

Chapter 9

Point-to-Point Protocol (PPP)

Introduction	9-3
The Point-to-Point Protocol	9-3
Encapsulation	9-3
Control Protocols	9-5
LCP Options	9-6
Configuring PPP	9-7
Link Quality Management	9-9
Multilink PPP	9-9
Bandwidth Allocation Protocol	9-10
Dial-On-Demand	9-11
Link Backup	9-11
Bandwidth on Demand	9-13
Always On/Dynamic ISDN (AODI)	9-14
Synchronous Dialling	9-14
PPP Over Ethernet	9-16
PPP over Ethernet Client Mode	9-17
PPP over Ethernet Access Concentrator Mode	9-17
Templates	9-18
PPP Callback	9-19
Magic Number	9-21
Authentication Protocols	9-22
Password Authentication Protocol (PAP)	9-22
Challenge-Handshake Authentication Protocol (CHAP)	9-23
Router configuration	9-24
Assigning IP Addresses	9-27
PPP Link Management	9-29
Configuring PPP Control Protocols	9-30
Debugging PPP Links	9-30
Configuration Examples	9-33
Configuring a PPP link	9-33
Multilink Aggregation	9-36
Dial-on-Demand Links	9-38
Link Quality Monitoring	9-39
Compression and Encryption	9-39
Leased Line Backup	9-41
Bandwidth on Demand	9-43
Bandwidth on Demand with Leased Line Circuits and ISDN	9-45
Command Reference	9-47
activate ppp	9-48
add ppp	9-49
add ppp acservice	9-53

create ppp	9-55
create ppp template	9-62
delete ppp	9-69
delete ppp acservice	9-70
destroy ppp	9-71
destroy ppp template	9-71
disable ppp	9-72
disable ppp accessconcentrator	9-72
disable ppp debug	9-73
disable ppp template debug	9-74
enable ppp	9-75
enable ppp accessconcentrator	9-75
enable ppp debug	9-76
enable ppp template debug	9-78
purge ppp	9-79
reset ppp	9-80
set ppp	9-81
set ppp acservice	9-88
set ppp template	9-90
show ppp	9-96
show ppp config	9-97
show ppp count	9-103
show ppp debug	9-117
show ppp idletimer	9-118
show ppp limits	9-119
show ppp multilink	9-120
show ppp nameserver	9-122
show ppp pppoe	9-123
show ppp template	9-124
show ppp txstatus	9-128
show ppp utilisation	9-129

Introduction

This chapter describes the main features of the Point-to-Point Protocol (PPP), support for it on the router, and how to configure network interfaces on the router to use the PPP.

PPP allows one device such as a host, router, or switch to connect to another single device via a WAN or LAN. It is the most common protocol for linking a host PC to an ISP. PPP runs over physical interfaces, including Ethernet ports, VLANs (over Ethernet switch ports), synchronous ports, ISDN and asynchronous ports, depending on the individual device.

The Point-to-Point Protocol was developed by the Internet Engineering Task Force (IETF) as a means of transmitting data for more than one network protocol over the same point-to-point serial link in a standard, vendor-independent way. It can carry IP, Novell IPX, AppleTalk, and DECnet traffic. Traffic can also be encrypted or compressed.

This implementation complies with RFC 1994.



Some interface and port types mentioned in this chapter may not be supported on your router. The interface and port types that are available vary depending on your product's model, and whether an expansion unit (PIC, NSM) is installed. For more information, see the Hardware Reference.

The Point-to-Point Protocol

The Point-to-Point Protocol consists of the following main components:

- A method for encapsulating datagrams over serial links.
- A Link Control Protocol (LCP) for establishing, configuring, and testing the data-link connection.
- A family of Network Control Protocols (NCPs) for establishing and configuring different network-layer protocols.

The mechanism that PPP uses to carry network traffic is to open a link with a short exchange of packets. Once the link is open, network traffic is carried with very little overhead. Frames are sent as unnumbered information frames, meaning that no data link acknowledgement is required and no retransmissions are carried out. Once the link is established, PPP acts as a straight data pipe for protocols.

Encapsulation

At the lowest level, the Point-to-Point Protocol is an example of the HDLC protocol and has the following features:

- Data comes in frames, delimited by special characters called flags.
- When a frame is not being sent, the sender transmits flags continually. This means that there is constant activity on any synchronous line that is running properly.

- The first four bytes of a PPP frame comprise a 1 octet address field that is always set to 0xFF, a 1 octet control field that is always set to 0x03 (“unnumbered information”), and a 2-octet protocol field.
- The data that follows the address and control fields is interpreted by the device receiving the frame depending on the encapsulation type.

Link Control Protocol (LCP) exists to bring up the PPP link before any other protocols can begin transmission. Each protocol carried over PPP has an associated Network Control Protocol (NCP) that negotiates options for the protocol and brings up the link for that protocol ([Table 9-1 on page 9-4](#)).

Table 9-1: Supported Network protocols and Network Control Protocols for the Point-to-Point Protocol

Protocol	PPP Type (hexadecimal)
LCP	0xC021
IP	0x0021
IPCP	0x8021
TCP/IP Comp	0x002D
TCP/IP Uncomp	0x002F
IPX	0x002B
IPXCP	0x802B
IPv6	0x0057
IPv6CP	0x8057
DECnet	0x0027
DECnetCP	0x8027
AppleTalk	0x0029
ATCP	0x8029
Multilink	0x003D
Individual Link Compression	0x00FB
ILCCP	0x80FB
Compression	0x00FD
CCP	0x80FD
Encryption	0x0053
ECP	0x8053
Bridging	0x0031
Bridge Spanning Tree	0x0201
BCP	0x8031
Bandwidth Allocation Protocol	0xC02D
BACP	0xC02B
Link Quality Report (LQR)	0xC025
Password Authentication Protocol (PAP)	0xC023
Challenge-Handshake Authentication Protocol (CHAP)	0xC223

The TCP/IP Comp and TCP/IP Uncomp protocols provide direct support for Van Jacobson's header compression. For more information on Van Jacobson's header compression see [Chapter 14, Internet Protocol \(IP\)](#).

Control Protocols

Control protocols are protocols run by PPP between the two stations at either end of a link to allow the link to be used to carry a particular type of traffic. The Link Control Protocol (LCP) must run before any other control protocol in order to allow the link to be used at all.

The local and remote stations negotiate the configuration options to be used on the link. A *configure request packet* is sent first containing configuration options. The remote station responds with a packet confirming that the options are okay, suggesting different options or rejecting the options. This exchange takes place in both directions and when a station has sent and received an acknowledge packet the link is declared open.

Once the link has been opened by the LCP, any authentication that is required is performed. When authentication has been completed successfully, or if no authentication is required, then a Network Control Protocol (NCP) is run for each network layer protocol using the link. The NCPs operate in a similar way to the LCP, negotiating configuration options specific to the network layer protocol. No NCPs can use the PPP link until the LCP has opened the link, and no data packets can be exchanged unless the appropriate NCP is open.

Control protocols consist of states, events, and packets. Events cause the state of a link to change ([Table 9-2 on page 9-5](#)). Two important events are *open* and *close*. They can be caused either by a management command or internally, for example, when the router powers up. An *open* event causes the control protocol to try to establish a link and a *close* event terminates a link. Other events are the hardware becoming available (up) or unavailable (down), timeouts, and the arrival of packets.

Table 9-2: States for control protocols of the Point-to-Point Protocol

State	Meaning
initial	Startup state; no open event has occurred and the hardware is down.
starting	An open event has occurred and the hardware is down.
closed	The hardware is up and no open event has occurred.
stopped	The hardware is up and a down or timeout event has occurred.
closing	The link has been up and a close event has occurred; trying to close link.
stopping	The link has been open and the remote station is trying to close the link.
req sent	A configure request has been sent; waiting for a reply.
ACK rcvd	A configure request has been sent, and an acknowledge received.
ACK sent	A configure request has been received, and an acknowledge sent.
opened	An acknowledge has been sent and received.

The state of a PPP link (LCP) and the NCPs running on that link can be displayed with the command:

```
show ppp
```

For information about configuring the LCP terminate and the configure request counters, see [“Configuring PPP Control Protocols”](#) on page 9-30.

LCP Options

The LCP attempts to negotiate the following options:

- Maximum Receive Unit (MRU).
- Endpoint Discriminator.
- Link Discriminator, as defined in RFC 2125.
- Authentication Protocol.
- Link Quality Reporting (LQR).
- Magic Number.
- Asynchronous Control Character Map (ACCM).
- Maximum Received Reconstructed Unit (MRRU).

All other options are set to the defaults specified in the relevant RFC.

Endpoint Discriminator Option

The Endpoint Discriminator Option is defined in RFC 1990 and is required for PPP to form multilink bundles from dynamic PPP calls. The Endpoint Discriminator provides a mechanism for identifying the physical location of the peer at the remote end of a PPP link. When two or more dynamic PPP calls are made from the same peer, with the same authentication information, they can be bundled together to form a multilink interface if they have the same Endpoint Discriminator. The router uses its MAC address to identify itself.

If an Endpoint Discriminator is received during LCP negotiation on a newly activated link in a static PPP interface with more than one link, and that Endpoint Discriminator value is different from the Endpoint Discriminators received during negotiation on the other active links in the interface, then the new link with the invalid Endpoint Discriminator is deactivated.

Link Discriminator Option

The Link Discriminator Option is defined in RFC 2125 and is required for the operation of BAP. During LCP negotiation it is used to declare a unique identifier for the link over which negotiation occurs. BAP uses this unique identifier to differentiate the various links in a multilink bundle.

Configuring PPP

The router supports PPP over the following, separately and as members of a multilink bundle:

- Ethernet (but not multilinked with other PPPoE interfaces)
- VLAN interfaces on Ethernet switch ports (but not multilinked with other PPPoE interfaces)
- Synchronous links (see [Chapter 7, Interfaces](#)) (routers with PIC bay only)
- ISDN calls (see [Chapter 11, Integrated Services Digital Network \(ISDN\)](#)) (routers with PIC bay only)
- ACC calls (see [Chapter 28, Asynchronous Call Control](#))
- MIOX calls (see [Chapter 12, X.25](#)) (routers with PIC bay only)
- L2TP calls (see [Chapter 37, Layer Two Tunneling Protocol \(L2TP\)](#))
- TDM groups (see [Chapter 32, Time Division Multiplexing \(TDM\)](#)) (routers with PIC bay only)

PPP can be used on the router to carry:

- IP
- IPX
- DECnet
- AppleTalk routing protocols
- bridged protocols
- compressed data
- encrypted data



Some interface and port types mentioned in this chapter may not be supported on your router. The interface and port types that are available vary depending on your product's model, and whether an expansion unit (PIC, NSM) is installed. For more information, see the [Hardware Reference](#).

To create a PPP interface, use the command:

```
create ppp=ppp-interface over=physical-interface [other-  
options...]
```

To remove an entire PPP interface, use the command:

```
destroy ppp=ppp-interface
```

To add physical interfaces to the PPP interface to form a multilink bundle, use the command:

```
add ppp=ppp-interface over=physical-interface [other-  
options...]
```

To modify interface parameters after the interface has been created, use the command:

```
set ppp=ppp-interface [over=physical-interface] [other-  
options...]
```

If an ISDN call is being added as the physical interface, multiple physical interfaces can be added using the NUMBER parameter. For example, the following command adds two identical ISDN calls (named "HeadOffice") as physical interfaces to PPP interface 0:

```
add ppp=0 over=isdn-headoffice num=2
```

To selectively delete members of a multilink bundle, use the command:

```
delete ppp=ppp-interface over=physical-interface
```

To disable an entire PPP interface, use the command:

```
disable ppp=interface
```

Disabling a dynamic PPP interface destroys it. To re-enable or reset a static PPP interface, use the commands:

```
enable ppp=interface
```

```
reset ppp=interface
```

One of the features of PPP is the negotiation of options for each protocol using the link. All options have a default to which the option is set if either end of the PPP link does not wish the option to be different from the default. The LCP attempts to negotiate the Maximum Receive Unit (MRU), Authentication Protocol, Link Quality Reporting (LQR), Magic Number, Asynchronous Control Character Map (ACCM), and Maximum Received Reconstructed Unit (MRRU) options. All other possible options are set to the defaults specified in the relevant RFC.

To negotiate Van Jacobson's TCP/IP header compression, use the command:

```
add ip interface=interface ipaddress={ipadd|dhcp} vjc=on
[other-options...]
```

For more information about turning on Van Jacobson's TCP/IP header compression, see [Chapter 14, Internet Protocol \(IP\)](#).



Van Jacobson's TCP/IP header compression should not be enabled on a multilink PPP interface.

To display information about a PPP interface, use the command:

```
show ppp[=ppp-interface] [configuration|count|idletimer|
multilink]
```

If CONFIGURATION is specified, the settings of configuration parameters such as LQR and restart timers are displayed. If COUNT is specified, counters from the interface MIB and counters for the users of the interface are displayed. If IDLETIMER is specified, the configured and current values of the idle timer are displayed. If MULTILINK is specified, information about the multilink bundle associated with the interface is displayed. The display includes the number of links in the bundle, the number of packets fragmented, the number of packets or fragments in the multilink receive queue, and information about the sequence numbers on the multilink bundle. If no optional parameters are specified, a summary of the configured PPP interfaces, the physical interfaces used and the Network Control Protocols (NCPs) in use is displayed.

Link Quality Management

Link quality management determines the quality of a PPP link. A Link Quality Report (LQR) packet is transmitted down the link by the router at regular intervals. This LQR packet contains information that determines how many packets are being lost on the link. The interval between transmissions of LQR packets is determined by the LQR timer value obtained from the peer during the negotiation of the LQR LCP option. To configure this timer at the peer, which defines how often the peer expects to see an LQR packet, use the commands:

```
create ppp=ppp-interface over=physical-interface lqr=period
add ppp=ppp-interface over=physical-interface lqr=on
set ppp=ppp-interface over=physical-interface lqr=period
```

If an LQR packet is not seen by the peer within the configured timer value the link is deemed to have failed and is reset.

Each LQR packet also contains the magic number determined during the LCP negotiation process. If the magic number in an incoming LQR packet is the same as the local magic number, then the link is deemed to be in loopback mode and is reset.

Multilink PPP

PPP provides a mechanism for combining a number of PPP links into a single bundle of links, whose bandwidth is the sum of the bandwidths of the individual links. This mechanism is known as multilink PPP (MP) and is described in RFC 1990. A PPPoE link cannot be multilinked with other PPPoE links.

When a packet is transmitted over a multilink bundle it is encapsulated by a multilink header that includes information to allow the packets sent over the links in the bundle to be sequenced. This gives the multilink bundle the same properties as a single PPP link. This encapsulation also includes information that allows large packets to be fragmented, spreading the data across a number of links and giving better packet throughput in some circumstances.

When a packet is about to be transmitted across a PPP multilink bundle, a decision is made as to which link to use to transmit the packet. All link speeds in the multilink bundle are the same, and packets are being transmitted at a rate so that each packet has been transmitted before the next packet arrives for transmission, a round-robin scheme is used to choose between links. If there is a choice between two or more equally desirable links, the packet is sent on the link that has been least recently used. Rotating traffic in this way prevents links from remaining idle for long periods of time and reduces the number of null fragments that must be transmitted during idle periods.

Both static and dynamic PPP interfaces can be multilinked. The Endpoint Discriminator LCP option ([“Endpoint Discriminator Option” on page 9-6](#)) lets a single dynamic PPP interface accept and bundle more than one call. If two or more dynamic PPP calls are made from the same peer with the same authentication information, they are bundled together to form a multilink interface.



Van Jacobson's TCP/IP header compression should not be enabled on a multilink PPP interface.

Bandwidth Allocation Protocol

The Bandwidth Allocation Protocol (BAP), defined in RFC 2125, provides a mechanism for two PPP peers to manage the bandwidth available to the protocols using a multilink PPP bundle by negotiating gracefully to add and remove links from the multilink bundle. The negotiation process allows each peer to choose the algorithm used to determine when to add or remove links in the multilink bundle.

The Bandwidth Allocation Control Protocol (BACP), defined in RFC 2125, is a standard PPP NCP protocol used to negotiate the use of BAP on a multilink PPP interface. BACP is negotiated once per multilink bundle. If BACP is negotiated on any of the links in a multilink bundle, it is opened for all of the links in the bundle. BACP must be successfully negotiated before BAP can be used.

The Favoured Peer Option is the only option defined for BACP and determines which peer is favoured when both peers simultaneously transmit the same BAP request. Each peer negotiates a 4-octet magic number, which is successfully negotiated when the two magic numbers are different. The favoured peer is the peer with the lowest magic number.

After BACP reaches the opened state, either peer can request that another link be added to the bundle by sending a BAP *Call-Request* or *Callback-Request* packet. A *Call-Request* packet is sent if the peer wishes to originate the call for the new link, and a *Callback-Request* packet is sent if the peer wishes its remote peer to originate the call for the new link.

A peer can also request that a link be dropped from the bundle. A BAP *Link-Drop-Query-Request* packet is sent to the remote peer to negotiate dropping a link. The link remains active as long as the remote peer considers the link necessary and rejects the *Link-Drop-Query-Request*. A peer can force the dropping of a link without negotiation by sending an LCP *Terminate-Request* packet on the link.

To configure BAP when a PPP interface is created, use the command:

```
create ppp=ppp-interface over=physical-interface bap={on|off}
      bapmode={call|callback}
```

To modify an existing PPP interface, use the command:

```
set ppp=ppp-interface bap={on|off} bapmode={call|callback}
```

By default, BAP is enabled ("ON"). If BAP is disabled, PPP uses the UPRATE, UPTIME, DOWNRATE and DOWNTIME parameters to manage bandwidth on demand (see "[Bandwidth on Demand](#)" on page 9-13).

Dial-On-Demand

A PPP interface can be configured for dial-on-demand over:

- an ISDN call (routers with PIC bay only)
- an ACC call (routers with PIC bay only)
- a synchronous port controlling a modem connected to the PSTN (routers with PIC bay only)
- PPPoE (on the host only)
- L2TP

To configure dial-on-demand operation use the commands:

```
create ppp=ppp-interface OVER=physical-interface IDLE={ON|
seconds} [other-options...]

set ppp=ppp-interface OVER=physical-interface IDLE={ON|
seconds} [other-options...]
```

The call is activated when there is traffic to transmit over the PPP interface. The call is disconnected when the link has been idle for the specified time. If the IDLE parameter is set to OFF, the dial-on-demand feature is disabled. The default for the IDLE parameter is OFF, and ON sets the idle time to 60 seconds. To display the configured and current timer values, use the command:

```
show ppp idletimer
```

Link Backup

A PPP link can be configured as a backup to provide redundancy for another PPP link.

In theory, any kind of PPP link can be configured to back up any other PPP link. A common application is an on-demand call configured as a backup to a permanent line. [Figure 9-1 on page 9-12](#) shows this configuration for an ISDN call as backup to a leased line (routers with PIC bay only).

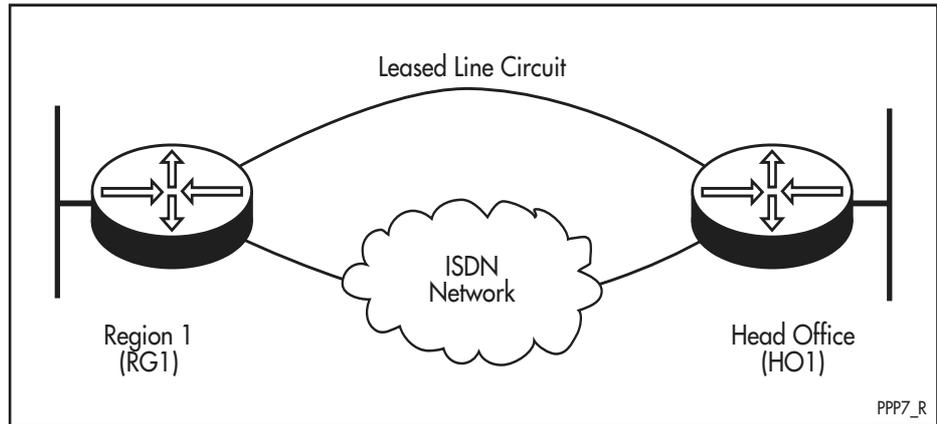
On-demand links that can be configured on the router include:

- ISDN links (routers with PIC bay only)
- ACC links (routers with PIC bay only)
- synchronous ports controlling a modem connected to the PSTN (routers with PIC bay only)
- PPPoE links
- MIOX circuits (routers with PIC bay only)
- L2TP links

Permanent connections that can be configured on the router include:

- permanent synchronous links (routers with PIC bay only)
- TDM links (routers with PIC bay only)
- MIOX circuits (routers with PIC bay only)

Figure 9-1: Example network configuration for leased line backup



To configure redundancy, create, or modify the PPP interface for the permanent link, use one of the commands:

```
create ppp=ppp-interface over=physical-interface type=primary
    configure=value [restart=seconds] [other-options...]

set ppp=ppp-interface [over=physical-interface] type=primary
    configure=value [restart=seconds] [other-options...]
```

To create or modify the PPP interface for the backup link, use the commands:

```
create ppp=ppp-interface over=physical-interface
    type=secondary [other-options...]

set ppp=ppp-interface [over=physical-interface] type=primary
    configure=value [restart=seconds] [other-options...]
```

When the primary link (TYPE=PRIMARY) fails, Link Quality Monitoring (LQM) or ECHO detects the failure and resets the link. This causes configure requests to be transmitted. The interval between successive retransmissions of configure request packets is set by using the RESTART parameter and is 3 seconds by default. If the primary link fails to open after the number of requests specified by the CONFIGURE parameter, the backup call is activated and traffic is redirected over the backup link. PPP continually attempts to reopen the primary link, and when the primary link is restored, the backup call is deactivated and traffic is redirected over the primary link again.

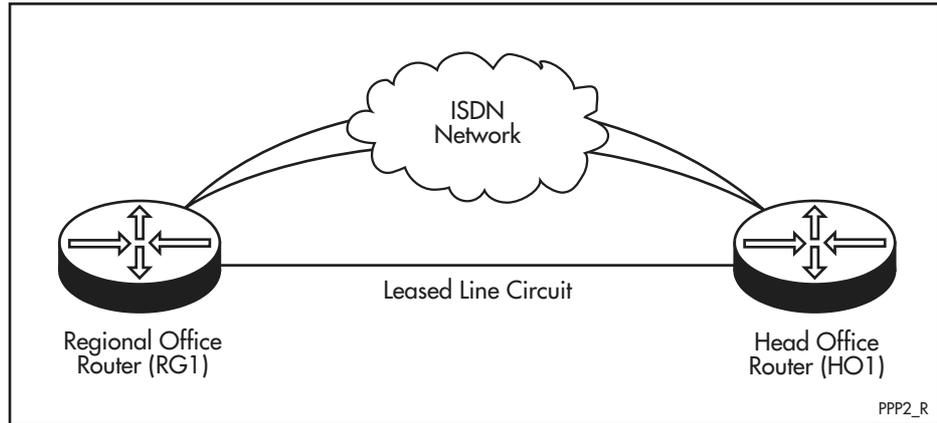
When the permanent synchronous, or TDM link enters loopback mode, LQR detects the loopback and resets the link. When the link tries to re-open, the negotiation of the Magic Number LCP option fails and the backup calls are activated. When the link leaves loopback mode, the negotiation succeeds, the permanent link reopens, the backup call is deactivated, and traffic is redirected over the permanent link.

Bandwidth on Demand

A PPP interface can be configured to provide bandwidth on demand (Figure 9-2 on page 9-13) over a number of:

- ISDN channels (routers with PIC bay only)
- ACC calls
- PPPoE connections
- L2TP calls

Figure 9-2: Example network configuration for bandwidth on demand



One application of bandwidth on demand is the use of ISDN calls to provide additional bandwidth to a leased line during peak load periods. This application is best suited to a network connection that has a fairly constant load most of the time, but is overloaded during peak periods. A leased line with sufficient capacity to handle the normal loading is supplemented by a connection to an ISDN service. This avoids the high cost of a leased line capable of handling peak loads but which is under-utilised most of the time.

Bandwidth on demand can be configured to use multiple on-demand connections, instead of a leased line, to provide the bandwidth required at any one time. This application is best suited to a network connection that has a variable and irregular load.

To configure bandwidth on demand, create a PPP interface, then add other physical interfaces to it. There are two options:

- Configure all physical interfaces to open on demand. In this case no channels are available when there is no traffic. To create the PPP interface, use the command:

```
create ppp=ppp-interface over=physical-interface-1
      type=demand [downrate=seconds] [downtime=seconds]
      [uprate=seconds] [uptime=seconds] [other-options...]
```

- Configure one physical interface as a primary interface, and all others to open on demand. In this case a call is always available, even when demand falls off completely. If a primary link is required, create the PPP interface by using the command:

```
create ppp=ppp-interface over=physical-interface-1
      [type=primary] idle={on|seconds} [other-options...]
```

In both cases, add further demand links to the same PPP interface by using the command:

```
add ppp=ppp-interface over=physical-interface-n type=demand
    [downrate=seconds] [downtime=seconds] [uprate=seconds]
    [uptime=seconds] [other-options...]
```

To trigger the addition and removal of calls, the total utilisation of the PPP interface as a percentage of the maximum bandwidth of the PPP interface is measured every second. Each time the utilisation remains above the threshold specified by the UPRATE parameter for a time longer than that specified by the UPTIME parameter, a new call is made, increasing the bandwidth of the PPP interface. When each new link is added, the total utilisation of the interface decreases. However, this decrease is momentary when the rate of utilisation is increasing. When the rate of utilisation decreases again, each time the utilisation drops below the threshold specified by the DOWNRATE parameter for a time longer than that specified by DOWNTIME parameter, a call is disconnected and the total bandwidth of the PPP interface is decreased.

For PRIMARY interfaces, use the IDLE parameter to determine when the link closes when there is no traffic for the specified time. The default for the IDLE parameter is OFF, and ON sets the idle time to 60 seconds.

Always On/Dynamic ISDN (AODI)

A PPP interface can be configured to provide AODI (*Always On/Dynamic ISDN*) by specifying a MIOX circuit as the primary link and an ISDN call as the demand link in the **add ppp** and **create ppp** commands:

```
create ppp=0 over=miox3-aodi idle=40000000
add ppp=0 over=isdn-aodi type=demand num=2
```

See “Always On/Dynamic ISDN (AODI)” on page 11-43 of Chapter 11, *Integrated Services Digital Network (ISDN)* for more information about configuring AODI.

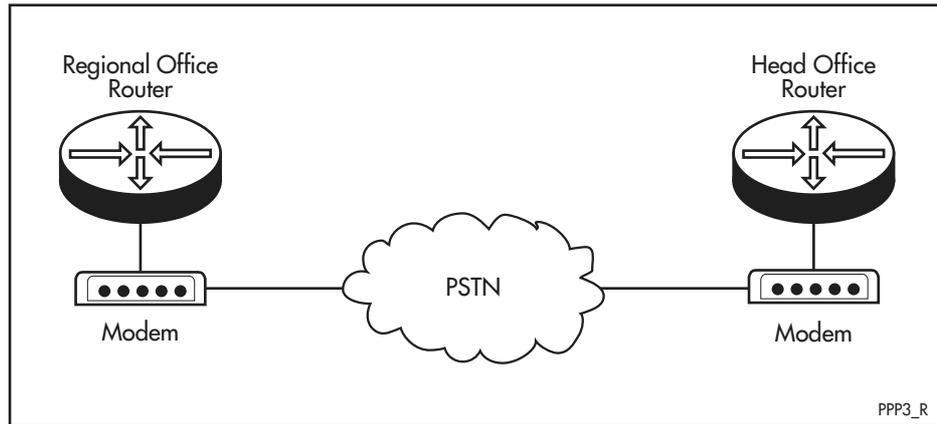
Synchronous Dialling

A PPP interface over a synchronous link can be configured to control a modem connected to the PSTN for router-to-router connections (Figure 9-3 on page 9-15). The functionality that uses V.25bis DTR support enables synchronous dialling to be used as an alternative to ISDN or ACC calls for dial on demand and leased line backup applications.



Synchronous links are available only on routers with PIC bays only.

Figure 9-3: Example network configuration for dial-on-demand using modems



Synchronous dialling is slower at setting up and taking down calls than ISDN, so the response time for handling events, such as bringing up additional links in a dial on demand application, is longer.

To configure the router to control a modem connected to a synchronous port, use the commands:

```
create ppp=ppp-interface over=syn0 modem=on [idle=on] [other-
options...]

set ppp=ppp-interface over=syn0 modem=on [idle=on] [other-
options...]
```

The router controls the modem using the modem's DTR input signal. For bidirectional calling each modem must be configured with a number to dial when the DTR signal from the router is raised. Each modem must also be configured to raise the DSR signal to the router when a call has been received and answered.

A modem makes a call when the router to which it is connected asserts DTR. The modem at the remote end of the link answers the call when its DTR signal is high. A modem that answers a call raises its DSR signal to the attached router, which responds by activating the PPP interface. A call is disconnected when the DTR signal of one of the modems is driven low. These conditions mean that DTR must be idle high so the modem is always ready to answer a call.

To make a call, the router drives DTR low and then high, leaving it ready to drop the call. To drop a call, the router drives DTR low and then high leaving it ready to answer a call. This has the side effect of causing the modem that drops the call to make another call. However, it encounters an engaged signal because the modem at the remote end of the link is still off-hook, and it then hangs up.

A potential problem with a bidirectional link is call collisions resulting from both modems attempting to dial each other at the same time. In dial on demand applications, a call collision may occur when traffic to be sent appears at both ends of the link at the same time. In leased line backup applications, a call collision may occur if the failure of the primary link is detected at the routers at each end of the link at the same time. The solution is a simple random backoff scheme. When a call collision occurs, each modem detects that the remote modem is engaged and hangs up after 15 seconds. The router

detects that the call has failed after 10 seconds and toggles DTR a random time later. This time varies between 15 and 45 seconds. If another collision occurs, the routers back off and try again until one of the modems establishes a call. This may take several minutes at most.

Another potential problem occurs when the routers are turned on. DTR is asserted causing the connected modem to initiate a call. If both routers are powered on at the same time, a call collision occurs. In this case the random backoff scheme is not used, and the modems hang up after 15 seconds and do not try again. However, if one router is powered up or reset, the call is successful as long as the modem and router at the remote end of the link are switched on. To avoid this extraneous call on power up, it is advisable to turn on each modem after the router to which it is connected has been powered up.

PPP Over Ethernet

PPP over Ethernet, defined in RFC 2516, *A Method of Transmitting PPP Over Ethernet*, provides the ability to connect a network of hosts over a single bridging access device to a remote *Access Concentrator*. An Access Concentrator may offer multiple services. A PPP over Ethernet link is a point-to-point connection between a host and a single service on an Access Concentrator. Typically, the bridging access device is a DSL or cable modem to which local hosts are connected via Ethernet, and the remote Access Concentrator is a server at an ISP. It is possible to tunnel a PPP over Ethernet session through an L2TP tunnel. For details, refer to [Chapter 37, Layer Two Tunneling Protocol \(L2TP\)](#). PPP over Ethernet enables multiple hosts at a remote site to share the same access device, while providing the access control and billing functionality of dial-up PPP connections.

The router can be configured as an Access Concentrator. Remote devices can access services configured on the router. The router can also be configured as a host, creating PPP links over Ethernet to services on remote Access Concentrators.

PPP over Ethernet has two distinct stages. In the *Discovery Stage*, the host discovers all the available Access Concentrators that offer the required service and then selects one. The host broadcasts an *Initiation* packet specifying the name of the required service or indicating that any service is acceptable. If a service name is specified, Access Concentrators that support the requested service respond with *Offer* packets that specify the Access Concentrator's unicast Ethernet Address.

If the Initiation packet indicated that any service was acceptable, all Access Concentrators that have services available respond with an *Offer* packet that specifies the Access Concentrator's unicast Ethernet Address. The host then selects an Access Concentrator and sends a *Request* packet specifying the name of the required service. The Access Concentrator responds with a *Session Confirmation* packet. When the Discovery Stage is complete, the host and the selected Access Concentrator have the information they need to create the point-to-point connection over Ethernet. In the *Session Stage* the host and the Access Concentrator exchange PPP packets.

PPP over Ethernet Client Mode

To configure the switch as a PPPoE client, create a PPP interface over an Ethernet service by using the command:

```
create ppp=ppp-interface over=physical-interface
[other-ppp-options]...
```

where *ppp-interface* is the PPP interface number and *physical-interface* is the name of the physical interface in the format *ETHn-servicename*. To specify that any service name is acceptable, use the special service name ANY. Service names may be up to 18 characters long and are usually supplied by the ISP providing the service.

