



# CHAPTER 1

## Configuring the PPPoE Intermediate Agent

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DSL Forum TR-101 [1] offers a means by which the PPPoE Discovery packets are tagged at the service provider's access switch with subscriber line specific information. The mechanism specifies using VSA of the PPPoE Discovery packets to add the line specific information at the switch. Even though you can perform Subscriber Line Identification (SLI) in another way (recreating virtual paths and circuits using stacked VLAN tags), DSL Forum 2004-071 [4] recommends the PPPoE Intermediate Agent mechanism. It cites lower provisioning costs and simpler co-ordination between OSS systems in charge of access switch and BRAS. PPPoE Intermediate Agent helps the service provider, BRAS, distinguish between end hosts connected over Ethernet to an access switch.

This chapter describes PPPoE Intermediate Agent on Catalyst 4500 series switches. It includes the following sections:

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### Note

For complete syntax and usage information for the switch commands used in this chapter, see the *Cisco Catalyst 4500 Series Switch Command Reference* and related publications at this location:

<http://www.cisco.com/en/US/products/hw/switches/ps4324/index.html>

If a command is not in the *Catalyst 4500 Series Switch Command Reference*, you can locate it in the Cisco IOS library. See the *Cisco IOS Command Reference* and related publications at this location:

<http://www.cisco.com/en/US/products/ps6350/index.html>

## Related Documents

Related Topic	Document Title
PPPoE Circuit-Id Tag Processing	<a href="#">Refer to the PPOE Circuit-Id Tag Processing chapter</a>
RADIUS attributes	<a href="#">Refer to the Cisco IOS Security Configuration Guide, Release 12.4</a>
DSL Forum Line-ID tag solution	<a href="#">DSL Forum 2004-71: Solution for Remote-ID in PPPoE Discovery Phase</a>
Migration to Ethernet-based DSL aggregation	<a href="#">DSL Forum Technical Report 101</a>

## RFCs

RFC	Title
RFC 2516	<a href="#">A Method for Transmitting PPP over Ethernet (PPPoE)</a>

## About PPPoE Intermediate Agent

PPPoE Intermediate Agent (PPPoE IA) is placed between a subscriber and BRAS to help the service provider BRAS distinguish between end hosts connected over Ethernet to an access switch. On the access switch, PPPoE IA enables Subscriber Line Identification by appropriately tagging Ethernet frames of different users. (The tag contains specific information such as which subscriber is connected to the switch and VLAN.) PPPoE IA acts as mini security firewall between host and BRAS by intercepting all PPPoE Active Discovery (PAD) messages on a per-port per-VLAN basis. It provides specific security feature such as verifying the intercepted PAD message from untrusted port, performing per-port PAD message rate limiting, inserting and removing VSA Tags into and from PAD messages, respectively.

## Enabling PPPoE IA on a Switch

This functionality allows you to enable or disable PPPoE IA globally on the switch:

```
Switch> enable
Switch# configure terminal
Switch(config)# pppoe intermediate-agent
```

By default, PPPoE IA is disabled globally.

## Configuring the Access Node Identifier for PPPoE IA on a Switch

This functionality allows you to set the Access Node Identifier of the switch. If unspecified, this parameter is derived automatically with the IP address of the management interface.

The following example shows how to set an access node identifier of **abcd**:

```
Switch> enable
Switch# configure terminal
Switch(config)# pppoe intermediate-agent format-type access-node-id string abcd
```

By default, *access-node-id* is not set.

## Configuring the Identifier String, Option, and Delimiter for PPPoE IA on an Switch

This functionality overrides the default automatic generation of circuit-id by the system.

The options available are sp, sv, pv and spv denoting slot:port, slot-vlan, port-vlan, and slot-port-vlan combinations, respectively. Valid delimiters are # . , ; / space.

The **no** form of this command without *WORD*, *options*, and *delimiters*, reverts to the default automatic generation of circuit-id.

