

# *IPLink 2800 Series* **Managed VPN Router**

## *Getting Started Guide*



### **Important**

This is a Class A device and is intended for use in a light industrial environment. It is not intended nor approved for use in an industrial or residential environment.

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# Summary Table of Contents

1	General information .....	19
2	Hardware installation .....	28
3	Getting started with the IPLink Managed VPN Router .....	40
4	Serial port configuration .....	46
5	T1/E1 port configuration .....	60
6	VPN configuration .....	69
7	Access control list configuration.....	81
8	Link scheduler configuration .....	95
9	LEDs status and monitoring .....	114
10	Contacting Patton for assistance .....	116
A	Compliance information .....	119
B	Specifications .....	122
C	Cabling .....	126
D	Port pin-outs .....	130
E	IPLink 2800 Series factory configuration .....	134
F	Installation checklist .....	136



# Table of Contents

<b>Summary Table of Contents .....</b>	<b>3</b>
<b>Table of Contents .....</b>	<b>5</b>
<b>List of Figures .....</b>	<b>11</b>
<b>List of Tables .....</b>	<b>12</b>
<b>About this guide .....</b>	<b>13</b>
Audience.....	13
Structure.....	13
Precautions .....	14
Safety when working with electricity .....	15
General observations .....	16
Typographical conventions used in this document.....	17
General conventions .....	17
<b>1 General information.....</b>	<b>19</b>
IPLink Model 2800 Series overview.....	20
IPLink 2800 Series detailed description .....	21
IPLink 2800 Series model codes .....	21
Serial WAN models .....	21
Ethernet WAN models .....	22
Model code extensions .....	23
Ports descriptions .....	24
Applications overview.....	25
Branch-Office virtual private network over Frame Relay service .....	25
Corporate multi-function virtual private network .....	26
<b>2 Hardware installation.....</b>	<b>28</b>
Planning the installation .....	29
Installation checklist .....	30
Site log .....	31
Network information .....	31
Network Diagram .....	31
IP related information .....	31
Software tools .....	31
Power source .....	31
Location and mounting requirements .....	32
Installing the VPN router.....	32
Mounting the VPN router .....	32
Connecting cables .....	32
Installing the Ethernet cable .....	32
Installing the serial WAN cable .....	33
Installing the V.35 interface cable .....	34
Installing the X.21 interface cable .....	35

Installing the T1/E1 twisted pair cables .....	36
Installing the E1 dual coaxial cables .....	37
Connecting to external power source .....	38
<b>3 Getting started with the IPLink Managed VPN Router .....</b>	<b>40</b>
Introduction .....	41
1. Configure IP address .....	42
Power connection and default configuration .....	42
Connect with the serial interface .....	42
Login .....	43
Changing the IP address .....	43
2. Connect the IPLink VPN Router to the network .....	44
3. Load configuration .....	44
<b>4 Serial port configuration .....</b>	<b>46</b>
Introduction .....	47
Serial port configuration task list .....	47
Disabling an interface .....	47
Enabling an interface .....	48
Configuring the encapsulation for Frame Relay .....	49
Enter Frame Relay mode .....	50
Configuring the LMI type .....	50
Configuring the keep-alive interval .....	51
Entering Frame Relay PVC configuration mode .....	51
Configuring the PVC encapsulation type .....	52
Binding the Frame Relay PVC to IP interface .....	52
Enabling a Frame Relay PVC .....	54
Disabling a Frame Relay PVC .....	54
Displaying serial port information .....	55
Displaying Frame Relay information .....	56
Integrated service access .....	57
<b>5 T1/E1 port configuration .....</b>	<b>60</b>
Introduction .....	61
T1/E1 port configuration task list.....	61
Enable/Disable T1/E1 port .....	61
Configuring T1/E1 port-type .....	62
Configuring T1/E1 clock-mode .....	62
Configuring T1/E1 line-code .....	62
Configuring T1/E1 framing .....	63
Configuring T1/E1 line-build-out (T1 only) .....	63
Configuring T1/E1 used-connector (E1 only) .....	63
Configuring T1/E1 application mode .....	64
Configuring T1/E1 LOS threshold .....	64
Configuring T1/E1 encapsulation .....	64
Create a Channel-Group .....	64

Configuring Channel-Group Timeslots .....	65
Configuring Channel-Group Encapsulation .....	65
Entering HDLC Configuration Mode .....	65
Configuring HDLC CRC-Type .....	66
Configuring HDLC Encapsulation .....	66
T1/E1 Configuration Examples .....	66
Example 1: Frame Relay without a channel-group .....	67
Example 2: Framerelay with a channel-group .....	68
Example 3: PPP without a channel-group .....	68
Example 4: PPP with a channel-group .....	68
<b>6 VPN configuration .....</b>	<b>69</b>
Introduction .....	70
Authentication .....	70
Encryption .....	70
Transport and tunnel modes .....	71
VPN configuration task list .....	71
Creating an IPsec transformation profile .....	71
Creating an IPsec policy profile .....	72
Creating/modifying an outgoing ACL profile for IPsec .....	74
Configuration of an IP interface and the IP router for IPsec .....	75
Displaying IPsec configuration information .....	75
Debugging IPsec .....	76
Sample configurations .....	77
IPsec tunnel, DES encryption .....	77
IPLink configuration .....	77
Cisco router configuration .....	78
IPsec tunnel, AES encryption at 256 bit key length, AH authentication with HMAC-SHA1-96 .....	78
IPLink configuration .....	78
Cisco router configuration .....	79
IPsec tunnel, 3DES encryption at 192 bit key length, ESP authentication with HMAC-MD5-96 .....	79
IPLink configuration .....	79
Cisco router configuration .....	79
<b>7 Access control list configuration.....</b>	<b>81</b>
Introduction .....	82
About access control lists .....	82
What access lists do .....	82
Why you should configure access lists .....	82
When to configure access lists .....	83
Features of access control lists .....	83
Access control list configuration task list.....	84
Mapping out the goals of the access control list .....	84
Creating an access control list profile and enter configuration mode .....	85
Adding a filter rule to the current access control list profile .....	85

Adding an ICMP filter rule to the current access control list profile .....	87
Adding a TCP, UDP or SCTP filter rule to the current access control list profile .....	89
Binding and unbinding an access control list profile to an IP interface .....	91
Displaying an access control list profile .....	92
Debugging an access control list profile .....	92
Examples .....	94
Denying a specific subnet .....	94
<b>8 Link scheduler configuration .....</b>	<b>95</b>
Introduction .....	96
Configuring access control lists .....	96
Configuring quality of service (QoS) .....	97
Applying scheduling at the bottleneck .....	97
Using traffic classes .....	97
Introduction to Scheduling .....	98
Priority .....	98
Weighted fair queuing (WFQ) .....	98
Shaping .....	99
Burst tolerant shaping or wfq .....	99
Hierarchy .....	99
Quick references .....	100
Setting the modem rate .....	100
Command cross reference .....	101
Link scheduler configuration task list.....	101
Defining the access control list profile .....	102
Packet classification .....	102
Creating an access control list .....	103
Creating a service policy profile .....	104
Specifying the handling of traffic-classes .....	106
Defining fair queuing weight .....	106
Defining the bit-rate .....	107
Defining absolute priority .....	107
Defining the maximum queue length .....	107
Specifying the type-of-service (TOS) field .....	107
Specifying the precedence field .....	108
Specifying differentiated services codepoint (DSCP) marking .....	108
Specifying layer 2 marking .....	109
Defining random early detection .....	110
Discarding Excess Load .....	110
Devoting the service policy profile to an interface .....	111
Displaying link arbitration status .....	112
Displaying link scheduling profile information .....	112
Enable statistics gathering .....	112
<b>9 LEDs status and monitoring .....</b>	<b>114</b>

Status LEDs.....	115
<b>10 Contacting Patton for assistance .....</b>	<b>116</b>
Introduction.....	117
Contact information.....	117
Patton Support Headquarters in the USA .....	117
Alternate Patton support for Europe, Middle East, and Africa (EMEA) .....	117
Warranty Service and Returned Merchandise Authorizations (RMAs).....	117
Warranty coverage .....	117
Out-of-warranty service .....	118
Returns for credit .....	118
Return for credit policy .....	118
RMA numbers .....	118
Shipping instructions .....	118
<b>A Compliance information .....</b>	<b>119</b>
Compliance.....	120
EMC .....	120
Safety .....	120
PSTN Regulatory .....	120
Radio and TV Interference (FCC Part 15) .....	120
CE Declaration of Conformity .....	120
Authorized European Representative .....	121
FCC Part 68 (ACTA) Statement (Model 2803 only).....	121
Industry Canada Notice (Model 2803 only).....	121
<b>B Specifications .....</b>	<b>122</b>
Ethernet interfaces.....	123
Sync serial interface .....	123
T1/E1 interface (Model 2803 only).....	123
PPP support .....	123
IP services.....	124
Management .....	124
Operating environment .....	124
Operating temperature .....	124
Operating humidity .....	124
System.....	124
Dimensions .....	124
Power supply .....	125
Internal AC version .....	125
12VDC version with External AC Power Adapter (Models 2802, 2821, 2835) .....	125
5VDC Version with External Power Adapter (Model 2805) .....	125
<b>C Cabling .....</b>	<b>126</b>
Introduction.....	127
Serial console.....	127

Ethernet 10Base-T and 100Base-T .....	128
<b>D Port pin-outs .....</b>	<b>130</b>
Introduction .....	131
Console port, RJ-45, EIA-561 (RS-232).....	131
Ethernet 10Base-T and 100Base-T port.....	132
Sync serial port .....	132
V.35 serial port .....	132
X.21 serial port .....	133
<b>E IPLink 2800 Series factory configuration .....</b>	<b>134</b>
Introduction .....	135
<b>F Installation checklist .....</b>	<b>136</b>
Introduction .....	137

## List of Figures

1	IPLink Managed VPN Router (2805 shown) . . . . .	20
2	IPLink 2800 Series X.21, and V.35 connectors . . . . .	21
3	IPLink 2800 Series 10Base-T Ethernet port connectors . . . . .	22
4	IPLink 2800 Series power input connectors . . . . .	23
5	IPLink 2800 Series front panels . . . . .	24
6	Branch-office virtual private network over a Frame-Relay service network . . . . .	25
7	Corporate multi-function virtual private network . . . . .	26
8	Connecting an IPLink 2800 Series device to a hub . . . . .	33
9	Rear view of the router showing location of V.35 interface connector . . . . .	34
10	Rear view of the router showing location of X.21 interface connector . . . . .	35
11	Rear panel of 2803K/EUI . . . . .	36
12	Rear panel of 2803T/EUI . . . . .	36
13	Rear panel of 2803K/UI . . . . .	37
14	Power connector location on rear panel . . . . .	38
15	VPN Router front panel LEDs and Console port locations (IPLink 2835 shown) . . . . .	39
16	Steps for setting up a new IPLink VPN Router . . . . .	41
17	Connecting to the terminal . . . . .	42
18	Connecting the IPLink VPN Router to the network . . . . .	44
19	IP interface wan is bound to PVC 1 on port serial 0 0 . . . . .	53
20	Typical Integrated Service Access Scenario with dedicated PVCs . . . . .	57
21	IP Context with logical IP interfaces bound to Ethernet port, serial port PVC 1 and PVC 2 . . . . .	58
22	Using traffic filters to prevent traffic from being routed to a network . . . . .	83
23	Deny a specific subnet on an interface . . . . .	94
24	IP context and related elements . . . . .	97
25	Packet routing in IPLink . . . . .	98
26	Example of Hierarchical Scheduling . . . . .	100
27	Elements of link scheduler configuration . . . . .	102
28	Scenario with Web server regarded as a single source host . . . . .	103
29	Structure of a Service-Policy Profile . . . . .	105
30	Using a Service Policy Profile on an IP Interface . . . . .	111
31	Examples of IPLink 2800 Series front panels . . . . .	115
32	Connecting a serial terminal . . . . .	127
33	Ethernet cross-over . . . . .	128
34	Ethernet straight-through . . . . .	129
35	EIA-561 (RJ-45 8-pin) port . . . . .	131

## List of Tables

1	General conventions	17
2	Rear panel ports	24
3	Installation checklist	30
4	Sample site log entries	31
5	Ethernet 10/100Base-T (RJ-45) port pin-outs	33
6	Signal pin-outs for the V.35 interface on the IPLink 2800	34
7	Signal pin-outs for the X.21 interface on the IPLink 2800	36
8	RJ-48C receptacle	36
9	Factory default IP address and network mask configuration	42
10	Command cross reference	101
11	TOS values and their meaning	108
12	Traffic control info (TCI) field	109
13	Values defining detail of the queuing statistics	113
14	IPLink LED Indications	115
15	RS-232 Console Port	131
16	RJ-45 socket	132
17	V.35 Female DB-25 connector	132
18	X.21 Female DB-15 connector	133
19	Installation checklist	137

# About this guide

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This guide describes IPLink VPN router hardware, installation, and configuration.

## Audience

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This guide is intended for the following users:

- Operators
- Installers
- Maintenance technicians

## Structure

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This guide contains the following chapters and appendices:

- [Chapter 1](#) on page 19 provides information about router features, capabilities, operation, and applications
- [Chapter 2](#) on page 28 provides hardware installation procedures
- [Chapter 3](#) on page 40 provides quick-start procedures for configuring the IPLink VPN router
- [Chapter 4](#) on page 46 provides an overview of the serial port and describes the tasks involved in its configuration through the IPLink router.
- [Chapter 5](#) on page 60 provides information on T1/E1 port configuration.
- [Chapter 6](#) on page 69 describes how to configure the VPN connections between two IPLink routers or between an IPLink and a third-party device.
- [Chapter 7](#) on page 81 provides an overview of IP access control lists and describes the tasks involved in their configuration through the IPLink router.
- [Chapter 8](#) on page 95 describes how to use and configure IPLink *quality of service* (QoS) features.
- [Chapter 9](#) on page 114 provides LED definitions
- [Chapter 10](#) on page 116 contains information on contacting Patton technical support for assistance
- [Appendix A](#) on page 119 contains compliance information
- [Appendix B](#) on page 122 contains specifications for the routers
- [Appendix C](#) on page 126 provides cable recommendations
- [Appendix D](#) on page 130 describes the router's ports and pin-outs
- [Appendix E](#) on page 134 lists the factory configuration settings for the IPLink VPN router
- [Appendix F](#) on page 136 provides license information that describes acceptable usage of the software provided with the IPLink VPN router

For best results, read the contents of this guide *before* you install the router.

## Precautions

Notes, cautions, and warnings, which have the following meanings, are used throughout this guide to help you become aware of potential problems. **Warnings** are intended to prevent safety hazards that could result in personal injury. **Cautions** are intended to prevent situations that could result in property damage or impaired functioning.

**Note** A note presents additional information or interesting sidelights.



IMPORTANT

The alert symbol and IMPORTANT heading calls attention to important information.



CAUTION

The alert symbol and CAUTION heading indicate a potential hazard. Strictly follow the instructions to avoid property damage.



CAUTION

The shock hazard symbol and CAUTION heading indicate a potential electric shock hazard. Strictly follow the instructions to avoid property damage caused by electric shock.



WARNING

The alert symbol and WARNING heading indicate a potential safety hazard. Strictly follow the warning instructions to avoid personal injury.



WARNING

The shock hazard symbol and WARNING heading indicate a potential electric shock hazard. Strictly follow the warning instructions to avoid injury caused by electric shock.

## Safety when working with electricity



WARNING

The IPLink contains no user serviceable parts. The equipment shall be returned to Patton Electronics for repairs, or repaired by qualified service personnel. Opening the IPLink case will void the warranty.



WARNING

**Mains Voltage:** Do not open the case when the power cord is attached. For systems without a power switch, line voltages are present within the power supply when the power cords are connected. The mains outlet that is utilized to power the device shall be within 10 feet (3 meters) of the device, shall be easily accessible, and protected by a circuit breaker.



WARNING

For units with an external power adapter, the adapter shall be a listed Limited Power Source.



WARNING

For AC powered units, ensure that the power cable used with this device meets all applicable standards for the country in which it is to be installed, and that it is connected to a wall outlet which has earth ground.



WARNING

Hazardous network voltages are present in WAN ports regardless of whether power to the IPLink is ON or OFF. To avoid electric shock, use caution when near WAN ports. When detaching cables, detach the end away from the IPLink first.



WARNING

Do not work on the system or connect or disconnect cables during periods of lightning activity.



WARNING

Before opening the chassis, disconnect the telephone network cables to avoid contact with telephone line voltages. When detaching the cables, detach the end away from the IPLink first.



The power supply automatically adjusts to accept an input voltage from 100 to 240 VAC (50/60 Hz).

Verify that the proper voltage is present before plugging the power cord into the receptacle. Failure to do so could result in equipment damage.



The interconnecting cables shall be acceptable for external use and shall be rated for the proper application with respect to voltage, current, anticipated temperature, flammability, and mechanical serviceability.



In accordance with the requirements of council directive 2002/96/EC on Waste of Electrical and Electronic Equipment (WEEE), ensure that at end-of-life you separate this product from other waste and scrap and deliver to the WEEE collection system in your country for recycling.

### **General observations**

- Clean the case with a soft slightly moist anti-static cloth
- Place the unit on a flat surface and ensure free air circulation
- Avoid exposing the unit to direct sunlight and other heat sources
- Protect the unit from moisture, vapors, and corrosive liquids


## Typographical conventions used in this document

This section describes the typographical conventions and terms used in this guide.

### General conventions

The procedures described in this manual use the following text conventions:

Table 1. General conventions

Convention	Meaning
Garamond blue type	Indicates a cross-reference hyperlink that points to a figure, graphic, table, or section heading. Clicking on the hyperlink jumps you to the reference. When you have finished reviewing the reference, click on the <b>Go to Previous View</b> button  in the Adobe® Acrobat® Reader toolbar to return to your starting point.
Futura bold type	Commands and keywords are in <b>boldface</b> font.
Futura bold-italic type	Parts of commands, which are related to elements already named by the user, are in <b>boldface italic</b> font.
Italicized Futura type	Variables for which you supply values are in <i>italic</i> font
Futura type	Indicates the names of fields or windows.
Garamond bold type	Indicates the names of command buttons that execute an action.
< >	Angle brackets indicate function and keyboard keys, such as <SHIFT>, <CTRL>, <C>, and so on.
[ ]	Elements in square brackets are optional.
{a   b   c}	Alternative but required keywords are grouped in braces ({ }) and are separated by vertical bars (   )
blue screen	Information you enter is in <b>blue screen</b> font.
screen	Terminal sessions and information the system displays are in <b>screen</b> font.
node	The leading IP address or nodename of an IPLink is substituted with <b>node</b> in <b>boldface italic</b> font.
2800	The leading <b>2800</b> on a command line represents the nodename of the IPLink
#	An hash sign at the beginning of a line indicates a comment line.



# Chapter 1 **General information**

## **Chapter contents**

IPLink Model 2800 Series overview .....	20
IPLink 2800 Series detailed description .....	21
IPLink 2800 Series model codes .....	21
Serial WAN models .....	21
Ethernet WAN models .....	22
Model code extensions .....	23
Ports descriptions .....	24
Applications overview.....	25
Branch-Office virtual private network over Frame Relay service .....	25
Corporate multi-function virtual private network .....	26

## IPLink Model 2800 Series overview

The IPLink Model 2800 Series Managed VPN Router (see [figure 1](#)) delivers secure, optimized communications across unsecured IP networks between any enterprise headquarters and remote offices, home offices (RoHo), or mobile users. Patton's IPLink 2800 family of VPN routers combines an integrated synch-serial interface for access to the Internet (or any IP network) with full-service IP routing, VPN security via IPSec, and type-of-service/quality-of-service (ToS/QoS) traffic shaping and prioritization. The built-in V.35 or X.21 serial interface delivers LAN-to-WAN connectivity without the additional expense of external adapters or CSU/DSU devices. The Model 2800 Series' flexible AC or DC power-source options accommodate virtually any installation environment.



Figure 1. IPLink Managed VPN Router (2805 shown)

Each member of the Model 2800 family provides two 10/100Base-T Ethernet ports and one integrated T1/E1, V.35, or X.21 synchronous serial WAN port to deliver a managed virtual-private-network (VPN) connection over the Internet or any unsecured IP network.

IPLink 2800 Series Routers support Frame-Relay and PPP networking with VPN and firewall functionality. Authentication and firewall services protect against unauthorized users while encryption, and anti-replay capabilities preserve data confidentiality. Patton's powerful CoS and QoS mechanisms provide traffic-shaping and prioritization to guarantee your mission-critical data is delivered promptly and unimpeded by traffic from other users on the same LAN. Besides assuring first priority for key information, Patton's advanced QoS technology enhances the quality and clarity of realtime application such as live voice and video communications with the main office. These compact VPN Routers support PPP/PPPoE and Frame Relay services over the serial WAN link.

The IPLink VPN Router performs the following major functions:

- Routed LAN-to-WAN connectivity between two 10/100 Ethernet LAN ports and one V.35, X.21, or synchronous serial WAN port.
- IP Routing with class-of-service/quality-of-service (CoS/QoS) support for Internet or IP-WAN access with traffic shaping and prioritization.

- VPN tunneling for secure traversal of unsecured IP networks
- IPSec payload encryption with authentication header (AH, specified in RFC 2402) and encapsulating security payload (ESP, specified in RFC 2406) protects data integrity and confidentiality and prevents unauthorized data-replay.
- Firewall capabilities including IP-address and IP-port filtering, access control lists (ACLs), and denial-of-service (DoS) attack detection.
- Enhanced IP services include domain name service (DNS) resolver and relay, NAT/NAPT, dynamic DNS, and DHCP server.

### IPLink 2800 Series detailed description

The IPLink 2800 Series Managed VPN Router provides secure managed VPN routed networking with 2-port Ethernet LAN connectivity and serial WAN access via a built-in V.35 or X.21 serial WAN interface (see [figure 2](#)).

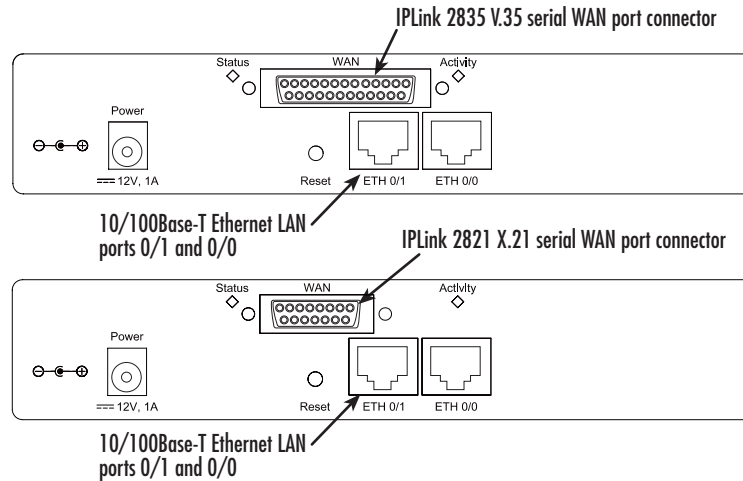


Figure 2. IPLink 2800 Series X.21, and V.35 connectors

### IPLink 2800 Series model codes

**Serial WAN models.** The following models come equipped with an integrated V.35 or X.21 serial WAN port and two 10/100Base-T Ethernet ports (see [figure 2](#)):

- IPLink 2821—X.21 WAN interface and two Ethernet ports
- IPLink 2835—V.35 WAN interface and two Ethernet ports
- IPLink 2803—T1/E1 WAN interface and two Ethernet ports

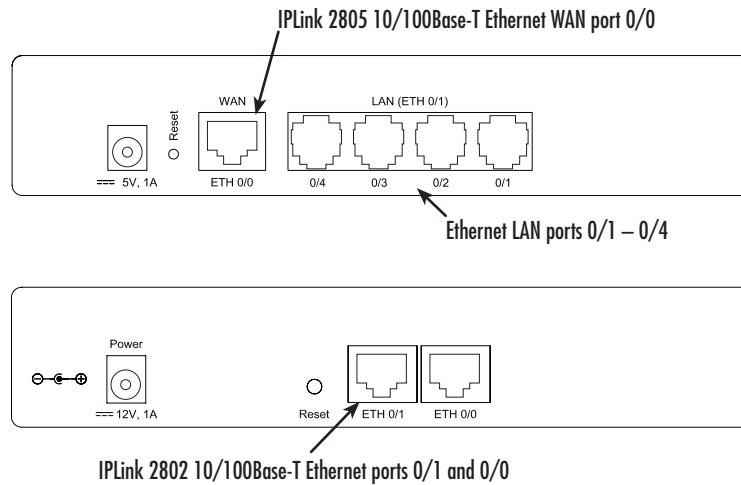
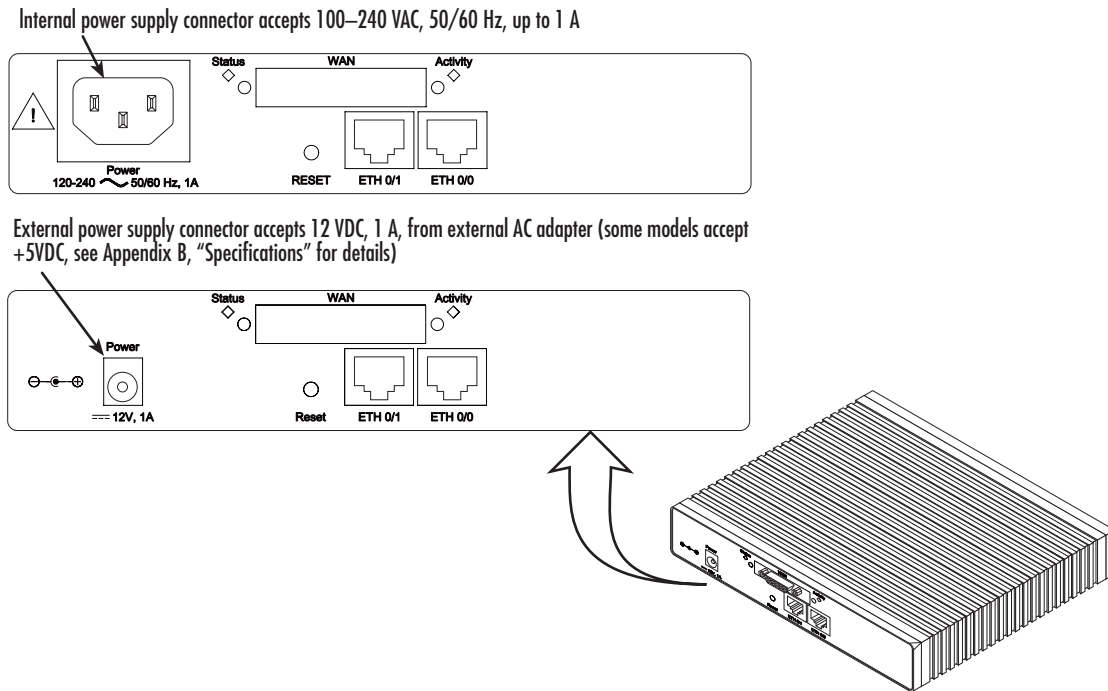


Figure 3. IPLink 2800 Series 10Base-T Ethernet port connectors

**Ethernet WAN models.** The following models come equipped with 10/100Base-T Ethernet ports only (see [figure 3](#)):

- **IPLink 2802**—Dual 10/100Base-T Ethernet ports, one for LAN connection and one for connection to a WAN
- **IPLink 2805**—Integrated Ethernet switch with four 10/100Base-T Ethernet ports and one 10/100Base-T Ethernet port for connection to a WAN
- **IPLink 2823**—Three 10/100 Base-T Ethernet ports with the independent purpose of WAN, LAN, and DMZ



### Model code extensions

A model-code extension indicates the type of power supply the Router model provides. The model-code conventions are:

- *UI* stands for internal 100–240V AC universal input power supply (see [figure 4](#))
- *EUI* stands for external 100–240V AC universal input power supply (see [figure 4](#))

For example, the model code *2821/EUI* describes an IPLink configured with the following:

- Two 10/100 Base-T Ethernet ports
- X.21 serial WAN data port
- External 120–220 VAC universal input power supply

*Ports descriptions*

The IPLink 2800 Series rear-panel ports are described in [table 2](#).

Table 2. Rear panel ports

Port	Location	Description
<b>10/100 Ethernet ETH 0/0 (WAN) &amp; ETH 0/1-0/4 (LAN)</b>	Rear panel	RJ-45 connectors (see <a href="#">figure 2</a> on page 21 and <a href="#">figure 3</a> on page 22) that connect the router to an Ethernet device (e.g., a cable or DSL modem, LAN hub or switch).
<b>WAN</b>	Rear panel	DB-25 or DB-15 receptacle provides a V.35 or X.21 serial interface for leased-line connection to a WAN at rates up to 2 Mbps.
<b>T1/E1</b>	Rear panel	E1—G.703/G.704 with HDB3 or AMI encoding. RJ-48C and dual coaxial connectors. T1—ANSI T1.403 & AT&T TR54016 with AMI coding/D4 framing or B8ZS coding/ESF framing. RJ-48C connector.
<b>Power</b>	Rear panel	The router is available in a DC or AC power input version (see <a href="#">figure 4</a> on page 23), labeled as follows: AC version (Internal power supply): 100–240 VAC, 50/60 Hz, 1 A DC version: +12 V, 1 A (Model 2821, 2802, 2835) or +5 VDC 1 A (Model 2805)
<b>Console</b>	Front panel	Used for service and maintenance and available on all IPLink 2800 models except the IPLink 2805, the <i>Console</i> port (see <a href="#">figure 5</a> ), an RS-232 RJ-45 connector, connects the router to a serial terminal such as a PC or ASCII terminal (also called a dumb terminal).

