Volume

1

The Speedlink™ System

General Information

DIAMOND LANE COMMUNICATIONS CORPORATION PROPRIETARY DATA

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Document Number: 17-0001
Rev.3.0
Date: 8/28/98

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Speedlink Documentation

Introduction

Speedlink documentation provides complete detailed instructions on how to install, test, and turn-up a Speedlink System. This documentation complies with all requirements in Bellcore Technical Reference TR-TSY-000454 *Supplier Documentation for Network Elements* and IP 0260 *Standards for Task Oriented Practices (TOPS)* requirements.

Target Audience

Speedlink documentation volumes are written at different levels of detail based on the reader's needs. Below is a list of the various volumes and the intended target audience for each.

VOLUME	TITLE	TARGET AUDIENCE
Volume 1	General	Anyone with a need to understand more about the Speedlink System and planning requirements.
Volume 2	Installation	Installation and Testing Technicians, and Engineers (Detailed Level Procedures)
Volume 3	Acceptance Testing	Testing Technicians and Engineers (Detailed Level Procedures)
Volume 4	Provisioning	Provisioning Technicians and Engineers (Detailed Level Procedures)
Volume 5	Maintenance and Testing	Maintenance and Testing Technicians and Engineers (Detailed Level Procedures)
Volume 6	DiamondView	Network Management Technicians (Tutorial and Reference Manual for DiamondView)
Volume 7	DiamondCraft	Testing and Installation Technicians and Engineers (Tutorial and Reference Manual for DiamondCraft)

Information Mapping Style

All documents are written in Information Mapping style, which presents information in small units or blocks. Each information block is identified by a "subject label" in the left margin and is separated from the next information block by a horizontal line. "Subject labels" make the document easy for the reader to scan and to find information.

Each Detailed Level Procedure states the required equipment and tools to perform the job, provides step by step instructions, with integrated graphics, to help the reader perform each task.

Chapter 1

SECTION 1 PRODUCT DESCRIPTION

Chapter 1 The Speedlink System Overview

The Speedlink Solution

The Speedlink System[1] is a third generation Digital Subscriber Line Access Multiplexer (DSLAM). The system uses Digital Subscriber Line (DSL) and Asynchronous Transfer Mode (ATM) technologies to deliver exceptionally high-speed data transmission over the existing copper network.

The Speedlink System also solves the local switch congestion problem by separating voice-frequency signals from the high speed data in the central office—and routing data traffic off the voice telephone switch.

The Speedlink System

The Speedlink System consists of several sub-systems:

- Speedlink Multiplexer
- Customer Premises Equipment (CPE)
- ADSL Splitter/Filters
  - – Central Office Plug-in splitter/filter card (required for POTS)
  - – Splitterless, in-line microfilter option at customer premises
  - – Optional End User Premises Network Interface Device (NID) Module
- DiamondView®[2] Element Management System
- DiamondCraft®[3] Craft Interface System®

[1] Speedlink is a trademark of Diamond Lane Communications Corporation.
[2] DiamondView is a registered trademark of Diamond Lane Communications Corporation.
[3] DiamondCraft is a registered trademark of Diamond Lane Communications Corporation.

The Speedlink Multiplexer

The Speedlink Multiplexer controls and routes xDSL traffic between the subscriber's Speedlink end user equipment (router, modem, or Network Interface Card) and the network service provider's ATM network. The Speedlink can be installed in the service provider's central office or co-location space—or it can be installed as a remote DSLAM in a Controlled Environmental Vault (CEV), hut, building equipment closet or campus environment.

Speedlink Multiplexer Components

The Speedlink Multiplexer consists of a Master Control Shelf and up to 12 modular Line Card Shelves. The Master Control Shelf contains the central control and communication functions of the system and provides the interface to the ATM Wide Area Network. The Line Card Shelves house the first stage multiplexer and provide mounting slots for line cards that deliver services to end users. All Speedlink components are shown in the block diagram below:

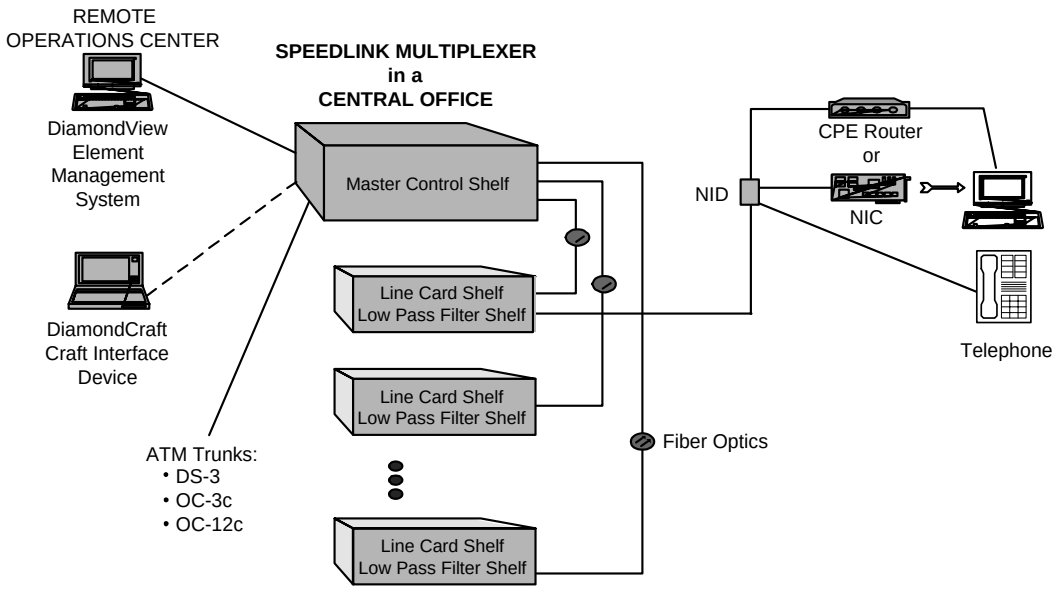

Figure 1: Speedlink System Components

Master Control Shelf (MCS)

The Master Control Shelf (MCS) contains the following components:

- 1 Common Systems Interface Panel (CSIP)
- 2 Master Control Processor (MCP) cards in a 1:1 protection group
- 1 Network Management Processor (NMP) card
- 2 Trunk cards – DS3T (45 Mbps), OC3T (155 Mbps) or OC12T[4] (622 Mbps) in a 1:1 protection group
- up to 12 broadband interface slots for 12 Master Line Card Adapter (MLA) cards

Figure 2: Speedlink Master Control Shelf (MCS)

The Common Systems Interface Panel (CSIP), which occupies the upper part of the MCS in the figure above, terminates central office DC power, local alarm contacts, and network management and operations support connections. The CSIP has circuit breakers for the entire MCS, and LEDs to display the current alarm status of the MCS. The CSIP also distributes power to each Line Card Shelf in the Speedlink Multiplexer.

The Master Control Processor (MCP) card controls the Multiplexer. The MCP's non-volatile memory retains vital provisioning database information and program information in the event the MCS loses power. This allows the Multiplexer to automatically return to its pre-power failure state when power returns. The Master Control Shelf has two MCPs for reliability purposes. In the event of an active MCP failure, the system will switch to the standby MCP within 50 milliseconds.

The Network Management Processor (NMP) card controls the Multiplexer's network management interfaces. The NMP provides all of the needed protocol

[4] Planned for future release.

support so the Speedlink Multiplexer can communicate with the DiamondView Element Management System and the DiamondCraft local craft terminal program. There is space for an *optional* NMP[5] for communications capacity expansion.

The **Trunk card** (duplicated for reliability) interfaces between the ATM backbone facility and the Multiplexer. There are three different trunk cards, depending on the size of the Multiplexer and traffic expectations:

- DS3T – A standard DS3 format signal with ATM payload.
- OC3T – A standard SONET OC-3c signal with ATM payload.
- OC12T[6]– A standard SONET OC-12c signal with ATM payload.

Each trunk card multiplexes and demultiplexes up to 12 broadband ATM cell streams from the Line Card Shelves into a standard payload. The “hot-swappable” trunk cards are 1 + 1 protected and can be inserted and removed without disrupting system operation, simplifying network upgrades.

For the DS3T interface, there are provisions for two trunk cards (one active, the other standby). A relay in the MCS backplane switches the DS3 facility to the optional standby DS3T trunk card within 50 milliseconds in the event that the active DS3T card fails.

For the OC3T and OC12T ATM network interfaces, there are provisions for two facilities, one active and one standby. This allows the Speedlink Multiplexer to provide both *card* protection switching (an active card and an optional standby card), and SONET *facility* 1+1 protection switching (two fiber optic cables, one active and one standby).

Each **Master Line Card Adapter** (MLA) card provides broadband interfaces with one Line Card Shelf at OC-3 rates over optical fiber, or at DS3[7] rates. The **broadband interface** slots accept cards that provide four different capabilities:

- interfaces to local Line Card Shelves
- interfaces to remote Line Card Shelves
- broadband customer service interfaces up to OC-3
- broadband interfaces to compliant ATM distribution systems

A single Master Control Shelf can support all interface types simultaneously.

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[5] Planned for future release.

[6] Planned for future release.

[7] For Remote Line Card Shelf application, planned for a future release.

A Master Control Shelf can connect to Remote Line Card Shelves over intermediate reach OC-3 rate multi-mode optical fiber connections[8] distributed by the Master Line Card Adapter (MLA). An MLAT3[9] card is planned for DS3 broadband service interface to Remote Line Card Shelves. The Master Control Shelf can contain up to 12 of any combination of MLA and MLAT3 cards.

Line Card Shelf (LCS)

A Line Card Shelf (LCS) has the same layout in both central office and remote applications. The figure below illustrates the layout of the LCS and RLCS:

Figure 3: Speedlink Line Card Shelf

Up to twelve Line Card Shelves connect to each Master Control Shelf in a star configuration. They can either be co-located with the MCS or placed in a remote location. Each Line Card Shelf has 24 mounting slots for line cards, plus one for the Line Card Shelf Multiplexer (LSM2) and one spare slot. The multi-service line card mounting slots support insertion of any Speedlink card, including:

- Dual and Quad ADSL Rate Adaptive (CAP) enabling greater than 6 Mbps downstream
- Quad ADSL Rate Adaptive (DMT) compliant with ANSI T1.413
- Octal SDSL—2B1Q interface, includes ATM translation, multi-rate up to 1.152 Mbps
- Octal IDSL—2B1Q interface, dedicated 128/144 Kbps
- Quad DS1[10] Inverse Multiplex interface

[8] Planned for future release.

[9] Planned for Release 4.0.

[10] Planned for future release.

The LCS design organizes the cards into groups of six, called “six packs,” with each group having its own cabling plan. The cables feature modular connectors, allowing the LCS to be quickly reconfigured and re-cabled if required. Service capacity is 48 lines per shelf with Dual line cards, 96 lines per shelf with Quad line cards, and 192 lines per shelf with Octal line cards.

The **CAP2 Dual ADSL line card** provides two Rate Adaptive Asymmetric DSL lines using Carrierless Amplitude Phase (CAP) modulation. It uses Frequency Division Duplex (FDD) multiplexing to transmit data in the 35 KHz to 1.3 MHz frequency spectrum for two lines. Separate bands or “channels” are assigned for Upstream and Downstream data transmission. The Upstream channel rate is 35 KHz up to 191 KHz, the Downstream channel rate is 240 KHz to 1.3 MHz. The CAP2 line card supports two ports.

The **CAP4 Quad ADSL line card** provides four Rate Adaptive Asymmetric DSL lines using Carrierless Amplitude Phase (CAP) modulation. It uses Frequency Division Duplex (FDD) multiplexing to transmit data in the 35 KHz to 1.3 MHz frequency spectrum for up to four lines. Separate bands or “channels” are assigned for Upstream and Downstream data transmission. The Upstream channel rate is 35 KHz up to 191 KHz, the Downstream channel rate is 240 KHz to 1.3 MHz. The CAP4 line card supports four ports.

The **DMT4 Quad ADSL line card** provides four Rate Adaptive Asymmetric DSL lines using ANSI standard Discrete Multi-Tone (DMT) modulation technique. DMT uses Frequency Division Duplex multiplexing to transmit data in the 35 KHz to 1.1 MHz frequency spectrum. It divides the frequency range into a 256 discrete bands or bins, each with 4 KHz bandwidth. Each band is independently modulated. The DMT4 line card supports four ports.

The **SDSL8 Octal SDSL line card** uses 2B1Q (2 Binary, 1 Quaternary) line encoding technique. This is a DSL line encoding technique that uses four variations in amplitude and polarity to represent two bits. The SDSL8 line card uses the entire frequency spectrum for data transmission—unlike the ADSL line cards, which can carry both data and analog voice transmissions. The SDSL8 line card supports eight ports.

The **IDSL8 Octal IDSL line card** implements frame-based protocol Interworking Functions (IWFs) to perform the ATM Segment and Reassembly (SAR) function at the IDSL8 line card. This allows IDSL subscriber’s to use their existing ISDN CPE. ISDL channels support two different types of Interworking Functions (IWFs): Point to Point over High-level Data Link Control and Frame Relay.

Point to Point (PPP) over High-level Data Link Control (HDLC):

- PPP over HDLC, Logical Link Control (LLC) encapsulated.
- PPP over HDLC, Virtual Channel (VC) multiplexed.

