.25 NCP Packet Switching Interface (NPSI) program running with ACF/NCP in the 3745. This allows the 3746-900 to carry all NPSI, SNA, and non-SNA traffic flows over connections to an X.25 private or public network.

### NCP Support (SNA Traffic)

X.25 Support (FC 5030), along with NCP (Version 7 Release 4 and higher), allows CLPs to perform X.25 Data Link Control (DLC) and data packet functions for SNA traffic. Data routing is performed by the NCP, which means that NPSI is not required. X.25 performance is significantly improved as shown below:

- For X.25 SNA traffic, the data throughput of the 3746-900 is multiplied by a factor of up to 10[4], allowing a 3745 Model 31A to support up to 10 000 packets per second (128 bytes/packet).
- For X.25 SNA traffic, the load of the 3745 processor (CCU) attached to the 3746-900 is reduced by up to 90%.

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[3] The LIC16 (ISDN PRI) is no longer manufactured.

[4] The improvement factor varies, depending on the network environment and traffic characteristics (message size, packet size, etc).

- X.25 lines can be used efficiently, close to 100% utilization, and at every speed up to 2.048 Mbps.

X.25 support in the 3746-900 complies with the ITU-T X.25 revision of 1993, and includes:

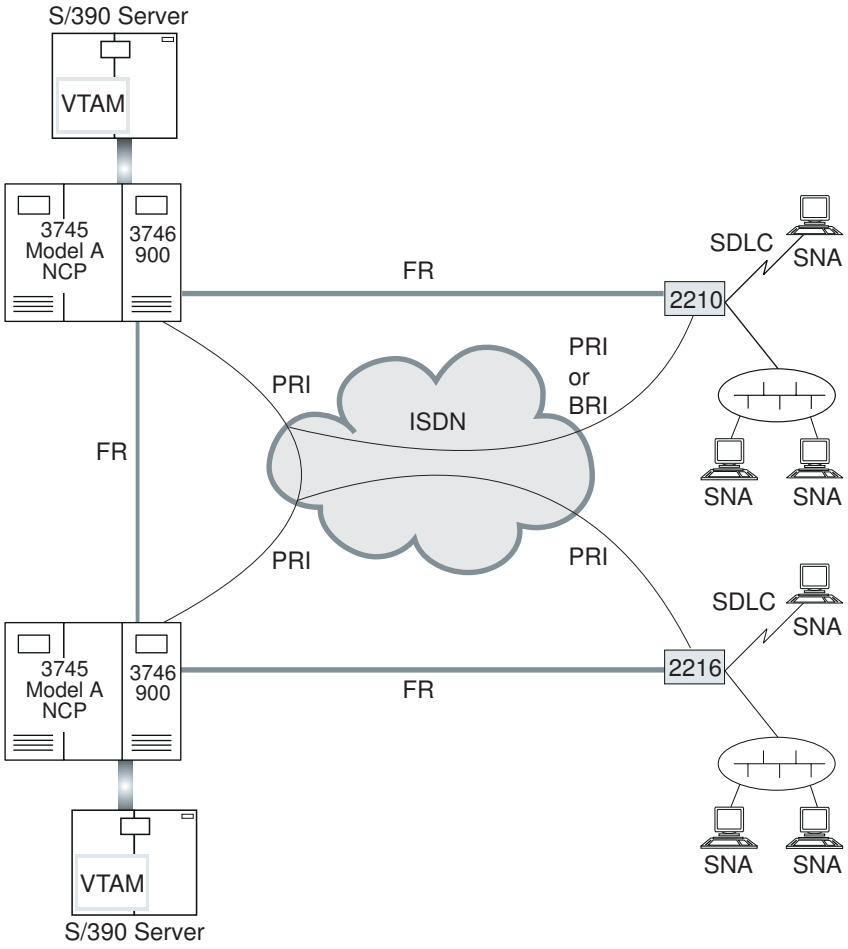
- Link Access Procedure - Balanced (LAPB) Modulo 8 and 128.
- Packet Layer Protocol (PLP) Modulo 8 and 128.
- Data packet segmentation and reassembly.
- SNA QLLC DTE connections (non-SNA connections require NPSI support).
- BNN subarea, INN subarea, APPN, and HPR/ANR traffic controlled by NCP.
- Permanent Virtual Circuit (PVC) and Switched Virtual Circuit (SVC) connections at speeds of up to 2.048 Mbps.
- Extended Numbering (TOA/NPI format).
- Concurrent operations with SDLC, frame relay, X.25 NPSI, ISDN and PPP[5] lines on the same CLP.
- Direct attachment of X.25 DTEs (OSI 8208).
- Performance monitoring and accounting through NPM.
- Remote NCP loading using mini NCP load modules.

## Connectivity to ISDN Networks

### Primary Rate Interface Support (Euro-ISDN)

The 3746-900 supports frame relay over ISDN Primary Rate Interface (PRI[3]) to conform with Euro-ISDN standards. The ISDN PRI ports of the 3746-900 (see “Line Interface Coupler 16 (LIC16) - FC 5216” on page C-5) allow ACF/NCP to route SNA traffic and APPN/HPR traffic to remote equipment supporting frame relay over ISDN, such as a 2210 Router, 2216 Multiaccess Connector, or another 3746-900.

[5] PPP lines are supported by the 3746 IP Router.




**Legend**:
BRI Basic Rate Interface (2B + D channels)
FR Frame Relay (via leased connections or Frame relay network)

*Figure 4-2. NCP Connectivity to ISDN Networks*

An ISDN PRI port on the 3746-900 provides one ISDN D channel reserved for ISDN signalling, and 30 ISDN B-channels at 64 kbps for transporting user data. The ISDN B-channels of a PRI port are reserved for connections with one or more remote equipment. Each PRI port supports 30 simultaneous ISDN connections at 64 kpbs. The 3746-900 does not support ISDN multiple B-channels (H0, H11, and H12), or ISDN calls using the bonding function; however, multiple ISDN B-channels between two 3746-900s can be used as a single logical connection (MLTG). This provides high bandwidth for communication between two ACF/NCPs.

The 3746-900 can automatically call remote equipment over ISDN. For incoming calls, the calling party's ISDN number is passed to VTAM for a verification process through the user's exit routine. Figure 4-2 on page 4-7 represents a sample network that uses frame-relay and ISDN connections, both primary (PRI) and basic (BRI). The 3746-900 PRI ports enable the following operations over a switched user network:

- Call on demand
- Additional bandwidth
- Frame-relay backup

## Call on Demand

When equipment does not need to be permanently connected to the 3746-900, ISDN can establish connections specifically for the duration of data transmissions. Up to a maximum of 30 ISDN B-channels per PRI port (1920 kbps) can be allocated to provide the necessary bandwidth.

## Additional Bandwidth

The advantages of additional bandwidth are as follows:

- When traffic rates exceed the capacity of permanent connections, temporary connections over ISDN can provide additional bandwidth. This means that the maximum bandwidth required for peak traffic times does not need to be permanently available for leased connections.
- For NCP-to-NCP traffic between two 3745/3746-900s, the frame-relay connection can be supported at peak traffic time by one or more ISDN B channel connections (see Figure 4-2 on page 4-7).
- MLTG support of NCP allows frame-relay and all the ISDN connections to be aggregated as a single logical connection between two controllers.

## Frame-Relay Back Up

NetView alerts, generated by a frame-relay link or port failure, can be used to trigger one or multiple ISDN calls (one per B channel) from the 3746-900 to any remote frame-relay terminating equipment. The following are scenarios of backup for frame relay:

- If a frame-relay connection with a 2210 fails, the 3746-900 restores the connection with the 2210's BRI port, for example, two ISDN B-channels at 2 x 64 kbps (see Figure 4-2 on page 4-7).
- For NCP-to-NCP traffic between two 3745/3746-900s, a MLTG can include frame-relay link(s) with ISDN B-channels required for backing up a failing frame-relay link (a maximum bandwidth of 1920 kbps per ISDN PRI port at 30 x 64 kbps). If the frame-relay connection fails, the 3746-900 sends ISDN calls to the second 3746-900. All the ISDN B-channels of the MLTG are treated as a

single logical connection between the two controllers (see Figure 4-2 on page 4-7). Once the frame-relay connection is restored and active in the MLTG, ISDN connections can be released non-disruptively with a NetView command. Establishing one permanent ISDN B channel between two 3746-900s is an effective way to avoid equipment disruption during a frame-relay failure.

## Frame-Relay Networking

ACF/NCP Version 7 Release 2 (and higher) supports frame-relay connections in the 3746-900.

The 3745 and the 3746-900 can be used to build a frame-relay network using leased lines.

The communication line adapters (CLAs) of the 3746-900 support Frame Relay Terminating Equipment (FRTE) and Frame-Relay Frame Handler (FRFH).

### Frame-Relay Frame Handler (FRFH)

Equipment that encapsulates messages in frame-relay frames (I-233), can transparently communicate with each other across 3745/3746-900 based frame-relay networks.

Frame-relay frame handling is off-loaded from the 3745 CCU to the adapters of the 3746-900. This provides high switching rates, making the 3745/3746-900 a powerful frame-relay node. Each CLA can switch up to 3000 frame-relay frames per second (64 bytes per frame).

### Bandwidth Reservation

The 3745 and 3746-900 can select the minimum bandwidth allocation of individual virtual circuits to an end station. This establishes the communication rate (COMRATE) of traffic flow on any given connection. Any unused bandwidth is automatically allocated to active connections, allowing traffic on these connections to flow faster than the minimum defined communication rate.

Alternatively, CIR can be used for more efficient bandwidth management through the frame-relay network. In compliance with ITU-T X.36 requirement for congestion management, the 3746 uses CIR to monitor data flow in the network. CIR adapts data in transit to the current capacity of the network, effectively enabling the 3746 to control the variable flow of traffic through every virtual circuit of the network.

### Frame-Relay Boundary Access Node (BAN)

A frame-relay Boundary Access Node (BAN) allows the 3745 and 3746-900 to communicate with frame-relay devices and any SNA physical units (PUs) downstream. Frame-relay devices can be connected via leased lines or a frame-relay network, and include the following:

- 2216 Nways Multiaccess Connector
- 2212 Access Utility
- 2210 and 6611 Router
- 2217 Multiprotocol Concentrator
- 2218 Nways Frame-Relay Access Device (FRAD)

**Dynamic route selection**

The 3745/3746-900 with ACF/NCP Version 7 Release 3 (and higher) dynamically routes SNA flows from downstream PUs to the appropriate destination, and eliminates the need for additional routers adjacent to the 3745/3746-900.

**Multiple stations over the same DLCI**

Frame-relay BAN uses the recommendations of RFC 1490 for bridged-frame format. BAN support by the 3745, 3746-900, 2210, 2212, 2216, 2217, 2218, and 6610 uses media access control (MAC) address multiplexing to minimize system definition in the BAN and NCP. This allows a practically unlimited number of stations to use the same Data Link Connection Identifier (DLCI) number.

The number of stations using the same DLCI is limited only by the bandwidth of the frame-relay link between the frame-relay access node and the 3745 or 3746-900.

**Multiple DLCIs over the same frame-relay link**

Although only one DLCI is needed between the 3745 or 3746-900 and a frame-relay device, frame-relay BAN can support multiple DLCIs between controllers and frame-relay devices.

**Frame-relay support for other Communication Controllers**

Installed communication controllers that do not support frame-relay connections (for example, the IBM 3720 and 3725) can be connected to an IBM 2210 or 2216. The 372x traffic is bridged over the frame-relay link (BAN function) by the 2210 or 2216. The 372x can then communicate with NCP (Version 7 Release 5) over a frame-relay port of the 3746-900. This function of the 3746-900 and NCP is called Frame-Relay BAN for NCP subarea traffic.

## Frame-Relay Boundary NN (BNN)

Frame-relay BNN allows the 3745 and the 3746-900 to route SNA traffic for frame-relay-attached equipment, such as the following:

- 2217 Nways Multiprotocol Concentrator
- 3174 Establishment Controller

Up to 127 physical units connected to a 3174 controller can access the 3745 or the 3746-900 over a single DLCI. This function is called service access point (SAP) multiplexing. The frame-relay BNN function uses RFC 1490 routed-frame format.

## Data Link Control Identifiers (DLCI)

Depending on the 3746-900 configuration, each CLP or CLP3 can support between 500 and 3000 DLCIs for identifying Permanent Virtual Circuits (PVCs).

Figure 4-3 on page 4-11 illustrates frame-relay support for the 3745/3746-900.

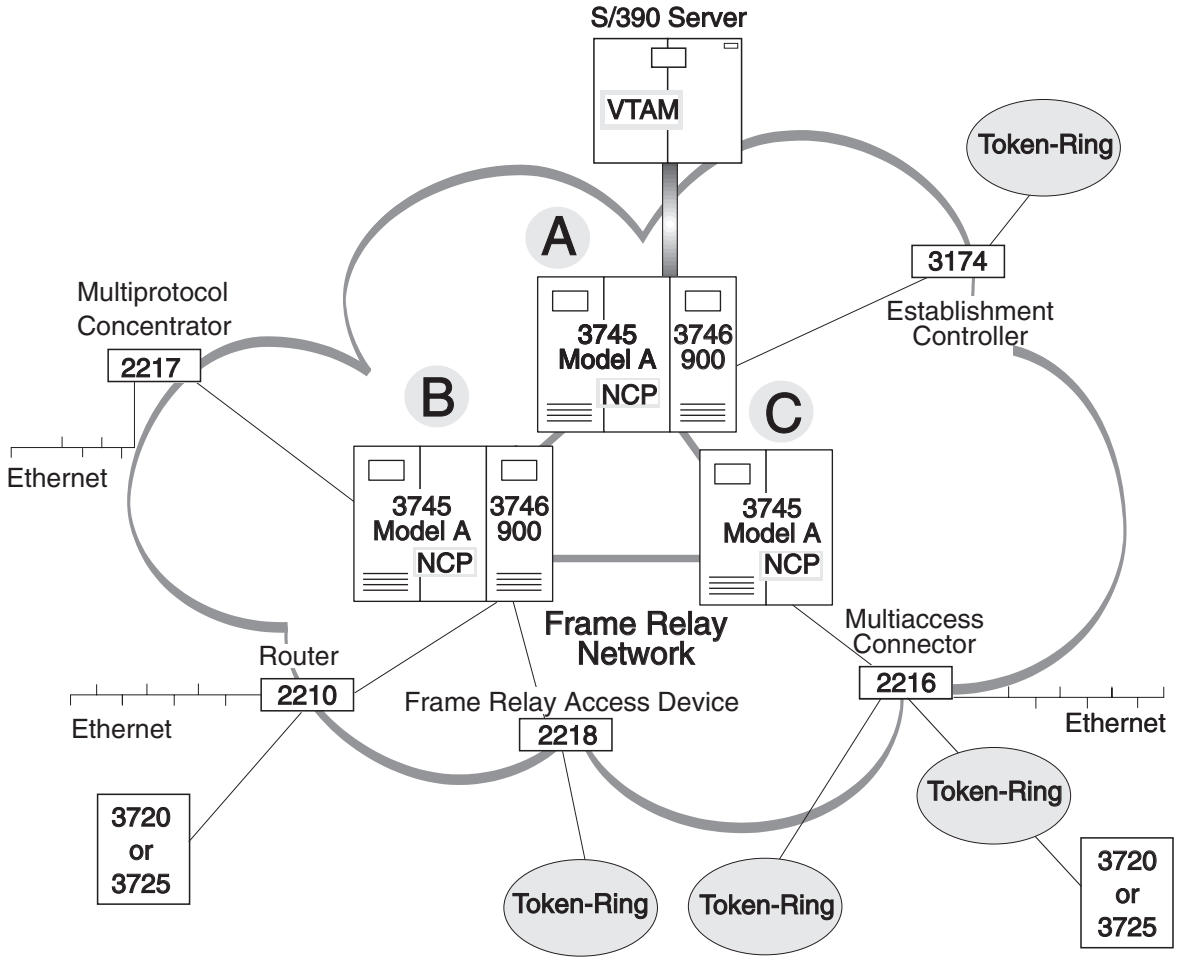



*Figure 4-3. Frame-Relay Networking for the 3745/3746-900*

## Non Disruptive Route Switching

Frame-relay networking in the 3745/3746-900 provides a significant increase in availability, as described in the following functions:

- Frame-relay frame switching substitute subport, which provides alternate frame-relay virtual circuit capability for SNA and non-SNA traffic. This allows automatic, non-disruptive route switching between frame-relay terminating equipment connected to 3745 or 3746-900 controllers.

  For example, in Figure 4-3, non-SNA devices connected to the 2210 can communicate with partner devices connected to the 2216, either via nodes **B** and **C** or via nodes **B**, **A**, and **C**.

- MLTG support for SNA traffic, a function which allows automatic, non-disruptive route switching if a line or intermediate node fails. Several frame-relay links or virtual circuits on different physical links (for example, intermediate 3745s and 3746-900s), can function as a single, logical end-to-end transmission group (TG).

  For example, in Figure 4-3, the circuit grouping of **A**-**B** and **A**-**C**-**B** can form an MLTG, allowing SNA traffic between frame-relay node **B** and S/390 applications to flow via two different physical paths.

## 3746 Nways Controller Operating in an SNA/APPN/HPR Network

As APPN/HPR network nodes (NNs), the 3746 helps you build a flexible networking environment, capable of evolving to meet your future networking requirements. Using DLUR[6], your network backbone can evolve to APPN/HPR without changing user applications and workstations.

## APPN Advantages

APPN operates without a hierarchy, establishing highly dynamic networks where nodes are easily connected and disconnected, and session routes determined according to the current status of the network. The 3746 as a NN has the following advantages:

- Dynamic and automatic networking.
- Network growth independent of platform.
- Simpler configuration and administration, including dynamic definition of resources and routes.
- Network adaptability to changes in configuration and workloads.
- Interoperability with SNA networks and SNA applications.
- End-to-end management.
- Open architecture.
- Scalability.

When operating in an APPN/HPR or mixed SNA and APPN/HPR environment, the 3746 provides the following networking capabilities:

- APPN/HPR Network Node services
- DLUR services
- ANR and RTP services for HPR traffic

## APPN/HPR Network Node (NN)

The 3746 supports APPN/HPR Network Node (NN) functions, including NN services for APPN end nodes connected to the 3746 (adjacent end nodes). As a Network Node, the 3746 has the following functions:

- Automatic update of the network connection topology.
- Dynamic location of network resources.
- Computation of network routes.
- Registration of adjacent end nodes to the APPN central directory server node (for example, VTAM).

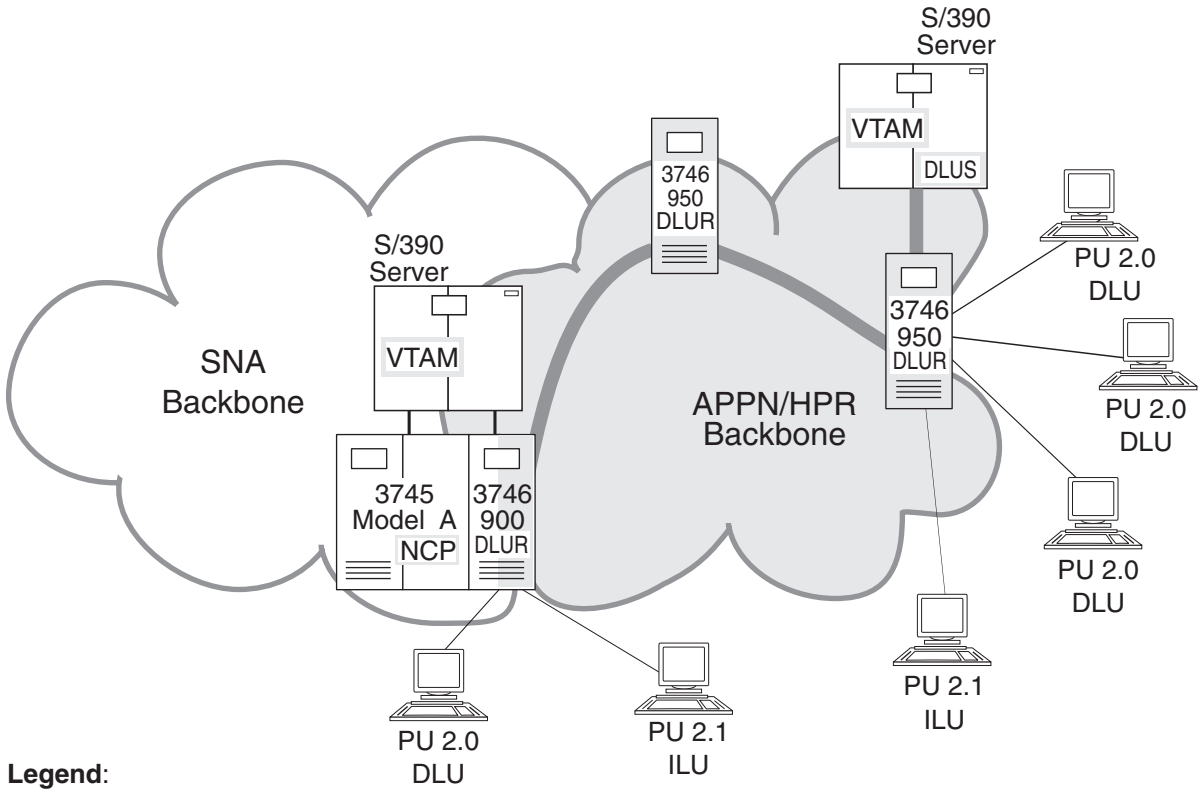
The 3746 NN supports the following types of end-node connections (see Figure 4-4 on page 4-13):

- APPN (PU type 2.1, such as IBM PS/2s and IBM 3174s).
- Non-APPN (PU types 1.0 and 2.0, such as 3270-type devices).
- LEN (PU type 2.1, such as IBM System/36™, or nodes without APPN installed, for example, an IBM AS/400, IBM 3174, IBM PS/2, or other PCs).

6 Extended Functions 4 supports an increased number of APPN/DLUR sessions through MAE ports. For more information, see "3746 and MAE Extended Functions 4" on page 2-8.

The 3746 APPN/HPR control point functions are performed by the NNP. Data is routed by adapters without any control point intervention, either port-to-port within an adapter, or adapter-to-adapter. This allows the 3746 to support high speed data transfer.

## Dependent Logical Unit Requester (DLUR)




**Legend**:

| | |
|---|---|
| DLU | Dependent LU (non-APPN) |
| DLUR | Dependent LU requester |
| DLUS | Dependent LU server |
| ILU | Independent LU (APPN) |
| | DLUR to DLUS path |

*Figure 4-4. Support for Dependent LUs*

The 3746 NN allows existing host-dependent SNA devices to access S/390 applications across an APPN/HPR network backbone. For example, a physical unit type 1.0 or 2.0 attached to the 3746 controller can access applications to either S/390 servers across the network (see Figure 4-4). This is made possible under the following conditions:

- In an SNA environment, host-dependent logical units (LUs) run a control session with the VTAM system services control point (SSCP), which allows dependent LUs to initiate LU-LU sessions with VTAM. In an LU-LU session, the dependent LU (secondary LU) can exchange data with the application LU (primary LU).
- In an APPN environment, dependent LUs (DLU) must reside on, or be owned by, an APPN node with DLUR. The DLUR node requests the DLUS of a VTAM network node to provide SSCP services for the dependent LUs owned by the

DLUR mode. The flow of SSCP-PU and SSCP-LU data is carried over two LU 6.2 sessions (APPN) between the DLUR node and DLUS node.

The 3746 provides DLUR, along with the DLUS support of VTAM (Version 4 Release 2 or higher). In a network with multiple VTAMs, only one VTAM with DLUS support is required. The 3746 can be configured with a backup VTAM and DLUS.

The DLUS can be placed in any APPN/HPR sub network, if an APPN path exists between the DLUS and each DLUR.

For improvements in SSCP-LU control session capacity, see “NNP Type 3 and NNP Type 4 Memory Expansion” on page 2-17 and Table E-5 on page E-6.

## High Performance Routing (HPR)

Both the IBM 3746-900 and 3746-950 support HPR, an extension of APPN, which was designed to establish fast links with low error rates.

Adding HPR to the 3746 platform enables you to implement high-availability solutions for both the data center and the network, and also achieve improved throughput between S/390 servers and the network. For example:

- The 3746 HPR platform provides increased throughput by a factor of up to 30 compared to 3745 SNA subarea performance in an NCP environment.
- You can use a 3746 with Automatic Network Routing (ANR) along with devices that support HPR end point support (Rapid Transport Protocol - HPR/RTP), such as the following:
  - Communication Manager/2 or Communication Server/2
  - IBM 2210 Nways Multiprotocol Router
  - IBM 2212 Access Utility
  - IBM 2216 Nways Multiaccess Connector
  - IBM 2217 Nways Multiprotocol Concentrator
  - IBM Network Utility
  - VTAM

APPN/HPR allows you to build a network with complete availability, 24 hours a day, 365 days a year.

3746 HPR advantages include:

- High data throughput between S/390 servers and the network.
- Dynamic re-routing around failed nodes and links without session disruption.
- Extended bandwidth and traffic load balancing over MLTGs, including mixed media.
- Synergy with the Parallel Sysplex processor implementation, providing end-to-end non-disruptive path switching to applications.
- Enhanced congestion control to improve link efficiency.
- Improved routing performance for intermediate nodes.
- Required storage amounts reduced in intermediate nodes.

The HPR architecture includes two layers:

- ANR in the intermediate nodes, the HPR base.
- RTP in the edge nodes, the HPR transport tower.

## Automatic Network Routing (ANR) Layer

ANR routes data packets across an HPR network, and uses a specific form of addressing to identify network routes. This form of addressing is based on the links and nodes that make up the route, and consists of labels contained in the data packet header. Each label describes the outbound link for exiting an intermediate node, so that the processing performed in each intermediate node is reduced. ANR layer has the following advantages:

- Source-independent routing.
- Connectionless, stateless, and fast routing, without the need for hop-by-hop error recovery procedures (non-ERP mode).
- Removal of incoming packets during line congestion.

## Rapid Transport Protocol (RTP) Layer

RTP establishes end-to-end connections between edge nodes of an APPN/HPR network. Each RTP connection carries traffic for multiple end users and control sessions. Data packets are routed by the intermediate ANR nodes along the RTP connection. The RTP layer results in the following advantages:

- Transport of APPN and SNA boundary traffic (DLUR).
- Selective transmission based on class of service.
- Using Adaptive Rate Base (ARB) for controlling flow and avoiding network congestion.
- End-to-end error recovery and selective re-transmission.
- Non-disruptive re-routing around network failures.

## HPR Multi-Link Transmission Group (MLTG)

HPR MLTG operates between two 3746 NNs, or between a 3746 and the Communication Server for OS/2 WARP program, without an intermediate HPR node. MLTG enables the 3746 to use a variable bandwidth on a single logical connection composed of multiple physical links or LANs. This is an advantage when single or multiple sessions require more bandwidth than provided by a single physical link or LAN.

The MLTG is defined by a single transmission group (TG) number. This is reported and recorded as a single TG in the APPN topology of NetView and 3746 NNP, and viewed as a single TG in the route calculation process. If there are errors in the link rates, error recovery can be determined on an individual link basis. If links become obsolete, they can be removed from the MLTG to save costs. If additional bandwidth is required, links can be automatically and dynamically added into the MLTG.

HPR MLTG is supported over SDLC, frame-relay and X.25 links, and token-ring and Ethernet LANs. The MAE ports do not support HPR MLTG.

## 3746 as a Mixed SNA and APPN/HPR Node

In a mixed SNA and APPN/HPR network, the 3746-900 can operate as the following:

- An SNA node (PU type 4) for network resources owned by the NCP running in the 3745.
- An APPN/HPR node for resources owned by the 3746 APPN/HPR control point.

Figure 4-4 on page 4-13 shows a scenario in which a 3745/3746-900 is channel-attached to a VTAM, and operating as an interchange node (ICN). As an ICN, the 3745/3746-900 allows the following:

- SNA devices connected on an SNA backbone can access applications in an APPN/HPR backbone.
- SNA/APPN devices connected on an APPN/HPR backbone can access S/390 applications in an SNA backbone.

This effectively provides any-to-any networking.

## X.25 Network Connectivity

The 3746 can attach to private or public X.25 networks as Data Terminal Equipment (DTE) node for routing APPN, SNA/DLUR, HPR, and IP traffic over X.25 connections. This 3746 support of X.25 connections removes the need of corresponding support from NCP or the NCP Packet Switching Interface (NPSI).

Support for X.25 includes:

- QLLC connections for APPN, SNA/DLUR, and HPR traffic.
- Routing of mixed APPN, SNA/DLUR, HPR, IP, and SNA/NCP traffic on the same X.25 link.
- PVC and SVC connections.
- Up to 2.048 Mbps speed.
- X.25, X.25 NCP, X.25 NPSI links on the same communication line adapter (SDLC, PPP, frame relay, and ISDN).

## Frame-Relay Networking

The 3746-900 controlled by the NNP and 3746-950 provide frame-relay networking functions similar to those provided by NCP for the 3746-900 (see “3745 and 3746-900 in an SNA Network (NCP Controlled)” on page 4-5).

Along with CIR, the 3746 uses the Bandwidth Reservation System (BRS). This is a method of reserving a percentage of the bandwidth to selected protocols flowing through the same virtual circuit, for example, APPN and IP.

The 3746 supports frame relay independently of NCP, based on RFC 1490 for Boundary Access Node (BAN) and Boundary Network Node (BNN), along with TCP/IP and HPR routing.

The 3746 operating as a frame-relay terminating point can use a variety of frame-relay devices, either directly connected via leased lines, or connected to a public or private frame-relay network.

IBM frame-relay devices for network access include the 2210 and 6611 Multiprotocol Routers, the 2212 Access Utility, the 2216 Multiaccess Connector, the 2217 Multiprotocol Concentrator, the 2218 Frame-Relay Access Device (FRAD), and the 3174 controller.

A 3746 using frame relay has the following cost-effective advantages:

- A multiprotocol transport network, with native routing of IP, SNA and APPN/HPR over the same WAN connection, will save costs on bandwidth, network administration, and network management.
- All multiprotocol traffic can be run through a single channel-attached and high throughput terminating point.

## Physical Media

The 3746-900 with NNP and 3746-950 provide the same connectivity. Both support the following:

- Token-ring and Ethernet LANs
- Leased frame-relay links
- Switched and leased SDLC links
- Frame-relay network connections
- X.25 network connections
- ATM, in the MAE
- ISDN network connections, in the MAE
- ESCON channels, including ESCON MPC+, in the MAE
- Parallel channels, including MPC+ support, in the MAE
- FDDI, in the MAE
- HSSI, in the MAE
- Fast Ethernet, in the MAE

For more information on adapters that support connectivity in the 3746, see Chapter 5, “Scalable Connectivity” on page 5-1.

## 3720/3725 and 3745/3746 SNA Migration to APPN/HPR

DLUR in the 3746 or other APPN/HPR equipment can facilitate the migration of VTAM-dependent SNA networks to 3746-based APPN/HPR networks (see “Dependent Logical Unit Requester (DLUR)” on page 4-13).

A possible scenario would be as follows:

1. Configure VTAM with a DLUS in the Communication Management Configuration (CMC) of the S/390 server.
2. From the SNA network periphery, progressively replace the 3725s and 3745s with IBM 2216 Multiaccess Connectors and 3746-950s operating as APPN/HPR NNs with dependent LU support. 3720s may be replaced by IBM 2210 Multiprotocol Routers or 2216s, operating as APPN/HPR NN, with dependent LU support.

VTAM and NCP can also allow APPN/HPR NNs to access VTAM APPN/HPR nodes across the remaining part of the SNA backbone.

### The Evolution to APPN/HPR

The 3746-900 can be upgraded to a stand-alone 3746-950 by installing the channel, line, and LAN connections of the 3745 and then detaching it from the 3745.

The 3746-900 with DLUR, and the 3746-950 can replace or consolidate one or more IBM 3720, 3725, or 3745 controllers. This means substantial benefits for throughput, price-to-performance ratio, physical installation requirements, and software changes.

The connectivity of the 3746-900 and 3746-950 for ESCON channels, communication lines, and LANs is unmatched by other existing APPN products. The 3746 offer a significant increase in data throughput and transaction rate through the following:

- APPN/HPR routing performed by the adapters with no intervention by NCP.
- Direct VTAM access via ESCON channel adapters.

The 3746 is the preferred solution in mid- or long-term strategies to migrate from SNA networking to APPN/HPR. Evolution to APPN/HPR is made simpler by the 3746-900 capacity to share the same ports and adapters between SNA (NCP) and APPN/HPR.

In this respect, one of the functions of the MAE is to provide access to both SNA and TCP/IP based host applications through channel access protocols. The ESCON channel adapters of the MAE can run a variety of channel access protocols, including Multi-Path Channel+ (MPC+), a protocol that improves the performance of APPN/HPR and TCP/IP, while reducing the consumption of host cycles.

### Customer Comments

The following reflects some customer comments on the advantages of migrating to APPN/HPR:

- No retrofits needed to accommodate new users and applications.
- Administrative overheads of a widespread client/server system eliminated.
- The time of link definition normally required with VTAM is reduced, keeping support costs down.
- APPC client/server applications distributed cost-effectively and quickly.

## 3745 and 3746-900 SNA Migration to APPN/HPR using a CNN

VTAM and NCP can function as a composite network node (CNN), allowing an SNA network to communicate with an APPN/HPR network. A CNN consists of a VTAM and one or more 3745s or 3745/3746-900s working together as an APPN/HPR NN (see Figure 4-5 on page 4-19). The communication controllers of a CNN support APPN and HPR/ANR protocols and appear to an attached node as a single NN. In addition to NN functions, the 3745s and 3746-900s of a CNN support SNA protocols, providing an SNA boundary for attached dependent logical units. A CNN supports ANR for HPR traffic, and allows SNA-based networks to migrate to APPN/HPR-based networks.

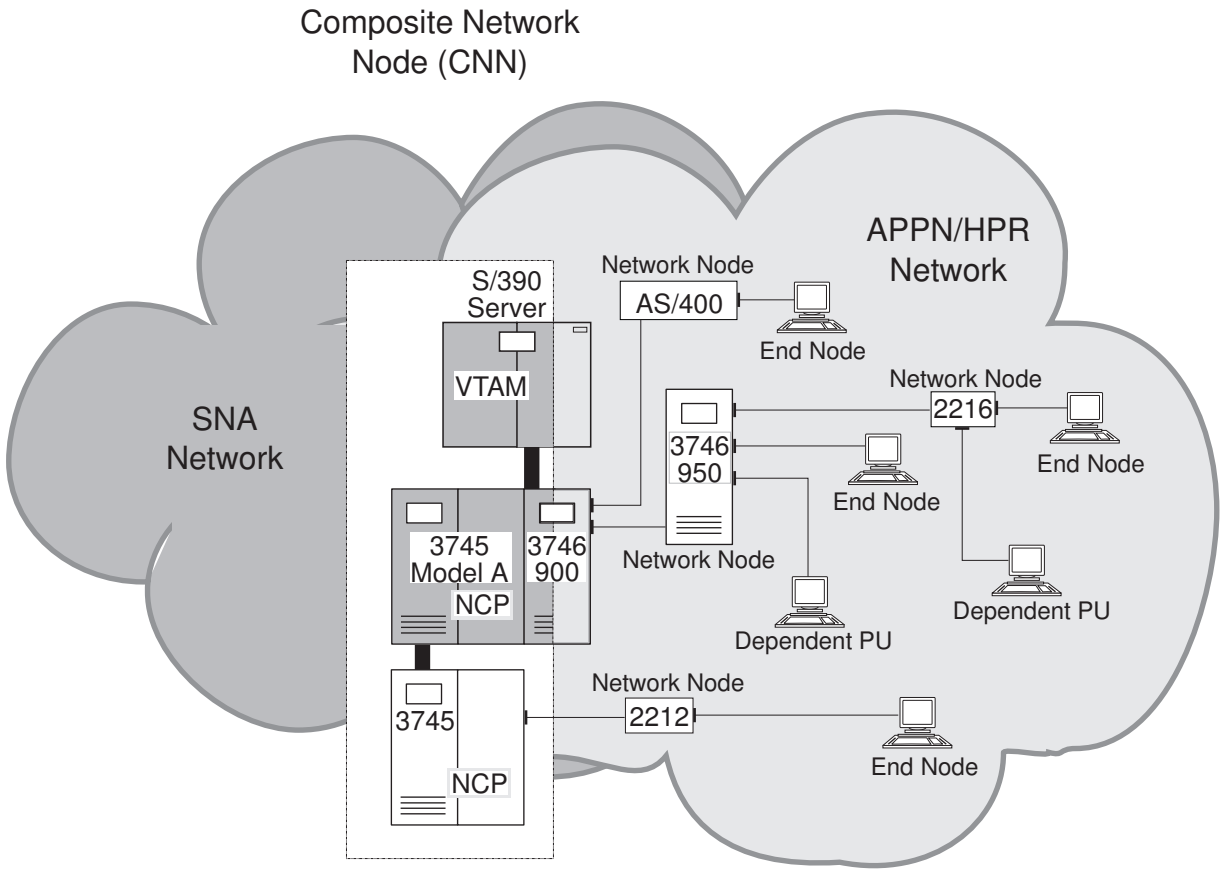



*Figure 4-5. APPN/HPR Composite Network Node (CNN) in an APPN/HPR Network*

## The Evolution to APPN/HPR

The CNN interconnects 3745 NNs, enabling them to be individually upgraded to APPN NNs (for example, replacing the 3745 with the 3746-950). As shown in Figure 4-5, a front-end 3746-900 can operate within a CNN for SNA connections, and also as an APPN NN for any APPN connections that can be moved to the 3746. These connections primarily include the following:

- All controllers that have migrated to APPN NNs (see the 3746-950 in Figure 4-5).
- Other NNs (see the AS/400 in Figure 4-5).
- Non-native APPN units, operating under DLUR in the 3746 (along with the DLUS function of VTAM).
- VTAM NN.

