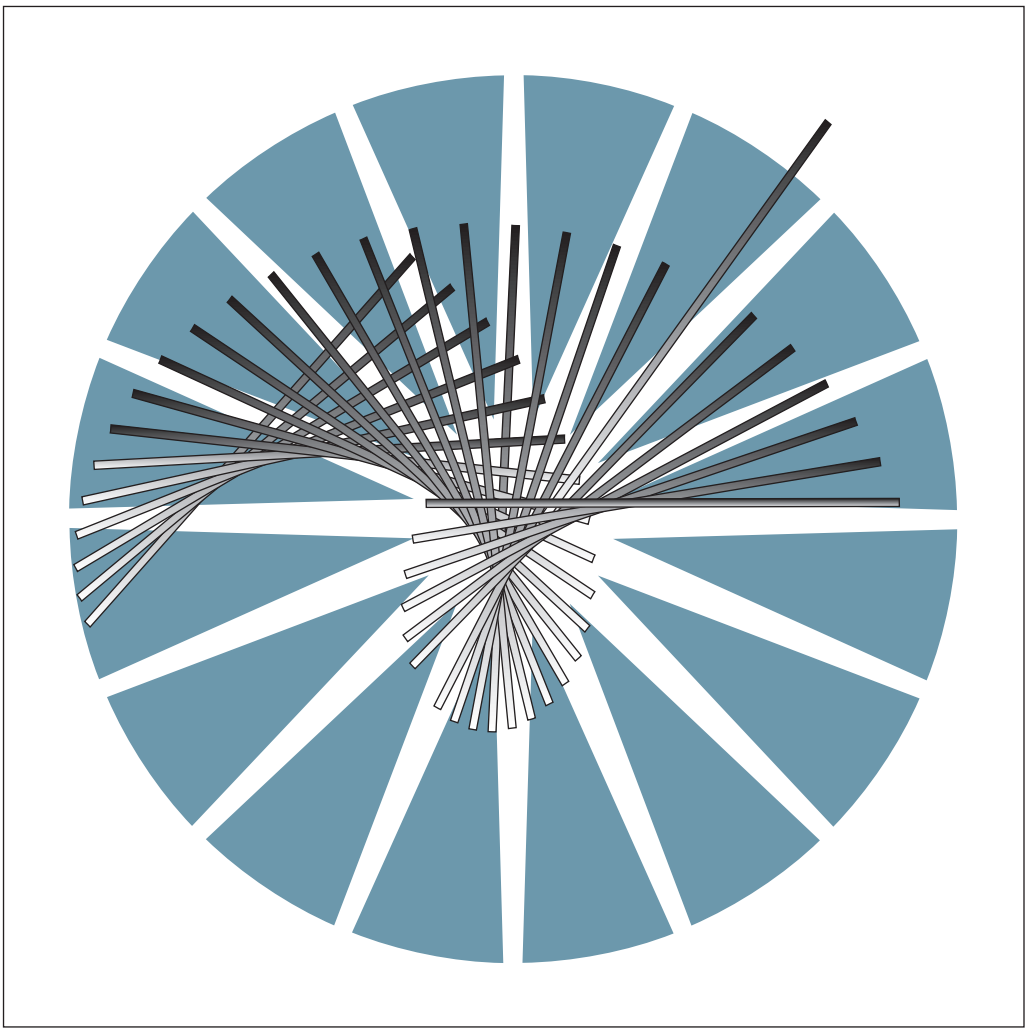
3745 Communication Controller Models A
3746 Nways Multiprotocol Controller
Models 900 and 950

Overview



GA33-0180-09

3745 Communication Controller Models A
3746 Nways Multiprotocol Controller
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Note!

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Tenth Edition (March 1998)

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About This Overview

This overview contains information on the following IBM communication controllers:

- 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 Model A as the following:
  - Systems Network Architecture (SNA) subarea routing node, in conjunction with Network Control Program (NCP) running in the 3745.
  - Advanced Peer-to-Peer Networking (APPN*)/High Performance Routing (HPR*) Network Node (NN).
  - Internet Protocol (IP) high end router.
- IBM 3746 Nways Multiprotocol Controller Model 950 (3746-950) functioning as the following:
  - APPN/HPR NN.
  - 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.

Conventions Used in This Overview

Throughout this overview, the term:

3745 Model A and 3745	Refers to IBM 3745 Models 17A, 21A, 31A, 41A, and 61A (with or without attached 3746 expansion units Models A11, A12, L13, L14, L15, 900).
3746 Model 900 and 3746-900	Refers to IBM 3746 Nways Multiprotocol Controller Model 900.
3746 Model 950 and 3746-950	Refers to IBM 3746 Nways Multiprotocol Controller Model 950.
3746	Refers to 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.

The reader should have an understanding of networking functions of the 3745, and channel connectivity of the S/390 Servers via Enterprise Systems Connection Architecture (ESCON*). For general information about ESCON, see *Introducing Enterprise Systems Connection*, GA23-0383.

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

How This Overview Is Organized

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

Chapter 2, “Functional Overview of the 3745 and the 3746 Controllers,” describes the functions and components to the 3745, the 3746-900, and the 3746-950.

Chapter 3, “Multiaccess Enclosure (MAE),” gives information on the MAE and its networking capabilities.

Chapter 4, “Network Solutions,” describes the networking solutions that the 3745 and the 3746 can bring to your network. These solutions include the following:

- 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,” describes the advantages of the 3746 connectivity, and includes examples of three adapter types (ESCON, token-ring, and communication line adapters).

Chapter 6, “System Management,” 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], and Remote Support Facility (RSF*).

Chapter 7, “High Availability,” describes how the 3745 and the 3746 are high availability solutions in the design of your network.

Appendix A, “Minimum Configuration of the 3745 and 3746,” describes the minimum hardware requirements for running your controller.

Appendix B, “Configuration Options for the 3746,” describes the expansion features of the 3745, 3746-900, 3746-950, including the Multiaccess Enclosure (MAE).

Appendix C, “Programming Support,” describes the programs that are available for system and network support.

Appendix D, “Connectivity of the 3746 APPN/HPR Network Node (NN)” describes the connectivity of the 3746 NN.

Appendix E, “The 3745 Model A and the 3746 Compared to Previous 3745 Models” describes the advantages of the 3745 Model A and 3746 controller as compared to 3745 Models xx0, the previous generation of 3745 controllers.

[1] TME 10 Remote Control includes DCAF (see “TME 10 Remote Control” on page 6-11).

What Is New in This Overview

This revised edition gives information on the latest developments of the 3746, mainly on the processors type 3, and the Multiaccess Enclosure (MAE).

New functions in IBM 3746 models 900 and 950 include high-speed WAN/LAN connectivity, fast S/390 server access, and remote site concentration. New high-speed connectivity options, together with scalability and performance improvements, offer high-end functions at a competitive cost. Combined with functions like the Interactive Network Dispatcher and TN3270e server, these new features help reduce costs and increase network performance and operations efficiency.

Processors Type 3

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 about three.

Multiaccess Enclosure (MAE)

The MAE supports advanced networking technologies for server access, and high-speed LAN, WAN, and ESCON adapters. Support includes the following:

- ATM adapters for 155 Mbps operation over single-mode or multi-mode optical fibers.
- Fast Ethernet and Fiber Distributed Data Interface (FDDI) support for high-bandwidth and high-capacity access to campus backbones or servers from attached LANs, WANs, ATM networks, and ESCON channels.
- 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.
- 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.
- Data Link Switching (DLSw).
- ESCON High Performance Data Transfer (HPDT) Multi-Path Channel+ (MPC+) support for HPR, TCP/IP and User Datagram Protocol (UDP) applications.
- Enterprise Extender support for transporting SNA applications over IP backbone networks.
- ISDN and Channelized T1/E1 support.

These new functions and features can be installed in existing 3746s.

Where to Find More Information

- "Customer Documentation for the 3746 Model 950" on page F-1.
- "Customer Documentation for the 3745 (Models 210, 310, 410, 610, 21A, 31A, 41A, and 61A), and 3746 (Model 900)" on page F-3.
- "Additional Customer Documentation for the 3745 Models 130, 150, 160, 170, and 17A" on page F-7.

- *IBM 3746 APPN/HPR Implementation Guide*, GG24-2536.
- *IBM 3746 IP Implementation Guide*, GG24-4845.

- *Introducing Enterprise Systems Connection*, GA23-0383.
- *SNA Network to APPN Network Migration Experience*, SG24-4656.
- *What's New in NPM Version 2.3*, SG24-2116.

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Chapter 1. General Information on 3745 and 3746 Controllers

Note: Licensed Internal Code for new 3746 functions, available as of December 1997 or later, and corresponding documentation are delivered on CD-ROM.

The IBM 3745 and 3746 Controllers Family

For more than two 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 communication controllers include the following:

- 3745 Models 130, 140, 150, 160, and 170[1].
- 3745 Models 210, 310, 410, and 610[1].
- 3745 Models 17A, 21A, 31A, 41A, and 61A (3745 Models A).
- 3746 Model 900 (3746-900).
- 3746 Model 950 (3746-950).

These communication controllers were originally designed for the attributes and advantages of SNA. Later innovations in the same line incorporated developments in APPN, HPR, and IP. The following illustrates the adaptability of these controllers to advances in networking technology:

- The 3746-950 can operate as an IP router and APPN/HPR Network Node (NN), independent from any 3745 running a Network Control Program (NCP).
- The 3746-900 supports the same routing functions as the 3746-950.
- The 3746-900 can operate as an IP router and APPN/HPR NN, and simultaneously operate as an NCP-controlled SNA subarea node or APPN composite network node (CNN).

The 3746 Models 900 and 950 form a new generation of controllers, the *3746 Nways Multiprotocol Controllers*. These controllers form the basis of efficient and reliable multiprotocol networks that support both SNA applications 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, and still support your 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.

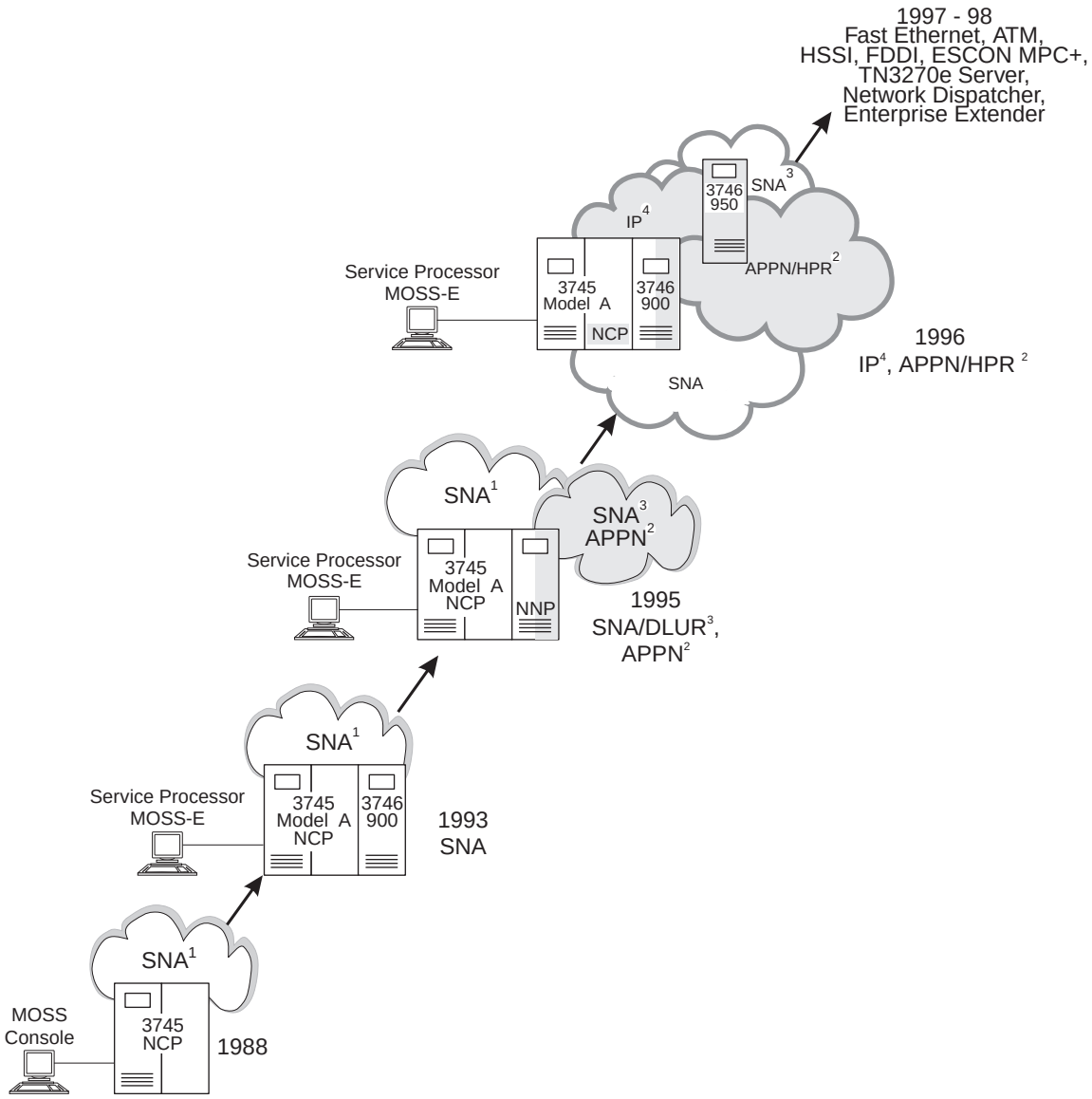


Figure 1-1. The Networking Evolution of IBM 3745 and 3746 Controllers

Notes:

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 the Dependent Logical Unit Requester support (DLUR), and a VTAM with Dependent LU Server (DLUS).
4. IP networking using the NNP and 3746 IP routing features, independent from NCP and TCP/IP MVS.

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 and then advances in HPR, an extension of APPN, and IP routing.

APPN/HPR performs the following:

- Flexible, peer-to-peer connectivity for smaller system users (such as AS/400*, PS/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 if there is a network failure.

Key characteristics of APPN/HPR include the following:

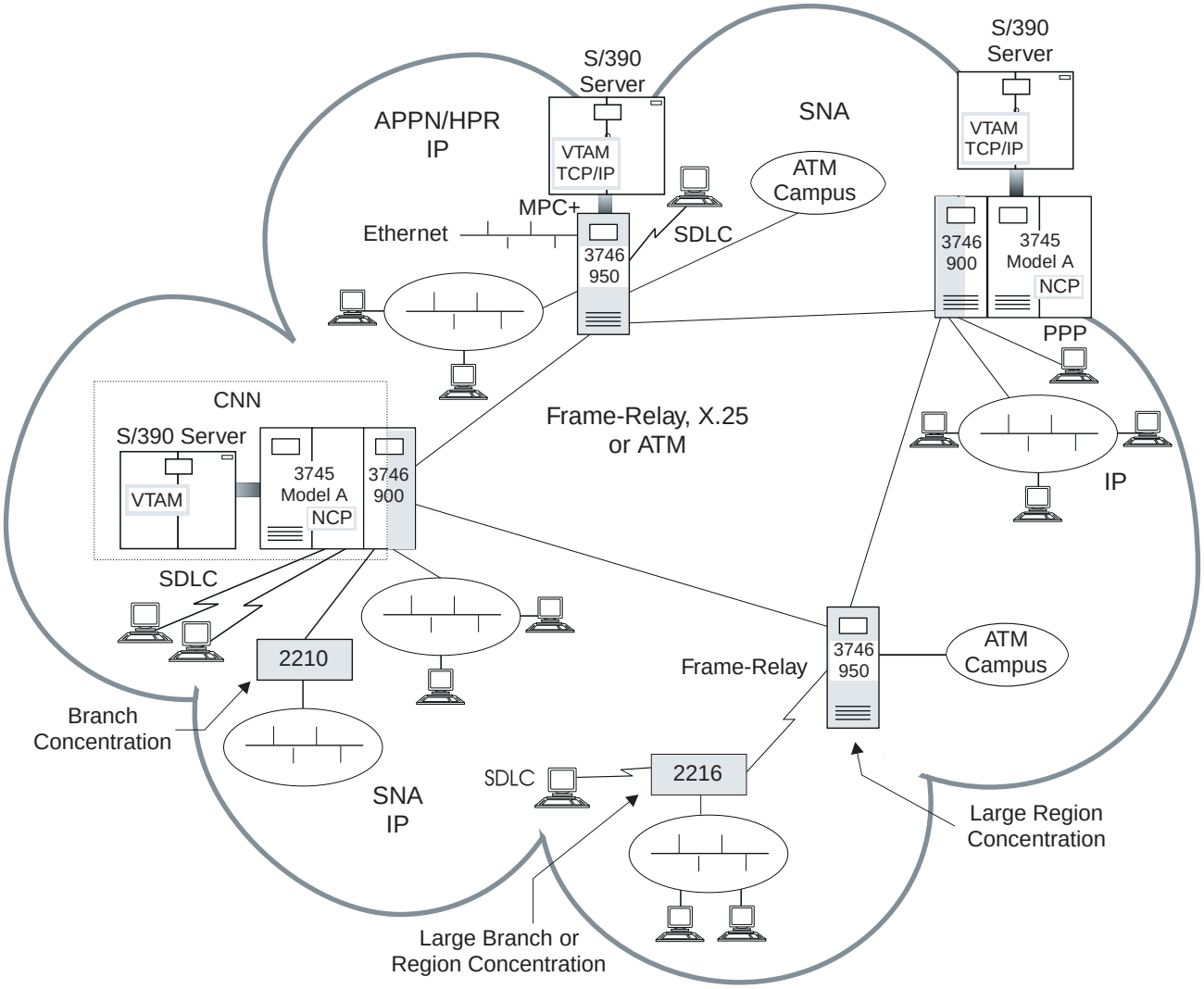
- Dynamic overview of the current network topology.
- Network management services, for example, automatic location of network end-system and intermediate-system resources.
- Dynamic selection of the best routes to remote users and applications.
- Ensuring transmission priority and traffic congestion 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 of 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 Multi-protocol Router
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 the 3746 Controllers

Note: Licensed Internal Code for new 3746 functions, available as of December 1997 or later, and corresponding documentation are delivered on CD-ROM.

The 3746 Nways Multiprotocol Controller Models 900 and 950 form the basis of a manageable, reliable and cost effective network - today - that can readily adapted to meet the networking requirements of tomorrow. Flexibility in 3746 design allows you to perform the following:

- 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.

Overview of the 3745 Model A

The 3745 Model A forms the basis of 3745-based SNA or APPN/HPR networks under NCP control.

The 3745 Model A supports the following features:

- SNA (NCP) support of the 3746-900.
- Up to 16 MB of storage per 3745 central control unit (CCU) for 3745 Models 31A and 61A.
- A service processor which provides Maintenance and Operator Subsystem - Extended (MOSS-E) functions.

Basic Configuration for 3745 Models 31A and 61A

New 3745 Models 31A and 61A have no basic features. Any Low-Speed Scanner (LSS), Line Interface Coupler (LIC), or LIC unit is optional. These lower cost 3745s make 3746-900 solutions more attractive.

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, for example, to use the 3745 channel adapters 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.

Overview of the 3746 Models 900 and 950

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 Dependent LU Requester (DLUR) support, to simplify network implementation and evolution.
- IP routing for high performance access to Internet or Intranet 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 or Communication Server/2
  - IBM 2210 Nways Multiprotocol Router
  - IBM 2216 Nways Multiaccess Connector
  - IBM 2217 Multiprotocol Concentrator.
- Powerful network management tools, for example, NetView*, NetView Performance Monitor (NPM*), and Nways Enterprise 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 processors (type 3), fully compatible and upgradeable from other processor types.

3746 Processors

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

Network Node Processor (NNP)

The NNP runs the APPN/HPR control point and IP management (SNMP agent) of the 3746. For the 3746 NN, it supports up to a total of 5000 physical units (PUs) and 15000 APPN/Dependent LU sessions (LU-LU sessions). The NNP type 2 (NNP2), a more powerful version of the NNP, supports up to 5000 PUs and 30,000 APPN/Dependent LU sessions.

Note: As an HPR intermediate networking node, the 3746 supports any number of sessions.

Service processor

The service processor runs the Maintenance and Operator Subsystem-Extended (MOSS-E) functions for the 3746 (and, in the case of the

3746-900, the attached 3745) and the Controller Configuration and Management (CCM) of the 3746 Network Node and IP router.

The service processor type 2, a more powerful version of the service processor, is equipped with a CD-ROM drive, and supports the recent enhancements of the 3746, mainly the Multiaccess Enclosure (MAE).

Adapter processors[1]

Each adapter 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, or Ethernet LAN, or ESCON channel fibers).

Significant improvements have been made to the processors of the 3746 to increase speed and functionality. The processors type 3 include communication line processors (CLP3), token-ring processors (TRP3), ESCON processors (ESCP3), and the controller bus and service processor (CBSP3).

The improved performance (connectivity) of each processor type 3 is as follows:

- CLP type 3, supporting up to:
  - 3000[2] PUs (1000 PUs over SDLC, and 2000[2] PUs over Frame relay, X.25, and ISDN) or about 12000 APPN/Dependent LU sessions controlled by the 3746 NN.
  - 2000[2] Frame relay virtual circuits (DLCIs).
- TRP type 3, supporting up to 2000 PUs or approximately 14000 APPN/Dependent LU sessions controlled by the 3746 NN.
- ESCP type 3, supporting up to:
  - 16 logical connections with S/390 server partitions running VTAM or TCP/IP.
  - Approximately 14,000 APPN/Dependent LU sessions controlled by the 3746 NN.
- CBSP, type 2 or type 3, runs the IP router protocols (RIP V1, OSPF V2, BGP V4) with a total of up to 5000 IP 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 (up to 30,000).

Note: Upgrades are available for type 2 processors to type 3 processors, and type 1 processors to type 3 processors.

The CLP, TRP2, ESCP2, and CBSP2 processors[3] support NCP, APPN/HPR, and IP traffic, but with lower connectivity and throughput. The TRP, ESCP, and CBSP (processors type 1[3]) support NCP traffic only.

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

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

3 These processors are no longer manufactured.

Overview of the Multiaccess Enclosure (MAE)

This power PC-based enclosure provides adapters for high-speed WAN/LAN connectivity, fast S/390 server access, and remote site concentration. Combined with MAE functions like TN3270e server and Interactive Network Dispatcher, these adapters increase network performance and operations efficiency.

