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About This Guide

Document Purpose and Intended Audience

This guide describes the Hotwire 8100/8200 Interworking Packet Concentrator (IPC), its internetworking features, and how it works in conjunction with the Hotwire Digital Subscriber Line Access Multiplexer (DSLAM). It also provides information on what you need to know before planning your network. Use this guide to:

- Obtain a basic understanding of the Hotwire IPC
- Understand how the IPC works with the DSLAM to provide network connections

This guide is intended for network planners, network administrators, and network maintainers. It is assumed that you have a basic understanding of internetworking protocols and their features. Specifically, you should have a basic familiarity with Simple Network Management Protocol (SNMP), Network Management Systems (NMSs), Asynchronous Transfer Mode (ATM) service, frame relay service, and the following internetworking concepts:

- Transmission Control Protocol/Internet Protocol (TCP/IP) applications
- IP and subnet addressing
- IP routing (also referred to as IP forwarding)
- Virtual circuits
- Virtual LANs

It is assumed that you are familiar with the Hotwire DSLAM and Remote Termination Unit (RTU). See the appropriate Hotwire documents for installation, configuration, and maintenance instructions. Also see the Hotwire 8100/8200 Interworking Packet Concentrator (IPC) User's Guide for more information about the Hotwire IPC.
Document Summary

Section Description

Chapter 1  Introduction to the Hotwire IPC. Provides an overview of the Hotwire IPC and its two model types. It also illustrates the interconnection of the IPC and DSLAM in a WAN and LAN environment.

Chapter 2  Packet Forwarding. Describes the types of packet forwarding modes supported by an IPC.

Chapter 3  Network Management. Describes how the Network Management System (NMS) connects and supervises the IPC and DSLAM.

Chapter 4  Network Models and Topologies. Discusses the two network models (Routed Access and Switched Access) that can be used in conjunction with a Hotwire DSLAM.

Chapter 5  Packet Walk-Through. Provides example of packet walk-through using XLANE service.

Chapter 6  Network Configurations. Describes the configuring of the Hotwire IPC in two steps:

- Configuring services between ATM switches
- How to establish VLAN communication policy between end-stations

Glossary  Defines acronyms and terms used in this document.

Index  List key terms, acronyms, concepts, and sections in alphabetical order.

Product-Related Documents

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<th>Document Number</th>
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<tr>
<td>5020-A2-GN10</td>
<td>Hotwire POTS Splitter Central Office Installation Instructions</td>
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<tr>
<td>5030-A2-GN10</td>
<td>Hotwire 5030 POTS Splitter Customer Premises Installation Instructions</td>
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<td>5446-A2-GN10</td>
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<td>8000-A2-GB20</td>
<td>Hotwire DSLAM for 8540 and 8546 DSL Cards User’s Guide</td>
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<td>8000-A2-GB21</td>
<td>Hotwire DSLAM for Models 8540 and 8546 DSL Cards Network Configuration Guide</td>
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<td>8000-A2-GB24</td>
<td>Hotwire DSLAM Configuration for 8540 and 8546 DSL Cards Startup Guide</td>
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<td>8000-A2-GN11</td>
<td>Hotwire Management Communications Controller (MCC) Card Installation Instructions</td>
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<td>8546-A2-GN10</td>
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<td>8600-A2-GN20</td>
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<tr>
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<td>Hotwire 8800 Digital Subscriber Line Access Multiplexer (DSLAM) Installation Guide</td>
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Contact your sales or service representative to order additional product documentation.

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Introduction to the Hotwire IPC

What is the Hotwire IPC?

The Hotwire Interworking Packet Concentrator (IPC) is an advanced, multi-layer concentrating platform that provides integrated Local Area Network (LAN) and Asynchronous Transfer Mode (ATM) concentration of traffic, Wide Area Network (WAN) connectivity, high-speed forwarding, virtual LANs, and Internet Protocol (IP) firewalls.

When used with the Hotwire 8800/8600 Digital Subscriber Line Access Multiplexer (DSLAM), the Hotwire IPC extends the range of the Hotwire DSLAM system’s backbone network connections. The IPC provides concentration for hundreds of Rate Adaptive Digital Subscriber Lines (RADSLs) onto an ATM or frame relay backbone network.

The IPC uses T1/E1, DS3/E3, and OC-3/STM-1 interfaces to provide DSLAMs with a powerful backbone concentrator access to an ATM or frame relay service.

NOTE:

The digital hierarchy designators for T carriers (e.g., T1 and T3) correspond to the designators for the digital signals (e.g., DS1 and DS3) level hierarchy. These designators are used interchangeably in this guide.
The following illustration provides a high-level view of the interconnection of the IPC and DSLAM in a WAN and LAN environment. One side of the IPC connects to the LAN (10BaseT) port on the DSLAM and the other connects to a WAN over an ATM or frame relay service. For detailed information about installation and connection, see the *Hotwire 8100/8200 Interworking Packet Concentrator (IPC) User’s Guide*.

**Hotwire Network Components**

The Hotwire IPC generally resides in a central office (CO) or wire center along with the Hotwire DSLAM. The Hotwire network components consist of the following electronic equipment and technology:

- 8100 or 8200 IPC chassis
- Service Modules
- Hotwire DSLAM
- Remote Termination Unit (RTU)
Hotwire IPC Chassis

The Hotwire IPC chassis is available in the 8100 IPC model and the 8200 IPC model. Both models can be configured with one or more WAN interfaces.

- **8100 IPC Model**

  The 8100 IPC is a standalone product or may be used as a cost-effective 10BaseT port expansion device for the 8200 IPC with a WAN uplink in a low-end configuration.

  It is a single module unit, in which you can combine Ethernet concentration with high-speed fast Ethernet, ATM or frame relay uplinks. The 8100 contains twelve 10BaseT ports on the front of the chassis and two slots for high-speed uplink submodules on the rear of the chassis.

  The chassis comes with an integrated Management Processor Module (MPM) built in for downloading software and receiving initialization and configuration information.

  See the *Hotwire 8100/8200 Interworking Packet Concentrator (IPC) User’s Guide* for installation, configuration, maintenance and troubleshooting information.
8200 IPC Model
The 8200 IPC chassis is available in two versions: a 9-slot chassis version and a 5-slot chassis version.

- The 9-slot chassis, with just one Wide Area Network Service Module (WSM), can aggregate packet traffic for up to 896 DSL ports (i.e., 224 10BaseT interfaces).

- The 5-slot chassis with just one Wide Area Network Service Module (WSM), can aggregate packet traffic for up to 384 DSL ports (i.e., 96 10BaseT interfaces).

See the Hotwire 8100/8200 Interworking Packet Concentrator (IPC) User’s Guide for installation, configuration, maintenance and troubleshooting information.

See your sales representative for a complete list of supported products.
IPC Service Modules

The IPC service modules are devices that perform software filtering translations between dissimilar network interfaces (e.g. Token Ring and Ethernet or ATM and Ethernet).

Both the 8100 and 8200 IPC models use several service module types for Ethernet, ATM and WAN forwarding technologies. This section lists the service modules available. For detailed information about each module, see the Hotwire 8100/8200 Interworking Packet Concentrator (IPC) User’s Guide.

The following table lists the service modules (sub-modules) and their parts description for the 8100 IPC.