A PPPoE link cannot be multilinked to another PPPoE link, but can be multilinked to other PPP calls by using the command:

```
add ppp=ppp-interface over=physical-interface
[other-ppp-options]...
```

PPPoE can be configured over ATM by first creating a virtual Ethernet interface over an ATM channel, then configuring PPP over the virtual Eth interface. (See the [create eth command on page 7-26 of Chapter 7, Interfaces](#).)

PPPoE can be configured on VLAN interfaces in both Client and Access Concentrator modes. To configure PPPoE in Client Mode, the physical-interface parameter *VLANn-servicename* has been added, where *servicename* is 1 to 18 characters long, and for a PPPoE client is usually supplied by the ISP providing the service. To specify that any service name is acceptable, you can use the special service name ANY.

PPP over Ethernet Access Concentrator Mode

To configure the router as a PPPoE Access Concentrator, add one or more access concentrator services, and enable Access Concentrator mode.

A PPPoE Access Concentrator service uses a PPP template to determine link parameters used for incoming PPPoE traffic. See [“Templates” on page 9-18](#) for more information about creating PPP templates. PPPoE AC services cannot use the default template. To create a template, use the command:

```
create ppp template=template [other-options...]
```

Then create a service, giving it a name up to 18 characters long by using the command:

```
add ppp acservice=service-name template=ppp-template
[acradius={off|on}] [maxsessions=1..512] [vlan={none|
0..4094}]
```

To enable the router to provide these Access Concentrator services, use the command:

```
enable ppp accessconcentrator
```

The router does not respond to PPPoE discovery initiation packets unless Access Concentrator mode has been enabled with this command, even if it has the requested service defined.

Templates

Templates are used whenever a call is created dynamically. The template is specified when defining the call. Dynamic PPP interfaces are created in response to a request from a lower layer to create a new PPP interface. PPP templates enable a range of configuration options available on static PPP interfaces to be applied to dynamic PPP interfaces.

A template is a blueprint for the configuration of dynamic PPP interfaces, specifying the link parameters. To create a new template, use the command:

```
create ppp template=template [copy=template]
    [authentication={chap|either|pap|none}] [bap={on|off}]
    [bapmode={call|callback}] [cbdelay=1..100]
    [cbmode={accept|off|request}] [cbnumber=e164number]
    [cbooperation={e164number|userauth}]
    [compalgorithm={predictor|stac1zs}] [compression={on|off|
link}] [debugmaxbytes=16..256] [description=description]
    [echo={on|off|period}] [encryption={on|off}]
    [fragment={on|off}] [fragoverhead=0..100] [idle={on|off|
time}] [indatalimit={none|1..65535}] [ippool={pool-name|
none}] [iprequest={on|off}] [login={all|radius|tacacs|
user}] [lqr={on|off|period}] [magic={on|off}]
    [maxlinks=1..64] [mru={on|off|256..1656}] [mtu=256..1500|
256..1492] [multilink={on|off}] [nullfragtimer=time]
    [onlinelimit={none|1..65535}] [outdatalimit={none|
1..65535}] [password=password] [predcheck={crc16|
crccitt}] [rechallenge={on|off|360..3600}] [restart=time]
    [staccheck={lcb|sequence}] [starentity=1..255]
    [totaldatalimit={none|1..65535}] [username=username]
```

Once a template has been created, it can be associated with the required dynamic link by using the commands:

```
add acc call=name asyn=port-number ppptemplate=template
set acc call=name ppptemplate=template
add isdn call=name number=number precedence={in|out}
    ppptemplate=template
set isdn call=name ppptemplate=template
add l2tp ip=ipadd-ipadd ppptemplate=template
add ppp acservice=service-name template=ppp-template
    [acradius={off|on}] [maxsessions=1..512] [vlan={none|
0..4094}]
set ppp acservice=service-name [acradius={off|on}]
    [maxsessions=1..512] [template=ppp-template] [vlan={none|
0..4094}]
```

When the lower layer activates a call that creates a dynamic PPP interface, PPP uses the associated template to create and configure the dynamic PPP interface. If no PPP template is specified in these commands, the default template is used (except for PPPoE AC services, for which a template must be created). The default template has defaults for all template parameters.



Configuration templates cannot be associated with TDM or SYN interfaces.

To modify or delete an existing template, use the commands:

```
set ppp template=template [options...]
destroy ppp template=template
```

To display the list of currently defined templates, including the default template (*pppT33*), use the command:

```
show ppp template
```

To display the configuration of a specific template, use the command:

```
show ppp template=template
```

To enable or disable the full range of PPP debugging options on a PPP template, use the commands:

```
enable ppp template=template debug={all|auth|bapstate|
callback|demand|enco|lcp|ncp|pkt|utilisation} [, ...]
[asyn=port-number] [timeout={none|1..4000000000}]
[numpkts={cont|1..4000000000}]
disable ppp template=template debug={all|auth|bapstate|
callback|demand|enco|lcp|ncp|pkt|utilisation} [, ...]
```

[Table 9-11 on page 9-76](#) lists the debugging options and their meanings. Any dynamic PPP interface created from a template that has debugging enabled displays the requested debug information. Debugging ceases when the dynamic PPP interface is destroyed.

PPP Callback

The PPP callback feature allows a PPP link to be configured to accept callback requests or to make callback requests. A callback request is made during the LCP negotiation using the LCP callback option that is defined in RFC 1570 as an LCP extension. This option contains a callback operation that specifies how the peer determines the number to use when making the call back, and contains a message field whose contents are dependent on the operation being used.

Dynamic PPP interfaces can support PPP callback provided the dynamic PPP interface is created using a PPP template in which PPP callback has been configured.

A PPP link is configured to make callback requests with the commands:

```
create ppp=ppp-interface over=physical-interface
cbmode=request

set ppp=ppp-interface over=physical-interface cbmode=request

create ppp template=template [description=description]
cbmode=request

set ppp template=template cbmode=request
```

A PPP link is configured to accept callback requests with the commands:

```
create ppp=ppp-interface over=physical-interface
    cbmode=accept authentication={chap|pap}

set ppp=ppp-interface over=physical-interface cbmode=accept

create ppp template=template [description=description]
    cbmode=accept authentication={chap|pap}

set ppp template=template cbmode=accept
```



For static PPP links, callback is supported only over ISDN calls.

Two types of callback request operations are supported by the router—user authentication and E.164 number. The user authentication callback operation specifies that the number to call back is contained in the User Authentication Database and is obtained during authentication just prior to the call being brought down. To configure user authentication callback, use the command:

```
create ppp=ppp-interface over=physical-interface
    cboperation=userauth

set ppp=ppp-interface over=physical-interface
    cboperation=userauth

create ppp template=template [description=description]
    cboperation=userauth

set ppp template=template cboperation=userauth
```

The E.164 number operation specifies that the callback number is contained in the message field of the callback option. When the E.164 number operation is configured for requesting a callback, the E.164 number must also be provided. To configure E.164 number callback, use the command:

```
create ppp=ppp-interface over=physical-interface
    cboperation=e164number cbnumber=e164number

set ppp=ppp-interface over=physical-interface
    cboperation=e164number cbnumber=e164number

create ppp template=template [description=description]
    cboperation=e164number cbnumber=e164number

set ppp template=template cboperation=e164number
    cbnumber=e164number
```

The CBOPERATION parameter is valid when the callback mode is set to request callback.

A PPP link that is configured to accept callback requests must also be configured to request authentication. This is necessary to prevent unauthorised peers from requesting a callback.

When a callback request is accepted, and authentication succeeds, the call is brought down and a call is made back to the peer making the request. If authentication fails the link is brought down and no call back is made. A delay between bringing down the call and attempting to make the call back can be configured in order to cope with any variable delays in bringing down the call (for example, due to any differences in ISDN switches). The units of this delay are tenths of seconds. To configure it, use the command:

```
create ppp=ppp-interface cbdelay=1..100 cbmode=request
set ppp=ppp-interface cbdelay=1..100
create ppp template=template cbdelay=1..100 cbmode=request
set ppp template=template cbdelay=1..100
```

The CBDELAY parameter is valid when the callback mode is set to accept callback requests.

Magic Number

The magic number option is used for loopback detection. A PPP interface that is looped back does not enter an opened state when the magic number option is enabled. The magic number option is enabled with the **MAGIC** parameter of the **add ppp** command on page 9-49, the **create ppp** command on page 9-55, the **set ppp** command on page 9-81, the **create ppp template** command on page 9-62 and the **set ppp template** command on page 9-90.

Authentication Protocols

The router supports two authentication protocols: the Password Authentication Protocol (PAP) and the Challenge-Handshake Authentication Protocol (CHAP). These protocols are typically used with PCs and hosts that connect to the router through on-demand calls (for example, ISDN calls or modems attached to the asynchronous or synchronous ports of the router) but may also be applied to network connections that use dedicated leased lines.

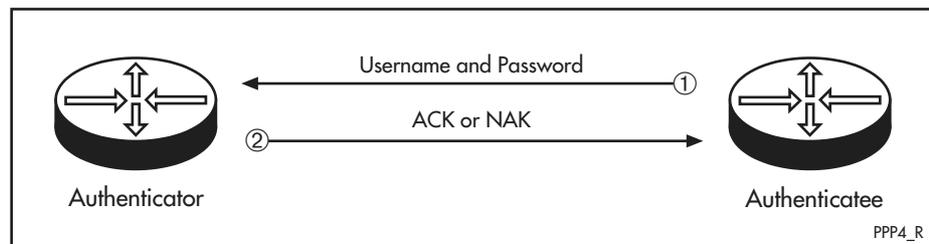
The PPP Link Control Protocol (LCP) establishes, configures, and tests data link connections between peers. Part of the process of configuring a link is the negotiation of various options, including an authentication protocol, which is performed before allowing Network Layer protocols to transmit data over the link. The local device performing the authentication is known as the *authenticator*. The device being authenticated is known as the *peer*. The router may also be configured to be BOTH an *authenticator* and a *peer*.

The Authentication phase is optional. It takes place after the PPP link has been established (the Link Establishment phase) and before proceeding to the Network-Layer Protocol phase, if authentication has been negotiated by the router at either end of the link.

Password Authentication Protocol (PAP)

The Password Authentication Protocol (PAP) is a relatively simple authentication protocol that allows a peer to establish its identity by repeatedly transmitting a user name/password pair to an authenticator until the authenticator acknowledges the peer or terminates the link. The peer requesting authentication controls the process; the authenticator simply responds to requests (Figure 9-4 on page 9-22).

Figure 9-4: The Password Authentication Protocol (PAP) authentication process



In the case of a PC using PPP to connect to the router via an asynchronous modem attached to an asynchronous port, the PC transmits a login name and password that the router compares against entries in the User Authentication Database and any defined TACACS, RADIUS or TACACS+ servers.

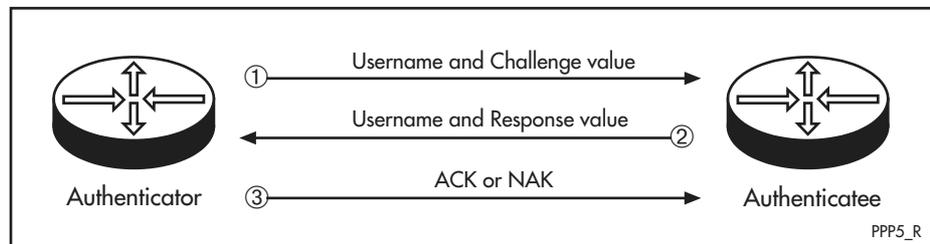
Transmitted passwords are not encrypted, and since the peer always uses the same user name/password pair there is no protection from playback or repeated trial-and-error attacks. PAP provides a similar level of security to a normal remote login.

Challenge-Handshake Authentication Protocol (CHAP)

The Challenge-Handshake Authentication Protocol (CHAP) is a more robust protocol that provides both authentication during the Link Establishment phase and verification at random intervals during the Network-Layer Protocol phase.

CHAP is controlled by the authenticator, which sends a *challenge* message containing an identifier and a unique challenge value to the peer. The peer responds with a user name and value calculated by applying a *one-way hash function* (MD5) to a string created by concatenating the identifier, the password for the user name and the challenge value. The authenticator compares the response against its own computation of the function, using the user name to look up the password in the User Authentication Database. If the values match, the authentication is acknowledged, otherwise the link is terminated (Figure 9-5 on page 9-23).

Figure 9-5: The Challenge Handshake Authentication Protocol (CHAP) authentication process



The challenge is repeated at intervals during the Network-Layer Protocol phase to ensure that there has been no change to the link. Each challenge uses a different identifier and challenge value. The identifier value changes in a predictable way (typically the value of a regularly incremented counter), but the challenge value is a unique and random value. The interval between challenges varies randomly between 5 and 15 minutes.

The CHAP rechallenge function is controlled by the RECHALLENGE parameter of the CREATE PPP or SET PPP command. This parameter specifies if rechallenge is on or off, or specifies a maximum rechallenge period. PPP calculates a random period for the CHAP rechallenge between the maximum rechallenge period and a minimum of 5 minutes. If ON is specified, the CHAP rechallenges take place with a maximum rechallenge period of 15 minutes. If OFF is specified, then CHAP rechallenges do not take place because the CHAP rechallenge is disabled. If a *time* is specified, then this time is the upper limit on the rechallenge time calculation. The default is ON.

The repeated challenges and changing identifier and challenge values provide protection against both playback and trial-and-error attacks. The uniqueness and random nature of the challenge value prevents an attacker from tricking an authenticatee into responding to a challenge then using the response to masquerade as the authenticatee to an authenticator. CHAP relies on the password being known to both the authenticator and the authenticatee, although the password is not transmitted over the link.

In the case of a PC using PPP to connect to the router via an asynchronous modem attached to an asynchronous port, the PC responds to a challenge with a login name and the value of the one-way hash function calculated over the identifier, password and challenge value. The router compares the response to its own calculation of the value, using the plaintext encoded login name to retrieve the password from the User Authentication Database.

In the case of two routers communicating over a network link, the user name is the user name set for the PPP interface with the USERNAME parameter of the [create ppp command on page 9-55](#) and the [set ppp command on page 9-81](#), or if this is not set, the router's system name is set with the [set system name command on page 1-124 of Chapter 1, Operation](#). The password is the password set for the PPP interface with the PASSWORD parameter of the CREATE PPP, CREATE PPP TEMPLATE, SET PPP and SET PPP TEMPLATE commands.

Router configuration

The router may be configured in one of the following modes:

- As a peer in a one-way authentication scheme.
- As an authenticator in a one-way authentication scheme.
- As both a peer and an authenticator in a two-way authentication scheme.

Table 9-3: Parameters of the CREATE PPP command for authentication

To configure a device as	To use PAP specify AUTHENTICATION=	To use CHAP specify AUTHENTICATION=	Specify USERNAME and PASSWORD
Authenticator	PAP (or EITHER if CHAP is never available)	CHAP or EITHER	No
Peer	NONE (the default)	NONE (the default)	Yes
Both Authenticator and Peer	PAP (or EITHER if CHAP is never available)	CHAP or EITHER	Yes

An explanation of the configuration for each of these modes is described next.

Configuring the Router as a Peer

The router can be configured as the peer in a one-way authentication scheme. When the router makes a call to a remote device (e.g. another router configured as an authenticator), the username and password that have been configured on the peer are used by the remote device to authenticate the peer. The remote device determines whether the username and password are valid, and accepts or rejects the connection. This is the most common PPP authentication configuration. A typical example is a router configured to dial into a remote ISP. The ISP provides clients with a username and password. The ISP's connection server expects the client's router to supply the username and password when it makes a call to the ISP.

To configure the router as a peer, create the PPP interface by using the command:

```
create ppp=ppp-interface over=physical-interface
      username=username password=password
```

To modify an existing PPP interface, use the command:

```
set ppp=ppp-interface username=username password=password
```

where *username* and *password* are supplied by the administrator of the authenticator (for example, the ISP).



Neither PAP or CHAP have been explicitly configured in this example so the router does not request authentication from remote devices during LCP negotiation. This is appropriate for the example above. Most ISPs configure their connection servers to request authentication only, and not to respond to authentication requests. If you configure the client router to request authentication but the ISP's connection server is not configured to respond to authentication requests (as is typical), the ISP's connection server refuses the connection from the client router and all connection attempts fail.

If a username is not set using these PPP commands, the peer router's system name is used as the username. The system name is set using the **set system name** command on page 1-124 of Chapter 1, Operation. The password can be set using the PPP commands.

Configuring the Router as an Authenticator

The router can be configured as the authenticator in a one-way authentication scheme. When the router receives a call from a remote device (e.g. a user dialling in via a modem or another device configured as a peer), it requests authentication from the remote device. The remote device supplies a username and password that the router validates before accepting or rejecting the connection. A typical example is an ISP configuring a router to accept dial-in connections from users or other remote devices (routers). The ISP's router requests authentication from the user. The user is expected to reply with the username and password supplied by the ISP when the user signed up for the service.

Each peer that wants to connect to the PPP interface on the authenticator must have a username and password configured that matches one of those stored in the User Authentication Database in the authenticator or in a defined TACACS, RADIUS, or TACACS+ server.

To configure the router as an authenticator

1. Create the PPP interface and specify the required authentication type by using the command:

```
create ppp=ppp-interface over=physical-interface
authentication={chap|pap|either}
```

To modify an existing PPP interface, use the command:

```
set ppp=ppp-interface over=physical-interface
authentication={chap|pap|either}
```

The EITHER option uses the PPP option negotiation process to request CHAP authentication. If the peer supports CHAP, CHAP is used. If the peer does not support CHAP but does support PAP, PAP is used. If the peer supports neither authentication protocol, then the link is terminated.

- If you are using the router's User Authentication Database, add a username and password to it for each user PC (or peer) that is allowed to dial in to the router by using the command:

```
add user=username password=password login=no
```

Alternatively, configure a TACACS (for PAP only), RADIUS, or TACACS+ server and add the user to it.



CHAP is not compatible with TACACS because the password is transmitted as plaintext between the TACACS server and the router.

Configuring the Router as an Authenticator and a Peer

The router can be configured as both an authenticator and a peer in a two-way authentication scheme. When the router makes a call to a remote device (e.g. another router configured as an authenticator), the username and password that have been configured on the router are used by the remote device to authenticate the router. The remote device determines whether the username and password are valid, and accepts or rejects the connection. When the router receives a call from a remote device (e.g. a user dialling in via a modem or another device configured as a peer), it requests authentication from the remote device. The remote device supplies a username and password that the router validates before accepting or rejecting the connection. A typical example is two routers configured to communicate via ISDN, a synchronous dial-up connection or an asynchronous dial-up connection.

To configure the router as both a peer and an authenticator

- Create the PPP interface by using the command:

```
create ppp=ppp-interface over=physical-interface
authentication={pap|chap|either} username=username
password=password
```

To modify an existing PPP interface, use the command:

```
set ppp=ppp-interface over=physical-interface
authentication={chap|pap|either} username=username
password=password
```

The EITHER option of the AUTHENTICATION parameter uses the PPP option negotiation process to request CHAP authentication. If the peer supports CHAP, CHAP is used. If the peer does not support CHAP but does support PAP, PAP is used. If the peer supports neither authentication protocol, then the link is terminated.

- If you are using the router's User Authentication Database, add a username and password to it for each user PC (or peer) that is allowed to dial in to the router by using the command:

```
add user=name password=password login=no
```

Alternatively, configure a TACACS (for PAP only), RADIUS, or TACACS+ server and add the user to it.



CHAP is not compatible with TACACS because the password is transmitted as plaintext between the TACACS server and the router.

This configuration is a combination of the configurations described in [“Configuring the Router as a Peer” on page 9-24](#) and [“Configuring the Router as an Authenticator” on page 9-25](#).

The AUTHMODE parameter can be used in the CREATE PPP or SET PPP commands to control when authentication is to be requested. If AUTHMODE is set to INOUT authentication is requested for both incoming and outgoing calls. Some devices do not accept calls when the calling router also requests authentication from the called router. In this case AUTHMODE can be set to IN so that only incoming calls result in authentication requests.

Assigning IP Addresses

The router supports multiple methods for assigning IP addresses to dynamic dial-in calls. The following procedure is used to select the IP address assigned to a dial-in call:

1. If the PPP interface has been added to the IP module by using the [**add ip interface** command on page 14-77 of Chapter 14, Internet Protocol \(IP\)](#), then the IP address, network mask, and MTU are as defined for that IP interface.
2. If the user is authenticated via RADIUS, and the RADIUS response supplies an IP address, then that IP address is used.
3. If the user is authenticated using TACACS and an ACC domain name has been specified with the [**add acc domainname** command on page 28-19 of Chapter 28, Asynchronous Call Control](#) then the domain name is appended to the login name and a Domain Name Service (DNS) request is issued to resolve the name to an IP address.
4. If the user is authenticated using TACACS and an ISDN domain name has been specified with the [**add isdn domainname** command on page 11-67 of Chapter 11, Integrated Services Digital Network \(ISDN\)](#), then the domain name is appended to the login name and a Domain Name Service (DNS) request is issued to resolve the name to an IP address.
5. If the user is authenticated by the User Authentication Database and an IP address and MTU are associated with the user’s login name, then they are used for the interface.
6. If the PPP call has an IP pool set, and the request to the IP pool is successful, then that IP address is used. See [“IP Address Pools” on page 14-51 of Chapter 14, Internet Protocol \(IP\)](#) for more information about creating IP address pools.
7. If all of the above steps fail to provide the necessary information then a message is displayed and the call is dropped.

See [“IP Address Pools” on page 14-51 of Chapter 14, Internet Protocol \(IP\)](#) for more information about creating IP address pools.

To associate an IP address pool with a PPP interface so that connections using that interface use IP addresses from the IP address pool, use either of the commands:

```
create ppp=ppp-interface over=physical-interface  
    ippool=pool-name [other-ppp-options...]  
  
set ppp=ppp-interface ippool=pool-name [other-ppp-options...]
```

To disassociate an IP address pool from a PPP interface so that connections using that interface no longer use IP addresses from the IP address pool, use the command:

```
set ppp=ppp-interface ippool=none
```

To associate an IP address pool with a PPP interface so that dynamic PPP interfaces created using the PPP template use IP addresses from the IP address pool, use either of the commands:

```
create ppp template=template ippool=pool-name
[other-template-options...]

set ppp template=template ippool=pool-name
[other-template-options...]
```

To disassociate an IP address pool from a PPP template so that dynamic PPP interfaces created using the PPP template no longer use IP addresses from the IP address pool, use the command:

```
set ppp template=template ippool=none
```

Once the IP address has been assigned, the router communicates it to the peer using the IP NCP. The IP Address option in IP NCP is used to inform each end of the link what the IP address of the other end of the link is by passing the address to the peer inside the option.

If a PPP interface is created with an IP address of 0.0.0.0, and remote IP address assignment is enabled, during the IP control protocol (IPCP) negotiation process the router allows the remote PPP peer to set the IP address of the local PPP interface. When the peer has an IP address to allocate, it passes the address to the requesting router in a IPCP Configure Nak packet. To configure the router to request an IP address using the IP address option, use the commands:

```
set ppp=ppp-interface iprequest=on

set ip int=ppp-interface ipaddress=0.0.0.0

enable ip remoteassign

reset ip
```

The IP NCP also provides a number of options for requesting name server addresses from the peer. These name server addresses consist of primary and secondary DNS and WINS (*Windows Internet Name Service*) server addresses. The router requests the primary DNS address from a peer, but supplies the peer with primary and secondary DNS and WINS server addresses when a request is made. To set values to be supplied to the peer, use the command:

```
set ppp [dnsprimary=ipadd] [dnssecondary=ipadd]
[winsprimary=ipadd] [winssecondary=ipadd]
```

PPP Link Management

Link management allows users to limit the connection time and data throughput on a PPP interface to thresholds they choose. For example, a user with an Internet connection via an Internet Service Provider (ISP) can limit the connection time or the amount of data transmitted over the PPP interface. By resetting the PPP link counters at the beginning of each billing period, they can keep their ISP bills within chosen limits.

Counters record cumulative up-time and input and output data throughput for each PPP link. The user can set thresholds for these parameters. If any of the thresholds are exceeded, the PPP link is closed. The link cannot be reopened until the counters are reset, or the threshold limits are increased or disabled.

The router writes the accumulated counters to flash memory every five minutes and every time the PPP link is closed. If the router is restarted, the counters are restored from flash memory to their previous values.

To create a new PPP interface with uptime and data throughput thresholds, use the command:

```
create ppp=ppp-interface [over=physical-interface]
[onlinelimit={none|1..65535}]
[indatalimit={none|1..65535}]
[outdatalimit={none|1..65535}]
[totaldatalimit={none|1..65535}] [other-options]...
```

To specify up-time and data throughput thresholds for an existing PPP interface, use the command:

```
set ppp=ppp-interface [onlinelimit={none|1..65535}]
[indatalimit={none|1..65535}]
[outdatalimit={none|1..65535}]
[totaldatalimit={none|1..65535}]
```

Similarly, a PPP template with thresholds is created with the command:

```
create ppp template=template [onlinelimit={none|1..65535}]
[indatalimit={none|1..65535}]
[outdatalimit={none|1..65535}]
[totaldatalimit={none|1..65535}] [other-options]...
```

To set thresholds on an existing PPP template, use the command:

```
set ppp template=template [onlinelimit={none|1..65535}]
[indatalimit={none|1..65535}]
[outdatalimit={none|1..65535}]
[totaldatalimit={none|1..65535}]
```

To reset the counters that record cumulative uptime and data throughput for a PPP interface to zero (0), use the command:

```
reset ppp=ppp-interface [counter]
[linkcounter={online|indata|outdata|totaldata|all}]
```

To display the cumulative counters, thresholds and remaining time or data throughput available on the interface, use the command:

```
show ppp[=ppp-interface] limits
```

Configuring PPP Control Protocols

The router uses a number of counters and timers to control the LCP and NCPs. The timers control the retransmission of *Configure-Request* and *Terminate-Request* control protocol packets. If the correct acknowledgement is not seen in the timeout period, another packet is transmitted. Counters control the number of times the packets can be sent. The *Configure* counter records retransmissions of *Configure-Requests*. If this counter exceeds the value set for it, the LCP resets the interface and starts again. The *Terminate* counter records retransmissions of *Terminate-Requests*. If this counter exceeds the value set for it, the link is assumed to be down. The *Failure* counter controls the number of attempts to reach an agreeable set of values for options being negotiated by an NCP. This counter is not used in the router.

To set values for the counters, use the commands:

```
create ppp=ppp-interface over=physical-interface
    [configure={value|continuous}] [terminate={value|
    continuous}]

add ppp=ppp-interface over=physical-interface
    [configure={value|continuous}] [terminate={value|
    continuous}]

set ppp=ppp-interface over=physical-interface
    [configure={value|continuous}] [terminate={value|
    continuous}]
```

The CONFIGURE parameter sets the number of configure requests sent before some action is taken. For the LCP the action is to reset the hardware and start again. For all other protocols the action is to give up. The default is CONTINUOUS, which means that requests are sent continuously.

The TERMINATE parameter sets the number of terminate requests sent when trying to close a link before it is assumed the link is down. The default is 2. The CONTINUOUS option specifies that requests be sent continuously.

Debugging PPP Links

If a PPP link fails to function correctly, bugs, or errors, in software could be the source of the problem. The PPP debugging commands allow users to establish that there is problem and then locate the source of the problem. The user may then be able to fix, or bypass, the bug, allowing the PPP link to function correctly.

To enable debugging on a PPP interface, use the command:

```
enable ppp=ppp-interface debug={all|auth|bapstate|callback|
    ctrlpkt|datapkt|decode|demand|enco|lcp|lqr|ncp|packet|
    pkt|pppoe|utilisation} [,...] [asyn=port-number]
    [timeout={none|1..4000000000}] [numpkts={cont|
    1..4000000000}]
```

To enable the debugging option for dynamic PPP interfaces created using a specified PPP template, use the command:

```
enable ppp template=template debug={all|auth|bapstate|
callback|ctrlpkt|datapkt|decode|demand|enco|lcp|lqr|ncp|
packet|pkt|pppoe|utilisation}[,...] [asyn=port-number]
[timeout={none|1..400000000}] [numpkts={cont|
1..400000000}]
```



Enabling all debug options with ENABLE PPP DEBUG=ALL may generate enormous amounts of output, causing the router to lock up. Use the TIMEOUT or NUMPKTS options to limit the amount of output generated.

To disable debugging on a PPP interface, use the command:

```
disable ppp=ppp-interface debug={all|auth|bapstate|callback|
ctrlpkt|datapkt|decode|demand|enco|lcp|lqr|ncp|packet|
pkt|pppoe|utilisation}[,...]
```

To disable the debugging option for dynamic PPP interfaces created using a PPP template, use the command:

```
disable ppp template=template debug={all|auth|bapstate|
callback|ctrlpkt|datapkt|decode|demand|enco|lcp|lqr|ncp|
packet|pkt|pppoe|utilisation}[,...]
```

PPP debugging is disabled by default.

The debugging options and their meanings are listed in [Table 9-4 on page 9-31](#). Output is sent to the specified asynchronous port or the terminal from which the command was entered.

Table 9-4: Point-to-Point Protocol (PPP) debugging options

Option	Description
ALL	All debug options.
AUTH	PPP authentication. If LCP opens on a link but the network protocols remain in the closed state, the most likely cause is an authentication failure.
BAPSTATE	BAP state machine transitions.
CALLBACK	Callback state machine transitions.
CTRLPKT	Hexadecimal dump of control packets received and transmitted on the PPP interface.
DATAPKT	Hexadecimal dump of data packets received and transmitted on the PPP interface.
DECODE	Decoded control packets. Disabling or enabling this option also automatically disable or enable AUTH debug.
DEMAND	Packets that cause on-demand links to be activated.
ENCO	ENCO state machine used to control attachment to and detachment from the ENCO (encryption/compression) module.
LCP	LCP state machine transitions.
NCP	NCP state machine transitions.
LQR	Decoded LQR packets.
PACKET PKT	Hexadecimal dump of all packets received and transmitted on the PPP interface. This option has the same effect as CTRLPKT and DATAPKT specified at the same time

Table 9-4: Point-to-Point Protocol (PPP) debugging options (continued)

Option	Description
PPPOE	PPPoE discovery packets received and transmitted, and PPPoE state transitions.
UTILISATION	Utilisation measurements for each lower layer interface and the overall utilisation.

The configuration information contained in Link Control Protocol (LCP) and Network Control Protocol (NCP) control packets is displayed in a readable format by using the DECODE debug option. For example, to enable PPP debug, use the command:

```
enable ppp=0 debug=decode
```

Then activate the PPP connection to this interface. Output similar to that in Figure 9-6 on page 9-32 is produced.

Figure 9-6: Example PPP packet decode debug output

Protocol specific fields

1 2 3 4 5 6 7 8 9

09:15:10 ppp0 Link0 (tnl-test) Rx: IPCP ConfReq: ID: 1, len: 44/44

IP Addresses ... Source 10.0.0.1 Destination 10.0.0.254

Compression ... Van Jacobson TCP Max Slot ID=15, Compress Slot ID

IP Address 10.0.0.254 Primary NBNS Addr 10.0.0.1

Primary NBNS Addr 10.0.0.2 Second DNS Addr 10.0.0.3

Key:

- 1 Time stamp
- 2 PPP interface
- 3 Link number
- 4 Connection
- 5 Direction - either Tx (Transmit) or Rx (Receive)
- 6 Protocol
- 7 Packet Type
- 8 Packet ID
- 9 Length - logical/physical (the lesser of the two is used)

PPP10

For comprehensive information about a specific protocol refer to the relevant RFC. See Table 9-5 on page 9-32 for a list of protocols and RFC number(s).

Table 9-5: Protocol and relevant RFC number(s)

Protocol	RFC number(s)
AppleTalk Control Protocol (ATCP)	RFC 2023
Bandwidth Allocation Control (BACP)	RFC 2125
Bandwidth Allocation Protocol (BAP)	RFC 1638
Banyan VINES Control Protocol (BVCP)	RFC 1763

Table 9-5: Protocol and relevant RFC number(s) (continued)

Protocol	RFC number(s)
Compression Control Protocol (CCP)	RFC 1962, 1978, 1974, 2118, 1993, 1977, 1967, 1975, 1979
Encryption Control Protocol (ECP)	RFC 1968, 1969
IP Control Protocol (IPCP)	RFC 1332
IP Version 6 Control Protocol (IPv6CP)	RFC 2472
Novel IPX Control Protocol (IPX)	RFC 1552
Link Control Protocol (LCP)	RFC 1661, 1662, 1570, 1663, 1990, 1976, 1934, 2125
NetBIOS Frames Control Protocol (NBFCP)	RFC 2097
OSI Network Layer Control Protocol (OSINLCP)	RFC 1377
Serial Data Control Protocol (SDCP)	RFC 1963

Configuration Examples

The following examples illustrate some of the options available for configuring PPP interfaces to provide a range of network services.

