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RADIUS Attribute for MAP

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Status of this Memo

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Abstract

Mapping of Address and Port (MAP) is a stateless mechanism for running IPv4 over IPv6-only infrastructure. It provides both IPv4 and IPv6 connectivity services simultaneously during the IPv4/IPv6 co-existing period. The Dynamic Host Configuration Protocol for IPv6 (DHCPv6) MAP options has been defined to configure MAP Customer Edge (CE). However, in many networks, the configuration information may be stored in Authentication Authorization and Accounting (AAA) servers while user configuration is mainly from Broadband Network Gateway (BNG) through DHCPv6 protocol. This document defines a Remote Authentication Dial In User Service (RADIUS) attribute that carries MAP configuration information from AAA server to BNG. The MAP RADIUS attribute are designed following the simplify principle. It provides just enough information to form the correspondent DHCPv6 MAP option.

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1. Introduction

Recently providers start to deploy IPv6 and consider how to transit to IPv6. Mapping of Address and Port (MAP) [I-D.ietf-softwire-map] is a stateless mechanism for running IPv4 over IPv6-only infrastructure. It provides both IPv4 and IPv6 connectivity services simultaneously during the IPv4/IPv6 co-existing period. MAP has adopted Dynamic Host Configuration Protocol for IPv6 (DHCPv6) [RFC3315] as auto-configuring protocol. The MAP Customer Edge (CE) uses the DHCPv6 extension options [I-D.mdt-softwire-map-dhcp-option] to discover MAP Border Relay (in tunnel model only) and to configure relevant MAP rules.

In many networks, user configuration information may be managed by AAA (Authentication, Authorization, and Accounting) servers. Current AAA servers communicate using the Remote Authentication Dial In User Service (RADIUS) [RFC2865] protocol. In a fixed line broadband network, the Broadband Network Gateways (BNGs) act as the access gateway of users. The BNGs are assumed to embed a DHCPv6 server function that allows them to locally handle any DHCPv6 requests initiated by hosts.

Since the MAP configuration information is stored in AAA servers and user configuration is mainly through DHCPv6 protocol between BNGs and hosts/CEs, new RADIUS attributes are needed to propagate the information from AAA servers to BNGs. The MAP RADIUS attribute are designed following the simplify principle, while providing enough information to form the correspondent DHCPv6 MAP option. [I-D.mdt-softwire-map-dhcp-option].

2. Terminology

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 RFC2119 [RFC2119].

The terms MAP CE and MAP Border Relay are defined in [I-D.ietf-softwire-map].

3. MAP Configuration process with RADIUS

The below Figure 1 illustrates how the RADIUS protocol and DHCPv6 cooperate to provide MAP CE with MAP configuration information.

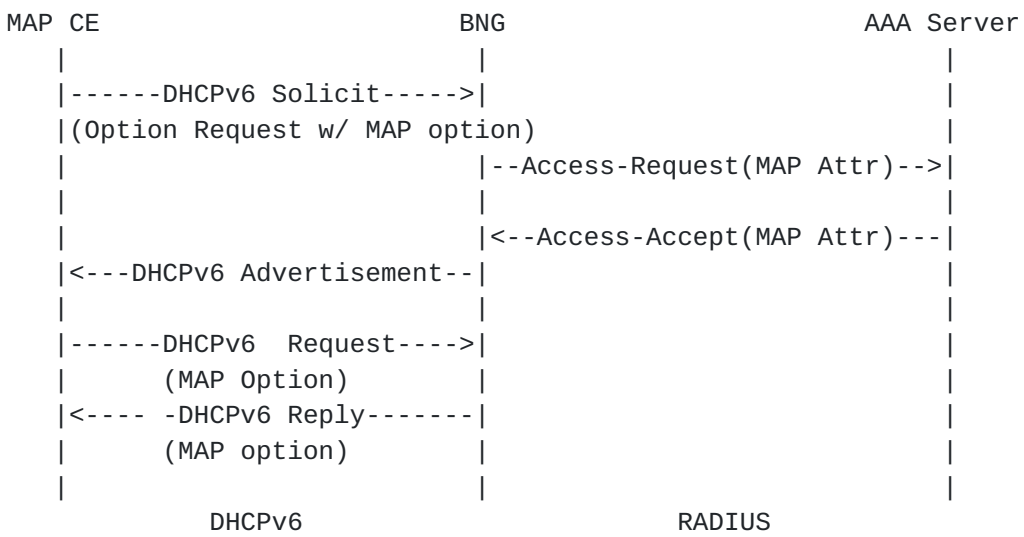


Figure 1: the cooperation between DHCPv6 and RADIUS combining with RADIUS authentication

