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PIM reserved bits and type space extension
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Abstract

The currently defined PIM version 2 messages share a common message header format. The common header definition contains eight reserved bits. This document specifies how these bits may be used by individual message types, and creates a registry containing the per message type usage. This document also extends the PIM type space by defining a new message type where four of the flag bits are used as an extended type range.

This document Updates [RFC7761](#) and [RFC3973](#) by defining the use of the currently Reserved field in the PIM common header. This document further updates [RFC7761](#) and [RFC3973](#), along with [RFC5015](#), [RFC6754](#) and I-D.ietf-pim-source-discovery-bsr, by specifying the use of the currently Reserved bits for each PIM message.

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[1.](#) Introduction

The currently defined PIM version 2 messages share a common message header format defined in the PIM Sparse Mode [[RFC7761](#)] and Dense Mode [[RFC3973](#)] specifications. The common header definition contains eight reserved bits. The message types defined in these documents all use this common header. However, several messages already make use of one or more bits, including the Bootstrap [[RFC5059](#)], DF-Election [[RFC5015](#)], and PIM Flooding Mechanism (PFM) [[I-D.ietf-pim-source-discovery-bsr](#)] messages. There is no document formally specifying that these bits are to be used per message type.

This document refers to the bits specified as Reserved in the common PIM header [[RFC7761](#)] [[RFC3973](#)] as PIM message type flag bits, or simply flag bits, and it specifies that they are to be separately

The PIM message types as defined in the PIM Sparse Mode [RFC7761] and Dense Mode [RFC3973] specifications are in the range from 0 to 15. That type space is almost exhausted. Message type 15 was reserved by [RFC6166] for type space extension. In Section 5, this document specifies the use of the flag bits for Type 15 in order to extend the PIM type space. The registration procedure for the extended type space is the same as for the existing type space, and the existing PIM message type registry is updated to include the extended type space.

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "NOT RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in [BCP 14](#) [[RFC2119](#)] [[RFC8174](#)] when, and only when, they appear in all capitals, as shown here.

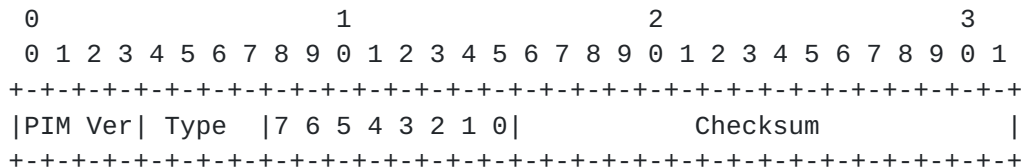
The common PIM header is defined in [section 4.9 of \[RFC7761\]](#) and [section 4.7.1 of \[RFC3973\]](#). This document updates the definition of the Reserved field and refers to that field as PIM message type flag bits, or simply flag bits. The new common header format is as below.

The Flags Bits field is defined in [Section 4](#). All other fields remain unchanged.

Unless otherwise specified, all the flag bits for each PIM type are Reserved [RFC8126]. They MUST be set to zero on transmission, and they MUST be ignored upon receipt. The specification of a new PIM type, MUST indicate whether the bits should be treated differently. Currently for the message types 0 (Hello), 1 (Register), 2 (Register Stop), 3 (Join/Prune), 5 (Assert), 6 (Graft), 7 (Graft-Ack), 8

(Candidate RP Advertisement), 9 (State Refresh) and 11 (ECMP Redirect), all flag bits are Reserved.

When defining flag bits it is helpful to have a well defined way of referring to a particular bit. The most significant of the flag bits, the bit immediately following the type field is referred to as bit 7. The least significant, the bit right in front of the checksum field is referred to as bit 0. This is shown in the diagram below.



4.1. Flag Bits for Type 4 (Bootstrap)

PIM message type 4 (Bootstrap) [[RFC5059](#)] defines flag bit 7 as No-Forward. The usage of the bit is defined in that document. The remaining flag bits are Reserved.

