ISDN/Dialer Access-Link Support for Broadband Aggregation

The ISDN/Dialer Access-Link Support for Broadband Aggregation feature provides client connectivity to a network through PPP connections by using an ISDN PRI Layer 2 Tunneling Protocol (L2TP) access concentrator (LAC) session over IPv4.

This module describes how to configure the ISDN and dialer access-link support for broadband aggregation.

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see Bug Search Tool and the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the feature information table.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Prerequisites for ISDN/Dialer Access-Link Support for Broadband Aggregation

- You must configure a Layer 2 Tunneling Protocol (L2TP) network server (LNS) and enable IPv4 before configuring ISDN support for broadband.

- Ensure that the ISDN/Dialer Access-Link Support for Broadband Aggregation feature installs correctly by enabling the activation of the *adventerprise* license upon the next reload.

```
enable
 configure terminal
  license boot level adventerprise
end
```

Restrictions for ISDN/Dialer Access-Link Support for Broadband Aggregation

- Only IPv4 PPP sessions inside Layer 2 Tunneling Protocol (L2TP) version 2 tunnels are supported.

- ISDN termination is not supported on the dialer interface or on the d-channel interface. To achieve PPP termination and aggregation (PTA), the router will need to act as a L2TP Access Concentrator (LAC) and forward incoming ISDN calls to a L2TP Network Server (LNS).

Information About ISDN/Dialer Access-Link Support for Broadband Aggregation

Deployment Model for ISDN/Dialer Access-Link Support for Broadband Aggregation

The ISDN/Dialer Access-Link Support for Broadband Aggregation feature provides support for ISDN and dialer PRI access link to broadband PPP IPv4 sessions at the Layer 2 Tunneling Protocol (L2TP) network server (LNS). These sessions are carried over PPP by the L2TP access concentrator (LAC) using ISDN over IPv4. The sessions are sent from the LAC to the LNS through L2TP tunnels. The LNS terminates the PPP sessions and assigns a network layer address to the client. The client data in the IPv4 packet is then routed to the ISP or a corporate network and forwarded to the final destination. The LNS also performs authentication,

authorization, and accounting (AAA) actions on the PPP sessions. The figure below describes the deployment model.

Figure 1: Topology Diagram
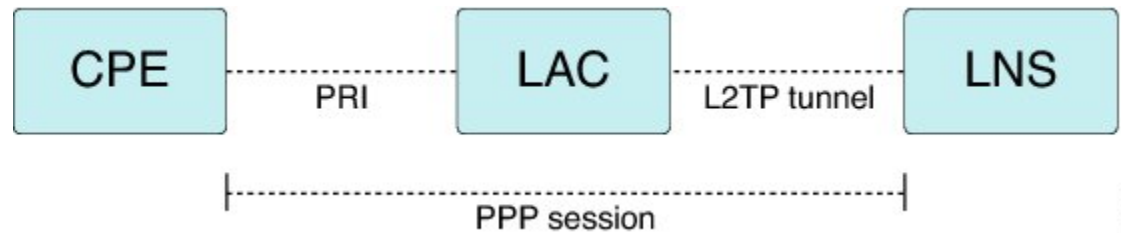
How to Configure ISDN/Dialer Access-Link Support for Broadband Aggregation

Note   Before you can configure the ISDN switch type on an interface, you must configure a global ISDN switch type by using the **isdn switch-type** global configuration command. Because global commands are processed before interface-level commands, the command parser does not accept the **isdn switch-type** command on an interface unless a switch type is first added globally.

Configuring an L2TP Access Concentrator

Perform this task to configure a virtual private dial-up network (VPDN), a Layer 2 Tunneling Protocol (L2TP) access concentrator (LAC), and an ISDN switch type.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **vpdn enable**
4. **vpdn search-order domain dnis**
5. **vpdn-group** *group-name*
6. **request-dialin**
7. **protocol l2tp**
8. **domain** *domain-name*
9. **exit**
10. **initiate-to ip** *ip-address*
11. **local name** *host-name*
12. **l2tp tunnel password** *password*
13. **exit**
14. **isdn switch-type** *switch-type*
15. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**vpdn enable** **Example:** `Device(config)# vpdn enable`	Enables VPDN on a device.
Step 4	**vpdn search-order domain dnis** **Example:** `Device(config)# vpdn search-order domain dnis`	Specifies how a network access server (NAS) or a tunnel switch performs VPDN tunnel authorization searches.
Step 5	**vpdn-group** *group-name* **Example:** `Device(config)# vpdn-group group1`	Creates and associates a VPDN group with a customer or a VPDN profile and enters VPDN group configuration mode.