Frame Relay interworking:

- Frame Relay (FRF.8) translated over HDLC. Includes PPP over Frame Relay, LLC encapsulated.
- Frame Relay (FRF.5) one-to-one multiplexed over HDLC.
- Frame Relay (FRF.5) many-to-one multiplexed over HDLC.
- Frame Relay PPP Virtual Channel (VC) multiplexed only.

A Permanent Virtual Connection (PVC) must be established to connect the trunk interface VPI/VCI with the IDSL line card port to transport data to and from the IDSL frame-based line cards. The IDSL8 line card supports eight ports.

The **Line Card Shelf Multiplexer (LSM2) card** statistically multiplexes the signals from the line cards. The LSM2 card uploads the aggregated data stream to the Master Line Card Adapter (MLA) card on the Master Control Shelf, transmitting data over a 155 Mbps OC-3c or 45 Mbps DS3 ATM link. The result is a reliable, star network architecture, with each LSM2 multiplexing and demultiplexes ATM cell streams for up to 24 line cards installed on the Line Card Shelf.

ADSL Link ID

The **ADSL Link ID** is a rack mount peripheral unit for confirming ADSL line connectivity. It is designed for Dual and Quad ADSL data service only configurations. A continuous base-band “beep” signal, transmitted by the unit through each ADSL line, notifies technicians that the line(s) are provisioned and working.

The base-band signal is a series of “beeps” corresponding to each channel number. For example, on a CAP4 card, a one “beep” signal is transmitted on channel one, a two “beep” signal is transmitted on channel two, a three “beep” signal is transmitted on channel three, and a four “beep” signal is transmitted on channel four.

25 pair cabling connects the ADSL Link ID to up to four line card “six-packs,” one six-pack per cable, on a single Line Card Shelf.

Remote Line Card Shelf (RLCS)

The **Speedlink System** can also be configured in a Remote Line Card Shelf[11] (RLCS) topology. This configuration uses a fiber optic OC-3c or copper DS3 link from the Master Control Shelf located in the central office to the Line Card Shelves in remote locations. The RLCS configuration enables the service provider to extend

DSL service to customers beyond the 18 Kft loop range, as well as to customers served over “derived” pairs through Digital Loop Carrier (DLC) remote terminals.

Fan Tray

Fan Trays are provided for both the Master Control Shelf and Line Card Shelves to provide forced air cooling.

Low Pass Filter Shelf (LPFS)

An optional, modular Low Pass Filter Shelf (LPFS) is available for ADSL applications when the local loop is used for both voice and data. This splitter function separates the low frequency voice signal from the high frequency ADSL data signal. The figure below illustrates the layout of the LPFS:

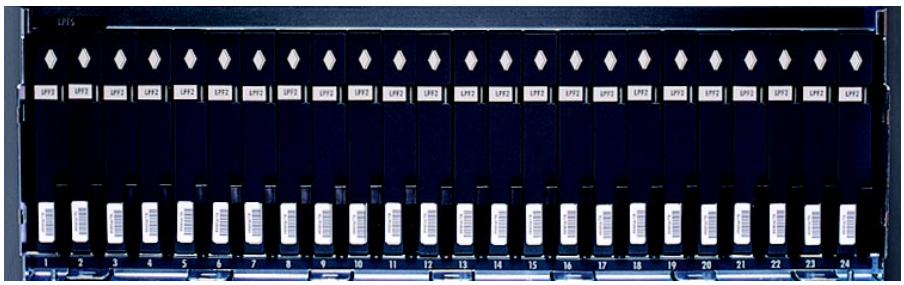

Figure 4: Speedlink Low Pass Filter Shelf

ADSL line circuits have band-pass filters that block the voice frequency energy. A low pass filter/splitter circuit external to the Line Card Shelf (LCS) is connected between the LCS and the voice switch. The voice signal is “split off” at the Low Pass Filter Shelf and sent to the switch unimpeded, while the ADSL line card receives the data signal. The diagram below illustrates this connection:

[11] Planned for future release.

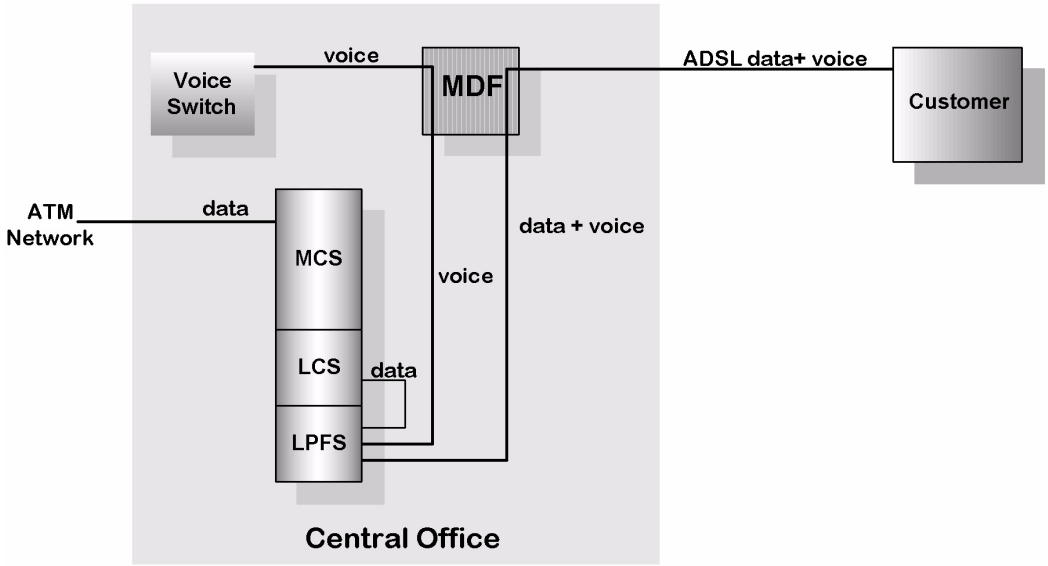

Figure 5: Low Pass Filter Shelf Connection

A twisted pair carries the POTS and data signals from the central office Main Distribution Frame (MDF) to the Low Pass Filter Shelf (LPFS). The LPFS may mount below the Line Card shelf, in an adjacent frame, or remotely from the multiplexer (within 655 cable feet). The LPFS contains low pass filter plug-in cards containing either two or four low pass filter circuits, depending on the number of circuits in the corresponding ASDL line cards. Each low pass filter circuit separates the voice frequency POTS signals from the ADSL signal with no impairment to either service. The Speedlink Low Pass Filter/Splitter circuits are passive and work with both CAP and DMT line modulation plans.

The LPFS supports the following LPF cards:

- LPF2 - for use with CAP2 ADSL line cards
- LPF4 - for use with CAP4 ADSL line cards
- LPF4D - for use with DMT4 ADSL line cards

The LPFS returns the POTS-only voice signal to the MDF. The ADSL line interface card receives the data signal via backplane cabling. This plan allows technicians to replace ADSL line cards in the LCS without affecting the lifeline POTS service. Loop testing can be performed on the cable pair, as it is today, while the ADSL service is in operation.

SDSL, IDSL, and DS1 line cards use the entire frequency spectrum for data transmission and do not require low pass filters. For these line cards the network

service provider connects cables from the DSX-1 frame or MDF, as appropriate, directly to the Line Card Shelf backplane.

This Speedlink Multiplexer has one Master Control Shelf, three Line Card Shelves, and three Low Pass Filter Shelves. This configuration can provide voice and data service for up to 288 ADSL lines.

Figure 6: Speedlink Multiplexer in a 7’ Bay Layout with Low Pass Filter Shelves

Splitterless In-Line Microfilter

The Speedlink System can be operated in a “splitterless” environment with customer installed in-line microfilters. These in-line filters are connected to each telephone(s) that shares the ADSL line and allows POTS and ADSL to share the same on-premises wire pair without interference. The in-line Microfilter eliminates the need for a “truck-roll” to install equipment at the customer premises.

Figure 7: In-Line Microfilter Installation

Network Interface Device (NID) with Remote Filter/ Splitter

The Speedlink Network Interface Device (NID) includes a passive Remote Low Pass Filter (RLPF) “splitter” device in a standard NID housing. Two types of NIDs are available: a small retrofit NID designed as an adjunct to an existing voice-only NID, and a large NID for new installations. Both types of NIDs are designed for installation on the outside wall of a building or telephone closet and are weather-hardened to meet TR-57 environmental requirements. The NID is employed where ADSL and POTS require separate on-premises wire pairs.

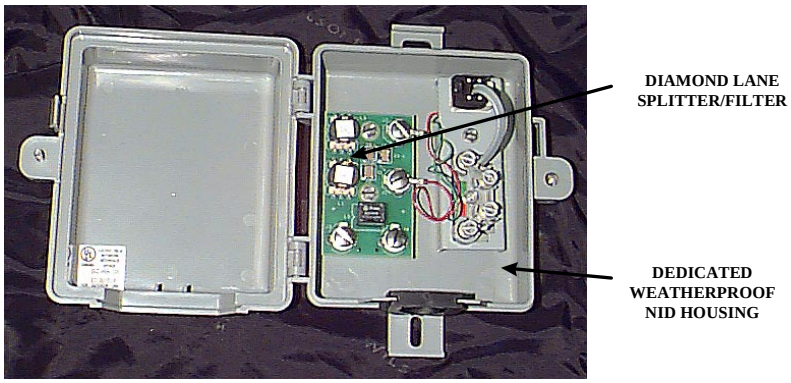

Figure 8: Speedlink NID with Remote Low Pass Filter

Customer Premises Equipment

Speedlink customer premises equipment comes in several different forms and for several different purposes:

Table 1: Customer Premises Equipment

CPE	APPLICATION
Routers	Deliver cost-effective, multi-user CPE solutions for remote LAN access users and other small office/home office applications.
Bridge/Modems	Provide simple, single host 10Base-T external operation.
NICs	Offer single-user, easy-to-use CPE solutions at consumer price levels.

Speedlink CPE products include full-featured LAN gateway routers, bridge/modems and low-cost network interface cards. All CPE products support standard industry interfaces and come in ADSL (CAP), ADSL (DMT), SDSL (2B1Q), and IDSL (2B1Q) formats. All CPE products work with numerous providers' equipment and interoperate with Speedlink System central office equipment.

Speedlink System Configurations

The Speedlink System can be configured in many different ways, depending on the characteristics of the loops it will serve. The Speedlink supports:

- a central office configuration
- a Remote Line Card Shelf[12] configuration
- a Remote DSLAM configuration

[12] Planned for future release.

Central Office Configuration

The **Central Office configuration** consists of:

- a Master Control Shelf (MCS)
- one to twelve Line Card Shelves (LCS)
- one to twelve (optional) Low Pass Filter Shelves (LPFS)
- one to twelve (optional) ADSL Link ID units

The figure below illustrates a Speedlink configuration with Low Pass Filter Shelves (providing service to up to 288 ADSL lines) and a Speedlink configuration without Low Pass Filter Shelves (providing service up to 384 data only ADSL lines or 768 SDSL lines).

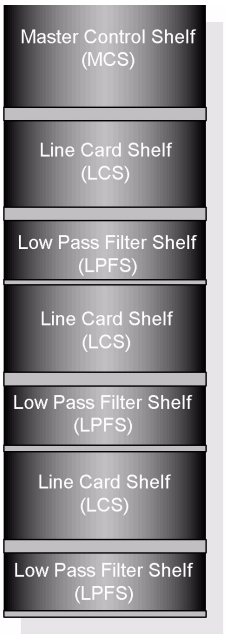

Figure 9: 7' Bay Layout with POTS Low Pass Filter Shelves

Figure 10: 7' Bay Layout without POTS Low Pass Filter Shelves

The MCS distributes the ATM traffic from the network service provider's ATM network to the appropriate LCSs over optical fiber as an OC-3c signal. Each LCS distributes the ATM traffic to the line cards over the LCS backplane. Each line card converts the ATM traffic into an xDSL signal, and sends it out over the twisted pairs to the Speedlink customer premises equipment (router, bridge/modem or NIC).

Remote DSLAM Configuration

The **Remote DSLAM configuration** is similar to the central office (C.O.) Speedlink Multiplexer, except that the Multiplexer is not in the central office. Instead, the network service provider can locate a Multiplexer in a Controlled Environment Vault (CEV) or hut.

Remote Line Card Shelf Configuration

In the **Remote Line Card Shelf (RLCS)**[13] configuration, the Multiplexer consists of multiple physical assemblies. Like the C.O. and Remote DSLAM configurations, the Master Control Shelf (MCS) distributes ATM traffic to 0-12 local Line Card Shelves (LCS). But because this is a *Remote* LCS configuration, the MCS also distributes ATM traffic to at least one Remote LCS over optical fiber as a SONET intermediate reach OC-3c signal. Like the C.O. or Remote DSLAM LCS, the Remote LCS distributes ATM traffic to its line cards. Each line card converts the ATM traffic into DSL signals, and sends the signals out over the twisted pair to the Speedlink end user equipment.

At the Remote Line Card Shelf (RLCS), the voice-frequency signal may be combined with the ADSL signal using a remote low pass filter arrangement. Because of the distance from the RLCS to the Main Distribution Frame (MDF), a loop carrier may have to carry POTS services to the MDF. The network service provider may decide to offer only ADSL services, and not offer POTS over the same twisted pair.