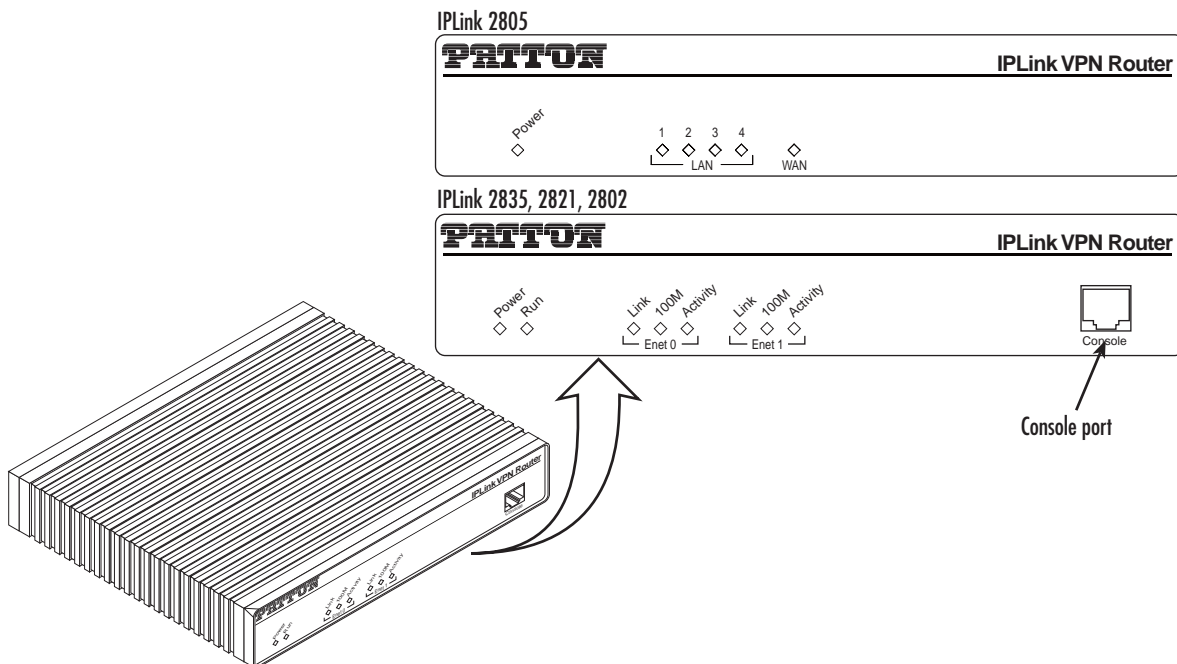


Figure 5. IPLink 2800 Series front panels

**Note** For LED descriptions, refer to chapter 9, “LEDs status and monitoring” on page 114.

## Applications overview

Patton’s IPLink managed VPN routers deliver the features you need for secure, optimized communication over non-secured IP networks. Combining VPN tunneling, standard IPSec encryption, and firewall capabilities with Patton’s powerful *quality of service* technology, IPLink VPN routers deliver private, prioritized networking for business, government, and military applications.

Banking, insurance, retail, utilities, railroads, or government, any organization with more than one site can benefit from the security and traffic-shaping advantages of the IPLink family of VPN routers. As traffic traverses unsecured networks, VPN tunneling with standard IPSec encryption plus firewall capabilities preserve data security and integrity. Meanwhile, IPLink’s ToS/QoS traffic-shaping and prioritization prevent critical information getting blocked or impeded by less important traffic while enhancing the quality of real-time applications such as voice and video.

IPLink 2800 Series *Serial WAN* models provide dual 10/100Base-T Ethernet ports with a selection of various synchronous serial WAN ports: V.35, X.21, or T1/E1. The two Ethernet ports provide full-featured IP routing plus Ethernet and IP-layer QoS services. The sync-serial port provides WAN access by means of a leased-line connection to the network. IPLink 2800 Series *Ethernet WAN* models provide one or four Ethernet LAN ports in addition to the Ethernet WAN interface. The following sections show some typical applications for the IPLink 2800 Series.

This chapter describes typical applications for which the IPLink 2800 Series series is uniquely suited.

### Branch-Office virtual private network over Frame Relay service

Featuring VPN tunneling combined with built-in frame-relay support and a selection of standard serial interfaces on-board, the IPLink 2800 Series offers the remote-branch office a secure, private and prioritized network connection to another location over virtually any available network service and any standard WAN interface.

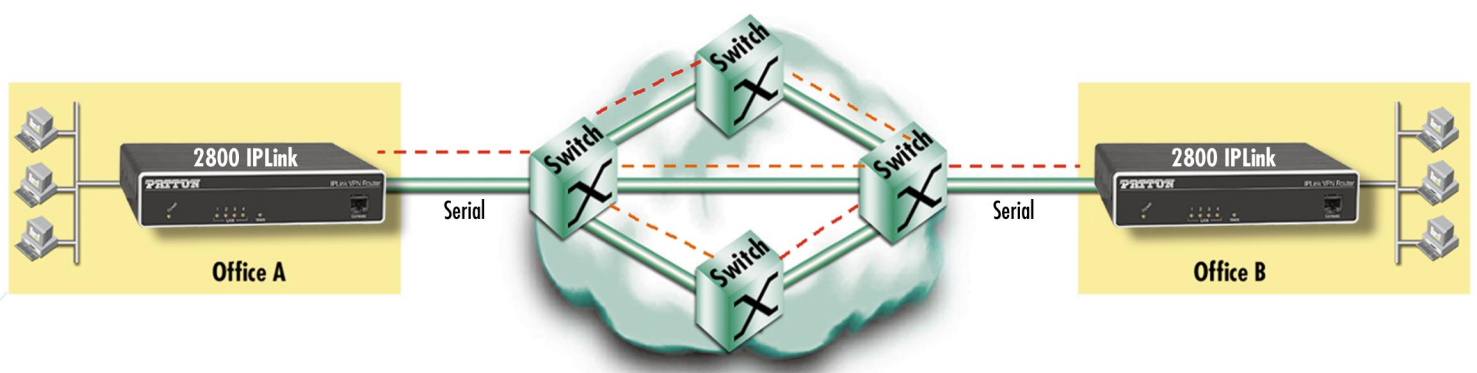


Figure 6. Branch-office virtual private network over a Frame-Relay service network

Figure 6 shows a branch-to-branch VPN connection through a frame-relay service network as delivered on serial lines. The IPLink 2800 Series can support a similar scenario with network service delivered via V.35 or X.21 serial interfaces, or an Ethernet WAN interface. For remote sites where PPP service is available, the 2800 Series also supports PPP network access over all the standard WAN interface options mentioned above.

In this specific application, all traffic between the branch and corporate offices is carried in an IPsec tunnel. All of the IPsec VPN traffic is encapsulated in Frame Relay for transport over the Frame Relay service network. The serial port is configured for Frame Relay.

To configure this application, you need to configure the following features:

- The serial port with Frame Relay as the encapsulation protocol
- An IPsec VPN between the two endpoints.

See [chapter 4](#) on page 46 to configure the serial port and [chapter 6](#) on page 69 to configure the VPN.

### Corporate multi-function virtual private network

The IPLink 2800 Series can deliver both private corporate intranet service and public Internet access to multiple remote sites by leveraging IPLink's multiple frame-relay PVC support (see [figure 7](#)). The enterprise enjoys the benefits of secure multi-office virtual private networking with QoS for prioritized traffic flow for mission-critical information.

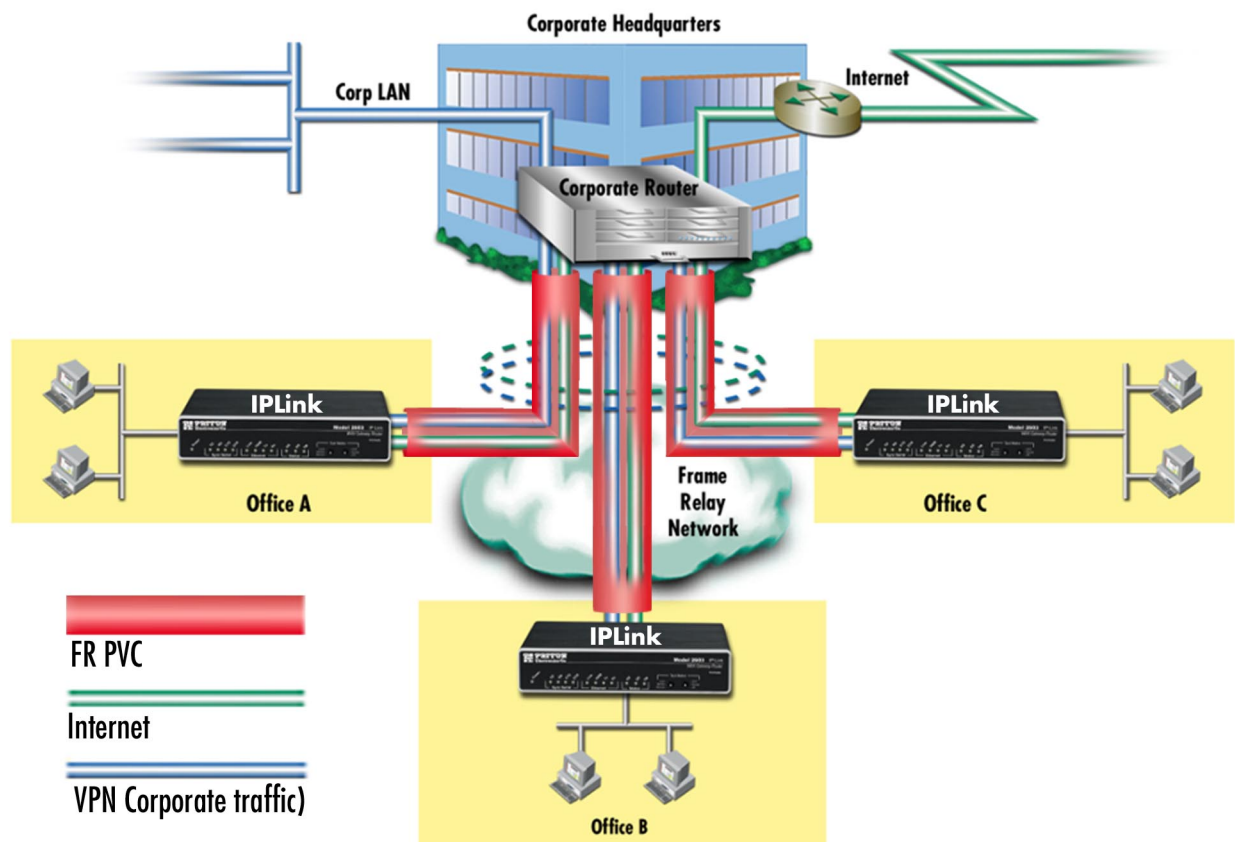


Figure 7. Corporate multi-function virtual private network

In [figure 7](#), the blue pipes represent VPN connections for private traffic within the corporate intranet, while the green pipes represent the Internet traffic. The red pipe is a Frame Relay PVC transporting Internet traffic and private corporate traffic over the VPN. Each of the three remote sites is connected with headquarters via an

IPLink VPN router. Each remote site can take advantage of the most convenient and locally available interface the WAN service can offer, whether X.21, or V.35.

The corporate multi-function application carries two types of traffic between each remote office and corporate's central office:

- Private corporate traffic (the intranet/extranet)
- Internet traffic

The service provider offers a Frame Relay network for access, so both the private corporate traffic and the Internet traffic is transported over a Frame Relay PVC with one DLCI. The corporate traffic is transported within IPSec VPN that is in the Frame Relay PVC. The separation of corporation and Internet traffic is managed by using an ACL using IP addresses as the watershed.

To configure this application, you must configure the following features:

- A serial Frame Relay link as the WAN service which will carry both private corporate traffic and public Internet traffic
- An IPSec VPN for private corporate traffic
- An ACL to distinguish between the two types of traffic so only the private corporate traffic is carried over the VPN.

See [chapter 4](#) on page 46 to configure the serial port, [chapter 6](#) on page 69 to configure the VPN, and [chapter 7](#) on page 81 to configure the ACL. [Chapter 8](#) on page 95 provides more in-depth explanations of scheduling various types of traffic. Various techniques are also described, including QoS and TOS.

## Chapter 2 **Hardware installation**

### **Chapter contents**

Planning the installation .....	30
Installation checklist .....	31
Site log .....	32
Network information .....	32
Network Diagram .....	32
IP related information .....	32
Software tools .....	32
Power source .....	32
Location and mounting requirements .....	33
Installing the VPN router .....	33
Mounting the VPN router .....	33
Connecting cables .....	33
Installing the Ethernet cable .....	33
Installing the serial WAN cable .....	34
Installing the V.35 interface cable .....	35
Installing the X.21 interface cable .....	36
Installing the T1/E1 twisted pair cables .....	37
Installing the E1 dual coaxial cables .....	38
Connecting to external power source .....	39

## Planning the installation

Before you start the actual installation, we strongly recommend that you gather all the information you will need to install and setup the device. See [table 3](#) for an example of what pre-installment checks you might need to carry out. Completing the pre-installation checks enables you to install and set up your VPN router within an existing network infrastructure with confidence.



The mains outlet that is utilized to power the equipment must be within 1 meter (3 feet) of the device and shall be easily accessible.

**Note** When setting up your VPN router you must consider cable length limitations, and potential electromagnetic interference (EMI) as defined by the applicable local and international regulations. Ensure that your site is properly prepared before beginning installation.

Before installing the VPN Router device, the following tasks should be completed:

- **Create a network diagram** (see section “[Network information](#)” on page 31)
- **Gather IP related information** (see section “[IP related information](#)” on page 31 for more information)
- **Install the hardware and software needed to configure the IPLink router.** (See section “[Software tools](#)” on page 31)
- **Verify power source reliability** (see section “[Power source](#)” on page 31).

When you finish preparing for your VPN Router installation, go to section “[Installing the VPN router](#)” on page 32 to install the device.

### Installation checklist

The installation checklist (see [table 3](#)) lists the tasks for installing an IPLink 2800 Series VPN Router. Make a copy of this checklist and mark the entries as you complete each task. For each IPLink 2800 Series VPN Router, include a copy of the completed checklist in your site log.

Table 3. Installation checklist

Task	Verified by	Date
Network information available & recorded in site log		
Environmental specifications verified		
Site power voltages verified		
Installation site pre-power check completed		
Required tools available		
Additional equipment available		
All printed documents available		
IPLink release & build number verified		
Rack, desktop, or wall mounting of chassis completed		
Initial electrical connections established		
ASCII terminal attached to console port		
Cable length limits verified		
Initial configuration performed		
Initial operation verified		

### Site log

Patton recommends that you maintain a site log to record all actions relevant to the system, if you do not already keep such a log. Site log entries should include information such as listed in [table 4](#).

Table 4. Sample site log entries

Entry	Description
Installation	Make a copy of the installation checklist and insert it into the site log
Upgrades and maintenance	Use the site log to record ongoing maintenance and expansion history
Configuration changes	Record all changes and the reasons for them
Maintenance	Schedules, requirements, and procedures performed
Comments	Notes, and problems
Software	Changes and updates to IPLink software

### Network information

When planning your installation there are certain network-connection considerations that you should take into account. The following sections describe such considerations for several types of network interfaces.

#### Network Diagram

Draw a network overview diagram that displays all neighboring IP nodes, connected elements and telephony components.

### IP related information

Before you can set up the basic IP connectivity for your IPLink 2800 Series you should have the following information:

- IP addresses and subnet masks used for Ethernet LAN and WAN ports
- IP addresses and subnet masks used for the V.35 or X.21 serial WAN port
- IP addresses and subnet masks used for the T1/E1 WAN port
- IP addresses of central TFTP Server used for configuration upload and download
- Login and password for PPPoE Access.

### Software tools

You will need a PC (or equivalent) with a VT-100 emulation program (e.g. HyperTerminal) to configure the software on your IPLink VPN Router.

### Power source

If you suspect that your AC power is not reliable, for example if room lights flicker often or there is machinery with large motors nearby, have a qualified professional test the power. Install a power conditioner if necessary.

### Location and mounting requirements

The IPLink VPN Router is intended to be placed on a desktop or similar sturdy, flat surface that offers easy access to the cables. Allow sufficient space at the rear of the chassis for cable connections. Additionally, you should consider the need to access the unit for future upgrades and maintenance.

## Installing the VPN router

IPLink VPN Router installation consists of the following:

- Placing the device at the desired installation location (see section “Mounting the VPN router” on page 32)
- Installing the interface and power cables (see section “Connecting cables” on page 32)

When you finish installing the IPLink router, go to chapter 3, “Getting started with the IPLink Managed VPN Router” on page 40.

### Mounting the VPN router

Place the VPN Router on a desktop or similar sturdy, flat surface that offers easy access to the cables. The VPN Router should be installed in a dry environment with sufficient space to allow air circulation for cooling.

**Note** For proper ventilation, leave at least 2 inches (5 cm) to the left, right, front, and rear of the IPLink VPN Router.

### Connecting cables



**Do not work on the system or connect or disconnect cables during periods of lightning activity.**



The interconnecting cables must be acceptable for external use and must be rated for the proper application with respect to voltage, current, anticipated temperature, flammability, and mechanical serviceability.

Installing VPN Router cables takes place in the following order:

1. Installing the 10/100 Ethernet port cable or cables (see section “Installing the Ethernet cable” on page 32)
2. Installing the cables:
  - a. V.35 or X.21 serial WAN cable (see section “Installing the serial WAN cable” on page 33) or
  - b. T1/E1 WAN cable (see section “Installing the serial WAN cable” on page 33)
3. Installing the power input (see section “Connecting to external power source” on page 38)

### Installing the Ethernet cable

The IPLink 2800 Series has automatic MDX (auto-cross-over) detection and configuration on the Ethernet ports. Any of the two ports (five on the Model 2805 and three on the Model 2823) can be connected to a host or hub/switch with a straight-through wired cable (see figure 1). Ethernet devices (10Base-T or 100Base-T) are

connected to the IPLink's Ethernet ports (see [table 5](#) for port pin-out listing) via a cable terminated with RJ-45 plugs.

Table 5. Ethernet 10/100Base-T (RJ-45) port pin-outs

Pin	Signal
1	TX+
2	TX-
3	RX+
6	RX-

**Note** Pins not listed are not used.

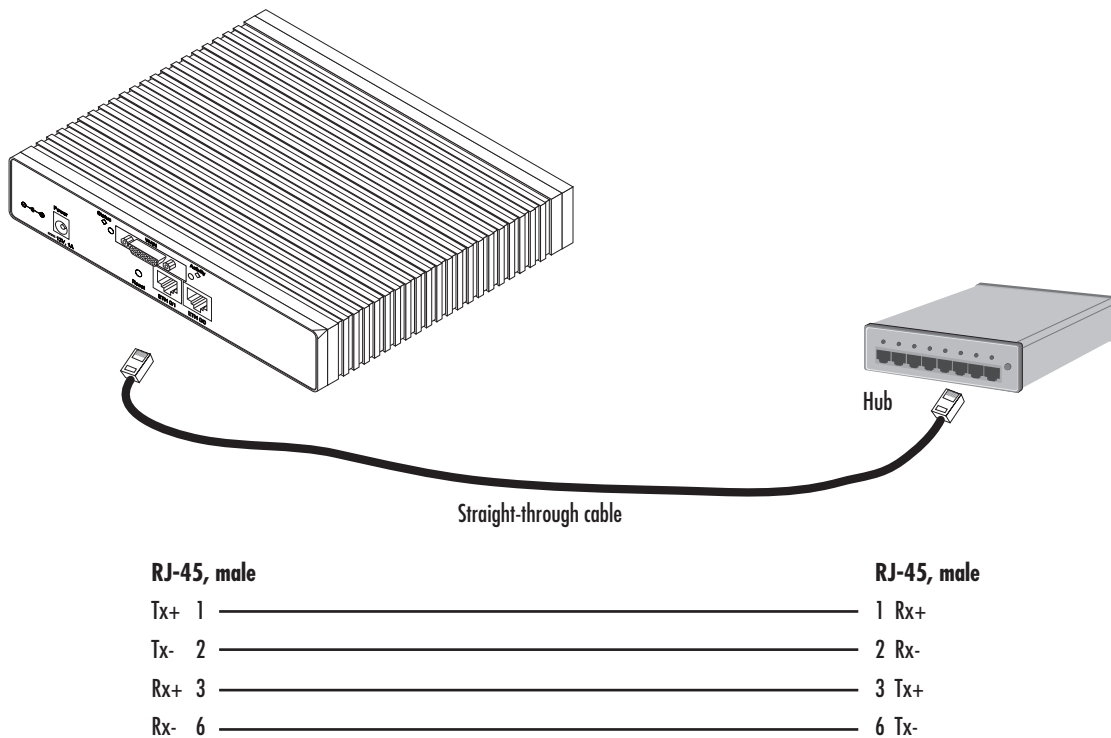


Figure 1. Connecting an IPLink 2800 Series device to a hub

### Installing the serial WAN cable

The IPLink 2800 Series is available with the following serial interfaces:

- V.35 (DB-25)—Model 2835, see section “[Installing the V.35 interface cable](#)” on page 34 for details on installing the interface cable
- X.21 (DB-15)—Model 2821, see section “[Installing the X.21 interface cable](#)” on page 35 for details on installing the interface cable
- T1/E1 (RJ48C connectors)—Model 2803, see section “[Installing the T1/E1 twisted pair cables](#)” on page 36 for details on installing the twisted pair cable

- E1 (Dual coaxial connectors)—Model 2803, see section “Installing the E1 dual coaxial cables” on page 37 for details on installing the coaxial cables

**Installing the V.35 interface cable.** The IPLink Model 2835 comes with a V.35 interface presented on a DB-25 female connector (see figure 2).

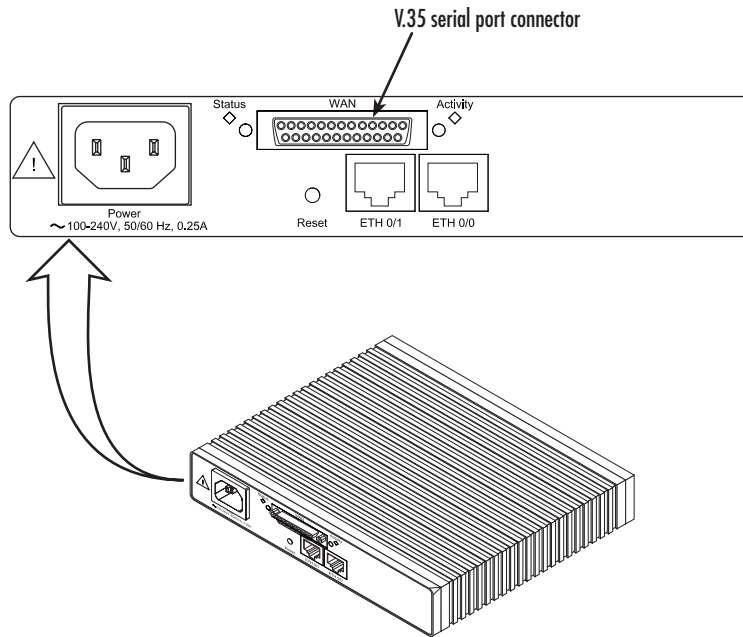


Figure 2. Rear view of the router showing location of V.35 interface connector

The signal pin-outs for the Model 2835 V.35 interface are shown in table 6.

Table 6. Signal pin-outs for the V.35 interface on the IPLink 2800

Pin	Signal	Pin	Signal
1	Frame Ground	12	TXCb
2	TXDa	14	TXDb
3	RXDa	15	RXCa
4	RTS	16	RXDb
5	CTS	17	RXCa
6	DSR	18	LL
7	Signal Ground	20	DTR
8	DCD	21	RL
9	RXCb	24	EXTCa
11	EXTCb		

The router's V.35 interface is wired as a DTE. No DCE configuration is possible. If you are directly connecting the router's V.35 interface to third-party equipment that cannot be configured as a DCE, you must use a tail-circuit cable. You can purchase a tail-circuit cable from a datacom-supply vendor. A tail-circuit cable will cross-over the necessary V.35 signals so that the two DTE interfaces can communicate.

**Note** Some third-party equipment will not be able to work properly in DTE-to-DTE configurations even when using a tail-circuit cable. Please refer to your third party equipment user manual for information on DTE-to DTE operation.

The router's V.35 interface requires a cable with a male DB-25 connector. Attach the male DB-25/M35 connector of the V.35 cable to the female DB-25 connector on the router. Attach the other end of the cable to the V.35 connector on local V.35 modem or multiplexer device.

**Installing the X.21 interface cable.** The IPLink Model 2821 comes with a V.35 interface presented on a DB-25 female connector (see [figure 3](#)).

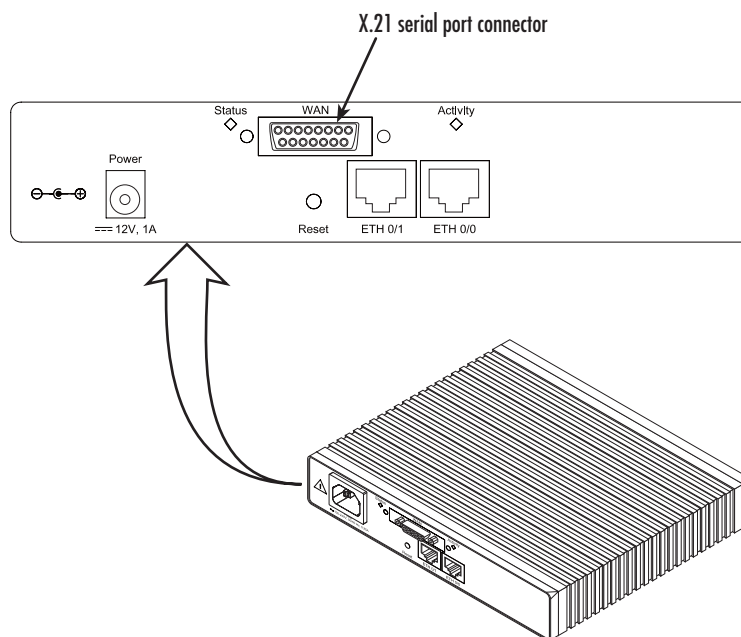


Figure 3. Rear view of the router showing location of X.21 interface connector

The signal pin-outs for the Model 2821 X.21 interface are shown in table 6.

Table 7. Signal pin-outs for the X.21 interface on the IPLink 2800

Pin	Signal	Pin	Signal
1	Frame Ground	8	Signal Ground
2	TXDa	9	TXDb
3	CNTa	10	CNTb
4	RXDa	11	RXDb
5	INDa	12	INDb
6	SETa	13	SETb

The the router’s X.21 interface is wired as a DCE. No DTE configuration is possible. The router’s X.21 interface requires a cable with a male DB-15 connector. Attach the male DB-15 connector of the X.21 cable to the female DB-15 connector on the router. Attach the other end of the cable to the X.21 connector on local modem or multiplexer device.

**Installing the T1/E1 twisted pair cables.** The PRI is usually connected to a PBX or switch (local exchange (LE)). Type and pin-outs of these devices vary depending on the manufacturer. In most cases, a straight-through RJ-48C to RJ-48C can be used to connect to the PRI (see for E1 RJ-48C pin-out listing) with a PBX. A cross-over cable is required to connect to an NT1, as illustrated in .

Table 8. RJ-48C receptacle

Pin	Signal
1	TX tip
2	TX ring
3	TX shield
4	RX tip
5	RX ring
6	RX shield

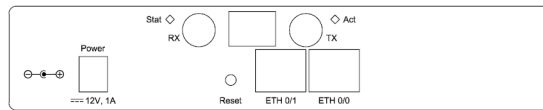


Figure 4. Rear panel of 2803K/EUI

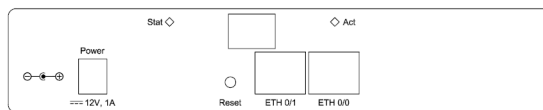


Figure 5. Rear panel of 2803T/EUI

**Note** Pins not listed are not used.



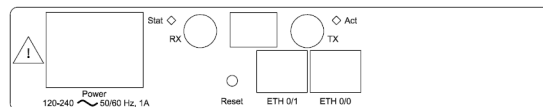
**Hazardous network voltages are present in the PRI cables. If you detach the cable, detach the end away from the IPLink first to avoid possible electric shock. Network hazardous voltages may be present on the device in the area of the PRI port, regardless of power being on or off.**



To prevent damage to the system, make certain you connect the PRI cable to the PRI port only and not to any other RJ type receptacle.