The MAE is designed to meet the following customer needs:

- Greater than T1/E1 capacity to a campus or data center.
- To connect a Fast Ethernet, HSSI, FDDI, or ATM backbone to other LANs, remote sites, and S/390 servers via ESCON.
- Increased throughput or large APPN/HPR, DLSw or TN3270e capacity.
- To consolidate SNA and IP networks.

The MAE adds ATM, ISDN PRI, FDDI, HSSI, and 10/100 Mbps Ethernet connectivity to the 3746:

Asynchronous Transfer Mode (ATM)

Support includes:

- One ATM interface per adapter.
- 155 Mbps operation over single-mode or multi-mode optional fibers.

ISDN Primary Rate Interface (ISDN PRI)

Support includes:

- One ISDN PRI interface per adapter.
- World-wide ISDN.

Fiber Distributed Data Interface (FDDI)

Support includes:

- One FDDI interface per adapter.
- Operates as either a Dual Attach Station (DAS) or a Single Attach Station (SAS) using multi-mode fiber (MMF).

HSSI

Support includes:

- One HSSI interface per adapter.
- Speeds up to 52 Mbps.

10/100 Mbps Ethernet

Support includes:

- One interface per adapter.
- Speeds of either 10 Mbps or 100 Mbps.

The MAE supports the following network design options:

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

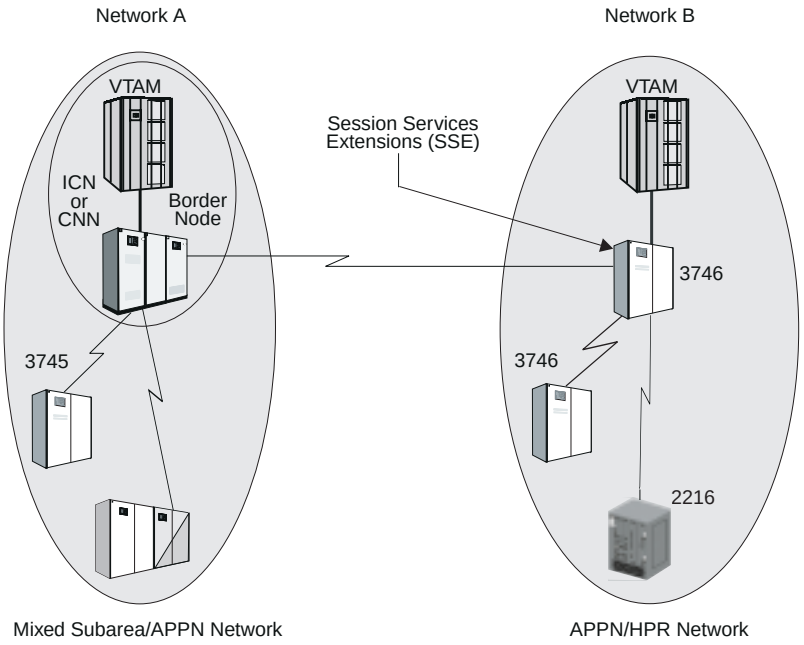
Some Specific 3746 Networking Capabilities

Session Services Extensions (SSE)

SSE allows the controller to connect to a border node in another APPN network. Users migrating from SNA networks to APPN/HPR can use SSE to migrate SNA Network Interconnection (SNI) links.

SSE also functions as a NN server for a VTAM end node, which allows the topology and directory services to be off-loaded from VTAM to the 3746.

For more information, see “3746 Extended Function 2 - Feature Code 5802” on page B-10.



Legend
ICN Interchange Node
CNN Composite Network Node

Figure 2-1. IBM 3746 Session Services Extensions (SSE)

Frame Relay Frame Handler (FRFH)

The Frame relay support of the 3746 provides superior switching-node capabilities. By using Frame relay Frame Handler (FRFH), the adapters of the 3746 can perform full-frame switching functions. This reduces the time of traffic flow through intermediate nodes, shortens the response time for users, and facilitates automatic non-disruptive recovery if there is a network failure.

Frame Relay Congestion Management

In compliance with ITU-T X.36 requirement for congestion management, the 3746 uses Committed Information Rate (CIR) to monitor data flow in networks. 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.

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.

Chapter 3. Multiaccess Enclosure (MAE)

Note: Licensed Internal Code for the new Multiaccess Enclosure (MAE) functions and corresponding documentation are delivered on CD-ROM.

Overview of the MAE

The MAE is designed primarily to provide a range of high-speed, high-availability connectivity options. The MAE is a super processor, providing multiple types of network interfaces.

The MAE houses eight adapter slots with up to eight ports per adapter. The MAE performs routing for TCP/IP, SNA/DLUR, APPN, and HPR traffic. The MAE provides high port density and supports SDLC, PPP, Frame relay, and X.25 WAN protocols.

Note: The MAE of the 3746-900 routes traffic independently of the NCP.

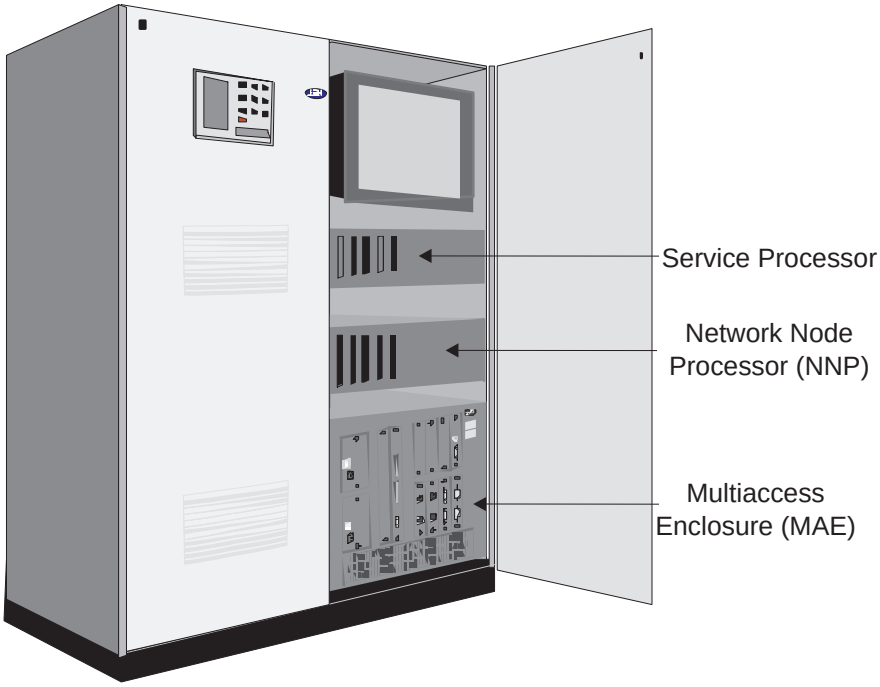


Figure 3-1. IBM 3746 Controller with a Multiaccess Enclosure (MAE)

MAE Components

Basic Functions in the MAE

The MAE base includes the following hardware:

- Power supply
- Cooling fan
- System card containing:
  - PowerPC microprocessor (200 Mhz).

  - 64 MB DRAM
  - PCMCIA token-ring card and cable (to connect the MAE to the service processor).
- Eight adapter slots
- One of the following connections to the 3746 controller:
  MAE feature 3001, with a direct attachment to the controller switch (see “MAE with Direct Attachment” on page 3-3).
  - MAE feature 3000, with one or two 8228 MAU(s) and corresponding token-ring cable(s) that connect to the MAE.

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

Prerequisite:

- NNP or NNP type 2.
- Service processor type 2.
- IP routing (feature code 5033).
- Controller expansion[1].

MAE Adapters

The MAE supports the following adapters:

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 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:

- Multi-mode Fiber (MMF), fiber optic cable with an ATM support chip for segmentation and reassembly (SAR), and SONET OC3c framing.
- Single-mode Fiber (SMF), fiber optic cable with an ATM support chip for SAR, and SONET OC3c framing.

ESCON
Supporting Multi-Path Channel+ (MPC+), LAN Channel Station (LCS), and Link Services Architecture (LSA) channel protocols.

ISDN Primary Rate Interface (World-wide)
Supporting Frame relay and PPP.

Ethernet
Supporting Ethernet 2.0, IEEE 802.3, and ISO 8802.3.

Token-ring
Supporting IEEE 802.5 and ISO 88025.5.

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[1] The cable for the MAE direct attachment is 9 m; this means that the controller expansion should be installed no more than 6 m from the 3746 controller.

V.35 and V.36

Supporting line speeds for a modem attachment, and line speeds for direct attachment.

X.21

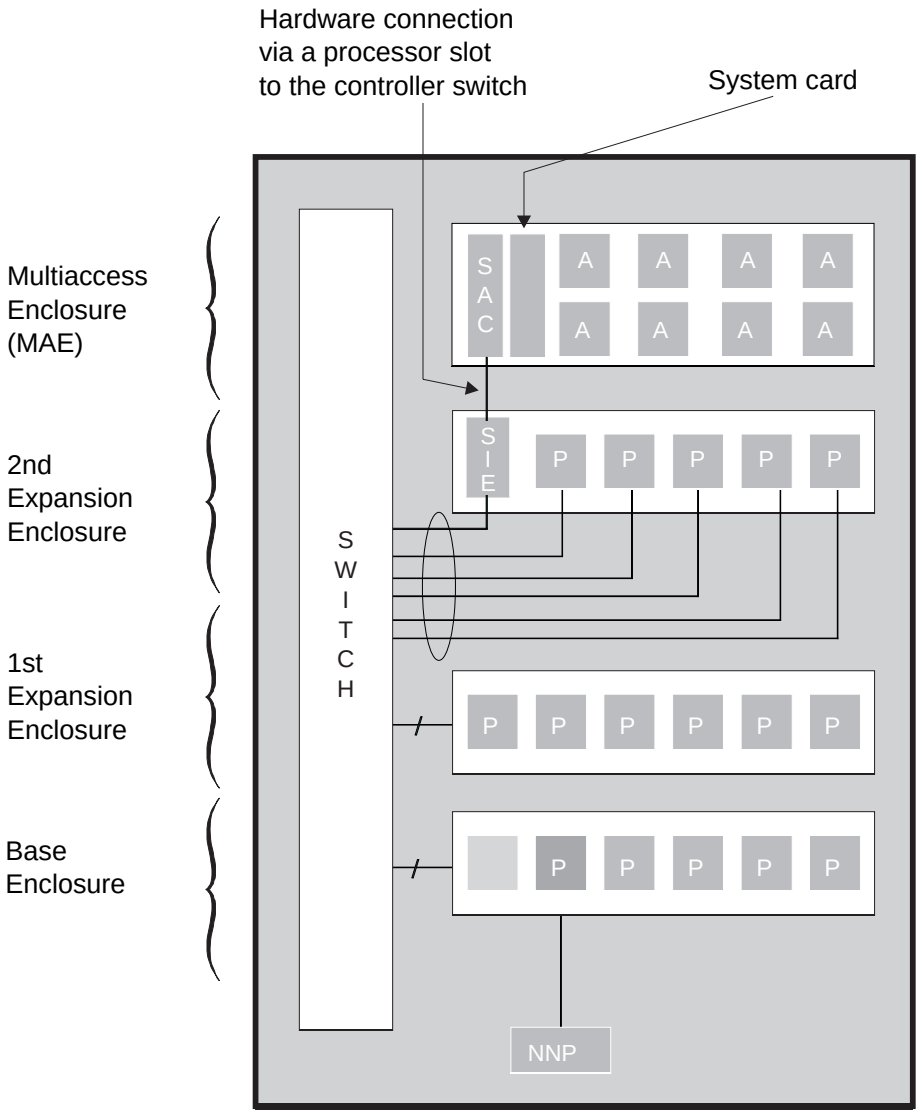
Supporting line speeds for a modem attachment, and line speeds for a direct attachment.

V.24/EIA 232

Supporting line speeds for a modem attachment, and line speeds for a direct attachment.

MAE with Direct Attachment

The MAE with direct attachment to the 3746 controller switch, feature code 3001, includes a switch adapter card installed into the MAE and a switch interface extension installed into a 3746 processor slot (see Figure 3-2 on page 3-4). For IP traffic, this direct attachment frees the token-ring connection required for traffic routed between the MAE feature 3000 and the other enclosures of the 3746. Depending on the packet size and number of processors, the IP throughput between the MAE and the other enclosures of the 3746 is increased over five-fold, compared to dual token-ring connections.



Legend:
SAC Switch Access Card
SIE Switch Interface Extension
A Adapter
P Processor
NNP Network Node Processor

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

Upgrade

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

TN3270e Server

The TN3270e server (feature code 5806) 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 (see 3-8), TN3270e servers can be distributed in the network within an IP infrastructure. This means that TN3270e servers running on IBM 2210, IBM 2216, and IBM 3746 platforms can be placed in locations that provide the best scalability and availability.

MAE Extended Functions

The MAE Extended Functions (feature code 5804) includes the following:

Interactive Network Dispatcher

This function 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.

The Network Dispatcher function provides load balancing among a set of IP servers adjacent to the router running this function. The load-balancing mechanism uses technology from IBM's Research Division to determine the most appropriate server to receive each new connection. Subsequent traffic for that connection is then forwarded to the same server. The routing is transparent to users and other applications. The load information is obtained from a set of weights based upon number of connections active per server, number of new connections since the last interval, feedback from response time of individual HTTP, FTP, SSL servers, and configurable policy information.

The Network Dispatcher sees only the incoming packets from the client to the server. It does not need to see the outgoing packets, which significantly reduces the overhead imposed by load balancing. The client's packet is forwarded to the chosen server exactly as it was created. Since Network Dispatcher is also available on AIX, Windows NT, and Sun Solaris, it is useful for many applications such as e-mail servers, Web Servers, distributed parallel database queries and other TCP/IP applications.

RIP Version 2

MAE adapters support RIP Version 2[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.
- Subnet masks to support 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 enhancements include the following:

- Support for the following high performance ATM Adapters:
  - 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.
- Support for Native APPN/HPR over ATM (AIW 8192) so that 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 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's QoS capabilities.
- Next Hop Resolution Protocol (NHRP[3]) enables short-cut routes for IP across ATM networks. NHRP supports zero-hop routing for end stations with NHRP and one-hop routing for stations without NHRP clients.
- 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 starts passing packets from the end station to other subnets. Additionally, the user can configure which ARP server is the primary and backup.
- Server Cache Synchronization Protocol (SCSP) distributes the SRP servers to eliminate a single point of failure.
- All the supported routed protocols and native ATM bridging may be multiplexed onto a single ATM permanent virtual circuit.

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2 MAE feature code 3000 supports RIP Version 2. The initial version of MAE feature code 3001 supports RIP Version 1.

3 MAE feature code 3000 only.

Frame Relay, PPP, ISDN, and WAN

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

- Frame Relay dial circuit interface is configurable on a V.25bis interface type. Frame relay data compression (mode-1 FRF.9) is configurable per PVC to run over a Frame relay interface. Congestion can be reduced with support for congestion management via CLLM messages, for example, SNMP traps sent on receipt of CLLM, FECN, or BECN frames, throttling transmission on receipt of FECN, and notifying FECN source.
- PPP Bandwidth Allocation Protocol/Bandwidth Allocation Control Protocol (BAP/BACP) adds the ability to dynamically add or drop links over ISDN B channels. Authentication servers can now be used so that names and passwords need not be configured at each router. Encryption Control Protocol (ECP) using Data Encryption Standard (DES) Cipher Block Chaining mode (CBC) is now available for PPP.
- ISDN I.430 and I.431 is supported to enable interconnecting to lease-line service from NTT.
- Ethernet locally-administered MAC address can be configured to override the default burned-in address.
- WAN support for Bandwidth Reservation (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. Enabling or disabling of adapters can be done from a single operator console without knowing which interface(s) is configured for WAN reroute.

APPN and DLSw

APPN and DLSw enhancements include:

- Native HPR over ATM (see 3-6), supporting implicit focal point and up to eight backups that enables 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 allows exchange of MAC address list between partners.

  NetBIOS session alive spoofing eliminates session alive frames on a dial-on-demand link.

MAE Extended Functions 2

The MAE Extended Functions 2 (feature code 5805) include 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/390 V2R4 and SAP R/3 application servers. Other UNIX System Services applications using UDP, such as NFS and DCE, can also 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 to APPN/HPR technology 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).

Enterprise Extender technology also reduces the demands on the data center routing platforms, providing a more cost-effective solution from other integration technologies. Enterprise Extender seamlessly routes packets through network protocol "edges", eliminating the need to perform 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 current 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 MAE 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. With the MAE supporting up to 4 adapters per box, this would allow up to 96 56 kbps or 64 kbps connections for T1 or up to 124 56 kbps or 64 kbps connections 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.

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 V1, OSPF V2, and BGP V4. To enable common IP routing functionality across the network, the 3746 shares a code base with the 2210 Nways Multiprotocol Router and the 2216 Nways Multiaccess Connector.

The 3746 IP router allows dynamic 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 dynamic routing of IP traffic over the following additional interfaces:

- ESCON MPC+ channels.
- ATM.
- FDDI.
- Fast Ethernet.
- HSSI.
- ISDN.

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

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

The 3746 IP support includes the following protocols:

- Routing Information Protocol (RIP) Version 1. 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 MAE[1]. For more information, see “MAE Extended Functions” on page 3-5.
- Open Shortest Path First (OSPF) Version 2. Supports different kinds of networks, for example PPP and broadcast (Ethernet or token-ring) networks. OSPF is the recommended topology exchange protocol for the Internet.
- Border Gateway Protocol (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.

IP packets are routed by the 3746 adapters (ESCON, token-ring, and communication line adapters), either port-to-port within the adapter, or adapter-to-adapter.

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 (feature code 5033) performs the following:

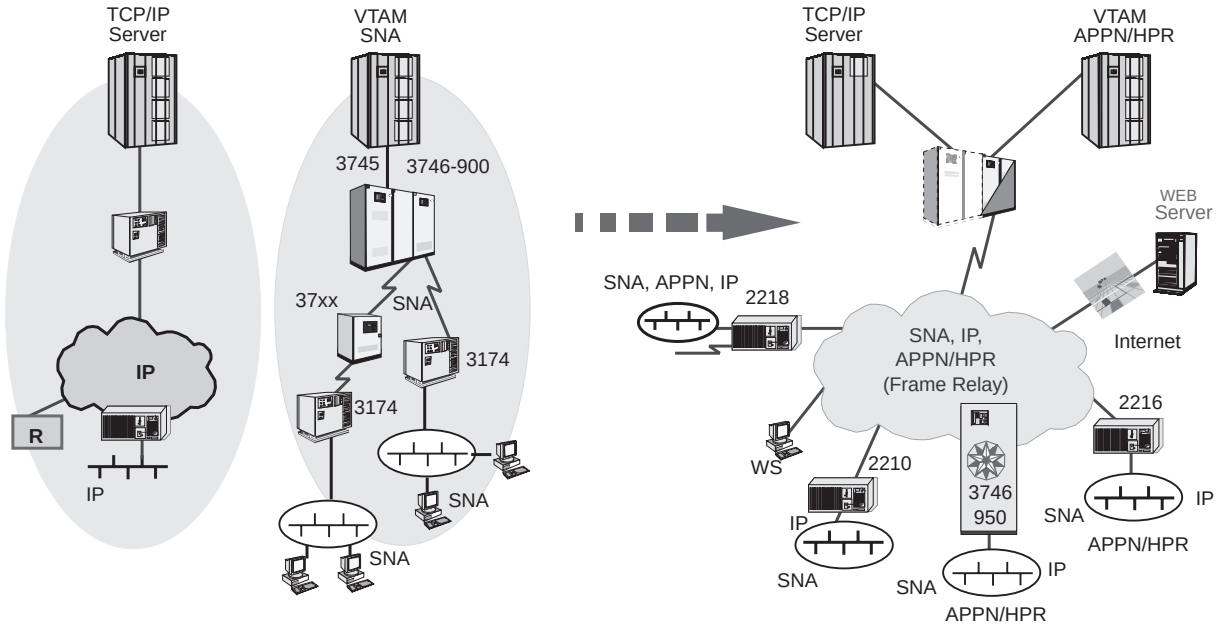
- Standard SNMP support for network management via NetView/AIX* or other platforms.
- Concurrent IP, APPN/HPR, and SNA (NCP) routing over the same adapters and ports.
- Efficient control of access and filtering.
- High data throughput between S/390 servers and the network, allowing consolidation of S/390 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.
- Native 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

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.

[1] The MAE feature code 3000 supports RIP Version 2. The initial version of MAE feature code 3001 supports RIP Version 1.



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

- 2210 Nways Multiprotocol Router
- 2217 Nways Multiprotocol Concentrator
- 2218 Nways 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 for traffic under the control of NCP, or Committed Information Rate (CIR) and Bandwidth Reservation System (BRS) for traffic under the control of the NNP.
- 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 supports internal routing between the NCP IP router 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 attached 3746 IP router.

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. This includes the following:

- 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) 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

A Multi-Link Transmission Group (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 Communication Line Processor (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 (feature code 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[2], allowing a 3745 Model 31A to support up to 10000 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%.
- 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 the following:

- 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[3] lines on the same CLP.
- Direct attachment of X.25 DTEs (OSI 8208).
- Performance monitoring and accounting through NetView Performance Monitor (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) to conform with Euro-ISDN standards. The ISDN PRI ports of the 3746-900 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.