Speedlink System Interfaces

The Speedlink System has the following classes of external interface:

- ATM wide area network interface (trunk)
- central office switch voice interface (POTS)
- subscriber line data interface

ATM Wide Area Network Interface

The Speedlink Multiplexer interfaces with ATM wide area network data routing, switching, and server equipment electrically at the DS3 rate (44.736 Mbps) and optically in SONET OC-3c (155.52 Mbps) or OC-12c[14] (622.08 Mbps) formats. The payload is ATM cells, initially in conformance with UNI 3.1 and with UNI 4.0 as it becomes available.

Central Office Switch POTS Interface

The Low Pass Filter Shelf (LPFS) POTS signal output will work with all central office switches. The LPFS does not alter the POTS signal, and the presence of the

[13] Planned for future release.

[14] Planned for future release.

ADSL does not affect any central office switch now in service. LPFS passive components ensure lifeline service is maintained should the Speedlink lose power.

Future Subscriber Line Interfaces

The Speedlink Multiplexer will support future customer interfaces in addition to those generated by the line cards described on page 5. The Speedlink supports ATM-switched wide area data network applications at DS1, DS3, and STS-3 data rates using HDSL, coaxial and optical line interfaces, as appropriate. The expected primary application of these interfaces is to provide an “edge concentrator” function between end users and ATM switched data services in conformance with Bellcore GR-2842 requirements. This will enable the Speedlink Multiplexer to fit into the evolving ATM target architecture for wide area networks, illustrated below.

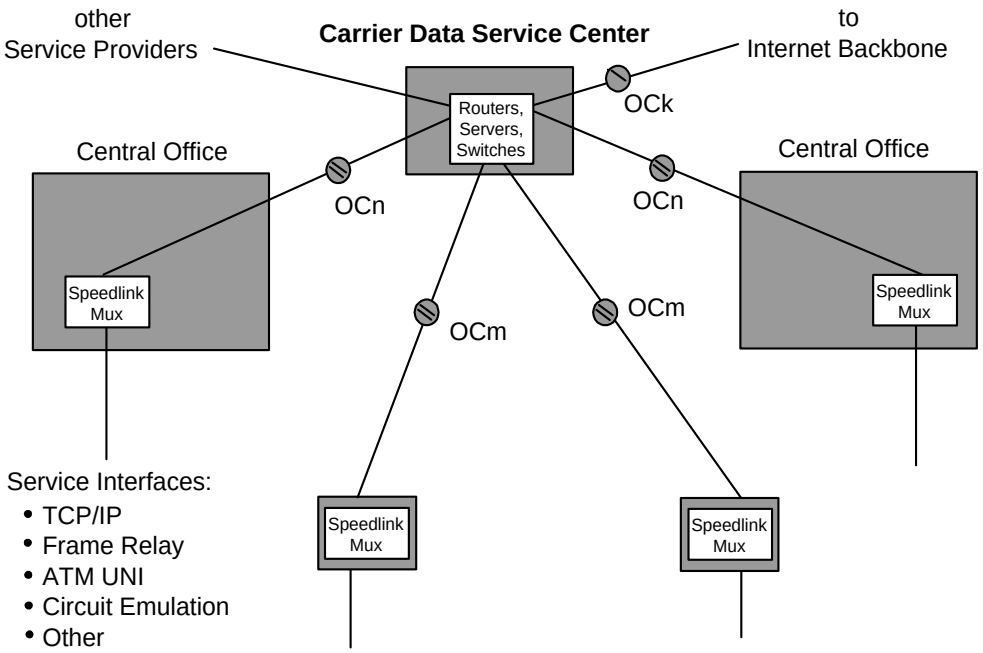

Figure 11: Speedlink Multiplexer As Part of ATM Wide Area Network

The Speedlink will support ATM switches that conform to UNI 3.1 and, as it becomes available, UNI 4.0.

Operations Support System Interfaces

The Speedlink Multiplexer has two different applications that provide Operations Support System (OSS) interfaces:

- DiamondView Element Management System
- DiamondCraft Craft Interface System

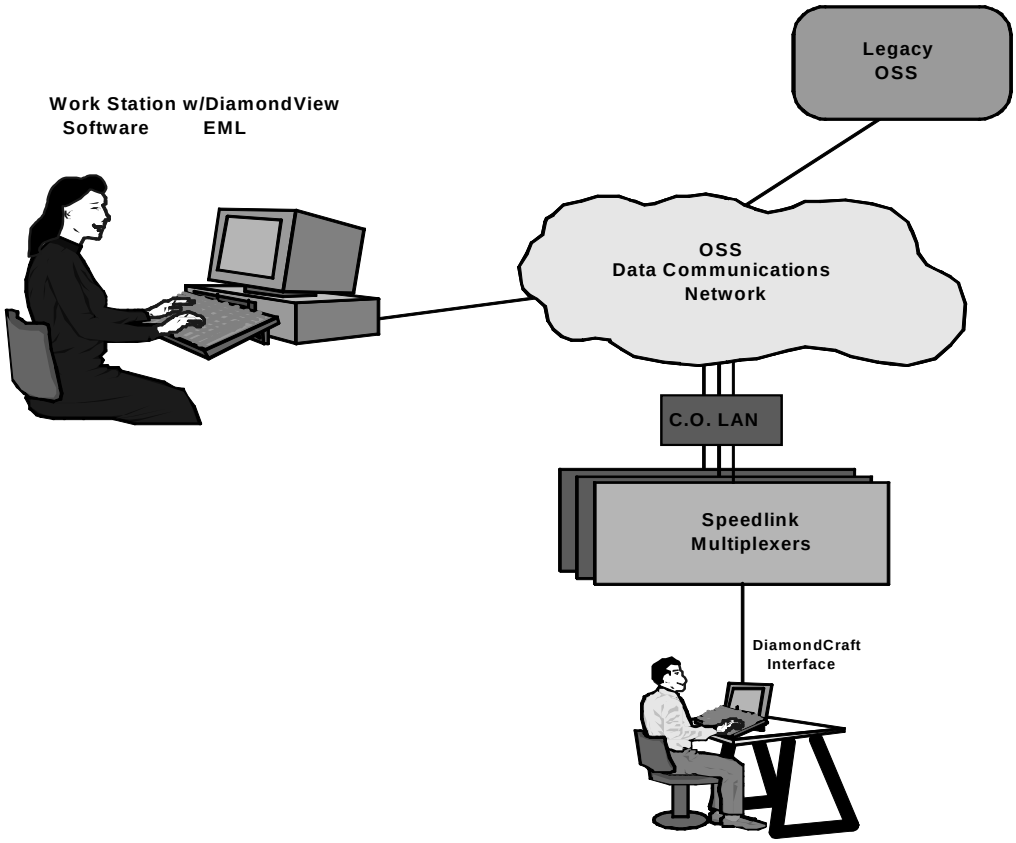

Figure 12: Speedlink System Element Management Concept

DiamondView Element Management System

The Speedlink System's **DiamondView Element Management** software features an easy "point-and-click" user interface consisting of graphical and dialog-based windows. The application enables network managers to either view the system at the multiplexer level, or "drill down" to the service port level for more detailed information. Designed to operate on either a Sun or HP UNIX workstation running HP OpenView Network Node Manager, DiamondView is able to access and manage multiple Speedlink Systems.

With DiamondView, network operators have both in-band and out-of-band network management capability for connecting to Speedlink network elements. This allows service providers to manage equipment through the same ATM facility

used by customer data, reducing overall operating costs. Additionally, DiamondView provides central office monitoring via four user programmable environmental alarms.

DiamondView uses Simple Network Management Protocol (SNMPv1) to communicate with the Speedlink System at the network element. It communicates over an Ethernet network originating at the 10Base-T port located on the MCS, or through in-band ATM payload cells in the trunk facility. The application is compliant with the Telecommunications Management Network (TMN) architecture at the element management layer (EML) and provides comprehensive fault, configuration, and performance monitoring of the Speedlink network.

DiamondCraft

DiamondCraft is a stand-alone, object-oriented, craft interface configuration and management application. Designed to communicate directly with a Speedlink System via the serial port using Point-to-Point Protocol (PPP) at speeds up to 38,400 baud or via a 10Base-T connection, DiamondCraft operates on any laptop or PC running the Windows NT operating system. This application is ideal for the setup and installation of Speedlink Systems, initiating communication with DiamondView Element Management Software, or for quick, on-site diagnosis of hardware-related or local network problems.

Chapter 2

SECTION 1 PRODUCT DESCRIPTION

Chapter 2 Speedlink Specifications

NEBS Level 3 Verification

The Speedlink System has been verified by Bellcore for all 33 of the Level 3 Network Equipment Building System (NEBS) requirements.

Electrical Safety Standards

Speedlink System elements conform, as applicable, to the following electrical safety standards:

Bellcore

- GR-1089-CORE, *Electromagnetic Compatibility and Electrical Safety*
- GR-49-CORE, *Generic Requirements for Outdoor Telephone Network Interface Devices*

Underwriters Laboratories (UL)

UL 497	Protectors for Paired Conductor Communications Circuits
UL 1459	Telephone Equipment
UL 1863	Communication Circuit Accessories
UL 1950	Information Technology Equipment Including Electrical Business Equipment (Second Edition)

Mechanical Safety Standards

Speedlink System elements conform to all applicable mechanical and physical safety standards contained within the following documents:

GR-63-CORE, *Network Equipment-Building System (NEBS) Requirements: Physical Protection,* Issue 1

TR-NWT-000078, *Generic Physical Design Requirements for Telecommunications Products and Equipment,* Issue 3

GR-49-CORE, *Generic Requirements for Outdoor Telephone Network Interface Devices*

Hardware Physical Specifications

Table 2: Speedlink Multiplexer Assemblies Dimensions

Assembly	Height (in.)	Depth (in.)	Body Width (in.)	Width w/ Mounting Flanges (in.)	Weight Empty	Weight Fully Loaded
MCS	14.38	12.00	21.25	23.37	45 lbs	74 lbs
LCS	12.13	12.00	21.25	23.37	32 lbs	65 lbs
LPFS	6.88	12.00	21.25	23.37	22 lbs	46 lbs
LINK ID	3.26	12.00	21.25	23.37	14	14

The Speedlink Multiplexer is designed for mounting in a standard telco relay rack. The drawing below shows mounting heights for the Master Control Shelf, Line Card Shelf and Low Pass Filter Shelf to support ADSL data plus voice applications.

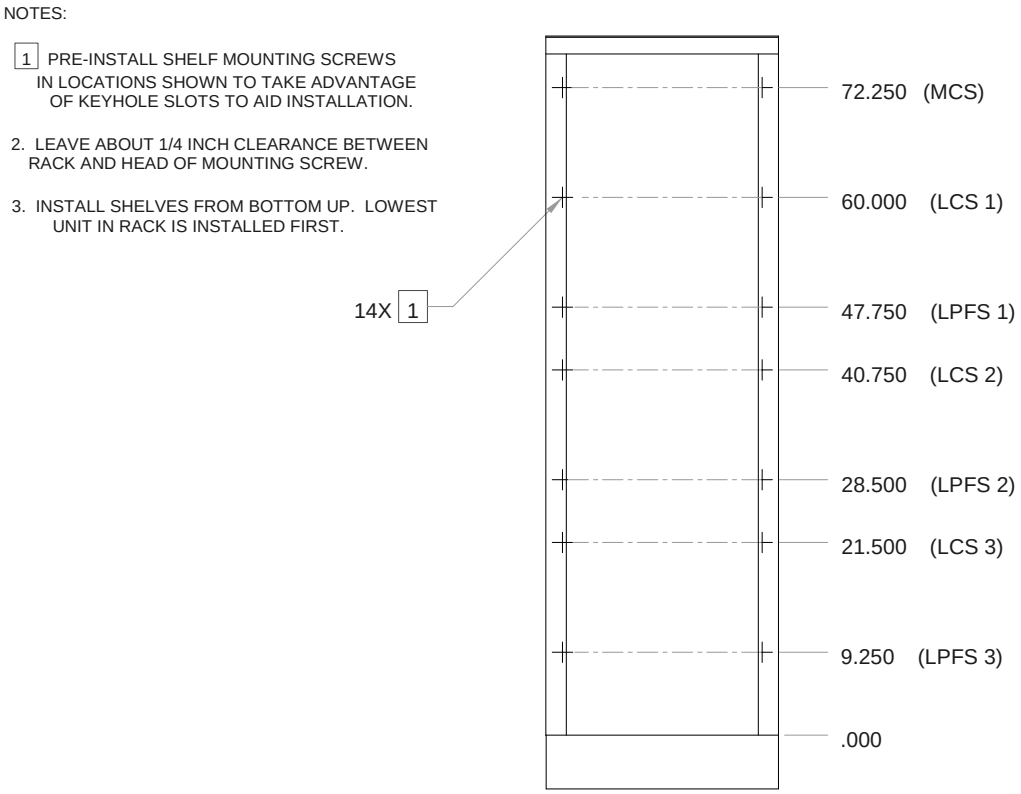

Figure 13: Speedlink Multiplexer Mounting Heights – MCS, LCS, and LPFS ADSL Data Plus Voice Configuration

The drawing below shows mounting heights for the Master Control Shelf and Line Card Shelf to support ADSL, SDSL, and IDSL data only applications.