4.2. Flag Bits for Type 10 (DF Election)

PIM message type 10 (DF Election) [[RFC5015](#)] specifies that the four most significant flag bits (bits 4-7) are to be used as a sub-type. The remaining flag bits are currently Reserved.

4.3. Flag Bits for Type 12 (PFM)

PIM message type 12 (PFM) [[I-D.ietf-pim-source-discovery-bsr](#)] defines flag bit 7 as No-Forward. The usage of the bit is defined in that document. The remaining flag bits are Reserved.

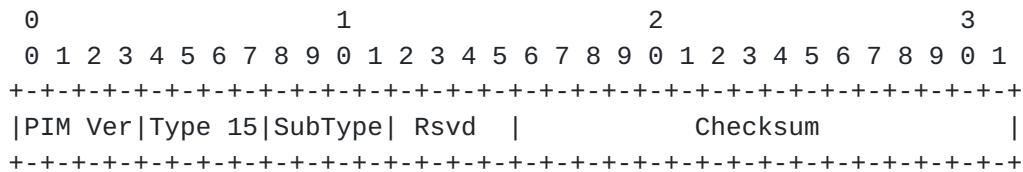
4.4. Flag Bits for Type 15 (Type Space Extension)

This type and the flag bit usage is defined in [Section 5](#).

5. PIM Type Space Extension

The type space defined by the existing PIM specifications is almost exhausted. This document defines type 15 (Type Space Extension) allowing for 16 additional types by using the four most significant flag bits (bits 4-7) as a new field to store the extended type. These types are referred to as types 15.0 to 15.15 where the last number denotes the value stored in the new field. The remaining four flag bits (bits 0-3) are Reserved to be used by each extended type. The specification of a new PIM extended type MUST indicate whether the bits should be treated differently. The common header for types

15.0 to 15.15 is shown in the diagram below. The extended type field "Rsvd" denotes the value after the dot.



6. Security Considerations

This document clarifies the use of the flag bits in the common PIM header and it extends the PIM type space. As such, there is no impact on security or changes to the considerations in [RFC7761] and [RFC3973].

7. IANA considerations

This document updates the PIM Message Types registry and also creates a PIM Message Type Flag Bits registry that shows which flag bits are defined for use by each of the PIM message types.

The following changes should be made to the existing PIM Message Types registry. For types 4 (Bootstrap) and 8 (Candidate RP Advertisement) a reference to [RFC5059](#) should be added. For type 15 (Reserved), the name should be changed to "Type Space Extension", and reference this document. In addition, there should be one new row at the bottom where it should say "15.0-15.15 Unassigned".

A new registry called "PIM Message Type Flag Bits" should be created in the pim-parameters section with registration procedure "IETF Review" as defined in [RFC8126] with this document as a reference. The initial content of the registry should be as below.

Type	bit(s)	Name	Reference
0	0-7	Reserved	[RFC3973] [RFC7761]
1	0-7	Reserved	[RFC3973] [RFC7761]
2	0-7	Reserved	[RFC3973] [RFC7761]
3	0-7	Reserved	[RFC3973] [RFC7761]
4	0-6	Reserved	[RFC3973] [RFC7761]
4	7	No-Forward	[RFC5059]
5	0-7	Reserved	[RFC3973] [RFC7761]
6	0-7	Reserved	[RFC3973] [RFC7761]
7	0-7	Reserved	[RFC3973] [RFC7761]
8	0-7	Reserved	[RFC3973] [RFC7761]
9	0-7	Reserved	[RFC3973] [RFC7761]
10	0-3	Reserved	[RFC3973] [RFC7761]
10	4-7	Sub-type	[RFC5015]
11	0-7	Reserved	[RFC6754]
12	0-6	Reserved	[RFC3973] [RFC7761]
12	7	No-Forward	[draft-ietf-pim-source-discovery-bsr]
13	0-7	Reserved	[RFC3973] [RFC7761]
14	0-7	Reserved	[RFC3973] [RFC7761]
15	4-7	Extended type	[this document]
15.0-15.15	0-3	Reserved	[this document]

8. References

8.1. Normative References

- [I-D.ietf-pim-source-discovery-bsr]
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