Moonv6 Test Suite

PPPoE for IPv6
Interoperablility Test Suite

Technical Document

Revision 0.2

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MODIFICATION RECORD

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INTRODUCTION

Acronyms

TR: Testing **R**outer
BRAS: Broadband **R**emote **A**ccess **S**erver
PPP: Point-to-**P**oint **P**rotocol
IPv6CP: IPv6 Control **P**rotocl
PPPoE: **PPP o**ver **E**thernet
IA_PD: **I**dentity **A**ssociation for **P**refix **D**elegation

Definitions

Point-to-Point Protocol (PPP):

PPP is used for encapsulating datagrams over serial links. PPP includes LCP (Link Control Protocol) to establish, configure, and test the data-link connection, and a family of NCP (Network Control Protocol) for establishing and configuring different network-layer protocols. In order to establish communications over a point-to-point link, PPP would first send LCP packets to configure and test the data link. After the link has been established, PPP would send NCP packets to choose and configure one or more network-layer protocols.

IPV6CP (IPv6 Control Protocl):

The NCP for establishing and configuring the IPv6 over PPP is referred as the IPv6 Control Protocol (IPV6CP). IPV6CP is responsible for configuring, enabling, and disabling the IPv6 protocol modules on both ends of the point-to-point link.

PPPoE (PPP over Ethernet):

PPPoE provides the ability to connect a network of hosts over a simple bridging access device to a remote access concentrator. To provide a point-to-point connection over Ethernet, PPPoE provide a discovery protocol to learn the Ethernet address of the remote peer, as well as establish a unique session identifier.

IA_PD (Identity Association for Prefix Delegation)

IA_PD is a new DHCPv6 option with a collection of prefixes assigned to the requesting router. Each IA_PD has an associated IAID, which is a unique identifier for this IA_PD.

TEST ORGANIZATION

This document consists of three test items with description blocks. The format of the description block is as follows:

Test Label:	The test label and title comprise the first line of the test block. The test label is composed by concatenating the short test suite name and the test number, separated by periods. So, test label PPPoE.1 refers to the second test of the PPPoE suite. The test number is 1.
Purpose:	The Purpose is a short statement describing what the test attempts to achieve. It is usually phrased as a simple assertion of the feature or capability to be tested.
References:	The References section lists cross-references to the specifications and documentation that might be helpful in understanding and evaluating the test and results.
Resource Requirements:	The Resource Requirements section specifies the software, hardware, and test equipment that will be needed to perform the test.
Discussion:	The Discussion is a general discussion of the test and relevant section of the specification, including any assumptions made in the design or implementation of the test as well as known limitations.
Test Setup:	The Test Setup section describes the configuration of all devices prior to the start of the test. Different parts of the procedure may involve configuration steps that deviate from what is given in the test setup. If a value is not provided for a protocol parameter, then the protocol's default is used for that parameter.
Procedure:	This section of the test description contains the step-by-step instructions for carrying out the test. These steps include such things as enabling interfaces, unplugging devices from the network, or sending packet from a test station. The test procedure also cues the tester to make observations, which are interpreted in accordance with the observable results given for that test part.
Observable Results:	This section lists observable results that can be examined by the tester to verify that the RUT is operating properly. When multiple observable results are possible, this section provides a short discussion on how to interpret them. The determination of a pass or fail for each test is usually based on how the RUT's behavior compares to the results described in this section.
Possible Problems:	This section contains a description of known issues with the test procedure, which may affect test results in certain situations.

REFERENCES

The following documents are referenced in this text:

- RFC 2516: A Method for Transmitting PPP Over Ethernet (PPPoE), February 1999
- RFC 2472: IP Version 6 over PPP, December 1998
- RFC 3633: IPv6 Prefix Options for Dynamic Host Configuration Protocol (DHCP) version 6, December 2003,

Test PPPoE.1: PPPoE Discovery Stage

Purpose: To verify that a router can discover and select a BRAS on Ethernet properly.