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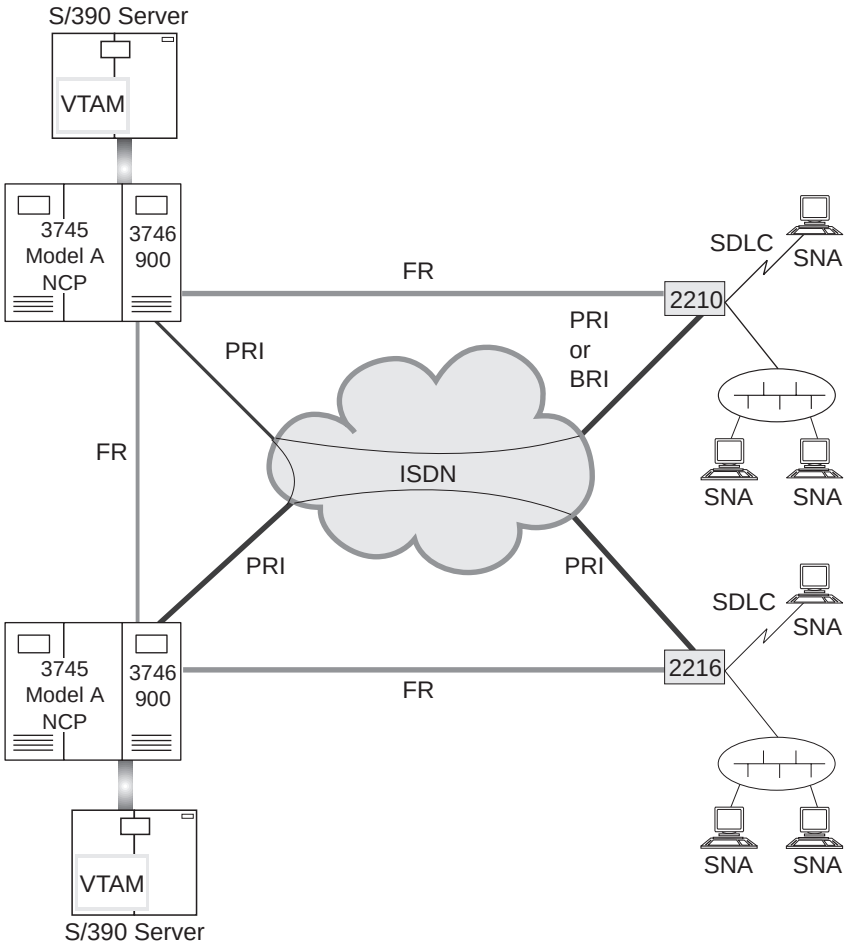
2 The improvement factor varies, depending on the network environment and traffic characteristics (message size, packet size, etc).

3 Point-to-Point Protocol lines are supported by the 3746 IP Router.



Legend:
PRI Primary Rate Interface (30B + D channels)
BRI Basic Rate Interface (2B + D channels)
FR Frame Relay (via leased connections or Frame relay network)

Figure 4-1. Connectivity to ISDN Network

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 4-1 on page 4-6 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 4-1 on page 4-6).
- 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 resulting from a Frame relay link failure 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 4-1 on page 4-6).
- 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 4-1 on

page 4-6). Once the Frame relay connection is restored and active in the MLTG, ISDN connections can be released non-disruptively with a NetView command. An effective way to avoid equipment disruption during a Frame relay failure is to establish one permanent ISDN B channel between two 3746-900s.

Frame Relay Networking

ACF/NCP Version 7 Release 2 (and higher) support 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 CLAs of the 3746-900 support Frame Relay Terminating Equipment (FRTE) and Frame Relay Frame Handler (FRFH).

Frame Relay Switching (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 switching 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 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.

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
- 2210 and 6611 Router
- 2217 Multiprotocol Concentrator
- 2218 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 Remote Function Call (RFC) 1490 bridged-frame format. BAN support by the 3745, 3746-900, 2210, 2216, 2217, 2218, and 6610 uses medium 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 the 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 4-2 on page 4-10 illustrates Frame relay support for the 3745/3746-900.

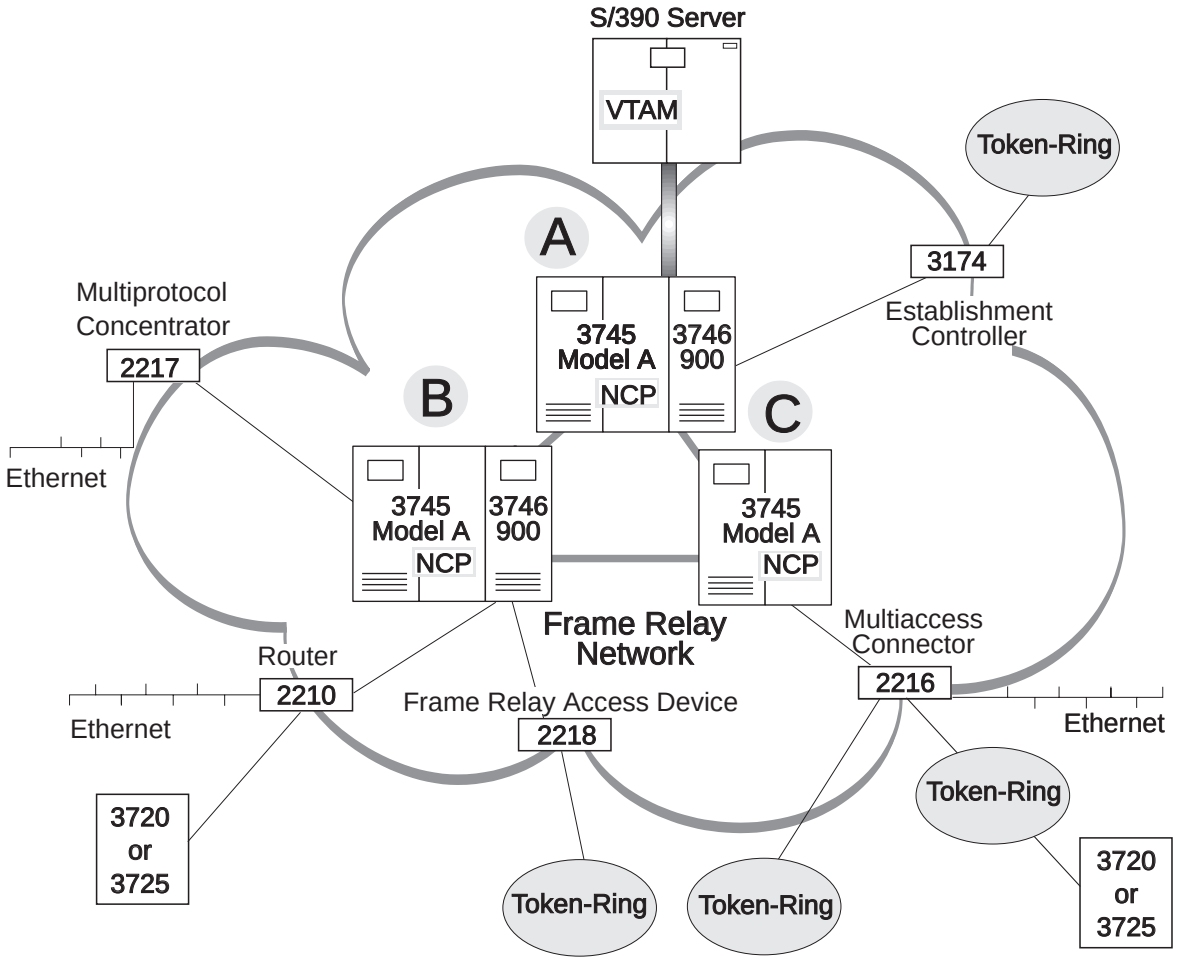


Figure 4-2. Frame Relay Networking for the 3745/3746-900

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 4-2, 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**.

- Multi-Link Transmission Group (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 4-2, 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 Dependant Logical Unit Requester (DLUR), 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 NN functions including NN services for the 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 4-3 on page 4-12):

- APPN (PU type 2.1, such as 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).

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)

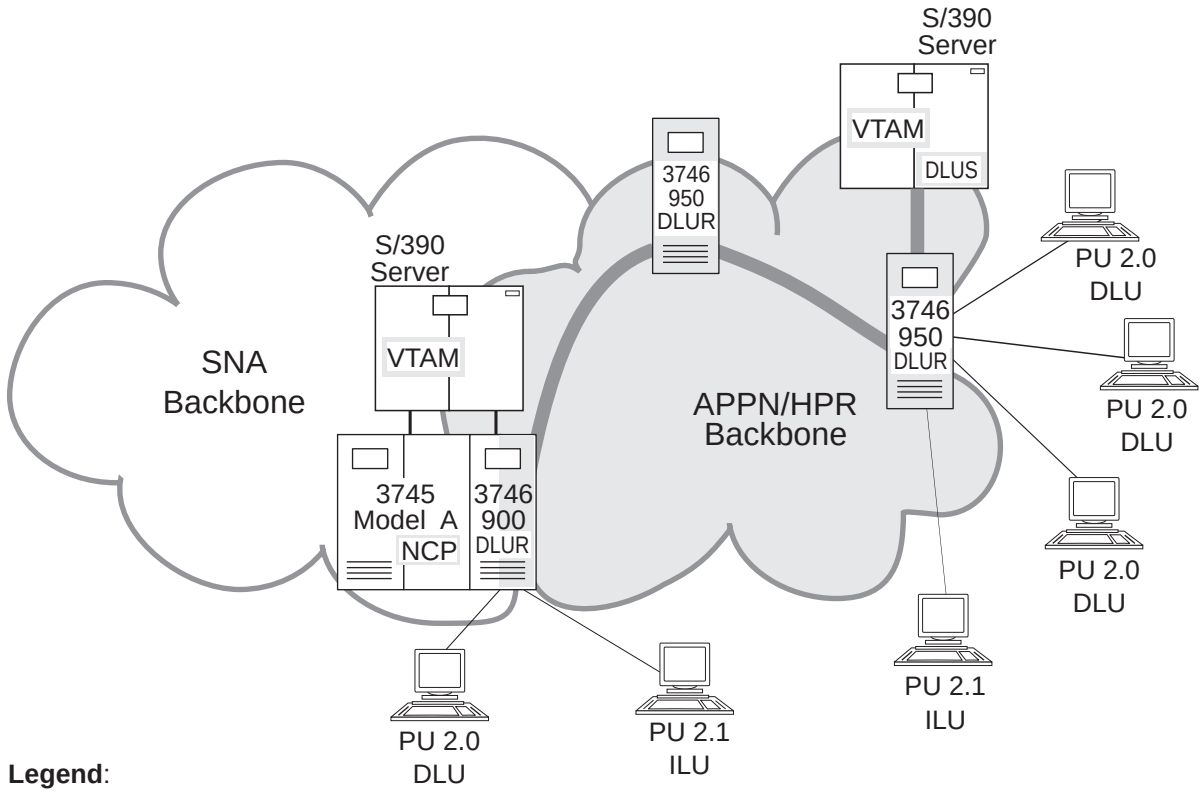


Figure 4-3. Support for Dependent LUs

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 4-3). 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 dependent logical unit server (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 DLUS can be placed in any APPN/HPR sub network, if an APPN path exists between the DLUS and each DLUR.

High-Performance Routing (HPR)

Both the IBM 3746-900 and 3746-950 support HPR, an extension of APPN architecture 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 Multiprotocol Router
  - IBM 2216 Multiaccess Connector
  - IBM 2217 Multiprotocol Concentrator
  - VTAM.

APPN/HPR allows you to build a network with complete availability, twenty-four hours a day, three-hundred and sixty-five 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 Multi-Link Transmission Groups (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 CS/2, 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.

3746-900 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 4-3 on page 4-12 shows a scenario where a 3745/3746-900 is channel-attached to a VTAM and operates 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 over an APPN/HPR backbone.
- SNA/APPN devices connected on an APPN/HPR backbone can access S/390 applications over 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 the following:

- 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, ISDN.

Frame Relay Networking

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

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 2210/6611 Multiprotocol Routers, 2216 Multiaccess Connectors, 2217 Multiprotocol Concentrators, 2218 Frame Relay Access Devices (FRADs), and 3174 controllers.

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, saves 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 NN and 3746-950 provide the same connectivity. Both support:

- ATM (in the MAE).
- Token ring and Ethernet LANs.
- Leased Frame relay links.
- Switched and leased SDLC links.
- ESCON channels, including ESCON MPC+ (in the MAE).
- Frame relay network connections.
- X.25 network connections.
- ISDN network connections.
- Fiber Distributed Date Interface (FDDI), in the MAE.

- High Speed Serial Interface (HSSI), in the MAE.
- Fast Ethernet, in the MAE.

More information about the adapters that support connectivity in the 3746 NN can be found in Chapter 5, “Scalable Connectivity.”

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

Dependent LU Requester (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 page 4-12).

A possible scenario would be as follows:

1. Configure VTAM with a dependent LU server (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

Composite Network Node (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 4-4). 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.

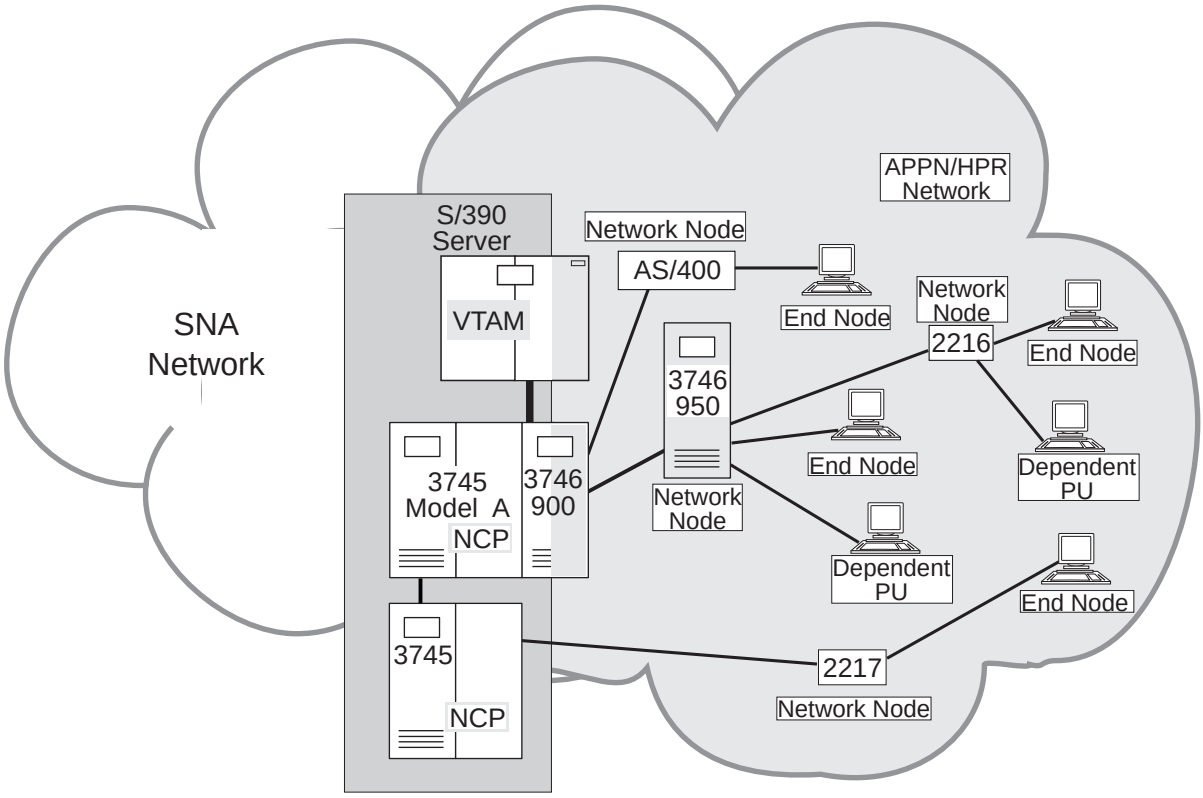


Figure 4-4. APPN/HPR Composite Network Node (CNN) in an APPN/HPR Network

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 4-4 on page 4-17, 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:

- All controllers that have migrated to APPN NNs (see the 3746-950 in Figure 4-4).
- Other NNs (see the AS/400 in Figure 4-4).
- 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:

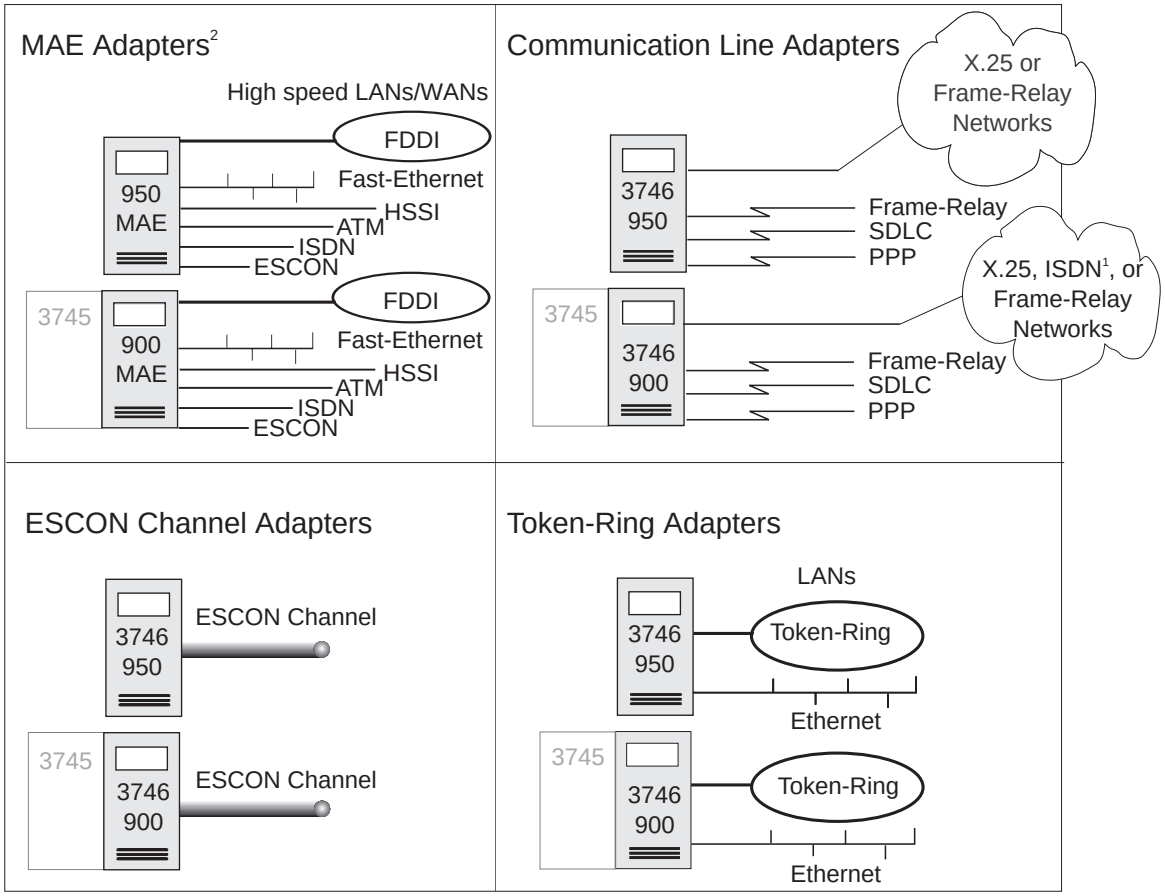
- Higher data throughput by routing via the 3746 adapters instead of the 3745.
- Freeing the 3745 processor of heavy traffic.
- PUs and sessions controlled by the 3746-900 NN do not require any 3745 storage, which allows for increased connectivity.

Chapter 5. Scalable Connectivity

The 3746-900 and the 3746-950 provide the same connectivity options:

- A choice between the following adapter types (see Figure 5-1 on page 5-2):
  - 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
    - FDDI
    - HSSI
    - V24, V35, V36, X21.
- Up to 23 adapters (of which 8 are in the MAE) or 16 adapters (if the MAE is not configured).

Each type of adapter (CLA, ESCA, TRA) and their specific licensed internal code (APPN/HPR, APPN/HPR and IP, or NCP for the 3746-900) can be configured during installation.



1CLA Connectivity to ISDN networks requires ACF/NCP support in the 3745.
2Low speed LANs/WANs (Ethernet, token-ring, Frame Relay, and X.25) are not represented.

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.
- 30,000 APPN and dependent 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 D, “Connectivity of the 3746 APPN/HPR Network Node (NN)” on page D-1.

Communication Line Adapter (CLA)

The 3746 CLA consists of the following (see Figure 5-2 on page 5-3):

- Communication Line Processor (CLP or CLP3).
- Any mix of up to four Line Interface Couplers (LIC), types 11, 12, or 16 (LIC11, LIC12, or LIC16).

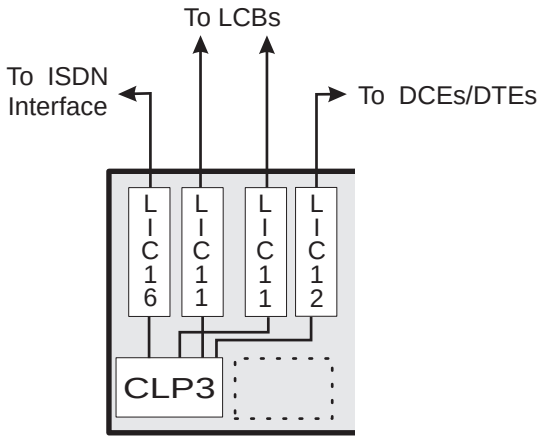


Figure 5-2. Communication Line Adapter (CLA)

The CLA of the 3746 provides the following:

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

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

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

Note: Support for LIC16 ISDN is provided in the 3746-900 in conjunction with ACF/NCP running in the 3745 (see page C-1). LIC16 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.

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 or CLP3 backs up the other in pairs. For further information, refer to Chapter 7, “High Availability.”

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) being used, the CLP3 improves the CLA throughput up to one-hundred percent, compared to the CLP.

CLP3 Connectivity

Compared to the CLP, the CLP3 improves the connectivity of the CLA by a factor of up to 4. 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 and CLP3s, the connectivity options for CLP3[1] is as follows:

- For SDLC connectivity, each CLP3 can support 1000 PUs simultaneously (for example, 3174 downstream PUs). Any ratio of PU-sharing between the LICs on the same processor can be used, for example, 100 PUs can be activated on one LIC11 and 200 via a second LIC11, 300 via a third LIC11, and so on.
- In addition to SDLC connectivity, each CLP3 can support a total of up to 3000 PUs over the following:
  - Any mix of Frame relay and ISDN interfaces
  - 3000 Virtual Circuits (VCs) over X.25 connections (one PU per SVC or PVC)
  - Any mix of the above up to 3000 PUs.
- Each CLP3 can support 3000 Data Link Connection Identifiers (DLCIs), of either Frame Relay Terminating Equipment (FRTE), or Frame Relay Switching Equipment (FRSE), distributed at random over active Frame relay and ISDN 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
  - 2210 and 6611 Multiprotocol Routers
  - 2216 Nways Multiaccess Connector
  - 2218 Frame Relay Access Device (FRAD).