**Installing the E1 dual coaxial cables.** If the PBX or switch connection provides dual coaxial cables for the E1 connection, the transmit cable from the PBX/switch connects to the RX coaxial connector. Similarly, the receive cable from the PBX/switch connects to the TX coaxial connector.

Figure 6. Rear panel of 2803K/UI



**Hazardous network voltages are present in the PRI cables. If you detach the cable, detach the end away from the IPLink first to avoid possible electric shock. Network hazardous voltages may be present on the device in the area of the PRI port, regardless of power being on or off.**



To prevent damage to the system, make certain you connect the PRI cable to the PRI port only and not to any other RJ type receptacle.

### Connecting to external power source

The VPN Router comes with one of the following power supply options as best-suited to the expected installation environment:

- 120/140VAC internal power supply (designated by the model code extension **UI**)
- 120/140VAC external power supply (designated by the model code extension **EUI**)
- 120VAC external power supply (designated by the model code extension **E**)

This section below describes installing the power cord into the VPN Router. Do the following:

**Note** Do not connect the power cord to the power outlet at this time.

1. If your unit is equipped with an internal power supply, go to step 2. Otherwise, insert the barrel type connector end of the AC power cord into the external power supply connector (see [figure 7](#)).
2. Insert the female end of the power cord into the internal power supply connector (see [figure 7](#)).

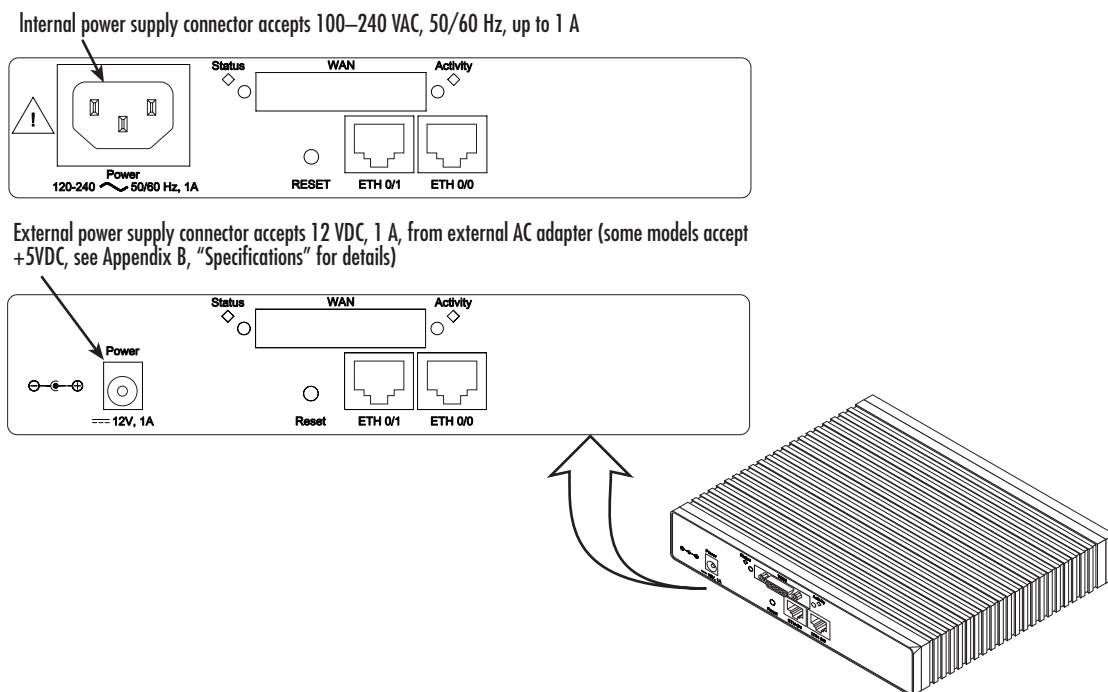


Figure 7. Power connector location on rear panel



The UI and EUI power supplies automatically adjust to accept an input voltage from 100 to 240 VAC (50/60 Hz).

Verify that the proper voltage is present before plugging the power cord into the receptacle. Failure to do so could result in equipment damage.

3. Verify that the AC power cord included with your VPN Router is compatible with local standards. If it is not, refer to chapter 10, “[Contacting Patton for assistance](#)” on page 116 to find out how to replace it with a compatible power cord.
4. Connect the male end of the power cord to an appropriate power outlet.

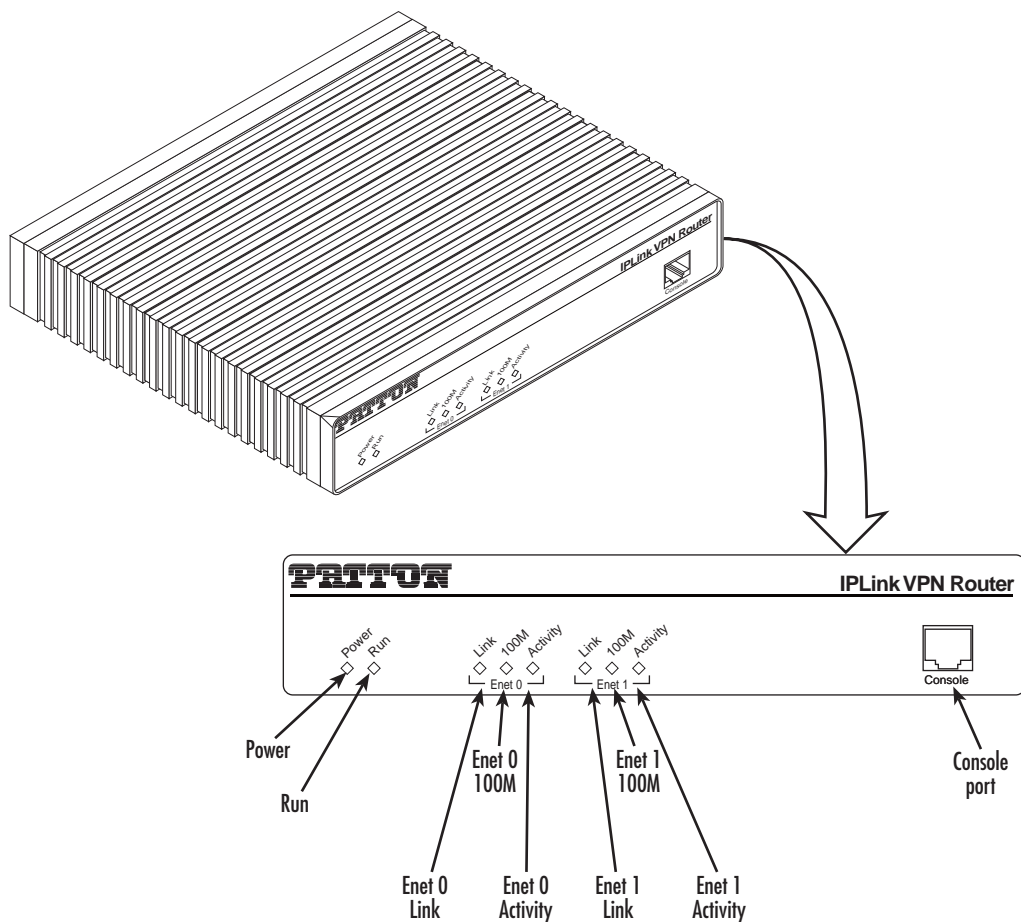


Figure 8. VPN Router front panel LEDs and Console port locations (IPLink 2835 shown)

5. Verify that the green *Power* LED is lit (see [figure 8](#)).

Congratulations, you have finished installing the IPLink VPN Router! Now go to chapter 3, “[Getting started with the IPLink Managed VPN Router](#)” on page 40.

## Chapter 3 **Getting started with the IPLink Managed VPN Router**

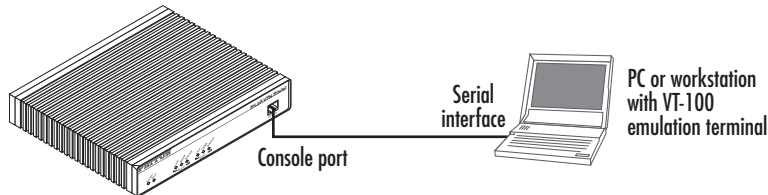
### **Chapter contents**

Introduction .....	42
1. Configure IP address .....	43
Power connection and default configuration .....	43
Connect with the serial interface .....	43
Login .....	44
Changing the IP address .....	44
2. Connect the IPLink VPN Router to the network.....	45
3. Load configuration .....	45

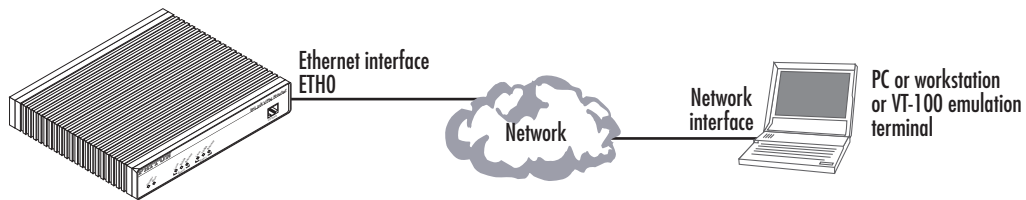
## Introduction

This chapter leads you through the basic steps to set up a new IPLink VPN Router. Figure 9 show the main steps for setting up a new IPLink VPN Router.

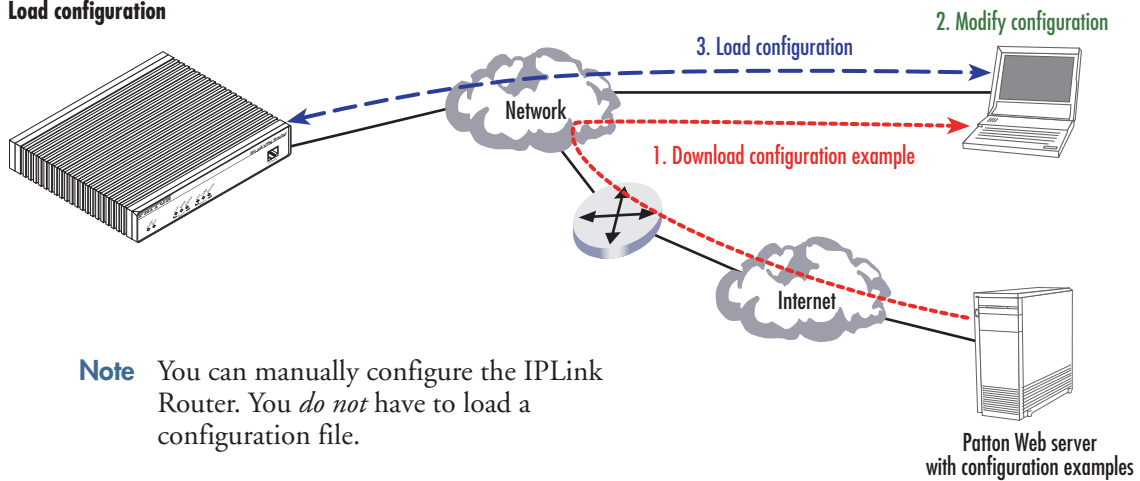
### 1 Configure IP address



### 2 Connect the IPLink VPN Router to the network



### 3 Load configuration



**Note** You can manually configure the IPLink Router. You *do not* have to load a configuration file.

Figure 9. Steps for setting up a new IPLink VPN Router

## 1. Configure IP address

### Power connection and default configuration

First the IPLink VPN Router must be connected to the mains power supply with the power cable. Wait until the Run LED stops blinking and lights constantly. Now the IPLink VPN Router is ready.

The factory default configuration for the Ethernet interface IP addresses and network masks are listed in [table 9](#).

Table 9. Factory default IP address and network mask configuration

	IP Address	Network Mask
Interface Ethernet 0/0 (ETH0)	172.16.40.1	255.255.0.0
Interface Ethernet 0/1 (ETH1)	192.168.1.1	255.255.255.0
Interface Ethernet 0/2 (ETH2)	x.x.x.x	x.x.x.x
Interface Ethernet 0/3 (ETH3)	x.x.x.x	x.x.x.x
Interface Ethernet 0/4 (ETH4)	x.x.x.x	x.x.x.x

All Ethernet interfaces are activated upon power-up.

If these addresses match with those of your network, go to section “[2. Connect the IPLink VPN Router to the network](#)” on page 44. Otherwise, refer to the following sections to change the addresses and network masks.

### Connect with the serial interface

The *Console* port is wired as an EIA-561, RS-232 port. Use the included Model 16F-561 adapter and cable (see [figure 10](#)) between the IPLink VPN Router’s *Console* port and a PC or workstation’s RS-232 serial interface. Activate the terminal emulation program on the PC or workstation that supports the serial interface (e.g. HyperTerm).

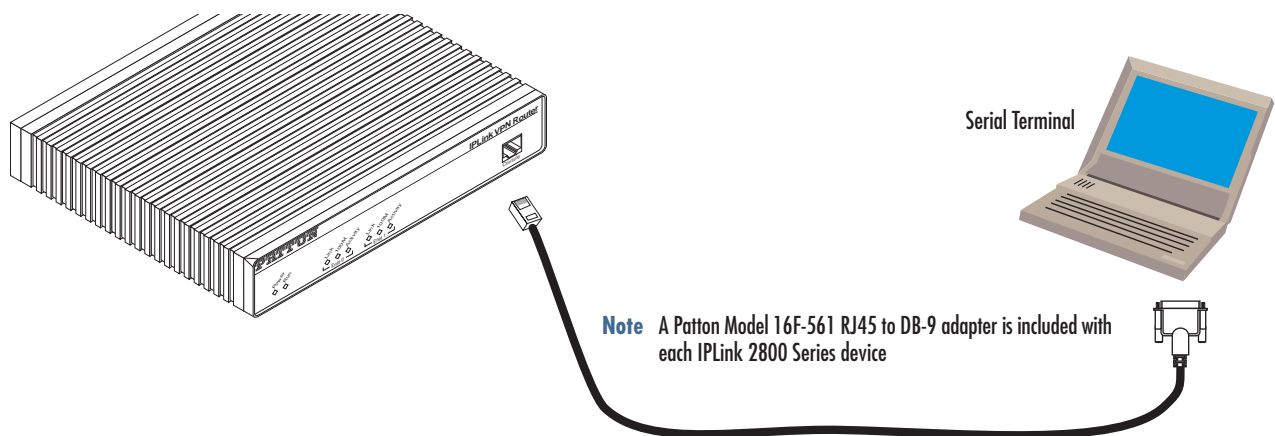


Figure 10. Connecting to the terminal

Terminal emulation program settings:

- 9600 bps
- no parity
- 8 bit

- 1 stop bit
- No flow control

### Login

Accessing your IPLink VPN Router via the local console port (or via a Telnet session) causes the login screen to display. Type the factory default login: *administrator* and leave the password empty. Press the *Enter* key after the password prompt.

```
login:administrator
password: <Enter>
172.16.40.1>
```

After you have successfully logged in you are in the operator execution mode, indicated by > as command line prompt. With the commands *enable* and *configure* you enter the configuration mode.

```
172.16.40.1>enable
172.16.40.1#configure
172.16.40.1(cfg)#
```

### Changing the IP address

Select the context IP mode to configure an IP interface.

```
172.16.40.1(cfg)#context ip router
172.16.40.1(ctx-ip)[router]#
```

Now you can set your IP address and network mask for the interface *eth0*. Within this example a class C network (172.16.1.0/24) is assumed. The IP address in this example is set to *172.16.1.99* (you should set this to an unused IP address on your network).

```
172.16.40.1(ctx-ip)[router]#interface eth0
172.16.40.1(if-ip)[eth0]#ipaddress 172.16.1.99 255.255.255.0
2002-10-29T00:09:40 : LOGINFO    : Link down on interface eth0.
2002-10-29T00:09:40 : LOGINFO    : Link up on interface eth0.
172.16.1.99(if-ip)[eth0]#
```

Copy this modified configuration to your new start-up configuration. Upon the next start-up the system will initialize itself using the modified configuration.

```
172.16.1.99(if-ip)[eth0]#copy running-config startup-config
172.16.1.99(if-ip)[eth0]#
```

The IPLink VPN Router can now be connected with your network.

## 2. Connect the IPLink VPN Router to the network

Depending whether you connect the IPLink VPN Router to a host directly or via a hub or switch either straight-through wired or cross-over cables must be used (see [figure 11](#)).

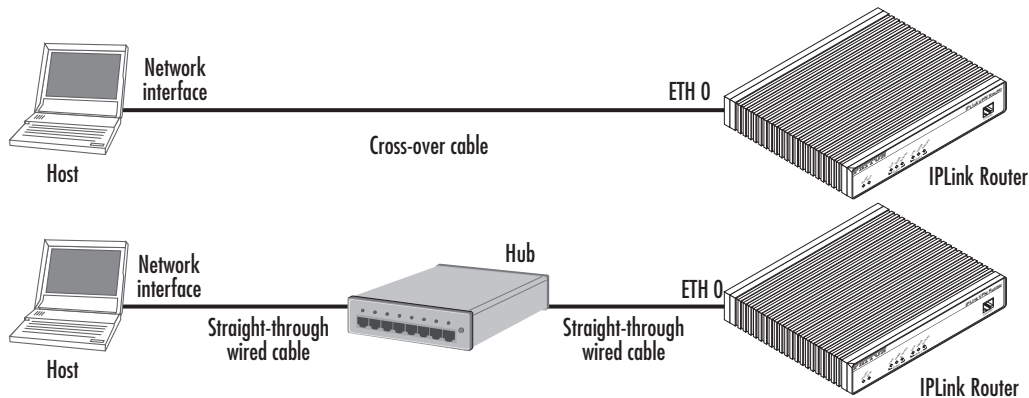


Figure 11. Connecting the IPLink VPN Router to the network

You can check the connection with the ping command to another host on the local LAN.

```
172.16.1.99(if-ip)[eth0]#ping <IP Address of the host>
```

Respectively from the host: *ping 172.16.1.99*

**Note** To ping outside your local LAN, you will need to configure the default gateway.

## 3. Load configuration

Patton provides a collection of configuration templates on the CD-ROM that came with the IPLink device, one of which may be similar enough to your application that you can use it to speed up configuring the IPLink router. Simply download the configuration note that matches your application to your PC. Adapt the configuration as described in the configuration note to your network (remember to modify the IP address) and copy the modified configuration to a TFTP server. The IPLink VPN Router can now load its configuration from this server.

In this example we assume the TFTP server on the host with the IP address 172.16.1.11 and the configuration named *IPL.cfg* in the root directory of the TFTP server.

```
172.16.1.99(if-ip)[eth0]#copy tftp://172.16.1.11/IPL.cfg startup-config
Download...100%
172.16.1.99(if-ip)[eth0]#
```

After the IPLink VPN Router has been rebooted the new start up configuration will be activated.

```
172.16.1.99(if-ip)[eth0]#reload
Running configuration has been changed.
Do you want to copy the 'running-config' to the 'startup-config'?
Press 'yes' to store, 'no' to drop changes : no
Press 'yes' to restart, 'no' to cancel : yes
The system is going down
```

## Chapter 4 **Serial port configuration**

### **Chapter contents**

Introduction .....	48
Serial port configuration task list .....	48
Disabling an interface .....	48
Enabling an interface .....	49
Configuring the encapsulation for Frame Relay .....	50
Enter Frame Relay mode .....	51
Configuring the LMI type .....	51
Configuring the keep-alive interval .....	52
Entering Frame Relay PVC configuration mode .....	52
Configuring the PVC encapsulation type .....	53
Binding the Frame Relay PVC to IP interface .....	53
Enabling a Frame Relay PVC .....	55
Disabling a Frame Relay PVC .....	55
Displaying serial port information .....	56
Displaying Frame Relay information .....	57
Integrated service access .....	58

## Introduction

---

This chapter provides an overview of the serial port and describes the tasks involved in its configuration through the IPLink router, it includes the following sections:

- Serial port configuration task list
- Configuration tasks
- Examples

The V.35 standard is recommended for speeds up to 48 kbps, although in practice it is used successfully at 4 Mbps. The X.21 standard is recommended for data interfaces transmitting at rates up to 2 Mbps and is used primarily in Europe and Japan.

The synchronous serial interface supports full-duplex operation and allows interconnection to various serial network interface cards or equipment.

The IPLink device supports the Frame Relay protocol on the synchronous serial interface. Frame Relay is an example of a packet-switched technology. Packet-switched networks enable end stations to dynamically share the network medium and the available bandwidth. Variable-length packets are used for more efficient and flexible transfers. These packets are then switched between the various network segments until the destination is reached. Statistical multiplexing techniques control network access in a packet-switched network. The advantage of this technique is that it provides more flexibility and more efficient use of bandwidth.

## Serial port configuration task list

---

Perform the tasks in the following sections to configure a synchronous serial interface:

- Disabling an interface (see page 47)
- Enabling an interface (see page 48)
- Configuring the serial encapsulation type (see page 49)
- Entering Frame Relay mode (see page 50)
- Configuring the LMI type (see page 50)
- Configuring the keep-alive interval (see page 51)
- Entering Frame Relay PVC configuration mode (see page 51)
- Configuring the PVC encapsulation type (see page 52)
- Binding the Frame Relay PVC to IP interface (see page 52)
- Disabling a Frame Relay PVC (see page 54)
- Displaying Frame Relay information (see page 56)

### Disabling an interface

Before you replace a compact serial cable or attach your IPLink to other serial equipment, use the **shutdown** command to disable the serial interfaces. This prevents anomalies and hardware faults. When you shut down an interface, it has the state *CLOSED* in the **show port serial** command display.

**Note** Use the **no shutdown** command to enable the serial interface after the configuration procedure.

This procedure describes how to shut down a serial interface

**Mode:** Administrator execution

Step	Command	Purpose
1	<b>node(cfg)#port serial</b> <i>slot port</i>	Selects the serial interface on slot and port
2	<b>node(prt-ser)[slot/port]#shutdown</b>	Shuts the selected interface down
3	<b>node(prt-ser)[slot/port]#show port serial</b>	Displays the serial interface configuration.

**Example:** Disabling an interface

The example shows how to disable the built-in serial interface on slot 0 and port 0 of an IPLink router. Check that *State* is set to *CLOSED* in the command output of **show port serial**.

```
2800(cfg)#port serial 0 0
2800(prt-ser)[0/0]#shutdown
2800(prt-ser)[0/0]#show port serial
```

```
Serial Interface Configuration
-----
```

```
Port          : serial 0 0 0
State         : CLOSED
Hardware Port : V.35
Transmit Edge : normal
Port Type     : DTE
CRC Type      : CRC-16
Max Frame Length: 2048
Recv Threshold : 1
Encapsulation :
```

### Enabling an interface

After configuring the serial interface or connecting other serial devices to your IPLink 2000, use the **no shutdown** command to enable the serial interfaces again. When you enable an interface, it has the state *OPENED* in the **show port serial** command display.

**Note** Use the **shutdown** command to disable the serial interface for any software or hardware configuration procedure.

This procedure describes how to enable a serial interface.

**Mode:** Administrator execution

Step	Command	Purpose
1	<b>node(cfg)#port serial</b> <i>slot port</i>	Selects the serial interface on slot and port
2	<b>node(prt-ser)[slot/port]#no shutdown</b>	Enables the interface
3	<b>node(prt-ser)[slot/port]#show port serial</b>	Displays the serial interface configuration.

**Example:** Enabling an interface

The example shows how to enable the built-in serial interface on slot 0 and port 0 of an IPLink router. Check that *State* is set to *OPENED* in the command output of **show port serial**.

```
2800(cfg)#port serial 0 0
2800(prt-ser)[0/0]#no shutdown
2800(prt-ser)[0/0]#show port serial

Serial Interface Configuration
-----

Port          : serial 0 0 0
State         : OPENED
Hardware Port : V.35
Transmit Edge : normal
Port Type     : DTE
CRC Type      : CRC-16
Max Frame Length: 2048
Recv Threshold : 1
Encapsulation :
```

**Configuring the encapsulation for Frame Relay**

The synchronous serial interface supports the Frame Relay serial encapsulation method.

To set the encapsulation method used by a serial interface, use the **encapsulation** interface configuration command.

This procedure describes how to set the encapsulation type of the serial interface for Frame Relay.

**Mode:** Administrator execution

Step	Command	Purpose
1	<b>node(cfg)#port serial</b> <i>slot port</i>	Selects the serial interface on <i>slot</i> and <i>port</i> .
2	<b>node(prt-ser)[<i>slot/port</i>]#[no] encapsulation { framerelay   ppp }</b>	Sets the encapsulation type for the selected interface.
3	<b>node(prt-ser)[<i>slot/port</i>]#show port serial</b>	Displays the serial interface configuration.

**Example:** Configuring the serial encapsulation type

The following example enables Frame Relay encapsulation for the serial interface on slot 0 and port 0 of an IPLink router. Check that in the command output of **show port serial** *Encapsulation* is set to *framerelay*.

```
2800(cfg)#port serial 0 0
2800(prt-ser)[0/0]#encapsulation framerelay
2800(prt-ser)[0/0]#show port serial

Serial Interface Configuration
-----

Port          : serial 0 0 0
State         : CLOSED
Hardware Port : V.35
```

```

Transmit Edge   : normal
Port Type       : DTE
CRC Type        : CRC-16
Max Frame Length: 2048
Recv Threshold  : 1
Encapsulation   : framerelay

```

### Enter Frame Relay mode

This section describes how to configure Frame Relay on the serial interface of an IPLink router, after setting the basic serial interface parameters according to the previous sections.

This procedure describes how to enter the Frame Relay configuration mode

**Mode:** Administrator execution

Step	Command	Purpose
1	<b>node(cfg)#port serial slot port</b>	Selects the serial interface on slot and port
2	<b>node(prt-ser)[slot/port]#framerelay</b>	Enters the Frame Relay configuration mode
3	<b>node(frm-rel)[slot/port]#</b>	Displays the Frame Relay configuration mode prompt

**Example:** Enter Frame Relay mode

The following example shows how to enter into the Frame Relay configuration mode for the serial interface on slot 0 and port 0 of an IPLink router.

```

2800(cfg)#port serial 0 0
2800(prt-ser)[0/0]#framerelay
2800(frm-rel)[0/0]#

```

### Configuring the LMI type

For a Frame Relay network, the line protocol is the periodic exchange of local management interface (LMI) packets between the IPLink device and the Frame Relay provider equipment. If the IPLink device is attached to a public data network (PDN), the LMI type must match the type used on the public network.

You can set one of the following three types of LMIs on the IPLink devices:

- **ansi** for ANSI T1.617 Annex D,
- **gof** for *Group of 4*, which is the default for Cisco LMI, and
- **itu** for ITU-T Q.933 Annex A.

This procedure describes how to set the LMI type.

**Mode:** Frame Relay

Step	Command	Purpose
1	<b>node(frm-rel)[slot/port]#lmi-type {ansi   gof   itu}</b>	Sets the LMI type

**Example:** Configuring the LMI type

The following example sets the LMI type to ANSI T1.617 Annex D for Frame Relay over the serial interface on slot 0 and port 0.

```
2800(cfg)#port serial 0 0
2800(prt-ser)[0/0]#framerelay
2800(frm-rel)[0/0]#lmi-type ansi
```

### Configuring the keep-alive interval

A keep-alive interval must be set to configure the LMI. By default, this interval is 10 seconds and, according to the LMI protocol, must be less than the corresponding interval on the switch. The keep-alive interval in seconds, which is represented by *number*, has to be in the range from 1 to 3600.

This procedure describes how to set the keep-alive interval

**Mode:** Frame Relay

Step	Command	Purpose
1	<b>node(frm-rel)[slot/port]#keepalive number</b>	Sets the LMI keep-alive interval

To disable keep-alives on networks that do not utilize LMI, use the **no keepalive** interface configuration command.

**Example:** Configuring the keep-alive interval

The following example sets the *keepalive* interval to 10 seconds for Frame Relay over the serial interface on slot 0 and port 0 of an IPLink router.

```
2800(cfg)#port serial 0 0
2800(prt-ser)[0/0]#framerelay
2800(frm-rel)[0/0]#keepalive 10
```

### Entering Frame Relay PVC configuration mode

The permanent virtual circuit (PVC) is a virtual circuit that is permanently established. PVCs save bandwidth associated with circuit establishment and tear down in situations where certain virtual circuits must exist all the time.

The Frame Relay network provides a number of virtual circuits that form the basis for connections between stations attached to the same Frame Relay network.

The resulting set of interconnected devices forms a private Frame Relay group, which may be either fully interconnected with a complete mesh of virtual circuits, or only partially interconnected.

In either case, each virtual circuit is uniquely identified at each Frame Relay interface by a Data Link Connection Identifier (DLCI). In most circumstances, DLCIs have strictly local significance at each Frame Relay interface.

Assigning a DLCI to a specified Frame Relay sub interface on the IPLink is done in the PVC configuration mode. The DLCI has to be in the range from 1 to 1022.

**Note** A maximum of eight PVCs can be defined.

This procedure describes how to enter the PVC configuration.

