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## Access-Network-Identifier Option in DHCP

### Abstract

This document specifies the format and mechanism that is to be used for encoding Access-Network Identifiers in DHCPv4 and DHCPv6 messages by defining new Access-Network-Identifier options and sub-options.

### Status of This Memo

This is an Internet Standards Track document.

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## Table of Contents

1. Introduction . . . . .	3
2. Motivation . . . . .	3
3. Terminology . . . . .	4
4. DHCPv4 Access-Network-Identifier Option . . . . .	5
4.1. DHCPv4 Access-Network-Identifier Sub-options . . . . .	5
4.2. DHCPv4 Access-Technology-Type Sub-option . . . . .	6
4.3. DHCPv4 Network-Identifier Sub-options . . . . .	7
4.3.1. DHCPv4 Network-Name Sub-option . . . . .	7
4.3.2. DHCPv4 Access-Point-Name Sub-option . . . . .	8
4.3.3. DHCPv4 Access-Point-BSSID Sub-option . . . . .	9
4.4. DHCPv4 Operator-Identifier Sub-options . . . . .	9
4.4.1. DHCPv4 Operator-Identifier Sub-option . . . . .	9
4.4.2. DHCPv4 Operator-Realm Sub-option . . . . .	10
5. DHCPv6 Access-Network-Identifier Options . . . . .	10
5.1. DHCPv6 Access-Technology-Type Option . . . . .	11
5.2. DHCPv6 Network-Identifier Options . . . . .	11
5.2.1. DHCPv6 Network-Name Option . . . . .	12
5.2.2. DHCPv6 Access-Point-Name Option . . . . .	12
5.2.3. DHCPv6 Access-Point-BSSID Option . . . . .	13
5.3. DHCPv6 Operator-Identifier Options . . . . .	13
5.3.1. DHCPv6 Operator-Identifier Option . . . . .	13
5.3.2. DHCPv6 Operator-Realm Option . . . . .	14
6. Relay Agent Behavior . . . . .	14
7. Server Behavior . . . . .	15
8. IANA Considerations . . . . .	16
9. Security Considerations . . . . .	17
10. References . . . . .	18
10.1. Normative References . . . . .	18
10.2. Informative References . . . . .	18
Acknowledgements . . . . .	19
Authors' Addresses . . . . .	20

## 1. Introduction

Access-network identification of a network device has a range of applications. For example, the Local Mobility Anchor (LMA) in a Proxy Mobile IPv6 (PMIPv6) domain is able to provide service treatment for the mobile node's traffic based on the access network to which the mobile node is attached.

This document specifies the Dynamic Host Configuration Protocol for IPv4 (DHCPv4) [RFC2131] and the Dynamic Host Configuration Protocol for IPv6 (DHCPv6) [RFC3315] options for access-network identification that is added by the relay agent in the DHCPv4 or DHCPv6 messages sent towards the server. The scope of applicability for this option is between a DHCP relay agent and a mobile access gateway where the same operator typically operates both these functions

A DHCP relay agent that is aware of the access network and access operator adds this information in the DHCP messages. This information can be used to provide differentiated services and policing of traffic based on the access network to which a client is attached. Examples of how this information can be used in mobile networks can be found in [RFC6757].

## 2. Motivation

PMIPv6 [RFC5213] can be used for supporting network-based mobility management in various types of network deployments. The network architectures, such as service provider Wi-Fi access aggregation or WLAN integrated mobile packet core, are examples where PMIPv6 is a component of the overall architecture. Some of these architectures require the ability of the LMA [RFC5213] to provide differentiated services and policing of traffic to the mobile nodes based on the access network to which they are attached. Policy systems in mobility architectures, such as Policy and Charging Control (PCC) [TS23203] and Access Network Discovery and Selection Function (ANDSF) [TS23402] in the 3GPP system, allow configuration of policy rules with conditions based on the access-network information. For example, the service treatment for the mobile node's traffic may be different when they are attached to an access network owned by the home operator than when owned by a roaming partner. In the case of access networks based on IEEE 802.11, the service treatment can also be different based on the configured Service Set Identifiers (SSIDs). Other examples of services include the operator's ability to apply tariff based on the location.

The PMIPv6 extension as specified in [RFC6757] defines PMIPv6 options to carry Access-Network Identifiers in PMIPv6 signaling from the Mobile Access Gateway (MAG) to the LMA. The MAG can learn this



All the mobility-related terms used in this document are to be interpreted as defined in the PMIPv6 specifications [RFC5213] and [RFC5844]. Additionally, this document uses the following abbreviations:

#### Service Set Identifier (SSID)

The Service Set Identifier (SSID) identifies the name of the IEEE 802.11 network. The SSID differentiates from one network to the other.