Support for the 3746 NN and 3746 IP

When a 3746 operates[2] as an APPN/HPR NN or IP router over communication line adapters ports, the connectivity options of a CLP3 are as follows:

- For SDLC connectivity, each CLP3 can support 1000 PUs simultaneously (for example, 3174 downstream PUs). Any ratio of PU-sharing between the LICs

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

2 This description provides maximum connectivity figures for the CLP3. For CLP figures, refer to Appendix D, “Connectivity of the 3746 APPN/HPR Network Node (NN)” on page D-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 10 of Table D-1 on page D-2.

on the same processor can be used, for example, 100 PUs can be activate on one LIC11 and 200 via a second LIC11, 300 via a third LIC11, and so on.
- Support for any mix of the following Frame relay and X.25 stations up to 2000:
  - PUs multiplexed over Frame relay DLCIs (including 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).
  - X.25 VCs carrying IP traffic.
  - X.25 VCs controlled by NPSI for the 3746-900.
- Support for a maximum of 2000 DLCIs over Frame relay connections. For the 3746-900, this includes DLCIs over 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[3]:

- 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 12000 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[3]:

- Frame relay (up to 120 lines), 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.

CLP3 in the 3746-900

Shares traffic controlled by NCP, the 3746 NN (APPN, Dependent LU, and HPR traffic), and the IP Router. The connectivity options of the 3746-900 CLP3 are as follows:

- SDLC port supporting 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 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). The connectivity options for the 3746-950 CLP3 are as follows:

- SDLC port supporting 3746 NN traffic.
- PPP port supporting 3746 IP router traffic;

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[3] These examples assume that the IP routing 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.

- 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 B, “Configuration Options for the 3746” and Appendix C, “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. By using ESCON Directors (ESCD), the S/390 can be up to 43 km away.
- More configuration flexibility.
- Increased performance.
- Decreased sensitivity to noise.

An ESCA consists of the following:

- One processor (ESCP[4], ESCP2[4] or ESCP3)
- One coupler (ESCC[4], 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 enhances 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 (CCU) of the associated 3745 (in the 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) being used, the ESCP3 improves the ESCA throughput up to sixty percent, compared to the ESCP2.

[4] No longer manufactured.

ESCP3 Connectivity

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

ESCON Multiple Image Facility (EMIF)

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

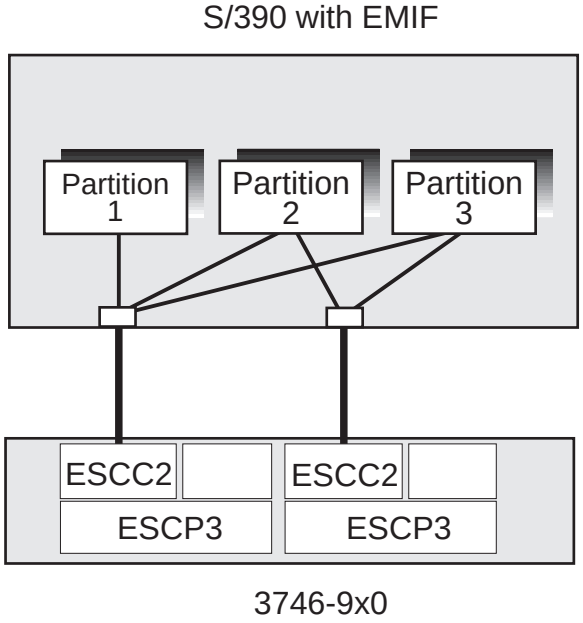

Figure 5-3. Example of EMIF Support with a 3746

ESCON Channel Adapter (ESCA) Connectivity

ESCON adapters (ESCAs) have the following connectivity options:

- An ESCA can communicate with 16 host logical stations (VTAMs, TCP/IPs, and TPFs) in up to 16 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 16):
  - ESCP3 supports about 12000 to 14000 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 option 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/NCP(s) 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[4], TRP2[4] 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.

Compared to the TRP, the TRP2 and TRP3 increase the 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:

TRP3 Throughput

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

TRP3 Connectivity

TRP3 improves the connectivity of the TRA, expressed in number of PUs and APPN/Dependent LU sessions activated by the NNP, by a factor of about 3.

3745 (NCP Support)

The 3746-900 of a 3745 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.

This means that 3745 has a capacity of 16 Ethernet ports, or eight high-speed lines, or a mixture of the two, and that the 3746-900 has a maximum capacity for 32 or 33 token-ring LANs[5].

---

5 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) - Feature Code 5602” on page B-12.

3746-900 With NCP Support

The TRA can connect up to 2000 PUs simultaneously (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, 1900 PUs can be active on one TIC3 while 100 can be active via the other TIC3.

500 PUs can be active on the TIC3 of the CBSP[4], CBSP2[4], or CBSP3 (see Figure A-1 on page A-2).

500 PUs can also be active on the TIC3 of the TRA connected to the CCU-B of the 3745[5].

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

The following are the connectivity potentials for a TRP3:

- Each TRP3 can connect up to 2000 active PUs.
- Each TRP3 supports a maximum of up to 14000[6] 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 13500 such sessions. These examples assume that the IP routing option is not present in the TRAs.
- 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 one or two NCPs.
- Each TIC3 can carry traffic for the 3746 NN (APPN/DLUR/HPR), the 3746 IP router, and one NCP.

The following are the connectivity potentials for a TRP2:

- Each TRP2 can connect up to 2000 PUs activated by NCP, or about 1400[6] PUs activated by the 3746 NN, or a mix of both.
- Each TRP2 of a 3746-950 can connect to about 1400[6] activated PUs.
- Each TRP2 supports a maximum of up to 4700[6] 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 will need two TIC3 ports.

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[6] See note 10 in Table D-1 on page D-2.

Chapter 6. System Management

Management of the 3745 Model 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 and NetView for AIX.

  NetView/390 can perform all the network management functions needed for the 3745 and 3746-900 controlled by NCP, and for the 3746 NN. NetView/AIX can perform all the network management functions needed for 3746 IP router, including the MAE.
- NetView Performance Monitor (NPM)
- Controller and Configuration Management (CCM)[1]
- Maintenance and Operator Subsystem-Extended (MOSS-E)[1].

Service Processor

The service processor performs the following:

- Runs Maintenance and Operator Subsystem-Extended (MOSS-E)[1] functions.
- Runs the CCM application 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 3746-950 and 3746-900 IP router and APPN/HPR NN are equipped with a network node processor (NNP) which provides the following:

- APPN/HPR control point functions for the 3746 NN, including the DLUR functions.
- IP management functions of the 3746 router.
- Support for CCM, accessed through the MOSS-E interface of the service processor, to:
  - 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.

[1] IBM Licensed Internal Code.

- Utility for storing IP and NN files, containing configuration parameters.

Note: The NNP can be configured in dual mode (see 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) Application

The Controller Configuration and Management (CCM) application simplifies the 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.
- Frame relay Terminal Equipment (FRTE).
- Definition of the NetView Performance Monitor (NPM).
- ESCON definitions for SNA (NCP), APPN/DLUR, HPR, and IP.

Telnet Support for Internet Protocol (IP) Operations

Along with CCM, IP resources for configuring and managing stations can be accessed through Telnet. When you have established a Telnet session, you can navigate in the three main environment levels (see Figure 6-1 on page 6-3).

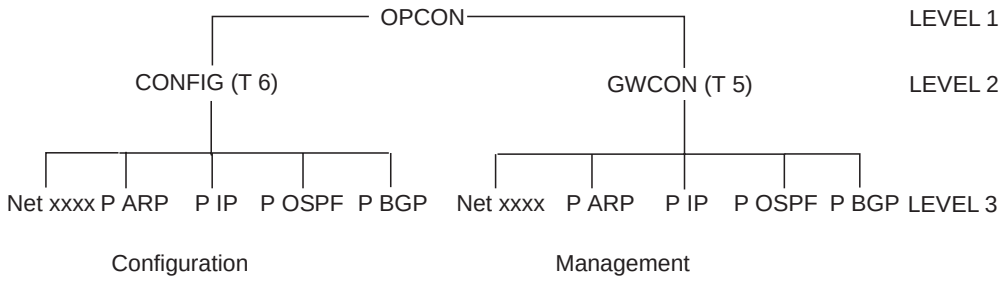
Level 1 OPCON environment.

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 environment that you are in back to OPCON (the *RANGE XXXX-YYYY ** command prompt).



Legend

xxxx Port number

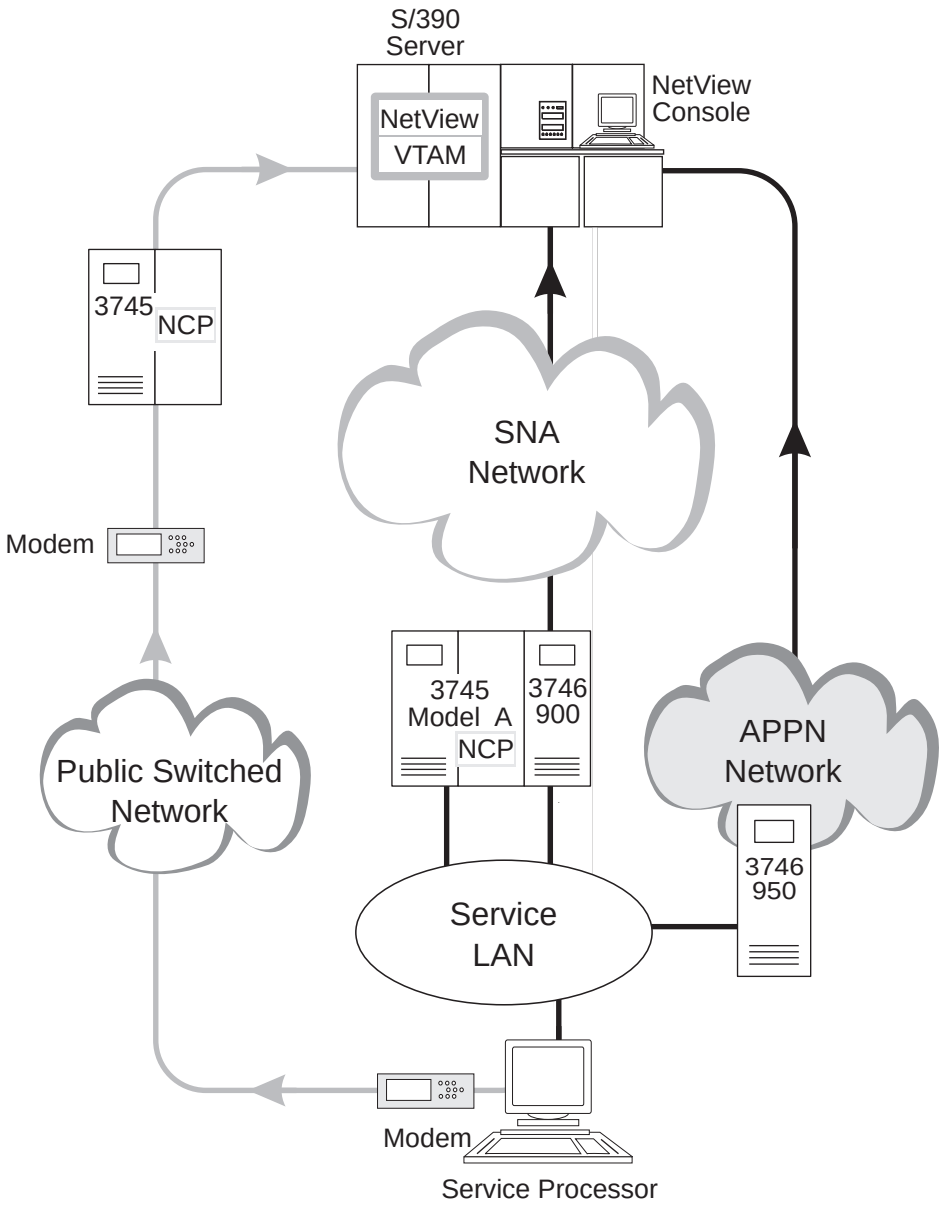
Figure 6-1. Internet Protocol (IP) Environment

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 (automated and triggered by alerts in SNATAM).

NetView is optional, yet recommended for network problem determination. 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

Notes:

If the NetView console is a NetView Graphic Monitor Facility (NGMF) workstation running TME 10 Remote Control[2], it can also be used as a remote console to access the MOSS-E via the service processor.

[2] TME 10 Remote Control has replaced Distributed Console Access Facility (DCAF).

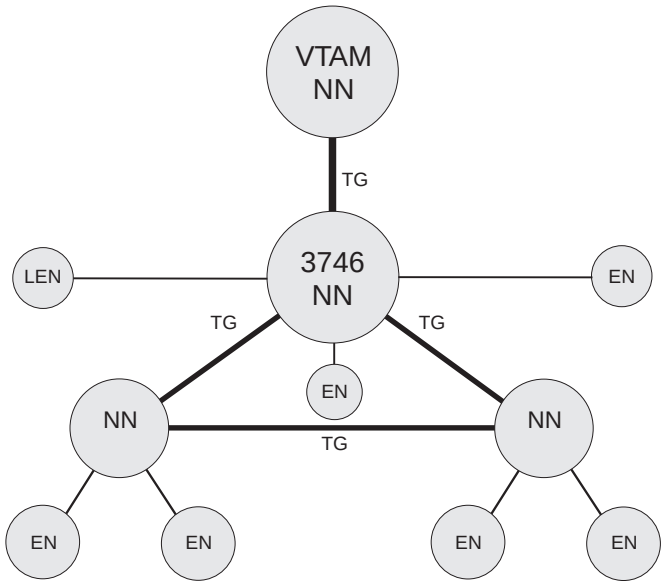
If the path to the user network is unavailable, a NGMF workstation (or any workstation running TME 10 Remote Control[2]) can also use the public switched network to access the service processor.

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.

For more information, see Figure 6-3.

Controller Configuration and Management (CCM) has the facility to display the local topology of 3746 APPN/HPR NNs (end nodes and dependent PUs). With TME 10 Remote Control[2] running in the NGMF workstation, the operator can remotely access 3746 NNs and run the 3746 node configuration, local topology display, and network management functions of the 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 on the 3746 configuration and traffic activity of resources used in APPN/DLUR and HPR traffic. This includes processor load and storage utilization of all the 3746 adapters, token-ring couplers, lines, Frame relay DLCIs and stations, and X.25 links. Performance monitoring is an aid in capacity planning for the 3745 and 3746.

For more information on programming support in NPM, see Table C-2 on page C-3.

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 or other SNMP management platforms. Along with the enhanced Router and Bridge Manager (RABM), NetView for AIX 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.
- An alarm is displayed on the service processor screen.
- An alert is sent to NetView.

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

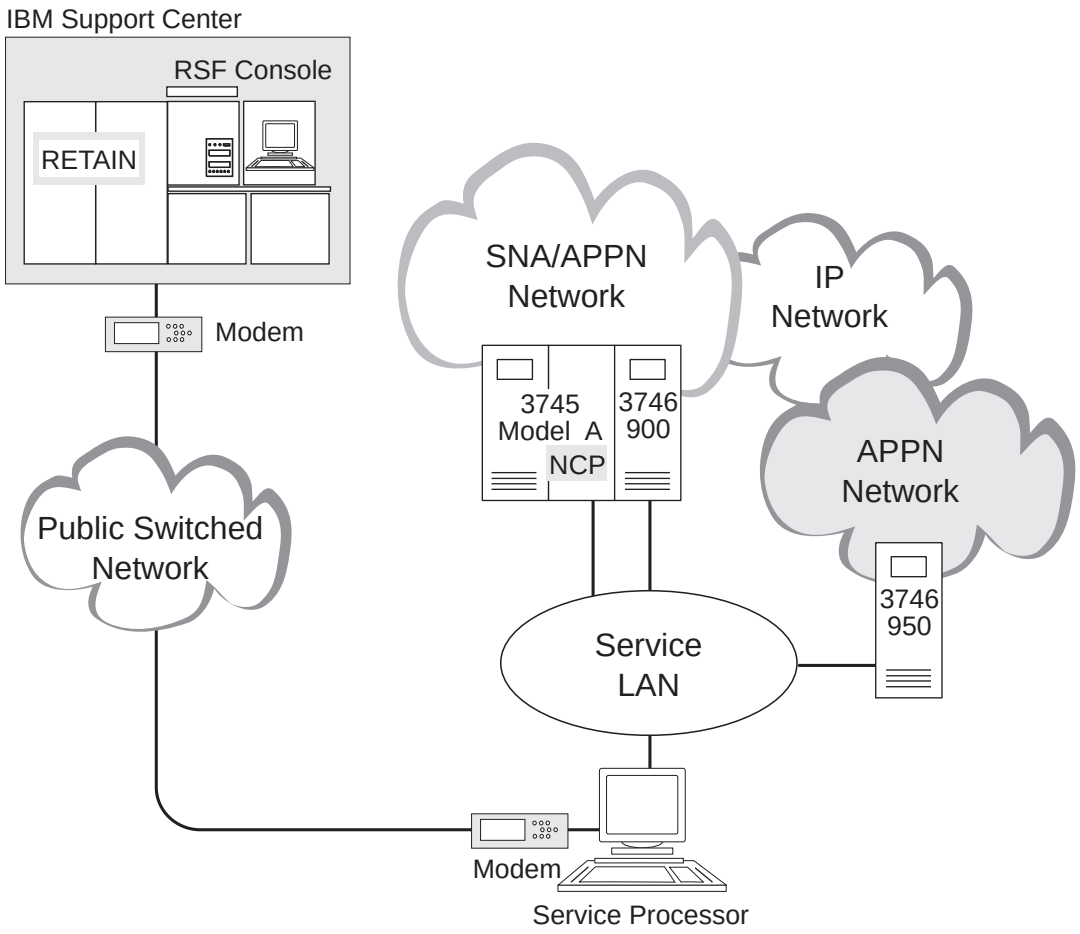


Figure 6-4. RSF and RETAIN Connections

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 hardware failure is the problem, an IBM service representative will visit your site with replacement parts.

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 screens are the same as 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 CCM[3] application 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 contains information about 3746 hardware resources.
- Reports 3746 box errors as alerts to NetView and sends error codes to the IBM Remote Support Facility (RSF). These error codes can also be stored locally and displayed.

Connecting the Service Processor

The service processor communicates with the 3745 Model A MOSS, the 3746, 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 TME 10 Remote Control[2] 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 bridges, appropriate LAN filtering must protect the service LAN segment. A service processor access unit (SPAU) is provided with the service processor for LAN connection to the 3745 and 3746 controllers.

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

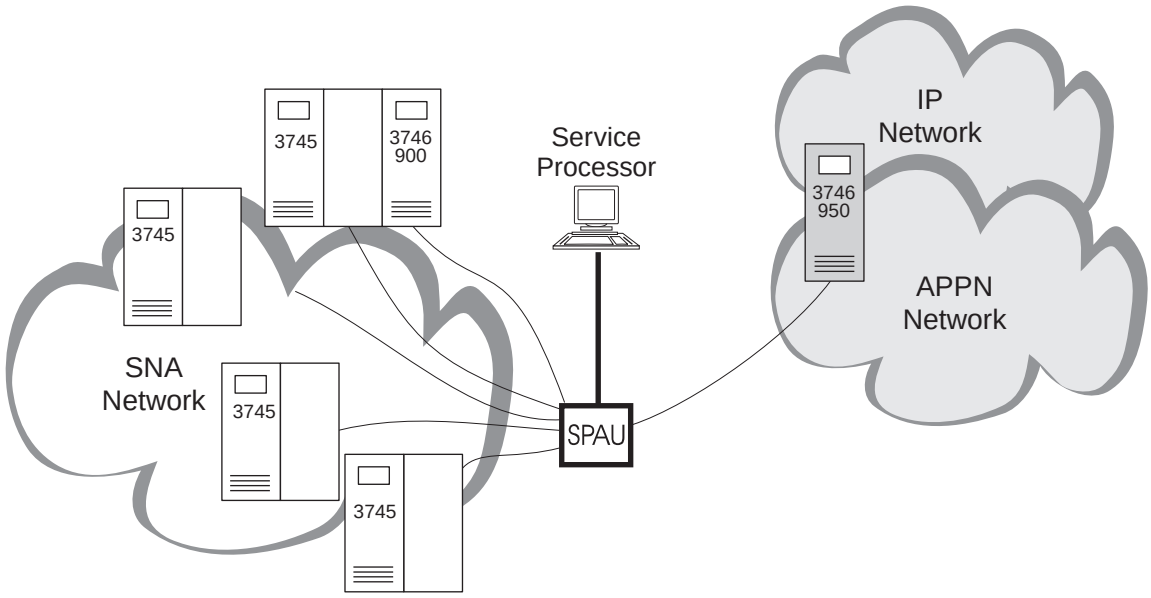
Note: Console ports of the 3745 Models 130, 150, 160, 170, 210, 310, 410, and 610 do not appear on the 3745 Model A.

[3] CCM is also available in a stand-alone OS/2 version.

Sharing the Service Processor

The service processor can support the following maximum configurations[4].:

- 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 APPN/HPR NN (see Figure 6-6 on page 6-10).



Legend
SPAU Service Processor Access Unit

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).

[4] A service processor equipped with the 64 MB Memory Expansion (feature code 5028), or preferably a service processor type 2 (feature code 5052) is required for configurations exceeding one 3745, possibly equipped with a 3746-900, or one 3746.

