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# IPv4 Traffic Offload Selector Option for Proxy Mobile IPv6
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Abstract

This specification defines a mechanism and a related mobility option for carrying IPv4 Offload traffic selectors between a mobile access gateway and a local mobility anchor in a Proxy Mobile IPv6 domain. Based on the received offload flow selectors from the local mobility anchor, a mobile access gateway can enable offload traffic rule on the selected IPv4 flows.

Status of this Memo

This Internet-Draft is submitted in full conformance with the provisions of BCP 78 and BCP 79.

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This Internet-Draft will expire on March 16, 2013.

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## 1. Introduction

Mobile Operators are expanding their network coverage by integrating various access technology domains (Ex: Wireless LAN, LTE) into a common IP mobile core. For providing IP mobility support to a mobile node irrespective of the access network to which it is attached. For example, the 3GPP S2a Proxy Mobile IPv6 [TS23402] reference point, specified by the 3GPP system architecture, is providing the needed protocol inter-working. When this protocol interface based on Proxy Mobile IPv6 [RFC5213] is used, the mobile node is topologically anchored at the local mobility anchor [RFC5213] in the home network. The mobile node's IPv4 traffic is always tunneled back from the mobile access gateway [RFC5213] in the access network to the local mobility anchor in the home network. This may not be the case with IPv6 traffic, as the mobile node can be assigned an IPv6 prefix from the access network in addition to the IPv6 prefix from the home network and thereby allowing the mobile node to use an IPv6 address from the access network for traffic that needs to be offloaded in the access network.

However, with the exponential growth in the mobile data traffic, mobile operators are exploring new ways to offload some of the IP traffic flows at the nearest access edge where ever there is an internet peering point, as supposed to carrying it all the way to the mobility anchor in the home network. Not all IP traffic need to be routed back to the home network, some of the non-essential traffic which does not require IP mobility support can be offloaded at the mobile access gateway in the access network. This approach allows efficient usage of the mobile packet core which helps in lowering transport costs. The local mobility anchor in the home network can potentially deliver the IP flow selectors to the mobile access gateway in the access network, for identifying the IP flows that need to be offloaded. Example of such non-essential traffic is entirely a policy decision. A given operator may choose to offload all traffic except that requires QoS services (Ex: Voice over IP traffic), or may choose to offload all HTTP traffic. From the point of view of this specification, its only about traffic matching a given flow selector and classification for offload. This approach has one limitation with respect to identifying encrypted traffic. IPsec encrypted traffic with no visibility into the application payload cannot be selected for offload.

This document defines a new mobility option, IP Traffic Offload Selector option for Proxy Mobile IPv6 (PMIPv6). This option can be used by the local mobility anchor to notify the mobile access gateway with the flow selectors that can used for selecting the flows for offloading them at the access edge. Since, the mobile node's IP address topologically belongs to the home network, the offloaded IP

traffic flows need to be NAT [RFC2663] translated. These offloaded flows will not have mobility support as the NAT becomes the anchor point for those flows. Given this NAT translation requirement for the offloaded traffic, this approach will be limited to mobile node's IPv4 flows. There are better ways to solve this problem for IPv6 and with the goal not to create NAT66 requirement, this specification does not support traffic offload support for IPv6 flows. This document also does not define any new semantics for flow selectors. The flow identification and the related semantics are all leveraged from [RFC6088].

## 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 base Proxy Mobile IPv6 specifications [RFC5213] and [RFC5844]. Additionally, this document uses the following abbreviations:

IP Flow

IP Flow represents a set of IP packets that match a traffic selector. The selector is typically based on the source IP address, destination IP address, source port, destination port and other fields in upper layer headers.

IP Traffic Offload

The approach of selecting specific IP flows and routing them through the access network, instead of tunneling them to the home network. Offload can also be between two access networks (Example: moving some of the traffic from LTE access to WLAN access).

NAT (Network Address Translation)

Network Address Translation [RFC2663] is a method by which IP addresses are mapped from one address realm to another, providing transparent routing to end hosts.

## 3. Solution Overview

The following illustrates the scenario where the mobile access gateway in an access network has the ability to offload some of the IPv4 traffic flows, based on the traffic selectors it received from the local mobility anchor in the home network. For example, all the HTTP flows may be offloaded at the mobile access gateway and all the other flows for that mobility session are tunneled back to the local mobility anchor. The offloaded flows have to be NAT translated and this specification does not impose any restrictions on the location of the NAT function. It is possible, the NAT function is collocated with the mobile access gateway, or its located some where in the edge of the access network. When the NAT is not collocated on the mobile access gateway, the NAT function should have the ability to identify the offloaded IP traffic for NAT policy enforcement. This could be achieved by configuring a specific VLAN between the mobile access gateway and the NAT device and ensuring all the traffic on that VLAN is NAT translated. This can also be achieved through other means and the details are outside the scope of this document.