**Mode:** Frame Relay

Step	Command	Purpose
1	<b>node(frm-rel)[slot/port]#pvc dlci</b>	Enters the PVC configuration mode by assigning a DLCI number to be used on the specified sub interface

**Example:** Entering Frame Relay PVC configuration mode

The following example enters the configuration mode for PVC with the assigned DLCI of 1 for Frame Relay over the serial interface on slot 0 and port 0 of an IPLink router.

```
2800(cfg)#port serial 0 0
2800(prt-ser)[0/0]#framerelay
2800(frm-rel)[0/0]#pvc 1
2800(pvc)[1]#
```

### Configuring the PVC encapsulation type

You must use the PVC configuration command **encapsulation rfc1490** to set the encapsulation type to comply with the Internet Engineering Task Force (IETF) standard (RFC 1490). Use this keyword when connecting to another vendor's equipment across a Frame Relay network.

This procedure describes how to set the encapsulation type to comply with RFC 1490

**Mode:** Frame Relay

Step	Command	Purpose
1	<b>node(frm-rel)[slot/port]#encapsulation rfc1490</b>	Sets RFC1490 PVC compliant encapsulation

**Example:** Configuring the PVC encapsulation type

The following example sets the encapsulation type to comply with RFC 1490 for PVC with the assigned DLCI of 1 for Frame Relay over the serial interface on slot 0 and port 0 of an IPLink router.

```
2800(cfg)#port serial 0 0
2800(prt-ser)[0/0]#framerelay
2800(frm-rel)[0/0]#pvc 1
2800(pvc)[1]#encapsulation rfc1490
```

### Binding the Frame Relay PVC to IP interface

A newly created permanent virtual circuit (PVC) for Frame Relay has to be bound to an IP interface for further use. The logical IP interface has to be already defined and should be named according to the use of the serial

Frame Relay PVC. If serial Frame Relay PVC shall be used as WAN access, a suitable name for the logical IP interface could be *wan* as in figure 12 below.

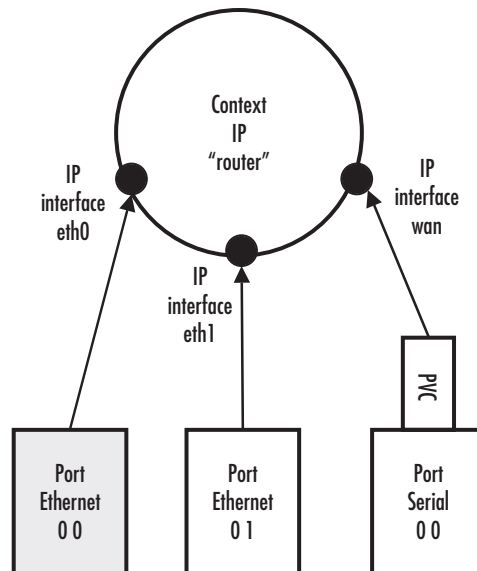


Figure 12. IP interface *wan* is bound to PVC 1 on port serial 0 0

This procedure describes how to bind the Frame Relay PVC DLCI on the serial interface to the logical IP interface *name*, which is related to the IP context router.

**Mode:** PVC

Step	Command	Purpose
1	<b><code>node(pvc)[dcli]#bind interface name router</code></b>	Binds Frame Relay PVC dcli to the IP interface name of IP context router

**Example:** Binding the Frame Relay PVC to IP interface

The following example binds the Frame Relay PVC 1 to the IP interface *wan* of IP context router to the serial interface on slot 0 and port 0 of an IPLink router.

```
2800(cfg)#port serial 0 0
2800(prt-ser)[0/0]#framrelay
2800(frm-rel)[0/0]#pvc 1
2800(pvc)[1]#bind interface wan router
```

### Enabling a Frame Relay PVC

After binding Framrelay PVC to an ip interface it must be enabled for packet processing. This procedure activates the PVC by opening the bound ip interface.

This procedure describes how to enable Framrelay PVC for packet processing

**Mode:** PVC

Step	Command	Purpose
1	<b><code>node(pvc)[dlci]#no shutdown</code></b>	Enables the Frame Relay PVC

**Example:** Disabling a Frame Relay PVC

The following example enables Frame Relay PVC with the DLCI 1 on the serial interface on slot 0 and port 0.

```
2800(cfg)#port serial 0 0
2800(prt-ser)[0/0]#framrelay
2800(frm-rel)[0/0]#pvc 1
2800(pvc)[1]#no shutdown
```

Check the PVC 1 status using **show running-config** and verify that the entry *no shutdown* occurs in the configuration part responsible for this PVC.

```
2800(pvc)[1]#show running-config
Running configuration:
#-----#
#                                             #
...
pvc 1
  encapsulation rfc1490
  bind interface wan router
  no shutdown
```

### Disabling a Frame Relay PVC

Frame Relay PVCs can be disabled whenever it is necessary. Be aware that disabling a specific PVC also disables the related serial interface and vice versa.

This procedure describes how to disable the Frame Relay PVC DLCI on the serial interface.

**Mode:** PVC

Step	Command	Purpose
1	<b><code>node(pvc)[dlci]#shutdown</code></b>	Disables the Frame Relay PVC DLCI.

**Example:** Disabling a Frame Relay PVC

The following example disables Frame Relay PVC 1 on the serial interface on slot 0 and port 0 of an IPLink router.

```
2800(cfg)#port serial 0 0
2800(prt-ser)[0/0]#framrelay
```

```
2800(frm-rel)[0/0]#pvc 1
2800(pvc)[1]#shutdown
```

Check the PVC 1 status by using **show running-config** and verify that the entry *shutdown* occurs in the configuration part responsible for this PVC.

```
2800(pvc)[1]#show running-config
Running configuration:
#-----#
#                                             #
# 2500                                         #
...
pvc 1
  encapsulation rfc1490
  bind interface wan router
  shutdown
  exit
...
```

### Displaying serial port information

The following example shows the commands used to display serial port configuration settings.

```
HDLC Driver: 0x8496b8
=====

Slot:                0
Number of Ports:    1
HDLC Driver: 0x8496b8
=====

Slot:                0
Number of Ports:    1

Port: serial 0 0 0
-----

State:                OPENED

Configuration
Hardware Port:       X.21
Port Type:           DCE
CRC:                 CRC-16
Transmit Edge:       Normal
Max Frame Length:   1920
Baudrate:            64000 bps
Recv Threshold:      1
```

### Displaying Frame Relay information

Since Frame Relay configuration for the serial interface is complex and requires many commands, it is helpful to list the frame relay configuration on screen.

This procedure describes how to display the Frame Relay configuration settings for the serial interface.

**Mode:** Port serial

Step	Command	Purpose
1	<b>node(prt-ser)[slot/port]#show framerelay</b>	Displays Frame Relay information.

**Example:** Displaying Frame Relay information

The following example shows the commands used to display Frame Relay configuration settings.

```
2800>enable
2800#configure
2800(cfg)#show framerelay
```

Framerelay Configuration:

Port	LMI-Type	Keepalive	Fragmentation
serial 0 0 0	ansi	10	disabled

PVC Configuration:

Port	DLCI	State	Fragment	Encaps	Binding
serial 0 0 0	1	open	disabled	rfc1490	wan@router

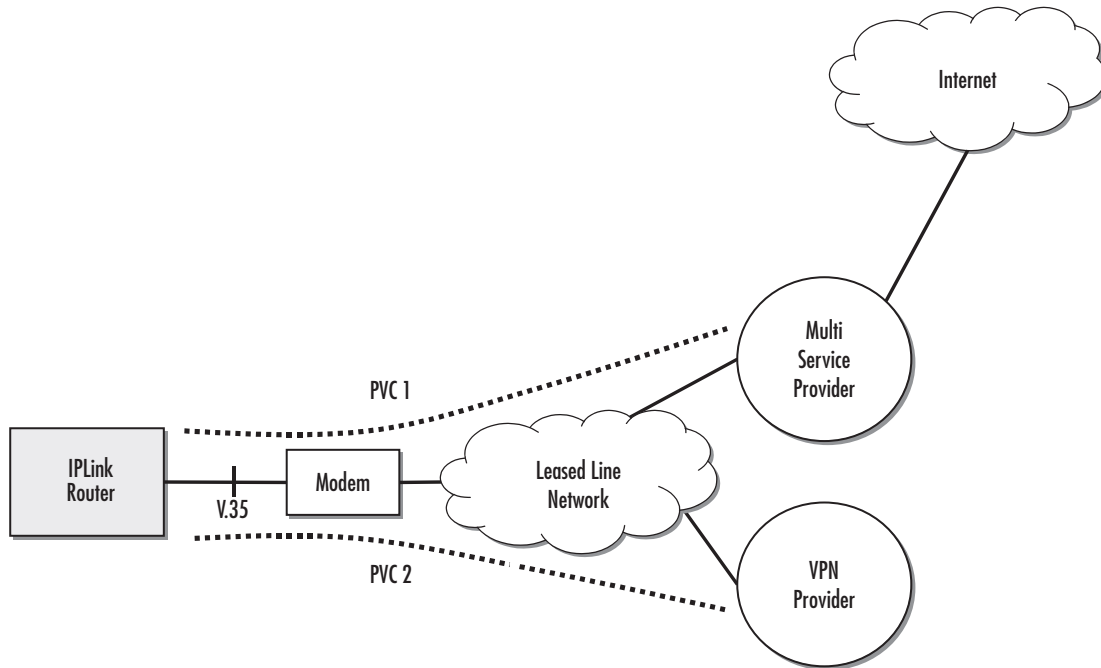


Figure 13. Typical Integrated Service Access Scenario with dedicated PVCs

### Integrated service access

The example in [figure 13](#) shows a typical integrated service access scenario, where different service providers are accessed via permanent virtual circuits (PVCs) on Frame Relay over the serial interface of an IPLink router.

The multi service provider (MSP) offers both Internet access and intranet services based on IP. The virtual private network (VPN) provider offers secure interconnections of local access networks (LAN) via its public wide area network based on IP. Since both providers are working independently, the IPLink needs a configuration, which has two dedicated PVCs on Frame Relay. The first PVC, labeled as PVC 1, connects to the MSP access device. The second PVC, labeled PVC 2, connects to the VPN provider access device on the leased line network.

A IPLink is working as a DTE and accesses the leased line network via a leased line modem connected to the serial interface. The hardware port protocol V.35 is used on the serial interface on slot 0 and port 0.

Devices accessing the MSP and VPN services are attached to the 100 Mbps Ethernet port 0/0 on the IPLink router. For that reason, an IP context with three logical IP interfaces bound to Ethernet port 0/0, PVC 1 and PVC 2 on serial port 0/0 as shown in [figure 13](#) has to be configured for the IPLink router. The IP interfaces are labeled to represent the function of their configuration. Hence Ethernet port 0/0 is named *lan*, PVC 1 is named *external* since external services are accessed via this PVC, and PVC 2 is named *internal* to indicate the private network interconnection via this PVC.

Between the leased line modem and the IPLink router, ANSI T.617 type of LMI packets have to be exchanged. In addition, the keep-alive interval has to be set to 20 seconds.

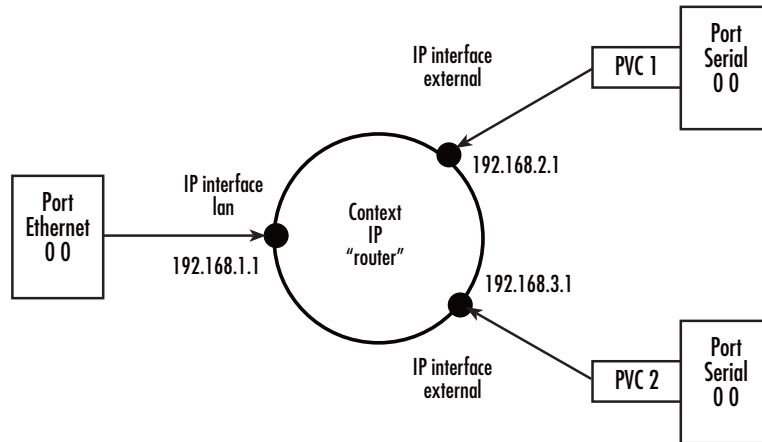


Figure 14. IP Context with logical IP interfaces bound to Ethernet port, serial port PVC 1 and PVC 2

The related IP, serial interface and Frame Relay configuration procedure is listed below. Where necessary, comments are added to the configuration for better understanding.

1. Enter the configuration mode.

```
2800>enable
2800#configure
...
```

2. Set up the IP interface configuration first. Be aware that not all of the necessary settings are listed below.

```
2800(cfg)#context ip router
2800(ctx-ip)[router]#interface external
2800(if-ip)[external]#interface internal
2800(if-ip)[internal]#interface lan
2800(if-ip)[lan]#exit
2800(ctx-ip)[router]#interface internal
2800(if-ip)[internal]#ipaddress 192.168.3.1 255.255.255.0
2800(if-ip)[internal]#interface external
2800(if-ip)[external]#ipaddress 192.168.2.1 255.255.255.0
2800(if-ip)[external]#interface lan
2800(if-ip)[lan]#ipaddress 192.168.1.1 255.255.255.0
...
```

3. Configure the serial interface settings.

```
2800(cfg)#port serial 0 0
2800(prt-ser)[0/0]#shutdown
2800(prt-ser)[0/0]#encapsulation framerelay
...
```

4. Configure the Frame Relay. You must thus change to the Frame Relay configuration mode. Use the service-policy profile defined above to give voice priority over data.

```
2800(prt-ser)[0/0]#framerelay
2800(frm-rel)[0/0]#lmi-type ansi
2800(frm-rel)[0/0]#keepalive 20
...
```

### 5. Configure the introduced PVCs.

```
2800(frm-rel)[0/0]#pvc 1
2800(pvc)[1]#encapsulation rfc1490
2800(pvc)[1]#bind interface external router
2800(pvc)[1]#no shutdown
2800(pvc)[1]#pvc 2
2800(pvc)[2]#encapsulation rfc1490
2800(pvc)[2]#bind interface internal router
2800(pvc)[2]#no shutdown
...
```

### 6. Check that the Frame Relay settings are correct.

```
2800(frm-rel)[0/0]#show framerelay
```

Framerelay Configuration:

Port	LMI-Type	Keepalive	Fragmentation
serial 0 0 0	ansi	20	disabled

PVC Configuration:

Port	DLCI	State	Fragment	Encaps	Binding
serial 0 0 0	1	open	disabled	rfc1490	external@router
serial 0 0 0	2	open	disabled	rfc1490	internal@router

## Chapter 5 **T1/E1 port configuration**

### **Chapter contents**

Introduction .....	62
T1/E1 port configuration task list.....	62
Enable/Disable T1/E1 port .....	62
Configuring T1/E1 port-type .....	63
Configuring T1/E1 clock-mode .....	63
Configuring T1/E1 line-code .....	63
Configuring T1/E1 framing .....	64
Configuring T1/E1 line-build-out (T1 only) .....	64
Configuring T1/E1 used-connector (E1 only) .....	64
Configuring T1/E1 application mode .....	65
Configuring T1/E1 LOS threshold .....	65
Configuring T1/E1 encapsulation .....	65
Create a Channel-Group .....	65
Configuring Channel-Group Timeslots .....	66
Configuring Channel-Group Encapsulation .....	66
Entering HDLC Configuration Mode .....	66
Configuring HDLC CRC-Type .....	67
Configuring HDLC Encapsulation .....	67
T1/E1 Configuration Examples .....	67
Example 1: Frame Relay without a channel-group .....	68
Example 2: Framereley with a channel-group .....	69
Example 3: PPP without a channel-group .....	69
Example 4: PPP with a channel-group .....	69

## Introduction

---

This chapter provides an overview of the T1/E1 WAN port, their characteristics and describes the configuration tasks.

The model 2803 has a T1/E1 WAN port on the rear panel of the unit. The T1 version (Model 2803T) has an RJ-48C connector, and the E1 version (Model 2803K) offers the user connectivity via either the RJ-48C or dual coaxial connectors. Both models can be configured for T1 or E1 operation.

The configurable parameters for the T1/E1 port are type (T1 or E1), clock mode (or source) (master or slave), line code (AMI, HDB3, or B8ZS), framing (CRC-4, ESF, or unframed), line-build-out (for T1 only) and encapsulation (channelized or HDLC).

A further feature is the creation and configuration of channel-groups.

## T1/E1 port configuration task list

---

This section describes the configuration tasks for the T1/E1 port.

- Enable/Disable T1/E1 port
- Configuring the T1/E1 port type
- Configuring T1/E1 clock mode
- Configuring T1/E1 line code
- Configuring T1/E1 framing
- Configuring T1 line build out (LBO) (T1 only)
- Configuring E1 impedance/connector
- Configuring T1/E1 application mode
- Configuring T1/E1 LOS threshold
- Configuring T1/E1 encapsulation
- Create a Channel-Group
- Configuring channel-group timeslots
- Configuring channel-group encapsulation
- Entering HDLC configuration mode
- Configuration HDLC CRC-type
- Configuring HDLC encapsulation

### **Enable/Disable T1/E1 port**

By default, the T1/E1 port is disabled. The following command is used for enabling or disabling it.

**Mode:** port e1t1 <slot> <port>

Step	Command	Purpose
1	[name] (prt-e1t1)[slot/port]# [no] shutdown	Enable/Disable the T1/E1 port. Default: <i>shutdown</i> (which is disabled)

### Configuring T1/E1 port-type

The T1/E1 Port can either work in T1 or in E1 (G.704) mode. This mode can be changed dynamically as long as no encapsulation or encapsulation 'hdlc' is set. Be aware that changing the port-type also resets the framing and linecode parameters to the default values of the new port-type. If port-type change is not allowed due to current configuration, an error message will be issued.

**Mode:** port e1t1 <slot> <port>

Step	Command	Purpose
1	[name] (prt-e1t1)[slot/port]# port-type {e1   t1}	Changes operation mode of the port. Default: <i>e1</i>

### Configuring T1/E1 clock-mode

The T1/E1 Port can either work in clock-master or in clock-slave mode. This setting defines the clock dependency of the internal data processing. In clock-master mode the internal data processing is running on an independent clock source. In clock-slave mode the clock source for internal data processing is recovered from the receive line interface. Be aware that always a port-pair of clock-master and clock-slave are connected together. In the other case the data transmission will fail due to bit failures.

**Mode:** port e1t1 <slot> <port>

Step	Command	Purpose
1	[name] (prt-e1t1)[slot/port]# clock {master   slave}	Configures the clock-mode of the port. Default: <i>master</i>

### Configuring T1/E1 line-code

Three different line codes can be selected on the T1/E1 port whereas only 'ami' is standardized for E1 and T1. If the port is running in E1 mode, 'hdb3' is also configurable and in T1 mode 'b8zs'. If a linecode will be selected that is not standardized for the current port mode, an error message will be advised.

**Mode:** port e1t1 <slot> <port>

Step	Command	Purpose
1	[name] (prt-e1t1)[slot/port]# linecode {ami   b8zs   hdb3}	Configures the line-code of the port. Default for e1: <i>hdb3</i> Default for t1: <i>b8zs</i>

### Configuring T1/E1 framing

Four framing formats are available for selection on the T1/E1 port. *Unframed* can only be used if the encapsulation is set for *hdlc*. All other currently available upper layer (encapsulation) protocols do not run in unframed mode, but in one of the framed modes.

In structured mode, E1 can be configured for *crc4* or *non-crc4*. T1 has a single framed option, *esf*.

The advantage of the unframed mode (obviously with *hdlc* encapsulation) is the utilization of the whole link speed for user data transmission, 2.048MBit/s for E1 and 1.544MBit/s for T1. However note that HDLC has its own overhead which decreases the actual data rate.

**Mode:** port e1t1 <slot> <port>

Step	Command	Purpose
1	<code>[name] (prt-e1t1)[slot/port]# framing {crc4   non-crc4   esf   unframed}</code>	Configures the framing of the port. E1 mode formats are: <i>crc4</i> , <i>non-crc4</i> , <i>unframed</i> . T1 mode formats are: <i>esf</i> , <i>unframed</i> . Default for <b>e1</b> : <i>crc4</i> Default for <b>t1</b> : <i>esf</i>

### Configuring T1/E1 line-build-out (T1 only)

The line build out configuration is used in long haul applications to prevent cross talk in the far end device.

**Mode:** port e1t1 <slot> <port>

Step	Command	Purpose
1	<code>[name] (prt-e1t1)[slot/port]# line-build-out {0   -7.5   -15   -22.5}</code>	Specifies the pulse attenuation in dB on the line interface. Default for t1: 0 dB

### Configuring T1/E1 used-connector (E1 only)

The E1 WAN port provides several line interface connector types, RJ-48C and dual coaxial BNC connectors. This command specifies which one is currently in use. Though the signal is always on all available connectors, the internal impedance matching must be selected for the appropriate interface (RJ-48C = 120 Ohm; BNC = 75 Ohm).

**Mode:** port e1t1 <slot> <port>

Step	Command	Purpose
1	<code>[name] (prt-e1t1)[slot/port]# used-connector {bnc   rj45}</code>	Specifies the currently used connector. Default for e1: <i>rj45</i>

### Configuring T1/E1 application mode

The T1/E1 port can be configured to work in either short-haul or in long-haul mode. **Short-haul** is the default application and should be used for transmission distances up to **180m/600ft**. For transmission distances up to **1800m/6000ft**, select the **long-haul** application.

**Mode:** port e1t1 <slot> <port>

Step	Command	Purpose
1	<code>[name] (prt-e1t1)[slot/port]#application {long-haul   short-haul}</code>	Specifies the e1/t1 application mode Default: <i>short-haul</i>

### Configuring T1/E1 LOS threshold

This command takes effect only if the T1/E1 port is configured for **long-haul** applications. It specifies the sensitivity for **Loss Of Signal threshold**. A signal suffers more attenuation over long distances than over short distances. Therefore the LOS-Threshold must be set higher for longer transmission distances. This command has a default value of -46dB what should be enough for distances up to 1600 m/5250 ft.

**Mode:** port e1t1 <slot> <port>

Step	Command	Purpose
1	<code>[ name] (prt-e1t1)[slot/port]#los-threshold {-4dB   -6dB   -8dB ... -46dB   -48dB}</code>	Specifies Loss Of Signal Threshold Default: <i>-46dB</i>

### Configuring T1/E1 encapsulation

Only 'hdlc' encapsulation is available on a T1/E1 port. Once encapsulation is configured as 'hdlc,' the 'hdlc' submode can be entered for selecting the next encapsulation type like **ppp** or **framerelay**. Depending on the port-type, the encapsulation 'hdlc' selects automatically all timeslots of the port for data transmission (1-31 for e1 and 1-24 for t1).

It is also possible to use the port in **channelized** mode. In "channelized" mode, the user selects less than the total number of timeslots for the channel (1-31 for E1, 1 – 24 for T1) is able to configure single or multiple timeslots for data transmission. To use this feature the encapsulation must be configured for 'channelized;' afterwards the **channel-group** command is used to create the channel-group. In the channel-group configuration mode, the user selects the specific timeslots, and the encapsulation 'hdlc' will be available again. Once the encapsulation of a T1/E1 port is set to 'channelized' it is not possible to change the port-type again or to use the 'unframed' framing format.

**Mode:** port e1t1 <slot> <port>

Step	Command	Purpose
1	<code>[name] (prt-e1t1)[slot/port]#[no] encapsulation {channelized   hdlc}</code>	Specifies the encapsulation type of the T1/E1 port. Default: <i>no encapsulation</i>

### Create a Channel-Group

If the desired encapsulated channel uses only selected time slots (not the entire T1/E1), then it is necessary to set up a channel-group. To create a channel-group, set the T1/E1 port's encapsulation to *channelized*. (See sec-

tion “Configuring T1/E1 encapsulation”.) On creating a new channel-group the channel-group configuration mode is immediately entered. To remove an existing channel-group the ‘no’ form of the command has to be used.

**Mode:** port e1t1 <slot> <port>

Step	Command	Purpose
1	<b>[name] (prt-e1t1)[slot/port]#[no] channel-group group-name</b>	Enters the channel-group configuration mode of <i>group-name</i> . If the group does not yet exist a new one will be created. The ‘no’ form of the command removes an existing channel-group.

### Configuring Channel-Group Timeslots

The ‘timeslots’ command configures an arbitrary sequence of timeslots for use in data transmission. The syntax of the command accepts comma-separated groups of timeslots. A group can be a single timeslot or a range of timeslots. The channel-group timeslots do not have to be contiguous. The ‘no’ form of the command releases all previously selected timeslots.

**Example:**

```
>timeslots 1,4,6           Selects three timeslots (1, 4 and 6)
>timeslots 1,4-6          Selects four timeslots (1, 4, 5 and 6)
>timeslots 1-3,4-6        Selects six timeslots (1, 2, 3, 4, 5 and 6)
```

**Mode:** channel-group *group-name*

Step	Command	Purpose
1	<b>[name] (ch-grp)[group-name]#[no] timeslots timeslots</b>	Selects the timeslots to be used. Default: <i>no timeslots</i>

### Configuring Channel-Group Encapsulation

In the channel-group configuration mode only the encapsulation type ‘hdlc’ is available. For more details see , “Configuring T1/E1 encapsulation” on page 64.

**Mode:** channel-group *group-name*

Step	Command	Purpose
1	<b>[name] (ch-grp)[group-name]#[no] encapsulation hdlc</b>	Specifies the encapsulation type of the channel-group. Default: <i>no encapsulation</i>

### Entering HDLC Configuration Mode

The hdlc configuration mode can be entered either from the “port T1/E1” configuration mode or from the “channel-group” configuration mode. If you cannot enter the hdlc mode, it may be due to an invalid or incomplete configuration, and an error message will be issued. In “port T1/E1” configuration mode, you only need to set the encapsulation for ‘hdlc’ in order to enter the hdlc configuration mode. In “channel-group” configura-

tion mode the encapsulation must be set to 'hdlc' as well followed by configuring at least one timeslot per the 'timeslots' command.

**Mode:** port e1t1 <slot> <port>

Step	Command	Purpose
1	[name] (prt-e1t1)[slot/port]# hdlc	Entering the hdlc configuration mode

**Mode:** channel-group <group>

Step	Command	Purpose
1	[name] (ch-grp)[group-name]#hdlc	Entering the hdlc configuration mode

### Configuring HDLC CRC-Type

This command specifies the length of the checksum for calculating the CRC of the hdlc-frame. It can be either a 16-bit or a 32-bit checksum.

**Mode:** hdlc

Step	Command	Purpose
1	[name] (hdlc)#crc-type {crc16   crc32}	Selects the checksum-type to be used. Default: <i>crc16</i>

### Configuring HDLC Encapsulation

The hdlc encapsulation command specifies what kinds of upper layer data are contained in the hdlc frames. Two encapsulation types are available, framerelay and ppp. Once the hdlc configuration mode has been entered, the procedure for setting up framerelay or ppp is exactly the same as for an X.21/V.35 serial port. For that reason, see 4, "Serial port configuration" on page 46 for details about frame relay configuration and the "IPLink Software Configuration Guide" for details about PPP configuration.

**Mode:** hdlc

Step	Command	Purpose
1	[name] (hdlc)#encapsulation {framerelay   ppp}	Specifies the encapsulation type of hdlc. Default: <i>no encapsulation</i>

### T1/E1 Configuration Examples

Here is a group of four configuration examples.

- Example 1: Frame Relay without a channel-group
- Example 2: Frame Relay with a channel-group
- Example 3: PPP without a channel-group
- Example 4: PPP with a channel-group

*Example 1: Frame Relay without a channel-group*

```
port elt1 0 0
  port-type e1
  framing crc4
  encapsulation hdlc

  hdlc
    encapsulation framerelay

  framerelay
    lmi-type itu

  pvc 100
    encapsulation rfc1490
    bind interface pvc100 router
    no shutdown

port elt1 0 0
  no shutdown
```

*Example 2: Framerelay with a channel-group*

```
port elt1 0 0
  port-type e1
  framing crc4
  encapsulation channelized

channel-group myGroup
  timeslots 13-17
  encapsulation hdlc

hdlc
  encapsulation framerelay

framerelay
  lmi-type itu

  pvc 100
    encapsulation rfc1490
    bind interface pvc100 router
    no shutdown

port elt1 0 0
  no shutdown
```

*Example 3: PPP without a channel-group*

```
port elt1 0 0
  port-type e1
  framing crc4
  encapsulation hdlc

hdlc
  encapsulation ppp
  bind interface myPPP router

port elt1 0 0
  no shutdown
```

*Example 4: PPP with a channel-group*

```
port elt1 0 0
  port-type e1
  framing crc4
  encapsulation channelized

channel-group yourGroup
  timeslots 1,9,16,23
  encapsulation hdlc

hdlc
  encapsulation ppp
  bind interface myPPP router

port elt1 0 0
  no shutdown
```

## Chapter 6 VPN configuration

### Chapter contents

Introduction .....	76
Authentication .....	76
Encryption .....	76
Transport and tunnel modes .....	77
VPN configuration task list .....	77
Creating an IPsec transformation profile .....	77
Creating an IPsec policy profile .....	78
Creating/modifying an outgoing ACL profile for IPsec .....	80
Configuration of an IP interface and the IP router for IPsec .....	81
Displaying IPsec configuration information .....	81
Debugging IPsec .....	82
Sample configurations .....	83
IPsec tunnel, DES encryption .....	83
IPLink configuration .....	83
Cisco router configuration .....	84
IPsec tunnel, AES encryption at 256 bit key length, AH authentication with HMAC-SHA1-96 .....	84
IPLink configuration .....	84
Cisco router configuration .....	85
IPsec tunnel, 3DES encryption at 192 bit key length, ESP authentication with HMAC-MD5-96 .....	85
IPLink configuration .....	85
Cisco router configuration .....	85

## Introduction

This chapter describes how to configure the VPN connections between two IPLink routers or between an IPLink and a third-party device.

