



Passport 4400

Release 3.1

Introduction

Part Number 800-1982-31, Rev. A

February 1999

Notice of Filing

Declaration of CE Conformance (for International sales)

A Declaration of CE Conformance is on file at the Nortel addresses shown below. The declaration lists the models described in this manual. If the unit carries the CE mark, this declaration certifies that it meets the specific EMC standards and safety (LVD) standards required for CE marking. If the product is a module, the module is CE-compliant only if it is placed in a CE-marked base unit.

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Any units not carrying the CE approval are not CE-compliant. Modules placed in these units may not meet emission standards for CE compliance.

Notice

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About this Document

The Passport 4400 Introduction and Road Map Manual is designed to assist the user in the understanding of the Passport 4400 and provide a road map for accessing pertinent reference materials. Included in this manual are descriptions of the Passport 4400 concepts and applications, model numbers, optional modules, and a matrix correlating Passport 4400 descriptive and operational information with the technical documentation which contains it. The appendixes contain a master table of contents and a master index, providing a road map to the topics covered in all the Passport 4400 manuals. The Glossary contains a list of terms pertinent to the Passport 4400 and its networking environment.

The following sections and their topics are contained in this manual:

- Section 1 - Concepts and Applications
- Section 2 - Ordering Codes
- Section 3 - Optional Modules
- Section 4 - Road Map to the Product Documentation
- Appendix A - Master Table of Contents
- Appendix B - Master Index
- Glossary - Glossary of Terms

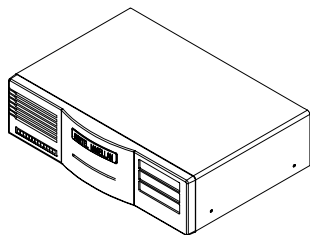
Passport 4400 Series

The Passport 4400 series of multiservice access devices combines voice, fax, video, IP and legacy data traffic over a choice of link options providing cost-effective and easily managed networking solutions.

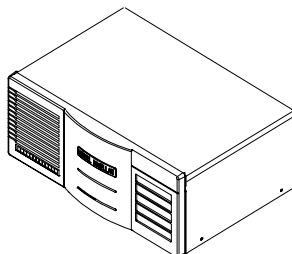
The Passport 4400 consists of the following base units:

- Model 4430 AC Base System
- Model 4450 160W AC Base System
- Model 4450 200W AC Base System
- Model 4450 160W DC Base System
- Model 4450 200W DC Base System
- Model 4455 160W AC Base System (with 68060 processor)
- Model 4455 200W AC Base System (with 68060 processor)

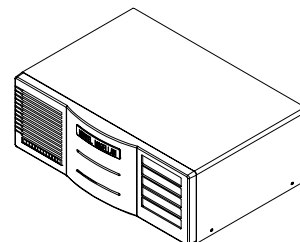
All base units include the chassis, power supply, fan unit, and Ethernet Base Module. Refer to Section 2, Ordering Codes, for a complete list of model numbers.



Model 4430



Model 4450 and 4455
(200W Power Supply Unit)



Model 4450 and 4455
(160W Power Supply Unit)

Concepts and Applications

1

This section discusses the key benefits and applications of the Passport 4400 in the areas listed below. (Special topics of interest that are included in the subsections, are parenthetically noted.)

- Product Concept
- Bandwidth Management
- Voice Networks (NAS and NAC)
- IP/IPX Networks (RFC 1490 Direct Connect)
- Video Networks
- Legacy Data Networks
- WANs Services (PANL, SVCs and Backup Services)
- Scalability
- Cascaded Networks
- User Core Router
- Integrated Passport 4400/6400 Networks
- Installation and Service (InstallTool)
- Traffic Management
- Standards-Based Interoperability

Product Concept

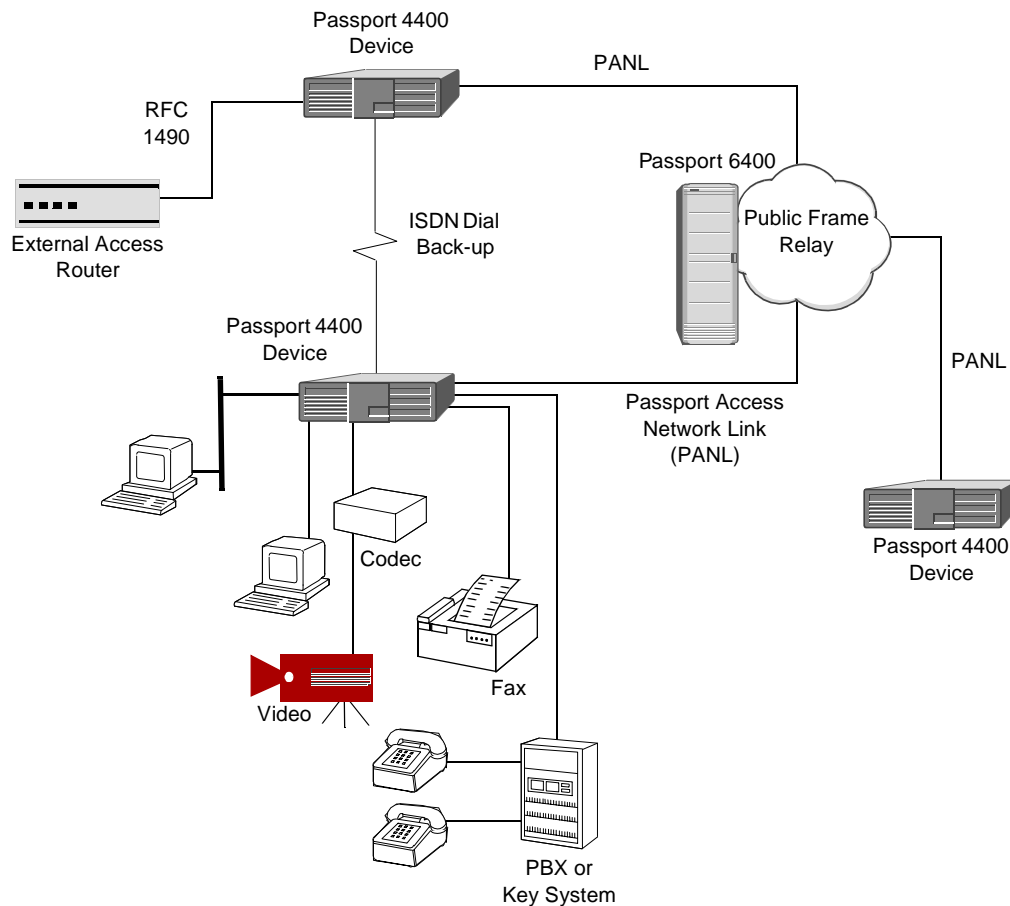
The Passport 4400 integrates voice, fax, video and data traffic over a single WAN connection, eliminating the need for separate, parallel branch network equipment and links.

Advanced bandwidth and voice technologies optimize bandwidth usage for maximum throughput and voice quality.

Data is transmitted from different WAN sources using a unique frame relay-based network link protocol, the Passport Access Network Link (PANL). PANL fragments long frames when voice frames need to be inserted. This reduces both delay and delay variation. PANL then reassembles frames at the other end of the link. The result is reduced WAN overhead and optional handling of voice traffic.

PANL can link the Passport 4400 to another Passport 4400 or to the Passport 6400. In addition to PANL connections, the Passport 4400 can connect to third party routers using frame relay PVCs and the RFC 1490 encapsulation standard.

Network connections can be leased line or over a Public Frame Relay network. And, the Passport 4400 protects its connections with a variety of backup services.



The Passport 4400 Product Concept

Bandwidth Management

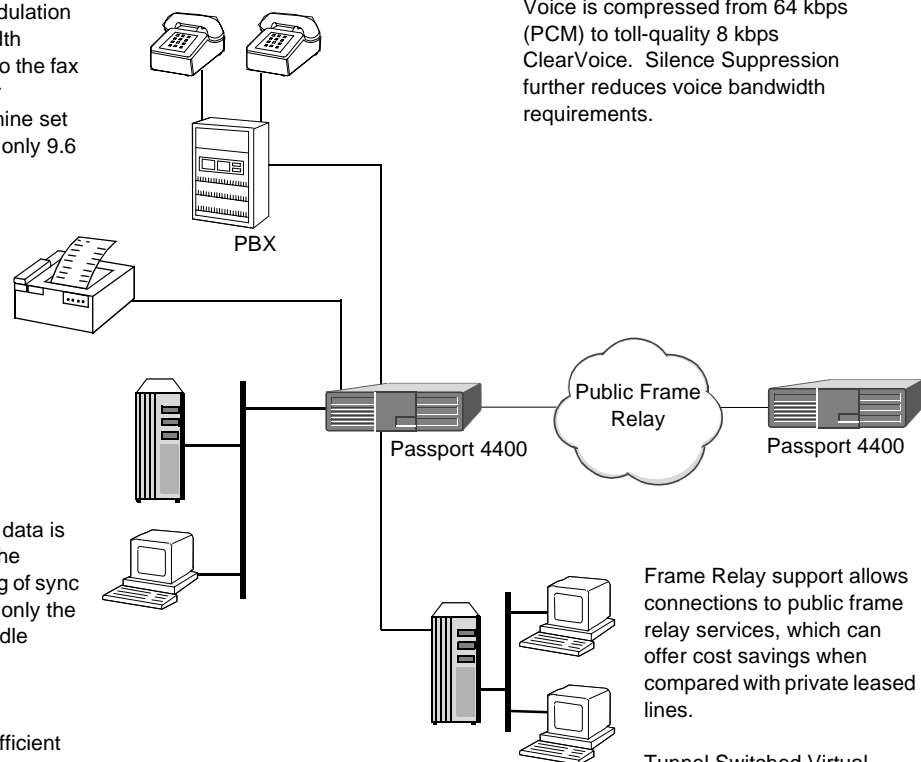
The Passport 4400 utilizes ClearVoice, silence suppression and fax demodulation technologies to reduce voice/fax bandwidth requirements as much as 96 percent, while delivering toll-quality voice. With both analog and digital voice/fax offerings, the Passport 4400 delivers efficient integration networking on WAN links ranging from 9.6 kbps to 1.544/2.048 Mbps.

Automatic fax demodulation reduces fax bandwidth requirements down to the fax machine setting. For example, a fax machine set at 9.6 kbps requires only 9.6 kbps of bandwidth.

Voice is compressed from 64 kbps (PCM) to toll-quality 8 kbps ClearVoice. Silence Suppression further reduces voice bandwidth requirements.

Synchronous (sync) data is passed by sensing the beginning and ending of sync frames and sending only the frame itself, not the idle characters.

Dynamic Bandwidth Allocation enables efficient use of bandwidth.



Bandwidth Management Technologies

Bandwidth Management Features

Feature	Description	Benefits
Voice Compression	Delivers toll-quality voice at 8 kbps, based on the ITU G.729 CS-ACELP voice compression standard.	Frees up bandwidth for other types of traffic. Toll quality voice. Voice interfaces have been proven worldwide in over 200 country-specific environments.
Silence Suppression	Allocates bandwidth only when a speaker is talking. During silent periods (40-60% of the time), bandwidth is dynamically allocated to other voice, fax or data channels.	Virtually cuts in half the amount of bandwidth used for voice conversations, for more efficient use of available bandwidth.
Bandwidth Optimization	Voice/data prioritization on network link.	Ensures application quality, with low delay for voice and consistent service for mission-critical data.
Dynamic Bandwidth Allocation	A channel gets bandwidth only at the precise instant of activity. Whenever a channel is idle, bandwidth is available for other channels.	Provides efficient use of bandwidth, unlike methods such as Time Division Multiplexing (TDM) which reserve bandwidth whether or not there's activity. End-to-end Switched Virtual Circuit (SVCs) avoids tandem transit bandwidth.
Tunneling Switched Virtual Circuits (SVCs) within a single PVC	All SVCs are tunneled within a single PVC on a public FR network. Each SVC can be assigned a different class of service and priority.	Reduces the number of frame relay PVCs purchased from a carrier.

PANL Termination on the Passport 6400	Access integration products like the passport 4400 fragment large data frames to provide QoS for delay-sensitive services like voice.	More efficient use of bandwidth in large networks.
Automatic Fax Demodulation	<p>Automatically detects fax signals.</p> <p>Converts analog fax data back to original digital form, requiring 9.6 kbps or less in one direction to send a fax.</p>	<p>Allows for more efficient use of available bandwidth. Fax signals cannot be compressed, but demodulating saves bandwidth from the 64 kbps standard transmission rate.</p> <p>Supports connection of virtually any fax machine. Fax demodulation has been proven worldwide in over 200 country-specific environments.</p>

Voice Networks

The Passport 4400 provides simple, cost-effective voice networking with the following key features.

- Users dial a directory number to establish a call. The end-user or customer directory numbers do not need to be changed upon installing a Passport 4400 network.
- Switched voice services means improved scalability. Calls are handled on an end-to-end, single-logical-hop basis, with only a single compression-decompression cycle to ensure the highest voice quality.

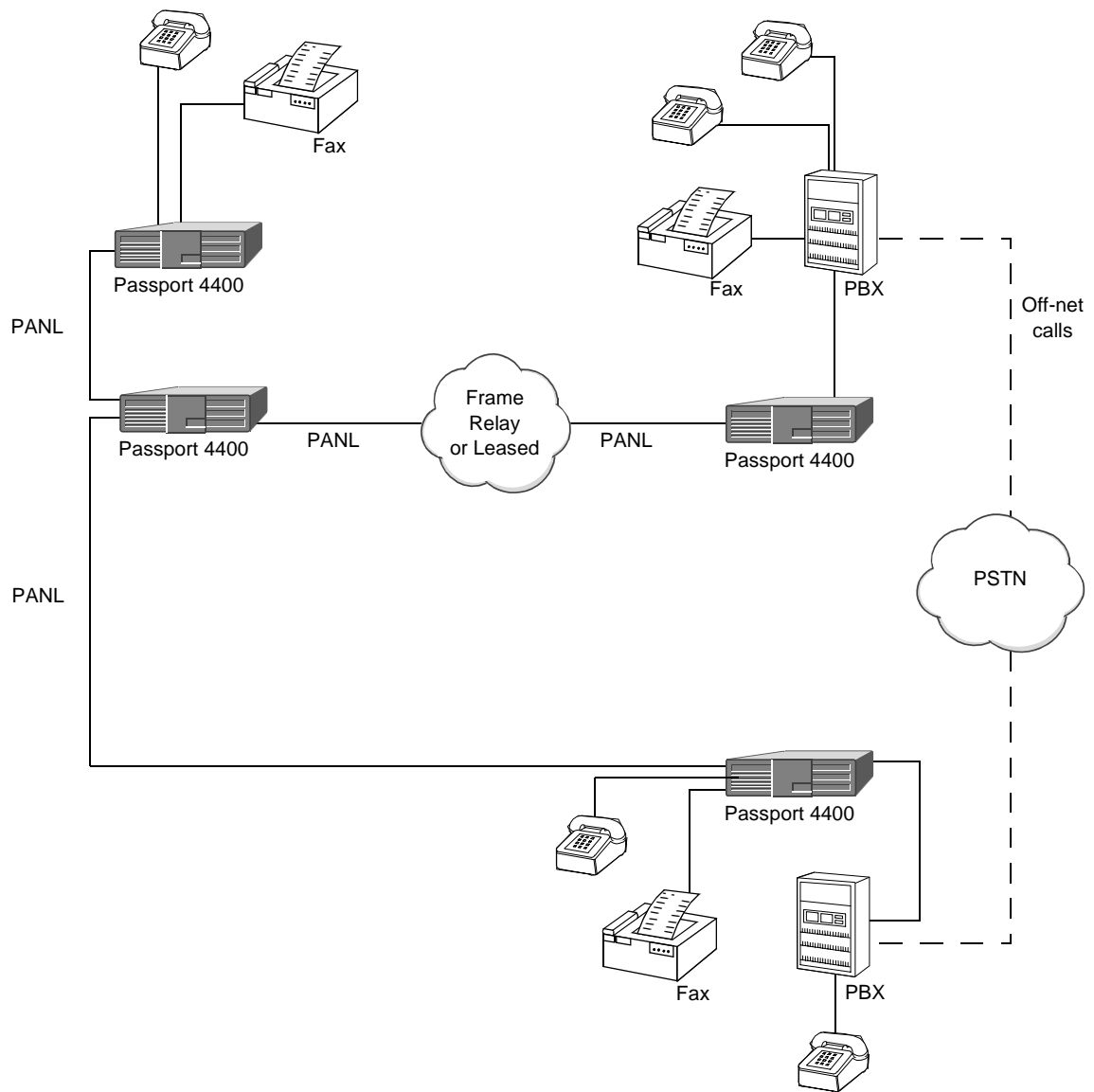
Voice/Fax Features

Feature	Description	Benefits
Integrated Networking	Permits voice and fax traffic to be integrated with video and data traffic.	Eliminates monthly phone/fax toll charges.
ClearVoice Voice Compression	<p>Delivers toll-quality voice at 8kbps, virtually indistinguishable from uncompressed voice.</p> <p>ClearVoice uses the ITU G.729 CS-ACELP voice compression standard, optimized based on years of Nortel telephony service.</p>	<p>Customers reap the economic benefits of integration without compromising voice quality.</p> <p>Frees up bandwidth for other types of traffic while providing toll-quality voice.</p> <p>Voice interfaces have been proven worldwide in more than 200 country-specific environments.</p>

Feature (cont'd)	Description (cont'd)	Benefits (cont'd)
Echo Celler Enable/Disable Option	Disables internal echo canceller when a more robust system is used externally, e.g., longer echo path.	Improves voice quality in off-net conference bridge applications where echo cancellation already exists.
Voice/Fax Switching	Allows user to call/fax any user on the Passport 4400 network. Allows voice/fax calls to be routed by Passport 4400 equipment directly.	Maintains voice quality, since a PBX is not required for tandem switching which would introduce voice delay.
Industry-standard analog (E&M, FXS, FXO) and digital voice/fax interface options	Supports connections to a wide variety of phone and fax equipment, including telephones, fax machines and analog and digital PBXs.	Enables connectivity to most common phones, fax machines, analog/digital PBXs, and key telephone systems.
ISDN Basic Rate Interface (BRI) option with Q.SIG protocol support.	Provides S/T electrical connection with both NT (PBX trunk or ISDN telephone) and TE (PBX station or PSTN line) modes. Supports ETSI Q.SIG common channel signaling protocol. Overlap dialing is also supported. Uses Nortel Networks' G.729-based ClearVoice technology.	Provides ISDN BRI connectivity to digital PBXs for locations requiring few voice ports (in increments of 2). Support of the industry-standard Q.SIG protocol enables support of advanced PBX features such as calling the ID display and call forwarding across a Passport network.
Autocall	Configurable option that permits a user to be connected automatically to a specific destination whenever their phone goes off-hook.	Simplifies calling, since no numbers must be dialed. Limits calling destinations when needed for cost/security reasons. Used to support auto-ringdown (ARD) applications used in Financial Trader / Brokerage Houses.
Country-Specific Phone Characteristics	Busy, dial and ringing tones are designed to sound <i>native</i> to the specific country.	Greater user acceptance, since tones sound <i>natural</i> .