BNGs act as a RADIUS client and as a DHCPv6 server. First, the MAP CE MAY initiate a DHCPv6 Solicit message that includes an Option Request option (6) [RFC3315] with the MAP option [draft-ietf-softwire-map-dhcp] from the MAP CE. But note that the ORO (Option Request option) with the MAP option could be optional if the network was planned as MAP-enabled as default. When BNG receives the SOLICIT, it SHOULD initiates radius Access-Request message, in which the User-Name attribute (1) SHOULD be filled by the MAP CE MAC address, to the RADIUS server and the User-password attribute (2) SHOULD be filled by the shared MAP password that has been preconfigured on the DHCPv6 server, requesting authentication as defined in [RFC2865] with MAP-Configuration attribute, defined in the next Section. If the authentication request is approved by the AAA server, an Access-Accept message MUST be acknowledged with the IPv6-MAP-Configuration Attribute. After receiving the Access-Accept message with MAP-Configuration Attribute, the BNG SHOULD respond the user an Advertisement message. Then the user can requests for a MAP Option, the BNG SHOULD reply the user with the message containing the MAP option. The recommended format of the MAC address is as defined in Calling-Station-Id (Section 3.20 in [RFC3580]) without the SSID (Service Set Identifier) portion.

Figure 2 describes another scenario, in which the authorization operation is not coupled with authentication. Authorization relevant to MAP is done independently after the authentication process. As similar to above scenario, the ORO with the MAP option in the initial DHCPv6 request could be optional if the network was planned as MAP-enabled as default.

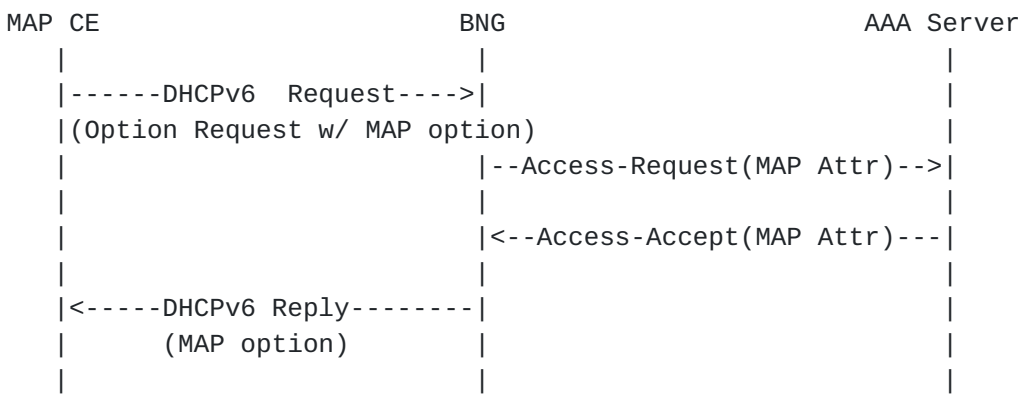


Figure 2: the cooperation between DHCPv6 and RADIUS decoupled with RADIUS authentication

In the abovementioned scenario, the Access-Request packet SHOULD contain a Service-Type attribute (6) with the value Authorize Only (17); thus, according to [RFC5080], the Access-Request packet MUST contain a State attribute that obtained from the previous authentication process.

In both above-mentioned scenarios, Message-authenticator (type 80) [RFC2869] SHOULD be used to protect both Access-Request and Access-Accept messages.

After receiving the MAP-Configuration Attribute in the initial Access-Accept, the BNG SHOULD store the received MAP configuration parameters locally. When the MAP CE sends a DHCPv6 Request message to request an extension of the lifetimes for the assigned address, the BNG does not have to initiate a new Access-Request towards the AAA server to request the MAP configuration parameters. The BNG could retrieve the previously stored MAP configuration parameters and use them in its reply.

If the BNG does not receive the MAP-Configuration Attribute in the Access-Accept it MAY fallback to a pre-configured default MAP configuration, if any. If the BNG does not have any pre-configured default MAP configuration or if the BNG receives an Access-Reject, the tunnel cannot be established.

