RFC 9465
PIM Null-Register Packing

Abstract

In PIM Sparse Mode (PIM-SM) networks, PIM Null-Register messages are sent by the Designated Router (DR) to the Rendezvous Point (RP) to signal the presence of multicast sources in the network. There are periodic PIM Null-Registers sent from the DR to the RP to keep the state alive at the RP as long as the source is active. The PIM Null-Register message carries information about a single multicast source and group.

This document defines a standard to send information about multiple multicast sources and groups in a single PIM message. This document refers to the new messages as the "PIM Packed Null-Register message" and "PIM Packed Register-Stop message".

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/rfc9465.

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1. Introduction

The DR periodically sends PIM Null-Registers to keep the state of existing multicast sources active on the RP. As the number of multicast sources increases, the number of PIM Null-Register messages that are sent also increases. This results in more PIM packet processing at the RP and the DR.

This document specifies a method to efficiently pack the content of multiple PIM Null-Register and Register-Stop messages [RFC7761] into a single message.

The document also discusses interoperability between PIM routers that support PIM Packed Null-Registers and PIM Packed Register-Stops and PIM routers that do not.

1.1. 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.

1.2. Terminology

RP: Rendezvous Point

DR: Designated Router

MSDP: Multicast Source Discovery Protocol

PIM-SM: PIM Sparse Mode

2. Packing Capability

The RP indicates its ability to receive PIM Packed Null-Register messages (Section 3) and send PIM Packed Register-Stop messages (Section 4) with a Packing Capability bit (P-bit) in the PIM Register-Stop message. The P-bit is allocated in Section 9.

```
 0                   1                   2                   3
 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|PIM Ver| Type  |7 6 5 4 3 2 1|P|          Checksum             |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|              Group Address (Encoded-Group format)             |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|             Source Address (Encoded-Unicast format)           |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```
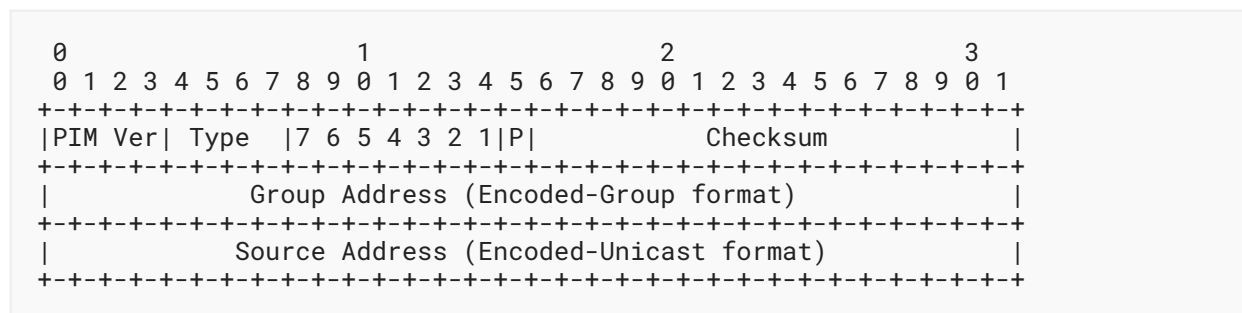
Figure 1: PIM Register-Stop Message with Packing Capability Option

The Group Address and Source Address fields in the PIM Register-Stop message are defined in Section 4.9.4 of [RFC7761]. The common header is defined in [RFC9436].

Packing Capability bit (P-bit; flag bit 0):   When set, it indicates the ability of the RP to receive PIM Packed Null-Register messages and send PIM Packed Register-Stop messages.

3. PIM Packed Null-Register Message Format

```
    0                   1                   2                   3
    0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
   |PIM Ver| Type  |Subtype| FB    |            Checksum           |
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
   |     Group Address[1]   (Encoded-Group format)                 |
   |     Source Address[1]  (Encoded-Unicast format)               |
   .                                                               .
   .                                                               .
   .                                                               .
   .                                                               .
   .     Group Address[N]                                          .
   |     Source Address[N]                                         |
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```
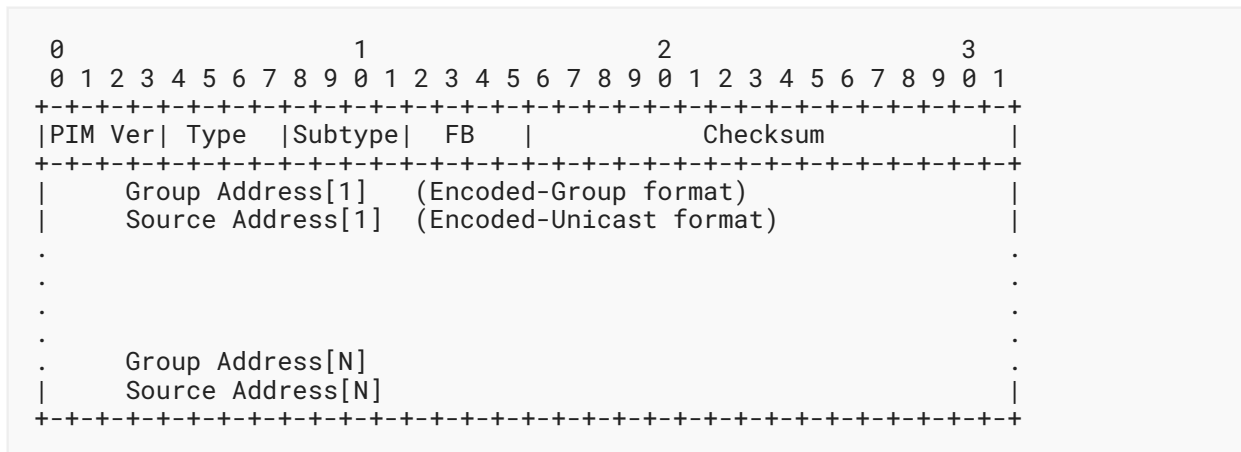
Figure 2: PIM Packed Null-Register Message Format

