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PIM Assert Message Packing
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Status of this Memo

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Abstract

In PIM-SM shared networks, there is typically more than one upstream router. When duplicate data packets appear on the LAN from different routers, assert packets are sent from these routers to elect a single forwarder. The PIM assert packets are sent periodically to keep the assert state. The PIM assert packet carries information about a single multicast source and group, along with the metric-preference and metric of the route towards the source or RP. This document defines a standard to send and receive multiple multicast source and group information in a single PIM assert packet in a shared network. This can be particularly helpful when there is traffic for a large number of multicast groups.

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1. Introduction

In PIM-SM shared networks, there is typically more than one upstream router. When duplicate data packets appear on the LAN, from different upstream routers, assert packets are sent from these routers to elect a single forwarder according to [RFC7761]. The PIM assert packets are sent periodically to keep the assert state. The PIM assert packet carries information about a single multicast

source and group, along with the corresponding metric-preference and metric of the route towards the source or RP.

This document defines a standard to send and receive multiple multicast source and group information in a single PIM assert packet in a shared network. It can efficiently pack multiple PIM assert packets into a single message and reduce the processing pressure of the PIM routers. This can be particularly helpful when there is traffic for a large number of multicast groups.

1.1. Requirements Language

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

RPF: Reverse Path Forwarding

RP: Rendezvous Point

SPT: Shortest Path Tree

RPT: RP Tree

2. Use Cases

PIM Asserts will happen in many services where multicast is used and not limited to the examples described below:

2.1. Enterprise network

When an Enterprise network is connected through a layer-2 network, the intra-enterprise runs layer-3 PIM multicast. The different sites of the enterprise are equivalent to the PIM connection through the shared network. Depending upon the locations and amount of groups there could be many asserts on the first hop routers.

2.2. Video surveillance

Video surveillance deployments have migrated from analog based systems to IP-based systems oftentimes using multicast. In certain deployments, when there are many cameras streaming to many groups, there may be issues with many asserts on first hop routers.

2.3. Financial Services

Financial services extensively rely on IP Multicast to deliver stock market data and its derivatives, and current multicast solution PIM is usually deployed. As the number of multicast flows grows, there are many stock data with many groups may result in many PIM asserts on a shared network from publisher to the subscribers.

2.4. IPTV broadcast video

PIM DR and BDR deployments are often used in host-side network for IPTV broadcast video services. Host-side access network failure scenario may be benefitted by assert packing when many groups are being used. According to [RFC7761] the DR will be elected to forward multicast traffic in the shared access network. When the DR recovers from a failure, the original DR starts to send traffic, and the current DR is still forwarding traffic. In the situation multicast traffic duplication maybe happen in the shared access network and can trigger the assert progress.

In the above scenarios, as the multicast service becomes widely deployed, the number of multicast entries increases, and a large number of assert messages may be sent in a very short period when multicast data packets trigger PIM assert process in the shared networks. The PIM routers need to process a large number of PIM assert small packets in a very short time. As a result, the device load is very large. The assert packet may not be processed in time or even is discarded, thus extending the time of traffic duplication in the network.

Additionally, future backhaul, or fronthaul, networks may want to connect L3 across an L2 underlay supporting Time Sensitive Networks (TSN). The infrastructure may run DetNet over TSN. These transit L2 LANs would have multiple upstreams and downstreams. This draft is taking a proactive approach to prevention of possible future assert issues in these types of environments.

3. Solution

The change to the PIM assert includes two elements: the PIM assert packing hello option and the PIM assert packing method.

There is no change required to the PIM assert state machine. Basically a PIM router can now be the assert winner/loser for multiple packed (S, G)'s in a single assert packet instead of one (S, G) assert at a time. An assert winner is now responsible for forwarding traffic from multiple (S, G)'s out of a particular interface based upon the multiple (S, G)'s packed in a single assert.

3.1. PIM Assert Packing Hello Option

The newly defined Hello Option is used by a router to negotiate the assert packet packing capability. It can only be used when all PIM routers, in the same shared network, support this capability.

This document defines two packing methods. One method is a simple merge of the original messages and the other is to extract the common message fields for aggregation.

3.2. PIM Assert Packing Simple Type

In this type of packing, the original assert message body is used as a record. The newly defined assert message can carry multiple assert records and identify the number of records.