Service Modules (Sub-Modules) for the 8100 IPC

<table>
<thead>
<tr>
<th>Part</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethernet Service Modules (EPSOM)</td>
<td>PESM-100C-FD-1: One 100BaseT Tx full-duplex Fast Ethernet service module with RJ45 connectors</td>
</tr>
<tr>
<td></td>
<td>PESM-100-Fx-FD1: One 100BaseT Fx full-duplex, multimode Fast Ethernet service module with SC connectors</td>
</tr>
<tr>
<td></td>
<td>PESM-100-Fx-FD1: One 100BaseT Fx full-duplex, single mode Fast Ethernet service module with SC connectors</td>
</tr>
<tr>
<td></td>
<td>PESM-100C-4: Four 100BaseT Tx full-duplex Fast Ethernet service module with RJ45 connectors</td>
</tr>
<tr>
<td>Asynchronous Transfer Mode Service Modules (ASMs)</td>
<td>PASM2-155Fx-1: One-port, multimode, OC-3c SONET rate and framing service module with SC connectors, 500 kB SRAM</td>
</tr>
<tr>
<td></td>
<td>PASM2-155Fx-1-1E: One-port, multimode, OC-3c SONET rate and framing service module with SC connectors, 2 MB SRAM</td>
</tr>
<tr>
<td></td>
<td>PASM2-155Fx-1: One-port, single mode, OC-3c SONET rate and framing service module with SC connectors, 500 kB SRAM</td>
</tr>
<tr>
<td></td>
<td>PASM2-155Fx-1-1E: One-port, single mode, OC-3c SONET rate and framing service module with SC connectors, 2 MB SRAM</td>
</tr>
<tr>
<td></td>
<td>PASM-DS3-1: One-port ATM service module, DS3, 45 Mbps with BNC connectors</td>
</tr>
<tr>
<td></td>
<td>PASM-ES-1: One-port ATM service module, DS3, 45 Mbps with BNC connectors</td>
</tr>
<tr>
<td>Wide Area Network Service Modules (WSMs)</td>
<td>PWSM-S-2: Two-port frame relay service module with 26-pin connectors, no data compression</td>
</tr>
<tr>
<td></td>
<td>PWSM-SC-4: Four-port frame relay service module with 26-pin connectors, and data compression</td>
</tr>
</tbody>
</table>
The following table lists the service modules and their parts description for the 8200 IPC.

### Service Modules for the 8200 IPC

<table>
<thead>
<tr>
<th>Part</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Management Processor Modules (MPM)</td>
<td>MPM with 16 MB DRAM, 4 MB FLASH (Switch)</td>
</tr>
<tr>
<td>Ethernet Service Modules (EPSON)</td>
<td>ESM-C-32: 32-port 10BaseT service module with RJ45 connectors, 1kB CAM</td>
</tr>
<tr>
<td></td>
<td>ESM-C-16: 16-port 10BaseT service module with RJ45 connectors, 1kB CAM</td>
</tr>
<tr>
<td></td>
<td>ESM-100FM-8: 8-port, multimode (100BaseT Fx) Fast Ethernet service module with SC connector, 4 kB CAM</td>
</tr>
<tr>
<td></td>
<td>ESM-100Fx-FD: One full-duplex, multimode (100BaseT Fx) Fast Ethernet service module with SC connectors, 2 kB CAM</td>
</tr>
<tr>
<td></td>
<td>ESM-100Fx-FD: One full-duplex, single mode (100BaseT Fx) Fast Ethernet service module with SC connectors, 2 kB CAM</td>
</tr>
<tr>
<td></td>
<td>ESM-100Fx-FD: Two full-duplex, single mode (100BaseT Fx) Fast Ethernet service module with SC connectors, 2 kB CAM</td>
</tr>
<tr>
<td>Asynchronous Transfer Mode Service Modules (ASMs)</td>
<td>ASM-155Fx: 1-port fiber multimode OC-3c SONET service module with SC connectors, 4 kB CAM</td>
</tr>
<tr>
<td></td>
<td>ASM2-155Fx: 2-port fiber multimode OC-3c SONET service module with SC connectors, 4 kB CAM</td>
</tr>
<tr>
<td></td>
<td>ASM2-155Fx: 1-port fiber single mode OC-3c SONET service module with SC connectors, 4 kB CAM</td>
</tr>
<tr>
<td></td>
<td>ASM2-155Fx: 2-port fiber single mode OC-3c SONET service module with SC connectors, 4 kB CAM</td>
</tr>
<tr>
<td></td>
<td>ASM-DS3: 1-port 45 Mbps DS-3 service module with BNC connectors, 2 kB CAM, 500 kB SRAM</td>
</tr>
<tr>
<td></td>
<td>ASM-DS3: 2-port 45 Mbps DS-3 service module with BNC connectors, 2 kB CAM, 500 kB SRAM</td>
</tr>
<tr>
<td></td>
<td>ASM-E3: 1-port, 34 Mbps E3 service module with BNC connectors, 2 kB CAM, 500 kB SRAM</td>
</tr>
<tr>
<td></td>
<td>ASM-E3: 2-port, 34 Mbps E3 service module with BNC connectors, 2 kB CAM, 500 kB SRAM</td>
</tr>
<tr>
<td>Wide Area Network Service Modules (WSMs)</td>
<td>WSM-SC-4W: 4-port serial frame relay service module with 26-pin connectors, FRF.9 data compression</td>
</tr>
<tr>
<td></td>
<td>WSM-SC-8W: 8-port serial frame relay service module with 26-pin connectors, FRF.9 data compression</td>
</tr>
</tbody>
</table>
Hotwire DSLAM

The Hotwire DSLAM is a DSL platform that provides high-speed Internet and Intranet access over traditional twisted-pair telephone wiring. When using the 8546 DSL card in the DSLAM, the DSLAM can be configured to interoperate with the 5446 RTU. In such a configuration, data packets are transported at multimegabit speeds over a Digital Subscriber Line (DSL) link.

In addition, each DSLAM contains a Management Communications Controller (MCC) card, which provides consolidated management access for the DSL cards and the Hotwire RTUs.

For information about DSL cards and RTUs, see the appropriate Hotwire DSL Card User’s Guide and appropriate RTU Installation Instructions. For information about the MCC card, see the Hotwire Management Communications Controller (MCC) Card User’s Guide.

There are two types of chassis available:

- **The Hotwire 8600 DSLAM Chassis**
  The Hotwire 8600 DSLAM is an independent, standalone system which can be stacked. When stacked, up to six systems can share management access through a single MCC card. That is, the first (or base) chassis is equipped with an MCC card in Slot 1, leaving Slots 2 and 3 available for up to two DSL cards or a maximum of eight DSL ports. Each additional chassis houses up to three DSL cards. By stacking you can incrementally expand your DSL access service.

For more information about the Hotwire 8600 DSLAM, see the *Hotwire 8600 Digital Subscriber Line Access Multiplexer (DSLAM) Installation Guide*. 

97-15350-01
The Hotwire 8800 DSLAM Chassis

The Hotwire 8800 DSLAM is a 20-slot chassis designed to house up to 18 DSL cards with one MCC card. (The remaining slot is reserved for future use.) The Hotwire 8800 chassis requires at least one DSL card and one MCC card. A fully populated chassis provides 72 DSL ports.

For information about the Hotwire 8800 DSLAM chassis, see the Hotwire 8800 Digital Subscriber Line Access Multiplexer (DSLAM) Installation Guide.

Hotwire RTU

A Hotwire Remote Termination Unit (RTU) resides at the customer premises. It connects to the local loop to provide high-speed connectivity to the Hotwire DSLAM.

In this release, the Hotwire 5446 RTU is the only supported RTU model for end-user system configurations. The 5446 RTU is composed of a DSL modem, which supports full-speed DSL line rates and an IP forwarder that can support multiple end-user systems. For more information, see the Hotwire 5446 Remote Termination Unit (RTU) Installation Instructions.
Connecting the DSLAM and IPC

Connections from the 8100 and 8200 IPC to the DSLAM are made from the IPC ESM to the Ethernet ports located on the front of the DSLAM. Each ESM may contain 12, 16, or 32 Ethernet (10BaseT) ports. Each port is connected to a single DSL card in a DSLAM at the DSL card’s corresponding 10BaseT port on the DSLAM chassis.

The MCC card is connected from its 10BaseT port on the front of the DSLAM chassis to a 10BaseT port on the ESM module. If your network supports multiple DSLAMs, the MCC card in each DSLAM is connected to a hub, which in turn, is connected to a single 10BaseT port on an ESM module.

The following diagram illustrates connections between the Hotwire DSLAM and the Hotwire IPC.

You can configure the DSLAM to use a Permanent Address Resolution Protocol (ARP) cache and avoid proxy ARPing. (For detailed information on proxy ARPing, refer to the appropriate Hotwire DSL card’s network configuration guide). By configuring a Permanent ARP Cache entry, (essentially, a static IP address and a Media Access Control (MAC) address) you can prevent every LAN Address from receiving broadcast messages and thus avoid a network overload. For detailed information on configuring the DSLAM to use Permanent ARP Cache, see the Hotwire DSLAM for 8540 and 8546 DSL Cards User’s Guide.
Packet Forwarding

Packet Forwarding Modes

The Hotwire IPC and DSLAM can be configured to support two modes of packet forwarding:

- unrestricted mode
- restricted mode

In the **unrestricted mode**, packets can be forwarded as follows:

- The DSLAM can be configured to support LAN-to-LAN forwarding. That is, a packet received on one port of a DSL card can be forwarded to another port on the same DSL card without having to be passed to the IPC/WAN network.