References: [RFC 2516: A Method for Transmitting PPP Over Ethernet (PPPoE)] Sections 3 and Sections 5.1 to 5.4

Resource Requirements:

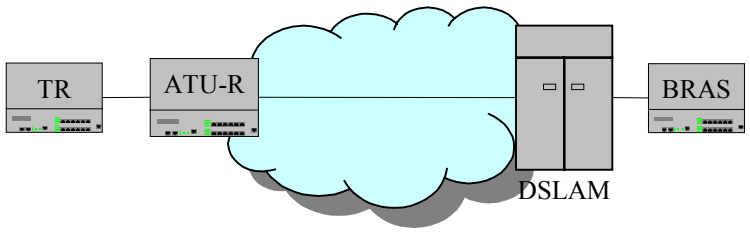
- Monitor to capture packets

Last Modification: Feb. 16, 2004

Discussion: PPPoE Discovery stage allows a TR to discover all BRAS on Ethernet and then select one. The stage consists of four messages exchanged between peers. First, the router should transmit a a *PADI* frame (PPPoE Active Discovery Initiation) to the *broadcast* Ethernet address ff:ff:ff:ff:ff:ff and the BRAS should then replies a *PADO* frame (PPPoE Active Discovery Offer) to the router's Ethernet address. After that, the router should send PADR packet (PPPoE Active Discovery Request) to the BRAS's Ethernet address and the BRAS should reply with a *PADS* packet (PPPoE Active Discovery Session−confirmation.) to router's Ethernet address. The session_ID in the payload must be set to the unique value generated for this PPPoE session if BRAS accepts the Service-Name in the previous PADR. When the stage completes, both peers know the PPPoE SESSION_ID and the peer's Ethernet address, which together define the PPPoE session uniquely.

Test Setup:

- Ensure ATU-R is in bridged mode.
- TR is connected to ADSL network with Ethernet interface.
- Traditional DSLM with ATM interface or IPv6 DSLAM can be used



Procedure:

1. Configure BRAS as a PPPoE server.
2. Enable TR to initiate a PPPoE session.
3. Observe the packets transmitted by the TR and BRAS on ADSL network.

Observable Results:

- Both TR and BRAS know the PPPoE SESSION_ID and the peer's Ethernet address, which together define the PPPoE session uniquely.

Possible Problems: None

Test PPPoE.2: PPPoE Session Stage

Purpose: To verify that a router and BRAS properly build a PPP session with necessary parameters for IPv6 network.

References: [RFC 2516: A Method for Transmitting PPP Over Ethernet (PPPoE)] Sections 6
[RFC 2472: IP Version 6 over PPP] Sections 3 and 4.1

Resource Requirements:

- Monitor to capture packets

Last Modification: Feb. 16, 2004

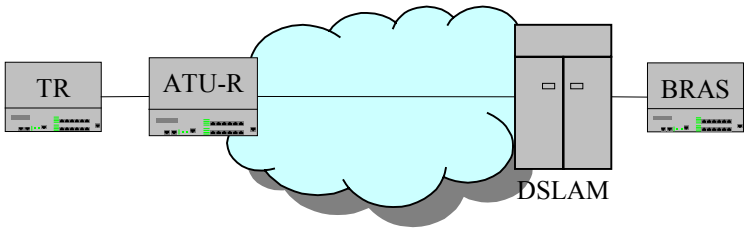
Discussion: PPPoE discovery stage builds a client-server relationship. When discovery stage completes successfully, both the router and the selected BRAS get the necessary information to build their point-to-point (PPP) session over Ethernet in the session phase. A PPPoE session is a normal PPP session with some modified encapsulation format because packets are transmitted over Ethernet instead of a serial link.

PPP includes LCP and NCP. LCP is used for establishing, configuring, and testing the data-link connection, while NCP is used for establishing and configuring different network-layer protocols. Different NCP must be defined to support different upper network layer protocol. In order to send IPv6 packets over PPP, IPV6CP must be used as NCP. Each end of the PPP link must first send LCP packets to configure and test the data link. After the link has been established, the peer may be authenticated. After that, IPV6CP packets are sent to choose and configure network-layer protocols to make datagrams be able to be sent over the link.