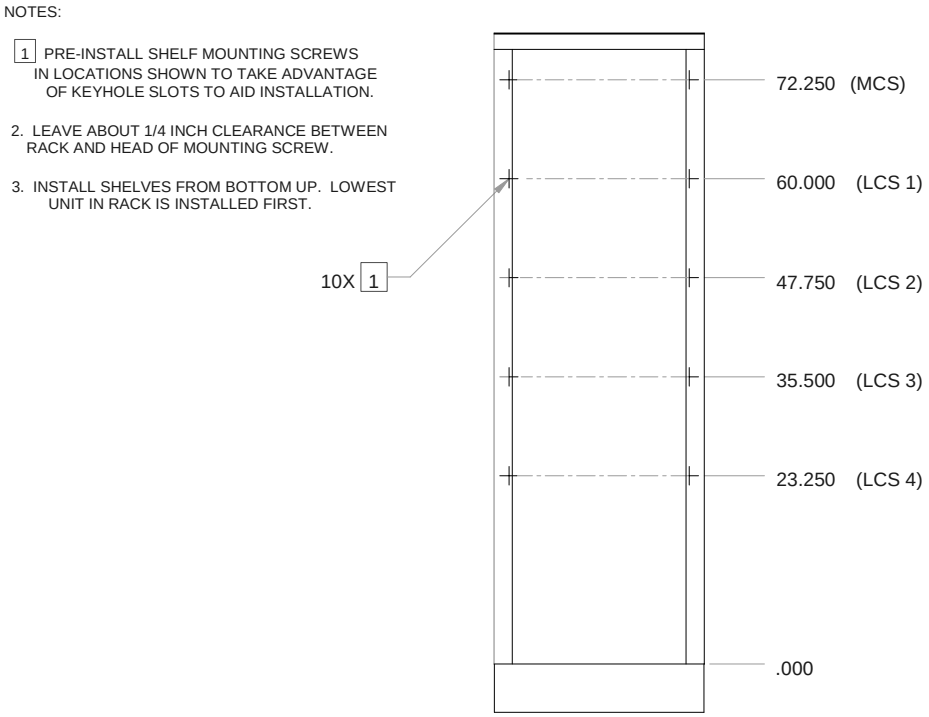

Figure 14: Speedlink Multiplexer Mounting Heights – MCS and LCS ADSL, SDSL, and IDSL Data Only Configuration

The drawing below shows mounting heights for the Master Control Shelf, Line Card Shelf, and ADSL Link ID to support ADSL data only applications.

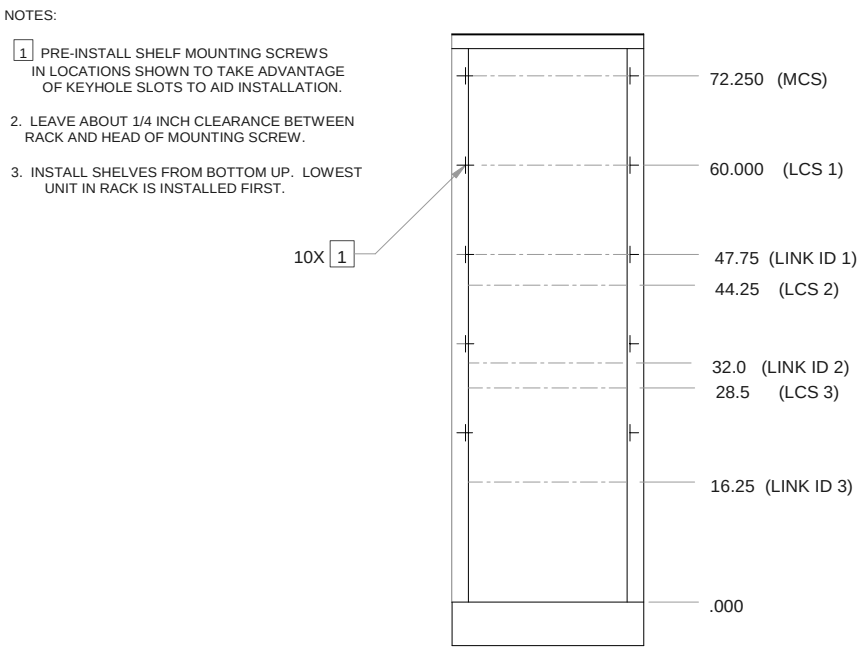

Figure 15: Speedlink Multiplexer Mounting Heights – MCS, LCS, and ADSL Link ID ADSL Data Only Configuration

The Speedlink Multiplexer central office design requires front and rear access for ATM network, telco and power cabling.

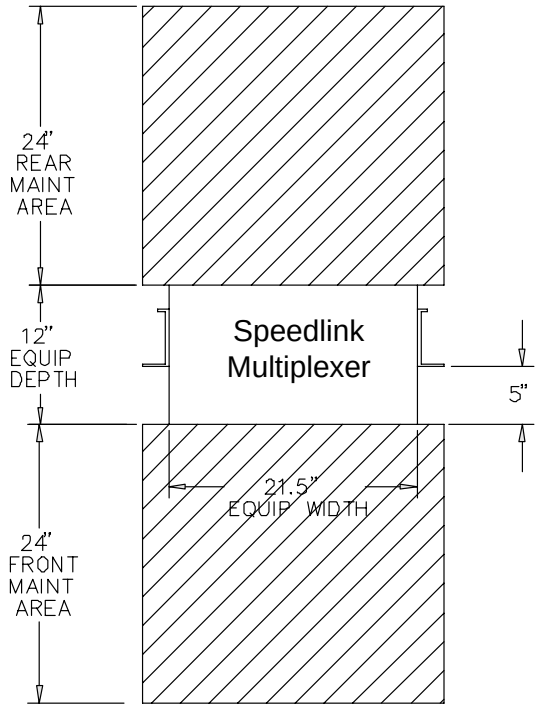

Figure 16: Speedlink Multiplexer in a Telco Relay Rack - Top View

Speedlink Customer Premises Equipment

Speedlink end user equipment comes in two broad categories: internal and external to the PC. Internal modems (Network Interface Cards) plug into the system board of a customer's PC. External routers or modems connect through 10Base-T Ethernet connectors to a variety of workstations, local ATM networks, and PCs where it is impractical to install an internal Speedlink Network Interface Card (NIC).

The Network Interface Cards conform to the dimensional standards for a full length, full height PCI Local Bus card. The document PCI Special Interest Group, *PCI Local Bus Specification*, Rev. 2.1, chapter 5, contains these dimensions.

Capacities

The following table lists the assemblies that make up a Speedlink Multiplexer, and the maximum capacity of each assembly:

Table 3: Capacities

Assembly	Card Type	Maximum Count
MCS	NMP	1
	MCP	2
	ATM Network Interface (DS3T or OC3T)	2
	Broadband Interface (MLA)	12
LCS	LSM2	1
	(spare)	1
	Line Cards	24
LPFS	Low Pass Filter Cards	24
Link ID	(none)	0

Software Specifications

DiamondView EMS Specifications

DiamondView 2.0 runs on either the HP 712/715 workstation, the HP B132/B160 workstation, or the Sun 170E workstation. It supports two different software environments:

- on the HP workstations:
  - HP Vue, OpenView 4.0x, and HP-UX 10.10
  - DCE, OpenView 5.0x, and HP-UX 10.20
- on the Sun workstation:
  - DCE, OpenView 5.0x, and Solaris 2.5.1[1]

The HP workstations require 128 MB of RAM, a 1280 x 1024 graphics resolution screen, PEX 5.x, and an 8 bit frame buffer.

The Sun 170E workstation requires 128 MB of RAM, a 1280 x 1024 graphics resolution screen, PEX 5.x, and a 24 bit frame buffer.

DiamondView Capacities

DiamondView will manage up to 40 Speedlink Multiplexers simultaneously.

[1] The current release of OpenView is 6.0 and the current release of Solaris is 2.6.

DiamondCraft Specifications

DiamondCraft is a Windows NT 4.0 or later application. Windows NT requires a 486 or Pentium class computer with a minimum of 16 MB of RAM (32 MB recommended), 6 MB of free disk space, and 20 MB of free disk space after installation. A color monitor (or laptop color display) with 256 colors is recommended.

DiamondCraft Capacities

DiamondCraft communicates with one Speedlink Multiplexer at a time.

Chapter 3

SECTION 1 PRODUCT DESCRIPTION

Chapter 3 ATM Network Element Interface

Hardware Requirements and Version Compatibility

The Speedlink System supports three network interfaces: DS3, OC-3c, and OC-12c[1], each carrying ATM payload. The Speedlink System fully conforms to the following requirements for DS3 network interface:

- ANSI, T1.404-1994, *Network-to-Customer Installation – DS3 Metallic Interface Specification*.
- ANSI, T1.102-1993, *Digital Hierarchy – Electrical Interfaces*.

Software Interface Specifications

Network Interface Facilities

The Speedlink System fully conforms to the following software requirements for DS3 network interface:

- Bellcore, GR-499-CORE, Issue 1, December 1995.
- Bellcore, TR-TSV-000773, Issue 1, June 1991, Revision 1, January 1993.
- ANSI T1.107-1995 *Digital Hierarchy – Formats Specifications*.

For OC-3c and OC-12c network interface, the applicable standards are:

- Bellcore, GR-253-CORE, Synchronous Optical Network SONET Transport System, Issue 2, December 1995.

With respect to the ATM payload, the Speedlink System conforms to:

- Bellcore, GR-2842-CORE, ATM Service Access Multiplexer (SAM) Generic Criteria, Issue 1, Revision 1.
- Bellcore, TR-NWT-01112, Broadband ISDN User to Network Interface and Network Node Interface Physical Layer Criteria, § 7.

[1] Planned for future release.

The Speedlink System will conform to the ATM Forum's UNI Traffic Management Specification Version 4.0 in the future.

Operations System Interfaces

The Speedlink Multiplexer supports north bound interfaces to an OSS via gateways provided by the DiamondView TMN Element Management System (EMS) platform. Gateways include Bellcore-compliant GR-833 CORE TLI and a CORBA 2.0 IDL for the Speedlink network elements (planned for Release 4.0).

Technical specifications:

- OMG 2.0 CORBA specifications
- Bellcore GR-833 CORE—"Network Element and Transport Surveillance Messages"
- Bellcore GR-2869 CORE General Requirements for operations based on TMN architecture

Chapter 4

SECTION 2 PLANNING AND ENGINEERING

Chapter 4 Product Specifications

Speedlink Interfaces

This chapter provides information that communications company planners and engineers will need when planning installation of the Speedlink System.

Speedlink System interface specifications can be found under "Hardware Requirements and Version Compatibility" and "Software Interface Specifications," page 27.

Performance Parameters

Speedlink System CAP ADSL Performance Parameters are listed below[1]:

AWG	Downstream Rate (Kbps)	Downstream Feet (Kft)	Upstream Rate (Kbps)	Upstream Feet (Kft)
24	640	20.7	90	21.0
24	960	19.8	272	20.7
24	1,280	19.1	408	20.5
24	1,600	18.2	544	20.5
24	1,920	17.9	680	18.8
24	2,240	17.0	816	17.0
24	2,685	16.5	952	16.8
24	3,200	16.0	1,088	12.8
24	4,480	15.0		
24	5,120	13.8		
24	6,272	13.3		
24	7,168	9.0		

Figure 17: CAP ADSL Data Rates and Ranges

NOTE: Lab tests conducted with ISDN NEXT + 6dB noise interference.

[1] The downstream rate of 7168 Kbps is supported by the CAP4 line card only.

Speedlink System DMT ADSL Performance Parameters are listed below:

AWG	Downstream Rate (Kbps)	Downstream Feet (Kft)	Upstream Rate (Kbps)	Upstream Feet (Kft)
24	640	17.0	288	15.6
24	960	15.8	416	12.8
24	1,280	15.0	544	11.2
24	1,600	13.4		
24	1,920	12.8		
24	2,240	12.3		
24	2,688	12.3		
24	3,200	12.1		
24	4,480	11.9		
24	5,120	11.8		
24	6,144	11.0		

Figure 18: DMT ADSL Data Rates and Ranges

NOTE: DMT performance tests conducted with ISDN NEXT + 6dB noise interference.

Speedlink System SDSL Performance Parameters are listed below:

AWG	ATUC / ATUR Rate (Kbps)	Distance (Kft)
24	192	24
24	384	21
24	768	16
24	1152	13.5

Figure 19: SDSL Data Rates and Ranges

NOTE: SDSL performance parameters based on lab tests with no noise. Operating distance at a given data rate may be reduced in the presence of bridged taps and crosstalk interference.

Speedlink System IDSL Performance Parameters to be determined.

Environmental Requirements

The Master Control Shelf is central office equipment. It will conform to all the environmental requirements contained in GR-63-CORE. Line Card Shelves co-located with the MCS will also conform to GR-63-CORE.

Remote Line Card Shelves[2] will operate within the outside plant environmental requirements contained in TR-57.

