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Authors: S. Venaas A. Retana
Cisco Systems, Inc. Futurewei Technologies, Inc.

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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 extends the PIM type space.

This document updates RFCs 7761 and 3973 by defining the use of the 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 bits for each PIM message.

This document obsoletes RFC 8736.

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/rfc9436>.

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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 updates the definition of the Reserved field and refers to it as the "Flag Bits field". It specifies that the flag bits are to be separately used on a per-message-type basis. It updates the "PIM Message Types" registry to indicate the per-message-type usage.

This document updates [RFC7761] and [RFC3973] by defining the use of the 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 bits for each PIM message.

The originally defined PIM message types were in the range from 0 to 15. Message type 15 had been reserved by [RFC6166] for type space extension. In Section 5, this document specifies the use of the Flag Bits field for message types 13, 14, and 15 in order to extend the PIM type space. The type space extension in [RFC6166] was made obsolete by [RFC8736]. This document obsoletes [RFC8736].

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 it as the "Flag Bits field". The updated common header format is as below.

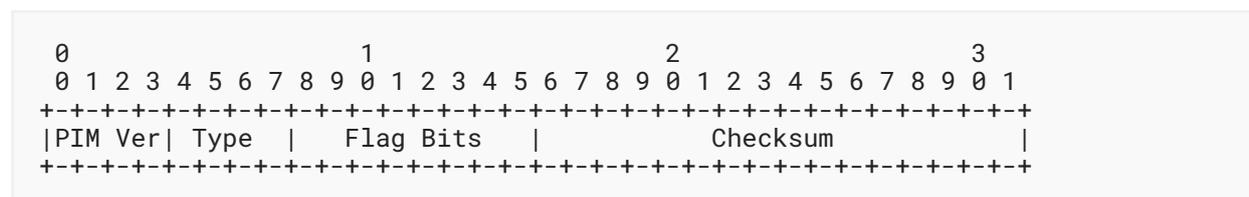


Figure 1: Updated Common Header

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 Unassigned [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.

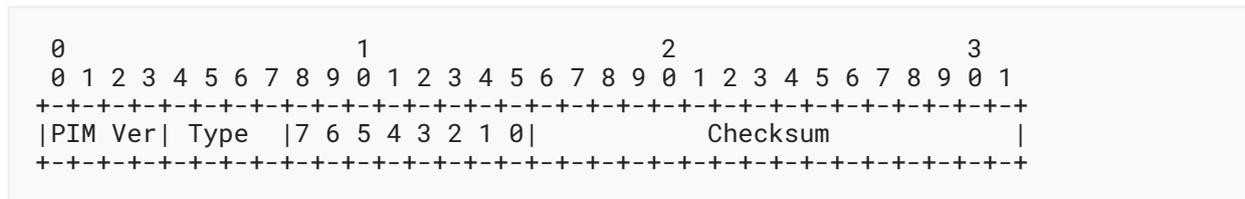


Figure 2: Flag Bits

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 unassigned.

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 unassigned.

4.3. Flag Bits for Type 12 (PIM Flooding Mechanism)

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 unassigned.

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 extends types 13, 14, and 15 such that each becomes 16 new types, resulting in 48 types available for future PIM extensions. This extension is achieved by defining a Subtype field (see [Figure 3](#)) using the four most significant flag bits (bits 4-7). The notation type.subtype is used to reference the new extended types. The remaining four flag bits (bits 0-3, abbreviated as FB below) are to be defined by each extended type.

Each of the extended types is represented by the eight bits resulting from the concatenation of the Type and Subtype fields. No relationship is expected or implied between extended type messages with a common Type field.