Feature (cont'd)	Description (cont'd)	Benefits (cont'd)
Configurable Jitter Buffer	Compensates for variable WAN link delay characteristics by changing the amount of time data is queued in the output portion of the voice port. This function directly increases or decreases the one-way propagation delay in the voice path. If set below 16 ms, it reduces the tail length of the echo canceller.	Improves voice quality in frame relay networks, particularly those with multiple links, which may have voice breakup due to public network congestion.
Analog Wink Start	Wink Start is a Trunk protocol used in Electronic Switching Networks of PBXs. The PBX collects full dialing information and then makes a routing choice (least-cost routing). It waits for acknowledgment (wink) from the next switching unit before sending the dialing information. This is the most common PBX tie trunk protocol.	The Wink Start protocol simplifies corporate dialing plans and supports Dual Tone Multi-Frequency (DTMF) dialing on tie trunks on products such as Nortel Networks' Norstar or AT&T Legend Hybrid Key Telephone systems.
Transparent Common Channel Signaling (CCS) support	Transparently passes "D-channel" signaling and force connects voice channels.	Enables all CCS signaling formats to be supported. Enables any digital PBX to pass advanced call features to other PBXs.
Hunt Groups	Allows more than one voice port to be assigned the same extension number. Multiple hunt groups may be defined.	Simplifies the calling procedure by allowing a user to dial an extension number and automatically get connected to the first available voice port. Without hunt groups, the user would have to hang up and dial another extension number, if the first number was busy.
Voice/Fax Contention	Allows multiple originating voice/fax channels to contend for connection to a smaller number of receiving channels.	Reduces equipment and networking costs at central sites, since a dedicated voice/fax channel is not required to handle each originating channel.

Feature (cont'd)	Description (cont'd)	Benefits (cont'd)
Hoot and Holler	An always-up voice connection method used in financial trader/brokerage firms. Hoot and Holler lines are not switched, and are always off-hook.	Enables use of the Passport 4400 in financial trader/brokerage applications.
Auto-Learning Directory Server (NAC/NAS)	<p>Dynamically adds, deletes and changes telephone numbers.</p> <p>Contains a centralized database of all telephone numbers in the network.</p> <p>Multiple servers may exist in the network.</p> <p>In a large network with both 4400 and 6400, NAC/NAS is not used. Instead, Passport 6400 Voice Networking Call Server (VNCS) provides equivalent functionality.</p>	<p>Simplifies operations, administration and maintenance.</p> <p>Provides added reliability.</p>
Voice Switching	<p>Voice calls can be placed between any two sites over the Passport 4400 network. Users dial the telephone number which the Passport 4400 translates into a switched call across the network using network addresses.</p> <p>Seamless connectivity with Passport 4400-attached PBX stations is provided, but call routing is handled without any need to transit through a tandem PBX.</p>	<p>The telephone numbering plan of the network does not need to be changed when implementing a Passport 4400-based solution.</p> <p>Eliminates the need for dedicated voice channels at the branch and the host site, reducing the number of voice channels required and thus reducing costs.</p> <p>Eliminates the need for tandem PBX equipment. Improves voice quality by eliminating the need for decompress and recompress at each tandem PBX.</p>



Voice/Fax Application

Auto-learning Directory Server

The Data Network Address (DNA)

Individual Passport 4400 units are identified by their Data Network Address (DNA). The DNA is assigned to each passport 4400 as a unique number, from one to 15 digits in length. The DNA is then used to map services from one Passport 4400 to another.

When networking between a Passport 4400 and a Passport 6400 switch, the DNAs used for the Passport 4400s can be matched to the numbering currently being used by the Passport 6400 network, following either standard x121 or e164 formats.

The Network Address Server (NAS)

The passport 4400 Network Address Server (NAS) is a UDP/IP-based server used to resolve the telephone number (DN) to Passport 4400 address (DNA) mapping in the Passport 4400 network. Its database contains all of the DNs in the network. Multiple NASs may exist in a network, for the purpose of reliability, scalability, and redundancy.

The voice call is via an SVC directly between the originating Passport 4400 and the destination Passport 4400. Once the destination address has been resolved, the NAS and NAC no longer participate in the call.

The NAS

- Resolves DN-DNA mappings using UDP/IP based protocol
- Dynamically populates the database with telephone numbers (DNs) as they are added, deleted, or changed. This happens at the time a new Passport 4400 is brought into the network and periodically once the Passport 4400 is operational in the network.
- Dynamically removes "old" entries in the database
- Has a keep-alive protocol between the client and server
- Uses standard transport and network level protocols (TCP, UDP/IP)
- Is SNMP-managed

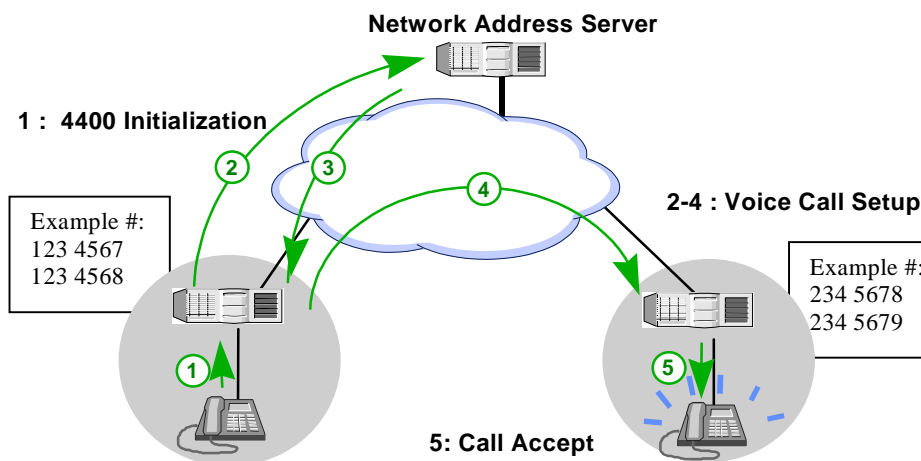
The Network Address Client (NAC)

The Network Address Client (NAC) is resident on each Passport 4400 to resolve DN-DNA requests. The NAC acts as a UDP/IP-based client with the ability to locally cache the DN-DNA address mapping.

The NAC

- Receives egress table information from the voice application, and registers the local DNs to known NASs in the network.

- Relays DN-DNA requests, if not in its local cache, to the NAS. After receiving the information from the NAS, it populates local cache with the DN-DNA address mapping.

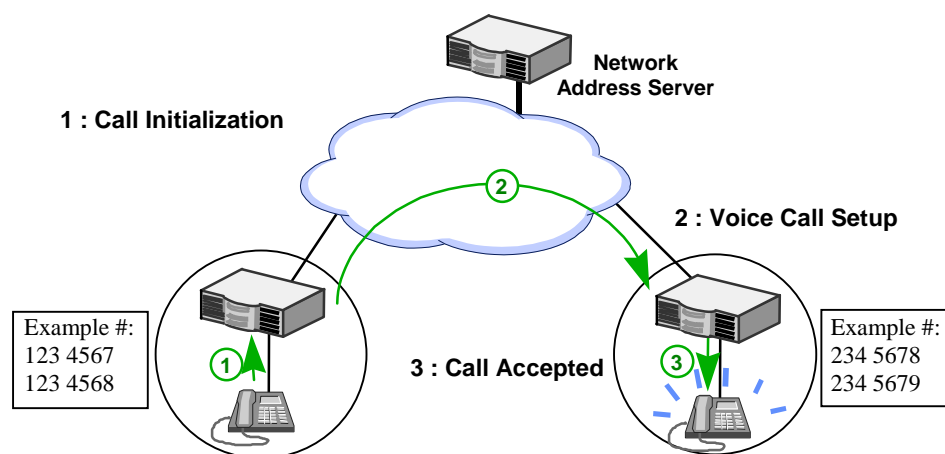


Voice Call Setup Using NAS

Note: In a large network with both Passport 4400s and 6400s, NAC/NAS is not used. The Passport 6400 Voice Networking Call Server (VNCS) provides equivalent functionality.

NAC Cache

Every Passport 4400 maintains a local cache of DN-DNA mapping of the last dialed telephone numbers. The local cache can be provisioned with up to 100 static entries of frequently dialed numbers. The purpose of the cache is to minimize the need for a Passport 4400 to interact with the NAS or VNCS, saving WAN bandwidth. When required to place an outgoing call, the Passport 4400 consults its local cache to obtain the DNA of the destination Passport 4400. If it fails to resolve the mapping with its local cache, it contacts the NAS or VNCS. This process also considerably reduces the number of requests to the NAS or VNCS.



Voice Call Setup Without NAS or VNCS

Note that the local cache has an upper bound on its size.

- The entries in the local cache will not get "aged-out".
- An entry will be removed if the Passport 4400 finds the destination Passport 4400 unreachable. A destination is considered to be unreachable, and the DNA non-existent, when a call fails to connect.
- If the local cache becomes full, room for a new entry is created through the removal of the oldest entry or the least used entry. Note that whenever an entry from the local cache is used to resolve matching, its time is updated.

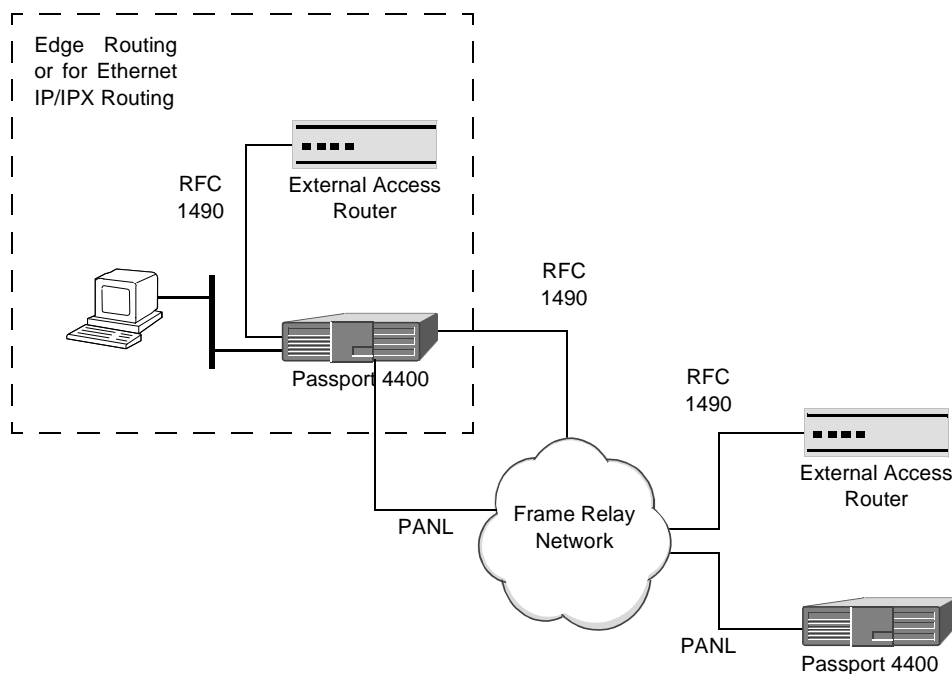
IP/IPX Networks

Integral routing allows for complete IP and IPX services between branch and central sites as well as to the public Internet services. Full support for IP and IPX routing and bridging for non-IP/IPX protocols allows quick and easy deployment of networking applications. Additionally, Nortel Networks' intelligent routing technology ensures efficient use of WAN bandwidth.

IP/IPX Features

Feature	Description	Benefits
Flexible IP routing Capability	Offers robust, feature-rich IP routing capabilities.	Fully compliant with IP standards to interwork with third-party products.
Intelligent multi-site transparent bridging	Allows bridging in point-to-point and star topologies.	Supports all LAN networking protocols.
RIPv2	Incorporates the latest RIP standard supporting Variable Length Subnet Masks (VLSM) and the Classless Inter-Domain Routing (CIDR) addressing scheme.	Offers broad network design possibilities.
Internet connectivity	Passport 4400s can interwork with other routers using frame relay PVCs and the RFC 1490 encapsulation standard.	Allows the network to connect to the Internet over public frame relay.
Integral routing capabilities	Routing function is performed by base product.	No additional modules or external routers are required.
ARP spoofing	Prevents ARP Broadcast Storms from traversing the WAN in applications where TCP/IP packets are bridged.	Reduces the amount of traffic forwarded across the WAN, saving bandwidth for other traffic.
RIP/SAP request spoofing	In IPX networks, this feature intercepts frequently-sent RIP and SAP broadcast information packets and handles them locally, rather than broadcasting over the WAN.	Reduces the amount of traffic forwarded across the WAN, saving bandwidth for other traffic.
RIP/SAP deltas	In IPX networks, RIP/SAP deltas send only routing and SAP table updates across the WAN instead of periodically sending the entire tables.	Reduces the amount of traffic forwarded across the WAN, saving bandwidth for other traffic.

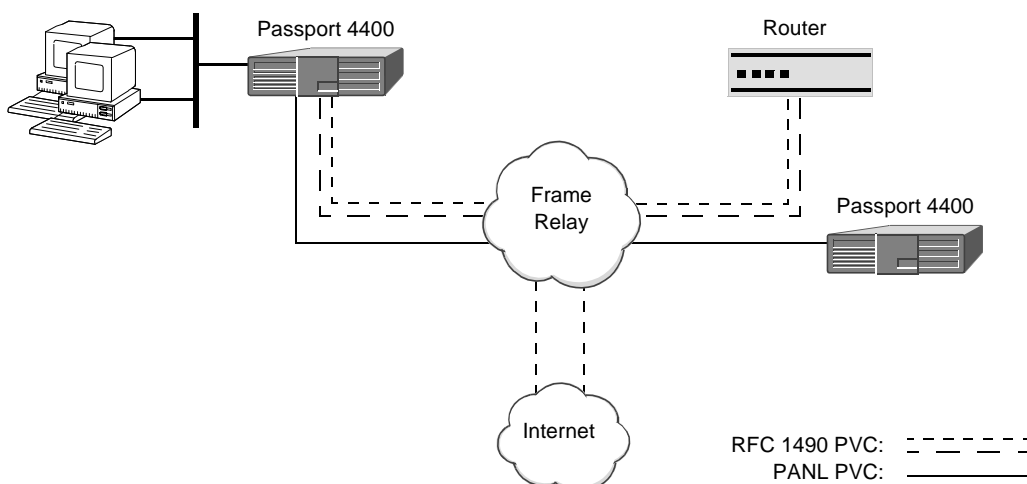
Feature (cont'd)	Description (cont'd)	Benefits (cont'd)
IP and IPX filters in bridged mode	Filtering capabilities allows the Passport 4400 to accept or ignore specific types of packets based on protocol, source and destination address, and patterns.	Isolates network traffic for security and bandwidth control, improving LAN performance.
BootP / DHCP Packet Forwarding	Forwards DHCP packets in both bridging and routing mode.	Simplifies IP network operations and maintenance.
Third-party equipment integration	Features such as premise frame relay and pass-through sync protocols support the attachment of existing routers and other FRADs.	Protects capital investment in existing routers and other FRADs.
Industry-standard interfaces	Supports RS-232, RS-530, RS449, V.35, X.21, Ethernet 10BaseT and AUI interfaces.	Assures worldwide interoperability. Simplifies installations.

**IP Services**

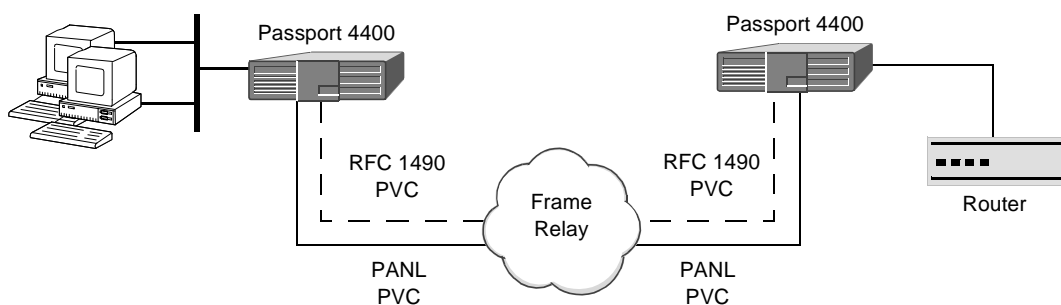
RFC 1490

The Passport 4400 supports RFC 1490 frame relay Direct Connect. This means that it interoperates with third-party routers directly off of the frame relay cloud. Third-party routers may also be connected to the Passport 4400 through their own frame relay ports.

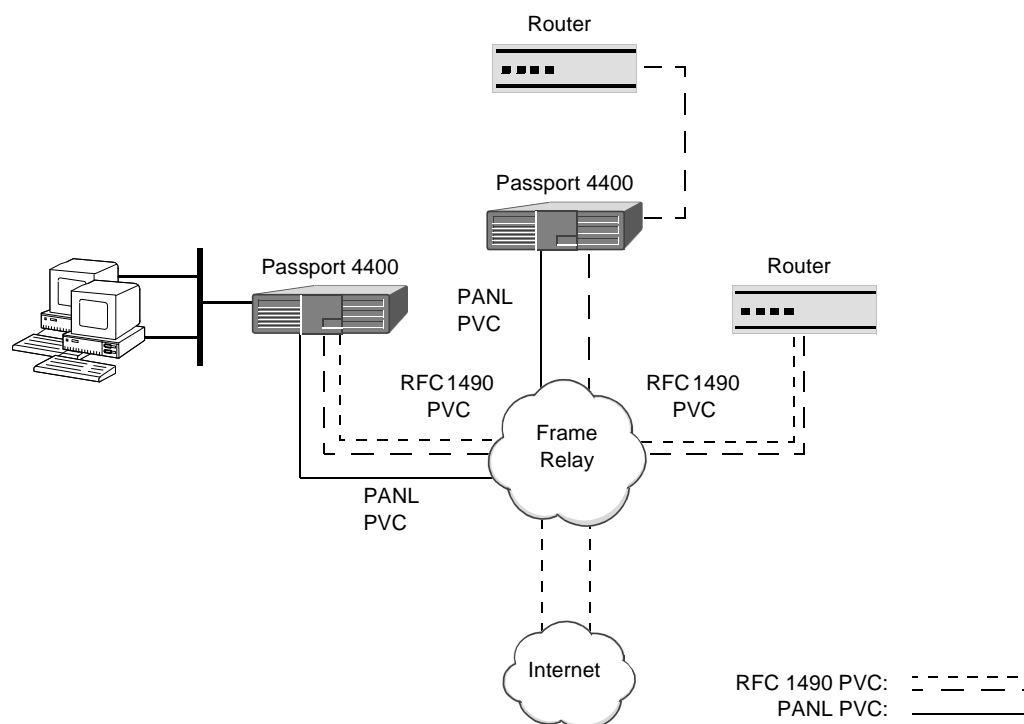
LAN traffic from a local Passport 4400 is transmitted over the frame relay network directly to a router. Support connections to the Internet are made via RFC 1490 encapsulation (see figure below).



Passport 4400 supports LAN connectivity to a remote router connected behind a Passport 4400. Traffic is transmitted over the link using RFC 1490 encapsulation (see figure below).



Combining the two previous applications, LAN traffic is carried between the Passport 4400's internal router, the Internet, and a third-party router connected to a Passport 4400 via its frame relay DCE connection. Typically, a customer will already have a router-based network. The third-party router can also act as an Internet gateway. In this capacity, the router can accept all Internet-bound traffic, then send smaller data packets to Passport 4400 nodes to help ensure voice quality of service (see figure on page 1-16).



IP Application

Video Networks

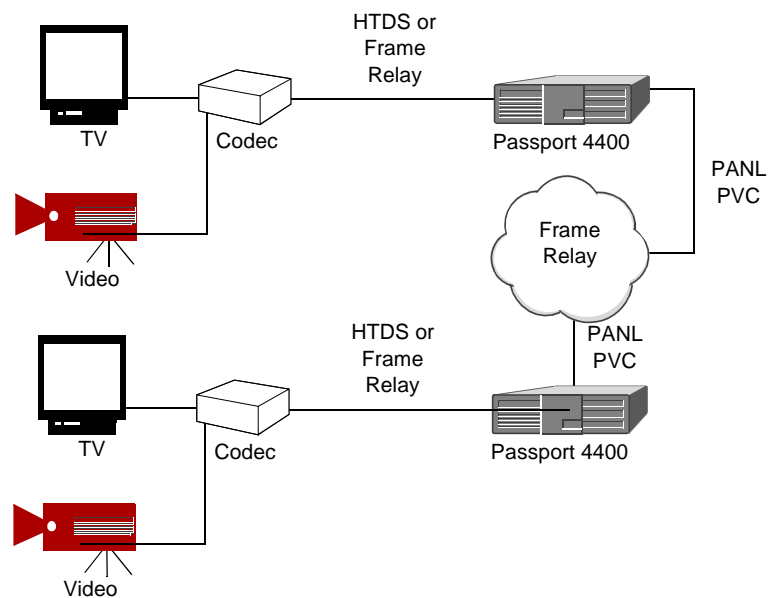
With video conferencing rising as a popular and cost-effective alternative to face-to-face meetings, Passport 4400 offers the ability to share visual materials through video conferences offering a “virtual meeting” without the cost and inconvenience of travel.

Video applications are increasingly being deployed to “virtual branch office” locations, such as stand-alone kiosks at airports, shopping malls, and other high-traffic sites. These interactive video applications are used to provide access to face-to-face services via video-link to a service center or “call center”, or to deliver multimedia information originating from a central source in order to facilitate frequent updating.

The Passport 4400 offers a cost-effective variety of services providing effective networking for video-based applications. Sophisticated traffic management provides end-to-end QoS and dynamic bandwidth allocation. Ease of management makes the Passport 4400 an ideal platform to support the growing use of video applications between central sites and branch offices.

Video Features

Feature	Description	Benefits
End-to-end QoS	Effective prioritization on WAN link from branch, along with adequate CIR service from provider (for public frame relay), ensures low delay and delay variation.	Delivers high quality video. Integrity of real-time applications ensures ease-of-use and user satisfaction.
Support for various video networking applications	Port 1 on base module or HDM supports the following types of video: <ul style="list-style-type: none"> H.323 video from leading videoconference equipment vendors (e.g., VTEL, Picturitel, etc.) for high-quality video using HDLC Transparent Data Service (HTDS) for point-to-point connections Frame relay-compliant video codecs using frame relay DCE service 	Flexible alternatives to support applications with differing requirements



Video Application

Legacy Data Networks

The Passport 4400 supports various legacy data services such as X.25, frame relay, and SDLC. These services can be supported transparently using HDLC Transparent Data Service (HTDS) and Constant Bit Rate service (CBR). The Passport 4400 will recognize and suppress idle flags for transparent HDLC and supports a cut-through mode for applications requiring low latency. For non-HDLC protocols, bits are transmitted transparently end to end.

Alternatively, the Legacy Data Module (LDM) can be used. The legacy data module permits Passport 4400s to provide direct support of legacy data protocols, including the following:

- X.25 (LAPB DCE)
- SNA/SDLC, X.25/QLLC, Async
- Asynchronous (ITI - X.3/X.28/X.29)
- HTDS
- Frame Relay
- Token Ring SNA (order with optional TR port)
- Token Ring ISRB/IFRG (order with optional TR port)

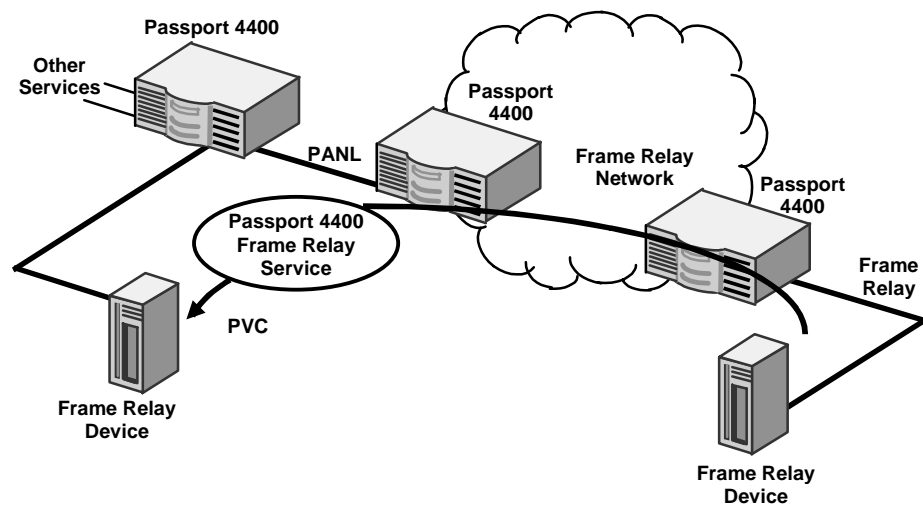
The LDM permits legacy service interworking between Passport 4400 series devices connected to a Passport backbone. Full service interworking for all legacy protocols supported by the LDM is possible with DPN-100 equipment as well.

LDM provides six data ports with an optional TR port. Additional fanout of data ports can be provided with up to two Legacy Expansion Modules (LEM) that support eight ports each.

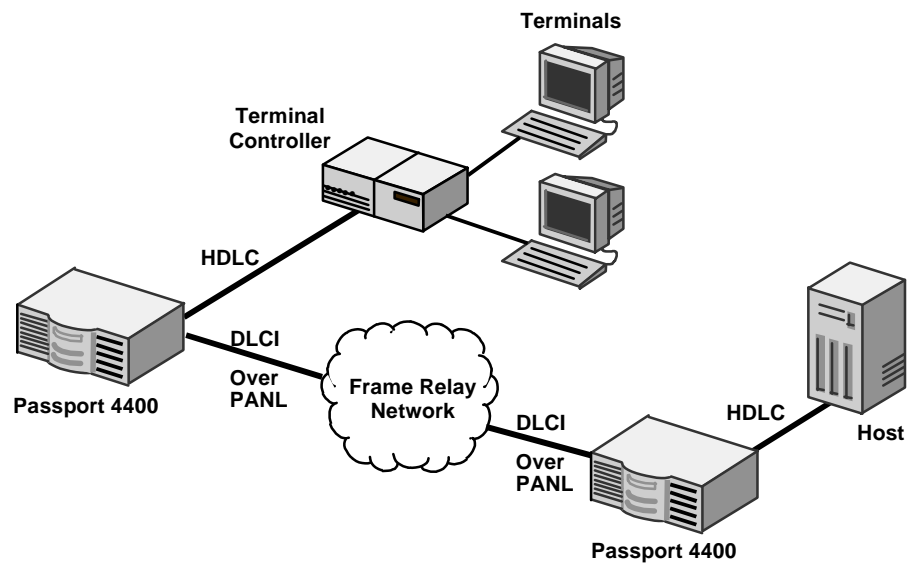
LDM is not manageable via SNMP, but can be managed with either NMS or OMS.

Legacy Data Features

Feature	Description	Benefits
Frame relay DCE service	<p>The Passport 4400 acts as the data communications equipment (DCE) and an outboard device, such as a router, acts as the DTE.</p> <p>The frame relay DCE service operates on the HDM and base card serial port up to 1.5 Mbps throughput, and can be clocked up to 2 Mbps.</p>	Supports and consolidates frame relay traffic from an existing outboard device, such as a router or FRAD.
HDLC Transparent Data Service	<p>The Passport 4400 HDLC transparent data service (HTDS) is used to transport HDLC-framed data, regardless of the specific HDLC-based protocol used to create the frame.</p> <p>HTDS provides a point-to-point connection between two DTE devices. The network will maintain the connection provided that the DTE devices continue transmitting data including idle flags to the Passport 4400.</p>	<p>The services route the data transparently between two devices. This allows the attached DTE to use any proprietary protocol for link layer and above that are compliant with HDLC framing.</p> <p>Traffic up to 1.5 Mbps is supported.</p>
Constant Bit Rate Service (Release 3.1 Feature)	<p>The Passport 4400 Constant Bit Rate service (CBR) is used to transport non-HDLC-framed data, regardless of the protocol.</p> <p>Provides a point-to-point connection between two DTE devices. The network will maintain the connection until the connection is manually taken down.</p>	The service routes the data transparently between two devices.
Legacy Data Module (LDM)	Provides more extensive legacy data protocol support, including X.25 LAPB, token ring SNA and ISRB, X.3, X.28, X.29.	Flexibility to integrate many different legacy data protocols over the Passport network.



Frame Relay Services



X.25 Application using HTDS

WAN Services

The Passport 4400 supports a broad range of network link options, including frame relay, ISDN and leased lines. This gives the flexibility to choose the most cost-effective WAN connection at each site.

The Passport Access Network Link (PANL)

The Passport 4400 uses a frame relay-based network link protocol called the Passport Access Network Link (PANL).

WAN Features

Feature	Description	Benefits
Public frame relay	Available from various providers, frame relay is a packet-switching technology that transmits information at speeds between 56 kbps and 2 Mbps (E1). The Passport 4400 provides a frame relay pass through access service that allows for PANL tunneling over public frame relay WANs.	Public frame relay is often less expensive than private leased lines and requires less expensive capital equipment.
Integrated Networking	Allows voice and fax to be carried with data and LAN traffic over a single PVC.	When frame relay costs are lower, customers can take advantage of that and use integrated networking to cut their costs further.
Hybrid Networks	Supports combination private leased line/public frame relay networks.	Allows customers to build the most cost-effective network possible.
Software configurable change-over between leased lines and public frame relay	The Passport 4400 supports both private leased line connection and public frame relay access standard.	No extra cost for frame relay support and customers can choose either networking protocol or a combination of both.
PANL (Passport Access Network Link)	Extension of the Frame Relay Forum's VoFR standard. Fragments long frames when needed to insert voice frames, cutting delay and delay variation. PANL reassembles frames at the other end of the link (i.e., where they enter the frame relay network).	Reduces WAN overhead and provides optimal handling of voice traffic.

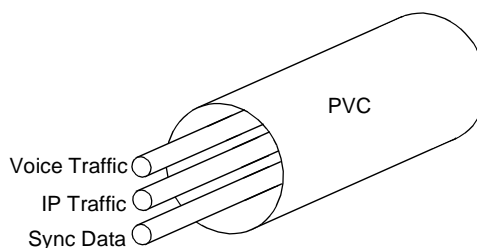
Switched Virtual Circuits

Switched Virtual Circuits (SVCs) provide dynamic any-to-any connectivity, eliminating the need for preconfigured connections between network nodes.

The SVCs are provisioned on the Passport 4400 device itself. This simplifies provisioning, since the Passport 4400 decreases the quantity of PVCs that need to be supplied by the frame relay service provider.

With Nortel Networks' SVC technology, multi-service traffic is carried over a single PVC. A different Class of Service (CoS) may be assigned to each SVC. For frame relay, the SVCs are carried within a PVC operating the PANL protocol. In leased line or ISDN applications, they are carried within the PANL protocol operating on the facility.

Feature	Description	Benefits
Switched Virtual Circuits (SVCs)	<p>Switched services provide dynamic any-to-any connectivity.</p> <p>Different CoS can be assigned to each SVC.</p> <p>SVCs are only provisioned by source/destination address, and on the device rather than with the service supplier.</p> <p>SVCs are provisioned on the device rather than with the service supplier.</p>	<p>Drastically cuts provisioning efforts, reducing operational costs.</p> <p>Enables cost-effective establishment of large networks.</p> <p>Enhances QoS. SVC priority is maintained across the entire 4400 (and 6400 if present) network.</p>
Tunneling SVCs within a single PVC	All SVCs are tunneled within a single PVC on a public FR network. Different priorities can be assigned to each SVC.	Reduces cost by removing the requirement for multiple PVCs to provide different QoS.
PANL termination on the Passport 6400	<p>Access integration products like the Passport 4400 fragment large data frames to provide QoS for delay-sensitive services like voice.</p> <p>PANL fragmentation is terminated at the first 6400, enabling more efficient transport of data on the high-speed 6400 backbone.</p>	More efficient use of bandwidth in large networks.



Tunnel Switched Virtual Circuits

Backup Services

The Passport 4400 provides backup services via dial-up analog modems, dial-up ISDN, and frame relay connections.

When analog or ISDN PSTN connections are used in the event of a primary WAN link failure, the Passport 4400 automatically establishes the backup link. It then re-establishes data connections to previously configured destinations.

The Passport 4400 uses an external auto-dial modem to set up a back-up call. The primary WAN connection and back-up connection are made to the same Passport 4400.

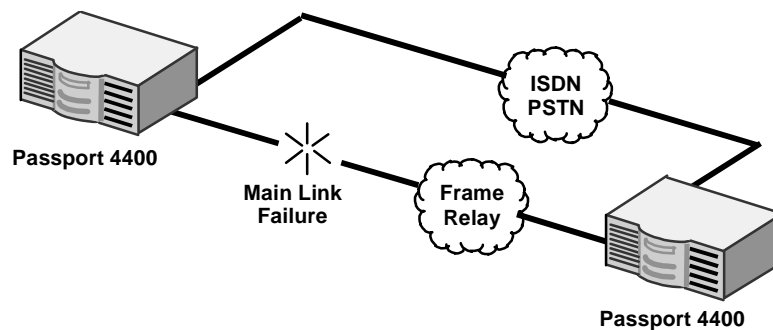
For analog PSTN connections, an auto-originate (auto-dial) modem and auto-answer modem are used. For ISDN PSTN connections, the ISDN TA WAN module or external TA can be used.

For mission critical applications, the Passport 4400 can use a public or private (leased line) backup service connection.

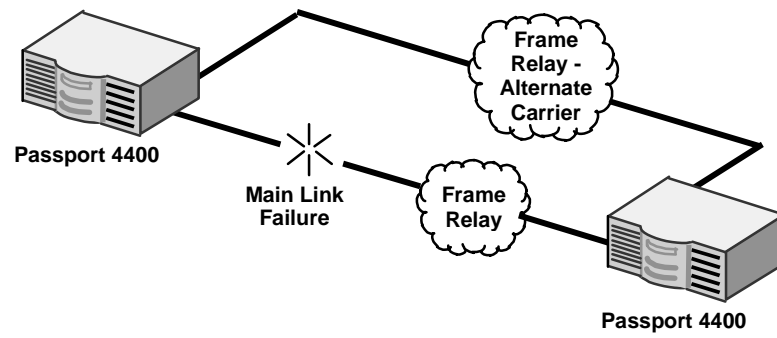
Backup Services Features

Feature	Description	Benefits
Dial Backup	<p>Allows the Passport 4400 to establish an alternate connection via the ISDN or analog PSTN.</p> <p>Data calls are re-established to the original destination.</p> <p>Automatically re-connects to primary link when service is re-established.</p>	<p>Protects against the failure of the network link.</p> <p>Alternate connection automatically made upon failure of the primary link.</p> <p>Increases reliability and availability of branch solutions.</p> <p>Avoids cost of redundant dedicated links.</p> <p>Provides lowest cost backup connection.</p>

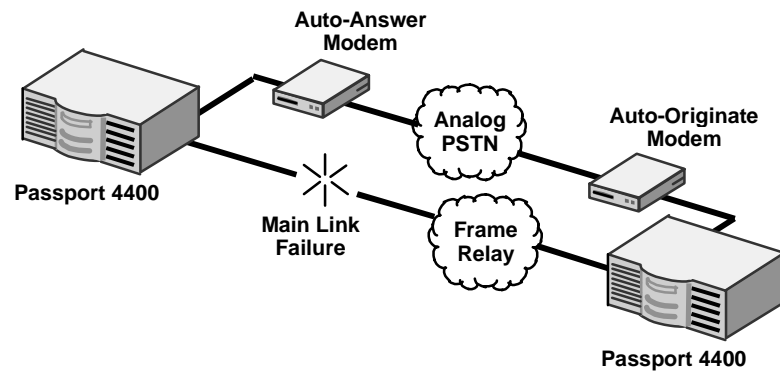
Dedicated Backup	<p>Allows the Passport 4400 to establish an alternate connection via a public frame backup service or dedicated leased line.</p> <p>Data calls are re-established to the original destination.</p> <p>Automatically re-connects to primary link when service is re-established.</p>	<p>Protects against the failure of the network link.</p> <p>Alternate connection automatically made upon failure of the primary link.</p> <p>Increases reliability and availability of branch and central site solutions.</p> <p>Provides highest level of network resilience for mission critical applications.</p>
Dial Backup Security	<p>Uses Calling Line Identification (CLID) and CUG on Passport to authenticate dial-backup call.</p>	<p>Ensures only authorized Passport 4400 units are able to dial into network.</p>
Link and Node Backup	<p>The passport 4400 can establish a backup link to either the same or a different destination. The Passport network can route around either link or node failure.</p>	<p>Highly resilient and reliable networking.</p>



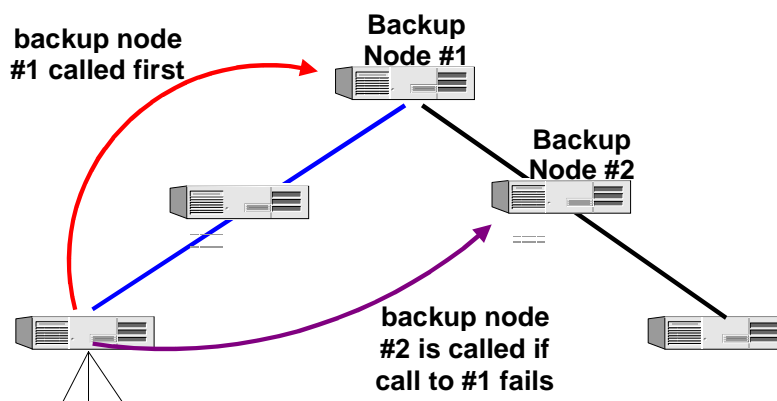
ISDN PSTN Dial Backup



Dedicated Frame Relay Backup



Analog PSTN Dial Backup



Node Backup

Scalability

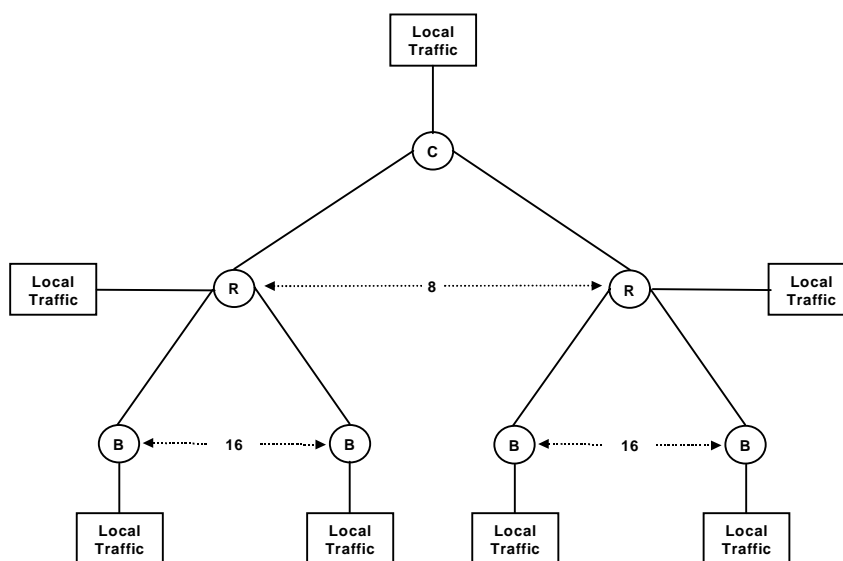
The Passport 4400 is highly scalable and can operate in networks as small as two nodes or as large as thousands of nodes. A network combining Passport 4400s together with Passport 6400 enterprise network switches is scaleable to thousands of nodes with fully integrated management support.

Available in 3- and 5-slot models (the 4430, 4450, and 4455) and configurable with a host of optional modules, the Passport 4400 provides a networking solution to meet the specific requirements of each individual site.

Feature	Description	Benefits
Flexible Equipment	Modular chassis: 3- and 5-slot models. Expansion cards for various services.	Extends equipment life, maximizing return on investment. Reduces life-cycle costs and inconvenience of fork-lift upgrades for new services and applications.

Cascaded Networks

Passport 4400s can be integrated into a single network through cascading. The following figure shows a number of devices connected in a cascaded network topology to demonstrate the possible fanout capabilities of the Passport 4400. In this example, there is a single Central site node (C) with eight Regional nodes (R) feeding it. The Regional nodes are each fed by 16 Branch nodes (B). None of the Branch nodes does switching. Each Local Traffic Box represents the “on-switch” traffic.

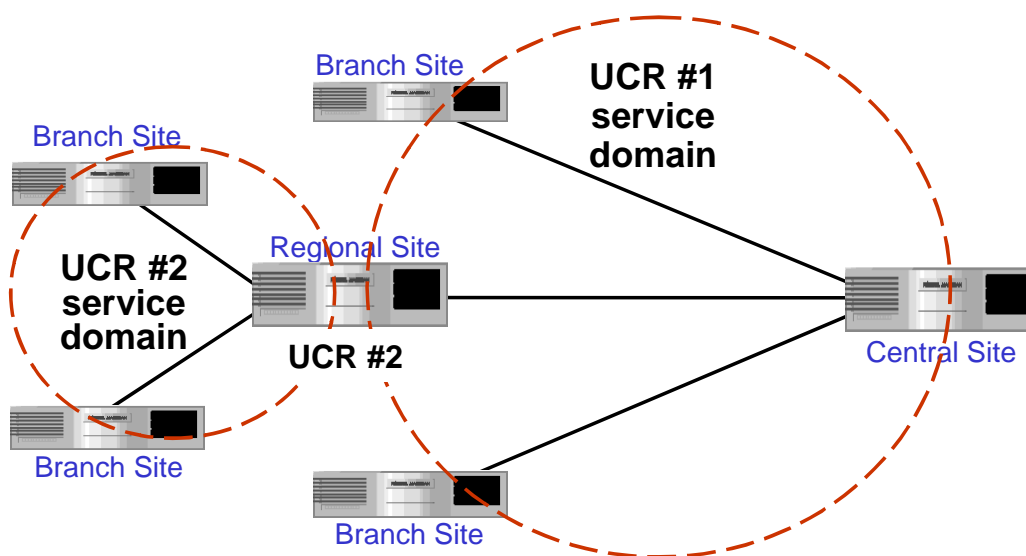


Cascaded Network

User Core Routing

Passport 4400s have integral, user core router (UCR) functionality. The UCR allows traffic to be routed and concentrated between remote-branch Passport 4400s. Each branch Passport 4400 has an SVC set up to the UCR. When a Passport 4400 sends data to the UCR, the UCR determines if the destination Passport 4400 is located on its list of DLCIs. The UCR subsequently forwards the data. Note that in many cases, end-users require access to a centralized server or host computer, to send or obtain data. This requirement can be met in a Passport 4400 network by locating the server or host computer behind the UCR, on the user LAN.

Note that the UCR only applies to LAN traffic.



User Core Router Network Example

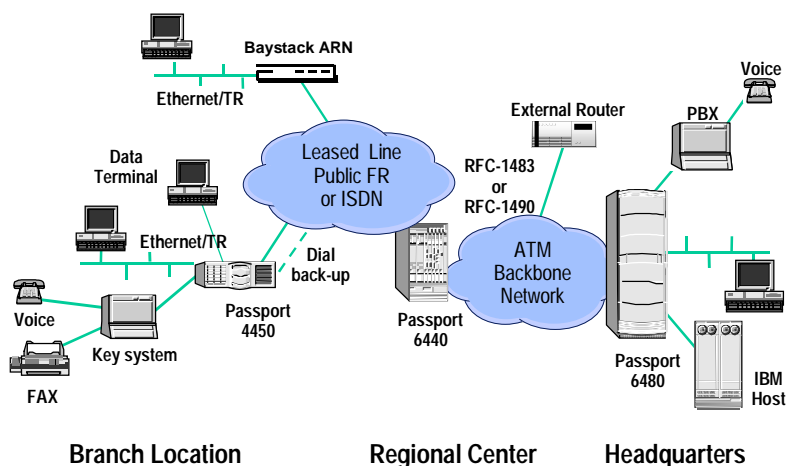
In the figure above, the following UCR options are represented:

- The Branch sites and Regional site in UCR #1 service domain have the bulk of their traffic going to either the Central site or each other.
- The Branch sites in UCR #2 service domain have the bulk of their traffic going to either the Regional site or each other.

Integrated Passport 4400/6400 Networks

Passport 4400 products interwork seamlessly with the larger and more powerful Passport 6400 products, providing complete end-to-end, fully integrated networking solutions. They extend the benefits of the Passport high-speed WAN network, including end-to-end switched virtual circuits and quality of service, to the smallest branch office.

Through the Passport Access Network Link, networking parameters are exchanged between the Passport 4400 products and the backbone Passport 6400. The Passport network also provides common network call routing and network management services for both Passport 6400 and Passport 4400. Hence, the passport 4400 is an integral component of the Passport network, rather than an overlay. This allows the Passport 4400 to benefit from the rich functionality of the Passport network by interworking with such Passport features as voice networking, IP networking, and LAN, SNA and frame relay services.



Integrated Passport 4400/6400 Network

Installation and Service

The Passport 4400 features promote simplified and time-efficient installation and service. These features were designed to:

- Minimize on-site visits and travel time
- Reduce on-site skill requirements and tools needed
- Reduce on-site configuration and data entry
- Minimize need to send units to the Network Control Center for configuration or troubleshooting

Installation and Service Features

Feature	Description	Benefits
Dual Bank Flash EPROM	Supports download of system, LAN and voice/fax software. Downloads can be initiated from any PC with an off-the-shelf communications package, such as ProComm. Dual bank capacity enables redundant software images and service data images.	Simplified upgrades. Lower operational costs. Commit and auto-fall-back capabilities.
TFTP upload and download	Allows existing configuration to be saved on a TFTP server or NMS station, and downloaded to a new unit.	Allows for off-site early preparation of complete configurations to be downloaded on-site after initial installation. Reduces on-site time to configure new units.
Local and remote loop back capabilities	ISDN Module: Remote (to Network) Loopback for B1 and B2 channels. WAN Module: Local (internal) Loopback only. T1 CSU Module: Local, Remote, Framer and Payload Loopback. 56K CSU Module: Remote (to Network) Loopback only. T1/E1 Module: Local, Remote and Payload Loopback.	Ensures proper hardware and cabling functionality.

Feature	Description	Benefits
Diagnostics and statistics	<p>CPU - Processor, Bandwidth and Buffer Utilization.</p> <p>Voice - Voice dB settings; E&M signal status; Voice and Fax statistics display counters.</p> <p>ISDN - Interface signals; error counters; frames sent/received; number of seconds with signal loss; D channel protocol sequence of events.</p> <p>LAN - System and bridge counters; ping utility (Multiple pings can be sent. Visual indication is provided for each ping sent and received. Round trip delay is also provided.).</p> <p>Switching - Network node list.</p> <p>WAN - DLCI list.</p>	<p>Enables network monitoring.</p> <p>Enables fine-tuning for optimal performance.</p> <p>Allows troubleshooting.</p>
High availability power and back up network links	<p>Load sharing AC power (4450/4455 only).</p> <p>Load sharing DC power (4450 only).</p> <p>Network link backup ISDN dial backup, analog modem dial backup, frame relay backup.</p>	Increases network reliability.
Centralized phone number database	Phone number database can reside on a separate Passport 4400 on the network.	<p>Phone numbers need to be programmed only once, as opposed to multiple times.</p> <p>Centralized database management: phone numbers do not need to be programmed at each site.</p>

In addition, the Passport 4400 has redundant power options and supports backup network links (ISDN dial-up, analog modem dial-up and frame relay backup) for increased network reliability.

InstallTool

The Passport 4400 features a Windows-based, user-friendly installation tool called InstallTool.

InstallTool 2.0 simplifies installation and basic configuration thus eliminating the requirement that Passport 4400 be installed by highly technical personnel. With its *Wizards* based approach, InstallTool walks the installer step-by-step through the setup of voice, video, IP/IPX, legacy data and WAN services.

The features of InstallTool are summarized in the list below. Note that the Passport 4400 is SNMP-based and thus third-party management tools (e.g., HP OpenView) may be used.