Temperature Range	Lower Limit		Upper Limit
■ Central Office Installation:	0° C (32° F)	to	+50° C (122° F)
■ Remote Line Card Shelf Installation:	-40°C (-40°F)	to	+65° C (149° F)

Relative Humidity

- 0 to 95% (non-condensing)

Reliability and Quality Specifications

The Speedlink Multiplexer conforms to the applicable requirements of the following reliability and quality specifications:

Bellcore

TR-NWT-000057	Functional Criteria for DLC Systems
GR-63-CORE	Network Equipment-Building Systems (NEBS) Requirements
TR-NWT-000078	Generic Physical Design Requirements
TR-NWT-000179	Quality System Generic Requirements for Software
GR-209-CORE	Generic Requirements for Product Change Notices
TA-TSY-000228	Generic Human Factors Requirements for Network Terminal Equipment, Preliminary
GR-282-CORE	Software Reliability and Quality Acceptance Criteria
TR-NWT-000284	Reliability and Quality Switching Systems Generic Requirements
GR-326-CORE	Generic Requirements for Single-Mode Optical Fiber Connectors
TR-332	Reliability Prediction Procedure for Electronic Equipment
TR-NWT-000357	Generic Requirements for Assuring the Reliability of Components Used in Telecommunications Systems
TR-STS-000383	Generic Requirements for Common Language Bar Code Labels
TR-TSY-000389	Supplier Data Program Analysis
TR-NWT-000418	Generic Reliability Assurance Requirements for Fiber Optic Transport Systems
TR-TSY-000454	Supplier Documentation for Network Elements
TR-NWT-000468	Reliability Assurance Practices for Optoelectronic Devices in Central Office Applications
GR-485-CORE	Common Language Equipment Coding Processed and

[2] Scheduled for future release.

	Guidelines, Generic Requirements
GR-499-CORE	Transport Systems Generic Requirements (TSGR)
FR-796	Reliability and Quality Generic Requirements (RQGR)
GR-839-CORE	Generic Requirements for Supplier-Provided Training
TR-NWT-000840	Electrostatic Discharge Control in the Manufacture of Telecommunications Equipment
GR-929-CORE	Reliability and Quality Measurements for Telecommunications Systems
TR-NWT-000930	Generic Requirements for Hybrid Microcircuits Used in Telecommunications Equipment
TA-NWT-000942	Hardware Reliability Assurance Program (H-RAP) Generic Requirements for Telecommunications Products
SR-TSY-000963	Network Switching Element Outage Performance Monitoring Procedures
TA-NWT-000983	Reliability Assurance Practices for Optoelectronic Devices in Loop Applications
TR-NWT-001037	Statistical Process Control Program Generic Requirements
GR-1089-CORE	Electromagnetic Compatibility and Electrical Safety - Generic Criteria for Network Telecommunications Equipment
SR-TSY-001171	Methods and Procedures for System Reliability Analysis
GR-1217-CORE	Generic Requirements for Separable Electrical Connectors Used in Telecommunications Hardware
GR-1252-CORE	Quality System Generic Requirements for Hardware

International Standards Organization (ISO)

ISO 9001	Quality Systems - Model for Quality Assurance in Design, Development, Production, Installation and Servicing

Underwriters Laboratories (UL)

UL 497	Protectors for Paired Conductor Communications Circuits
UL 1459	Telephone Equipment
UL 1863	Communication Circuit Accessories
UL 1950	Information Technology Equipment Including Electrical Business Equipment (Second Edition)

Chapter 5

SECTION 2 PLANNING AND ENGINEERING

Chapter 5 Planning

DSL Loop Qualification

DSL requires a non-loaded loop that conforms to the North American Revised Resistance Design (RRD) rules; i.e. a loop within 18,000 feet from the Central Office. Today 90 – 95% of existing non-loaded loops, that conform to North American Revised Resistance Design (RRD) rules, will successfully carry DSL traffic.

DSL for Unqualified Loops

There are ways of providing DSL service to customers served by loops that do not conform to the RRD rules, or to customers served by loops long enough to affect data rate performance. There are two possible solutions to these problems: a Remote LCS, or digital loop carriers with a Remote LCS.

See the diagram on page 52 that describes the Remote LCS with DLC configuration[1].

DSL Compatibility Issues

There are two potential compatibility issues that may affect DSL service: ISDN and HDSL. ISDN and HDSL interference within a binder group may reduce effective DSL data rates on a given loop. Rate adaptive ADSL will adjust the data rate on the loop to accommodate interference.

Cabling

Central Office DC Power Cabling

The Speedlink System is powered by central office battery (-48 volts DC). Central office battery is connected to the Speedlink at the Master Control Shelf (MCS) Commons Systems Interface Panel (CSIP) Power and Distribution Board.

[1] Scheduled for future release.

The Speedlink has two DC power inputs (Battery “A” and Battery “B”). Each of these inputs is capable of supplying power to the Speedlink during central office maintenance operations. The recommended gauge wire for power cabling is 8 AWG. The Speedlink System requires -42.75 to -56.0 VDC central office power. Battery “A” and “B” power inputs are fused at 15 amps for -48 VDC operation.

The CSIP Power and Distribution Board distributes -48 VDC central office power to the MCS and to a maximum of four Line Card Shelves in a standard single relay rack configuration. Auxiliary CSIP Power and Distribution Boards are required to distribute power to each additional relay rack configuration of up to four Line Card Shelves per rack.

Line Card Shelf power cabling is fully connectorized. 14 AWG cables are shipped with the Speedlink System.

DS3 ATM Network Cabling

WECO 728A equivalent coax cables with “75 ohm” BNC socket connectors are run from the DSX-3 cross connect panel to the Speedlink Master Control Shelf (MCS). “Transmit[2]” and “Receive[3]” trunk cables are routed through a cable port at the back or side of the MCS, and terminated on BNC “pin” connectors mounted on the front of the MCS backplane.

OC3 ATM Network Cabling

Duplex single-mode (9/125 micron) optical fiber with SC duplex connectors is run from the Optical Distribution Frame (ODF) to the Speedlink Master Control Shelf (MCS). “Transmit” and “Receive” trunk cables are routed through the front of the MCS card cage, and terminated on inset connectors on the OC3T trunk card faceplate.

MCS to LCS Fiber Optic Cabling

Line Card Shelves are connected to the Master Control Shelf via Line Card Shelf Multiplexer (LSM2) cards. Each LSM2 card connects to a Master Line Card Adapter (MLA) card in the Master Control Shelf. The LSM2 and MLA cards exchange signals at OC-3c rate over multi-mode fiber optical cable.

Fiber optic cabling is fully connectorized. Duplex fiber optic cables (62.5µm diameter) with SC duplex connectors at both ends are provided with each Line Card Shelf or OC3T card shipped.

Subscriber Line Cabling

The Speedlink System can be configured for ADSL, SDSL, and IDSL data service only, or ADSL data plus voice service, based on the needs of the network service

[2] Transmit — data being sent to the ATM Network.

[3] Receive — data being received from the ATM Network.

provider. Subscriber line cabling varies, depending on the configuration of the Speedlink.

Data Service Only Configuration

The connection between the local exchange network and the Speedlink is made at the Line Card Shelf (LCS) backplane. Each LCS is designed for connection to a maximum of one hundred and ninety-two (192) VF cable/pairs at the Main Distribution Frame (MDF).

The LCS cabling plan organizes line cards into four groups of six channel slots, to support a total of 24 dual, quad and octal line cards. Each group of six channel slots interconnects to a single connector on the LCS backplane for ports 1 through 4, and to a second connector on the backplane for ports 5 through 8, required for octal line cards.

Cable stubs—round 25 pair cables with a laminated flat end—are shipped with the Speedlink System. Each cable stub is equipped with a 50 position female ribbon connector on the flat end, and a 50 position Amp Champ[4] female connector on the round cable end. The flat end of the 25 pair cable stub connects to the LCS backplane. The round end of the cable stub connects to a 25 pair[5] cable which is connected to subscriber lines at the MDF.

The Speedlink can be cabled to include ADSL Link IDs for Dual and Quad ADSL line card configurations. An ADSL Link ID can support up to four ADSL line card six-packs, one per 25 pair cable, for a total of four cables and 24 ADSL line cards per LCS.

Data plus Voice Configuration

When the Speedlink System is configured for ADSL data plus voice service, the connection between the local exchange network and the Speedlink is made at the Low Pass Filter Shelf (LPFS) backplane. Data plus voice frequency signals are received from the customer at the Low Pass Filter Shelf. The LPF card “splits” the low frequency voice signal from the high frequency data signal. The voice signal is sent onto the switch unimpeded—the data signal is received by the line card. Each LPFS is designed for connection to a maximum of ninety-six VF cable/pairs at the Main Distribution Frame (MDF).

The Low Pass Filter Shelf cabling plan organizes up to 24 Low Pass Filter cards into groups of six channel slots. Each group of six cards requires three connections on the LPFS backplane:

---

[4] Cable stubs with 710 or MS2 connectors are available based on the requirements of the telecommunications company.

[5] The network service provider may choose to run 100 pair VF cables from the MDF to the Speedlink.

- Connection One: Data signals are sent to and received from the line card. This connection is made at the LPFS and LCS backplanes.
- Connection Two: Data plus voice signals are received from and sent to the subscriber. This connection between the LPFS and the local exchange network is made at the MDF.
- Connection Three: Voice signals are sent to and received from the voice switch. The connection between the LPFS and the switch is made at the MDF.

LPFS to LCS cabling is fully connectorized. One end of the 25 pair cable is connected to the LPFS backplane the other end connects to its corresponding connector on the Line Card Shelf backplane.

LPFS to MDF *subscriber* cable stubs, round 25 pair cables with a laminated flat end, are shipped with the Speedlink System. Cable stubs are equipped with a 50 position female ribbon connector on the flat end, and a 50 position Amp Champ[6] female connector on the round cable end. The flat end of the 25 pair cable stub connects to the LPFS backplane. The round end of the cable stub connects to a 25 pair[7] cable which is connected to subscriber lines at the MDF.

LPFS to MDF *switch* cable stubs, round 25 pair cables with a laminated flat end, are shipped with the Speedlink System. Cable stubs are equipped with a 50 position female ribbon connector on the flat end, and a 50 position Amp Champ[8] male connector on the round cable end. The flat end of the 25 pair cable stub connects to the LPFS backplane. The round end of the cable stub connects to a 25 pair[9] cable which is connected to the central office switch at the MDF.

[6] Cable stubs with 710 or MS2 connectors are available based on the requirements of the network service provider.

[7] The network service provider may choose to run 100 pair VF cables from the MDF to the Speedlink.

[8] Cable stubs with 710 or MS2 connectors are available based on the requirements of the network service provider.

[9] The network service provider may choose to run 100 pair VF cables from the MDF to the Speedlink.

Hardware (MCS) **Physical Component Layout**

The Master Control Shelf (MCS) looks like this:

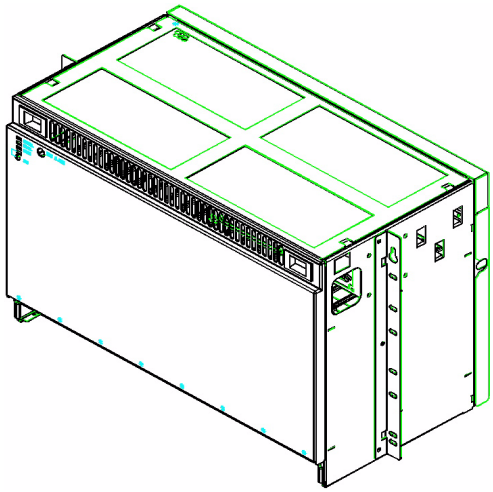

Figure 20: Master Control Shelf Assembly

Hardware (LCS) The Line Card Shelf (LCS) looks like this:

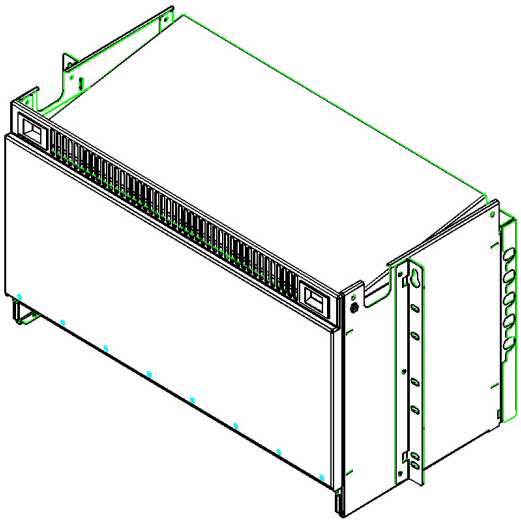

Figure 21: Line Card Shelf Assembly

Hardware (ADSL Link ID)

The ADSL Link ID assembly looks like this:

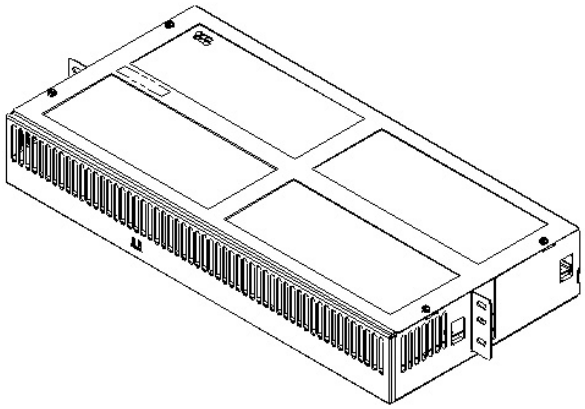

Figure 22: ADSL Link ID Assembly

Hardware (LPFS)

The Low Pass Filter Shelf (LPFS) assembly looks like this:

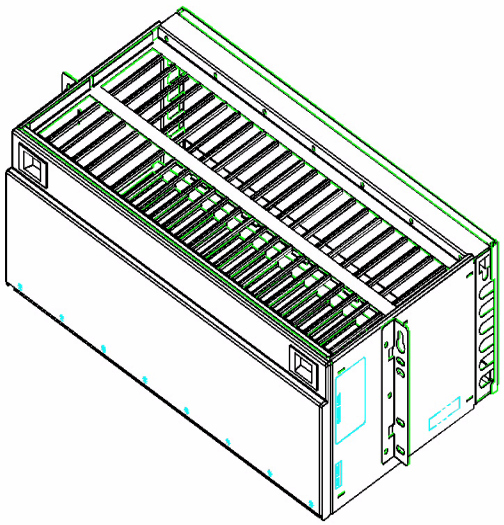

Figure 23: Low Pass Filter Shelf Assembly

Diamond Lane Communications Corporation Proprietary Data

Hardware and Software Requirements

DiamondView

You must have the following hardware to run the DiamondView Element Management System Release 2.0:

- An HP 712/715, or B132/B160 hardware platform
- 128 MB of RAM
- a 1280 x 1024 graphics resolution screen
- PEX 5.x
- an 8 bit frame buffer

OR

- Sun 170E hardware platform
- 128 MB of RAM
- 1280 x 1024 graphics resolution screen
- PEX 5.x
- a 24 bit frame buffer

DiamondView 2.0 supports two different software environments:

- on the HP workstations:
  - HP Vue, OpenView 4.0x, and HP-UX 10.10
  - DCE, OpenView 5.0x, and HP-UX 10.20
- on the Sun workstation:
  - DCE, OpenView 5.0x, and Solaris 2.5.1[10]

DiamondCraft

You must have the following hardware to run the DiamondCraft craft interface software:

- a PC-compatible with a 486 or higher processor
- 16 MB of RAM
- 6 MB of free disk space and at least 20 MB of free disk after installation
- a VGA resolution or higher monitor (or laptop display) with at least 256 colors

In addition, we recommend:

- a Pentium processor or equivalent
- 32 MB of RAM (especially if you expect to run other applications in the background)

[10] The current release of OpenView is 6.0 and the current release of Solaris is 2.6.