- The DSLAM and IPC can support LAN-to-LAN forwarding. Packets received on one port of a DSL card can be forwarded to an IPC in the same wire center and then to a port on another DSL card in the same DSLAM that sent the packet, or to a port on a DSL card in a different DSLAM.

- Packets can be forwarded from the DSLAM to the IPC’s WAN interface and onto a frame relay or ATM network.

In the **restricted mode**, all packets are forwarded from the DSLAM to the IPC’s WAN interface and onto a frame relay or ATM network only.

The following sections discuss unrestricted and restricted modes in more detail.
Unrestricted Packet Forwarding Mode

In unrestricted mode data packets are sent using one of the following methods:

- **DSL-to-DSL Level 3 Forwarding**
  Data packets can be forwarded between ports internally on the DSL card. This is referred to as DSL-to-DSL level 3 forwarding. In this scenario, packets received on one DSL port can be forwarded to another DSL port on the same DSL card without having to be forwarded to an IPC or WAN backbone as illustrated below.

![Diagram of DSL-to-DSL Level 3 Forwarding](image1)

- **DSL-to-LAN Forwarding**
  Using DSL-to-LAN forwarding, data packets are forwarded from the DSLAM to the IPC and then to a port on another DSL card in the same DSLAM as illustrated below.

![Diagram of DSL-to-LAN Forwarding](image2)
Using the DSL-to-LAN forwarding scheme, packets can also be forwarded from the DSLAM to the IPC and then to a port on another DSL card in a different DSLAM, as shown in the following illustration.

- **LAN-to-WAN Forwarding**
  Using LAN-to-WAN packet forwarding, data packets are sent from the DSLAM to the IPC and then to the ATM or frame relay backbone network as illustrated below.
Restricted Packet Forwarding Mode

The restricted mode permits only the LAN-to-WAN forwarding, as described in the previous section. In the restricted packet forwarding mode, all packets from a DSL port are forwarded to the WAN interface on the IPC and then to the ATM or frame relay backbone network only.

Using the DSLAM, packets cannot be internally looped between two DSL ports on one DSL card, or between two DSL cards networked to the same IPC. This mode of operation is an essential feature required for Competitive Access Providers (CAP) deploying a Hotwire IPC product in the same wire center within a Regional Bell Operating Company’s (RBOC) central office. This conforms to the Telecommunications Reform Act of 1996.

**NOTE:**

The Hotwire IPC resides in its own chassis and connects to the DSLAM over 10BaseT interfaces. Installation, maintenance, and operation are independent of the Hotwire DSLAM.
Network Management

3

Network Management Overview

Both IPC and DSLAM support the industry standard Simple Network Management Protocol (SNMP). The Paradyne Data Communications Equipment (DCE) Manager, running on UNIX and Windows platforms, provides Network Management System (NMS) support for both IPC and DSLAM.

The NMS provides full support for the DSLAM and basic support for the IPC. For detailed information on how NMS provides full support of the DSLAM, see the Performance Wizard User’s Guide. The basic support provided for the IPC includes device discovery, icon display and trap reporting. Configuration of the IPC and DSLAM is accomplished using a telnet session through the NMS.

How NMS Connects to IPC

This section provides examples of network connections between NMS and the IPC and DSLAM.

In the following illustration, the 10BaseT connection from the hub adapter to the DSLAM terminates at the MCC card in the DSLAM. The User Datagram Protocol/Internet Protocol (UDP/IP) is used to describe how messages reach an application program within a destination computer.
In the following illustration, the 10BaseT connection from the IPC to the DSLAM terminates at the MCC card in the DSLAM. The NMS, as shown, resides on its own IP network.

NOTE:
The MCC card provides consolidated management access for the DSL cards. It also provides alarm monitoring of the DSL cards, the DSLAM power and cooling systems, and interfaces to the central office alarm system. The MCC card interfaces with external managers and servers (e.g. File Transfer Protocol servers) for system configuration and management.
Network Models and Topologies

Overview

Two general network models can be used to deploy the IPC and the Hotwire DSLAM. Within these models three different network configurations can be designed, depending on whether or not the concentrator node is switched or routed and on the WAN services employed. The concentrator node typically refers to devices that constitute the network backbone. This chapter describes the two network models and discusses the three topologies that can be configured.

Network Models

There are two network models that can be deployed when used in conjunction with the Hotwire DSLAM. The two models are:

- Routed Access Network Model
- Switched Access Network Model

The primary difference between these two network models is that in the Routed Access Network Model, the router partitions broadcast domains across the access network (traffic flooding caused by broadcasting is localized); whereas, in the switched network access model, broadcast traffic is flooded to all Network Service Providers (NSPs). For more information see Frame Flooding in AutoTracker VLANs, in the Hotwire 8100/8200 Interworking Packet Concentrator (IPC) User’s Guide.
Routed Access Network Model

In the Routed Access Network Model, the IPC back-hauls traffic to a single default router located in the Network Access Provider’s (NAP) concentrator node. This network model is illustrated below. The wire center refers to equipment that resides typically in a central office.

In the diagram above:

- **Service** indicates that data passing through the router is changing from IP over MAC packets to IP/MAC over ATM cells or frame relay frames and vice-versa.
- **1483** refers to Request for Comment (RFC) 1483, which defines IP encapsulation over ATM adaptation layer 5.
- **1490** refers to RFC 1490, which defines multiprotocol encapsulation over frame relay.

Key:

- Service = 1483 Bridge, 1490 Bridge
- Interfaces:
  - Frame Relay – T1/E1
  - ATM – T3/OC-3/STM-1
Switched Access Network Model

In the Switched Access Network model, the IPC back-hauls traffic to multiple routers, where a router is located at each NSP as shown below.

In the diagram above:

- **Service** indicates that data passing through the router is changing from IP over MAC packets to IP/MAC over ATM cells or frame relay frames and vice-versa.

Key:

- Service = 1483 Bridge, 1490 Bridge
- Interfaces:
  - Frame Relay – T1/E1
  - ATM – T3/OC-3/STM-1
Network Topologies

The IPC provides LAN aggregation of data packets to and from the 10BaseT interface of the Hotwire DSLAM, as well as WAN access for a number of different network topologies. Traffic movement across the access network (either switched or routed) and the WAN services configured define the network topology. These network topologies usually form a spoke/hub network. For example, the Hotwire IPC and DSLAM reside in the wire center (spoke), aggregating and forwarding to the concentrator node (or hub). The concentrator node is the point in the network that connects the NSP with the wire centers. The wire center refers to equipment that typically resides in the CO. The Hotwire 8100/8200 IPC and the Hotwire DSLAM reside in the wire center.

The predominant attributes characterizing these topologies are:

- ATM Switched Access Network using point-to-point bridging
- ATM or Frame Relay Routed Access Network using point-to-point bridging
- ATM Switched Access Network using XLANE Service

These network topologies on the IPC and DSLAM are configured with the following features:

- Source-Based Routing (on the DSLAM)
- Network address policy Virtual Local Area Networks (VLANs) (on the IPC)
- WAN services (point-to-point bridging or XLANE service on the IPC)

Detailed information on source-based routing can be found in the appropriate Hotwire DSLAM Network Configuration Guide. Detailed information on Network Address Policy and WAN services can be found in the *Hotwire 8100/8200 Interworking Packet Concentrator (IPC) User’s Guide*. 
Source-Based Routing

Source-based routing is a feature that must be configured on the Hotwire DSLAM for restricted mode packet forwarding operation. **Restricted mode** packet-forwarding operation specifies that all LAN traffic is forwarded to the IPC’s WAN interface. With source-based routing, the source addresses of upstream packets are compared to a source address listed in a static route table. If a match is found, the packet is forwarded. Source-based routing provides security, preventing End-User System (ES)-to-ES routing when those ESs are attached to LANs through different 5446 RTUs, but are attached to the same DSL card. Therefore, source-based routing can ensure that all upstream traffic within a service domain is sent to the NAP.

Network Address VLAN Policies

The IPC supports five different AutoTracker VLAN Policies. VLAN Policies are the rules you use to define membership in a VLAN. Using **network address policies** you can define membership in a VLAN based on network addressing criteria. In the example topologies in this section, broadcast packets are always forwarded to all ports that are members of the same VLAN as the source port. For example, if port B is a member of VLANs 3 and 4, then a broadcast packet from port B will be flooded to all ports that are members of VLAN 3 and/or 4.

