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Configuring the Cisco 827 Router as a PPPoE Client With NAT

Document ID: 8514

Introduction

Prerequisites

- Requirements

- Components Used

- Conventions

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- Network Diagram

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- Debug the PPPoE Client

- Debug the PPPoE Server

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Related Information

Introduction

In Cisco IOS® Software Release 12.1(3)XG, a PPP over Ethernet (PPPoE) client feature was introduced for the Cisco 827 router. This feature allows the PPPoE functionality to be moved to the router. Multiple PCs can be installed behind the Cisco 827. Before their traffic is sent to the PPPoE session, it can be encrypted, filtered, and so forth. Also, Network Address Translation (NAT) can run.

This document shows a PPPoE client configured on the ATM interface (the DSL interface) of the Cisco 827 router. This configuration can also be used on a Cisco 1700 router with an asymmetric digital subscriber line (ADSL) WAN interface card (WIC).

The configuration on the Cisco 6400 node route processor (NRP) can also be used on another router used as an aggregator and with an ATM interface.

Prerequisites

Requirements

There are no specific requirements for this document.

Components Used

This document is not restricted to specific software and hardware versions.

Conventions

For more information on document conventions, refer to the Cisco Technical Tips Conventions.

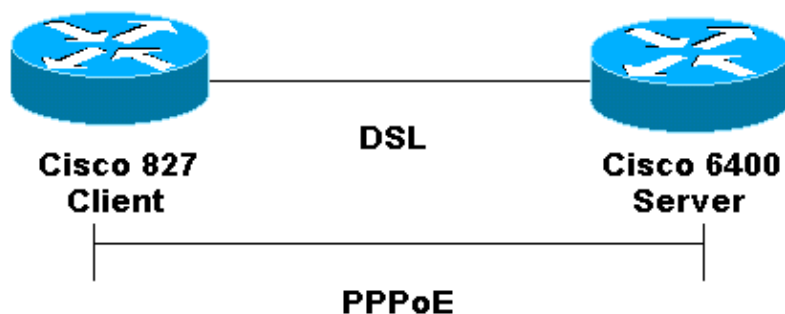
Configure

In this section, you are presented with the information used to configure the features described in this document.

Note: In order to find additional information on the commands used in this document, use the Command Lookup Tool (registered customers only) .

Network Diagram

This document uses this network setup:



Configurations

This document uses these configurations:

- Cisco 827 Router
- Cisco 6400 NRP

PPPoE is configured on the Cisco 827 router with the virtual private dial network (VPDN) commands. Make sure you configure these commands first.

Note: For information about how to change the size of the maximum transmission unit (MTU), refer to Troubleshooting MTU Size in PPPoE Dialin Connectivity.

Cisco 827 Router
<pre>! vpdn enable no vpdn logging !--- This is the default. ! vpdn-group pppoe request-dialin !--- This is the PPPoE client that requests to establish a session !--- with the aggregation unit (6400 NRP). protocol pppoe</pre>

```

!

!--- This is the Internal Ethernet network.

!
interface Ethernet0
 ip address 10.92.1.182 255.255.255.0
 ip nat inside

!--- The DSL interface.

!
interface ATM0
 no ip address
 no atm ilmi-keepalive
 bundle-enable
 dsl operating-mode auto
 hold-queue 224 in

!--- All defaults.

!--- PPPoE runs on top of AAL5SNAP. However, the
!--- encap aal5snap command is not used.

!
interface ATM0.1 point-to-point
 pvc 1/1
  pppoe-client dial-pool-number 1

!--- pvc 1/1 is an example value that must be changed
!--- in order to match the value used by the ISP.

!

!--- The PPPoE client code ties into a dialer interface upon
!--- which a virtual-access interface is cloned.

!
interface Dialer1
 ip address negotiated
 ip mtu 1492

!--- Ethernet MTU is 1500 by default -- 1492 + PPPoE headers = 1500

 ip nat outside
 encapsulation ppp
 dialer pool 1

!--- Ties to ATM interface.

 ppp authentication chap callin
 ppp chap hostname <username>
 ppp chap password <password>
!

!--- Note: The ISP instructs you about the

```

```

!--- type of authentication to use.
!--- In order to change from PPP CHAP to PPP PAP, replace
!--- ppp authentication chap callin
!--- ppp chap hostname <username>
!--- ppp chap password <password>
!--- with ppp authentication pap callin
!--- ppp pap sent-username <username> password <password>

!--- For NAT, overload on the Dialer1 interface
!--- and add a default route out since dialer IP address can change.

ip nat inside source list 1 interface Dialer1 overload
ip classless
ip route 0.0.0.0 0.0.0.0 dialer1
no ip http server
!
access-list 1 permit 10.92.1.0 0.0.0.255

!--- For NAT.
!