The Group Address and Source Address fields in the PIM Packed Null-Register message are
defined in Section 4.9.4 of [RFC7761]. The common header is defined in [RFC9436].

Type, Subtype: PIM Packed Null-Register (13.0).

N: The total number of records; a record consists of a Group Address and Source Address pair.

After parsing the PIM common header, individual records are then parsed one by one until the
end of the PIM Packed Null-Register message. This length is inferred from the IP layer.

Sending or receiving a PIM Packed Null-Register message has the equivalent effect of sending or
receiving an individual Null-Register message for each record represented in the PIM Packed
Null-Register message.

4. PIM Packed Register-Stop Message Format

```
 0                   1                   2                   3
 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|PIM Ver| Type  |Subtype|  FB   |            Checksum           |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|     Group Address[1]  (Encoded-Group format)                  |
|     Source Address[1]  (Encoded-Unicast format)               |
.                                                               .
.                                                               .
.                                                               .
.                                                               .
.     Group Address[N]                                          .
|     Source Address[N]                                         |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```
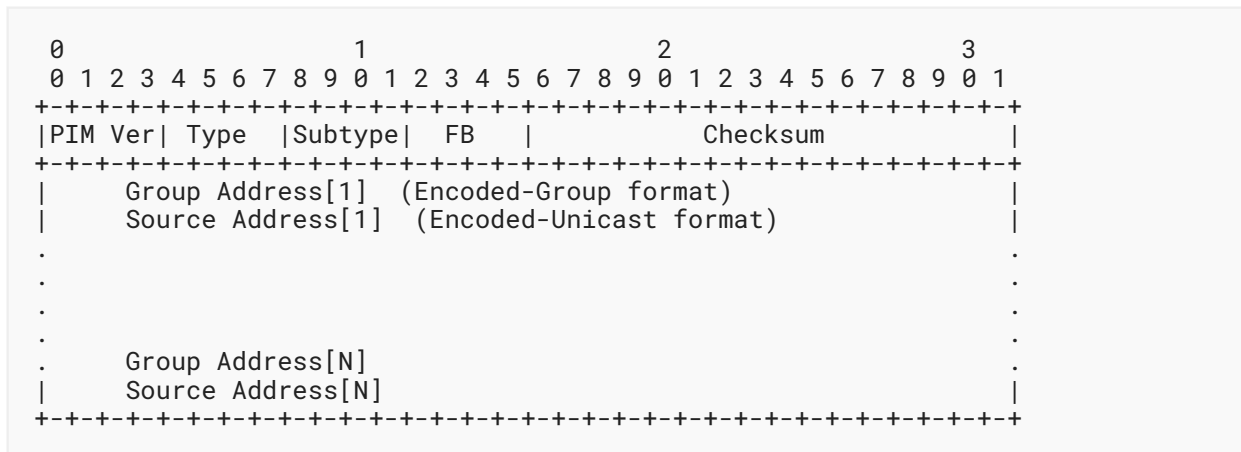
Figure 3: PIM Packed Register-Stop Message Format

The Group Address and Source Address fields in the PIM Packed Register-Stop message are defined in Section 4.9.4 of [RFC7761]. The common header is defined in [RFC9436].

Type, Subtype: PIM Packed Register-Stop (13.1).

N: The total number of records; a record consists of a Group Address and Source Address pair.

After parsing the PIM common header, individual records are then parsed one by one until the end of the PIM Packed Register-Stop message. This length is inferred from the IP layer.

Sending or receiving a PIM Packed Register-Stop message has the equivalent effect of sending or receiving an individual Null-Register message for each record represented in the PIM Packed Register-Stop.

5. Protocol Operation

As specified in [RFC7761], the DR sends PIM Register messages towards the RP when a new source is detected.

When this feature is enabled/configured, an RP supporting this specification **MUST** set the P-bit (flag bit 0) in all Register-Stop messages.

When a Register-Stop message with the P-bit set is received, the DR **SHOULD** send PIM Packed Null-Register messages (Section 3) to the RP instead of multiple Register messages with the N-bit set [RFC7761]. The DR **MAY** use a mixture of PIM Packed Null-Register messages and Register messages. The decision is up to the implementation and out of the scope of this document. However, it is **RECOMMENDED** to stick to the PIM Packed Null-Register and PIM Packed Register-Stop formats as long as the RP and DR have the feature enabled.

After receiving a PIM Packed Null-Register message, the RP **SHOULD** start sending PIM Packed Register-Stop messages (Section 4) to the corresponding DR instead of individual Register-Stop messages. The RP **MAY** use a mixture of PIM Packed Register-Stop messages and individual Register-Stop messages. The decision is up to the implementation and out of the scope of this document. However, it is **RECOMMENDED** to stick to the PIM Packed Null-Register and PIM Packed Register-Stop formats as long as the RP and DR have the feature enabled.

6. Operational Considerations

6.1. PIM Anycast RP Considerations

The PIM Packed Null-Register packet format should be enabled only if it is supported by all the routers in the Anycast-RP set [RFC4610]. This consideration applies to PIM Anycast RP with Multicast Source Discovery Protocol (MSDP) [RFC3446] as well.