Power Consumption

Power consumption for line cards is not use-sensitive in Release 3.0. In the future, the Speedlink may implement a power management scheme that would reduce power consumption when the circuit is not actively in use. See the Power Consumption charts on pages 42 through 47.

Chapter 6

SECTION 2 PLANNING AND ENGINEERING

Chapter 6 Engineering

General Power Requirements

The MCS and LCS require -48 V DC power that meets the TR-57 electrical power supply standards.

The Low Pass Filter Shelf (LPFS) contains only passive devices and requires no power.

The Auxiliary CSIP requires no power until an alarm occurs. The maximum power consumption in a fully loaded system during an alarm state is 8.5 watts.

The ADSL Link ID has a maximum power consumption of 3.0 watts.

Component Power Consumption Charts

The following tables show power consumption requirements for each Speedlink shelf assembly and maximum DC power requirements for Speedlink configurations equipped with CAP2, CAP4, DMT4, SDSL8, and IDSL8 line cards:

Master Control Shelf Power Consumption

		TOTAL WATTS (10.08 per MLA card)											
		1 MLA	2 MLAs	3 MLAs	4 MLAs	5 MLAs	6 MLAs	7 MLAs	8 MLAs	9 MLAs	10 MLAs	11 MLAs	12 MLAs
1 NMP	(7.2 W)	55	65	75	85	95	105	116	126	136	146	156	166
1 MCP	(6.0 W)												
1 DS3T	(10.8 W)												
Fan Tray	(21.0 W)												
1 NMP	(7.2 W)	66	76	86	96	106	116	127	137	147	157	167	177
1 MCP	(6.0 W)												
2 DS3Ts	(21.6 W)												
Fan Tray	(21.0 W)												
1 NMP	(7.2 W)	61	71	81	91	101	111	122	132	142	152	162	172
2 MCPs	(12.0 W)												
1 DS3T	(10.8 W)												
Fan Tray	(21.0 W)												
1 NMP	(7.2 W)	72	82	92	102	112	122	133	143	153	163	173	183
2 MCPs	(12.0 W)												
2 DS3Ts	(21.6 W)												
Fan Tray	(21.0 W)												

Figure 24: Master Control Shelf (MCS) Power Consumption with DS3T Trunk Cards

		TOTAL WATTS (10.08 per MLA card)											
		1 MLA	2 MLAs	3 MLAs	4 MLAs	5 MLAs	6 MLAs	7 MLAs	8 MLAs	9 MLAs	10 MLAs	11 MLAs	12 MLAs
1 NMP	(7.2 W)	55	65	75	86	96	106	116	126	136	146	156	166
1 MCP	(6.0 W)												
1 OC3T	(11.0 W)												
Fan Tray	(21.0 W)												
1 NMP	(7.2 W)	66	76	86	97	107	117	127	137	147	157	167	177
1 MCP	(6.0 W)												
2 OC3Ts	(22.0 W)												
Fan Tray	(21.0 W)												
1 NMP	(7.2 W)	61	71	81	92	102	112	122	132	142	152	162	172
2 MCPs	(12.0 W)												
1 OC3T	(11.0 W)												
Fan Tray	(21.0 W)												
1 NMP	(7.2 W)	72	82	92	103	113	123	133	143	153	163	173	183
2 MCPs	(12.0 W)												
2 OC3Ts	(22.0 W)												
Fan Tray	(21.0 W)												

Figure 25: Master Control Shelf (MCS) Power Consumption with OC3T Trunk Cards

Diamond Lane Communications Corporation Proprietary Data

Line Card Shelf Power Consumption

Total CAP2 line cards	1	2	3	4	5	6	7	8	9	10	11	12
CAP2 Card Watts	11	21	32	42	53	63	74	84	95	106	116	127
LSM2 Watts	16	16	16	17	17	17	17	18	18	18	19	19
Fan Tray Watts	21	21	21	21	21	21	21	21	21	21	21	21
TOTAL WATTS	**48**	**58**	**69**	**80**	**91**	**101**	**112**	**123**	**134**	**145**	**156**	**167**

Total CAP2 line cards	13	14	15	16	17	18	19	20	21	22	23	24
CAP2 Card Watts	137	148	158	169	180	190	201	211	222	232	243	253
LSM2 Watts	19	20	20	20	20	21	21	21	21	22	22	22
Fan Tray Watts	21	21	21	21	21	21	21	21	21	21	21	21
TOTAL WATTS	**177**	**189**	**199**	**210**	**221**	**232**	**243**	**253**	**264**	**275**	**286**	**296**

Figure 26: Line Card Shelf Power Consumption with CAP2 Line Cards

Total CAP4 line cards	1	2	3	4	5	6	7	8	9	10	11	12
CAP4 Card Watts	14	28	41	55	69	83	96	110	124	138	151	165
LSM2 Watts	16	16	16	17	17	17	17	18	18	18	19	19
Fan Tray Watts	21	21	21	21	21	21	21	21	21	21	21	21
TOTAL WATTS	**51**	**65**	**78**	**93**	**107**	**121**	**134**	**149**	**163**	**177**	**191**	**205**

Total CAP4 line cards	13	14	15	16	17	18	19	20	21	22	23	24
CAP4 Card Watts	179	193	206	220	234	248	261	275	289	303	316	330
LSM2 Watts	19	20	20	20	20	21	21	21	21	22	22	22
Fan Tray Watts	21	21	21	21	21	21	21	21	21	21	21	21
TOTAL WATTS	**219**	**234**	**247**	**261**	**275**	**290**	**303**	**317**	**331**	**346**	**359**	**373**

Figure 27: Line Card Shelf Power Consumption with CAP4 Line Cards

Total DMT4 line cards	1	2	3	4	5	6	7	8	9	10	11	12
DMT4 Card Watts	20	40	60	80	100	120	140	160	180	200	220	240
LSM2 Watts	16	16	16	17	17	17	17	18	18	18	19	19
Fan Tray Watts	21	21	21	21	21	21	21	21	21	21	21	21
TOTAL WATTS	**57**	**77**	**97**	**118**	**138**	**158**	**178**	**199**	**219**	**239**	**260**	**280**

Total DMT4 line cards	13	14	15	16	17	18	19	20	21	22	23	24
DMT4 Card Watts	260	280	300	320	340	360	380	400	420	440	460	480
LSM2 Watts	19	20	20	20	20	21	21	21	21	22	22	22
Fan Tray Watts	21	21	21	21	21	21	21	21	21	21	21	21
TOTAL WATTS	**300**	**321**	**341**	**361**	**381**	**402**	**422**	**442**	**462**	**483**	**503**	**523**

Figure 28: Line Card Shelf Power Consumption with DMT4 Line Cards

Total SDSL8 line cards	1	2	3	4	5	6	7	8	9	10	11	12
SDSL8 Card Watts	16	33	49	66	82	99	115	131	148	164	181	197
LSM2 Watts	16	16	16	17	17	17	17	18	18	18	19	19
Fan Tray Watts	21	21	21	21	21	21	21	21	21	21	21	21
TOTAL WATTS	**53**	**70**	**86**	**104**	**120**	**137**	**153**	**170**	**187**	**203**	**221**	**237**

Total SDSL8 line cards	13	14	15	16	17	18	19	20	21	22	23	24
SDSL8 Card Watts	213	230	246	263	279	296	312	328	345	361	378	394
LSM2 Watts	19	20	20	20	20	21	21	21	21	22	22	22
Fan Tray Watts	21	21	21	21	21	21	21	21	21	21	21	21
TOTAL WATTS	**253**	**271**	**287**	**304**	**320**	**338**	**354**	**370**	**387**	**404**	**421**	**437**

Figure 29: Line Card Shelf Power Consumption with SDSL8 Line Cards

NOTE: SDSL8 line card tests were conducted at 1152 Kbps.

Total IDSL8 line cards	1	2	3	4	5	6	7	8	9	10	11	12
IDSL8 Card Watts	8	15	23	30	38	45	53	60	68	75	83	90
LSM2 Watts	16	16	16	17	17	17	17	18	18	18	19	19
Fan Tray Watts	21	21	21	21	21	21	21	21	21	21	21	21
TOTAL WATTS	**45**	**52**	**60**	**68**	**76**	**83**	**91**	**99**	**107**	**114**	**123**	**130**

Total IDSL8 line cards	13	14	15	16	17	18	19	20	21	22	23	24
IDSL8 Card Watts	98	105	113	120	128	135	143	150	158	165	173	180
LSM2 Watts	19	20	20	20	20	21	21	21	21	22	22	22
Fan Tray Watts	21	21	21	21	21	21	21	21	21	21	21	21
TOTAL WATTS	**138**	**146**	**154**	**161**	**169**	**177**	**185**	**192**	**200**	**208**	**216**	**223**

Figure 30: Line Card Shelf Power Consumption with IDSL8 Line Cards

Equipment Configurations

There are many possible configurations of the Speedlink Multiplexer, depending on the combination of options selected. One option is data plus voice. If data plus voice is offered, the Low Pass Filter Shelf (LPFS) must be installed between the Main Distribution Frame (MDF) and the Line Card Shelf (LCS). The LPFS can be co-located with the LCS:

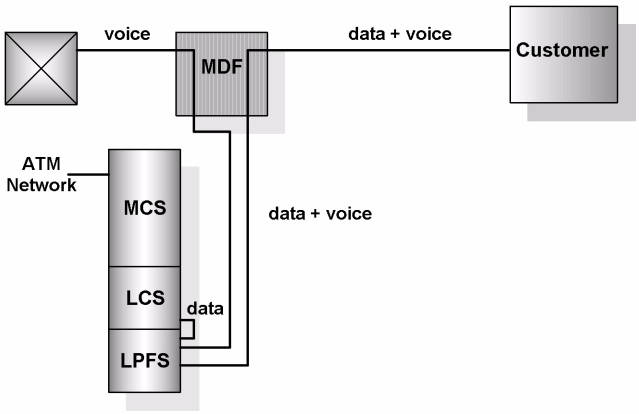

Figure 31: LPFS Co-Located With LCS

The LPFS can be co-located with the MDF:

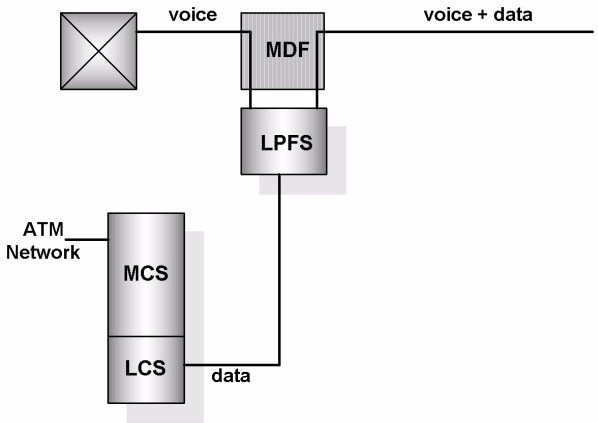

Figure 32: LPFS Co-Located With MDF

Diamond Lane Communications Corporation Proprietary Data

The LPFS can be located independently of the MDF and LCS:

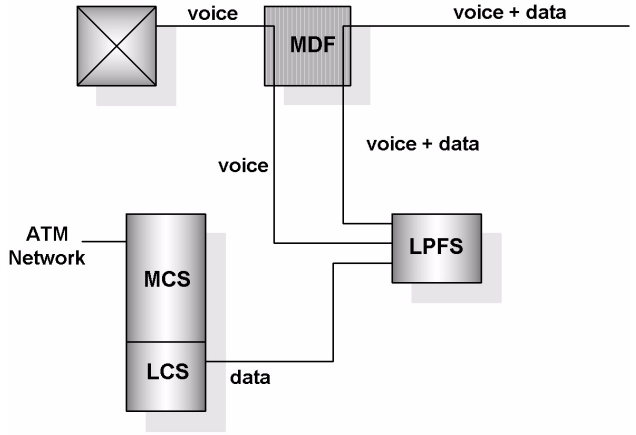

Figure 33: LPFS Located Independently from the MDF and LCS

Lengths of cables between the MDF and the LPFS, and also between the LPFS and the LCS, can affect both voice and data performance and should be minimized whenever possible. In no case should the LPFS be located more than 655 feet from the LCS.