```

Cisco 6400 NRP

```

*** local ppp user

!--- Or, use AAA.

username <username> password <password>

!--- Begin with the VPDN commands.
!--- Notice that the PPPoE is bound here to
!--- a virtual-template instead of on the ATM interface.
!--- You cannot (at this time) use more than one
!--- virtual-template (or VPDN group) for PPPoE that begins
!--- with the VPDN commands.

vpdn enable
no vpdn logging
!
vpdn-group pppoe
accept-dialin

!--- PPPoE server mode.

    protocol pppoe
    virtual-template 1
!
!
interface ATM0/0/0
no ip address
no atm ilmi-keepalive
hold-queue 500 in

!--- The binding to the virtual-template

```

```

!--- interface is configured in the VPDN group.

!
interface ATM0/0/0.182 point-to-point
 pvc 1/82
  encapsulation aal5snap

!--- Needs the command on the server side.

  protocol pppoe
  !
  !

!--- Virtual-template is used instead of dialer interface.

!
interface Virtual-Template1
 ip unnumbered Loopback10
 ip mtu 1492
 peer default ip address pool ippool
 ppp authentication chap
 !
 !
interface Loopback10
 ip address 8.8.8.1 255.255.255.0
 !
 ip local pool ippool 9.9.9.1 9.9.9.5

```

Verify

There is currently no verification procedure available for this configuration.

Troubleshoot

This section provides information you can use to troubleshoot your configuration.

Certain **show** commands are supported by the Output Interpreter Tool (registered customers only) , which allows you to view an analysis of **show** command output.

Note: Before you issue **debug** commands, refer to Important Information on Debug Commands.

Debug the PPPoE Client

In order to debug the PPPoE client on the Cisco 827 router or Cisco 6400 NRP, you must consider the protocol stack. You can start to troubleshoot at the bottom.

- 4. PPP Layer
- 3. Ethernet Layer
- 2. ATM Layer
- 1. DSL Physical Layer

1. DSL Physical Layer

Make sure the line is up and trained.

```
show interface atm0

ATM0 is up, line protocol is up
  Hardware is PQUICC_SAR (with Alcatel ADSL Module)

show dsl interface atm0

!--- Look for "Showtime" in the first few lines.

Modem Status:          ATU-R (DS)                ATU-C (US)
                      Showtime (DMTDSL_SHOWTIME)
```

2. ATM Layer

If the ATM interface is up, use the **debug atm packets** command to see if anything comes in from the ISP.

Note: You do not see outgoing packets with this command because of the way the packets are processed.

You need to see output similar to this , with the same Type, SAP, CTL, and OUI fields that show that the incoming ATM packet is AAL5SNAP.

```
debug atm packet
03:21:32: ATM0(I):
VCD:0x2 VPI:0x1 VCI:0x1 Type:0x0 SAP:AAAA CTL:03 OUI:0080C2
TYPE:0007 Length:0x30
03:21:32: 0000 0050 7359 35B7 0001 96A4 84AC 8864 1100 0001
000E C021 09AB 000C 0235
03:21:32: 279F 0000 0000
03:21:32:
```

3. Ethernet Layer

Complete Ethernet frames are in the AAL5SNAP packets. There is no **debug** Ethernet packet command. However, you need to perform some VPDN debugs in order to see the PPPoE frames.

For reference, an Ethernet frame which is a PPPoE frame contains one of two Ethertypes:

- 0x8863 Ethertype = PPPoE control packet (handles the PPPoE session)
- 0x8864 Ethertype = PPPoE data packet (contains PPP packets)

One important note is that there are two sessions in PPPoE. The PPPoE session which is a VPDN L2TP type session and the PPP session. Therefore, in order to establish PPPoE, you have a PPPoE session establishment phase and a PPP session establishment phase.

Termination usually involves a PPP termination phase and a PPPoE termination phase.