This packing method is simply extended from the original assert packet, but, because the multicast service deployment often uses a small number of sources and RPs, there may be a large number of assert records with the same metric preference or route metric field, which wastes the payload of the transmitted message

3.3. PIM Assert Packing Aggregation Type

When the source or RP addresses, in the actual deployment of the multicast service, are very few, this type of packing will combine the records related to the source address or RP address in the assert message.

* (S, G) assert is aggregated according to the same source address, and all SPT (S, G) entries corresponding to the source address are merged into one assert record.

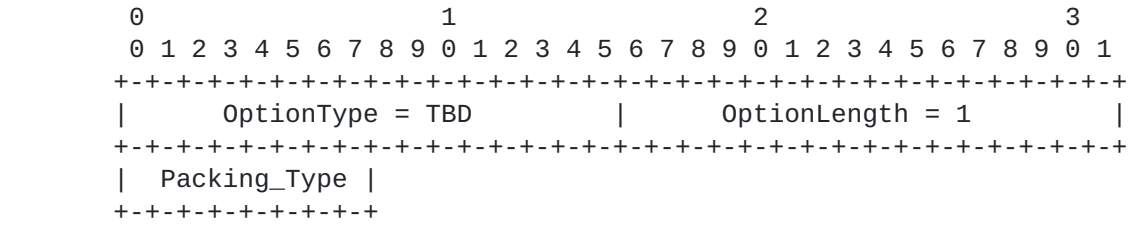
* (*, G) assert is aggregated according to the same RP address, and all (*, G) and RPT (S, G) entries corresponding to the RP address are merged into one assert record.

This method can optimize the payload of the transmitted message by merging the same field content, but will add the complexity of the packet encapsulation and parsing.

4. Packet Format

This section describes the format of new PIM messages introduced by this document. The messages follow the same transmission order as the messages defined in [RFC7761]

4.1. PIM Assert Packing Hello Option



- OptionType: TBD

- OptionLength: 1

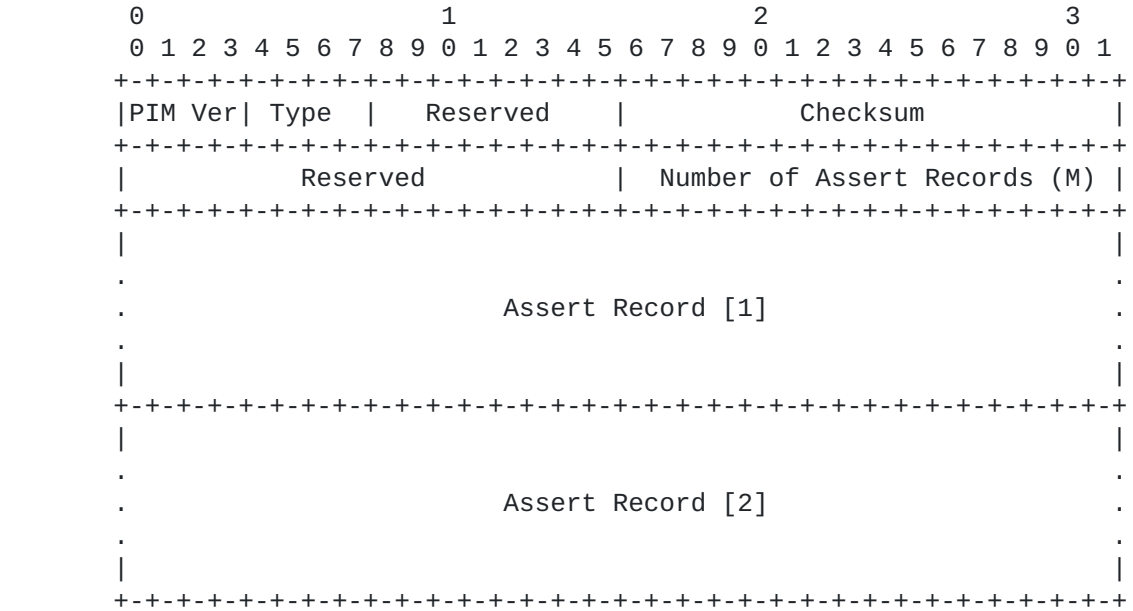
- Packing_Type: The specific packing mode is determined by the value of this field:

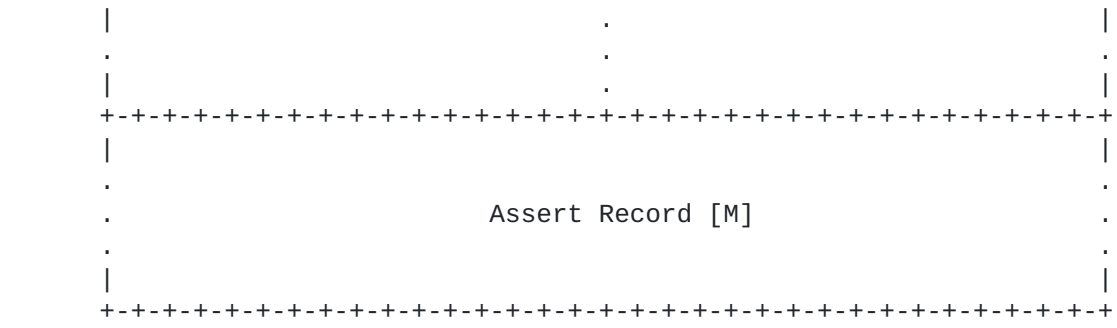
  1: indicates simple packing type as described in section 2.2

  2: indicates aggregating packing type as described in section 2.3

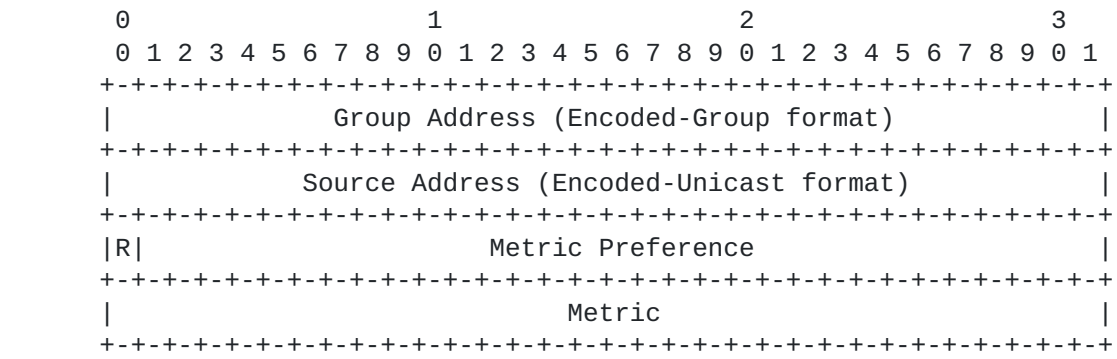
  3-255: reserved for future

4.2. PIM Assert Simple Packing Format





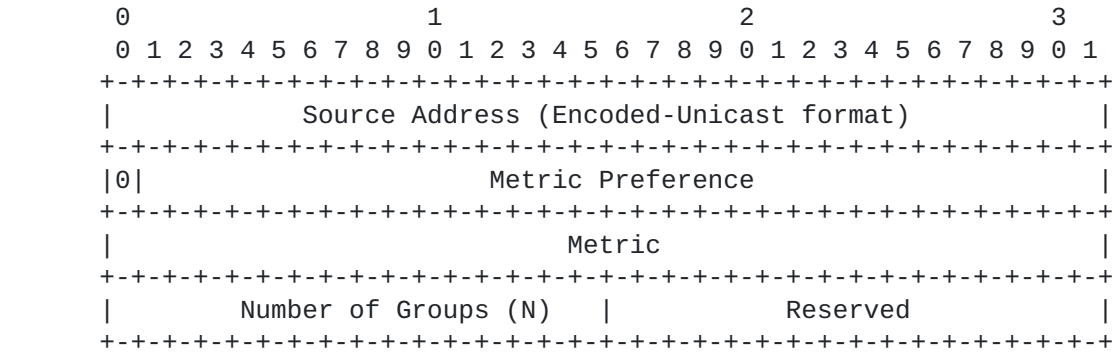
The format of each record is the same as the PIM assert message body of section 4.9.6 in [RFC7761].