	Command or Action	**Purpose**
Step 6	**request-dialin** **Example:** Device(config-vpdn)# request-dialin	Creates a request-dialin VPDN subgroup that indicates the dialing direction and initiates the tunnel; enters VPDN request-dialin group configuration mode.
Step 7	**protocol l2tp** **Example:** Device(config-vpdn-req-in)# protocol l2tp	Specifies that L2TP is the tunneling protocol used by the VPDN subgroup.
Step 8	**domain** *domain-name* **Example:** Device(config-vpdn-req-in)# domain xyz.com	Specifies the domain name of users that are to be forwarded to a tunnel server using VPDN.
Step 9	**exit** **Example:** Device(config-vpdn-req-in)# exit	Returns to VPDN group configuration mode.
Step 10	**initiate-to ip** *ip-address* **Example:** Device(config-vpdn)# initiate-to ip 192.0.2.55	Specifies an IP address that is used for Layer 2 tunneling.
Step 11	**local name** *host-name* **Example:** Device(config-vpdn)# local name host1	Specifies a local hostname that the tunnel uses to identify itself.
Step 12	**l2tp tunnel password** *password* **Example:** Device(config-vpdn)# l2tp tunnel password password1	Sets a password that the device uses to authenticate the Layer 2 Tunneling Protocol (L2TP) tunnel.
Step 13	**exit** **Example:** Device(config-vpdn)# exit	Returns to global configuration mode.
Step 14	**isdn switch-type** *switch-type* **Example:** Device(config)# isdn switch-type primary-4ess	Selects a service provider switch type that accommodates PRI. • In this example, the ISDN switch type is primary-4ess.
Step 15	**end** **Example:** Device(config)# end	Returns to privileged EXEC mode.

Configuring a PRI Group

Perform this task to specify an ISDN switch type and to configure a PRI group.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **isdn switch-type** *switch-type*
4. **controller** {**T1** | **E1**} *slot/port*
5. **framing esf**
6. **linecode** {**ami** | **b8zs** | **hdb3**}
7. **cablelength long** *db-gain-value db-loss-value*
8. **pri-group timeslots** *timeslot-range*
9. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**isdn switch-type** *switch-type* **Example:** `Device(config)# isdn switch-type primary-ni`	Selects a service provider switch type that accommodates PRI.
Step 4	**controller** {**T1**	**E1**} *slot/port* **Example:** `Device(config)# controller T1 0/1`	Enters controller configuration mode.
Step 5	**framing esf** **Example:** `Device(config-controller)# framing esf`	Selects the extended super frame (esf) type for the T1 data line.

	Command or Action	Purpose
Step 6	**linecode** {**ami** | **b8zs** | **hdb3**} **Example:** `Device(config-controller)# linecode b8zs`	Selects the line code type for T1 or E1 lines. • Alternate Mark Inversion (AMI) is the default for T1 lines. • Bipolar With 8-Bit Substitution (B8ZS) is valid only for the T1 controller. • High-Density Bipolar 3 (hdb3) is the default for E1 lines.
Step 7	**cablelength long** *db-gain-value db-loss-value* **Example:** `Device(config-controller)# cablelength long gain36 0db`	Increases the pulse of a signal at the receiver and decreases the pulse from the transmitter by using pulse equalization and line build-out for a T1 cable.
Step 8	**pri-group timeslots** *timeslot-range* **Example:** `Device(config-controller)# pri-group timeslots 1-2`	Configures the PRI group for the T1 or E1 controller to carry voice traffic. • Use a hyphen to indicate a range. Groups of time slot ranges separated by commas (for example: 1-4,8-23) are also accepted. • You can configure the PRI group to include all available time slots, or you can configure a select group of time slots for the PRI group.
Step 9	**end** **Example:** `Device(config-controller)# end`	Returns to privileged EXEC mode.

Configuring a Dialer for an ISDN PRI Interface

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface serial** *controller-number***:***time-slot*
4. **no ip address**
5. **dialer rotary-group** *interface-number*
6. **dialer-group** *group-number*
7. **exit**
8. **isdn switch-type** *switch-type*
9. **isdn timer** *timer milliseconds*
10. **isdn skipsend-idverify**
11. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**interface serial** *controller-number***:***time-slot* **Example:** `Device(config)# interface serial 0/1/7:23`	Specifies a serial interface created on a channelized E1 or channelized T1 controller and enters interface configuration mode.
Step 4	**no ip address** **Example:** `Device(config-if)# no ip address`	Removes an existing IP address or disables IP processing.
Step 5	**dialer rotary-group** *interface-number* **Example:** `Device(config-if)# dialer rotary-group 100`	Includes a specified interface in a dialer rotary group.