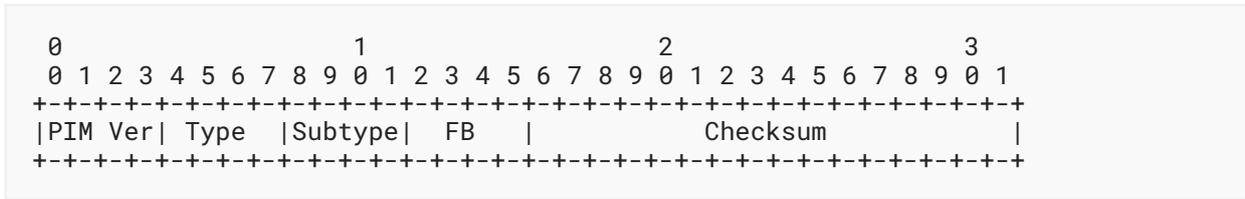


Figure 3: Subtypes

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 and changes their registration status to Unassigned except where the bits have already been specified, as shown in Table 1. The registration policy remains IETF Review [RFC8126]. Assignments to this registry **MUST** define any non-default usage (see Section 4) of the flag bits in addition to the type.

Extended type 15.15 is Reserved [RFC8126] for future extensions.

Because this document obsoletes [RFC8736], IANA has changed the references to [RFC8736] in the registry to point to this document instead.

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

Type	Name	Flag Bits	Reference
0	Hello	0-7: Unassigned	[RFC3973] [RFC7761]
1	Register	0-7: Unassigned	[RFC7761]
2	Register Stop	0-7: Unassigned	[RFC7761]
3	Join/Prune	0-7: Unassigned	[RFC3973] [RFC7761]
4	Bootstrap	0-6: Unassigned	[RFC5059] [RFC7761]
		7: No-Forward	[RFC5059]
5	Assert	0-7: Unassigned	[RFC3973] [RFC7761]
6	Graft	0-7: Unassigned	[RFC3973]

Type	Name	Flag Bits	Reference
7	Graft-Ack	0-7: Unassigned	[RFC3973]
8	Candidate RP Advertisement	0-7: Unassigned	[RFC7761]
9	State Refresh	0-7: Unassigned	[RFC3973]
10	DF Election	0-3: Unassigned	[RFC5015]
		4-7: Subtype	[RFC5015]
11	ECMP Redirect	0-7: Unassigned	[RFC6754]
12	PIM Flooding Mechanism	0-6: Unassigned	[RFC8364]
		7: No-Forward	[RFC8364]
13.0-15.14	Unassigned	0-3: Unassigned	
15.15	Reserved	0-3: Reserved	RFC 9436

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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- [RFC7761] Fenner, B., Handley, M., Holbrook, H., Kouvelas, I., Parekh, R., Zhang, Z., and L. Zheng, "Protocol Independent Multicast - Sparse Mode (PIM-SM): Protocol Specification (Revised)", STD 83, RFC 7761, DOI 10.17487/RFC7761, March 2016, <<https://www.rfc-editor.org/info/rfc7761>>.
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- [RFC6754] Cai, Y., Wei, L., Ou, H., Arya, V., and S. Jethwani, "Protocol Independent Multicast Equal-Cost Multipath (ECMP) Redirect", RFC 6754, DOI 10.17487/RFC6754, October 2012, <<https://www.rfc-editor.org/info/rfc6754>>.
- [RFC8364] Wijnands, IJ., Venaas, S., Brig, M., and A. Jonasson, "PIM Flooding Mechanism (PFM) and Source Discovery (SD)", RFC 8364, DOI 10.17487/RFC8364, March 2018, <<https://www.rfc-editor.org/info/rfc8364>>.
- [RFC8736] Venaas, S. and A. Retana, "PIM Message Type Space Extension and Reserved Bits", RFC 8736, DOI 10.17487/RFC8736, February 2020, <<https://www.rfc-editor.org/info/rfc8736>>.

Authors' Addresses

Stig Venaas

Cisco Systems, Inc.
Tasman Drive
San Jose, CA 95134
United States of America
Email: stig@cisco.com

Alvaro Retana

Futurewei Technologies, Inc.
2330 Central Expressway
Santa Clara, CA 95050
United States of America
Email: alvaro.retana@futurewei.com