VTAM, as an interchange node, operates as a PU type 5 within the CNN, and as a PU type 2.1 within the APPN network.

Connecting the 3746-900 NN internally to the 3745/3746-900 CNN allows one NN to communicate with another. Connecting to the 3746-900 NN has the following advantages:

- Higher data throughput by routing through 3746 adapters instead of the 3745.
- Freeing the 3745 processors of heavy traffic.

- PUs and sessions controlled by the 3746-900 NN do not require any 3745 storage, which allows for increased connectivity.

# Chapter 5. Scalable Connectivity

The 3746 provides a range of connectivity options:

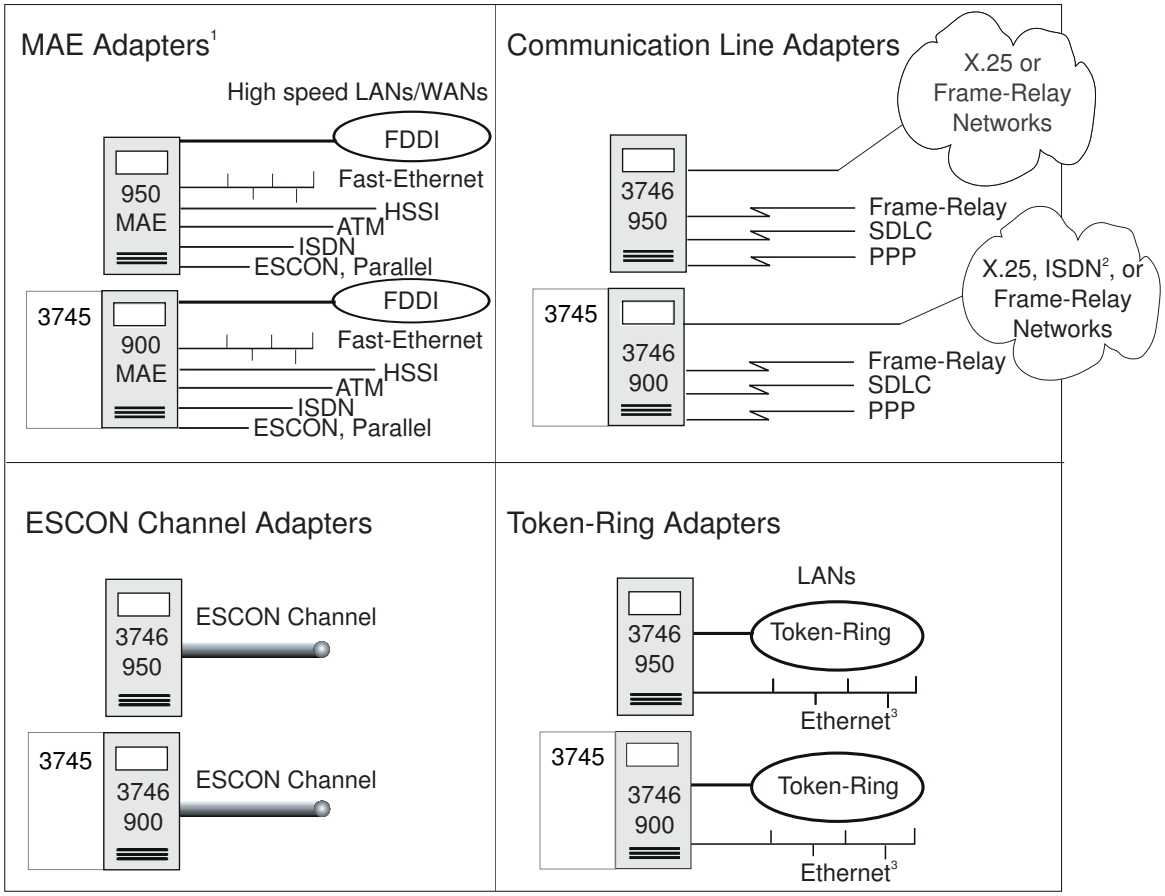
- Communication Line Adapter (CLA)
- ESCON Channel Adapter (ESCA)
- Token-Ring Adapter (TRA)
- The following adapters in the MAE:
  - ISDN
  - ATM (SMF, MMF)
  - Ethernet and fast Ethernet
  - Token-Ring and Fast Token-Ring (FasTR)
  - FDDI
  - HSSI
  - ESCON channel
  - Parallel channel
  - V.24, V.35, V.36, X.21

For more information on available MAE adapters, see “MAE Channel Adapters” on page D-4 and “MAE Low/Medium-Speed LAN and WAN Adapters” on page D-6.

The 3746 can be installed with 16 adapters (without the MAE) or up to 23 adapters (including 8 in the MAE[1]).

For each type of adapter (CLA, ESCA, TRA), the loading of optional licensed internal code (APPN/HPR, or APPN/HPR with IP) can be configured during installation.

[1] Installing the MAE FC 3001 in the 3746 requires a processor slot in the controller for the Switch Interface Extension (SIE) card.




**Notes:**

1. Low speed LANs/WANs (Ethernet, token-ring, frame-relay, and X.25) are not represented.
2. No longer manufactured. ISDN adapters are available on the MAE. For more information, see Appendix D, “Configuration Options for the 3746 (MAE)” on page D-1.
3. CLA connectivity to ISDN networks requires ACF/NCP support in the 3745.

*Figure 5-1. Adapter Options for Different Types of Connectivity*

The 3746 NN can support a total of up to:

- 240 lines
- 5000 PUs (APPN/HPR nodes and SNA PUs)
- 35 000 APPN and dependent LU sessions
- 60 000 SSCP-LU sessions

As an HPR/ANR node, the 3746 NN supports any number of HPR/ANR sessions.

For a summary of the 3746 NN and adapter connectivity, refer to Appendix E, “Connectivity and Performance of the 3746 APPN/HPR Network Node (NN)” on page E-1.

## Communication Line Adapter (CLA)

The 3746 CLA consists of the following (see Figure 5-2):

- Communication Line Processor (CLP[2] or CLP3).
- Any mix of up to four Line Interface Couplers (LICs), Types 11, 12, or 16 (LIC11, LIC12, or LIC16[3]).

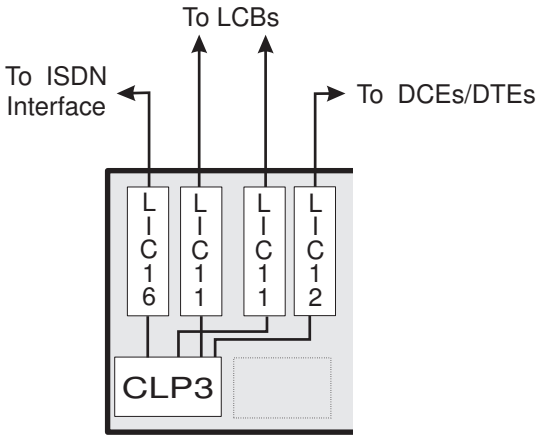



*Figure 5-2. Communication Line Adapter (CLA)*

The CLA of the 3746 provides the following:

- High connectivity and performance
- Cabling flexibility
- Backup capability (using CLP[2] or CLP3 pairs)

Up to 120 active communication lines can be attached to each CLP[2] or CLP3.

Communication lines operate in half- or full-duplex mode, using SDLC, PPP, frame-relay, or X.25 line protocol. The LIC16[3] uses frame-relay framing for primary access to Euro-ISDN.

**Note:** Support for LIC16[3] ISDN is provided in the 3746-900 in conjunction with ACF/NCP running in the 3745 (see page F-1). LIC16[3] ISDN connections are not supported by the 3746 NN and the 3746 IP router. ISDN PRI ports for APPN/HPR and IP are located on the MAE.

CLAs support:

- V.24 leased and switched lines (600 bps up to 28.8 kbps)
- V.35 leased lines (56 kpbs up to 2.048 Mbps)
- X.21 leased and switched lines (600 bps up to 2.048 Mbps)
- V.25 bis protocol over V.24 switched lines
- Euro-ISDN PRI connections (LIC16[3])
- Any number of devices per line or LIC. For example, for SNA and APPN/HPR physical units (PUs), 100 PUs can be activated on one LIC11, 200 via the

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2 No longer manufactured.

3 No longer manufactured. ISDN adapters are available on the MAE. For more information, see Appendix D, “Configuration Options for the 3746 (MAE)” on page D-1.

second LIC11, 300 via a third LIC11, and so on. The maximum depends only on CLP[2] or CLP3 capacity.

**Note:** The X.21 switched operation is only supported for connecting an external ISDN terminal adapter to an SDLC port controlled by ACF/NCP (3746-900).

Lines with speeds of up to 256 kbps are connected to the LIC11 through a line connection box (LCB). LCBs can be remote from the 3746, while housing the active remote connectors (ARCs) that provide the interface-to-line equipment. LCBs provide flexibility, expandability, and simplified cabling.

High availability is optimized when each CLP[2] or CLP3 backs up the other in pairs. For further information, refer to Chapter 7, “High Availability” on page 7-1.

## CLP3 Enhancements Versus CLP

The performance enhancements of the CLP3 compared to the CLP are as follows:

**CLP3 Throughput**

Depending on traffic patterns (message/packet size, etc) and mix of traffic types (IP, APPN/DLUR, HPR, NCP), the CLP3 improves the CLA throughput up to one-hundred percent, compared to the CLP[2].

**CLP3 Connectivity**

The CLP3 improves the connectivity of the CLA by a factor of up to 4, compared to the CLP[2]. For example, about twice as many lines controlled by NCP (3746-900), or about three times the number of lines, PUs and APPN/Dependent LU sessions controlled by the NNP.

## 3746-900 With NCP Support Only

If the 3746 APPN/HPR and 3746 IP routing options are not present in the CLPs[4] and CLP3s, the connectivity for CLP3 is as follows:

**SDLC**

Each CLP3 can support up to 1000 PUs simultaneously (for example, 3174 downstream PUs)

**Frame relay, X.25**

In addition to SDLC connectivity, each CLP3 can support a total of up to 3000 PUs over any mix of the following:

- Frame-relay DLCIs (up to 3000)
- X.25 (one PVC or SVC per active PU, up to 3000)
- ISDN LIC16[3] interfaces

**Frame relay**

Each CLP3 can support 3000 Data Link Connection Identifiers (DLCIs), for either Frame Relay Terminating Equipment (FRTE), or Frame Relay Switching Equipment (FRSE), distributed at random over active frame-relay and ISDN (LIC16[3]) lines. The CLP3 supports multiplexing for multiple SNA stations (PUs) over a single frame-relay DLCI. The following equipment can multiplex PUs on a frame-relay DLCI:

- 3174 Establishment Controller
- 2217 Nways Multiprotocol Concentrator

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[4] The CLP is no longer manufactured. The connectivity figures in this description apply also to the CLP.

- 2210 and 6611 Multiprotocol Routers
- 2212 Access Utility
- 2216 Nways Multiaccess Connector
- 2218 Frame-Relay Access Device (FRAD)

## Support for the 3746 NN and 3746 IP

When a 3746 operates[5] as an APPN/HPR NN or IP router over communication line adapters ports, the connectivity of a CLP3 is as follows:

**SDLC**

Each CLP3 can support 1000 PUs simultaneously (for example, 3174 downstream PUs).

**Frame relay, X.25**

In addition to the SDLC connectivity, each CLP3 can support any mix of the following frame-relay and X.25 stations up to 2000:

- PUs multiplexed over frame-relay DLCIs (including LIC16[3] ISDN connections for the 3746-900).
- Frame-relay DLCIs carrying IP traffic.
- PUs connected over X.25 VCs (one PVC or SVC per active PU, up to 2000).
- X.25 VCs carrying IP traffic.
- X.25 VCs controlled by NPSI for the 3746-900.

**Frame relay**

Support for a maximum of 2000 DLCIs over frame-relay connections. For the 3746-900, this includes DLCIs over LIC16[3] ISDN connections (controlled by NCP).

Any frame-relay or X.25 port can concurrently handle APPN, Dependent LU, HPR, IP, and (for the 3746-900) NCP traffic.

Examples of CLP3 connectivity with APPN/HPR[6]:

- Frame relay (up to 120 lines), running 2000 PUs and about 7500 APPN/Dependent LU sessions controlled by the NNP, or 100 PUs and about 12 000 such sessions.
- SDLC (20 lines), running 1000 PUs and about 8200 APPN/Dependent LU sessions controlled by the NNP, or 100 PUs and about 11500 such sessions.

Examples of CLP connectivity with APPN/HPR[6]:

- Frame relay (up to 120 lines and 500 DLCIs), running 500 PUs and about 2000 APPN/Dependent LU sessions controlled by the NNP, or 100 PUs and about 3300 such sessions.
- SDLC (20 lines), running 500 PUs and about 1100 APPN/Dependent LU sessions controlled by the NNP, or 100 PUs and about 2600 such sessions.

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5 This description provides maximum connectivity figures for the CLP3. For CLP figures, refer to Appendix E, “Connectivity and Performance of the 3746 APPN/HPR Network Node (NN)” on page E-1. Not all the maximum connection capabilities of the CLP3 (SDLC lines, PUs controlled by NCP, PUs controlled by the NNP, and 3746 NN sessions) are possible simultaneously. See also note 3 of Table E-1 on page E-2.

6 These examples assume that the IP routing (installation option) is not present in any CLP or CLP3. The CLP and CLP3 support any number of sessions controlled by NCP (3746-900) and any number of HPR sessions crossing the 3746 as an intermediate (ANR) node.

### CLP3 in the 3746-900

Shares traffic controlled by NCP, the 3746 NN (APPN, Dependent LU, and HPR traffic), and the IP router. Each port of the 3746-900 CLP3 can be one of the following:

- SDLC port, supporting either NCP traffic for one CCU or 3746 NN traffic
- PPP port supporting 3746 IP Router traffic
- Frame-relay or X.25 port supporting:
  - NCP traffic for one CCU
  - 3746 NN traffic
  - 3746 IP traffic
- X.25 port supporting NPSI traffic for one CCU
- ISDN port (LIC16[3]) supporting NCP traffic from one CCU

### CLP3 in the 3746-950

Shares traffic controlled by the 3746 NN (APPN, Dependent LU, and HPR) and traffic controlled by the 3746 IP router. A given port can be assigned to the 3746 NN traffic (SDLC port), the 3746 IP router traffic (PPP port), or both traffic (frame-relay or X.25 port). Each port of the 3746-950 CLP3 can be one of the following:

- SDLC port supporting 3746 NN traffic
- PPP port supporting 3746 IP router traffic
- Frame-relay port supporting 3746 NN traffic and (or) 3746 IP traffic
- X.25 port supporting 3746 NN traffic and (or) 3746 IP traffic

**Note:** For more information about CLAs, refer to Appendix C, “Configuration Options for the 3746 (Base)” and Appendix F, “Programming Support.”

## ESCON Channel Adapter (ESCA)

Native support of ESCON architecture provides flexibility in the design of host connections. ESCAs allow communication with ES/3090™, ES/9000, and 9672 processors (S/390 servers).

ESCON channels have the following advantages:

- Connectivity over greater distances between the 3745/3746 and the S/390. For example, the standard connection between a 3746 and a S/390 is up to 3 km (1.9 miles). By using ESCON Directors (ESCDs), the S/390 can be up to 43 km (26.7 miles) away.
- More configuration flexibility.
- Increased performance.
- Decreased sensitivity to noise.

An ESCA consists of the following:

- One processor (ESCP[2], ESCP2[2], or ESCP3)
- One coupler (ESCC[2], ESCC2)

Compared to the ESCON channel processor (ESCP), the ESCON channel processor Type 2 and Type 3 (ESCP2 and ESCP3) support traffic routing for the

3746 NN and 3746 IP Router, and enhance ESCON performance for NCP traffic (for the 3746-900).

Compared to the ESCON coupler (ESCC), the ESCON coupler Type 2 (ESCC2) provides:

- Higher data throughput for applications (for example, file transfer between S/390s and distributed servers).
- Enhanced performance in heavy interactive traffic environments using small messages or packets.

The ESCP2 and ESCP3 can concurrently support:

- NCP traffic for the Central Control Units (CCUs) of the associated 3745 (3746-900 only).
- 3746 NN traffic.
- 3746 IP router traffic.

## ESCP3 Enhancements Versus the ESCP2

The performance enhancements of the ESCP3 compared to the ESCP2 are as follows:

**ESCP3 Throughput**

Depending on traffic patterns (message/packet size, etc) and mix of traffic types (IP, APPN/DLUR, HPR), the ESCP3 improves the ESCA throughput up to 60%, compared to the ESCP2.

**ESCP3 Connectivity**

The ESCP3 improves the connectivity of the ESCA (in the number of APPN and Dependent LU sessions controlled by the NNP) by a factor of about 3, compared to the ESCP2.

## ESCON Multiple Image Facility (EMIF)

The 3746 supports ESCON Multiple Image Facility (EMIF) as shown in Figure 5-3 on page 5-8. EMIF allows several logical partitions (LPs) to share the same ESCON channel. A single ESCON channel adapter (ESCA) can communicate with several LPs in a S/390 server without the need of an ESCON director.

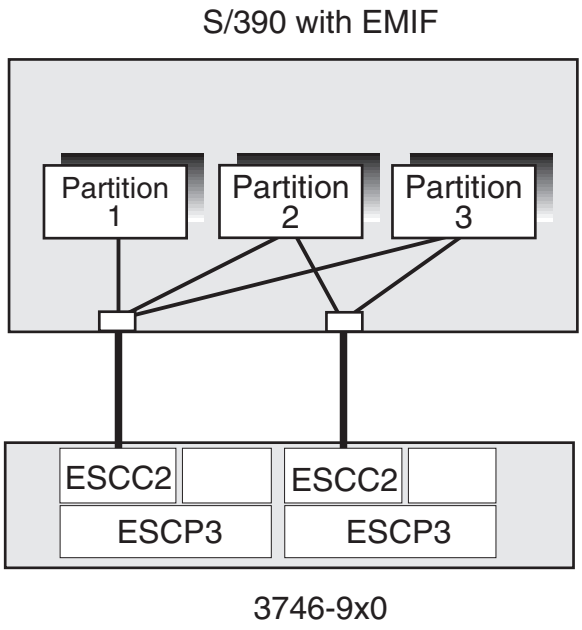


*Figure 5-3. Example of EMIF Support with a 3746*

## ESCON Channel Adapter (ESCA) Connectivity

ESCON adapters (ESCAs) have the following connectivity options:

- An ESCA can communicate with 32 host logical stations (VTAMs, TCP/IPs, and TPFs) in up to 32 LPARs.
- An ESCA can be shared by one or two active NCPs in the 3745 (3746-900 only), the 3746 NN, and the 3746 IP router.
- An ESCA can support any mix of 3746- and NCP-controlled logical connections to VTAMs, TPFs, and TCP/IPs.
- An ESCA supports any number of HPR sessions (ANR) between HPR edge nodes and HPR VTAM nodes, and for the 3746-900, any number of sessions controlled by NCP.
- Depending on the number of ESCON logical connections (1 to 32):
  - ESCP3 supports about 10 000 to 14 000 APPN/Dependent LU sessions controlled by the NNP.
  - ESCP2 supports about 3300 to 4900 APPN/Dependent LU sessions controlled by the NNP.

    **Note:** These figures assume that the IP routing software is not present in the ESCAs.

The following brief scenarios show the flexibility of ESCON adapters:

- An ESCA connects the 3746 to an S/390 server via ESCON optical fibers. To provide higher availability, two ESCAs can be attached to the S/390, either directly or by using one or two ESCDs. This provides a duplicate path between the 3745/3746-900 or the 3746-950 and the S/390.
- Parallel Transmission Groups (TGs) can be established in ACF/NCPs running in the 3745 attached to the 3746-900 by using two or more channels (ESCON and/or parallel).

- Parallel TGs can be established for the 3746 NN by using two or more ESCON connections.

## Token-Ring Adapter (TRA)

A token-ring adapter (TRA) in a 3746-900 and 3746-950 consists of the following:

- One token-ring processor (TRP[2], TRP2[2] or TRP3)
- One or two Token-Ring Interface Couplers Type 3 (TIC3)

The TRA routes SNA subarea (3746-900 only), APPN/HPR, and IP traffic over Ethernet LANs through the Ethernet port option (FC 5631[7]).

Compared to the TRP[2], the TRP2[2], and TRP3 increase processing power and memory size, while supporting the 3746 NN and IP routing.

### TRP3 Enhancements Versus the TRP2

The performance enhancements of the TRP3 compared to the TRP2 are as follows:

**Physical Units (NCP, NNP)**

The TRP3 supports up to 4000 SNA PUs controlled by NCP or the NNP, a 100% increase compared to the TRP or TRP2 (support for 2000 PUs).

**Throughput**

Depending on traffic patterns (message/packet size, etc) and mix of traffic types (IP, NCP, APPN/DLUR, HPR), the TRP3 improves the TRA throughput up to seventy percent, compared to the TRP2.

**Connectivity (NNP)**

The TRP3 improves the connectivity of the TRA (in the number of PUs and APPN/Dependent LU sessions activated by the NNP) by a factor of about 3, compared to the TRP2.

### 3745 (NCP Support)

The 3746-900 can support many token-ring LANs. This has the following advantages:

- Reduces the number of TRAs in the 3745 base frame
- Increases 3745 base frame capacity for Ethernet and lines at T1/E1 speed

### 3746-900 With NCP Support

The TRP3 can connect up to 4000 PUs simultaneously (for example, PS/2s, or 3174s and downstream PUs). When two TIC3s are connected to the same TRP, any ratio of PU-sharing between the TIC3s can be used. For example, 2000 PUs can be active on one TIC3 while 1000 can be active via the other TIC3.

500 PUs can be active on the TIC3 of the CBSP[2], CBSP2[2], or CBSP3 (see Figure B-1 on page B-3).

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7 No longer manufactured. Ethernet adapters (FC 3281 and FC 3288) are available for the MAE. For more information, see Appendix D, “Configuration Options for the 3746 (MAE)” on page D-1.

8 For 3745 Models 41A and 61A, a TIC slot is used by the controller bus coupler (CBC) to connect to the second CCU. For more information, see “Controller Bus Coupler (CBC) - FC 5602” on page C-16.

Up to 4000 PUs can be active on the TIC3 of the TRP3 connected to the CCU-B of the 3745[8].

The TIC3 can operate close to the token-ring media speed (16 Mbps), providing very high throughput between workstations and S/390 applications or S/390 databases and local servers.

## 3746 NN and 3746 IP Support

Connectivity of the TRP3 includes:

- Each TRP3 can connect up to 4000 active PUs (activated by NCP or NNP)
- Each TRP3 supports a maximum of up to 14 000[9] APPN/Dependent LU sessions controlled by the 3746 NN.
- As connectivity examples, a TRP3 can support 2000 PUs along with about 7800 APPN/Dependent LU sessions controlled by the 3746 NN, or 100 PUs along with about 13 500 such sessions. These examples assume that the IP routing option is not present in any TRA.
- Each TRP3 supports any number of ANR sessions over HPR connections between HPR/RTP edge nodes, and can connect any number of IP stations.
- The TRP3 can concurrently carry traffic controlled by the 3746 NN, the 3746 IP router and, for the 3746-900, one or two NCPs.
- Each TIC3 can carry traffic for the 3746 NN (APPN/DLUR/HPR), the 3746 IP router, and one NCP (3746-900).

Connectivity of the TRP2 includes the following:

- Each TRP2 can connect up to 2000 PUs activated by NCP, or about 1400[9] PUs activated by the 3746 NN, or a mix of both.
- Each TRP2 of a 3746-950 can activate about 1400[9] PUs.
- Each TRP2 supports a maximum of up to 4700[9] APPN/Dependent LU sessions controlled by the 3746 NN.
- As an example, a TRP2 can support 500 PUs (APPN/HPR nodes and (or) dependent PUs), with a total of about 3000 APPN/Dependent LU sessions activated by the 3746 NN.
- Each TRP2 supports any number of ANR sessions over HPR connections between HPR/RTP edge nodes, and can connect any number of IP stations.
- The TRP2 can concurrently carry traffic controlled by the 3746 NN, the 3746 IP router and one or two NCPs. Each TIC3 can carry traffic for the 3746 NN (APPN/DLUR/HPR), the 3746 IP router, and one NCP.

**Note:** A token-ring LAN that attaches PUs controlled by NCP in CCU-A and PUs controlled by NCP in CCU-B requires two TIC3 ports.

---

[9] See note 3 on page E-3 of Table E-1.

# Chapter 6. System Management

Management of the 3745 Models A, the 3746-900, and the 3746-950 involves the following processes:

- Configuration
- Activation of 3746 lines or ports
- Display of 3746 status information
- Problem determination and resolution (for example, line tests)
- Maintenance operation

These management processes are performed by the following programs and utilities:

- NetView for S/390 (NetView/390 performs network management functions for the 3745 and 3746-900 controlled by NCP, and for the 3746 NN).
- NetView for AIX[1] (performs network management functions for the 3746 IP router, including the MAE).
- NPM, for the 3745 and the 3746-900 controlled by NCP, and the 3746 NN.
- The CCM[2] program.
- MOSS-E[2].

## Service Processor

The service processor performs the following:

- Runs the MOSS-E program.
- Runs the CCM program of the 3746-900 and the 3746-950.
- Provides access to the 3746 APPN/HPR control point functions of the NNP.
- Provides access to the 3746 IP management functions of the NNP.
- Provides an operator interface for configuring and managing 3746 APPN/HPR and IP resources.

## Network Node Processor (NNP)

The network node processor of the 3746-950 and 3746-900 provides the following:

- APPN/HPR control point functions for the 3746 NN, including DLUR.
- IP management functions of the 3746 router.
- Support for CCM, accessed through the MOSS-E interface of the service processor, to perform the following:
  - Configure 3746-900 NCP (ESCON only), and 3746 NN and IP resources.
  - Manage 3746 NN and IP resources.
  - Activate and deactivate ports and APPN/HPR stations.
  - Display information on local topology and resources for the 3746.
- Utility for storing IP and NN files, containing configuration parameters.

---

1 After NetView for AIX V 4.0, the product name is Tivoli NetView.

2 IBM Licensed Internal Code.

**Note:** The NNP can be configured in dual mode (see "Dual Network Node (NNP) Processor" on page 7-2).

## Using System Management Tools

The following is a summary of some of the system management tools used in the 3745, the 3746-900, and the 3746-950.

## Controller Configuration and Management (CCM)

CCM provides support for simple configuration of 3746 IP router and 3746 NN resources. For example:

- Parameter default values can be changed and saved as new default values. This is an aid for configuring identical lines, ports, or stations.
- Configuration file management facilities, for example:
  - Importing/exporting configurations
  - Managing ports, stations, and APPN/DLUR sessions.

Configuration definitions are dynamically cross-checked for consistency.

CCM also provides support for the following:

- Configuration changes that deactivate or activate resources without interrupting the operations of the 3746.
- Simple definitions and operations through **Delete**, **Copy**, and **Search** functions.
- Management of IP operations.
- HPR/ANR parameters.
- Frame-Relay Terminal Equipment (FRTE) definitions.
- Definition of NPM.
- ESCON definitions for SNA (NCP), APPN/DLUR, HPR, and IP.

Further enhancements to CCM, including CCM files editing, are contained in 3746 Extended Functions 4 and 3746 Extended Functions 5. For more information, see “Controller Configuration and Management (CCM) Enhancements” on page 2-6 and “Enhanced Network Management for APPN/HPR Environments” on page 2-10.

## Telnet Support for IP Operations

Along with CCM, configuring and managing IP resources can be performed through Telnet (for more information, see “Accessing the 3746 IP Router Via Telnet” on page 6-14). When you have established a Telnet session, you can navigate in the three main environment levels (see Figure 6-1 on page 6-3).

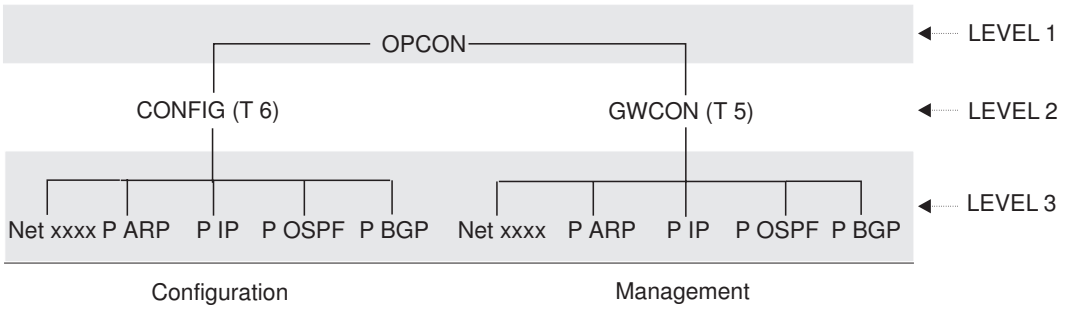
**Level 1** OPCON environment.

**Level 2** CONFIG (or T 6) environment for configuration, GWCON (or T 5) environment for management.

**Level 3** Protocol environments (Netxxxx, P ARP, P IP, P OSPF, P BGP).

You can configure and manage IP resources within these levels. Navigating these levels requires the following simple commands:

- Level 3 commands allow you into a specified environment.
- Typing **EXIT** returns you to the previous level.
- Pressing Ctrl and 0 together returns you from the current environment back to OPCON (the *RANGE XXXX-YYYY ** command prompt).




Legend

**xxxx** Port number

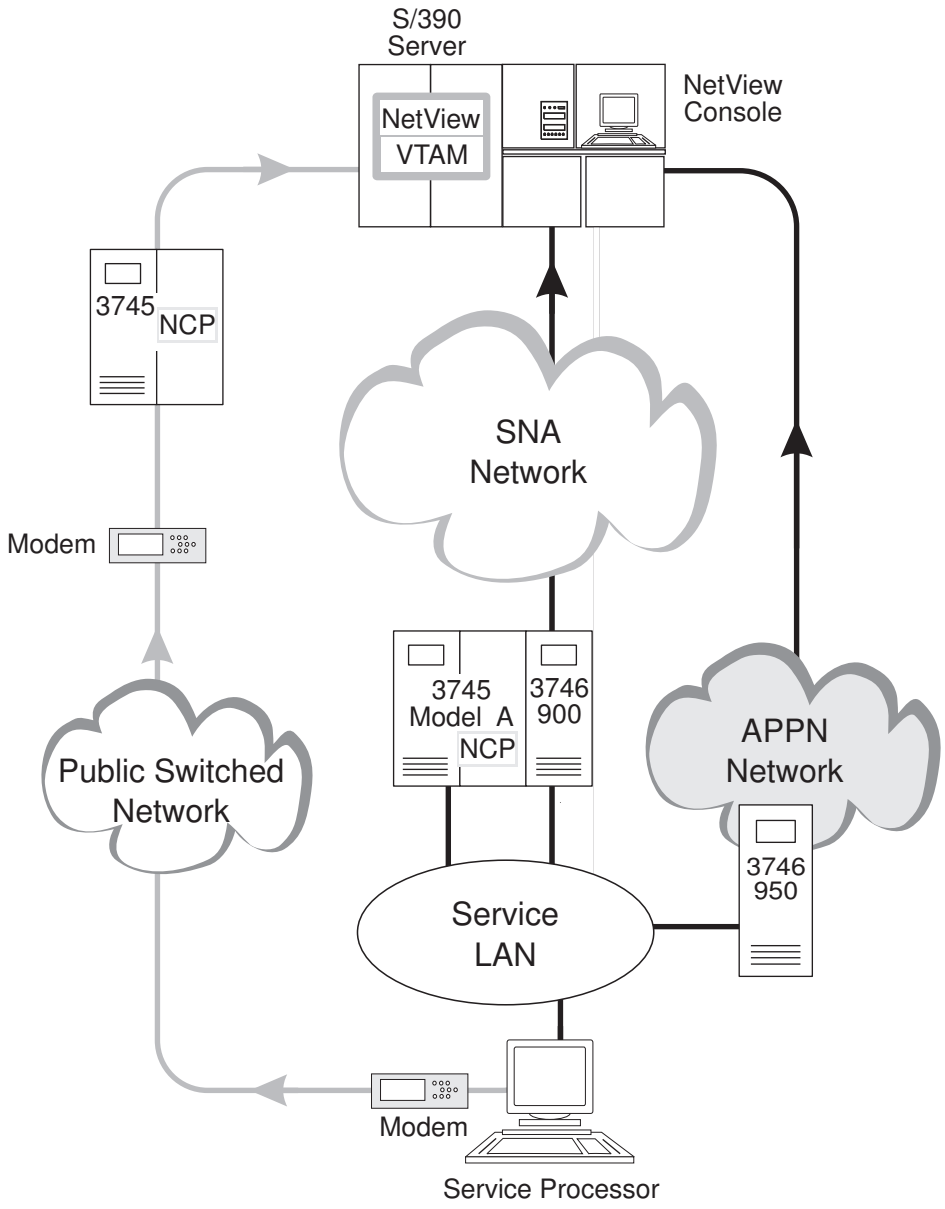
*Figure 6-1. Internet Protocol (IP) Environment*

## NetView/390

The NetView/390 program supports:

- Alert reporting for the 3745, the 3746-900, and the 3746-950.
- Displays of the APPN/HPR networking topology, including the local topology of the 3746 network.
- Operator commands, for example activating and deactivating the 3746 NN, (possibly automated or triggered by alerts in SNATAM).
- Operator RUNCMD commands, supported by the Extended Functions 4 and 3746 Extended Functions 5. For more information, see “Network Management from NetView for OS/390” on page 2-7 and “Enhanced Network Management for APPN/HPR Environments” on page 2-10.

The 3745 and 3746 alerts are sent to NetView over the SNA or APPN network. MOSS-E reports 3746 and service processor alerts to NetView via mainstream or alternate paths (see Figure 6-2 on page 6-4).




**Legend**:
Mainstream Path through SNA or APPN network
Alternate Path

*Figure 6-2. Alert Reporting to NetView*

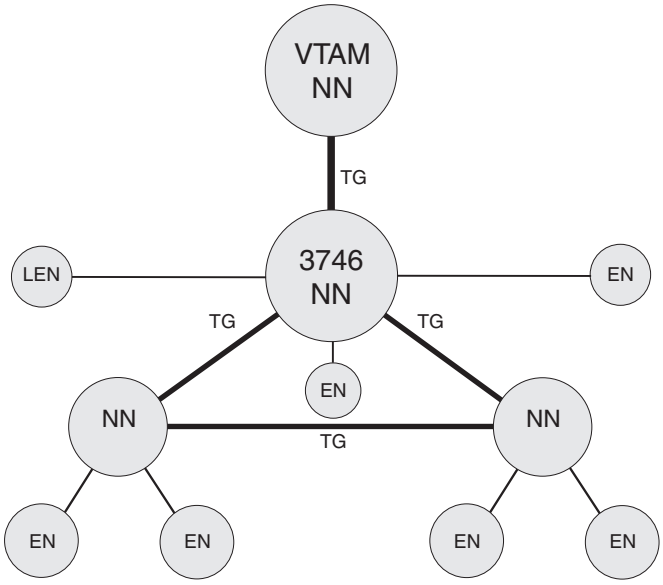
If the NetView console is a NetView Graphic Monitor Facility (NGMF) workstation running TME 10 Remote Control[3], it can also be used as a remote console to access the MOSS-E via the service processor. If no path is available through the user network, a NGMF workstation (or any workstation running TME 10 Remote Control[3]) can also use the public switched network to access the service processor.

[3] Tivoli Management Environment (TME) 10 Remote Control (no longer available) contains the Distributed Console Access Facility (DCAF) program. If needed, new Tivoli DCAF licenses can be obtained by ordering 5799-XEN (RPQ P85585) and the necessary features for 3745 and 3746 support.

The NGMF workstation, via the SNATAM function of NetView/390, provides a graphic display of the APPN/HPR network topology, including any of the following:

- APPN topology agent nodes
- Transmission Groups (TGs)
- Ports
- Logical links
- Network Nodes (NNs)
- End Nodes (ENs)
- Low Entry Networking (LEN) Nodes

CCM has the facility to display the local topology of 3746 APPN/HPR NNs (end nodes and dependent PUs). With TME 10 Remote Control[3] running in the NGMF workstation, the operator can remotely access 3746 NNs and run the configuration, local topology display, and network management functions of CCM. Changes in configuration and status are updated dynamically on the NetView graphic display.




