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Access Network Identifier (ANI) Option for Proxy Mobile IPv6 draft-ietf-netext-access-network-option-08.txt

Abstract

The local mobility anchor in a Proxy Mobile IPv6 domain is able to provide access network and access operator specific handling or policing of the mobile node traffic using information about the access network to which the mobile node is attached. This specification defines a mechanism and a related mobility option for carrying the access network identifier and the access operator identification information from the mobile access gateway to the local mobility anchor over Proxy Mobile IPv6.

Status of this Memo

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1. Introduction

Proxy mobile IPv6 [RFC5213] can be used for supporting network-based mobility management in various type of network deployments. The network architectures, such as Service provider Wi-Fi access aggregation or, WLAN integrated mobile packet core are examples where Proxy Mobile IPv6 is a component of the overall architecture. Some of these architectures require the ability of the local mobility anchor (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 PCC [TS23203] and ANDSF [TS23402] in 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 a access network owned by the home operator than when owned by a roaming partner. The service treatment can also be different based on the configured Service Set Identifiers (SSID) in case of IEEE 802.11 based access networks. Other examples of location services include the operator's ability to display a location specific Web Page, or apply tariff based on the location.

The Proxy Mobile IPv6 specification [RFC5213] allows for carrying the Access Technology Type (ATT) information from the mobile access gateway (MAG) to the local mobility anchor (LMA). However, the Access Technology Type alone is not necessarily sufficient for a suitable policy to be applied at the local mobility anchor. Therefore, there is a need for an additional access network related information to be available at the local mobility anchor. Learning the access network operator identity may not be possible for an local mobility anchor without a support of an additional policy framework that is able to provide required information out of band to the local mobility anchor. Such a policy framework may not be required for all Proxy Mobile IPv6 deployments and hence an alternative approach for carrying such information is required to ensure that additional information related to the access network is available.

This document defines a new mobility option, Access Network Identifier (ANI) option and its sub-options for Proxy Mobile IPv6, that can be used by mobile access gateway for carrying the access network information to the local mobility anchor. The specific details on how the local mobility anchor uses this information are out-of-scope for this document. These mobility options are optional and are not mandatory for the Proxy Mobile IPv6 protocol.

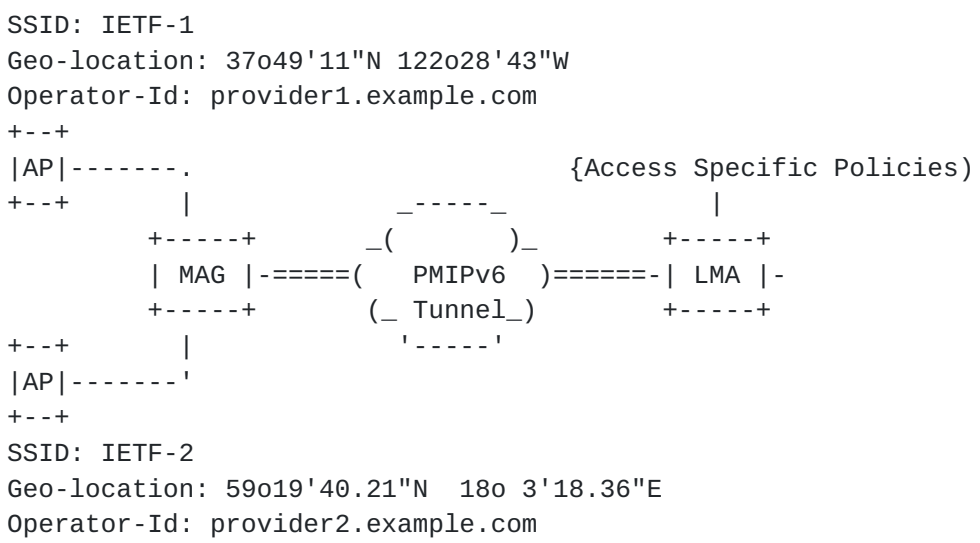

Figure 1: Access Networks attached to MAG

Figure 1 illustrates an example Proxy Mobile IPv6 deployment where the mobile access gateway delivers the information elements related to the access network to the local mobility anchor over Proxy Mobile IPv6 signaling messages. In this example, the additional information could comprise the SSID of the used IEEE 802.11 network, the geo-location of the mobile node known to the mobile access gateway, and the identities of the operators running the IEEE 802.11 access network infrastructure.