**A group** defines a physical space within a network and may be multiple switches or a set of ports.

**NOTE:**

When using network address policies, subnet mask addressing must be behind each DSL card. For example, all end-user systems, RTUs, and e1a IP addresses associated with DSL card 1 and downstream from DSL card 1 should be in subnet range 155.1.3.x. Similarly, all end-user systems, RTUs, and e1a IP addresses associated with DSL card 2 and downstream from DSL card 2 should be in subnet range 155.1.4.x.
 Wan Services

Two types of WAN services are employed in these network topologies:

- Point-to-Point (PTOP) bridging service, and
- XLANE Service.

For a detailed explanation of these services, see the Hotwire 8100/8200 Interworking Packet Concentrator (IPC) User’s Guide.

**NOTE:**

If the packet flow in these topologies is operating in the restricted mode, then source-based routing is a feature that must be configured on the DSLAM.

Point-to-Point Bridging Service

PTOP bridging service allows for communication across an ATM infrastructure using a single Virtual Circuit (VC). The PTOP configuration is useful in routed networks and switched networks where each 10BaseT port is dedicated to a single NSP. Network topologies using PTOP service do not require intensive configuration. This section provides a discussion of three PTOP topologies:

- ATM switched access network with one NSP per DSL card
- ATM/frame relay access network with multiple NSPs per DSL card
- ATM/frame relay access network with one NSP per DSL card

XLANE Service

XLANE service is useful with IPC private encapsulation or standard RFC 1483 encapsulation for interoperability with other vendors and in switched networks where 10BaseT ports are shared across multiple NSPs. In the Hotwire 8100/8200 Interworking Packet Concentrator (IPC) User’s Guide, XLANE service is referred to as VLAN Clusters service.
Network Topology Examples

This section provides examples of the three main network topologies and the characteristics of each.

ATM Switched Access Network with One NSP per DSL Card

The following illustrations show a VC configured as a Permanent Virtual Circuit (PVC).

Key:
- \( R_n \) = Router at NSP\( n \)
- \( V_{Cn} \) = Virtual Circuit for NSP\( n \)

In the example above:
- The network topology uses ATM switching in the concentrator node with all end-user systems connected to each DSL card subscribing to the same NSP. That is, all end-user systems connected to DSL card number 1 by means of a Hotwire RTU subscribe to NSP\( a \).
- The routers located at NSP\( b \), and NSP\( c \) support bridge/router service over VCs to the ATM switch. The router at NSP\( a \) does not support bridge/router service but may be linked to the ATM switch over a LAN (10BaseT) connection to another IPC and then over \( V_{Ca} \).
ATM point-to-point bridging can be configured using either of the following methods, depending on the network topology and available resources:

- A unique PTOP bridging service can be configured for each DSL card, where each DSL card is in a separate group with a unique VC between the IPC and the NSP.
- A unique PTOP bridging service can be configured for all DSL cards in the same group that supports the same NSP. That is, one VC is configured for all DSL cards that support the same NSP.

The restricted mode of operation in an ATM PTOP bridging topology requires the existence of a source-based static route on the DSL card for every end-user system behind the RTU. The next-hop address for the source-based static route is the NSP router interface.

On the IPC, one VLAN exists within each group for all end-user systems on a DSL card. A unique VC is configured for each group and for each NSP. However, multiple VCs can be configured for one NSP with certain network topologies (i.e., if multiple DSL cards are supporting one NSP and you want to use one VC per DSL card).

The point-to-point Bridging service can use one of the following methods:

- Logical Link Control (LLC) encapsulation if the ATM switch is not an 8200 IPC, or
- IPC encapsulation (PTOP Private) if an IPC is placed between the ATM switch and the NSP router.
**Topology Characteristics**

Following are the primary characteristics of an ATM switched access network using PTOP with one NSP per DSL card.

- No broadcast leakage downstream because each DSL card is configured for one VLAN. DSL<sub>n</sub> is associated with NSP<sub>n</sub> only and all DSL cards associated with NSP<sub>n</sub> have their own VC<sub>n</sub> that is within a unique group. DSL cards that support the same NSP may share a VC.

- Traffic forwarding upstream is secure because each LAN port is dedicated to one NSP that is associated with one group having one VC.

- No traffic is looped back in either direction over the WAN interface because an NSP does not share a VC with another NSP. Each VC is in a separate group.

- There is maximum traffic isolation between NSPs.

- All end-user systems attached to the same DSL card support one NSP only.

- One NSP per <i>n</i> DSL modules.

- One VLAN per group.

- One VC per group.

- DSL card uses source-based routing in the restricted mode of operation.

- ATM service: PTOP RFC 1483.

- One ATM service per group.

- NSP router has an ATM interface with bridged/router capability.
ATM/Frame Relay Routed Access Network with Multiple NSPs per DSL Card

This network topology has a router in the concentrator node. This router can support frame relay or ATM on both of its interfaces. The WAN service is frame relay or ATM. The frame relay service uses PTOP based on RFC 1490 encapsulation and the ATM uses PTOP based on RFC 1483 encapsulation, ensuring interoperability of devices from other vendors. In this network topology each DSL card can support multiple NSPs. One VC is used between the concentrator node’s router and the IPC, trunking all NSP traffic and prohibiting traffic from looping back between the router and the IPC.

The concentrator node’s router needs to have integrated bridging and routing capability.

The restricted mode of operation in this topology requires the existence of a source-based static route on the DSL card for every end-user system behind a Hotwire RTU. The next-hop address for the source-based static route is the NSP router interface.

Key:
- \( R_n \) = Router at NSP \( n \)
- VC = Virtual Circuit for all NSPs
Topology Characteristics

Following are the chief characteristics of an ATM/frame relay routed access network using PTOP bridging with multiple NSPs per DSL card.

- Each DSL card can support multiple NSPs.
- No traffic is looped back between the concentrator node’s router and the IPC because only one VC is configured.
- Requires minimal configuration (one group having one service with one VC).
- Service type: ATM – PTOP RFC 1483 or frame relay – PTOP RFC 1490.
- One VC between the router and IPC, trunking all NSP traffic.
- DSL card uses source-based routing in restricted mode of operation.
- Multiple VLANs per group.
- Integrated bridging and routing on router.

ATM/Frame Relay Routed Access Network with One NSP per DSL Card

In this network topology, each DSL card supports one NSP. This is the primary difference between this model and the previous one. A VC can be configured for each NSP. A unique group is created for each NSP that is supported and the group runs one PTOP service. Downstream broadcast traffic can be isolated to those DSL cards only that support the specified NSP.
The concentrator node’s router supports frame relay or ATM on both of its interfaces. The WAN service is frame relay or ATM. The frame relay service uses PTOP based on RFC 1490 and the ATM uses PTOP based on RFC 1483. In this network model, each DSL card can support multiple NSPs. One VC is used between the concentrator node’s router and the IPC. VLANs can be configured for each LAN port and must reside in one group.

The restricted mode of operation in this model requires the existence of a source-based static route on the DSL card for every end-user behind an RTU. The next-hop address for the source-based static route is the NSP router interface.

Topology Characteristics

Following are the primary characteristics of an ATM or frame relay routed access network using PTOP bridging with one NSP per DSL card.

- No broadcast leakage downstream because each DSL card is configured over one VLAN. DSL $n$ is associated with NSP$n$ only and all DSL cards associated with NSP$n$ have their own VC$n$, which is within a unique group. DSL cards that support the same NSP share a VC.
- Traffic forwarded upstream is secure because each LAN port is dedicated to one NSP that is associated with one group having one VC.
- No traffic is looped back in either direction over the WAN interface because an NSP does not share a VC with another NSP. Each VC is in a separate group.
- There is maximum traffic isolation between NSPs.
- Service type: ATM – PTOP RFC1483 or frame relay – PTOP RFC1490.
- All end-user systems attached to a DSL card support only one NSP.
- One VLAN per group.
- One VC per group.
- One service per group.
- Each DSL card supports one NSP.
- Integrated bridging and routing on router.
- DSL card uses source-based routing in the restricted mode of operation.
ATM Switched Access Network Using XLANE Service with Multiple NSPs For Each DSL Card

In this network topology, an ATM switch resides in the concentrator node. The 8200 IPC’s WAN service is ATM and the type is XLANE service. Each DSL card can support multiple NSPs. In the diagram above, each DSL card supports the same three NSPs. The IPC is configured with one group having three VCs, one for each NSP. The IPC maintains traffic separation between the VCs. Downstream broadcast traffic from each NSP is sent over its respective VC, but is not looped back over the other NSP’s VCs (although they are in the same group) because of XLANE Service. One ATM service only is configured on the IPC and it has multiple VCs connected over that service. (By contrast, if multiple PTOP services are configured, it would loop back all broadcast packets over all VCs every time a broadcast packet is sent over a VC.)