#### Operator-Identifier

The Operator-Identifier is the Structure of Management Information (SMI) Network Management Private Enterprise Code of the IANA-maintained "Private Enterprise Numbers" registry [SMI]. It identifies the operator running the access network where the client is attached.

### 4. DHCPv4 Access-Network-Identifier Option

The Access-Network Identifier (ANI) carries information related to the identity of the access network to which the client is attached. This information includes access-technology type, network identifier, and access network operator identifiers.

Relay agents that include ANI information include one or more sub-options (see Section 4.1) in the Relay Agent Information option [RFC3046].

#### 4.1. DHCPv4 Access-Network-Identifier Sub-options

The Access-Network-Identifier information will be defined in multiple sub-options allocated from the "DHCP Relay Agent Sub-Option Codes" registry.

ANI Sub-options: The ANI sub-options consist of a sequence of Sub-Option Code, Length, and Value tuples for each sub-option, encoded in the following manner:

Subopt	Len	Sub-option Data					
code	N	s1	s2	s3	s4	...	sN

#### Subopt code

The 1-octet code for the sub-options defined in the following sections.

**Len**

An unsigned 8-bit integer giving the length of the Sub-option Data field in this sub-option in octets.

**Sub-option Data (s1 to sN)**

The data area for the sub-option.

The initial assignment of the DHCP Access-Network-Identifier sub-options is as follows:

SUB-OPTION CODE	SUB-OPTION DESCRIPTION
13	Access-Technology-Type Sub-option
14	Access-Network-Name Sub-option
15	Access-Point-Name Sub-option
16	Access-Point-BSSID Sub-option
17	Operator-Identifier Sub-option
18	Operator-REALM Sub-option

**4.2. DHCPv4 Access-Technology-Type Sub-option**

This sub-option is used for exchanging the type of the access technology of the network to which the client is attached. Its format is as follows:

0	1	2	3
0 1 2 3 4 5 6 7 8 9	0 1 2 3 4 5 6 7 8 9	0 1 2 3 4 5 6 7 8 9	0 1
Subopt Code	Length	Reserved	ATT

**Subopt Code**

13

**Length**

2

**Reserved**

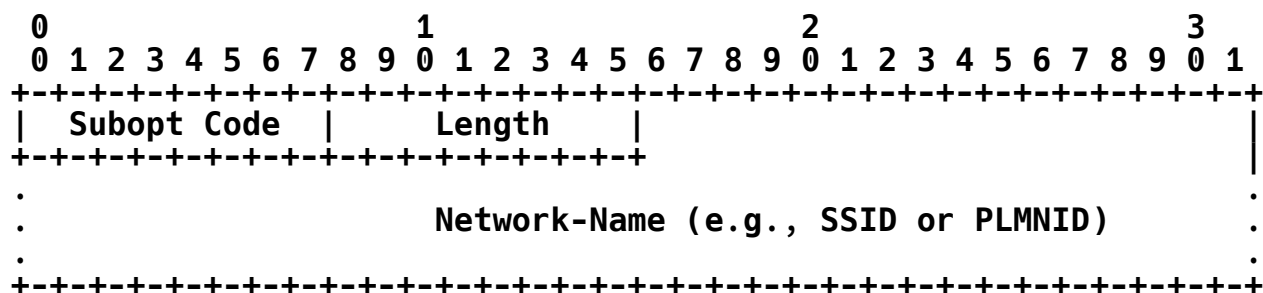
An 8-bit field that is unused for now. The value MUST be initialized to 0 by the sender and MUST be ignored by the receiver.

**Access-Technology-Type (ATT)**

An 8-bit field that specifies the access technology through which the client is connected to the access link from the IANA name space "Access Technology Type Option type values" registry defined in [RFC5213].

**4.3. DHCPv4 Network-Identifier Sub-options**

These sub-options are used for carrying the name of the access network (e.g., an SSID in the case of an IEEE 802.11 access network or a Public Land-based Mobile Network (PLMN) Identifier [TS23003] in the case of a 3GPP access network) and the Access-Point Name to which the client is attached. The format of these sub-options is defined in the following sections. The Network-Identifier sub-options are only for the currently known access-technology types.