A *virtual private network* (VPN) is a private data network that uses the public telecommunications infrastructure, maintaining privacy through the use of a tunneling protocol and security procedures.

There are different technologies to implement a VPN. IPLink applies the *internet protocol security* (IPsec) Architecture (see RFC 2401). The following sections describe the main building blocks of the IPsec architecture as implemented in IPLink router.

### Authentication

Authentication verifies the integrity of data stream and ensures that it is not tampered with while in transit. It also provides confirmation about data stream origin.

Two authentication protocols are available:

- Authentication header (AH): protects the IP payload, the IP header, and the authentication header itself
- Encapsulating security payload (ESP): protects the IP payload and the ESP header and trailer, but not the IP header

Two algorithms perform the authentication:

- HMAC-MD5-96: is a combination of the *keyed-hashing for message authentication* (HMAC) and the *message digest version 5* (MD5) hash algorithm. It requires an authenticator of 128-bit length and calculates a hash of 96 bits over the packet to be protected (see RFC 2403).
- HMAC-SHA1-96: is a combination of the (HMAC) and the *secure hash algorithm version 1* (SHA1). It requires an authenticator of 160 bit length and calculates a hash of 96 bits over the packet to be protected (see RFC 2404).

### Encryption

Encryption protects the data in transit from unauthorized access. Encapsulating security payload (ESP) is the protocol to transport encrypted IP packets over IP (see RFC 2406).

The following encryption algorithms are available:

	Key Length [Bit]	RFC
DES-CBC (Data Encryption Standard - Cipher Block Chaining)	56	2405
3DES-CBC (Triple Data Encryption Standard - Cipher Block Chaining)	128 or 192 <sup>a</sup>	1851
AES-CBC (Advanced Encryption Standard - Cipher Block Chaining)	128, 192, or 256	3268

- a. The 3DES algorithm uses only 112 out of the 128 Bit or 168 out of the 192 Bit as key information. Cisco only supports 192 Bit keys with 3DES.

The single DES algorithm no longer offers adequate security because of its short key length (a minimum key length 100 bits is recommended). The AES algorithm is very efficient and allows the fastest encryption. AES with a key length of 128 bits is therefore the recommended algorithm.

### Transport and tunnel modes

The mode determines the payload of the ESP packet and hence the application:

- Transport mode: Encapsulates only the payload of the original IP packet, but not its header, so the IPsec peers must be at the endpoints of the communications link.
- A secure connection between two hosts is the application of the transport mode.
- Tunnel mode: Encapsulates the payload and the header of the original IP packet. The IPsec peers can be (edge) routers that are not at the endpoints of the communications link.

A secure connection of the two (private) LANs, a ‘tunnel’, is the application of the tunnel mode.

### VPN configuration task list

To configure a VPN connection, perform the following tasks:

- Creating an IPsec transformation profile
- Creating an IPsec policy profile
- Creating/modifying an outgoing ACL profile for IPsec
- Configuration of an IP Interface and the IP router for IPsec
- Displaying IPsec configuration information
- Debugging IPsec

#### Creating an IPsec transformation profile

The IPsec transformation profile defines which authentication and/or encryption protocols, which authentication and/or encryption algorithms shall be applied.

**Procedure:** To create an IPsec transformation profile

**Mode:** Configure

mac-sha1-96 } Enables authentication and defines the authentication protocol and the hash algorithm

Step	Command	Purpose
<b>1</b>	<b>node(cfg)#profile ipsec-transform</b> <i>name</i>	Creates the IPsec transformation profile <i>name</i>
<b>2</b> <b>optional</b>	<b>node(pf-ipstr)[<i>name</i>]#esp-encryption { aes-cbc   des-cbc   3des-cbc } [<i>key-length</i>]</b>	Enables encryption and defines the encryption algorithm and the key length
<b>3</b> <b>optional</b>	<b>node(pf-ipstr)[<i>name</i>]#{ ah-authentication   esp-authentication } { hmac-md5-96   hmac-sha1-96 }</b>	Enables authentication and defines the authentication protocol and the hash algorithm

Use **no** in front of the above commands to delete a profile or a configuration entry.

**Example:** Create an IPsec transformation profile

The following example defines a profile for AES-encryption at a key length of 128.

```
2800(cfg)#profile ipsec-transform AES_128
2800(pf-ipstr)[AES_128]#esp-encryption aes-cbc 128
```

### **Creating an IPsec policy profile**

The IPsec policy profile supplies the keys for the encryption and/or the authenticators for the authentication, the *security parameters indexes* (SPIs), and IP address of the peer of the secured communication. Furthermore, the profile defines which IPsec transformation profile to apply and whether transport or tunnel mode shall be most effective.

The SPI identifies a secured communication channel. The IPsec component needs the SPI to select the suitable key or authenticator. Inbound and outbound channels can have the same SPI, but the channels in the same direction—inbound or outbound—must have unique SPIs. The SPI is not encrypted and can be monitored.

**Procedure:** To create an IPsec policy profile

Mode: Configure

Step	Command	Purpose
1	<b>node(cfg)#profile ipsec-policy-manual</b> <i>name</i>	Creates the IPsec policy profile name
2	<b>node(pf-ipstr)[name]#use profile ipsec-transform</b> <i>name</i>	Selects the IPsec transformation profile to be applied
3 optional	<b>node(pf-ipstr)[name]#session-key</b> { inbound   outbound } { ah-aauthentication   esp-aauthentication   esp-encryption } <i>key</i>	<p>Sets a key for encryption or an authenticator for authentication, either for inbound or outbound direction. The key shall consist of hexadecimal digits (0..9, A..F); one digit holds 4 Bit of key information.</p> <p>The key setting must match definitions in the respective IPsec transformation profile. In particular, the length of the key or authenticator must match the implicit (see section “Authentication” on page 70 and “Encryption” on page 70) or explicit specification.</p> <p>Keys must be available for inbound and outbound directions. They can be different for the two directions. Make sure that the inbound key of one peer matches the outbound key of the other peer.</p>
4	<b>node(pf-ipstr)[name]#spi</b> { inbound   outbound } { ah   esp } <i>spi</i>	<p>Sets the SPI for encryption (esp) or authentication (ah), either for inbound or outbound direction. The SPI shall be a decimal figure in the range 1..2<sup>32</sup>-1.</p> <p>SPIs must be available for encryption and/or authentication as specified in the respective IPsec transformation profile.</p> <p>SPIs must be available for inbound and outbound directions. They can be identical for the two directions but must be unique in one direction. Make sure that the inbound SPI of one peer matches the outbound SPI of the other peer.</p>
5	<b>node(pf-ipstr)[name]#peer</b> <i>ip-address</i>	<p>Sets the IP address of the peer</p> <p><b>Note</b> The peers of the secured communication must have static IP address. DNS resolution is not available yet.</p>
6	<b>node(pf-ipstr)[name]#mode</b> { tunnel   transport }	Selects tunnel or transport mode

Use **no** in front of the above commands to delete a profile or a configuration entry.

**Example:** Create an IPsec policy profile

The following example defines a profile for AES-encryption at a key length of 128.

```
2800(cfg)#profile ipsec-policy-manual ToBurg
2800(pf-ipsma)[ToBurg]#use profile ipsec-transform AES_128
2800(pf-ipsma)[ToBurg]#session-key inbound esp-encryption 1234567890ABCDEF1234567890ABCDEF
2800(pf-ipsma)[ToBurg]#session-key outbound esp-encryption
FEDCBA0987654321FEDCBA0987654321
2800(pf-ipsma)[ToBurg]#spi inbound esp 1111
2800(pf-ipsma)[ToBurg]#spi outbound esp 2222
2800(pf-ipsma)[ToBurg]#peer 200.200.200.1
2800(pf-ipsma)[ToBurg]#mode tunnel
```

### Creating/modifying an outgoing ACL profile for IPsec

An access control list (ACL) profile in the outgoing direction selects which outgoing traffic to encrypt and/or authenticate, and which IPsec policy profile to use. IPsec does not require an incoming ACL.

**Note** Outgoing and incoming IPsec traffic passes an ACL (if available) twice, once before and once after encryption/authentication. So the respective ACLs must permit the encrypted/authenticated and the plain traffic.

For detailed information on how to set-up ACL rules, see chapter 7, “Access control list configuration” on page 81.

**Procedure:** To create/modify an outgoing ACL profile for IPsec

**Mode:** Configure

Step	Command	Purpose
1	<b>node(cfg)#profile acl name</b>	Creates or enters the ACL profile name
2	<b>node(pf-ipstr)[name]#permit ...</b> <b>[ ipsec-policy name ]</b>	The expression ‘ipsec-policy name’ appended to a permit ACL rule activates the IPsec policy profile <i>name</i> to encrypt/authenticate the traffic identified by this rule.

**Note** New entries are appended at the end of an ACL. Since the position in the list is relevant, you might need to delete the ACL and rewrite it completely.

**Example:** Create/modify an ACL profile for IPsec

The following example configures an outgoing ACL profile that interconnects the two private networks 192.168.1/24 and 172.16/16.

```
2800(cfg)#profile acl VPN_Out
2800(pf-acl)[VPN_Out]#permit ip 192.168.1.0 0.0.0.255 172.16.0.0 0.0.255.255 ipsec-policy
ToBurg
2800(pf-acl)[VPN_Out]#permit ip any any
```

### Configuration of an IP interface and the IP router for IPsec

The IP interface that provides connectivity to the IPsec peer, must now activate the outgoing ACL profile configured in the previous section. Furthermore, the IP router must have a route for the remote network that points to the respective IP interface.

**Procedure:** To activate the outgoing ACL profile and to establish the necessary route

**Mode:** Configure

Step	Command	Purpose
<b>1</b>	<b>node(cfg)#context ip router</b>	Enter IP context
<b>2</b>	<b>node(ctx-ip)[router]#interface if-name</b>	Create/enter the IP interface <i>if-name</i>
<b>3</b>	<b>node(if-ip)[if-name]# use profile acl name out</b>	Activate the outgoing ACL profile <i>name</i>
<b>4</b>	<b>node(if-ip)[if-name]#context ip router</b>	Enter IP context
<b>5 optional</b>	<b>node(ctx-ip)[router]#route remote-network-address remote-network-mask if-name 0</b>	Creates a route for the remote network that points the above IP interface <i>if-name</i>  You can omit this setting if the default route already points to this IP interface or to a next hub reachable via this IP interface, and if there is no other route.  Make also sure that the IP router knows how to reach the peer of the secured communication. Usually, a default route does this job.

**Example:** Activate outgoing ACL and establish route

The following example configures an outgoing ACL profile that interconnects the two private networks 192.168.1/24 and 172.16/16.

```
2800(cfg)#context ip router
2800(ctx-ip)[router]#interface WAN
2800(if-ip)[WAN]#use profile acl VPN_Out out
2800(if-ip)[WAN]#context ip router
2800(ctx-ip)[router]#route 172.16.0.0 255.255.0.0 WAN 0
```

### Displaying IPsec configuration information

This section shows how to display and verify the IPsec configuration information.

**Procedure:** To display IPsec configuration information

**Mode:** Configure

Step	Command	Purpose
<b>1 optional</b>	<b>node(cfg)#show profile ipsec-trans-form</b>	Displays all IPsec transformation profiles
<b>2 optional</b>	<b>node(cfg)#show profile ipsec-policy-manual</b>	Displays all IPsec policy profiles

**Example:** Display IPsec transformation profiles

```
2800(cfg)#show profile ipsec-transform
```

```
IPSEC transform profiles:
```

```
Name: AES_128
  ESP Encryption: AES-CBC, Key length: 128
```

**Example:** Display IPsec policy profiles

```
2800(cfg)#show profile ipsec-policy-manual
```

```
Manually keyed IPsec policy profiles:
```

```
Name: ToBurg, Peer: 200.200.200.1, Mode: tunnel, transform-profile: AES_128
  ESP SPI Inbound: 1111, Outbound: 2222
  ESP Encryption Key Inbound: 1234567890ABCDEF1234567890ABCDEF
  ESP Encryption Key Outbound: FEDCBA0987654321FEDCBA0987654321
```

**Debugging IPsec**

A debug monitor and an additional **show** command are at your disposal to debug IPsec problems.

**Procedure:** To debug IPsec connections

**Mode:** Configure

Step	Command	Purpose
<b>1</b>	<b><code>node(cfg)#debug ipsec</code></b>	Enables IPsec debug monitor
<b>2</b> <b>optional</b>	<b><code>node(cfg)#show ipsec security-associations</code></b>	Summarizes the configuration information of all IPsec connections. If an IPsec connection does not show up, then one or more parameters are missing in the respective Policy Profile.  The information 'Bytes (processed)' supports debugging because it indicates whether IPsec packets depart from ('OUT') or arrive at ('IN') the IPLink router.

**Example:** IPsec Debug Output

```
2800(cfg)#debug ipsec
IPSEC monitor on
23:11:04 ipsec > Could not find security association for inbound ESP packet. SPI:1201
```

**Example:** Display IPsec Security Associations

```
2800(cfg)#show ipsec security-associations
```

```
Active security associations:
```

```
Dir Type      Policy      Mode      Udp-Encapsulation
Peer          SPI AH      SPI ESP   AH          ESP-Auth   ESP-Enc
Bytes (processed/lifetime) Seconds (age/lifetime)
```

```

IN  MANUAL      ToBurg   Tunnel   no
200.200.200.1  -         1111    -         -         AES-CBC 128
3622/unlimited          19047/unlimited

OUT MANUAL      ToBurg   Tunnel   no
200.200.200.1  -         2222    -         -         AES-CBC 128
2857/unlimited          19047/unlimited

```

## Sample configurations

The following sample configurations establish IPsec connections between an IPLink and a Cisco router. To interconnect two IPLink routers instead, derive the configuration for the second IPLink by doing the following modifications:

- Swap 'inbound' and 'outbound' settings
- Adjust the 'peer' setting
- Swap the private networks in the ACL profiles
- Adjust the IP addresses of the LAN and WAN interfaces
- Adjust the route for the remote network

### IPsec tunnel, DES encryption

#### IPLink configuration

```

profile ipsec-transform DES
  esp-encryption des-cbc 64

profile ipsec-policy-manual VPN_DES
  use profile ipsec-transform DES
  session-key inbound esp-encryption 1234567890ABCDEF
  session-key outbound esp-encryption FEDCBA0987654321
  spi inbound esp 1111
  spi outbound esp 2222
  peer 200.200.200.1
  mode tunnel

profile acl VPN_Out
  permit ip 192.168.1.0 0.0.0.255 172.16.0.0 0.0.255.255 ipsec-policy VPN_DES
  permit ip any any

profile acl VPN_In
  permit esp any any
  permit ah any any
  permit ip 172.16.0.0 0.0.255.255 192.168.1.0 0.0.0.255
  deny ip any any

context ip router

interface LAN
  ipaddress 192.168.1.1 255.255.255.0

interface WAN
  ipaddress 200.200.200.2 255.255.255.252

```

```

use profile acl VPN_In in
use profile acl VPN_Out out

context ip router
route 0.0.0.0 0.0.0.0 200.200.200.1 0
route 172.16.0.0 255.255.0.0 WAN 0

```

### Cisco router configuration

```

crypto ipsec transform-set DES esp-des
!
crypto map VPN_DES local-address FastEthernet0/1
crypto map VPN_DES 10 ipsec-manual
set peer 200.200.200.2
set session-key inbound esp 2222 cipher FEDCBA0987654321
set session-key outbound esp 1111 cipher 1234567890ABCDEF
set transform-set DES
match address 110
!
access-list 110 permit ip 172.16.0.0 0.0.255.255 192.168.1.0 0.0.0.255
!
interface FastEthernet0/0
ip address 172.16.1.1 255.255.0.0
!
interface FastEthernet0/1
ip address 200.200.200.1 255.255.255.252
crypto map VPN_DES
!
ip route 192.168.1.0 255.255.255.0 FastEthernet0/1

```

## IPsec tunnel, AES encryption at 256 bit key length, AH authentication with HMAC-SHA1-96

### IPLink configuration

```

profile ipsec-transform AES_SHA1
  esp-encryption aes-cbc 256
  ah-authentication hmac-sha1-96

profile ipsec-policy-manual VPN_AES_SHA1
  use profile ipsec-transform AES_SHA1
  session-key inbound ah-authentication 1234567890ABCDEF1234567890ABCDEF12345678
  session-key outbound ah-authentication FEDCBA0987654321FEDCBA0987654321FEDCBA09
  session-key inbound esp-encryption
1234567890ABCDEF1234567890ABCDEF1234567890ABCDEF1234567890ABCDEF
  session-key outbound esp-encryption
FEDCBA0987654321FEDCBA0987654321FEDCBA0987654321FEDCBA0987654321
  spi inbound ah 3333
  spi outbound ah 4444
  spi inbound esp 5555
  spi outbound esp 6666
  peer 200.200.200.1
  mode tunnel
...

```

Rest of the configuration, see above, just change the name of the IPsec policy profile in the ACL profile 'VPN\_Out'

### Cisco router configuration

```

crypto ipsec transform-set AES_SHA1 ah-sha-hmac esp-aes 256
!
crypto map VPN_AES_SHA1 local-address FastEthernet0/1
crypto map VPN_AES_SHA1 10 ipsec-manual
  set peer 200.200.200.2
  set session-key inbound esp 6666 cipher
FEDCBA0987654321FEDCBA0987654321FEDCBA0987654321FEDCBA0987654321
  set session-key outbound esp 5555 cipher
1234567890ABCDEF1234567890ABCDEF1234567890ABCDEF1234567890ABCDEF
  set session-key inbound ah 4444 FEDCBA0987654321FEDCBA0987654321FEDCBA09
  set session-key outbound ah 3333 1234567890ABCDEF1234567890ABCDEF12345678
  set transform-set AES_SHA1
  match address 110
!
...

```

For the remainder of the configuration (see above), just change the name of the IPsec policy profile in the ACL profile *VPN\_Out*

### IPsec tunnel, 3DES encryption at 192 bit key length, ESP authentication with HMAC-MD5-96

#### IPLink configuration

```

profile ipsec-transform TDES_MD5
  esp-encryption 3des-cbc 192
  esp-authentication hmac-md5-96

profile ipsec-policy-manual VPN_TDES_MD5
  use profile ipsec-transform TDES_MD5
  session-key inbound esp-authentication 1234567890ABCDEF1234567890ABCDEF
  session-key outbound esp-authentication FEDCBA0987654321FEDCBA0987654321
  session-key inbound esp-encryption 1234567890ABCDEF1234567890ABCDEF1234567890ABCDEF
  session-key outbound esp-encryption FEDCBA0987654321FEDCBA0987654321FEDCBA0987654321
  spi inbound esp 7777
  spi outbound esp 8888
  peer 200.200.200.1
  mode tunnel
...

```

For the remainder of the configuration (see above), just change the name of the IPsec policy profile in the ACL profile *VPN\_Out*

### Cisco router configuration

```

crypto ipsec transform-set 3DES_MD5 esp-3des esp-md5-hmac
!
crypto map VPN_3DES_MD5 local-address FastEthernet0/1
crypto map VPN_3DES_MD5 10 ipsec-manual
  set peer 200.200.200.2
  set session-key inbound esp 8888 cipher FEDCBA0987654321FEDCBA0987654321FEDCBA0987654321
  authenticator FEDCBA0987654321FEDCBA0987654321
  set session-key outbound esp 7777 cipher 1234567890ABCDEF1234567890ABCDEF1234567890ABCDEF
  authenticator 1234567890ABCDEF1234567890ABCDEF
  set transform-set 3DES_MD5

```

```
    match address 110
    !
    ...
```

For the remainder of the configuration (see above), just change the name of the IPsec policy profile in the ACL profile *VPN\_Out*.

## Chapter 7 **Access control list configuration**

### **Chapter contents**

Introduction .....	88
About access control lists .....	88
What access lists do .....	88
Why you should configure access lists .....	88
When to configure access lists .....	89
Features of access control lists .....	89
Access control list configuration task list .....	90
Mapping out the goals of the access control list .....	90
Creating an access control list profile and enter configuration mode .....	91
Adding a filter rule to the current access control list profile .....	91
Adding an ICMP filter rule to the current access control list profile .....	93
Adding a TCP, UDP or SCTP filter rule to the current access control list profile .....	95
Binding and unbinding an access control list profile to an IP interface .....	97
Displaying an access control list profile .....	98
Debugging an access control list profile .....	98
Examples .....	100
Denying a specific subnet .....	100

## Introduction

---

This chapter provides an overview of IP Access Control Lists and describes the tasks involved in configuring them through the IPLink router.

This chapter includes the following sections:

- About access control lists
- Access control list configuration task list (see page 84)
- Examples (see page 94)

## About access control lists

---

This section briefly describes what access lists do, why and when you should configure access lists, and basic versus advanced access lists.

### *What access lists do*

Access lists filter network traffic by controlling whether routed packets are forwarded, dropped or blocked at the router's interfaces. Your router examines each packet to determine whether to forward or drop the packet, based on the criteria you specified within the access lists.

Access list criteria could be the source address of the traffic, the destination address of the traffic, the upper-layer protocol, or other information.

**Note** Sophisticated users can sometimes successfully evade or fool basic access lists because no authentication is required.

### *Why you should configure access lists*

There are many reasons to configure access lists. For example, you can use access lists to restrict contents of routing updates, or to provide traffic flow control. But one of the most important reasons to configure access lists is to provide security for your network, and this is the reason explored in this chapter.

You should use access lists to provide a basic level of security for accessing your network. If you do not configure access lists on your router, all packets passing through the router could be allowed onto all parts of your network.

For example, access lists can allow one host to access a part of your network, and prevent another host from accessing the same area. In [figure 15](#) host A is allowed to access the Human Resources network and host B is prevented from accessing the Human Resources network.

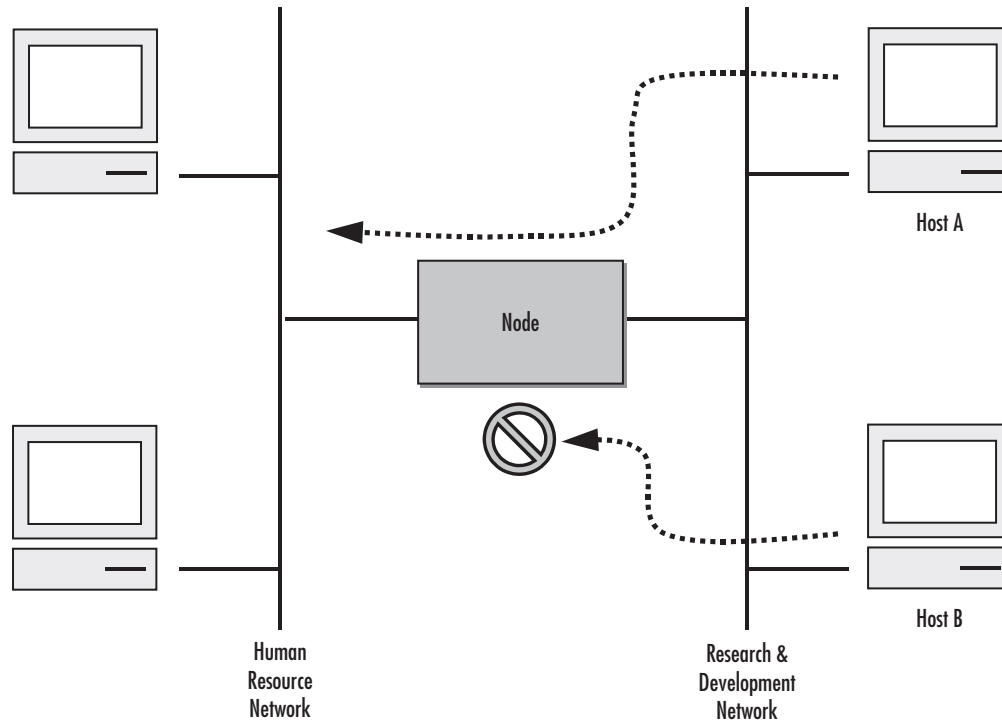


Figure 15. Using traffic filters to prevent traffic from being routed to a network

You can also use access lists to decide which types of traffic are forwarded or blocked at the router interfaces. For example, you can permit e-mail traffic to be routed but at the same time block all Telnet traffic.

### When to configure access lists

Access lists should be used in firewall routers, which are often positioned between your internal network and an external network such as the Internet. You can also use access lists on a router positioned between two parts of your network, to control traffic entering or exiting a specific part of your internal network.

To provide the security benefits of access lists, you should configure access lists at least on border routers, i.e. those routers situated at the edges of your networks. This provides a basic buffer from the outside network or from a less controlled area of your own network into a more sensitive area of your network.

On these routers, you should configure access lists for each network protocol configured on the router interfaces. You can configure access lists so that inbound traffic or outbound traffic or both are filtered on an interface.

### Features of access control lists

The following features apply to all IP access control lists:

- A list may contain multiple entries. The order access of control list entries is significant. Each entry is processed in the order it appears in the configuration file. As soon as an entry matches, the corresponding action is taken and no further processing takes place.

- All access control lists have an implicit *deny ip any any* at the end. A packet that does not match the criteria of the first statement is subjected to the criteria of the second statement and so on until the end of the access control list is reached, at which point the packet is dropped.
- Filter types include IP, Internet Control Message Protocol (ICMP), Transmission Control Protocol (TCP), User Datagram Protocol (UDP), and Stream Control Transmission Protocol (SCTP).
- An empty access control list is treated as an implicit *deny ip any any* list.

**Note** Two or more administrators should not simultaneously edit the configuration file. This is especially the case with access lists. Doing this can have unpredictable results.

Once in access control list configuration mode, each command creates a statement in the access control list. When the access control list is applied, the action performed by each statement is one of the following:

- **permit** statement causes any packet matching the criteria to be accepted.
- **deny** statement causes any packet matching the criteria to be dropped.

To delete an entire access control list, enter configuration mode and use the **no** form of the **profile acl** command, naming the access list to be deleted, e.g. `no profile acl name`. To unbind an access list from the interface to which it was applied, enter the IP interface mode and use the **no** form of the access control list command.

## Access control list configuration task list

---

To configure an IP access control list, perform the tasks in the following sections.

- Mapping out the goals of the access control list
- Creating an access control list profile and enter configuration mode (see page 85)
- Adding a filter rule to the current access control list profile (see page 85)
- Adding an ICMP filter rule to the current access control list profile (see page 87)
- Adding a TCP, UDP or SCTP filter rule to the current access control list profile (see page 89)
- Binding and unbinding an access control list profile to an IP interface (see page 91)
- Displaying an access control list profile (see page 92)
- Debugging an access control list profile (see page 92)

### Mapping out the goals of the access control list

To create an access control list you must:

- Specify the protocol to be filtered
- Assign a unique name to the access list
- Define packet-filtering criteria

A single access control list can have multiple filtering criteria statements.

Before you begin to enter the commands that create and configure the IP access control list, be sure that you are clear about what you want to achieve with the list. Consider whether it is better to deny specific accesses and permit all others or to permit specific accesses and deny all others.

**Note** Since a single access control list can have multiple filtering criteria statements, but editing those entries online can be tedious. Therefore, we recommend editing complex access control lists offline within a configuration file and downloading the configuration file later via TFTP to your IPLink device.

### Creating an access control list profile and enter configuration mode

This procedure describes how to create an IP access control list and enter access control list configuration mode

**Mode:** Administrator execution

Step	Command	Purpose
1	<b>node(cfg)#profile acl name</b>	Creates the access control list profile <i>name</i> and enters the configuration mode for this list

*name* is the name by which the access list will be known. Entering this command puts you into *access control list configuration mode* where you can enter the individual statements that will make up the access control list.

Use the **no** form of this command to delete an access control list profile. You cannot delete an access control list profile if it is currently linked to an interface. When you leave the access control list configuration mode, the new settings immediately become active.