In the illustration above, the routers located at NSPb, and NSPc support bridge/router service over VCs to the ATM switch. The router at NSPa does not support bridge/router service but may be linked to the ATM switch over a LAN (10BaseT) connection to another IPC and then over VCa.

The restricted mode of operation in this model requires the existence of a source-based static route on the DSL card for every end-user behind a RTU. The next-hop address for the source-based static route is the NSP router interface.
Topology Characteristics

Following are the primary characteristics of an ATM switched access network model using XLANE service with multiple NSPs per DSL card.

- Each DSL card can support multiple NSPs.
- Downstream traffic from the router to the IPC is not looped back to all VCs because there is only one XLANE service.
- One group for all DSL cards.
- ATM service is XLANE Method II with RFC 1483.
- One ATM service per group.
- Multiple VCs per XLANE service.
- One VC per NSP on the NSP’s router.
- DSL card uses source-based routing in the restricted mode of operation.
Packet Walk-Through

Overview

This chapter provides an example of a packet walk-through using XLANE service in the restricted mode.

Switched Network Model Assumptions

The following assumptions are made regarding each of the devices in the switched network model using XLANE service in the restricted mode of packet-forwarding:

- **For the RTU:**
  - A host route entry has been configured in the Hotwire RTUs for ES1 and ES2.
  - A service domain IP entry exists for the Hotwire RTUs.

- **For the DSLAM:**
  - Destination host-based routes exist between the DSL card and the RTUs.
  - Source-based routed exist between the DSL card and the NSP router.
  - Upstream filtering is disabled.
  - DSL card uses source-based routing to ensure the restricted mode of packet forwarding.

- **For the IPC:**
  - All VCs are in one group.
  - ATM service is XLANE Method II with 1483 bridging.
  - There are multiple VCs per XLANE service.
  - There is one VC per NSP on the NAP’s router.
— DSL cards can support more than one NSP.

— Four VLANs using Network Address Policies are configured, two each on ports one and two. This ensures that all upstream broadcast traffic from known MAC addresses is forwarded to the WAN port only.

**For the Routers:**

— Each NSP router has a route configured to the other's NSP router.

— One VC between the NSP router and each IPC has been configured.

— The router supports integrated bridge/routing.

**Packet Walk-Through**

The following illustration shows a high-level view of ES1 pinging ES2. Two detailed illustrations follow showing upstream and downstream packet flow.

**NOTE:**

Each RTU is configured to support two Service Domains; however, for simplicity, only one ES is depicted connected to an RTU.
The following table shows partial routing from DSL card 1 in the previous diagram:

<table>
<thead>
<tr>
<th>Host/Net</th>
<th>Subnet Mask</th>
<th>Next-Hop Address</th>
<th>S/D (Source/Destination)</th>
<th>PA (Proxy ARP)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) 155.1.3.4</td>
<td>255.255.255.255</td>
<td>155.1.2.2</td>
<td>src (source)</td>
<td>N</td>
</tr>
<tr>
<td>2) 155.1.3.4</td>
<td>255.255.255.255</td>
<td>155.1.3.3</td>
<td>dst (destination)</td>
<td>Y</td>
</tr>
</tbody>
</table>
The following diagram depicts an upstream packet flow. Numbers and arrows in the illustration correspond to the packet flow stages described in the text that follows.

1. ES1 (155.1.3.4) originates a Protocol Data Unit (PDU) addressed to ES2 (176.1.4.11). Because ES1 and ES2 are on different networks (155.1.3 and 176.1.3, respectively), ES1 ARPs for its default gateway IP address (which is RTU1’s Service Provider IP address, 155.1.3.3) to map RTU1’s IP address to a MAC address.

2. RTU1 receives the broadcast ARP request from ES1.

3. RTU1 replies to the ARP request with its own MAC address.

4. After ES1 receives the ARP reply, it sends the unicast packet (Ping request) to the MAC address of the RTU.

5. Upon receiving the unicast packet, RTU1 forwards it to DSL1 over its DSL interface.

6. When DSL card 1 receives this PDU, it consults its routing table to determine how it should be routed. Because a source route is defined for ES1 (having a next-hop address of Ra), DSL1 forwards the PDU to Ra over its Ethernet interface. DSL1 ARPs for Ra to map its IP address to a MAC address.

If static ARP cache on DSL 1 has been configured for ES2, then the ARP from DSL1 to Ra can not occur. The remaining steps assumes that static ARP cache has not been configured.
7. The IPC, on receiving the broadcast ARP request from DSL1, learns DSL1’s source MAC address (i.e., associates this with Port 1) and determines in which VLANs the source address qualifies for membership. The IPC also sends the broadcast to all ports associated with Group 1 (i.e., Port 2 and the WAN port).

Broadcast/multicast MAC PDUs from the DSL card are forwarded on all XLANE VCs (and to all DSL cards dependent on network address policies). DSL cards discard any broadcast/multicast PDUs.

**NOTE:**

Subsequent broadcasts from DSL1 are forwarded to VLANs associated with this port only.

8. After the ATM switch receives the PDU ARP request, it forwards the cells to those ports associated with VCa and VCb. Note that the IPC breaks the packets into cells, per RFC 1483, before sending them to its ATM WAN port.

9. After receiving the PDU, Ra replies by sending a unicast ARP reply over VCa.

10. The ATM switch forwards the PDU ARP reply to the IPC.

11. On receiving the PDU ARP reply, the IPC learns Ra’s MAC address and tags it to VCa.

**NOTE:**

All subsequent unicast traffic to Ra is sent over VCa only, provided that the MAC aging timer has not expired.

Simultaneously, the IPC sends the PDU to all ports associated with Group 1 because this is an unknown MAC address.

12. After DSL1 receives the PDU, it sends a unicast packet (Ping request) to Ra.

13. After the IPC receives the PDU (and having learned which VLANs and VCs this is associated with), it forwards the Ping request to VCa over its WAN port.

14. After receiving the PDU on its VCa interface, the ATM switch forwards it to Ra.

15. Communication between Ra and Rb are ignored for the purpose of simplicity.

16. The ARP requests and replies between Rb and ES2 are similar to the steps described above.
In the remainder of our example packet walk-through, it is assumed that Ra has received the Ping reply from ES2 and is now forwarding it to ES1. The following diagram shows a downstream packet flow.

1. Because Ra has an IP interface with an address of 155.1.2.2, it sends an ARP request for ES1 (155.1.3.4). Ra learned the MAC address of the DSLAM’s e1a when it did an ARP request. The Ping request PDU from the ES has its IP address, therefore Ra needs to resolve it.

2. This PDU is sent to the ATM switch over VCa.

3. The ATM forwards the PDU to the IPC over VCa.

4. Having previously learned Ra’s source MAC address during the ARP process (previous Step 9), when the IPC receives the broadcast packet (ARP request), it forwards the PDU to all VLANs (2,3,4,5) associated with that WAN port.

5. Because DSL1 has a destination route for ES1 (155.1.3.4) with proxy ARP enabled, DSL1 responds to the ARP request from Ra with its own MAC address (proxy ARP). As previously indicated, the PDU is sent to the IPC and ATM switch.
6. After receiving the ARP response, Ra sends the Ping reply directly to DSL1’s MAC address. As previously described, the PDU is sent to the ATM switch and IPC.

7. DSL1 consults its routing table to identify the next-hop address to which the Ping reply will be forwarded. Because a host route is defined for ES1 RTU1’s NAP IP address is used as the next-hop address.

8. DSL1 then forwards the packet over the DSL port connected to RTU1.

9. Upon receiving the packet, RTU1 forwards the packet to its 10BaseT port because it has a host route for ES1.
Network Configurations

Overview

This chapter provides configuration examples for the Hotwire IPC and DSLAM. This chapter shows configuring the Hotwire IPC for two ATM services (PTOP and XLANE) and for VLAN services.

