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IPv6 over Point-to-Point ATM Link

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Status of this Memo

Abstract

This memo defines a communication mechanism to exchange both IPv6 unicast and multicast packets over an ATM network used as a point-to-point link.

1. Introduction

ATM has become one of the most popular link-layer technologies in the Internet. Typical usage of ATM is categorized as follows:

(1) Broadcast network such as LAN emulation(LANE)
(2) Non-Broadcast Multiple Access(NBMA) networks
(3) Point-to-point networks

This memo discusses a communication mechanism for an IPv6[IPV6] over a point-to-point ATM link(3). One of applications of ATM is a fat pipe typically found in backbone networks.

This memo defines IEEE 802.2 logical link control(LLC) headers for IPv6 over a point-to-point ATM link. The default of MTU size of

point-to-point ATM and a mechanism to generate an interface identifier are also specified.

2. Scope of This Memo

Throughout this memo, the term "point-to-point ATM link" means that one virtual circuit(VC) is established between two nodes and the VC can be accessible through one logical network interface. This link is abstracted as a serial link to the IPv6 layer. It is not our intention to recommend that ATM be used exclusively for point-to-point networks.

In this memo, ATM Adaptation Layer 5(AAL5)[ATM-ENCAP] is assumed to carry IPv6 packets over ATM. Both IPv6 unicast and multicast packets are delivered only to the opposite end of the point-to-point ATM link.

Please note that point-to-point ATM link here is not a special case of NBMA(2). While NBMA requires a special mechanism for multicast, a point-to-point ATM link here does not require it.

There is strong demand to implement an IPv6 network over a point-to-point ATM link without such a special mechanism. So, it is highly desired to define LLC headers of IPv6 over a point-to-point ATM link for inter-operability.

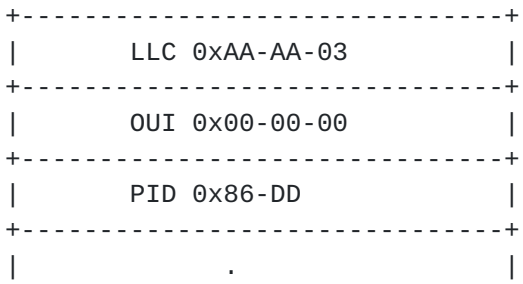
3. Standard Keywords

This memo occasionally uses terms which are in capital letters. When the terms "MUST", "SHOULD", "MUST NOT", "SHOULD NOT", and "MAY" appear capitalized, they are being used to indicate particular requirements, whose definitions are found in [KEYWORDS].

4. IPv6 packet encapsulation

LLC encapsulation is adopted to exchange IPv6 packets over a point-to-point ATM link in this memo. Null encapsulation is not adapted since it is very likely that both IPv6 and IPv4 are used on a point-to-point ATM link at the same time.

0x86DD is assigned for the EtherType of IPv6[IPV6-ETHER], so this memo chooses 0x86DD as the Protocol Identifier(PID) according to [ATM-ENCAP]. The encapsulation for both IPv6 unicast and multicast on a point-to-point ATM link is defined as follows:



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|       IPv6 packet             |
|             .                 |
+-------------------------------+
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5. MTU size

The default MTU size for IPv6 over point-to-point ATM SHOULD be 9180 octets according to [AAL5-MTU]. Values other than the default MAY be used.

An automatic negotiation mechanism for the MTU is not defined in this memo. It is not usually necessary on ATM point-to-point links as long as the same MTU value is correctly configured at each end of nodes.

However, it is useful to provide a configuration mechanism of MTU in certain cases. For example, suppose that a host and a router are connected with a point-to-point ATM link and the router is also attached to a LAN whose MTU is smaller than 9180. To prevent overhead of Path MTU Discovery triggered by the host, an administrator may wish to configure the MTU of the ATM interface to the smaller one in the router. This value will be announced to the host via Router Advertisements(RA) through the point-to-point ATM link then the host will adjust its MTU for the link.

6. Interface Identifier

An interface for a point-to-point ATM link MUST have a 64 bit interface token for IPv6. It MUST be unique within the link. That is, for the point-to-point ATM link, it MUST be different from the peer's token.

The interface token SHOULD be generated according to the following steps:

(A) If the ATM interface has an EUI 64 bit MAC address, generate an interface identifier with it according to "Links or Nodes with EUI-64 Identifiers" in Appendix A of [AARCH].

(B) If the ATM interface has an IEEE 802 48 bit MAC address, generate an interface identifier with it according to "Links or Nodes with IEEE 802 48 bit MAC's" in Appendix A of [AARCH].