**4.3.1. DHCPv4 Network-Name Sub-option**

**Subopt Code**

14

**Length**

The length of the Network-Name field.

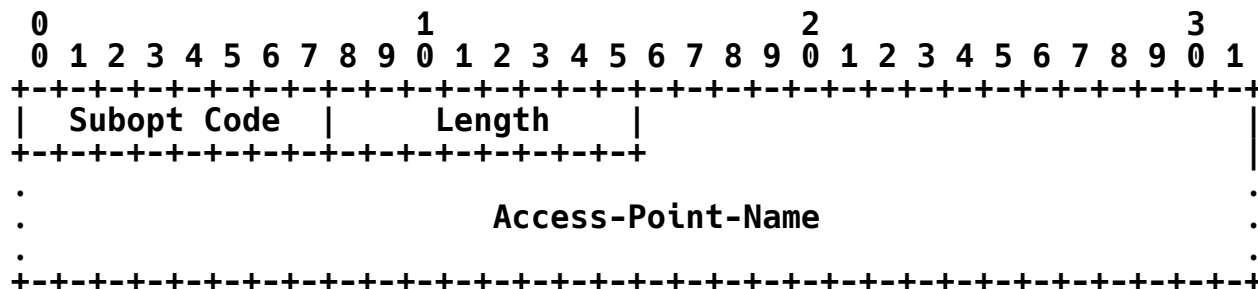
**Network-Name**

The name of the access network to which the mobile node is attached. The encoding MUST be UTF-8 as described in [RFC3629].

The type of the Network-Name is dependent on the access technology to which the mobile node is attached. For networks based on IEEE 802.11, the Network-Name will be the SSID of the network. For 3GPP access-based networks, it is the PLMN Identifier of the access network, and for 3GPP2 access, the Network-Name is the ANI [ANI].

When encoding the PLMN Identifier, both the Mobile Network Code (MNC) [TS23003] and Mobile Country Code (MCC) [TS23003] MUST be three digits. If the MNC in use only has two digits, then it MUST be preceded with a '0'.

#### 4.3.2. DHCPv4 Access-Point-Name Sub-option



**Subopt Code**  
15

**Length**  
The length of the Access-Point-Name field.

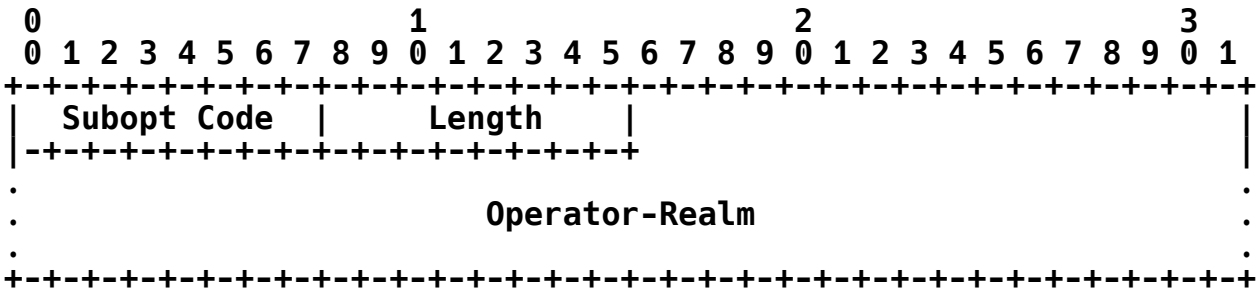
##### Access-Point-Name

The name of the access point (physical device name) to which the mobile node is attached. This is the identifier that uniquely identifies the access point. While the Network-Name (e.g., SSID) identifies the operator's access network, the Access-Point-Name identifies a specific network device in the network to which the mobile node is attached. In some deployments, the Access-Point-Name can be set to the string representation of the Media Access Control (MAC) address of the device as specified in [RFC6991] (see mac-address typedef) or some unique identifier that can be used by the policy systems in the operator network to unambiguously identify the device. The encoding MUST be UTF-8 as described in [RFC3629].





4.4.2. DHCPv4 Operator-Realm Sub-option



Subopt Code  
18

Length  
The length of the Operator-Realm field.

Operator-Realm  
Realm of the operator (e.g., EXAMPLE.COM). Please refer to Section 3.1.3 of [RFC6757] for additional details.