For more detail on configuring the IPC for other network services, see the Hotwire 8100/8200 Interworking Packet Concentrator (IPC) User’s Guide.

- Configuring services between ATM switches.
  The PTOP bridging service is specified to allow two groups to communicate across an ATM infrastructure using a single Virtual Circuit on the IPC. A group defines a physical space within a network and can be multiple switches or a set of ports.
  XLANE services support configuring multiple Virtual Circuits over one ATM service.

- Establishing Virtual Local Area Network (VLAN) communications policy between end-user systems.

The examples in this chapter uses the ATM Switched Access network model with the network address policies (or rules) run by the IPC’s AutoTracker VLAN software.
Hardware Requirements

To verify interworking between the Hotwire DSLAM and the IPC, the following equipment is required:

- Hotwire 8800 DSLAM or Hotwire 8600 DSLAM and a Hotwire RTU
- Hotwire 8200 IPC with an Ethernet Service Module (ESM) and either a WAN Service Module (WSM) or ATM Service Module (ASM)
- An ATM or frame relay switch (or another Hotwire IPC) to verify IPC connectivity

In addition, if verification of end-to-end connectivity is desired, the following equipment is required:

- NSP workstation
- NMS workstation
- Routers: one for the service network and one for the management network
- End-user systems

ATM Services

For information on how to configure the Hotwire 8800/8600 DSLAM and the Hotwire RTU, refer to the appropriate Hotwire DSLAM Network Configuration Guide and the appropriate Hotwire DSLAM User’s Guide. The specific documents that are appropriate depend upon the DSL cards used in the DSLAM.

For information, regarding the Hotwire IPC user interface and detailed procedures for setting ATM services, refer to the Hotwire 8100/8200 Interworking Packet Concentrator (IPC) User’s Guide.
The following diagram shows the basic interworking wiring for an ATM switched network (using either PTOP or XLANE).

- ES are connected to Hotwire RTUs. Up to four RTUs can be connected to each Hotwire DSL card.
- Each 10BaseT interface on the MCC card and DSL cards connect to a port on the Hotwire IPC’s ESM module.
- The ESM module aggregates IP traffic and forwards it to a WAN interface on the ASM module.
- The ASM interface connects to the ATM switch.
- The ATM switch connects to the router and finally to the NSP.
- The wire center refers to equipment that typically resides in the central office (CO). The Hotwire IPC and the Hotwire DSLAM reside in the wire center.
- The concentrator node, where the ATM switch resides, is the backbone network.

Because the Hotwire DSLAM operation is transparent to the 8200 IPC, you should configure and verify the DSLAM and RTU first. Refer to the appropriate Hotwire DSLAM Network Configuration Guide and the Hotwire DSLAM User’s Guide.

Configure and interconnect the Hotwire DSLAM, the Hotwire RTU, end-user systems, NMS, and NSP systems (routers and servers). Verify end-to-end connectivity, from the ES to the NSP utility and from the NMS to the RTU by using a network diagnostic tool, such as the Ping utility.
Configuring Groups

An unconfigured IPC contains one group, a default group (Group 1) which contains all physical ports on the IPC. It also contains one VLAN (VLAN 1). However, you can use AutoTracker to create additional groups. When you add a new group, you give it a name and number. Then you add ports from the default group to the new group. For detailed information on creating and configuring groups, refer to the Hotwire 8100/8200 Interworking Packet Concentrator (IPC) User’s Guide.

Procedure

To create a new group:

1. Type `crgp` at any prompt. You may also type a number (for example, `crgp 3`) to create a group number, or the system will assign one.

2. The following prompt appears: Description (no quotes):
Enter a description of the group.

3. The following prompt appears: Enable FR routing? (n):
   Type `n`.
   A positive response means that you wish to perform RFC 1490 Routing.

4. The following prompt appears: Enable ATM CIP?: (n):
   Type `n`.
   A positive response means that you wish to enable ATM Classical IP.

5. After you have responded to the Enable ATM CIP? prompt, the following prompt appears: Enable IP? (y):
   Type `n`.

6. The following prompt appears: Enable IPX?:
   Type `n`.

7. The following message appears: Do you wish to configure the interface group for this Virtual LAN at this time? (y)
   Press Enter.
   A message is appears confirming that you have created a new group. Then the following prompt appears:

   Initial Slot/Interface Assignments: – For example, first I/O Module (slot 2), second interface would be 2/2. Specify a range of interfaces and/or a list as in :2/1-3, 3/3, 3/5, 4/6-8

8. Type in the ports (total number of interfaces) that you want to include in this group.
9. If you enter a port that is already assigned to a group (as in default group 1), the following message appears:

   Initial Slot/Interface Assignments: 2/8
   2/8 - This interface has already been assigned to Group 1-
   (Default Group 1).
   Do you wish to remove it from that Group and assign it (with new configuration values) to this group (n)?

10. Type y at each port prompt to change its group assignment and begin setting port parameters.

11. You will be prompted to add a description of each port.

12. The following prompt appears:
   Bridge Mode: {Auto-Switch (a)
   Optimized Device Switching (o),
   Spanning Tree Bridge (b)

   Press Enter to accept the default. For detailed information about bridge modes, refer to the Hotwire 8200/8100 Interworking Packet Concentrator (IPC) User’s Guide.

13. The following prompt appears:
   Flood Limit (bytes/second) (192000)
   Press Enter to accept the default.

14. The following prompt appears:
   Output format type: {Default (IP-Eth II; IPX 802.3) (d)
   Ethernet II (e)
   SNAP (s)
   LLC (l)

   Press Enter to accept the default.

15. The following prompt appears:
   Ethernet_802.2 Pass Through (Yes | No) (y):
   Press Enter to accept the default.

16. The following prompt appears:
   Admin Status {disable (d), enable (e)} (e):
   Press Enter to accept the default.

17. The following prompt appears:
   slot/port 2/8 is not currently mirrored
   Mirroring enabled {no (n), yes (y)} (n):
   Press Enter to accept the default.

   When you have completed all the steps, a message similar to the following appears:

   Adding port 2/8 to Group 3

   You may modify interfaces to this group using the addvp, modvp, and rmvp commands. Refer to the Hotwire 8200/8100 Interworking Packet Concentrator (IPC) User’s Guide for more information.
Configuring ATM Services

The following sections describe how to configure ATM services.

Before configuring ATM services on the IPC, you must configure the IP address of the IPC to be a host route in the Hotwire DSLAM’s management domain. Refer to the appropriate Hotwire DSLAM Configuration Guide.

Configuring PTOP Service

**NOTE:**
Skip this section if PTOP service is not being configured.

**Procedure**
To configure point-to-point bridging services for ATM on the Hotwire IPC:

1. At any prompt in the IPC User Interface, type *services*, followed by ?.
2. Type *cas* to create a service and then the slot/port for the service (for example, *cas2* if you want to configure slot 2 for ATM services).
4. For Encaps type, select RFC 1483 for non-IPC devices.
5. For Connection type, select PVC.
6. For PTOP Groups, enter the Group number to which service is associated.
7. For PTOP Connection, type the number of the VC that is to be part of the PTOP service.
8. For Admin status, select Enable.
9. At the *Enter (option = value/save/cancel)* prompt, type *save*.
Configuring XLANE Service

This section describes procedures for configuring XLANE services.

**NOTE:**
Skip this section if XLANE service is not being configured.

XLANE service, also referred to as VLAN Cluster, is discussed in detail in the *Hotwire 8100/8200 Interworking Packet Concentrator (IPC) User’s Guide*. You can find a complete discussion and procedures for setting them up in that document.

**Procedure**

To set up XLANE service Method II:

1. At any prompt, type `services` followed by `?`.
2. At the services command menu, type `cas` and then the slot/port for the service. (for example, type `cas3` if you want to configure slot 3 for XLANE service).
3. For Service type, choose VLAN Cluster.
4. At the `Description` prompt, type a description of the service. It can consist of up to 30 alphanumeric characters.
5. For Number of others in cluster, type the number of VCs to be configured in that XLANE service.
6. For Change cluster info, type `yes` to modify the cluster information.
7. For Encapsulation format, select 1483. Encapsulation format 1483 enables interoperability with other vendor’s switches.
8. For Connection type, select PVC.

**NOTE:**
The following field is part of a sub-menu that appears as a result of typing `yes` for `Change cluster format` in Step 6.
9. For Data-Direct VC, assign a unique VC number for each Data-Direct Virtual Circuit.
10. At the `Enter (option = value/save/cancel)` prompt, type `save`.