6.2. Interoperability between Different Versions

A router (DR) can decide to use the PIM Packed Null-Register message format based on the Packing Capability received from the RP as part of the PIM Register-Stop. This ensures compatibility with routers that do not support processing of the new packet format. The Packing Capability information **MUST** be indicated by the RP via the PIM Register-Stop message sent to the DR. Thus, a DR will switch to the new packet format only when it learns that the RP is capable of handling the PIM Packed Null-Register messages.

Conversely, a DR that does not support the packed format can continue generating the PIM Null-Register as defined in Section 4.4 of [RFC7761].

6.3. Disabling PIM Packed Message Support at RP and/or DR

Consider a PIM RP router that supports PIM Packed Null-Registers and PIM Packed Register-Stops. In scenarios where this router no longer supports this feature, for example, in case of a software downgrade, it will not send a PIM Register-Stop message to the DR in response to a PIM Packed Null-Register message.

When the DR switches to Data Registers from Null-Registers, it **MUST** start a Packed_Register_Probe_Time timer. If no PIM Packed Register-Stop or Register-Stop with the P-bit set is received within Packed_Register_Probe_Time seconds, the DR can decide that the RP no longer supports PIM Packed Null-Registers. The Packed_Register_Probe_Time timer is configurable; its default value is 60 seconds.

When Packed_Register_Probe_Time expires, the DR **MAY** also send an unpacked PIM Null-Register and check the PIM Register-Stop to see if the P-bit is set or not. If it is not set, then the DR will continue sending unpacked PIM Null-Register messages.

In case the network manager disables the Packing Capability at the RP (or in other words, disables the feature from the RP), the router **MUST NOT** advertise the Packing Capability. However, an implementation **MAY** choose to still parse any packed registers if they are received. This may be particularly useful in the transitional period after the network manager disables it.

7. Fragmentation Considerations

As explained in Section 4.4.1 of [RFC7761], the DR may perform Path MTU Discovery to the RP before sending PIM Packed Null-Register messages. Similarly, the RP may perform Path MTU Discovery to the DR before sending PIM Packed Register-Stop messages. In both cases, the number of records in a message should be limited such that it can fit within the Path MTU.

8. Security Considerations

The Security Considerations in [RFC7761] apply to this document. In particular, the effect of forging a PIM Packed Null-Register or Register-Stop message would be amplified to all the records included instead of just one.

By forging a PIM Register-Stop message and setting the P-bit, an attacker can trigger the use of PIM Packed Null-Register messages by a DR, thus creating unnecessary churn in the network.

9. IANA Considerations

IANA has assigned a Packing Capability bit (0) in the PIM Register-Stop common header in the "PIM Message Types" registry.

IANA has assigned a PIM message type (13.0) for PIM Packed Null-Register in the "PIM Message Types" registry. Flag bits 0-3 for this message type are "Unassigned".

IANA has assigned a PIM message type (13.1) for PIM Packed Register-Stop in the "PIM Message Types" registry. The flag bits 0-3 for this message type are "Unassigned".

10. Normative References

[RFC2119]   Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", BCP 14, RFC 2119, DOI 10.17487/RFC2119, March 1997, <https://www.rfc-editor.org/info/rfc2119>.

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[RFC4610]   Farinacci, D. and Y. Cai, "Anycast-RP Using Protocol Independent Multicast (PIM)", RFC 4610, DOI 10.17487/RFC4610, August 2006, <https://www.rfc-editor.org/info/rfc4610>.

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