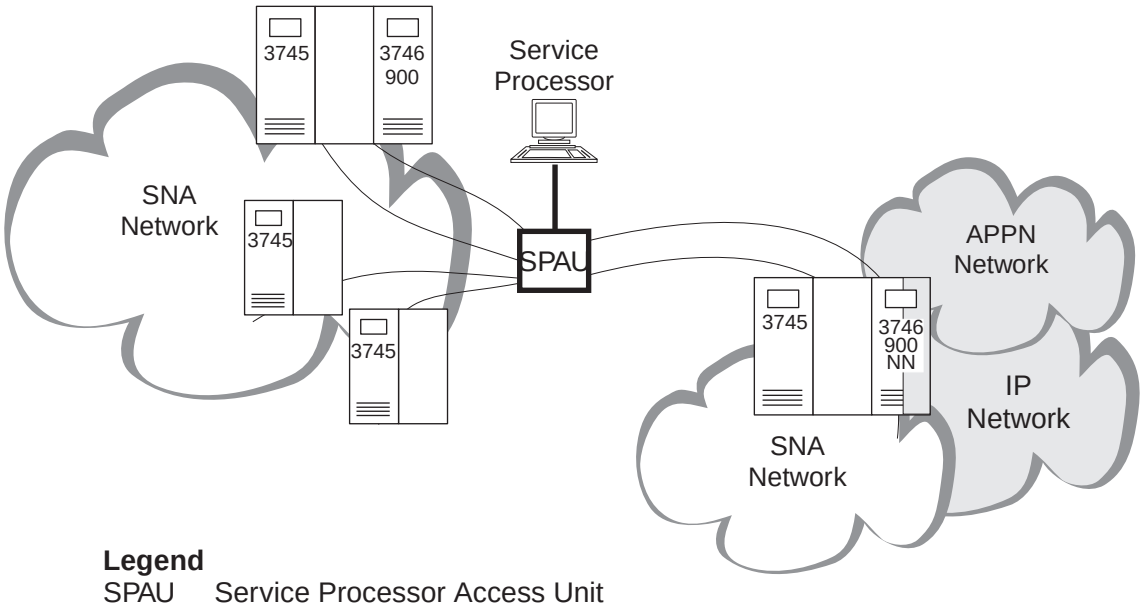


Figure 6-6. Example 2 of a Maximum Configuration for a Service Processor. The service processor connects to four 3745s and two 3746-900s, one of them operating as an IP router and APPN/HPR NN.

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. However, a single TME 10 Remote Control[2] 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.

IBM recommends that all controllers be in the same room and within 10 m of the service processor to facilitate service access.

Backing Up the Service Processor

Although the normal 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:

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.

TME 10 Remote Control

Tivoli Management Environment (TME) 10 Remote Control provides the Distributed Console Access Facility (DCAF) code.

Accessing the Service Processor Via TME 10 Remote Control

Operator consoles can access the service processor MOSS-E by using TME 10 Remote Control. 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). Requirements for running TME 10 Remote Control are as follows:

- TME 10 Remote Control 1.0 (DCAF 1.3 with CSD 1.3.1) can control service processors equipped with an optical disk drive.
- TME 10 Remote Control 2.0 (DCAF 1.3 with CSD 1.3.3) 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.

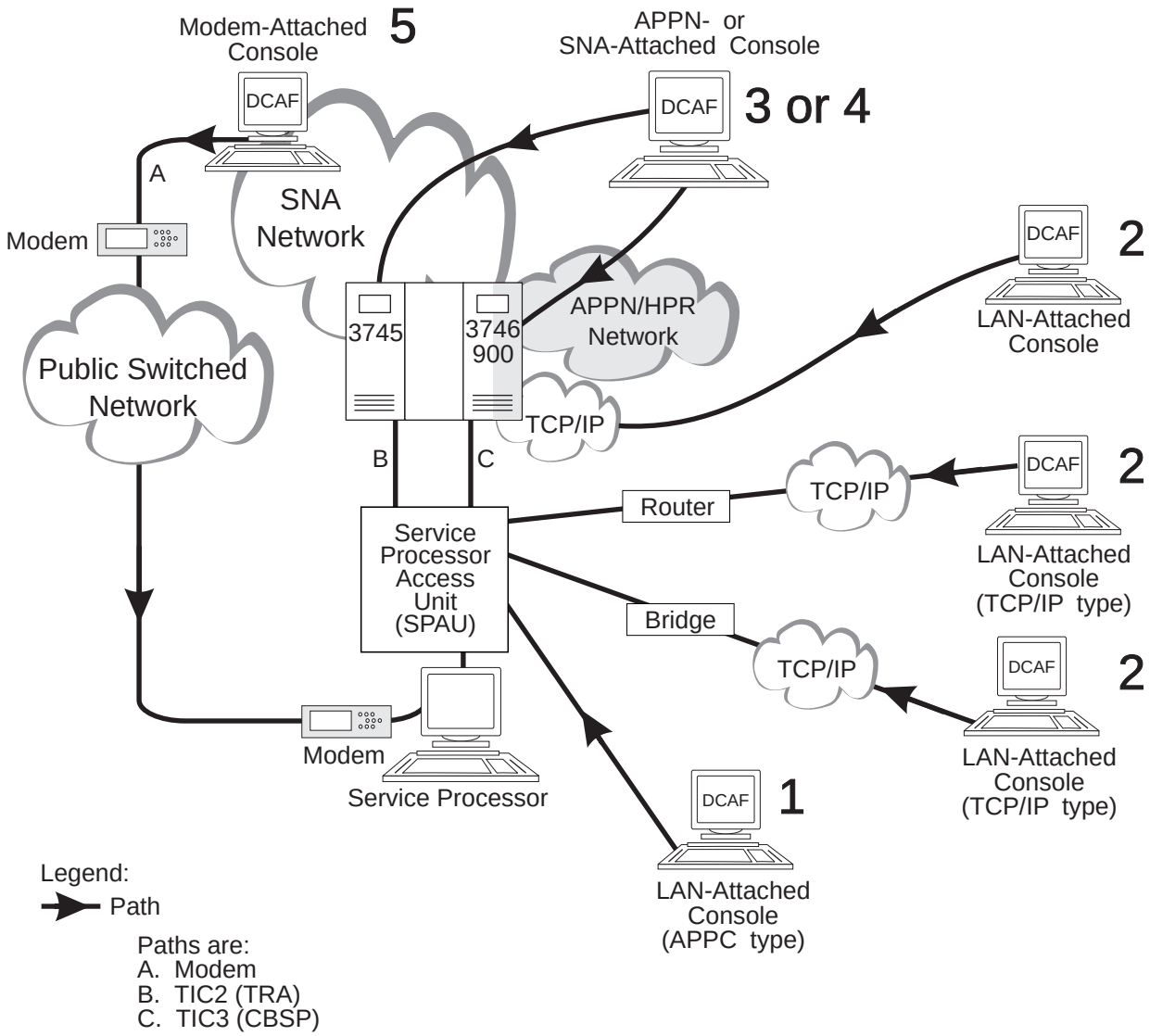


Figure 6-7. Console Attachments

The numbers in Figure 6-7 represent the following console connections to the service processor:

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

2, **LAN-attached** (TCP/IP type) console attached to the SPAU via a bridge or router with appropriate filtering, or to the 3746 via the TCP/IP network.

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

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

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

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

Hardware Requirements and Recommendations

For workstations operated 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 80MB and at least 10MB 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 the *Planning Guide*, GA33-0457.

Accessing the 3746 IP Router Via Telnet

Along with the TME 10 Remote Control capabilities described in “Accessing the Service Processor Via TME 10 Remote Control” on page 6-11, it is possible to access the 3746 IP router for configuration and management purposes via Telnet on an IP station.

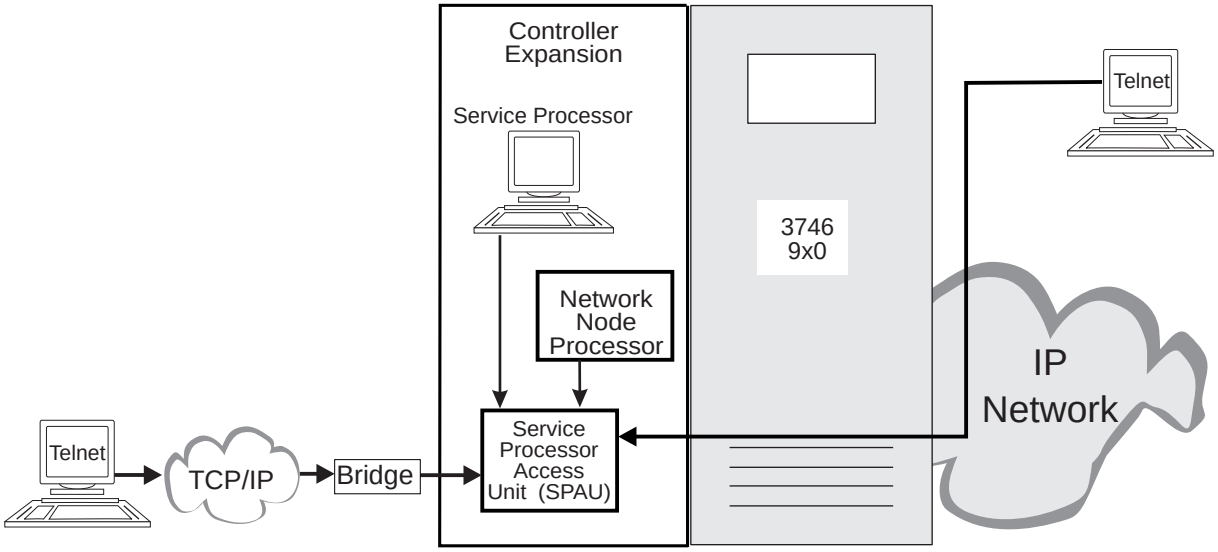


Figure 6-8. Telnet Remote Console Attachments.

Attention

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

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 Model A, the 3746-900, and the 3746-950 are designed to continue operating during 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 to automatically and non-disruptively (3746) take over network operations if the active power supply fails.

Twin-Backup or Twin-Dual Mode (3745 CCUs)

The 3746-900 controlled by the NCP can be customized to function as a 3745 Model 41A and Model 61A, operating with two active NCPs, one in each CCU. This results in the following:

- 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.

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 normally 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.

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 Groups (MLTGs)
Support for MLTG can be configured in the following:

- 3745 and 3746-900 SNA subarea traffic controlled by NCP (see page 4-4).
- 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 4-10).

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 has been established, all the 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 reader[1].

On-line Code Upgrades

The 3746 remains operational 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 compatible with network operations.

[1] New service processors are equipped with a CD-ROM reader and new levels of code provided on a CD-ROM media. For service processors equipped with an optical disk drive, code updates are provided either via optical disk media or down-loaded from RETAIN. These service processors do not support two levels of code per 3746.

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.

Note: Two 3746-900s, or one 3746-900 and one 3746-950, attached to the same service processor, can have different code levels. Therefore, each 3746 can have its own active level and own non-active level.

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 their basic configuration.

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

Concurrent Maintenance

Concurrent maintenance for the 3746-900 and 3746-950 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 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. Minimum Configuration of the 3745 and 3746

This chapter describes the minimum configuration and the equipment required for running a 3745, a 3746-900, and a 3746-950.

3745 Minimum Configuration

Only the 3745 Model A supports the attachment of a 3746-900. All 3745 Models (17A, 21A, 31A, 41A, 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.

3745 Models 31A and 61A Minimum Configuration - Feature Code 8000

New 3745 Models 31A and 61A have no basic features. Any Low-Speed Scanner (LSS), Line Interface Coupler (LIC), or LIC unit is optional.

Service Processor Type 2 - Feature Code 5052

The service processor includes the MOSS-E Licensed Internal Code required for running the 3745 and 3746.

A 28800 bps 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 token-ring connections to the controllers, the service processor, and the NNPs. The 3746 base enclosure is equipped with a token-ring port (a TIC3) for communications with the service processor.

16 MB Storage - Feature Code 7200

This provides a CCU storage of 16 MB for the 3745 Models 31A and 61A only[1] . 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.

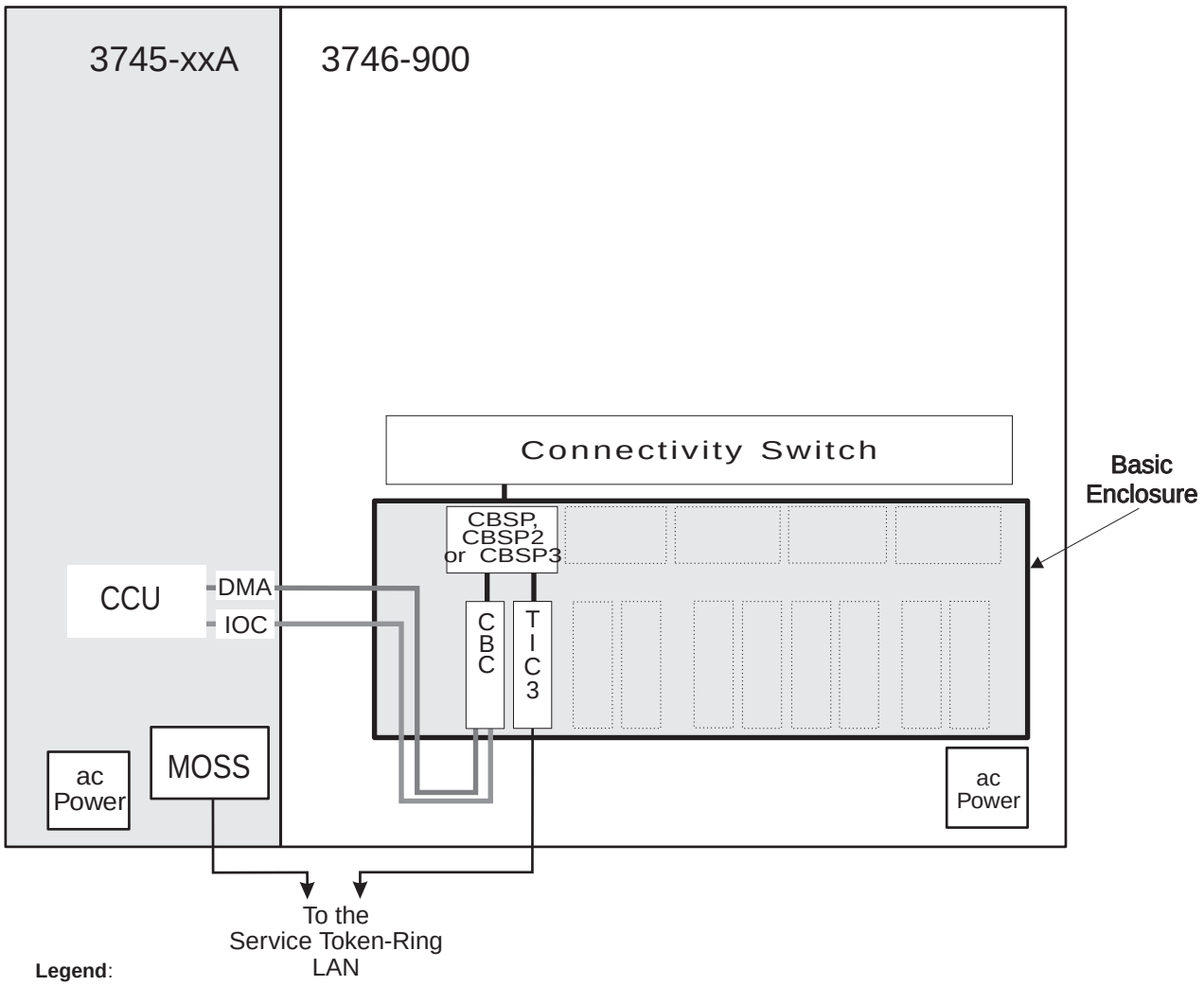
[1] The CCU storage of the 3745 Models 17A, 21A, and 41A can be optionally increased by adding the 4 MB storage increment (feature code 7100). The amount of storage in the CCUs of Model 61A must be the same. The amount of storage in the CCUs of Model 41A must be the same (limited to 8 MB).

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 A-1).

Note: Operations as an APPN/HPR NN or IP router require a CBSP type 2[2] or type 3, an NNP[2] or NNP type 2 and a controller expansion (see "3746-950 Minimum Configuration" on page A-3).



Legend:

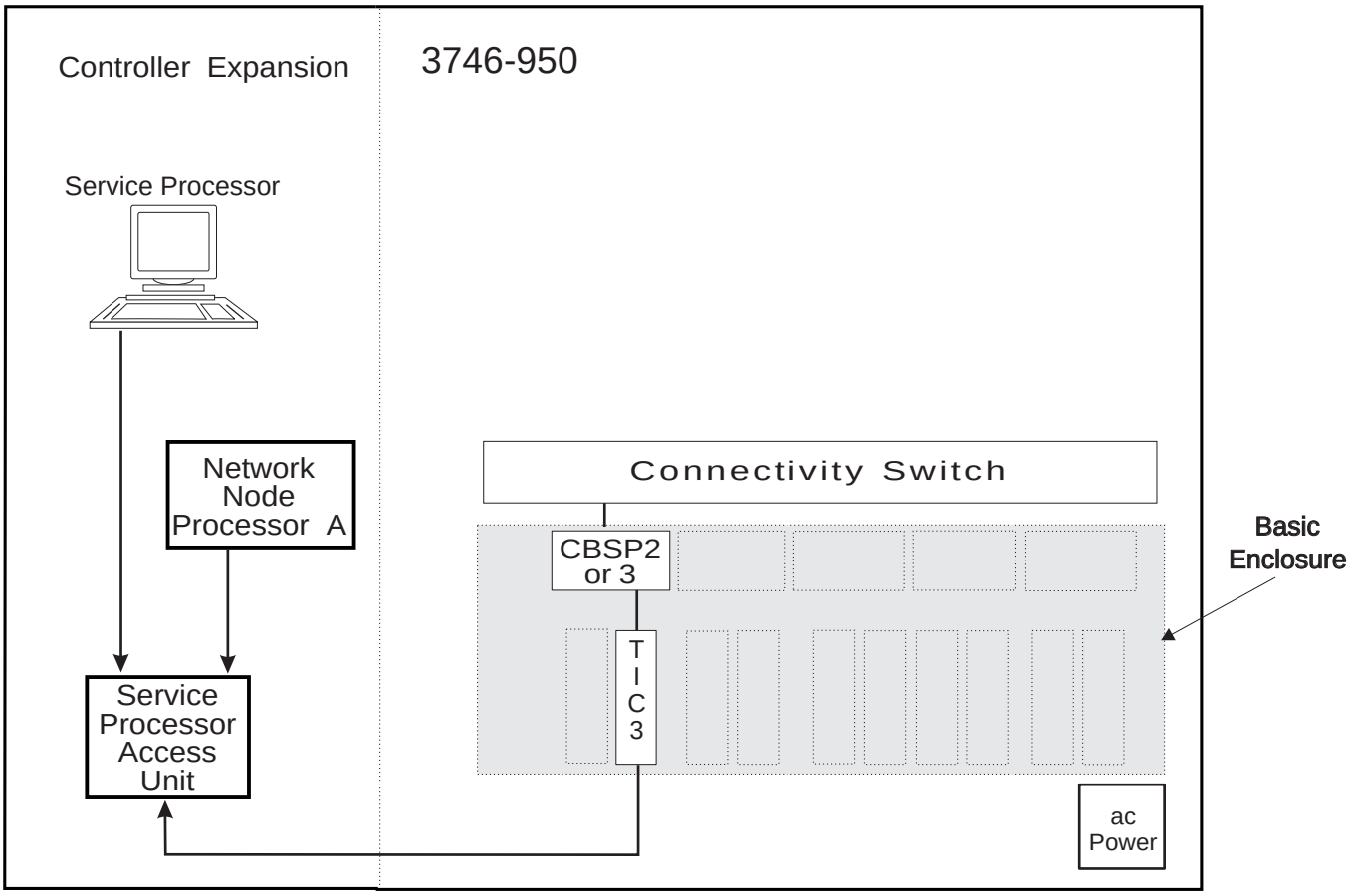
CBC	Controller bus coupler
CBSP	Controller bus and service processor[2]
CCU	Central control unit
DMA	Direct Memory access
IOC	Input/output control
TIC3	Token-ring coupler type 3

Figure A-1. 3746-900 Minimum Configuration. The 3746-900 is attached to a single CCU 3745.

[2] The NNP, CBSP and CBSP type 2 (CBSP 2) are no longer manufactured.

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 A-2).



Legend:

CBSP2 Controller bus and service processor type 2

TIC3 Token-ring coupler type 3

Figure A-2. 3746-950 Minimum Configuration

The minimum configuration for a 3746 includes the following:

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.

CBSP[2], CBSP2[2], 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[3].

Network Node Processor (NNP)

The Network Node Processor (NNP[2] or NNP type 2) 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 IP router and NN and the 3746 Model 950. Houses the NNP and service processor. The controller expansion, the NNP, and the service processor are features of the 3745 Models A and 3746. See Appendix B, “Configuration Options for the 3746” on page B-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.

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[3] 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.

Appendix B. Configuration Options for the 3746

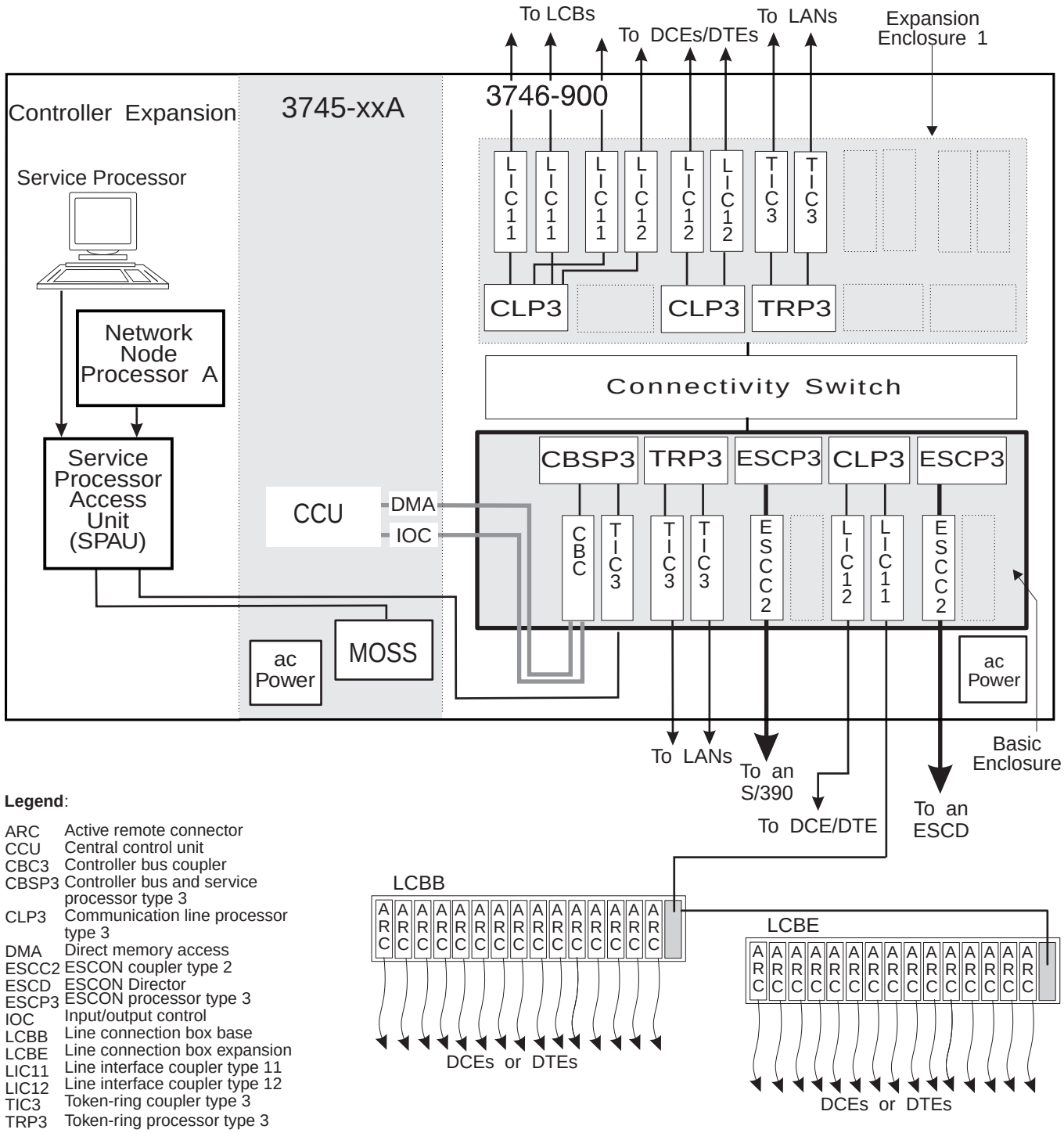
Network Expansion Through 3746 Adapters

The basic enclosure of each 3746 controller houses up to four 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 possibilities are provided with the MAE, which can be installed as an extension to existing controllers. The MAE can house a further eight adapters, supporting interface types other than those of the 3746, and independent of NCP control. The MAE has a direct hardware connection to the controller switch. The hardware connection is installed into an empty processor slot of the controller.