If a second IPC is deployed between the ATM switch and the router at the NSP, configure it in the same manner.
Establish VLAN Policies

VLAN policies (or rules) determine membership in the VLAN. You can define physical or logical policies for devices. Physical policies consist of port rules; that is, you define one or more ports as members in the VLAN.

Logical policies are:
- MAC address policy
- Protocol policy
- Network address policy
- User-defined policy

The following sections describe how to set-up VLAN policies that will determine how traffic with a certain subnet address automatically gets assigned to a VLAN. For detailed information on VLAN policies, refer to the Hotwire 8100/8200 Interworking Packet Concentrator (IPC) User’s Guide.

AutoTracker VLAN

AutoTracker VLAN is the software that you can use to control network communication between the IPC and the DSLAM. Using AutoTracker, you can focus on the logical representation of your network rather than on the physical topology. AutoTracker VLANs are established based on the policy configured in the IPC network management system. You must determine which policies are necessary to create a virtual LAN, that assigns those policies to the appropriate switches. For a more detailed discussion of AutoTracker and AutoTracker VLANs, refer to the Hotwire 8100/8200 Interworking Packet Concentrator (IPC) User’s Guide.

Configuring VLAN Policies

After configuring the ATM service, you must set the VLAN policy that defines membership in a VLAN for the end-user systems.

Create AutoTracker VLANs by using Hotwire IPC’s AutoTracker VLAN software. There are several types of VLAN policies. However, the following example shows how to set the network address Policies only. Network address policies are the rules that allow you to specify membership in the VLAN based on network addressing criteria. By choosing the appropriate options from the AutoTracker menu, you can:
- Enter the name, number, and other basic information for this VLAN.
- Define the policy that defines membership in the VLAN.

You can find a detailed discussion of AutoTracker VLANs and complete procedures for setting them up in Creating AutoTracker VLANs, in the Hotwire 8100/8200 Interworking Packet Concentrator (IPC) User’s Guide.
The following is a high-level procedure for setting VLAN policies.

**Entering basic VLAN Information:**

**Procedure**

To enter basic VLAN information:

1. At any prompt, type `cratvl`.
2. For Enter the VLAN Group ID for this VLAN, type **2**.
   All VLANs must belong to a group. You have identified this VLAN with group 2.
3. For Enter the VLAN ID for this VLAN, type **2**.
   This will identify the VLAN with the group specified above.
4. For Enter the new VLAN’s description, type a textual description of this VLAN. You may use up to 30 alphanumeric characters.
5. For Enter the Admin Status for this VLAN, type **e** (Enable).
   Once the VLAN is enabled, the IPC begins to use the policies you defined.

**Defining the VLAN Policy and Setting the IP Address and Subnet Mask:**

**Procedure**

To define VLAN policy and set IP and subnet mask addresses:

1. Type **4** to select Network Address Rules from the menu that is displayed after completing the procedure above.
2. For Set Rule Admin Status to, type **e** (Enable).
   Admin Status for a policy is different from Admin Status for a VLAN in that it pertains only to this specific rule within this specific VLAN. Enabling the rule allows the IPC to determine membership in the VLAN.
3. For Select Network Protocol, type **1** to select IP.
4. For Enter the IP Address, enter the IP address that you want to include in this VLAN. You may use dotted decimal or hexadecimal notation (e.g., 136.26.117.20).
5. For Enter the IP Mask (0xffff00), enter the IP Subnet mask.
   The default subnet mask, shown in parentheses, is derived from the IP address class entered in Step 4.
6. At the **Configure more rules for this VLAN** prompt, type **n**.
Additional Configuration Information

The following two sections provide additional connectivity information as well as an overview of how to configure a Cisco ATM Interface Processor (AIP) for interoperability with an IPC.

Connecting Equipment

Procedure

To connect devices in the network:

1. Connect the 8200 IPC to the ATM switch and verify connectivity.
2. Connect the ATM switch to the NSP or NSP’s router.
3. Connect the 10BaseT interfaces of the IPC to the DSL card and MCC card 10BaseT (e1a) interfaces on the Hotwire DSALM.
4. Verify end-to-end connectivity.
Cisco AIP and Hotwire IPC Interoperability: An Overview

Before configuring the IPC and Cisco ATM Interface Processor (AIP) to interoperate, you must be sure the following conditions are set up. For more detailed information, refer to the previous sections on configuring an IPC for ATM services, the Hotwire 8100/8200 Interworking Packet Concentrator (IPC) User’s Guide, and the Cisco IOS Command Reference Guide.

- Configure ATM service (PTOP or XLANE) specifying RFC 1483 encapsulation on the IPC. On the Cisco AIP, choose aal5snap encapsulation.
- The IPC and the AIP must have identical Virtual Path Identifiers (VPI)/Virtual Channel Identifiers (VCI) numbers.
- The sublayer type should match on the IPC and AIP. Choose PLCP.
- The line type should match (default = CbitParity).
- The Payload Scrambling mode must match on the IPC and AIP. It should be either On or Off for both.
- On the IPC the default timing mode is local and on the AIP it is line.

Configuring a Cisco 7500 AIP:

Refer to the Cisco IOS Command Reference Guide for detailed information on configuring a Cisco 7500.

Procedure

1. Assign a Bridge Group Number and define Spanning Tree Protocol (for example, IEEE 802.1 D).
2. Specify the protocol to be routed on this Bridge Group.
3. Specify ATM interface and configure ATM PVC.

NOTE:
VPI and VCI on both the IPC and Cisco must be identical.
4. Assign the Bridge Group to this ATM interface.
5. Create a Map Group and Map List for the ATM interface.
7. Enable Bridged Virtual Interface (BVI).
8. Assign an IP address to the BVI.
## Glossary

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<tr>
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<th>Definition</th>
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<tr>
<td>10BaseT</td>
<td>An Ethernet LAN that works on twisted-pair wiring.</td>
</tr>
<tr>
<td>Access Node</td>
<td>Refers to a Hotwire DSLAM or series of DSLAMs interworking within the wire center.</td>
</tr>
<tr>
<td>Address Mask</td>
<td>A 32-bit mask used to identify the network and local portions of an IP address. See Subnet Address Mask.</td>
</tr>
<tr>
<td>AIP</td>
<td>ATM Interface Processor.</td>
</tr>
<tr>
<td>ARP</td>
<td>Address Resolution Protocol. The TCP/IP protocol used to dynamically bind an IP address to a low-level physical hardware address (usually a Media Access Control (MAC) address).</td>
</tr>
<tr>
<td>ASM</td>
<td>ATM Service Module.</td>
</tr>
<tr>
<td>ATM</td>
<td>Asynchronous Transfer Mode. A high-bandwidth, low-delay, connection-oriented switching and multiplexing technique using fixed-size cells.</td>
</tr>
<tr>
<td>ATM Switch</td>
<td>A specialized switch which sits in the carrier backbone network. It is a high capacity, cell-based switch designed to support broadband networking. Its fully integrated access, multiplexing and switching functions provide the capability for a variety of combined data, video, imaging and voice services on a single platform.</td>
</tr>
<tr>
<td>Backbone</td>
<td>Typically, the part of a communications network which carries the heaviest traffic. Referred to as the part of a network which joins LANs together, whether inside a building, across a city or country.</td>
</tr>
<tr>
<td>Bridging</td>
<td>Connections between two network segments allowing the passing of data packets between the two network segments.</td>
</tr>
<tr>
<td>BVI</td>
<td>Bridged Virtual Interface.</td>
</tr>
<tr>
<td>CAM</td>
<td>Content Addressable Memory.</td>
</tr>
<tr>
<td>CAP</td>
<td>Competitive Access Provider.</td>
</tr>
<tr>
<td>Concentrator Node</td>
<td>Refers to an internetworking or switching system.</td>
</tr>
<tr>
<td>DCE Manager</td>
<td>Data Communications Equipment Manager. A network management system that helps the network administrator manage devices using Simple Network Management Protocol (SNMP) and HP OpenView.</td>
</tr>
<tr>
<td>Domain</td>
<td>A block of IP addresses. Syntactically, all IP addresses within a given domain would share a common IP address prefix of some length.</td>
</tr>
<tr>
<td>DRAM</td>
<td>Dynamic Random Access Memory. The readable/writable memory used to store data in personal computers.</td>
</tr>
<tr>
<td>DSL</td>
<td>Digital Subscriber Line. The non-loaded, local-loop copper connection between the customer and the first node within the network.</td>
</tr>
<tr>
<td>DSL Card</td>
<td>Digital Subscriber Line Card. The primary card in the Hotwire DSLAM system. It has one Ethernet port and four DSL ports.</td>
</tr>
<tr>
<td>DSLAM</td>
<td>Digital Subscriber Line Access Multiplexer. A platform for DSL modems that provide simultaneous high-speed digital data access and analog POTS over the same twisted-pair telephone line.</td>
</tr>
</tbody>
</table>
Name of the DSL card’s and MCC card’s 10BaseT (Ethernet) interface.