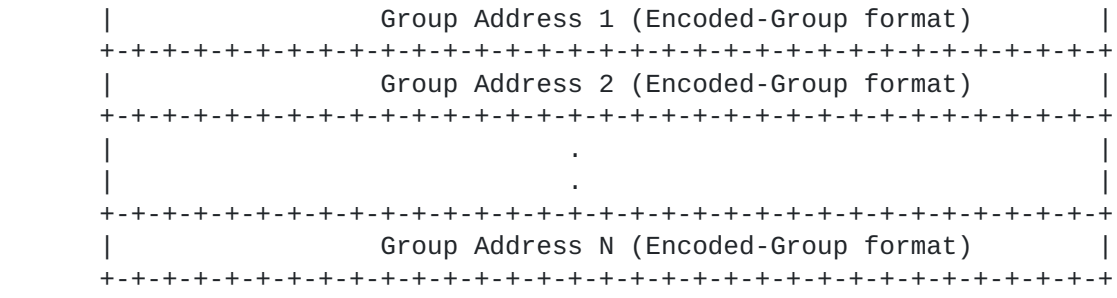


4.3. PIM Assert Aggregation Packing Format

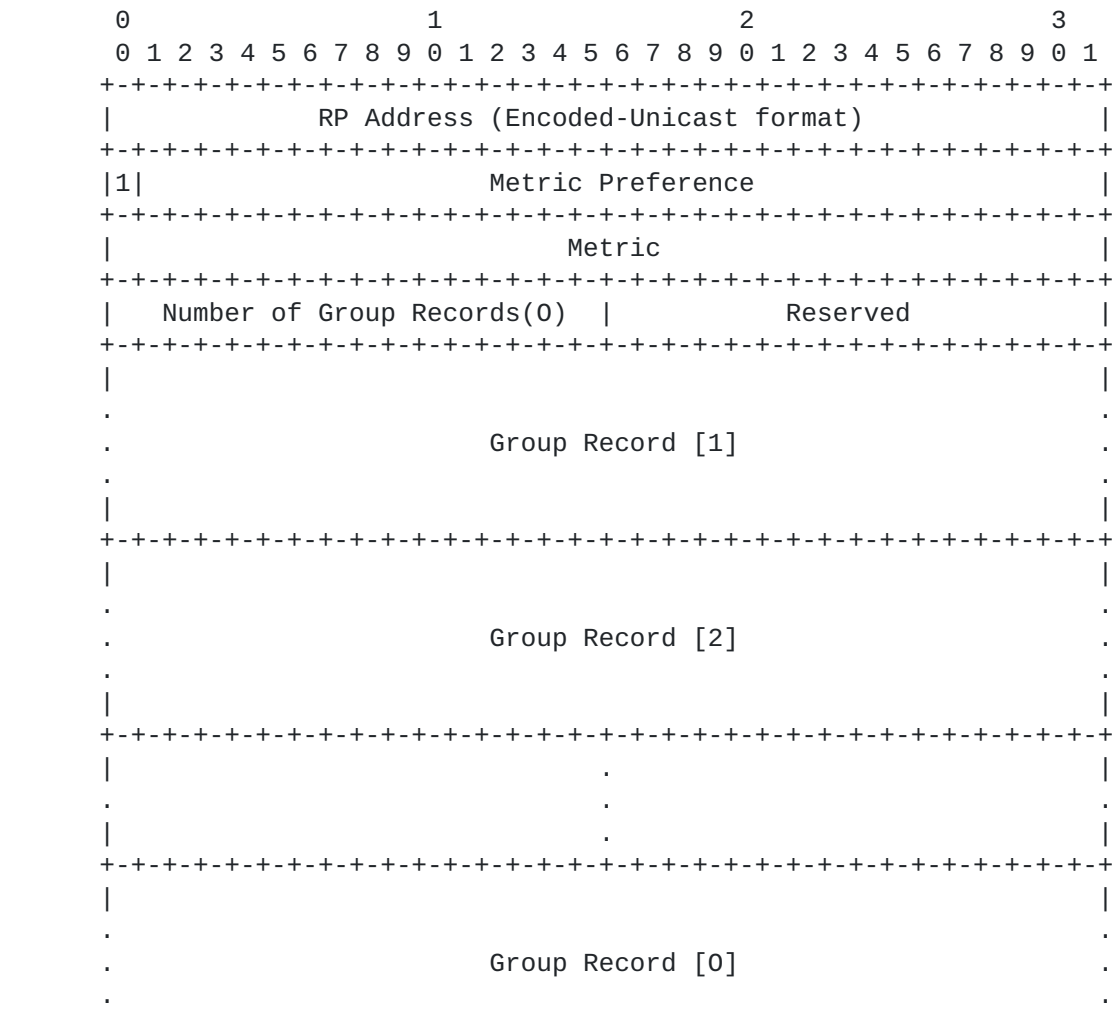
This method also extends PIM assert packets to carry multiple records. The specific assert packet format is the same as section 3.2, but the records are divided into two types.