**Legend:**

**EN** End Node
**LEN** Low Entry Networking
**NN** Network Node
**TG** Transmission Group
**VTAM** Virtual Telecommunications Access Method

*Figure 6-3. APPN/HPR Topology View of the Network*

## NetView Performance Monitor (NPM)

NPM reports data about the 3746 configuration, and traffic activity of resources activated by NCP or the NNP. This includes processor load and storage utilization of all the 3746 adapter processors (CBSP, ESCP, TRP, CLP), token-ring couplers, lines, frame-relay DLCIs and stations, and X.25 links. Performance monitoring contributes to capacity planning for the 3745 and 3746.

For more information on programming support in NPM, see Table F-5 on page F-4.

For more information on improved NPM functions, see "NetView Performance Monitor (NPM)" on page 2-11.

## NetView for AIX

The SNMP agent of the 3746 IP router supports standard management information base (MIB), and the new MIB for ESCON. This allows the 3746 IP router to be operated from NetView for AIX[2] or other SNMP management platforms. Along with the enhanced Router and Bridge Manager (RABM), NetView for AIX[2] supports:

- IP alerts from the 3746
- IP router topology display, including the 3746s
- IP traffic counters
- IP MIB access

## IBM Service Support

Service support for 3745 Models A and 3746 is provided through automatic problem reports sent to the IBM support center (also called the Remote Technical Assistance Information Network, or RETAIN®) and NetView (see Figure 6-4 on page 6-7). When a problem is detected in the 3745 or the 3746, the following occurs:

- A report is stored in an event log of the MOSS-E (SRC file).
- An alarm is displayed on the service processor panel.
- An alert is sent to NetView.

Users of IBM Remote Support Facility (RSF) can choose whether problems and error data are reported to the IBM support center automatically, or reported by the operator.

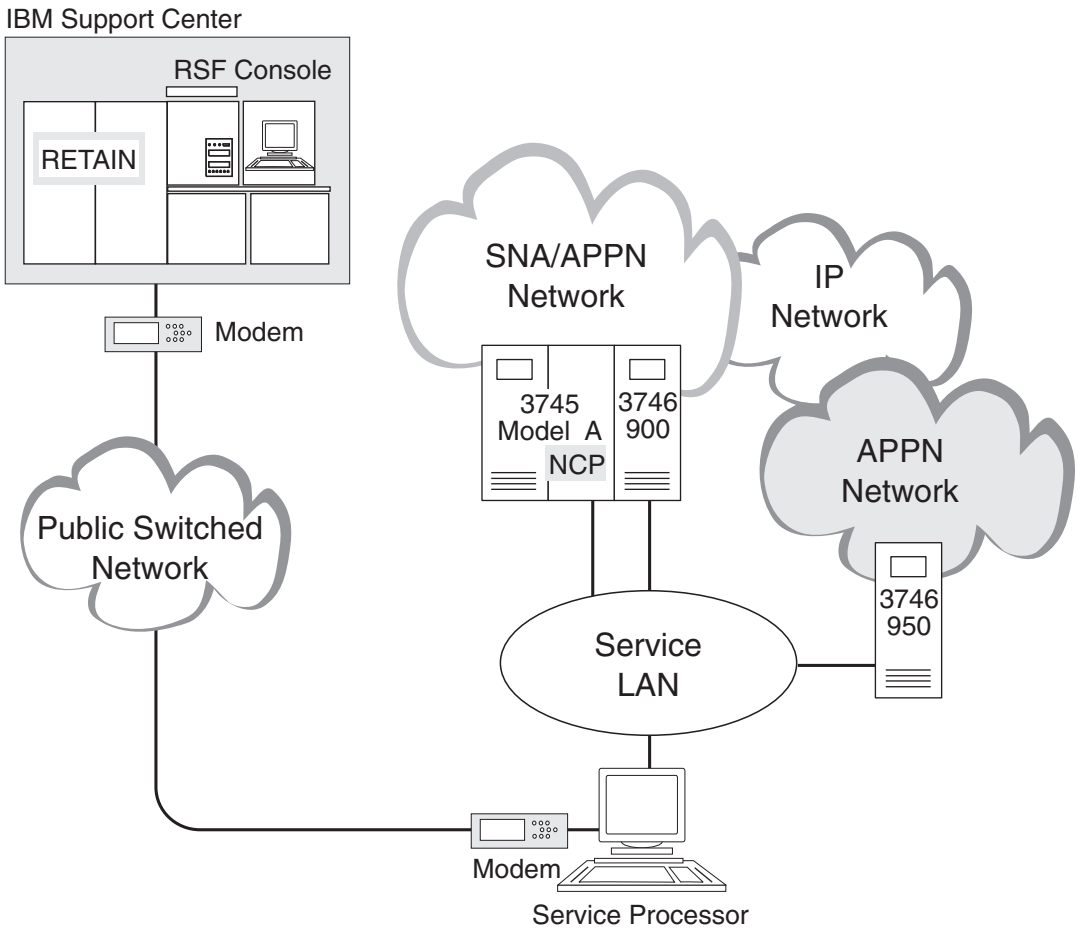



*Figure 6-4. RSF and RETAIN Connections*

Other services provided by the IBM support center include the following:

- Microcode changes for correcting problems can be automatically transferred from the support center to the service processor hard disk.
- If additional help is required, the support center can remotely access the service processor.
- If a hardware failure is detected, an IBM service representative will replace the failing part(s).

**Note:** If you have NetView, you can investigate a problem by using NetView alerts, and find additional information (3745 and 3746 alarms) at the service processor.

If you do not have NetView, you can review the messages stored in the VTAM event log (LOGREC) and find additional information (the alarms) at the service processor.

## More on the Service Processor

The service processor provides a single user interface for the 3745, 3746-900, and 3746-950 to perform operator and service functions.

The service processor runs the MOSS-E and performs the following:

- Maintenance and Operator Subsystem (MOSS) functions in the 3745.

  **Note:** The MOSS panels are the same as those displayed at the operator consoles of the 3745 Models 130, 150, 160, 170, 210, 310, 410, and 610.

- Graphic display and status of controllers connected to the service processor.
- Maintenance of the 3746.
- Operating the 3746 NN and IP router, including the MAE.

The MOSS-E works in a multi-task and window environment, and provides contextual on-line help.

The service processor also performs the following:

- Runs the CCM[4] program for:
  - Configuring the 3746 APPN/HPR NN and IP router (including the MAE). CCM includes ESCON Generation Assistant (EGA) functions.
  - Displaying information about the 3746 resources (for example, current local network topology).
  - Managing multiple configurations of 3746 resources.
- Loads the microcode of the 3746.
- Stores the 3746 files. For example, the configuration data file-extended (CDF-E) file containing information about 3746 hardware resources.
- Reports 3746 box errors as alerts to NetView and sends error codes to the IBM RSF. These error codes can also be stored locally and displayed.

## Connecting the Service Processor

The service processor communicates with the 3745 MOSS, the 3746, the MAE, and the NNP via a service LAN (16-Mbps token-ring). The service LAN can be shared with other 3745s and 3746s.

If the service LAN connects a 3746-900 operating as an IP router or APPN/HPR NN, or a 3746-950, the connection of user stations to the service LAN is not supported (the service LAN must be isolated from user traffic). Only Java Console workstations or TME 10 Remote Control[3] stations can be connected to the service LAN (for remotely controlling the service processor, or operating the 3746 NN and 3746 IP router). If remote console access to the service LAN is done via a bridge or router, appropriate LAN filtering must protect the service LAN segment. A service processor access unit (SPAU) is provided with the service processor for LAN connections to the 3745 and 3746 controllers.

4 CCM is also available in a stand-alone OS/2 version.

The 3745 Model A runs specific MOSS hardware and microcode to support communication with the service processor.

**Notes:**

1. Console ports of the 3745 Models 130, 150, 160, 170, 210, 310, 410, and 610 do not appear on the 3745 Models A.
2. Installations with multiple 3745s, 3746s, and service processors must have a service LAN for each service processor.

## Sharing the Service Processor

The service processor can support the following maximum configurations[5]:

- Four 3745s and two 3746-900s operating in an SNA mode (controlled by NCP).
- Four 3745s, one 3746-900 operating in an SNA mode (controlled by NCP), and one 3746-950 (see Figure 6-5).
- Four 3745s and two 3746-900s, one of which operates as an IP router and/or APPN/HPR NN (see Figure 6-6 on page 6-10).

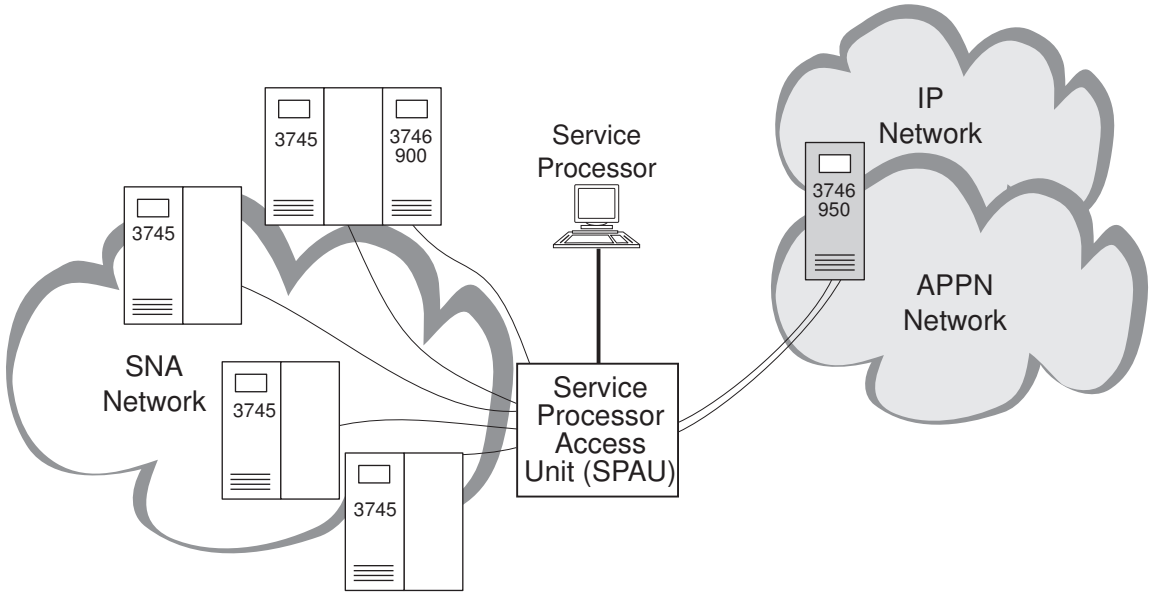



*Figure 6-5. Example 1 of a Maximum Configuration for a Service Processor. The service processor connects to four 3745s, one 3746-900 (SNA), and one 3746-950 (IP, APPN/HPR).*

[5] A service processor equipped with the 64 MB Memory Expansion (FC 5028, no longer manufactured), or preferably a Service Processor Type 2 (FC 5052), Type 3 (FC 5053), Type 4 (FC 5054), or a Service Processor upgraded to Type 3 (FC 5050) or Type 4 (FC 5450), is required for configurations exceeding one 3745, possibly equipped with a 3746-900, or one 3746.

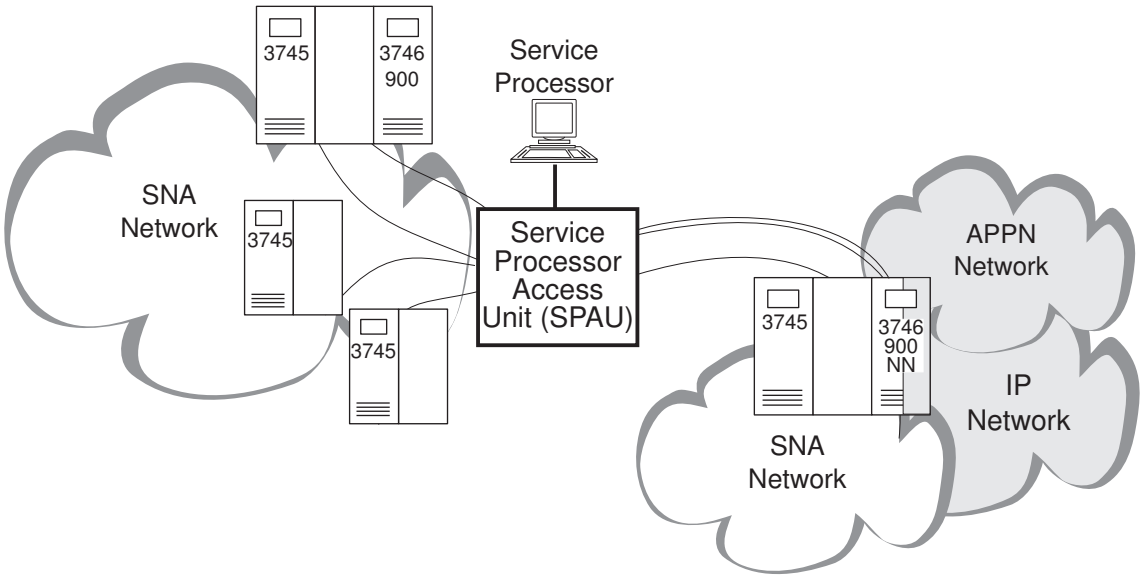



*Figure 6-6. Example 2 of a Maximum Configuration for a Service Processor. The service processor connects to four 3745s and two 3746-900s, one of them operating as an IP router and APPN/HPR NN.*

Connecting an additional machine to a service processor does not interrupt the machines that are already running.

Large installations that need more than four 3745s and two 3746s require several service processors, each with its own service LAN. However, a single Java Console workstation or TME 10 Remote Control[3] console located at a central control point can access and control all the 3745s and 3746s.

**Note:** A token-ring bridge cannot be installed between the service processor and the 3745s and 3746s it controls.

To facilitate service access, IBM recommends that all controllers be installed in the same room and within 10 m (33 ft) of the service processor.

## Backing Up the Service Processor

Although network operations are not affected if the service processor is temporarily inoperable, a second or backup service processor will provide a higher level of reliability.

During normal operations, the backup service processor is not connected to the service processor LAN and remains powered OFF most of the time. The hard disk of the backup service processor should be a duplicate of the active service processor. If recovery is necessary, then the failing service processor should be disconnected from the LAN, and the backup service processor connected and started up.

When a backup service processor has been installed, backing up requires the following procedure:

1. Copying the configuration data of the active service processor to the hard disk of the backup service processor.
2. Copying the active MOSS-E microcode to the hard disk of the backup service processor.

3. Repeating step 1 and 2 after each configuration or code change.

## Remote Workstation Access to the Service Processor

A remote workstation can be configured to control the MOSS-E running in a service processor. In this type of configuration, the remote workstation functions as the controlling workstation, and the service processor functions as the target workstation.

By utilizing this type of remote access, a user can run the MOSS-E as though seated in front of the target service processor.

Remote workstation access to the service processor is possible through one of the following:

- TME10 Remote Control[3] (see "Accessing the Service Processor Via TME 10 Remote Control" below)
- Java Console (see "Accessing the Service Processor Via Java Console" on page 6-13)
- Telnet (see "Accessing the 3746 IP Router Via Telnet" on page 6-14)

## Accessing the Service Processor Via TME 10 Remote Control

Operator consoles can access the service processor MOSS-E by using TME 10 Remote Control[3]. The service processor becomes the TME 10 Remote Control target workstation and the console becomes the remote TME 10 Remote Control (controlling) workstation (see Figure 6-7 on page 6-12). Requirements for running TME 10 Remote Control are as follows:

- TME 10 Remote Control 2.1 with APARs (DCAF 1.3 with CSD 1.3.3 and APARs) can control service processors equipped with an optical disk drive.
- TME 10 Remote Control 2.0 (DCAF 1.3 with CSD 1.3.3) and Tivoli DCAF 1.3.4 (RPQ P85585)[3] can control service processors equipped with CD-ROM drive or optical disk drive.

**Note:** Only one remote console can control the service processor at a given time.

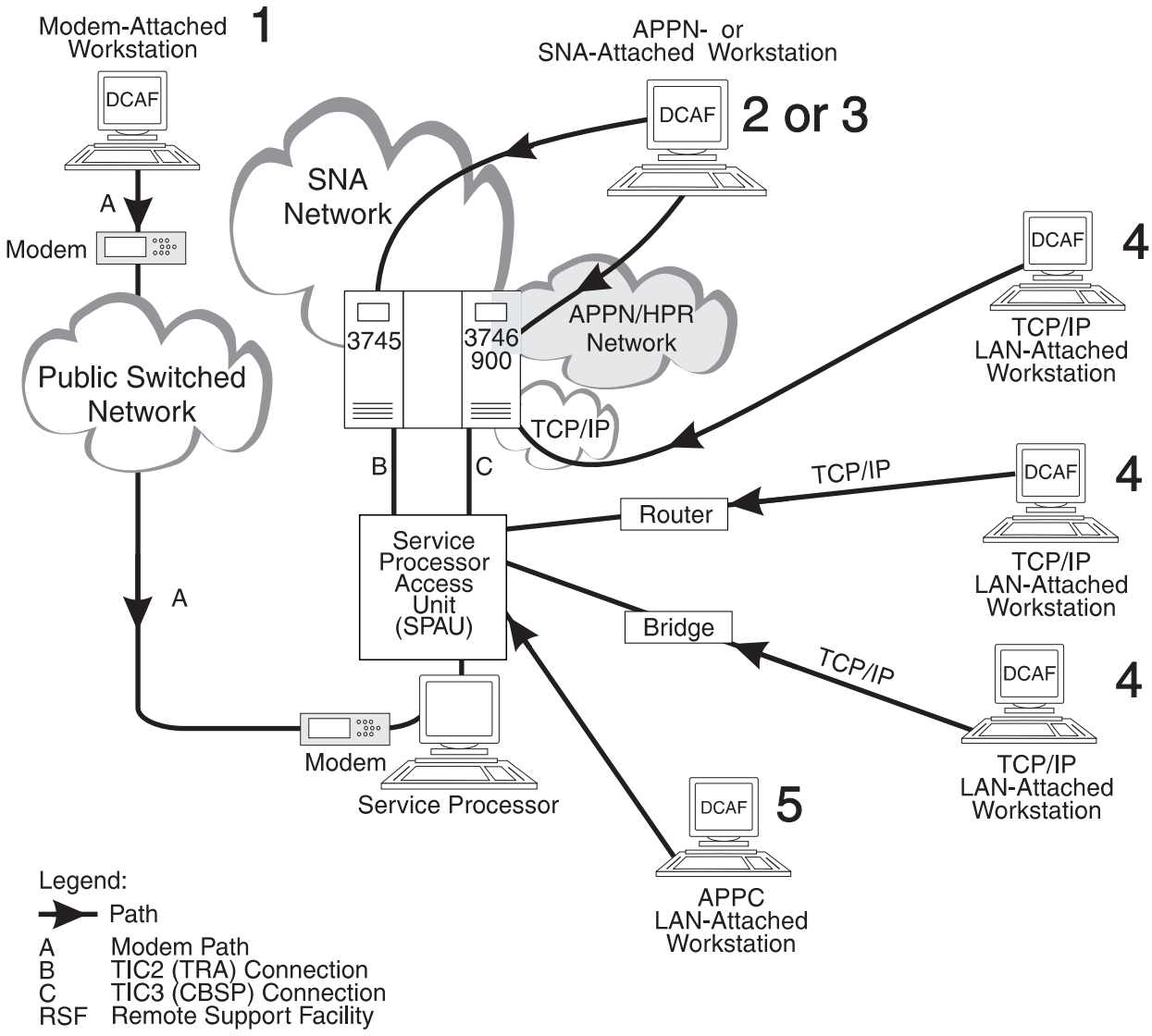



*Figure 6-7. Console Attachments*

The numbers in Figure 6-7 represent the following types of console connection to the service processor:

**1**, **Modem-attached** consoles that use the public switched telephone network to access the service processor via a Synchronous Data Link Control (SDLC) port and modem.

**2**, **APPN-attached** console communicating with the service processor via an LU6.2 session over the network backbone.

**3**, **SNA-attached** console communicating with the service processor via an Logical Unit (LU) 6.2 session over the network backbone.

**4**, **TCP/IP LAN-attached** console attached to the SPAU via a bridge or a router with appropriate filtering.

**5**, **APPC LAN-attached** console attached directly to the Service Processor Access Unit (SPAU), or indirectly through a token-ring LAN bridge.

**Note:** The same port and modem is used for RSF and RETAIN calls.

### Hardware Requirements and Recommendations

For workstations operating as TME 10 Remote Control (DCAF) consoles of the 3745 and 3746, IBM recommends using:

- PS/2s (or equivalent) with at least a 80386 microprocessor and VGA display (for example, an IBM 8515 color display).
- A hard disk of at least 8 MB and at least 10 MB of storage (RAM).
- A pointing device.
- A QWERTY keyboard is necessary. If this type of keyboard is not available, then the QWERTY equivalent keys must be used. For example, on an AZERTY keyboard, you must use the "q" key when you want to type an "a".

  **Note:** To find the equivalent keys on IBM non-QWERTY keyboards, refer to OS/2 documentation on keyboard layouts or codes.
- For a LAN-attached console (APPC or TCP/IP type), an IBM token-ring Network Adapter A, operating at 16 Mbps.
- For a modem-attached console, a synchronous modem (such as an IBM 7857, 7858 or equivalent) and a multiprotocol adapter (MPA) card.

  **Note:** If the modem does not provide dialing capability, a telephone set must be provided for dialing the service processor.

  Required characteristics of the service processor modem are provided in Chapter "Physical Planning Details" of the *Planning Series: Physical Planning*, GA27-4238.

## Accessing the Service Processor Via Java Console

Java Console enables a local workstation to control a remote service processor. While DCAF is required for SNA-based networking, Java Console takes advantage of the flexibility in IP networking.

### Java Console Support

#### Communications

Java Console supports communications using TCP/IP protocol over the following connections:

- Asynchronous line
- LAN

#### Programming Requirements

Requires the 3745 Java Console Support (FC 5801), or the 3746 Extended Functions 3 (FC 5801[6]), or the Extended Functions 4 (FC 5810 or 5811). Java Console runs on OS/2 Warp (versions 3 and 4), Windows (95, 98, and NT), AIX/UNIX, and Macintosh workstations, with TCP/IP protocol installed, via a Web browser or Java application program.

#### Network browsers

Java Console has been tested with the following network browsers:

- Internet Explorer Version 4.01 for Windows 95
- Netscape Communicator Version 4.04 for Windows 95

[6] No longer available.

- Netscape Explorer Version 2.02 with Java Version 1.1 for OS/2 Warp

**Mouse and Keyboard**

Both the mouse and keyboard remain active for the remote workstation and the service processor during a Java Console session.

## Accessing the 3746 IP Router Via Telnet

Along with the remote access capabilities described in “Remote Workstation Access to the Service Processor” on page 6-11, it is possible to access the 3746 IP router for configuration and management purposes via Telnet from an IP station (see “Telnet Support for IP Operations” on page 6-2).

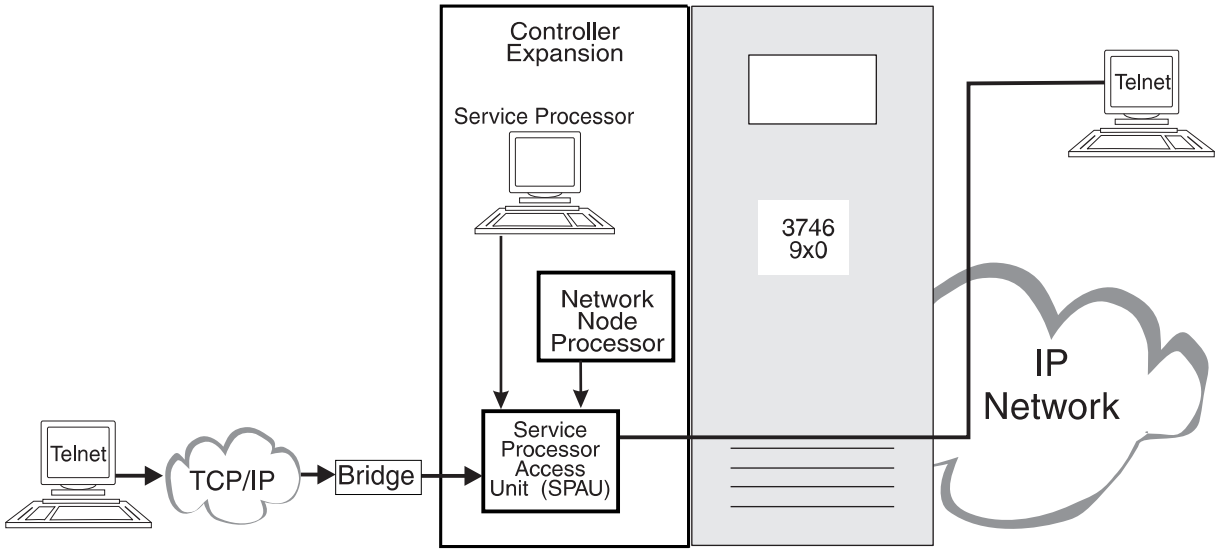



*Figure 6-8. Telnet Remote Console Attachments.*

**Please note!**

A Telnet remote console cannot access MOSS-E functions.

### Hardware Requirements and Recommendations

To access the 3746 IP router via Telnet, the workstation must support IP with Telnet Client. Attachments can be the following:

- LAN (token-ring, Ethernet)
- WAN links (frame-relay, Point-to-Point Protocol)

## Fast NCP Dump Transfer (3746-900)

The service processor reserves hard disk space for up to four NCP dumps from attached 3745 Model As. Only one dump per CCU can be stored at a time.

MOSS-E can transfer NCP dumps from the service processor hard disk to an S/390 server via the SNA backbone. This is used instead of a VTAM command, and significantly reduces the dump transfer time (recommended for the 16 MB CCU storage feature). This method uses 3270 terminal emulation on the service processor to transfer the dump file.

# Chapter 7. High Availability

The 3745 Models A, the 3746-900, and the 3746-950 are designed to continue operating during most of the upgrade procedures and maintenance, and remain fully functional if there is network disruption or congestion. This design facility includes the following functions:

- Backup
- Microcode management
- Concurrent upgrade
- Concurrent maintenance
- Customer access
- Component reliability

## Backup

The following equipment and functions are designed to increase the availability of the 3745, 3746-900, and 3746-950:

**Second Power Supply**
Installing a second power supply in the 3746 to automatically and non-disruptively take over network operations if the active power supply fails.

**Twin-Backup or Twin-Dual Mode (3745 CCUs)**
A 3745 Model 41A or 61A with two active NCPs, one in each CCU, operates the 3746-900 as follows:

- Each ESCON channel adapter can carry traffic for both CCUs.
- Any LAN or WAN port can be activated by the NCP in either CCU.
- After deactivation by one NCP, the LAN or WAN port can be activated in the other NCP.

**Token-Ring LANs**
The TICs of the 3745, the 3746-900, and the 3746-950 support TIC port swapping, duplicate TIC address, and token-ring non-disruptive route switching and, with the Extended Functions 4 (FC 5810 or 5811), token-ring connection balancing. For more information, see “Improved Performance through Connection Balancing” on page 2-8.

**Note:** The 3746 NN and IP router does not support TIC port swapping.

**Communication Line Processor (CLP, CLP3)**
Two adjacent CLPs or CLP3s, properly configured, can operate in backup mode. Normally, each processor controls one or two LICs. If one processor fails, the second CLP or CLP3 automatically takes control of the LICs attached to the failed processor. This increases controller availability for users of communication lines. The Extended Functions 4 (FC 5810 or 5811) provides frame-relay BAN connection balancing, allowing back-up between adapters and machines. For more information, see “Improved Performance through Connection Balancing” on page 2-8.

**ESCON Director (ESCD)**
ESCDs can have backup channel connections for increased system availability.

**Parallel Transmission Groups (TGs)**

For APPN/HPR traffic, parallel TGs can be defined on:

- ESCON
- LAN ports
- Frame-relay and SDLC links

For NCP-controlled traffic, parallel TGs can be defined on:

- ESCON
- Parallel channels

**Multi-Link Transmission Group (MLTG)**

Support for MLTG can be configured in the following:

- 3745 and 3746-900 SNA subarea traffic controlled by NCP (see page 4-5).
- 3746 HPR traffic (see page 4-1).

If a link of the MLTG fails, the corresponding sessions are automatically rerouted over the other links, without session disruption.

**Frame-Relay Frame Switching Substitute Subport**

Substitute subports are available in the 3745 and 3746 for frame-relay PVCs to be controlled by the NCP and/or 3746 NNP (see page 4-11).

**Service Processor Backup**

Installing a second service processor for higher availability. For more information, see "Backing Up the Service Processor" on page 6-10.

**Dual Network Node Processor (NNP)**

Installing two NNPs in the 3746-900 and the 3746-950 for higher availability. Each NNP alternates active and standby modes. If the active NNP fails, the standby NNP becomes active.

**Persistent Communications (LU-LU Sessions)**

The 3746 NNP establishes user sessions via the adapters of the 3746, but does not route the traffic. When LU-LU sessions are established, all user traffic is routed by the adapters. This means that established user traffic (for example, user sessions with S/390 server applications) remains uninterrupted if the NNP fails.

## Dual Level of Licensed Internal Code

Two levels of 3746 code can be installed on the hard disk drive of the service processor, provided it is equipped with CD-ROM[1].

**Important:** When the service processor is shared between two 3746-900s, the same level of code operates in both 3746-900s. The other level of code is "non-active," ready to be loaded in both 3746-900s (see description below).

**Note:** If the new code level to be installed contains a new version of operating system for the service processor, this function is unavailable.

[1] Service Processors Type 2 (FC 5052), Type 3 (FC 5053), Type 4 (FC 5054), and service processors upgraded to Type 3 (FC 5050) or Type 4 (FC 5450) are equipped with a CD-ROM and new levels of code are provided on a CD-ROM media. Service processors equipped with an optical disk drive do not support two levels of code per 3746.

### On-Line Code Upgrades

The 3746 remains fully operational, including the service processor, during the installation of a new code level. While the new code is being installed as the 'non-active' level, the 3746 remains in production on the current 'active level'.

The 3746 is interrupted only during activation of the non-active level (re-IML), which lasts about 5 to 15 minutes, depending on the number of processors in the 3746 configuration. You may perform this activation at a later time, when it is convenient with network operations.

### Backup Production Level

After the new code level has been activated, the previous production level becomes 'non-active', but remains available for possible reactivation if you need to switch back to this production level. If this is needed, the 3746 interruption time is again limited to the re-IML time of the 3746.

### Testing a Non-Active Level

The dual level of code also allows you to test a new level of code, maintenance level or functional level, by taking advantage of unused machine time. For example, you can activate a trial level of code and then come back to the production level when required.

## Concurrent Upgrade

A processor, coupler, LCB, or ARC can be installed on a 3746-900 or 3746-950 while the machine is running. Adapters can be installed on the 3745 Model 21A, 31A, 41A, and 61A while the machine is running (except new adapters that require the same power supply of an adapter already installed).

The low-speed scanner (LSS) configuration of a 3745 Model 21A, 31A, 41A, or 61A can be upgraded while the machine is running, provided the 3745 is not using the resources of the 3746-900.

**New basic configuration for models 31A and 61A**

New 3745 Models 31A and 61A no longer include low-speed scanners in the basic configuration.

Concurrent upgrades can occur whatever type of routing protocol is used (SNA, IP, or APPN/HPR).

## Concurrent Maintenance

Concurrent maintenance is a method of running the machine with backup equipment, while your IBM service representative diagnoses the problem with any failed equipment.

A processor, coupler, LCB, or ARC can be replaced on a 3746-900 or a 3746-950 while the machine is running. Adapters can be replaced on the 3745 Models 21A, 31A, 41A, and 61A while the machine is running (except for new adapters that require the same power supply of an adapter already installed).

**Note:** Concurrent maintenance can occur no matter what type of routing protocol is used (SNA, IP, or APPN/HPR).

## Customer Access

ARCs, LCBs, and associated cables are user-accessible. You can modify the hardware configuration for low- and medium-speed lines, or replace an LCB or ARC without needing an IBM service representative.

**Note:** Couplers for the 3746 (LIC11, LIC12, and LIC16) are not user-accessible for installation or replacement.

## Reliable and Duplicated Components

All components of the 3746-900 and 3746-950 are designed for high reliability. Some components are duplicated beyond the minimum requirements of the machine in case of equipment failure. For example:

- Adapters and couplers are individually attached to the power supply so that if one fails, the others continue to work.
- There are multiple cooling fans so that if one fails, the remaining fans can sufficiently cool the frame.

# Appendix A. Configuration Options for the 3745 Model 170

This appendix describes the configuration options of the 3745 Model 170. For additional information about the 3745-170, refer to *3745 Models 130, 150, 160, and 170: Introduction*, GA33-0138.

**Note:** Only the 3745 Models A support the attachment of a 3746-900.

## 3745 Model 170 Minimum Configuration

The 3745-170 runs under the control of NCP and contains the following basic features:

- Central Control Unit (CCU)
- 4 MB memory (expandable to 8 MB)
- Input/Output Control (IOC) bus
- Direct Memory Access (DMA) bus

The Maintenance and Operator Subsystem (MOSS) in the 3745 runs the hard disk drive, diskette drive, control panel, and two communication ports for attachment to operator consoles.

## Network Expansion Through 3745-170 Adapters

## Channel Adapter - FC 1563

Provides the interface between the 3745 and IBM 4341, 4361, 4381, 937X, 3090, ES/9000, or S/390 processors. Support includes the following types of attachment:

- To a byte multiplexer, block multiplexer or selector channel.
- In Data Streaming mode, to a block multiplex channel of an IBM 937X, 3090 or ES/9000.
- To an IBM 3044 Model D02 with the Enhanced Tape Attachment (ETA), FC 6053, enabling a host connection of up to 2 km (1.24 miles) fiber cable length.
- When not operating in Data Streaming mode, supports attachment to an IBM 3044 Model D01 Fiber Optic Channel Extender Link (only with NCP).
- ESCON I/O channel via the IBM 9034 ESCON Converter.

Cable group 0185[1] (channel cable) is available for this adapter (and one EPO cable group code 1178 if required). Otherwise, FC 2999[1] includes the channel cable for this adapter.

[1] In selected countries, FC 2999 is a generic reference for ordering standard cables along with adapter features. For example, for a Token-Ring Adapter (FC 4771), two 9 meter cables are shipped with this adapter for token-ring connection. For more information about these cables and other cable options, see the chapter "Physical Planning Details" of the *Planning Series: Physical Planning*, GA27-4238.

## Buffer Chaining Channel Adapter (BCCA) - FC 1573

Provides the interface between the 3745 and an IBM 4381, 937X, 3090, or ES/9000 processor. Support includes the following types of attachment:

- To a byte multiplexer, block multiplexer or selector channel.
- In Data Streaming mode, to a block multiplex channel of an IBM 937X, 3090 or ES/9000.
- To an IBM 3044 Model D02 with the Enhanced Tape Attachment (ETA) FC 6053, enabling a host connection at up to 2 km (1.24 miles) fiber cable length.
- When not operating in Data Streaming mode, supports attachment to an IBM 3044 Model D01 Fiber Optic Channel Extender Link (only with NCP).
- ESCON I/O channel via the IBM 9034 ESCON Converter.

Operates with the same functions as the Channel Adapter FC 1563 in DCI, HS or Data Streaming mode, or operates with a buffer chaining process and improved performance when attached to a block multiplex channel of an IBM 937X, 3090 or ES/9000. The BCCA supports Native Sub-Channel only. Emulator Sub-Channels in PEP or stand-alone EP configurations are not supported. Cable group 0185[1] (channel cable) is available for this adapter (and if required, one EPO cable group FC 1178). Otherwise, FC 2999[1] includes the channel cable for this adapter.

## Ethernet LAN Adapter - FC 4781

When using Carrier Sense Multiple Access/Collision Detection (CSMA/CD), this feature provides the attachment to Ethernet V.2 or IEEE 802.3 LAN through OEM Attachment Unit Interface (AUI) transceivers. AUI transceivers are required to meet the standards in the IEEE 802.3 Recommendation, and support the Signal Quality Error (SQE) test signal enabling. This feature is plug compatible with the High-Speed Scanner FC 4741. External cabling is made through IEEE 802.3 15-pin D-type female AUI connectors on the tail-gate. This feature comes with two LAN ports which can be active at the same time.

Cables for this adapter are not provided and must meet IEEE 802.3 specifications.

## Token-Ring Adapter (TRA) - FC 4771

Provides two attachment ports to a token-ring network using standard protocols. Supports attachment to a 4-Mbps token-ring via IBM Cabling System, or telephone twisted pair wiring, and to a 16-Mbps token-ring via IBM Cabling System (speeds are software selectable per port). In the IBM 3745 Model 170, this feature supports the following:

- Message segmenting up to 4 Kb per segment at 4 Mbps, and up to 16 Kb per segment at 16 Mbps.
- Early Token Release option at 16 Mbps.
- Mixing INN and BNN traffic on the same TRA port.

*Table A-1. Cables Compatible with FC 4771*

| Country | Cable group[1] |
|---|---|
| Except Japan | 1666 |
| Japan | 1667 |

FC 2999[1] includes two cables for this adapter.

# Additional Network Expansion Options

## Low-Speed Scanner - FC 4721

Controls the data and data link control for communication lines operating at speeds up to 256 kbps.