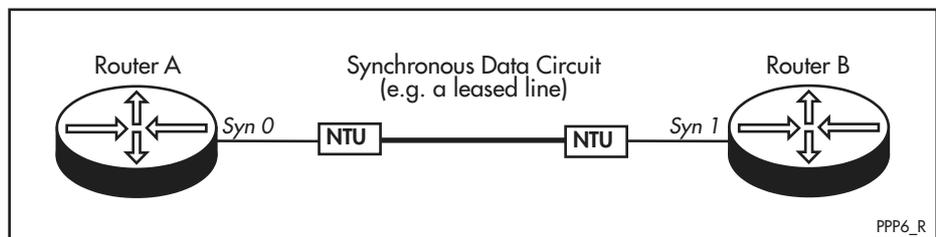
Configuring a PPP link

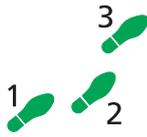
In this example, a Point-to-Point Protocol (PPP) link is set up between two routers (Figure 9-7 on page 9-33). The function of PPP is to maintain a channel between the routers, over which data can be exchanged. To exchange data, the relevant routing module(s) must be assigned to use a PPP link.



Some interface and port types mentioned in this example may not be supported on your router. The interface and port types that are available vary depending on your product's model, and whether an expansion unit (PIC, NSM) is installed. For more information, see the AR400 Series Router Hardware Reference.

Figure 9-7: Example network for configuring a PPP link





To configure a PPP link

1. Connect the routers to the Data Circuit

Ensure that the NTUs or modems are correctly installed on the data circuit—try a remote loop back.

Using the correct cables, connect the synchronous interface on each router (synchronous interface 0 on Router A, synchronous interface 1 on Router B) to the local NTU or modem. Contact your authorised distributor or reseller if you are unsure which cables to use.

2. Create the PPP interface.

On Router A, create a PPP interface numbered 0 over synchronous port 0:

```
create ppp=0 over=syn0
```

On Router B, create a PPP interface numbered 1 over synchronous port 1:

```
create ppp=1 over=syn1
```

The PPP interface is enabled by default when it is created.

To configure additional PPP links, repeat the above commands for each additional PPP link. Each PPP interface on a router has a unique number and can run over different synchronous interfaces. For example, PPP7 could run over SYN3. However, keeping the interface numbers the same as the physical port numbers wherever possible makes management easier.

3. Add an on-demand call.

Additional physical interfaces can be added to the PPP interface to form a multilink bundle, using the [add ppp command on page 9-49](#). For example, a PPP interface may also be created to use an ISDN call as a physical interface. The ISDN call must have been defined previously by using the command:

```
add isdn call=demand num=23432 prec=in
```

To add the ISDN call “demand” as a physical interface to the PPP interface created above, on Router A use the command:

```
add ppp=0 over=isdn-demand
```

On Router B, use the command:

```
add ppp=1 over=isdn-demand
```

The PPP interface may be configured for dial on demand operation by adding the IDLE=ON option to the CREATE commands, or the option may be set at a later date with the SET command:

```
set ppp=0 idle=on
```

4. Enable routing modules to use the interface.

Once a PPP interface has been defined and configured, routing modules can be configured to use the interface. The procedures for achieving this are described in the chapter for the particular routing module.

In general, commands that contain the parameter INTERFACE= can refer to a PPP interface by name. The form of the name is “pppn”, where *n* is the interface number for the PPP module.

Examples of commands that can refer to a PPP interface include:

```
add ip interface=pppn...
add ipx circuit interface=pppn...
add decnet interface=pppn...
add apple port=pppn...
```

As an example, the IP routing module is to use the PPP interface just configured. The RIP routing protocol is to be used, so the PPP link has to be assigned its own an IP subnet. Use of OSPF as the routing protocol would mean that the PPP link could be set up as a unnumbered link. The subnet assigned to the PPP link is 172.16.254.0, with 255.255.255.0 as the subnet mask. The local (Router A) end of the link has address 172.16.254.1, and the remote (Router B) end has address 172.16.254.2. RIP is to be enabled to the remote end of the link. Router A already has an IP interface for the Ethernet interface, with an IP address of 172.16.9.59. The commands for Router A are:

```
enable ip
add ip int=ppp0 ip=172.16.254.1 mask=255.255.255.0
add ip rip int=ppp0
```

5. Test that the link is active.

The PPP interface can be checked with the command:

```
show ppp
```

which produces a display like [Figure 9-8 on page 9-35](#). For each control protocol (listed in the *CP* field), the corresponding *State* field should be set to open.

Figure 9-8: Example output from the **show ppp** command for a PPP link

Name	Enabled	ifIndex	Over	CP	State
ppp0	YES	04		IPCP	OPENED
			syn0	LCP	OPENED
			isdn-demand	LCP	OPENED

If the LCP has a state that is not open, check the configuration of the physical interfaces used by the PPP interface. Check that the cables connecting the synchronous ports to the local NTUs or modems are the correct type. Contact your authorised distributor or reseller for assistance.

Check the NTUs or modems are correctly installed. Perform a remote loop back from each end alternately. Contact the Telecom supplier or your authorised distributor or reseller if this fails.

Some modems or NTUs may require signals that are not provided by the router directly. These can usually be 'strapped' internal to the NTU or modem by the Telecom supplier or external wire jumpers can be added to the cable. Check with the Telecom supplier or your authorised distributor or reseller.

Check that the synchronous ports have been configured correctly for the network to which they are connected. Check the synchronous interface counters for high link error rates by using the command:

```
show syn=0 counter
```

The counters that usually increase with high link error are the *Aborts*, *CRCErrors* and *UnderlengthFrames* counters. See [Chapter 7, Interfaces](#) for a

detailed description of these counters. The error counters should be low in relation to the good frame counters. The *seconds* counter gives the length of time that the counters have been active and can be used to assess the quality of the link.

It is normal for most serial wide area links to have a low error rate. Check with the Telecom supplier for an estimate of what they regard as acceptable.

To try to resolve this situation, consider the following possibilities:

1. This circuit may be faulty. Ask the Telecom supplier to test it.
2. This could be caused by poor quality or overlong cables, especially at higher link speeds. This is probably not a factor when below 1–2Mbps link speeds. Contact your authorised distributor or reseller for assistance.

For a PPP interface that is using an ISDN call as the physical interface, check that the calls have been properly defined and are active on the routers at each end of the link.

If the routing protocol is not in an open state, check the configuration of the routing module. As a first step, the IP configuration can be checked with the command:

```
show ip interface
```

which produces a display like [Figure 9-9 on page 9-36](#).

Figure 9-9: Example output from the **show ip interface** command for a PPP link configured for use by the IP routing module

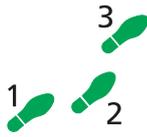
Interface Pri. Filt	Type Pol.Filt	IP Address Network Mask	Bcast MTU	PArp VJC	Filt GRE	RIP Met. OSPF Met.	SAMode DBcast	IPSc Mul.
LOCAL	-	Not Set	-	-	---	-	-	--
---	---	-	-	-	---	-	-	---
eth0	Static	202.36.163.36	1	On	---	01	Pass	--
---	---	255.255.255.0	1500	-	---	0000000001	None	---
ppp0	Static	192.168.1.1	1	-	---	01	Pass	--
---	---	255.255.255.0	1500	Off	---	0000000001	None	---
ppp1	Static	192.168.2.1	1	-	---	01	Pass	--
---	---	255.255.255.0	1500	Off	---	0000000001	None	---

Multilink Aggregation

Traffic can be sent over multiple physical interfaces using PPP multilink. A PPP interface is created and configured to use more than one physical interface (e.g. ISDN B channels or synchronous ports). Any combination of physical interface types may be used (e.g. two ISDN B channels, or one ISDN B channel and a synchronous port, or three synchronous ports). This example expands on “[A Basic ISDN Setup](#)” on page 11-48 of Chapter 11, *Integrated Services Digital Network (ISDN)*, by aggregating traffic on two ISDN B channels between router HO1 and RG1.



Some interface and port types mentioned in this example may not be supported on your router. The interface and port types that are available vary depending on your product's model, and whether an expansion unit (PIC, NSM) is installed. For more information, see the [AR400 Series Router Hardware Reference](#).



To configure channel aggregation on a PPP interface:

1. Set up the ISDN call.

Create an ISDN call between routers HO1 and RG1 as in “A Basic ISDN Setup” on page 11-48 of Chapter 11, *Integrated Services Digital Network (ISDN)*.

2. Create a PPP interface to use the ISDN call.

Create a PPP interface to use the ISDN call Region1 twice (i.e. activate two calls using the same call definition). On the Head Office router, create PPP0 to use ISDN call Region1:

```
create ppp=0 over=isdn-region1 num=2 idle=on
```

On the Region 1 router, create PPP0 to use the ISDN call HeadOffice twice:

```
create ppp=0 over=isdn-region1 num=2 idle=on
```

3. Configure routing modules to use the PPP interface.

Configure one or more routing modules to use the PPP interface. See “A Basic ISDN Setup” on page 11-48 of Chapter 11, *Integrated Services Digital Network (ISDN)*.

4. Test the configuration.

Check the PPP configuration by using the command:

```
show ppp
```

The expected output is shown in [Figure 9-10 on page 9-37](#). All control protocols should have their State set to open. If either PPP LCP is not in an open state, check that the ISDN calls are active on both routers. If any routing control protocols (in this case IPCP) are not open, check the configuration of the routing module on both routers.

Figure 9-10: Example output from a **show ppp** command for a PPP interface aggregated over two ISDN B channels

Name	Enabled	ifIndex	Over	CP	State
ppp0	YES	04		IPCP	OPENED
			isdn-Region1	LCP	OPENED
			isdn-Region1	LCP	OPENED

Check the ISDN calls by using the command:

```
show isdn call
```

The expected output is shown in [Figure 9-11 on page 9-38](#). There should be two active calls with the State field set to ‘ON’. If not, the calls can be attempted again either by deactivating and then reactivating them, or by resetting the interface.

Figure 9-11: Example output from the **show isdn call** command for a PPP interface aggregated over two ISDN B channels

ISDN call details				
Name	Number	Remote call	State	Precedence
Region1	043332345	-	IN & OUT	OUT

ISDN active calls				
Index	Name	User	State	Prec
0	Region1	03-00	ON	Yes
1	Region1	03-36	ON	Yes

For the HO1 router the commands are:

```
deactivate isdn call=region1
activate isdn call=region1
activate isdn call=region1
```

or:

```
reset ppp=0
```

The **deactivate isdn call** command deactivates **all** calls with the specified name. In this example, PPP has been configured to make two Region1 calls. The **deactivate isdn call** command deactivates (hang up) both calls. The **activate isdn call** command makes a single call based on the specified call definition. To reactivate both calls for this example, the **activate isdn call** command must be used twice.

Dial-on-Demand Links

A PPP interface can be configured so that it brings the link up only when there is traffic to send. This feature is useful on switched interfaces (e.g. ISDN) because the physical layer is available all the time for other types. This feature is sometimes called "dial on demand". The link is disconnected when there has been no traffic for a specified period of time. This feature is disabled by default. The following examples assume PPP interface 0 has been configured as in "[A Basic ISDN Setup](#)" on page 11-48 of Chapter 11, [Integrated Services Digital Network \(ISDN\)](#).

To enable dial-on-demand and use the default disconnect timer (60 seconds), use the command:

```
set ppp=0 idle=on
```

To enable dial-on-demand with the disconnect timer set to 20 seconds, use the command:

```
set ppp=0 idle=20
```

To disable dial-on-demand, use the command:

```
set ppp=0 idle=off
```

To check the configuration, use the command:

```
show ppp=0 conf
```

Link Quality Monitoring

Link quality monitoring is used to measure the quality of a link. The protocol used is an option negotiated when the link is brought up. There is one protocol for this, Link Quality Report (LQR). Packet and octets loss count, and link failure can be determined using LQR. The negotiation process determines how often a router should receive an LQR packet on a PPP interface. When a router does not receive two consecutive LQR packets within the specified time frame it resets the link. When using an ISDN call with the PPP interface, this disconnects the call when it is connected and tries to reconnect it.

The LQR counters can be displayed with the command:

```
show ppp=0 count
```

and the network manager can decide whether the level of packet and octet loss is good or bad. In a multilink configuration, LQR can be configured differently on each physical interface in the multilink bundle.

The following examples assume PPP interface 0 has been configured as in [“A Basic ISDN Setup” on page 11-48 of Chapter 11, Integrated Services Digital Network \(ISDN\)](#).

To enable LQR with the default timer (60 seconds), use the command:

```
set ppp=0 over=isdn-headoffice lqr=on
```

To enable LQR with the timer set to 20 seconds, use the command:

```
set ppp=0 over=isdn-headoffice lqr=20
```

To disable LQR, use the command:

```
set ppp=0 over=isdn-headoffice lqr=off
```

To check the configuration, use the command:

```
show ppp=0 conf
```

Compression and Encryption

PPP interfaces can be configured to use hardware resources (e.g. a MAC card) to provide compression and/or encryption over wide area links. See [Chapter 25, Compression and Encryption Services](#) for more information. Compression must be configured on per-interface basis, on the routers at both ends of the PPP link.

For PPP multilink interfaces, the data may be compressed before the packets are forwarded to the multilinking process (COMP=ON). This means that all packets on all member links of the multilink carry compressed data, or the data may be compressed after the packets are forwarded to the multilinking process (COMP=LINK), in which case only packets on the specified member link of the multilink carry compressed data. For multilink bundled interfaces with fragmentation enabled (FRAG=ON), the data must not be compressed before the packets are forwarded to the multilinking process (COMP=ON). However, the data may be compressed after the packets are forwarded to the multilinking process (COMP=LINK).

The following example commands illustrate some of the options for enabling compression.



Some interface and port types mentioned in this example may not be supported on your router. The interface and port types that are available vary depending on your product's model, and whether an expansion unit (PIC, NSM) is installed. For more information, see the AR400 Series Router Hardware Reference.

To create a PPP interface aggregating synchronous port 0 and synchronous port 1 with compression enabled only on synchronous port 1, use the commands:

```
create ppp=0 over=syn0
add ppp=0 over=syn1 comp=link
```

To change the compression from synchronous port 1 to synchronous port 0, use the commands:

```
set ppp=0 over=syn1 comp=off
set ppp=0 over=syn0 comp=link
reset ppp=0
```

To enable compression before aggregation, use the commands:

```
set ppp=0 comp=on
reset ppp=0
```

To disable compression, use the commands:

```
set ppp=0 comp=off
reset ppp=0
```

To check any of these configurations, use the command:

```
show ppp config
```

Encryption must be configured on per-interface basis, on the routers at both ends of the PPP link. A star entity must be associated with the PPP interface, and specifies the encryption algorithm to use. See [“Star Key Management” on page 44-5 of Chapter 44, Link Compression and Encryption](#) for more information about creating star entities. Enable encryption when a PPP interface is created or by modifying the configuration of an existing PPP interface by using the commands:

```
create ppp=ppp-interface over=physical-interface
encryption=on starentity=1..255

set ppp=ppp-interface over=physical-interface encryption=on
starentity=1..255
```

For PPP interfaces created over L2TP calls, data cannot be compressed before the packets are forwarded to the multilinking process (COMP=ON). The Encryption Control Protocol (ECP) defined in RFC 1968 is used to negotiate encryption options with the remote peer. During ECP negotiation, ECP option 0 is used to offer the peer the encryption algorithm configured in the associated star entity. If the star entity associated with the peer is not configured with the same encryption algorithm, the option is rejected, the negotiation fails, and the link is closed.

Leased Line Backup

A PPP interface can be configured to use an ISDN call to back up a synchronous (leased) line. When a link is added to a PPP interface it can be assigned a channel type of PRIMARY or SECONDARY. The default channel type is PRIMARY. To perform leased line backup the PPP link using the synchronous line must be assigned a channel type of PRIMARY and the PPP link using the ISDN must be assigned a channel type of SECONDARY. When a primary link failure is detected (by LQR), it is reset and an attempt is made to reopen the link. If the LCP of the primary link fails to reach an open state after sending a number of configure requests, the secondary link is activated. The primary link continually tries to reopen and closes the secondary link when it succeeds. The CONFIGURE parameter specifies the number of configure requests required before the secondary link is activated, and defaults to CONTINUOUS. The RESTART parameter controls how often configure requests are transmitted and defaults to 3 seconds. To enable lease line backup, the CONFIGURE parameter needs to be set to a value other than CONTINUOUS.

This example illustrates how to configure leased line backup between two routers (Figure 9-12 on page 9-41, Table 9-6 on page 9-41).



Some interface and port types mentioned in this example may not be supported on your router. The interface and port types that are available vary depending on your product's model, and whether an expansion unit (PIC, NSM) is installed. For more information, see the AR400 Series Router Hardware Reference.

Figure 9-12: Example configuration for leased line backup

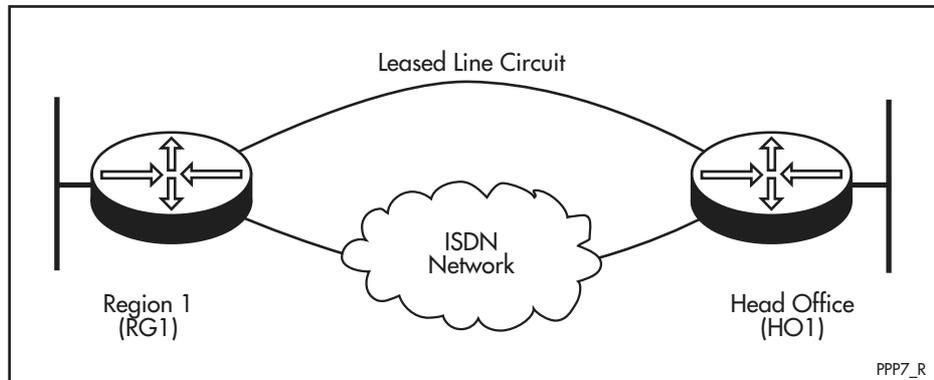
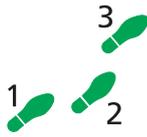


Table 9-6: Example configuration parameters for leased line backup

Site	Region 1	Head Office
Router Name	RG1	HO1
ISDN Number	1234567	9876543
IP Address for PPP0	192.168.35.114	192.168.35.113
IP Address for Eth0	192.168.35.110	192.168.35.45
Subnet Mask	255.255.255.240	255.255.255.240



To configure leased line backup

1. Create the ISDN calls.

An ISDN call must be defined on each router so that either router may initiate a call to transfer data. For a more detailed example of creating ISDN calls see [“A Basic ISDN Setup” on page 11-48 of Chapter 11, Integrated Services Digital Network \(ISDN\)](#).

Set the ISDN call profile appropriate for the ISDN service provider. The default profile is the ETSI specification for European Union (EU) countries (ETB for Basic Rate interfaces or ETP for Primary Rate interfaces). To use the Australian Telecom profile, for example, on Basic Rate interface BRI 0 for router HO1 and RG1, use the following command on each router:

```
set q931=bri0 profile=aus
```

On the Head Office router, create a call to the Region 1 router:

```
add isdn call=region1 prec=in outsub=local searchsub=local
number=1234567
```

On the Region 1 router create a call to the Head Office router:

```
add isdn call=region1 prec=out outsub=local
searchsub=local number=9876543
```

2. Create a PPP interface over the synchronous interface.

Create the PPP interface, setting the CONFIGURE parameter to 5 and the LQR timer to 10 seconds. This speeds up link failure detection as the default is 60 seconds. The default link type is PRIMARY. On the Head Office router create a PPP interface:

```
create ppp=0 over=syn0 conf=5 lqr=10
```

On the Region 1 router create a PPP interface:

```
create ppp=0 over=syn0 conf=5 lqr=10
```

3. Add the ISDN calls to the PPP interface.

Add the ISDN calls, specifying a link type of SECONDARY. On the Head Office router add an ISDN call:

```
add ppp=0 over=isdn-region1 type=secondary
```

On the Region 1 router add an ISDN call:

```
add ppp=0 over=isdn-region1 type=secondary
```

4. Configure IP.

Configure a routing module to use the PPP interfaces. It could be IPX, DECnet, AppleTalk or bridging but for this example IP is used. Configure IP at the Head Office router:

```
enable ip
add ip int=ppp0 ip=192.168.35.113 mask=255.255.255.240
```

Configure IP at the Region 1 router:

```
enable ip
add ip int=ppp0 ip=192.168.35.114 mask=255.255.255.240
```

For a more detailed example of configuring IP see [“Configuration Examples” on page 14-53 of Chapter 14, Internet Protocol \(IP\)](#).

Bandwidth on Demand

A PPP interface can be configured to use up to two B channels on a Basic Rate ISDN interface, or up to 30 B channels on a Primary Rate ISDN interface, to provide bandwidth on demand. PPP activates channels when the used bandwidth exceeds an upper threshold and deactivates channels when the bandwidth drops below a lower threshold. To configure bandwidth on demand, the ISDN channels are assigned a TYPE of DEMAND when added to the PPP interface. Assigning one channel a type of PRIMARY and other channels a TYPE of DEMAND ensures that there is always one channel available. If all channels are assigned a TYPE of DEMAND, then there are no channels active when there is no traffic; some traffic causes one channel to be activated and continuous traffic causes other channels to be activated. If there is one channel remaining opened, then the IDLE timer determines when this should be closed. In this case, the IDLE timer should not be set to OFF.

This example illustrates how to configure bandwidth on demand between two routers (Figure 9-13 on page 9-43, Table 9-7 on page 9-43).



Some interface and port types mentioned in this example may not be supported on your router. The interface and port types that are available vary depending on your product's model, and whether an expansion unit (PIC, NSM) is installed. For more information, see the AR400 Series Router Hardware Reference.

Figure 9-13: Example configuration for bandwidth on demand

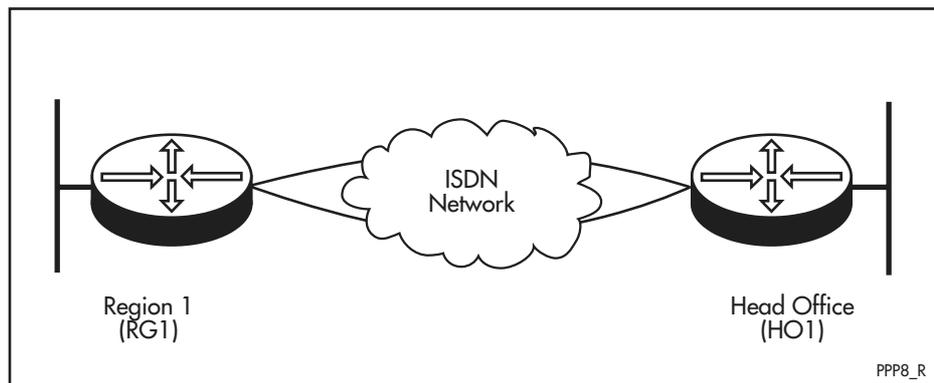
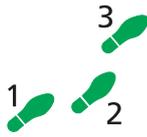


Table 9-7: Example configuration parameters for bandwidth on demand

Site	Region 1	Head Office
Router Name	RG1	HO1
ISDN Number	1234567	9876543
IP Address for PPP0	192.168.35.114	192.168.35.113
IP Address for Eth0	192.168.35.110	192.168.35.45
Subnet Mask	255.255.255.240	255.255.255.240



To configure PPP for bandwidth on demand:

1. Create the ISDN calls.

An ISDN call must be defined on each router so that either router may initiate a call to transfer data. For a more detailed example of creating ISDN calls see [“A Basic ISDN Setup” on page 11-48 of Chapter 11, Integrated Services Digital Network \(ISDN\)](#).

Set the ISDN call profile appropriate for the ISDN service provider. The default profile is the ETSI specification for European Union (EU) countries (ETB for Basic Rate interfaces or ETP for Primary Rate interfaces). To use the Australian Telecom profile, for example, on Basic Rate interface BRI 0 for router HO1 and RG1, use the following command on each router:

```
set q931=bri0 profile=aus
```

On the Head Office router, create calls to the Region 1 router:

```
add isdn call=region1 prec=in outsub=local searchsub=local
number=1234567
add isdn call=demand prec=in outsub=local searchsub=local
number=1234567
```

On the Region 1 router create calls to the Head Office router:

```
add isdn call=region1 prec=out outsub=local
searchsub=local number=9876543
add isdn call=demand prec=out outsub=local searchsub=local
number=9876543
```

2. Create a PPP interface to use the ISDN calls.

Create the PPP interface with one primary channel and one demand channel. The primary channel is created with the IDLE parameter ON (defaults to 60 seconds). The demand channel is added with the TYPE parameter set to DEMAND. On the Head Office router create a PPP interface:

```
create ppp=0 over=isdn-region1 idle=on
add ppp=0 over=isdn-demand type=demand
```

On the Region 1 router create a PPP interface:

```
create ppp=0 over=isdn-region1 idle=on
add ppp=0 over=isdn-demand type=demand
```

3. Configure IP.

Configure a routing module to use the PPP interfaces. It could be IPX, DECnet or bridging but for this example IP is used. Static routes must be defined with on-demand links because a routing protocol would keep a link up continuously. Configure IP at the Head Office router:

```
enable ip
add ip int=ppp0 ip=192.168.35.113 mask=255.255.255.240
add ip route=192.168.35.96 int=ppp0 next=192.168.35.114
met=2
```

Configure IP at the Region 1 router:

```
enable ip
add ip int=ppp0 ip=192.168.35.114 mask=255.255.255.240
add ip route=192.168.35.0 int=ppp0 next=192.168.35.113
met=2 mask=255.255.255.0
add ip route=0.0.0.0 int=ppp0 next=192.168.35.113 met=3
```

For a more detailed example of configuring IP see [“Configuration Examples” on page 14-53 of Chapter 14, Internet Protocol \(IP\)](#).

Bandwidth on Demand with Leased Line Circuits and ISDN

A PPP interface can be configured to use a number of ISDN channels to provide bandwidth on demand. PPP activates channels when the used bandwidth exceeds an upper threshold, and deactivates channels when the bandwidth drops below a lower threshold. To configure bandwidth on demand, the ISDN channels are assigned a TYPE of DEMAND when added to the PPP interface. Assigning one channel a type of PRIMARY and other channels a TYPE of DEMAND ensures that there is always one channel available. If all channels are assigned a TYPE of DEMAND, then there are no channels active when there is no traffic; some traffic causes one channel to be activated and continuous traffic causes other channels to be activated. If there is one channel remaining open, then the IDLE timer determines when this should be closed. In this case, the IDLE timer should not be set to OFF.

This example illustrates how to configure bandwidth on demand between two routers (Figure 9-14 on page 9-45, Table 9-8 on page 9-45).



Some interface and port types mentioned in this example may not be supported on your router. The interface and port types that are available vary depending on your product's model, and whether an expansion unit (PIC, NSM) is installed. For more information, see the AR400 Series Router Hardware Reference.

Figure 9-14: Example configuration for bandwidth on demand with leased line circuits and ISDN

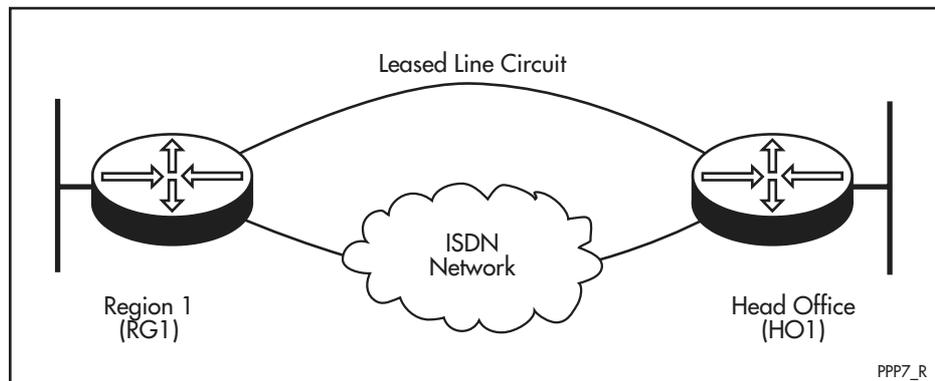
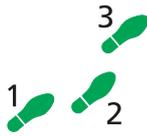


Table 9-8: Example configuration parameters for bandwidth on demand with leased line circuits and ISDN

Site	Region 1	Head Office
Router Name	RG1	HO1
ISDN Number	1234567	9876543
IP Address for PPP0	192.168.35.114	192.168.35.113
IP Address for Eth0	192.168.35.110	192.168.35.45
Subnet Mask	255.255.255.240	255.255.255.240



To configure bandwidth on demand with leased line circuits and ISDN:

1. Create the ISDN calls.

An ISDN call must be defined on each router so that either router may initiate a call to transfer data. For a more detailed example of creating ISDN calls see [“A Basic ISDN Setup” on page 11-48 of Chapter 11, Integrated Services Digital Network \(ISDN\)](#).

Set the ISDN call profile appropriate for the ISDN service provider. The default profile is the ETSI specification for European Union (EU) countries (ETB for Basic Rate interfaces or ETP for Primary Rate interfaces). To use the Australian Telecom profile, for example, on Basic Rate interface BRI 0 for router HO1 and RG1, use the following command on each router:

```
set q931=bri0 profile=aus
```

On the Head Office router, create a call to the Region 1 router:

```
add isdn call=region1 outsub=local searchsub=local prec=in
number=1234567
```

On the Region 1 router create a call to the Head Office router:

```
add isdn call=region1 outsub=local searchsub=local
prec=out number=9876543
```

2. Set up the synchronous interfaces.

The synchronous interfaces on both routers must be set to the same speed as the leased line. For example, for a 9600 baud leased line, the synchronous interfaces must be set to 9600 baud by using the following command on each router:

```
set syn=0 speed=9600
```

The speed of the synchronous interface must be set to correctly match the actual speed of the WAN connection, otherwise the utilisation calculations produce erroneous results.

3. Create a PPP interface to use the ISDN calls.

Create the PPP interfaces to use a leased line and one ISDN channel, and set the thresholds for bandwidth on demand. On the Head Office router create a PPP interface:

```
create ppp=0 over=syn0
add ppp=0 over=isdn-region1 type=demand
set ppp=0 uprate=80 downrate=20
```

On the Region 1 router create a PPP interface:

```
create ppp=0 over=syn0
add ppp=0 over=isdn-region1 type=demand
set ppp=0 uprate=80 downrate=20
```

4. Configure IP.

Configure a routing module to use the PPP interfaces. It could be IPX, DECnet or bridging but for this example IP is used. Static routes must be defined with on-demand links because a routing protocol would keep a link up continuously. Configure IP at the Head Office router:

```
add ip int=ppp0 ip=192.168.35.113 mask=255.255.255.240
add ip route=192.168.35.96 int=ppp0 next=192.168.35.114
met=2
```

Configure IP at the Region 1 router:

```
add ip int=ppp0 ip=192.168.35.114 mask=255.255.255.240
add ip route=192.168.35.0 int=ppp0 next=192.168.35.113
    met=2
add ip route=0.0.0.0 int=ppp0 next=192.168.35.113 met=3
```

For a more detailed example of configuring IP see “[Configuration Examples](#)” on page 14-53 of [Chapter 14, Internet Protocol \(IP\)](#). The command:

```
enable ppp=0 debug=util
```

can be used to see what bandwidth utilisation is being reported and the average utilisation. All values are expressed in hexadecimal. The utilisation is measured every second.

Command Reference

This section describes the commands available on the router to configure and manage the Point-to-Point Protocol on the router. The Point-to-Point Protocol (PPP) can be used on:

- Ethernet (ETH ports)
- Ethernet (VLANs)
- Synchronous links (routers with PIC bay only)
- ISDN calls (see [Chapter 11, Integrated Services Digital Network \(ISDN\)](#)) (routers with PIC bay only)
- ACC calls (see [Chapter 28, Asynchronous Call Control](#)), MIOX circuits (see [Chapter 12, X.25](#))
- L2TP calls (see [Chapter 37, Layer Two Tunnelling Protocol \(L2TP\)](#))
- TDM groups (see [Chapter 32, Time Division Multiplexing \(TDM\)](#)) (routers with PIC bay only)

PPP can be used to carry:

- IP
- compressed data
- encrypted data
- DECnet
- IPX
- AppleTalk routing protocols
- bridged protocols



Some interface and port types mentioned in this chapter may not be supported on your router. The interface and port types that are available vary depending on your product's model, and whether an expansion unit (PIC, NSM) is installed. For more information, see the [AR400 Series Router Hardware Reference](#).