The following example shows how to set an identifier string **word** with option **spv** delimited by “:”:

```
Switch> enable
Switch# configure terminal
Switch(config) pppoe intermediate-agent format-type
                identifier-string string word
                option spv delimiter :
```

This command does not affect the circuit ID configured explicitly per-interface or per-interface per-VLAN with the **pppoe intermediate-agent format-type circuit-id** or **pppoe intermediate-agent vlan num format-type circuit-id** commands.

## Configuring the Generic Error Message for PPPoE IA on an Switch

This functionality sets the Generic-Error message of the switch. PPPoE IA sends this message only on a specific error condition. If you do not specify **string {WORD}**, the error message is not added.

The following example shows how to configure a generic message of **packet\_length>1484**:

```
Switch> enable
Switch# configure terminal
Switch(config) pppoe intermediate-agent format-type
                generic-error-message string packet_length>1484
PPPoE Discover packet too large to process. Try reducing the number of tags added.
```

By default the **generic-error-message** is not set. The **string** value is converted to UTF-8 before it is added to the response. The message similar to the following will appear:

```
PPPoE Discover packet too large to process. Try reducing the number of tags added.
```



### Note

This TAG (0x0203 Generic-Error) indicates an error. It can be added to PADO or PADS packets generated by PPPoE IA and then sent back to user in reply of PADI or PADR, when a PPPoE discovery packet received by PPPoE IA with PPPoE payload greater than 1484 bytes. Error data must be a UTF-8 string.

## Enabling PPPoE IA on an Interface

This functionality enables the PPPoE IA feature on an interface. The **pppoe intermediate-agent** command has an effect only if the PPPoE IA feature was enabled globally with this command. (You need to enable *globally* to activate PPPoE IA static ACL and on an interface for PPPoE IA processing of PPPoE discovery packets received on that interface.)

This setting applies to all frames passing through this interface, regardless of the VLAN they belong to. By default the PPPoE IA feature is disabled on all interfaces. You need to run this command on every interface that requires this feature.

The following example shows how to enable PPPoE IA on FastEthernet 3/1:

```
Switch> enable
Switch# configure terminal
Switch(config) interface FastEthernet 3/1
Switch(config-if) pppoe intermediate-agent
```

**Note**

Enabling PPPoE IA on an interface does not ensure that incoming packets are tagged. For this to happen PPPoE IA must be enabled globally, and at least one interface that connects the switch to PPPoE server has a trusted PPPoE IA setting. Refer to the following section for details.

## Configuring the PPPoE IA Trust Setting on an Interface

This functionality sets a physical interface as trusted. The following example shows how to set FastEthernet interface 3/2 as trusted:

```
Switch> enable
Switch# configure terminal
Switch(config) interface FastEthernet 3/2
Switch(config-if) pppoe intermediate-agent trust
```

This setting is disabled by default.

**Note**

Interfaces that connect the switch to PPPoE server are configured as trusted. Interfaces that connect the switch to users (PPPoE clients) are untrusted.

## Configuring PPPoE IA Rate Limiting Setting on an Interface

This functionality limits the rate (per second) at which PPPoE Discovery packets (PADI, PADO, PADR, PADS, or PADT) are received on an interface. When the incoming packet rate achieves or exceeds the configured limit, a port enters an err-disabled state.

The following example shows how to set a rate limit of 30 at FastEthernet 3/1:

```
Switch> enable
Switch# configure terminal
Switch(config) interface FastEthernet 3/1
Switch(config-if) pppoe intermediate-agent limit rate 30
```

**Note**

The parameter for rate limiting is the number of packets per second. If the incoming packet rate exceeds this value, the port shuts down.

## Configuring PPPoE IA Vendor-tag Stripping on an Interface

This functionality enables an administrator to strip the vendor-specific tag (VSA) from PADO, PADS, and PADT packets received on an interface before forwarding them to the user.

The following example shows how to enable stripping on FastEthernet 3/2:

```
Switch> enable
Switch# configure terminal
Switch(config) interface FastEthernet 3/2
Switch(config-if) pppoe intermediate-agent vendor-tag strip
```

This setting is disabled by default.