## High-Speed Scanner - FC 4741

Provides scanner functions for the attachment of a V.35 or X.21 SDLC non-switched data link, operating at speeds up to 2.048 Mbps. Data links include the following:

- Unframed T1[2] (1.544 Mbps) through Network Communication Terminal Equipment (NCTE).
- T1 Multiplexer[3], for example, an Integrated Digital Network Exchange IDNX/20 (IBM 9736), IDNX/40 (IBM 9737), IDNX/70 (IBM 9738[3]), the AVANTI ACCUPAC or the VERILINK 551 VCC when not directly attached.

  **Note:** The 3745 can benefit from the AT&T DACS service by selecting a compatible NCTE, for example the IDNX or the VERILINK 551 VCC.

The HSS can operate as an INN link between two 3745s, or between a 3745 and a 3725 or 3720, if attached to a LIC Type 3 or LIC Type 4B. Line speeds for direct attachment can be selected from 245 kbps, 1.475 kbps, and 1.843 kbps (limited to 245 kbps for 3745-3725 or 3745-3720 INN links). HSS provides two physical ports (only one can operate at a time).

*Table A-2. Cables Compatible with FC 4741*

| Country | Equipment | Attachment | Cable group[1] |
|---|---|---|---|
| Except Japan | 3745 to 3745, 3745 to 3720, 3745 to 3725 | V.35 DTE | 5837[1] |
| - | 3745 to 3745, 3745 to 3720, 3745 to 3725 | V.35 DCE | 5831[2] |
| - | 3745 to 3745, 3745 to 3720, 3745 to 3725 | X.21 DTE | 5839[1] |
| - | 3745 to 3745, 3745 to 3720, 3745 to 3725 | X.21 DCE | 5844[2] |
| - | 3745 to 3745 | EIA-547 DTE | 5845[1] |
| - | 3745 to 3745 | EIA-547 DCE | 5844[2] |
| Japan | 3745 to 3745, 3745 to 3720, 3745 to 3725 | V.35 DTE | 5836[1] |
| - | 3745 to 3745, 3745 to 3720, 3745 to 3725 | V.35 DCE | 5830[2] |
| - | 3745 to 3745, 3745 to 3720, 3745 to 3725 | X.21 DTE | 5838[1] |
| - | 3745 to 3745, 3745 to 3720, 3745 to 3725 | X.21 DCE | 5832[2] |
| - | 3745 to 3745, 3745 to 3720, 3745 to 3725 | EIA-547 DTE | 5843[1] |
| - | 3745 to 3745, 3745 to 3720, 3745 to 3725 | EIA-547 DCE | 5842[2] |

**Notes:**

1. For a 3745 which provides clocking.
2. For a 3745 which receives clocking.

[2] Available in Canada only.

[3] Not available in Canada.

FC 2999[1] includes one DCE cable for this adapter. Order a second cable by part number for V.35 or X.21 DCE attachment when the two ports are actually used.

## LIC Base Type 1 - FC 4902

The LIC Base Type 1 (LIB1) houses up to 8 LICs of Type 1, 3, 4A, or 4B, divided into two areas of 4 LICs each. LIC Types can be mixed in the same area.

## Line Interface Coupler (LIC) Type 1 - FC 4911

Provides four RS-232-D/CCITT V.24 interfaces for communication lines operating at transmission speeds up to 19.2 kbps. The lines can be used either for duplex or half-duplex data transmission. Each interface may also be used as a port for RS-366/CCITT V.25, V.25bis, X.20bis, or X.21bis transmission. LIC Type 1 provides direct attachment (without modem) from 50 bps up to 19.2 kbps, and also provides attachment to lines using the Airlines Line Control (ALC) protocol.

**Note:** For each LIC Type 1, four cables must be ordered; for DCE, autocall equipment and/or direct attachment.

*Table A-3. Cables Compatible with FC 4911*

| Country | Type of attachment | Cable group[1] |
|---|---|---|
| Except Japan | Not supporting X.21bis | 1604 |
| - | Supporting X.21bis for DCA | 8154 |
| - | Automatic calling units | 1616 |
| - | Asynchronous DTEs | 1607 |
| - | Synchronous DTEs | 1611 |
| Japan | Not supporting X.21bis | 1628 |
| - | Supporting X.21bis for DCE | 8154 |
| - | Not supporting X.21bis for NTT DCE | 1621 |
| - | Supporting X.21bis for NTT DCE | 8153 |
| - | Automatic calling units | 1610 |
| - | Asynchronous DTEs | 1612 |
| - | Synchronous DTEs | 1627 |
| - | NTT automatic calling units | 1634 |

FC 2999[1] includes 4 DCE cables for this adapter.

**Prerequisites:** For ALC operation, the IBM 3745-170 may require any or all of the following:

- LIC Base Type 1, FC 4902
- Low-Speed Scanner, FC 4721
- RPQ 7L1148 for ALC operation

## Line Interface Coupler (LIC) Type 3 - FC 4931

Provides attachment for one non-switched communication line via the CCITT V.35 interface at speeds up to 256 kbps. The line may be used either for duplex or half-duplex data transmission. LIC Type 3 provides direct attachment (without modem) at up to 245 kbps.

| Table A-4. Cables Compatible with FC 4931 | | |
|---|---|---|
| **Country** | **Type of attachment** | **Cable group[1]** |
| Except Japan | DCE | 1613 |
| - | Direct attachment | 1605 |
| Japan | DCE | 1618 |
| - | Direct attachment | 1623 |

FC 2999[1] includes a DCE cable for this adapter.

**Prerequisites:** A LIC Type 3 on the IBM 3745-170 may require any or all of the following:

- LIC Base Type 1, FC 4902
- Low-Speed Scanner, FC 4721

## Line Interface Coupler (LIC) Type 4A - FC 4941

Provides four RS-422/CCITT X.21 interfaces for communication lines operating at speeds up to 9600 bps. Supports both switched and non-switched operation, and conforms to the CCITT V.11 Recommendation. Provides direct attachment (without modem) at 2400, 4800, or 9600 bps.

| Table A-5. Cables Compatible with FC 4941 | | |
|---|---|---|
| **Country** | **Type of attachment** | **Cable group[1]** |
| Except Japan | DCE | 1606 |
| - | Direct attachment | 1608 |
| Japan | DCE | 1624 |
| - | Direct attachment | 1625 |

**Prerequisites:** A LIC Type 4A on the IBM 3745-170 may require any or all of the following:

- LIC Base Type 1, FC 4902
- Low-Speed Scanner, FC 4721

**Availability:** No longer manufactured. Cable groups and FC 2999 are no longer applicable to this adapter.

## Line Interface Coupler (LIC) Type 4B - FC 4942

Provides one RS-422/CCITT X.21/X.24 interface for a communication line operating at speeds up to 256 kbps. Supports both switched and non-switched operation, and conforms with the CCITT V.11 Recommendation. Provides direct attachment (without modem) at up to 245 kbps.

| Table A-6. Cables Compatible with FC 4942 | | |
|---|---|---|
| **Country** | **Type of attachment** | **Cable group[1]** |
| Except Japan | DCE | 1606 |
| - | Direct attachment | 1608 |
| Japan | DCE | 1624 |
| - | Direct attachment | 1625 |

FC 2999[1] includes a DCE cable for this adapter.

**Prerequisites:** A LIC Type 4B on the on the IBM 3745-170 may require any or all of the following:

- LIC Base Type 1, FC 4902
- Low-Speed Scanner, FC 4721

## Memory Expansion - FC 7101

A memory expansion of 4 MB (bringing the total to 8 MB), designed to support NCP load modules of up to 6 MB.

# Appendix B. 3745 Models A and 3746 Minimum Configurations and Upgrades

This chapter describes the following:

- Minimum configuration requirements for running a 3745 Model A, a 3746-900, and a 3746-950.
- Upgrade possibilities for the 3745 (all models) and the 3746 (see "3745 and 3746-900 Migration Paths and Upgrades" on page B-6).

## 3745 Models A Minimum Configuration

The 3745 Models A supports the attachment of a 3746-900. All 3745 Models (17A, 21A[1], 31A, 41A[1], and 61A) require a service processor running MOSS-E and are shipped with 4 MB storage.

## 3745 Models 21A and 41A Minimum Configuration

These models include the following additional basic equipment:

- Eight LICs (any mix of LIC types).
- Two Low Speed Scanners (LSS).
- One LIC unit.

**Availability:** No longer manufactured.

## 3745 Models 31A and 61A Minimum Configuration - FC 8000

New 3745 Models 31A and 61A have no basic features and are identified by including FC 8000 in the order. Any Low-Speed Scanner (LSS), Line Interface Coupler (LIC), or LIC unit is optional.

## Service Processor Type 4 - FC 5054

The service processor[3] includes the MOSS-E Licensed Internal Code required for running the 3745 and 3746.

An RSF modem is provided with the service processor in selected countries, depending on national telecommunication regulations.

One service processor can handle up to four 3745s and two 3746s.

A service processor access unit (SPAU) is included with the service processor. The SPAU includes 8 ports for inter-connecting controllers, the service processor, and NNPs on a service token-ring. The 3746 base enclosure is equipped with a token-ring port (a TIC3) for communications with the service processor. For more information about the Service Processor Type 4 (and Service Processor Upgrade to Type 4), see "Service Processor Type 4 - FC 5054" on page C-13 and "Service Processor Upgrade to Type 4 - FC 5450" on page C-13 respectively.

[1] The 3745 Models 21A and 41A are no longer manufactured.

## 16 MB Storage - FC 7200

Provides a CCU storage of 16 MB for the 3745 Models 31A and 61A only[2]. When this feature is installed, the ACF/NCP load modules can be up to 12 MB.

To take advantage of this feature, the other 3745 models can be upgraded as follows:

- 3745 Models 210, 310, and 21A, upgraded to a 3745 Model 31A or 61A.
- 3745 Models 410, 610, and 41A, upgraded to a 3745 Model 61A.

## Java Console Support - FC 5801

For 3745 Models 17A, 21A, 31A, 41A, and 61A not equipped with a 3746 Model 900, this Licensed Internal Code feature provides the following:

- Java Console, a remote access control program that allows a remote workstation to control the service processor.
- Java Console file manager function for downloading and uploading files (for example, CCM configuration files) from the remote workstation to the 3745 service processor.

# 3746 Minimum Configuration

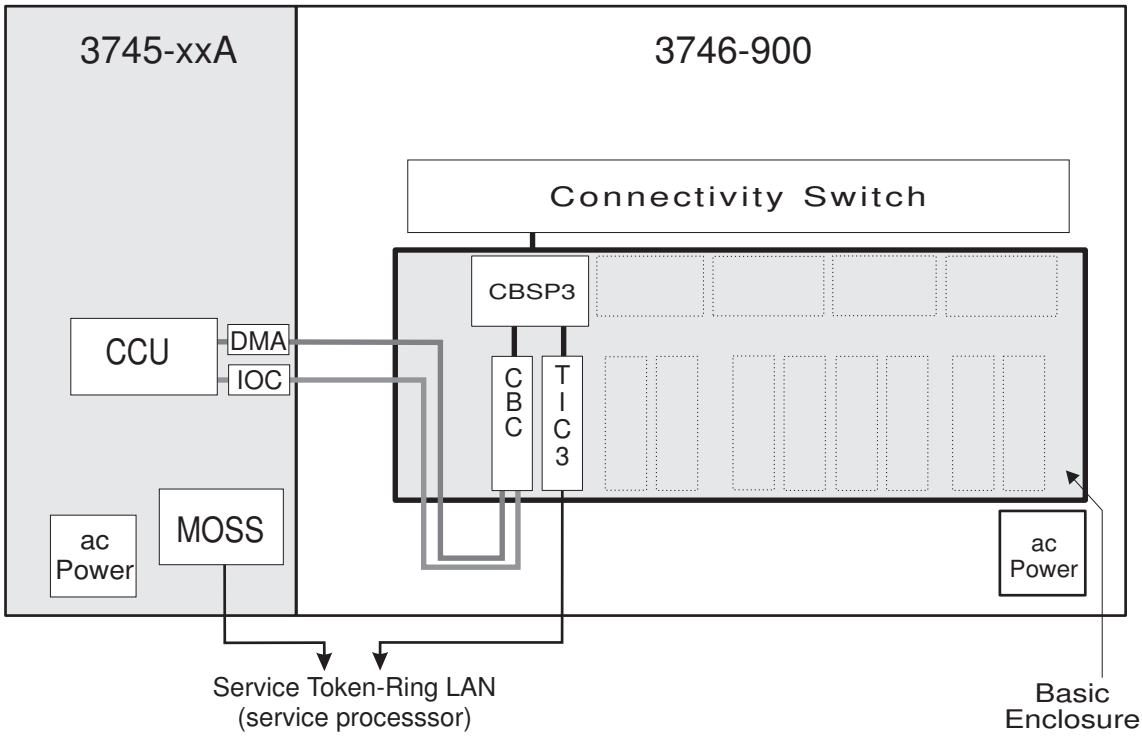
## 3746-900 Minimum Configuration

The minimum configuration for a 3746-900 to operate is the hardware attachments to the CCU of the 3745 and to the service processor (see Figure B-1 on page B-3).

**Note:** Operations as an APPN/HPR Network Node or IP router require a CBSP Type 2[3] or Type 3, an NNP[3] or NNP Type 2[3], Type 3[3] or Type 4 and a controller expansion (see "3746-950 Minimum Configuration" on page B-3).

[2] The CCU storage of the 3745 Models 17A, 21A, 31A, 41A, and 61A can be optionally increased by adding the 4 MB storage increment (FC 7100) to enable ACF/NCP load modules of 6 MB. The amount of storage in the two CCUs of Model 61A must be the same. The amount of storage in the two CCUs of Model 41A must be the same (limited to 8 MB).

[3] The NNP, NNP Type 2 (NNP2), NNP Type 3 (NNP3), CBSP, CBSP Type 2 (CBSP2), and service processors Type 1 (FCs 5020 and 5021), Type 2 and Type 3 are no longer manufactured.



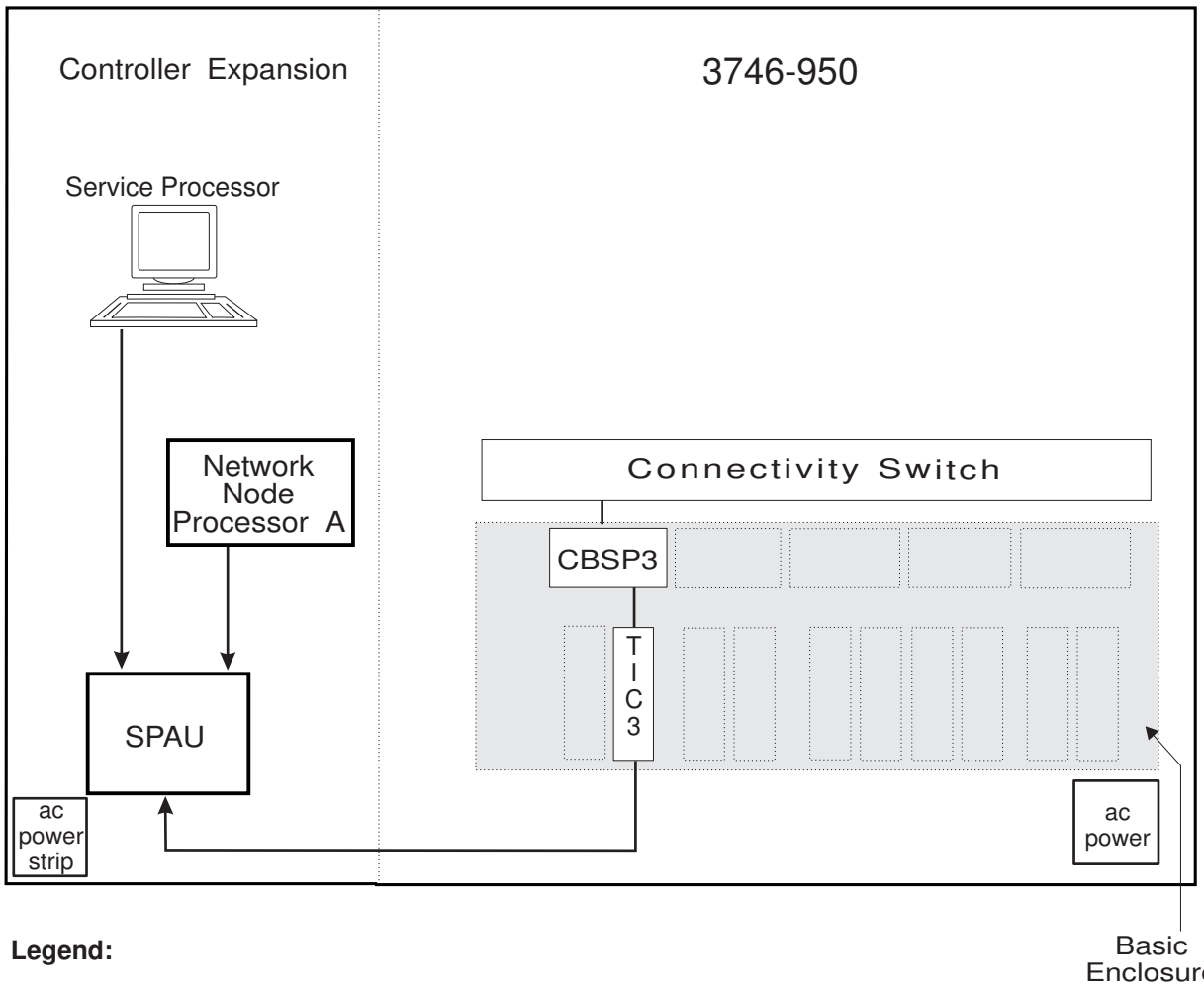

**Legend:**

CBC Controller bus coupler
CBSP3 Controller Bus and Service Processor Type 3
CCU Central control unit
DMA Direct memory access
IOC Input/output control
TIC3 Token-Ring Coupler Type 3

*Figure B-1. 3746-900 Minimum Configuration. The 3746-900 is attached to a single CCU 3745 (model 17A, 21A, 31A).*

## 3746-950 Minimum Configuration

The minimum configuration for a 3746-950 to operate is the hardware for the 3746 IP Router and APPN/HPR control point, and the hardware attachment to the service processor (see Figure B-2 on page B-4).




**Legend:**

CBSP3 Controller Bus and Service Processor Type 3
SPAU Service processor access unit
TIC3 Token-Ring Coupler Type 3

*Figure B-2. 3746-950 Minimum Configuration*

## 3746 Minimum Configuration for NNP Operations

The minimum configuration for a 3746 operating as an APPN/HPR NN, and (or) IP router includes:

**ac power** The ac power supply requires a *single phase*, 200-240V, 50-60 Hz source. The voltage and frequency varies according to local country and voltage requirements.

**Basic enclosure** The basic enclosure includes four processor slots and eight coupler slots for adapter options.

**CBSP[3], CBSP2[3], CBSP3** In the 3746-900, the Controller Bus and Service Processor (CBSP, CBSP Type 2 or CBSP Type 3) connects the controller bus coupler (CBC) to the connectivity switch. The CBSP, CBSP2, and CBSP3 also connect the 3746 to the service token-ring LAN via

a TIC3. The CBSP2 or CBSP3 is required to support the 3746 NN and IP router functions.

**Note:** An installed CBSP or CBSP2 can be upgraded to CBSP3.

**TIC3**

The TIC3 connects the CBSP, CBSP2, or CBSP3 to the service processor access unit (SPAU). User workstations operating at 16 Mbps can access host applications via this TIC3.

**Note:** User workstations cannot operate on the service LAN of a 3746-950, or a 3746-900 operating as an IP router or APPN/HPR NN.

**Connectivity switch**

The high speed connectivity switch connects all the adapters, and allows the IP and APPN/HPR traffic to be switched directly from adapter to adapter. NCP traffic flows through the CBSP, CBSP2 or CBSP3 and the 3745 CCU.

**Controller bus coupler**

*Only available on the 3746-900.*

The CBC attaches the Input/Output Control (IOC) bus and the Direct Memory Access (DMA) bus of the first 3745 CCU to the 3746-900 CBSP[4].

**Network Node Processor (NNP)**

The Network Node Processor (NNP[3], NNP Type 2[3], NNP Type 3[3], or Type 4) provides the control point functions of the 3746 APPN/HPR Network Node and supports the management of the 3746 IP router.

**Service processor**

Generally housed in a controller expansion.

**Controller expansion**

Required for the 3746-900 equipped with an NNP and for the 3746-950. Houses the NNP and service processor. The controller expansion, the NNP, and the service processor are features of the 3745 Models A or 3746.

For more information, see Appendix C, “Configuration Options for the 3746 (Base)” on page C-1.

**Control panel**

The control panel on the front door is similar in design and function to the one on the 3745.

**Cooling unit**

Includes six fans.

---

4 The IOC bus is used for control and the DMA bus for data transfer between the 3745 CCU and the 3746-900. These buses are attached to the internal connectivity switch of the 3746 Model 900 via the CBC and the CBSP.

# 3745 and 3746-900 Migration Paths and Upgrades

## Upgrading Your 3745 and 3746-900

The capabilities of installed 3745s can be extended with the following upgrades:

- Model 130, 150, 160, or 170 conversion to a Model 17A.
- Model 210, 310, 410, or 610 conversion to a Model 21A, 31A, 41A[6], or 61A.

The capabilities of the 3746-900 can be extended with an upgrade to a 3746 APPN/HPR Network Node and/or IP router (Model 900 or 950). Upgrading your 3745 Models A and 3746-900 preserves your existing investment in communication controllers.

The summary below shows the migration paths that are available to upgrade the following controllers:

- 3745
- 3746-900

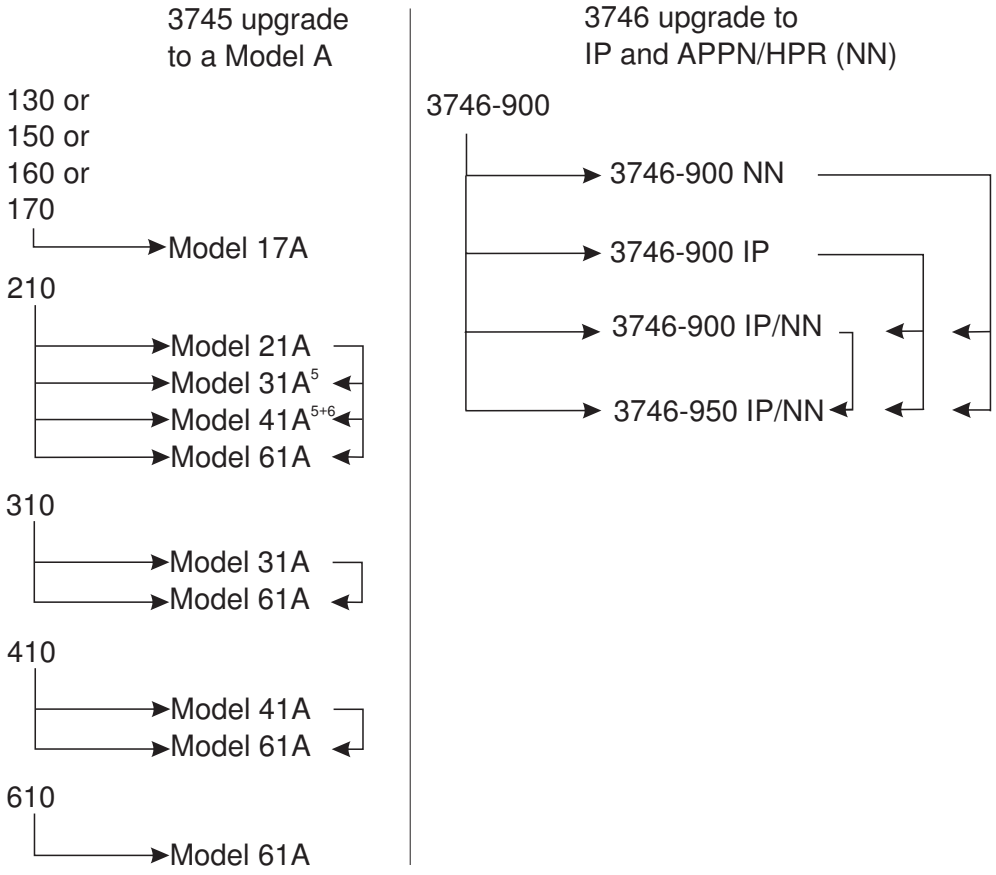



*Figure B-3. Upgrading a 3745 or 3746-900.*

5 Can be later upgraded to a Model 61A.

6 Upgrades from Models 210 and 21A to Model 41A are no longer available.

The following is a brief description on the changes that are required for upgrading your equipment:

- To upgrade your 3745 requires an IBM service representative to make hardware and microcode changes, including the installation of the service processor.
- To upgrade your 3746-900 to a 3746 IP router or APPN/HPR NN, you need to install CBSP3 (see "CBSP or CBSP2 Upgrade to CBSP3 - FC 5123" on page C-16), if a CBSP2 or CBSP3 is not already installed. The following must also be installed for the upgrade to work:
  - Service Processor Type 2 (FC 5052), Type 3 (FC 5053), or Type 4 (FC 5054). Older Service Processors (FC 5020[3] and FC 5021[3]) can be used after an upgrade to Type 4 (FC 5450).
  - Network Node Processor (NNP) Type 4 (FC 5424).
- To upgrade your 3746-900 to a 3746-950 requires ordering a 3746 model conversion, and a CBSP3 upgrade (if a CBSP is installed), in addition to the above service processor and NNP.

## Upgrading to a More Powerful 3745

When you upgrade a 3745 by connecting a 3746-900, the potential growth in network traffic may require more processing power.

To increase the processing power of a 3745-21A, for example, you can upgrade the 3745 to the more powerful CCU technology of a model 31A or 61A, or to the second CCU of a model 41A[6] or 61A (see Figure B-4).

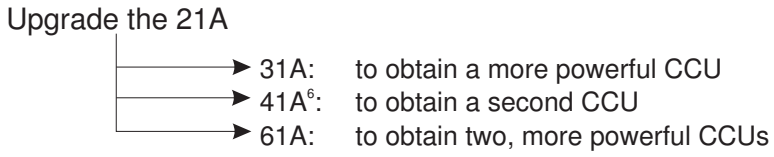



*Figure B-4. Example of a 3745 Upgrade.*

## Adding 3746 Expansion Unit Models A11 or A12

**Note:** Models A11 and A12 are no longer manufactured.

The 3746-900 is installed as the rightmost expansion unit of a 3745 Model 21A, 31A, 41A, or 61A. A reconfiguration consisting in adding a 3746-A11 or 3746-A12 requires closing down 3745 operations, and reassembling the expansion units so that the 3746-A11 or 3746-A12 can be placed between the 3745 and the 3746-900.

## Expansion Enclosures

Your 3746-900 and 3746-950 can be expanded by simply adding Expansion Enclosures[7] and installing new adapters into any available slot (see Figure C-1 on page C-2 and Figure C-2 on page C-3).

ESCON, token-ring, and communication line adapters can be mixed in the same enclosure. However, if you fill the slots with only one type of adapter, the total for each will be the following:

- For ESCON, 16 channel couplers.
- For token-ring, 32 or 33 token-ring couplers.
- For communication line, 32 LICs with the capacity of one of the following:
  - 32 lines operating above 256 kbps and up to 2 Mbps
  - 256 line interfaces of up to 256 kbps
  - 480 line interfaces of up to 64 kbps (X.21)
  - 600 line interfaces of up to 28.8 kbps (V.24) or 64 kbps (V.35)

See Table B-1 and Table B-2 on page B-9 for information about maximum configurations in a 3746-900 and 3746-950 with a single type of adapter.

To read a table, select a single type of adapter in the first column of either Table B-1 on page B-9 or Table B-2 on page B-9.

[7] For the Multiaccess Enclosure (MAE), see Appendix D, "Configuration Options for the 3746 (MAE)" on page D-1.

*Table B-1. Maximum Configuration of the 3746-900 with a Single Type of Adapter[7]*

| 3745-17A, 3745-21A and 3745-31A | | | | |
|---|---|---|---|---|
| **Adapter Type ↓** | **ESCON Channel Ports** | **Token-Ring LAN Ports (TIC3)[1]** | **Low-Speed Lines (LIC11)** | **1.5 Mbps/2 Mbps Lines (LIC12)** |
| **ESCA** | 16 | 1 | - | - |
| **TRA (TIC3)** | - | 33 | - | - |
| **CLA (CLP+LIC11)** | - | 1 | 600[2] | - |
| **CLA (CLP+LIC12)** | - | 1 | - | 32[2] |
| **3745-41A and 3745-61A** | | | | |
| **Adapter Type ↓** | **ESCON Channel Ports** | **Token-Ring LAN Ports (TIC3)[1]** | **Low-Speed Lines (LIC11)** | **1.5 Mbps/2 Mbps Lines (LIC12)** |
| **ESCA** | 15 | 2 | - | - |
| **TRA (TIC3)** | - | 32 | - | - |
| **CLA (CLP+LIC11)** | - | 2 | 540[2] | - |
| **CLA (CLP+LIC12)** | - | 2 | - | 30[2] |

**Notes:**

1. The service token-ring used to interconnect the service processor, 3745, and 3746-900 is available for user stations, unless the 3746-900 is operated as an APPN/HPR NN or IP router.
2. Up to 240 lines (the total of LIC11 and LIC12 lines) can be controlled by the 3746 NNP.

*Table B-2. Maximum Configurations of the 3746-950 with a Single Type of Adapter[7]*

| **Adapter Type ↓** | **ESCON Channel Ports** | **Token-Ring LAN Ports (TIC3)[1]** | **Low-Speed Lines (LIC11)** | **1.5 Mbps/2 Mbps Lines (LIC12)** |
|---|---|---|---|---|
| **ESCA** | 16 | - | - | - |
| **TRA (TIC3)** | - | 32 | - | - |
| **CLA (CLP+LIC11)** | - | - | 240[2] | - |
| **CLA (CLP+LIC12)** | - | - | - | 32[2] |

**Notes:**

1. The service token-ring used to interconnect the service processor, the NNP, and the 3746-950 *is not available* for user stations.
2. Maximum number of active lines (total of LIC11 and LIC12 lines) controlled by the 3746 NNP is 240.

## Maximum Configurations for a 3745 with a 3746 Model 900

Table B-3 does not include 3746 Models A11, A12, L13, L14, and L15 which are no longer manufactured, nor the MAE[7].

*Table B-3. Maximum Configurations for a 3745 with an Attached 3746 Model 900 (without MAE[7])*

| **Configuration Types[1]** | **Frame** | **3745 Model (Base Frame Only)** | | | | |
|---|---|---|---|---|---|---|
| | | **17A** | **21A** | **31A** | **41A** | **61A** |
| 3745 Central Control Units (CCU) | 3745 | 1 | 1 | 1 | 2 | 2 |
| Maximum Storage (MB per CCU) | 3745 | 8 | 8 | 16 | 8 | 16 |
| Parallel channel adapters | 3745<br>3746-900 | 4<br>- | 8<br>- | 8<br>- | 8<br>- | 8<br>- |
| ESCON channel adapters | 3745<br>3746-900 | -<br>16 | -<br>16 | -<br>16 | -<br>15 | -<br>15 |
| Token-Ring LAN ports (4/16 Mbps) | 3745<br>3746-900 | 2<br>33 | 8<br>33 | 8<br>33 | 8<br>32 | 8<br>32 |
| Lines up to 19.2 kbps | 3745 | 96 | 128 | 128 | 128 | 128 |
| Lines up to 28.8 kbps | 3746-900[2] | 600[3] | 600[3] | 600[3] | 600[3] | 600[3] |
| Lines up to 64 kbps | 3745<br>3746-900[2] | 24<br>600[3] | 32<br>600[3] | 32<br>600[3] | 32<br>600[3] | 32<br>600[3] |
| Lines up to 256 kbps | 3745<br>3746-900[2] | 6<br>256 | 8<br>256 | 8<br>256 | 8<br>240 | 8<br>240 |
| Lines up to 2 Mbps | 3745<br>3746-900 | 2<br>32 | 8<br>32 | 8<br>32 | 8<br>30 | 8<br>30 |
| Ethernet type V.2 ports | 3745<br>3746-900 | 4<br>8[4] | 16[4]<br>8[4] | 16[4]<br>8[4] | 16[4]<br>8[4] | 16[4]<br>8[4] |

**Notes:**

1. Some items are mutually exclusive. Therefore, not all the maximum connection capabilities are possible on the same machine.

   The maximum operational capacity may be lower than the maximum physical capacity given above. For example, the maximum number of active lines in the 3746 Model 900 (600) can be reached with a mix of lines having speeds in the range from 600 bps to 64 kbps.

2. Up to 240 lines can be controlled by the 3746 NNP. The remaining lines are controlled by NCP.
3. For X.21 lines, the maximum number is 480.
4. No longer manufactured. Ethernet ports (10 Mbps/100 Mbps) are available on the MAE[7].

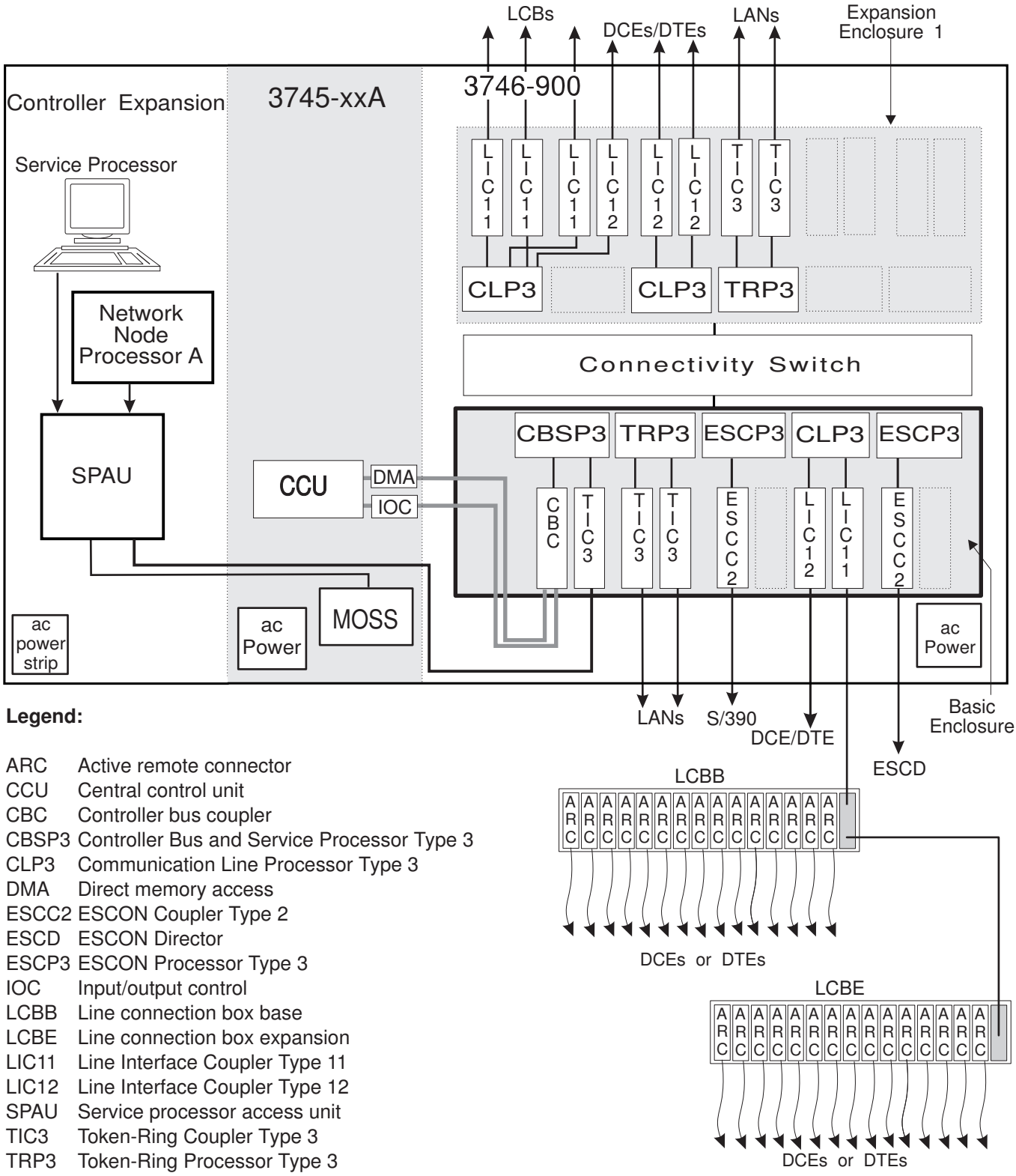
# Appendix C. Configuration Options for the 3746 (Base)

## Network Expansion Through 3746 Adapters

The basic enclosure of the 3746 controller houses up to four optional adapters. A second and third expansion enclosure can house up to six adapters each, bringing the capacity to 16 adapters. Adapter types can be mixed in each enclosure and placed in any position. This allows flexibility in configuring the combination of adapters in the enclosure, and for upgrading established configurations according to the evolution of your system.

Additional expansion is made possible with the MAE. For more information, see Chapter 3, “Functional Overview of the Multiaccess Enclosure” on page 3-1 and Appendix D, “Configuration Options for the 3746 (MAE)” on page D-1.