The selectors that are delivered to the mobile access gateway can be used to classify the traffic, so it can be offloaded to the access network. The parameters in the IP traffic selectors can be used to match against the header fields in the data packets. These parameters include Source IP address, Destination IP address, TCP/UDP Port numbers, and other fields.

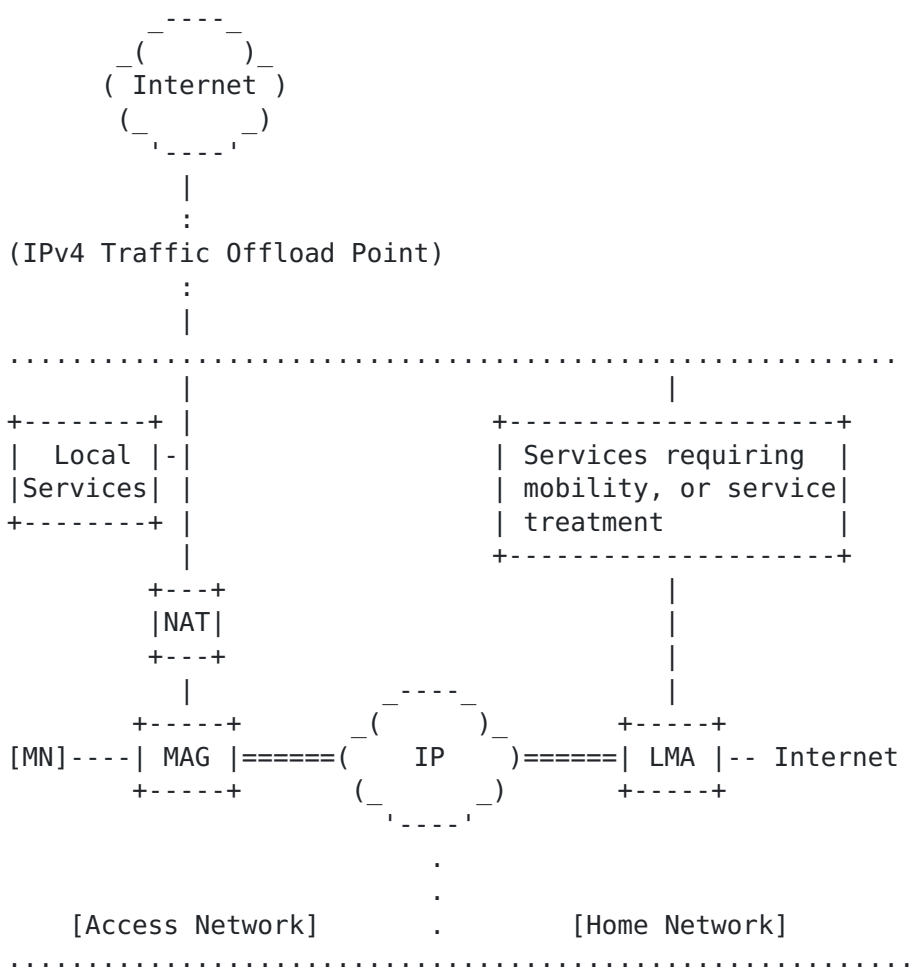


Figure 1: IP Traffic Offload Support at the MAG

Figure 2 explains the operational sequence of the Proxy Mobile IPv6 protocol signaling message exchange between the mobile access gateway and the local mobility anchor for negotiating the IP Traffic Offload selectors. The details related to DHCP transactions, or Router Advertisements on the access link are not shown here as that is not the key focus of this specification.

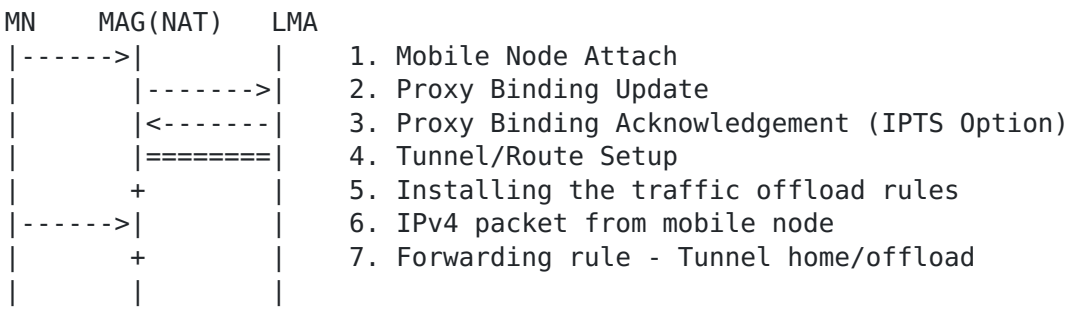


Figure 2: Exchange of IP Traffic Offload Selectors

## 3.1. LMA Considerations

The following considerations apply to the local mobility anchor.