As specified in [RFC3315], section 18.1.4, "Creation and Transmission of Rebind Messages ", if the DHCPv6 server to which the DHCPv6 Renew message was sent at time T1 has not responded by time T2, the MAP CE (DHCPv6 client) SHOULD enters the Rebind state and attempt to contact any available server. In this situation, the secondary BNG receiving the DHCPv6 message MUST initiate a new Access-Request towards the AAA

server. The secondary BNG MAY include the MAP-Configuration Attribute in its Access-Request.

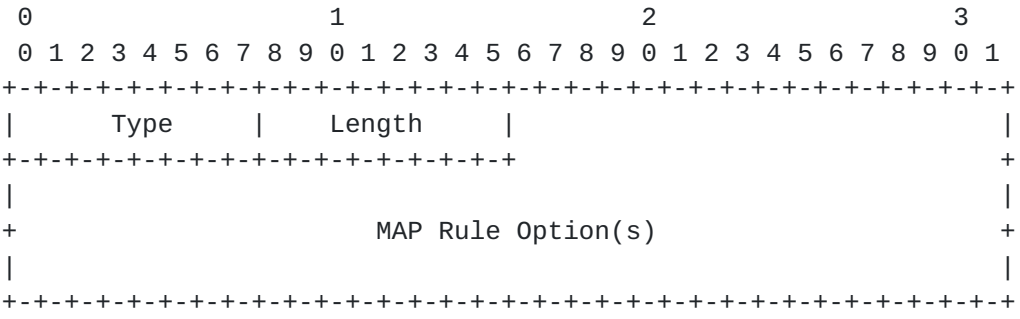
4. Attributes

This section defines MAP-Rule Attribute which is used in the MAP scenario. The attribute design follows [RFC6158] and referring to [I-D.ietf-radext-radius-extensions].

The MAP RADIUS attribute are designed following the simplify principle. The sub options are organized into two categories: the necessary and the optional.

4.1. MAP-Configuration Attribute

The MAP-Configuration Attribute is structured as follows:



Type

TBD

Length

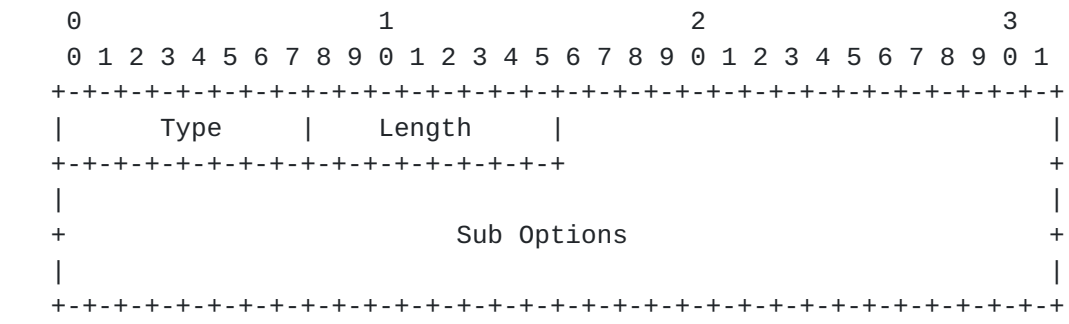
2 + the length of the Rule option(s)

MAP Rule Option (s)

A variable field that may contains one or more Rule option(s), defined in Section 4.2.

4.2. MAP Rule Options

Depending on deployment scenario, one Default Mapping rule and zero or more other type Mapping Rules MUST be included in one MAP-Configuration Attribute.



Type

1 Basic Mapping Rule (Not Forwarding Mapping Rule)

2 Forwarding Mapping Rule (Not Basic Mapping Rule)

3 Default Mapping Rule

4 Basic & Forwarding Mapping Rule

Length

2 + the length of the sub options

Sub Option

A variable field that contains necessary sub options defined in Section 4.3 and zero or several optional sub options, defined in Section 4.4.

4.3. Sub Options for MAP Rule Option

The sub options do not include EA-Len Embedded-Address length , because it can be calculated by the combine of prefix4len, prefix6-len, PSID and offset bits.

4.3.1. Rule-IPv6-Prefix Sub Option

The Rule-IPv6-Prefix Sub Option is necessary for every MAP Rule option. It should appear for once and only once.

The IPv6 Prefix sub option is follow the framed IPv6 prefix designed in [RFC3162].