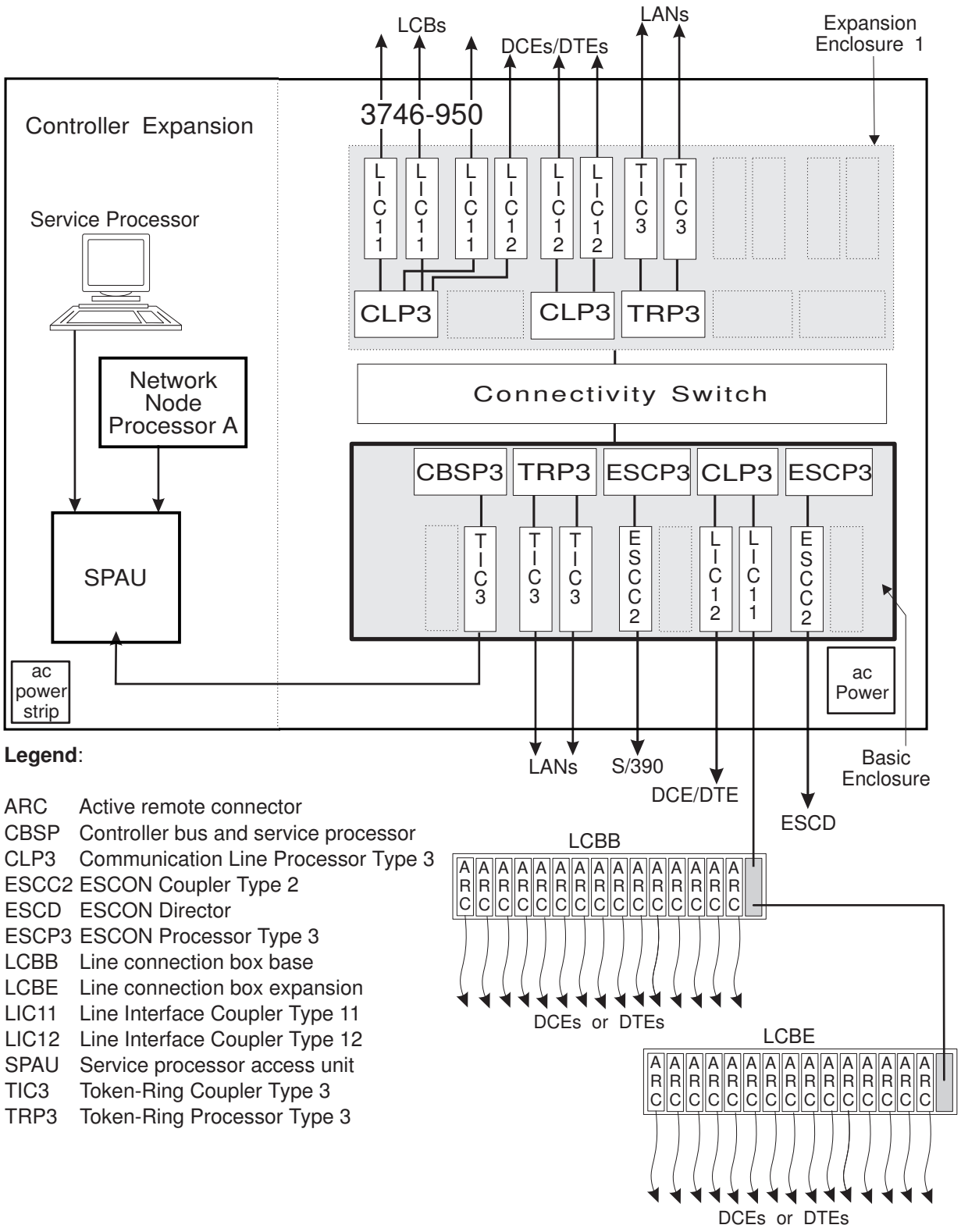
Figure C-1 on page C-2 and Figure C-2 on page C-3 respectively shows Expansion Enclosure 1 (FC 5015) of a 3746-900 and a 3746-950.




**Legend:**

| | |
|---|---|
| ARC | Active remote connector |
| CCU | Central control unit |
| CBC | Controller bus coupler |
| CBSP3 | Controller Bus and Service Processor Type 3 |
| CLP3 | Communication Line Processor Type 3 |
| DMA | Direct memory access |
| ESCC2 | ESCON Coupler Type 2 |
| ESCD | ESCON Director |
| ESCP3 | ESCON Processor Type 3 |
| IOC | Input/output control |
| LCBB | Line connection box base |
| LCBE | Line connection box expansion |
| LIC11 | Line Interface Coupler Type 11 |
| LIC12 | Line Interface Coupler Type 12 |
| SPAU | Service processor access unit |
| TIC3 | Token-Ring Coupler Type 3 |
| TRP3 | Token-Ring Processor Type 3 |

*Figure C-1. Example Configuration for a 3746-900. This configuration includes two ESCON channel adapters, two token-ring adapters, and three communication line adapters.*




**Legend**:

| | |
|---|---|
| ARC | Active remote connector |
| CBSP | Controller bus and service processor |
| CLP3 | Communication Line Processor Type 3 |
| ESCC2 | ESCON Coupler Type 2 |
| ESCD | ESCON Director |
| ESCP3 | ESCON Processor Type 3 |
| LCBB | Line connection box base |
| LCBE | Line connection box expansion |
| LIC11 | Line Interface Coupler Type 11 |
| LIC12 | Line Interface Coupler Type 12 |
| SPAU | Service processor access unit |
| TIC3 | Token-Ring Coupler Type 3 |
| TRP3 | Token-Ring Processor Type 3 |

*Figure C-2. Example Configuration for a 3746-950. This configuration includes two ESCON channel adapters, two token-ring adapters, and three communication line adapters.*

## Communication Line Adapter (CLA) Components

The communication line adapter (CLA) consists of several components:

- Communication Line Processor (CLP[1]) or CLP Type 3
- Line interface coupler (LIC)
- Line connection box (LCB)
- Active remote connector (ARC)

## Communication Line Processor Type 3 (CLP3) - FC 5203

The CLP3 (and CLP) can run up to four LICs to provide the following support:

- Frame-relay, SDLC, and PPP links
- Frame-relay network connections
- X.25 network connections

The CLP3 (and CLP) also supports:

- Two-way alternate data link control support (half-duplex mode)
- Two-way simultaneous data link control support (full-duplex mode)
- Port swapping capability for NCP-controlled lines (3746-900)
- Wrap test support for NCP-controlled lines (3746-900)
- LPDA®2 support for NCP-controlled lines (3746-900)

For more details on the CLP3 (and CLP), see Chapter 5, “Scalable Connectivity” on page 5-1.

## Line Interface Coupler 11 (LIC11) - FC 5210

LIC11 consists of the following:

- The LIC11 itself
- A line connection box base (LCBB) connected to the LIC11

LIC11 supports the following ITU-T lines:

- V.24 switched and leased lines, with speeds from 600 bps to 28.8 kbps.
- V.25 bis functions (for example, IBM 7852, 7855, 7857, and 7858).
- V.34 modem synchronous communication.
- V.35 leased lines operating at speeds up to 256 kbps.
- X.21 leased lines operating at speeds from 600 bps to 256 kbps.
- X.21 switched connection to an ISDN terminal adapter (basic rate interface), controlled by NCP (3746-900).

LIC11 can operate up to 30 lines with speeds of 600 bps to 64 kbps, or eight lines operating at speeds above 64 kbps. The LIC11 connects to the DCEs/DTEs through the LCBB and the LCBE.

[1] No longer manufactured.

## Line Interface Coupler 12 (LIC12) - FC 5212

LIC12 operates leased lines at speeds from 56 kbps up to 2.048 Mbps. The port of the LIC12, depending on the external cable used, provides the following type of ITU-T interface:

- V.35
- X.21

  In the 3746-900, NCP can control a LIC12 X.21 port connected to an ISDN terminal adapter (Primary Rate Interface).

## Line Interface Coupler 16 (LIC16) - FC 5216

LIC16[1] supports Euro-ISDN Primary Rate Interface (PRI). LIC16[1] operates under the control of the NCP and supports SNA traffic over 30 ISDN-B channels at 64 kbps.

## Line Connection Box Extension (LCBE) - FC 5202

An LCB Base (LCBB) providing the same line connectivity as the LCBE is provided with the LIC11, FC 5210. The LCBE is used to extend the LCBB connectivity. It is connected to the LCBB via a 35 cm cable.

A line connection box can have up to 15 active remote connectors (ARCs). It can be installed in any one of the following:

- 3746-900 controller
- 3746-950 controller
- Controller expansion (FC 5023)
- Standard 19-inch rack

An LCB is divided into four ARC groups called LCB areas, three of which have four ARCs, and the remaining group three ARCs. Operating specifications for ARCs are one of the following:

1. Up to four ARCs operating at up to 64 kbps per ARC group
2. One ARC operating at a speed higher than 64 kbps per ARC group

## LIC11 Cables

Cables connecting the LCB Base to the LIC11 are manufactured in standard lengths. Cable FCs indicate the length and the type of cable (see Table C-1). LIC11 cables up to 15 m (49 ft) long are provided at no additional charge.

*Table C-1. LIC11 Cables and FCs*

| FC | Cable length | Attachment type |
|---|---|---|
| 9913 | 1.3 m (4 ft) | LCB Base in 3746[1] |
| 9714[2] | 7 m (23 ft) | standard |
| 9715[2] | 7 m (23 ft) | plenum[3] |
| 9716 | 15 m (49 ft) | standard |
| 9717 | 15 m (49 ft) | plenum[3] |
| 5218 | 35 m (115 ft) | standard |
| 5219[2] | 35 m (115 ft) | plenum[3] |
| 5220[2] | 70 m (229.5 ft) | standard |
| 5221[2] | 70 m (229.5 ft) | plenum[3] |
| 5222 | 105 m (344.5 ft) | standard |
| 5223[2] | 105 m (344.5 ft) | plenum[3] |

**Notes:**

1. Up to two LCBs maximum
2. No longer manufactured
3. USA and Canada only

## Active Remote Connector (ARC) - FCs 64xx, 65xx, 66xx

ARC cards are housed in the LCBs. The cable and connector provide the necessary physical and electrical interface for connecting a data circuit-terminating equipment (DCE or modem) or data terminal equipment (DTE) to the 3746 (see Figure C-1 on page C-2).

There are several ARC types defined by the following:

- Interface (V.24, V.35, or X.21)
- Type of attachment (either modem- or direct-attached)
- Cable length from 0.6 m (2 ft) to 15 m (49 ft)

Two categories of ARC features are available:

- ARCs with a standard ITU-T interface connector to attach to a DCE (modem) or a DTE (terminal).
- ARCs attached to either a DCE or a DTE through cables originally designed for 3745 LIC Types 1, 3, and 4.

See Table C-2 on page C-7 for ARC types, cable lengths, and their feature codes.

*Table C-2. ARC Types and FCs*

| ARC FCs, with attachment type (DTE[1] or DCE[2]) and cable length | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **64xx** | | | | **65xx** | | | | **66xx** | | | |
| 6400 | V.24 | DTE | 15 m (49 ft) | 6500 | V.35 | DTE | 15 m (49 ft) | 6600 | X.21 | DTE | 15 m (49 ft) |
| 6402[3] | V.24 | DCE | 0.6 m (2 ft) | 6502[3] | V.35 | DCE | 0.6 m (2 ft) | 6602[3] | X.21 | DCE | 0.6 m (2 ft) |
| 6404 | V.24 | DCE | 2.4 m (7.9 ft) | 6504 | V.35 | DCE | 2.4 m (7.9 ft) | 6604 | X.21 | DCE | 2.4 m (7.9 ft) |
| 6405 | V.24 | DCE | 5 m (16.5 ft) | 6505 | V.35 | DCE | 5 m (16.5 ft) | 6605 | X.21 | DCE | 5 m (16.5 ft) |
| 6406 | V.24 | DCE | 1.2 m (4 ft) | 6506 | V.35 | DCE | 1.2 m (4 ft) | 6606[2] | X.21 | DCE | 1.2 m (4 ft) |
| 6410[3] | V.24 | DCE | 10 m (33 ft) | 6510[3] | V.35 | DCE | 10 m (33 ft) | 6610[3] | X.21 | DCE | 10 m (33 ft) |
| 6415 | V.24 | DCE | 12 m (39 ft) | 6515 | V.35 | DCE | 15 m (49 ft) | 6615 | X.21 | DCE | 15 m (49 ft) |
| 6480[3] | V.24 | DTE | 5 m (16.5 ft) | 6580[3] | V.35 | DTE[4] | 5 m (16.5 ft) | 6620[3] | X.21 | DTE[4] | 5 m (16.5 ft) |
| 6482[3] | V.24 | DCE[4] | 1.2 m (4 ft) | 6582[3] | V.35 | DCE[4] | 1.2 m (4 ft) | 6622[3] | X.21 | DCE[4] | 1.2 m (4 ft) |
| 6484[3] | V.24 | DCE[4] | 2.4 m (7.9 ft) | 6584[3] | V.35 | DCE[4] | 2.4 m (7.9 ft) | 6624[3] | X.21 | DCE[4] | 2.4 m (7.9 ft) |
| 6485 | V.24 | DCE[4] | 5 m (16.5 ft) | 6585 | V.35 | DCE[4] | 5 m (16.5 ft) | 6625 | X.21 | DCE[4] | 5 m (16.5 ft) |
| 6486[3] | V.24 | DCE[4] | 0.6 m (2 ft) | 6586[3] | V.35 | DCE[4] | 0.6 m (2 ft) | 6626[3] | X.21 | DCE[4] | 0.6 m (2 ft) |
| - | - | - | - | - | - | - | - | 6630[3] | X.21 | DCE[5] | 5 m (16.5 ft) |
| - | - | - | - | - | - | - | - | 6635[2] | X.21 | DCE[5] | 15 m (49 ft) |

**Notes:**

1. DTE refers to a direct attachment.
2. DCE refers to modem attachment.
3. No longer manufactured.
4. For connection to existing 3745 cable of the same type.
5. Transfix ARCs are primarily designed for those DCEs in France which do not support I and C signalling over X.21 interfaces.

## ESCON Channel Adapter (ESCA) Components

The ESCA consists of two components (see Figure C-1 on page C-2):

- ESCON processor (ESCP[1], ESCP Type 2[1], or ESCP Type 3).
- ESCON coupler (ESCC[1]) or ESCC Type 2 (ESCC2).

An ESCON Channel Adapter (ESCA) provides the following support:

- 3746 IP routing to MVS TCP/IP.
- Parallel Transmission Groups (through direct attachment to the S/390 or through one or two ESCDs) in SNA traffic controlled by NCP, or APPN/HPR traffic controlled by the NNP.

- IPL port for loading NCP and activating the 3745/3746-900 (SNA).
- Compatibility with IBM 9032 ESCON Directors (ESCDs) Models 1, 2, and 3.

ESCA features are shown in Figure C-1 on page C-2 and Figure C-2 on page C-3.

## ESCON Channel Processor Type 3 (ESCP3) - FC 5523

The new Extended Functions 4 in the 3746 enables the ESCP3 to support 32 logical connections to S/390 server partitions running VTAM or TCP/IP. The ESCP3 (and ESCP2) supports the 3746 NN and 3746 IP routing (for more information, see Chapter 5, “Scalable Connectivity” on page 5-1).

ESCPs support the standard 3 km (1.8 miles) ESCON fiber distance, but do not support the ESCON extended distance feature. However, longer distances are possible through an ESCD using ESCON Extended Distance interface. An S/390 can be accessed from up to 23 km (14.3 miles) away or alternatively, accessed from up to 43 km (26.7 miles) away, through two cascaded ESCDs, each with the Extended Distance interface.

Table C-3 shows the maximum 3745/3746-900-to-S/390 and 3746-950-to-S/390 distances for various ESCON configurations. See also Figure C-3 on page C-9.

*Table C-3. Maximum 3746-to-S/390 Distances*

| **Extended Distance Links** | **Direct Host Connection** km (miles) | **One ESCON Director** km (miles) | **Two Cascaded ESCON Directors** km (miles) |
|---|---|---|---|
| 0 | 3 (1.8) | 6 (3.7) | 9 (5.5) |
| 1 | - | 23 (14.3) | 26 (16.1) |
| 2 | - | - | 43 (26.7) |

Figure C-3 on page C-9 illustrates the maximum 3746-to-S/390 distances.

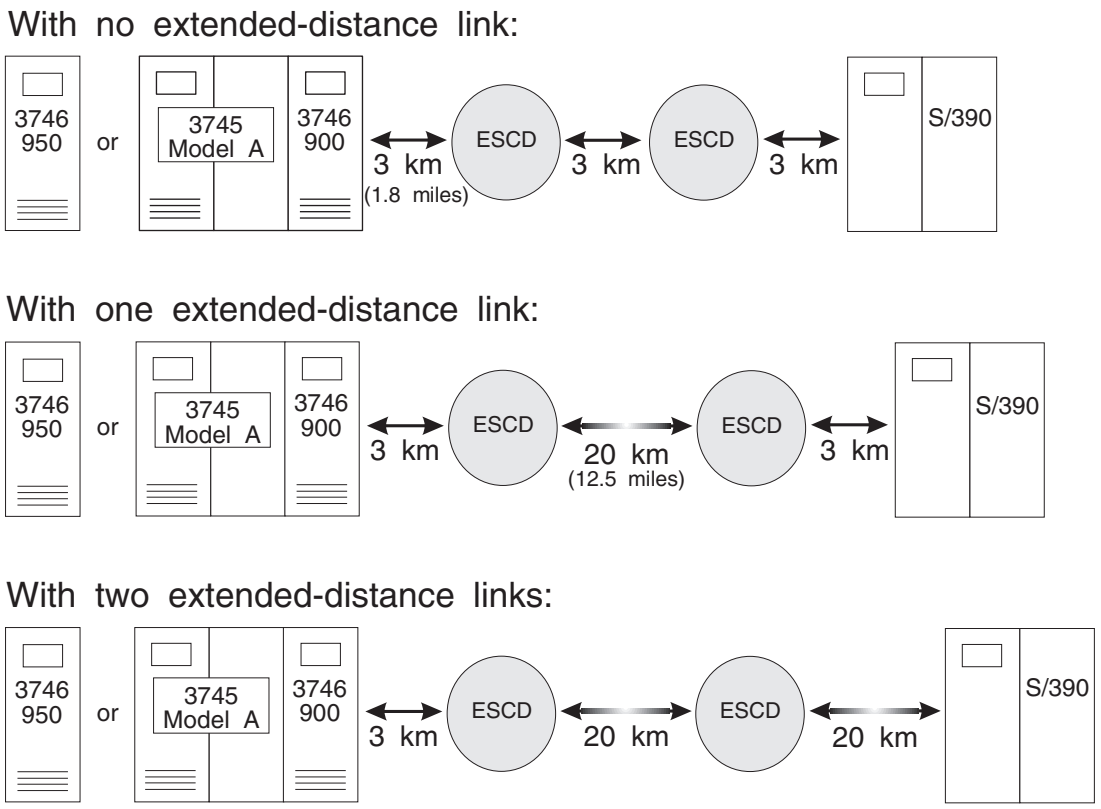



*Figure C-3. Extended ESCON Support. This figure shows different possible distances between the 3746 and the S/390 through ESCON connections.*

## ESCON Channel Coupler Type 2 (ESCC2) - FC 5502

ESCC[1] and ESCC2 contain the interface to the ESCON multimode, duplex fiber-optic channel cable. ESCC2 is an enhancement of ESSC, providing the same functions, but with an increase in throughput and reduction in channel utilization. Any ESCC can be field upgraded to an ESCC2. There is one ESCON channel coupler per ESCON channel processor.

## Token-Ring Adapter (TRA) Components

The TRA consists of two component types (see Figure C-1 on page C-2):

- Token-Ring processor (TRP[1], TRP Type 2[1], or TRP Type 3).
- Token-Ring Interface Coupler type 3 (TIC3).

The functions of the token-ring Adapter (TRA) are as follows:

- 3746 IP routing, 3746 APPN/HPR routing, SNA traffic support for NCP (3746-900).
- Support for 4-Mbps and 16-Mbps token-ring LANS.
- Early Token Release (for 16 Mbps).
- Variable frame sizes.
- Swapping token-ring ports controlled by the NCP (3746-900).
- Duplicate TIC addresses.

The service processor token-ring LAN (connected to the TIC3 of the CBSP) operates at 16 Mbps.

## Token-Ring Processor Type 3 (TRP3) - FC 5623

The TRP3 provides IEEE 802.2 logical control, and supports 3746 APPN/HPR and IP routing (for more information, see Chapter 5, “Scalable Connectivity” on page 5-1).

With the new functionality of Extended Functions 4, the TRP3 supports up to 3000 PUs controlled by NCP or the NNP.

## Token-Ring Interface Coupler Type 3 (TIC3) - FC 5601

TIC3 handles media access control (MAC). One or two TICs can be connected to each processor.

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# 3746 Licensed Internal Code Features

## X.25 Support - FC 5030

The X.25 feature enables the CLP3 (and CLP) to support X.25 connections. The support is as follows:

- The CLP3 (and CLP) can perform X.25 DLC and data packet functions over PVCs and SVCs.
- In the 3746-900, supports SNA Qualified Logical Link Control (QLLC) for NCP subarea and peripheral traffic, without the need for NPSI in the 3745.
- Supports SNA QLLC traffic (APPN, SNA/DLUR, HPR) for the 3746 NN, and IP traffic for 3746 IP router (requires FC 5800[1], or 5810, or 5811).

## IP Routing - FC 5033

Provides the required licensed internal code in the 3746-900 and 3746-950 for the following:

- IP routing functions in all types of processors (TRP2/TRP3, ESCP2/ESCP3, and CLP/CLP3).
- IP Routing tables in the CBSP2 and CBSP3 Processors.
- IP management functions in the NNP (SNMP agent, Telnet).

## 3746 Extended Functions 1 - FC 5800

Provides functions which are now included in Extended Functions 4, FC 5810, or 5811. For a description of these functions, see “3746 Extended Functions 1” on page 2-15.

**Availability:** No longer available.

## 3746 Extended Function 2 - FC 5802

Provides Session Services Extensions (SSE) and Enhanced Topology Garbage collection for the 3746 base adapters. For more information about these functions, see “3746 Extended Functions 2” on page 2-14.

MAE Extended Functions 3, FC 5807, supports SSE over the MAE adapters.

**Prerequisites:**

- A Service Processor Type 2 (FC 5052), a Service Processor Type 3 (FC 5053) or a Service Processor Upgrade to Type 3 (FC 5050), or a Service Processor Type 4 (FC 5054) or a Service Processor Upgrade to Type 4 (FC 5450).
- 3746 Extended Functions 1 (FC 5800), or Extended Functions 4 (FC 5810, or 5811).

## 3746 Extended Functions 3 - FC 5801

Provides functions which are now included in Extended Functions 4 (FC 5810 or 5811). For a description of these functions, see "3746 Extended Functions 3" on page 2-11.

**Note:** FC 5801 installed in a 3745 without an attached 3746 Model 900 enables Java Console support.

**Availability:** No longer available.

## 3746 and MAE Extended Functions 4 - FC 5810

The 3746 and MAE Extended Functions 4 supports 3746 and MAE enhancements and all the functions previously included in the following:

- 3746 Extended Functions 1 (FC 5800), and 3 (FC 5801).
- MAE Extended Functions 1 (FC 5804), 2 (FC 5805), and 3 (FC 5807).

For a description of these functions, see "3746 and MAE Extended Functions 4" on page 2-8.

## Upgrade from Extended Functions to Extended Functions 4 - FC 5811

This feature provides the same functions as the Extended Functions 4 (FC 5810), and is available as an upgrade option for 3746 users who have already acquired at least the 3746 Extended Functions 1 (FC 5800), or the MAE Extended Functions 1 (FC 5804). It includes 3746 and MAE functions plus all the functions previously included in the following:

- 3746 Extended Functions 1 (FC 5800), and 3 (FC 5801).
- MAE Extended Functions 1 (FC 5804), 2 (FC 5805), and 3 (FC 5807).

For a description of these functions, see "3746 and MAE Extended Functions 4" on page 2-8.

## 3745 Extended Functions 5 - FC 5812

The 3746 Extended Functions 5 (FC 5812) complement the 3746 and MAE Extended Functions 4 (FC 5810 or FC 5812) to provide increased capacity and performance and enhanced network management.

For more information, see "3746 Extended Functions 5" on page 2-4.

# Additional Options

## Ethernet Port - FC 5631

The Ethernet Port FC 5631[1] allows the connection of a local Ethernet segment to the 3746, and supports SNA (NCP), IP (except in USPF environments) and APPN/HPR traffic. Composed of a bridge unit and a token-ring coupler for an internal connection to the token-ring processor. An attachment device and internal cables are provided with this feature.

**Availability:** No longer manufactured. Ethernet adapter features are available on the MAE. For more information, see Appendix D, "Configuration Options for the 3746 (MAE)" on page D-1.

## Service Processor Type 2 - FC 5052

The Service Processor Type 2[1] is equipped with a 200 MHz processor, 96 MB of memory, a 2 GB hard disk drive, and a CD-ROM. It supports the MAE, FC 3001.

**Availability:** No longer manufactured.

## Service Processor Type 3 - FC 5053

The Service Processor Type 3[1] supports the MAE FC 3001. A service processor can be ordered with either the 3746-900, the 3746-950 or a 3745 Models A (see "3745 Models A Minimum Configuration" on page B-1). The Service Processor Type 3 is based on a 6275 system unit (installable in a Controller Expansion) which includes the following:

- Pentium II 350 MHz or 450 MHz processor
- 96 MB memory
- 3.2 GB disk capacity
- CD-ROM drive

The Service Processor Type 3 also includes:

- 15-inch monitor
- Keyboard, mouse
- 28.8-kbps modem
- Service processor access unit (8228)

**Availability:** No longer manufactured. Replaced by Service Processor Type 4.

## Service Processor Upgrade to Type 3 - FC 5050

Service Processor Upgrade to Type 3 - FC 5050[1] upgrades service processors 5020 and 5021 to a Service Processor Type 3 (FC 5053). It is based on a 6275 system unit (installable in a Controller Expansion) which features the following:

- Pentium II 350 MHz processor
- 96 MB memory
- 3.2 GB disk capacity
- CD-ROM drive

The Service Processor Type 3 upgrade also includes:

- 15-inch monitor
- 28.8-kbps modem

**Availability:** No longer manufactured. Replaced by Service Processor Type 4.

## Service Processor Type 4 - FC 5054

This Service Processor replaces the Service Processor Type 3 (FC 5053). The Service Processor Type 4 is based on the 6563 PC platform. It includes a 6563 PC-based control unit with Pentium III 533 MHz processor, 128 MB memory, 13.5 GB hard disk capacity, CD-ROM drive, and 15-inch monitor. A Service Processor Access Unit is included in the Service Processor feature to interconnect the 3745/3746, the Service Processor, the Network Node Processor, and the Multiaccess Enclosure via the Service token-ring. The Service Processor can be shared on the same Service token-ring with up to four 3745s and up to two 3746-9x0s. One of the two 3746s can be equipped with an NNP. The IBM 7858 modem provided with the Service Processor Type 4 feature supports remote operator access at speeds up to 33.6 kbps.

A second Service Processor can be installed as a backup. The backup Service Processor is not connected to the service ring until the active Service Processor is disconnected.

The Service processor has a table-top form factor, but it can be installed in the 3745/3746 Controller Expansion (FC 5023).

## Service Processor Upgrade to Type 4 - FC 5450

This feature provides the upgrade of an installed Service Processor Type 1 (FC 5020 or FC 5021) or Service Processor Type 2 (FC 5052) or Service Processor Type 3 (FC 5050 or FC 5053) to a Service Processor Type 4. It includes a 6563 PC-based control unit with Pentium III 533 MHz processor, 128 MB memory, 13.5 GB hard drive capacity, and CD-ROM drive. This upgrade also includes a 15-inch monitor and an IBM 7858 modem for remote operator access at speeds up to 33.6 kbps.

## Service Processor HDD Upgrade - FC 5026

The Service Processor Upgrade FC 5026[1] increases the hard disk capacity of service processor 9577, FC 5020. This is required for a service processor to support a 3746 operating as an IP router or APPN/HPR NN.

**Availability:** No longer manufactured. Replaced by Service Processor Upgrade to Type 4, FC 5450.

## Service Processor CD-ROM Drive Upgrade - FC 5051

The Service Processor CD-ROM Drive Upgrade, FC 5051[1] replaces the optical disk drive by a CD-ROM drive. This upgrade is designed for service processor Type 9585 and 3172, previously available as FC 5021.

**Availability:** No longer manufactured. Replaced by Service Processor Upgrade to Type 4, FC 5450.

## Service Processor Memory Expansion - FC 5028

A 64 MB memory expansion previously available in Service Processor FC 5021 (rack-mountable and tower versions) is required for CD-ROM, FC 5051[1], and provides support for large configurations, for example:

- A service processor shared between multiple 3745s and 3746s. Required when an additional 3745 or 3746 is connected to the service processor.
- 3746 with two expansion enclosures (FCs 5015 and 5016).

Large configurations increase the activity of the service processor and more memory is required to prevent excessive memory swapping on disk.

The service processor with minimum memory (32 MB) may also slow down responses to the operator, for example, while using CCM.

**Note:** Memory expansion is not required for Service Processor FC 5052, 5053, or 5050 which already has a 96 MB memory base, or Service Processor Type 4 (FC 5054 or FC 5450) which has 128 MB of memory. Also, this memory expansion cannot be installed in Service Processor FC 5020 (desktop version).

**Availability:** No longer manufactured. Replaced by Service Processor Upgrade to Type 4, FC 5450.

## Service Processor Rack-Mount Kit - FC 5029

This feature provides a kit for installing service processors, FCs 5020 and 5021, or re-installing any service processor type, as a rack-mounted unit in the controller expansion, FC 5023. New service processors Type 4 (FC 5054) are provided with the necessary rack-mount kit.

## Network Node Processor Type 2 (NNP2) - FC 5122

The NNP2[1] (or NNP[1]) is required for the 3746-950 and 3746-900 to operate as an IP router or APPN/HPR NN. The NNP contains the hardware and the licensed internal code required to support the APPN/HPR NN control point and IP router SNMP agent. The NNP2 is equipped with a 200 MHz processor, 64 MB of memory, and a 2 GB hard disk drive.

For more information about the number of PUs, SSCP-LU sessions, and LU sessions supported by the NNP, see “NNP Connectivity (Maximum Number of PUs and Sessions)” on page E-5.

**Availability:** No longer manufactured. Replaced by the NNP Type 4, FC 5424.

## Network Node Processor Type 3 (NNP3) - FC 5423

The NNP contains the hardware and the licensed internal code required to support the APPN/HPR NN control point and IP router SNMP agent.

The NNP Type 3[1] is based on the 6275 system unit which is installed in Controller Expansion (FC 5023) and features the following:

- Pentium II 350 or 450 MHz processor
- 128 MB memory
- 3.2 GB disk capacity (2 GB formatted)

You can also install a second NNP for higher availability (see "Dual Network Node (NNP) Processor" on page 7-2.

For more information about the number of PUs, SSCP-LU sessions, and LU sessions supported by the NNP, see “NNP Connectivity (Maximum Number of PUs and Sessions)” on page E-5.

**Availability:** No longer manufactured. Replaced by the NNP Type 4, FC 5424.

## Network Node Processor Type 3 Memory Expansion - FC 5047

Increases the memory of the NNP Type 3 from 128 MB to 160 MB. This memory increment allows DLUR in the 3746 to support up to 60 000 SSCP-LU control sessions, an increase of 30 000 sessions, compared to the NNP2 with a 64 MB memory expansion, or a base NNP3.

For dual NNP configurations (see "Dual Network Node (NNP) Processor" on page 7-2), this feature must be installed in both NNPs Type 3.

For more information about the number of PUs, SSCP-LU sessions, and LU sessions supported by the NNP, see “NNP Connectivity (Maximum Number of PUs and Sessions)” on page E-5.

## Network Node Processor Upgrade to Type 3 - FC 5049

NNP upgrade to NNP3 - FC 5049[1] upgrades an installed NNP Type 1 (FC 5022) or an NNP Type 2 (FC 5122) to an NNP Type 3 with the equivalent in improved performance and connectivity.

For more information about the number of PUs, SSCP-LU sessions, and LU sessions supported by the NNP, see “NNP Connectivity (Maximum Number of PUs and Sessions)” on page E-5.

**Availability:** No longer manufactured. Replaced by NNP Upgrade to Type 4 (FC 5448).

## Network Node Processor Type 4 - FC 5424

This Network Node Processor replaces the Network Node Processor Type 3 (FC 5423). This feature provides the hardware and the base Licensed Internal Code of the APPN/HPR control point. The NNP Type 4 is based on the 6563 PC platform, providing a Pentium III 533 MHz processor with 128 MB base memory and 13.5 GB hard disk capacity. In addition, the NNP Type 4 memory can be expanded from 128 MB to 256 MB (FC 5447).

A second Network Node Processor running in hot standby mode may be optionally configured to ensure very high availability for the network control operations. For dual NNP configurations, the two NNPs must have the same memory size (128 or 256 MB). However, a NNP Type 4 with 256 MB memory can be configured with a NNP Type 3 with 160 MB memory. The Network Node Processor must be housed in a Controller Expansion (FC 5023).

For more information about the number of PUs, SSCP-LU sessions, and LU sessions supported by the NNP, see “NNP Connectivity (Maximum Number of PUs and Sessions)” on page E-5.

## Network Node Processor Type 4 Memory Expansion - FC 5447

This feature provides an additional 128 MB of memory. For dual NNP configurations, the two NNPs must have the same memory size. However, an NNP Type 4 with 256 MB of memory can be configured with a NNP Type 3 with 160 MB of memory.

For more information about the number of PUs, SSCP-LU sessions, and LU sessions supported by the NNP, see “NNP Connectivity (Maximum Number of PUs and Sessions)” on page E-5.

## Network Node Processor Upgrade to Type 4 - FC 5448

This feature provides the upgrade of an installed NNP Type 1 (FC 5022), NNP Type 2 (FC 5122) or NNP Type 3 (FC 5049 or FC 5423) to a NNP Type 4. It includes a 6563 PC-based control unit with Pentium III 533 MHz processor, 128 MB base memory, and 13.5 GB hard drive.

For more information about the number of PUs, SSCP-LU sessions, and LU sessions supported by the NNP, see "NNP Connectivity (Maximum Number of PUs and Sessions)" on page E-5.

## Network Node Processor Memory Expansion - FC 5027

A 64 MB memory expansion enables the NNP to support more than 3000 PUs and nodes, or more than 9000[2] APPN and DLUR sessions (LU-LU sessions).

For more information about the number of PUs, SSCP-LU sessions, and LU sessions supported by the NNP, see "NNP Connectivity (Maximum Number of PUs and Sessions)" on page E-5.

## Network Node Processor Memory Expansion - FC 5037

A 64 MB memory expansion enables the NNP Type 2 to support more than 3000 PUs and nodes, or more than 9000[2] APPN and DLUR sessions (LU-LU sessions).

For more information about the number of PUs, SSCP-LU sessions, and LU sessions supported by the NNP, see "NNP Connectivity (Maximum Number of PUs and Sessions)" on page E-5.

## CBSP or CBSP2 Upgrade to CBSP3 - FC 5123

A Controller Bus and Service Processor Type 2 (CBSP2) or Type 3 (CBSP3) is required in the 3746 for IP router and APPN/HPR operations. The CBSP3 supports up to 35 000 APPN or dependent LU data sessions, 10 000 IP routes and 10 000 OSPF routes. New 3746s are automatically equipped with a CBSP3 Base (FC 9023). The CBSP3 upgrade provides the upgrade from CBSP or CBSP2 to CBSP3.

## Controller Bus Coupler (CBC) - FC 5602

Required for connecting the 3746-900 to the second CCU of a 3745 Model 41A[1] or 61A. The CBC is installed in one of the TRA coupler slots and uses a standard TRP, TRP2, or TRP3. The remaining coupler slot can be used by a TIC3 to connect to a token-ring LAN.

**Note:** This feature is not available for the 3746-950.

## Expansion Enclosure 1 - FC 5015

Adding an expansion enclosure to the 3746-900 or 3746-950 increases the capacity to 10 processors and 20[3] or 21 coupler slots. The expansion enclosure has six

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2 This number of sessions does not include HPR intermediate sessions (ANR), which are supported in any quantity.

3 For 3745 Models 41A and 61A, one coupler slot is used by the controller bus coupler to connect to the second CCU. For more information, see "Controller Bus Coupler (CBC) - FC 5602."

processor slots on the front side and twelve coupler slots on the back (see Figure C-1 on page C-2 and Figure C-2 on page C-3).

## Expansion Enclosure 2 - FC 5016

Adding a second expansion enclosure to the 3746-900 or 3746-950 increases the capacity to 16 processors and 32[3] or 33 coupler slots. The expansion enclosure has six processor slots on the front side and twelve coupler slots on the back.