2. Conventions and Terminology

2.1. Conventions

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].

2.2. Terminology

All the mobility related terms used in this document are to be interpreted as defined in the Proxy Mobile IPv6 specifications [RFC5213] and [RFC5844]. Additionally, this document uses the following abbreviations:

Service Set Identifier

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

Vendor ID

The Vendor ID is the SMI Network Management Private Enterprise Code of the IANA-maintained Private Enterprise Numbers registry [SMI].

3. Access Network Identifier Option

The Access Network Identifier option is a mobility header option used to exchange access network related information between a local mobility anchor and a mobile access gateway. The option can be included in both Proxy Binding Update (PBU) and Proxy Binding Acknowledgement (PBA) messages, and there can only be a single instance of this mobility option in a mobility message. The Access Network Identifier mobility option always contains one or more Access Network Identifier Sub-options. The Access Network Identifier Sub-option is described in Section 3.1.

The alignment requirement for this option is 4n.

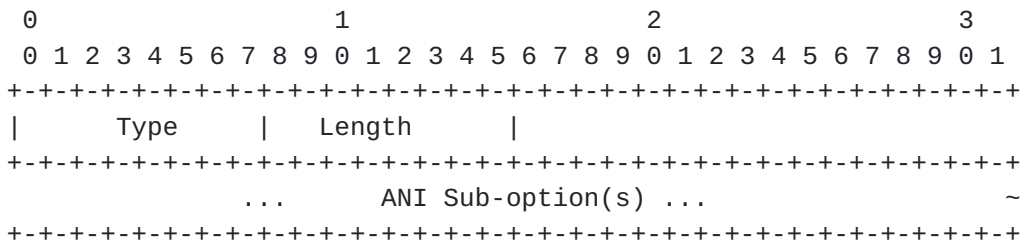

Figure 2: Access Network Identifier Option

Type: (IANA-1)

Length: 8-bit unsigned integer indicating the length in octets of the option, excluding the type and length fields.

3.1. Format of the Access Network Identifier Sub-Option

The Access Network Identifier Sub-Options are used for carrying information elements related to the access network to which the mobile node is attached to. These sub-options can be included in the Access Network Identifier option defined in Section 3. The format of this sub-option is as follows:

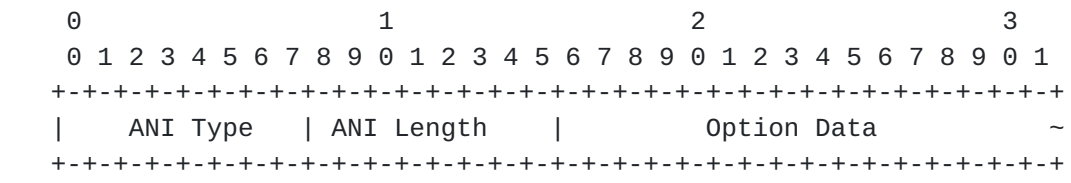

Figure 3: Access Network Identifier Sub-Option

ANI Type: 8-bit unsigned integer indicating the type of the Access Network Identifier sub-option. This specification defines the following types:

0 - Reserved

1 - Network-Identifier Sub-option

2 - Geo-Location Sub-option

3 - Operator-Identifier Sub-option

ANI Length: 8-bit unsigned integer indicating the number of octets needed to encode the Option Data, excluding the ANI Type and ANI Length fields of the sub-option.

3.1.1. Network-Identifier Sub-Option

The Network-Identifier is a mobility sub-option that can be carried in Access Network Identifier option defined in Section 3. This sub-option can be used for carrying the name of the access network (e.g., a SSID in case of IEEE 802.11 Access Network, or PLMN Identifier [TS23003] in case of 3GPP access), to which the mobile node is attached. There can only be a single instance of this specific sub-option in any Access Network Identifier option. The format of this option is defined below.