SubType

1 (SubType number, for the Rule-IPv6-Prefix6 sub option)

SubLen

20 (the length of the Rule-IPv6-Prefix6 sub option)

Reserved

Reserved for future usage. It should be set to all zero.

prefix6-len

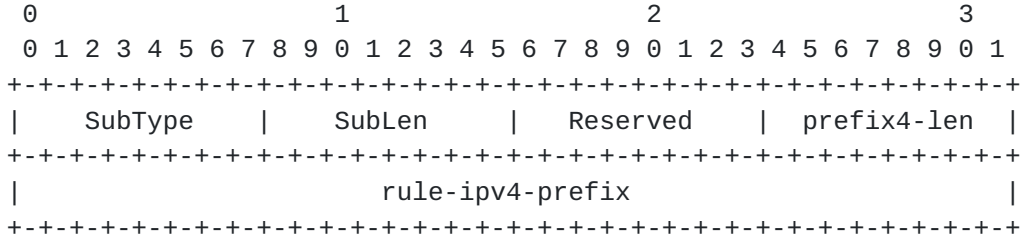
length of the IPv6 prefix, specified in the rule-ipv6-prefix field, expressed in bits

rule-ipv6-prefix

a 128-bits field that specifies an IPv6 prefix that appears in a MAP rule

"For the encapsulation mode the Rule IPv6 prefix can be the full IPv6 address of the BR." [I-D.ietf-softwire-map]

4.3.2. Rule-IPv4-Prefix Sub Option



SubType

2 (SubType number, for the Rule-IPv4-Prefix6 sub option)

SubLen

8 (the length of the Rule-IPv4-Prefix6 sub option)

Reserved

Reserved for future usage. It should be set to all zero.

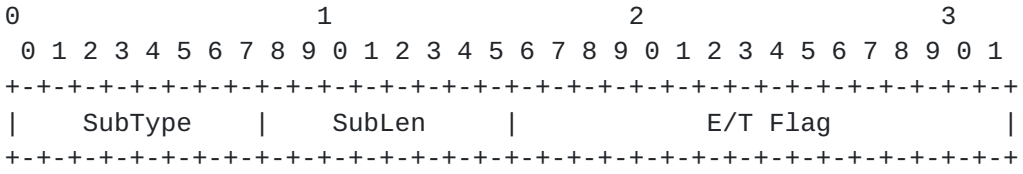
Prefix4-len

length of the IPv6 prefix, specified in the rule-ipv6-prefix field, expressed in bits

rule-ipv4-prefix

a 32-bits field that specifies an IPv4 prefix that appears in a MAP rule

4.3.3. Encapsulation/Translation Flag Sub Option



SubType

3 (SubType number, for the E/T flag sub option)

SubLen

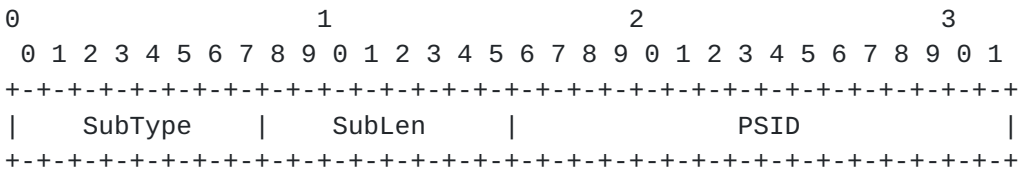
4 (the length of the E/T flag sub option)

E/T Flag

indicate the MAP transport mode: encapsulation or translation. all 0 for encapsulation, all 1 for translation.

If this sub option is not present, the default is to be assumed as encapsulation mode.

4.3.4. PSID Sub Option



SubType

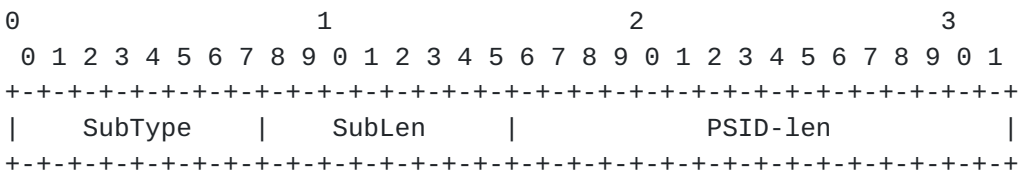
4 (SubType number, for the PSID Sub Option sub option)

SubLen

4 (the length of the PSID Sub Option sub option)

PSID (Port-set ID)
Explicit 16-bit (unsigned word) PSID value. The PSID value algorithmically identifies a set of ports assigned to a CE. The first k-bits on the left of this 2-octets field is the PSID value. The remaining (16-k) bits on the right are padding zeros.