## Controller Expansion - FC 5023

A controller expansion is an extension of the 3745 Models A or 3746, and can also be installed as a stand-alone unit. A controller expansion is required for the NNP(s) and MAE. This feature is recommended for installing the service processor with the keyboard, display, RSF modem, and service processor access unit (SPAU). It can house LCBs and Ethernet attachment[1] features.

Depending on the 3746 configuration, two controller expansions may be necessary for housing the above features.

## Side Covers - FC 5024

If a controller expansion (FC 5023) is installed as a stand-alone unit or is attached to a 3745 Model 17A, it requires two side covers. This feature is not required for a controller expansion attached to a 3746, or a 3745 Model 21A, 31A, 41A, or 61A.

## Controller Expansion 2nd AC Distribution - FC 5002

This feature provides a second power strip (and external power cord) for the controller expansion, FC 5023. Recommended for dual NNP configurations, and the 2nd AC power supply of the MAE (FC 3500).

## Dual Power Input - FC 5000

This features provides a backup power supply for the 3746 (single phase, 200-240 V ac, 50-60 Hz).

If there is a power failure, the second power supply automatically takes over without disrupting network operations.

## Cables for ESCON Adapters

Fiber optic jumper cables are required for attaching a 3746 ESCON adapter to an S/390 server, an IBM 9032 ESCON Director Model 3, or an IBM 9033 ESCON Director Model 1. A duplex-to-duplex 62.5/125 micron multimode fiber optic jumper cable (cable group 0185) is provided with each ESCON Channel Coupler (FC 5502) and MAE ESCON adapter (FC 3287).

The following fixed lengths are available:

| | |
|---|---|
| 4 meters (12 ft) | 46 meters (150 ft) |
| 7 meters (20 ft) | 61 meters (200 ft) |
| 13 meters (40 ft) | 77 meters (250 ft) |
| 22 meters (70 ft) | 92 meters (300 ft) |
| 31 meters (100 ft)[1] | 107 meters (350 ft) |
| | 122 meters (400 ft) |

**Note:**

[1]In Europe, Middle-East, and Africa countries, this cable is automatically provided with the ordered ESCON coupler or adapter.

For additional information on ESCON planning (custom-length or fixed-length cables, fiber-optic adapters and couplers used in distribution panels), refer to the chapter "Physical Planning Details" in the *Planning Series: Physical Planning*, GA27-4238.

# Appendix D. Configuration Options for the 3746 (MAE)

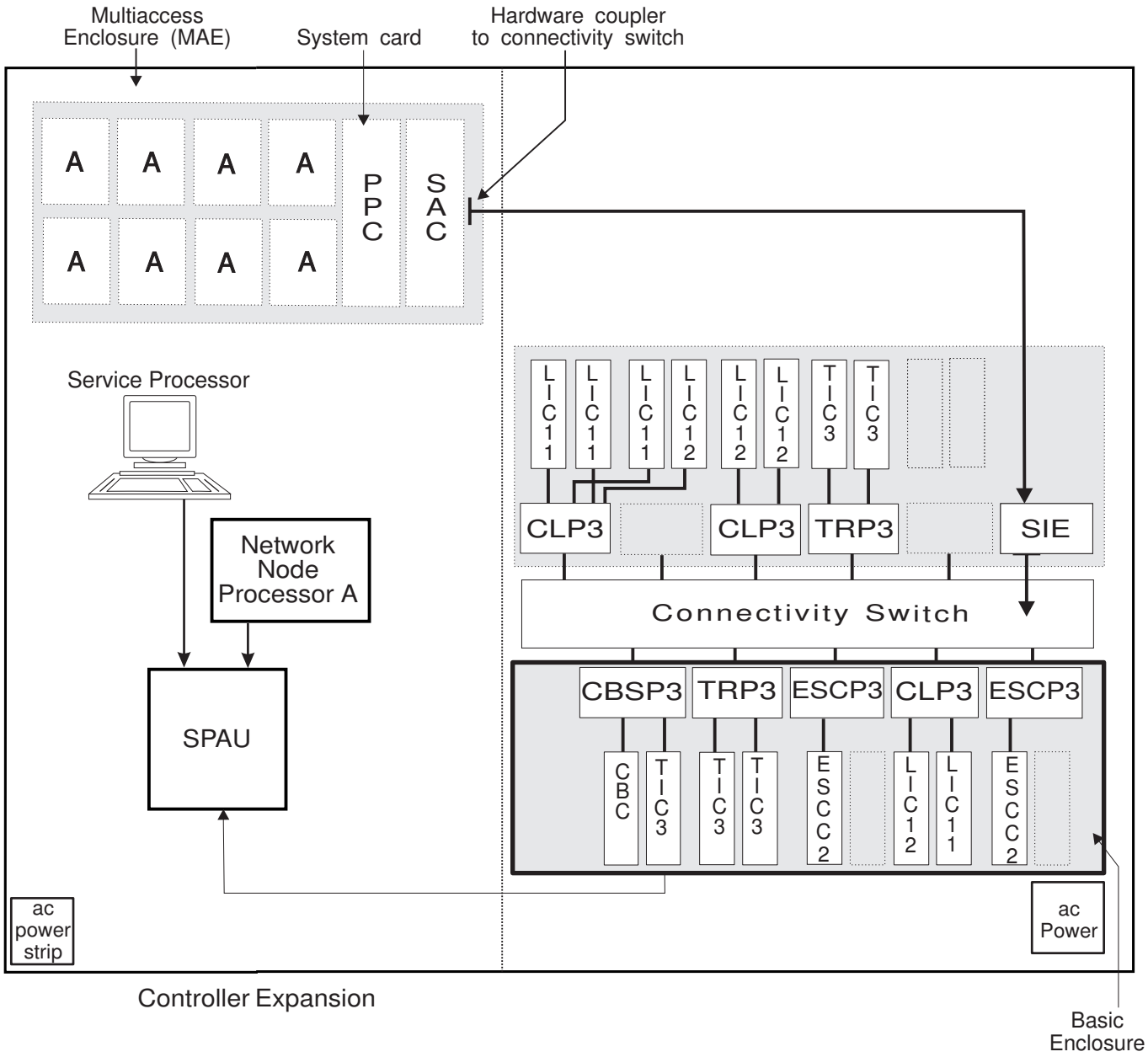
Additional expansion possibilities for the 3746 are provided by the MAE. The MAE can house a further eight adapters, supporting interface types other than those of the 3746 base, and running independently of NCP control.

The MAE FC 3001[1] is equipped with a direct hardware connection to the controller switch. The hardware connection is installed into an empty processor slot of the controller.[2]

Figure D-1 on page D-2 shows MAE FC 3001 with the connection to the connectivity switch.

[1] No longer manufactured.

[2] For installation of the most recent hardware features of the 3746 and MAE Extended Functions 4 and 3746 Extended Functions 5, 3746s equipped with an MAE FC 3000 must be upgraded (MAE 3000 upgrade to MAE 3001). This upgrade remains available.




**Legend:**

A Adapter
CBC Controller bus coupler
CBSP3 Controller Bus and Service Processor Type 3
CLP3 Communication Line Processor Type 3
ESCC2 ESCON Coupler Type 2
ESCP3 ESCON Processor Type 3
LIC11 Line Interface Coupler Type 11
LIC12 Line Interface Coupler Type 12
PPC PowerPC
SAC Switch Access Card
SIE Switch Interface Extension
SPAU Service processor access unit

*Figure D-1. Example Configuration for a 3746-900 with an MAE. This configuration shows a 3746 equipped with a MAE and an Expansion Enclosure (3745-xxA is not represented).*

## MAE with Direct Attachment - FC 3001

MAE with Direct Attachment (FC 3001)[1] includes a high speed, hardware attachment to the 3746 connectivity switch, and is designed for IP traffic. The direct attachment is installed in a processor slot of the controller base.

To carry APPN/HPR traffic, or traffic for NCP, the MAE requires a 2-port Token-Ring Adapter, FC 3280, and one to two Token-Ring Couplers Type 3, FC 5601.

**Prerequisites:**

- NNP Type 2 (FC 5122), NNP Type 3 (FC 5423) or NNP Upgrade to Type 3 (FC 5049), or NNP Type 4 (FC 5424) or NNP Upgrade to Type 4 (FC 5448)
- Service Processor Type 2 (FC 5052), Type 3 (FC 5053), Service Processor Upgrade to Type 3 (FC 5050), Service Processor Type 4 (FC 5054), or Service Processor Upgrade to Type 4 (FC 5450)

## MAE 64-MB Memory Expansion - FC 3520

MAE 64-MB Memory Expansion (FC 3520)[1] extends the memory of the MAE from 64 MB to 128 MB. This enables the MAE to support more sessions, for example APPN, DLSw, or TN3270E.

## MAE 128-MB Memory Card - FC 3521

Features a 128-MB DIMM memory card in the MAE 3001, designed for additional TN3270E and APPN/DLUR session support. For more information, see “MAE Memory Expansion” on page 3-2

## MAE 256-MB Memory Card - FC 3522

Features a 256-MB DIMM memory card in the MAE 3001, designed for additional TN3270E and APPN/DLUR session support. For more information, see “MAE Memory Expansion” on page 3-2

## MAE Second AC Power Supply - FC 3500

MAE Second AC Power Supply (FC 3500)[1] provides a second power supply input for the MAE. If the 3746 is installed with a dual AC power input (FC 5000), a second AC distribution (FC 5002), is required. FC 5002 includes an external power cord for the Controller Expansion (FC 5023), housing the MAE.

## MAE 3001 Token-Ring Kit - FC 5713

Provides a token-ring connection for non-IP traffic (APPN/HPR, NCP) between the MAE, FC 3001, and adapters in other enclosures. It includes a token-ring access unit and a token-ring cable for an internal connection between the MAE and this access unit.

**Note:** A TIC3 with a token-ring cable must be available on a TRP Type 2 or Type 3 for the connection to the token-ring access unit.

# MAE Channel Adapters

## ESCON Channel Adapter (LIC287) - FC 3287

Provides an ESCON channel interface to S/390 servers.

- Direct attachment directly to the mainframe ESCON channel, or to an ESCON Director.
- Support for a 62.5/125 um multimode fiber.

The MAE supports up to 4 ESCON adapters, in combination with parallel channel adapters. The maximum distance between the adapter and the server is 3 km (1.8 miles). Longer distances can be supported via an ESCON Director with an ESCON Extended Distance interface of up to 23 km (14.3 miles) total, or two cascaded ESCON Directors with the ESCON Extended Distance interface of up to 43 km (26.7 miles) total.

For more information, see Table C-3 on page C-8 and Figure C-3 on page C-9.

For available cables, see “Cables for ESCON Adapters” on page C-17.

## 1 Port Parallel Channel Adapter (LIC299) - FC 3299

Port Parallel Channel Adapter (LIC299) (FC 3299)[1] provides the 3746 with parallel channel connections to S/390 and S/370 servers. The adapter complies with the Original Equipment Manufacturer’s Information (OEMI) for I/O interfaces in the S/360 and S/370. The MAE supports up to 4 channel adapters per MAE, with any mix of ESCON and parallel adapters. The adapter provides:

- One parallel channel port per adapter.
- On board processor that off-loads the MAE processor, enabling more efficient data transfer with S/370 or S/390 servers.
- Adapter extenders compatible with this adapter can cover up to 3 km (1.86 mi) maximum, using one of the following:
  - 9034 (ES/9000) Enterprise ESCON Converter
  - 3044[3] Fiber Optic Channel Extender Link Model
- Data transfer, using DCI, or data streaming with speeds of 3.0 and 4.5 MBps.
- Operation in byte or block multiplex mode.

**Note:** The maximum cable length is 113 m (370 ft).

[3] One 3044 channel extender is supported per 3746.

# MAE High-Speed LAN and WAN Adapters

## FDDI MMF Adapter (LIC286) - FC 3286

FDDI MMF Adapter (LIC286) (FC 3286)[1] provides one attachment to a FDDI hub or switch using a multimode fiber optic cable. The attachment provides:

- Support at 100 Mbps.
- Attachment as either a single attaching station (SAS) or as a dual attaching station (DAS). Dual homing is supported for SAS attachment to two hubs or switches.
- Hardware-based transparent bridge filtering.
- The following standards:
  - ISO 9314-1
  - ISO 9314-2
  - ISO/IEC 9314-3
  - FDDI Station Management (Rev. 7.3)
- MMF SC media connectors.

## 10/100-Mbps Ethernet Adapter (LIC288) - FC 3288

Provides one attachment to an 100BaseTx repeater, hub, or switch using a unshielded twisted pair (UTP)-5 copper cable. The attachment provides:

- Network speed of 10 Mbps, 100 Mbps or auto-negotiation.
- Operational mode of half-duplex, full-duplex or auto-negotiation.
- Hardware-based transparent bridge filtering.
- The following standards:
  - IEEE 802.3 10-Mbps Ethernet
  - IEEE 802.3u 100-Mbps Ethernet
- Shielded RJ-45 connector.
- Maximum of 6, in combination with FC 3280 and FC 3281.

Cable FC 3713 is available for this adapter.

## 155-Mbps ATM MMF Adapter (LIC294) - FC 3294

Provides one attachment at 155 Mbps to an ATM switch over a multimode fiber optic cable. Each attachment provides:

- 8 MB of packet memory and 2 MB of control memory for high-performance support.
- A specialized ATM support chip to perform the segmentation and reassembly function (SAR) for ATM adaptation layer 5 (AAL-5).
- Synchronous optical NETwork (SONET) OC-3c framing standard.
- Nominal operating wavelength of 1300 nm using LED-based technology.
- Support for a 62.5/125 um multimode fiber.
- Transceiver support for a maximum cable length of 2 km.
- A multimode duplex SC connector.
- A maximum of 2, in combination with other ATM adapter types.

Cable FC 5710 (10 m) or FC 5715 (40 m) is available for this adapter.

## 155-Mbps ATM SMF Adapter (LIC295) - FC 3295

155-Mbps ATM SMF Adapter (LIC295) (FC 3295)[1] provides one attachment at 155 Mbps to an ATM switch over a single-mode fiber optic cable. Each attachment provides:

- 8 MB of packet memory and 2 MB of control memory for high-performance support.
- A specialized ATM support chip to perform the segmentation and reassembly function (SAR) for ATM adaptation layer 5 (AAL-5).
- SONET OC-3c framing standard.
- Nominal operating wavelength of 1310 nm using laser-based technology.
- Support for a 9/125 um single mode fiber.
- Transceiver support for a maximum cable length of 20 km.
- A single mode polarized duplex SC connector.
- A maximum of 2, in combination with other ATM adapter types.

Cable FC 5720[1] of 10 m (32.8 ft), or FC 5725[1] of 40 m (131 ft) is available for this adapter.

## High-Speed Serial Interface (LIC289) - FC 3289

Provides one attachment to a HSSI data circuit-terminating equipment (DCE) over shielded twisted-pair (STP) cable. The attachment provides:

- Network speed range of 1.544 Mbps to 52 Mbps.
- Data terminal equipment (DTE) interface for network applications (DCE for back-to-back tests).
- Compliance with the following standards:
  - ANSI/EIA/TIA 612
  - ANSI/EIA/TIA 613
- 50-pin connector.
- Maximum cable length of 50 ft (15.4 m).
- A 4.6 m (15 ft) cable is provided with this adapter to attach to a HSSI DCE.

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# MAE Low/Medium-Speed LAN and WAN Adapters

## Token-Ring Adapter (LIC280) - FC 3280

Provides two token-ring attachments. Each attachment provides:

- 4-Mbps or 16-Mbps ring speed operation.
- Autosensing of ring speed.
- Compliance with IEEE 802.5 and ISO 8802.5 standards.
- Media access control (MAC) standard error and status reporting and management counters.
- Support for STP or UTP cable.
- Shielded RJ45 jack connector.

- A maximum of 6, in combination with FC 3281 and FC 3288.

Cable FC 3713 is available for this adapter.

## Ethernet Adapter (LIC281) - FC 3281

Ethernet Adapter (LIC281) (FC 3281)[1] provides two Ethernet attachments. Each attachment provides:

- Compliance with Ethernet 2.0, IEEE 802.3, and ISO 8802.3 standards.
- Support for either twisted-pair (10Base-T) and thin coaxial cable (10Base2).
- MAC standard error, status reporting, and management counters.
- Shielded RJ45 jack (10Base-T) and BNC connector (10Base2).
- A maximum of 6, in combination with FC 3280 and FC 3288.

Cable FC 3713 is available for this adapter.

## ISDN PRI (T1/J1) Adapter (LIC283) - FC 3283

ISDN PRI (T1/J1) Adapter (LIC283) (FC 3283)[1] provides one attachment to an ISDN Primary Rate service at T1[4]/J1 speed, or can be configured as a channelized T1 interface. This attachment provides:

- Support for T1/J1 line speed of 1.544 Mbps.
- 23 B-channels at 64 kbps for data and one 64-kbps D-channel as an ISDN interface, or up to 24 DS0s when used as a channelized T1.
- Selectable framing to D4 (SF), D5 (ESF), or SLC-96R formats.
- Detection and generation of remote alarm indicators (yellow and blue alarms).
- Facility Data Link (FDL) support.
- Generation of DSX-1 and CSU line build outs.
- Generation and detection of CSU loop codes.
- Line error counters for BPV, CV, CRC6, and framing bit errors.
- Monitoring and enforcing of ANSI ones density requirement.
- Extraction and insertion of robbed bit signalling.
- B8ZI and AMI line coding.
- DB-26 (26-pin D-shell) female connector.
- A maximum of 4 adapters.

Cable FC 3714[1] is available for this adapter.

## 4-Port ISDN PRI/Channelized T1/J1 Adapter (LIC297) - FC 3297

4-Port ISDN PRI/Channelized T1/J1 Adapter (LIC297) (FC 3297)[1] provides four ports, each one attaching to an ISDN Primary Rate service at T1/J1 speed, or a channelized T1/J1 interface. Each attachment provides:

- Support for T1/J1 line speed of 1.544 Mbps.
- 23 B-channels at 64 kbps for data and one 64-kbps D-channel as an ISDN interface, or up to 24 DS0s when used as a channelized T1.
- Support for a mix of ISDN PRI and channelized interfaces on the same adapter.

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4 T1 lines are used generally in non-European countries. E1 lines are used generally in Europe.

5 D4 and D5 indicate AT&T Superframe (SF) and (ESF) Extended SuperFrame standards, as specified in Technical Reference (TR) 54016.

- Selectable framing to D4[5] Selectable Framing (SF), D5[5] Extended SuperFrame Format (ESF), or Subscriber Loop Carrier (SLC)-96R formats.
- Interface specifications for connecting international digital links, specified in ITU-T recommendations G.703 and G.704.
- Detection and generation of remote alarm indicators (yellow and blue alarms).
- Facility Data Link (FDL) support.
- Generation of Digital System X-connect (DSX-1) and channel service unit (CSU) line build outs.
- Generation and detection of CSU loop codes.
- Line error counters for Bi-Polar Violations (BPV), CV, Cyclic Redundancy Check (CRC)-6, and framing bit errors.
- Monitoring and enforcing of ANSI density requirements for digital line coding.
- Extraction and insertion of robbed bit signalling.
- B8ZI and Alternate Mark Inversion (AMI) line coding.

The adapter comes with a RJ-48C connector, compatible with cable, FC 3717[1], or FC 3719[1].

**Note:** The MAE can run a maximum of 1 adapter. Adding the optional four port daughter card, FC 3251[1], brings a total of 8 ports.

## 4-Port ISDN PRI/Channelized T1/J1 Daughter Card - FC 3251

4-Port ISDN PRI/Channelized T1/J1 Daughter Card (FC 3251)[1] is an optional four port daughter card that can be added to the 4-port ISDN adapter, FC 3297, bringing a total of 8 ports. Each of the four ports connects to an ISDN Primary Rate service line at T1/J1 speed, or a channelized T1/J1 interface. Each attachment provides:

- Support for T1/J1 line speed of 1.544 Mbps.
- 23 B-channels at 64 kbps for data and one 64-kbps D-channel as an ISDN interface, or up to 24 DS0s when used as a channelized T1.
- Support for a mix of ISDN PRI and channelized interfaces on the same adapter.
- Selectable framing to D4 (SF), D5 (ESF), or SLC-96R formats.
- Interface specifications for connecting international digital links, specified in ITU-T recommendations G.703 and G.704.
- Detection and generation of remote alarm indicators (yellow and blue alarms).
- Facility Data Link (FDL) support.
- Generation of DSX-1 and CSU line build outs.
- Generation and detection of CSU loop codes.
- Line error counters for BPV, CV, CRC-6, and framing bit errors.
- Monitoring and enforcing of ANSI density requirements for digital line coding.
- Extraction and insertion of robbed bit signalling.
- B8ZI and AMI line coding.
- A maximum of 4.

The adapter comes with a RJ-48C connector, compatible with cable FC 3717[1], or FC 3719[1].

## ISDN PRI (E1) Adapter (LIC292) - FC 3292

ISDN PRI (E1) Adapter (LIC292) (FC 3292)[1] provides one attachment to an ISDN Primary Rate service at E1[4] speed or can be configured as a channelized E1 interface. This attachment provides:

- Support for E1 line speed of 2.048 Mbps.
- 30 B-channels at 64 kbps for data and one 64-kbps D-channel for signalling when used as an ISDN interface, or up to 31 DS0s when used as a channelized E1.
- Selectable framing to FAS, CAS, and CRC-4 formats.
- Detection and generation of remote and AIS alarms.
- Full access to both Si and Sa bits.
- Generation of line build outs for a 120 ohm line.
- Three separate loopbacks for testing.
- Line error counters for bipolar and code violation, CRC-4 code word errors, FAS errors and E-bits.
- Extraction and insertion of CAS signalling.
- B8ZI and AMI line coding.
- DB-26 (26-pin D-shell) female connector.
- A maximum of 4 adapters.

Cable FC 3715 is available for this adapter.

## 4-Port ISDN PRI/Channelized E1 Adapter (LIC298) - FC 3298

Provides four ports, each one attaching to an ISDN Primary Rate service at E1 speed, or a channelized E1 interface. Each attachment provides:

- Support for E1 line speed of 2.048 Mbps.
- 30 B-channels at 64 kbps for data and one 64-kbps D-channel for signalling as an ISDN interface, or up to 31 DS0s as a channelized E1.
- Selectable framing to frame alignment signal (FAS), circuit associated signalling (CAS), and CRC-4 formats.
- Interface specifications for connecting international digital links, specified in ITU-T recommendations G.703 and G.704.
- Detection and generation of remote and Alarm Indication Signal (AIS) alarms.
- Full access to both Si and Sa bits.
- Generation of line build outs for a 120 ohm line.
- Three separate loopbacks for testing.
- Line error counters for bipolar and code violations, CRC-4 code word errors, FAS errors and E-bits.
- Extraction and insertion of CAS signalling.
- B8ZI, AMI, and HDB3 line coding.

The adapter comes with a RJ-48C connector, compatible with cable FC 3718.

**Note:** The MAE can run a maximum of 1 adapter. Adding the optional four port daughter card, FC 3252[1], brings a total of 8 ports.

## 4-Port ISDN PRI/Channelized E1 Daughter Card - FC 3252

4-Port ISDN PRI/Channelized E1 Daughter Card (FC 3252)[1] provides four ports, each one attaching to an ISDN Primary Rate service at E1 speed, or a channelized E1 interface. This is an optional four port daughter card that can be added to the base adapter, FC 3298, for a total of 8 ports. Each attachment provides:

- Support for E1 line speed of 2.048 Mbps
- 30 B-channels at 64 kbps for data and one 64-kbps D-channel as an ISDN interface, or up to 31 DS0s when used as a channelized E1.
- Selectable framing to FAS, CAS, and CRC-4 formats.
- Interface specifications for connecting international digital links, specified in ITU-T recommendations G.703 and G.704.
- Detection and generation of remote and AIS alarms.
- Full access to both Si and Sa bits.
- Generation of line build outs for a 120 ohm line.
- Three separate loopbacks for testing.
- Line error counters for bipolar and code violations, CRC-4 code word errors, FAS errors and E-bits.
- Extraction and insertion of CAS signalling.
- B8ZI, AMI, and HDB3 line coding.

The adapter comes with a RJ-48C connector, compatible with cable FC 3718.

## V.35/V.36 Adapter (LIC290) - FC 3290

Provides six attachments to ITU-T V.35 or V.36 WANs. Each attachment provides:

- Support for receiving clocking (modem attach) at a line speed from 9.6 kbps to 2.048 Mbps.
- Support for providing clock (direct attach) from 9.6 kbps to 460.8 kbps as well as 1.544 Mbps and 2.048 Mbps.
- Software selectable to receive clock (modem attach) or provide clock (direct attach) with the appropriate cable.
- A 100-pin D-shell female connector.

Cable FCs 3702 or 3703[1] is available for this adapter.

## X.21 Adapter (LIC291) - FC 3291

X.21 Adapter (LIC291) (FC 3291) provides eight attachments to ITU-T X.21 WANs. Each attachment provides:

- Support for receiving clocking (modem attach) at a line speed from 9.6 kbps to 2.048 Mbps.
- Support for providing clock (direct attach) from 9.6 kbps to 460.8 kbps as well as 1.544 Mbps and 2.048 Mbps.

- Software selectable to receive clock (modem attach) or provide clock (direct attach) with the appropriate cable.
- A 100-pin D-shell female connector.

Cable FC 3704 is available for this adapter.

## V.24/EIA-232 Adapter (LIC282) - FC 3282

Provides eight attachments to ITU-T V.24/EIA-232 WANs. Each attachment provides:

- Support for receiving clocking (modem attach) at a line speed from 9.6 kbps to 64 kbps.
- Support for providing clock (direct attach) from 9.6 kbps to 64 kbps.
- Software selectable to receive clock (modem attach) or provide clock (direct attach) with the appropriate cable.
- A 100-pin D-shell female connector.

Cable FC 3701 is available for this adapter.

# MAE Licensed Internal Code Options

## TN3270E Server - FC 5806

Provides a TN3270 gateway function for downstream TN3270 clients, enabling access to SNA applications on the S/390. When clients make a TCP connection to the TN3270 server, this is mapped to a corresponding SNA LU-LU session that the server maintains with the S/390.

For more information, see “TN3270E Server (MAE)” on page 3-7.

## 3746 and MAE Extended Functions 4 - FC 5810

The 3746 and MAE Extended Functions 4 supports 3746 and MAE enhancements and all the functions previously included in the following:

- 3746 Extended Functions 1 (FC 5800), and 3 (FC 5801).
- MAE Extended Functions 1 (FC 5804), 2 (FC 5805), and 3 (FC 5807).

For a description of these functions, see “3746 and MAE Extended Functions 4” on page 2-8.

## Upgrade from Extended Functions to Extended Functions 4 FC - 5811

This feature provides the same functions as the Extended Functions 4 (FC 5810), and is available as an upgrade option for 3746 users who have already acquired at least the 3746 Extended Functions 1 (FC 5800), or the MAE Extended Functions 1 (FC 5804). It includes 3746 and MAE functions plus all the functions previously included in the following:

- 3746 Extended Functions 1 (FC 5800), and 3 (FC 5801).
- MAE Extended Functions 1 (FC 5804), 2 (FC 5805), and 3 (FC 5807).

For a description of these functions, see “3746 and MAE Extended Functions 4” on page 2-8.

## MAE Extended Functions 1 - FC 5804

Provides MAE functions which are now included in Extended Functions 4, FC 5810 or FC 5811. For a description of these functions, see “MAE Extended Functions 1” on page 3-13.

**Availability:** No longer available.

## MAE Extended Functions 2 - FC 5805

Provides MAE functions which are now included in Extended Functions 4, FC 5810 or FC 5811. For a description of these functions, see “MAE Extended Functions 2” on page 3-11.

**Availability:** No longer available.

## MAE Extended Functions 3 - FC 5807

Provides MAE functions which are now included in Extended Functions 4, FC 5810 or FC 5811. For a description of these functions, see “MAE Extended Functions 3” on page 3-9.

**Availability:** No longer available.

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## Cables for MAE Adapters

**FC 3701 - EIA 232/V.24 Fanout Cable**
A cable with 8 connections (25-pin D-shell male), each one 1.8 m (5.2 ft) in length. Each connection can be attached to a EIA-232/V.24 modem.

Compatible with cables 3705 and 3706.

**FC 3702 - V.35 Fanout Cable**
A cable with a 1.2 m (4 ft) cable to a distribution box containing 6 25-pin D-shell male connectors.

Compatible with cables 3707 and 3708, for standard V.35 physical interfaces.

**FC 3703 - V.36 Fanout Cable**[1]
A cable with 6 connections (37-pin D-shell male), each one 3 m (9.8 ft) in length. Each connection can be attached to a V.36 modem.

Compatible with cables 3709 and 3710.

**FC 3704 - X.21 Fanout Cable**
A cable with 8 connections (15-pin D-shell male), each one 1.8 m (5.9 ft) in length. Each connection can be attached to an X.21 modem.

Compatible with cables 3711 and 3712.

**FC 3705 - EIA-232/V.24 Serial Interface Cable**
A 3 m (10 ft) extension cable with a 25-pin D-shell male connector for attachment to a modem.

**FC 3706 - EIA-232/V.24 Direct Attach Cable**[1]
A 3 m (10 ft) cable with a 25-pin D-shell female connector for direct device attachment.

**FC 3707 - V.35 Serial Interface Cable**
A 3 m (10 ft) extension cable with a 34-pin male block connector for attachment to a modem.

**FC 3708 - V.35 Direct Attach Cable**[1]
A 2 m (6.6 ft) cable with a 34-pin female block connector for direct device attachment.

**FC 3709 - V.36 Serial Interface Cable**[1]
A 3 m (10 ft) extension cable with a 37-pin male D-shell connector for attachment to a modem.

**FC 3710 - V.36 Direct Attach Cable**[1]
A 3 m (10 ft) cable with a 37-pin female D-shell connector for direct device attachment.

**FC 3711 - X.21 Serial Interface Cable**
A 3 m (10 ft) extension cable with a 15-pin D-shell male connector for attachment to a modem.

**FC 3712 - X.21 Direct Attach Cable**[1]
A 3 m (10 ft) cable with a 15-pin D-shell female connector for direct device attachment.

**FC 3713 - Multi-purpose RJ-45 Cable**
A 7.6 m (25 ft) Category 5 cable with an RJ-45 connector for attachment to token-ring hubs or switches, Ethernet 10Base-T hubs or switches, or Ethernet 100BaseT hubs or switches.

**FC 3714 - RJ-48 T1 ISDN PRI / Channelized T1 Cable**[1]
A 15 m (49 ft) cable with a RJ-48 connector for attachment to T1 ISDN PRI switches, or to T1 interfaces.

**FC 3715 - ISDN PRI (E1) / Channelized E1 Cable**[1]
A 30 m (98 ft) cable with "flying leads" for attachment to E1 ISDN PRI switches, or E1 interfaces.

**FC 3716 - RJ-48 J1 ISDN PRI / Channelized J1 Cable**[1]
A 15 m (49 ft) cable with a RJ-48 connector for attachment to J1 ISDN PRI switches, or J1 interfaces.

**FC 3717 - RJ-48C ISDN PRI / Channelized T1 Cable**[1]
A 15 m (49 ft) cable with an RJ-48C connection at each end for attachment to T1 ISDN PRI switches, or to T1 interfaces.

**FC 3718 - RJ-48C ISDN PRI / Channelized E1 Cable**
A 15 m (49 ft) cable with an RJ-48C connection to the adapter and "flying leads" for connecting to E1 ISDN PRI switches, or E1 interfaces.

**FC 3719 - Keyed RJ-48C ISDN PRI / Channelized J1 Cable**[1]
A 15 m (49 ft) cable with an RJ-48C connection to the adapter and a keyed RJ-48C connection, compliant with ISO 10173, for attachment to J1 ISDN PRI switches, or to J1 interfaces.

**FC 3720 - Parallel Channel Bus-and-Tag Upstream Cable**[1]
An upstream connection to other devices on a parallel channel bus and tag.

**FC 3721 - Parallel Channel Bus-and-Tag Downstream Cable**[1]
A downstream connection to other devices on a parallel channel bus and tag.

**FC 3799 - V.35 Serial Interface Cable - France**[1]
A 0.3 m (1 ft) cable for adapting the standard V.35 34-pin male block connector to the connector required for V.35 modems in France.

**FC 5710 - MMF ATM External Cable**[1]
A 10 m (32 ft) plenum rated cable for a multimode fiber ATM adapter (FC 3294).

**FC 5715 - MMF ATM External Cable**
A 40 m (131 ft) plenum rated cable for the multimode fiber ATM adapter (FC 3294).

**FC 5720 - SMF ATM External Cable**[1]
A 10 m (32 ft) plenum rated cable for the single mode fiber ATM adapter (FC 3295).

**FC 5725 - SMF ATM External Cable**[1]
A 40 m (131 ft) plenum rated cable for the single mode fiber ATM adapter (FC 3295).

# Appendix E. Connectivity and Performance of the 3746 APPN/HPR Network Node (NN)

The number of PUs, frame-relay DLCIs, and sessions available through the previous processors CBSP, ESCP, TRP, CBSP2, ESCP2, TRP2, CLP and current processors CBSP3, ESCP3, TRP3, and CLP3 are given in Table E-1 on page E-2 of this Appendix.

**Note:** Processors CBSP, CBSP2, ESCP, TRP, ESCP2, TRP2, CLP are no longer manufactured.

## Adapter Connectivity

Table E-1 on page E-2 shows the maximum number of PUs, frame-relay DLCIs, and APPN or Dependent LU sessions that various 3746-900 and 3746-950 adapters can run.

The available storage in the processors determines the actual maximum number of 3746-controlled lines (SDLC), PUs, and sessions.

The table assumes that these adapters are not loaded with IP routing software. If IP routing is selected at installation time for one, two or all processor categories (ESCP2/ESCP3, TRP2/TRP3, CLP/CLP3), the maximum number of PUs, sessions (and SLDC lines) per processor of the selected category (or categories) is reduced. Expressed in LU-LU sessions (data sessions for APPN or Dependent LUs), this reduction is about 1000 sessions.

*Table E-1. Adapter Level Connectivity*

| Adapter | 3746 Model 900 | | | | 3746 Model 950 | |
|---|---|---|---|---|---|---|
| | PUs[1] | | | Sessions[2] 3746 NN | PUs[1] | Sessions[2] |
| | 3746 NN | NCP | Total | | | |
| **ESCP** | 0 | 16 | 16 | 0 | - | - |
| **ESCP2**[3] | 16[4] | 16 | 16[4] | 4900 | 16[4] | 4900 |
| **ESCP3**[3] | 32[4] | 32 | 32[4] | 14000 | 32[4] | 14000 |
| **TRP** | 0 | 2000 | 2000 | 0 | - | - |
| **TRP2**[3] | 1400 | 2000 | 2000 | 4700 | 1400 | 4700 |
| **TRP3**[3] | 4000 | 4000 | 4000 | 14000 | 4000 | 14000 |
| **For CCU B**[5]**:** | | | | | | |
| **TRP** | 0 | 500 | 500 | 0 | - | - |
| **TRP2**[3] | 1000 | 2000 | 2000 | 4000 | - | - |
| **TRP3**[3] | 4000 | 4000 | 4000 | 13000 | - | - |
| **CBSP** | - | 500 | 500 | - | - | - |
| **CBSP2/CBSP3**[6]**:** | - | 500 | 500 | - | - | - |
| **CBSP2/CBSP3**[7]**:** | 0 | 0 | 0 | 0 | 0 | 0 |
| **CLP with:** | | | | | | |
| **3000 DLCIs**[6] | - | 4000[8] | 4000[8] | - | - | - |
| **500 DLCIs**[3+9] | 1000[10] | 2000[11] | 2000[11] | 3300 | 1000[10] | 3300 |
| **CLP3 with:** | | | | | | |
| **3000 DLCIs**[6] | - | 4000[8] | 4000[8] | - | - | - |
| **2000 DLCIs**[3+9] | 3000[12] | 3000[13] | 3000[13] | 12000 | 3000[12] | 12000 |

**Legend:**

| | | | |
|---|---|---|---|
| **CBSP2** | Controller Bus and Service Processor (Type 2) | **ESCP** | ESCON Processor |
| | | **ESCP2** | ESCON Processor (Type 2) |
| **CBSP3** | Controller Bus and Service Processor (Type 3) | **ESCP3** | ESCON Processor (Type 3) |
| | | **LU** | Logical unit |
| **CCU** | Central control unit | **NN** | Network node |
| **CLP** | Communication Line Processor | **PU** | Physical unit |
| **CLP3** | Communication Line Processor (Type 3) | **TRP** | Token-ring processor |
| | | **TRP2** | Token-ring processor (Type 2) |
| **DLCI** | Data link connection identifier | **TRP3** | Token-ring processor (Type 3) |

**Notes related to Table E-1:**

1. These are adjacent PUs[1] (or ESCON logical link stations), such as end nodes (ENs), network nodes (NNs), LEN nodes, dependent PUs, gateway downstream PUs, and X.25 virtual circuits. For the 3746-900, the total of NCP-controlled and 3746-controlled stations cannot exceed the number in the **Total** column.
2. These are the LU-LU (data) sessions (for independent and dependent LUs) routed by the 3746 adapter, including sessions originating or terminating in non-adjacent[1] nodes. Sessions which are entirely routed within the adapter (port-to-port on the same adapter) count for two sessions in these numbers. HPR/ANR sessions between HPR/RTP nodes can be any number, provided these sessions do not begin or end in the 3746. For the 3746-900, these numbers do not include the sessions routed by NCP. The quantity of NCP-routed sessions depends on the 3745 storage capacity.