Figure B-1 on page B-2 and Figure B-2 on page B-3 respectively shows the expansion enclosure of a 3746-900 and a 3746-950.

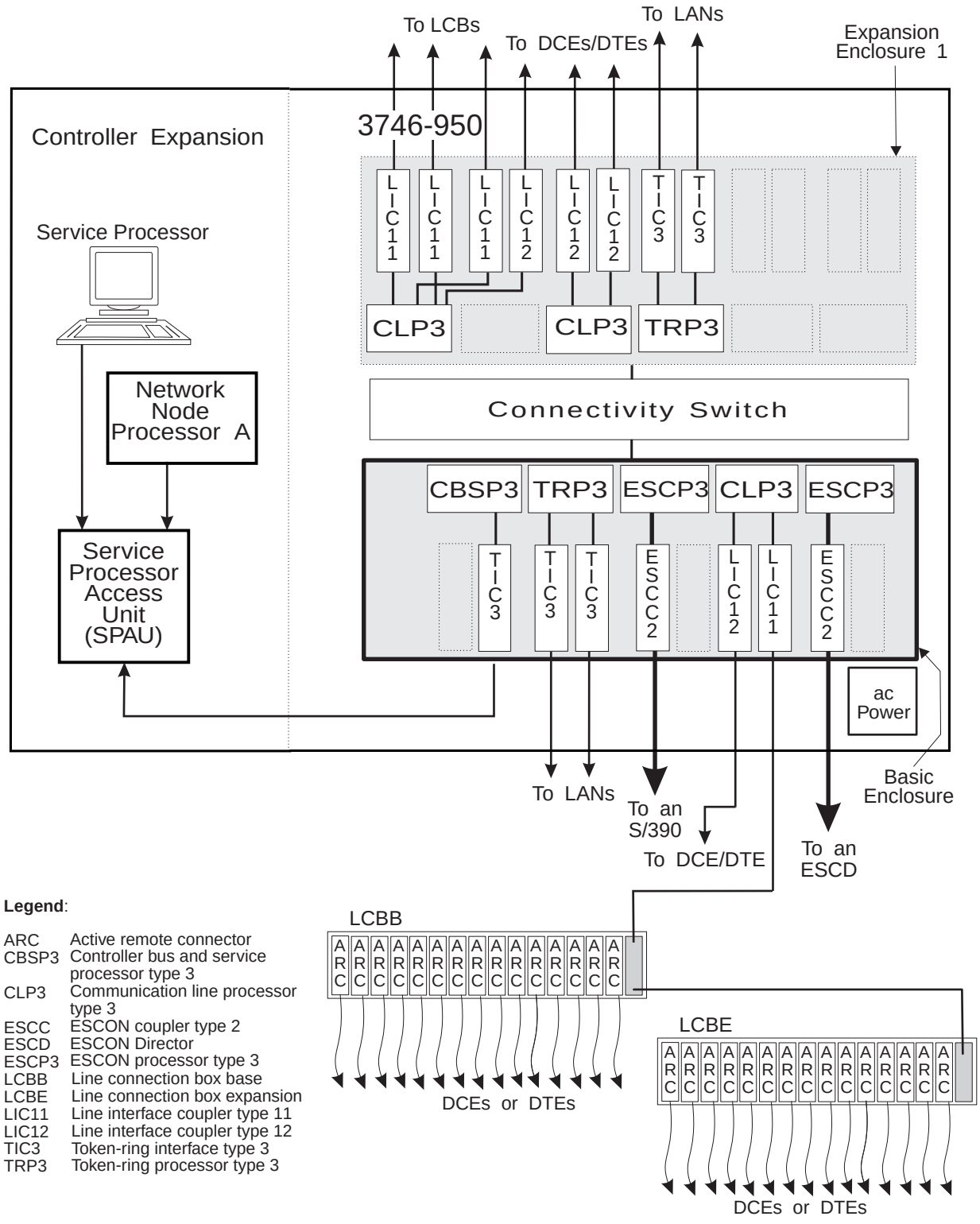
Figure B-3 on page B-4 shows the MAE with its connection to the connectivity switch.



Legend:

ARC	Active remote connector
CCU	Central control unit
CBC3	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
TIC3	Token-ring coupler type 3
TRP3	Token-ring processor type 3

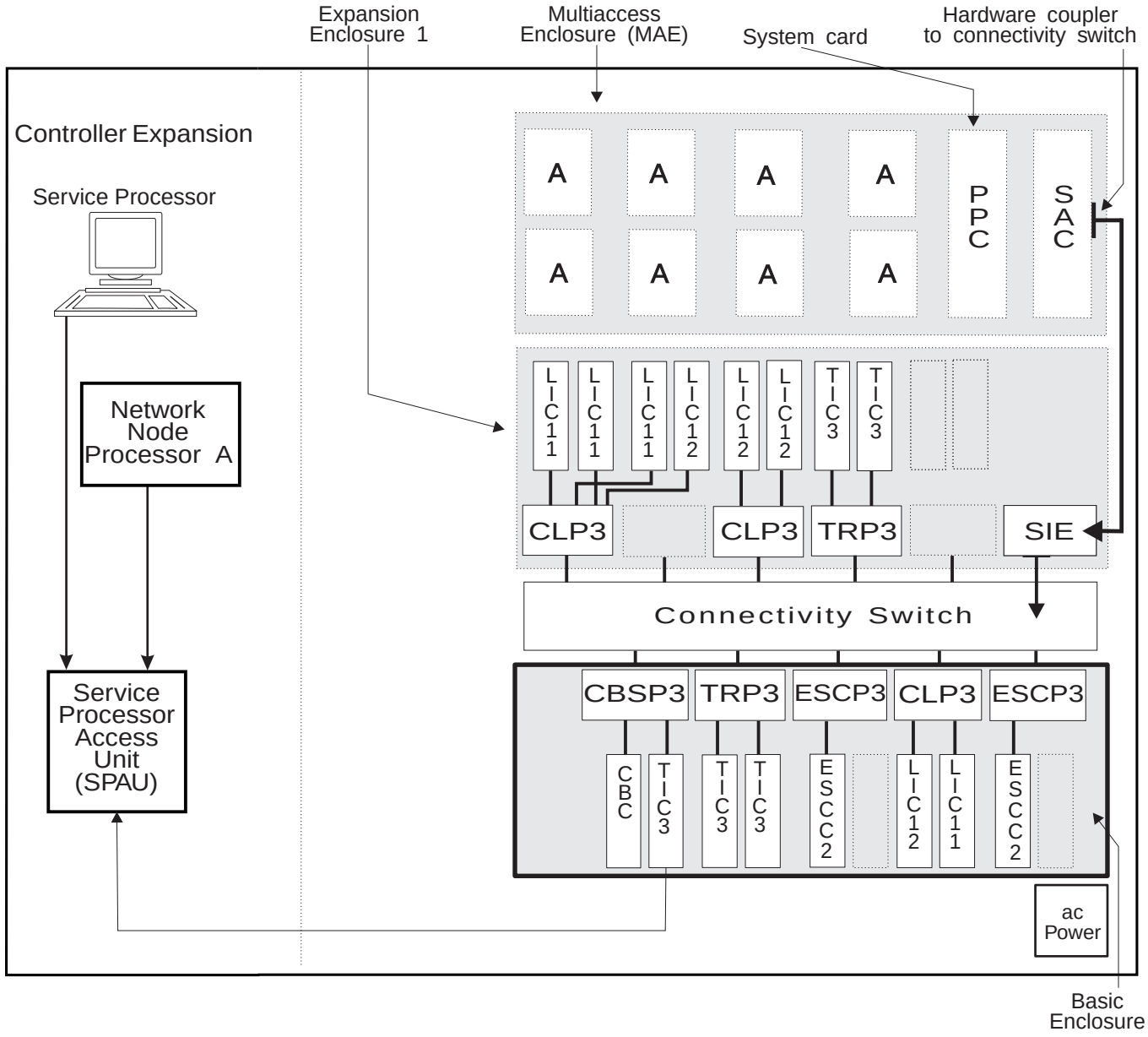
Figure B-1. Example Configuration for a 3746-900. This configuration includes two ESCON channel adapters, two token-ring adapters, and three communication line adapters.



Legend:

ARC	Active remote connector
CBSP3	Controller bus and service processor type 3
CLP3	Communication line processor type 3
ESCC	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
TIC3	Token-ring interface type 3
TRP3	Token-ring processor type 3

Figure B-2. Example Configuration for a 3746-950. This configuration includes two ESCON channel adapters, two token-ring adapters, and three communication line adapters.



Legend:

SAC	Switch Access Card
SIE	Switch Interface Extension
A	Adapter
CBC3	Controller bus coupler
CBSP3	Controller bus and service processor type 3
CLP3	Communication line processor type 3
ESCC2	ESCON coupler type 2
ESCD	ESCON Director
ESCP3	ESCON processor type 3
LIC11	Line interface coupler type 11
LIC12	Line interface coupler type 12
TIC3	Token-ring coupler type 3
TRP3	Token-ring processor type 3
PPC	Power PC

Figure B-3. Example Configuration for a 3746-900 with an MAE. This configuration shows a 3746 equipped with a MAE and an Expansion Enclosure (3745-xxA of the 3746-900 is not represented).

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) - Feature Code 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).
- LPDA2 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) - Feature Code 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.

Line Interface Coupler 12 (LIC12) - Feature Code 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

[1] No longer manufactured.

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) - Feature Code 5216

LIC16 supports Euro-ISDN Primary Rate Interface. LIC16 operates under the control of the NCP and supports SNA traffic over 30 ISDN-B channels at 64 kbps.

Line Connection Box Extension (LCBE) - Feature Code 5202

Note: An LCB Base (LCBB) providing the same line connectivity as the LCBE is provided with the LIC11, feature code 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 (feature code 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 group.
2. One ARC operating at a speed higher than 64 kbps per group.

LIC11 Cables

Cables connecting the LCB Base to the LIC11 are manufactured in standard lengths. Cable feature codes indicate the length and the type of cable (see Table B-1). LIC11 cables up to 15 m long are provided at no additional charge.

Table B-1. LIC Types and Feature Codes

Feature Code	Cable length	Attachment type
9913	1.3 m	LCB Base inside 3746 frame[3].
9714[2]	7 m	standard
9715[2]	7 m	plenum[1]
9716	15 m	standard
9717	15 m	plenum[1]
5218	35 m	standard
5219	35 m	plenum[1]
5220[2]	70 m	standard
5221[2]	70 m	plenum[1]
5222	105 m	standard
5223[2]	105 m	plenum[1]

Notes:

1. USA and Canada only.
2. No longer manufactured.
3. Up to two LCBs maximum.

Active Remote Connector (ARC) - Feature Codes 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 B-1 on page B-2).

There are several ARC types defined by the following:

- Cable attachment.
- Interface (V.24, V.35, or X.21).
- Type of attachment (either modem- or direct-attached).
- Cable length (from 0.6 m to 15 m).

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 B-2 for ARC types, cable lengths, and feature codes.

Table B-2. ARC Types and Feature Codes

ARC Feature Codes, with attachment type (DTE[1] or DCE[2]) and cable length		
64xx	**65xx**	**66xx**
6400 V.24 DTE 15m	6500 V.35 DTE 15m	6600 X.21 DTE 15m
6404 V.24 DCE 2.4m	6504 V.35 DCE 2.4m	6604 X.21 DCE 2.4m
6405 V.24 DCE 5m	6505 V.35 DCE 5m	6605 X.21 DCE 5m
6406 V.24 DCE 1.2m	6506 V.35 DCE 1.2m	6606 X.21 DCE 1.2m
6410[3] V.24 DCE 10m	6510[3] V.35 DCE 10m	6610[3] X.21 DCE 10m
6415 V.24 DCE 12m	6515 V.35 DCE 15m	6615 X.21 DCE 15m
6480[3] V.24 DTE 5m	6580[3] V.35 DTE[5] 5m	6620[3] X.21 DTE[5] 5m
6482[3] V.24 DCE[5] 1.2m	6582[3] V.35 DCE[5] 1.2m	6622[3] X.21 DCE[5] 1.2m
6484[3] V.24 DCE[5] 2.4m	6584[3] V.35 DCE[5] 2.4m	6624[3] X.21 DCE[5] 2.4m
6485 V.24 DCE[5] 5m	6585 V.35 DCE[5] 5m	6625 X.21 DCE[5] 5m
6486[3] V.24 DCE[5] 0.6m	6586[3] V.35 DCE[5] 0.6m	6626[3] X.21 DCE[5] 0.6m
-	-	6630[3] X.21 DCE (transfix[4]) 5m
-	-	6635 X.21 DCE (transfix[4]) 15m

Notes:

1. DTE refers to a direct attachment.
2. DCE refers to modem attachment.
3. No longer manufactured.
4. Transfix ARCs are primarily designed for those DCEs in France which do not support I and C signalling over an X.25 interface.
5. For connection to existing 3745 cable of the same type.

ESCON Channel Adapter (ESCA) Components

The ESCA consists of two components (see Figure B-1 on page B-2):

- ESCON processor (ESCP[1], ESCP type 2[1], or ESCP type 3).
- ESCON coupler (ESCC[1]) or ESCC type 2 (ESCC 2).

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 B-1 on page B-2 and Figure B-2 on page B-3.

ESCON Channel Processor Type 3 (ESCP3) - Feature Code 5523

ESCP3 supports 16 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 ESCON fiber distance (3 km), 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 away or alternatively, accessed from up to 43 km away, through two cascaded ESCDs, each with the Extended Distance interface.

Table B-3 shows the maximum 3745/3746-900-to-S/390 and 3746-950-to-S/390 distances for various ESCON configurations. See also Figure B-4 on page B-9.

Table B-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 B-4 on page B-9 illustrates the maximum 3746-to-S/390 distances.

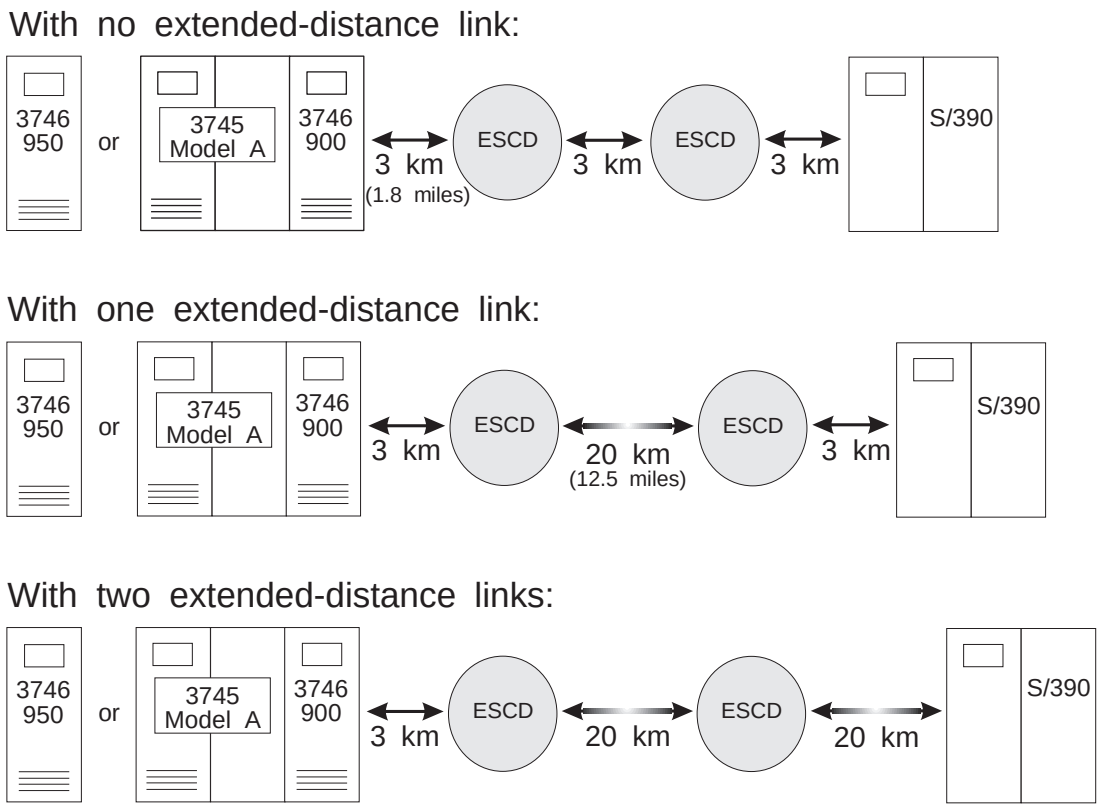


Figure B-4. Extended ESCON Support. This figure shows different possible distances between the 3746 and the S/390 through ESCON connections.

ESCON Channel Coupler Type 2 (ESCC2) - Feature Code 5502

ESCC[1] and ESCC2 contain the interface to the ESCON multi-mode, duplex fiber-optic channel cable. ESCC2 is an enhancement of ESSC, providing the same functions, but with an increase in throughput and 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 B-1 on page B-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) - Feature Code 5623

The TRP3 (TRP and TRP2) provides IEEE 802.2 logical control. The TRP3 (and TRP2) supports 3746 NNP and 3746 IP routing (for more information, see Chapter 5, “Scalable Connectivity” on page 5-1).

Token-Ring Interface Coupler Type 3 (TIC3) - Feature Code 5601

TIC3 handles medium access control (MAC). One or two TICs can be connected to each processor.

3746 Extended Function 1 - Feature Code 5800

This feature provides the following functions:

- 3746 NCP internal IP routing (NCP V7R6 is required).
- Dynamic windowing enhancement for Frame relay and ISDN (NCP V7R6 is required).
- X.25 traffic controlled by the NNP (independent of NCP).
- HPR/MLTG support over token-ring, Ethernet, SDLC, Frame relay, and X.25.
- BRS for 3746 PPP lines (IP traffic).
- Frame relay switching (FRFH) for 3746 lines controlled by the NNP.
- CIR for Frame relay lines controlled by the NNP, with BRS at DLCI level.
- PRI Euro-ISDN enhancements (see “Line Interface Coupler 16 (LIC16) - Feature Code 5216” on page B-6).
  - Automatic backup of Frame relay links over ISDN (non-disruptive for NCP operations).
  - Support of LIC16 for NPM (NPM V2R3 and PTFs).

3746 Extended Function 2 - Feature Code 5802

This feature provides Session Services Extensions (SSE) as part of package with 3746 Extended Function 1. SSE is a protocol enhancement to both the 3746-900 and the 3746-950 and allows the controller to connect to a border node in another APPN network.

Ethernet Port - Feature Code 5631

This feature allows the connection of a local Ethernet segment to the 3746, and supports SNA (NCP), IP and APPN/HPR traffic. This feature is 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.

Service Processor Type 2 - Feature Code 5052

A service processor is required for configuration, management, and maintenance of the 3746. The service processor type 2 supports the MAE and replaces service processor feature code 5020 and 5021 which are no longer available. A service processor can be ordered with either the 3746-900, the 3746-950 or a 3745 Model A (see “3745 Minimum Configuration” on page A-1). The service processor type 2 is equipped with a 200 Mhz processor, 96 MB of memory, a 2 GB hard disk drive, and a CD-ROM.

Service Processor HDD Upgrade - Feature Code 5026

This upgrade increases the hard disk capacity of service processor 9577, feature code 5020. This is required for a service processor to support a 3746 Nways Controller Model 900 or 950, operating as an IP router or APPN/HPR NN. This hard disk capacity increase must be ordered also for service processor 9585, feature code 5021, to support the CD-ROM option (feature code 5051).

Service Processor CD-ROM Drive Upgrade - Feature Code 5051

This feature upgrades an optical disk drive to a CD-ROM drive. This upgrade is designed for service processors types 9585 (tower model) and 3172 (rack-mount model), previously available as feature code 5021.

Service Processor Memory Expansion - Feature Code 5028

A 64 MB memory expansion in service processor feature code 5021 (rack-mountable and tower versions) is required for CD-ROM, feature code 5051, and provides support for large configurations, for example:

- A service processor shared between multiple 3745s and 3746s. This feature is required when an additional 3745 or 3746 is connected to the service processor.
- 3746 with two expansion enclosures (feature codes 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 feature code 5052 which already has a 96 MB memory base. Also, this memory expansion cannot be installed in service processor feature code 5020 (desktop version).

CBSP3 Upgrade - Feature Code 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 is required to support more than 15000 (and up to 30000) APPN or dependent LU data sessions. New 3746s are automatically equipped with a CBSP3 Base (feature code 9023). The CBSP3 upgrade, feature code 5123, provides the upgrade from CBSP or CBSP2 to CBSP3.