The Interface Identifier of IPv6 unicast addresses of a PPP interface, should be negotiated in the IPV6CP phase with the Interface-Identifier configuration option. This configuration option provides a way to negotiate a unique 64-bit interface identifier to be use for the address autoconfiguration at the local end of the PPP link.

Test Setup:

- Ensure ATU-R is in bridged mode.
- TR is connected to ADSL network with Ethernet interface.
- Traditional DSLM with ATM interface or IPv6 DSLAM can be used.
- Ensure both TR and BRAS support IPV6CP.
- Authentication of PPP between TR and BRAS is optional.



Procedure:

1. Configure BRAS as a PPPoE server with IPV6CP function.
2. Make TR negotiates interface-identifier configuration option in IPV6CP with BRAS.
3. Enable TR to initiate a PPPoE session with IPV6CP function.
4. Observe the packets transmitted by the TR and BRAS on ADSL network.

Observable Results:

- TR and BRAS should build a PPPoE session over Ethernet and the IPV6CP interface identifier of both sides be negotiated.
- Both TR and BRAS can auto-configure their IPv6 link local address and ping(v6) to each other with the IPv6 link-local address.

Possible Problems: None.

Test PPPoE.3: IPv6 Prefix Delegation over the PPPoE session

Purpose: To verify that a router can get IPv6 prefix delegation from BRAS properly after PPPoE session is built.

References: [RFC 3633: IPv6 Prefix Options for Dynamic Host Configuration Protocol (DHCP) version 6] Sections 7, 9 and 10

Resource Requirements:

- Monitor to capture packets

Last Modification: Feb. 16, 2004

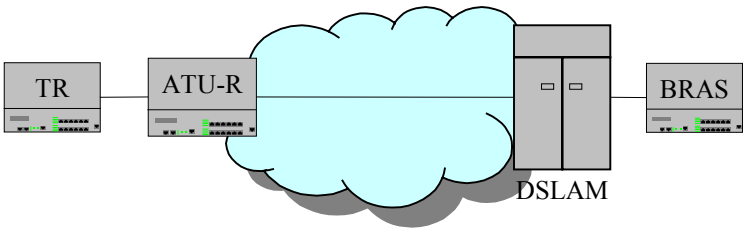
Discussion: A new options, IA_PD option, for Dynamic Host Configuration Protocol (DHCP) is defined to provide a mechanism for the delegation of IPv6 prefixes from a delegating router to requesting routers.

A requesting router first creates an IA_PD and assigns it an IAID. The requesting router then transmits a Solicit message containing an IA_PD option. Delegating routers that can delegate prefixes to the IA_PD respond to the requesting router with an Advertise message. The requesting router may include prefixes in the IA_PDs as a hint to the delegating router about specific prefixes for which the requesting router has a preference. When the requesting router has identified a delegating router, the requesting router uses a Request message to populate the IA_PDs with prefixes. The requesting router includes one or more IA_PD options in the Request message. The delegating router returns prefixes and other information about the IA_PDs to the requesting router in IA_PD options in a Reply message. The requesting router records the lifetimes for the delegated prefix(es) and uses the prefix(es).

The requesting router is then responsible for the delegated prefix(es). For example, the requesting router might assign a subnet from a delegated prefix to one of its interfaces, and begin sending router advertisements for the prefix on that link.

Test Setup:

- Ensure ATU-R is in bridged mode.
- TR is connected to ADSL network with Ethernet interface.
- Traditional DSLM with ATM interface or IPv6 DSLAM can be used.
- Ensure the PPPoE session is built between TR and BRAS.
- At least one or more IPv6 interfaces are enabled on TR and Configure TR to assign a subnet to its IPv6 interfaces from the delegated prefix(es).
- The related information, such as IPv6 prefix for TR, on BRAS can be configured directly on BRAS or got from an external Radius server.



Procedure:

1. Configure BRAS as prefix delegation router.
2. Configure TR as a prefix requesting router.
3. Observe the packets transmitted by the TR and BRAS on ADSL network.

Observable Results:

- TR gets an IPv6 prefix delegation from BRAS.
- TR assigns IPv6 subnets to its interfaces form the delegated prefix.

Possible Problems: None.