The PPPoE establishment phase consists of the identification of the PPPoE client and server (the MAC addresses), and the assignment of a session ID. After this is complete, the normal PPP establishment occurs just like any other PPP connection.

In order to debug, use VPDN PPPoE debugs to help you determine if the PPPoE connect phase is successful.

```

#debug vpdn pppoe-events

06:17:58: Sending PADI: vc=1/1

!--- A broadcast Ethernet frame (in this case encapsulated in ATM)
!--- that requests a PPPoE server, "Are there any PPPoE servers out there??"

06:18:00: PPPOE: we've got our pado and the pado timer went off

!--- This is a unicast reply from a PPPoE server
!--- (very similar to a DHCP offer).

06:18:00: OUT PADR from PPPoE tunnel

!--- This is a unicast reply that accepts the offer.

06:18:00: IN PADS from PPPoE tunnel

!--- This is a confirmation and the establishment completes.

```

The PPP establishment begins as in any other PPP initiation. After the PPPoE session is established, use **show vpdn** commands in order to get the status.

```

#show vpdn
%No active L2TP tunnels
%No active L2F tunnels

PPPoE Tunnel and Session Information Total tunnels 1 sessions 1

PPPoE Tunnel Information

Session count: 1

PPPoE Session Information
SID  RemMAC          LocMAC          Intf  VASt  OIntf  VC
1   0050.7359.35b7  0001.96a4.84ac  Vi1   UP    AT0    1  1

```

You can get packet count information using the **show vpdn session all** command.

```

show vpdn session all
%No active L2TP tunnels
%No active L2F tunnels

PPPoE Session Information Total tunnels 1 sessions 1

session id: 1
local MAC address: 0001.96a4.84ac, remote MAC address: 0050.7359.35b7
virtual access interface: Vi1, outgoing interface: AT0, vc: 1/1
    1656 packets sent, 1655 received, 24516 bytes sent, 24486 received

```

Other **debug** commands:

- **debug vpdn pppoe-data**
- **debug pppoe-errors**
- **debug pppoe-packets**

PPP Layer

After the PPPoE session has been established, the PPP debugs are the same as for any other PPP establishment.

The same **debug ppp negotiation** and **debug ppp authentication** commands are used. This is sample output.

Note: In this sample, the hostname is "client1" and the name of the remote Cisco 6400 NRP is "nrp-b".

```
06:36:03: Vi1 PPP: Treating connection as a callout
06:36:03: Vi1 PPP: Phase is ESTABLISHING, Active Open [0 sess, 1 load]
06:36:03: Vi1 PPP: No remote authentication for call-out
06:36:03: Vi1 LCP: O CONFREQ [Closed] id 1 len 10
06:36:03: Vi1 LCP:   MagicNumber 0x03013D43 (0x050603013D43)
06:36:03: Vi1 LCP: I CONFACK [REQsent] id 1 len 10
06:36:03: Vi1 LCP:   MagicNumber 0x03013D43 (0x050603013D43)
06:36:05: Vi1 LCP: I CONFREQ [ACKrcvd] id 2 len 15
06:36:05: Vi1 LCP:   AuthProto CHAP (0x0305C22305)
06:36:05: Vi1 LCP:   MagicNumber 0x65E315E5 (0x050665E315E5)
06:36:05: Vi1 LCP: O CONFACK [ACKrcvd] id 2 len 15
06:36:05: Vi1 LCP:   AuthProto CHAP (0x0305C22305)
06:36:05: Vi1 LCP:   MagicNumber 0x65E315E5 (0x050665E315E5)
06:36:05: Vi1 LCP: State is Open
06:36:05: Vi1 PPP: Phase is AUTHENTICATING, by the peer [0 sess, 1 load]
06:36:05: Vi1 CHAP: I CHALLENGE id 9 len 26 from "nrp-b"
06:36:05: Vi1 CHAP: Using alternate hostname client1
06:36:05: Vi1 CHAP: Username nrp-b not found
06:36:05: Vi1 CHAP: Using default password
06:36:05: Vi1 CHAP: O RESPONSE id 9 len 28 from "client1"
06:36:05: Vi1 CHAP: I SUCCESS id 9 len 4
06:36:05: Vi1 PPP: Phase is FORWARDING [0 sess, 1 load]
06:36:05: Vi1 PPP: Phase is AUTHENTICATING [0 sess, 1 load]
06:36:05: Vi1 PPP: Phase is UP [0 sess, 1 load]
06:36:05: Vi1 IPCP: O CONFREQ [Closed] id 1 len 10
06:36:05: Vi1 IPCP:   Address 0.0.0.0 (0x030600000000)
06:36:05: Vi1 CDPCP: O CONFREQ [Closed] id 1 len 4
06:36:05: Vi1 IPCP: I CONFREQ [REQsent] id 1 len 10
06:36:05: Vi1 IPCP:   Address 8.8.8.1 (0x030608080801)
06:36:05: Vi1 IPCP:   Address 8.8.8.1 (0x030608080801)
06:36:05: Vi1 IPCP:   Address 9.9.9.2 (0x030609090902)
06:36:05: Vi1 IPCP: O CONFREQ [ACKsent] id 2 len 10
06:36:05: Vi1 IPCP:   Address 9.9.9.2 (0x030609090902)
06:36:05: Vi1 LCP: I PROTREJ [Open] id 3 len 10 protocol CDPCP (0x820701010004)
06:36:05: Vi1 CDPCP: State is Closed
06:36:05: Vi1 IPCP: I CONFACK [ACKsent] id 2 len 10
06:36:05: Vi1 IPCP:   Address 9.9.9.2 (0x030609090902)
06:36:05: Vi1 IPCP: State is Open
06:36:05: Di1 IPCP: Install negotiated IP interface address 9.9.9.2
06:36:05: Di1 IPCP: Install route to 8.8.8.1
06:36:06: %LINEPROTO-5-UPDOWN: Line protocol on Interface Virtual-Access1,
changed state to up
```