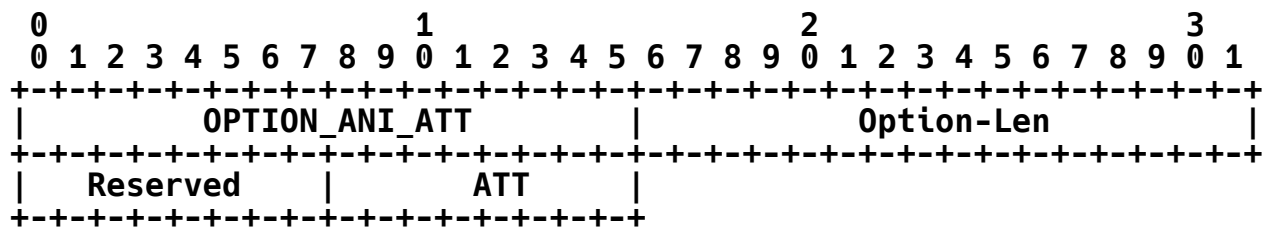
5. DHCPv6 Access-Network-Identifier Options

The Access-Network-Identifier options defined here may be added by the DHCPv6 relay agent in Relay-forward messages.

OPTION CODE	OPTION DESCRIPTION
105	OPTION_ANI_ATT
106	OPTION_ANI_NETWORK_NAME
107	OPTION_ANI_AP_NAME
108	OPTION_ANI_AP_BSSID
109	OPTION_ANI_OPERATOR_ID
110	OPTION_ANI_OPERATOR_REALM

5.1. DHCPv6 Access-Technology-Type Option

This option is used for exchanging the type of access technology the client uses to attach to the network. Its format is as follows:



Option-Code  
OPTION\_ANI\_ATT (105)

Option-Len  
2

Reserved  
An 8-bit field that is unused for now. The value MUST be initialized to 0 by the sender and MUST be ignored by the receiver.

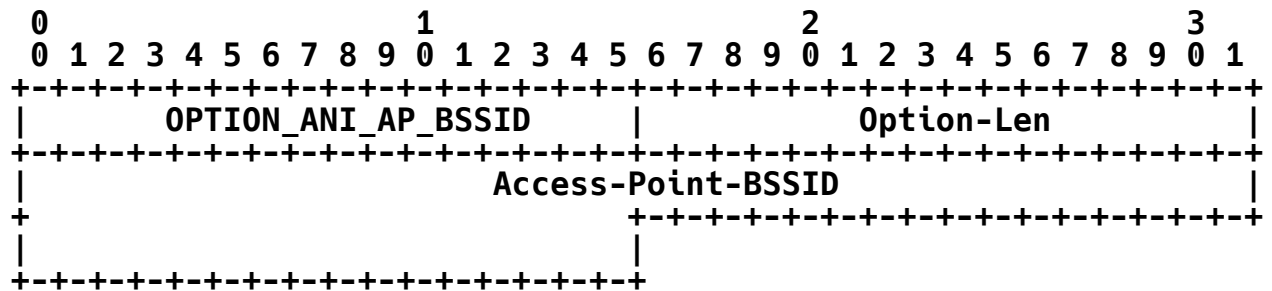
Access-Technology-Type (ATT):  
The contents of this field are the same as the ATT field described in Section 4.2.

5.2. DHCPv6 Network-Identifier Options

These options can be used for carrying the name of the access network (e.g., an SSID in the case of an IEEE 802.11 access network or a PLMN Identifier [TS23003] in the case of a 3GPP access network) and an Access-Point Name to which the client is attached. The format of these options is defined below.



### 5.2.3. DHCPv6 Access-Point-BSSID Option



Option-Code

OPTION\_ANI\_AP\_BSSID (108)

Option-Len

6

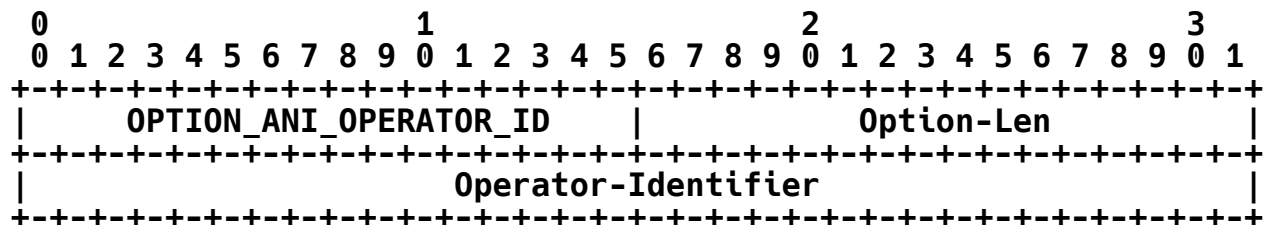
Access-Point-BSSID

The contents of this field are the same as the Access-Point-BSSID field described in Section 4.3.3.