Note: A node may have multiple virtual interfaces on a single physical ATM interface. Though such a node may generate the same interface identifier for the virtual interfaces, it is not a problem since interface identifiers are not necessarily unique on the node.

(C) If an EUI 64 bit MAC address is available anywhere on the node, generate an interface identifier with it according to "Links or Nodes with EUI-64 Identifiers" in Appendix A of [AARCH].

(D) If an IEEE 802 48 bit MAC address is available anywhere on the node, generate an interface identifier with it according to

"Links or Nodes with IEEE 802 48 bit MAC's" in Appendix A of [AARCH].

(E) If an IEEE global identifier is not available, a different

source of uniqueness should be used. For example, a suggested source of uniqueness is machine serial numbers. If such a source is available, generate an interface identifier with it according to "Links with Non-Global Identifiers" in Appendix A of [AARCH].

(F) If a good source of uniqueness cannot be found, generate an interface identifier with a random number according to "Links with Non-Global Identifiers" in Appendix A of [AARCH].

7. Neighbor Discovery

As of this writing, NDP[IPV6-ND] over point-to-point links is being discussed in IPng working group. If an RFC on this topic will appear in the future, NDP over point-to-point ATM links is required to implement according to the RFC.

Until such an RFC becomes available, this memo specifies the following requirements. If a node receives a Neighbor Solicitation message from its peer through the point-to-point ATM link, the node MUST send a Neighbor Advertisement message in response. A node MUST NOT discard a Neighbor Solicitation message nor a Neighbor Advertisement message even if a link layer address option is not included in the message or if a link layer address option with an unknown format to the node is included in the message. This is because link layer address resolution is not necessary on point-to-point ATM links. Moreover, in all cases, any link layer address options SHOULD be ignored since they do not provide any useful information.

8. Relationship with PPP

This memo is one of the current simple solutions. PPP[PPP] is a more advanced solution with more features and subsequently needs more resources. Currently, the only feature provided by PPP which is not covered by this memo is Maximum Receive Unit (MRU) negotiation. Duplicated Token Discovery is possible by Duplicated Address Detection defined in [IPV6-AUTO].

This memo provides an enough mechanism for current several well-managed and relatively static ATM environments. IPv6 over PPP over a point-to-point ATM link combined with [PPP] and [PPPATM] may be used in the future if less-managed and more dynamic IPv6 on ATM circumstances are needed or if more useful configuration options are defined for it.

9. Security Consideration

It is believed that this memo does not introduce new security problems to IPv6.

Acknowledgements

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References

[AAL5-MTU] R. Atkinson, "Default IP MTU for use over ATM AAL5", RFC 1626, 1994.

[AARCH] R. Hinden and S. Deering "IP Version 6 Addressing Architecture", Internet-Draft, <draft-ietf-ipngwg-addr-arch-v2-06.txt>, 1997.

[ATM-ENCAP] J. Heinanen, "Multiprotocol Encapsulation over ATM Adaptation Layer 5", RFC1483, 1993.

[EUI64] "64-Bit Global Identifier Format Tutorial", http://standards.ieee.org/db/oui/tutorials/EUI64.html.

[IPV6] S. Deering and R. Hinden, "Internet Protocol, Version 6 (IPv6) Specification", RFC 1883, 1996.

[IPV6-AUTO] S. Thomson and T. Narten, "IPv6 Stateless Address Autoconfiguration", Internet-Draft, <draft-ietf-ipngwg-addrconf-v2-01.txt>, 1997

[IPV6-ETHER] M. Crawford, "Transmission of IPv6 Packets over Ethernet Networks", Internet-Draft, <draft-ietf-ipngwg-trans-ethernet-04.txt>, 1997.

[IPV6-ND] T. Narten, E. Nordmark, and W. Simpson, "Neighbor Discovery for IP Version 6 (IPv6)", Internet-Draft, <draft-ietf-ipngwg-discovery-v2-01.txt>, 1997.

[KEYWORDS] S. Bradner, "Key words for use in RFCs to Indicate Requirement Levels", RFC 2119, March 1997.

[PPP] D. Haskin and E. Allen, "IP Version 6 over PPP", Internet-Draft, <draft-ietf-ipngwg-ipv6-over-ppp-05.txt>, 1997.

[PPPATM] G. Gross, M. Kaycee, A. Lin, A. Mails, and J. Stephens, "PPP Over AAL5", Internet-Draft, <draft-ietf-pppext-aal5-04.txt>, 1997.

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