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RFC 8736
PIM Message Type Space Extension and Reserved Bits

Abstract

The 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 three new message types. For each of the new types, four of the previously reserved bits are used to form an extended type range.

This document updates RFCs 7761 and 3973 by defining the use of the currently Reserved field in the PIM common header. This document further updates RFCs 7761 and 3973, along with RFCs 5015, 5059, 6754, and 8364, by specifying the use of the currently reserved bits for each PIM message.

This document obsoletes RFC 6166.

Status of This Memo

This is an Internet Standards Track document.

This document is a product of the Internet Engineering Task Force (IETF). It represents the consensus of the IETF community. It has received public review and has been approved for publication by the Internet Engineering Steering Group (IESG). Further information on Internet Standards is available in Section 2 of RFC 7841.

Information about the current status of this document, any errata, and how to provide feedback on it may be obtained at https://www.rfc-editor.org/info/rfc8736.

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1. Introduction

The PIM version 2 messages share a common message header format defined in the PIM Sparse Mode specification [RFC7761]. The common header definition contains eight reserved bits. While all message types use this common header, 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] as "PIM message type Flag Bits" or, simply, "Flag Bits", and it specifies that they are to be separately used on a per-message-type basis. It creates a registry containing the per-message-type usage.

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], [RFC5059], [RFC6754], and [RFC8364], by specifying the use of the currently reserved bits for each PIM message.

The currently defined PIM message types 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 message types 13, 14, and 15 in order to extend the PIM type space. This document obsoletes [RFC6166].

2. Conventions Used in This Document

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.

3. PIM Header Common Format

The common PIM header is defined in Section 4.9 of [RFC7761]. 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.

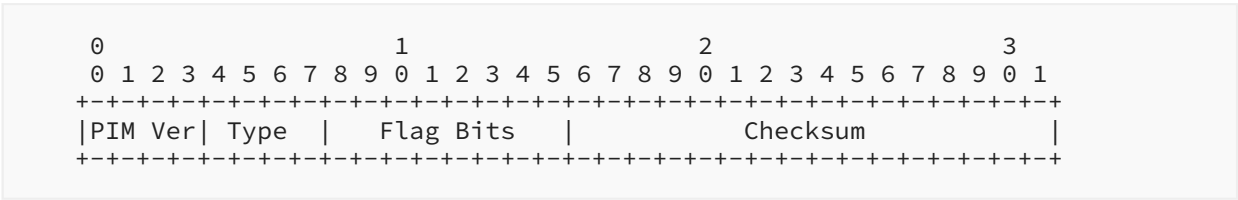

Figure 1: New Common Header

The Flag Bits field is defined in Section 4. All other fields remain unchanged.

4. Flag Bit Definitions

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.

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.

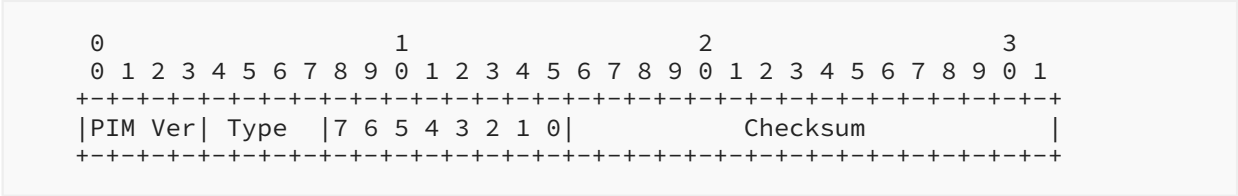

Figure 2: Flag Bits

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 subtype. The usage of those bits is defined in that document. The remaining flag bits are reserved.

4.3. Flag Bits for Type 12 (PFM)

PIM message type 12 (PIM Flooding Mechanism) [RFC8364] 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 Types 13, 14, and 15 (Type Space Extension)

These types and the corresponding flag bits are defined in Section 5.

