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Internet-Draft Universitaet Bremen TZI
Intended status: Standards Track July 2, 2008
Expires: January 3, 2009

Extension headers for 6lowpan
draft-bormann-6lowpan-ext-hdr-00.txt

Status of this Memo

Abstract

6lowpan applications sometimes need to include application-specific information in layer 2 packets that are intended to be processed as 6lowpan packets. This document specifies a way to include this information in a 6lowpan packet in such a way that it can be ignored by implementations that don't care for it.

$Id: draft-bormann-6lowpan-ext-hdr.xml,v 1.5 2008/07/02 06:23:58 cabo Exp $

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1. Introduction

The 6lowpan format specification [RFC4944] defines a format for transporting IPv6 packets over IEEE 802.15.4 networks. 6lowpan applications sometimes need to include application-specific information in these layer 2 packets, even though they are ultimately intended to be processed as 6lowpan packets. This document specifies a way to include this information in a 6lowpan packet in such a way that it can be ignored by implementations that don't care for it.

One motivation for this document is the emerging ISA100.11a specification [ISA-100-11a], which uses the 6lowpan mechanism to identify a layer 2 frame as "NALP" (Not a Lowpan frame) as it needs to transport non-6lowpan information at the start of the packet and is thus not compatible with the basic 6lowpan frame format. The choice of NALP will make it impossible for standard-conforming 6lowpan implementations to interpret any ISA100.11a packets, even if the ISA100.11a specific information in those headers is of no concern to the device processing the packet.

The present specification defines an extension header in the spirit of RTP's extension header, which "is designed so that the header extension may be ignored by other interoperating implementations that have not been extended" [RFC3550]. The requirements for such an extension header in 6lowpan are modest, as the overall frame size of the IEEE 802.15.4 frame is rather limited: It is simply not very useful to define an elaborate option structure such as that provided by IPv6 hop-by-hop options [RFC2460]. Similar to RFC 3550, the present specification therefore limits itself to defining as much of the format as is needed by non-interested implementations to skip the extension header. 6lowpan applications are expected to define how extension headers used in the application, if any, are interpreted.

Another consequence of the limited frame size of IEEE 802.15.4 is the limited size that is expected to be useful for extension headers. The present specification supports extension headers with any number between 1 to 16 bytes of payload. However, due to the way 6lowpan headers are structured, multiple extension headers can be present in one IEEE 802.15.4 frame. If an application should need more than 16 bytes of extension header space in a single IEEE 802.15.4 frame, it needs to divide the information into multiple extension headers.

2. Extension Header

This section motivates and then defines the detailed structure of the extension header.

Given the requirements set out above, we opt for a simple format for the extension header: the initial byte both indicates the presence of the extension header and the length of its payload, and the rest of the header are the payload bytes. As we need to support 1 to 16 bytes of payload (and assuming that all 16 numbers need to be supported), four bits of the initial byte are used for supplying the payload length.

The remaining question is what space those 16 initial byte values should be taken from. The NALP space is reserved for non-6lowpan frames. The dispatch byte space is theoretically available, but quite limited; taking out 16 of the 64 values would be a significant reduction of that space. Therefore, the present specification opts for allocating 16 values out of the unused values in the fragment header space, i.e., the values 1101nnnn (where nnnn is the binary length of the payload in bytes minus 1). The resulting structure of the extension header is:

```
  0   1   2   3   4   5   6   7
+---+---+---+---+---+---+---+---+
| 1   1   0   1 | n   n   n   n |  initial byte
+---+---+---+---+---+---+---+---+
:                               :
/    1-16 octets of payload     /  nnnn + 1 bytes
:                               :
+---+---+---+---+---+---+---+---+
```

The extension header is followed by a valid 6lowpan packet, which may again start with an extension header to accommodate more than 16 bytes of extension payload. Where multiple extension headers are used in one packet, the application is free to assign semantics to the payload lengths actually used, i.e., an extension header with 10 bytes and one with 12 bytes may be interpreted by the application in a different way than an extension header with 12 bytes (containing the 10 bytes of the first extension header in the previous form plus the first two bytes of the second extension header in the previous form) and an extension header with 10 bytes (containing the last 10 bytes of the second extension header in the previous form) would be. This can be used to imply length information that may otherwise require length fields in the payload.

3. Security considerations

The security considerations of [RFC4944] apply.

Application developers making use of this specification must keep in mind that security mechanisms that operate on layer 3 and above will not protect the layer 2 headers including the extension header.

4. IANA Considerations

The "6lowpan-parameters" registry needs to be updated by replacing

```
11 001000 through 11 011111
             reserved for future use
```

with

```
11 001000 through 11 001111
             reserved for future use
11 01xxxx    EXT -- Extension Header [RFCthis]
```

5. Acknowledgements

This document was prompted by Geoff Mulligan's observations on the ISA100.11a work.

6. References

6.1. Normative References

[RFC4944] Montenegro, G., Kushalnagar, N., Hui, J., and D. Culler, "Transmission of IPv6 Packets over IEEE 802.15.4 Networks", RFC 4944, September 2007.

6.2. Informative References

[ISA-100-11a]
ISA, "ISA100.11a Draft standard", May 2008.

[RFC2460] Deering, S. and R. Hinden, "Internet Protocol, Version 6 (IPv6) Specification", RFC 2460, December 1998.

[RFC3550] Schulzrinne, H., Casner, S., Frederick, R., and V. Jacobson, "RTP: A Transport Protocol for Real-Time Applications", STD 64, RFC 3550, July 2003.

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