Bidirectional Forwarding Detection (BFD) for Multi-point Networks and Protocol Independent Multicast - Sparse Mode (PIM-SM) Use Case
draft-ietf-pim-bfd-p2mp-use-case-00

Abstract

This document discusses the use of Bidirectional Forwarding Detection (BFD) for multi-point networks to provide nodes that participate in Protocol Independent Multicast - Sparse Mode (PIM-SM) with the sub-second convergence. Optional extension to PIM-SM Hello, as specified in RFC 7761, to bootstrap point-to-multipoint BFD session. also defined in this document.

Status of This Memo

This Internet-Draft is submitted in full conformance with the provisions of BCP 78 and BCP 79.

Internet-Drafts are working documents of the Internet Engineering Task Force (IETF). Note that other groups may also distribute working documents as Internet-Drafts. The list of current Internet-Drafts is at https://datatracker.ietf.org/drafts/current/.

Internet-Drafts are draft documents valid for a maximum of six months and may be updated, replaced, or obsoleted by other documents at any time. It is inappropriate to use Internet-Drafts as reference material or to cite them other than as "work in progress."

This Internet-Draft will expire on April 25, 2019.

Copyright Notice

Copyright (c) 2018 IETF Trust and the persons identified as the document authors. All rights reserved.

This document is subject to BCP 78 and the IETF Trust’s Legal Provisions Relating to IETF Documents (https://trustee.ietf.org/license-info) in effect on the date of publication of this document. Please review these documents carefully, as they describe your rights and restrictions with respect to this document. Code Components extracted from this document must
include Simplified BSD License text as described in Section 4.e of
the Trust Legal Provisions and are provided without warranty as
described in the Simplified BSD License.

Table of Contents

1. Introduction ............................................. 2
   1.1. Conventions used in this document ................... 3
       1.1.1. Terminology ...................................... 3
       1.1.2. Requirements Language ............................. 3
   2. Problem Statement ...................................... 3
   3. Applicability of p2mp BFD ................................. 3
       3.1. Multipoint BFD Encapsulation ......................... 4
   4. IANA Considerations ..................................... 5
   5. Security Considerations .................................. 5
   6. Acknowledgments ......................................... 5
   7. Normative References .................................... 5
Authors’ Addresses ........................................... 6

1. Introduction

Faster convergence in the control plane, in general, is beneficial
and allows minimizing periods of traffic blackholing, transient
routing loops and other scenarios that may negatively affect service
data flow. That equally applies to unicast and multicast routing
protocols.

[RFC7761] is the current specification of the Protocol Independent
Multicast - Sparse Mode (PIM-SM) for IPv4 and IPv6 networks.
Confirming implementation of PIM-SM elects a Designated Router (DR)
on each PIM-SM interface. When a group of PIM-SM nodes is connected
to shared-media segment, e.g. Ethernet, the one elected as DR is to
act on behalf of directly connected hosts in context of the PIM-SM
protocol. Failure of the DR impacts the quality of the multicast
services it provides to directly connected hosts because the default
failure detection interval for PIM-SM routers is 105 seconds.
Introduction of Backup DR (BDR), proposed in
[I-D.ietf-pim-dr-improvement] improves convergence time in the PIM-SM
over shared-media segment but still depends on long failure detection
interval.

Bidirectional Forwarding Detection (BFD) [RFC5880] had been
originally defined to detect failure of point-to-point (p2p) paths -
single-hop [RFC5881], multihop [RFC5883]. [I-D.ietf-bfd-multipoint]
extends the BFD base specification [RFC5880] for multipoint and
multicast networks, which precisely characterizes deployment
scenarios for PIM-SM over LAN segment. This document demonstrates
how point-to-multipoint (p2mp) BFD can enable faster detection of
PIM-SM router ailure and thus minimize multicast service disruption. The document also defines the extension to PIM-SM [RFC7761] to bootstrap a PIM-SM router to join in p2mp BFD session over shared-media link.

1.1. Conventions used in this document

1.1.1. Terminology

BFD: Bidirectional Forwarding Detection
BDR: Backup Designated Router
DR: Designated Router
p2mp: Pont-to-Multipoint
PIM-SM: Protocol Independent Multicast - Sparse Mode

1.1.2. 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.