Some telecommunications service providers may decide not to offer data plus voice. In this case the LPFS is unnecessary, because there is no voice signal carried by the loop. The Speedlink Multiplexer then consists of an MCS, one or more LCSs, and one or more optional Link IDs.

It is also valid to configure a Speedlink Multiplexer with some LCSs supporting data plus voice connections, and others supporting data only connections. Such a system would have LPFSs for the LCSs supporting data plus voice, but not for the LCSs supporting data only.

Another set of choices involves where to locate an LCS. For this release, all LCSs must be co-located with the MCS. For later releases, an LCS may be at a remote location. The remote LCS supports loops that do not conform to the Revised Resistance Design rules or contain load coils. This configuration looks like this:

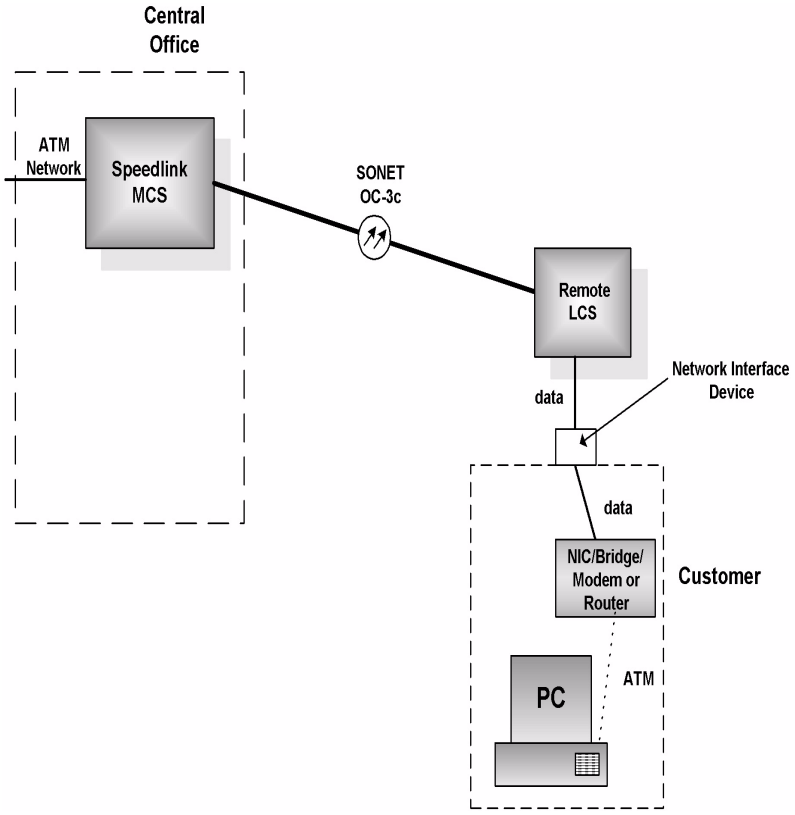

Figure 34: Remote LCS Configuration: Data Only

While the configuration on the previous page is for data only, a data plus voice version is also available using an LPFS:

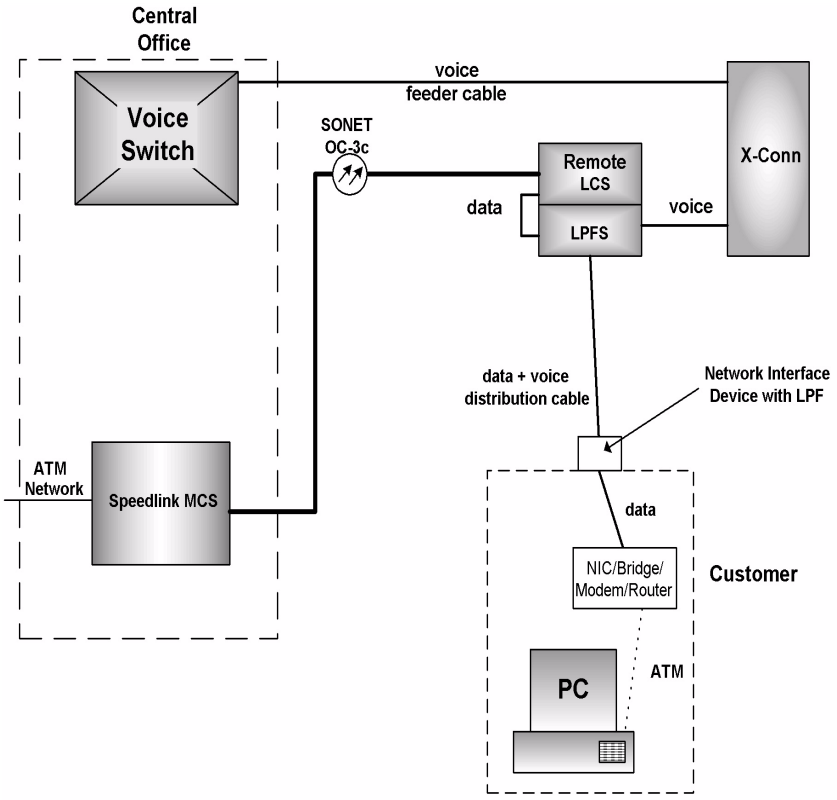

Figure 35: Remote LCS Configuration: Data plus Voice

Another configuration combines a remote LCS configuration with a digital loop carrier (DLC)[1] to provide both ADSL and voice services. In this case the Remote Line Card Shelf may be equipped with one or more DS1 cards to support the digital loop carrier DS1 trunks.

[1] Scheduled for future release.

You can also use this configuration for loops that marginally conform to the RRD rules, but because of their length, have low bit rates. By shortening the loop so that it only runs to the remote LCS co-located with the DLC remote terminal, the customer's effective bit rate increases:

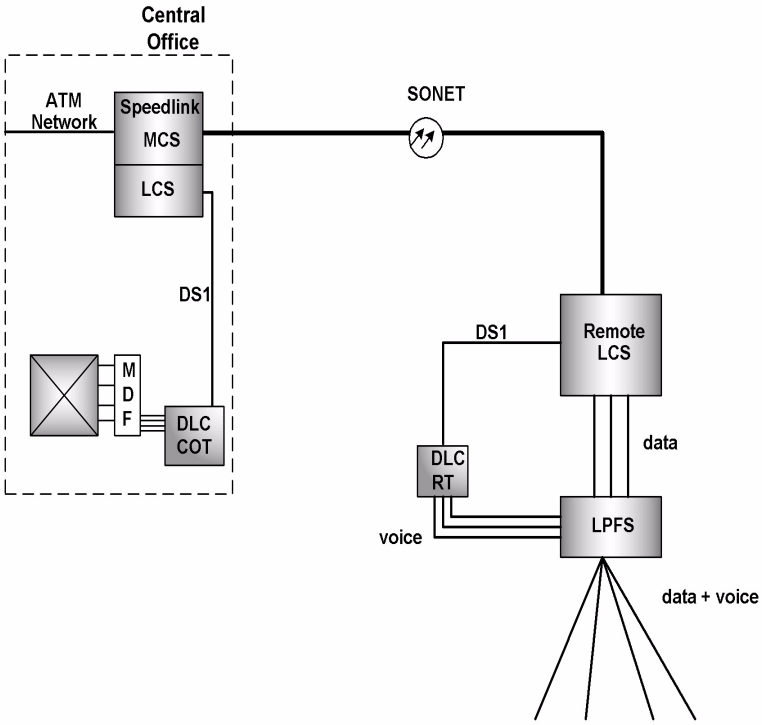

Figure 36: Remote LCS Configuration With Digital Loop Carrier

Operations Systems Standards (OSS) Conformance

The Speedlink is presently at Stage 2 of the Osmine Certification process for a TL1 gateway connection to the OSS environment.

Technical specifications:

- OMG 2.0 CORBA specifications
- Bellcore GR-833 CORE—"Network Element and Transport Surveillance Messages"
- Bellcore GR-2869 CORE General Requirements for operations based on TMN architecture

Electrical Protection Requirements

The Speedlink Multiplexer's MDF interface conforms to GR-1089, protecting the Multiplexer from 1st level lightning protection (1500V maximum). The Multiplexer also conforms to GR-1089 and UL 1459 with respect to power-cross overvoltage (600V AC maximum).

The Speedlink modem's interface to the PC conforms to GR-1089 and GR-49, protecting the modem from 2nd level lightning protection. The Speedlink's router interface to the twisted pair conforms to FCC Part 68 and UL 1459 electrical protection standards.

Traffic

The most traffic intensive application for the Speedlink System is File Transfer Protocol (FTP). Other applications, such as Web browsing, offer a much lighter load due to shorter files, or lower statistics due to human processing time.

Conservative traffic statistics assume 20% of all users FTP files upstream.

In the upstream direction, the size of the internal links (i.e., 155.52 Mbps) guarantees a single point of congestion, at the trunk card. The buffers of the MLA were sized for 20% simultaneous FTP sessions for TCP/IP segments of 1500 bytes and a window size of 8,192 bytes. The MLA has buffering for 2048 cells which is equivalent to approximately 98 kbytes, enough to store over 30% of the window.

With the double star architecture of the Speedlink, there is no congestion in the downstream direction. The LSM2 provides a minimum 1023 cell buffers per port, based on an octal line card (8191 cells per slot divided by the number of ports on the line card), to adapt the incoming 155.52 Mbps data stream to the outgoing DSL line rate.

Diamond Lane Communications Corporation Proprietary Data

Diamond Lane Communications
Glossary and Acronyms

Asymmetric Digital Subscriber Line (ADSL)

Asymmetrical data signals for Internet access that share twisted pairs with POTS and that use modern signal modulation techniques to accomplish the data communications task.

Alarm

A signal used to indicate that an abnormality, a fault, or a failure has been detected. Alarms may be distinguished by type and by the severity of the event that caused the alarm.

Alarm Indication Signal (AIS)

A downstream signal in a digital network that replaces the normal traffic signal when a maintenance alarm indication has been activated (indicating an upstream failure detection – error or alarm on the network). It is used in the OSI network management model.

ATM Adaptation Layer (AAL)

ATM Adaptation Layer is located above ATM and converts non-ATM bit streams into ATM cells. The AAL protocol supports higher-layer service requirements.

Asynchronous Transfer Mode (ATM)

A multiplexed information transfer and switching process (cell-switched technology) in which data is organized into fixed length (53 octet) cells and transmitted according to each application's requirement. ATM is generally deployed in enterprise networks, which often connect LANs over wide areas that require large amounts of data to be transported over great distances.

Auxiliary Common Systems Interface Panel (CSIP)

Each Auxiliary CSIP connects and distributes central office power to up to four Line Card Shelves (LCS). Auxiliary CSIPs are required for Speedlink Systems with over five Line Card Shelves.

Bit Error Rate (BER)

A measurement of transmission quality expressed as a ratio (ratio of error bits to the total number of bits transmitted – erroneous bits per million). The BER indicates how many bits are incorrectly transmitted in a given bit stream. The BER depends on the type and length of transmission.

CAP2

Carrierless Amplitude and Phase (CAP) ADSL line card, 2 ports per line card.

CAP4

Carrierless Amplitude and Phase (CAP) ADSL line card, 4 ports per line card.

CBR (Constant Bit Rate)

Data that are transmitted at a constant rate on an ATM network.

CELL

In general, fast packet-switching technologies—such as ATM (Asynchronous Transfer Mode). The ATM Cell has a 5-byte header and contains 48 bytes of payload.

Central Office (CO)

The Local Exchange switch that terminates individual local telephone subscriber lines for switching and connection to the public network (locally and long distance).

Common Management Information Protocol (CMIP)

An OSI network management/service interface protocol created and standardized by ISO. Based on the basic data storage concept in which management information is collected and stored for subsequent retrieval by a management application. Provides for the transmission of event notifications and the transmission of operations directed toward managed objects.

Common Systems Interface Panel (CSIP) Power and Distribution Board

The CSIP Power and Distribution Board is located in the Master Control Shelf (MCS). Central office power is terminated at the CSIP and is distributed to the Master Control Shelf and up to four Line Card Shelves.

Common Systems Interface Panel (CSIP) Alarm Board

All Speedlink alarm connections are made at the CSIP Alarm Board; central office visual, audible, remote Bay Alarm and remote input alarms. The Alarm Board has LEDs to display Speedlink alarm status.

Constant Bit Rate (CBR)

Applications or services in a digital network that are to be the same bandwidth for the duration of the call.

CPE (Customer Premise Equipment)

Refers to telephone and related equipment located on the customer's premises (office or home).

Customer Network Management (CNM)

A feature of ATM, Frame Relay and SMDS which allows customers to directly view and manage their public data service (communications networks) in the same way they view and manage their local area networks.