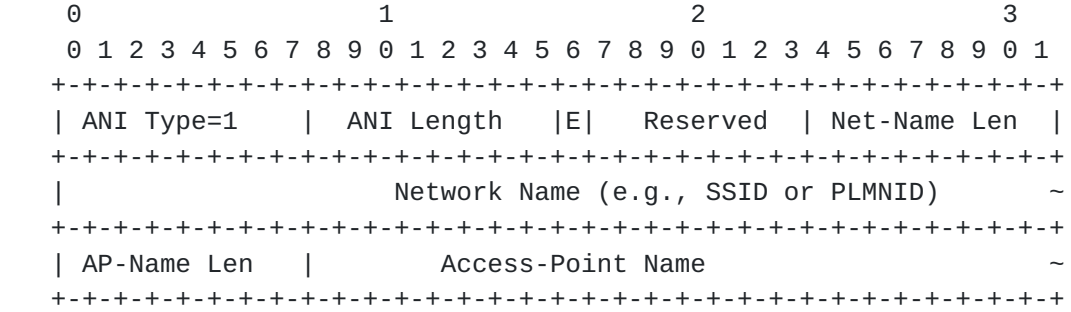

Figure 4: Network-Identifier Sub-option

ANI Type: It should be set to value of (1), indicating that its a Network-Identifier sub-option

ANI Length: Total length of this sub option, excluding the ANI Type and ANI length fields. The value can be in the range of 2 to 32 octets.

'E'-bit: 1-bit flag for representing the encoding of the following name field. MUST be set to zero (0) if the network name is encoded using 8-bit octets or to one (1) if the network name is encoded using UTF-8.

Reserved: MUST be set to zero when sending and ignored when received.

Net-Name Length: 8-bit field for representing the length of the network name to be followed.

Network Name: The name of the access network to which the mobile node is attached. The type of the network-name is dependent on the Access Technology to which the mobile node is attached. If its 802.11 access, the network-name is the SSID of the network. If the access network is 3GPP access, the network-name is the PLMN Identifier of the network. If the access network is 3GPP2 access, the network-name is the Access Network Identifier [ANI].

When encoding the PLMN Identifier, both MNC and MCC codes MUST be 3 digists. If the MNC in use only has 2 digits, then it MUST be preceded with a '0'. Encoding MUST be UTF-8.

AP-Name Length: 8-bit field for representing the length of the access point name to be followed. If the access point name is not carried, this length should be set to zero.

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. In some deployments the name can be set to the mac-address of the device. The string is carried in UTF-8 representation.

3.1.2. Geo-Location ANI Sub-Option

The Geo-Location is a mobility sub-option that can be carried in Access Network Identifier option defined in Section 3. This sub-option can be used for carrying the Geo-location of the network to which the mobile node is attached, as known to the mobile access

gateway. There can only be a single instance of this specific sub-option in any Access Network Identifier option. The format of this option is defined below.

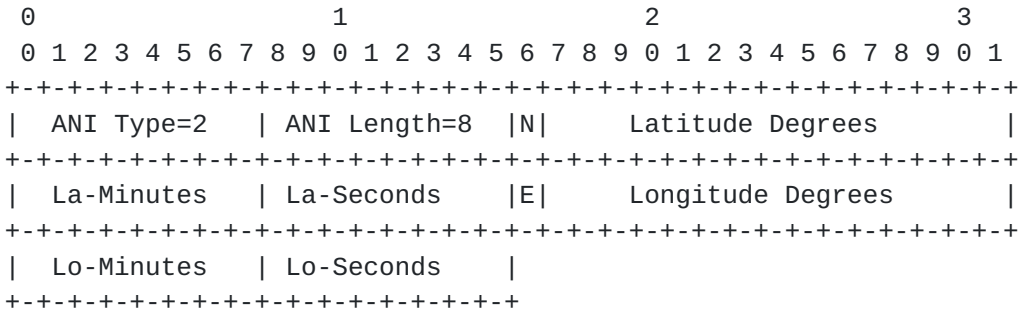

Figure 5: Geo-Location ANI sub-option

ANI Type: It should be set to value of (2), indicating that its Geo-Location sub-option

ANI Length: Total length of this sub-option, excluding the ANI Type and ANI length fields. It should be set to a value of (8).