Debug the PPPoE Server

In order to debug the Cisco 6400 (the PPPoE server), use the same bottom-up procedure used for the Cisco 827 router (the client). The difference is in the DSL physical layer, where you need to check the DSL Access Multiplexer (DSLAM).

- 4. PPP Layer
- 3. Ethernet Layer

- 2. ATM Layer
- 1. DSL Physical Layer

1. DSL Physical Layer

In order to check the DSL physical layer, you need to see the DSL statistics on the DSLAM. For Cisco DSLAMs, use the **show dsl interface** command.

2. ATM Layer

On the Cisco 6400 side, you can also use a **debug atm packet** command and enable the Cisco 6400 for a specific permanent virtual circuit (PVC).

```
debug atm packet interface atm 0/0/0.182 vc 1/82
```

You need to see output similar to this , with the same Type, SAP, CTL, and OUI fields that show that the incoming ATM packet is AAL5SNAP.

```
4d04h: ATM0/0/0.182(I):
VCD:0x3 VPI:0x1 VCI:0x52 Type:0x900 SAP:AAAA CTL:03 OUI:0080C2 TYPE:0007 Length:0x30
4d04h: 0000 0001 96A4 84AC 0050 7359 35B7 8864 1100 0001 000E C021 0A2E 000C 65E3
4d04h: 15E5 0000 0000
```

Note: You do not see outgoing packets with this command because of the way the packets are processed.

3. Ethernet Layer

The same VPDN **show commands** and **debugs** used on the Cisco 827 router can be used on the Cisco 6400 NRP to look at the PPPoE establishment.

```
#debug vpdn pppoe-events

4d04h: IN PADI from PPPoE tunnel

4d04h: OUT PADO from PPPoE tunnel

4d04h: IN PADR from PPPoE tunnel

4d04h: PPPoE: Create session
4d04h: PPPoE: VPN session created.

4d04h: OUT PADS from PPPoE tunnel

#show vpdn
%No active L2TP tunnels
%No active L2F tunnels

PPPoE Tunnel and Session Information Total tunnels 1 sessions 1

PPPoE Tunnel Information

Session count: 1
PPPoE Session Information
SID      RemMAC      LocMAC      Intf      VASt      OIntf      VC
1        0001.96a4.84ac  0050.7359.35b7  Vi4      UP        AT0/0/0 1    82

nrp-b#show vpdn session all
%No active L2TP tunnels
```

%No active L2F tunnels

PPPoE Session Information Total tunnels 1 sessions 1

session id: 1

local MAC address: 0050.7359.35b7, remote MAC address: 0001.96a4.84ac

virtual access interface: Vi4, outgoing interface: AT0/0/0, vc: 1/82

30 packets sent, 28 received, 422 bytes sent, 395 received

Other **debug** commands:

- **debug vpdn pppoe-data**
- **debug pppoe-errors**
- **debug pppoe-packets**

4. PPP Layer

This is PPP **debug** output from the Cisco 6400 NRP that corresponds to the earlier **debug** from the Cisco 827 router.

```
debug ppp negotiation and debug ppp authentication
4d04h: Vi2 PPP: Treating connection as a dedicated line
4d04h: Vi2 PPP: Phase is ESTABLISHING, Active Open [0 sess, 1 load]
4d04h: Vi2 LCP: O CONFREQ [Closed] id 1 len 15
4d04h: Vi2 LCP:   AuthProto CHAP (0x0305C22305)
4d04h: Vi2 LCP:   MagicNumber 0x65F62814 (0x050665F62814)
4d04h: Vi2 LCP: I CONFREQ [REQsent] id 1 len 10
4d04h: Vi2 LCP:   MagicNumber 0x03144FF9 (0x050603144FF9)
4d04h: Vi2 LCP: O CONFACK [REQsent] id 1 len 10
4d04h: Vi2 LCP:   MagicNumber 0x03144FF9 (0x050603144FF9)
4d04h: Vi3 LCP: I ECHOREQ [Open] id 60 len 8 magic 0xA60C0000
4d04h: Vi3 LCP: O ECHOREP [Open] id 60 len 8 magic 0x51A0BEF6
4d04h: Vi2 LCP: TIMEOUT: State ACKsent
4d04h: Vi2 LCP: O CONFREQ [ACKsent] id 2 len 15
4d04h: Vi2 LCP:   AuthProto CHAP (0x0305C22305)
4d04h: Vi2 LCP:   MagicNumber 0x65F62814 (0x050665F62814)
4d04h: Vi2 LCP: I CONFACK [ACKsent] id 2 len 15
4d04h: Vi2 LCP:   AuthProto CHAP (0x0305C22305)
4d04h: Vi2 LCP:   MagicNumber 0x65F62814 (0x050665F62814)
4d04h: Vi2 LCP: State is Open
4d04h: Vi2 PPP: Phase is AUTHENTICATING, by this end [0 sess, 1 load]
4d04h: Vi2 CHAP: O CHALLENGE id 10 len 26 from "nrp-b"
4d04h: Vi2 CHAP: I RESPONSE id 10 len 28 from "client1"
4d04h: Vi2 PPP: Phase is FORWARDING [0 sess, 1 load]
4d04h: Vi2 PPP: Phase is AUTHENTICATING [0 sess, 1 load]
4d04h: Vi2 CHAP: O SUCCESS id 10 len 4
4d04h: Vi2 PPP: Phase is UP [0 sess, 1 load]
4d04h: Vi2 IPCP: O CONFREQ [Closed] id 1 len 10
4d04h: Vi2 IPCP:   Address 8.8.8.1 (0x030608080801)
4d04h: Vi2 IPCP: I CONFREQ [REQsent] id 1 len 10
4d04h: Vi2 IPCP:   Address 0.0.0.0 (0x030600000000)
4d04h: Vi2 IPCP: Pool returned 9.9.9.2
4d04h: Vi2 IPCP: O CONFNAK [REQsent] id 1 len 10
4d04h: Vi2 IPCP:   Address 9.9.9.2 (0x030609090902)
4d04h: Vi2 CDPCP: I CONFREQ [Not negotiated] id 1 len 4
4d04h: Vi2 LCP: O PROTREJ [Open] id 3 len 10 protocol CDPCP (0x820701010004)
4d04h: Vi2 IPCP: I CONFACK [REQsent] id 1 len 10
4d04h: Vi2 IPCP:   Address 8.8.8.1 (0x030608080801)
4d04h: Vi2 IPCP: I CONFREQ [ACKrcvd] id 2 len 10
4d04h: Vi2 IPCP:   Address 9.9.9.2 (0x030609090902)
4d04h: Vi2 IPCP: O CONFACK [ACKrcvd] id 2 len 10
4d04h: Vi2 IPCP:   Address 9.9.9.2 (0x030609090902)
```

```
4d04h: Vi2 IPCP: State is Open
4d04h: Vi2 IPCP: Install route to 9.9.9.2
4d04h: %LINEPROTO-5-UPDOWN: Line protocol on Interface Virtual-Access2,
changed state to up
```

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