   These maximum figures apply only to processors that have a few PUs or only one ESCON station.
3. Not all the maximum connection capabilities may be possible. For a given processor, the maximum number of resources in a category (3746-controlled PUs, NCP-controlled PUs, 3746-controlled sessions, SDLC links) depends on the number of active resources in other categories, the presence of the IP routing feature, and, in the CLP, the mix of lines (SDLC, frame relay, X.25).

   For example, TRP2s (without IP routing) can support simultaneously a total of 500 APPN/HPR PUs and about 3000 data sessions.
4. This includes any logical stations (TCP/IP) used by the 3746 IP router.
5. This is the TRP, TRP2, or TRP3 which connects the second CCU of a 3745 Model 41A or 61A to the 3746-900.
6. For a 3746-900 fully controlled by NCP (neither 3746 APPN/HPR nor 3746 IP routing is used).
7. For any 3746-950, and any 3746-900 using the 3746 APPN/HPR network node (NN) or IP routing support.
8. Up to 1000 SDLC PUs and any mix of up to 3000 frame-relay PUs, ISDN (LIC16[2]) PUs, and X.25 virtual circuits (one PVC or SVC per PU).
9. Applicable when the APPN/HPR option is loaded in the CLPs and CLP3s of the 3746 (mandatory option for the 3746-950).
10. Up to about 1000 PUs over SDLC, frame-relay, and X.25 lines.
11. Up to 1000 SDLC PUs and any mix of up to 1000 frame-relay PUs, ISDN (LIC16[2]) PUs, and X.25 virtual circuits (one PU per PVC or SVC).
12. Up to 1000 SDLC PUs and any mix of up to 2000 frame-relay PUs and X.25 virtual circuits (one PU per PVC or SVC).
13. Up to 1000 SDLC PUs and any mix of up to 2000 frame-relay PUs, ISDN (LIC16[2]) and X.25 virtual circuits (one PU per PVC or SVC).

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1 Adjacent PU or node means that there is no routing node between the 3746 and the PU or node.

2 No longer manufactured.

## Network Node (NN) Connectivity

Table E-2 gives the maximum number of PUs, APPN and Dependent LU sessions, and lines that a 3746 NN can run.

*Table E-2. Network Node-Level Connectivity*

| Connectivity | | Comments |
|---|---|---|
| **Type** | **Number**[1] | |
| PU | 5000 | End Nodes, LEN Nodes, NNs, Dependent PUs. |
| LU-LU Sessions | 35 000[2] | This includes all the LU-LU (data) sessions using 3746 DLUR and APPN routing, including intermediate sessions involving non-adjacent nodes. HPR/ANR sessions between HPR nodes connected to the 3746 are in addition to this number of sessions and can be in any quantity. |
| SSCP-LU Sessions | 60 000[4] | This includes all the SSCP-LU (control) sessions activated by the NNP (Type 3 or Type 4). |
| Lines | 240[3] | Frame-relay, SDLC, X.25 (and PPP). |

**Note:**

1. For the 3746-900, the resources beyond these quantities are controlled by NCPs either as part of a PU type 4 (SNA) node or part of an APPN CNN.
2. 35 000 APPN/Dependent LU sessions support. The Network Node Processor Type 3 (NNP3) (FC 5423), equipped with a 32 MB Memory Expansion (FC 5047) and the NNP Type 4 (FC 5424), equipped with the 128 MB Memory Expansion (FC 5447), support up to 35 000 LU-LU (data) sessions. Out of these 35 000 sessions, 20 000 sessions can be established by the NNP3 or NNP4 acting as the Network Node (NN) server of the attached PUs (PU2s, APPN End Nodes, LENs). The remaining sessions are established by other Network Node Servers (2210, 2212, 2216, Communication Server for OS/2 WARP, Network Utility) for their LUs and downstream PUs. The MAE, with its own APPN Control Point, can be one of these Network Nodes. This support, requires the CBSP Type 3.

   For other NNP configurations, see “NNP Connectivity (Maximum Number of PUs and Sessions)” on page E-5.
3. In conjunction with other lines used for IP Routing.
4. This support requires an NNP Type 3 (FC 5423[2]) equipped with a 32 MB Memory Expansion (FC 5047) or an NNP Type 4 (FC 5424) equipped with a 128 MB Memory Expansion (FC 5447). For other NNP configurations, see “NNP Connectivity (Maximum Number of PUs and Sessions)” on page E-5.

## NNP Performance (Network Restart Time)

Actual performance depends on multiple environmental factors, which may include: products present in the network, parameter settings, and traffic characteristics.

The following comparison between the NNP Type 1 (FC 5022), NNP Type 2 (FC 5122), and NNP Type 4 (FC 5424) is based on a network configuration of 750 PUs, 30 000 SSCP-LU control sessions, and 10 000 LU-LU data sessions.

*Table E-3. Network Restart Time*

| Network Restart Time: | NNP4 (128 MB) | NNP2 (128 MB) | NNP1 (128 MB) |
|---|---|---|---|
| **Expressed in minutes** | 11 | 16.5 | 19 |
| **Compared to NNP4** | | +50% | +75% |

The above comparison can be expressed in activation rates (cumulative).

*Table E-4. Number of Activations*

| Number of Activations/sec | NNP4 (128 MB) | NNP2 (128 MB) | NNP1 (128 MB) |
|---|---|---|---|
| **SSCP-PU** | 1.1 | 0.75 | 0.65 |
| **SSCP-LU** | 45 | 30 | 25.5 |
| **LU-LU** | 15 | 10 | 8.5 |

## NNP Connectivity (Maximum Number of PUs and Sessions)

Table E-5 on page E-6 summarizes the maximum number of PUs and sessions supported by NNP Type 1 (FC 5022), NNP Type 2 (FC 5122), NNP Type 3 (FC 5423), and NNP Type 4 (FC 5424). The maximum numbers are cumulative under certain conditions indicated in the table. Capacity planning is available from IBM (CF3745, PC3745), to validate the NNP type and memory size required to support specific quantities of PUs, LU-LU sessions and SSCP-LU sessions.

In addition, the Extended Functions 4 (FC 5810 or 5811) provides a service processor function allowing the 3746 operator to display a history of the NNP memory utilization over up to 5 days.

**Note:** The maximum NNP connectivity does not take into consideration the user contraints about network activation time or network restart time. Depending on the network environment, a given NNP type may support many more PUs and sessions than required, but may not be powerful enough to restart the network as fast as needed. The NNP performance is another factor to consider before concluding which NNP type can handle a given network connectivity. See “NNP Performance (Network Restart Time).”

*Table E-5. NNP Base Memory and Memory Expansion Support Capacity*

| NNP Type - NNP Memory Configuration | PUs[1] | SSCP-LU Sessions[2] | LU-LU Sessions[3] |
|---|---|---|---|
| NNP1 base or NNP2 base (64 MB) | 3000[6] | 15 000 | 9000 |
| NNP1 with 64 MB memory expansion (128 MB) | 5000[6] | 30 000 | 15 000 |
| NNP2 with 64 MB memory expansion (128 MB) | 5000[6] | 30 000 | 30 000[4] |
| NNP3 base or NNP4 base (128 MB) | 5000[6] | 30 000 | 30 000[4] |
| NNP3 with 32 MB Memory expansion (160 MB) and with 3746 Extended Functions 2 (FC 5802) | 5000[6] | 40 000 | 30 000[4] |
| NNP3 with 32 MB Memory Expansion (160 MB) and without 3746 Extended Functions 2 (FC 5802)[7] | 5000[6] | 60 000 | 35 000[8] |
| NNP4 with Memory Expansion (256 MB) and with 3746 Extended Functions 2 (FC 5802)[7] | 5000[6] | 40 000 | 30 000[4] |
| NNP4 with Memory Expansion (256 MB) and without 3746 Extended Functions 2 (FC 5802)[7] | 5000[6] | 60 000 | 35 000[8] |

**Note:**

1. Maximum number of PUs (PU2s, LENs, APPN End Nodes, APPN Network Nodes, and so on).
2. Maximum number of SSCP-LU (control) sessions activated by the NNP.
3. Maximum number of LU-LU (data) sessions, routed through the 3746 controlled by the NNP (see also Note 4).
4. Out of these 30 000 sessions, up to 15 000 sessions can be established by the NNP Type 2, NNP Type 3, or NNP Type 4, the remaining sessions being established by other APPN Network Nodes and routed through the 3746 Network Node.
5. For optimum network activation time, the NNP base (64 MB) should not be used to control more PUs than indicated in the following examples:
   - PUs which have no CP-CP sessions with the NNP (PU2s, LENs): 1500 PUs with 15 000 SSCP-LU sessions and 9000 LU-LU sessions
   - PUs which have CP-CP sessions with the NNP (APPN End Nodes or Network Nodes): 1000 PUs with 9000 LU-LU sessions
6. If the PUs controlled by the NNP have no CP-CP sessions with the NNP (PU2s, LENs) this maximum of 5000 PUs is cumulative with the other columns (maximum number of SSCP-LUs and LU-LUs). If PUs run CP-CP sessions with the NNP (APPN End Nodes or Network Nodes), the maximum of 5000 PUs is cumulative with the other columns as long as the number of PUs with CP-CP sessions does not exceed 2500.
7. The extended number of sessions (60 000 SSCP-LU and/or 35 000 LU-LU) is incompatible with 3746 Extended Functions 2 (FC 5802).
8. Out of these 35 000 sessions, up to 20 000 can be established by the NNP Type 3 or NNP Type 4, the remaining sessions being established by other APPN Network Nodes and routed through the 3746 Network Node.

# Appendix F. Programming Support

## Network Control Programs and System Support Programs (3746-900)

The 3745 Models A and 3746-900 are supported by the versions (V) and releases (R) of IBM licensed programs, as shown in Table F-3 on page F-2.

**Note:** As an IP router or APPN/HPR Network Node, the 3746 operates independently from NCP. Programming requirements depend only on the 3746-900 interfaces and functions that need to be supported by programs running in the attached 3745 Models A (NCP, NPSI, or other). The minimum level is NCP V6R3 for the 3745 Model 17A, and NCP V6R2 for other 3745 Models A.

## Required NCP Support for Extended Functions 4

The NCP and SSP APARs required for the functions listed in Table F-1 are integrated in NCP V7R8 and SSP V4R8.

*Table F-1. Required NCP and SSP APAR for Extended Functions 4*

| Function | APAR numbers (MVS) | APAR numbers (VM) | APAR numbers (VSE) |
|---|---|---|---|
| Token-ring connection balancing (TRP3) | NCP V7R6 and V7R7<br>IR40132<br>SSP V4R6 and V4R7<br>IR40150 | V7R6 and V7R7<br>IR40132<br>SSP V4R6 and V4R7<br>IR40160 | NCP V7R6 and V7R7<br>IR40135<br>SSP V4R6 and V4R7<br>IR40163 |
| Frame-Relay BAN connection balancing (CLP3) | NCP V7R7<br>IR40133<br>SSP V4R7<br>IR40151 | NCP V7R7<br>IR40133<br>SSP V4R7<br>IR40161 | NCP V7R7<br>IR40136<br>SSP V4R7<br>IR40164 |
| ESCP support for 32 LPARs (ESCP3) | NCP V7R6 and V7R7<br>IR40131<br>SSP V4R6 and V4R7<br>IR40152 | NCP V7R6 and V7R7<br>IR40131<br>SSP V4R6 and V4R7<br>IR40162 | NCP V7R6 and V7R7<br>IR40134<br>SSP V4R6 and V4R7<br>IR40165 |

## Required NCP Support for Extended Functions 5

The NCP and SSP APARs required for the functions listed in Table F-2 are integrated in NCP V7R8 SUP for MVS and VM (SMC0019) and SSP V4R8 SUP for MVS and VM (SMC0019).

*Table F-2. Required NCP and SSP APAR for Extended Functions 5*

| Function | APAR numberes (MVS) | APAR numbers (VM) | APAR numbers (VSE) |
|---|---|---|---|
| Token-Ring Dynamic Windowing[1] | NCP V7R8: IR42608<br>SSP V4R8: IR42617 | NCP V7R8: IR42608<br>SSP V4R8: IR42618 | NCP V7R8: IR42611<br>SSP V4R8: IR42619 |
| X.25 QLLC for DDX-P Lines | NCP V7R8: IR42600<br>SSP V4R8: IR42660 | NCP V7R8: IR42600<br>SSP V4R8: IR42662 | NCP V7R8: IR42602<br>SSP V4R8: IR42663 |

**Notes:**

1. NTuneMON Version 3 is required for dynamic tuning of the "dw" and "dwc" suboperands of the DYNWIND keyword.

*Table F-3. Programming Support for the 3745 Models A and 3746-900*

| S/390 Operating System | NCP[1] | NRF | SSP | EP[2] | 3746-900 Support | | | | | | 3745 Models A | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ESCON | Token-Ring | Communication Lines[3] | | | | 21A 31A 41A 61A | 17A |
| | | | | | | | SDLC | FR | X.25, BAN[4] | LIC16 ISDN | | |
| MVS/VM | V6R2 | R8 | V3R8 | R11 | √ | √ | No | No | No | No | √ | No |
| MVS | V6R3 | R8 | V3R9 | R11 | √ | √ | √ | No | No | No | √ | √ |
| MVS/VM/VSE | V7R1 | R9 | V4R1 | R12 | √ | √ | √ | No | No | No | √ | √ |
| MVS | V7R2 | R9 | V4R2 | R12 | √ | √ | √ | √ | No | No | √ | √ |
| MVS | V7R3 | R9 | V4R3 | R12 | √ | √ | √ | √ | √[5] | No | √ | √ |
| MVS/VM/VSE | V7R4 | R9 | V4R4 | R12 | √ | √ | √ | √ | √[6] | No | √ | √ |
| MVS/VM/VSE | V7R5 | R9 | V4R5 | R12 | √[7] | √[7] | √ | √[7] | √[7] | √ | √ | √ |
| MVS/VM/VSE | V7R6[8] | R9 | V4R6 | R12 | √ | √ | √ | √[7] | √[7] | √ | √ | √ |
| MVS/VM/VSE | V7R7[8] | R9 | V4R7 | R14 | √ | √ | √ | √[7] | √[7] | √ | √ | √ |
| MVS/VM/VSE | V7R8[8] | R9 | V4R8 | R14 | √ | √ | √ | √[7] | √[7] | √ | √ | √ |

**Notes:**

1. If you have a 3746-900 installed, NCP V7 is required for NCP Tier C, which provides no-charge support for all the adapters of the 3746 Nways Controller Model 900 (3746-900 equipped with a NNP).
2. The partitioned emulation programming (PEP) extension of NCP is provided by EP. EP communication over ESCON channels is not supported.
3. PPP lines are supported by the IP routing feature of the 3746-900, but not by NCP.
4. Frame-relay Boundary Access Node (BAN) function.
5. X.25 requires NPSI V3R8.
6. With NCP V7R4 (and above) and X.25 Support (FC 5030) in the 3746-900, NPSI is not required for SNA (NCP) communications over X.25. NPSI is required only for non-SNA traffic.
7. NCP V7R5 (and above) supports frame-relay BAN for INN traffic, and port sharing between NCP traffic, 3746 IP router and 3746 APPN/HPR NN traffic. This sharing applies to ESCON, token-ring, X.25, and frame-relay ports, and to frame-relay DLCIs.
8. NCP V7 R6 (and above) supports internal IP routing between the 3746 IP router and the 3745.

**Legend:**

**BAN** Boundary Access Node
**EP** Emulation Program
**FR** Frame Relay
**ISDN** Integrated Services Digital Network
**NCP** Network Control Program
**NRF** Network Routing Facility
**SSP** System Support Programs

# S/390 Server Communications Support

## TCP/IP for MVS (OS/390 for MVS)

To support native IP routing (RIP) over channel adapters, TCP/IP V3R2 with PTFs (documented in APAR II09903) is required at minimum. This APAR also includes PTFs on MVS.

RIP Version 2 support over channel adapters requires at minimum TCP/IP V3R2 with PTF UQ21140 or OS/390 V2R5.

MPC+ support over the ESCON and parallel channel adapters of the MAE requires at minimum OS/390 V2R4 for UDP or OS/390 V2R5 for IP.

The ESCON Processor Type 3 support of MTU values larger than 4 KB (up to 7 KB) requires OS/390 for MVS Version 2 Release 8 with APARs PQ39577 and OW44775, or OS/390 for MVS Version 2 Release 10.

## TCP/IP for VM

This program does not provide support for channel connections to the 3745 or 3746.

## ACF/VTAM

*Table F-4. VTAM Support and Required Version Numbers*

| Traffic Type | Channel adapters | Version and Release (minimum) |
|---|---|---|
| SNA (NCP) | ESCP2/ESCP3 | V3R4.1 (MVS/ESA)<br>V3R4 (VM/ESA)<br>V3R3 (VSE/ESA) |
| APPN/ISR | ESCP2/ESCP3 | V4R1 |
| APPN/HPR | ESCP2/ESCP3 | V4R4[1] |
| Dependent LUs (DLUS function) | ESCP2/ESCP3, MAE channel adapters[2] | V4R4 |
| SNA (non-APPN) | MAE channel adapters[2] (using LSA) | V3R4 |
| APPN/ISR | MAE channel adapters[2] (using LSA) | V4R2 |
| APPN/HPR | MAE channel adapters[2] (using MPC+) | V4R4[3] |
| 3746 TN3270E Server | 3745/3746/MAE channel adapters | See Note 4 |

**Notes:**

1. With necessary PTFs
2. ESCON, parallel channel
3. With APAR OW26732
4. Depends on upstream traffic type over the channel adapter (see the corresponding line in the table).

## Transaction Processing Facility (TPF)

To support ESCON channel operation, TPF Version 3 or Version 4 is required.

Native TCP/IP stack in TPF (PUT11) supports IP over the ESCON adapters of the 3746.

## NetView/390

NetView is recommended for network management of the 3745 and 3746. Different versions of NetView provide the following:

**Support for full alerts in the 3745 with a 3746-900 controlled by NCP**
Provided by NetView Version 2 Release 4 and later.

**Support for full alerts in the 3746s controlled by the NNP (3746 NN)**
Provided by NetView Version 3 Release 1. Alert support for 3746 NNs is also provided by NetView Version 2 Release 4 after alert customization.

**Support for APPN/HPR NNs of the 3746-900 and 3746-950**
Provided by the APPN Topology Manager function of NetView Version 3 Release 1 (also provided by the APPNTAM feature of NetView Version 2 Release 4).

## NetView Performance Monitor (NPM)

The following table shows NPM support and APAR numbers depending on the Version and Release level.

NPM V2R5 supports the functions listed in Table F-5 without 3745/3746-specific APARs.

For current information about available APARs, refer to informational APARs II07986 (NPM V2R2) or II10487 (NPM V2R3), which also contain NPM dependencies on other software products.

*Table F-5. NPM Support and Required APAR Numbers*

| Support | V1R6 | V2R1 | V2R2 | V2R3 | V2R4 |
|---|---|---|---|---|---|
| 3745/3746-900 (NCP) | No APAR | No APAR | No APAR | No APAR | No APAR |
| 3746-900; Frame relay (NCP V7R2) | N/A | OW07715 | OW07715 | No APAR | No APAR |
| Frame-relay line utility on NPM panels | N/A | N/A | OW10029 | No APAR | No APAR |
| 3746-900; X.25 (NPSI V3R8, NCP V7R3) | N/A | OW10583 | OW10583 | No APAR | No APAR |
| 3746-900; X.25 (NCP V7R4) | N/A | OW19297 | OW19297 | No APAR | No APAR |
| 3746-900 adapter utilization; processor, storage, TIC3 (NCP V7R3) | N/A | OW08565<br>OW10584 | OW08565<br>OW10584 | No APAR | No APAR |
| 3746-900 CNN; LAN counters for non-ERP traffic (ANR) over TIC3 (NCP V7R4) | OW17878 | OW17876 | OW17876 | No APAR | No APAR |
| 3746-900 and 950 resources controlled by NNP (3746 NN):<br><br>- Counter thresholds monitoring and alert generation<br>- Counters display in 3270 online panels | N/A<br><br>N/A<br>N/A | OW08565<br>OW10584<br>OW17876<br>OW19447<br>N/A<br>N/A | OW08565<br>OW10584<br>OW17876<br>OW19447<br>OW26306<br>OW26463 | <br><br>OW19447<br>OW26306<br>OW26463 | No APAR |
| 3746-900 and 3746-950 counters of active PUs per TIC3 | N/A | N/A | N/A | N/A | OW37743 |
| 3745/3746 microcode level F64810 or later | N/A | N/A | OW37743 | OW37743 | OW37743 |

## NTuneMON

NTuneMON monitors the network, and along with the NTuneNCP feature running in the 3745, provides on-line interactive tuning of NCP keyword parameters. Optimization of network performance is greatly simplified by NTuneMON.

For the 3746 controlled by the NNP, similar facilities are provided by CCM.

### NETDA/2

NETDA/2, running on PS/2, provides network definition aids which simplify SNA, APPN/HPR, and frame-relay network design activities.

## AIX Support (Tivoli)

### NetView for AIX

Network management for the 3746 IP router requires:

- Router and Bridge Manager (RABM), available with Nways Manager Suite[1] (Version 2) for Windows/NT/AIX/HP-UX, or Nways Element Manager[1] (Version 2) for Windows NT/AIX/HP-UX.
- Programs, such as NetView for AIX[2], at the level required by the above network management program.

### CCM Remote Configuration ("CCM Batch")

The CCM Remote Configuration facility of Extended Functions 4 (FC 5810 or 5811) requires AIX Version 4.1[2] or above.

## OS/2 Support

The CCM Remote Configuration facility (CCM files editing) of Extended Functions 5 (FC 5812) requires a workstation running OS/2. The OS/2 workstation required for remote console access via DCAF can be used for this purpose.

The CCM utility provided for configuration of the 3746 APPN/HPR and IP parameters, including the ESCON definitions for NCP, also requires a workstation running OS/2.

## DCAF Console Support

### Minimum Programming Requirements

Distributed Console Access Facility (DCAF) and Tivoli Management Environment (TME) 10 Remote Control (5697-RCL), which contains DCAF, are no longer available. New Tivoli DCAF licenses can be obtained by ordering 5799-XEN (RPQ P85585) and the necessary FCs for 3745/3746 support.

You need the following minimum program levels on your workstation to remotely access the service processor:

- OS/2 Version 2.1 or higher.
- Communications Manager/2 Version 1.11 or higher, or Communication Server/2.

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1 Previously, Router and Bridge Manager (RABM) provided network management support for the 3746 IP router. RABM was part of products that are no longer available: Nways Enterprise Manager, Nways Campus Manager LAN for AIX (V2R1), Nways Campus Manager Suite for AIX (V2R1), and Nways Manager for AIX (V1.2.1).

2 After NetView for AIX V 4.0, the product name is Tivoli NetView.

- LAN Adapter Protocol Support (LAPS) Version 2.2 or higher for LAN-Attached workstations.
- TCP/IP Version 2.0 or higher for LAN-attached (TCP/IP type) workstations.
- DCAF[3], or TME 10 Remote Control[3].

**Notes:**

- Network Transport Services/2 (NTS/2) should be installed for LAN-attached consoles and SNA-attached consoles connected to an SNA network via a LAN.
- Accessing the service processor via an SNA or APPN/HPR network backbone requires the following:
  - TME 10 Remote Control remote workstations and gateway workstations configured as physical units type 2.1 (PU 2.1). If the TME workstation is downstream from a 3174 control unit, the 3174 must have either of the following:
    - Configuration Support B plus 8Q0800 Programming Request for Price Quotation (PRPQ).
    - Configuration Support C (APPN feature).
  - When using 3725 Communication Controllers in the network backbone, the controllers must be loaded with NCP V4R3 and operate under VTAM V3R2 or higher.
  - When using 3720 and 3745 communication controllers in the network backbone, the controllers must be loaded with NCP V5R2 or higher and operate under VTAM V3R2 or higher.

## Java Console Support

### Minimum Programming Requirements

The controlling workstation may be operated on any of the following platforms:

- OS/2, OS/2 Warp
- Windows 95, Windows 98, and Windows NT
- AIX/UNIX

The minimum program levels required on your workstation to remotely access the service processor is a web browser (for example, Internet Explorer 4.0, or Netscape 4.0) with Java 1.1 or later enabled.

[3] For the minimum levels required, see “Accessing the Service Processor Via TME 10 Remote Control” on page 6-11.

# Telnet Access

## Programming Requirements

To remotely access NNP functions, make sure that your remote workstation runs an operating system that supports TCP/IP, including the Telnet Client program.

# Appendix G. The 3745 Models A and the 3746 Compared to Previous 3745 Models

**Note:** Previous 3745 Models include the 130, 150, 160, 170, 210, 310, 410, and 610. These models are no longer manufactured, except Model 170.

## Business Solutions

The 3745 Models A, the 3746-900, and the 3746-950 bring new design solutions and adaptability to today's fast-changing network technology. Examples of this adaptability are as follows:

- 3746 ESCON channel, token-ring, and communication line adapters can concurrently route SNA, IP and APPN/HPR traffic.
- 3745 Models A operating ACF/NCP Version 7 to expand SNA subarea networking capabilities.

The improved connectivity of the 3746 (up to 32 lines operating at speeds above 256 kbps up to 2 Mbps, and more for the MAE adapters) allows more lines operating at faster transmission speeds.

Frame-relay links connected to the 3746 allow each virtual connection between end stations to be assigned individual communication rates (percentage of the bandwidth). This allows mission-critical data requiring short response times to be carried at a faster rate, and other less critical traffic, such as file transfers between LAN servers and S/390 server databases, to be assigned a lower rate in the remaining bandwidth.

The 3746 frame-relay Boundary Access Node (BAN) function allows equipment, such as a 2210 Multiprotocol Router, 2212 Access Utility, 2216 Multiaccess Connector, and 2218 FRAD, to access the SNA backbone via either of the following:

- Private leased line
- Public frame-relay connection

Frame-relay BAN has the following advantages:

- Dynamic routing of the SNA flows, instead of static predefined DLCI switching. This allows authorized downstream PUs to access host applications over an SNA backbone.
- Direct access from BAN equipment to the 3746 removes the need for an intermediate router, locally attached to a token-ring port.
- MAC address support, allowing any number of downstream PUs to be connected to the router, with access to the 3746 over the same frame-relay DLCI number.

Frame-relay service access point (SAP) multiplexing of the 3746 allows units, such as a 2217 concentrator or a 3174 controller, to use a single frame-relay DLCI number for multiple downstream SNA stations. This simplifies network administration and reduces the costs of frame-relay services.

High performance 3746 adapters provide the following:

- Opportunities to support more data transfer.
- More efficient interaction between user and host applications, for example, image processing, or database access in a client/server environment.

The price-to-performance ratio of 3746 adapters increases if you consolidate multiple 37xx installations with 3746 machines.

The reliability and availability of the 3745 and 3746 contribute to the success of businesses that depend on cost-effective and efficient networks.

## System Management Solutions

The consolidation of front-end processing on fewer pieces of equipment is made possible by the following attributes of the 3746-900 and 3746-950:

- Multiprotocol routing
- High level performance
- Connectivity to ESCON channels, HSSI and ATM
- Extended communication line capacity
- Extended LAN capacity, including Fast Ethernet and FDDI

Consolidation simplifies network management and reduces associated operational costs.

### Cabling

A method of cabling via line connection boxes (LCBs) and the active remote connectors (ARCs) saves floor space around the 3745/3746 frames, and decreases the number of cables between the machine and the modem.

Line interfaces and the cables can be relocated with the modems, requiring less time and effort to install, and easy access if needed.

### Service Processor

The service processor running MOSS-E complements the 3745 MOSS and replaces the operator console of the first generation 3745s (Models 130 to 610). MOSS-E includes new functionality for maintaining and remotely controlling the 3745 and 3746. Some of the functions of the service processor are listed below:

- A dual level of microcode can be run and maintained in the service processor (if equipped with CD-ROM). Microcode upgrades can occur in the non-active level of the service processor.
- A single service processor can run up to four 3745s, and two 3746s with one operating as a 3746 IP router, or APPN/HPR NN, or both.
- The service processor of the 3745 and 3746 automatically:
  - Reports problems to the IBM RSF
  - Loads microcode fixes
- A service processor can be remotely accessed by an OS/2 workstation running DCAF via SNA, APPN, or IP networks, or by a Java 1.1-enabled workstation via a TCP/IP connection to:
  - Save the cost of access via a switched telephone network.

– Provide reliable and efficient remote control of the 3745/3746 via high speed communication lines.

## User Productivity Solutions

The 3746 increases user productivity by providing several networking solutions, including frame-relay frame switching, higher availability, expansion, and increased connectivity and performance.

### Frame-Relay Switching

Frame-relay switching throughput in the 3746 (CLP/CLP3) increases the bandwidth utilization in many traffic environments, whether interactive or file transfer. The 3745/3746-900 SNA flow control and frame-relay congestion functions hold the frame-relay throughput at T1 (1544 Mbps) or E1 (2048 Mbps) speeds or subspeeds.

The 3746 frame-relay switching allows protocols other than IP, SNA, and APPN/HPR to be carried by a 3745/3746 based frame-relay network. Either a communication rate or, better, a CIR can be assigned to an individual virtual circuit between two end stations, providing a high-quality transport network.

### Availability

As user productivity depends significantly on the availability of the network, the maintenance support of 3745 Models A and 3746 ensures short turn around times between problem detection and problem repair. The 3745 and 3746 automatically report problems to the RETAIN system at the IBM RSF, a fast and efficient method of problem solving.

The 3746 is designed for high availability, and can run continuously during the following procedures:

- Maintenance (concurrent diagnosis and maintenance).
- Installation and reconfiguration of channel, LAN, and line adapters (concurrent upgrade).

### Expansion

Consolidating existing communication controllers on a single 3745/3746-900 or 3746-950 reduces the workload of system programmers. For example, reducing NCPs means fewer NCP generations, and reduced NCP licensing fees.

Migrating communication lines, LAN, and channel connections from the 3745 conventional adapters to 3746-900 adapters reduces the load on the 3745s.

### Connectivity

The high throughput of the ESCON channel adapter combined with the high-performance LAN and WAN adapters significantly reduces data transfer times. This is an asset during peak traffic hours, when adapters may be overloaded.

## Performance

Performance[1] features of the 3746-900 and the 3746-950 include the following:

- The 3746-900 reduces the workload of the 3745, freeing CCU cycles and memory for NCP activities, for example SNA routing.
- Given the same traffic load, the 3745 with a 3746-900 operates much faster than a 3745 alone. For example, in a pure token-ring and ESCON environment, the 3745/3746-900 maximum data throughput is up to three times the standalone 3745.
- 3746 communication line adapters (CLAs) increase the number of high-speed lines (up to 32 lines operating at up to 2048 Mbps), to allow for more users, improved traffic rate between users and applications, and shorter response times.
- The CLA provides frame-relay frame switching, independent of the ACF/NCP in the attached 3745. This allows higher switching throughput and frees the 3745 of traffic loads, enabling more processing power to be dedicated to SNA routing.
- ESCON channel adapters (ESCAs) in the 3746 are designed for transferring large volumes of data at high speed, especially highly-interactive client/server applications. Depending on the traffic type (SNA, IP, APPN, or HPR/ANR), a 3746 operating with an ESCA and a token-ring adapter (TRA) can transfer data files five to ten times faster than a 3745 with a parallel channel adapter and a TRA.
- The ESCA in the 3746 supports EMIF for accessing multiple host images via a single ESCON channel, increasing the utilization of ESCON hardware.

## Growth

You can migrate the 3745 to 3746 ESCON connectivity, frame-relay technology, and 3746 IP and APPN/HPR routing if you need to allow for more users and greater network access. The 3746 permits large number of users and high volume of data in the network. Greater access can be achieved through the performance of the following communication controller features:

- ESCAs in the 3746 can perform the following:
  - Concentrate network traffic on fewer physical interfaces
  - Route traffic to appropriate ESCON channels via ESCON director(s)
  - Communicate with several LPARs over a single ESCON channel using EMIF
- TRAs in the 3746 can be increased to provide up to 32 LAN ports.
- High throughput in the 3746 is possible through the following:
  - The 4-Mbps/16-Mbps TRAs in the 3746-900 can off-load the 3745 internal bus and CCU. By connecting the token-ring LANs to the 3746-900 instead of to the 3745, up to 70% of the CCU processing load can be saved for SNA (NCP) traffic.

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[1] The actual performance depends on several factors, for example, the system configuration and the mix of traffic types. The configuration aid CF3745 provides performance capabilities for adapters and controllers in specific configurations and traffic environments.

  - TRAs are efficient, and depending on the type of traffic, adapter throughput can approximately reach the speed of the token-ring LAN (16 Mbps). This increases the amount of traffic flowing through a single token-ring port of the 3745, and allows large token-ring backbones to access host data bases and applications.
  - In LAN environments, the 3746 maximum aggregate data throughput, for example, throughput to S/390 servers, is up to 60 times greater than a 3745 Model 210.

- The CLAs of the 3746 provide excellent price-to-performance ratio for SDLC, PPP, frame-relay, X.25 and ISDN communication lines. The 3746-900 saves the 3745 up to 50% of the CCU processing load, allowing twice the amount of SNA traffic controlled by NCP[2]. Other networks and traffic can be consolidated on the 3745/3746 network, and existing networks opened to new users.
- Frame-relay switching, off-loaded to 3746-900 adapters, relieves the corresponding traffic load for the 3745, and allows an increase in the other traffic loads controlled by NCP (usually SNA). Frame relay on the 3746 supports much higher throughputs than a stand-alone 3745 (not using a 3746-900).
- The 16 MB storage of the 3745 Models 31A and 61A provides the following options:
  - To operate with ACF/NCP load modules of up to 12 megabytes, allowing twice the amount of workstations connected to an SNA network subarea controlled by a ACF/NCP.
  - Greater availability of network designs via alternate paths and duplicate user definitions in ACF/NCP.
- The 3745 Models 31A and 61A has the processing power to manage growth in traffic from increasing the connectivity of the 3745/3746-900.
- The 3745/3746-900 SNA node can evolve to a 3746 IP routing and APPN/HPR node.

[2] The actual maximum throughput depends on the 3745 model and the type of traffic.

# Appendix H. Bibliography

## Customer Documentation for the 3746 Model 950

*Table H-1 (Page 1 of 5). Customer Documentation for the 3746 Model 950*

This customer documentation has the following formats:



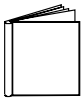
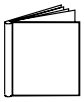
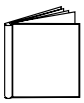
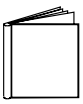

| | | |
|---|---|---|
| **Finding Information** | | |
| | | ***3745 Models A and 3746 Books***<br><br>All of the books in the 3745 Models A and 3746 library are available on the CD-ROM that contains the Licensed Internal Code (LIC) for the machine. |
| **Preparing for Operation** | | |
|  | GA33-0400 | ***IBM 3745 Communication Controller All Models***[1]<br>***IBM 3746 Expansion Unit Model 900***<br>***IBM 3746 Nways Multiprotocol Controller Model 950***<br><br>***Safety Information***[2]<br><br>Provides general safety guidelines. |
| **Evaluating and Configuring** | | |
|  | GA33-0180 | ***IBM 3745 Communication Controller Models A***[3]<br>***IBM 3746 Nways Multiprotocol Controller***<br>***Models 900 and 950***<br><br>***Overview***<br><br>Gives an overview of connectivity capabilities within SNA, APPN, and IP networking. |
|  | GA27-4234 | ***IBM 3745 Communication Controller Models A***[2]<br>***IBM 3746 Expansion Unit Model 900***<br>***Models 900 and 950***<br><br>***Planning Series: Overview, Installation, and Integration***<br><br>Provides information for:<br>• Overall 3746 planning<br>• Installation and upgrade scenarios<br>• Controller and service processor network integration<br>• Related MOSS-E and CCM worksheets for these tasks. |

*Table H-1 (Page 2 of 5). Customer Documentation for the 3746 Model 950*



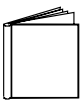
GA27-4235

***IBM 3745 Communication Controller Models A[2]***
***IBM 3746 Expansion Unit Model 900***
***Models 900 and 950***

***Planning Series: Serial Line Adapters***

Provides information for:

- Serial line adapter descriptions
- Serial line adapter line weights and connectivity
- Types of SDLC support
- Configuring X.25 lines
- Performance tuning for frame-relay, PPP, X.25, and NCP lines.
- CCM worksheets for serial line definitions
- ISDN adapter description and configuration.



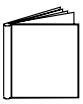
GA27-4236

***IBM 3745 Communication Controller Models A[2]***
***IBM 3746 Expansion Unit Model 900***
***Models 900 and 950***

***Planning Series: Token-Ring, and Ethernet***

Provides information for:

- Token-ring adapter description and configuration
- Ethernet adapter description and configuration
- CCM worksheets for token-ring definitions.