### Note

Generally, you would configure vendor-tag stripping on an interfaces connected to the PPPoE server. If you configure stripping, incoming packets are stripped of their VSAs (which carry subscriber and line identification information). For this to happen, the PPPoE Intermediate agent must be enabled to make the **pppoe intermediate-agent vendor-tag strip** command effective, and the interface must be set to trust. In isolation, the command has no effect.

## Configuring PPPoE IA Circuit-ID and Remote-ID on an Interface

The **[no] pppoe intermediate-agent format-type circuit-id** command sets the circuit ID on an interface and overrides the automatic generation of circuit ID by the switch. Without this command, one default tag (for example, Ethernet x/y:z on the PPPoE to which the user is connected) inserted by an intermediate-agent.

The **[no] pppoe intermediate-agent format-type remote-id** command sets the remote ID on an interface.

This functionality causes tagging of PADI, PADR, and PADT packets (belonging to PPPoE Discovery stage) received on this physical interface with circuit ID or remote ID. This happens regardless s of their VLAN if PPPoE IA is not enabled for that VLAN.

You should use remote ID instead of circuit ID for subscriber line identification. You should configure this setting on every interface where you enabled PPPoE IA because it is not set by default. The default value for remote-id is the switch MAC address (for all physical interfaces).

The following example shows how to configure the circuit ID as root and the remote ID as granite:

```
Switch> enable
Switch# configure terminal
Switch(config) interface FastEthernet 3/1
Switch(config-if) pppoe intermediate-agent format-type circuit-id string root
Switch(config-if) pppoe intermediate-agent format-type remote-id string granite
```

## Enabling PPPoE IA for a Specific VLAN on an Interface

This functionality allows you to enable PPPoE IA on either a specific VLAN, a comma-separated list such as “x,y,” or a range such as “x-y.”

Specific VLAN:

```
Switch# configure terminal
Switch(config)# interface FastEthernet 3/1
Switch(config-if)# vlan-range 5
Switch(config-if-vlan-range)# pppoe intermediate-agent
```

Comma-separated VLAN list:

```
Switch# configure terminal
Switch(config)# interface FastEthernet 3/1
Switch(config-if)# vlan-range 5,6
Switch(config-if-vlan-range)# pppoe intermediate-agent
```

VLAN range:

```
Switch# configure terminal
Switch(config)# interface FastEthernet 3/1
Switch(config-if)# vlan-range 5-9
Switch(config-if-vlan-range)# pppoe intermediate-agent
```




---

**Note** The `pppoe intermediate-agent` command in the `vlan-range` mode is not dependent on the same command in interface mode. The `pppoe intermediate-agent` command will take effect independently of the command in the interface mode. To make this happen, PPPoE IA must be enabled globally and at least one interface is connected to the PPPoE server.

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## Configuring PPPoE IA Circuit-ID and Remote-ID for a VLAN on an Interface

In this section you set the circuit ID and remote ID for a specific VLAN on an interface. The command overrides the circuit ID and remote ID specified for this physical interface and the switch uses the *WORD* value to tag packets received on this VLAN. This parameter is unset by default.

The default value of `remote-id` is the switch MAC address (for all VLANs). You would set this parameter to encode subscriber-specific information.



**Note**

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The `circuit-id` and `remote-id` configurations in `vlan-range` mode are affected only if PPPoE IA is enabled globally and in `vlan-range` mode.

---

This example shows how to set the `circuit-id` to `aaa` and the `remote-id` as `ccc` on interface `g3/7`:

```
Switch(config)# int g3/7
Switch(config-if)# vlan-range 5
Switch(config-if)# pppoe intermediate-agent
Switch(config-if-vlan-range)# pppoe intermediate-agent format-type circuit-id string aaa
Switch(config-if-vlan-range)# pppoe intermediate-agent format-type remote-id string ccc
```




---

**Note** The `vlan-range` mode commands configure PPPoE IA for either a specific VLAN, multiple VLANs, or VLAN range, depending on what you specify in the syntax.

---

## Displaying Configuration Parameters

The `show pppoe intermediate-agent [info|statistics] [interface {interface}]` command displays the various configuration parameters, statistics, and counters stored for PPPoE.