### 5.3. DHCPv6 Operator-Identifier Options

The Operator-Identifier options can be used for carrying the Operator-Identifier of the access network to which the client is attached. The format of these options is defined below.

#### 5.3.1. DHCPv6 Operator-Identifier Option



Option-Code

OPTION\_ANI\_OPERATOR\_ID (109)

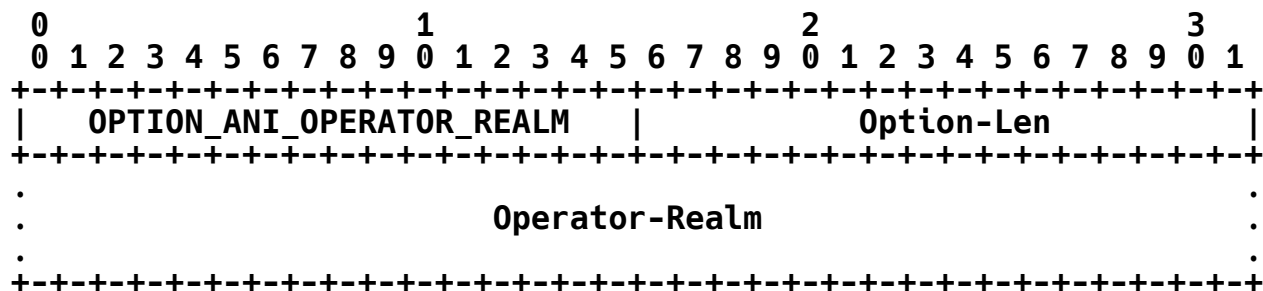
Option-Len

4

Operator-Identifier

The contents of this field are the same as the DHCPv4 Operator-Identifier Sub-option field described in Section 4.4.1.

### 5.3.2. DHCPv6 Operator-Realm Option



#### Option-Code

OPTION\_ANI\_OPERATOR\_REALM (110)

#### Option-Len

The length of the Operator-Realm field.

#### Operator-Realm

The contents of this field are the same as the Operator-Realm field described in Section 4.4.2.

## 6. Relay Agent Behavior

DHCPv4 relay agents MAY include sub-options as defined in Section 4.2 through 4.4 of [RFC3046] in the Relay Agent Information option for providing information about the access network over which DHCP messages from the client are received.

The DHCPv4 relay agent MUST include the DHCPv4 Access-Technology-Type Sub-option (Section 4.2) when including any of these sub-options in the DHCP message: DHCPv4 Network-Name Sub-option (Section 4.3.1), DHCPv4 Access-Point-Name Sub-option (Section 4.3.2), and DHCPv4 Access-Point-BSSID Sub-option (Section 4.3.3).

DHCPv6 Relay Agents MAY include options (defined in Section 5) in the Relay-forward message when forwarding any DHCPv6 message type from clients to the servers to provide information about the access network over which DHCPv6 messages from the client are received.

The DHCPv6 relay agent MUST include the DHCPv6 Access-Technology-Type Option (Section 5.1) when including any of these options in the DHCP message: DHCPv6 Network-Name Option (Section 5.2.1), DHCPv6 Access-Point-Name Option (Section 5.2.2), and DHCPv6 Access-Point-BSSID Option (Section 5.2.3).

## 7. Server Behavior

The DHCPv4 base specification [RFC2131] requires that the DHCPv4 server ignore the DHCPv4 Access-Network-Identifier Option if it does not understand the option.

If the DHCPv4 server does not understand the received sub-option defined in Sections 4.1 through 4.4 of [RFC3046], the DHCPv4 Relay-Agent-Information Option, it **MUST** ignore those sub-options only. If the DHCPv4 server is able to process the DHCPv4 Access-Network-Identifier sub-options defined in Sections 4.1 through 4.4 of [RFC3046], the DHCPv4 Relay-Agent-Information Option, it **MAY** use this information obtained from the sub-option for address pool selection or for policy decisions as per its configured policy. This information obtained from the sub-option **SHOULD NOT** be stored unless it is absolutely needed. However, if it is stored, the information **MUST** be deleted as quickly as possible to eliminate any possibility of the information getting exposed to an intruder.