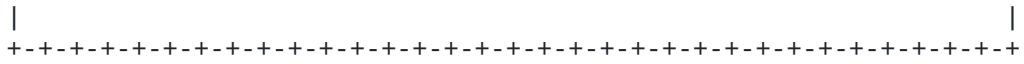
The (S, G) assert records are organized by the same source address, and the specific message format is:



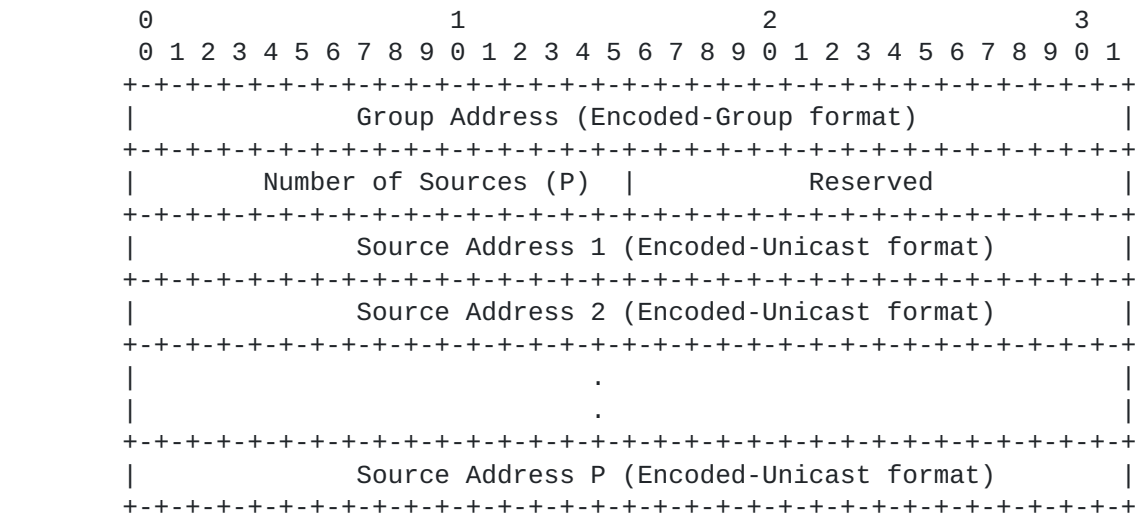


The (*, G) assert records are organized in the same RP address and are divided into two levels of TLVs. The first level is the group record of the same RP address, and the second level is the source record of the same multicast group address, including (*, G) and RPT (S, G), and the specific message format is:





The format of each group record is:



5. IANA Considerations

This document requests IANA to assign a registry for PIM assert packing Hello Option in the PIM-Hello Options. The assignment is requested permanent for IANA when this document is published as an RFC. The string TBD should be replaced by the assigned values accordingly.

6. Security Considerations

For general PIM-SM protocol Security Considerations, see [RFC7761].

TBD

7. References

7.1. Normative References

[RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", BCP 14, RFC 2119, March 1997.

[RFC7761] Fenner, B., Handley, M., Holbrook, H., Kouvelas, I.,Parekh, R., Zhang, Z., and L. Zheng, "Protocol IndependentMulticast - Sparse Mode (PIM-SM): Protocol Specification(Revised)", RFC 7761, March 2016

[RFC8174] Leiba, B., "Ambiguity of Uppercase vs Lowercase in RFC 2119 Key Words", BCP 14, RFC 8174, May 2017

7.2. Informative References

TBD

8. Acknowledgments

The authors would like to thank the following for their valuable contributions of this document:

TBD

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