Network Node Processor Type 2 (NNP2) - Feature Code 5122

The NNP2 (or NNP[1]) is required for the 3746-950 and 3746-900 to operate as an IP router or APPN/HPR NN. The NNP2 contains the hardware and the licensed internal code required to support the APPN/HPR NN control point and IP router SNMP agent.

You can also install a second NNP2 for higher availability (see 7-2).

NNP Memory Expansion - Feature Code 5027

A 64MB memory expansion enables the NNP to support more than 3000 PUs and nodes, and more than 9000[2] APPN and DLUR sessions (LU-LU sessions).

X.25 Support - Feature Code 5030

The X.25 feature provides code that enables the CLP3 (and CLP) to support X.25 lines. The support is as follows:

- The CLP3 (and CLP) can perform X.25 DLC and data packet functions over PVC and SVC.
- 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 feature code 5800).

IP Routing - Feature Code 5033

This feature provides the required licensed internal code in the 3746-900 and 3746-950 for the following:

- IP routing functions in all types of processors (CBSP2/CBSP3, TRP2/TRP3, ESCP2/ESCP3, and CLP/CLP3).
- IP management functions in the NNP (SNMP agent, Telnet).

Controller Bus Coupler (CBC) - Feature Code 5602

This feature is required for connecting the 3746-900 to the second CCU of a 3745 Model 41A and 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 - Feature Code 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 processor slots on the front side and twelve coupler slots on the back (see Figure B-1 on page B-2 and Figure B-2 on page B-3).

Expansion Enclosure 2 - Feature Code 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.

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2 This number of sessions does not include 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) - Feature Code 5602."

Controller Expansion - Feature Code 5023

A controller expansion is an extension of the 3745 Model 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 features.

Two controller expansions are necessary for housing all the features of a large network environment.

Side Covers - Feature Code 5024

Two side covers are required for a standalone controller expansion (feature code 5023), or one attached to a 3745-17A. This feature is not required for a controller expansion attached to a 3746-950, a 3746-900, or a 3745 Model 21A, 31A, 41A, or 61A.

Dual Power Input - Feature Code 5000

This features provides a backup power supply for the 3746-950 (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.

Multiaccess Enclosure (MAE) - Feature Code 3000

The MAE houses eight adapter slots for extending the APPN, APPN/DLUR, HPR, and IP routing capacities of the 3746. A mix of communication interfaces within the MAE allows for greater flexibility in network design and evolution. The MAE supports very high data throughputs.

MAE with Direct Attachment - Feature Code 3001

This MAE includes a high speed, hardware attachment to the 3746 connectivity switch, designed for IP traffic. The direct attachment is installed in a processor slot of the controller base.

MAE Memory Expansion - Feature Code 3520

This feature extends the memory of the MAE from 64 MB to 128 MB. This enables the MAE to support memory intensive environments, for example APPN, DLSw, or TN3270e environments.

MAE Second AC Power Supply - Feature Code 3500

This feature provides a second power supply input for the MAE. It must be configured, along with a second AC distribution (feature code 5002), if the MAE is installed in a 3746 with a dual AC power input, feature code 5000. This feature includes a power cord for the second AC distribution.

MAE Token-Ring Kit - Feature Code 5713

This feature provides a token-ring connection in the MAE for non-IP traffic (APPN/HPR, NCP) between the MAE 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 a TIC3.

Note: A TIC3 with a token-ring cable must be available on a TRP type 2 or type 3 for a connection to the token-ring access unit.

MAE Extended Functions - Feature Code 5804

This feature provides the following:

- Interactive Network Dispatcher, which enables greater scalability and load-balancing for S/390 and IP/web servers.
- Protocol enhancements for Frame relay, PPP, ISDN, ATM (Native HPR over ATM), APPN/HPR and DLSw.
- Support for the MAE memory expansion.

For more information, see “MAE Extended Functions” on page 3-5.

MAE Extended Functions 2 - Feature Code 5805

This feature provides the following support:

Adapter support
FDDI, Fast Ethernet, and HSSI.

High Performance Data Transfer (HPDT) User Datagram Protocol (UDP)
HPDT Multi-Path Channel+ (MPC+), extended to include IP support over the MAE ESCON channel.

HPDT TCP
HPDT TCP/IP extends the efficiencies of HPDT services to IP applications using OS/390 V2R5.

Enterprise Extender
Enterprise Extender is a simple set of extensions to the APPN/HPR technology to integrate SNA into IP backbone networks.

X.25 Scalability of the MAE
This extends the X.25 capacity from a limit of 239 VCs to a limit of 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.

Dial-in support
For SDLC PU Type 2 devices.

For more information, see Chapter 3, “Multiaccess Enclosure (MAE)” on page 3-1.

TN3270e Server - Feature Code 5806

This feature 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 Chapter 3, “Multiaccess Enclosure (MAE)” on page 3-1.

FDDI MMF Adapter (LIC286 in the MAE) - Feature Code 3286

This feature provides one attachment to a FDDI hub or switch using a multi-mode fiber optic cable. The attachment provides:

- Support at 100 Mbps.
- Attachment as either a single attachment station (SAS) or as a dual attachment 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 in the MAE) - Feature Code 3288

This feature provides one attachment to an 100BaseTx repeater, hub, or switch using a 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.

Note: Cable feature code 3713 is available for this adapter.

High Speed Serial Interface (LIC289 in the MAE) - Feature Code 3289

This feature provides one attachment to a HSSI DCE over STP cable. The attachment provides:

- Network speed range of 1.544 Mbps to 52 Mbps.
- DTE interface for network applications (DCE for back-to-back tests).
- The following standards:
  - ANSI/EIA/TIA 612
  - ANSI/EIA/TIA 613.
- 50 pin connector.
- Maximum cable length of 50 ft (15.4 m).
- A 15 foot (4.6 m) cable is provided with this adapter to attach to a HSSI DCE.

155 Mbps ATM MMF Adapter (LIC294 in the MAE) - Feature Code 3294

Provides one attachment at 155 Mbps to an ATM switch over a multi-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 OC3c framing.
- Nominal operating wavelength of 1300nm using LED-based technology.
- Support for a 62.5/125um multi-mode fiber.
- Transceiver support for a maximum cable length of 2 km.
- A multi-mode duplex SC connector.

Cable feature code 5710 (10 m) or feature code 5715 (40 m) is available for this adapter.

155 Mbps ATM SMF Adapter (LIC295 in the MAE) - Feature Code 3295

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 OC3c framing.
- Nominal operating wavelength of 1310nm using laser-based technology.
- Support for a 9/125um single mode fiber.
- Transceiver support for a maximum cable length of 20 km.
- A single mode polarized duplex SC connector.

Cable feature code 5720 (10 m) or feature code 5725 (40 m) is available for this adapter.

ESCON Channel Adapter (LIC287 in the MAE) - Feature Code 3287

This feature provides an ESCON channel interface for S/390 server connectivity.

- Maximum distance of 3 km. Longer distances can be supported via an ESCON Director with an ESCON Extended Distance interface (up to 23 km total) or two cascaded ESCON Directors with the ESCON Extended Distance interface (up to 43 km total).
- The ability to attach directly to the mainframe ESCON channel or to an ESCON Director.
- Support for a 62.5/125um multi-mode fiber.

Cable is available for this adapter (see “Cables for ESCON Adapters” on page B-20).

ISDN PRI (T1/J1) Adapter (LIC283 in the MAE) - Feature Code 3283

Provides one attachment to an ISDN Primary Rate service at T1/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 64 kbps B-channels for data and one 64 kbps D-channel for signalling for ISDN, 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 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.

Cable feature code 3714 is available for this adapter.

ISDN PRI (E1) Adapter (LIC292 in the MAE) - Feature Code 3292

Provides one attachment to an ISDN Primary Rate service at E1 speed or can be configured as a channelized E1 interface. This attachment provides:

- Support for E1 line speed of 2.048 Mbps.
- 30 64 kbps B-channels 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 CRC4 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, CRC4 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.

Cable feature code 3715 is available for this adapter.

Token-Ring Adapter (LIC280 in the MAE) - Feature Code 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.
- MAC standard error and status reporting and management counters.
- Support for shielded twisted pair (STP) or unshielded twisted pair (UTP).
- Shielded RJ45 jack connector.

Cable feature code 3713 is available for this adapter.

Ethernet Adapter (LIC281 in the MAE) - Feature Code 3281

Provides two Ethernet attachments. Each attachment provides:

- Compliance with Ethernet 2.0, IEEE 802.3, and ISO 8802.3.
- Support for either twisted pair cable (10BaseT) and thin coax (10Base2).
- MAC standard error and status reporting and management counters.
- Shielded RJ45 jack (10BaseT) and BNC connector (10Base2).

Cable feature code 3713 is available for this adapter.

V.24/EIA-232 Adapter (LIC282 in the MAE) - Feature Code 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 feature code 3701 is available for this adapter.

V.35/V.36 Adapter (LIC290 in the MAE) - Feature Code 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 feature codes 3702 or 3703 is available for this adapter.

X.21 Adapter (LIC291 in the MAE) - Feature Code 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 feature code 3704 is available for this adapter.

Cables for MAE Adapters

Feature Code 3701 - EIA 232/V.24 fanout cable

The fanout cable provides 8 connections (25pin D-shell male) each of which is 1.8 meter (5.2 feet) in length. Each connection is suitable for connection to a EIA-232/V.24 modem.

Cables 3705 and 3706 are available to complement this cable.

Feature Code 3702 - V.35 fanout cable

The fanout cable provides a 1.2 meter (4 foot) cable to a distribution box containing 6 25 pin D-shell male connectors.

Cables 3707 and 3708 are available to complement this cable and provide a standard V.35 physical interface.

Feature Code 3703 - V.36 fanout cable

The fanout cable provides 6 connections (37 pin D-shell male) each of which is 3 meter (9.8 feet) in length. Each connection is suitable for connection to a V.36 modem.

Cables 3709 and 3710 are available to complement this cable.

Feature Code 3704 - X.21 fanout cable

The fanout cable provides 8 connections (15 pin D-shell male) each of which is 1.8 meter (5.9 feet) in length. Each connection is suitable for connection to an X.21 modem.

Cables 3711 and 3712 are available to complement this cable.

Feature Code 3705 - EIA-232/V.24 serial interface cable

This cable provides a 3 meter (10 foot) extension cable with a 25 pin D-shell male connector for attachment to a modem.

Feature Code 3706 - EIA-232/V.24 direct attach cable

This cable provides a 3 meter (10 foot) cable with a 25 pin D-shell female connector for direct device attachment.

Feature Code 3707 - V.35 serial interface cable

This cable provides a 3 meter (10 foot) extension cable with a 34 pin male block connector for attachment to a modem.

Feature Code 3708 - V.35 direct attach cable

This cable provides a 2 meter (6.6 foot) cable with a 34 pin female block connector for direct device attachment.

Feature Code 3709 - V.36 serial interface cable

This cable provides a 3 meter (10 foot) extension cable with a 37 pin male D-shell connector for attachment to a modem.

Feature Code 3710 - V.36 direct attach cable

This cable provides a 3 meter (10 foot) cable with a 37 pin female D-shell connector for direct device attachment.

Feature Code 3711 - X.21 serial interface cable

This cable provides a 3 meter (10 foot) extension cable with a 15 pin D-shell male connector for attachment to a modem.

Feature Code 3712 - X.21 direct attach cable

This cable provides a 3 meter (10 foot) cable with a 15 pin D-shell female connector for direct device attachment.

Feature Code 3713 - Multi-purpose RJ-45 cable

This cable provides a 7.6 meter (25 foot) Category 5 cable with an RJ-45 connector for attachment to Token ring hubs or switches, Ethernet 10BaseT hubs or switches, or Ethernet 100BaseT hubs or switches.

Feature Code 3714 - RJ-48 T1 ISDN PRI / Channelized T1 cable

This cable provides a 15 meter cable with a RJ-48 connector for attachment to T1 ISDN PRI switches or to T1 interfaces.

Feature Code 3715 - ISDN PRI (E1) / Channelized E1 cable

This cable provides a 30 meter cable with "flying leads" suitable for wiring to E1 ISDN PRI switches or E1 interfaces.

Feature Code 3716 - RJ-48 J1 ISDN PRI / Channelized J1 cable
This cable provides a 15 meter cable with a RJ-48 connector for attachment to J1 ISDN PRI switches or J1 interfaces.

Feature Code 3799 - V.35 serial interface cable - France
This cable provides a 0.3 meter cable that adapts the standard V.35 34 pin male block connector to the connector required for attachment to V.35 modems in France.

Feature Code 5710 - MMF ATM External Cable 10m
Provides plenum rated cable for Multimode Fiber ATM Adapter (feature code 3294).

Feature Code 5715 - MMF ATM External Cable 40m
Provides plenum rated cable for Multimode Fiber ATM Adapter (feature code 3294).

Feature Code 5720 - SMF ATM External Cable 10m
Provides plenum rated cable for Single Mode Fiber ATM Adapter (feature code 3295).

Feature Code 5725 - SMF ATM External Cable 40m
Provides plenum rated cable for Single Mode Fiber ATM Adapter (feature code 3295).

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 multi-mode fiber optic jumper cable is provided with each ESCON Channel Coupler (feature code 5502) and MAE ESCON adapter (feature code 3287).

The following fixed lengths are available:

4 meters (12 feet)
7 meters (20 feet)
13 meters (40 feet)
22 meters (70 feet)
31 meters (100 feet)[4]
46 meters (150 feet)
61 meters (200 feet)
77 meters (250 feet)
92 meters (300 feet)
107 meters (350 feet)
122 meters (400 feet)

For ordering custom-length cables, fiber-optic adapters and couplers used in distribution panels, or one of the above fixed length cables, and for additional general information about ESCON planning, refer to the *Planning Guide*, GA33-0457, which includes an appendix on physical planning for the 3746.

[4] In Europe, the Middle-East, and Africa, this cable is automatically provided with the ordered ESCON coupler or adapter.

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:

- Models 130, 150, 160, or 170 to a Model 17A.
- Models 210, 310, 410, or 610 to a Model 21A, 31A, 41A, 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 Model A and 3746-900 preserves your existing investment in communication controllers.

The summary below shows the migration paths that are available to upgrade your controllers:

- 3745 (see Figure B-5).
- 3746-900 to a 3746 IP router and APPN/HPR NN.
- 3746-900 to a 3746-950 (see Figure B-5).

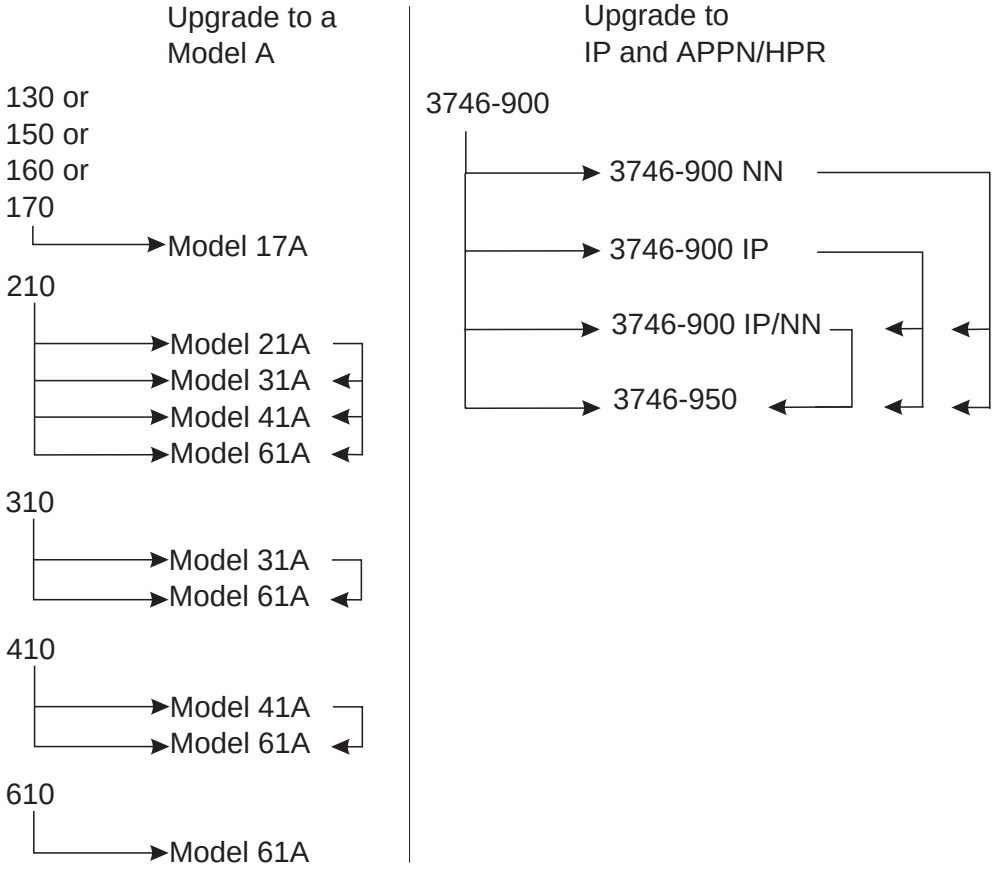

Figure B-5. Upgrading a 3745 or 3746

See the following notes for a brief description on the changes that are required for upgrading your equipment:

Notes:

- 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 “CBSP3 Upgrade - Feature Code 5123” on page B-11), if a CBSP2 or CBSP3 is not already installed. The following must also be installed for the upgrade to work:
  - Service processor feature code 5052. Under certain conditions, service processor feature code 5021[1] (or service processor feature code 5020[1], after an upgrade with feature code 5026) can be used.
  - Network Node Processor (NNP) feature code 5122.
- 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 NCP-Controlled 3745

When you upgrade a 3745 by connecting a 3746-900 or installing 16 MB of storage, 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 CCU of a model 31A and 61A, or to the second CCU of a model 41A and 61A (see Figure B-6).

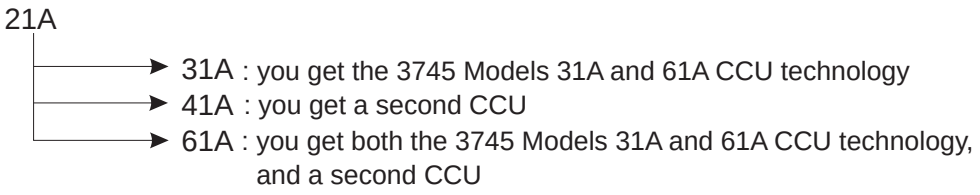

Figure B-6. Example of a 3745 Upgrade

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 more enclosures and installing new adapters into any available slot.

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 TICs.

- For communication line, 32 LICs with the capacity of one of the following:
  - 32 high-speed lines of up to 2 Mbps
  - 240 medium-speed line interfaces of up to 256 kbps
  - 480 (V.35/X.21) medium- and low-speed line interfaces of up to 64 kbps
  - 600 (V.24) medium- and low-speed line interfaces of up to 64 kbps.

See Table B-4 and Table B-5 on page B-24 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-4 or Table B-5 on page B-24.

Table B-4. Configuration for the 3746-900 with One Type of Adapter

3745-17A, 3745-21A and 3745-31A				
Adapter Type ↓	**ESCON Channel Ports**	**Token-Ring LAN Ports (TIC3)**[1]	**Low-/Medium-Speed Lines (LIC11)**	**High-Speed 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-/Medium-Speed Lines (LIC11)**	**High-Speed Lines (LIC12)**
ESCA	15	2	-	-
TRA (TIC3)	-	32	-	-
CLA (CLP+LIC11)	-	2	540[2]	-
CLA (CLP+LIC12)	-	2	-	30[2]

Note:

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 NN, and IP router.

Table B-5. Maximum Configurations of the 3746-950 with a Single Type of Adapter

Adapter Type ↓	ESCON Channel Ports	Token-Ring LAN Ports (TIC3)[1]	Low-/Medium-Speed Lines (LIC11)	High-Speed Lines (LIC12)
ESCA	16	-	-	-
TRA (TIC3)	-	32	-	-
CLA (CLP+LIC11)	-	-	240[2]	-
CLA (CLP+LIC12)	-	-	-	32[2]

Note:

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 NN and IP router is 240.

Maximum Configurations for a 3745 with a 3746 Model 900

Table B-6 does not include 3746 Models A11, A12, L13, L14, nor L15[1].

Table B-6. Maximum Configurations for a 3745 with an Attached 3746 Model 900

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 3746-900	4 -	8 -	8 -	8 -	8 -
ESCON channel adapters	3745 3746-900	- 16	- 16	- 16	- 15	- 15
Token-ring LAN ports (4/16 mbps)	3745 3746-900	2 33	8 33	8 33	8 32	8 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 3746-900[2]	24 600[3]	32 600[3]	32 600[3]	32 600[3]	32 600[3]
Lines up to 256 kbps	3745 3746-900[2]	6 256	8 256	8 256	8 240	8 240
Lines up to 2 Mbps	3745 3746-900	2 32	8 32	8 32	8 30	8 30
Ethernet type V.2 ports	3745 3746-900	4 4	16 8	16 8	16 8	16 8

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 network node and IP router. The remaining lines are controlled by NCP.

3. For X.21/V.35 lines, the maximum number is 480.

Appendix C. 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 C-1.

Note: The 3746 operates as an IP router and APPN/HPR NN 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 Model A (NCP, NPSI, or other). The minimum level is NCP V6R3 for the 3745 Model 17A, and NCP V6R2 for other 3745 Models A.

Table C-1. 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[7]				21A 31A 41A 61A	17A
							SDLC	FR	X.25, BAN[3]	Euro-ISDN		
MVS, VM	V6R2	R8	V3R8	R11	Yes	Yes	No	No	No	No	Yes	No
MVS	V6R3	R8	V3R9	R11	Yes	Yes	Yes	No	No	No	Yes	Yes
MVS, VM, VSE	V7R1	R9	V4R1	R12	Yes	Yes	Yes	No	No	No	Yes	Yes
MVS	V7R2	R9	V4R2	R12	Yes	Yes	Yes	Yes	No	No	Yes	Yes
MVS	V7R3	R9	V4R3	R12	Yes	Yes	Yes	Yes	Yes[4]	No	Yes	Yes
MVS, VM, VSE	V7R4	R9	V4R4	R12	Yes	Yes	Yes	Yes	Yes[5]	No	Yes	Yes
MVS, VM, VSE	V7R5	R9	V4R5	R12	Yes	Yes	Yes	Yes[6]	Yes[6]	Yes	Yes	Yes
MVS, VM, VSE	V7R6	R9	V4R6	R12	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

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. Frame relay boundary access node (BAN) function.
4. X.25 requires NPSI V3R8.
5. NPSI is not required for SNA communications over X.25. NPSI is required only for non-SNA traffic.
6. Frame relay BAN for NCP INN traffic, and Frame relay line/DLCI sharing between NCP traffic and 3746 NNP (IP router and APPN/HPR NN).
7. PPP lines are supported by the IP routing feature of the 3746-900, but not by NCP.