See “Conventions” on page xcv of Preface in the front of this manual for details of the conventions used to describe command syntax. See [Appendix A, Messages](#) for a complete list of messages and their meanings.

activate ppp

Syntax `ACTIVATE PPP=ppp-interface RXPKT=hexstring`

where:

- *ppp-interface* is the PPP interface number, from 0 to 1023.
- *hexstring* is a string of hexadecimal characters.

Description This command creates and sends a PPP packet to the specified PPP interface as if the packet had been received from the lower layer interface, and is intended for diagnostic and testing purposes.

The RXPKT parameter specifies the PPP packet to create and send, as a string of hexadecimal characters. For detailed information about PPP packet formats, see RFC 1661, “*The Point-to-Point Protocol (PPP)*”.



This command is intended for debugging purposes only, and should not be used during normal operation.

Examples To create and send an LCP packet requesting CHAP authentication to PPP interface 1, use the command:

```
ACTIVATE PPP=1 RXPKT=ff03c023012100090305c22305
```

add ppp

Syntax ADD PPP=*ppp-interface* OVER=*physical-interface*
 [AUTHENTICATION={CHAP|EITHER|PAP|NONE}] [AUTHMODE={IN|OUT|INOUT}] [CBDELAY=1..100] [CBMODE={ACCEPT|OFF|REQUEST}] [CBNUMBER=*e164number*]
 [CBOPERATION={E164NUMBER|USERAUTH}]
 [COMPALGORITHM={PREDICTOR|STACLZS}] [COMPRESSION={LINK|OFF}] [CONFIGURE={*value*|CONTINUOUS}] [ECHO={OFF|ON|*period*}] [LQR={ON|OFF|*period*}] [MAGIC={ON|OFF}]
 [MODEM={ON|OFF}] [NUMBER=*number*] [PREDCHECK={CRC16|CRCCITT}] [RECHALLENGE={ON|OFF|360..3600}]
 [RESTART=*time*] [STACCHECK={LCB|SEQUENCE}]
 [TERMINATE={*value*|CONTINUOUS}] [TYPE={DEMAND|PRIMARY|SECONDARY}]

where:

- *ppp-interface* is the PPP interface number, from 0 to 1023.
- *physical-interface* is:
 - ATM (e.g. atm0.1)
 - SYN*n*
 - ISDN-*callname*
 - ACC-*callname*
 - MIOX*n*-*circuitname*
 - TDM-*groupname*
 - TNL-*callname*
 - ETH*n*-*servicename*
 - VLAN*n*-*servicename*
- *servicename* is 1 to 18 characters long and for a PPPoE client, is usually supplied by the ISP providing the service.
- *e164number* is the phone number to dial when performing callback. It may contain digits (0–9) and should be a valid phone number as described in CCITT standard E.164.
- *period* is an integer from 1 to 4294967295.
- *number* is the number of ISDN B channels.

Description This command adds a lower layer interface or link to an existing PPP interface. This configures PPP multilink, which groups links together for increased bandwidth. The following may be added:

- an ATM channel
- a synchronous port
- an ISDN call
- an ACC call
- a MIOX circuit
- TDM group
- an L2TP call

- a PPP over Ethernet service over an ETH interface
- a PPP over Ethernet service over a VLAN interface

The OVER parameter specifies the physical interface over which the PPP interface runs. For PPP over Ethernet and PPP over VLAN links, use the service name provided by your ISP, or the special service name ANY to specify that any service is acceptable.

The AUTHENTICATION parameter specifies the authentication protocol to be used on the physical interface or channel. If CHAP is specified, the Challenge-Handshake Authentication Protocol (CHAP) is used. If PAP is specified, the Password Authentication Protocol (PAP) is used. If EITHER is specified, the router uses the option negotiation process to negotiate the authentication protocol to be used with the device at the remote end of the link, specifying CHAP as the first choice. If NONE is specified, no authentication protocol is used. The default is NONE.

The AUTHMODE parameter specifies how authentication requests to peers are affected by the direction of the call. The AUTHMODE parameter is valid when the AUTHENTICATION parameter is a value other than NONE and the physical interface is a call. When IN is specified, authentication is requested for incoming calls from peers. When OUT is specified, authentication is requested for outgoing calls to peers. When INOUT is specified, authentication is always requested regardless of the direction of the call. The default is INOUT. This parameter is valid for:

- ISDN calls
- ACC calls

The CBDELAY parameter specifies the delay in tenths of a second between bringing down a call for callback and actually making the call back to the peer. This parameter handles different timing requirements of various ISDN switches and is valid for PPP links over ISDN calls and when the callback mode is REQUEST. The default is 1.

The CBMODE parameter specifies whether a callback request is to be made or accepted during the LCP negotiation. If REQUEST is specified, a request is made for callback. If ACCEPT is specified, requests for callback received from the peer are accepted and processed; however, AUTHENTICATION must be set to PAP or CHAP. If OFF is specified, no callback requests are made and callback requests are not accepted. The default is OFF.

The CBNUMBER parameter specifies the number to include when requesting a callback with the CBOPERATION parameter set to E164NUMBER. The number specified should be a phone number as specified in the E.164 standard.

The CBOPERATION parameter specifies the callback operation to be included in the callback request to specify to the peer how to determine the callback number. If USERAUTH is specified, the peer uses the username and password supplied during authentication to look up the callback number. If E164NUMBER is specified, the callback number specified by the CBNUMBER parameter is included in the callback request. The default is USERAUTH.

The COMPALGORITHM parameter specifies the compression algorithm to use when compressing and decompressing PPP packets. If PREDICTOR is specified, the Predictor algorithm is used with type 1 encapsulation as specified in RFC 1978. If STACLZS is specified, the Stac LZS algorithm is used as specified in RFC 1974. The default is STACLZS. This parameter does not apply to L2TP calls.

The COMPRESSION parameter enables compression for the physical interface being added. The default is OFF. The LINK option should only be used when compression is required on the interface being added and not on others. For example, if a PPP multilink uses a compressing modem link and a normal dedicated leased line, COMPRESSION should be set to OFF on the physical interface to which the modem is connected, and LINK for the physical interface to which the dedicated leased line is connected. If compression is required on all physical interfaces of a PPP interface, compression should be enabled by setting the COMPRESSION parameter to ON in the [create ppp command on page 9-55](#), the [create ppp template command on page 9-62](#), [set ppp command on page 9-81](#) or the [set ppp template command on page 9-90](#). This parameter does not apply to L2TP calls.

The CONFIGURE parameter sets the number of configure requests sent before some action is taken. For the LCP the action is to reset the hardware and start again. For all other protocols the action is to give up. The default is CONTINUOUS, which means that requests are sent continuously.

The ECHO parameter specifies whether LCP Echo Request and Echo Reply messages determine link quality. When three consecutive Echo Request messages are transmitted without receiving an Echo Reply response, the link is deemed to be down. If OFF is specified, Echo Request messages are not transmitted. If ON is specified, Echo Request messages are transmitted every 10 seconds. If a period in seconds is specified, Echo Request messages are transmitted at the specified interval. The LQR function has precedence over the ECHO function. They cannot both be enabled at the same time. However, both LQR and ECHO can be ON at the same time if ECHO is turned on first, then LQR.

The LQR parameter sets the LQR timer for link quality management. If ON is specified, LQR is enabled with a default timer of 60 seconds. If a time is specified, LQR is enabled with the timer set to the specified time. If OFF is specified, LQR is disabled. The LQR function has precedence over the ECHO function. They cannot both be enabled at the same time. However, both LQR and ECHO can be ON at the same time if ECHO is turned on first. The default is ON.

The MAGIC parameter enables or disables negotiation of the magic number option. The default is ON. The magic number is used to determine whether an interface is looped back. The interface does not reach an open state when there is a loopback.

The MODEM parameter specifies the state of synchronous modem control. The default is OFF. If ON is specified, the router manipulates the DTR signal to trigger the modem to make a call whenever there is traffic (IDLE=ON) or when a backup link is required (TYPE=SECONDARY). Raising DTR to the modem triggers the modem to initiate a call to the modem at the other end of the link and enter data transfer mode. The router keeps the DTR signal to the modem raised, and responds to the modem raising the DSR signal by activating the PPP interface. This parameter is valid when the OVER parameter specifies a synchronous interface.

The NUMBER parameter specifies the number of physical interfaces to be added. This parameter is valid when the OVER parameter specifies an ISDN call as the physical interface. The default is 1.

The PREDCHECK parameter specifies the type of CRC to be used for Predictor compression. The Predictor RFC specifies using CRC-16, however some router manufacturers have implemented Predictor with CRC-CCITT that is the CRC specified in RFC 1662, "PPP in HDLC-link Framing". This value is not negotiated so the same value needs to be configured at both ends of the link for Predictor compression to work correctly. This parameter does not apply to L2TP calls.

The RECHALLENGE parameter specifies if the CHAP rechallenge function is ON, OFF, or the maximum rechallenge period. PPP calculates a random period for the CHAP rechallenge between the maximum rechallenge period and a minimum of 5 minutes. If ON is specified, then CHAP rechallenges take place with a maximum rechallenge period of 15 minutes. If OFF is specified, then CHAP rechallenges do not take place. If a time is specified, then the time, which is between 360 and 3600 seconds, is used as the upper limit on the rechallenge time calculation. The default is ON.

The RESTART parameter specifies the time between successive retransmissions of unacknowledged configure requests or terminate requests. The default is 3 seconds.

The STACCHECK parameter specifies the check mode to used for the Stac LZS compression algorithm. If SEQUENCE is specified an incrementing sequence number is used to determine whether a packet has been lost and therefore whether the compression history needs to be reset. If LCB is specified an LCB value is used to determine if an error has occurred in a packet. The default is SEQUENCE. This parameter does not apply to L2TP calls.

The TERMINATE parameter sets the number of terminate requests sent when trying to close a link before it is assumed the link is down. The default is 2. The CONTINUOUS option specifies that requests be sent continuously.

The TYPE parameter specifies the role of the physical interface for bandwidth on demand and link backup. The default is PRIMARY. If PRIMARY is specified, the link is open all the time (IDLE=OFF) or open whenever there is traffic (IDLE=ON). If SECONDARY is specified, the link is open when the associated primary link fails. If DEMAND is specified, the link is open when additional bandwidth is required.

Examples To add Ethernet interface 0 as an additional physical interface to PPP interface 1, and enable STAC LZS compression on the synchronous link with a check mode of LCB, use the command:

```
ADD PPP=1 OVER=ETH0-any COMP=LINK STACCHECK=LCB
```

To add ISDN call 'demand' as an additional physical interface to PPP interface 1, and enable STAC LZS compression on the link with a check mode of LCB, use the command:

```
ADD PPP=1 OVER=ISDN-demand COMPRESSION=LINK STACCHECK=LCB
```

To add a PPPoE interface on VLAN2, using the service name ANY, as an additional physical interface to PPP interface 1, and enable STAC LZS compression of the synchronous link with a check mode of LCB, use the command:

```
ADD PPP=1 OVER=vlan2-any COMPRESSION=LINK STACCHECK=LCB
```

Related Commands

- [add ppp acservice](#)
- [create ppp](#)
- [delete ppp](#)
- [delete ppp acservice](#)
- [set ppp](#)
- [show ppp](#)

add ppp acservice

Syntax `ADD PPP ACSERVICE=service-name TEMPLATE=ppp-template
[ACRADIUS={OFF|ON}] [MAXSESSIONS=1..512] [VLAN={NONE|
0..4094}]`

where:

- *service-name* is a character string of up to 18 characters. *service-name* should not be “any”.
- *template* is a number from 0 to 31.

Description This command adds a new PPP over Ethernet Access Concentrator service to the router. PPPoE hosts are able to connect to the router using this service.

The ACSERVICE parameter specifies the name of the new PPPoE service that is to be added.

The TEMPLATE parameter specifies the PPP template to use when creating a dynamic PPP over Ethernet interface. The specified template must exist. See [“Templates” on page 9-18](#) for more information about creating PPP templates.

The MAXSESSIONS parameter specifies the maximum number of PPPoE sessions that are allowed to simultaneously provide the PPPoE service. The default is 1.

The ACRADIUS parameter specifies whether PPPoE hosts are authenticated by a RADIUS server using the host’s MAC address. If OFF is specified, the RADIUS authentication is not performed. If ON is specified, the RADIUS authentication is performed. The default is OFF.



RADIUS authentication is performed only if it is specified by the template associated with this PPPoE service.

The VLAN parameter specifies which VLAN the service is offered on. If a VLAN identification is specified, the service is offered on that VLAN and not on any Ethernet ports. If NONE is specified, the service is not offered on any VLANs, but is offered on Ethernet ports. A service can be offered on several VLANs, but it is necessary to issue one ADD PPP ACSERVICE command for each VLAN. For example:

```
ADD PPP ACSERVICE=bob TEMPLATE=1 VLAN=5
ADD PPP ACSERVICE=bob TEMPLATE=1 VLAN=12
```

To offer the service on Ethernet interfaces only, there is no need to use the VLAN parameter as it defaults to NONE.

Examples To add a new PPPoE Access Concentrator service named armadillo to be offered using template 5 with a maximum of 10 simultaneous sessions and no RADIUS authentication, use the command:

```
ADD PPP ACSERVICE=armadillo TEMPLATE=5 MAXSESSIONS=10
```

Related Commands

- create ppp
- create ppp template
- delete ppp acservice
- destroy ppp template
- disable ppp accessconcentrator
- enable ppp accessconcentrator
- set ppp acservice

create ppp

Syntax CREATE PPP=*ppp-interface* OVER=*physical-interface*
 [AUTHENTICATION={CHAP|EITHER|PAP|NONE}] [AUTHMODE={IN|OUT|INOUT}] [BAP={ON|OFF}] [BAPMODE={CALL|CALLBACK}]
 [CBDELAY=1..100] [CBMODE={ACCEPT|OFF|REQUEST}]
 [CBNUMBER=*e164number*] [CBOPERATION={E164NUMBER|USERAUTH}] [COMPALGORITHM={PREDICTOR|STACLZS}]
 [COMPRESSION={ON|OFF|LINK}] [CONFIGURE={*value*|CONTINUOUS}] [DEBUGMAXBYTES=16..256]
 [DESCRIPTION=*description*] [DOWNRATE=0..100]
 [DOWNTIME=*time*] [ECHO={ON|OFF|*period*}] [ENCRYPTION={ON|OFF}] [FRAGMENT={ON|OFF}] [FRAGOVERHEAD=0..100]
 [IDLE={ON|OFF|*time*}] [INDATALIMIT={NONE|1..65535}]
 [IPPOOL={*pool-name*|NONE}] [IPREQUEST={ON|OFF}]
 [LQR={ON|OFF|*period*}] [MAGIC={ON|OFF}] [MODEM={ON|OFF}]
 [MRU={ON|OFF|256..1656}] [NULLFRAGTIMER=*time*]
 [NUMBER=*number*] [ONLINELIMIT={NONE|1..65535}]
 [OUTDATALIMIT={NONE|1..65535}] [PASSWORD=*password*]
 [PREDCHECK={CRC16|CRCCITT}] [RECHALLENGE={ON|OFF|360..3600}] [RESTART=*time*] [STACCHECK={LCB|SEQUENCE}]
 [STARENTITY=1..255] [TERMINATE={*value*|CONTINUOUS}]
 [TOTALDATALIMIT={NONE|1..65535}] [TYPE={DEMAND|PRIMARY|SECONDARY}] [UPRATE=0..100] [UPTIME=*time*]
 [USERNAME=*username*]

where:

- *ppp-interface* is the PPP interface number, from 0 to 1023.



The maximum number of PPP interfaces that can be created depends on the available memory (RAM) on the router. When the number of available buffers falls below buffer level 2, the command fails and an error is displayed. To see the number of available buffers, use the [show buffer](#) command on page 1-131 of Chapter 1, Operation.

- *physical-interface* is:
 - ATM (e.g. atm0.1)
 - SYN*n*
 - ISDN-*callname*
 - ACC-*callname*
 - MIOX*n*-*circuitname*
 - TDM-*groupname*
 - TNL-*callname* (L2TP tunnel)
 - ETH*n*-*servicename*
 - VLAN*n*-*servicename*
- *e164number* is the phone number to dial when performing callback. It may contain digits (0–9) and should be a valid phone number as described in CCITT standard E.164.
- *value* is a retry threshold.

- *description* is a character string 1 to 70 characters long. Valid characters are any printable character.
- *time* is a timer value in seconds.
- *period* is an integer from 1 to 4294967295.
- *pool-name* is a character string, 1 to 15 characters long. Valid characters are any printable characters. If *pool-name* contains spaces, it must be in double quotes.
- *number* is the number of ISDN B channels.
- *password* is the password to use for authentication 1 to 64 characters long. It may contain any printable character and is case sensitive.
- *username* is the username to use for authentication 1 to 64 characters long. It may contain any printable character and is case sensitive.

Description This command creates the specified PPP interface running over:

- an ATM channel
- a synchronous port
- an ISDN call
- an ACC call
- a MIOX circuit
- TDM group
- an L2TP call
- a PPP over Ethernet service
- a PPP over Ethernet service over a VLAN interface

For PPP over Ethernet and PPP over VLAN links, use the service name provided by your ISP, or the special service name ANY to specify that any service is acceptable.

PPP interfaces are enabled automatically when they are created.

The OVER parameter specifies the physical interface over which the PPP interface runs. Additional physical interfaces can be added to the PPP interface using the [add ppp command on page 9-49](#).

The AUTHENTICATION parameter specifies the authentication protocol to be used on the physical interface or channel. If CHAP is specified, the Challenge-Handshake Authentication Protocol (CHAP) is used. If PAP is specified, the Password Authentication Protocol (PAP) is used. If EITHER is specified, the router uses the option negotiation process to negotiate the authentication protocol to be used with the device at the remote end of the link, specifying CHAP as the first choice. If NONE is specified, no authentication protocol is used. The default is NONE.

The AUTHMODE parameter specifies how authentication requests to peers are affected by the direction of the call. The AUTHMODE parameter is valid when the AUTHENTICATION parameter is set to a value other than NONE and the physical interface is a call. If IN is specified, authentication is requested for incoming calls from peers. If OUT is specified, authentication is requested for outgoing calls to peers. If INOUT is specified, authentication is always requested regardless of the direction of the call. The default is INOUT. This parameter is valid for:

- ISDN calls
- ACC calls

The BAP parameter specifies whether the Bandwidth Allocation Protocol is used for negotiating the activation of demand PPP links. The default is ON.

The BAPMODE parameter specifies which peer originates another link to add to the multilink bundle. For CALLBACK mode, the number to call must be configured on the call at the lower layer (ISDN, ACC, MIOX, L2TP). The default is CALL.

The CBDELAY parameter specifies the delay, in tenths of a second, between bringing down a call for callback and actually making the call back to the peer. This parameter handles different timing requirements of various ISDN switches and is valid for PPP links over ISDN calls and when the callback mode is REQUEST. The default is 1.

The CBMODE parameter specifies whether a callback request is to be made or accepted during the LCP negotiation. If REQUEST is specified, a request is made for callback. If ACCEPT is specified, requests for callback received from the peer are accepted and processed; however, AUTHENTICATION must be set to PAP or CHAP. If OFF is specified, no callback requests are made and callback requests are not accepted. The default is OFF.

The CBNUMBER parameter specifies the number to include when requesting a callback with the CBOPERATION parameter set to E164NUMBER. The number specified should be a phone number as specified in the E.164 standard.

The CBOPERATION parameter specifies the callback operation to be included in the callback request to specify to the peer how to determine the callback number. If USERAUTH is specified, the peer uses the username and password supplied during authentication to look up the callback number. If E164NUMBER is specified, the callback number specified by the CBNUMBER parameter is included in the callback request. The default is USERAUTH.

The COMPALGORITHM parameter specifies the compression algorithm to use when compressing and decompressing PPP packets. If PREDICTOR is specified the Predictor algorithm is used with type 1 encapsulation as specified in RFC 1978. If STACLZS is specified the Stac LZS algorithm is used as specified in RFC 1974. The default is STACLZS. This parameter does not apply to L2TP calls.

The COMPRESSION parameter enables or disables the use of compression for the interface. When used with multilink, setting COMPRESSION to ON compresses packets before they are sent to individual links. Setting COMPRESSION to LINK enables compression for the link specified by the OVER parameter. The default is OFF. The LINK option should be used only when compression is required on some physical interfaces and not on others. For example, if a PPP multilink uses a compressing modem link and a normal dedicated leased line, COMPRESSION should be set to OFF on the physical

interface to which the modem is connected, and LINK for the physical interface to which the dedicated leased line is connected. If compression is required on all physical interfaces of a PPP interface, the COMPRESSION parameter should be set to ON. This parameter does not apply to L2TP calls.

The CONFIGURE parameter sets the number of configure requests sent before some action is taken. For the LCP the action is to reset the hardware and start again. For all other protocols the action is to give up. The default is CONTINUOUS, which means that requests are sent continuously.

The DEBUGMAXBYTES parameter specifies the maximum number of bytes that are displayed for each packet when the CTRLPKT, DATAPKT, PACKET, and PKT debug options are enabled. The default is 60.

The DESCRIPTION parameter specifies a user-defined description for the interface, to make it easier to distinguish between a number of PPP interfaces.

The DOWNTIME parameter specifies the time, in seconds, that the PPP interface must have a total utilisation (as a percentage) below the threshold specified by the DOWNRATE parameter, before a channel is closed. The default is 60 for DOWNTIME and 20 for DOWNRATE. The UPRATE, UPTIME, DOWNRATE and DOWNTIME parameters are used with the TYPE parameter to configure bandwidth on demand.

The ECHO parameter specifies whether LCP Echo Request and Echo Reply messages are used to determine link quality. If three consecutive Echo Request messages are transmitted without receiving an Echo Reply response, the link is deemed to be down. If OFF is specified, Echo Request messages are not transmitted. If ON is specified, Echo Request messages are transmitted every 10 seconds. If a period in seconds is specified, Echo Request messages are transmitted at the specified interval. The LQR function has precedence over the ECHO function. They cannot both be enabled at the same time. However, both LQR and ECHO can be ON at the same time if ECHO is turned on first.

The ENCRYPTION parameter enables or disables the use of encryption for the interface. The default is OFF.

The FRAGMENT parameter applies to a multilink bundle interface and determines whether packets are fragmented. The default is OFF. Fragmentation cannot be enabled if compression or encryption are configured.

The FRAGOVERHEAD parameter specifies the maximum allowable overhead, as a percentage, for fragmenting packets using the variable fragmentation scheme for multilink PPP. If this limit is exceeded for any packet, the packet is fragmented using the fixed fragmentation scheme. The default is 5. The variable fragmentation scheme spreads the packet over all the links in the multilink bundle by splitting the packet into variable sized fragments to match the speed of individual links. Larger fragments are transmitted over faster links, thereby providing an inherent load balancing scheme. The fixed fragmentation scheme spreads the packet over all the links in the multilink bundle by splitting the packet into equal fixed sized fragments. If the number of links is large and the packet is relatively small a fragment is not transmitted over every link.

The IDLE parameter controls the dial-on-demand feature. If ON is specified, dial-on-demand is enabled with a default timer of 60 seconds. If a time is specified, dial-on-demand is enabled with the timer set to the specified time. If OFF is specified, dial-on-demand is disabled. When the dial-on-demand feature is activated, PPP brings up the link when there is traffic to be sent, and

takes down the link when there has been no traffic for the specified timer period. The effect on a PPP interface using an on-demand call is to connect the call when traffic is to be sent and disconnect the call when no traffic has been sent or received for the specified time period. For leased lines, this parameter has no effect, as the links are always connected. The default is OFF.

The INDATALIMIT parameter specifies the input data threshold, in megabytes, for the PPP interface. When the interface's cumulative input data counter exceeds this limit, the link is closed and any further attempts to open the link fails. If the input data counter for the interface is cleared with the [reset ppp command on page 9-80](#), the link can be reopened. The default is NONE, which sets no threshold.

The IPPOOL parameter specifies the IP pool to use to allocate IP addresses for the remote end of the PPP connection. If NONE is specified, IP addresses are not allocated from an IP pool. The default is NONE. See ["IP Address Pools" on page 14-51 of Chapter 14, Internet Protocol \(IP\)](#) for more information about creating IP address pools.

The IPREQUEST parameter specifies whether a request is to be made for an IP address to be allocated by the peer during the IPCP negotiation. If ON is specified, a request is made. If OFF is specified, a request is not specified. The default is OFF.

The LQR parameter sets the LQR timer for link quality management. If ON is specified, LQR is enabled with a default timer of 60 seconds. If a time is specified, LQR is enabled with the timer set to the specified time. If OFF is specified, LQR is disabled. The LQR function has precedence over the ECHO function. They cannot both be enabled at the same time. However, both LQR and ECHO can be ON at the same time if ECHO is turned on first, then LQR. The default is ON.

The MAGIC parameter enables or disables negotiation of the magic number option. The default is ON. The magic number is used to determine if a interface is looped back. The interface does not reach an open state when there is a loopback.

The MODEM parameter specifies the state of synchronous modem control. The default is OFF. If ON is specified, the router manipulates the DTR signal to trigger the modem to make a call whenever there is traffic (IDLE=ON) or when a backup link is required (TYPE=SECONDARY). Raising DTR to the modem triggers the modem to initiate a call to the modem at the other end of the link and enter data transfer mode. The router keeps the DTR signal to the modem raised, and responds to the modem raising the DSR signal by activating the PPP interface. This parameter is valid when the OVER parameter specifies a synchronous interface.

The MRU parameter specifies whether the MRU (Maximum Receive Unit) option is included, and what value is sent in LCP configuration requests while bringing up this interface. If OFF is specified, the MRU option is omitted. If a decimal value is specified, the transmitted MRU option is set to this value. If ON is specified, the MRU is calculated normally. The default is ON.

The NULLFRAGTIMER parameter specifies the maximum time, in seconds, a link in a multilink bundle may be idle before a NULL fragment is transmitted over the link. NULL fragments are used to keep the last sequence number transmitted over the link up to date. The default is 3.

The NUMBER parameter specifies the number of physical interfaces to be created. This parameter is valid when the OVER parameter specifies an ISDN call as the physical interface. The default is 1.

The ONLINELIMIT parameter specifies the up-time threshold, in hours, for the PPP interface. When the interface's cumulative up-time counter exceeds this limit, the link is closed and any further attempts to open the link fails. If the up-time counter for the interface is cleared with the [reset ppp command on page 9-80](#), the link can be reopened. The default is NONE, which sets no threshold.

The OUTDATALIMIT parameter specifies the output data threshold, in megabytes, for the PPP interface. When the interface's cumulative output data counter exceeds this limit, any further attempts to open the link fail. If the output data counter for the interface is cleared with the [reset ppp command on page 9-80](#), the link can be reopened. The default is NONE, which sets no threshold.

The PASSWORD parameter specifies the password to use when the peer requests authentication using either CHAP or PAP. This is normally required for network lines between routers, for which an authentication protocol has been selected with the AUTHENTICATION parameter.

The PREDCHECK parameter specifies the type of CRC to be used for Predictor compression. The Predictor RFC specifies using CRC-16, however some router manufacturers have implemented Predictor with CRC-CCITT, which is the CRC specified in RFC 1662, "PPP in HDLC-link Framing". This value is not negotiated so the same value needs to be configured at both ends of the link for Predictor compression to work correctly. This parameter does not apply to L2TP calls.

The RECHALLENGE parameter specifies if the CHAP rechallenge function is on, off or the maximum rechallenge period. PPP calculates a random period for the CHAP rechallenge between the maximum rechallenge period and a minimum of 5 minutes. If ON is specified, the CHAP rechallenges take place with a maximum rechallenge period of 15 minutes. If OFF is specified, then CHAP rechallenges do not take place. If a time is specified, then the time, which is between 360 and 3600 seconds, is used as the upper limit on the rechallenge time calculation. The default is ON.

The RESTART parameter specifies the time between successive retransmissions of unacknowledged configure requests or terminate requests. The default is 3 seconds.

The STACCHECK parameter specifies the check mode to used for the Stac LZS compression algorithm. If SEQUENCE is specified an incrementing sequence number is used to determine whether a packet has been lost and therefore whether the compression history needs to be reset. If LCB is specified an LCB value is used to determine if an error has occurred in a packet. The default is SEQUENCE. This parameter does not apply to L2TP calls.

The STARENTITY parameter specifies the star entity and the encryption algorithm to be used by the encryption channel configured by the PPP interface. This parameter must be specified if PPP encryption is enabled.

The TERMINATE parameter sets the number of terminate requests sent when trying to close a link before it is assumed the link is down. The default is 2. The CONTINUOUS option specifies that requests be sent continuously.

The `TOTALDATALIMIT` parameter sets the total data throughput threshold, in megabytes, for the PPP interface. When the interface's cumulative total data counter exceeds this limit, the link is closed and any further attempts to open the link fail. If the total data counter for the interface is cleared with the [reset ppp command on page 9-80](#), the link can be reopened. The default is `NONE`, which corresponds to no threshold.

The `TYPE` parameter specifies the role of the physical interface for bandwidth on demand and link backup. The default is `PRIMARY`. If `PRIMARY` is specified, the link is open all the time (`IDLE=OFF`) or open whenever there is traffic (`IDLE=ON`). If `SECONDARY` is specified, the link is open when the associated primary link fails. If `DEMAND` is specified, the link is open when additional bandwidth is required.

The `UPTIME` parameter specifies the time, in seconds, that the PPP interface must have a total utilisation (as a percentage) above the threshold specified by the `UPRATE` parameter, before an additional channel is opened. The default is 30 for `UPTIME` and 80 for `UPRATE`. The `UPRATE`, `UPTIME`, `DOWNRATE` and `DOWNTIME` parameters are used with the `TYPE` parameter to configure bandwidth on demand.

The `USERNAME` parameter specifies the username to be used when generating PAP authentication requests and when responding to CHAP authentication challenges. If the `USERNAME` is not set, the router's system name is used by default.



For security reasons, this command is accepted only if the user has Security Officer privilege.

Examples To create PPP interface 0 with two on-demand channels over the ISDN call "ISDN-Region1", use the command:

```
CREATE PPP=0 OVER=ISDN-Region1 IDLE=ON NUM=2 TYPE=DEMAND
```

To create PPP interface 0 over a PPPoE client session over a VLAN interface with ID 2, using a service named "access", use the command:

```
CREATE PPP=0 OVER=vlan2-access
```

Related Commands

- [add ppp](#)
- [delete ppp](#)
- [delete ppp acservice](#)
- [disable ppp](#)
- [enable ppp](#)
- [reset ppp](#)
- [set ppp](#)
- [show ppp](#)
- [show ppp config](#)
- [show ppp limits](#)

create ppp template

Syntax CREATE PPP TEMPLATE=*template* [COPY=*template*]
 [AUTHENTICATION={CHAP|EITHER|PAP|NONE}] [BAP={ON|OFF}]
 [BAPMODE={CALL|CALLBACK}] [CBDELAY=1..100]
 [CBMODE={ACCEPT|OFF|REQUEST}] [CBNUMBER=*e164number*]
 [CBOPERATION={E164NUMBER|USERAUTH}]
 [COMPALGORITHM={PREDICTOR|STACLZS}] [COMPRESSION={ON|OFF|LINK}] [DEBUGMAXBYTES=16..256]
 [DESCRIPTION=*description*] [DOWNRATE=0..100]
 [DOWNTIME=*time*] [ECHO={ON|OFF|*period*}] [ENCRYPTION={ON|OFF}] [FRAGMENT={ON|OFF}] [FRAGOVERHEAD=0..100]
 [IDLE={ON|OFF|*time*}] [INDATALIMIT={NONE|1..65535}]
 [IPPOOL={*pool-name*|NONE}] [IPREQUEST={ON|OFF}]
 [LOGIN={ALL|RADIUS|TACACS|USER}] [LQR={ON|OFF|*period*}]
 [MAGIC={ON|OFF}] [MAXLINKS=1..64] [MRU={ON|OFF|256..1656}] [MTU=256..1500|256..1492] [MULTILINK={ON|OFF}] [NULLFRAGTIMER=*time*] [ONLINELIMIT={NONE|1..65535}] [OUTDATALIMIT={NONE|1..65535}] [PASSWORD=*password*] [PREDCHECK={CRC16|CRCCITT}] [RECHALLENGE={ON|OFF|360..3600}] [RESTART=*time*] [STACHECK={LCB|SEQUENCE}] [STARENTITY=1..255] [TERMINATE={*value*|CONTINUOUS}] [TOTALDATALIMIT={NONE|1..65535}] [UPRATE=0..100] [UPTIME=*time*] [USERNAME=*username*]

where:

- *template* is a number from 0 to 31.
- *e164number* is the phone number to dial when performing callback. It may contain digits (0–9) and should be a valid phone number as described in CCITT standard E.164.
- *description* is a character string 1 to 70 characters long. Valid characters are any printable character.
- *period* is an integer from 1 to 4294967295.
- *time* is a timer value in seconds.
- *pool-name* is a character string 1 to 15 characters long. Valid characters are any printable characters. If *pool-name* contains spaces, it must be in double quotes.
- *password* is the password to use for authentication 1 to 64 characters long. It may contain any printable character, and is case sensitive.
- *value* is a retry threshold.
- *username* is the username to use for authentication 1 to 64 characters long. It may contain any printable character, and is case sensitive.

