IEEE P802.11
Wireless LANs

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| Proxy Neighbor Discovery  |
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Abstract

802.11-2016 11.22.14 describes a WNM STA ARP Proxy, and also adds an IPv6 ARP Proxy.

However, there is no such thing as ARP in IPv6. The equivalent function to IPv4 ARP Proxy is IPv6 ND Service.

This function operates differently from what 11.22.14 describes, as assuming equivalence with IPv4 ARP Proxy is an oversimplification.

This submission proposes a correction to the text, aiming at accurately stating the function description.

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| Comment | Proposed change | Resolution |
| There is no such thing as ARP in IPv6.The equivalent function to IPv4 ARP Proxy is IPv6 ND Service.This function operates differently from what 11.21.14 describes, as assuming equivalence with IPv4 ARP Proxy is an oversimplification. | Clarify the functional differences for IPv6 ND services, and point to the relevant RFCs (8928 and 8929) that clarify how the registration function may operate on an AP. | Revise  |

Discussion: this change proposal was adopted in 802.11md, but the RFC numbers were not available yet at that time. A race condition prevented the change to make it to the final 802.11-2020.

Summary of the motivation: there is no such thing as an IPv6 proxy. Yet 11.21.14 gives this impression. Additionally, that clause provides guidance on IPv6 behavior, but the recommendation is incomplete and miguided in some cases. One option is to remove all guidance, but this leaves the impression of IPv6 proxy. A better option is to add a clarifying note.

Current IEEE 802.11REVme D0.0 text:

11.21.14 Proxy ARP serviceImplementation of the proxy ARP service is optional for a WNM STA. A STA that implements the proxy ARP service has dot11ProxyARPImplemented equal to true. When dot11ProxyARPImplemented is true, dot11WirelessManagementImplemented shall be true. When dot11ProxyARPActivated is true, the Proxy ARP Service bit in the Extended Capabilities field shall be set to 1 to indicate that the AP supports the proxy ARP service. When dot11ProxyARPActivated is false, the Proxy ARP Service bit shall be set to 0 to indicate that the AP does not support the proxy ARP service.

When the AP sets the Proxy ARP field to 1 in the Extended Capabilities element, the AP shall maintain a Hardware Address to Internet Address mapping for each associated station, and shall update the mapping when the Internet Address of the associated station changes. When the IPv4 address being resolved in the ARP request packet (IETF RFC 826) is used by a non-AP STA currently associated to the BSS, the proxy ARP service shall respond on behalf of the STA to an ARP request or an ARP Probe (IETF RFC 5227).

When an AP receives an ARP Request from one associated STA or from the DS with a target IP Address that corresponds to a second associated STA, the AP shall insert the second STA MAC address as the Sender’s MAC Address in the ARP Response packet.

When an IPv6 address is being resolved, the ARP service shall respond with a Neighbor Advertisement message (Section 4.4, IETF RFC 4861) on behalf of an associated STA to an Internet Control Message Protocol version 6 (ICMPv6) Neighbor Solicitation message (Section 4.3, IETF RFC 4861). When MAC address mappings change, the AP may send unsolicited Neighbor Advertisement Messages on behalf of a STA.

NOTE—The Neighbor Solicitation message is used for both address discovery and duplicate address detection (IETF RFC 4862).

Proposed change:

Replace the last paragraph with the following text:

When an IPv6 address is being resolved, the ARP service shall respond with a Neighbor
Advertisement message (Section 4.4, IETF RFC 4861) on behalf of an associated STA to an Internet Control
Message Protocol version 6 (ICMPv6) Neighbor Solicitation message (Section 4.3, IETF RFC 4861). When
MAC address mappings change, the AP may send unsolicited Neighbor Advertisement Messages on behalf
of a STA.

NOTE—The Neighbor Solicitation (NS) message is used for both address discovery and duplicate address detection (IETF RFC 4862 and IETF RFC 6775[BX1]).

In contrast to IPv4, IPv6 enables a node to form multiple addresses, some of them temporary and with a particular attention paid to privacy. Addresses may be formed and deprecated asynchronously to the association. Even if the knowledge of IPv6 addresses used by a STA can be obtained by snooping protocols such as IPv6 Neighbor Discovery (ND) and DHCPv6, or by observing data traffic sourced at the STA, such methods provide only an imperfect knowledge of the state of the STA at the AP. This may result in a loss of connectivity for some IPv6 addresses, in particular for addresses rarely used and in a situation of mobility. This may also result in undesirable state persistence in the AP when a STA ceases to use an IPv6 address. It results that snooping protocols is not a recommended technique and that it should only be used as last resort.

The recommended alternative is to use the IPv6 registration method speficied in IETF RFC 8505[BX2]. By that method, the AP exposes its capability to proxy ND to the STA in Router Advertisement messages. In turn, the STA may request proxy ND services from the AP for one or more IPv6 addresses, using an Address Registration Option. The Registration state has a lifetime that limits unwanted state peristence in the network. The registration is optionally secured using IETF RFC 8928][BX4] to prevent address theft and impersonation. The registration carries a sequence number, which enables a fast mobility without a loss of connectivity.

The proxy ND operation needs to cover Duplicate Address Detection (Section 5.4, IETF RFC 4862), Neighbor Unreachability Detection (Section 7, IETF RFC 4861), Address Resolution (Section 7.2 IETF RFC 4861) and Address Mobility (section 6, IETF RFC 8929[BX3]) to transfer a role of ND proxy to the AP where a STA is associated following the mobility of the STA. The proxy ND specification associated to the address registration is [IETF RFC 8929[BX3]]. With that specification, the AP participates to the protocol as a backbone router, typically operating as a bridging proxy though the routing proxy operation is also possible. As a bridging proxy, the proxy replies to NS lookups with the MAC address of the STA, and then bridges packets to the STA normally; as a routing proxy, it replies with its own MAC address and then routes to the STA at the IP layer. The routing proxy reduces the need to expose the MAC address of the STA on the wired side, for a better stability and scalability of the bridged fabric.

Insert the following references to annex A:

**References:**

[BX1] IETF RFC 6775, Neighbor Discovery Optimization for IPv6 over Low-Power Wireless Personal Area Networks, Z. Shelby, S. Chakrabarti, E. Nordmark, C. Bormann, November 2012.

[BX2] IETF RFC 8505, An Update to 6LowPAN ND, P. Thubert, E. Nordmark, S. Chakrabarti, C. Perkins, June 2018.

[BX3] IETF RFC 8929, 6lo backbone router, [P.](https://tools.ietf.org/html/draft-ietf-6lo-backbone-router-06) Thubert, C.E. Perkins, E. Levy-Abegnoly, November 2020.

[BX4]IETF 8928, Address Protected Neighbor Discovery for Low-power and Lossy Networks, [P.](https://tools.ietf.org/html/draft-ietf-6lo-ap-nd-06) Thubert, B. Sarikaya, M. Sethi, R. Struik, November 2020.