InstallTool

Hardware Platforms Supported	PC
Operating Systems Supported	Windows 95/98, Windows NT 4.0
User Interface	GUI and text-based CLI
Installation	User-friendly, forms-based GUI to assist in the setup of basic parameters
Access to CLI	Direct access through Telnet or through a serial port
Check for Connectivity	Uses TCP/IP Ping function

Traffic Management

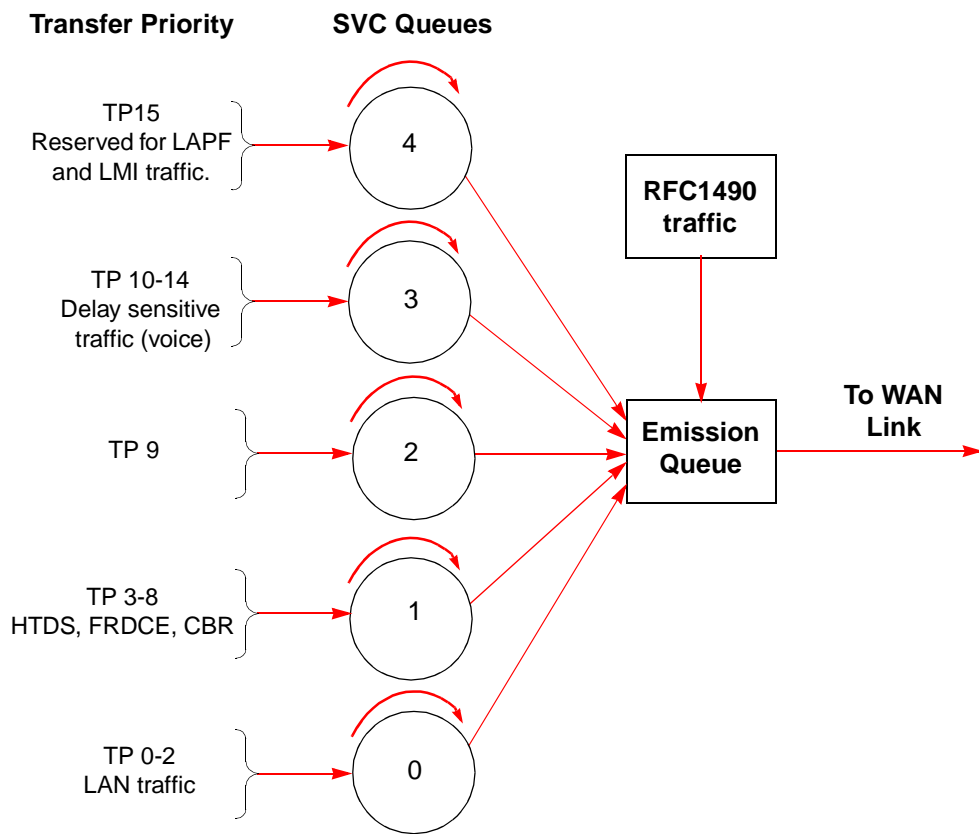
Passport 4400 utilizes a unique traffic management scheme that ensures the quality real-time voice and video, and prompt servicing of critical data applications.

The egress priority management on the WAN link from the Passport 4400 product ensures that voice cells are not unduly delayed by large data frames by fragmenting the frames to insert the voice cells. Specifying minimum throughput for data applications will ensure that these are not completely squeezed out by a surge in voice traffic.

Using public frame relay as the WAN access link from the Passport 4400, the quality of transport into the frame relay network has a limited amount of dependency on the delay-related performance of that network. Frame relay network providers are beginning to offer delay guarantees and users generally experience very satisfactory performance with the purchase of adequate CIR.

Traffic Management Features

Feature	Description	Benefits
Multiple CoS	<p>Egress priority based upon two dimensions:</p> <ul style="list-style-type: none"> • Importance: application priority • Delay tolerance: delay sensitivity 	<p>Prioritization ensures traffic receives required level of service.</p> <p>Mission-critical applications (e.g., on-line transaction processing) will get through with high importance for quick response.</p> <p>Real-time voice and video will receive low-delay (low latency) processing to ensure quality of sound/picture.</p>
Sophisticated queuing scheme	<p>Applies round-robin selection for packets or weighted allocation on a per-service basis.</p> <p>Works with multiple CoS to insert traffic onto link in priority order.</p>	Dynamic bandwidth allocation.
Fragmentation of long data frames to insert voice frames	Large data frames fragmented for insertion of delay-sensitive frames (e.g., real-time voice, video).	Maintains voice quality even with large Ethernet frames on link.
Reassembly of data frames at first backbone (Passport 6400) node	Fragmented frames reassembled before traversing backbone network.	Eliminates need for “mirror access device” at large sites to reassemble frames.



Passport 4400 Traffic Management Process

Standards-Based Interoperability

The Passport 4400 uses proven, standards-based networking services and protocols, allowing it to interoperate with other standards-based systems. In general, a standards-based implementation also substantially lowers life-cycle costs, since it is easy to upgrade and modify as standards evolve and feature sets are enriched.

Passport 4400 uses standard protocols such as G.729 CS-ACELP voice compression, frame relay UNI, RFC 1490 and Ethernet IEEE 802.3. These protocols represent implementation of standards from most of the International Standards Organizations (ISO), or de facto standards.

The Passport 4400's compliance to safety and emission standards make it applicable in virtually every country.

Feature	Description	Benefits
Worldwide standards compliance	<p>Nortel Networks' products are designed to comply with emissions and safety standards worldwide, including the most current European Union (EU) standards. They also comply with RFCs (Requests for Comment) such as RFC 1042 (for IP) and RFC 1362 (for IPX).</p> <p>Nortel Networks' products are certified by numerous network providers, including AT&T, MCI, Sprint, WorldComm and EMI.</p> <p>Also, Nortel Networks is ISO 9001 certified to ensure a consistent level of quality in delivery of products and services.</p>	Customers with multinational networking requirements find a single-vendor solution through Nortel Networks and its authorized resellers.

Ordering Codes 2

Ordering Codes are used when ordering specific Passport 4400 packages and accessories. The following lists contain the Passport 4400 Ordering Codes and their descriptions.

Base Systems

AC Base Systems

Each AC package listed below contains the Ethernet base Module and the management port cable. Software, power cords and data cables are ordered separately.

Ordering Code	Description
NTJ737BA	4430 AC Base System (without power cord)* 3-Slot AC unit, Management Port Cable, Hardware Installation Manual
NTJ738BA	4450 160W AC Base System (without power cord)* 5-Slot 160W AC unit, Management Port Cable, Hardware Installation Manual
NTJ739BA	4450 200W AC Base System (without power cord)* 5-Slot 200W AC unit, Management Port Cable, Hardware Installation Manual
NTJ742AA	4455 160W AC Base System (without power cord)* High performance 5-Slot 160W AC unit, Management Port Cable, Hardware Installation Manual
NTJ743AA	4455 200W AC Base System (without power cord)* High performance 5-Slot 200W AC unit, Management Port Cable, Hardware Installation Manual

DC Base Systems

Each DC package listed below contains the Ethernet base Module and the management port cable. Software, power cords and data cables are ordered separately.

Ordering Code	Description
NTJ740BA	4450 160W DC Base System (without power cord)* 5-Slot 160W DC unit, Management Port Cable, Hardware Installation Manual
NTJ741BA	4450 200W DC Base System (without power cord)* 5-Slot 200W DC unit, Management Port Cable, Hardware Installation Manual

* Configured orders will include blank panels to fill up the unit (you only need to order additional blanks if they will be required as replacements or additions).

Software and Document Packages

WAN Interface Modules

Ordering Code	Description
NTAU03AA	Serial WAN Module
NTAU05AA	ISDN TA Module (U Interface)
NTAU06AA	ISDN TA Module (S/T Interface)
NTAU04AA	T1 CSU/DSU Module
NTAU96AA	E1 DSU 120 ohms twisted pair
NTAU97AA	E1 DSU 75 ohms coaxial
NTAU02AA	56 kbps CSU/DSU Module

High Speed Data Modules

Ordering Code	Description
NTAU74AA	8-Port High Speed Data Module
NTAU83AA	4-Port High Speed Data Module

Legacy Data Modules

Ordering Code	Description
NTAU73AB	6-Port Legacy Data Module (LDM)
NTAU71AB	6-Port Legacy Data Module with Token Ring
NTAU77AB	8-port Legacy Data Expansion Module (LEM)
NTA150AA	LDM Memory Expansion Module (required on LDM when used with LEMs)

Analog Voice / Fax Modules

Ordering Code	Description
NTAU61AA	Single-Channel Analog Voice Module (AVM/1)
NTAU62AA	Dual-Channel Analog Voice Module (AVM/2)
NTAU50AA	Universal Analog Voice Module (UAVM/2)

Analog Voice / Fax Interface Modules

Ordering Code	Description
NTLN23AA	FXO Voice Interface Module for UAVM/2
NTAY12AA	FXS Voice Interface Module for UAVM/2
NTAY09AA	E&M Voice Interface Module for UAVM/2

Digital Voice Modules

Ordering Code	Description
NTAY99AA	Single-Port T1 Voice Module (TVM/1)
NTAY14AA	Dual-Port T1 Voice Module (TVM/2)
NTAY15AA	Single-Port E1 Voice Module (EVM/1)
NTAY16AA	Dual-Port E1 Voice Module (EVM/2)
NTAY18AA	12-Channel Digital Voice Expansion Module (DVEM/12). DVEM Power Cable Harness, NTAU32AA, included.
NTAU60AA	Single-Channel Digital Voice Module for TVM/EVM
NTBQ54AA	Digital Voice Module 6-Pack for TVM/EVM
NTBQ55A	Digital Voice Module 12-Pack for TVM/EVM
NTAU76BA	Single-Port/Dual-Channel ISDN BRI Voice Module, S/T Interface (only works with 4430/4450 base systems)

DRAM Memory Upgrade Kit

Ordering Code	Description
NTAU95AA	16 MB DRAM Upgrade Kit (for use only on R1.0 and R1.1 4400 systems with 8 MB DRAM)

Flash Memory Upgrade Kits

Ordering Code	Description
NTBQ69AA	4430/4450 16 MB Flash Memory Upgrade Kit
NTBQ70AA	4455 16 MB Flash Memory Upgrade Kit
NTAU94AA	Data Compression SIMM

Data Cables

Ordering Code	Description
NTAU18AA	V.24 Cable to DCE (DB25 MALE) - 15 ft.
NTAU19AA	V.24 Cable to DTE (DB25 Female) - 15 ft.
NTAU20AA	V.35 Cable to DCE (34-Pin Male) - 15 ft.
NTAU21AA	V.35 Cable to DTE (34-Pin Female) - 15 ft.
NTAU22AA	V.36 Type 1 Cable to DCE (37-Pin Male) - 15 ft.
NTAU23AA	V.36 Type 1 Cable to DTE (37-Pin Female) - 15 ft.
NTAU24AA	V.36 Type 2 Cable to DCE (37-Pin Male) - 15 ft.

Ordering Code	Description
NTAU25AA	V.36 Type 2 Cable to DTE (37-Pin Female) - 15 ft.
NTAU26AA	X.21 Cable to DCE (DB-15 Male) - 15 ft.
NTAU27AA	X.21 Cable to DTE (DB-15 Female) - 15 ft.
NTAU30AA	V.35 Cable to DCE (DB-15 Male) 15 Ft.
NTAU17AA	Management Cable to DTE (RJ-45 to DB-25 Male) - 6 ft.
NTML79AA	CSU/DSU Cable (RJ-45 to RJ-45) - 14 ft.
NTMU09AA	CSU/DSU Crossover Cable (RJ-45 to RJ-45) - 14 ft.

Power Cables

Ordering Code	Description
NTFP83AA	AC Power Cord - North America, Taiwan, Thailand, Korea and CALA (except Argentina)
NTFP84AA	AC Power Cord - Japan
NTFP85AA	AC Power Cord - U.K., Ireland and Hong Kong
NTFP86AA	AC Power Cord - Continental Europe and Indonesia
NTFP87AA	AC Power Cord - Australia, New Zealand, China, and Argentina
NTFP88AA	AC Power Cord - Switzerland
NTEP56AA	AC Power Cord - Denmark
NTEP57AA	AC Power Cord - Italy
NTEP58AA	AC Power Cord - India
NTEP59AA	AC Power Cord - Israel

Miscellaneous Hardware

Ordering Code	Description
N/A*	Spare Back Panel Faceplate - Full Slot
N/A*	Spare Back Panel Faceplate - WAN Slot
N/A*	Spare Back Panel Faceplate - Voice Interface Module
NTAY76AA	4430 Rackmount Kit
NTAY73AA	4450/4455 160W Rackmount Kit
NTAY74AA	4450/4455 200W Rackmount Kit

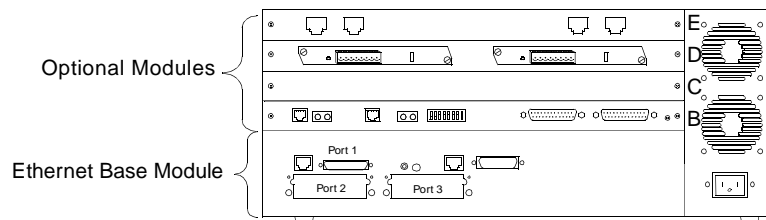
* Configured units include sufficient blank panels as appropriate to the order.

User Manuals

MICOM Ordering Code	Description
NTBQ67AA	4400 3.1 User Manuals in a Two-Binder Set (excluding Interworking Manuals)
NTBQ72AA	CD-ROM OF 4400 3.1 User Manuals (excluding Interworking Manuals)
NTBQ88AA	4400 Interworking Manuals in a Binder

Optional Modules 3

The Passport 4400 base unit includes an Ethernet Base Module (EBM) installed in the first slot, Line Interface Module (LIM) A. The remaining slots (LIMs B, C, D, E) can house optional expansion or data modules as required. (The Passport 4450 has four optional module slots; the Passport 4430 has two.) Each optional module requires one slot on the Passport 4400.



Passport 4400 - Rear View

The following voice expansion modules are available for the Passport 4400:

- Analog Voice Module (AVM)
- Universal Analog Voice Module (UAVM)
- T1 Voice Module (TVM)
- E1 Voice Module (EVM)
- Digital Voice Module (DVM)
- Digital Voice Expansion Module (DVEM)
- ISDN BRI Voice Module (IVM)

Two data services modules are also available: the Legacy Data Module (LDM), to provide low speed data services, and the High-speed Data Module (HDM), to add data port capability to the Passport 4400.

Expansion Module Features

To minimize speech bandwidth requirements, all voice modules use G.729 CS-ACELP. High quality voice channels are supported with as little as 8 kbps of bandwidth. Silence suppression technology allows the Passport 4400 to transmit voice only when someone is actually talking. During silent periods, voice bandwidth is automatically allocated for other types of traffic.

Automatic fax demodulation is standard on every voice channel. This allows the Passport 4400 to convert analog fax signals back into their original 9.6 kbps digital form. This is more efficient and cost effective than using the 64 kbps of bandwidth typically required for fax transmission. As a result, fax can be transmitted along with data and voice over a common line, eliminating inter-office toll calls for fax transmissions.

Analog Voice Modules

There are two types of analog voice modules available for the Passport 4400.

- Analog Voice Module (AVM)
- Universal Analog Voice Module (UAVM).

Up to four analog voice modules (AVM or UAVM) are supported on the Passport 4450, for a maximum of eight analog voice ports. Up to two analog voice modules are supported on the Passport 4430, for a maximum of four analog voice ports.

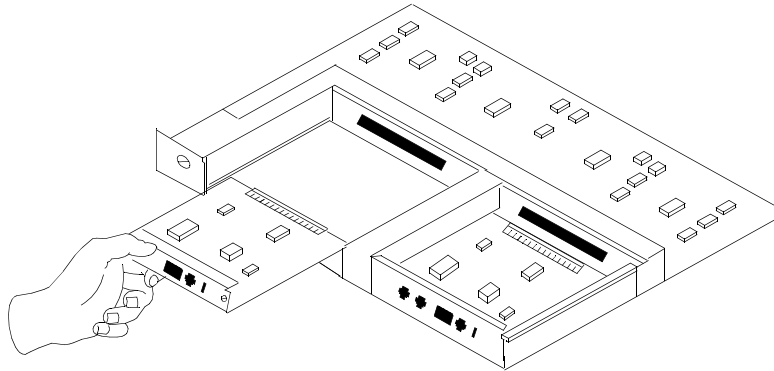
Analog Voice Modules (AVM)

The Analog Voice Module supports two analog voice interfaces and is field configurable for FXS, FXO or E&M. While the UAVM supports individual interface modules, the AVM provides jumper-selectable interfaces.

Universal Analog Voice Module (UAVM)

The dual-channel Universal Analog Voice Module supports up to two of the following interface modules:

- FXS Interface - Provides connection to a standard single-line type 2500 or type 500 telephone instrument, trunk side of a key telephone system, or a loop start trunk circuit of a PBX to a central office (CO). It also supports Group 3 fax machines.
- FXO Interface - Supports a single CO loop start line coming from central office (CO) or CENTREX stations. It also supports connections as a station line off a PBX and recognizes ringing signals and draws current to indicate an active state.
- E&M Interface - Connects to the tie line trunk of a private branch exchange (PBX) or other voice switching systems. Supports Types I, II, IV and V voice signaling.