	Command or Action	Purpose
Step 6	**dialer-group** *group-number* **Example:** Device(config-if)# dialer-group group1	Controls access by configuring an interface to belong to a specific dialing group.
Step 7	**exit** **Example:** Device(config-if)# exit	Returns to global configuration mode.
Step 8	**isdn switch-type** *switch-type* **Example:** Device(config)# isdn switch-type primary-4ess	Selects a service provider switch type that accommodates PRI.
Step 9	**isdn timer** *timer milliseconds* **Example:** Device(config)# isdn timer T321 30000	Identifies and configures an ISDN timer and changes the value of the timer for network, call connect, and disconnect waiting periods.
Step 10	**isdn skipsend-idverify** **Example:** Device(config)# isdn skipsend-idverify	Stops user-side PRI interfaces from sending ID verification information.
Step 11	**end** **Example:** Device(config)# end	Returns to privileged EXEC mode.

Configuring a Dialer Interface by Enabling PPP Authentication

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface dialer** *dialer-rotary-group-number*
4. **no ip address**
5. **encapsulation** *encapsulation-type*
6. **dialer in-band**
7. **dialer idle-timeout** *seconds*
8. **dialer-group** *group-number*
9. **no peer default ip address**
10. **ppp authentication** *protocol1* [*protocol2...*] [**if-needed** | *list-name* | **default** | **callin** | **one-time** | **optional**]
11. **exit**
12. **dialer-list** *dialer-group* **protocol** *protocol-name* {**permit** | **deny** | **list** *access-list-number* | **access-group**}
13. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** Device> enable	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** Device# configure terminal	Enters global configuration mode.
Step 3	**interface dialer** *dialer-rotary-group-number* **Example:** Device(config)# interface dialer 100	Defines a dialer rotary group and enters interface configuration mode.
Step 4	**no ip address** **Example:** Device(config-if)# no ip address	Removes an existing IP address or disables IP processing.
Step 5	**encapsulation** *encapsulation-type* **Example:** Device(config-if)# encapsulation ppp	Sets the encapsulation method used by the interface.

		Command or Action	Purpose
Step 6		**dialer in-band** **Example:** `Device(config-if)# dialer in-band`	Specifies that dial-on-demand routing (DDR) is to be supported.
Step 7		**dialer idle-timeout** *seconds* **Example:** `Device(config-if)# dialer idle-timeout 5000`	Specifies the duration of idle time before a call is disconnected.
Step 8		**dialer-group** *group-number* **Example:** `Device(config-if)# dialer-group group1`	Controls access by configuring an interface to belong to a specific dialing group.
Step 9		**no peer default ip address** **Example:** `Device(config-if)# no peer default ip address`	Disables a prior peer IP address pooling configuration on an interface or removes the default address from your configuration.
Step 10		**ppp authentication** *protocol1* [*protocol2*...] [**if-needed** | *list-name* | **default** | **callin** | **one-time** | **optional**] **Example:** `Device(config-if)# ppp authentication chap callin`	Enables at least one PPP authentication protocol and specifies the order in which the protocols are selected on the interface.
Step 11		**exit** **Example:** `Device(config-if)# exit`	Returns to global configuration mode.
Step 12		**dialer-list** *dialer-group* **protocol** *protocol-name* {**permit** | **deny** | **list** *access-list-number* | **access-group**} **Example:** `Device(config)# dialer-list dialergroup1 protocol ip permit`	Defines a DDR dialer list for dialing by protocol or by a combination of a protocol and a previously defined access list.
Step 13		**end** **Example:** `Device(config)# end`	Returns to privileged EXEC mode.

Verifying ISDN/Dialer Access-Link Support for Broadband Aggregation

SUMMARY STEPS

1. **enable**
2. **show ppp all**
3. **show vpdn**

DETAILED STEPS

Step 1   **enable**
Enables privileged EXEC mode.

Example:

```
Device> enable
```

Step 2   **show ppp all**
Displays the PPP session information.

Example:

```
Device# show ppp all

Interface/ID OPEN+ Nego* Fail-      Stage    Peer Address    Peer Name
------------ -------------------- -------- --------------- --------------------
Se0/1/0:0    LCP+ CHAP*            Fwded    10.1.1.1         example@example.com
```

Step 3   **show vpdn**
Displays basic information about all active virtual private dial-up network (VPDN) tunnels.

Example:

```
Device# show vpdn

L2TP Tunnel and Session Information Total tunnels 1 sessions 1

LocTunID   RemTunID   Remote Name   State   Remote Address   Sessn L2TP Class/
                                                             Count VPDN Group
46988      29813      o2-lns        est     192.0.2.55        1     1

LocID      RemID      TunID     Username, Intf/        State  Last Chg Uniq ID
                                Vcid, Circuit
2300       46414      46988     example@e..., Se0/1/0:0  est    00:00:38 3
```

Troubleshooting Tips

Use the following commands to troubleshoot the ISDN/dialer access-link support for broadband aggregation:

- **debug dialer**—Displays debugging information about the packets received on a dialer interface.