The **info** keyword appears if the PPPoE Intermediate Agent is enabled globally on an interface or on a VLAN (in an interface). It also informs you about the access node ID and generic error message of the switch, as well as the identifier string options and delimiter values configured globally by the following command:

```
Switch(config)# pppoe intermediate-agent format-type ?
  access-node-id      Access Node Identifier
  generic-error-message  Generic Error Message
  identifier-string    Identifier String
```

The **info** keyword also displays the circuit ID, remote ID, trust and rate limit configurations, and vendor tag strip setting for all interfaces and for all VLANs pertaining to those interfaces. If any of these parameters are not set, they are not displayed.

The **statistics** option displays the number of PADI/PADR/PADT packets received, and the time the last packet was received on all interfaces and on all VLANs pertaining to those interfaces.

If **interface** is specified, information or statistics applicable only to that physical interface and pertaining VLANs is displayed.

Although PPoE IA is supported on PVLANS, be aware that no PVLAN association (primary and secondary VLAN mapping) information is displayed.

The PPPoE IA show commands such as **show pppoe intermediate-agent info**, **show pppoe intermediate-agent info interface g3/7**, or **show pppoe intermediate-agent statistics** do not provide information about private VLAN association (primary and secondary VLAN mapping). However, they do provide information about VLANs regardless of private or normal VLANs, as the following example illustrate:

```
Switch# show pppoe intermediate-agent info
Switch PPPOE Intermediate-Agent is enabled

PPPOE Intermediate-Agent trust/rate is configured on the following Interfaces:

Interface          IA          Trusted   Vsa Strip   Rate limit (pps)
-----
GigabitEthernet3/4  no         yes       yes         unlimited
PPPOE Intermediate-Agent is configured on following VLANs:
2-3
GigabitEthernet3/7  no         no        no          unlimited
PPPOE Intermediate-Agent is configured on following VLANs:
2-3

Switch# show pppoe intermediate-agent info interface g3/7
Interface          IA          Trusted   Vsa Strip   Rate limit (pps)
-----
GigabitEthernet3/7  yes        no        no          unlimited
PPPoE Intermediate-Agent is configured on following VLANs:
2-3

Switch# show pppoe intermediate-agent statistics

PPPOE IA Per-Port Statistics
-----

Interface : GigabitEthernet3/7
Packets received
All = 0
PADI = 0 PADO = 0
PADR = 0 PADS = 0
PADT = 0
Packets dropped:
Rate-limit exceeded = 0
```

```

Server responses from untrusted ports = 0
Client requests towards untrusted ports = 0
Malformed PPPoE Discovery packets = 0
Vlan 2: Packets received PADI = 0 PADO = 0 PADR = 0 PADS = 0 PADT = 0
Vlan 3: Packets received PADI = 0 PADO = 0 PADR = 0 PADS = 0 PADT = 0

Switch# show pppoe intermediate-agent statistics interface g3/7
Interface : GigabitEthernet3/7
Packets received
All = 3
PADI = 0 PADO = 0
PADR = 0 PADS = 0
PADT = 3
Packets dropped:
Rate-limit exceeded = 0
Server responses from untrusted ports = 0
Client requests towards untrusted ports = 0
Malformed PPPoE Discovery packets = 0
Vlan 2: Packets received PADI = 6 PADO = 0 PADR = 6 PADS = 0 PADT = 6
Vlan 3: Packets received PADI = 4 PADO = 0 PADR = 4 PADS = 0 PADT = 4

```

## Clearing Packet Counters

This section illustrates how to clear packet counters on all interfaces (per-port and per-port-per-VLAN).

