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Interoperability of 6LoWPAN
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Status of this Memo

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Abstract

This document specifies the gateway architecture for the

interoperability between 6LoWPAN and external IPv6 networks. The gateway does the compression and decompression of IPv6 packets and performs the mapping between 16 bit short addresses and the IPv6 addresses for both the external IPv6 networks and 6LowPAN, respectively.

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1. Introduction

6LoWPAN is an IPv6 based low-power wireless personal area network which is comprised of devices that conform to the IEEE 802.15.4-2003 standard[ieee802.15.4]. As described in [I-D.kushalnagar-lowpan-goals-assumptions], there are several issues to be solved for enabling IP communication between 6LoWPAN devices. The limited packet size of 6LoWPANs is one of them; The PDU size of IEEE 802.15.4 is 127 octets while the MTU size of IPv6 packets is 1280 octets. [I-D.montenegro-lowpan-ipv6-over-802.15.4] introduces the adaption layer of fragmentation and reassembly for IPv6 packets, while providing a header compression scheme for reducing the size of the IPv6 header.

The issue proposed in this document is about the interoperability between the external IPv6 networks and 6LoWPAN. As shown in [I-D.kushalnagar-lowpan-goals-assumptions], it is obvious that the interoperability is one of the very basic requirements of providing IP connectivity to 6LoWPAN. This document specifies the gateway architecture for the interoperability. The gateway does the compression and decompression of IPv6 packets and performs the mapping between 16 bit short addresses and the IPv6 addresses for both the external IPv6 networks and 6LowPAN, respectively.

[I-D.montenegro-lowpan-ipv6-over-802.15.4] didn't define transmission between external IPv6 networks and 6LoWPAN. For external IPv6 packets, it cannot compress the address of the packets. So, the mapping between 16-bit short addresses and the IPv6 addresses is necessary in order to communicate with external IPv6 networks. Notice that the mapping is not about 64-bit extend addresses but 16-bit short addresses. The reason is why using 16-bit short addresses is more efficient for the transmission than 64-bit extend addresses. So, this document describes the mapping 16-bit short addresses from the addresses for 6LoWPAN as well as the mapping for external IPv6 networks.

This document is based on [I-D.montenegro-lowpan-ipv6-over-802.15.4] for the adaptation layer of fragmentation and reassembly, the stateless address auto-configuration based on EUI-64[EUI64], the IPv6 link local address, the unicast address mapping, and the encoding of UDP header fields.

2. Terminology

ET:
Expiration Time
IID:
Interface IDentifier
MAC:
Media Access Control
MTU:
Maximum Transmission Unit
PAN:
Personal Area Network
PDU:
Protocol Data Unit

2.1 Requirements notation

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].

3. Gateway Architecture for Interoperability

This section defines the gateway architecture for the interoperability between IPv6 networks and 6LoWPAN. The gateway SHOULD do the fragmentation and reassembly at the sub-IP layer for external IPv6 packets to/from 6LoWPAN. The main function of the fragmentation and reassembly is the same as in [I-D.montenegro-lowpan-ipv6-over-802.15.4] except that the traffic is come from/to the external IPv6 networks.

The gateway SHOULD do the compression and decompression of IPv6 packets in between IPv6 networks and 6LoWPAN. The compression implies the dettaching the 64-bit address prefix from the destination address of an IPv6 packet coming from external IPv6 networks in order to obtain the EUI-64 identifier for the IEEE 802.15.4 destination. The decompression is the exact opposite operation to the compression.

The gateway MAY further compress IPv6 packets by introducing or mapping (16-bit) short addresses for both the external IPv6 networks and 6LoWPAN. The gateway MAY maintain mapping table(s) for this translation. The mapping SHOULD be applied to both the IPv6 addresses of external IPv6 networks and 6LoWPAN, while the mapping table entries for them are different from each other. Notice that for 6LoWPAN devices, the mapping of a 16-bit short address is done for the EUI-64 identifier which is obtained by the above mentioned compression, not the 128-bit IPv6 address. In this document, we defines two mapping table types for external IPv6 networks and 6LoWPAN which will be described in Section 3.1.

For communicating with external IPv6 networks, there are two possible traffic: inbound traffic from an external IPv6 network to an internal 6LoWPAN and outbound traffic from an internal 6LoWPAN to an external IPv6 network.