N: When the flag (N) is set to a value of (1), it means North, else its South

Latitude Degrees: Allowed range from 0 to 90 degrees, northern or southern hemisphere as qualified by the (N) flag

La-Minutes: Allowed range is 0 to 59.

La-Seconds: Allowed range is 0 to 59. Any fractional values must be rounded off to the nearest integer.

E: When the flag (E) is set to a value of (1), it means East, else its West

Longitude Degrees: Allowed range from 0 to 90 degrees, eastern or western hemisphere as qualified by the (E) flag

Lo-Minutes: Allowed range is 0 to 59.

Lo-Seconds: Allowed range is 0 to 59. Any fractional values must be rounded off to the nearest integer.

3.1.3. Operator-Identifier Sub-Option

The Operator-Identifier sub-option can be used for carrying the operator identifier of the access network to which the mobile node is attached. There can only be a single instance of this specific sub-option in any Access Network Identifier option. The format of this option is defined below.

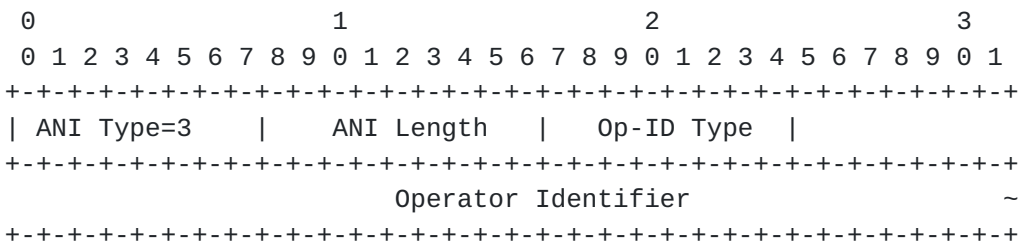

Figure 6: Operator-Identifier Sub-option

ANI Type: It should be set to value of (3), indicating that its Operator-Identifier sub-option

ANI Length: Total length of this sub option, excluding the ANI Type and ANI length fields.

Operator Identifier (Op-ID) Type: 8-bit unsigned integer indicating the type of the Operator Identifier. Currently the following types are defined:

0 - Reserved.

1 - Vendor ID as a four octet Private Enterprise Number [SMI].

2 - Realm of the operator. Realm names are required to be unique, and are piggybacked on the administration of the DNS namespace. Realms are encoded using a domain name encoding defined in [RFC1035].

Operator Identifier: Up to 253 octets of the operator identifier. The encoding of the identifier depends on the used Operator-ID Type. Numeric values are encoded in network byte order and strings have no terminating '\0' mark.

4. Protocol Considerations

The following considerations apply to the local mobility anchor and the mobile access gateway.

4.1. Mobile Access Gateway Considerations

- The conceptual Binding Update List entry data structure maintained by the mobile access gateway, described in Section 6.1 of [RFC5213], MUST be extended to store the access network related information elements associated with the current session. Specifically, the following parameters must be defined.

  Network-Identifier

  Access Point Name

  Operator-Identifier

  Geo-Location

- If the mobile access gateway is configured to support Access Network Information option, it SHOULD include this option with the specific sub-options in all Proxy Binding Update messages (including in Proxy Binding Updates for lifetime extension and for deregistration) that it sends to the local mobility anchor. The Access Network Information option SHOULD be constructed as specified in Section 3. It should include the relevant ANI sub-options that the mobile access gateway is configured to carry them in the Proxy Mobile IPv6 messages.

- The access network information elements, such as Access Network Name, Geo-location and the Operator Identifier, typically are statically configured on the mobile access gateway on a per-interface basis (Example: Access Point (AP-1) is attached through interface-1, and the SSID is X, Geo-Location is Y). In some deployments, this information can also be dynamically obtained, such as through DHCP Option (82), which is the DHCP Relay Agent Information option [RFC3046]. When the mobile node sends a DHCP Request, the Access Points typically add the SSID information to the Option 82 of the DHCP request and when the mobile access gateway receives this request, it can parse the Option 82 of the DHCP request and obtain the SSID name. The specific details on how the mobile access gateway obtains these information elements are access technology and deployment specific, and is out-side the scope of this document. It is possible those information elements are configured on the MAG on a per-interface basis, or dynamically obtained through some of out of means, such as based on CAPWAP

protocol.