5. PIM Type Space Extension

This document defines types 13, 14, and 15, such that each of these types has 16 subtypes, providing a total of 48 subtypes available for future PIM extensions. This is achieved by defining a new Subtype field (see Figure 3) using the four most significant flag bits (bits 4-7). The notation type.subtype is used to reference these new extended types. The remaining four flag bits (bits 0-3) are reserved to be used by each extended type (abbreviated as FB below).

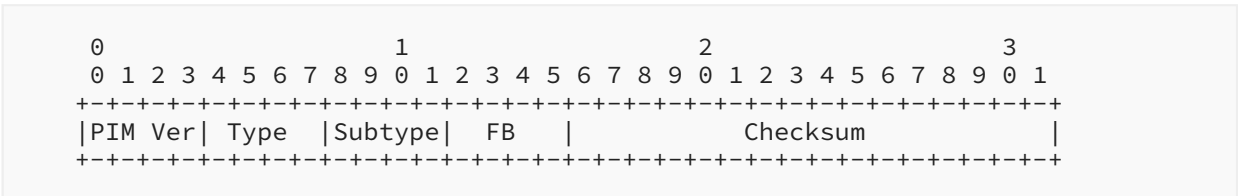

Figure 3: Subtypes

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 to indicate which flag bits are defined for use by each of the PIM message types. The registry now references this document. The registration policy remains IETF Review [RFC8126]. Assignments into this registry **MUST** define any non-default usage (see Section 4) of the flag bits in addition to the type.

The updated "PIM Message Types" registry is shown below.

Type	Name	Flag Bits	Reference
0	Hello	0-7: Reserved	[RFC3973][RFC7761]
1	Register	0-7: Reserved	[RFC7761]
2	Register Stop	0-7: Reserved	[RFC7761]
3	Join/Prune	0-7: Reserved	[RFC3973][RFC7761]
4	Bootstrap	0-6: Reserved	[RFC5059][RFC7761]
		7: No-Forward	[RFC5059]
5	Assert	0-7: Reserved	[RFC3973][RFC7761]
6	Graft	0-7: Reserved	[RFC3973]
7	Graft-Ack	0-7: Reserved	[RFC3973]
8	Candidate RP Advertisement	0-7: Reserved	[RFC7761]
9	State Refresh	0-7: Reserved	[RFC3973]
10	DF Election	0-3: Reserved	[RFC5015]
		4-7: Subtype	[RFC5015]
11	ECMP Redirect	0-7: Reserved	[RFC6754]
12	PIM Flooding Mechanism	0-6: Reserved	[RFC8364]

Type	Name	Flag Bits	Reference
		7: No-Forward	[RFC8364]
13.0-15.15	Unassigned	0-3: Unassigned	RFC 8736

Table 1: Updated PIM Message Types Registry

The unassigned types above, as explained in Section 5, use the extended type notation of type.subtype. Each extended type only has 4 flag bits available. New extended message types should be assigned consecutively, starting with 13.0, then 13.1, etc.

8. References

8.1. Normative References

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[RFC8126] Cotton, M., Leiba, B., and T. Narten, "Guidelines for Writing an IANA Considerations Section in RFCs", BCP 26, RFC 8126, DOI 10.17487/RFC8126, June 2017, <https://www.rfc-editor.org/info/rfc8126>.

[RFC8174] Leiba, B., "Ambiguity of Uppercase vs Lowercase in RFC 2119 Key Words", BCP 14, RFC 8174, DOI 10.17487/RFC8174, May 2017, <https://www.rfc-editor.org/info/rfc8174>.

8.2. Informative References

[RFC3973] Adams, A., Nicholas, J., and W. Siadak, "Protocol Independent Multicast - Dense Mode (PIM-DM): Protocol Specification (Revised)", RFC 3973, DOI 10.17487/RFC3973, January 2005, <https://www.rfc-editor.org/info/rfc3973>.

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[RFC5059] Bhaskar, N., Gall, A., Lingard, J., and S. Venaas, "Bootstrap Router (BSR) Mechanism for Protocol Independent Multicast (PIM)", RFC 5059, DOI 10.17487/RFC5059, January 2008, <https://www.rfc-editor.org/info/rfc5059>.

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