**Example:** Create an access control list profile

In the following example the access control list profile named *WanRx* is created and the shell of the access control list configuration mode is activated.

```
2800>enable
2800#configure
2800(cfg)#profile acl WanRx
2800(pf-acl)[WanRx]#
```

### Adding a filter rule to the current access control list profile

The commands **permit** or **deny** are used to define an IP filter rule. This procedure describes how to create an IP access control list entry that permits access

**Mode:** Profile access control list

Step	Command	Purpose
1	<b>node(pf-acl)[name]#permit ip {src src-wildcard   any   host src} {dest dest-wildcard   any   host dest} [cos group]</b>	Creates an IP access of control list entry that permits access defined according to the command options

This procedure describes how to create an IP access control list entry that denies access

**Mode:** Profile access control list

Step	Command	Purpose
1	<b>node(pf-acl)[name]#deny ip {src src-wildcard   any   host src} {dest dest-wildcard   any   host dest} [cos group]</b>	Creates an IP access of control list entry that denies access defined according to the command options

Where the syntax is:

Keyword	Meaning
<b>src</b>	The source address to be included in the rule. An IP address in dotted-decimal-format, e.g. 64.231.1.10.
<b>src-wildcard</b>	A wildcard for the source address. Expressed in dotted-decimal format this value specifies which bits are significant for matching. One-bits in the wildcard indicate that the corresponding bits are ignored. An example for a valid wildcard is 0.0.0.255, which specifies a class C network.
<b>any</b>	Indicates that IP traffic to or from all IP addresses is to be included in the rule.
<b>host src</b>	The address of a single source host.
<b>dest</b>	The destination address to be included in the rule. An IP address in dotted-decimal-format, e.g. 64.231.1.10.
<b>dest-wildcard</b>	A wildcard for the destination address. See <i>src-wildcard</i>
<b>host dest</b>	The address of a single destination host.
<b>cos</b>	Optional. Specifies that packets matched by this rule belong to a certain Class of Service (CoS). For detailed description of CoS configuration refer to chapter 8, “ <a href="#">Link scheduler configuration</a> ” on page 95.
<b>group</b>	CoS group name.

If you place a *deny ip any any* rule at the top of an access control list profile, no packets will pass regardless of the other rules you defined.

**Example:** Create IP access control list entries

Select the access-list profile named WanRx and create some filter rules for it.

```
2800(cfg)#profile acl WanRx
2800(pf-acl)[WanRx]#permit ip host 62.1.2.3 host 193.14.2.11 cos Urgent
2800(pf-acl)[WanRx]#permit ip 62.1.2.3 0.0.255.255 host 193.14.2.11
2800(pf-acl)[WanRx]#permit ip 97.123.111.0 0.0.0.255 host 193.14.2.11
2800(pf-acl)[WanRx]#deny ip any any
2800(pf-acl)[WanRx]#exit
2800(cfg)#
```

### Adding an ICMP filter rule to the current access control list profile

The command **permit** or **deny** are used to define an ICMP filter rule. Each ICMP filter rule represents an ICMP access of control list entry.

This procedure describes how to create an ICMP access control list entry that permits access

**Mode:** Profile access control list

Step	Command	Purpose
1	<b>node(pf-acl)[name]#permit icmp</b> {src src-wildcard   <b>any</b>   <b>host</b> src} {dest dest-wildcard   <b>any</b>   <b>host</b> dest} [ <b>msg</b> name   <b>type</b> type   <b>type</b> type <b>code</b> code] [ <b>cos</b> group]	Creates an ICMP access of control list entry that permits access defined according to the command options

This procedure describes how to create an ICMP access control list entry that denies access

**Mode:** Profile access control list

Step	Command	Purpose
1	<b>node(pf-acl)[name]#deny icmp</b> {src src-wildcard   <b>any</b>   <b>host</b> src} {dest dest-wildcard   <b>any</b>   <b>host</b> dest} [ <b>msg</b> name   <b>type</b> type   <b>type</b> type <b>code</b> code] [ <b>cos</b> group]	Creates an ICMP access of control list entry that denies access defined according to the command options

Where the syntax is as following:

Keyword	Meaning
<b>src</b>	The source address to be included in the rule. An IP address in dotted-decimal-format, e.g. 64.231.1.10.
<b>src-wildcard</b>	A wildcard for the source address. Expressed in dotted-decimal format this value specifies which bits are significant for matching. One-bits in the wildcard indicate that the corresponding bits are ignored. An example for a valid wildcard is 0.0.0.255, which specifies a class C network.
<b>any</b>	Indicates that IP traffic to or from all IP addresses is to be included in the rule.
<b>host src</b>	The address of a single source host.
<b>dest</b>	The destination address to be included in the rule. An IP address in dotted-decimal-format, e.g. 64.231.1.10
<b>dest-wildcard</b>	A wildcard for the destination address. See <i>src-wildcard</i> .
<b>host dest</b>	The address of a single destination host.
<b>msg name</b>	The ICMP message name. The following are valid message names:  administratively-prohibited, alternate-address, conversion-error, dod-host-prohibited, dod-net-prohibited, echo, echo-reply, general-parameter-problem, host-isolated, host-precedence-unreachable, host-redirect, host-tos-redirect, host-tos-unreachable, host-unknown, host-unreachable, information-reply, information-request, mask-reply, mask-request, mobile-redirect, net-redirect, net-tos-redirect, net-tos-unreachable, net-unreachable, network-unknown, no-room-for-option, option-missing, packet-too-big, parameter-problem, port-unreachable, precedence-unreachable, protocol-unreachable, reassembly-timeout, redirect, router-advertisement, router-solicitation, source-quench, source-route-failed, time-exceeded, timestamp-reply, timestamp-request, traceroute, ttl-exceeded, unreachable
<b>type type</b>	The ICMP message type. A number from 0 to 255 (inclusive)
<b>code code</b>	The ICMP message code. A number from 0 to 255 (inclusive)
<b>cos</b>	Optional. Specifies that packets matched by this rule belong to a certain Class of Service (CoS). For detailed description of CoS configuration refer to chapter 8, “ <a href="#">Link scheduler configuration</a> ” on page 95.
<b>group</b>	CoS group name.

If you place a *deny ip any any* rule at the top of an access-list profile, no packets will pass regardless of the other rules you defined.

**Example:** Create ICMP access control list entries

Select the access-list profile named WanRx and create the rules to filter all ICMP echo requests (as used by the ping command).

```
2800(cfg)#profile acl WanRx
2800(pf-acl)[WanRx]#deny icmp any any type 8 code 0
2800(pf-acl)[WanRx]#exit
2800(cfg)#
```

The same effect can also be obtained by using the simpler message name option. See the following example.

```
2800(cfg)#profile acl WanRx
2800(pf-acl)[WanRX]#deny icmp any any msg echo
2800(pf-acl)[WanRX]#exit
2800(cfg)#
```

### Adding a TCP, UDP or SCTP filter rule to the current access control list profile

The commands **permit** or **deny** are used to define a TCP, UDP or SCTP filter rule. Each TCP, UDP or SCTP filter rule represents a respective access of control list entry.

This procedure describes how to create a TCP, UDP or SCTP access control list entry that permits access

**Mode:** Profile access control list

Step	Command	Purpose
1	<b>node(pf-acl)[name]#permit {tcp   udp   sctp} {src src-wildcard   any   host src} [{eq port   gt port   lt port   range from to}] {dest dest-wildcard   any   host dest} [{eq port   gt port   lt port   range from to}] [{cos group   cos-rtp group-data group-ctrl}]</b>	Creates a TCP, UDP or SCTP access of control list entry that permits access defined according to the command options

This procedure describes how to create a TCP, UDP or SCTP access control list entry that denies access

**Mode:** Profile access control list

Step	Command	Purpose
1	<b>node(pf-acl)[name]#deny {tcp   udp   sctp} {src src-wildcard   any   host src} [{eq port   gt port   lt port   range from to}] {dest dest-wildcard   any   host dest} [{eq port   gt port   lt port   range from to}] [{cos group   cos-rtp group-data group-ctrl}]</b>	Creates a TCP, UDP or SCTP access of control list entry that denies access defined according to the command options

Where the syntax is:

Keyword	Meaning
<b>src</b>	The source address to be included in the rule. An IP address in dotted-decimal-format, e.g. 64.231.1.10.
<b>src-wildcard</b>	A wildcard for the source address. Expressed in dotted-decimal format this value specifies which bits are significant for matching. One-bits in the wildcard indicate that the corresponding bits are ignored. An example for a valid wildcard is 0.0.0.255, which specifies a class C network.
<b>any</b>	Indicates that IP traffic to or from all IP addresses is to be included in the rule.
<b>host src</b>	The address of a single source host.
<b>eq port</b>	Optional. Indicates that a packets port must be equal to the specified port in order to match the rule.
<b>lt port</b>	Optional. Indicates that a packets port must be less than the specified port in order to match the rule.
<b>gt port</b>	Optional. Indicates that a packets port must be greater than the specified port in order to match the rule
<b>range from to</b>	Optional. Indicates that a packets port must be equal or greater than the specified from port and less than the specified to port to match the rule.
<b>dest</b>	The destination address to be included in the rule. An IP address in dotted-decimal-format, e.g. 64.231.1.10.
<b>dest-wildcard</b>	A wildcard for the destination address. See <i>src-wildcard</i> .
<b>host dest</b>	The address of a single destination host.
<b>cos</b>	Optional. Specifies that packets matched by this rule belong to a certain Class of Service (CoS). For detailed description of CoS configuration refer to chapter 8, “ <a href="#">Link scheduler configuration</a> ” on page 95.
<b>cos-rtp</b>	Optional. Specifies that the rule is intended to filter RTP/RTCP packets. In this mode you can specify different CoS groups for data packets (even port numbers) and control packets (odd port numbers). Note: this option is only valid when protocol UDP is selected.
<b>group</b>	CoS group name.
<b>group-data</b>	CoS group name for RTP data packets. Only valid when the rtp option has been specified
<b>group-ctrl</b>	CoS group name for RTCP control packets. Only valid when the rtp option has been specified.

**Example:** Create TCP or UDP access control list entries

Select the access-list profile named WanRx and create the rules for:

Permitting any TCP traffic to host 193.14.2.10 via port 80, and permitting UDP traffic from host 62.1.2.3 to host 193.14.2.11 via any port in the range from 1024 to 2048.

```
2800(cfg)#profile acl WanRx
2800(pf-acl)[WanRx]#permit tcp any host 193.14.2.10 eq 80
2800(pf-acl)[WanRx]#permit udp host 62.1.2.3 host 193.14.2.11 range 1024 2048
2800(pf-acl)[WanRx]#exit
2800(cfg)#
```

### Binding and unbinding an access control list profile to an IP interface

The command **use** is used to bind an access control list profile to an IP interface. This procedure describes how to bind an access control list profile to incoming packets on an IP interface

**Mode:** Profile access control list

Step	Command	Purpose
1	<b>node(if-ip)[if-name]#use profile acl name in</b>	Binds access control list profile name to incoming packets on IP interface <i>if-name</i>

Where the syntax is:

Keyword	Meaning
<b>if-name</b>	The name of the IP interface to which an access control list profile gets bound
<b>name</b>	The name of an access control list profile that has already been created using the profile acl command. This argument must be omitted in the <b>no</b> form
<b>in</b>	Specifies that the access control list profile applies to incoming packets on this interface.
<b>out</b>	Specifies that the access control list applies to outgoing packets on this interface.

The **no** form of the **use** command is used to unbind an access control list profile from an interface. When using this form the name of an access control list profile, represented by the *name* argument above, is not required. This procedure describes how to unbind an access control list profile to incoming packets on an IP interface

**Mode:** Interface

Step	Command	Purpose
1	<b>node(if-ip)[if-name]#no use profile acl in</b>	Unbinds access control list profile for incoming packets on IP interface <i>if-name</i>

Where the syntax is:

Keyword	Meaning
<b>if-name</b>	The name of the IP interface to which an access control list profile gets bound
<b>in</b>	Specifies that the access control list profile applies to incoming packets on this interface.
<b>out</b>	Specifies that the access control list applies to outgoing packets on this interface.

Thus for each IP interface only one incoming and outgoing access control list can be active at the same time.

**Example:** Bind and unbind an access control list entries to an IP interface

Bind an access control list profile to incoming packets on the interface *wan* in the IP router context.

```
2800(cfg)#context ip router
2800(cfg-ip)[router]#interface wan
2800(cfg-if)[wan]#use profile acl WanRx in
```

Unbind an access control list profile from an interface.

```
2800(cfg)#context ip router
2800(cfg-ip)[router]#interface wan
2800(cfg-if)[wan]#no use profile acl in
```

**Note** When unbinding an access control list profile the *name* argument is not required, since only one incoming and outgoing access control list can be active at the same time on a certain IP interface.

### Displaying an access control list profile

The **show profile acl** command displays the indicated access control list profile. If no specific profile is selected all installed access control list profiles are shown. If an access control list is linked to an IP interface the number of matches for each rule is displayed. If the access control list profile is linked to more than one IP interface, it will be shown for each interface.

This procedure describes how to display a certain access control list profile

**Mode:** Administrator execution or any other mode, except the operator execution mode

Step	Command	Purpose
1	<b>node#show profile acl</b> <i>name</i>	Displays the access control list profile <i>name</i>

**Example:** Displaying an access control list entries

The following example shows how to display the access control list profile named WanRx.

```
2800#show profile acl WanRx
IP access-list WanRx. Linked to router/wan/in.
deny icmp any any msg echo
permit ip 62.1.2.3 0.0.255.255 host 193.14.2.11
permit ip 97.123.111.0 0.0.0.255 host 193.14.2.11
permit tcp any host 193.14.2.10 eq 80
permit udp host 62.1.2.3 host 193.14.2.11 range 1024 2048
deny ip any any
```

### Debugging an access control list profile

The **debug acl** command is used to debug the access control list profiles during system operation. Use the **no** form of this command to disable any debug output.

This procedure describes how to debug the access control list profiles

**Mode:** Administrator execution or any other mode, except the operator execution

Step	Command	Purpose
1	<b>node#debug acl</b>	Enables access control list debug monitor

This procedure describes how to activate the debug level of an access control list profiles for a specific interface.

**Mode:** Interface

Step	Command	Purpose
<b>1</b>	<b><code>node(cfg)#context ip router</code></b>	Selects the IP router context
<b>2</b>	<b><code>node(ctx-ip)[router]#interface if-name</code></b>	Selects IP interface <i>if-name</i> for which access control list profile shall be debugged
<b>3</b>	<b><code>node(if-ip)[if-name]#debug acl {in   out} [level]</code></b>	Enables access control list debug monitor with a certain debug level for the selected interface <i>if-name</i>

Where the syntax is:

Keyword	Meaning
<b>if-name</b>	The name of the IP interface to which an access control list profile gets bound
<b>level</b>	The detail level. Level 0 disables all debug output, level 7 shows all debug output.
<b>in</b>	Specifies that the settings for incoming packets are to be changed.
<b>out</b>	Specifies that the settings for outgoing packets are to be changed.

**Example:** Debugging access control list profiles

The following example shows how to enable debugging for incoming traffic of access control lists on interface *wan*. On level 7 all debug output is shown.

```
2800(cfg)#context ip router
2800(cfg-ip)[router]#interface wan
2800(cfg-if)[wan]#debug acl in 7
```

The following example enables the debug monitor for access control lists globally.

```
2800#debug acl
```

The following example disables the debug monitor for access control lists globally.

```
2800#no debug acl
```

## Examples

### Denying a specific subnet

Figure 16 shows an example in which a server attached to network 172.16.1.0 shall not be accessible from outside networks connected to IP interface *lan* of the IPLink device. To prevent access, an incoming filter rule named *Jamming* is defined, which blocks any IP traffic from network 172.16.2.0 and has to be bound to IP interface *lan*.

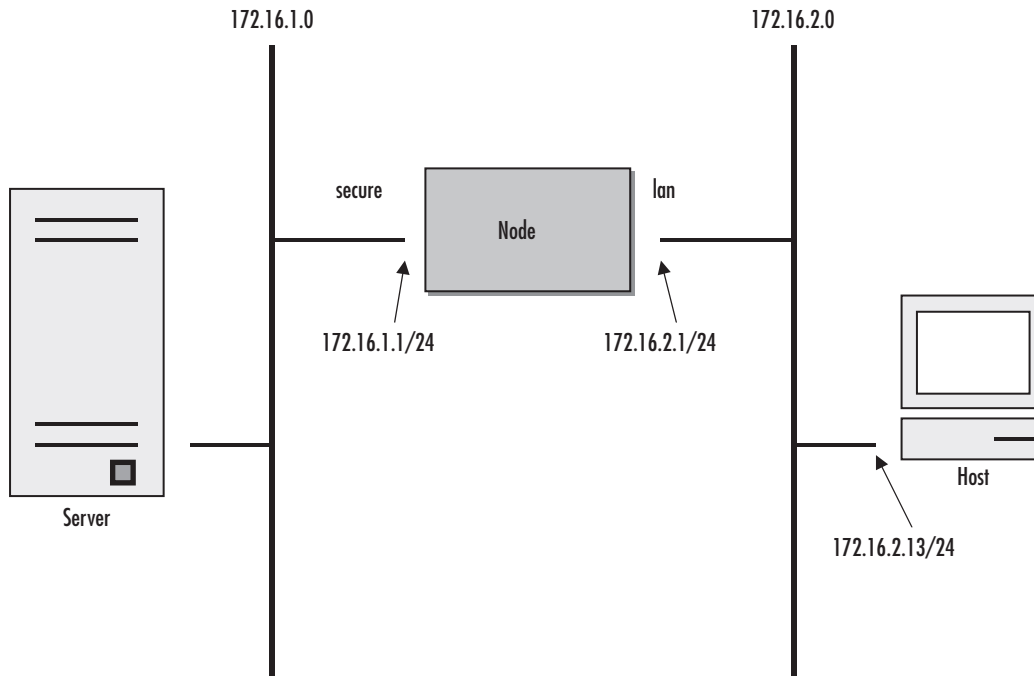


Figure 16. Deny a specific subnet on an interface

The commands that have to be entered are listed below. The commands access the IPLink device via a Telnet session running on a host with IP address 172.16.2.13, which accesses the IPLink via IP interface *lan*.

```
172.16.2.1>enable
172.16.2.1#configure
172.16.2.1(cfg)#profile acl Jamming
172.16.2.1(pf-acl)[Jamming]#deny ip 172.16.2.0 0.0.0.255 172.16.1.0 0.0.0.255
172.16.2.1(pf-acl)[Jamming]#permit ip any any
172.16.2.1(pf-acl)[Jamming]#exit
172.16.2.1(cfg)#context ip router
172.16.2.1(cfg-ip)[router]#interface lan
172.16.2.1(if-ip)[lan]#use profile acl Jamming in
172.16.2.1(if-ip)[lan]#exit
172.16.2.1(cfg-ip)#copy running-config startup-config
```

## Chapter 8 **Link scheduler configuration**

### **Chapter contents**

Introduction .....	102
Configuring access control lists .....	102
Configuring quality of service (QoS) .....	103
Applying scheduling at the bottleneck .....	103
Using traffic classes .....	103
Introduction to Scheduling .....	104
Priority .....	104
Weighted fair queuing (WFQ) .....	104
Shaping .....	105
Burst tolerant shaping or wfq .....	105
Hierarchy .....	105
Quick references .....	106
Setting the modem rate .....	106
Command cross reference .....	107
Link scheduler configuration task list.....	107
Defining the access control list profile .....	108
Packet classification .....	108
Creating an access control list .....	109
Creating a service policy profile .....	110
Specifying the handling of traffic-classes .....	112
Defining fair queuing weight .....	112
Defining the bit-rate .....	113
Defining absolute priority .....	113
Defining the maximum queue length .....	113
Specifying the type-of-service (TOS) field .....	113
Specifying the precedence field .....	114
Specifying differentiated services codepoint (DSCP) marking .....	114
Specifying layer 2 marking .....	115
Defining random early detection .....	116
Discarding Excess Load .....	116
Devoting the service policy profile to an interface .....	117
Displaying link arbitration status .....	118
Displaying link scheduling profile information .....	118
Enable statistics gathering .....	118

## Introduction

---

This chapter describes how to use and configure the IPLink Quality of Service (QoS) features. Refer to 7, “[Access control list configuration](#)” on page 81 for more information on the use of access control lists.

This chapter includes the following sections:

- Quick references (see page 100)
- Packet Classification (see page 102)
- Assigning bandwidth to traffic classes (see page 100)
- Link scheduler configuration task list (see page 101)

QoS in networking refers to the capability of the network to provide a better service to selected network traffic. This chapter shows you how to configure the IPLink router to best use the access link.

In many applications you can gain a lot by applying the minimal configuration found in the quick reference section, but read sections “[Applying scheduling at the bottleneck](#)” and “[Using traffic classes](#)” first to understand the paradox of why we apply a rate-limit to reduce delay and what a “traffic-class” means.

## Configuring access control lists

---

Packet filtering helps to control packet movement through the network. Such control can help to limit network traffic and to restrict network use by certain users or devices. To permit or deny packets from crossing specified interfaces, the IPLink 2800 provides access control lists.

An access control list is a sequential collection of permit and deny conditions that apply to packets on a certain interface. Access control lists can be configured for all routed network protocols (IP, ICMP, TCP, UDP, and SCTP) to filter the packets of those protocols as the packets pass through an IPLink 2800. The 2800 tests packets against the conditions in an access list one by one. The first match determines whether the IPLink 2800 accepts or rejects the packet. Because the IPLink 2800 stops testing conditions after the first match, the order of the conditions is critical. If no conditions match, the software rejects the address.

For information and examples on how configure access control lists, refer to chapter 7, “[Access control list configuration](#)” on page 81.

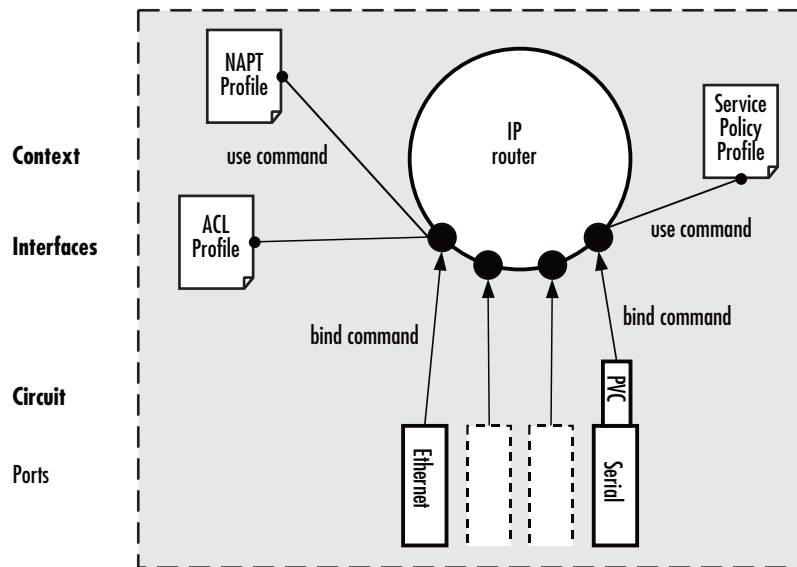


Figure 17. IP context and related elements

## Configuring quality of service (QoS)

In the IPLink 2800, the link scheduler enables the definition of QoS profiles for network traffic on a certain interface, as shown in [figure 17](#). QoS refers to the ability of a network to provide improved service to selected network traffic over various underlying technologies including Frame Relay, Ethernet and 802.x type networks, and IP-routed networks. In particular, QoS features provide improved and more predictable network service by providing the following services:

- Supporting dedicated bandwidth
- Improving loss characteristics
- Avoiding and managing network congestion
- Shaping network traffic
- Setting traffic priorities across the network

### Applying scheduling at the bottleneck

When an IPLink acts as an access router, the access link is the point where intelligent use of scarce resources really makes a difference. Frequently, the access link modem is outside of the IPLink and the queuing would happen in the modem, which does not distinguish between packet types. To improve QoS, you can configure the IPLink to send no more data to the Internet than the modem can carry. This keeps the modem's queue empty and gives the IPLink control over which packet is sent over the access link at what time.

### Using traffic classes

The link scheduler needs to distinguish between different types of packets. We refer to those types as “traffic-classes”. You can think of the traffic-class as if every packet in the IPLink has a tag attached to it on which the classification can be noted. The access control list “stage” (ACL) can be used to apply such a traffic-class name to some type of packet based on its IP-header filtering capabilities. The traffic-class tags exist only inside the IPLink router, but layer 2 priority bits (802.1pq class-of-service) and IP header type-of-service bits (TOS field)

can be used to mark a specific packet type for the other network nodes. By default the traffic-class tag is empty. Refer to [figure 18](#) on page 98 when using the ACL to classify traffic. It illustrates the sequence of processing stages every routed packet passes. Only stages that have been installed in the data path with a “use profile...” statement in the corresponding interface configuration are present. Both an input direction ACL on the receiving interface as well as an output ACL on the transmitting interface can be used to classify a packet for special handling by the output link scheduler on the transmit interface. But as visible from the figure no ACL can be used for an input link scheduler.

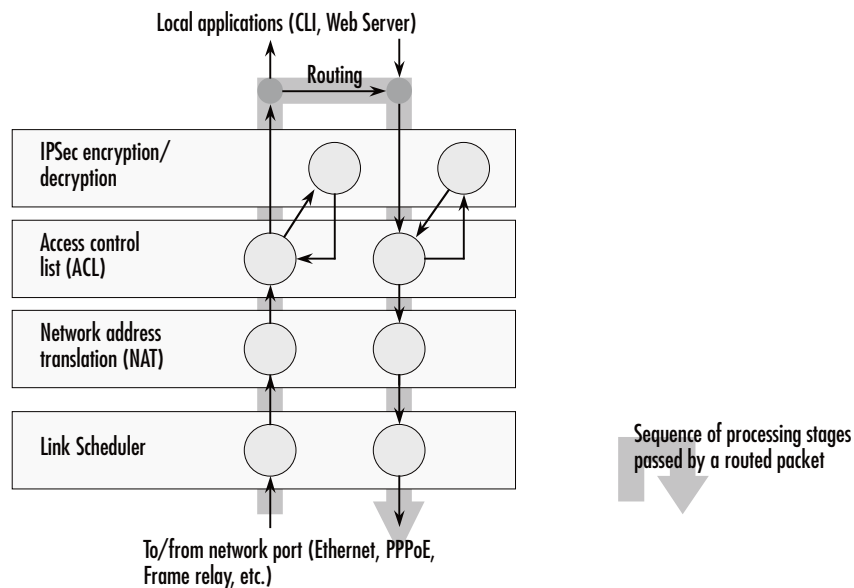


Figure 18. Packet routing in IPLink

The QoS features in IPLink are a combination of an access control list (used for packet classification) and a service-policy profile (used by the link arbiter to define the arbitration mode and the order in which packets of different classes are served).

### Introduction to Scheduling

Scheduling essentially means to determine the order in which packets of the different traffic-classes are served. The following sections describe the ways this arbitration can be done.

#### Priority

One way of ordering packets is to give priority to one traffic-class and to serve the other traffic-classes when the first has nothing to send. IPLink uses the priority scheme to make sure that voice packets generated by the IPLink will experience as little delay as possible.

#### Weighted fair queuing (WFQ)

This arbitration method assures a given minimal bandwidth for each source. An example: you specify that traffic-class A gets three times the bandwidth of traffic-class B. So A will get a minimum of 75% and B will get a minimum of 25% of the bandwidth. But if no class A packets are waiting B will get 100% of the bandwidth.

Each traffic-class is in fact assigned a *relative* weight, which is used to share the bandwidth among the currently active classes. Patton recommends that you specify the weight as percent which is best readable.

### Shaping

There is another commonly used way to assign bandwidth. It is called *shaping* and it makes sure that each traffic-class will get just as much bandwidth as configured and not more. This is useful if you have subscribed to a service that is only available for a limited bandwidth e.g. low delay. When connecting the IPLink to a *DiffServ* network shaping might be a required operation.

### Burst tolerant shaping or wfq

For weighted fair queuing and shaping there is a variation of the scheduler that allows to specify if a traffic class may temporarily receive a higher rate as long as the average stays below the limit. This burstiness measure allows the network to explicitly assign buffers to bursty sources.

When you use shaping on the access link the shaper sometimes has the problem that multiple sources are scheduled for the same time - and therefore some of them will be served too late. If the rate of every source had to strictly obey its limit, all following packets would also have to be delayed by the same amount, and further collisions would reduce the achieved rate even further. To avoid this effect, the IPLink shaper assumes that the burstiness needed for sources to catch up after *collisions* is implicitly allowed. Future versions of IPLink might allow setting the burst rate and bursting size if more control over its behavior is considered necessary.

Burst tolerance has a different effect when used with *weighted fair queuing*. Think of it as a higher initial rate when a source device starts transmitting data packets. This allows giving a higher *weight* to short data transfers. This feature is sometimes referred to as a *service curve*.

### Hierarchy

An arbiter can either use wfq *or* shaping to determine which source to serve next. If you want the scheduler to follow a combination of decision criteria you can combine different schedulers in hierarchy to do a multi-level arbitration. Hierarchical scheduling is supported in IPLink with service-policy profiles used inside service-policy profiles. In [figure 19](#) an example of hierarchical scheduling is illustrated. The 1<sup>st</sup> level arbiter *Level\_1* uses weighted fair queuing to share the bandwidth among source classes VPN, Web and incorporates the traffic from the 2<sup>nd</sup> level arbiter *Low\_Priority*, which itself uses shaping to share the bandwidth among source classes Mail and Default.