Digital Loop Carrier (DLC)

Network transmission equipment used to provide a pair gain function. DLC equipment is deployed in situations in which the cost of the equipment is more than offset by the savings in copper distribution accomplished by eliminating need for as many copper pairs. Digital loop carrier systems consist of two parts—a Central Office Terminal (COT) and a Remote Terminal. The COT provides the multiplexing/demultiplexing function of individual voice signals to the composite multiplexed signal at the interface between the switching equipment and the DLC. The Remote Terminal provides the multiplexing/demultiplexing function at the interface between the individual subscriber pairs and the DLC equipment.

DiamondCraft™

DiamondCraft is the Speedlink's stand-alone craft interface application. It communicates directly with a Speedlink through a serial port connection using Point-to Point Protocol (PPP).

DiamondView™

DiamondView is the Speedlink's Element Management System (EMS). It is a HP Open View® application and operates on a UNIX workstation.

DS1 (Digital Signal Level One)

1.544 Mb/s digital signal.

DS3 (Digital Signal Level Three)

44.736 Mb/s digital signal – equivalent of 28 T-1 channels (also referred to as T-3).

DS3T

The DS3 trunk card provides the interface between ATM backbone facility and the Speedlink. It multiplexes and de-multiplexes up to 12 broadband ATM cell streams from the MLA cards and sends this “payload” out over the ATM network. The Speedlink has two DS3T cards in a 1:1 protection group.

DSLAM (Digital Subscriber Line Access Multiplexer)

An ATM access mux/concentrator that grooms traffic from multiple low rate lines into a high rate trunk (DS1, DS3, OC3, OC12).

Egress

Outgoing direction to a network or network device, as opposed to the ingress (or entrance).

Element Management Systems (EMS)

Software used to manage and monitor components of a telecommunication system at the lower levels of the Telecommunications Management Network.

Graphical User Interface (GUI)

A generic name for the computer interface that substitutes graphics for characters. The GUI permits users to directly manipulate graphical objects displayed on the monitor.

HDSL (High bit rate Digital Subscriber Line)

HDSL provides a DS1 on two copper wire pairs (without the loop engineering and repeaters required for a standard T1 system).

HEC (Header Error Control)

An 8-bit field (the last byte) of the ATM-cell header, whose purpose is to allow a receiver to detect, and possibly correct, transmission errors in the cell header. It is used for checking integrity only.

IEEE (Institute of Electrical and Electronics Engineers)

An international engineering organization that defines standards related to networking and other areas.

IETF (Internet Engineering Task Force)

One of two technical engineering bodies of the Internet Architecture Board. The IETF is responsible for solving short-term engineering needs and standards of the Internet.

Ingress

Incoming direction to a network or network device, as opposed to the egress (or exit).

IP (Internet Protocol)

A component of the TCP/IP protocol suite. IP operates at the Layer 3 of the OSI Reference model.

ISO (International Standards Organization)

The International Standards Organization is an international organization founded in 1946 to facilitate the development of international data communication standards.

ITU (International Telecommunications Union)

An organization established by the United Nations. The ITU sets telecommunications standards and allocates frequencies to various uses worldwide.

LAN (Local Area Network)

A privately owned and administered network for data communications, usually within a building or campus environment, used to connect computers and peripheral devices. Communication is typically accomplished by broadcasting on a connectionless basis over a shared medium.

Line Card

A line card serves as the interface between a line and a communications device.

Line Card Shelf (LCS)

The Speedlink System is made up of one Master Control Shelf and up to twelve Line Card Shelves. Each LCS has 24 mounting slots for line cards, a Line Card Shelf Multiplexer (LSM or LSM2) card, and an optional LSM or LSM2 card for Remote Line Card Shelf protection group application.

Line Card Shelf Multiplexer (LSM or LSM2) card

The LSM or LSM2 card communicates with the Master Line Card Adapter (MLA) card over multi-mode optical cable at OC-3 rates. The LSM or LSM2 multiplexes and demultiplexes ATM cell streams for up to 24 line cards in a Line Card Shelf.

Low Pass Filter Shelf (LPFS)

Data plus voice frequency signals are received from the customer at the Low Pass Filter Shelf. the LPF card “splits” the low frequency voice signal from the high frequency ADSL signal. The voice signal is sent onto the voice switch unimpeded; while data signal is received by the CAP2 line card.

LOF (Loss of Frame)

A condition that can occur in digital transmissions when the receiving equipment loses frame alignment data (used to determine channel assignments and channel boundaries).

LPF2

Low Pass Filter card, 2 ports per card.

LPF4

Low Pass Filter card, 4 ports per card.

Master Control Shelf (MCS)

The MCS contains the central control and communication functions for the Speedlink System and serves as the ATM network interface.

Master Control Processor (MCP) card

The MCP card is the central control and communications for the Speedlink, it stores program and provisioning database information. The Speedlink has two MCP cards in a 1:1 protection group.

Master Line Card Adapter (MLA) card

Each MLA card provides the broadband interface to one Line Card Shelf at OC-3 rates over optical fiber. There are up to twelve MLA cards in a Master Control Shelf providing the broadband interface for up to twelve Line Card Shelves and up to 288 line cards.

Management Information Base (MIB)

The MIB contains all the provisioning information for the Speedlink Multiplexer. (The MIB contains data available to a network management program. The network manager queries the MIB.)

Multiplexer

Equipment that aggregates two or more channels onto a single transmission channel.

NEBS (Network Equipment Building System)

NEBS is the Network Equipment Building System specification authored by Bellcore. NEBS compliance is required by many carrier customers; the Speedlink System shipping today is already NEBS-compliant.

NIC (Network Interface Card)

An electronic circuitry board that usually fits into an expansion slot of a PC whose purpose is to connect to a Local Area Network. A NIC is designed to comply with both a specific LAN Medium Access Control procedure (CSMA/CD for Ethernet) and a specific physical medium (e.g. twisted pair wire, coax, or multi-mode fiber). Associated with the NIC is a unique address called the MAC address. It works with the network software and computer operating system to transmit and receive messages on the network.

NID (Network Interface Device)

The Diamond Lane NID ADSL Splitter divides the ADSL and POTS signals and works in conjunction with the router at the subscriber end. The splitter installs on the outside of a home or building, and is enclosed in a weatherproof wall mount enclosure. It features primary lighting and AC power fault protection, and is a passive device, requiring no power or management from the central office or subscriber.

Network Management Processor (NMP) card

The NMP card controls the Speedlink's network management interfaces and provides the protocol support for communication for DiamondView and DiamondCraft.

OC-1 (Optical Carrier Level-1)

A SONET line rate of 51.840 Mb/s. Direct electrical-to-optical mapping of the STS signal with frame synchronous scrambling.

OC-3 (Optical Carrier Level-3)

A SONET line rate of 155.520 Mb/s. 3 x OC-1. Direct electrical-to-optical mapping of the STS signal with frame synchronous scrambling.

OC-12

Sonet channel of 622.08 Mbps.

OSI (Open System Interconnection Reference Model)

An internationally accepted set of standards for communication between various systems manufactured by different vendors. The OSI Reference Model is a seven-layer model developed by the ISO (International Standardization Organization) to describe how to connect any combination of devices to communicate.

PCI (Peripheral Component Interconnect)

Bus of an Intel PC. PCI transfers data between the PC's main microprocessor and peripherals at up to 132Mbps.

PCR (Peak Cell Rate)

PDR (Protocol Data Unit)

In data communication protocols, a unit of data created by a given protocol layer at one place and logically transferred to the same layer at another place called a peer. This is the OSI terminology for "packet".

PLCP (Physical Layer Convergence Protocol)

The part of the physical layer that adapts the transmission facility to handle DQDB functions as defined in IEEE 802.6-1990.

POP (Point-of-Presence)

The physical place within a LATA (the long distance carrier's local office) where the IEC provides services to the LEC, and perhaps directly to end-users.

POTS (Plain Old Telephone Service)

A term used to describe analog, voice-only basic telephone service. All POTS lines work on loop start signaling.

PPP (Point-to-Point Protocol)

A layer 2 protocol (relative to the OSI reference model) that allows a computer to use TCP/IP with a standard telephone line and a high-speed modem.

PVC (Permanent Virtual Circuit)

A permanent association between two DTEs established by configuration (established administratively via a service order process). A PVC uses a fixed logical channel to maintain a connection between the DTEs. After a PVC is defined, it requires no setup operation before data is sent and no disconnect operation after. The concept of a PVC is included in Networks supporting X.25, Frame Relay and ATM.

QoS (Quality of Service)

In ATM networks, a set of parameters for describing a transmission. These parameters include values such as allowable cell loss. The parameters apply to virtual channel connections and virtual path connections.

Remote Line Card Shelf (RLCS)

A RLCS allows customers served off of long loops — beyond 18,000 ft from the central office — access to xDSL service. The RLCS is located remotely from the central office in an outside cabinet and connected to the central office Master Control Shelf via fiber optic extensions.

Remote Low Pass Filter (RLPF)

The RLPF is a remote passive low pass filter "splitter" device. It splits the high frequency ADSL data signal from the voice signal at the customer end just like the Low Pass Filter card in the central office. There are two types of RLPF – a retrofit RLPF available a standard Network Interface Device housing and a standalone RLPF.

RFC (Request for Comments)

In the Internet community, a series of documents that contain protocol and model descriptions, experimental results, and reviews. All Internet standard protocols are written up as RFCs.

SDSL (Symmetric Digital Subscriber Line)

Also referred to as Single-Line Digital Subscriber Line, SDSL supports symmetrical T1/E1 transmissions. It uses a single copper-pair wire and has a maximum operating range of 10,000 feet. It is capable of accommodating applications that require identical downstream and upstream speeds, such as video conferencing.

Serial Port

A hardware input/output port in which only one pin is available for data transmission in a given direction – bits are transmitted in sequence (one bit at a time). The wiring for a port is associated with a particular physical interface (i.e., RS-232). A serial port is most commonly used for a modem or a mouse.

Service Provider

A service provider is an organization or individual that provides telephone access to a network or to another service, such as the Internet.

SNMP (Simple Network Management Protocol)

The network management protocol used within TCP/IP-based internets. Defines the protocol for managers (clients) to communicate with agents (servers). The agent interfaces directly with the networking layers on the monitored network device to obtain the network management information. An agent is installed on every network device that will be managed or monitored. A client is a application program that is installed at the network operations center. It communicates with the SNMP agents to collect information in the form of MIB variables. SNMP is a request/reply protocol that uses the operations of Set or Get on data items in a agents MIB.

SNR (Signal-to-Noise Ratio)

In a transmission, SNR is the ratio between the signal and noise levels at a given point, usually at the receiving end of the transmission. The SNR value is generally expressed

in decibels (dB). The SNR can be used to determine how long a cable segment can before the signal loss is unacceptably high. The SNR also helps determine whether a particular type of cable is appropriate for the intended use.

SOHO (Small Office – Home Office)

SONET (Synchronous Optical NETwork)

SONET is a high-speed, fiber-optic system, which provides an interface and mechanism for optical transmission of digital information. At the interface, signals are converted from electrical to optical form (and back to electrical form at the destination). SONET is an ANSI standard. Transmission rates range from 51.84Mbps to 13.22Gbps.

Speedlink Multiplexer

The Speedlink Multiplexer is classified as a Digital Subscriber Line Access Multiplexer (DSLAM). The Speedlink Multiplexer uses Digital Subscriber Line (xDSL) and Asynchronous Transfer Mode (ATM) technologies to deliver high speed data rates over the exiting copper network.

SVC (Switched Virtual Circuit)

A virtual connection set up on demand via a signaling protocol connection that is established for a communications session that is terminated after the session is over. This is in contrast to a permanent virtual circuit (PVC), which is a connection that is always established.

T1

DS1 rate electrical signal (two pair). T1 is suited for voice, data and image transmissions. T1 has a bandwidth of 1.544 megabits per second (Mbps), which comes from two dozen 64 kilobit per second (Kbps) channels, together with one 8Kbps framing channel.

TCP/IP (Transmission Control Protocol / Internet Protocol)

TCP/IP is a suite of several networking protocols developed for use on the Internet.

Telnet

Telnet is the terminal-remote host protocol developed for ARPAnet in 1974. On the Internet, it is a service program that allows you to connect to other computers at another site permitting you to interact with applications as if by a local terminal.

Trap

A method used to isolate an abnormal condition or operation.

TMN (Telecommunications Management Network)

A concept where all Operation and Maintenance Centers are linked together to form a network.

UBR (Unspecified Bit Rate)

In ATM networks, a UBR connection transmits at variable rates.

UNI (User-to-Network Interface)

In ATM networks, one of three levels of interface. A UNI specification which defines Layer 1 and Layer 2 protocols required for CPE and carrier equipment to interoperate. UNI specifications provide physical media and line rate implementation options.

VBR (Variable Bit Rate)

In ATM networks, a VBR connection transmits in bursts, at variable speeds.

VDSL (Very-high-speed Digital Subscriber Line)

VDSL provides DSL service at a data rate in excess of 10Mbps (up to 52Mbps). VDSL has a maximum operating range from 1,000 feet to 4,500 feet on 24-gauge wire.

VPI (Virtual Path Identifier)

An identifier (value) in an ATM cell that identifies the data of one Virtual Path connection from the data of another connection.

WAN (Wide Area Network)

A WAN is a network of computers and related communications equipment whose elements may be in dispersed sites with distances great enough to require common carrier provided communication lines.

xDSL (all forms of Digital Subscriber Lines)

The “x” represents the various types of digital subscriber lines: ADSL, RADSL, SDSL, HDSL, or VDSL.

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