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

Host-Resident Communications Support

TCP/IP for MVS

To support native IP routing over ESCON channels, TCP/IP V3R2 with PTFs (documented in APAR II09903) is required. This APAR also includes PTFs on MVS.

TCP/IP for VM

This program does not provide support for channel connections to the 3745 or 3746.

ACF/VTAM*

- To support ESCON channels, NCP requires the following ACF/VTAM versions:
  - For MVS/ESA*, Version 3 Release 4.1 or higher.
  - For VM/ESA*, Version 3 Release 4 or higher.
  - For VSE/ESA*, Version 3 Release 3 or higher.
- To support APPN over ESCON channels, the 3746-900 and 3746-950 requires ACF/VTAM Version 4 Release 1 or higher.
- To support dependent LUs, the DLUR of the 3746-900 and 3746-950 requires the DLUS function of ACF/VTAM. Version 4 Release 4 (or above) with necessary PTFs is recommended.
- To support APPN/HPR over ESCON channels, the 3746-900 and 3746-950 require ACF/VTAM Version 4 Release 4 with the necessary PTFs.

Transaction Processing Facility (TPF)

To support ESCON channel operation, TPF Version 3 or Version 4 is required.

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.
- Support for full alerts 3746 NNs 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 for AIX

Network management for the 3746 IP router requires:

- Router and Bridge Manager (RABM), available with Nways Enterprise Manager program number 5777-AAK, Nways Campus Manager LAN for AIX (V2R1), and Nways Campus Manager Suite for AIX (V2R1). Order Part Numbers 84H0030, 84H0031, 84H0032, or 84H0033 (media dependant).
- Programs, such as NetView for AIX, at the level required by the above network management programs.

NetView Performance Monitor (NPM)

The following table shows NPM support and APAR numbers depending on the Version and Release level.

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 C-2. NPM Support and Required APAR Numbers

Support	**V1R6**	**V2R1**	**V2R2**	**V2R3**
3745/3746-900 (NCP)	No APAR	No APAR	No APAR	No APAR
3746-900; Frame relay (NCP V7R2)	N/A	OW07715	OW07715	No APAR
Frame relay line utility on NPM panels	N/A	N/A	OW10029	No APAR
3746-900; X.25 (NPSI V3R8, NCP V7R3)	N/A	OW10583	OW10583	No APAR
3746-900; X.25 (NCP V7R4)	N/A	OW19297	OW19297	No APAR
3746-900 adapter utilization; processor, storage, TIC3 (NCP V7R3)	N/A	OW08565 OW10584	OW08565 OW10584	No APAR
3746-900 CNN; LAN counters for non-ERP traffic (ANR) over TIC3 (NCP V7R4)	OW17878	OW17876	OW17876	No APAR
3746-900 and 950; APPN/DLUR and HPR (3746 NN):	N/A	OW08565 OW10584 OW17876 OW19447	OW08565 OW10584 OW17876 OW19447	OW19447
- Counter thresholds monitoring and alert generation	N/A	N/A	OW26306	OW26306
- Counters display in 3270 online panels	N/A	N/A	OW26463	OW26463

NTune*

NTune MON monitors the network, and along with NTune NCP running in the 3745, provides on-line interactive tuning of NCP keyword parameters. Optimization of network performance is greatly simplified by NTune products.

For the 3746 NNs, 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.

Tivoli Management Environment (TME)

Minimum Programming Requirements

TME 10 Remote Control 1.0 (5697-RCL, media feature 5815) replaces DCAF, and provides the required code (DCAF 1.3 Base and CSD) to level 1.3.3.

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.
- TME 10 Remote Control.
- 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.

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.

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 D. Connectivity of the 3746 APPN/HPR Network Node (NN)

The number of PUs, Frame relay DLCIs, and sessions available through the ESCP, TRP, ESCP2, TRP2, CLP and enhanced processors ESCP3, TRP3, and CLP3 are given in Table D-1 on page D-2 of this Appendix.

Note: Processors ESCP, TRP, ESCP2, TRP2, CLP are no longer manufactured.

Adapter Connectivity

Table D-1 on page D-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.

Note: The above assumes that these adapters are not loaded with IP routing software, as this would lower the maximum number of PUs and sessions controlled by the 3746 NN.

The available storage in the processors determines the actual maximum number of 3746-controlled lines (SDLC), PUs, and sessions.

Table D-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[10]	16[9]	16	16[9]	4900	16[9]	4900
ESCP3[10]	16[9]	16	16[9]	14000	16[9]	14000
TRP	0	2000	2000	0	-	-
TRP2[10]	1400	2000	2000	4700	1400	4700
TRP3[10]	2000	2000	2000	14000	2000	14000
For CCU B[3]**:**						
TRP	0	500	500	0	-	-
TRP2[10]	1000	2000	2000	4000	-	-
TRP3[10]	2000	2000	2000	13000	-	-
CBSP	-	500	500	-	-	-
CBSP2/CBSP3[4]**:**	-	500	500	-	-	-
CBSP2/CBSP3[5]**:**	0	0	0	0	0	0
CLP with:						
3000 DLCIs[4]	-	4000[6]	4000[6]	-	-	-
500 DLCIs[13]	1000[8]	2000[7]	2000[7]	3300	1000[8]	3300
CLP3 with:						
3000 DLCIs[4]	-	4000[6]	4000[6]	-	-	-
2000 DLCIs[13]	3000[12]	3000[11]	3000[11]	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 D-1:

1. These are adjacent PUs (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 all the LU data sessions (independent and dependent LUs) routed by the 3746 adapter, including LU-LU sessions involving non-adjacent nodes. HPR/ANR sessions between HPR/RTP nodes, that do not begin or end in the 3746, are not part of these numbers and can be any number. 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 figures apply only to processors that have a few PUs or only one ESCON station.
3. This is the TRP, TRP2, or TRP3 used to connect the 3745 CCU-B to the 3746-900.
4. For a 3746-900, if neither 3746 APPN/HPR nor 3746 IP routing is used in any CLP/CLP3.
5. For any 3746-950, and any 3746-900 using the 3746 APPN/HPR network node (NN) or IP routing support.
6. Up to 1000 SDLC PUs and any mix of up to 3000 Frame relay PUs, ISDN PUs, and X.25 virtual circuits (one PVC or SVC per PU).
7. Up to 1000 SDLC PUs and any mix of up to 1000 Frame-relay PUs, ISDN PUs, and X.25 virtual circuits (one PU per PVC or SVC).
8. Up to about 1000 PUs over SDLC, Frame relay, and X.25 lines.
9. This includes any logical stations (TCP/IP) used by the 3746 IP router.
10. 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, on 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.
11. Up to 1000 SDLC PUs and any mix of up to 2000 Frame relay PUs, ISDN 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. Applicable when the APPN/HPR option is loaded in the CLPs and CLP3s of the 3746.

Network Node (NN) Connectivity

Table D-2 gives the total number of PUs, APPN and Dependent LU sessions, and the lines that a 3746 NN can run with any adapter configuration.

Table D-2. Network Node-Level Connectivity

Connectivity		Comments
Type	**Number**	
PU	5000	End Nodes, LEN Nodes, NNs, Dependent PUs.
Sessions	30000	All the LU-LU sessions using 3746 DLUR and APPN routing, including 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.
SDLC Line	240	Frame relay, SDLC, X.25 (and PPP).
Note: For the 3746-900, the resources beyond these quantities are controlled by NCP(s) either as part of a PU type 4 (SNA) node or part of an APPN CNN.		

Appendix E. The 3745 Model A and the 3746 Compared to Previous 3745 Models

Note: Previous 3745 Models include the 130, 140, 150, 160, 170, 210, 310, 410, and 610. These models are no longer manufactured.

Business Solutions

The 3745 Model 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 Model 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) 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 2210/6611 multiprotocol routers, 2216 multiaccess connectors, and 2218 FRADs, to access the SNA backbone via either:

- 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 remote support facility (RSF)
  - Loads microcode fixes.
- A service processor can be remotely accessed by an OS/2 workstation running TME 10 Remote Control[1] via SNA, APPN, or IP networks 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.

[1] TME 10 Remote Control replaces DCAF.

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 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 holds the Frame relay throughput at T1 (1544 Mbps) or E1 (2048 Mbps) speeds or subspeeds.

The 3746 Frame relay switching and allows protocols other than IP, SNA, and APPN/HPR to be carried by a 3745/3746 based Frame relay network. A communication rate or CIR can be assigned to an individual virtual circuit between two end stations, providing a high-quality transport network for the protocols carried over this virtual circuit.

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 remote support facility (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 ESCON channel, token-ring, and communication line processors and couplers (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[2] features of the 3746-900 and the 3746-950 include the following:

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[2] 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.

- 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.
  - 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 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[3]. 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.

[3] The actual maximum throughput depends on the 3745 model and the type of traffic.

Appendix F. Bibliography

Customer Documentation for the 3746 Model 950

Table F-1 (Page 1 of 2). Customer Documentation for the 3746 Model 950

This customer documentation has the following formats:

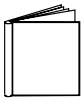
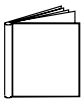
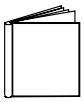
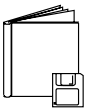
Finding Information		
		3745 Models A and 3746 Books Starting with engineering change (EC) F12380, all of the books in the 3745 Models A and 3746 library are available on the CD-ROM that contains the Licensed Internal Code (LIC) for this EC.
Preparing for Operation		
	GA33-0400	***IBM 3745 Communication Controller All Models***[1] ***IBM 3746 Expansion Unit Model 900*** ***IBM 3746 Nways Multiprotocol Controller Model 950*** ***Safety Information***[2] Provides general safety guidelines
Evaluating and Configuring		
	GA33-0180	***IBM 3745 Communication Controller Models A***[3] ***IBM 3746 Nways Multiprotocol Controller*** ***Models 900 and 950*** ***Overview*** Gives an overview of connectivity capabilities within SNA, APPN, and IP networking.
	GA33-0457	***IBM 3745 Communication Controller Models A***[2] ***IBM 3746 Expansion Unit Model 900*** ***Models 900 and 950*** ***Planning Guide*** Planning for: • Field upgrades • Service processor and alert management configuration • Network integration (NCP, APPN, and IP control) • Physical installation.

Table F-1 (Page 2 of 2). Customer Documentation for the 3746 Model 950

Operating and Testing



SA33-0356

IBM 3746 Nways Multiprotocol Controller Model 950

***User's Guide*[2]**

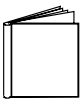
Explains how to:

- 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.

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.
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.

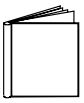
Managing Problems

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.

[1] Models 130 to 61A.
[2] Documentation shipped with the 3746-950
[3] 3745 Models 17A to 61A.

Customer Documentation for the 3745 (Models 210, 310, 410, 610, 21A, 31A, 41A, and 61A), and 3746 (Model 900)

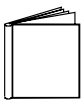
Table F-2 (Page 1 of 4). Customer Documentation for the 3745 Models X10 and X1A, and 3746 Model 900

This customer documentation has the following formats:

Finding Information

3745 Models A and 3746 Books

Starting with engineering change (EC) F12380, 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 this EC.



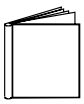
SA33-0172

IBM 3745 Communication Controller
Models 210 to 61A
IBM 3746 Expansion Unit Model 900

Customer Master Index[1]

Provides references for finding information in the customer documentation library.

Evaluating and Configuring



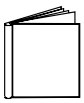
GA33-0092

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.

Table F-2 (Page 2 of 4). Customer Documentation for the 3745 Models X10 and X1A, and 3746 Model 900

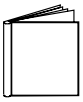
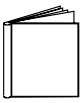
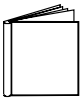
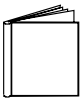
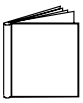
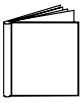
	GA33-0457	***IBM 3745 Communication Controller Models A***[2] ***IBM 3746 Expansion Unit Model 900*** ***Models 900 and 950*** ***Planning Guide*** Planning for: • Field upgrades • Service processor and alert management configuration • Network integration (NCP, APPN, and IP control) • Physical installation.
Preparing Your Site		
	GC22-7064	***IBM System/360, System/370, 4300 Processor*** ***Input/Output Equipment Installation Manual-Physical Planning*** (Including Technical News Letter GN22-5490) Provides information for physical installation for the 3745 Models 130 to 610. For 3745 Models A and 3746 Model 900, refer to the *Planning Guide*, GA33-0457.
	GA33-0127	***IBM 3745 Communication Controller*** ***Models 210, 310, 410, and 610*** ***Preparing for Connection*** Helps for preparing the 3745 Models 210 to 610 cable installation. For 3745 Models A refer to the *Connection and Integration Guide*, SA33-0129.
Preparing for Operation		
	GA33-0400	***IBM 3745 Communication Controller All Models***[3] ***IBM 3746 Nways Multiprotocol Controller*** ***Models 900 and 950*** ***Safety Information***[1] Provides general safety guidelines.
	SA33-0129	***IBM 3745 Communication Controller All Models***[3] ***IBM 3746 Nways Multiprotocol Controller Model 900*** ***Connection and Integration Guide***[1] 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*** ***Portable Keypad Display*** ***Migration and Integration Guide*** Contains information for moving and testing LIC types 5 and 6.

Table F-2 (Page 3 of 4). Customer Documentation for the 3745 Models X10 and X1A, and 3746 Model 900

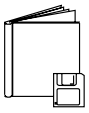
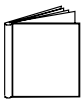
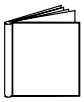
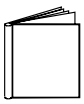
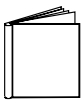
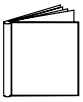
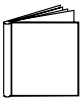
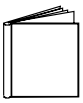
	SA33-0158	***IBM 3745 Communication Controller All Models***[3] ***IBM 3746 Nways Multiprotocol Controller Model 900*** ***Console Setup Guide***[1] Provides information for: • Installing local, alternate, or remote consoles for 3745 Models 130 to 610 • Configuring user workstations to remotely control the service processor for 3745 Models A and 3746 Model 900 using: – DCAF program – Telnet Client program.
Customizing Your Control Program		
	SA33-0178	***Guide to Timed IPL and Rename Load Module*** Provides VTAM procedures for: • Scheduling an automatic reload of the 3745 • Getting 3745 load module changes transparent to the operations staff.
Operating and Testing		
	SA33-0098	***IBM 3745 Communication Controller All Models***[4] ***Basic Operations Guide***[1] Provides instructions for daily routine operations on the 3745 Models 130 to 610.
	SA33-0177	***IBM 3745 Communication Controller Models A***[2] ***IBM 3746 Nways Multiprotocol Controller Model 900*** ***Basic Operations Guide***[1] 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 All Models***[3] ***Advanced Operations Guide***[1] Provides instructions for advanced operations and testing, using the 3745 MOSS console.
	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. 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 online help.

Table F-2 (Page 4 of 4). Customer Documentation for the 3745 Models X10 and X1A, and 3746 Model 900

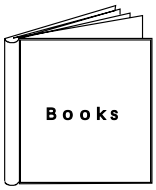
	SH11-3081	***IBM 3746 Nways Multiprotocol Controller Models 900 and 950*** ***Controller Configuration and Management: User's Guide***[5] Explains how to use CCM and gives examples of the configuration process.
Managing Problems		
	SA33-0096	***IBM 3745 Communication Controller All Models***[3] ***Problem Determination Guide***[1] A guide to perform problem determination on the 3745 Models 130 to 61A.
	On-line Information	***Problem Analysis Guide*** An online guide to analyze alarms, events, and control panel codes on: • IBM 3745 Communication Controller Models A[2] • IBM 3746 Nways Multiprotocol Controller Models 900 and 950.
	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.

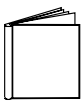
Additional Customer Documentation for the 3745 Models 130, 150, 160, 170, and 17A

Table F-3. Additional Customer Documentation for the 3745 Models 130 to 17A

This customer documentation has the following format:



Finding Information



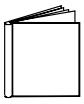
SA33-0142

IBM 3745 Communication Controller
Models 130, 150, 160, 170, and 17A
IBM 3746 Nways Multiprotocol Controller Model 900

Customer Master Index[1]

Provides references for finding information in the customer documentation library.

Evaluating and Configuring



GA33-0138

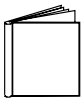
IBM 3745 Communication Controller
Models 130, 150, and 170

Introduction

Gives an introduction about the IBM Models 130 to 170 capabilities, including Model 160.

For Model 17A refer to the *Overview*, GA33-0180.

Preparing Your Site



GA33-0140

IBM 3745 Communication Controller
Models 130, 150, 160, and 170

Preparing for Connection

Helps for preparing the 3745 Models 130 to 170 cable installation.

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 Communication Function

AIW APPN Implementation Workshop

AIX Advanced Interactive Executive

ANR Automatic Network Routing

APAR Authorized Program Analysis Report

APPC Advanced Program-to-Program Communication

APPN Advanced Peer-to-Peer Networking

ARB Adaptive Rate-Base congestion control

ARC Active Remote Connector

ATM Asynchronous Transfer Mode

BACP Bandwidth Allocation Control Protocol

BAN Boundary Access Node

BAP Bandwidth Allocation Protocol

BGP Border Gateway Protocol

BNN Boundary Network Node

bps bits per second

Bps bytes per second

BRI Basic Rate Interface

BRS Bandwidth Reservation System

CBC Control Bus Coupler

Cipher Block Chaining

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

CDF-E Configuration Data File - Extended

CDLC Channel Data Link Control

CIR Committed Information Rate

CLA Communication Line Adapter

CLP Communication Line Processor

CMC Communication Management Configuration

CNN Composite Network Node

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

DTE Data Terminal Equipment

EBN Extended Border Node

ECP Encryption Control Protocol

EGA ESCON Generation Assistant

EGP Exterior Gateway Protocol

EIA External Interface Adapter

EMIF ESCON Multiple Image Facility

EN End Node

EP Emulation Program

ERP Error Recovery Procedure

ES Enterprise System

ESA Enterprise Systems Architecture

ESCA ESCON channel adapter, also called ESCON adapter

ESCC ESCON channel coupler type 1, also called ESCON coupler type 1

ESCD ESCON Director

ESCON Enterprise Systems Connection

ESCP ESCON channel processor, also called ESCON processor

FDDI Fiber Distributed Data Interface

FDX Full Duplex

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

HPR High Performance Routing

HSSI High Speed Serial Interface

HTTP Hypertext Transfer Protocol

Hz Hertz

ICMP Internet Control Message Protocol

ICN Interchange Node

IEEE Institute of Electrical and Electronics Engineers

INN Intermediate Network Node

I/O Input/Output

IOC Input/Output Control

IP Internet Protocol

ISDN Integrated Service Digital Network

ITU-T International Telecommunication Union - Telecommunication (formerly: CCITT)

kbps kilobits per second

km kilometer; 0.62 mile

LAN Local Area Network

LAPB Link Access Procedure - Balanced

LAPS LAN Adapter 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 Line Interface Coupler

LPAR Logical Partition

LPDA2 Link Problem Determination Aid-2

LSA Link Services Architecture

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

MCL Microcode Change Level

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

MVS Multiple Virtual Storage

NCP Network Control Program

NGMF NetView Graphic Monitor Facility

NFS Network File System

NHRP Next Hop Resolution Protocol

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 Transport Services

NTT Nippon Telegraph and Telephone

OSI Open System Interconnection

OSPF Open Shortest Path First

PCI Programming Communication Interface

PCMCIA Personal Computer Memory Card International Association

PEP Partitioned Emulation Programming

PLP Packet Layer Protocol

PPP Point-to-Point 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

RABM Router and Bridge Manager

RETAIN Remote Technical Assistance Information Network

RFC Remote Function Call

RIP Routing Information Protocol

RSF Remote Support Facility

RTP Rapid Transport Protocol

SAP Service Access Point

SAR SAS

Single Attach Station Segmentation and Reassembly

SCSP Server Cache Synchronization Protocol

SDLC Synchronous Data Link Control

SMF Single Mode Fiber

SNA Systems Network Architecture

SNATAM SNA Terminal Access Method

SNI SNA Network Interconnection

SNMP Simple Network Management Protocol

SPAU Service Processor Access Unit

SSCP System Services Control Point (VTAM)

SSE Session Services Extensions

SSP System Support Program

SVC Switched Virtual Circuit

TCP Transmission Control Protocol

TFTP Trivial File Transfer Protocol

TOA Type of Address

TAM Topology and Accounting Management

TIC Token-Ring Interface Coupler

TG Transmission Group

TME Tivoli Management Environment

TPF Transaction Processing Facility

TRA Token-Ring Adapter

TRP Token-Ring Processor

UDP User Datagram Protocol

URL Uniform Resource Locator

VC Virtual Circuit

VM Virtual Machine

VSE Virtual Storage Extended

VTAM Virtual Telecommunications Access Method

WAN Wide Area Network

Glossary

This glossary defines new terms used in this manual. It also includes terms and definitions from the *IBM Dictionary of Computing,* SC20-1699.

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 PS/2 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.

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.

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.

medium 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 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 PS/2 attached to the 3745 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. It continuously transfers code to and from the processors inside the controller.

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). An IBM licensed program for a user at one workstation to remotely monitor, control, and operate another workstation. *TME is the new name for DCAF.*

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). Line adapter for IBM Token-Ring Network, composed of one token-ring processor card (TRP), and 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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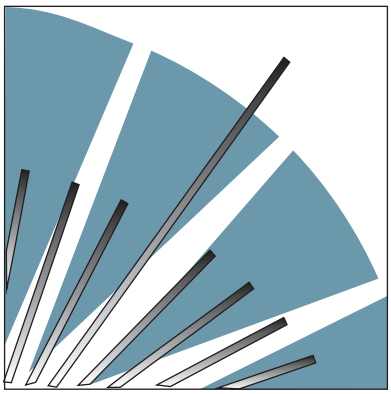

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