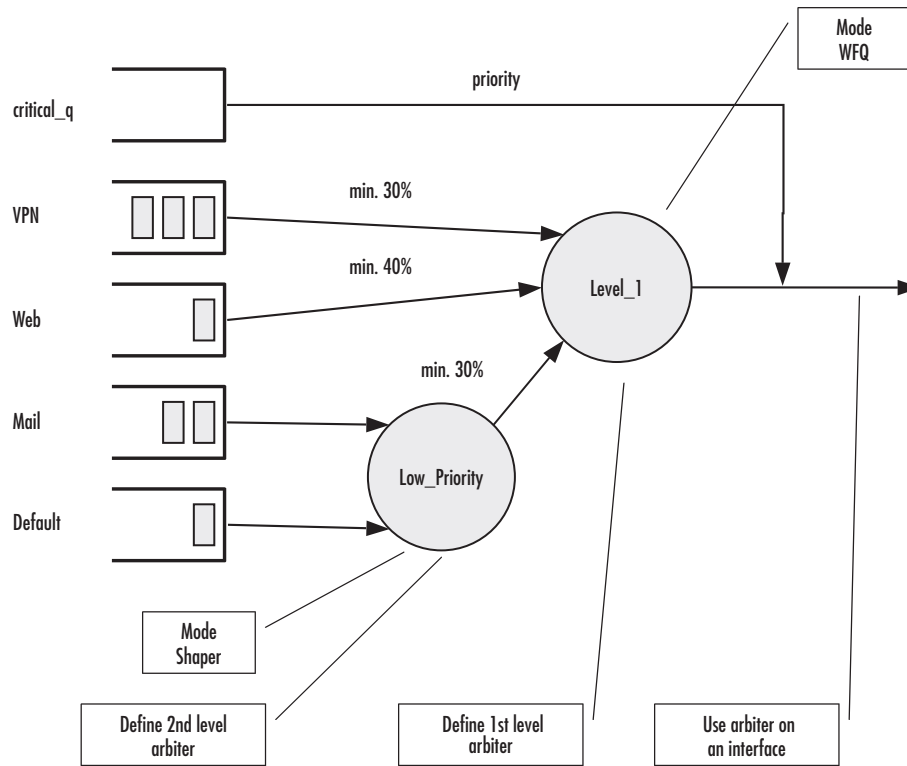


Figure 19. Example of Hierarchical Scheduling

## Quick references

The following sections provide a minimal “standard” link scheduler configuration for the case where a (DSL/cable) modem link is shared for all traffic. You will also find a command cross reference list for administrators familiar with Cisco’s IOS QoS features and having to become acquainted with IPLink QoS configuration.

### Setting the modem rate

To match the data multiplexing of different traffic types to the capacity of the access link is the most common application of the IPLink link scheduler.

1. Create a minimal profile.

```
profile service-policy modem-512
  rate-limit 512 header-length 20 atm-modem
  source traffic-class critical_q
  priority
```

2. Apply the profile just created to the interface connected to the modem.

```
context ip
interface wan
  use profile service-policy modem-512 out
```

Some explanations:

- “modem-512” is the title of the profile which is referred to when installing the scheduler
- “rate-limit 512” allows no more than 512 kbit/sec to pass which avoids queuing in the modem.
- “header-length 20” specifies how many framing bytes are added by the modem to “pack” the IP packet on the link. The framing is taken into account by the rate limiter.
- “atm-modem” tells the rate limiter that the access link is ATM based. This option includes the ATM overhead into the rate limit calculation. Please add 8 bytes to the header-length for AAL5 in this case.
- “source traffic-class” enters a sub-mode where the specific handling for a traffic-class is described. The list of sources in the service-policy profile tells the arbiter which “traffic sources” to serve.
- “critical\_q” is the traffic-class for the highest priority packet streams that you have selected.
- “priority” means that packet of the source being described are always passed on immediately, packets of other classes follow later if the rate limit permits.

### Command cross reference

Comparing IPLink with the Cisco IOS QoS software command syntax often helps administrators to straightforwardly configure IPLink devices. In [table 10](#) the Cisco IOS Release 12.2 QoS commands are in contrast with the respective IPLink commands.

Table 10. Command cross reference

Action	IOS command	IPLink command
Specifies the name of the policy map or profile to be created or modified.	<b>policy-map</b> policy-map-name	<b>profile service-policy</b> profile-name
Specifies the name of the class map or class to be created.	<b>class-map</b> class-map-name	<b>source traffic-class</b> class-name
For IOS specifies average or peak bit rate shaping. for the IPLink assigns the average bit rate to a source.	<b>shape</b> {average   peak} cir [bc] [be]	<b>rate</b> bit-rate
For IOS specifies or modifies the bandwidth allocated for a class belonging to a policy map. Percent defines the percentage of available bandwidth to be assigned to the class. for the IPLink assigns the weight of the selected source (only used with wfq).	<b>bandwidth</b> {bandwidth-kbps   <b>percent</b> percent}	<b>share</b> percent-of-bandwidth

### Link scheduler configuration task list

To configure QoS features, perform the tasks described in the following sections. Depending on your requirements some of the tasks are required while other tasks are optional.

- Defining the access control list profile
- Creating a service-policy profile (see page 104)
- Specifying the handling of traffic-classes (see page 106)
- Devoting the service policy profile to an interface (see page 111)
- Displaying link arbitration status (see page 112)

- Displaying link scheduling profile information (see page 112)
- Enable statistics gathering (see page 112)

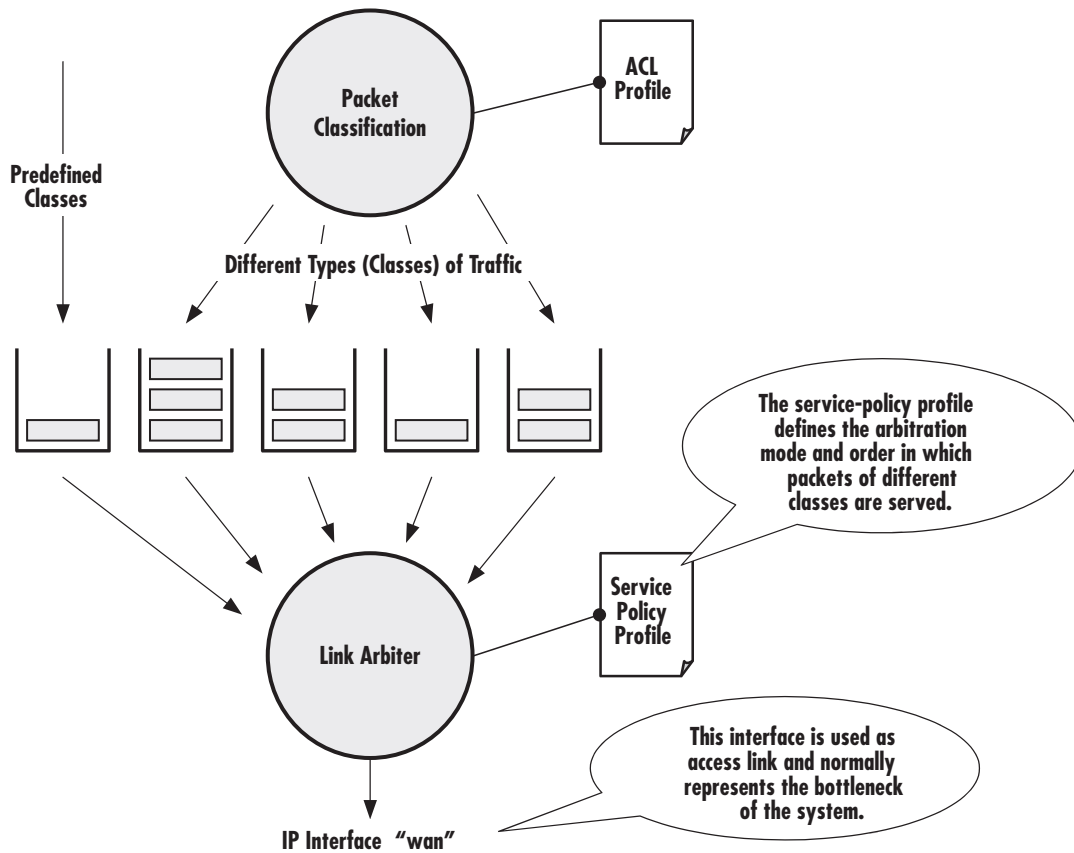


Figure 20. Elements of link scheduler configuration

## Defining the access control list profile

### Packet classification

The basis for providing any QoS lies in the ability of a network device to identify and group specific packets. This identification process is called *packet classification*. In IPLink access control lists are used for packet classification.

An access control list in IPLink consists of a series of packet descriptions like “addressed to xyz”. Those descriptions are called rules. For each packet the list of descriptions is sequentially checked and the first rule that matches decides what happens to the packet. As far as filtering is concerned the rule decides if the packet is discarded (“deny”) or passed on (“permit”). You can also add a traffic-class to the rule and if this rule is the first matching rule for a packet it is tagged with the traffic-class name.

Some types of packets you do not have to tag with ACL. Voice and data packets from of for the IPLink itself are automatically tagged with predefined traffic-class names: Predefined internal classes for data are:

- **local-default**—All other packets that originate from the IPLink itself.
- **default**—All traffic that has not otherwise been labeled.

### Creating an access control list

The procedure to create an access control list is described in detail in chapter 7, “Access control list configuration” on page 81.

At this point a simple example is given, that shows the necessary steps to tag any outbound traffic from a Web server. The scenario is depicted in [figure 21](#). The IP address of the Web server is used as source address in the permit statement of the IP filter rule for the access control list.

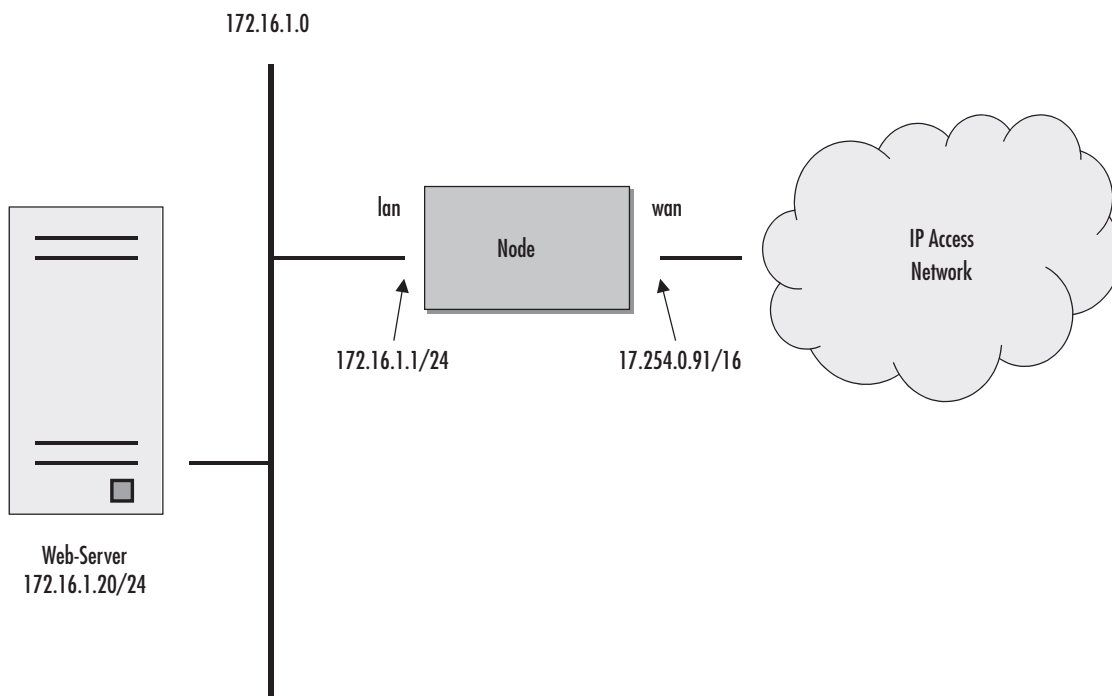


Figure 21. Scenario with Web server regarded as a single source host

A new access control list has to be created. In the example above, the traffic-class that represents outbound Web related traffic is named *Web*.

Access control list have an implicit “deny all” entry at the very end, so packets that do not match the first criteria of outbound Web related traffic will be dropped. That is why a second access control list entry—one that allows all other traffic—is necessary.

This procedure describes creating an access control list for tagging web traffic from the single source host at a certain IP address.

Mode: Configure

Step	Command	Purpose
1	<b><code>node(cfg)#profile acl</code></b> <i>name</i>	Creates a new access control list profile named <i>name</i>
2	<b><code>node(pf-acl)[name]#permit ip host ip-address any traffic-class</code></b> <i>class-name</i>	Creates an IP access control list entry that permits access for host at IP address <i>ip-address</i> , and specifies that packets matched by this rule belong to the traffic-class <i>class-name</i> .
3	<b><code>node(pf-acl)[name]#permit ip any any</code></b>	Creates an IP access control list entry that permits IP traffic to or from all IP addresses.

**Example:** Defining the access control list profile

In the example below a new access control list profile named *Webserver* is created. In addition an IP access control list entry that permits access for host at IP address *172.16.1.20*, and specifies that packets matched by this rule belong to the traffic-class *Web* is added. Finally an IP access control list entry that permits IP traffic to or from all IP addresses is added to the access control list.

```
2800(cfg)#profile acl Webserver
2800(pf-acl)[Webserv~]#permit ip host 172.16.1.20 any traffic-class Web
2800(pf-acl)[Webserv~]#permit ip any any
```

After packet classification is done using access control lists, the link arbiter needs rules defining how to handle the different traffic-classes. For that purpose you create a service-policy profile. The service policy profile defines how the link arbiter has to share the available bandwidth among several traffic classes on a certain interface.

### Creating a service policy profile

The service-policy profile defines how the link scheduler should handle different traffic-classes. The overall structure of the profile is as follows:

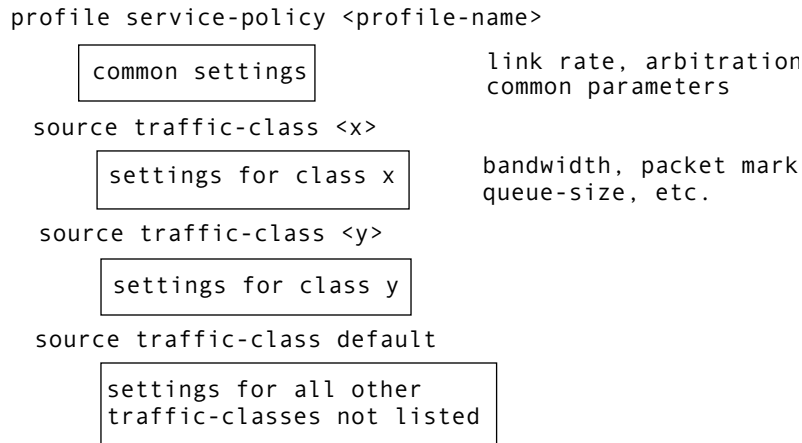


Figure 22. Structure of a Service-Policy Profile

The template shown above specifies an arbiter with three inputs which we call “sources”: x, y and “default”. The traffic-class “default” stands for all other packets that belong neither to traffic-class x nor y. There is no limit on the number of sources an arbiter can have.

**Example:** Creating a service policy profile

The following example shows how to create a top service-policy profile named *sample*. This profile does not include any hierarchical sub-profiles. The bandwidth of the outbound link is limited to 512 kbps therefore the interface rate-limit is set to 512. In addition weighted fair queuing (wfq) is used as arbitration scheme among the source classes.

```

profile service-policy sample
rate-limit 512
mode wfq
source traffic-class Web
share 30
source traffic-class local-default
share 20
source traffic-class default
queue-limit 40
share 50

```

The first line specifies the name of the link arbiter profile to configure. On the second line the global bandwidth limit is set. The value defining the bandwidth is given in kilobits per second. Each service-policy profile must have a “rate-limit” except if no scheduling is used i.e. the link scheduler is used for packet marking only (like setting the TOS byte).

How the bandwidth on an IP interface is shared among the source classes is defined on the third line. The mode command allows selecting between the weighted fair queuing and shaping arbitration mode. The default mode is wfq - the command shown above can therefore be omitted.

The following lines configure the source traffic-classes. When using weighted fair queuing (wfq) each user-specified source traffic-class needs a value specifying its share of the overall bandwidth. For this purpose the share command is used, which defines the relative weights of the source traffic-classes and policies.

At a some point the source traffic-class *default* must be listed. This class must be present, because it defines how packets, which do not belong to any of the traffic-classes listed in the profile are to be handled. When all listed “traffic-classes” have “priority” the handling of the remaining traffic is implicitly defined and the “default” section can be omitted. Similarly if no scheduling is used i.e. the link scheduler is used for packet marking only (e.g. setting the TOS byte) the “default” section can also be omitted.

The table below shows the basic syntax of the service-policy profile structure:

**Mode:** Configure

Step	Command	Purpose
1	<b>node(cfg)# profile service-policy</b> <i>name</i>	Creates a new service policy profile named <i>name</i>
2	<b>node(pf-srvpl)[<i>name</i>]#rate-limit</b> <i>value</i>	Limits global interface rate to <i>value</i> in kbps. Be aware, that the actual rate-limit on a given interface has to be defined for reliable operation.
3	<b>node(pf-srvpl)[<i>name</i>]#mode</b> { <b>shaper</b>   <b>wfq</b> }	Sets the arbitration scheme to mode <i>shaper</i> or weighted fair queuing ( <i>wfq</i> ). If not specified <i>wfq</i> is default.
4	<b>node(pf-srvpl)[<i>name</i>]#source</b> { <b>traffic-class</b>   <b>policy</b> } <i>src-name</i>	Enters source configuration mode for a traffic-class or a hierarchical lower level service-policy profile named <i>src-name</i> .
5	<b>node (src)[<i>src-name</i>]....</b>	At this point the necessary commands used to specify the handling of the traffic-class(es) have to be entered.
6	<b>node (src)[<i>src-name</i>]exit</b>	Leaves the source configuration mode (optional)
7	<b>node(pf-srvpl)[<i>name</i>]#...</b>	Repeat steps 4 to 6 for all necessary source classes or lower level service policy profiles.
8	<b>node(pf-srvpl)[<i>name</i>]#exit</b>	Leaves the service-policy profile mode

### Specifying the handling of traffic-classes

Several commands are available to specify what happens to a packet of a specific traffic-class.

#### Defining fair queuing weight

The command **share** is used with *wfq* link arbitration to assign the weight to the selected traffic-class. When defining a number of source classes, the values are relative to each other. It is recommended to split 100—which can be read as 100%—among all available source classes, e.g. with 20, 30 and 50 as value for the respective **share** commands, which represent 20%, 30% and 50%.

Mode: Source

Command	Purpose
<b>node(src)[name]#share</b> <i>percentage</i>	Defines fair queuing weight (relative to other sources) to <i>percentage</i> for the selected class or policy <i>name</i>

### Defining the bit-rate

The command **rate** is used with shaper link arbitration to assign the (average) bit-rate to the selected source. When enough bandwidth is available each source will exactly receive this bandwidth (but no more), when overloaded the shaper will behave like a wfq arbiter. Bit-rate specification for shaper (kilobits).

Mode: Source

Command	Purpose
<b>node(src)[name]#rate</b> [ <i>kilobits</i>   <b>remaining</b> ]	Defines the (average) bit-rate to the selected in kbps <i>kilobits</i> or as <i>remaining</i> if a second priority source is getting the unused bandwidth for the selected class or policy <i>name</i>

### Defining absolute priority

This command **priority** can only be applied to classes, but not to lower level polices. The class is given absolute priority effectively bypassing the link arbiter. Care should be taken, as traffic of this class may block all other traffic. The packets given “priority” are taken into account by the “rate-limit”. Use the command **police** to control the amount of “priority” traffic.

Mode: Source

Command	Purpose
<b>node(src)[name]#priority</b>	Defines absolute priority effectively bypassing the link arbiter for the selected class or policy <i>name</i>

### Defining the maximum queue length

The command **queue-limit** specifies the maximum number of packets queued for the class *name*. Excess packets are dropped. Used in “class” mode—queuing only happens at the leaf of the arbitration hierarchy tree. The **no** form of this command reverts the queue-limit to the internal default value, which depends on your configuration.

Mode: Source

Command	Purpose
<b>node(src)[name]#queue-limit</b> <i>number-of-packets</i>	Defines the maximum number of packets queued for the selected class or policy <i>name</i>

### Specifying the type-of-service (TOS) field

The **set ip tos** command specifies the type-of-service (TOS) field value applied to packets of the class *name*. TOS and DSCP markings cannot be used at the same time. The **no** form of this command disables TOS marking.

The type-of-service (TOS) byte in an IP header specifies precedence (priority) and type of service (RFC791, RFC1349). The precedence field is defined by the first three bits and supports eight levels of priority. The next four bits—which are set by the **set ip tos** command—determine the type-of-service (TOS).

Table 11. TOS values and their meaning

TOS Value	IPLink Value	Meaning
1000	8	Minimize delay.
0100	4	Maximize throughput.
0010	2	Maximizes reliability.
0001	1	Minimize monetary costs.
0000	0	All bits are cleared, normal service, "default TOS".

Historically those bits had distinct meanings but since they were never consistently applied routers will ignore them by default. Nevertheless you can configure your routers to handle specific TOS values and IPLink allows you to inspect the TOS value in the ACL rules and to modify the TOS value with the link scheduler **set ip tos** command.

Mode: Source

Command	Purpose
<b>node(src)[name]#set ip tos value</b>	Defines the type-of-service (TOS) value applied to packets of for the selected class or policy <i>name</i> . Standard ToT values are 0, 1, 2, 4, and 8, as given in <a href="#">table 11</a> on page 108, but any number from 0 to 15 can be configured.

### Specifying the precedence field

The **set ip precedence** command specifies the precedence marking applied to packets of the class name. Precedence and DSCP markings cannot be used at the same time.

The type-of-service (TOS) byte in an IP header specifies precedence (priority) and type of service (RFC791, RFC1349). The precedence field is defined by the first three bits and supports eight levels of priority. The lowest priority is assigned to 0 and the highest priority is 7.

The **no** form of this command disables precedence marking.

Mode: Source

Command	Purpose
<b>node(src)[name]#set ip precedence value</b>	Defines the precedence marking value applied to packets of for the selected class or policy <i>name</i> . The range for <i>value</i> is from 0 to 7, but only values from 0 to 5 should be used.

### Specifying differentiated services codepoint (DSCP) marking

Differentiated services enhancements to the Internet protocol are intended to enable the handling of “traffic-classes” throughout the Internet. In this context the IP header TOS field is interpreted as something like a

“traffic-class” number called. With IPLink you can inspect the DSCP value in the ACL rules and modify the DSCP value with the link scheduler **set ip dscp** command.

**Note** When configuring service differentiation on the IPLink router, ensure that codepoint settings are arranged with the service provider.

The command **set ip dscp** sets the DS field applied to packets of the class *name*. Additionally shaping may be needed to make the class conformant. The **no** form of this command disables packet marking.

**Mode:** Source

Command	Purpose
<b>node(src)[name]#set ip dscp value</b>	Defines the Differentiated Services Codepoint value applied to packets of for the selected class or policy <i>name</i> . The range for <i>value</i> is from 0 to 63.

### Specifying layer 2 marking

The IEEE ratified the 802.1p standard for traffic prioritization in response to the realization that different traffic classes have different priority needs. This standard defines how network frames are tagged with user priority levels ranging from 7 (highest priority) to 0 (lowest priority). 802.1p-compliant network infrastructure devices, such as switches and routers, prioritize traffic delivery according to the user priority tag, giving higher priority frames precedence over lower priority or non-tagged frames. This means that time-critical data can receive preferential treatment over non-time-critical data.

Under 802.1p, a 4-byte Tag Control Info (TCI) field is inserted in the Layer 2 header between the Source Address and the MAC Client Type/Length field of an Ethernet Frame. [Table 12](#) lists the tag components.

Table 12. Traffic control info (TCI) field

Tag Control Field	Description
Tagged Frame Type Interpretation	Always set to 8100h for Ethernet frames (802.3ac tag format)
3-Bit Priority Field (802.1p)	Value from 0 to 7 representing user priority levels (7 is the highest)
Canonical	Always set to 0
12-Bit 802.1Q VLAN Identifier	VLAN identification number

802.1p-compliant infrastructure devices read the 3-bit user priority field and route the frame through an internal buffer/queue mapped to the corresponding user priority level.

The command **set layer2 cos** specifies the layer 2 marking applied to packets of this class by setting the 3-bit priority field (802.1p). The **no** form of this command disables packet marking.

Please note that the Ethernet port must be configured for 802.1Q framing. Standard framing has no class-of-service field.

**Mode:** Source

Command	Purpose
<b>node(src)[name]#set layer2 cos value</b>	Defines the Class-Of-Service value applied to packets of for the selected class or policy <i>name</i> . The range for <i>value</i> is from 0 to 7.

### Defining random early detection

The command **random-detect** is used to request random early detection (RED). When a queue carries lots of TCP transfers that last longer than simple web requests, there is a risk that TCP flow-control might be inefficient. A burst-tolerance index between 1 and 10 may optionally be specified (exponential filter weight). The **no** form of this command reverts the queue to default “tail-drop” behavior.

**Mode:** Source

Command	Purpose
<b>node(src)[name]#random-detect</b> {burst-tolerance}	Defines random early detection (RED) for queues of for the selected traffic-class or policy name. The range for the optional value <i>burst-tolerance</i> is from 1 to 10.

### Discarding Excess Load

The command **police** controls traffic arriving in a queue for class *name*. The value of the first argument *average-kilobits* defines the average permitted rate in kbps, the value of the second argument *kilobits-ahead* defines the tolerated burst size in kbps ahead of schedule. Excess packets are dropped.

This procedure describes defining discard excess load

**Mode:** Source

Command	Purpose
<b>node(src)[name]#police</b> <i>average-kilobits</i> <b>burst-size</b> <i>kilobits-ahead</i>	Defines how traffic arriving in a queue for the selected class or policy name has to be controlled. The value <i>average-kilobits</i> for average rate permitted is in the range from 0 to 10000 kbps. The value <i>kilobits-ahead</i> for burst size tolerated ahead of schedule is in the range from 0 to 10000.

### Devoting the service policy profile to an interface

Any service policy profile needs to be bound to a certain IP interface to get activated. According the terminology of IPLink a service policy profile is used on a certain IP interface, as shown in figure 23.

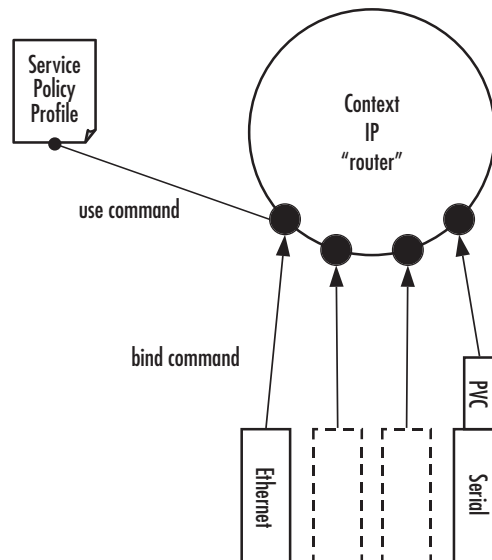


Figure 23. Using a Service Policy Profile on an IP Interface

Therefore the **use profile service-policy** command allows attaching a certain service policy profile to an IP interface that is defined within the IP context. This command has an optional argument that defines whether the service policy profile is activated in receive or transmit direction.

Providers may use input shaping to improve downlink voice jitter in the absence of voice support. The default setting **no service-policy** sets the interface to FIFO queuing.

**Mode:** Interface

Step	Command	Purpose
1	<b>node(if-ip)[if-name]#use profile service-policy name {in   out}</b>	Applies the service policy profile <i>name</i> to the selected interface <i>if-name</i> . Depending on selecting the optional <b>in</b> or <b>out</b> argument the service policy profile is active on the receive or transmit direction. Be aware that service policy profiles can only be activated on the transmit direction at the moment.

**Example:** Devoting the service policy profile to an interface

The following example shows how to attach the service policy profile *Voice\_Prio* to the IP interface wan that is defined within the IP context for outgoing traffic.

```
2800>enable
2800#configure
2800(cfg)#context ip router
2800(ctx-ip)[router]#interface wan
2800(if-ip)[wan]#use profile service-policy Voice_Prio out
```

### Displaying link arbitration status

The **show service-policy** command displays link arbitration status. This command supports the optional argument **interface** that select a certain IP interface. This command is available in the operator mode.

**Mode:** Operator execution

Step	Command	Purpose
1	<b>node&gt;show service-policy {interface name}</b>	Displays the link arbitration status

**Example:** Displaying link arbitration status

The following example shows how to display link arbitration status information.

```
2800>show service-policy
available queue statistics
-----
default
  - packets in queue: 10
```

### Displaying link scheduling profile information

The **show profile service-policy** command displays link scheduling profile information of an existing service-policy profile. This command is only available in the administrator mode.