Description This command creates a PPP template that is used to configure dynamic PPP interfaces. The PPP interface is created when one of the following is activated:

- ISDN call
- ACC call
- L2TP call
- PPP over Ethernet service

The **TEMPLATE** parameter specifies the number of the template to create. The specified template must not already exist.

The **AUTHENTICATION** parameter specifies the authentication protocol to be used on the physical interface or channel. If **CHAP** is specified, the Challenge-Handshake Authentication Protocol (CHAP) is used. If **PAP** is specified, the Password Authentication Protocol (PAP) is used. If **EITHER** is specified, the router uses the option negotiation process to negotiate the authentication protocol to be used with the device at the remote end of the link, specifying **CHAP** as the first choice. If **NONE** is specified, no authentication protocol is used. The default is **NONE**.

The **BAP** parameter specifies whether the Bandwidth Allocation Protocol is used for negotiating the activation of demand PPP links. The default is **ON**.

The **BAPMODE** parameter specifies which peer originates another link to add to the multilink bundle. For **CALLBACK** mode, the number to call must be configured on the call at the lower layer (**ISDN**, **ACC**, **L2TP**). The default is **CALL**.

The **CBDELAY** parameter specifies the delay, in tenths of a second, between bringing down a call for callback and actually making the call back to the peer. This parameter is used to handle the different timing requirements, for example of various **ISDN** switches, and is valid when the callback mode is **REQUEST**. The default is **1**.

The **CBMODE** parameter specifies whether a callback request is to be made or accepted during the LCP negotiation. If **REQUEST** is specified, a request is made for callback. If **ACCEPT** is specified, requests for callback received from the peer are accepted and processed; however, **AUTHENTICATION** must be set to **PAP** or **CHAP**. If **OFF** is specified, no callback requests are made and callback requests are not accepted. The default is **OFF**.

The **CBNUMBER** parameter specifies the number to include when requesting a callback with the **CBOPERATION** parameter set to **E164NUMBER**. The number specified should be a phone number as specified in the E.164 standard.

The **CBOPERATION** parameter specifies the callback operation to be included in the callback request to specify to the peer how to determine the callback number. If **USERAUTH** is specified, the peer uses the username and password supplied during authentication to look up the callback number. If **E164NUMBER** is specified, the callback number specified by the **CBNUMBER** parameter is included in the callback request. The default is **USERAUTH**.

The **COMPALGORITHM** parameter specifies the compression algorithm to use when compressing and decompressing PPP packets. If **PREDICTOR** is specified the Predictor algorithm is used with type 1 encapsulation as specified in RFC 1978. If **STACLZS** is specified, the Stac LZS algorithm is used as specified in RFC 1974. The default is **STACLZS**. This parameter does not apply to **L2TP** calls.

The **COMPRESSION** parameter enables or disables the use of compression for the interface. When used with multilink, setting **COMPRESSION** to **ON** compresses the packets before they are sent to the individual links. Setting **COMPRESSION** to **LINK** enables compression for the link specified by the **OVER** parameter. The default is **OFF**. The **LINK** option should be used when compression is required on some physical interfaces and not on others. For example, if a PPP multilink uses a compressing modem link and a normal dedicated leased line, **COMPRESSION** should be set to **OFF** on the physical

interface to which the modem is connected, and LINK for the physical interface to which the dedicated leased line is connected. If compression is required on all physical interfaces of a PPP interface, the COMPRESSION parameter should be set to ON. This parameter does not apply to L2TP calls.

The COPY parameter specifies the name of an existing template to copy as the defaults for this template. Any other parameters modify the copy.

The DEBUGMAXBYTES parameter specifies the maximum number of bytes that are displayed for each packet when the CTRLPKT, DATAPKT, PACKET, and PKT debug options are enabled. The default is 60.

The DESCRIPTION parameter specifies a user-defined description for the interface, to make it easier to distinguish between a number of PPP interfaces.

The DOWNTIME parameter specifies the time, in seconds, that the PPP interface must have a total utilisation (as a percentage) below the threshold specified by the DOWNRATE parameter, before a channel is closed. The default is 60 for DOWNTIME and 20 for DOWNRATE. The UPRATE, UPTIME, DOWNRATE and DOWNTIME parameters are used with the TYPE parameter to configure bandwidth on demand.

The ECHO parameter specifies whether LCP Echo Request and Echo Reply messages are used to determine link quality. If three consecutive Echo Request messages are transmitted without receiving an Echo Reply response, the link is deemed to be down. If OFF is specified, Echo Request messages are not transmitted. If ON is specified, Echo Request messages are transmitted every 10 seconds. If a period in seconds is specified, Echo Request messages are transmitted at the specified interval. The LQR function has precedence over the ECHO function. They cannot both be enabled at the same time. However, both LQR and ECHO can be ON at the same time if ECHO is turned on first, then LQR.

The ENCRYPTION parameter enables or disables the use of encryption for the interface. The default is OFF.

The FRAGMENT parameter applies to a multilink bundle interface, and determines whether packets are fragmented. The default is OFF. Fragmentation cannot be enabled when compression or encryption are configured.

The FRAGOVERHEAD parameter specifies the maximum allowable overhead, as a percentage, for fragmenting packets using the variable fragmentation scheme for multilink PPP. If this limit is exceeded for any packet, the packet is fragmented using the fixed fragmentation scheme. The default is 5. The variable fragmentation scheme spreads the packet over all the links in the multilink bundle by splitting the packet into variable sized fragments to match the speed of individual links. Larger fragments are transmitted over faster links, thereby providing an inherent load balancing scheme. The fixed fragmentation scheme spreads the packet over all the links in the multilink bundle by splitting the packet into equal fixed sized fragments. If the number of links is large and the packet is relatively small a fragment is not transmitted over every link.

The IDLE parameter controls the dial-on-demand feature. If ON is specified, dial-on-demand is enabled with a default timer of 60 seconds. If a time is specified, dial-on-demand is enabled with the timer set to the specified time. If OFF is specified, dial-on-demand is disabled. When the dial-on-demand feature is activated, PPP brings up the link when there is traffic to be sent, and

takes down the link when there has been no traffic for the specified timer period. The effect on a PPP interface using an on-demand call is to connect the call when traffic is to be sent and disconnect the call when no traffic has been sent or received for the specified timer period. For leased lines, this parameter has no effect, as the links are always connected. The default is OFF.

The INDATALIMIT parameter specifies the input data threshold, in megabytes, for the PPP interface. When the interface's cumulative input data counter exceeds this limit, the link is closed and any further attempts to open the link fails. If the input data counter for the interface is cleared with the [reset ppp command on page 9-80](#), the link can be reopened. The default is NONE, which sets no threshold.

The IPPOOL parameter specifies the IP pool to use to allocate IP addresses for dynamic dial-in PPP connections. If NONE is specified, IP addresses are not allocated from an IP pool. The default is NONE. See ["IP Address Pools" on page 14-51 of Chapter 14, Internet Protocol \(IP\)](#) for more information about creating IP address pools.

The IPREQUEST parameter specifies whether a request is to be made for an IP address to be allocated by the peer during the IPCP negotiation. If ON is specified, a request is made. If OFF is specified, a request is not specified. The default is OFF.

The LOGIN parameter specifies which login procedure the call creating this dynamic interface must use when it is activated. If RADIUS is specified, the router sends requests to the configured RADIUS server(s) to authenticate the call. If TACACS is specified, the router sends requests to the configured TACACS server(s) to authenticate the call. If USER is specified, the router checks the User Authentication Database to authenticate the call. If ALL is specified, the router tries all methods to authenticate the call.

The LQR parameter sets the LQR timer for link quality management. If ON is specified, LQR is enabled with a default timer of 60 seconds. If a time is specified, LQR is enabled with the timer set to the specified time. If OFF is specified, LQR is disabled. The LQR function has precedence over the ECHO function. They cannot both be enabled at the same time. However, both LQR and ECHO can be ON at the same time if ECHO is turned on first, then LQR. The default is ON.

The MAGIC parameter enables or disables negotiation of the magic number option. The default is ON. The magic number determines if an interface is looped back. The interface does not reach an open state when there is a loopback.

The MAXLINKS parameter specifies the maximum number of links allowed in a multilink PPP interface created using this template. The default is 2.



When using the MAXLINKS parameter without BAP, a link is brought up fully before being checked. If the remote station is configured to bring up more links than the local station can accept, links may be brought up and torn down repeatedly. Therefore, to stop this situation occurring, also implement BAP when MAXLINKS is implemented.

The MRU parameter specifies whether the MRU (Maximum Receive Unit) option is included, and what value is sent in LCP configuration requests while bringing up this interface. If OFF is specified, the MRU option is omitted. If a

decimal value is specified, the transmitted MRU option is set to this value. If ON is specified, the MRU is calculated normally. The default is ON.

The MTU parameter specifies the value of the maximum transmission unit. The allowable MTU values for the PPP lower layers are shown in [Figure 9-9 on page 9-66](#).

Table 9-9: Allowable MTU values

Interface	Minimum MTU	Maximum MTU	Default MTU
PPP (except over Ethernet)	256	1500	1500
PPP over Ethernet	256	1492	1492



For normal operations do not change the default MTU values.

The MULTILINK parameter specifies whether incoming dynamic PPP calls using this template are multilinked together. If ON is specified, incoming dynamic PPP calls from the same peer and with the same authentication information are multilinked together. If OFF is specified, incoming dynamic PPP calls are not multilinked under any circumstances. The default is ON.

The NULLFRAGTIMER parameter specifies the maximum time, in seconds, a link in a multilink bundle may be idle before a NULL fragment is transmitted over the link. NULL fragments are used to keep the last sequence number transmitted over the link up to date. The default is 3.

The ONLINELIMIT parameter specifies the up-time threshold, in hours, for the PPP interface. When the interface's cumulative up-time counter exceeds this limit, the link is closed and any further attempts to open the link fail. If the up-time counter for the interface is cleared with the [reset ppp command on page 9-80](#), the link can be reopened. The default is NONE, which sets no threshold.

The OUTDATA LIMIT parameter specifies the output data threshold, in megabytes, for the PPP interface. When the interface's cumulative output data counter exceeds this limit, any further attempts to open the link fail. If the output data counter for the interface is cleared with the [reset ppp command on page 9-80](#), the link can be reopened. The default is NONE, which sets no threshold.

The PASSWORD parameter specifies the password to use when the peer requests authentication using either CHAP or PAP. This is normally required for network lines between routers, for which an authentication protocol has been selected with the AUTHENTICATION parameter.

The PREDCHECK parameter specifies the type of CRC to be used for Predictor compression. The Predictor RFC specifies using CRC-16, however some router manufacturers have implemented Predictor with CRC-CCITT, which is the CRC specified in RFC 1662, "PPP in HDLC-link Framing". This value is not negotiated so the same value needs to be configured at both ends of the link for Predictor compression to work correctly. This parameter does not apply to L2TP calls.

The RECHALLENGE parameter specifies if the CHAP rechallenge function is on, off or the maximum rechallenge period. PPP calculates a random period for

the CHAP rechallenge between the maximum rechallenge period and a minimum of 5 minutes. If ON is specified, the CHAP rechallenges take place with a maximum rechallenge period of 15 minutes. If OFF is specified, then CHAP rechallenges do not take place. If a time is specified, then the time, which is between 360 and 3600 seconds, is used as the upper limit on the rechallenge time calculation. The default is ON.

The RESTART parameter specifies the time between successive retransmissions of unacknowledged configure requests or terminate requests. The default is 3 seconds.

The STACCHECK parameter specifies the check mode to used for the Stac LZS compression algorithm. If SEQUENCE is specified an incrementing sequence number is used to determine whether a packet has been lost and therefore whether the compression history needs to be reset. If LCB is specified an LCB value is used to determine if an error has occurred in a packet. The default is SEQUENCE. This parameter does not apply to L2TP calls.

The STARENTITY parameter specifies the star entity and the encryption algorithm to be used by the encryption channel configured by the PPP interface. This parameter must be specified if PPP encryption is enabled.

The TERMINATE parameter sets the number of terminate requests sent when trying to close a link before it is assumed the link is down. The default is 2. The CONTINUOUS option specifies that requests be sent continuously.

The TOTALDATALIMIT parameter sets the total data throughput threshold, in megabytes, for the PPP interface. When the interface's cumulative total data counter exceeds this limit, the link is closed and any further attempts to open the link fail. If the total data counter for the interface is cleared with the [reset ppp command on page 9-80](#), the link can be reopened. The default is NONE, which corresponds to no threshold.

The UPTIME parameter specifies the time, in seconds, that the PPP interface must have a total utilisation (as a percentage) above the threshold specified by the UPRATE parameter, before an additional channel is opened. The default is 30 for UPTIME and 80 for UPRATE. The UPRATE, UPTIME, DOWNRATE and DOWNTIME parameters are used with the TYPE parameter to configure bandwidth on demand.

The USERNAME parameter specifies the username to be used when generating PAP authentication requests and when responding to CHAP authentication challenges. If the USERNAME is not set, the router's system name is used by default.



For security reasons, this command is accepted only if the user has Security Officer privilege.

Examples To create a template that creates a dynamic PPP interface with BAP and Predictor compression enabled, use the command:

```
CREATE PPP TEMPLATE=1 BAP=ON BAPMODE=CALL
DESCRIPTION="Dynamic PPP with Predictor and BAP"
COMPRESSION=ON COMPALGORITHM=PREDICTOR
```

To create a template that creates a dynamic PPP interface with BAP and STAC LZS compression enabled, use the command:

```
CREATE PPP TEMPLATE=1 BAP=ON BAPMODE=CALL
DESCRIPTION="Dynamic PPP with STAC LZS and BAP"
COMPRESSION=ON COMPALGORITHM=STACLZS
```

To create PPP template *pppT2* using the factory default settings, use the command:

```
CREATE PPP TEMPLATE=2
```

Related Commands

- [destroy ppp template](#)
- [disable ppp template debug](#)
- [enable ppp template debug](#)
- [reset ppp](#)
- [set ppp acservice](#)
- [set ppp template](#)
- [show ppp pppoe](#)
- [show ppp limits](#)
- [show ppp template](#)

delete ppp

Syntax DELETE PPP=*ppp-interface* OVER=*physical-interface*
[NUMBER=*number*] [TYPE={DEMAND | PRIMARY | SECONDARY}]

where:

- *ppp-interface* is the PPP interface number from 0 to 1023.
- *physical-interface* is:
 - ATM (e.g. atm0.1)
 - SYN*n*
 - ISDN-*callname*
 - ACC-*callname*
 - MIOX*n*-*circuitname*
 - TDM-*groupname*
 - TNL-*callname*
 - ETH*n*-*servicename*
 - VLAN*n*-*servicename*
- *number* is the number of ISDN B channels to delete.

Description This command deletes the specified lower layer interface from an existing PPP multilink bundle. The interface may be left with no lower layer interfaces.

The OVER parameter specifies the interface to be deleted.

The NUMBER parameter specifies the number of ISDN channels to be deleted. This parameter is valid when the OVER parameter specifies an ISDN call as the interface. The default is 1.

The TYPE parameter specifies the role of the interface for bandwidth on demand and link backup. The default is PRIMARY.

Examples To delete Ethernet interface 2 as a interface from PPP interface 1, use the command:

```
DELETE PPP=1 OVER=ETH2-any
```

To delete ISDN call "demand" as a interface from PPP interface 1, use the command:

```
DELETE PPP=1 OVER=ISDN-demand
```

To delete the PPPoE service "any" on vlan2 as a physical interface from PPP interface 1, use the command:

```
DELETE PPP=1 OVER=vlan2-any
```

Related Commands

- add ppp
- add ppp acservice
- delete ppp acservice
- disable ppp
- enable ppp
- reset ppp
- set ppp
- show ppp

delete ppp acservice

Syntax DELETE PPP ACSERVICE=*service-name* [VLAN={NONE|0..4094}]

where:

- *service-name* is a character string of up to 18 characters.

Description This command deletes a PPP over Ethernet Access Concentrator service from the router. Note that it is not possible to delete a service that is currently in use.

The ACSERVICE parameter specifies the name of the new PPPoE service that is to be deleted.

The VLAN parameter specifies the VLAN on which the service is offered. This parameter is used to further identify the service that is to be deleted, as it is possible to have two or more services with the same name but which are offered on different VLANs. If a VLAN identification is specified, the service with the specified name on that VLAN is deleted. If NONE is specified, the service offered on the Ethernet ports (whose name matches the specified name) is deleted. The default for this parameter is NONE.

Examples To delete the PPPoE Access Concentrator service named *armadillo*, use the command:

```
DELETE PPP ACSERVICE=armadillo
```

Related Commands

- add ppp acservice
- create ppp
- create ppp template
- destroy ppp
- destroy ppp template
- set ppp acservice

destroy ppp

Syntax DESTROY PPP=*ppp-interface*

where:

- *ppp-interface* is the PPP interface number, from 0 to 1023.

Description This command destroys the specified PPP interface, as opposed to the [delete ppp command on page 9-69](#), which deletes a physical interface used by a PPP interface.

Examples To destroy PPP interface 0, use the command:

```
DESTROY PPP=0
```

Related Commands

- [add ppp](#)
- [add ppp acservice](#)
- [delete ppp](#)
- [disable ppp](#)
- [enable ppp](#)
- [reset ppp](#)
- [set ppp](#)
- [show ppp](#)

destroy ppp template

Syntax DESTROY PPP TEMPLATE=*template*

where *template* is a number from 0 to 31

Description This command destroys the specified PPP template and eliminates any call associations. The TEMPLATE parameter specifies the number of the template to destroy. The specified template must already exist.

Examples To destroy template 1, use the command:

```
DESTROY PPP TEMPLATE=1
```

Related Commands

- [create ppp template](#)
- [disable ppp template debug](#)
- [enable ppp template debug](#)
- [set ppp acservice](#)
- [show ppp pppoe](#)

disable ppp

Syntax DISABLE PPP=*ppp-interface*

where:

- *ppp-interface* is the PPP interface number, from 0 to 1023.

Description This command disables the specified PPP interface. The interface must currently be enabled. The interface is not available for use by higher layer network protocols, but the configuration of a static PPP interface is retained, and is restored when the interface is re-enabled. PPP interfaces are enabled automatically when they are created.

Examples To disable PPP interface 2, use the command:

```
DISABLE PPP=2
```

Related Commands

- [add ppp](#)
- [add ppp acservice](#)
- [delete ppp](#)
- [disable ppp](#)
- [enable ppp](#)
- [reset ppp](#)
- [set ppp](#)
- [show ppp](#)

disable ppp accessconcentrator

Syntax DISABLE PPP ACCESSCONCENTRATOR

Description This command disables PPPoE Access Concentrator (AC) mode on the router. When AC mode has been disabled, the router does not respond to PPPoE discovery initiation packets, even if it has the requested service defined. PPPoE AC mode cannot be disabled while services are in use.

Example To stop the router acting as a PPPoE access concentrator and offering any AC services that have been defined on the router, use the command:

```
DISABLE PPP ACCESSCONCENTRATOR
```

Related Commands

- [add ppp](#)
- [delete ppp](#)
- [disable ppp](#)
- [enable ppp](#)
- [set ppp](#)
- [show ppp](#)

disable ppp debug

Syntax `DISABLE PPP=ppp-interface DEBUG={ALL | AUTH | BAPSTATE | CALLBACK | CTRLPKT | DATAPKT | DECODE | DEMAND | ENCO | LCP | LQR | NCP | PACKET | PKT | PPPOE | UTILISATION} [, . . .]`

where:

- *ppp-interface* is the PPP interface number, from 0 to 1023.

Description This command disables the debugging option for the specified PPP interface. The option must currently be enabled. A list of options separated by commas may be specified to disable more than one debugging option at a time. By default PPP debugging is disabled.

The DEBUG parameter specifies which debugging options are to be disabled. The value of this parameter is a single item or a comma-separated list of items. The items allowed and the debugging that results from specifying the item are shown in [Table 9-10 on page 9-73](#).

Table 9-10: Point-to-Point Protocol (PPP) debugging options

Option	Description
ALL	All debug options.
AUTH	PPP authentication. If LCP opens on a link but the network protocols remain in the closed state, the most likely cause is an authentication failure.
BAPSTATE	BAP state machine transitions.
CALLBACK	Callback state machine transitions.
CTRLPKT	Hexadecimal dump of control packets received and transmitted on the PPP interface.
DATAPKT	Hexadecimal dump of data packets received and transmitted on the PPP interface.
DECODE	Decoded control packets. Disabling this option also automatically disables AUTH debug.
DEMAND	Packets that cause on-demand links to be activated.
ENCO	ENCO state machine used to control attachment to and detachment from the ENCO (encryption/compression) module.
LCP	LCP state machine transitions.
LQR	Decoded LQR packets.
NCP	NCP state machine transitions.
PACKET PKT	Hexadecimal dump of all packets received and transmitted on the PPP interface. This option has the same effect as CTRLPKT and DATAPKT specified at the same time
PPPOE	PPPoE discovery packets received and transmitted, and PPPoE state transitions.
UTILISATION	Utilisation measurements for each lower layer interface and the overall utilisation.

Examples To disable all debugging options on PPP interface 2, use the command:

```
DISABLE PPP=2 DEBUG=ALL
```

Related Commands [disable ppp template debug](#)
[enable ppp debug](#)
[enable ppp template debug](#)
[show ppp debug](#)
[show ppp utilisation](#)

disable ppp template debug

Syntax `DISABLE PPP TEMPLATE=template DEBUG={ALL|AUTH|BAPSTATE|CALLBACK|CTRLPKT|DATAPKT|DECODE|DEMAND|ENCO|LCP|LQR|NCP|PACKET|PKT|PPPOE|UTILISATION} [, ...]`

where *template* is a number from 0 to 31

Description This command disables the debugging option for dynamic PPP interfaces created using the specified PPP template. A list of options separated by commas may be specified to disable more than one debugging option at a time.

The TEMPLATE parameter specifies the number of the template for which debugging is to be disabled. The specified template must already exist.

The DEBUG parameter specifies which debugging options are to be disabled. The value of this parameter is a single item or a comma-separated list of items. The items allowed and the debugging that results from specifying the item are shown in [Table 9-10 on page 9-73](#).

Examples To disable the display of debugging information for dial on demand link activation on template 2, use the command:

```
DISABLE PPP TEMPLATE=2 DEBUG=DEMAND
```

Related Commands [create ppp template](#)
[destroy ppp template](#)
[enable ppp template debug](#)
[set ppp acservice](#)
[show ppp utilisation](#)

enable ppp

Syntax `ENABLE PPP=ppp-interface`

where *ppp-interface* is the PPP interface number from 0 to 1023.

Description This command enables a specific PPP interface. The interface must be a currently disabled static interface. The interface configuration is restored to the settings in existence before the interface was disabled. The interface is made available to network layer protocols to transmit and receive data. PPP interfaces are enabled automatically when they are created.

Examples To enable PPP interface 2, use the command:

```
ENABLE PPP=2
```

Related Commands

- [add ppp](#)
- [add ppp acservice](#)
- [delete ppp](#)
- [delete ppp acservice](#)
- [disable ppp](#)
- [reset ppp](#)
- [set ppp](#)
- [show ppp](#)

enable ppp accessconcentrator

Syntax `ENABLE PPP ACCESSCONCENTRATOR`

Description This command enables the router to perform as a PPPoE Access Concentrator (AC). While performing as an AC, the router offers AC services that have been defined with the ADD PPP ACSERVICE command. The router does not respond to PPPoE discovery initiation packets, even when it has the requested service defined, unless Access Concentrator mode has been enabled with this command.

Examples To define an AC service named 'bob' that uses dynamic PPP interfaces based on PPP template 1 (which already exists) and then enable the service to be offered by the router as an AC, use the commands:

```
ADD PPP ACSERVICE=bob TEMPLATE=1
ENABLE PPP ACCESSCONCENTRATOR
```

Related Commands

- [add ppp](#)
- [add ppp acservice](#)
- [delete ppp](#)
- [delete ppp acservice](#)
- [disable ppp](#)
- [enable ppp](#)
- [set ppp](#)
- [set ppp acservice](#)
- [show ppp](#)

enable ppp debug

Syntax `ENABLE PPP=ppp-interface DEBUG={ALL | AUTH | BAPSTATE | CALLBACK | CTRLPKT | DATAPKT | DECODE | DEMAND | ENCO | LCP | LQR | NCP | PACKET | PKT | PPPOE | UTILISATION} [, ...] [ASYN=port-number] [TIMEOUT={NONE | 1..4000000000}] [NUMPKTS={CONT | 1..4000000000}]`

where:

- *ppp-interface* is the PPP interface number from 0 to 1023.
- *port-number* is the number of an asynchronous port on the router. Port numbers start at zero (0).

Description This command enables the debugging option for a specific PPP interface. Debugging may or may not be enabled already. By default PPP debugging is disabled.

Debugging information is sent to the port or telnet session from which the command was entered if the ASYN parameter is not specified; otherwise, it is sent to the specified port. A list of options separated by commas may be specified to enable more than one debugging option at a time. For packet debugging, the number of packets output may be specified. For all other types of debugging, the length of time to continue debugging may be specified.

The DEBUG parameter specifies which debugging options are to be enabled. The value of this parameter is a single item or a comma-separated list of items. The items allowed and the debugging that results from specifying the item are shown in [Table 9-11 on page 9-76](#).

Table 9-11: Point-to-Point Protocol (PPP) debugging options

Option	Description
ALL	All debug options.
AUTH	PPP authentication. If LCP opens on a link but the network protocols remain in the closed state, the most likely cause is an authentication failure.
BAPSTATE	BAP state machine transitions.
CALLBACK	Callback state machine transitions.
CTRLPKT	Hexadecimal dump of control packets received and transmitted on the PPP interface.
DATAPKT	Hexadecimal dump of data packets received and transmitted on the PPP interface.
DECODE	Decoded control packets. Enabling this option also automatically enables AUTH debug.
DEMAND	Packets that cause on-demand links to be activated.
ENCO	ENCO state machine used to control attachment to and detachment from the ENCO (encryption/compression) module.
LCP	LCP state machine transitions.
LQR	Decoded LQR packets.
NCP	NCP state machine transitions.

Table 9-11: Point-to-Point Protocol (PPP) debugging options (continued)

Option	Description
PACKET PKT	Hexadecimal dump of all packets received and transmitted on the PPP interface. This option has the same effect as CTRLPKT and DATAPKT specified at the same time
PPPOE	PPPoE discovery packets received and transmitted, and PPPoE state transitions.
UTILISATION	Utilisation measurements for each lower layer interface and the overall utilisation.



*Enabling all debug options with **ENABLE PPP DEBUG=ALL** may generate enormous amounts of output, causing the router to lock up. Use the **TIMEOUT** or **NUMPKTS** options to limit the amount of output generated.*

The ASYN parameter specifies the asynchronous port to which the debug output is to be sent. This enables debugging to be enabled in a script. The default is to send the output to the terminal or Telnet session from which the command was executed. Each time the ENABLE PPP DEBUG command is entered the destination of the debugging output is calculated again using this rule.

The TIMEOUT parameter specifies a time in seconds after which debugging automatically ceases. If NONE is specified, then debugging must be disabled manually. The timeout applies to debugging modes that do not involve the output of data packets; that is, all debugging modes except for CTRLPKT, DATAPKT, DECODE, LQR, and PKT. The value of the TIMEOUT parameter the first time an applicable debugging mode is enabled is retained for future ENABLE PPP TEMPLATE DEBUG commands. The default is NONE.

The NUMPKTS parameter specifies, for CTRLPKT, DATAPKT, DECODE, LQR, PACKET, and PKT debugging, the number of packets to be displayed before debugging ceases. This option is useful when attempting to debug a very busy link, since the amount of output generated by PKT debugging can easily cause the router to lock up the device to which the debugging output is being sent. The value of this parameter the first time CTRLPKT, DATAPKT, DECODE, LQR, PACKET, and PKT debugging are enabled is retained for subsequent ENABLE PPP TEMPLATE DEBUG commands. If CONT is specified, packet debugging continues indefinitely and must be disabled manually. The default is CONT.

Examples To enable the display of debugging information for dial on demand link activation on PPP interface 2, use the command:

```
ENABLE PPP=2 DEBUG=DEMAND
```

Related Commands

- [disable ppp debug](#)
- [disable ppp template debug](#)
- [enable ppp template debug](#)
- [show ppp debug](#)
- [show ppp utilisation](#)

enable ppp template debug

Syntax `ENABLE PPP TEMPLATE=template DEBUG={ALL | AUTH | BAPSTATE | CALLBACK | CTRLPKT | DATAPKT | DECODE | DEMAND | ENCO | LCP | LQR | NCP | PACKET | PKT | PPPOE | UTILISATION} [, ...] [ASYN=port-number] [TIMEOUT={NONE | 1..4000000000}] [NUMPKTS={CONT | 1..4000000000}]`

where:

- *template* is a number from 0 to 31.
- *port-number* is the number of an asynchronous port on the router. Ports are numbered starting at zero (0).

Description This command enables the debugging option for dynamic PPP interfaces created using the specified PPP template. Debugging may or may not be enabled already. Debugging information is sent to the port or telnet session from which the command was entered if the ASYN parameter was not specified; otherwise, it is sent to the specified port. A list of options separated by commas may be specified to enable more than one debugging option at a time. For packet debugging, the number of packets output may be specified. For all other types of debugging, the length of time to continue debugging may be specified.

The TEMPLATE parameter specifies the number of the template for which debugging is to be enabled. The specified template must already exist.

The DEBUG parameter specifies which debugging options are to be enabled. The value of this parameter is a single item or a comma-separated list of items. The items allowed and the debugging that results from specifying the item are shown in [Table 9-11 on page 9-76](#).



Enabling all debug options with ENABLE PPP TEMPLATE DEBUG=ALL may generate enormous amounts of output, causing the router to lock up. Use the TIMEOUT or NUMPKTS options to limit the amount of output generated.

The ASYN parameter specifies the asynchronous port to which the debug output is to be sent. This enables debugging to be enabled in a script. The default is to send the output to the terminal or Telnet session from which the command was executed. Each time the ENABLE PPP TEMPLATE DEBUG command is entered the destination of the debugging output is calculated again using this rule.

The TIMEOUT parameter specifies a time in seconds after which debugging automatically stops. If NONE is specified, then debugging must be disabled manually. The timeout applies to debugging modes that do not involve the output of data packets; that is, all debugging modes except for CTRLPKT, DATAPKT, DECODE, LQR, and PKT. The value of the TIMEOUT parameter the first time an applicable debugging mode is enabled is retained for future ENABLE PPP TEMPLATE DEBUG commands. The default is NONE.

The NUMPKTS parameter specifies, for CTRLPKT, DATAPKT, DECODE, LQR, PACKET, and PKT debugging, the number of packets to be displayed before debugging ceases. This option is useful when attempting to debug a very busy link, since the amount of output generated by PKT debugging can easily cause

the router to lock up the device to which the debugging output is being sent. The value of this parameter the first time CTRLPKT, DATAPKT, DECODSE, LQR, PACKET, and PKT debugging are enabled is retained for subsequent ENABLE PPP TEMPLATE DEBUG commands. If CONT is specified, packet debugging continues indefinitely and must be disabled manually. The default is CONT.

Examples To enable the display of debugging information for dial on demand link activation on template 2, use the command:

```
ENABLE PPP TEMPLATE=2 DEBUG=DEMAND
```

Related Commands

- [create ppp template](#)
- [destroy ppp template](#)
- [disable ppp template debug](#)
- [set ppp acservice](#)
- [show ppp pppoe](#)
- [show ppp utilisation](#)

purge ppp

Syntax PURGE PPP

Description This command destroys all PPP interfaces and reinitialises the PPP module.

Examples To the PPP configuration, use the command:

```
PURGE PPP
```

Related Commands

- [delete ppp](#)
- [delete ppp acservice](#)
- [disable ppp](#)
- [enable ppp](#)

reset ppp

Syntax RESET PPP=*ppp-interface* [COUNTER] [LINKCOUNTER={ONLINE | INDATA | OUTDATA | TOTALDATA | ALL}]

where:

- *ppp-interface* is the PPP interface number, from 0 to 1023.