- **debug isdn q931**—Displays information about call setup and teardown of ISDN network connections (Layer 3) between the local router (user side) and the network.

- **debug ppp authentication**—Displays authentication protocol messages, including Challenge Handshake Authentication Protocol (CHAP) packet exchanges and Password Authentication Protocol (PAP) exchanges.

- **debug ppp negotiation**—Displays information on traffic and exchanges of PPP packets sent during PPP startup, when PPP options are negotiated.

Configuration Examples for ISDN/Dialer Access-Link Support for Broadband Aggregation

Example: Configuring an L2TP Access Concentrator

The following example shows how to configure the Layer 2 Tunneling Protocol (L2TP) access concentrator (LAC):

```
Device(config)# vpdn enable
Device(config)# vpdn search-order domain dnis
Device(config)# vpdn-group group1
Device(config-vpdn)# request-dialin
Device(config-vpdn-req-in)# protocol l2tp
Device(config-vpdn-req-in)# domain xyz.com
Device(config-vpdn-req-in)# exit
Device(config-vpdn)# initiate-to ip 192.0.2.55
Device(config-vpdn)# local name host1
Device(config-vpdn)# l2tp tunnel password password1
Device(config-vpdn)# exit
Device(config)# isdn switch-type primary-4ess
```

Example: Configuring a PRI Group

The following example shows how to specify the ISDN PRI on the T1 controller for slot 0, port 1, and configures time slots 1 to 2:

```
Device(config)# isdn switch-type primary-ni
Device(config)# controller T1 0/1
Device(config-controller)# framing esf
Device(config-controller)# linecode b8zs
Device(config-controller)# cablelength long gain36 0db
Device(config-controller)# pri-group timeslots 1-2
```

Example: Configuring a Dialer for an ISDN PRI Interface

The following example shows how to specify the dialer profile configuration for an ISDN PRI interface:

```
Device(config)# interface serial 0/1/7:23
Device(config-if)# no ip address
Device(config-if)# dialer rotary-group 100
Device(config-if)# dialer-group group1
Device(config-if)# exit
Device(config)# isdn switch-type primary-4ess
Device(config)# isdn timer T321 30000
Device(config)# isdn skipsend-idverify
```

Example: Configuring a Dialer Interface by Enabling PPP Authentication

```
Device(config)# interface dialer 100
Device(config-if)# no ip address
Device(config-if)# encapsulation ppp
Device(config-if)# dialer in-band
Device(config-if)# dialer idle-timeout 5000
Device(config-if)# dialer-group group1
Device(config-if)# no peer default ip address
Device(config-if)# ppp authentication chap callin
Device(config-if)# exit
Device(config)# dialer-list dialergroup1 protocol ip permit
```

Additional References

Related Documents

Related Topic	Document Title
Cisco IOS commands	Cisco IOS Master Command List, All Releases
Broadband and DSL commands	Cisco IOS Broadband Access Aggregation and DSL Command Reference
Dial commands	Cisco IOS Dial Technologies Command Reference
VPDN commands	Cisco IOS VPDN Command Reference
Broadband and DSL configuration	*Broadband Access Aggregation and DSL Configuration Guide*
Technical support documentation for L2TP	*Layer 2 Tunnel Protocol (L2TP)*
Technical support documentation for PPP	*Point-to-Point Protocol (PPP)*

Standards and RFCs

Standard/RFC	Title
RFC 1661	*Point-to-Point Protocol (PPP)*
RFC 2661	*Layer Two Tunneling Protocol (L2TP)*

Technical Assistance

Description	Link
The Cisco Support and Documentation website provides online resources to download documentation, software, and tools. Use these resources to install and configure the software and to troubleshoot and resolve technical issues with Cisco products and technologies. Access to most tools on the Cisco Support and Documentation website requires a Cisco.com user ID and password.	http://www.cisco.com/cisco/web/support/index.html

Feature Information for ISDN/Dialer Access-Link Support for Broadband Aggregation

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Table 1: Feature Information for ISDN/Dialer Access-Link Support for Broadband Aggregation

Feature Name	Releases	Feature Information
ISDN/Dialer Access-Link Support for Broadband Aggregation	Cisco IOS XE Release 3.8S	The ISDN/Dialer Access-Link Support for Broadband Aggregation feature provides client connectivity to a network through PPP by using an ISDN PRI LAC session over IPv4.