Universal Analog Voice Module with Interface Modules

T1/E1 and Digital Voice Modules

T1/E1 digital voice and data is supported on the Passport 4400 through the use of the modules and components described below:

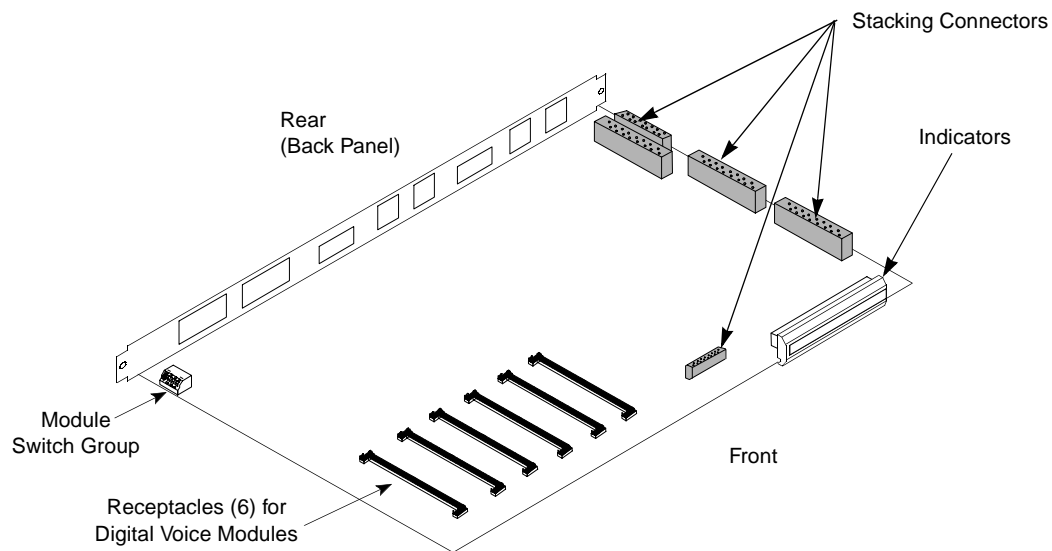
- T1 Voice Module (TVM) - provides a T1 interface to a PBX. Up to six Digital Voice Modules plug into this module.
- E1 Voice Module (EVM)- provides an E1 interface to a PBX. Up to six Digital Voice Modules plug into this module.
- Digital Voice Expansion Module (DVEM) - provides slots to support additional DVMs.
- Digital Voice Module (DVM) - is a SIMM module that is plugged directly into the TVM, EVM or DVEM.

T1 Voice Module (TVM)

The T1 Voice Module provides a user interface to one or two 1.544 Mbps T1 lines. It can support a maximum of 24 Digital Voice Modules (six on the module, the rest on the Digital Voice Expansion Modules).

E1 Voice Module (EVM)

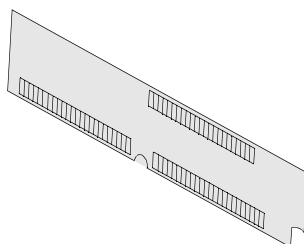
The E1 Voice Module provides a user interface to one or two 2.048 Mbps E1 lines. It can support a maximum of 30 Digital Voice Modules (six on the module, the rest on the Digital Voice Expansion Modules).



T1/E1 Voice Module

Digital Voice Module (DVM)

The Digital Voice Module is a 72-pin SIMM that plugs into the top of the TVM/EVM or DVEM. One DVM is required for each voice channel.

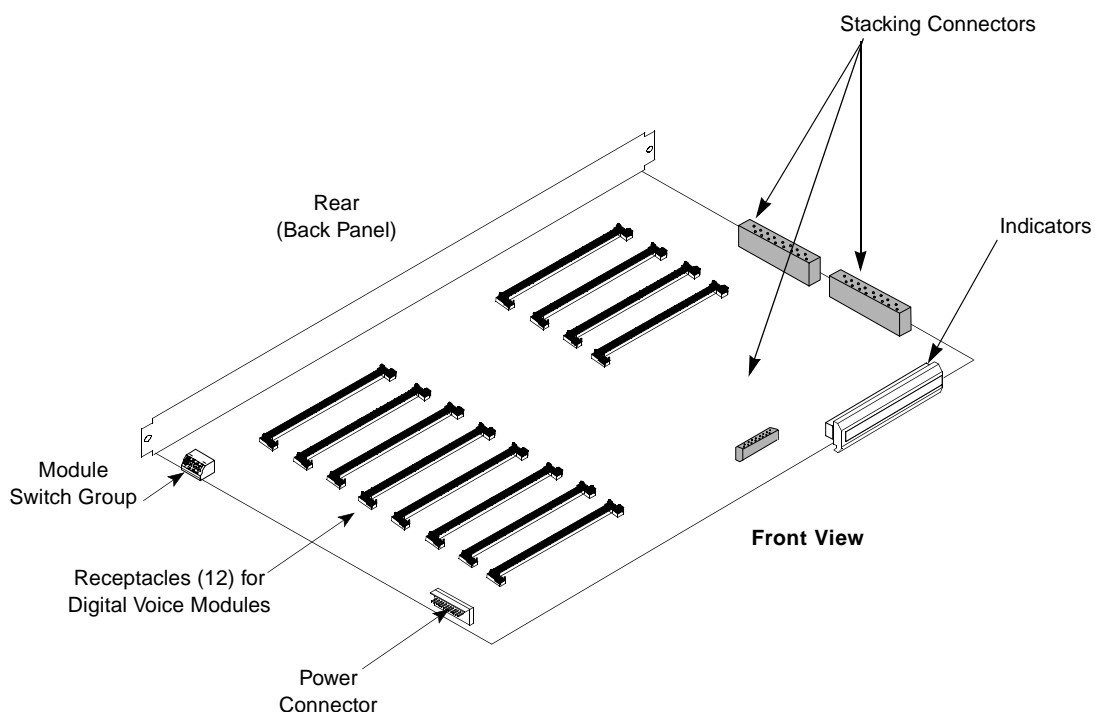


Digital Voice Module

Digital Voice Expansion Module (DVEM)

The Digital Voice Expansion Module is used when more than six voice channels are required. Up to two DVEMs can be installed in a chassis, each holding up to 12 DVMs.

- Notes:**
- In order to use a DVEM, a TVM or EVM must also be installed in the chassis. A TVM or EVM with two DVEMs fully populated with DVMs provides 30 voice channels.
 - If you are using a DVEM, ensure that you purchase and use the power harness (MICOM Oder Code PC-DC/DVEM or Nortel PEC Code NTAU32AA).



Digital Voice Expansion Module

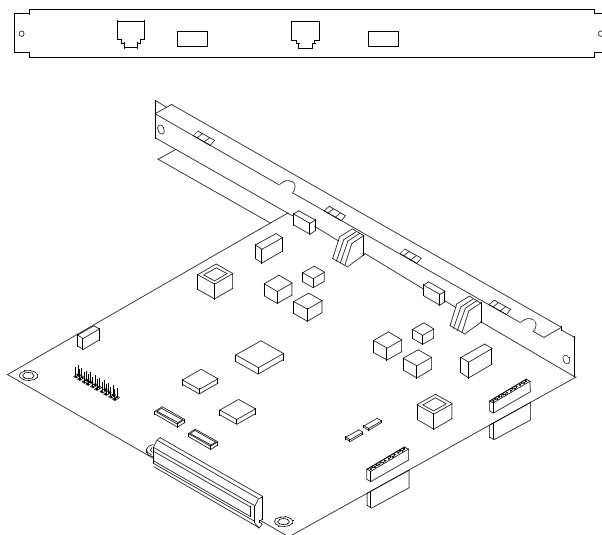
ISDN BRI Voice Module

The ISDN BRI Voice Module (IVM/1) is an expansion module providing the Passport 4400 with an ISDN interface for connection to an ISDN PBX, ISDN phone, or other ISDN protocol.

Note: The ISDN BRI Voice Module will not operate with the Passport 4455. It is used only with the 4430 and 4450.

The BRI connects to the trunk side of an ISDN PBX, serving as one half of an ISDN tie trunk that connects two ISDN PBXs.

Signalling is over the ISDN D-channel, using the Q-Sig protocol. The Passport 4400 recognizes the Q-Sig commands to provide call setup, call tear down and the channeling of the dialed digits to its counterpart at the remote end. Once communication is established, the B-channels are opened to the flow of two-way voice traffic. When call tear down is requested by the PBX, the associated Passport 4400 terminates the call.



ISDN BRI Voice Module

Compatible Marathon Voice Modules

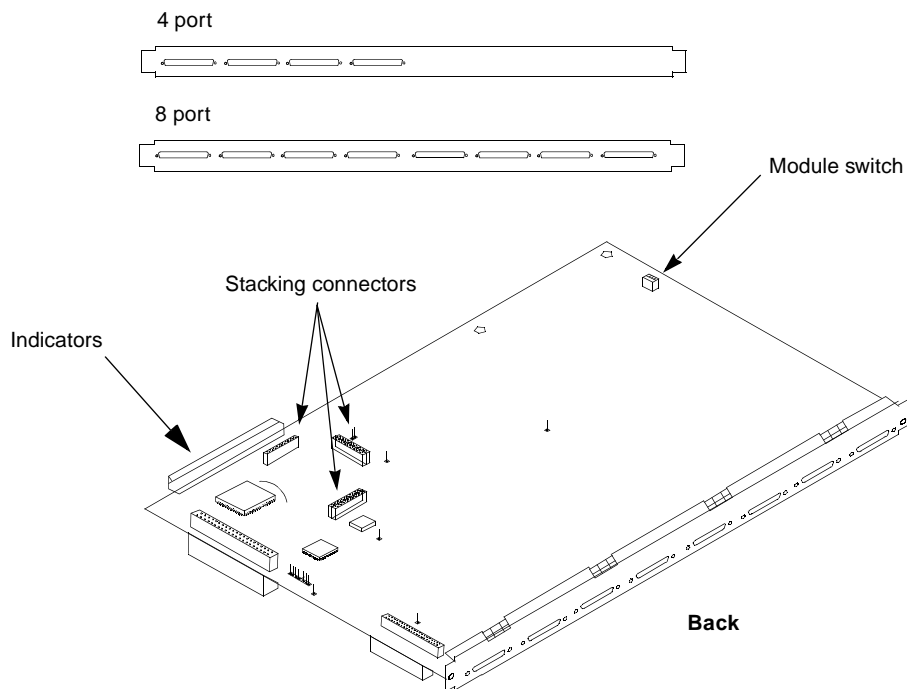
The following lists the Marathon voice modules that can be used in the Passport 4400.

Description	Passport 4400 Module	Marathon Equivalent
T1 Voice Module (TVM)—single channel	NTAY99AA	5000TAM/1E, Rev M or later
T1 Voice Module (TVM)—dual channel	NTAU14AA	5000TAM/2, Rev M or later
E1 Voice Module (EVM)—single channel	NTAY15AA	5000EAM/1E, Rev K or later
E1 Voice Module (EVM)—dual channel	NTAY16AA	5000EAM/2, Rev K or later
Digital Voice Expansion Module (DVEM)	NTAY18AA	5000DVEM/12
Digital Voice Module (DVM)	NTAU60AA (also kits NTBQ54AA and NTBQ55AA)	5000DVM, Rev L or later
Analog Voice/Fax Module (AVM)—single channel	NTAU61AA	5000CVM/1
Analog Voice/Fax Module (AVM)—dual channel	NTAU62AA	5000CVM/2
Universal Analog Voice Module (UAVM)	NTAU50AA	5000UVM
FXS Interface for UAVM	NTAY12AA	5000V/XSL
FXO Interface for UAVM	NTLM23AA	5000V/XOL
E&M Interface for UAVM	NTAY09AA	5000V/EM+

High-speed Data Module (HDM)

There are two versions of the High-speed Data Module (HDM), one with four ports and one with eight ports. The High-speed Data Module provides additional port capability, identical to port 1 on the Ethernet Base Module. The module supports RS-232, V.35, V.36, and X.21 interfaces, determined by the cable used. The module can support both DTE and DCE mode with speeds from 1200 bps to 1920 Mbps.

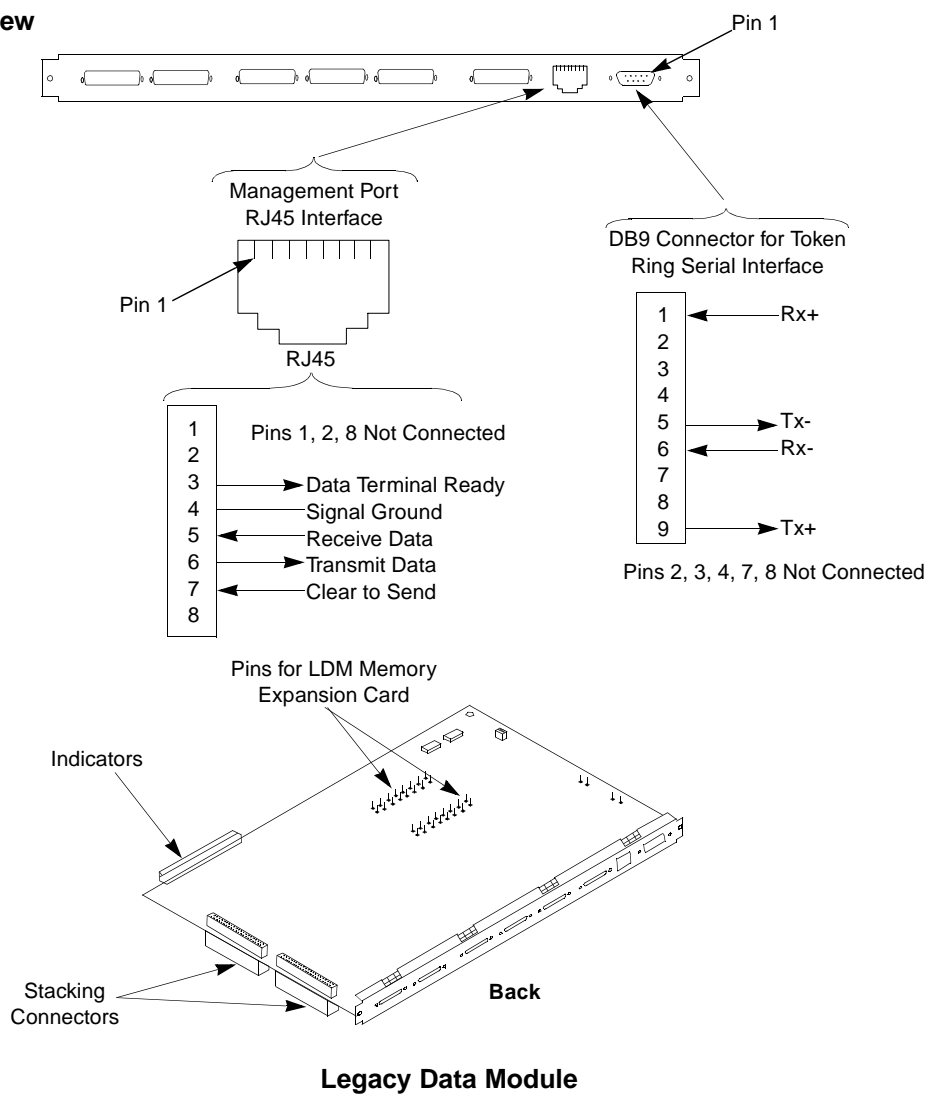
Rear View



Low-speed Data Service Modules

Low-speed data service is provided through the Legacy Data Module (LDM). The LDM provides interface ports that support legacy data protocols in Passport 4400. Additional interface ports are supported through the use of the Legacy Data Expansion Module (LEM).

Rear View



Road Map to the Product Documentation

4

The following chart indicates which user document provides the information needed to perform various functions of the Passport 4400.