- If the protocol configuration variable, EnableANISubOptNetworkIdentifier Section 6, is set to a value of (1), the mobile access gateway SHOULD include the Network-Identifier sub-option in the Access Network Identifier option carried in the Proxy Binding Update. For including the Network-Identifier sub-option, the mobile access gateway needs to be aware of the network name of the access network (Ex: SSID in case WLAN Access Network) to which the mobile node is attached. This sub-option also includes the access-point name for carrying the name of the access point to which the mobile node is attached. The access-point name is specially important for applying location services and given that the network-name (Ex: SSID) may not provide the needed uniqueness for identifying a location. This sub-option MUST be constructed as described in Section 3.1.1

- If the protocol configuration variable, EnableANISubOptGeoLocation Section 6, is set to a value of (1), the mobile access gateway SHOULD include the Geo-Location sub-option in the Access Network Identifier option carried in the Proxy Binding Update. For including the Geo-Location sub-option, the mobile access gateway needs to be aware of the GPS coordinates of the network to which the mobile node is attached. This sub-option MUST be constructed as described in Section 3.1.2.

- If the protocol configuration variable, EnableANISubOptOperatorIdentifier Section 6, is set to a value of (1), the mobile access gateway SHOULD include the Operator-Identifier sub-option in the Access Network Identifier option carried in the Proxy Binding Update. For including the Operator-Identifier sub-option, the mobile access gateway needs to be aware of the operator identity of that access network. This sub-option MUST be constructed as described in Section 3.1.3.

If the mobile access gateway had any of the Access Network Information mobility option included the Proxy Binding Update sent to a local mobility anchor, then the Proxy Binding Acknowledgement received from the local mobility anchor is also expected to contain the Access Network Information mobility option with the specific sub-options. If the mobile access gateway receives a Proxy Binding Acknowledgement with a successful Status Value but without an Access Network Information mobility option, then the mobile access gateway SHOULD log the event and based on its local policy MAY proceed to terminate the mobility session. In this case the mobile access gateway knows the local mobility anchor does not understand the Access Network Information mobility option and therefore MAY consider it as a misconfiguration of the Proxy Mobile IPv6 domain.

4.2. Local Mobility Anchor Considerations

- The conceptual Binding Cache entry data structure maintained by the local mobility anchor, described in Section 5.1 of [RFC5213], MUST be extended to store the access network related information elements associated with the current session. Specifically, the following parameters must be defined.

  Network-Identifier

  Access Point Name

  Operator-Identifier

  Geo-Location

- On receiving a Proxy Binding Update message [RFC5213] from a mobile access gateway with the Access Network Information option, the local mobility anchor must process the option and update the corresponding fields in the Binding Cache entry. If the option is not understood by that LMA implementation, it will skip the option.

- If the local mobility anchor understands the Access Network Identifier mobility option received in a Proxy Binding Update and also agrees with the sub-option(s) content defined in this specification, then the local mobility anchor MUST echo the Access Network Identifier mobility option back to a mobile access gateway in a Proxy Binding Acknowledgement. The Access Network Identifier sub-options defined in this specification MUST NOT be altered by the local mobility anchor. Future specification utilizing Access Network Identifier mobility option MAY define use cases and new sub-options that can purposely be altered by a local mobility anchor.

- If the received Proxy Binding Update message does not include the Access Network Information option, but the mobility session associated to that request has the previously notified access network specific information elements, the same MUST be updated and those information elements previously received MUST be removed.

- The local mobility anchor MAY choose to use the access network information options for applying any access operator specific handling or policing of the mobile node traffic.

5. IANA Considerations

This document requires the following IANA actions.

Action-1: This specification defines a new Mobility Header option, the Access Network Identifier. This mobility option is described in Section 3. The Type value for this option needs to be assigned from the same numbering space as allocated for the other mobility options, as defined in [RFC6275].