Inbound traffic

For the destination address of an inbound IPv6 packet, the gateway maps the IID of the destination to the corresponding (16-bit) short address using the internal device address mapping table. In a compressed packet, the short address is put into the 'Address of final destination' field of the final destination field and the 'S' field is set 1 in sub-IP. The assignment of the 16-bit short address for an IID depends on the assignment strategy which is out of scope of this document. For the source address, the gateway assigns and maps an external 16-bit short address in the external device address mapping table. The assignment strategy for an external short address is TBD. The external short address will be deleted after the expiration time which will be described in Section 3.1.2.

Note: [I-D.montenegro-lowpan-ipv6-over-802.15.4] did not describe about the source address of the originator though do about the

final destination field. The context for the source address is valid if and only if it defines the source address of the originator in sub-IP.

Outbound traffic

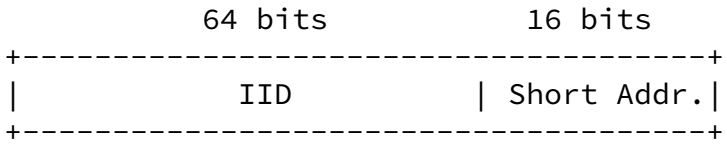
The outbound traffic can be classified by the following two categories. First category is the reply traffic for the above mentioned inbound traffic. In this case, a 6LoWPAN device can use 16-bit short addresses for both destination and source addresses. Notice that there is an assigned external short address in the external device address mapping table prior to the reply traffic and the definition for the source addressof the originator in sub-IP. The outbound traffic should arrive at the gateway before the expiration time of the external short address. The operation for the outbound traffic after the expiration is TBD. Second category is the originating outbound traffic. Because there is no mapped external short address for the destination of external IPv6 networks, there can be no compression for the destination in this case.

3.1 Mapping Tables

The gateway MAY have the internal and external device address mapping tables.

3.1.1 Internal Device Address Mapping Table

This table consists of 64-bit interface identifier (IID) and 16-bit short address. This table MUST contain the mapping information of all the devices in 6LoWPAN. The maximum size of the mapping table is 2^16 entries. The case of multiple gateways (i.e. multiple mapping tables) is dealt in Section 3.3.



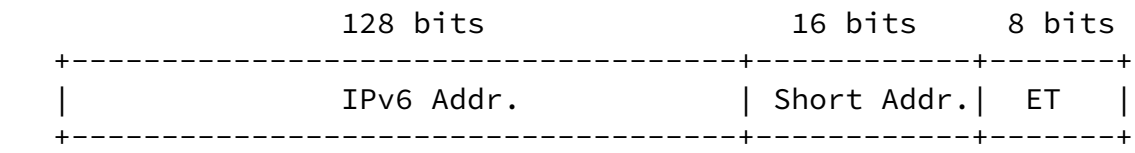
<Fig. 1. Internal Device Address Mapping Table>

Interface Identifier: The 64 bit IID assigned to each 6LoWPAN device.

Short Address: The 16 bit short address assigned to each 6LoWPAN device.

3.1.2 External Device Address Mapping Table

This table consists of 128-bit IPv6 address, 16-bit short address and ET(Expiration Time).



<Fig. 2. External Device Address Mapping Table>

IPv6 Address: The IPv6 address of the external device.

Short Address: The 16 bit short address for the external IPv6 address.

ET: The expiration time field.

3.2 Registration

The gateway maintains the internal device mapping table for the mapping of 16 bit short address for all devices in the 6LoWPAN. In order to setup the table, there should be a registration procedure which is TBD.

3.3 Multiple Gateways

In this document, we assume that there is one gateway for a 6LoWPAN, even though the number of gateways is not restricted. The more communication with external IPv6 networks, the more overheads the gateway undergo. One of the methods reducing the overheads is distributing the burden over multiple gateways. We will cover such issues as distributed mapping of 16-bit short addresses by multiple gateways and (on-demand or hierarchical) routing and tunneling between gateways, in future revision.

4. Header Compression

The method of the header compression follows [I-D.montenegro-lowpan-ipv6-over-802.15.4]. The size of the address in the 'M' field is reduced because the gateway maps 64-bit link-layer addresses to 16-bit short addresses.

5. IANA Considerations

There is at the time of this publication no IANA consideration.

6. Security Considerations

TBD

7. Acknowledgements

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8. References

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