4.3.5. PSID Length Sub Option



SubType

5 (SubType number, for the PSID Length sub option)

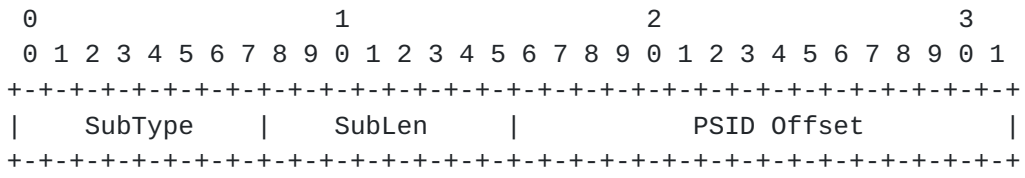
SubLen

4 (the length of the PSID Length sub option)

PSID-len

Bit length value of the number of significant bits in the PSID field. (also known as 'k'). When set to 0, the PSID field is to be ignored. After the first 'a' bits, there are k bits in the port number representing valid of PSID. Subsequently, the address sharing ratio would be 2 ^k.

4.3.6. PSID Offset Sub Option



SubType

6 (SubType number, for the PSID Offset sub option)

SubLen

4 (the length of the PSID Offset sub option)

PSID Offset

4 bits long field that specifies the numeric value for the MAP algorithm's excluded port range/offset bits (A-bits), as per section 5.1.1 in [I-D.ietf-softwire-map]. Default must be set to 4.

4.4. Table of attributes

The following table provides a guide to which attributes may be found in which kinds of packets, and in what quantity.

Request	Accept	Reject	Challenge	Accounting Request	#	Attribute
0-1	0-1	0	0	0-1	TBD1	MAP-Configuration
0-1	0-1	0	0	0-1	1	User-Name
0-1	0	0	0	0	2	User-Password
0-1	0-1	0	0	0-1	6	Service-Type
0-1	0-1	0-1	0-1	0-1	80	Message-Authenticator

The following table defines the meaning of the above table entries.

0	This attribute MUST NOT be present in packet.
0+	Zero or more instances of this attribute MAY be present in packet.
0-1	Zero or one instance of this attribute MAY be present in packet.
1	Exactly one instance of this attribute MUST be present in packet.

5. Diameter Considerations

This attribute is usable within either RADIUS or Diameter [RFC6733]. Since the Attributes defined in this document will be allocated from the standard RADIUS type space, no special handling is required by Diameter entities.

6. Security Considerations

In MAP scenarios, both CE and BNG are within a provider network, which can be considered as a closed network and a lower security threat environment. A similar consideration can be applied to the RADIUS message exchange between BNG and the AAA server.

Known security vulnerabilities of the RADIUS protocol are discussed in [RFC2607], [RFC2865], and [RFC2869]. Use of IPsec [RFC4301] for providing security when RADIUS is carried in IPv6 is discussed in [RFC3162].

A malicious user may use MAC address proofing and/or dictionary attack on the shared MAP password that has been preconfigured on the DHCPv6 server to get unauthorized MAP configuration information.

Security considerations for MAP specific between MAP CE and BNG are discussed in [I-D.ietf-softwire-map]. Furthermore, generic DHCPv6 security mechanisms can be applied DHCPv6 intercommunication between MAP CE and BNG.

Security considerations for the Diameter protocol are discussed in [RFC6733].

7. IANA Considerations

This document requires the assignment of two new RADIUS Attributes Types in the "Radius Types" registry (currently located at http://www.iana.org/assignments/radius-types for the following attributes:

- MAP-Configuration TBD1

IANA should allocate the numbers from the standard RADIUS Attributes space using the "IETF Review" policy [RFC5226].

8. Acknowledgments

The authors would like to thank for valuable comments from Peter Lothberg, Wojciech Dec, and Suresh Krishnan .etc.

9. References

9.1. Normative References

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[I-D.mdt-softwire-map-dhcp-option]
T. Mrugalski, et al., "DHCPv6 Options for Mapping of Address and Port", draft-mdt-softwire-map-dhcp-option, working in progress.

9.2. Informative References

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