Description This command resets the specified PPP interface, the general counters for the specified PPP interface, or the cumulative up-time, and input/output data counters.

If neither the COUNTER nor LINKCOUNTER parameters are specified, the interface is reset if it is a static interface, forcing the interface to renegotiate all protocols and options.

If the COUNTER parameter is specified, all counters for the interface are reset to zero (0) except for the Link Quality Monitoring (LQM) counters, and cumulative up-time and input/output data counters.

If the LINKCOUNTER parameter is specified, one or all of the up-time and input/output data counters are reset to zero (0). If ONLINE is specified the up-time counter is reset to zero. If INDATA is specified the input data counter is reset to zero. If OUTDATA is specified the output data counter is reset to zero. If TOTALDATA is specified the total data counter is reset to zero. If ALL is specified all four counters are reset to zero.

Examples To reset PPP interface 0, use the command:

```
RESET PPP=0
```

To reset all counters for PPP interface 0 without resetting the interface itself, use the command:

```
RESET PPP=0 COUNTER
```

Related Commands

- [add ppp acservice](#)
- [delete ppp](#)
- [delete ppp acservice](#)
- [disable ppp](#)
- [enable ppp](#)
- [purge ppp](#)
- [set ppp](#)
- [show ppp limits](#)

set ppp

Syntax SET PPP [DNSPRIMARY=*ipadd*] [DNSSECONDARY=*ipadd*]
 [WINSPRIMARY=*ipadd*] [WINSSECONDARY=*ipadd*]

SET PPP=*ppp-interface* [OVER=*physical-interface*]
 [AUTHENTICATION={CHAP|EITHER|PAP|NONE}] [AUTHMODE={IN|OUT|INOUT}] [BAP={ON|OFF}] [BAPMODE={CALL|CALLBACK}]
 [CBDELAY=1..100] [CBMODE={ACCEPT|OFF|REQUEST}]
 [CBNUMBER=*e164number*] [CBOPERATION={E164NUMBER|USERAUTH}] [COMPALGORITHM={PREDICTOR|STACLZS}]
 [COMPRESSION={ON|OFF|LINK}] [CONFIGURE={*value*|CONTINUOUS}] [DEBUGMAXBYTES=16..256]
 [DESCRIPTION=*description*] [DOWNRATE=0..100]
 [DOWNTIME=*time*] [ECHO={ON|OFF|*period*}] [ENCRYPTION={ON|OFF}] [FRAGMENT={ON|OFF}] [FRAGOVERHEAD=0.100]
 [IDLE={ON|OFF|*time*}] [INDATALIMIT={NONE|1..65535}]
 [IPPOOL={*pool-name*|NONE}] [IPREQUEST={ON|OFF}]
 [LQR={ON|OFF|*period*}] [MAGIC={ON|OFF}] [MAXLINKS=1..64]
 [MODEM={ON|OFF}] [MRU={ON|OFF|256..1656}]
 [NULLFRAGTIMER=*time*] [ONLINELIMIT={NONE|1..65535}]
 [OUTDATALIMIT={NONE|1..65535}] [PASSWORD=*password*]
 [PREDCHECK={CRC16|CRCCITT}] [RECHALLENGE={ON|OFF|360..3600}] [RESTART=*time*] [STACCHECK={LCB|SEQUENCE}]
 [STARENTITY=1..255] [TERMINATE={*value*|CONTINUOUS}]
 [TOTALDATALIMIT={NONE|1..65535}] [TYPE={DEMAND|PRIMARY|SECONDARY}] [UPRATE=0..100] [UPTIME=*time*]
 [USERNAME=*username*]

where:

- *ppp-interface* is the PPP interface number, from 0 to 1023.
- *physical-interface* is:
 - ATM (e.g. atm0.1)
 - SYN*n*
 - ISDN-*callname*
 - ACC-*callname*
 - MIOX*n*-*circuitname*
 - TDM-*groupname*
 - TNL-*callname*
 - ETH*n*-*servicename*
 - VLAN*n*-*servicename*
- *e164number* is the phone number to dial when performing callback. It may contain digits (0-9) and should be a valid phone number as described in CCITT standard E.164.
- *value* is a retry threshold.
- *ipadd* is an IP address in dotted decimal notation.
- *description* is a character string 1 to 70 characters long. Valid characters are any printable character.
- *time* is a timer value in seconds.

- *period* is a decimal number from 1 to 4294967295.
- *pool-name* is a character string 1 to 15 characters long. Valid characters are any printable characters. If *pool-name* contains spaces, it must be in double quotes.
- *password* is the password to use for authentication 1 to 64 characters long. It may contain any printable character, and is case sensitive.
- *username* is the username to use for authentication 1 to 64 characters long. It may contain any printable character, and is case sensitive.

Description This command is used to change the configuration parameters of a PPP interface running over:

- an ATM channel
- a synchronous port
- an ISDN call
- an ACC call
- a MIOX circuit
- TDM group
- an L2TP call
- a PPP over Ethernet service
- a PPP over Ethernet service over a VLAN interface

For PPP over Ethernet and PPP over VLAN links, use the service name provided by your ISP, or the special service name ANY to specify that any service is acceptable.

If a dynamic interface is modified with this command, the changes are lost when the interface goes down. This command is also used to set global primary and secondary DNS and WINS server addresses. In this case the PPP interface may not be specified. All other options require the PPP interface to be specified.

The OVER parameter specifies the physical interface over which the PPP interface is running. Additional physical interfaces can be added to the PPP interface with the [add ppp command on page 9-49](#).

The AUTHENTICATION parameter specifies the authentication protocol to be used on the physical interface or channel. If CHAP is specified, the Challenge-Handshake Authentication Protocol (CHAP) is used. If PAP is specified, the Password Authentication Protocol (PAP) is used. If EITHER is specified, the router uses the option negotiation process to negotiate the authentication protocol to be used with the device at the remote end of the link, specifying CHAP as the first choice. If NONE is specified, no authentication protocol is used. The default is NONE.

The AUTHMODE parameter specifies how authentication requests to peers are affected by the direction of the call. The AUTHMODE parameter is valid when the AUTHENTICATION parameter is set to a value other than NONE and the physical interface is a call. If IN is specified, authentication is requested for

incoming calls from peers. If OUT is specified, authentication is requested for outgoing calls to peers. If INOUT is specified, authentication is always requested regardless of the direction of the call. The default is INOUT. This parameter is valid for:

- ISDN calls
- ACC calls

The BAP parameter specifies whether the Bandwidth Allocation Protocol is used for negotiating the activation of demand PPP links. The default is ON.

The BAPMODE parameter specifies which peer originates another link to add to the multilink bundle. For CALLBACK mode, the number to call must be configured on the call at the lower layer (ISDN, ACC, MIOX, L2TP). The default is CALL.

The CBDELAY parameter specifies the delay, in tenths of a second, between bringing down a call for callback and actually making the call back to the peer. This parameter handles different timing requirements of various ISDN switches and is valid for PPP links over ISDN calls and when the callback mode is REQUEST. The default is 1.

The CBMODE parameter specifies whether a callback request is made or accepted during the LCP negotiation. If REQUEST is specified, a request is made for callback. If ACCEPT is specified, requests for callback received from the peer are accepted and processed, however AUTHENTICATION must be set to PAP or CHAP. If OFF is specified, no callback requests are made and callback requests are not accepted. The default is OFF.

The CBNUMBER parameter specifies the number to include when requesting a callback with the CBOPERATION parameter set to E164NUMBER. The number specified should be a phone number as specified in the E.164 standard.

The CBOPERATION parameter specifies the callback operation to be included in the callback request to specify to the peer how to determine the callback number. If USERAUTH is specified, the peer uses the username and password supplied during authentication to look up the callback number. If E164NUMBER is specified, the callback number specified by the CBNUMBER parameter is included in the callback request. The default is USERAUTH.

The COMPALGORITHM parameter specifies the compression algorithm to use when compressing and decompressing PPP packets. If PREDICTOR is specified the Predictor algorithm is used with type 1 encapsulation as specified in RFC 1978. If STACLZS is specified the Stac LZS algorithm is used as specified in RFC 1974. The default is STACLZS. This parameter does not apply to L2TP calls.

The COMPRESSION parameter enables or disables the use of compression for the interface. When used with multilink, setting COMPRESSION to ON compresses packets before they are sent to individual links. Setting COMPRESSION to LINK enables compression for the link specified by the OVER parameter. The default is OFF. The LINK option should be used only when compression is required on some physical interfaces and not on others. For example, if a PPP multilink uses a compressing modem link and a normal dedicated leased line, COMPRESSION should be set to OFF on the physical interface to which the modem is connected, and LINK for the physical interface to which the dedicated leased line is connected. If compression is required on all physical interfaces of a PPP interface, the COMPRESSION parameter should be set to ON. This parameter does not apply to L2TP calls.

The CONFIGURE parameter sets the number of configure requests sent before some action is taken. For the LCP the action is to reset the hardware and start again. For all other protocols the action is to give up. The default is CONTINUOUS, which means that requests are sent continuously.

The DEBUGMAXBYTES parameter specifies the maximum number of bytes that are displayed for each packet when the CTRLPKT, DATAPKT, PACKET, and PKT debug options are enabled. The default is 60.

The DESCRIPTION parameter specifies a user-defined description for the interface, to make it easier to distinguish between a number of PPP interfaces.

The DNSPRIMARY parameter specifies the IP address to pass to a peer when it requests a primary DNS address using the IPCP primary DNS option. If neither this parameter nor the IP nameserver is configured, and the PPP interface is assigned an IP interface, then IPCP negotiates for a primary DNS address.

The DNSSECONDARY parameter specifies the IP address to pass to a peer when it requests a secondary DNS address using the IPCP secondary DNS option. If neither this parameter nor the IP Secondary Nameserver is configured, and the PPP interface is assigned an IP interface, then IPCP negotiates for a secondary DNS address.

The DOWNTIME parameter specifies the time, in seconds, that the PPP interface must have a total utilisation (as a percentage) below the threshold specified by the DOWNRATE parameter, before a channel is closed. The default is 60 for DOWNTIME and 20 for DOWNRATE. The UPRATE, UPTIME, DOWNRATE and DOWNTIME parameters are used with the TYPE parameter to configure bandwidth on demand.

The ECHO parameter specifies whether LCP Echo Request and Echo Reply messages are used to determine link quality. If three consecutive Echo Request messages are transmitted without receiving an Echo Reply response, the link is deemed to be down. If OFF is specified, Echo Request messages are not transmitted. If ON is specified, Echo Request messages are transmitted every 10 seconds. If a period in seconds is specified, Echo Request messages are transmitted at the specified interval. The LQR function has precedence over the ECHO function. They cannot both be enabled at the same time. However, both LQR and ECHO can be ON at the same time if ECHO is turned on first, then LQR.

The ENCRYPTION parameter enables or disables the use of encryption for the interface. The default is OFF.



For security reasons, the ENCRYPTION parameter is accepted only if the user has Security Officer privilege.

The FRAGMENT parameter applies to a multilink bundle interface, and determines whether packets are fragmented. The default is OFF. Fragmentation cannot be enabled when compression or encryption are configured.

The FRAGOVERHEAD parameter specifies the maximum allowable overhead, as a percentage, for fragmenting packets using the variable fragmentation scheme for multilink PPP. When a packet exceeds this limit, it is fragmented using the fixed fragmentation scheme. The default is 5. The variable

fragmentation scheme spreads the packet over all the links in the multilink bundle by splitting the packet into variable sized fragments to match the speed of individual links. Larger fragments are transmitted over faster links, thereby providing an inherent load balancing scheme. The fixed fragmentation scheme spreads the packet over all the links in the multilink bundle by splitting the packet into equal fixed sized fragments. If the number of links is large and the packet is relatively small a fragment is not transmitted over every link.

The IDLE parameter controls the dial-on-demand feature. If ON is specified, dial-on-demand is enabled with a default timer of 60 seconds. If a time is specified, dial-on-demand is enabled with the timer set to the specified time. If OFF is specified, dial-on-demand is disabled. When the dial-on-demand feature is activated, PPP brings up the link when there is traffic to be sent, and takes down the link when there has been no traffic for the specified timer period. The effect on a PPP interface using an on-demand call is to connect the call when traffic is to be sent and disconnect the call when no traffic has been sent or received for the specified timer period. For leased lines, this parameter has no effect, as the links are always connected. The default is OFF.

The INDATALIMIT parameter specifies the input data threshold, in megabytes, for the PPP interface. When the interface's cumulative input data counter exceeds this limit, the link is closed and any further attempts to open the link fail. If the input data counter for the interface is cleared with the [reset ppp command on page 9-80](#), the link can be reopened. The default is NONE, which sets no threshold.

The IPPOOL parameter specifies the IP pool to use to allocate IP addresses for the remote end of the PPP connection. If NONE is specified, IP addresses are not allocated from an IP pool. The default is NONE. See ["IP Address Pools" on page 14-51 of Chapter 14, Internet Protocol \(IP\)](#) for more information about creating IP address pools.

The IPREQUEST parameter specifies whether a request is to be made for an IP address to be allocated by the peer during the IPCP negotiation. If ON is specified, a request is made. If OFF is specified, a request is not specified. The default is OFF.

The LQR parameter sets the LQR timer for link quality management. If ON is specified, LQR is enabled with a default timer of 60 seconds. If a time is specified, LQR is enabled with the timer set to the specified time. If OFF is specified, LQR is disabled. The LQR function has precedence over the ECHO function. They cannot both be enabled at the same time. However, both LQR and ECHO can be ON at the same time if ECHO is turned on first, then LQR. The default is ON.

The MAGIC parameter enables or disables negotiation of the magic number option. The default is ON. The magic number determines whether a interface is looped back. The interface does not reach an open state when there is a loopback.

The MAXLINKS parameter specifies the maximum number of links allowed in a multilink PPP interface created using this template. The default is 2.



When using the MAXLINKS parameter without BAP, a link is brought up fully before being checked. If the remote station is configured to bring up more links than the local station accepts, links may be brought up and torn down repeatedly. Therefore, to stop this situation occurring, also implement BAP when MAXLINKS is implemented.

The MODEM parameter specifies the state of synchronous modem control. The default is OFF. If ON is specified, the router manipulates the DTR signal to trigger the modem to make a call whenever there is traffic (IDLE=ON) or when a backup link is required (TYPE=SECONDARY). Raising DTR to the modem triggers the modem to initiate a call to the modem at the other end of the link and enter data transfer mode. The router keeps the DTR signal to the modem raised, and responds to the modem raising the DSR signal by activating the PPP interface. This parameter is valid when the OVER parameter specifies a synchronous interface.

The MRU parameter specifies whether the MRU (Maximum Receive Unit) option is included, and what value is sent in LCP configuration requests while bringing up this interface. If OFF is specified, the MRU option is omitted. If a decimal value is specified, the transmitted MRU option is set to this value. If ON is specified, the MRU is calculated normally. The default is ON.

The NULLFRAGTIMER parameter specifies the maximum time, in seconds, a link in a multilink bundle may be idle before a NULL fragment is transmitted over the link. NULL fragments are used to keep the last sequence number transmitted over the link up to date. The default is 3.

The ONLINELIMIT parameter specifies the up-time threshold, in hours, for the PPP interface. When the interface's cumulative up-time counter exceeds this limit, the link is closed and any further attempts to open the link fail. If the up-time counter for the interface is cleared with the [reset ppp command on page 9-80](#), the link can be reopened. The default is NONE, which sets no threshold.

The OUTDATALIMIT parameter specifies the output data threshold, in megabytes, for the PPP interface. When the interface's cumulative output data counter exceeds this limit, any further attempts to open the link fail. If the output data counter for the interface is cleared with the [reset ppp command on page 9-80](#), the link can be reopened. The default is NONE, which sets no threshold.

The PASSWORD parameter specifies the password to use when the peer requests authentication using either CHAP or PAP. This is normally required for network lines between routers, for which an authentication protocol has been selected with the AUTHENTICATION parameter.

The PREDCHECK parameter specifies the type of CRC to be used for Predictor compression. The Predictor RFC specifies using CRC-16, however some router manufacturers have implemented Predictor with CRC-CCITT, which is the CRC specified in RFC 1662, "PPP in HDLC-link Framing". This value is not negotiated so the same value needs to be configured at both ends of the link for Predictor compression to work correctly. This parameter does not apply to L2TP calls.

The RECHALLENGE parameter specifies whether the CHAP rechallenge function is on, off, or the maximum rechallenge period. PPP calculates a random period for the CHAP rechallenge between the maximum rechallenge period and a minimum of 5 minutes. If ON is specified, the CHAP rechallenges take place with a maximum rechallenge period of 15 minutes. If OFF is specified, then CHAP rechallenges do not take place. If a time is specified, then the time, which is between 360 and 3600 seconds, is used as the upper limit on the rechallenge time calculation. The default is ON.

The **RESTART** parameter specifies the time between successive retransmissions of unacknowledged configure requests or terminate requests. The default is 3 seconds.

The **STACCHECK** parameter specifies the check mode to used for the Stac LZS compression algorithm. If **SEQUENCE** is specified an incrementing sequence number is used to determine whether a packet has been lost and therefore whether the compression history needs to be reset. If **LCB** is specified an LCB value is used to determine if an error has occurred in a packet. The default is **SEQUENCE**. This parameter does not apply to L2TP calls.

The **STARENTITY** parameter specifies the star entity and the encryption algorithm to be used by the encryption channel configured by the PPP interface. This parameter must be specified if PPP encryption is enabled.

The **TERMINATE** parameter sets the number of terminate requests sent when trying to close a link before it is assumed the link is down. The default is 2. The **CONTINUOUS** option specifies that requests are sent continuously.

The **TOTALDATALIMIT** parameter sets the total data throughput threshold, in megabytes, for the PPP interface. When the interface's cumulative total data counter exceeds this limit, the link is closed and any further attempts to open the link fail. If the total data counter for the interface is cleared with the **reset ppp command on page 9-80**, the link can be reopened. The default is **NONE**, which corresponds to no threshold.

The **TYPE** parameter specifies the role of the physical interface for bandwidth on demand and leased line backup. The default is **PRIMARY**. If **PRIMARY** is specified, the link is open all the time (**IDLE=OFF**) or opened whenever there is traffic (**IDLE=ON**). If **SECONDARY** is specified, the link opens when the associated primary link fails. If **DEMAND** is specified, the link opens when additional bandwidth is required.

The **UPTIME** parameter specifies the time, in seconds, that the PPP interface must have a total utilisation (as a percentage) above the threshold specified by the **UPRATE** parameter, before an additional channel is opened. The default is 30 for **UPTIME** and 80 for **UPRATE**. The **UPRATE**, **UPTIME**, **DOWNRATE**, and **DOWNTIME** parameters are used with the **TYPE** parameter to configure bandwidth on demand.

The **USERNAME** parameter specifies the username to be used when generating PAP authentication requests and when responding to CHAP authentication challenges. If the **USERNAME** is not set, the router's system name is used by default.

The **WINSPRIMARY** parameter specifies the IP address to pass to a peer when it requests a primary WINS server address with the IPCP primary WINS server option.

The **WINSSECONDARY** parameter specifies the IP address to pass to a peer when it requests a primary WINS server address with the IPCP secondary WINS server option.

Examples To disable compression on the Ethernet interface 0 link of PPP interface 1, use the command:

```
SET PPP=1 OVER=ETH0 COMP=OFF
```

Related Commands

- add ppp
- add ppp acservice
- create ppp
- reset ppp
- show ppp
- show ppp config
- show ppp limits

set ppp acservice

Syntax SET PPP ACSERVICE=*service-name* [ACRADIUS={OFF|ON}]
 [MAXSESSIONS=1...512] [TEMPLATE=*ppp-template*]
 [VLAN={NONE|0..4094}]

where:

- *service-name* is a character string of up to 18 characters.
- *n* is the number of an Ethernet interface.
- *ppp-template* is a number from 0 to 31.

Description This command sets the parameters associated with the specified PPPoE Access Concentrator service.

The ACSERVICE parameter specifies the name of the PPPoE service whose parameters are to be changed.

The ACRADIUS parameter specifies whether PPPoE hosts are authenticated by a RADIUS server using the host's MAC address as the radius parameter calling-station ID. If OFF is specified, the RADIUS authentication is not performed. If ON is specified, the RADIUS authentication is performed. The default is OFF.



Radius authentication is performed only if it is specified by the template associated with this PPPoE service.

The MAXSESSIONS parameter specifies the maximum number of PPPoE sessions that are allowed to simultaneously provide the PPPoE service. The default is 1.

The TEMPLATE parameter specifies the PPP template to use when creating a dynamic PPP over Ethernet interface. The specified template must exist. See [“Templates” on page 9-18](#) for more information about creating PPP templates.

The VLAN parameter specifies the VLAN on which the service is offered. This parameter further identifies the service whose parameters are to be changed, as it is possible to have two or more services with the same name but offered on different VLANs. It is not possible to change the VLAN on which the service is offered. If a VLAN identification is specified, the service with the specified name on that VLAN has its parameters changed. If NONE is specified, the service offered on the Ethernet ports (whose name matches the specified name) is deleted. If the VLAN parameter is omitted, the service is mapped to its

corresponding VLAN (if one exists). If multiple VLANs exist for the service, you are asked to specify a VLAN. The default for this parameter is NONE.

Examples To set a limit of 20 simultaneous sessions for the service named *armadillo*, use the command:

```
SET PPP ACSERVICE=armadillo MAXSESSIONS=20
```

Related Commands

- [add ppp acservice](#)
- [create ppp](#)
- [create ppp template](#)
- [delete ppp acservice](#)
- [destroy ppp](#)
- [destroy ppp template](#)

set ppp template

Syntax SET PPP TEMPLATE=*template* [AUTHENTICATION={CHAP|EITHER|PAP|NONE}] [BAP={ON|OFF}] [BAPMODE={CALL|CALLBACK}] [CBDELAY=1..100] [CBMODE={ACCEPT|OFF|REQUEST}] [CBNUMBER=*e164number*] [CBOPERATION={E164NUMBER|USERAUTH}] [COMPALGORITHM={PREDICTOR|STACLZS}] [COMPRESSION={ON|OFF|LINK}] [DEBUGMAXBYTES=16..256] [DESCRIPTION=*description*] [ECHO={ON|OFF|*period*}] [ENCRYPTION={ON|OFF}] [FRAGMENT={ON|OFF}] [FRAGOVERHEAD=0..100] [IDLE={ON|OFF|*time*}] [INDATALIMIT={NONE|1..65535}] [IPPOOL={*pool-name*|NONE}] [IPREQUEST={ON|OFF}] [LOGIN={ALL|RADIUS|TACACS|USER}] [LQR={ON|OFF|*period*}] [MAGIC={ON|OFF}] [MAXLINKS=1..64] [MRU={ON|OFF|256..1656}] [MTU=256..1500|256..1492] [[MULTILINK={ON|OFF}] [NULLFRAGTIMER=*time*] [ONLINELIMIT={NONE|1..65535}] [OUTDATALIMIT={NONE|1..65535}] [PASSWORD=*password*] [PREDCHECK={CRC16|CRCCITT}] [RECHALLENGE={ON|OFF|360..3600}] [RESTART=*time*] [STACHECK={LCB|SEQUENCE}] [STARENTITY=1..255] [TOTALDATALIMIT={NONE|1..65535}] [USERNAME=*username*]

where:

- *template* is a number from 0 to 31.
- *e164number* is the phone number to dial when performing callback. It may contain digits (0–9) and should be a valid phone number as described in CCITT standard E.164.
- *description* is a character string 1 to 70 characters long. Valid characters are any printable character.
- *period* is a decimal number from 1 to 4294967295.
- *time* is a timer value in seconds.
- *pool-name* is a character string 1 to 15 characters long. Valid characters are any printable characters. If *pool-name* contains spaces, it must be in double quotes.
- *password* is the password to use for authentication 1 to 64 characters long. It may contain any printable character and is case sensitive.
- *username* is the username to use for authentication 1 to 64 characters long. It may contain any printable character and is case sensitive.

Description This command modifies an existing PPP template that is used to configure dynamic PPP interfaces. The PPP interface is created when one of the following is activated:

- ISDN call
- ACC call
- L2TP call
- PPP over Ethernet service

The TEMPLATE parameter specifies the number of the template to modify. The specified template must already exist.

The AUTHENTICATION parameter specifies the authentication protocol to be used on the physical interface or channel. If CHAP is specified, the Challenge-Handshake Authentication Protocol (CHAP) is used. If PAP is specified, the Password Authentication Protocol (PAP) is used. If EITHER is specified, the router uses the option negotiation process to negotiate the authentication protocol to be used with the device at the remote end of the link, specifying CHAP as the first choice. If NONE is specified, no authentication protocol is used. The default is NONE.

The BAP parameter specifies whether the Bandwidth Allocation Protocol is used for negotiating the activation of demand PPP links. The default is ON.

The BAPMODE parameter specifies which peer originates another link to add to the multilink bundle. For CALLBACK mode, the number to call must be configured on the call at the lower layer (ISDN, ACC, L2TP). The default is CALL.

The CBDELAY parameter specifies the delay in tenths of a second between bringing down a call for callback and actually making the call back to the peer. This parameter handles different timing requirements, for example of various ISDN switches, and is valid when the callback mode is REQUEST. The default is 1.

The CBMODE parameter specifies whether a callback request is made or accepted during the LCP negotiation. If REQUEST is specified, a request is made for callback. If ACCEPT is specified, requests for callback received from the peer are accepted and processed; however, AUTHENTICATION must be set to PAP or CHAP. If OFF is specified, no callback requests are made and callback requests are not accepted. The default is OFF.

The CBNUMBER parameter specifies the number to include when requesting a callback with the CBOPERATION parameter set to E164NUMBER. The number specified should be a phone number as specified in the E.164 standard.

The CBOPERATION parameter specifies the callback operation to be included in the callback request to specify to the peer how to determine the callback number. If USERAUTH is specified, the peer uses the username and password supplied during authentication to look up the callback number. If E164NUMBER is specified, the callback number specified by the CBNUMBER parameter is included in the callback request. The default is USERAUTH.

The COMPALGORITHM parameter specifies the compression algorithm to use when compressing and decompressing PPP packets. If PREDICTOR is specified, the Predictor algorithm is used with type 1 encapsulation as specified in RFC 1978. If STACLZS is specified, the Stac LZS algorithm is used as specified in RFC 1974. The default is STACLZS. This parameter does not apply to L2TP calls.

The COMPRESSION parameter enables or disables the use of compression for the interface. When used with multilink, setting COMPRESSION to ON compresses packets before they are sent to the individual links. Setting COMPRESSION to LINK enables compression for the link specified by the OVER parameter. The default is OFF. The LINK option should be used when compression is required on some physical interfaces and not on others. For example, if a PPP multilink uses a compressing modem link and a normal

dedicated leased line, COMPRESSION should be set to OFF on the physical interface to which the modem is connected, and LINK for the physical interface to which the dedicated leased line is connected. If compression is required on all physical interfaces of a PPP interface, the COMPRESSION parameter should be set to ON. This parameter does not apply to L2TP calls.

The DEBUGMAXBYTES parameter specifies the maximum number of bytes that are displayed for each packet when the CTRLPKT, DATAPKT, PACKET, and PKT debug options are enabled. The default is 60.

The DESCRIPTION parameter specifies a user-defined description for the interface, to make it easier to distinguish between a number of PPP interfaces.

The ECHO parameter specifies whether LCP Echo Request and Echo Reply messages are used to determine link quality. If three consecutive Echo Request messages are transmitted without receiving an Echo Reply response, the link is deemed to be down. If OFF is specified, Echo Request messages are not transmitted. If ON is specified, Echo Request messages are transmitted every 10 seconds. If a period in seconds is specified, Echo Request messages are transmitted at the specified interval. The LQR function has precedence over the ECHO function. They cannot both be enabled at the same time. However, both LQR and ECHO can be ON at the same time if ECHO is turned on first, then LQR.

The ENCRYPTION parameter enables or disables the use of encryption for the interface. The default is OFF.



For security reasons, the ENCRYPTION parameter is accepted only if the user has Security Officer privilege.

The FRAGMENT parameter applies to a multilink bundle interface and determines whether packets are fragmented. The default is OFF. Fragmentation cannot be enabled when compression or encryption are configured.

The FRAGOVERHEAD parameter specifies the maximum allowable overhead, as a percentage, for fragmenting packets using the variable fragmentation scheme for multilink PPP. When a packet exceeds this limit, it is fragmented using the fixed fragmentation scheme. The default is 5. The variable fragmentation scheme spreads the packet over all the links in the multilink bundle by splitting the packet into variable sized fragments to match the speed of individual links. Larger fragments are transmitted over faster links, thereby providing an inherent load balancing scheme. The fixed fragmentation scheme spreads the packet over all the links in the multilink bundle by splitting the packet into equal fixed sized fragments. If the number of links is large and the packet is relatively small a fragment is not transmitted over every link.

The IDLE parameter controls the dial-on-demand feature. If ON is specified, dial-on-demand is enabled with a default timer of 60 seconds. If a time is specified, dial-on-demand is enabled with the timer set to the specified time. If OFF is specified, dial-on-demand is disabled. When the dial-on-demand feature is activated, PPP brings up the link when there is traffic to be sent, and takes down the link when there has been no traffic for the specified timer period. The effect on a PPP interface using an on-demand call is to connect the call when traffic is to be sent and disconnect the call when no traffic has been sent or received for the specified timer period. For leased lines, this parameter has no effect, as the links are always connected. The default is OFF.

The `INDATALIMIT` parameter specifies the input data threshold, in megabytes, for the PPP interface. When the interface's cumulative input data counter exceeds this limit, the link is closed and any further attempts to open the link fail. If the input data counter for the interface is cleared with the [reset ppp command on page 9-80](#), the link can be reopened. The default is `NONE`, which sets no threshold.

The `IPPOOL` parameter specifies the IP pool to use to allocate IP addresses for dynamic dial-in PPP connections. If `NONE` is specified, IP addresses are not allocated from an IP pool. The default is `NONE`. See ["IP Address Pools" on page 14-51 of Chapter 14, Internet Protocol \(IP\)](#) for more information about creating IP address pools.

The `IPREQUEST` parameter specifies whether a request is to be made for an IP address to be allocated by the peer during the IPCP negotiation. If `ON` is specified, a request is made. If `OFF` is specified, a request is not specified. The default is `OFF`.

The `LOGIN` parameter specifies which login procedure the call creating this dynamic interface must use when it is activated. If `RADIUS` is specified, the router sends requests to the configured RADIUS server(s) to authenticate the call. If `TACACS` is specified, the router sends requests to the configured TACACS server(s) to authenticate the call. If `USER` is specified, the router checks the User Authentication Database to authenticate the call. If `ALL` is specified, the router tries all methods to authenticate the call.

The `LQR` parameter sets the LQR timer for link quality management. If `ON` is specified, LQR is enabled with a default timer of 60 seconds. If a time is specified, LQR is enabled with the timer set to the specified time. If `OFF` is specified, LQR is disabled. The LQR function has precedence over the `ECHO` function. They cannot both be enabled at the same time. However, both LQR and `ECHO` can be `ON` at the same time if `ECHO` is turned on first, then LQR. The default is `ON`.

The `MAGIC` parameter enables or disables negotiation of the magic number option. The default is `ON`. The magic number determines if a interface is looped back. The interface does not reach an open state when there is a loopback.

The `MAXLINKS` parameter specifies the maximum number of links allowed in a multilink PPP interface created using this template. The default is 2.



When using the `MAXLINKS` parameter without `BAP`, a link is brought up fully before being checked. If the remote station is configured to bring up more links than the local station accepts, links may be brought up and torn down repeatedly. Therefore, to stop this situation occurring, also implement `BAP` when `MAXLINKS` is implemented.

The `MRU` parameter specifies whether the MRU (Maximum Receive Unit) option is included, and what value is sent in LCP configuration requests while bringing up this interface. If `OFF` is specified, the MRU option is omitted. If a decimal value is specified, the transmitted MRU option is set to this value. If `ON` is specified, the MRU is calculated normally. The default is `ON`.

The `MTU` parameter specifies the value of the maximum transmission unit. The allowable MTU values for the PPP lower layers are shown in [Figure 9-12 on page 9-94](#).

Table 9-12: Allowable MTU values

Interface	Minimum MTU	Maximum MTU	Default MTU
PPP (except over Ethernet)	256	1500	1500
PPP over Ethernet	256	1492	1492



For normal operations do not change the default MTU values.

The MULTILINK parameter specifies whether incoming dynamic PPP calls using this template are multilinked together. If ON is specified, incoming dynamic PPP calls from the same peer and with the same authentication information are multilinked together. If OFF is specified, incoming dynamic PPP calls are not multilinked under any circumstances. The default is ON.

The NULLFRAGTIMER parameter specifies the maximum time, in seconds, a link in a multilink bundle may be idle before a NULL fragment is transmitted over the link. NULL fragments are used to keep the last sequence number transmitted over the link up to date. The default is 3.

The ONLINELIMIT parameter specifies the up-time threshold, in hours, for the PPP interface. When the interface's cumulative up-time counter exceeds this limit, the link is closed and any further attempts to open the link fail. If the up-time counter for the interface is cleared using the [reset ppp command on page 9-80](#), the link can be reopened. The default is NONE, which sets no threshold.

The OUTDATALIMIT parameter specifies the output data threshold, in megabytes, for the PPP interface. When the interface's cumulative output data counter exceeds this limit, any further attempts to open the link fail. If the output data counter for the interface is cleared using the [reset ppp command on page 9-80](#), the link can be reopened. The default is NONE, which sets no threshold.

The PASSWORD parameter specifies the password to use when the peer requests authentication using either CHAP or PAP. This is normally required for network lines between routers, for which an authentication protocol has been selected with the AUTHENTICATION parameter.

The PREDCHECK parameter specifies the type of CRC to be used for Predictor compression. The Predictor RFC specifies using CRC-16, however some router manufacturers have implemented Predictor with CRC-CCITT, which is the CRC specified in RFC 1662, "PPP in HDLC-link Framing". This value is not negotiated so the same value needs to be configured at both ends of the link for Predictor compression to work correctly. This parameter does not apply to L2TP calls.

The RECHALLENGE parameter specifies if the CHAP rechallenge function is on, off or the maximum rechallenge period. PPP calculates a random period for the CHAP rechallenge between the maximum rechallenge period and a minimum of 5 minutes. If ON is specified, the CHAP rechallenges take place with a maximum rechallenge period of 15 minutes. If OFF is specified, then CHAP rechallenges do not take place. If a time is specified, then the time, which is between 360 and 3600 seconds, is used as the upper limit on the rechallenge time calculation. The default is ON.

The RESTART parameter specifies the time between successive retransmissions of unacknowledged configure requests or terminate requests. The default is 3 seconds.

The STACCHECK parameter specifies the check mode to used for the Stac LZS compression algorithm. If SEQUENCE is specified an incrementing sequence number is used to determine whether a packet has been lost and therefore whether the compression history needs to be reset. If LCB is specified an LCB value is used to determine if an error has occurred in a packet. The default is SEQUENCE. This parameter does not apply to L2TP calls.

The STARENTITY parameter specifies the star entity and the encryption algorithm to be used by the encryption channel configured by the PPP interface. This parameter must be specified if PPP encryption is enabled.

The TOTALDATALIMIT parameter sets the total data throughput threshold, in megabytes, for the PPP interface. When the interface's cumulative total data counter exceeds this limit, the link is closed and any further attempts to open the link fail. If the total data counter for the interface is cleared using the [reset ppp command on page 9-80](#), the link can be reopened. The default is NONE, which corresponds to no threshold.

The USERNAME parameter specifies the username to be used when generating PAP authentication requests and when responding to CHAP authentication challenges. If the USERNAME is not set, the router's system name is used by default.

Examples To modify template 1 to use LCP Echo for link quality management, use the command:

```
SET PPP TEMPLATE=1 ECHO=ON
```

To modify template 0 to the MTU value 1400, use the command:

```
SET PPP TEMPLATE=0 MTU=1400
```

Related Commands

- [create ppp template](#)
- [destroy ppp template](#)
- [disable ppp template debug](#)
- [enable ppp template debug](#)
- [reset ppp](#)
- [set ppp template](#)
- [show ppp pppoe](#)
- [show ppp limits](#)
- [show ppp template](#)

show ppp

Syntax SHOW PPP[=*ppp-interface*]

where *ppp-interface* is the PPP interface number from 0 to 1023

Description This command displays a list of each PPP interface, users of the interface, physical interfaces that the interface is running over, and the current state of the interface (Figure 9-15 on page 9-96, Table 9-13 on page 9-96).

Figure 9-15: Example output from the **show ppp** command for a PPP link

Name	Enabled	ifIndex	Over	CP	State
ppp0	YES	04		IPCP	OPENED
			syn0	LCP	OPENED
			isdn-demand	LCP	OPENED

Table 9-13: Parameters in the output of the SHOW PPP command

Parameter	Meaning
Name	The name of the PPP interface.
Enabled	YES if the PPP interface is enabled; NO if it is disabled.
IfIndex	The value of ifIndex for the PPP interface.
Over	The lower layer(s) used by the PPP interface; SYN <i>n</i> , ISDN- <i>callname</i> , ACC- <i>callname</i> , MIOX <i>n</i> - <i>circuitname</i> , TDM- <i>groupname</i> , ETH <i>n</i> - <i>servicename</i> , VLAN <i>n</i> - <i>servicename</i> , TNL- <i>callname</i> .
CP	A list of the network and link control protocols running over the PPP interface; one or more of "IPCP", "IPV6CP", "IPXCP", "BCP", "DNCP", "ATCP", "LCP", "CCP", "ILCCP", "ECP", "BACP" or "MULTI".
State	The state of the PPP links; either "INITIAL", "STARTING", "CLOSED", "STOPPED", "CLOSING", "STOPPING", "REQ SENT", "ACK RCVD", "ACK SENT" or "OPENED".

Examples To display information about PPP interface 2, use the command:

```
SHOW PPP=2
```

Related Commands [show ppp config](#)
[show ppp count](#)

show ppp config

Syntax SHOW PPP[=*ppp-interface*] CONFIG

where *ppp-interface* is the PPP interface number from 0 to 1023

Description This command displays the configuration of a PPP interface ([Figure 9-16 on page 9-98](#), [Table 9-14 on page 9-99](#)).

Figure 9-16: Example output from the **show ppp config** command

Interface - description	Configured	Negotiated	
Parameter			

ppp0 - Link to Southern Regional Office		Local	Peer
Bandwidth Allocation Protocol	ON		
Bandwidth Allocation Call Mode	CALL		
Multilink Fragmentation	OFF		
Acceptable Fragment Overhead (%)	5		
Null Fragment Timer (seconds)	3		
Session Timer (seconds)	OFF		
Idle Timer (seconds)	OFF		
Maximum Receive Unit (bytes)	OFF	NONE	NONE
Compression	ON	ON	ON
Encryption	OFF	OFF	OFF
Username	NOT SET		
Password	NOT SET		
Bundle Endpoint Discr Class	0		
Bundle Endpoint Discr Value	[]		
Bundle Username	NOT SET		
Bundle Maximum Links	2		
acc-btb			
Type	primary		
Restart Timer (seconds)	3		
Max-Configure	continuous		
Max-Terminate	2		
Echo Request Timer (seconds)	OFF		
Callback Mode	OFF		
Link Compression	ON	ON	ON
LQR Timer (seconds)	60	OFF	OFF
Magic Number	ON	OFF	OFF
Link Discriminator	0000	OFF	OFF
Link Endpoint Discr Class	0		
Link Endpoint Discr Value			
Authentication	CHAP	NONE	NONE
Authentication Mode	INOUT		
CHAP Rechallenge (max. period seconds)	900		
Utilisation (%)	0		
Compression			
Algorithm	STACLZS	STACLZS	STACLZS
Stac LZS Checkmode	SEQUENCE	SEQUENCE	SEQUENCE
PPPoE			
Session ID		4B5C	4B5C
MAC Address of Peer		00-00-cd-00-5e-65	
Service Name	aardvark		
IP			
IP Compression Protocol	NONE	NONE	NONE
IP Pool	Test		
IP Address Request	OFF		
IP Address	192.168.1.1	192.168.1.1	192.168.1.2
Primary DNS Address	192.168.2.3	NONE	NONE
Secondary DNS Address	192.168.5.1	NONE	NONE
Primary WinS Address	192.168.5.5		NONE
Secondary WinS Address	NOT SET		NONE
Debug			
Maximum packet bytes to display	22		

Table 9-14: Parameters in the output of the SHOW PPP CONFIG command

Parameter	Meaning
Configured	This column specifies the value that has been configured for a parameter. The value may be modified by the negotiation process between the local and remote ends of the PPP link.
Negotiated/Local	For a link in the open state, this column contains the value that the local end of the link uses for a parameter as a result of the negotiation process. For a link that is not open, this column contains the initial value for a parameter.
Negotiated/Peer	For a link in the open state, this column contains the value that the remote end of the link uses for a parameter as a result of the negotiation process. For a link that is not open, this column contains the initial value for a parameter.
ppp<n> - <description>	The name and description of the interface. Following fields display information about the interface as a whole.
Bandwidth Allocation Protocol	Whether the Bandwidth Allocation Protocol is enabled on the interface.
Bandwidth Allocation Call Mode	The call mode for the Bandwidth Allocation Protocol, if the Bandwidth Allocation Protocol is enabled on the interface; either "CALL" or "CALLBACK".
Multilink fragmentation	Whether multilink packets may be fragmented.
Acceptable Fragment Overhead (%)	The maximum amount of overhead allowed to be added to each packet due to variable fragmentation. If this level is exceeded when fragmentation of a packet is done using the variable fragmentation scheme, then the fixed fragmentation scheme is used instead.
Null Fragment Timer (seconds)	Seconds that the link must be idle for before a Null fragment is sent on a link in a multilink bundle.
Session Timer (seconds)	Seconds before a link is disconnected, or whether the session timer is disabled.
Idle Timer (seconds)	Seconds that a link must be idle before it is disconnected, or whether the idle timer is disabled.
Maximum Receive Unit (bytes)	The maximum allowable length for packets received at the PPP layer. The MRU of the peer is used as the MTU of the upper layers so that they do not transmit anything that is too long for the peer to handle.
Compression	Whether compression is enabled for the entire PPP interface.
Encryption	Whether encryption is enabled for the entire PPP interface.
Username	The username used by the PPP interface for both PAP and CHAP authentication or whether a username has not been set.
Password	Whether a password has been set for the entire PPP interface.
Up Rate (%utilisation)	The utilisation level on the link where an additional channel is opened when the interface has on-demand links.
Up Time (seconds)	Seconds that the utilisation level on the link must exceed <i>Up Rate</i> before an additional channel is opened when the interface has on-demand links.

Table 9-14: Parameters in the output of the SHOW PPP CONFIG command (continued)

Parameter	Meaning
Down Rate (%utilisation)	The utilisation level on the link below which a channel is closed when the interface has on-demand links.
Down Time (seconds)	Seconds that the utilisation level on the link must be below <i>Down Rate</i> before a channel is closed when the interface has on-demand links.
Bundle Endpoint Discr Class	The class of endpoint discriminator used to uniquely identify this link's endpoint.
Bundle Endpoint Discr Value	The hexadecimal value of the endpoint discriminator used to uniquely identify this link's endpoint.
Bundle Username	The username assigned to the multilink bundle or whether a username has not been set.
Bundle Maximum Links	The maximum number of links allowed in a multilink bundle. If the Maximum Links value is 0xFFFFFFFF, this value is displayed as 'N/A' rather than as a huge number. If the Maximum Receive Unit is set to OFF, OFF is displayed.
LCP Information	This section is repeated once for each LCP (physical interface) operating over the PPP interface.
<lcp-name>	The name of an LCP operating over this PPP interface. Following fields display information about this LCP (link).
Number of primary channels	The number of channels with a TYPE of PRIMARY carried over the ISDN call, if this physical interface is an ISDN call.
Number of secondary channels	The number of channels with a TYPE of SECONDARY carried over the ISDN call, if this physical interface is an ISDN call.
Number of demand channels	The number of channels with a TYPE of DEMAND carried over the ISDN call, if this physical interface is an ISDN call.
Type	The role of this physical interface for bandwidth on demand and leased line backup; either "demand", "primary" or "secondary".
Modem Control	Whether modem control is enabled (valid on synchronous interfaces).
Restart Timer	Seconds between configure requests for this physical interface.
Max-Configure	The maximum number of configure requests sent before PPP gives up trying to open this link, or "continuous".
Max-Terminate	The maximum number of Terminate requests sent before PPP gives up trying to open this link and declares this link down, or "continuous".
Echo Request Timer (seconds)	The time, in seconds, between transmissions of LCP <i>Echo Request</i> messages when LCP <i>Echo Request/Echo Reply</i> messages are used to monitor link state, or "OFF" if LQR is used to determine link status.
Callback Mode	Whether this link requests callback, accepts callback, or does neither.
Callback Operation	The callback operation to include in the callback request when the callback mode is REQUEST; either "USERAUTH" or "E164NUMBER". This field is displayed if <i>Callback Mode</i> is set to "REQUEST".

Table 9-14: Parameters in the output of the SHOW PPP CONFIG command (continued)

Parameter	Meaning
Callback Number	The callback number included in callback requests when the callback mode is REQUEST and the callback operation is E164NUMBER. This field is displayed if <i>Callback Mode</i> is set to "REQUEST" and <i>Callback Operation</i> is set to "E164NUMBER".
Callback Delay (tenths of a second)	The delay, in tenths of a second, between deactivating a call for callback and making the return call. This field is displayed if <i>Callback Mode</i> is set to "ACCEPT".
Link Compression	Whether compression is enabled for this link rather than the entire PPP interface.
LQR Timer (seconds)	Seconds between LQR packets transmitted over this physical interface.
Magic Number	Whether the magic number option is enabled for this physical interface.
Link Discriminator	The link discriminator value for this physical interface, or "OFF" if the link discriminator LCP option is not enabled.
Link Endpoint Discr Class	The class of link endpoint discriminator assigned to this end of the physical interface.
Link Endpoint Discr Value	The value the of link endpoint discriminator assigned to this end of the physical interface, expressed in hexadecimal.
Authentication	The authentication protocol in use on this physical interface; either NONE, PAP, CHAP, or EITHER.
Authentication Mode	Whether authentication is requested on incoming ISDN calls, outgoing ISDN calls, or both; either IN, OUT, or INOUT.
CHAP Rechallenge	Seconds for the maximum interval between CHAP rechallenges, or "OFF" if the CHAP rechallenge is disabled. This parameter is displayed when CHAP is configured.
Utilisation (%)	The bandwidth utilisation, as a percentage of time the interface is transmitting data, for this physical interface.
Link Compression	Information about link compression on this physical interface if link compression is enabled on this physical interface.
Algorithm	The compression algorithm used to compress packets on this physical interface; either "PREDICTOR" or "STAC_LZS".
Stac LZS Checkmode	The check mode used by the Stac LZS compression algorithm to determine if a decompression history is unsynchronised on this physical interface; either "NONE", "LCB", "CRC", "SEQUENCE" or "EXTENDED".
Predictor LZS Checkmode	The check mode used by the Predictor compression algorithm to determine if a decompression history is unsynchronised on this physical interface; either "CRC-16" or "CRC-CCITT".
Channel Information	This section is displayed when the LCP (physical interface) is an ISDN interface, and is repeated once for each channel in the physical interface. Basic Rate ISDN interfaces have 2 channels. Primary Rate ISDN interfaces have 30 channels.
bri<n> - channel <n> pri<n> - channel <n>	The interface and channel number of physical interfaces that are ISDN calls. Following fields display information specific to this channel.

Table 9-14: Parameters in the output of the SHOW PPP CONFIG command (continued)

Parameter	Meaning
Type	The role of this channel for bandwidth on demand and leased line backup; either "demand", "primary" or "secondary".
Utilisation (%)	The bandwidth utilisation, as a percentage of time the interface is transmitting data, for the physical interface.
Link Compression	Whether compression is enabled for the link rather than the entire PPP interface.
LQR Timer (seconds)	Seconds between LQR packets transmitted over the physical interface.
Magic Number	Whether the magic number option is enabled for the physical interface.
Link Discriminator	The link discriminator value for the physical interface, or whether the link discriminator LCP option is not enabled.
Link Endpoint Discr Class	The class of link endpoint discriminator assigned to this end of the physical interface.
Link Endpoint Discr Value	The value the of link endpoint discriminator assigned to this end of the physical interface, expressed in hexadecimal.
Authentication	The authentication protocol in use on the physical interface; either NONE, PAP, CHAP, or EITHER.
NCP Information	This section is repeated once for each NCP configured on the PPP interface.
Encryption	Information about encryption on the PPP interface, if encryption is enabled on the interface.
Star Entity Identifier	The star entity and encryption algorithm used on the PPP interface.
Link Compression	Information about link compression on the PPP interface if link compression is enabled on the PPP interface.
Algorithm	The compression algorithm to use for compressing packets on the PPP interface; either "PREDICTOR" or "STAC_LZS".
Stac LZS Checkmode	The check mode used by the Stac LZS compression algorithm to determine if a decompression history is unsynchronised on the PPP interface; either "NONE", "LCB", "CRC", "SEQUENCE" or "EXTENDED".
Predictor LZS Checkmode	The check mode used by the Predictor compression algorithm to determine if a decompression history is unsynchronised on the PPP interface; either "CRC-16" or "CRC-CCITT".
IP	Information about the IP NCP on the PPP interface, if IP is enabled on this PPP interface.
IP Compression Protocol	The IP compression protocol enabled on the PPP interface; either "VJC" or "NONE".
IP Pool	The name of the IP address pool used to assign IP addresses for this PPP interface, or "NOT SET" if an IP address pool has not been assigned.
IP Address Request	Whether an IP address is requested from the peer during IPCP negotiation; either "ON" or "OFF".

Table 9-14: Parameters in the output of the SHOW PPP CONFIG command (continued)

Parameter	Meaning
IP Address	The IP address configured at each end of the link, "0.0.0.0" if the PPP interface is an unnumbered interface, or "NONE" if an IP address has not been assigned.
Primary DNS Address	The IP address of the primary DNS server, passed to a peer in response to an IPCP primary DNS request.
Secondary DNS Address	The IP address of the secondary DNS server, passed to a peer in response to an IPCP secondary DNS request.
Primary WinS Address	The IP address of the primary WINS server, passed to a peer in response to an IPCP primary WINS server request.
Secondary WinS Address	The IP address of the secondary WINS server, passed to a peer in response to an IPCP secondary WINS server request.
Debug	Information about debugging on the PPP interface.
Maximum packet bytes to display	The maximum number of bytes of each PPP packet displayed by the PACKET debugging option.
PPPoE Information	This section is displayed when the LCP (physical interface) is an ethernet interface.
Session ID	The hexadecimal value of the session ID number for the current PPP over Ethernet session. The number is allocated by the Access Concentrator, which is the local router when the router acts as an access concentrator or the remote peer when the router acts as a client.
MAC Address of Peer	The MAC address of the peer where the router is currently connected via the PPP over Ethernet session.
Service Name	The name of the Ethernet service that the PPP interface is using, of "ANY" if the special service name ANY was specified when configuring the PPP interface.

Examples To display the configuration for PPP interface 2, use the command:

```
SHOW PPP=2 CONFIG
```

Related Commands [show ppp](#)
[show ppp count](#)
[show ppp utilisation](#)

show ppp count

Syntax `SHOW PPP [=ppp-interface] COUNT [= { INTERFACE | LCP | MULTILINK | NCP | PPPOE }]`

where *ppp-interface* is a number from 0 to 1023

Description This command displays counters for the interface. If INTERFACE is specified, counters from the Interfaces MIB are displayed ([Figure 9-17 on page 9-104](#), [Table 9-15 on page 9-104](#)). If LCP is specified, counters for LCP, LQR, CCP, ECP and authentication protocols are displayed ([Figure 9-18 on page 9-106](#), [Table 9-16 on page 9-107](#)). If MULTILINK is specified, counters for the multilink protocol are displayed ([Figure 9-19 on page 9-112](#), [Table 9-17 on](#)

page 9-112). If NCP is specified, counters for the NCPs are displayed (Figure 9-20 on page 9-113, Table 9-18 on page 9-113). If PPPOE is specified, counters for PPPoE active discovery packets that have been sent and received are displayed (Figure 9-21 on page 9-115, Table 9-20 on page 9-116).

If a category is not specified, all counters are displayed, including those for BAP and BACP (Table 9-19 on page 9-114).

Figure 9-17: Example output from the **show ppp count=interface** command

ppp0	1519 seconds	Last change at:	974 seconds
Interface Counters			
ifInOctets	116554	ifOutOctets	91792
ifInUcastPkts	0	ifOutUcastPkts	0
ifInNUcastPkts	2098	ifOutNUcastPkts	1538
ifInDiscards	0	ifOutDiscards	0
ifInErrors	3	ifOutErrors	0
ifInUnknownProtos	0	ifOutQLen	0

Table 9-15: Parameters in the output of the **show ppp count=interface** command

Parameter	Meaning
ppp0	The interface name.
seconds	Seconds since the interface was last re-initialised.
Last change at	Seconds since the interface entered its current operational state.
ifInOctets	The total number of octets received over the interface, including two octets per frame for PPP address and control information, two octets per frame for the FCS, one octet per frame for a flag and two octets per frame for the PPP header (six for multilink), and the number of octets in the user data packets and PPP control packets.
ifInUcastPkts	The total number of subnetwork-unicast packets delivered to a higher-layer protocol.
ifInNUcastPkts	The total number of non-unicast packets delivered to a higher-layer protocol.
ifInDiscards	The total number of inbound packets chosen to be discarded to prevent their being delivered to a higher-layer protocol even though no errors had been detected. One reason for discarding such packets would be to free up buffer space.
ifInErrors	The total number of inbound packets that contained errors preventing them from being deliverable to a higher-layer protocol.
ifInUnknownProtos	The total number of discarded packets received via the interface because of an unknown or unsupported protocol.
ifOutOctets	The total number of octets transmitted over the interface, including two octets per frame for PPP address and control information, two octets per frame for the FCS, one octet per frame for a flag and two octets per frame for the PPP header (six for multilink), and the number of octets in the user data packets and PPP control packets.
ifOutUcastPkts	The total number of packets that higher-layer protocols requested be transmitted to a subnetwork-unicast address, including those that were discarded or not sent.

Table 9-15: Parameters in the output of the **show ppp count=interface** command

Parameter	Meaning
ifOutNUcastPkts	The total number of packets that higher-layer protocols requested be transmitted to a non-unicast address, including those that were discarded or not sent.
ifOutDiscards	The total number of outbound packets chosen to be discarded to prevent their being transmitted even though no errors had been detected. One possible reason for discarding such a packet could be to free up buffer space.
ifOutErrors	The total number of outbound packets with errors preventing them from being transmitted.
ifOutQLen	The length of the output packet queue.

Figure 9-18: Example output from the **show ppp count=lcp** command

CCP			
inOctets	52456	outOctets	38959
inUserPkts	2101	outUserPkts	1538
inConfigureRequest	3	outConfigureRequest	3
inConfigureAcknowledge	3	outConfigureAcknowledge	3
inConfigureNAK	0	outConfigureNAK	0
inConfigureReject	0	outConfigureReject	0
inTerminateRequest	0	outTerminateRequest	0
inTerminateAcknowledge	0	outTerminateAcknowledge	0
inCodeReject	0	outCodeReject	0
decodeSuccesses	2098	encodeSuccesses	1538
decodeFailures	3	encodeFailures	0
decodeDiscards	0	encodeDiscards	0
inResetRequests	8	outResetRequests	3
inResetAcks	3	outResetAcks	2
encoEventsWithLcpDown	0		
LQM OVER: syn1			
lqrFailures	0	loopbacksDetected	0
inLQRs	16	outLQRs	16
inPktLost	0	outPktLost	0
inOctetLost	0	outOctetLost	0
		outLQRsLost	0
		outLQRsTransit	0
PAP OVER: syn1			
inRequest	1	outRequest	0
inAck	0	outAck	1
inNak	0	outNak	0
LCP OVER: syn1			
inOctets	25316	outOctets	19158
inUserPkts	929	outUserPkts	749
inConfigureRequest	3	outConfigureRequest	7
inConfigureAcknowledge	3	outConfigureAcknowledge	3
inConfigureNAK	0	outConfigureNAK	0
inConfigureReject	3	outConfigureReject	0
inTerminateRequest	0	outTerminateRequest	1
inTerminateAcknowledge	1	outTerminateAcknowledge	0
inCodeReject	0	outCodeReject	0
inProtocolReject	3	outProtocolReject	0
inEchoRequest	0	outEchoRequest	0
inEchoReply	0	outEchoReply	0
inDiscardRequest	0	outDiscardRequest	0
echoFailures	0	badEchoReplies	0

Table 9-16: Parameters in the output of the **show ppp count=lcp** command

Parameter	Meaning
ECP	Information about the encryption control protocol (ECP).
inOctets	The number of octets received by the encryption protocol. This includes two octets per frame for the PPP encryption header, the number of octets of encrypted data received, and the number of octets in control protocol packets (ECP). For multilinks an extra six octets per frame are included for the multilink header.
inUserPkts	The number of packets received for the encryption control protocol.
inConfigureRequest	The number of <i>Configure-Request</i> packets received for the encryption control protocol.
inConfigureAcknowledge	The number of <i>Configure-Acknowledge</i> packets received for the encryption control protocol.
inConfigureNAK	The number of <i>Configure-NAK</i> packets received for the encryption control protocol.
inConfigureReject	The number of <i>Configure-Reject</i> packets received for encryption control protocol.
inTerminateRequest	The number of <i>Terminate-Request</i> packets received for encryption control protocol.
inTerminateAcknowledge	The number of <i>Terminate-Acknowledge</i> packets received for the encryption control protocol.
inCodeReject	The number of <i>Code-Reject</i> packets received for the encryption control protocol.
inResetRequests	The number of <i>Reset-Request</i> packets received to reset the encryption history.
inResetACKs	The number of <i>Reset-Acknowledge</i> packets received to reset the encryption history.
decodeSuccesses	The number of encrypted packets successfully decoded.
decodeFailures	The number of encrypted packets that failed to be decoded.
decodeDiscards	The number of packets to be decoded that were discarded.
getSessKeySuccesses	The number of times a session key has been retrieved from the STAR module.
getMktSuccesses	The number of times a master key table has been retrieved from the STAR module.
starEventsNotAttached	The number of times the PPP interface received an event from the STAR module when it was not attached.
abortedNegotiations	The number of times an ECP negotiation was aborted
outOctets	The number of octets transmitted by the encryption protocol. This includes two octets per frame for the PPP encryption header, the number of octets of encrypted data transmitted, and the number of octets in control protocol packets (ECP). For multilinks an extra six octets per frame are included for the multilink header.
outUserPkts	The number of packets transmitted by the encryption control protocol.
outConfigureRequest	The number of <i>Configure-Request</i> packets transmitted by the encryption control protocol.

Table 9-16: Parameters in the output of the **show ppp count=lcp** command

Parameter	Meaning
outConfigureAcknowledge	The number of <i>Configure-Acknowledge</i> packets transmitted by the encryption control protocol.
outConfigureNAK	The number of <i>Configure-NAK</i> packets transmitted by the encryption control protocol.
outConfigureReject	The number of <i>Configure-Reject</i> packets transmitted by the encryption control protocol.
outTerminateRequest	The number of <i>Terminate-Request</i> packets transmitted by the encryption control protocol.
outTerminateAcknowledge	The number of <i>Terminate-Acknowledge</i> packets transmitted by the encryption control protocol.
outCodeReject	The number of <i>Code-Reject</i> packets transmitted by the encryption control protocol.
outResetRequests	The number of <i>Reset-Request</i> packets transmitted to reset the compression history.
outResetACKs	The number of <i>Reset-Acknowledge</i> packets transmitted to reset the compression history.
encodeSuccesses	The number of packets successfully encoded.
encodeFailures	The number of packets that failed to be encoded correctly.
encodeDiscards	The number of packets to be encoded that were discarded.
getSessKeyFailures	The number of times the PPP interface failed to retrieve a session key from the STAR module.
getMktFailures	The number of times the PPP interface failed to retrieve a master key from the STAR module.
starEventsWithLcpDown	The number of times the PPP interface received an event from the STAR module when the interface's LCP was not in the opened state.
CCP ILCCP OVER: <interface>	Information about the compression control protocol (CCP) or ILCCP and the physical interface over which ILCCP is running.
inOctets	The number of octets received by the compression protocol. This includes two octets per frame for the PPP compression header, the number of octets of compressed data received, and the number of octets in control protocol packets (CCP). For multilinks an extra six octets per frame are included for the multilink header.
inUserPkts	The number of packets received by the compression control protocol.
inConfigureRequest	The number of <i>Configure-Request</i> packets received by the compression control protocol.
inConfigureAcknowledge	The number of <i>Configure-Acknowledge</i> packets received by the compression control protocol.
inConfigureNAK	The number of <i>Configure-NAK</i> packets received by the compression control protocol.
inConfigureReject	The number of <i>Configure-Reject</i> packets received by the compression control protocol.
inTerminateRequest	The number of <i>Terminate-Request</i> packets received by the compression control protocol.

Table 9-16: Parameters in the output of the **show ppp count=lcp** command

Parameter	Meaning
inTerminateAcknowledge	The number of <i>Terminate-Acknowledge</i> packets received by the compression control protocol.
inCodeReject	The number of <i>Code-Reject</i> packets received by the compression control protocol.
decodeSuccesses	The number of packets successfully decoded by the compression or encryption control protocol.
decodeFailures	The number of packets that failed to be decoded correctly by the compression or encryption control protocol.
decodeDiscards	The number of packets that were discarded by the compression or encryption control protocol.
inResetRequests	The number of <i>Reset-Request</i> packets received to reset the compression history.
inResetACKs	The number of <i>Reset-Acknowledge</i> packets received to reset the compression history.
encoEventsWithLcpDown	The number of times the PPP interface received an event from the ENCO module when the interface's LCP was not in the opened state.
outOctets	The number of octets transmitted by the compression protocol. This includes two octets per frame for the PPP compression header, the number of octets of compressed data transmitted, and the number of octets in control protocol packets (CCP). For multilinks an extra six octets per frame are included for the multilink header.
outUserPkts	The number of packets transmitted by the compression control protocol.
outConfigureRequest	The number of <i>Configure-Request</i> packets transmitted by the compression control protocol.
outConfigureAcknowledge	The number of <i>Configure-Acknowledge</i> packets transmitted by the compression control protocol.
outConfigureNAK	The number of <i>Configure-NAK</i> packets transmitted by the compression control protocol.
outConfigureReject	The number of <i>Configure-Reject</i> packets transmitted by the compression control protocol.
outTerminateRequest	The number of <i>Terminate-Request</i> packets transmitted by the compression control protocol.
outTerminateAcknowledge	The number of <i>Terminate-Acknowledge</i> packets transmitted by the compression control protocol.
outCodeReject	The number of <i>Code-Reject</i> packets transmitted by the compression control protocol.
encodeSuccesses	The number of packets successfully encoded.
encodeFailures	The number of packets that failed to be encoded correctly.
encodeDiscards	The number of packets to be encoded that were discarded.
outResetRequests	The number of <i>Reset-Request</i> packets transmitted to reset the compression history.
outResetACKs	The number of <i>Reset-Acknowledge</i> packets transmitted to reset the compression history.

Table 9-16: Parameters in the output of the **show ppp count=lcp** command

Parameter	Meaning
LQM OVER: <interface>	Information about LQR and the physical interface over which LQR is running.
lqrFailures	The number of times the LQR timer has timed out.
loopbacksDetected	The number of times the link entered loopback mode.
inLQRs	The number of LQR packets received.
inPktLost	The number of inbound LQR packets lost.
inOctetLost	The number of inbound LQR octets lost.
outLQRs	The number of LQR packets transmitted.
outPktLost	The number of outbound LQR packets lost.
outOctetLost	The number of outbound LQR octets lost.
outLQRsLost	The number of outbound LQR packets lost.
outLQRsTransit	The number of outbound LQR packets in transit.
PAP OVER: <interface>	Information about PAP and the physical interface over which PAP is running.
inRequest	The number of PAP <i>Authenticate-Request</i> packets received.
inAck	The number of PAP <i>Authenticate-Acknowledgement</i> packets received.
inNak	The number of PAP <i>Authenticate-Negative-Acknowledgement</i> packets received.
outRequest	The number of PAP <i>Authenticate-Request</i> packets transmitted.
outAck	The number of PAP <i>Authenticate-Acknowledgement</i> packets transmitted.
outNak	The number of PAP <i>Authenticate-Negative-Acknowledgement</i> packets transmitted.
CHAP OVER: <interface>	Information about CHAP and the physical interface over which CHAP is running.
inChallenge	The number of CHAP <i>Challenge</i> packets received for.
inResponse	The number of CHAP <i>Response</i> packets received.
inSuccess	The number of CHAP <i>Success</i> packets received.
inFailure	The number of CHAP <i>Failure</i> packets received.
outChallenge	The number of CHAP <i>Challenge</i> packets transmitted.
outResponse	The number of CHAP <i>Response</i> packets transmitted.
outSuccess	The number of CHAP <i>Success</i> packets transmitted.
outFailure	The number of CHAP <i>Failure</i> packets transmitted.
LCP OVER: <interface>	Information about the LCP and the physical interface over which LCP is running.

Table 9-16: Parameters in the output of the **show ppp count=lcp** command

Parameter	Meaning
inOctets	The number of octets received by the link control protocol. This includes the number of octets in control protocol packets (e.g. LCP, LQR, PAP, CHAP), plus the number of octets of data received. The number of octets of data equals the number of inOctets recorded for compression or encryption when enabled. If compression or encryption is not enabled, the number of inOctets of data equals the sum of the inOctets recorded for all the user protocols on this link. For multilinks an extra six octets per frame are included for the multilink header.
inUserPkts	The number of packets received for the LCP.
inConfigureRequest	The number of <i>Configure-Request</i> packets received for the LCP.
inConfigureAcknowledge	The number of <i>Configure-Acknowledge</i> packets received for the LCP.
inConfigureNAK	The number of <i>Configure-NAK</i> packets received for the LCP.
inConfigureReject	The number of <i>Configure-Reject</i> packets received for the LCP.
inTerminateRequest	The number of <i>Terminate-Request</i> packets received for the LCP.
inTerminateAcknowledge	The number of <i>Terminate-Acknowledge</i> packets received for the LCP.
inCodeReject	The number of <i>Code-Reject</i> packets received for the LCP.
inProtocolReject	The number of Protocol Reject packets received for the LCP.
inEchoRequest	The number of Echo Request packets received for the LCP.
inEchoReply	The number of Echo Reply packets received for the LCP.
inDiscardRequest	The number of Discard Request packets received for the LCP.
echoFailures	The number of times the ECHO timer has timed out.
outOctets	The number of octets transmitted by the link control protocol. This includes the number of octets in control protocol packets (e.g. LCP, LQR, PAP, CHAP), plus the number of octets of data received. The number of octets of data equals the number of inOctets recorded for compression or encryption when enabled. If compression or encryption is not enabled, the number of outOctets of data equals the sum of the outOctets recorded for all the user protocols on this link. For multilinks an extra six octets per frame are included for the multilink header.
outUserPkts	The number of packets sent for the LCP.
outConfigureRequest	The number of <i>Configure-Request</i> packets sent for the LCP.
outConfigureAcknowledge	The number of <i>Configure-Acknowledge</i> packets sent for the LCP.
outConfigureNAK	The number of <i>Configure-NAK</i> packets sent for the LCP.
outConfigureReject	The number of <i>Configure-Reject</i> packets sent for the LCP.
outTerminateRequest	The number of <i>Terminate-Request</i> packets sent for the LCP.
outTerminateAcknowledge	The number of <i>Terminate-Acknowledge</i> packets sent for the LCP.

Table 9-16: Parameters in the output of the **show ppp count=lcp** command

Parameter	Meaning
outCodeReject	The number of <i>Code-Reject</i> packets sent for the LCP.
outProtocolReject	The number of Protocol Reject packets sent for the LCP.
outEchoRequest	The number of Echo Request packets sent for the LCP.
outEchoReply	The number of Echo Reply packets sent for the LCP.
outDiscardRequest	The number of Discard Request packets sent for the LCP.
badEchoReplies	The number of <i>Echo Reply</i> packets received with a different ID than the original <i>Echo Request</i> packet.

Figure 9-19: Example output from the **show ppp count=multilink** command

Multilink Counters			
inWholeFragments	1538	outWholeFragments	1538
inStartFragments	0	outStartFragments	0
inMiddleFragments	0	outMiddleFragments	0
inEndFragments	0	outEndFragments	0
inNullFragments	54	outNullFragments	54

Table 9-17: Parameters in the output of the **show ppp count=multilink** command

Parameter	Meaning
inWholeFragments	The number of multilink encapsulated fragments received that contain a whole packet.
inStartFragments	The number of multilink encapsulated fragments received that contain the start of a packet.
inMiddleFragments	The number of multilink encapsulated fragments received that contain part of a packet that is not the start or the end.
inEndFragments	The number of multilink encapsulated fragments received that contain the end of a packet.
inNullFragments	The number of NULL multilink encapsulated fragments that have been received.
outWholeFragments	The number of multilink encapsulated fragments transmitted that contain a whole packet.
outStartFragments	The number of multilink encapsulated fragments transmitted that contain the start of a packet.
outMiddleFragments	The number of multilink encapsulated fragments transmitted that contain part of a packet that is not the start or the end.
outEndFragments	The number of multilink encapsulated fragments transmitted that contain the end of a packet.
outNullFragments	The number of NULL multilink encapsulated fragments that have been transmitted.

Figure 9-20: Example output from the **show ppp count=ncp** command

IPCP			
inOctets	63611	outOctets	91768
inUserPkts	2098	outUserPkts	1538
inConfigureRequest	1	outConfigureRequest	1
inConfigureAcknowledge	1	outConfigureAcknowledge	1
inConfigureNAK	0	outConfigureNAK	0
inConfigureReject	0	outConfigureReject	0
inTerminateRequest	0	outTerminateRequest	0
inTerminateAcknowledge	0	outTerminateAcknowledge	0
inCodeReject	0	outCodeReject	0

Table 9-18: Parameters in the output of the **show ppp count=ncp** command

Parameter	Meaning
inOctets	The number of octets received by the network protocol. This includes two octets per frame for the PPP protocol header, the number of octets of user data to be passed up to the user protocol, and the number of octets in control protocol packets (e.g. IPCP, ATCP).
inUserPkts	The number of packets received for the network control protocol.
inConfigureRequest	The number of Configure-Request packets received for the network control protocol.
inConfigureAcknowledge	The number of Configure-Acknowledge packets received for the network control protocol.
inConfigureNAK	The number of Configure-NAK packets received for the network control protocol.
inConfigureReject	The number of Configure-Reject packets received for the network control protocol.
inTerminateRequest	The number of Terminate-Request packets received for the network control protocol.
inTerminateAcknowledge	The number of Terminate-Acknowledge packets received for the network control protocol.
inCodeReject	The number of Code-Reject packets received for the network control protocol.
outOctets	The number of octets transmitted by the network protocol. This includes two octets per frame for the PPP protocol header, the number of octets of user data passed down from the user protocol, and the number of octets in control protocol packets (e.g. IPCP, ATCP).
outUserPkts	The number of packets sent for the network control protocol.
outConfigureRequest	The number of Configure-Request packets sent for the network control protocol.
outConfigureAcknowledge	The number of Configure-Acknowledge packets sent for the network control protocol.
outConfigureNAK	The number of Configure-NAK packets sent for the network control protocol.
outConfigureReject	The number of Configure-Reject packets sent for the network control protocol.

Table 9-18: Parameters in the output of the **show ppp count=ncp** command (continued)

Parameter	Meaning
outTerminateRequest	The number of Terminate-Request packets sent for the network control protocol.
outTerminateAcknowledge	The number of Terminate-Acknowledge packets sent for the network control protocol.
outCodeReject	The number of Code-Reject packets sent for the network control protocol.

Table 9-19: Parameters in the output of the **show ppp count** command for **bap** and **bacp**

Parameter	Meaning
BAP	Information about the operation of BAP.
inCallReq	The number of <i>Call-Request</i> packets received by the BAP protocol.
inCallResp	The number of <i>Call-Response</i> packets received by the BAP protocol.
inCallbackReq	The number of <i>Callback-Request</i> packets received by the BAP protocol.
inCallbackResp	The number of <i>Callback-Response</i> packets received by the BAP protocol.
inLinkDropQueryReq	The number of <i>Link-Drop-Query-Request</i> packets received by the BAP protocol.
inLinkDropQueryResp	The number of <i>Link-Drop-Query-Response</i> packets received by the BAP protocol.
inCallStatusInd	The number of <i>Call-Status-Indication</i> packets received by the BAP protocol.
inCallStatusResp	The number of <i>Call-Status-Response</i> packets received by the BAP protocol.
inErrors	The number of packets received by the BAP protocol that contained errors.
inDiscards	The number of packets received by the BAP protocol that were discarded.
outCallReq	The number of <i>Call-Request</i> packets transmitted by the BAP protocol.
outCallResp	The number of <i>Call-Response</i> packets transmitted by the BAP protocol.
outCallbackReq	The number of <i>Callback-Request</i> packets transmitted by the BAP protocol.
outCallbackResp	The number of <i>Callback-Response</i> packets transmitted by the BAP protocol.
outLinkDropQueryReq	The number of <i>Link-Drop-Query-Request</i> packets transmitted by the BAP protocol.
outLinkDropQueryResp	The number of <i>Link-Drop-Query-Response</i> packets transmitted by the BAP protocol.
outCallStatusInd	The number of <i>Call-Status-Indication</i> packets transmitted by the BAP protocol.
outCallStatusResp	The number of <i>Call-Status-Response</i> packets transmitted by the BAP protocol.

Table 9-19: Parameters in the output of the **show ppp count** command for **bap** and **bacp**

Parameter	Meaning
BACP	Information about the operation of BACP.
inOctets	The number of octets received by the BACP protocol.
inUserPkts	The number of packets received by the BACP protocol.
inConfigureRequest	The number of <i>Configure-Request</i> packets received by the BACP protocol.
inConfigureAcknowledge	The number of <i>Configure-Acknowledge</i> packets received by the BACP protocol.
inConfigureNAK	The number of <i>Configure-NAK</i> packets received by the BACP protocol.
inConfigureReject	The number of <i>Configure-Reject</i> packets received by the BACP protocol.
inTerminateRequest	The number of <i>Terminate-Request</i> packets received by the BACP protocol.
inTerminateAcknowledge	The number of <i>Terminate-Acknowledge</i> packets received by the BACP protocol.
inCodeReject	The number of <i>Code-Reject</i> packets received by the BACP protocol.
outOctets	The number of octets transmitted by the BACP protocol.
outUserPkts	The number of packets transmitted by the BACP protocol.
outConfigureRequest	The number of <i>Configure-Request</i> packets transmitted by the BACP protocol.
outConfigureAcknowledge	The number of <i>Configure-Acknowledge</i> packets transmitted by the BACP protocol.
outConfigureNAK	The number of <i>Configure-NAK</i> packets transmitted by the BACP protocol.
outConfigureReject	The number of <i>Configure-Reject</i> packets transmitted by the BACP protocol.
outTerminateRequest	The number of <i>Terminate-Request</i> packets transmitted by the BACP protocol.
outTerminateAcknowledge	The number of <i>Terminate-Acknowledge</i> packets transmitted by the BACP protocol.
outCodeReject	The number of <i>Code-Reject</i> packets transmitted by the BACP protocol.

Figure 9-21: Example output from the **show ppp count=pppoe** command

ppp0	1519 seconds	Last change at:	974 seconds
PPPoE Counters			
PADIs Rx	1	PADIs Tx	0
PADOs Rx	0	PADOs Tx	1
PADRs Rx	1	PADRs Tx	0
PADSS Rx	0	PADSS Tx	1
PADTs Rx	0	PADTs Tx	0

Table 9-20: Parameters in the output of the **show ppp count=pppoe** command

Parameter	Meaning
PADIs Rx	The number of PADI packets received.
PADIs Tx	The number of PADI packets transmitted.
PADOs Rx	The number of PADO packets received.
PADOs Tx	The number of PADO packets transmitted.
PADRs Rx	The number of PADR packets received.
PADRs Tx	The number of PADR packets transmitted.
PADs Rx	The number of PADS packets received.
PADs Tx	The number of PADS packets transmitted.
PADT Rx	The number of PADT packets received.
PADT Tx	The number of PADT packets transmitted.

Examples To display the interface counters for PPP interface 1, use the command:

```
SHOW PPP=1 COUNT=INTERFACE
```

Related Commands

- [show ppp](#)
- [show ppp config](#)
- [show ppp idletimer](#)
- [show ppp multilink](#)
- [show ppp utilisation](#)

show ppp debug

Syntax `SHOW PPP[=ppp-interface] DEBUG`

where *ppp-interface* is a number from 0 to 1023

Description This command displays the debugging options that are currently enabled for the specified or all PPP interfaces (Figure 9-22 on page 9-117, Table 9-21 on page 9-117).

Figure 9-22: Example output from the **show ppp debug** command

Interface	Enabled Debug Modes
-----	-----
ppp0	AUTH, DECODE, LCP, PKT, UTILISATION
-----	-----

Table 9-21: Parameters in the output of the **show ppp debug** command

Parameter	Meaning
Interface	The interface name.
Enabled Debug Modes	The list of currently enabled debug modes for the interface; one or more of "AUTH", "BAPSTATE", "CALLBACK", "CTRLPKT", "DATAPKT", "DECODE", "DEMAND", "ENCO", "LCP", "LQR", "NCP", "PKT", "PPPOE" or "UTILISATION".

Examples To display the debugging options set for all PPP interfaces, use the command:

```
SHOW PPP DEBUG
```

Related Commands

- [disable ppp debug](#)
- [disable ppp template debug](#)
- [enable ppp debug](#)
- [enable ppp template debug](#)

show ppp idletimer

Syntax SHOW PPP[=*ppp-interface*] IDLETIMER

where *ppp-interface* is a number, from 0 to 1023

Description This command displays the configured and current values of the PPP idle timer for the specified or all PPP interfaces (Figure 9-23 on page 9-118, Table 9-22 on page 9-118).

Figure 9-23: Example output from the **show ppp idletimer** command

Interface	Configured Idle Time	Idle Timer Value
ppp0	60	EXPIRED

Table 9-22: Parameters in the output of the **show ppp idletimer** command

Parameter	Meaning
ppp0	The interface name.
Configured Idle Time	Seconds that a link must be idle before it is disconnected, or whether the idle timer is disabled.
Idle Timer Value	Seconds remaining until the link is disconnected or whether the timer has expired.

Examples To display the idle timers for all PPP interfaces, use the command:

```
SHOW PPP IDLETIMER
```

Related Commands

- [show ppp](#)
- [show ppp config](#)
- [show ppp count](#)
- [show ppp multilink](#)

show ppp limits

Syntax `SHOW PPP[=ppp-interface] LIMITS`

where *ppp-interface* is a number from 0 to 1023

Description This command displays information about the accumulated up-time and input/output data counters for all PPP interfaces or a specific one. It shows the current values of the counters, and any defined threshold limits (See [Figure 9-24](#)).

Figure 9-24: Example output from the **show ppp** Limits command

Name		Current	Limit	Remaining
ppp0	Up Time	16:12	25 hrs	08:47
	In Data	EXCEEDED	50 MB	0.0 MB
	Out Data	21.5 MB	Unlimited	--
	Total Data	71.5 MB	Unlimited	--

Table 9-23: Parameters in the **show ppp limits** command output

Parameter	Meaning
Name	The name of the PPP interface.
Over	The lower layer(s) used by the PPP interface; <i>SYNn</i> , <i>ISDN-callname</i> , <i>ACC-callname</i> , <i>MIOXn-circuitname</i> , <i>TDM-groupname</i> , <i>ETHn-servicename</i> , <i>VLANn-servicename</i> , <i>TNL-callname</i> .
Up-Time	The cumulative up-time, in hours, for the interface.
In Data	The cumulative input data throughput, in megabytes, for the interface.
Out Data	The cumulative output data throughput, in megabytes, for the interface.
Total Data	The cumulative total data throughput, in megabytes, for the interface.
Current	The current value of the cumulative counter, or "EXCEEDED" if the interface counter has exceeded the corresponding threshold limit.
Limit	The threshold limits for the interface, or "Unlimited" if no value has been specified.
Remaining	The remaining time/data throughput allowed before the limit is exceeded and the link closed.

Example To display the up-time and input/output data counters for PPP interface 0, use the command:

```
SHOW PPP=0 LIMITS
```

Related Commands

- [add ppp acservice](#)
- [create ppp template](#)
- [reset ppp](#)
- [set ppp](#)
- [set ppp acservice](#)

show ppp multilink

Syntax SHOW PPP[=*ppp-interface*] MULTILINK

where *ppp-interface* is a number from 0 to 1023

Description This command displays information about a multilink bundle for all PPP interfaces or a specific one (Figure 9-25, Table 9-24 on page 9-120).

Figure 9-25: Example output from the **show ppp multilink** command

Interface	Parameter	Value
ppp0	Multilink Enabled	Yes
	Fragmentation Enabled	No
	Acceptable fragmentation overhead for VF scheme (%)	5
	Minimum packet size for fragmentation using VF scheme (bytes)	120
	Null fragment timer (seconds)	3
	Number of links in bundle	4
	Total bandwidth of bundle (bps)	256000
	Number of packets fragmented using VF scheme	0
	Number of packets fragmented using FF scheme	0
	Number of packets not fragmented	971
	Next output sequence number	972
	Minimum sequence number received on bundle	863
	Next expected sequence number	866
	Length of receive queue	0
	Discards from receive queue	0

Table 9-24: Parameters in the output of the **show ppp multilink** command

Parameter	Meaning
ppp0	The interface name.
Multilink Enabled	Whether multilink is enabled on this PPP interface.
Fragmentation Enabled	Whether fragmentation is enabled on this PPP interface.
Acceptable fragmentation overhead for VF scheme (%)	The maximum acceptable overhead for fragmentation using the variable fragmentation scheme, as a percentage of packet size.
Minimum packet size for fragmentation using VF scheme (bytes)	The minimum size packet that may be fragmented using the variable fragmentation scheme.
Null fragment timer (seconds)	Seconds that the link must be idle before a null fragment is transmitted.
Number of links in bundle	The number of links in the multilink bundle.
Total bandwidth of bundle (bps)	The total bandwidth in bits per second of the multilink bundle.
Number of packets fragmented using VF scheme	The number of packets that have been fragmented using the variable fragmentation scheme.
Number of packets fragmented using FF scheme	The number of packets that have been fragmented using the fixed fragmentation scheme.

Table 9-24: Parameters in the output of the **show ppp multilink** command (continued)

Parameter	Meaning
Number of packets not fragmented	The number of packets that have not been fragmented.
Next output sequence number	The sequence number to use in the next transmission over the multilink bundle.
Minimum sequence number received on bundle	The lowest sequence number received via the multilink bundle.
Next expected sequence number	The next sequence number expected via the multilink bundle.
Length of receive queue	The current length of the receive queue.
Discards from receive queue	The number of packets discarded from the receive queue due to lost packets causing sequence number synchronisation to be lost.

Examples To display multilink information for all PPP interfaces, use the command:

```
SHOW PPP MULTILINK
```

Related Commands [show ppp](#)
[show ppp config](#)
[show ppp count](#)
[show ppp idletimer](#)

show ppp nameserver

Syntax SHOW PPP NAMESERVER

Description This command displays information about the currently configured global DNS and WINS servers (Figure 9-26 on page 9-122, Table 9-25 on page 9-122).

Figure 9-26: Example output from the **show ppp nameserver** command

Name Server	Address
-----	-----
Primary DNS	192.168.2.3
Secondary DNS	192.168.5.1
Primary WinS	192.168.5.5
Secondary WinS	Not Set
-----	-----

Table 9-25: Parameters in the output of the **show ppp nameserver** command

Parameter	Meaning
Primary DNS Address	The IP address of the primary DNS server, passed to a peer in response to an IPCP primary DNS request.
Secondary DNS Address	The IP address of the secondary DNS server, passed to a peer in response to an IPCP secondary DNS request.
Primary WinS Address	The IP address of the primary WINS server, passed to a peer in response to an IPCP primary WINS server request.
Secondary WinS Address	The IP address of the secondary WINS server, passed to a peer in response to an IPCP secondary WINS server request.

Examples To display the currently configure DNS and WINS servers, use the command:

```
SHOW PPP NAMESERVER
```

Related Commands [set ppp](#)
[show ppp](#)

show ppp pppoe

Syntax SHOW PPP PPPOE

Description This command displays information about PPPoE interfaces and services that are currently configured (Figure 9-27 on page 9-123, Table 9-26 on page 9-123).

Figure 9-27: Example output from the **show ppp pppoe** command

```

PPPOE
-----
PPP1:
  Service Name ..... bob
  Peer Mac Address ..... 00-00-cd-00-ab-a3
  Session ID ..... a1a3

  Access Concentrator Mode ..... Enabled

Services:
  bob
    Max sessions ..... 2
    Current Sessions ..... 1
    Template ..... 1
    MAC RADIUS Authentication ... YES
  carol
    Max sessions ..... 5
    Current Sessions ..... 0
    Template ..... 1
    MAC RADIUS Authentication ... YES

PPPOE Counters:
  Rejected PADI packets ..... 0
  Rejected PADO packets ..... 0
  Rejected PADR packets ..... 0
  Rejected PADS packets ..... 0
  Rejected PADT packets ..... 0
-----

```

Table 9-26: Parameters in the output of the **show ppp pppoe** command

Parameter	Meaning
Service Name	The name of the service either that the PPPoE interface is offering (if the interface is in access concentrator mode) or that the PPPoE interface is requesting/using (if the interface is not in access concentrator mode).
Peer Mac Address	The MAC address of the PPPoE peer.
Session ID	The ID of the current session.
Access Concentrator Mode	Enabled indicates that the router is acting as a PPPoE Access Concentrator. Disabled indicates that it is acting as a PPPoE client.
Services	The list of PPPoE services that the router can offer. This list is displayed when the router is in Access Concentrator mode.
Max Session	The maximum number of simultaneous instances of the service that are permitted.

Table 9-26: Parameters in the output of the **show ppp pppoe** command (continued)

Current Sessions	The number of instances of the service currently in use.
Template	The number of the PPP template used to make PPP sessions that run over the service.
MAC RADIUS Authentication	On indicates that when RADIUS User Authentication is in use, the MAC address of the PPPoE peer is sent with the username and password. Off indicates that the peer MAC address is not sent.
Rejected PADI packets	The number of PPPoE PADI packets rejected because the requested service name was not available.
Rejected PADO packets	The number of PPPoE PADO packets rejected because no PPPoE interface was expecting a PADO or the PADO was not matched with a PPPoE interface.
Rejected PADR packets	The number of PPPoE PADR packets rejected because the PADR packet was not matched with a PPPoE interface.
Rejected PADS packets	The number of PPPoE PADS packets rejected because the PADS packet was not matched with a PPPoE interface.
Rejected PADT packets	The number of PPPoE PADT packets rejected because the PADT packet was not matched with a PPPoE interface.

Examples To display information about all the currently configured PPPoE interfaces and general PPPoE counters, use the command:

```
SHOW PPP PPPOE
```

Related Commands

- [add ppp](#)
- [create ppp](#)
- [enable ppp debug](#)
- [show ppp](#)
- [show ppp config](#)

show ppp template

Syntax SHOW PPP TEMPLATE [=*template*] [DEBUG]

where *template* is a number from 0 to 31

Description This command displays information about PPP templates.

The TEMPLATE parameter specifies the number of the template to display. If a template is not specified, information is displayed about all templates, including the default template. If a template is specified, information about the specified template is displayed ([Figure 9-28 on page 9-125](#), [Table 9-27 on page 9-125](#)). If no templates have been defined, the default template is displayed.

If DEBUG is specified, the debugging modes enabled for the template or all templates are displayed ([Figure 9-29 on page 9-127](#), [Table 9-28 on page 9-127](#)).

Figure 9-28: Example output from the **show ppp template** command

```

Template - Description
Parameter                               Value
-----
pppt0 - Template for calls from Head Office
Multilink                               ON
Maximum links                            4
Bandwidth Allocation Protocol            ON
Bandwidth Allocation Call Mode           CALL
Multilink fragmentation                   OFF
Acceptable Fragment Overhead (%)         5
Null Fragment Timer (seconds)            3
Idle Timer (seconds)                      OFF
Compression                              ON
Compression Algorithm                     STACLZS
Compression Checkmode                     LCB
Encryption                               OFF
Username                                 NOT SET
Password                                 NOT SET
Login Servers                             RADIUS, TACACS, USER
IP Pool                                  NOT SET
Request IP Address                        NO
Link
Authentication                           NONE
CHAP Rechallenge (max. period seconds)    900
Callback Mode                             OFF
Callback Operation                        USER
Callback Number                           -
Callback Delay (seconds)                   5
Echo Timer (seconds)                       10
LQR Timer (seconds)                       60
Magic Number                              ON
Maximum Receive Unit                       OFF
Restart Timer (seconds)                    3
Debug
Maximum packet bytes to display           32
-----

```

Table 9-27: Parameters in the output of the **show ppp template** command

Parameter	Meaning
pppT<template> - <description>	The number and description of the template.
Multilink	Whether dynamic PPP calls can be multilinked together; either "ON" or "OFF".
Maximum links	The maximum number of links allowed in a multilink bundle created with this template.
Bandwidth Allocation Protocol	Whether the Bandwidth Allocation Protocol is enabled; either "ON" or "OFF".
Bandwidth Allocation Call Mode	The call mode for the Bandwidth Allocation Protocol, if the Bandwidth Allocation Protocol is enabled; either "CALL" or "CALLBACK".
Multilink fragmentation	Whether multilink packets may be fragmented.

Table 9-27: Parameters in the output of the **show ppp template** command (continued)

Parameter	Meaning
Acceptable Fragment Overhead(%)	The maximum amount of overhead allowed to be added to each packet due to variable fragmentation. If this level is exceeded when fragmentation of a packet is done using the variable fragmentation scheme, then the fixed fragmentation scheme is used instead.
Null Fragment Timer	Seconds that the link must be idle for before a Null fragment is sent on a link in a multilink bundle.
Idle Timer (seconds)	Seconds that a link must be idle before it is disconnected or whether the idle timer is disabled.
Compression	Whether compression is enabled.
Compression Algorithm	The compression algorithm to use for compressing packets; either "PREDICTOR" or "STACLZS".
Compression Checkmode	The check mode used by the compression algorithm to determine when a decompression history becomes unsynchronised; either SEQUENCE, LCB, CRC 16, or CRCCCITT.
Encryption	Whether encryption is enabled.
Username	The username used by the PPP interface for both PAP and CHAP authentication, or "NOT SET" if a username has not been set.
Password	Whether a password has been set for the entire PPP interface.
Login Servers	The authentication servers to use; "USER", "RADIUS", "TACACS", "TACACSPLUS", or "NOT SET" if a login server has not been set.
IP Pool	The name of the IP address pool used to assign IP addresses for this PPP interface, or "NOT SET" if an IP address pool has not been assigned.
Request IP Address	Whether an IP address is requested from the peer during IPCP negotiation.
Authentication	The authentication protocol in use; either NONE, PAP, CHAP, or EITHER.
CHAP Rechallenge	Seconds for the maximum interval between CHAP rechallenges or whether CHAP rechallenge is disabled.
Callback Mode	Whether the link requests callback, accepts callback or does neither.
Callback Operation	The callback operation included in callback requests; either "USERAUTH" or "E164NUMBER".
Callback Number	The callback number to include in callback requests when the callback operation is E164NUMBER.
Callback Delay (seconds)	Seconds for the delay between deactivating a call for callback and making the call back to the peer.
Echo Timer (seconds)	Seconds for the interval between transmissions of LCP <i>Echo Request</i> messages.
LQR Timer (seconds)	Seconds between LQR packets transmitted over the physical interface.
Maximum Receive Unit	The MRU value to include in LCP requests, DEFAULT, or OFF.

Table 9-27: Parameters in the output of the **show ppp template** command (continued)

Parameter	Meaning
Maximum Transmission Unit	The value for the maximum transmission unit; the default is 1500.
Magic Number	Whether the magic number option is enabled.
Restart Timer	Seconds between configure requests for the physical interface.
Maximum packet bytes to display	The maximum number of bytes of each PPP packet displayed by the PACKET debugging option.

Figure 9-29: Example output from the **show ppp template debug** command

Template	Call	Enabled Debug Modes
-----	-----	-----
pppT0		PKT, LCP, NCP
-----	-----	-----

Table 9-28: Parameters in the output of the **show ppp template debug** command

Parameter	Meaning
Template	The name of a PPP template.
Call	The lower layer call using this template, if any.
Enabled Debug Modes	The debugging modes enabled for the template (and call); one or more of "AUTH", "BAPSTATE", "CALLBACK", "DEMAND", "ENCO", "LCP", "NCP", "PKT" or "UTILISATION".

Examples To display the configuration for all templates, use the command:

```
SHOW PPP TEMPLATE
```

To display the configuration for template 1, use the command:

```
SHOW PPP TEMPLATE=1
```

To display the debugging modes enabled for template 3, use the command:

```
SHOW PPP TEMPLATE=3 DEBUG
```

- Related Commands**
- [create ppp template](#)
 - [destroy ppp template](#)
 - [disable ppp template debug](#)
 - [enable ppp template debug](#)
 - [set ppp acservice](#)
 - [set ppp template](#)

show ppp txstatus

Syntax SHOW PPP[=*ppp-interface*] TXSTATUS

where:

- *ppp-interface* is the PPP interface number, from 0 to 1023.

Description This command displays information about the status of a PPP transmission queue for the specified interface of all interfaces (Figure 9-30 on page 9-128, Table 9-29 on page 9-128).

Figure 9-30: Example output from the **show ppp txstatus** command

Interface	Parameter	Value

ppp0	Interface transmission queue length	0
eth0	Packets started transmission	198
	Packets being transmitted	0
	Packets lost during transmission	3
	Packets finished transmission	195
	Packets discarded in pipe	0
	Link transmission queue length	0
	Driver bandwidth (bps)	48000
	Driver transmission delay (ms)	0
	Driver transmission status	Ready

Table 9-29: Parameters in the output of the **show ppp txstatus** command

Parameter	Meaning
ppp<n>	The name of a PPP interface.
Interface transmission queue length	The length of the output queue for this PPP interface.
<physical-interface>	The name of a physical interface or channel forming part of this PPP interface.
Packets started transmission	The total number of packets that higher-layer protocols requested be transmitted to a non-unicast address, including those that were discarded or not sent.
Packets being transmitted	The number of packets currently being transmitted on this physical interface or channel.
Packets lost during transmission	The number of packets lost during transmission on this physical interface or channel.
Packets finished transmission	The number of packets that have been transmitted and acknowledged on this physical interface or channel.
Packets discarded in pipe	The number of packets discarded on this physical interface or channel.

Table 9-29: Parameters in the output of the **show ppp txstatus** command (continued)

Parameter	Meaning
Link transmission queue length	The length of the output queue for this physical interface or channel.
Driver bandwidth (bps)	The bandwidth of the layer 1 device driver for this physical interface or channel.
Driver transmission delay (ms)	Milliseconds of the delay in the layer 1 device driver for this physical interface or channel.
Driver transmission status	Whether the layer 1 device driver for this physical interface or channel is busy or ready.

Examples To show the status of the PPP transmission queue, use the command:

```
SHOW PPP TXSTATUS
```

Related Commands [show ppp](#)

show ppp utilisation

Syntax `SHOW PPP[=ppp-interface] UTILISATION`

where:

- *ppp-interface* is the PPP interface number, from 0 to 1023.

Description This command shows PPP utilisation measurements for each lower layer interface and the overall utilisation for all PPP interfaces, or a particular interface if specified (Figure 9-31 on page 9-129 and Table 9-30 on page 9-129). The data is sent to the port, or telnet session, where the command was entered.

Figure 9-31: Example output from the **show ppp utilisation** command

Interface: ppp0	Time: 15:45:39	
Over: tdm-0	Utilisation(%): 93	Bandwidth(bps): 2048000
Over: tdm-1	Utilisation(%): 2	Bandwidth(bps): 2048000
Utilisation Overall(%): 47	Up Timer(seconds): 0	Down Timer(seconds): 0

Table 9-30: Parameters in the output of the **show ppp utilisation** command

Parameter	Meaning
Interface	The PPP interface being queried.
Time	The time the command was processed.
Over	The name of each lower layer interface of the PPP interface in question.

Table 9-30: Parameters in the output of the **show ppp utilisation** command (continued)

Parameter	Meaning
Utilisation(%)	The current utilisation rate of each lower layer interface.
Bandwidth(bps)	The bandwidth of each lower layer interface.
Utilisation Overall(%)	The overall utilisation rate of the PPP interface.
Up Timer(seconds)	The time remaining after which an additional channel opens, providing that the overall utilisation rate remains above the threshold specified by the UPRATE parameter when the CREATE/SET PPP command was issued.
Down Timer(seconds)	The time remaining after which a channel closes, providing that the overall utilisation rate remains below the threshold specified by the DOWNRATE parameter when the CREATE/SET PPP command was issued.

Examples To show utilisation statistics on PPP interface 2, use the command:

```
SHOW PPP=2 UTILISATION
```

Related Commands

- [enable ppp debug](#)
- [disable ppp debug](#)
- [enable ppp template debug](#)
- [disable ppp template debug](#)
- [show ppp config](#)
- [show ppp debug](#)