Any end-user computer system that connects to a network.

Ethernet Service Module.

A type of network that supports high-speed communication among systems. It is a widely-implemented standard for LANs. All hosts are connected to a coaxial cable where they contend for network access using a Carrier Sense, Multiple Access with Collision Detection (CSMA/CD) paradigm.

A rule or set of rules applied to a specific interface to indicate whether a packet can be forwarded or discarded.

One identifiable group of bits that includes a sequence of bits for control, framing, etc.

A high-speed connection-oriented packet switching WAN protocol using variable length frames.

File Transfer Protocol. A TCP/IP standard protocol that allows a user on one host to access and transfer files to and from another host over a network, provided that the client supplies a login identifier and password to the server.

A physical space within a network and can be multiple switches or a set of ports.

A computer attached to a network that shares its information and devices with the rest of the network. See end-user system (ES).

A host having a subnet mask of 255.255.255.255.

An electronic device to which multiple computers attach, usually using twisted-pair wiring.

Worldwide interconnected networks that predominantly use the TCP/IP protocol. The Internet is a three level hierarchy composed of backbone networks, mid-level networks, and stub networks.

Internet Protocol. An open networking protocol used for Internet packet delivery.

Interworking Packet Concentrator. The IPC fundamentally takes Local Area Network (LAN) Internet Protocol (IP) traffic and concentrates the traffic onto high speed Wide Area Network (WAN) interfaces.

Internet Protocol address. The address assigned to an internet host.


Integrated Routing and Bridging.

Integrated Services Digital Network. Telecommunication service that uses digital transmission and switching technology to provide voice and digital data communications on a bearer (B) channel while sending signaling on the data (D) channel.

Local Area Network. A privately owned and administered data communications network limited to a small geographic area.

Media Access Control Address. The unique fixed address of a piece of hardware, normally set at the time of manufacture, and used in LAN protocols.

Management Communications Controller Card. The card in a Hotwire DSLAM system or stack that is used primarily for monitoring and configuring the Hotwire DSLAM.

Management Processor Module. This card performs management functionality, such as, maintenance of user configuration information, downloading of switching module software, basic bridge management, and basic routing functions.
NAP  Network Access Provider. The NAP provides a transit network service permitting connection of service subscribers to Network Service Providers (NSPs). The NAP is typically the network provider (e.g., a Regional Bell Operating Company, an Alternate Local Exchange Carrier) that has access to the copper twisted pairs over which the DSLs operate.

NID  Network Interface Device. An electronic device that connects the telephone line and POTS splitter to the telephone network.

NMS  Network Management System. The system responsible for managing a portion of the network. An NMS communicates to a Simple Network Management Protocol (SNMP) agent via SNMP to obtain (get) or configure (set) specific parameters or variables within control of the SNMP agent (e.g., DCE Manager).

NSP  Network Service Provider. NSPs can be either public data network providers (i.e., Internet Service Providers) or private data network providers (i.e., corporate intranets) who provide network services based on the Internet Protocol (IP). In some cases, the NSP and the NAP can be a single network provider.

Packet  A group of control and data characters that are switched as a unit within a communications network. Used in this document to refer to a block of data sent across an IP switching network.

PDU  Protocol Data Unit. A message of a given protocol comprising payload and protocol-specific control information, usually contained in a header.

Ping  Packet InterNet Groper. A program that is useful for testing and debugging networks. It sends an Echo packet to the specified host, and waits for a response. It reports success or failure and statistics about its operation. The ping program is supported from both the DSL and MCC cards.

POP  Point of Presence. The POP is the access point to the Network Access Provider network for a Network Service Provider (NSP). The NSP is typically connected to the POP across an access link that terminates on a router on the NSP premises.

POTS  Plain Old Telephone Service. Standard telephone service over the PSTN, with an analog bandwidth of less than 4 KHz.

POTS Splitter  A device that filters out the DSL signal and allows the POTS frequencies to pass through.

PPP  Point-to-Point Protocol. A protocol for framing IP when sending across a serial line. It allows a computer to connect to the Internet using a standard dial-up telephone line and a high-speed modem.

Proxy ARP  Proxy Address Resolution Protocol (ARP). The technique in which one machine, usually a router, answers ARP requests intended for another by supplying its own physical address. By pretending to be another machine, the router accepts responsibility for forwarding packets. The purpose of proxy ARP is to allow a site to use a single IP network address with multiple physical networks.

PSTN  Public Switched Telephone Network. A network shared among many users who can use telephones to establish connections between two points. Also known as dial network.

PTOP  Point to Point bridging service that provides a service to allow two groups to communicate across an ATM infrastructure using a single VLAN Cluster (VC).


RADSL  Rate Adaptive Digital Subscriber Line. A technique for the use of an existing twisted pair line that permits simultaneous POTS and high-speed data communication at adaptive symmetric and asymmetric rates.
Glossary

**Router**
A device that connects LANs by dynamically routing data according to destination and available routes.

**Routing Table**
A table that stores information about possible destinations for packets being routed through the Hotwire DSLAM and identifies the next hop address to which to send the packet.

**RTU**
Remote Termination Unit. A device, such as the Hotwire 5446 RTU, that is installed at the end-user site (customer premises). The RTU connects to the local loop to provide high-speed Internet or Intranet connectivity to the Hotwire DSLAM.

**Service Modules**
Devices that perform software filtering translations between dissimilar network interfaces (e.g., Token Ring and Ethernet or ATM and Ethernet). See Filter

**Service Subscriber**
The service subscriber is the user (or set of users) that has contracted to receive networking services (e.g., Intranet access, remote LAN access) from one or more Network Service Providers (NSPs).

**SNMP**

**SNMP Agent**
An application level program typically running on a host system which facilitates communication to an NMS manager. See NMS.

**SNMP Trap**
A notification message to the SNMP manager when an unusual event occurs on a network device, such as a reinitialization.

**SONET**
Synchronous Optical NETwork. An ANSI standard for the transmission of digital data over optical networks.

**SP**
Service Provider. A group or organization that provides connections to a part of the Internet. If you want to connect a network of computers or a single personal computer to the Internet, you must talk to a “service provider”.

**SRAM**
Static Random Access Memory. A form of RAM that is preferred over DRAM, because of its ability to access data in memory faster.

**STM**
Synchronous Transfer Mode. Transport and switching of digital data in a regular and fixed pattern.

**Subnet Address Mask**
A bit mask used to select bits from an IP address for subnet addressing. The subnet mask is a 32-bit Internet address written in dotted-decimal notation with all the 1s in the network and subnet portions of the address.

**Telnet**
Virtual terminal protocol in the Internet suite of protocols. Allows the user of one host computer to log into a remote host computer and interact as a normal terminal user for that host.

**UDP**
User Datagram Protocol. A TCP/IP protocol describing how messages reach application programs within a destination computer. This protocol is normally bundled with IP-layer software. UDP is a transport layer, providing datagram mode of communication for delivery of packets to a remote or local user.

**VC**
Virtual Circuit. A logical connection or packet-switching mechanism established between two devices at the start of transmission.

**VLAN**
Virtual Local Area Network. A logical grouping of users regardless of their physical location on the network.

**VLAN Switch**
A layer 2 networking device.

**WAN**
Wide Area Network. A network that spans a large geographic area.
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</tr>
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<td>Wire center</td>
<td>A wire center is usually a local serving office where the DSLs from the service subscribers are terminated on the Hotwire DSLAM.</td>
</tr>
<tr>
<td>WSM</td>
<td>WAN Service Module.</td>
</tr>
<tr>
<td>XLANE Service</td>
<td>A service designed for networks that consist of a collection of IPCs interconnected over an ATM switched network in which the switches are mesh interconnected with PTOP virtual circuits.</td>
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