- If the received Proxy Binding Update includes the IP Traffic Offload Selector option (Section 4), but if the configuration variable, EnableIPTrafficOffloadSupport (Section 6) on the local mobility anchor is set to a value of (0), then the local mobility anchor MUST ignore the IP Traffic Offload Selector option and process the rest of the packet as per [RFC5213]. This would have no effect on the operation of the rest of the protocol.

- If the received Proxy Binding Update includes the IP Traffic Offload Selector option (Section 4), and if the configuration variable, EnableIPTrafficOffloadSupport (Section 6) on the local mobility anchor is set to a value of (1), then the local mobility anchor can acquire the offload policy from a network function (Ex: AAA or PCRF) and can construct the traffic selectors based on the offload policy and deliver those selectors in the Proxy Binding Acknowledgement message using the IP Traffic Offload Selector option. The specific details on how the offload policy for a mobile node is provisioned on the local mobility anchor is out of the scope for this document. However, if the received Proxy Binding Update included a proposed Offload traffic selectors, the local mobility anchor MAY choose to honor that request and include the proposed selectors in the reply.

- If the received Proxy Binding Update does not include the IP Traffic Offload Selector option (Section 4), and if the configuration variable, EnableIPTrafficOffloadSupport (Section 6) on the local mobility anchor is set to a value of (1), then the local mobility anchor SHOULD NOT include the IP Traffic Offload Selector option in the Proxy Binding Acknowledgement.

### 3.2. MAG Considerations

- If the configuration variable, EnableIPTrafficOffloadSupport on the mobile access gateway is set to a value of (0), then the mobile access gateway MUST NOT include the IP Traffic Offload Selector option (Section 4) in the Proxy Binding Update message that it sends to the local mobility anchor. Otherwise, the option MUST be included in the Proxy Binding Update message. When this option is included, it is an indication to the local mobility anchor that the mobile access gateway is capable of supporting IP Traffic Offload support. The TS format field of the IP Traffic Offload Selector option MUST be set to a value of (255), indicating that the mobile access gateway is not proposing any specific offload policy for that mobility session, but a request to the local mobility anchor to provide the IP traffic offload flow selectors for that mobility session.

- The mobile access gateway MAY choose to include its proposed IP traffic offload flow selectors in the IP Traffic Offload Selector option (Section 4). Including this offload traffic selectors serves as a proposal to the local mobility anchor, which the local mobility anchor can override with its own offload policy, or agree to the proposed policy. When including the offload traffic selectors, the TS format field of the IP Traffic Offload Selector option MUST be set to the respective flow specification type.

- If there is no IP Traffic Offload Selector option in the corresponding Proxy Binding Acknowledgement message, that the mobile access gateway receives in response to a Proxy Binding Update, it serves as an indication that the local mobility anchor does not support IP Traffic Offload support for that mobility session, and it implies the local mobility anchor cannot deliver IP flow selectors for that mobility session. The mobile access gateway upon accepting the Proxy Binding Acknowledgement message MUST NOT enable any offload policy for that mobility session. All the mobile node's IP flows MUST be tunneled back to the local mobility anchor.

- If there is an IP Traffic Offload Selector option in the corresponding Proxy Binding Acknowledgement message, it is an indication that the local mobility anchor has provided the IP traffic Offload selectors for that mobility session [RFC5213] and the identified IP flows have to be offloaded. Considerations related to (M) flag MUST be applied. The mobile access gateway SHOULD enable traffic offload for those identified flows. The delivered offload selectors rules MUST be applied only for the flows associated to that mobility session.

- If the mobile access gateway is not capable, or enabled to support IP Traffic Offload support, but if the received Proxy Binding Acknowledgement message has the IP Traffic Offload Selector option, the mobile access gateway SHOULD ignore the option and process the rest of the packet as per [RFC5213].

## 4. IP Traffic Offload Selector Option

A new mobility option, IP Traffic Offload Selector option, is defined for using it in Proxy Binding Update (PBU) and Proxy Binding Acknowledgement (PBA) messages exchanged between a mobile access gateway and a local mobility anchor. This option is used for carrying the flow selectors for enabling IP traffic offload function at the mobile access gateway.