The following example illustrates how to do this:

```
Switch# clear pppoe intermediate-agent statistics
```

Issuing of the above command clears the counters for all PPPoE discovery packets (PADI,PADO,PADR,PADS,PADT) received on DUT.

```

Switch# show pppoe intermediate-agent statistics interface g3/7
Interface : GigabitEthernet3/7
Packets received
All = 0
PADI = 0 PADO = 0
PADR = 0 PADS = 0
PADT = 0
Packets dropped:
Rate-limit exceeded = 0
Server responses from untrusted ports = 0
Client requests towards untrusted ports = 0
Malformed PPPoE Discovery packets = 0
Vlan 2: Packets received PADI = 0 PADO = 0 PADR = 0 PADS = 0 PADT = 0
Vlan 3: Packets received PADI = 0 PADO = 0 PADR = 0 PADS = 0 PADT = 0

```

## Debugging PPPoE Intermediate Agent

The **debug pppoe intermediate-agent [packet | event | all]** command enables you to display useful PPPoE information that assists in debugging. This command is disabled by default.

The **packet** option of the command displays the contents of a packet received in the software: source and destination MAC address of Ethernet frame, code, version and type of PPPoE Discovery packet and a list of TAGs present.



The **event** option of the command echoes important messages (interface state change to errdisabled due to PPPoE discovery packets entering at a rate exceeding the configured limit). It is the only event shown by the **debug pppoe intermediate-agent event** command.

The **all** option enables both package and event options.

The following example illustrates how to enter the debug command with the **packet** option:

```
Switch# debug pppoe intermediate-agent packet
PPPOE IA Packet debugging is on

*Sep  2 06:12:56.133: PPPOE_IA: Process new PPPoE packet, Message type: PADI, input
interface: Gi3/7, vlan : 2 MAC da: ffff.ffff.ffff, MAC sa: aabb.cc00.0000
*Sep  2 06:12:56.137: PPPOE_IA: received new PPPoE packet from inputinterface
(GigabitEthernet3/4)
*Sep  2 06:12:56.137: PPPOE_IA: received new PPPoE packet from inputinterface
(GigabitEthernet3/8)
*Sep  2 06:12:56.137: PPPOE_IA: Process new PPPoE packet, Message type: PADO, input
interface: Gi3/4, vlan : 2 MAC da: aabb.cc00.0000, MAC sa: 001d.e64c.6512
*Sep  2 06:12:56.137: PPPOE_IA: Process new PPPoE packet, Message type: PADO, input
interface: Gi3/8, vlan : 2 MAC da: aabb.cc00.0000, MAC sa: aabb.cc80.0000
*Sep  2 06:12:56.137: PPPOE_IA: received new PPPoE packet from inputinterface
(GigabitEthernet3/7)
*Sep  2 06:12:56.137: PPPOE_IA: Process new PPPoE packet, Message type: PADR, input
interface: Gi3/7, vlan : 2 MAC da: 001d.e64c.6512, MAC sa: aabb.cc00.0000
*Sep  2 06:12:56.145: PPPOE_IA: received new PPPoE packet from inputinterface
(GigabitEthernet3/4)
*Sep  2 06:12:56.145: PPPOE_IA: Process new PPPoE packet, Message type: PADS, input
interface: Gi3/4, vlan : 2 MAC da: aabb.cc00.0000, MAC sa: 001d.e64c.6512
```

The following example illustrates how to enter the debug command with the **event** option:

```
Switch# debug pppoe intermediate-agent event
PPPOE IA Event debugging is on

*Jul 30 19:00:10.254: %PPPOE_IA-4-PPPOE_IA_ERRDISABLE_WARNING: PPPOE IA received 5 PPPOE
packets on interface Gi3/7
*Jul 30 19:00:10.254: %PPPOE_IA-4-PPPOE_IA_RATE_LIMIT_EXCEEDED: The interface Gi3/7 is
receiving more than the threshold set
*Jul 30 19:00:10.394: %PM-4-ERR_DISABLE: STANDBY:pppoe-ia-rate-limit error detected on
Gi3/7, putting Gi3/7 in err-disable stat
```

## Troubleshooting Tips

When the **radius-server attribute 31 remote-id** global configuration command is entered in the PPPoE Agent Remote-ID Tag and DSL Line Characteristics feature configuration on the BRAS, the **debug radius** privileged EXEC command can be used to generate a report that includes information about the incoming access interface, where discovery frames are received, and about the session being established in PPPoE extended NAS-Port format (format d).