Topic	Release Notes for R3.1.0 (800-1953-31)	Introduction (800-1982-31)	Hardware Install (800-1951-31)	InstallTool 2.0 Startup Guide (800-1983-31)	Operators (800-1952-31)	CLI Ref (800-1950-31)	Analog Voice Module (800-1943-31)	T1/E1/Digital Voice Module (800-1944-31)	ISDN BRI Voice Module (800-1942-31)
Product Features		X							
Product Benefits and Applications		X							
Network and Engineering Considerations	X				X				
Safety and Agency Requirements			X						
Required Hardware Code and Release Levels	X								
Product Ordering Codes		X							
Hardware Description			X						
Unit Specifications			X						
Unit Installation: <ul style="list-style-type: none"> • Unpacking • Rack Installation • Powering Up • Verifying operation 			X						

Topic	Release Notes for R3.1.0 (800-1953-31)	Introduction (800-1982-31)	Hardware Install (800-1951-31)	InstallTool 2.0 Startup Guide (800-1983-31)	Operators (800-1952-31)	CLI Ref (800-1950-31)	Analog Voice Module (800-1943-31)	T1/E1/Digital Voice Module (800-1944-31)	ISDN BRI Voice Module (800-1942-31)
Ethernet Base Module Connection: <ul style="list-style-type: none"> • FRDCE Serial Access Port • Management Port • Ethernet Access Ports 			X						
Interface Module Connection and Installation: <ul style="list-style-type: none"> • WAN serial • 56K CSU/DSU • T1 CSU/DSU • ISDN 			X						
Expansion Module Connection and Installation: <ul style="list-style-type: none"> • High-speed Data • T1 Voice • E1 Voice • Digital Voice • Analog Voice • Universal Analog Voice 			X						
UVM Interface Module Connection and Installation: <ul style="list-style-type: none"> • FXO • FXS • E&M 			X				X		
Expansion Module Stacking Order			X						
Removing Optional Modules			X						

Topic	Release Notes for R3.1.0 (800-1953-31)	Introduction (800-1982-31)	Hardware Install (800-1951-31)	InstallTool 2.0 Startup Guide (800-1983-31)	Operators (800-1952-31)	CLI Ref (800-1950-31)	Analog Voice Module (800-1943-31)	T1/E1/Digital Voice Module (800-1944-31)	ISDN BRI Voice Module (800-1942-31)
Configuring Five-slot Power Supply			X						
Definition of Unit and Module Indicators			X				X	X	
Cable Diagrams and Pin Assignments			X						
Installing the InstallTool Software on a PC				X					
Linking a PC to the Passport 4400				X					
Loading Factory Default Configuration Values via the InstallTool				X					
Loading Factory Default Configuration Values via the CLI					X				
Basic Node Parameter Provisioning via the InstallTool				X					
Basic WAN Port Provisioning via the InstallTool				X					
Basic LAN Services Provisioning via the InstallTool: <ul style="list-style-type: none"> Bridging IP routing IPX routing 				X					

Topic	Release Notes for R3.1.0 (800-1953-31)	Introduction (800-1982-31)	Hardware Install (800-1951-31)	InstallTool 2.0 Startup Guide (800-1983-31)	Operators (800-1952-31)	CLI Ref (800-1950-31)	Analog Voice Module (800-1943-31)	T1/E1/Digital Voice Module (800-1944-31)	ISDN BRI Voice Module (800-1942-31)
Basic T1/E1 Digital and Analog Voice Channel Provisioning via the InstallTool				x					
InstallTool Ping Utility				x					
InstallTool Script Utility				x					
InstallTool Display Progress Utility				x					
Accessing the Command Line Interface (CLI)					x	x			
Software Installation—Boot Menu Procedure (FTP)	x								
Software Installation—Runtime Download Procedure (TFTP)					x				
Node Parameter Configuration					x				
IfIndexes					x				
How a Passport 4400 Operates in a Passport Network					x				
Network Node Configuration					x				
Overview of Passport Access Network Links (PANL)		x			x				
Netlink Configuration					x				
Netlink Monitoring					x				

Topic	Release Notes for R3.1.0 (800-1953-31)	Introduction (800-1982-31)	Hardware Install (800-1951-31)	InstallTool 2.0 Startup Guide (800-1983-31)	Operators (800-1952-31)	CLI Ref (800-1950-31)	Analog Voice Module (800-1943-31)	T1/E1/ Digital Voice Module (800-1944-31)	ISDN BRI Voice Module (800-1942-31)
Overview of the Global Circuit Manager (GCM)					X				
Primary and Backup Port Configuration					X				
Primary and Backup Link Switching and Timing					X				
Alternate WAN Module Configuration: <ul style="list-style-type: none"> • ISDN • T1 CSU • E1 CSU • 56K CSU 					X				
LAN Services Overview: <ul style="list-style-type: none"> • Bridging • IP Routing • IPX Routing 		X			X				
LAN Services Configuration					X				
LAN Services Filtering Configuration					X				
LAN Services Monitoring					X				
Connecting to a Third-Party Router					X				
Connecting to a Network Management System					X				
Adding a Virtual Port					X				

Topic	Release Notes for R3.1.0 (800-1953-31)	Introduction (800-1982-31)	Hardware Install (800-1951-31)	InstallTool 2.0 Startup Guide (800-1983-31)	Operators (800-1952-31)	CLI Ref (800-1950-31)	Analog Voice Module (800-1943-31)	T1/E1/ Digital Voice Module (800-1944-31)	ISDN BRI Voice Module (800-1942-31)
Frame Relay Services Overview					X				
Frame Relay Pass-Through Configuration					X				
Defining Multiple Frame Relay Switch Maps					X				
Frame Relay Monitoring					X				
HDL (SDLC) Transparent Data Services (HTDS) Overview					X				
HTDS Configuration					X				
Constant Bit Rate (CBR) Services Overview					X				
CBR Configuration					X				
Passport 4400 Traffic Management Overview		X			X				
Traffic Management Configuration					X				
Traffic Management Monitoring					X				
Backing Up and Restoring Configuration Files from a TFTP Server					X				
Bootp Relay Configuration					X				
System Utilities: <ul style="list-style-type: none"> Telnet Reset Ping 					X				

Topic	Release Notes for R3.1.0 (800-1953-31)	Introduction (800-1982-31)	Hardware Install (800-1951-31)	InstallTool 2.0 Startup Guide (800-1983-31)	Operators (800-1952-31)	CLI Ref (800-1950-31)	Analog Voice Module (800-1943-31)	T1/E1/Digital Voice Module (800-1944-31)	ISDN BRI Voice Module (800-1942-31)
System Administration Commands: <ul style="list-style-type: none"> Identifying the Unit Assigning User Privileges Setting Management Port Parameters Setting the System Clock Enabling and Setting Traps Taking a Port Offline Monitoring System Parameters 					X				
Passport 4400 Enterprise Traps Description					X				
How to Use the Command Line Interface (CLI)						X			
Overview of CLI Services						X			
Definition of CLI Command Prompts						X			
Definition of CLI Commands						X			
Definition of CLI Command Verbs						X			
Definition of CLI Parameters						X			
Definition of CLI Objects						X			
Default Values for CLI Settings						X			

Topic	Release Notes for R3.1.0 (800-1953-31)	Introduction (800-1982-31)	Hardware Install (800-1951-31)	InstallTool 2.0 Startup Guide (800-1983-31)	Operators (800-1952-31)	CLI Ref (800-1950-31)	Analog Voice Module (800-1943-31)	T1/E1/ Digital Voice Module (800-1944-31)	ISDN BRI Voice Module (800-1942-31)
Analog Voice Module Overview							X		
Analog Voice Module Configuration: <ul style="list-style-type: none"> • Ingress Tables • Egress Tables • Voice Profiles • Voice Switching Profiles • Autocall Application • Hoot and Holler • Call Restriction 							X		
Analog Voice Show and Test Commands							X		
Analog Voice Channel Level Adjustment							X		
PBX Interface Diagrams							X		
Voice Channel Code Download to DSP							X		
T1/E1 and Digital Voice Modules Overview								X	
T1/E1 Voice Module Configuration: <ul style="list-style-type: none"> • T1 Line Parameter Profiles • E1 Line parameter Profiles • Setting Data Port Parameters 								X	

Topic	Release Notes for R3.1.0 (800-1953-31)	Introduction (800-1982-31)	Hardware Install (800-1951-31)	InstallTool 2.0 Startup Guide (800-1983-31)	Operators (800-1952-31)	CLI Ref (800-1950-31)	Analog Voice Module (800-1943-31)	T1/E1/ Digital Voice Module (800-1944-31)	ISDN BRI Voice Module (800-1942-31)
Interconnecting the DSO Channels								X	
T1/E1 Voice Module Show and Test Commands								X	
Digital Voice Module Configuration: <ul style="list-style-type: none"> • Ingress tables • Egress Tables • Voice Profiles • Voice Switching Profiles • Autocall Application • Hoot and Holler • Call Restrictions 								X	
Transparent CCS Configuration								X	
Digital Voice Module Show and Test Commands								X	
T1/E1 Specifications								X	
T1 Cabling Requirements								X	
Voice Channel Code Download to DSP								X	
Digital Voice Module Level Adjustment Procedures								X	
ISDN BRI Voice Module Overview									X
ISDN Configuration									X
ISDN BRI D-Channel Monitoring									X

Topic	Release Notes for R3.1.0 (800-1953-31)	Introduction (800-1982-31)	Hardware Install (800-1951-31)	InstallTool 2.0 Startup Guide (800-1983-31)	Operators (800-1952-31)	CLI Ref (800-1950-31)	Analog Voice Module (800-1943-31)	T1/E1/ Digital Voice Module (800-1944-31)	ISDN BRI Voice Module (800-1942-31)
ISDN BRI Voice Channel Configuration: <ul style="list-style-type: none"> EgressTable Entry Creating a Library of Voice Profiles Assigning Profiles to Channels Creating a Library of Voice Switching Profiles Autocall Overlap Dialing 									X
ISDN BRI Voice Channel Monitoring									X
ISDN BRI Applications: <ul style="list-style-type: none"> Trunk Application BRI-to-PRI Application Passport Network/ ISDN PSTN Application 									X

Topic	Release Notes for R3.1.0 (800-1953-31)	Introduction (800-1982-31)	Hardware Install (800-1951-31)	InstallTool 2.0 Startup Guide (800-1983-31)	Operators (800-1952-31)	CLI Ref (800-1950-31)	Analog Voice Module (800-1943-31)	T1/E1/ Digital Voice Module (800-1944-31)	ISDN BRI Voice Module (800-1942-31)
Remote Server Interface (RSI) Commands: <ul style="list-style-type: none"> Address Resolution Adding/Defining/Deleting Reset Commands Setting RSI Parameters RSI Show Commands 							X	X	X
NAS/NAC Commands: <ul style="list-style-type: none"> Address Resolution Adding/Defining/Deleting Setting Server and Aging Time Show NAC Commands 							X	X	X
Glossary of Passport 4400 and Related terms		X					X	X	
3.1 Known Issues and Workarounds	X								
Post-production Updates to the Manuals	X								

Accessing the Product Documentation

Each Passport 4400 unit is shipped with the following product documentation:

- Passport 4400 Introduction and Road Map (800-1982-31)
- Passport 4400 Hardware Installation Manual (800-1951-31)
- Passport 4400 Release 3.1 InstallTool Version 2.0 Startup Guide (800-1983-31)

The entire set of Passport 4400 product documentation—all manuals listed in the documentation road map chart above— can be obtained in one of the following manners.

- For softcopy of the documentation in PDF format, access the Nortel Networks Web site at URL <http://www3.nortelnetworks.com/product/manuals/index.htm>.
- For hardcopy of the documentation in a two-binder set, use ordering code NTBQ67AA.
- For hardcopy of the documentation on CD-ROM, use ordering code NTBQ72AA.

Note: For a set of the Passport 4400 Interworking documents, describing guidelines and configuration for Passport 4400-to-6400 connections, use order code NTBQ88AA.

Master Table of Contents

A

The following appendix lists the table of contents of all the manuals in the Passport 4400 documentation set.

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ISDN BRI Manual	800-1942-31
Analog Voice Module Manual	800-1943-31
T1/E1 and Digital Voice Manual	800-1944-31
CLI Reference Manual	800-1950-31
Hardware Installation Manual	800-1951-31
Operator's Manual	800-1952-31
InstallTool Release 2.0 Startup Guide	800-1983-31

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Master Index

B

The following master index lists all subjects indexed in each of the Passport 4400 user manuals. Each entry lists the subject, the manual(s) in which the subject is indexed, and the corresponding page number(s) containing information on the subject. The user manuals are referenced by the unique portion of their part number, e.g., [1943]. Use the chart below to locate the manual associated with each part number.

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Analog Voice Module Manual	800- 1943 -31
T1/E1 and Digital Voice Manual	800- 1944 -31
CLI Reference Manual	800- 1950 -31
Hardware Installation Manual	800- 1951 -31
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Glossary

AB or ABCD

Signalling bits associated with every digital voice channel. In T1 these bits are “robbed” from the least significant bit of every sixth voice sample. In a T1 extended superframe, A is obtained from frame 6, B from frame 12, C from frame 18, and D from frame 24. In a T1 superframe, C = A, and D = B. See definitions for superframe and extended superframe.

In E1, these bits are submultiplexed in time slot 16 with two DS0 channels in a CAS (Channel Associated Signalling) format.

A-Law

A non-linear voice encoding/decoding method associated with E1 type high-speed digital transmission

AMI (Alternate Mark Inversion)

In industry usage, AMI is a bipolar digital transmission format, where every other logical ones bit (mark) alternates between plus 3 volts and minus 3 volts, with logical zeros at zero volt. See Bipolar Violation.

When defining the DSX-1 and DS-1 interface code parameters, AMI implies that B8ZS zeros suppression is not enabled.

ARP (Address Resolution Protocol)

A mechanism for mapping network-layer addresses to data-link-layer addresses (for example, LAN media access control addresses).

B-Channel

Bearer channel. In ISDN, a full-duplex, 64 kbps channel used to send user data.

BECN (Backward Explicit Congestion Notification)

The BECN bit in the Frame Relay header of a frame that warns the receiving device that the frames it is receiving (traveling in the opposite direction) have encountered congestion or congested resources.

Bc

See Committed Burst.

B8ZS

A T1 zeros suppression technique, where an all-zeros byte is replaced with a code of 00011011, and each ones pair is transmitted with a bipolar violation. See HDB3.

Bipolar

A method of digital information transmission, where logical ones are coded both positively and negatively with respect to a zero base reference.

Bipolar Violation (BPV)

When two consecutive logical ones bits (marks) are transmitted with the same polarity. When the T1 format is AMI, then a bipolar violation indicates that a line error occurred.

Bit Stuffing

A zeros suppression technique, where bit 7 of every byte is forced to a "1". With this method, only 56 kbps of every 64 kbps DS0 channel is available for data.

Bypass

A connection command, where selected DS0 channels are passed through transparently between the DSX-1 and DS-1 lines. Applies only to T1 E1 voice modules with dual T1 or E1 ports.

BRI (Basic Rate Interface)

Refers to the interface between an ISDN subscriber and the ISDN switch (that is, the local loop). It consists of two 64 Kbits/s B-channels and one 16 Kbits/s D-channel.

Channel Bank

A T1 digital multiplexer which normally breaks out the 1.544 Mbps digital stream into 24 DS0 channels, but can also support multiple DS0 channels. Does not usually support sub-DS0 rates.

CAS (Channel Associated Signaling)

A means of passing T1 or E1 signalling information. In E1, time slot 16 is used in a multiframe structure of 16 frames (0-15). Each frame other than frame 0, carries signaling information bits ABCD for two voice channels. In T1, the ABCD bits are robbed from every byte of every sixth frame. See ABCD.

CCS (Common Channel Signaling)

A means of passing signaling information for multiple bearer channels over a single data link, using one of the DS0 time slots. In E1, time slot 16 carries the signaling information. In T1 time slot 24 is usually dedicated to signaling, but any one of the time slots may be configured for a that purpose. Signaling information for individual channels is passed by HDLC protocol. Examples include Q.SIG, Q921/931, DPNSS and SS#7.

Channel Loopback

A diagnostic tool for testing the integrity of a DS0 channel.

CIR (Committed Information Rate)

The rate in bits per second at which the network agrees to transfer information over a permanent virtual circuit (PVC) in Frame Relay. CIR is related to committed burst (Bc) and measurement interval (Tc) as $CIR=Bc/Tc$.

CLI (Command Line Interface)

An terminal based utility that allows the operator to enter instructions from the keyboard and then execute those instructions.

Clocking, Data Port

Source for clocking either of the two data ports. Can be either a system clock or a tail circuit.

Clocking, System

Source for clocking the T1 voice module. Can be either DSX-1 interface, DS-1 interface, or internal.

Committed Burst (Bc)

The maximum amount of data (in bits) that a network agrees to transfer under normal conditions over a measurement interval. The data may be in the form of one frame or many frames.

CO (Central Office)

A telephone company facility which houses switching equipment for connecting subscriber lines to each other, both locally and over long distances.

CFP1 (Control and Function Processor)

A processor card that incorporates Passport 6400 functionality normally available on several function processors (FPs) and the control processor (CP). The CFP1 provides full CP functionality to manage and control Passport applications for system and network functions as well as four serial ports and two LAN ports for data switching.

CPE (Customer Premise Equipment)

Telephone equipment, typically PBX or Key Telephone System, installed at the customer's office rather than the telephone company's office.

CSU (Channel Service Unit)

In industry usage, a device located between the digital line coming from the Central Office and the local data communications equipment. It provides line equalization and conditioning functions suitable for meeting the requirements of the T1 service provider.

CUG (Closed User Group)

A collection of users whose members are governed by certain rules of access with respect to communication with each other, with members of other closed user groups, and with the open part of the network. This maintains security and prohibits unauthorized access as well as providing a logical partitioning of the network for better access control.

