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Z. Cao
T. Sun
China Mobile
S. McCann
Research in Motion
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DHCPv4 and DHCPv6 Options for Access Network Query Protocol Servers
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Abstract

This document defines a DHCPv4 option and DHCPv6 option of the Access Network Query Protocol (ANQP) server address. These options are used to configure the ANQP server addresses on the Access Point of WLAN system.

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1. Introduction

Access Network Query Protocol (ANQP) was defined by IEEE 802.11u Task Group [[IEEE-ELEVENU](#)] and is now integrated into the 802.11-2012 specification suite. And ANQP has been further extended by the Hotspot 2.0 Technical Group of Wi-Fi Alliance (WFA), and it has been included in the representative certification program called "Passpoint" [[PASSPOINT](#)].

ANQP is an example of the query protocol for access network information retrieval, and it is transported by the IEEE 802.11 defined Generic Advertisement Service (GAS) Public Action frames. GAS enables a WLAN client (e.g., a STA) to exchange messages with an advertisement server (e.g., an ANQP server) in the pre-association state, i.e., prior to association. With the information retrieved via this server, the WLAN client connection manager can make informed selection among multiple access networks. One example of using ANQP is that the WLAN client in a roaming environment can select the correct visited access network that has roaming relationship with its home service provider without user intervention.

In a scalable deployment environment, the ANQP server will not be placed on the Access Point (AP), rather it should be placed on a centralized device that serves different APs. The AP will forward the ANQP message on the IP network between AP and ANQP Server. Then the problem of configuring the ANQP server address on the AP arises.

This document defines a DHCPv4 option and DHCPv6 option of the ANQP server addresses. As introduced above, these options are used to configure the ANQP server addresses on the APs. This document also defines the "Advertisement Protocol Type" field in the DHCPv4/v6 options which can be extended to configure other types of advertisement protocols servers.

1.1. Requirements Language

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in [RFC 2119](#) [[RFC2119](#)].

[2.](#) Terminology

ANQP: Access Network Query Protocol. ANQP is an example of a query protocol for access network information retrieval transported by Generic Advertisement Service (GAS) Public Action frames defined in IEEE 802.11. ANQP message exchanges happen before network association. ANQP is defined in the IEEE 802.11 specification and

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has been further extended by the Wi-Fi Alliance.

ANQP Server: ANQP Server is the network entity that terminates and responds to ANQP enquiries. In a scalable deployment, the ANQP Server is placed in centralized device and administrated by the Wi-Fi server provider.

IEEE 802.11u: IEEE 802.11u-2011 is an amendment to the IEEE 802.11-2007 standard that added features that improve interworking with external networks. It is now incorporated within IEEE 802.11-2012. A key amendment to IEEE 802.11-2012 is the capability of WLAN client network discovery and selection.

Passpoint: Wi-Fi Alliance Certified Program Name. The technical specification of Passpoint is based on the output of the WFA Hotspot 2.0 (HS2.0) Technical Task Group. HS2.0 defines further vendor specific ANQP options and has developed a test plan for Passpoint certification.

RLQP: Registered Location Query Protocol. This is an additional advertisement protocol defined by IEEE 802.11af [[RLQP](#)] (TV White Spaces), which assists with location information, but operates as a separate RLQP Server. The RLQP Server and ANQP Server may be co-located.

[3.](#) DHCPv4 Option of ANQP Server Address

This section describes the ANQP Server Address Option for DHCPv4.

The option layout is depicted below Figure 1:

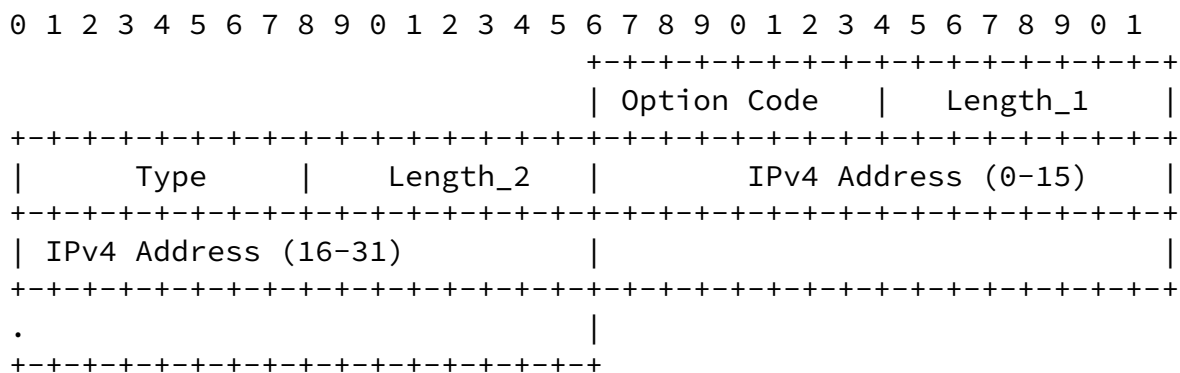


Figure 1: ANQP Server Address Option for DHCPv4

Option Code: OPTION-IPv4_Address-Adv-Server

Length_1 Length (in bytes) of the option excluding the 'Option Code' and the 'Length_1' fields;

Type (Advertisement Server Type): Indicates the type of the advertisement server. There are different advertisement servers defined in 802.11, including ANQP and RLQP. The values of those server types are discussed in [Section 5](#).

Length_2: Length (in bytes) of the IPv4 addresses of the advertisement server; its value equals four times of the number of IPv4 addresses (4*N);

IP Address: IPv4 address(es) of ANQP server(s)

Note: Length_2 is necessary because there are multiple types of advertisement servers and each has different number of IPv4 addresses configured.