The alignment requirement for this option is 4n.

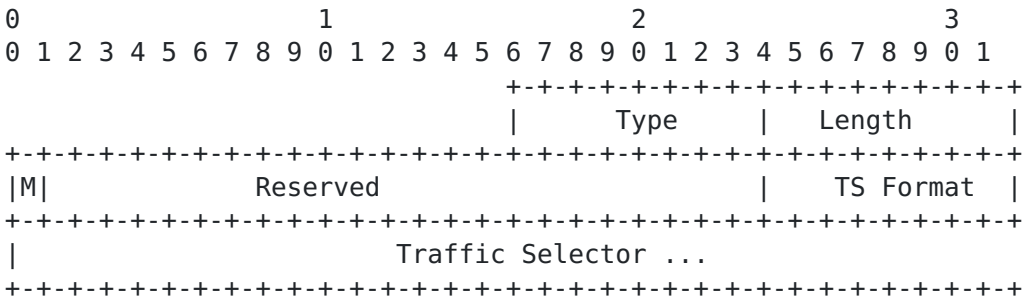


Figure 3: IP Traffic Offload Selector Option

Type
<IANA-1>

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

Reserved
This field is unused for now. The value MUST be initialized to 0 by the sender and MUST be ignored by the receiver.

IP Traffic Offload Mode Flag
This field indicates the offload mode. If the (M) flag value is set to a value of (1), it is an indication that all the IP flows associated to that mobility session except the identified IP flow(s) in this mobility option SHOULD be offloaded at the mobile

access gateway. If the (M) flag value is set to a value of (0), it is an indication that the identified IP flow(s) in this mobility option SHOULD be offloaded at the mobile access gateway and all other IP flows associated with that mobility session need to be tunneled to the local mobility anchor.

TS Format
An 8-bit unsigned integer indicating the Traffic Selector Format. The values for this field are maintained by the "Traffic Selector Format" namespace defined in [RFC6089]. The value of "255" is reserved and is used when there are no selectors to carry. In this case, the option is used only as a capability indicator. When the value of TS Format field is set to (1), the format that follows is the IPv4 Binary Traffic Selector specified in section 3.1 of [RFC6088].

TS Selector
A variable-length opaque field for including the traffic specification identified by the TS format field.

## 5. IANA Considerations

This document requires the following two IANA actions.

- Action-1: This specification defines a new Mobility Header option, IP Traffic Offload Selector option. This option is described in Section 4. The Type value for this option needs to be assigned from the same numbering space as allocated for the other mobility options [RFC6275].

- Action-2: The Sub-type field of the IP Traffic Offload Selector option described in Section 4 uses the number space from "Traffic Selector Format" namespace specified in [RFC6089]. This specification reserves the value (255) (NULL Selector) from that number space.

## 6. Protocol Configuration Variables

This specification defines the following configuration variable that control the use of IP Traffic Offload support for a mobility session. 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.

EnableIPTrafficOffloadSupport

This flag indicates whether or not IP Traffic Offload support needs to 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 IP Traffic offload support is disabled.

When this flag on the mobile access gateway is set to a value of (1), the mobile access gateway MUST enable the IP Traffic offload support for a mobility session, specifically it MUST include the IP Traffic Offload Selector option in the Proxy Binding Update messages and offload the negotiated IP flows to the access network. If the value of the flag is set to a value of (0), mobile access gateway MUST NOT enable IP Traffic Offload support and it MUST NOT include this option in the Proxy Binding Update.

Similarly, when this flag on the local mobility anchor is set to a value of (1), the local mobility anchor SHOULD enable support for IP Traffic offload support. When the local mobility anchor chooses to enable IP Traffic offload support and if there is offload flow policy specified for a mobility node, it SHOULD deliver the offload selectors to the mobile access gateway by including the IP Traffic Offload Selector option in the Proxy Binding Acknowledgement message.

## 7. Security Considerations

The IP Traffic Offload Selector 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 [RFC5213] and does not require any special security considerations. Carrying IP traffic offload selectors does not introduce any new security vulnerabilities.

When IPv4 traffic offload support is enabled for a mobile node, the mobile access gateway selectively offloads some of the mobile node's traffic flows to the access network. Typically, these offloaded flows get NAT translated and essentially that introduces certain vulnerabilities which are common to any NAT deployment. These vulnerabilities and the related considerations have been well documented in the NAT specification [RFC2663]. There are no additional considerations above and beyond what is already documented by the NAT specifications and which are unique to the approach specified in this document.

## 8. Acknowledgements

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