D-Channel

A bidirectional channel, also known as delta channel, used to carry call control messages and signaling information over ISDN links.

Data Port

A high-speed data port located on the T1 or E1 Voice Module. Each port is available for transfer of video, X.25, external router, or any customer premise equipment synchronously clocked in multiples of 56/64 kbps.

Data Port Loopback

A diagnostic tool for testing the circuits between the T1 or E1 voice module and the equipment connected to the selected data port.

Data Port Rate

A configuration option of 56 or 64 kbps. Actual rate is determined by the selected option times the number of DS0 channels assigned for connection to that port. Example: selected option = 56 kbps; number of connected DS0 channels = 2; rate = 112 kbps.

DCE (Data Circuit Equipment)

The equipment at the network side of a subscriber link that provides both interface control and the means of digital transmission between user premises and the network switches.

Diagnostic Digital Test

See Internal Digital Test.

Diagnostic Metallic Test

See Internal Line Test.

Digital Voice Expansion Module

A printed circuit board mounted directly above the T1 or E1 voice module or another digital voice expansion module, and used to accommodate additional digital voice modules (12 maximum).

Digital Voice Channel

A 64 kbps PCM-coded voice channel obtained from a digital PBX and compressed to a lower rate for transmission over the WAN.

Digital Voice Module

The module where a single voice channel is processed. Up to six digital voice modules can be installed on the T1 or E1 voice module.

DLC (Data Link Control)

DLC is an interface providing logical link control connection services.

DLCI (Data Link Connection Identifier)

Ten bits within the two address octets of a frame relay address header which carry information used to locally identify virtual circuits or permanent virtual circuits.

DNA (Data Network Address)

A DNA is an identifier given to applications in many data networks. This address is used as the fundamental identifier for setting up a virtual circuit between data networks.

DPBE (Digital Private Branch Exchange)

See PBX.

Drop and Insert

A process whereby DS0 channels received from one T1 or E1 interface are dropped within the T1 or E1 voice module and replaced with new information destined for the other T1 or E1 interface. Applies only to T1 or E1 voice modules with dual T1 or E1 ports.

DS0 (Digital Service Level 0)

A 64 kbps time slot on the T1 or E1 service.

DS1 (Digital Service Level 1)

A 1.544 Mbps (T1) digital service in North America, consisting of 24 DS0 channels. In countries outside of North America the DS1 service is 2048 Mbps (E1), consisting of 32 DS0 channels. Of these, 30 are available for bearer data, and two for signalling, framing, and network functions.

DS-1

As used with Passport 4400 voice service, the network end of the T1 or E1 line interfacing with the T1 or E1 voice module, respectively. See DSX-1.

DSU (Data Service Unit)

Device used in digital transmission that adapts the physical interface on a DTE device to transmission facility such as T1 or E1. The DSU is also responsible for signal timing function. Often referred to with CSU as CSU/DSU.

DSX-1

As used with Passport 4400 voice service, the local end of the T1 or E1 line interfacing with the T1 or E1 voice module, respectively. See DS-1.

DTE (Data Terminal Equipment)

The name used to designate the user equipment on a subscriber link.

DTMF (Dual Tone Multifrequency)

A signalling method in telephony, using a combination of two tones: one high frequency and one low frequency.

E1

A European standard for digital voice and data communication, transmitted at the rate of 2.048 Mbps.

E1 Voice Module A

T1 processing and switching device than can accommodate up to six digital voice modules. May have one or two T1 interface ports.

E1 Frame

A TDM sequence of 32 8-bit words, generated 8000 times a second. Of the 32 8-bit words, 30 are voice or data channels, one is a signaling channel, and one is a framing channel.

E1 Multiframe

Refers to either of two independent E1 framing implementations, as follows:

CAS Signaling Multiframe - A sequence of 16 E1 frames for the purpose of carrying, in addition to voice and data, CAS signaling information for each of 30 voice channels.

CRC Multiframe - A sequence of 16 E1 frames carrying, in addition to voice and data, a CRC data link for the purpose of monitoring E1 link integrity. The E1 voice module adheres to the multiframe structure as specified by the CCITT Recommendations for G.704 2.048 Mbps.

E&M

Signaling convention used between voice PBXs.

EIR (Excess Information Rate)

The sustainable rate of data transfer in excess of CIR that the network delivers if there is available bandwidth. It is related to excess burst (Be) and measurement interval (Tc) as $EIR = Be/Tc$.

E-type Filters

Use Etype codes in transparent bridging and source-route bridging access lists for filtering frames by protocol type.

Extended Superframe

An extension of the T1 superframe, consisting of 24 frames. It provides additional signaling and error checking capabilities. See Superframe.

External Digital Loopback Test

Also known as the Payload Loopback Test, it is used to verify the integrity of the transmit and receive paths of the selected T1 or E1 line. In addition, it is used to test the circuits involved in unframing and framing of the data stream.

External Line Loopback Test

Also known as the Line Loopback test. Similar to the External Digital Loopback test, except that it does not test the unframing and framing circuits.

FECN (Forward Explicit Congestion Notification)

The FECN bit is used in the Frame Relay header of a frame to warn the receiving-end device that the frames it is receiving (traveling in the same direction) have encountered congestion or congested resources.

Filters

A process or device that screens network traffic for certain characteristics, such as source address, destination address, or protocol, and determines whether to forward or discard that traffic based on the established criteria.

Frame

See T1 frame and E1 frame

FP (Function Processor)

A type of processor card for the Passport 6400 that supports physical interface connections to subscriber lines and network trunks. It is optimized to support the software that performs the real-time functions associated with the forwarding and routing of frames. Different types of FPs support different types of physical interfaces, such as DS1, E1, V.35, and V.11 access and trunks. See also Control and Function Processor.

FRS (Frame Relay Service)

A streamlined ISO data link layer protocol. A frame relay network supports only core communications functions (such as transparency, multiplexing, and orderly delivery). This simplified processing (as opposed to traditional packet data protocols) permits higher speeds and lower delays for a given processing capability.

Simplification is made possible by the assumed use of improved transmission facilities (high quality digital facilities), which are affected by fewer transmission errors. Many functions such as sequencing flow control and retransmission are performed by the end-user equipment.

HDB3

A zero suppression coding method used in E1 transmission systems. It limits the maximum number of consecutive zeros to three. Any four consecutive zeros are replaced with a pattern that includes a bipolar violation. See B8ZS.

HDLC Transparent Data Service (HTDS)

A service that transports HDLC-framed data across the network without interpretation, except that interframe flags are not transmitted. The efficiency of the transmission is increased by not transmitting flags.

HG (Hunt Group)

Hunt groups are a group of network addresses (DNAs) reachable from a unique DNA and configured so that an incoming call automatically searches for an available address in the group.

HTDS

See HDLC Transparent Data Service.

Idle Channel

A DS0 channel currently not connected to any other channel or port within the T1 or E1 voice module.

Idle Code

A value ranging from 0 to 255 that identifies a DS0 channel as being in the idle state. Configured by the user individually for the DSX-1 and DS-1 interfaces, it applies to all DS0 channels within that interface.

Internal Digital Loopback Test

Also known as Diagnostic Digital Loopback Test. Similar to the Line Loopback Test, it does pass through the circuits involved in unframing and framing of the data stream.

Internal Line Loopback Test

Also known as Diagnostic Metallic Loopback test. It loops back all 24 DS0 channels of the selected T1 line (or 30 channels of the E1 line) to interfaces currently connected to it. It also tests the circuits involved in unframing and framing of the data stream.

IP Address

A 32-bit address assigned to hosts using TCP/IP. An IP address belongs to one of five classes; a, b, c, d or e. Each is written as four octets separated by periods. Each address consists of a network number, an optional subnetwork number and a host number. The network and subnetwork numbers together are used for routing, while the host number is used to address an individual host within the network or subnetwork. A subnet mask is used to extract network and subnetwork information from the IP address.

IPX (Internetwork packet exchange)

A proprietary network-layer data exchange protocol designed for Novel NetWare.

ISDN (Integrated Services Digital Network)

A digital technology which provides combined voice and data services. BRI access to an ISDN switch provides 2B+D (two 64 Kbit/s B-channels and one 16 Kbit/s D-channel) over an existing copper telephone line.

Out-of-band signaling is sent over the D-channel to request the setup of one of the B-channels (for high-speed data or voice applications) or of the D-channel for low-speed data (which can be multiplexed with the signaling and other low-speed data applications from other terminals on the same loop).

Keep Alive

A message sent by one network device to inform another network device that the virtual circuit between the two is still active.

LAN (Local Area Network)

A network that connects microcomputers, workstations, printers, and other devices together, limited to local distances. A typically LAN has a high bandwidth and supports shared media.

LAPD (Link Access Process on the D-channel)

The data link layer protocol that has been defined for ITU-T Q.921. LAPD is an ISDN access protocol used with links established on a D-channel.

LMI (Local Management Interface)

Set of enhancements to the basic frame relay specification. LMI includes support for a keep-alive mechanism, which verifies that data is flowing; a multicast mechanism. This provides the network server with its local DLCI and the multicast DLCI; global addressing, which gives DLCIs global rather than local significance in frame relay networks; and a status mechanism, which provides an on-going status report on the DLCIs known to the switch.

MAC (Media Access Control)

A 48-bit address unique to each local area network interface. This address is usually derived from the manufacturer's ID number and the serial number of the interface chip set.

MAC Filter

A filter type based on source or destination MAC address.

Measurement Interval (Tc)

The time interval over which rates and burst sizes are measured. In general, its duration is proportional to the burstiness of the traffic.

MIB (Management Information Base)

A data base containing configuration and status information relating to a specific managed object or objects. Provides a description of all the components and variables within a component that a Network Management System may access. It provides the way of naming each of these components and variables. MIB is a concept defined in network management standards such as SNMP.

MMTC (Multimedia Traffic Classes)

Multimedia traffic classes (MMTC) are subscriber options that enable you to select the traffic handling preferences from the network to meet the application requirements. MMTC handle delay-sensitive multimedia traffic and minimize the delay transfer time and delay variance through the Passport network.

MPANL

See PANL.

Mu-Law

A non-linear voice encoding/decoding method associated with T1 type high-speed digital transmission.

NMS (Network Management System)

In general, a system that helps to control, provision, and monitor the Passport node.

Object

A software entity controlled by a MIB.

Ones Density

A requirement in T1 and E1 transmissions, that the bit stream include a minimum percentage of ones (1s). Since the receiving end cannot track on 0s, proper ones density insures reliable clock recovery.

PANL

A Passport link support service designed to communicate with Passport 4400 access units. PANL includes proprietary protocol elements derived from ITU-T X.36 (Frame Relay) and signaling protocols (Q.922 and Q.933) to enhance the treatment of voice traffic over links shared with application data and enable secure signaling as a Frame Relay application.

Path Cost

Value based on hop count. Used to compare various paths through the network environment. Path cost value is used by routing protocols to determine the most favorable path to a particular destination.

PCM (Pulse Code Modulation)

A digitalization technique using 8 bits, repeated 8000 times a second for a combined rate of 64 kbps, to represent voice conversation.

PBX (Private Branch Exchange)

A privately owned phone system installed within the facilities of an organization. It allows communication among users within the organization, as well as between those users and the outside world. It differs from a key telephone system, in that the user must dial an access number such as 9 to get an outside line.

PORS (Path Oriented Routing System)

A routing system used by Passport 6400s in which the path is determined when the connection is set up and is fixed for the duration of the connection. In the event of trunk failure the path may be rerouted. The path then remains fixed in its new configuration. An advantage of path-oriented techniques is that the delay variance between two end-points can be minimized by specifying the path in advance. This characteristic is important for some traffic types, for example, a video signal carried over a Transparent Data Service (TDS).

PPA (Physical Point of Attachment)

As used with the 4400 device, PPA is not a literal physical point of attachment, but is an internal identifier for the 4400 code. Each application module has one or more PPAs associated with it, but PPA numbers are unique only within the module; they are not unique across all devices or slots.

For physical interfaces, the PPA number corresponds to the physical port number on the module. For logical or virtual interfaces, the number corresponds to a logical port or interface and is dependent on the interface module type. If a device does not support PPAs, the value - 1 is used to indicate that the field is not used as an identifier.

PSTN (Public Switched Telephone Network)

Typically, the local telephone company.

PVC

See Virtual Circuit.

QOS (Quality of Service)

Quality of service parameters control the amount of traffic the source in an ATM network sends over an SVC. If any switch along the path cannot accommodate the requested QOS parameters, the request is rejected and a rejection message is forwarded back to the originator of the request.

QRSS (Quasi Random Signal Source)

A pseudo-random serial test pattern with a length of 1048576 bits. It is limited to a maximum of 14 consecutive zeros.

RIP (Routing Information Protocol)

A protocol that uses hop count as a routing metric.

RS-232

An electrical and mechanical standard for interconnecting data communications equipment with a maximum speed of 20,000 bps. The interconnecting cable is usually limited to 50 feet.

RSA

An entry point for applications requiring access to Passport 6400 servers. Currently, the RSA provides access to the Voice Networking Call Server for Passport 4400-based applications.

RSI

A Passport 4400-based process that communicates with the RSA to access the Passport 6400 servers.

SAP Filter

SAP input filters allow a routing device to determine whether or not to accept information about a service. SAP output filters are applied prior to the routing device sending information out a specific interface.

SDT (Single Dial Tone)

A feature which allows users to dial a single number to reach a site accessed through multiple extensions.

Signaling

A handshaking protocol used between telephone equipment. Includes supervising (on/off hook line status), alerting (ringing), and call addressing (dialing) for switched services.

SNAP (Subnetwork Access Protocol)

Operates between a network entity in the subnetwork and a network entity in the end system. The SNAP entity in the end system makes use of the services of the subnetwork and performs the functions of data transfer, connection management and QOS selection.

SNMP (Simple Network Management Protocol)

A multivendor standard network management protocol that polls components in the network, typically over an IP-based network. The protocol data units are encoded in ASN.1. SNMP concentrates primarily on the observation and control of the network. It is defined by RFC1157 and RFC1213.

SPVC (Soft Permanent Virtual Circuits)

Soft PVCs support the same functionality as the nailed-up connections but eliminate the need to manually provision each node along the connection. The end point is provisioned but the connection route is selected automatically. See also Virtual Circuits.

Spanning Tree

A bridge protocol that allows for redundant paths to exist between destinations, but prevents loops by restricting packets from using less efficient paths.

Superframe (D4)

A T1 standard of twelve 193-bit frames grouped together for purposes of frame recognition, signalling and error checking. Of the 193 bits in a frame, 192 are data bits and one is a framing bit. The twelve framing bits in the superframe are released in a sequence of 100011011100, a pattern recognized by the receiving end.

SVC

See Virtual Circuit.

System Clock

A configurable parameter for the clock source used in the T1 or E1 voice module. Options include the DSX-1 interface, the DS-1 interface (if dual port), and a clock generated internally within the T1 or E1 voice module.

T1

A North American standard for digital voice and data communication transmitted at the rate of 1.544 Mbps.

T1 Voice Module

A T1 processing and switching device that can accommodate up to six digital voice modules. May have one or two T1 interface ports.

T1 Frame

A TDM sequence of 193 bits, consisting of 24 8-bit words plus a framing bit, and generated 8000 times per second. Each 8-bit word represents one DS0 channel.

T1 or E1 Line

One of two (DSX-1 and DS-1) physical T1 or E1 interfaces (ports) to the T1 or E1 voice module, respectively. It consists of two twisted wire pairs, capable of carrying information at the transfer rate of 1.544 Mbps or 2048 Mbps, respectively.

Tc

See measurement interval.

TDM

Time division multiplexing.

TFTP (Trivial File Transfer Protocol)

A protocol that governs transferring files between nodes without protection against packet loss.

Trap

A message sent by an SNMP agent to an NMS console or terminal to indicate the occurrence of a significant event, such as a defined condition or a threshold has been reached.

UNI (User to Network Interface)

The frame relay service is provided through a standard interface between the user device and the network, called the user-to-network interface.

Virtual Circuit

Provides the user with the equivalent of a physical connection to a destination address using shared facilities. Virtual circuits can be permanent (PVC) or switched (SVC). The virtual circuit is anchored in the processor cards connected to the end user devices.

V.35

An electrical and mechanical standard for interconnecting high-speed (above 19.2 dBm) data communications equipment used both in North America and European countries.

WAN (Wide Area Network)

A network used for data communications among widely distributed geographic sites. Technologies used include leased lines, connecting routers, multiplexers, packet switches, voice switches, and products like Passport.

X.21

An electrical and mechanical standard for interconnecting high-speed (above 19.2 dBm) data communications equipment used mainly in European countries.

Zero Suppression

One of three schemes used to insure ones density. See B8ZS, HDB3 and Bit Stuffing.

Passport 4400
Introduction

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Publication: 800-1982-31 Rev. A
Date: February 1999
Printed in Canada