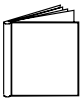
GA27-4237

***IBM 3745 Communication Controller Models A[2]***
***IBM 3746 Expansion Unit Model 900***
***Models 900 and 950***

***Planning Series: ESCON Channels***

Provides information for:

- ESCON adapter descriptions
- ESCON configuration and tuning information
- ESCON configuration examples
- CCM worksheets for ESCON definitions.



GA27-4238

***IBM 3745 Communication Controller Models A[2]***
***IBM 3746 Expansion Unit Model 900***
***Models 900 and 950***

***Planning Series: Physical Planning***

Provides information for:

- 3746 physical planning details
- Explanation of installation sheets
- 3746 plugging sheets.

*Table H-1 (Page 3 of 5). Customer Documentation for the 3746 Model 950*

GA27-4239

***IBM 3745 Communication Controller Models A²***
***IBM 3746 Expansion Unit Model 900***
***Models 900 and 950***

***Planning Series: Management Planning***

Provides information for:

- Overview for 3746
- 3746 APPN/HPR, IP router, and X.25
- NetView Performance Monitor (NPM), remote consoles, and RSF.

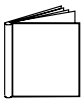
GA27-4240

***IBM 3745 Communication Controller Models A²***
***IBM 3746 Expansion Unit Model 900***
***Models 900 and 950***

***Planning Series: Multiaccess Enclosure Planning***

Provides information for:

- MAE adapters and physical planning details
- MAE ESCON planning and configuration
- MAE APPN/HPR and IP management
- ATM and ISDN support
- MAE worksheets.



GA27-4241

***IBM 3745 Communication Controller Models A²***
***IBM 3746 Expansion Unit Model 900***
***Models 900 and 950***

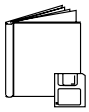
***Planning Series: Protocol Introductions***

Provides information for:

- Introduction and overview of APPN/HPR, IP, token-ring, Ethernet, frame-relay, PPP, X.25, and ESCON channels.

*Table H-1 (Page 4 of 5). Customer Documentation for the 3746 Model 950*

**Operating and Testing**



SA33-0356

***IBM 3746 Nways Multiprotocol Controller Model 950***

***User's Guide***[2]

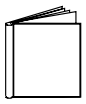
Explains how to:

- Carry out daily routine operations on Nways controller
- Install, test, and customize the Nways controller after installation
- Configure user's workstations to remotely control the service processor using:
  - DCAF program
  - Telnet client program
  - Java Console support.

On-line information

***Controller Configuration and Management Application***

Provides a graphical user interface for configuring and managing a 3746 APPN/HPR network node and IP Router, and its resources.
It is also available as a stand-alone application, using an OS/2 workstation.
Defines and explains all the 3746 Network Node and IP Router configuration parameters through its on-line help.

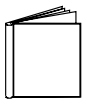


SH11-3081

***IBM 3746 Nways Multiprotocol Controller Models 900 and 950***

***Controller Configuration and Management: User's Guide***[2]

Explains how to use CCM and gives examples of the configuration process.



GA33-0479

***IBM 3745 Communication Controller Models A***
***IBM 3746 Nways Multiprotocol Controller Models 900 and 950***

***Command Reference Guide***[5]

Explains how to use the RUNCMD commands from NetView for OS/390 and gives examples.

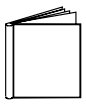
**Managing Problems**

On-line information

***Problem Analysis Guide***

An on-line guide to analyze alarms, events, and control panel codes on:

- IBM 3745 Communication Controller Models A[3]
- IBM 3746 Nways Multiprotocol Controller Models 900 and 950.



SA33-0175

***IBM 3745 Communication Controller Models A***[3]
***IBM 3746 Expansion Unit Model 900***
***IBM 3746 Nways Multiprotocol Controller Model 950***

***Alert Reference Guide***

Provides information about events or errors reported by alerts for:

- IBM 3745 Communication Controller Models A[3]
- IBM 3746 Nways Multiprotocol Controller Models 900 and 950.

*Table H-1 (Page 5 of 5). Customer Documentation for the 3746 Model 950*

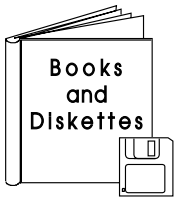
[1] Models 130 to 61A.
[2] Documentation shipped with the 3746-950
[3] 3745 Models 17A to 61A.

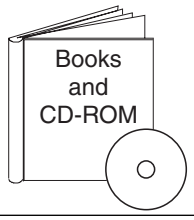
# Customer Documentation for the 3745 (All Models), and 3746 (Model 900)

*Table H-2 (Page 1 of 6). Customer Documentation for the 3745 Models x10 and x1A, and 3746 Model 900*

This customer documentation has the following formats:





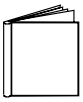




**Finding Information**

***3745 Models A and 3746 Books***

All of the books in the 3745 Models A and 3746 library are available on the CD-ROM that contains the Licensed Internal Code (LIC) for the machine.

**Evaluating and Configuring**



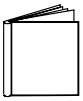
GA33-0092

***IBM 3745 Communication Controller***
***Models 210, 310, 410, and 610***

***Introduction***

Gives an introduction of the IBM Models 210 to 610 capabilities.

For Models A, refer to the *Overview*, GA33-0180.

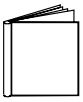


GA33-0180

***IBM 3745 Communication Controller Models A[2]***
***IBM 3746 Nways Multiprotocol Controller***
***Models 900 and 950***

***Overview***

Gives an overview of connectivity capabilities within SNA, APPN, and IP networking.



GA27-4234

***IBM 3745 Communication Controller Models A[2]***
***IBM 3746 Expansion Unit Model 900***
***Models 900 and 950***

***Planning Series: Overview, Installation, and Integration***

Provides information for:

- Overall 3746 planning
- Installation and upgrade scenarios
- Controller and service processor network integration
- Related MOSS-E and CCM worksheets for these tasks.

*Table H-2 (Page 2 of 6). Customer Documentation for the 3745 Models x10 and x1A, and 3746 Model 900*

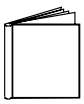
GA27-4235

***IBM 3745 Communication Controller Models A[2]***
***IBM 3746 Expansion Unit Model 900***
***Models 900 and 950***

***Planning Series: Serial Line Adapters***

Provides information for:

- Serial line adapter descriptions
- Serial line adapter line weights and connectivity
- Types of SDLC support
- Configuring X.25 lines
- Performance tuning for frame-relay, PPP, X.25, and NCP lines.
- CCM worksheets for serial line definitions
- ISDN adapter description and configuration.



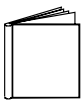
GA27-4236

***IBM 3745 Communication Controller Models A[2]***
***IBM 3746 Expansion Unit Model 900***
***Models 900 and 950***

***Planning Series: Token-Ring, and Ethernet***

Provides information for:

- Token-ring adapter description and configuration
- Ethernet adapter desription and configuration
- CCM worksheets for token-ring definitions.



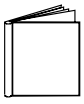
GA27-4237

***IBM 3745 Communication Controller Models A[2]***
***IBM 3746 Expansion Unit Model 900***
***Models 900 and 950***

***Planning Series: ESCON Channels***

Provides information for:

- ESCON adapter descriptions
- ESCON configuration and tuning information
- ESCON configuration examples
- CCM worksheets for ESCON definitions.



GA27-4238

***IBM 3745 Communication Controller Models A[2]***
***IBM 3746 Expansion Unit Model 900***
***Models 900 and 950***

***Planning Series: Physical Planning***

Provides information for:

- 3746 physical planning details
- Explanation of installation sheets
- 3746 plugging sheets.

*Table H-2 (Page 3 of 6). Customer Documentation for the 3745 Models x10 and x1A, and 3746 Model 900*

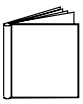
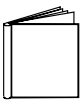
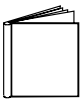
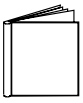
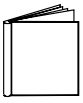
| | | |
|---|---|---|
|  | GA27-4239 | ***IBM 3745 Communication Controller Models A[2]***<br>***IBM 3746 Expansion Unit Model 900***<br>***Models 900 and 950***<br><br>***Planning Series: Management Planning***<br><br>Provides information for:<br>• Overview for 3746<br>• 3746 APPN/HPR, IP router, and X.25<br>• NetView Performance Monitor (NPM), remote consoles, and RSF. |
|  | GA27-4240 | ***IBM 3745 Communication Controller Models A[2]***<br>***IBM 3746 Expansion Unit Model 900***<br>***Models 900 and 950***<br><br>***Planning Series: Multiaccess Enclosure Planning***<br><br>Provides information for:<br>• MAE adapters and physical planning details<br>• MAE ESCON planning and configuration<br>• MAE APPN/HPR and IP management<br>• ATM and ISDN support<br>• MAE worksheets. |
|  | GA27-4241 | ***IBM 3745 Communication Controller Models A[2]***<br>***IBM 3746 Expansion Unit Model 900***<br>***Models 900 and 950***<br><br>***Planning Series: Protocol Introductions***<br><br>Provides information for:<br>• Introduction and overview of APPN/HPR, IP, token-ring, Ethernet, frame-relay, PPP, X.25, and ESCON channels. |
| **Preparing Your Site** | | |
|  | GC22-7064 | ***IBM System/360, System/370, 4300 Processor***<br><br>***Input/Output Equipment Installation Manual-Physical Planning***<br>(Including Technical News Letter GN22-5490)<br><br>Provides information for physical installation for the 3745 Models 130 to 610.<br><br>For 3745 Models A and 3746 Model 900, refer to the *Planning Series: Physical Planning*, GA27-4238. |
|  | GA33-0127 | ***IBM 3745 Communication Controller***<br>***Models 210, 310, 410, and 610***<br><br>***Preparing for Connection***<br><br>Helps for preparing the 3745 Models 210 to 610 cable installation.<br><br>For 3745 Models A refer to the *Connection and Integration Guide*, SA33-0129. |
| **Preparing for Operation** | | |

*Table H-2 (Page 4 of 6). Customer Documentation for the 3745 Models x10 and x1A, and 3746 Model 900*

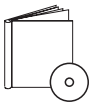
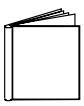
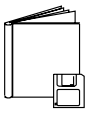
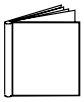
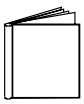
| | | |
|---|---|---|
|  | GA33-0400 | ***IBM 3745 Communication Controller All Models***[3]<br>***IBM 3746 Nways Multiprotocol Controller***<br>***Models 900 and 950***<br><br>***Safety Information***[1]<br><br>Provides general safety guidelines. |
|  | SA33-0129 | ***IBM 3745 Communication Controller All Models***[3]<br>***IBM 3746 Nways Multiprotocol Controller Model 900***<br><br>***Connection and Integration Guide***[1]<br><br>Contains information for connecting hardware and integrating network of the 3745 and 3746-900 after installation. |
|  | SA33-0416 | ***Line Interface Coupler Type 5 and Type 6***<br>***Portable Keypad Display***<br><br>***Migration and Integration Guide***<br><br>Contains information for moving and testing LIC types 5 and 6. |
|  | SA33-0158 | ***IBM 3745 Communication Controller All Models***[3]<br>***IBM 3746 Nways Multiprotocol Controller Model 900***<br><br>***Console Setup Guide***[1]<br><br>Provides information for:<br>• Installing local, alternate, or remote consoles for 3745 Models 130 to 610<br>• Configuring user workstations to remotely control the service processor for 3745 Models A and 3746 Model 900 using:<br>– DCAF program<br>– Telnet Client program<br>– Java Console support. |
| **Customizing Your Control Program** | | |
|  | SA33-0178 | ***Guide to Timed IPL and Rename Load Module***<br><br>Provides VTAM procedures for:<br>• Scheduling an automatic reload of the 3745<br>• Getting 3745 load module changes transparent to the operations staff. |
| **Operating and Testing** | | |
|  | SA33-0098 | ***IBM 3745 Communication Controller***<br>***All Models***[4]<br><br>***Basic Operations Guide***[1]<br><br>Provides instructions for daily routine operations on the 3745 Models 130 to 610. |

*Table H-2 (Page 5 of 6). Customer Documentation for the 3745 Models x10 and x1A, and 3746 Model 900*

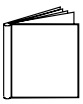
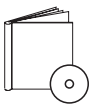
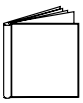
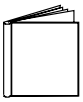
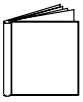
| | | |
|---|---|---|
|  | SA33-0177 | ***IBM 3745 Communication Controller Models A*[2]<br>*IBM 3746 Nways Multiprotocol Controller Model 900***<br><br>***Basic Operations Guide*[1]**<br><br>Provides instructions for daily routine operations on the 3745 Models 17A to 61A, and 3746 Model 900 operating as an SNA node (using NCP), APPN/HPR Network Node, and IP Router. |
|  | SA33-0097 | ***IBM 3745 Communication Controller<br>All Models*[3]**<br><br>***Advanced Operations Guide*[1]**<br><br>Provides instructions for advanced operations and testing, using the 3745 MOSS console. |
|  | On-line Information | ***Controller Configuration and Management Application***<br><br>Provides a graphical user interface for configuring and managing a 3746 APPN/HPR Network Node and IP Router, and its resources.<br>It is also available as a stand-alone application, using an OS/2 workstation.<br>Defines and explains all the 3746 Network Node and IP Router configuration parameters through its online help. |
|  | SH11-3081 | ***IBM 3746 Nways Multiprotocol Controller<br>Models 900 and 950***<br><br>***Controller Configuration and Management: User's Guide*[5]**<br><br>Explains how to use CCM and gives examples of the configuration process. |
|  | GA33-0479 | ***IBM 3745 Communication Controller Models A<br>IBM 3746 Nways Multiprotocol Controller<br>Models 900 and 950***<br><br>***Command Reference Guide*[5]**<br><br>Explains how to use the RUNCMD commands from NetView for OS/390 and gives examples. |
| **Managing Problems** | | |
|  | SA33-0096 | ***IBM 3745 Communication Controller<br>All Models*[3]**<br><br>***Problem Determination Guide*[1]**<br><br>A guide to perform problem determination on the 3745 Models 130 to 61A. |
|  | On-line Information | ***Problem Analysis Guide***<br><br>An online guide to analyze alarms, events, and control panel codes on:<br>• IBM 3745 Communication Controller Models A[2]<br>• IBM 3746 Nways Multiprotocol Controller Models 900 and 950. |

*Table H-2 (Page 6 of 6). Customer Documentation for the 3745 Models x10 and x1A, and 3746 Model 900*

SA33-0175

***IBM 3745 Communication Controller Models A[2]***
***IBM 3746 Expansion Unit Model 900***
***IBM 3746 Nways Multiprotocol Controller Model 950***

***Alert Reference Guide***

Provides information about events or errors reported by alerts for:

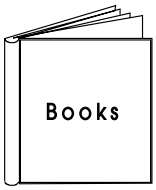
- IBM 3745 Communication Controller Models A[2]
- IBM 3746 Nways Multiprotocol Controller Models 900 and 950.

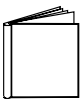
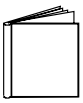
[1] Documentation shipped with the 3745.
[2] 3745 Models 17A to 61A.
[3] 3745 Models 130 to 61A.
[4] Except 3745 Models A.
[5] Documentation shipped with the 3746-900.

# Additional Customer Documentation for the 3745 Models 130, 150, 160, 170, and 17A

*Table H-3. Additional Customer Documentation for the 3745 Models 130 to 17A*

This customer documentation has the following format:




| | | |
|---|---|---|
| **Finding Information** | | |
| | | ***3745 Models A and 3746 Books***<br><br>All of the books in the 3745 Models A and 3746 library are available on the CD-ROM that contains the Licensed Internal Code (LIC) for the machine. |
| **Evaluating and Configuring** | | |
|  | GA33-0138 | ***IBM 3745 Communication Controller***<br>***Models 130, 150, 160, and 170***<br><br>***Introduction***<br><br>Gives an introduction about the IBM Models 130 to 170 capabilities, including Model 160.<br><br>For Model 17A refer to the *Overview*, GA33-0180. |
| **Preparing Your Site** | | |
|  | GA33-0140 | ***IBM 3745 Communication Controller***<br>***Models 130, 150, 160, and 170***<br><br>***Preparing for Connection***<br><br>Helps for preparing the 3745 Models 130 to 170 cable installation.<br><br>For 3745 Model 17A refer to the *Connection and Integration Guide*, SA33-0129. |

[1] Documentation shipped with the 3745.

# List of Abbreviations

**ac** alternating current

**ACF** Advanced Communications Function

**AIW** APPN Implementers Workshop

**AIS** alarm indication signal

**AIX** Advanced Interactive Executive

**AMI** alternate mark inversion

**ANR** Automatic Network Routing

**ANSI** American National Standards Institute

**APAR** authorized program analysis report

**APPC** advanced program-to-program communication

**APPN** advanced peer-to-peer networking

**ARB** adaptive rate-base

**ARC** Active Remote Connector

**ATM** asynchronous transfer mode

**B8ZS** bipolar with 8 zero substitution

**BACP** Bandwidth Allocation Control Protocol

**BAN** boundary access node

**BAP** Bandwidth Allocation Protocol

**BECN** backward explicit congestion notification

**BGP** Border Gateway Protocol

**BNC** bayonet Niell-Concelman

**BNN** boundary network node

**bps** bits per second

**Bps** bytes per second

**BPV** bipolar violation

**BRI** basic rate interface

**BRS** bandwidth reservation system

**CAS** circuit associated signalling

**CBC** cipher block chaining

Controller Bus Coupler

**CBSP** Controller Bus and Service Processor

**CCITT** Comité Consultatif International Télégraphique et Téléphonique. (The international telegraph and telephone consultative committee, now ITU-T.)

**CCM** Controller Configuration and Management

**CCU** central control unit

**CD** collision detection

**CDF-E** Configuration Data File - Extended

**CDLC** channel data link control

**CHAP** Cryptographic Handshake Authentication Protocol

**CIR** committed information rate

**CLA** Communication Line Adapter

**CLLM** consolidated link layer management

**CLP** Communication Line Processor

**CMC** Communication Management Configuration

**CNN** composite network node

**COS** class of service

**CRC** cyclic redundancy check

**CSMA** carrier sense multiple access

**CSU** channel service unit

**DAS** dual attach station

**DB/2** Database/2

**dc** direct current

**DCAF** distributed console access facility

**DCE** data circuit-terminating equipment

**DES** data encryption standard

**DLC** data link control

**DLCI** Data Link Connection Identifier

**DLSw** data link switching

**DLU** dependent logical unit

**DLUR** dependent logical unit requester

**DLUS** dependent logical unit server

**DMA** direct memory access

**DOS** disk operating system

**DRAM** dynamic random access memory

**DSX** digital system x-connect

**DS0** digital system level 0

**DTE** data terminal equipment

**EBN** extended border node

**ECP** Encryption Control Protocol

**EGA** ESCON Generation Assistant

**EGP** Exterior Gateway Protocol

**EIA** Electronic Industries Association

**EMIF** ESCON multiple image facility

**EN** end node

**EP** emulation program

**EPO** emergency power off

**ERP** error recovery procedures

**ES** Enterprise Systems

**ESA** enterprise systems architecture

**ESCA** ESCON Channel Adapter, also called ESCON Adapter

**ESCC** ESCON Channel Coupler, also called ESCON Coupler

**ESCD** ESCON director

**ESF** extended superframe

**ESCON** enterprise systems connection

**ESCP** ESCON Channel Processor, also called ESCON Processor

**FAS** frame alignment signal

**FDDI** fiber distributed data interface

**FDL** facility data link

**FDX** full duplex

**FECN** forward explicit congestion notification

**FR** Frame Relay

**FRAD** Frame-Relay Access Device

**FRFH** Frame-Relay Frame Handler

**FRSE** Frame-Relay Switching Equipment

**FRTE** Frame-Relay Terminating Equipment

**FTP** file transfer protocol

**HDX** half duplex

**HPDT** high performance data transfer

**HPR** High Performance Routing

**HSSI** high speed serial interface

**HTTP** Hypertext Transfer Protocol

**Hz** Hertz

**ICMP** internet control message protocol

**ICN** interchange node

**IEC** International Electrotechnical Commission

**IEEE** Institute of Electrical and Electronics Engineers

**IETF** Internet Engineering Task Force

**INN** intermediate network node

**I/O** input/output

**IOC** input/output control

**IP** internet protocol

**IPSec** Internet Protocol Security

**IPX** Internetwork Packet eXchange

**ISA** industry standard architecture

**ISDN** integrated services digital network

**ISO** International Organization for Standardization

**ISP** Internet Service Provider

**ISR** intermediate session routing

**ITU-T** International Telecommunication Union - Telecommunication (formerly: CCITT)

**kbps** kilobits per second

**km** kilometer; 0.62 mile

**L2F** Layer Two Forwarding

**L2TP** Layer 2 Tunneling protocol

**LAC** L2TP Access Concentrator

**LAN** local area network

**LAPB** link access protocol - balanced

**LAPS** LAN adapter and protocol support

**LCB** Line Connection Box

**LCBB** Line Connection Box Base

**LCBE** Line Connection Box Expansion

**LCS** LAN channel station

**LEN** low entry networking

**LIC** licensed internal code

line interface coupler

**LNS** L2TP network server

**LP** logical partition

**LPAR** logically partitioned mode

**LPDA2** link problem determination aid-2

**LSA** link services architecture

**LSS** low-speed scanner

**LU** logical unit

**m** meter; 3.28 feet; 39.37 inches

**MAC** medium access control

**MAU** multistation access unit

**Mbps** megabit per second

**MB** megabyte; 1 048 476 bytes

**MBps** megabyte per second

**MCL** microcode change level

**MHz** mega hertz

**MIB** management information base

**MLTG** multi-link transmission group

**MMF** multimode fiber

**MOSS-E** Maintenance and Operator Subsystem - Extended

**MPA** multiprotocol adapter

**MPC** multi-Path channel

**MSS** Multiprotocol Switch Services

**MVS** multiple virtual storage

**NAT** network address translation

**NAPT** network address and port translation

**NCP** network control program

**NGMF** NetView Graphic Monitor Facility

**NFS** network file system

**NHRP** Next Hop Routing Protocol

**NIC** network interface card

**nm** nanometer

**NN** network node

**NNP** Network Node Processor

**NPI** numbering plan identification

**NPM** NetView Performance Monitor

**NPSI** NCP packet switching interface

**NRF** network routing facility

**NRZ** non-return-to-zero

**NRZI** non-return-to-zero inverted

**NTS** network transmission subsystem

**NTT** Nippon Telegraph and Telephone

**OSI** open systems interconnection

**OSPF** open shortest path first

**PCI** Programming Communication Interface

**PCMCIA** Personal Computer Memory Card International Association

**PEP** partitioned emulation program

**PLP** packet layer protocol

**PPP** point-to-point protocol

**PPTP** point-to-point tunnelling protocol

**PRI** primary rate interface

**PRPQ** programming request for price quotation

**PTF** program temporary fix

**PU** physical unit

**PVC** permanent virtual circuit

**QLLC** qualified logical link control

**QoS** quality of service

**RADIUS** Remote Authentication Dial-In User Service

**RABM** Router and Bridge Manager

**RETAIN** Remote Technical Assistance Information Network

**RFC** request for comment

**RIP** routing information protocol

**RSF** remote support facility

**RTP** rapid transport protocol

**SAP** service access point

**SAR** segmentation and reassembly

**SC** stick-and-twist

**SAS** single attach station

**SCSP** Server Cache Synchronization Protocol

**SDLC** synchronous data link control

**SDRAM** static DRAM

**SF** selectable framing

**SLC** subscriber loop carrier

**SMF** single-mode fiber

**SNA** systems network architecture

**SNATAM** SNA terminal access method

**SNI** SNA network interconnection

**SNMP** simple network management protocol

**SONET** synchronous optical network

**SPAU** Service Processor Access Unit

**SSCP** system services control point (VTAM)

**SSE** Session Services Extensions

**SSP** system support programs

**SSL** Secure Sockets Layer

**STP** shielded twisted pair

**SVC** switched virtual circuit

**TACACS** Terminal Access Control System

**TAM** Topology and Accounting Management

**TCP** transmission control protocol

**TFTP** trivial file transfer protocol

**TIA** Telecommunications Industries Association

**TIC** Token- interface coupler

**TG** transmission group

**TME** Tivoli Management Environment

**TOA** type of address

**TPF** transaction processing facility

**TRA** token-ring adapter

**TRP** token-ring Processor

**UDP** user datagram protocol

**UFC** Universal Feature Card

**um** unit of measure

**URL** Uniform Resource Locator

**UTP** unshielded twisted pair

**VC** virtual circuit

**VM** virtual machine

**VPN** virtual private network

**VRRP** Virtual Router Redundancy Protocol

**VSE** virtual storage extended

**VTAM** virtual telecommunications access method

**WAN** wide area network

**XCA** external communications adapter

# Glossary

This glossary defines new terms used in this manual.

**10BASE2**. The IEEE 802.3 Ethernet standard that supports a transmission rate of 10 Mbps using RG 58 A/U and RG 58 C/U coaxial cable and BNC connectors. 10BASE2 is sometimes called "thin Ethernet" or "thinnet."

**10BASE-T**. The IEEE 802.3 Ethernet standard that supports a transmission rate of 10 Mbps using two twisted-pair wires (Category 3 telephone wiring). 10BASE-T is the most widely deployed 10-Mbps Ethernet transmission protocol in use today.

**Advanced Communication Function (ACF)**. A group of IBM licensed programs, principally VTAM programs, for example, TCAM, NCP, and SSP, that use the concepts of Systems Network Architecture (SNA), including distribution of function and resource sharing.

**advanced peer-to-peer networking (APPN)**. Data communications support that routes data in a network between two or more advanced program-to-program communications (APPC) systems that do not need to be adjacent.

**authorized program analysis report (APAR)**. A report of a problem caused by a suspected defect in a current unaltered release of a program.

**boundary network node (BNN)**. (1) In SNA, deprecated term for *boundary node (BN)*. (2) In NCP, deprecated term for *peripheral node*.

**bits per second (bps)**. In serial transmission, the instantaneous bit speed with which a device or channel transmits a character.

**central control unit (CCU)**. In the 3745, the controller hardware unit that contains the circuits and data flow paths needed to execute instructions and to control its storage and the attached adapters.

**communication line adapter (CLA)**. A functional unit that converts the serial-by-bit output of a station to a parallel bit form and from a parallel bit form to a serial-by-bit input to a station.

**communication management configuration (CMC)**. In VTAM, configuring a single host processor to allow for the consolidation of many network management functions for the entire network.

**configuration data file - extended (CDF-E)**. A 3746-900 MOSS-E file that contains a description of all the hardware features (presence type, address, and characteristics).

**control subsystem**. The part of the controller that stores and executes the control program, and monitors the data transfers over the channel and transmission interfaces.

**controller**. A device that directs the transmission of data over the data links of a network; its operation may be controlled by a program executed in a processor to which the controller is connected or it may be controlled by a program executed within the device. Examples are the IBM 3705, IBM 3725/3726, IBM 3720, IBM 3745 and IBM 3746.

**data circuit-terminating equipment (DCE)**. The equipment installed at the user's premises that provides all the functions required to establish, maintain, and terminate a connection, and the signal conversion between the data terminal equipment (DTE) and the line. For example, a modem is a DCE.

**data terminal equipment (DTE)**. That part of a data station that serves as a data source, data link, or both, and provides for the data communication control function according to protocols. For example, the IBM 3745 can be a DTE.

**dependent logical unit (DLU)**. Any logical unit (LU) that is made active by a command from the host system over a data link. Such logical units can be used only as secondary logical units, and can have only one active LU-to-LU session at a time. Contrast with independent logical unit.

**disk operating system (DOS)**. An operating system for computer systems that use disks and diskettes for auxiliary storage of program and data.

**direct memory access (DMA)**. The transfer of data between memory and input/output units without processor intervention.

**Distributed Console Access Facility (DCAF)**. An IBM licensed program that lets a user at one workstation to remotely monitor, control, and operate another workstation. *This program has now been renamed Tivoli Management Environment (TME).*

**emulation program (EP)**. An IBM control program that allows a channel-attached 3705 or 3725 communication controller to emulate the functions of an IBM 270x device. See also network control program.

**End node (EN)**. In SNA, a node in an APPN network that can be a source or a target node, but does not provide any routing or session services to any other node.

**Enterprise Systems Architecture (ESA)**. A set of IBM products and services that provides a dynamically connected environment within an enterprise.

**ESCON adapter**. See ESCON channel adapter (ESCA).

**ESCON channel**. A channel having an Enterprise System Connection* channel-to-control-unit I/O interface that uses optical cables as a transmission medium.

**ESCON channel adapter (ESCA)**. A controller hardware unit used to attach the controller to a host via ESCON fiber optics. An ESCA consists of an ESCON channel processor and an ESCON channel coupler.

**ESCON channel coupler (ESCC, ESCC2)**. A controller hardware unit which is the interface between the ESCON channel processor and the ESCON fiber optic cable.

**ESCON channel processor (ESCP)**. A controller hardware unit which provides the channel data link control for the ESCON channel adapter.

**ESCON coupler**. See ESCON channel coupler (ESCC, ESCC2).

**ESCON director (ESCD)**. A device that provides connectivity capability and control for attaching any two links to each other.

**ESCON processor**. See ESCON channel processor (ESCP).

**hertz (Hz)**. A unit of frequency equal to one cycle per second.

**Host**. See host processor.

**host processor**. (1) A processor that controls all or part of a user application network. (2) In a network, the processing unit where the access method for the network resides. (3) In an SNA network, the processing unit that contains a system services control point (SSCP). (4) A processing unit that executes the access method for attached communication controllers. Also called *host*.

**IBM service representative**. An individual in IBM who does maintenance services for IBM products or systems. (Also called an *IBM customer engineer* or *IBM CE*.)

**input/output control (IOC)**. The circuit that controls the input/output from/to the channel adapters and scanners via the IOC bus.

**integrated services digital network (ISDN)**. A digital end-to-end telecommunication network that supports multiple services including, but not limited to, voice and data.

**International Telecommunication Union (ITU)**. The specialized telecommunication agency of the United Nations, established to provide standardized communication procedures and practices, including frequency allocation and radio regulations worldwide. (Formerly CCITT).

**Internet Protocol (IP)**. In TCP/IP, a protocol that routes data from its source to its destination in an Internet environment.

**LAN-attached console**. A workstation attached to the token-ring LAN that has the service processor attached. It is used to operate remotely the MOSS and MOSS-E via DCAF.

**line**. See transmission line.

**line interface coupler (LIC)**. A circuit that attaches up to four transmission cables to the controller (from DTEs, DCEs, or telecommunication lines).

**link access protocol-balanced (LAPB)**. A protocol used for accessing an X.25 network at the link level. LAPB is a duplex, asynchronous, symmetric protocol, used in point-to-point communication.

**logical partition**. A subset of the processor hardware that is defined to support the operation of a system control program (SCP). See also *logically partitioned (LPAR) mode*.

**logically partitioned (LPAR) mode**. A central processor mode, available on the Configuration frame when using the PR/SM feature, that allows an operator to allocate processor unit hardware resources among logical partitions.

**LP**. Logical partition.

**LP number**. Logical partition number. This allows multiple logical host partitions (LPs) to share one ESCON fiber connection.

**LPAR mode**. Logically partitioned mode.

**Link Problem Determination Aid (LPDA*)**. A series of test commands executed by an IBM DCE to determine which of various network components may be causing an error in the network.

**local area network (LAN)**. A computer network located on a user's premises within a limited geographical area. Communication within a LAN is not subject to external regulation; however, communication across the LAN boundary may be subject to some form of regulation.

**logical unit (LU)**. In SNA, a port through which an end user accesses the SNA network in order to communicate with another end user and through which the end user accesses the functions provided by system services control points (SSCPs). An LU can support at least two sessions, one with an SSCP and one with another LU, and may be capable of supporting many sessions with other logical units.

**low entry networking node (LEN)**. In an APPN network, a node that uses the LU session type 6.2 node type 2.1 architecture without the APPN extension. A LEN has no Control Point-to-Control Point session with a Network Node.

**maintenance and operator subsystem (MOSS)**. The part of the 3745 that provides operating and servicing facilities to the user and IBM service representative.

**maintenance and operator subsystem-extended (MOSS-E)**. The licensed internal code loaded on the service processor fixed disk to provide maintenance and operator facilities to the user and IBM service representative.

**media access control (MAC)**. For LAN, the method of determining which device has access to the transmission medium at any time.

**modem (modulator-demodulator)**. See DCE.

**multistation access unit (MAU)**. In the IBM Token-Ring network, a wiring concentrator that connects up to eight nodes to a ring.

**NetView Performance Monitor (NPM)**. An IBM licensed program that collects, monitors, analyses, and displays data relevant to the performance of a VTAM telecommunication network. It runs as an on-line VTAM application program.

**Network Control Program (NCP)**. An IBM licensed program that provides communication controllers supports for single-domain, multiple domain, and interconnected network capability.

**network node processor (NNP)**. The processor that is running the APPN Network Node and SNMP functions of the 3746-900 or 3746-950.

**Network Routing Facility (NRF)**. An IBM licensed program that resides in the NCP, which provides a path for messages between terminals, and routes messages over this path without going through the host processor.

**nonswitched line**. A connection between systems or devices that does not have to be made by dialing. The connection can be point-to-point or multipoint. The line can be nonswitched or private. Contrast with *switched line.*

**operator console**. The IBM Operator Console that is used to operate and service a 3745 Model 130, 150, 160, 170, 210, 310, 410, or 610 through the MOSS.

**partitioned emulation programming (PEP)**. A function of a network control program that enables a communication controller to operate some telecommunication lines in network control mode while simultaneously operating others in emulation mode.

**permanent virtual circuit (PVC)**. In X.25 communications, a virtual circuit that have a logical channel permanently assigned to it at each DTE. Call-establishment protocols are not required. Contrast with switched virtual circuit.

**physical unit (PU)**. In SNA, the component that manages and monitors the resources, such as attached links and adjacent link stations, associated with a node, as requested by an SSCP via an SSCP-PU session. An SSCP activates a session with the physical unit in order to indirectly manage, through the PU, resources of the node such as attached links. This term applies to type 2.0, type 4, and type 5 nodes only.

**qualified logical link control (QLLC)**. An X.25 protocol that allows the transfer of data link control information between two adjoining SNA nodes that are connected to an X.25 packet-switching data network.

**remote console**. A workstation attached to the 3745 or 3746 either by a switched line (with modems) or by one of the communication lines of the user network.

**remote support facility (RSF)**. RSF provides IBM maintenance assistance when requested via the public switched network. It is connected to the IBM RETAIN database system.

**service access point (SAP)**. A logical point made available by an adapter where information can be received and transmitted.

**service processor**. The processor, based on a PS/2, which is attached to the 3745 and 3746-900 or 3746-950 via a token-ring LAN and runs the MOSS-E code and utilities such as CCM.

**service representative**. See IBM service representative.

**switched line**. A transmission line with which the connections are established by dialing, only when data transmission is needed. The connection is point-to-point and uses a different transmission line each time it is established. Contrast with *nonswitched line*.

**switched virtual circuit (SVC)**. A virtual circuit that is requested by a virtual call. It is released when the

virtual circuit is cleared. Contrast with permanent virtual circuit.

**Synchronous Data Link Control (SDLC)**. A discipline conforming to subsets of the Advanced Data Communication Control Procedures (ADCCP) of the American National Standards Institute (ANSI) and High-level Data Link Control (HDLC) of the International Organization for Standardization, for managing synchronous, code-transparent, serial-by-bit information transfer over a link connection. Transmission exchanges may be duplex or half-duplex over switched or nonswitched links. The configuration of the link connection may be point-to-point, multipoint, or loop.

**system support program (SSP)**. An IBM program that manages programs and the operation of associated devices, such as the display station and printer.

**telecommunication line**. Any physical medium, such as a wire or microwave beam, that is used to send data.

**Tivoli Management Environment (TME) 10 Remote Control**. An IBM licensed program for a user at one workstation to remotely monitor, control, and operate another workstation. This is equivalent to DCAF. These products are no longer available.

**Token-Ring Interface Coupler Type 3 (TIC3)**. A circuit that attaches an IBM Token-Ring network to an IBM 3746-900 or 3746-950.

**Token-Ring Adapter (TRA)**. 3746 adapter for IBM Token-Ring Network, composed of one Token-Ring processor card (TRP), and one or two token-ring interface couplers (TICs).

**transmission group (TG)**. In SNA, a group of links between adjacent subarea nodes appearing as a single logical link for routing messages.

**transmission line**. The physical means for connecting two or more DTEs (via DCEs). It can be nonswitched or switched. Also called a *line*.

**twin**. Configuration with two CCUs.

**twin-backup**. Mode of operation identical to twin-dual with fallback capability.

**twin-dual**. Mode of operation with two CCUs operating simultaneously in two distinct subareas.

**twin-standby**. Mode of operation with one CCU active and the other in standby, ready to take over.

**Virtual Storage Extended (VSE)**. An IBM licensed program whose full name is Virtual Storage Extended/Advanced Function. It is a software operating system controlling the execution of programs.

**Virtual Telecommunication Access Method (VTAM)**. A set of programs that maintain control of the communication between terminals and application programs running under DOS, OS/1, and OS/2 operating systems.

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**3745 Communication Controller Models A and 170**
**3746 Nways Multiprotocol Controller**
**Models 900 and 950**
**Overview**

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