2. Problem Statement

[RFC7761] does not provide a method for fast, e.g. sub-second, failure detection of a neighbor PIM-SM router. BFD already has many implementations based on HW that are capable to support multiple sub-second session concurrently.

3. Applicability of p2mp BFD

[I-D.ietf-bfd-multipoint] may provide the efficient and scalable solution for the fast-converging environment that has head-tails relationships. Each such group presents itself as p2mp BFD session with its head being the root and other routers being tails of the p2mp BFD session. Figure 1 displays the new BFD Discriminator TLV [RFC7761] to bootstrap tail of the p2mp BFD session.
Figure 1: BFD Discriminator TLV to Bootstrap P2MP BFD session

where new fields are interpreted as:

- OptionType is a value (TBA1) assigned by IANA Section 4 that identifies the TLV as BFD Discriminator TLV;

- OptionLength value is always 4

- My Discriminator - My Discriminator value allocated by the root of the p2mp BFD session.

If PIM-SM routers, that support this specification, are configured to use p2mp BFD for faster convergence, then the router to be monitored, referred to as ‘head’, MUST create BFD session MultipointHead, as defined in [I-D.ietf-bfd-multipoint]. The head MUST include BFD TLV in its PIM-Hello message and periodically transmit BFD control packets. Source IP address of the BFD control packet MUST be the same as the source IP address of the PIM-Hello with BFD TLV messages being transmitted by the head. The values of My Discriminator in the BFD control packet and My Discriminator field of the BFD TLV in PIM-Hello, transmitted by the head MUST be the same. When a PIM-SM router configured to monitor the head, referred to as ‘tail’, via p2mp BFD receives PIM-Hello packet with BFD TLV it MAY create p2mp BFD session as MultipointTail, as defined in [I-D.ietf-bfd-multipoint], and demultiplex p2mp BFD test session based on head’s source IP address the My Discriminator value it learned from BFD Discriminator TLV. If the head ceased to include BFD TLV in its PIM-Hello message, tails MUST close the corresponding MultipointTail BFD session. If the tail detects MultipointHead failure it MUST remove the neighbor. If the failed head node was PIM-SM DR or BDR the tail MAY start DR Election process as specified in Section 4.3.2 [RFC7761] or in Section 4.1 [I-D.ietf-pim-dr-improvement] respectively.

3.1. Multipoint BFD Encapsulation

The MultipointHead of p2mp BFD session when transmitting BFD control packet:
MUST set TTL value to 1;

SHOULD use group address ALL-PIM-ROUTERS (‘224.0.0.13’ for IPv4 and ‘ff02::d’ for IPv6) as destination IP address

MAY use network broadcast address for IPv4 or link-local all nodes multicast group for IPv6 as the destination IP address;

MUST set destination UDP port value to 3784 when transmitting BFD control packets, as defined in [I-D.ietf-bfd-multipoint].

## 4. IANA Considerations

IANA is requested to allocate a new OptionType value from PIM Hello Options registry according to:

<table>
<thead>
<tr>
<th>Value Name</th>
<th>Length Number</th>
<th>Name Protocol</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>TBA</td>
<td>4</td>
<td>BFD Discriminator</td>
<td>This document</td>
</tr>
</tbody>
</table>

Table 1: BFD Discriminator option type

## 5. Security Considerations

Security considerations discussed in [RFC7761], [RFC5880], and [I-D.ietf-bfd-multipoint], apply to this document.

## 6. Acknowledgments

Authors cannot say enough to express their appreciation of comments and suggestions we received from Stig Venaas.

## 7. Normative References

[I-D.ietf-bfd-multipoint]

[I-D.ietf-pim-dr-improvement]
Zhang, Z., hu, f., Xu, B., and m. mishra, "PIM DR Improvement", draft-ietf-pim-dr-improvement-05 (work in progress), June 2018.


Authors’ Addresses

Greg Mirsky
ZTE Corp.

Email: gregimirsky@gmail.com

Ji Xiaoli
ZTE Corporation
No.50 Software Avenue, Yuhuatai District
Nanjing
China

Email: ji.xiaoli@zte.com.cn