The DHCPv4 server **MUST** ignore the received DHCPv4 Access-Network-Identifier Option and process the rest of the message as per the base DHCPv4 specifications if the received DHCPv4 message does not include the DHCPv4 Access-Technology-Type Sub-option (Section 4.2) but does include any one of these other options: DHCPv4 Network Name Sub-option (Section 4.3.1), DHCPv4 Access-Point-Name Sub-option (Section 4.3.2), or DHCPv4 Access-Point-BSSID Sub-option (Section 4.3.3).

DHCPv6 base specification [RFC3315] requires that the DHCPv6 server ignore the DHCPv6 Access-Network-Identifier Option if it does not understand the option.

If the DHCPv6 server receives the options defined in Section 5 and is configured to use the options defined in Section 5, it **SHOULD** look for the DHCPv6 Access-Network-Identifier options in the Relay-forward message of the DHCPv6 relay agent(s) based on its configured policy. The server **MAY** use received ANI options for its address pool selection policy decisions as per its configured policy. This information obtained from the options **SHOULD NOT** be stored unless it is absolutely needed. However, if it is stored, the information **MUST** be deleted as quickly as possible to eliminate any possibility of the information getting exposed to an intruder.

The DHCPv6 server **MUST** ignore the received DHCPv6 Access-Network-Identifier Option and process the rest of the message as per the base DHCPv6 specifications if the received DHCPv6 message does not include the DHCPv6 Access-Technology-Type Option (Section 5.1) but it does include any one of these other options: DHCPv6 Network-Name Option

(Section 5.2.1), DHCPv6 Access-Point-Name Option (Section 5.2.2), or DHCPv6 Access-Point-BSSID Option (Section 5.2.3).

## 8. IANA Considerations

IANA has assigned sub-option codes for the following DHCPv4 sub-options from the "DHCP Relay Agent Sub-Option Codes" registry, <<http://www.iana.org/assignments/bootp-dhcp-parameters>>:

SUB-OPTION CODE	SUB-OPTION DESCRIPTION
13	Access-Technology-Type Sub-option
14	Access-Network-Name Sub-option
15	Access-Point-Name Sub-option
16	Access-Point-BSSID Sub-option
17	Operator-Identifier Sub-option
18	Operator-REALM Sub-option

IANA has assigned option codes for the following DHCPv6 options from the "Option Codes" registry for DHCPv6, <<http://www.iana.org/assignments/dhcpv6-parameters>>, as specified in [RFC3315]:

OPTION CODE	OPTION DESCRIPTION
105	OPTION_ANI_ATT
106	OPTION_ANI_NETWORK_NAME
107	OPTION_ANI_AP_NAME
108	OPTION_ANI_AP_BSSID
109	OPTION_ANI_OPERATOR_ID
110	OPTION_ANI_OPERATOR_REALM



## 9. Security Considerations

Since there is no privacy protection for DHCP messages, an eavesdropper who can monitor the link between the DHCP server and relay agent can discover access-network information.

[RFC3118] and [RFC3315] describe many of the threats in using DHCP. [RFC3118] and [RFC3315] each provide a solution; the Authentication Option for DHCPv4 and DHCPv6 (respectively). However, neither of these options are in active use and therefore are not a viable mitigation option. DHCP itself is inherently insecure and thus link-layer confidentiality and integrity protection **SHOULD** be employed to reduce the risk of disclosure and tampering.

It is possible for a rogue DHCP relay agent to insert or overwrite with incorrect Access-Network-Identifier options for malicious purposes. A DHCP client can also pose as a rogue DHCP relay agent by sending incorrect Access-Network-Identifier options. While the introduction of fraudulent DHCP relay agent information options can be prevented by a perimeter defense that blocks these options unless the DHCP relay agent is trusted, a deeper defense using the authentication sub-option for the DHCPv4 Relay-Agent-Information Option [RFC4030] **SHOULD** be deployed as well. Administrators **SHOULD** configure DHCP servers that use this option to communicate with their relay agents using IPsec, as described in Section 21.1 of [RFC3315].

The information elements that this document is exposing are the client's access-network information. These pertain to the access network to which the client is attached, such as Access-Technology Type (e.g., WLAN, Ethernet, etc.), Access-Point Identity (Name, BSSID), and Operator-Identifier and Operator-Realm. In deployments where this information cannot be secured using IPsec [RFC4301] or other security protocols, administrators **SHOULD** disable the capability specified in this document on the DHCP entities.

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