Action-2: This specification defines a new mobility sub-option format, Access Network Information (ANI) sub-option. The format of this mobility sub-option is described in Section 3.1. This sub-option can be carried in Access Network Information option. The type value for this sub-option needs to be managed by IANA, under the Registry, Access Network Information sub-option. This specification reserves the following type values. Approval of new Access Network Information (ANI) sub-option type values are to be made through IANA Expert Review.

0 - Reserved

1 - Network-Identifier Sub-option

2 - Geo-Location Sub-option

3 - Operator-Identifier Sub-option

Action-3: This specification defines a new mobility sub-option, Operator-Identifier sub-option. The format of this mobility sub-option is described in Section 3.1.3. The Operator Identifier (Op-Id) Type field of this sub-option introduces a new number space. This number space needs to be managed by IANA, under the Registry, Operator Identifier Type Registry. This specification reserves the following type values. Approval of new Operator Identifier Type values are to be made through IANA Expert Review.

0 - Reserved

1 - Vendor ID as a four octet Private Enterprise Number

2 - Realm of the operator

6. Protocol Configuration Variables

This specification defines the following configuration variables that control the use of Access Network Information related sub-options in

Proxy Mobile IPv6 signaling messages. The mobility entities, local mobility anchor and the mobile access gateway MUST allow these variables to be configured by the system management. The configured values for these protocol variables MUST survive server reboots and service restarts.

EnableANISubOptNetworkIdentifier

This flag indicates whether or not support for Network-Identifier sub-option should be enabled. This configuration variable is available at both in the mobile access gateway and at the local mobility anchor. The default value for this flag is set to (0), indicating that the support for Network-Identifier sub-option is disabled.

When this flag on the mobile access gateway is set to a value of (1), the mobile access gateway SHOULD include this sub-option in the Proxy Binding Update messages that it sends to the local mobility anchor, otherwise it SHOULD NOT include the sub-option.

Similarly, when this flag on the local mobility anchor is set to a value of (1), the local mobility anchor SHOULD enable support for this sub-option, otherwise it SHOULD ignore this sub-option.

EnableANISubOptGeoLocation

This flag indicates whether or not support for Geo-Location sub-option should be enabled. This configuration variable is available at both in the mobile access gateway and at the local mobility anchor. The default value for this flag is set to (0), indicating that the support for Geo-Location sub-option is disabled.

When this flag on the mobile access gateway is set to a value of (1), the mobile access gateway SHOULD include this sub-option in the Proxy Binding Update messages that it sends to the local mobility anchor, otherwise it SHOULD NOT include the sub-option.

Similarly, when this flag on the local mobility anchor is set to a value of (1), the local mobility anchor SHOULD enable support for this sub-option, otherwise it SHOULD ignore this sub-option.

EnableANISubOptOperatorIdentifier

This flag indicates whether or not support for Operator-Identifier sub-option should be enabled. This configuration variable is available at both in the mobile access gateway and at the local mobility anchor. The default value for this flag is set to (0), indicating that the support for Operator-Identifier sub-option is disabled.

When this flag on the mobile access gateway is set to a value of (1), the mobile access gateway SHOULD include this sub-option in the Proxy Binding Update messages that it sends to the local mobility anchor, otherwise it SHOULD NOT include the sub-option.

Similarly, when this flag on the local mobility anchor is set to a value of (1), the local mobility anchor SHOULD enable support for this sub-option, otherwise it SHOULD ignore this sub-option.

7. Security Considerations

The Access Network Information option defined in this specification is for use in Proxy Binding Update and Proxy Binding Acknowledgement messages. This option is carried like any other mobility header option as specified in [RFC6275] and does not require any special security considerations.

The Geo-location sub-option carried in the Access Network Information option exposes the geo-location of the mobile node as presented by the mobile access gateway and this information should be considered as very sensitive. Care must be taken to secure the Proxy Mobile IPv6 signaling messages when carrying this sub-option. The base Proxy Mobile IPv6 specification [RFC6275] specifies the use of IPsec for securing the signaling messages and those mechanisms can be enabled for protecting this information.

8. Acknowledgements

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