**Mode:** Administrator execution

Step	Command	Purpose
1	<b>node#show profile service-policy name</b>	Displays link scheduling profile information of the service-policy profile <i>name</i>

**Example:** Displaying link scheduling profile information

The following example shows how to display link scheduling profile information of an existing service-policy profile *VoIP\_Layer2\_CoS*.

```
2800#show profile service-policy VoIP_Layer2_CoS
VoIP_Layer2_CoS
  default (mark layer 2 cos -1)
```

### Enable statistics gathering

Using the **debug queue statistics** commands enables statistic gathering of link scheduler operations.

The command has optional values (in the range of 1 to 4) that define the level of detail (see [table 13](#)).

Table 13. Values defining detail of the queuing statistics

Optional Value	Implication on Command Output
0	Statistic gathering is switched off
1	Display amount of packets <i>passed</i> (did not have to wait), <i>queued</i> (arrived earlier than rate permitted) and <i>discarded</i> (due to overflowing queue)
2	Also collects byte counts for the categories listed above
3	Also keeps track of the peek queue lengths ever reached since the last configuration change or reload
4	Adds delay time monitoring

**Note** The debug features offered by IPLink require the CPU resources of your IPLink router. Therefore do not enable statistic gathering or other debug features if it is not necessary. Disable any debug feature after use with the **no** form of the command.

You can enable queue statistics for all queues of a link scheduler by placing the **debug queue statistics** command in the profile header. Queue statistics are reset whenever the configuration is changed or IPLink is reloaded.

**Mode:** Source

Step	Command	Purpose
1	<b>node(src)[name]#debug queue statistics level</b>	Enables statistic gathering for the selected class or policy <i>name</i> . The optional argument <i>level</i> , which is in the range from 1 to 4, defines the verbosity of the command output.

**Example:** Enable statistics gathering for all queues of a profile

The following example shows how to enable statistic gathering for all traffic-classes

```
2800>enable
2800#configure
2800(cfg)#profile service-policy sample
2800(pf-srvpl)[sample]#debug queue statistics 4
```

## Chapter 9 **LEDs status and monitoring**

---

### **Chapter contents**

Status LEDs.....	121
------------------	-----

## Status LEDs

This chapter describes IPLink gateway router front panel LEDs. Figure 24 shows IPLink 2800 Series LEDs. LED definitions are listed in table 14 on page 115.

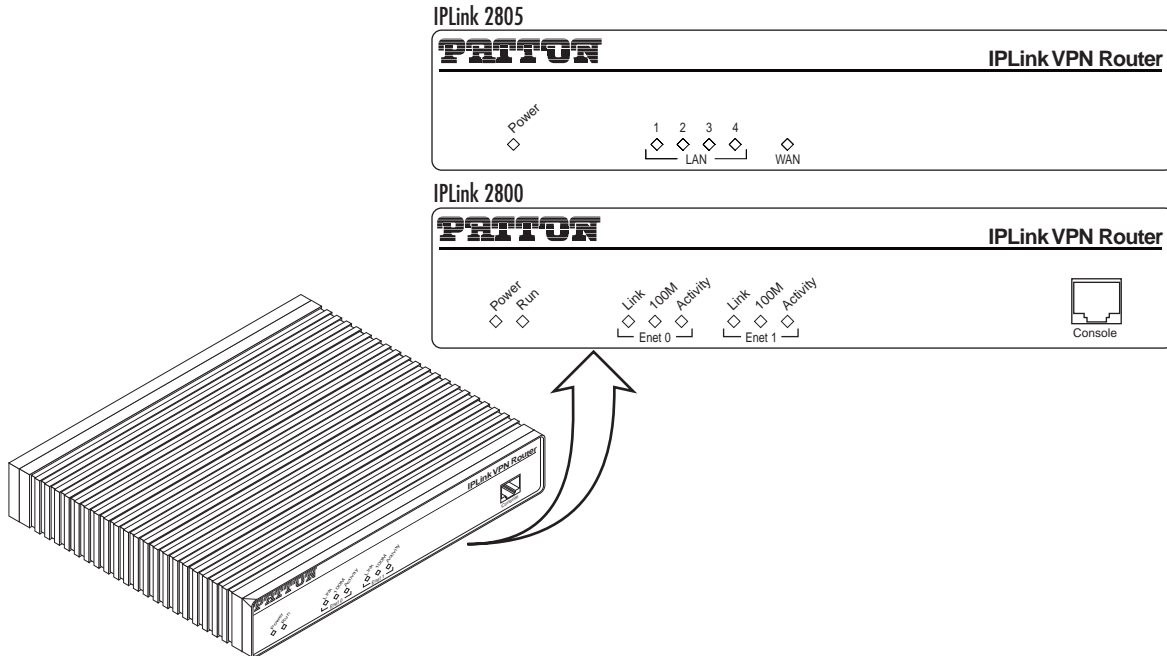


Figure 24. Examples of IPLink 2800 Series front panels

Table 14. IPLink LED Indications

LED	Description
<b>Note</b> If an error occurs, all LEDs will flash once per second.	
Power	When lit, indicates power is applied. Off indicates no power applied.
Run	When lit, indicates normal operation. Flashes once per second during boot (startup).
Serial	<ul style="list-style-type: none"> <li>STATUS: Lit when serial link is up.</li> <li>ACTIVITY: Flashes when serial data is transmitted or received from the unit.</li> </ul>
Ethernet (each port)	<ul style="list-style-type: none"> <li>Link: Lit when Ethernet link is up.</li> <li>100M: On when 100-Mbps Ethernet is selected.</li> <li>Activity: Flashes when data is received or transmitted from the unit to the LAN.</li> </ul>

## Chapter 10 **Contacting Patton for assistance**

### **Chapter contents**

Introduction .....	123
Contact information .....	123
Patton Support Headquarters in the USA .....	123
Alternate Patton support for Europe, Middle East, and Africa (EMEA) .....	123
Warranty Service and Returned Merchandise Authorizations (RMAs) .....	123
Warranty coverage .....	123
Out-of-warranty service .....	124
Returns for credit .....	124
Return for credit policy .....	124
RMA numbers .....	124
Shipping instructions .....	124

## Introduction

---

This chapter contains the following information:

- “Contact information”—describes how to contact Patton technical support for assistance.
- “Warranty Service and Returned Merchandise Authorizations (RMAs)”—contains information about the RAS warranty and obtaining a return merchandise authorization (RMA).

## Contact information

---

Patton Electronics offers a wide array of free technical services. If you have questions about any of our other products we recommend you begin your search for answers by using our technical knowledge base. Here, we have gathered together many of the more commonly asked questions and compiled them into a searchable database to help you quickly solve your problems.

### **Patton Support Headquarters in the USA**

- Online support—available at <http://www.patton.com>
- E-mail support—e-mail sent to [support@patton.com](mailto:support@patton.com) will be answered within 1 business day
- Telephone support—standard telephone support is available five days a week—from **8:00 am to 5:00 pm EST (1300 to 2200 UTC)**—by calling **+1 (301) 975-1007**
- Fax—+1 (253) 663-5693

### **Alternate Patton support for Europe, Middle East, and Africa (EMEA)**

- Online support—available at <http://www.patton-inalp.com>
- E-mail support—email sent to [support@patton-inalp.com](mailto:support@patton-inalp.com) will be answered within 1 day
- Telephone support—standard telephone support is available five days a week—from **8:00 am to 5:00 pm CET (0900 to 1800 UTC/GMT)**—by calling **+41 (0) 31 985 25 55**
- Fax—+41 (0) 31 985 25 26

## Warranty Service and Returned Merchandise Authorizations (RMAs)

---

Patton Electronics is an ISO-9001 certified manufacturer and our products are carefully tested before shipment. All of our products are backed by a comprehensive warranty program.

**Note** If you purchased your equipment from a Patton Electronics reseller, ask your reseller how you should proceed with warranty service. It is often more convenient for you to work with your local reseller to obtain a replacement. Patton services our products no matter how you acquired them.

### **Warranty coverage**

Our products are under warranty to be free from defects, and we will, at our option, repair or replace the product should it fail within one year from the first date of shipment. Our warranty is limited to defects in workmanship or materials, and does not cover customer damage, lightning or power surge damage, abuse, or unauthorized modification.

### *Out-of-warranty service*

Patton services what we sell, no matter how you acquired it, including malfunctioning products that are no longer under warranty. Our products have a flat fee for repairs. Units damaged by lightning or other catastrophes may require replacement.

### *Returns for credit*

Customer satisfaction is important to us, therefore any product may be returned with authorization within 30 days from the shipment date for a full credit of the purchase price. If you have ordered the wrong equipment or you are dissatisfied in any way, please contact us to request an RMA number to accept your return. Patton is not responsible for equipment returned without a Return Authorization.

### *Return for credit policy*

- Less than 30 days: No Charge. Your credit will be issued upon receipt and inspection of the equipment.
- 30 to 60 days: We will add a 20% restocking charge (crediting your account with 80% of the purchase price).
- Over 60 days: Products will be accepted for repairs only.

### **RMA numbers**

RMA numbers are required for all product returns. You can obtain an RMA by doing one of the following:

- Completing a request on the RMA Request page in the *Support* section at <http://www.patton.com>
- By calling **+1 (301) 975-1007** and speaking to a Technical Support Engineer
- By sending an e-mail to [returns@patton.com](mailto:returns@patton.com)

All returned units must have the RMA number clearly visible on the outside of the shipping container. Please use the original packing material that the device came in or pack the unit securely to avoid damage during shipping.

### *Shipping instructions*

The RMA number should be clearly visible on the address label. Our shipping address is as follows:

#### **Patton Electronics Company**

RMA#: xxxx

7622 Rickenbacker Dr.

Gaithersburg, MD 20879-4773 USA

Patton will ship the equipment back to you in the same manner you ship it to us. Patton will pay the return shipping costs.

# Appendix A **Compliance information**

## **Chapter contents**

Compliance .....	120
EMC .....	120
Safety .....	120
PSTN Regulatory .....	120
Radio and TV Interference (FCC Part 15) .....	120
CE Declaration of Conformity .....	120
Authorized European Representative .....	121
FCC Part 68 (ACTA) Statement (Model 2803 only).....	121
Industry Canada Notice (Model 2803 only) .....	121

## Compliance

---

### **EMC**

- FCC Part 15, Class A
- EN55022, Class A
- EN55024

### **Safety**

- UL 60950-1/CSA C22.2 N0.60950-1
- IEC/EN60950-1
- AS/NZS 60950-1

### **PSTN Regulatory**

- ACTA Part 68 (Model 2803)
- CS03 (Model 2803)
- AS/ACIF S016 (Model 2803)

## Radio and TV Interference (FCC Part 15)

---

The IPLink router generates and uses radio frequency energy, and if not installed and used properly—that is, in strict accordance with the manufacturer's instructions—may cause interference to radio and television reception. The IPLink router have been tested and found to comply with the limits for a Class A computing device in accordance with specifications in Subpart B of Part 15 of FCC rules, which are designed to provide reasonable protection from such interference in a commercial installation. However, there is no guarantee that interference will not occur in a particular installation. If the IPLink router does cause interference to radio or television reception, which can be determined by disconnecting the unit, the user is encouraged to try to correct the interference by one or more of the following measures: moving the computing equipment away from the receiver, re-orienting the receiving antenna and/or plugging the receiving equipment into a different AC outlet (such that the computing equipment and receiver are on different branches).

## CE Declaration of Conformity

---

This equipment conforms to the requirements of Council Directive 1999/5/EC on the approximation of the laws of the member states relating to Radio and Telecommunication Terminal Equipment and the mutual recognition of their conformity.

The safety advice in the documentation accompanying this product shall be obeyed. The conformity to the above directive is indicated by the CE sign on the device. The signed Declaration of Conformity can be downloaded from the Patton website at [www.patton.com/certifications](http://www.patton.com/certifications).

## Authorized European Representative

---

D R M Green

European Compliance Services Limited.

Oakdene House, Oak Road

Watchfield,

Swindon, Wilts SN6 8TD, UK

## FCC Part 68 (ACTA) Statement (Model 2803 only)

---

This equipment complies with Part 68 of FCC rules and the requirements adopted by ACTA. On the bottom side of this equipment is a label that contains—among other information—a product identifier in the format **US: AAAEQ##TXXXX**. If requested, this number must be provided to the telephone company.

A plug and jack used to connect this equipment to the premises wiring and telephone network must comply with the applicable FCC Part 68 rules and requirements adopted by the ACTA.

This equipment uses a Universal Service Order Code (USOC) jack: RJ-11C.

If this equipment causes harm to the telephone network, the telephone company will notify you in advance that temporary discontinuance of service may be required. But if advance notice isn't practical, the telephone company will notify the customer as soon as possible. Also, you will be advised of your right to file a complaint with the FCC if you believe it is necessary.

The telephone company may make changes in its facilities, equipment, operations or procedures that could affect the operation of the equipment. If this happens the telephone company will provide advance notice in order for you to make necessary modifications to maintain uninterrupted service.

If trouble is experienced with this equipment, for repair or warranty information, please contact our company. If the equipment is causing harm to the telephone network, the telephone company may request that you disconnect the equipment until the problem is resolved.

Connection to party line service is subject to state tariffs. Contact the state public utility commission, public service commission or corporation commission for information.

## Industry Canada Notice (Model 2803 only)

---

This equipment meets the applicable Industry Canada Terminal Equipment Technical Specifications. This is confirmed by the registration number. The abbreviation, *IC*, before the registration number signifies that registration was performed based on a Declaration of conformity indicating that Industry Canada technical specifications were met. It does not imply that Industry Canada approved the equipment.

## Appendix B **Specifications**

### **Chapter contents**

Ethernet interfaces .....	129
Sync serial interface .....	129
T1/E1 interface (Model 2803 only) .....	129
PPP support .....	129
IP services .....	130
Management .....	130
Operating environment .....	130
Operating temperature .....	130
Operating humidity .....	130
System .....	130
Dimensions .....	130
Power supply .....	131
Internal AC version .....	131
12VDC version with External AC Power Adapter (Models 2802, 2821, 2835) .....	131
5VDC Version with External Power Adapter (Model 2805) .....	131

## Ethernet interfaces

---

10/100Base-TX Ethernet WAN port

4-port 10/100Base-TX Ethernet LAN switch (Model 2805)

10/100Base-TX Ethernet LAN port (all other models)

All ports full duplex, autosensing, auto-MDIX 10/100 Full Duplex/Autosensing Ethernet RJ-45

## Sync serial interface

---

ITU-T X.21 or V.35 interface

Female DB-15 and DB-25 connectors (receptacles)

DTE orientation. (DCE orientation for X.21 is available from the Patton factory upon special request).

## T1/E1 interface (Model 2803 only)

---

- T1: RJ-48C connector (receptacle)
- E1: RJ-48C connector (receptacle) and dual BNC coaxial connectors (receptacles)
- Line Rate
  - 1.544 Mbps (T1) in accordance with ANSI T1.403
  - 2.048 Mbps (E1) in accordance with ITU-T G.703
- Line Coding
  - T1 AMI or B8ZS (default), selectable
  - E1 AMI or HDB3 (default), selectable
- Clocking is software selectable as Internal or Network Timing source (default)
- T1 Line Build-out
  - Transmit: Selectable for 0, -7.5, -15, -22.5 dB
  - Receive: Automatic
- Line Framing
  - T1 ESF (default) and unframed
  - E1 CRC (default), non-CRC-4, and unframed
- Isolation 1,500 Vrms

## PPP support

---

X.21 or V.35 WAN

Frame-Relay (8 PVCs)

RFC1490, FRF.12 fragmentation

LMI, Q.933D, ANSI 617D, Gang of Four

PPP, PAP, CHAP, LCP, IPCP

## IP services

---

IPv4 router; RIPv1, v2 (RFC 1058 and 2453)

Programmable static routes

ICMP redirect (RFC 792); Packet fragmentation

DiffServe/ToS set or queue per header bits

Packet Policing discards excess traffic

802.1p VLAN tagging

IPSEC AH & ESP Modes

Manual Key; IKE optional

AES/DES/3DES Encryption

## Management

---

Industry standard CLI with local console (RJ-45, RS-232) and remote Telnet access

TFTP configuration & firmware loading

SNMP v1 agent (MIB II and private MIB)

Built-in diagnostic tools (trace, debug)

Java™ Applet; HPOV Integration with NNM

## Operating environment

---

### **Operating temperature**

32–104°F (0–40°C)

### **Operating humidity**

5–80% (non condensing)

## System

---

CPU Motorola MPC875 operating at 66 MHz

Memory:

- 32 Mbytes SDRAM
- 8 Mbytes Flash

## Dimensions

---

7.3W x 1.6H x 6.1D in. (18.5H x 4.1W x 15.5D cm)

## Power supply

---

### **Internal AC version**

Internal power supply 100–240 VAC, 50/60 Hz, 200 mA

### **12VDC version with External AC Power Adapter (Models 2802, 2821, 2835)**

Uses external AC Adaptor which provides 12VDC via barrel type connector

AC Adapter Input: 90-264VAC, 47-63Hz

AC Adapter Output: 12 VDC, 1.25A max

**Note** Power must be provided by an agency-approved external SELV source which provides reinforced insulation from the AC mains power and where the DC connector is the disconnect device. The source must have a rating of 12 VDC, 1.25 A.

### **5VDC Version with External Power Adapter (Model 2805)**

Uses external AC Adaptor which provides 5VDC via barrel type connector

AC Adapter Input: 100-240VAC, 50-60Hz

AC Adapter Output: 5 VDC, 2A max.

**Note** Power must be provided by an agency-approved external SELV source which provides reinforced insulation from the AC mains power and where the DC connector is the disconnect device. The source must have a rating of 5 VDC, 2 A

# Appendix C **Cabling**

---

## **Chapter contents**

Introduction .....	134
Serial console .....	134
Ethernet 10Base-T and 100Base-T .....	135

## Introduction

This section provides information on the cables used to connect the IPLink to the existing network infrastructure and to third party products.



The interconnecting cables must be acceptable for external use and must be rated for the proper application with respect to voltage, current, anticipated temperature, flammability, and mechanical serviceability.

## Serial console

The IPLink can be connected to a serial terminal over its serial console port, as depicted in [figure 25](#).

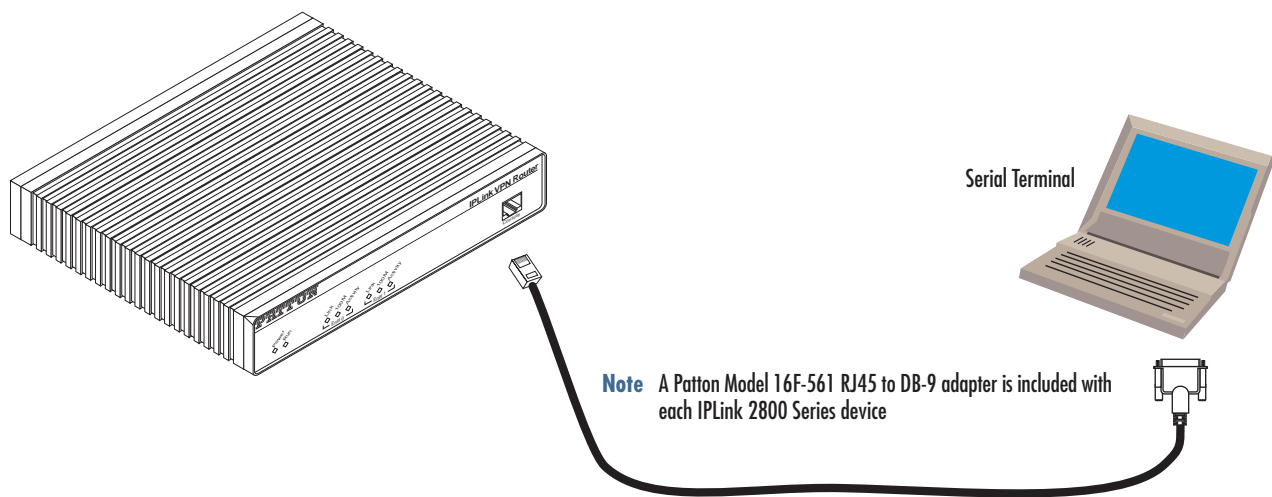


Figure 25. Connecting a serial terminal

**Note** See section “Console port, RJ-45, EIA-561 (RS-232)” on page 131 for console port pin-outs.

## Ethernet 10Base-T and 100Base-T

Ethernet devices (10Base-T/100Base-T) are connected to the IPLink over a cable with RJ-45 plugs. Use a cross-over cable to a host, or a straight cable to a hub. See [figure 26](#) (host) and [figure 27](#) on page 129 (hub) for the different connections.

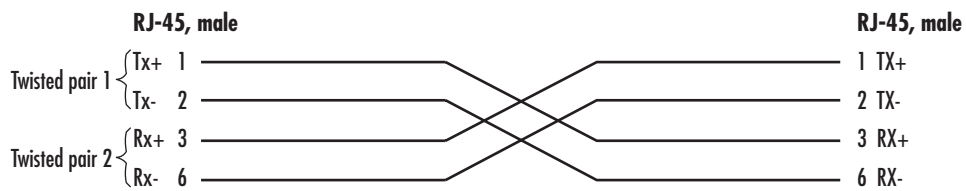
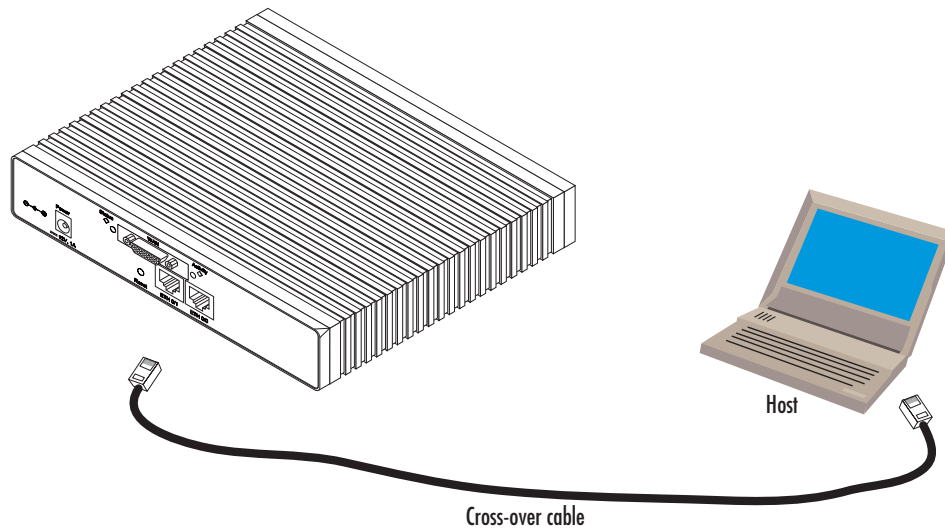


Figure 26. Ethernet cross-over

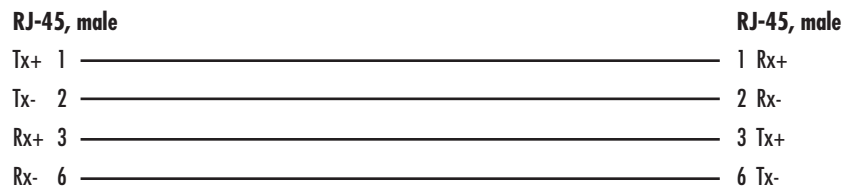
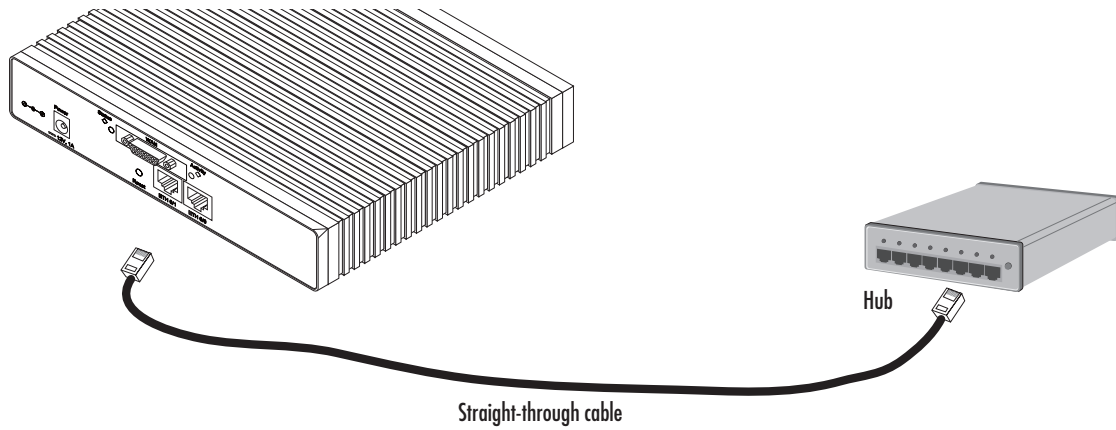


Figure 27. Ethernet straight-through

## Appendix D **Port pin-outs**

---

### **Chapter contents**

Introduction .....	138
Console port, RJ-45, EIA-561 (RS-232) .....	138
Ethernet 10Base-T and 100Base-T port .....	139
Sync serial port .....	139
V.35 serial port .....	139
X.21 serial port .....	140

## Introduction

This section provides pin-out information for the ports of the IPLink router.

### Console port, RJ-45, EIA-561 (RS-232)

The RS-232 serial console port of the IPLink is configured to operate as a DCE. View the image in [figure 28](#) showing the RJ-45 receptacle with the numerical identification of the pin numbers and functions.

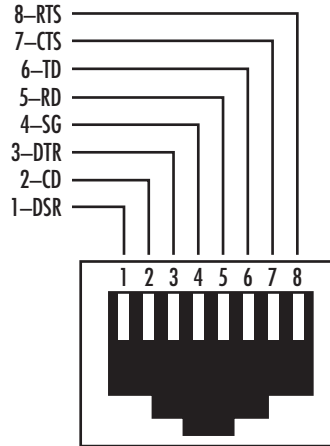


Figure 28. EIA-561 (RJ-45 8-pin) port

Table 15. RS-232 Console Port

Pin No.	Signal Name	Signal Direction
1	DSR	from IPLink
2	CD	from IPLink
3	DTR	to IPLink
4	Signal Ground	-
5	RD	from IPLink
6	TD	to IPLink
7	CTS	from IPLink
8	RTS	to IPLink

Refer to [table 15](#) which tabulates the pin number, signal name and the direction of the signal.

## Ethernet 10Base-T and 100Base-T port

Table 16. RJ-45 socket

Pin	Signal	Direction
1	TX+	from IPLink
2	TX-	from IPLink
3	RX+	to IPLink
6	RX-	to IPLink

The Ethernet ports are auto-detect MDI-X.

**Note** Pins not listed are not used.

## Sync serial port

### V.35 serial port

Table 17. V.35 Female DB-25 connector

V.35 Interface Pin-Out	
Pin	Signal
1	Frame Ground
2	TD-a
3	RD-a
4	RTS
5	CTS
6	DSR
7	Signal Ground
8	DCD
9	RC-b
11	ETC-b
12	TC-b
14	TD-b
15	RC-a
16	RD-b
17	RC-a
18	LL
20	DTR
21	RL
24	ETC-a

## X.21 serial port

Table 18. X.21 Female DB-15 connector

X.21 Interface Pin-Out	
Pin	Signal
1	Frame Ground
2	TD-a
3	CNTRL-a
4	RD-a
5	IND-a
6	SET-a
8	Signal Ground
9	TD-b
10	CNTRL-b
11	RD-b
12	IND-b
13	SET-b

**Note** Pins not labeled are not used.

# Appendix E **IPLink 2800 Series** **factory configuration**

---

## **Chapter contents**

Introduction .....	142
--------------------	-----

## Introduction

---

The factory configuration settings for the IPLink 2800 Series devices are as follows:

```
#-----#
# 2800 Series
# R3.xx BUILDxxxxx
# 2005-01-18T00:00:00
# Factory configuration file
#-----#
profile napt NAPT
profile dhcp-server DHCP
  network 192.168.1.0 255.255.255.0
  include 192.168.1.10 192.168.1.19
  lease 2 hours
  default-router 192.168.1.1

context ip router

  interface eth0
    ipaddress 172.16.40.1 255.255.0.0
    use profile napt NAPT

  interface eth1
    ipaddress 192.168.1.1 255.255.255.0

context ip router
  dhcp-server use DHCP

port ethernet 0 0
  medium auto
  encapsulation ip
  bind interface eth0 router
  no shutdown

port ethernet 0 1
  medium auto
  encapsulation ip
  bind interface eth1 router
  no shutdown
```

# Appendix F **Installation checklist**

---

## **Chapter contents**

Introduction .....144

## Introduction

This appendix lists the tasks for installing an IPLink 2800 Series Managed VPN Router (see [table 19](#)). Make a copy of this checklist and mark the entries as you complete each task. For each IPLink 2800 Series Router, include a copy of the completed checklist in your site log.

Table 19. Installation checklist

Task	Verified by	Date
Network information available & recorded in site log		
Environmental specifications verified		
Site power voltages verified		
Installation site pre-power check completed		
Required tools available		
Additional equipment available		
All printed documents available		
IPLink release & build number verified		
Rack, desktop, or wall mounting of chassis completed		
Initial electrical connections established		
ASCII terminal attached to console port		
Cable length limits verified		
Initial configuration performed		
Initial operation verified		