This section describes the ANQP Server Address Option for DHCPv6.
The option layout is depicted below Figure 2:

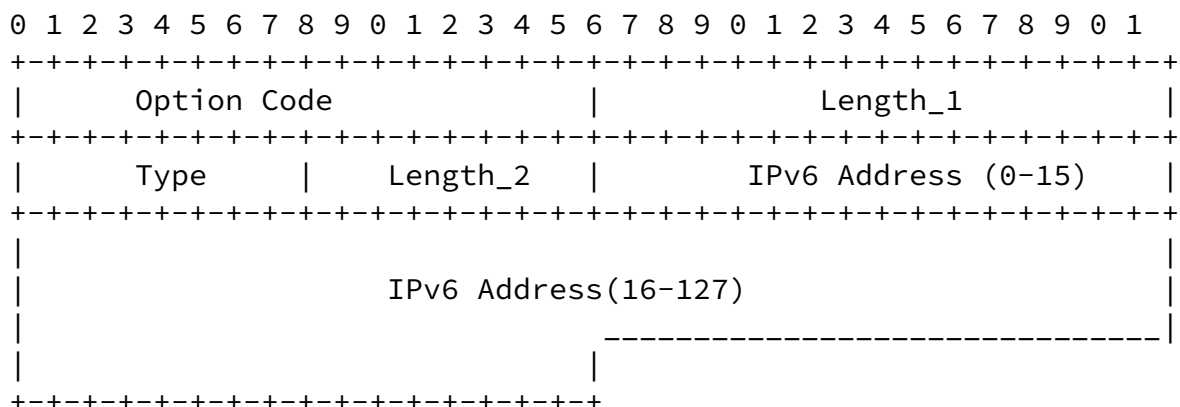


Figure 2: ANQP Server Address Option for DHCPv6

Option Code: OPTION-IPv6_Address-Adv-Server

Length_1: Length (in bytes) of the option excluding the 'Option Code' and the 'Length_1' fields;

Type (Advertisement Server Type): Indicates the type of the advertisement server. There are different advertisement servers defined in 802.11, including ANQP and RLQP. The values of those server types are discussed in [Section 5](#).

Length_2: Length (in bytes) of the IPv6 addresses of the advertisement server; its value equals 16 times of the number of IPv6 addresses (16*N);

IP address: IPv6 address(es) of ANQP server(s)

Note: Length_2 is necessary because there are multiple types of advertisement servers and each has different number of IPv6 addresses configured.

5. Advertisement Server Type

There are different types of advertisement servers defined in 802.11, including ANQP Server and RLQP Server. IEEE may define other advertisement servers in future. To make options defined in this document scalable to further extensions, and also avoid the need of an individual option code for each of such advertisement servers, this document defines the Advertisement Server Type field in both the DHCPv4 and DHCPv6 options.

The Advertisement Server Type value of ANQP is suggested in this document as below.

Type	Value
Reserved	0
ANQP	1
Reserved	2-255

In addition to ANQP, other advertisement protocols have been defined within IEEE 802.11 (e.g. RLQP). These operate in a similar manner to ANQP, but allow information exchange with different servers than that of the ANQP Server. The Advertisement Server Type value of other protocols including RLQP will be extended by future work.

6. IANA Considerations

This document has the following requests to the IANA.

Option Code for OPTION-IPv4_Address-Adv-Server in DHCPv4, as defined in Section. 3 of this document.

Option Code for OPTION-IPv6_Address-Adv-Server in DHCPv6, as defined in Section. 4 of this document.

Advertisement Server Type for ANQP, as defined in Section. 5 of this document.

7. Security Considerations

If adversaries are able to forge rogue ANQP Server options, the ANQP messages will be directed to wrong servers and bogus information about the queried access network would be injected. The DHCP authentication option described in [RFC3315] and [RFC3118] MAY be used to mitigate the above attacks. Lower layer security such as L2 traffic filtering and firewall SHOULD be configured to prevent such attacks.

8. References

8.1. Normative References

[IEEE-ELEVENU]

IEEE, "IEEE 802.11u Specification", 2011, <<http://standards.ieee.org/findstds/standard/802.11-2012.html>>.

[PASSPOINT]

Wi-Fi Alliance, "Wi-Fi CERTIFIED Passpoint", 2012, <<http://www.wi-fi.org/discover-and-learn/wi-fi-certified-passpoint>>.

[RLQP]

"Wireless LAN in the TV White Space", 2012, <http://www.ieee802.org/11/Reports/tgaf_update.htm>.

8.2. Informative References

[RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", [BCP 14](#), [RFC 2119](#), March 1997.

[RFC3118] Droms, R. and W. Arbaugh, "Authentication for DHCP Messages", [RFC 3118](#), June 2001.

[RFC3315] Droms, R., Bound, J., Volz, B., Lemon, T., Perkins, C., and M. Carney, "Dynamic Host Configuration Protocol for IPv6 (DHCPv6)", [RFC 3315](#), July 2003.

Zhen Cao
China Mobile
Xuanwumenxi Ave. No. 32
Beijing, 100871
China

Phone: +86-10-52686688
Email: zehn.cao@gmail.com, caozhen@chinamobile.com

Tao Sun
China Mobile
Xuanwumenxi Ave. No. 32
Beijing, 100871
China

Phone: +86-10-52686688
Email: suntao@chinamobile.com

Stephen McCann
Research in Motion
200 Bath Road
Slough, SL1 3XE,
United Kingdom

Phone: +44 1754 66700
Fax:
Email: smccann@rim.com
URI: