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PIM DR Improvement
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Abstract

PIM is worldly deployed multicast protocol. This document will improve the stability of PIM protocol, decrease the lost of multicast packets when the PIM DR (Designed Router) is down.

Status of This Memo

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

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This Internet-Draft will expire on September 2, 2016.

Table of Contents

1. Introduction

Multicast technology is used widely. Many modern technology use PIM technology, such as IPTV, Net-Meeting, and so on. There are many events that will influence the quality of multicast services. Except the unicast routes changing will cause the lost of multicast packets. The change of DR cause the lost of multicast packets too.

When a DR on a share-media LAN is down, other routers will elect a new DR until the expiration of Hello-Holdtime. The default value of Hello-Holdtime is 105 seconds. Although the value of Hello-Holdtime can be changed by manual, when the DR is down, there are still many multicast packets will be lost. The quality of IPTV and Net-Meeting will be influenced.

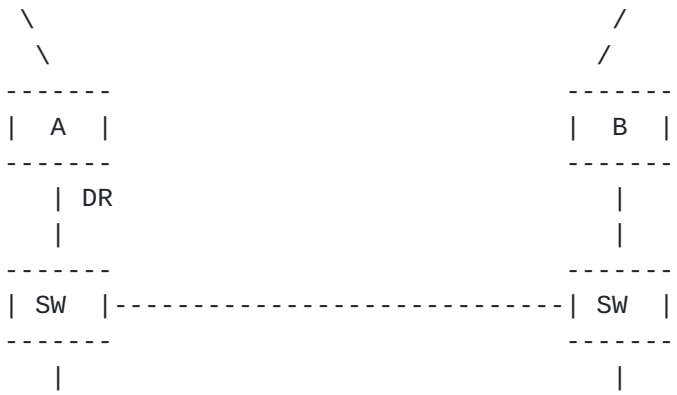

Figure 1: An example of multicast network

For example, there were two routers on one Ethernet. RouterA was elected to DR. When RouterA is down, the multicast packets are

discarded until the RouterB is elected to DR and RouterB imports the multicast flows successfully.

We suppose that there is only a RouterA in the Ethernet at first in Figure 1. RouterA is the DR who is responsible for forwarding multicast flows. When RouterB connects the Ethernet, RouterB will be elected to DR because a high priority. So RouterA will stop forwarding multicast packets. The multicast flows will not recover until RouterB joins the multicast group after it is elected to DR.

2. Terminology

Backup Designated Router (BDR): A shared-media LAN like Ethernet may have multiple PIM-SM routers connected to it. Except for DR, a other router who will act on behalf of directly connected hosts with respect to the PIM-SM protocol. But BDR will not forward the flows. When DR is down, the BDR will forward multicast flows immediately. A single BDR is elected per interface like the DR.

3. PIM hello message format

In RFC4601, the PIM hello message format was defined. In this document, we define two new option values which are including Type, Length, and Value.

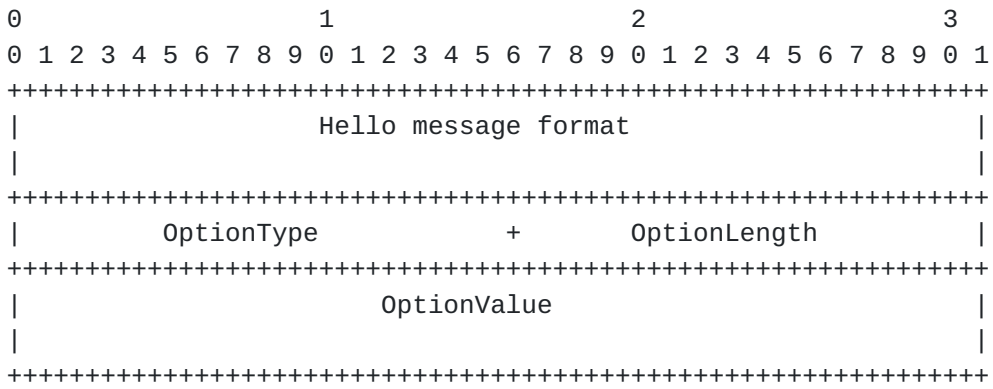

Figure 2: Hello message format

3.1. DR Option format

- OptionType : The value is TBD.
- OptionLength: If the network is support IPv4, the OptionLength is 4 octets. If the network is support IPv6, the OptionLength is 16 octets.

- OptionValue: The OptionValue is IP address of DR. If the network is support IPv4, the value is IPv4 address of DR. If the network is support IPv6, the value is IPv6 address of DR.

3.2. BDR Option format

- OptionType : The value is TBD.

- OptionLength: If the network is support IPv4, the OptionLength is 4 octets. If the network is support IPv6, the OptionLength is 16 octets.

- OptionValue: The OptionValue is IP address of BDR. If the network is support IPv4, the value is IPv4 address of BDR. If the network is support IPv6, the value is IPv6 address of BDR.

4. The Protocol Treatment

A new router starts to send hello messages with the values of DR and BDR are all set to 0 after its interface is enabled in PIM on a share-media LAN. When the router receive hello messages from other routers on the same share-media LAN, the router will check if the value of DR or BDR is filled. If the value of DR or BDR is filled with IP address of router who is sending hello messages, the router will store the IP address.

Then the new router compare the priority and IP address itself to the stored IP address of DR and BDR accord to the algorithm of RFC 4601. If the new router notices that it is better to be DR than the existed DR or BDR. The router will make itself the BDR, and send new hello messages with its IP address as BDR and existed DR. If the router notices that the existed DR is most priority in the share-media LAN, but the existed BDR is set to 0x0 in the received hello messages, or the existed BDR is not better than the new router to be DR except existed DR, the router will elect itself to BDR. If the router notices that it is not better to be DR than existed DR and BDR, the router will respect the PIM protocol.

When the new router becomes the new BDR, the router will join the existed multicast groups, import multicast flows from upstream routers. But the BDR MUST not forward the multicast flows to avoid the duplicate multicast packets in the share-media LAN. The new router will monitor the DR. When the DR becomes unavailable because of the down or other reasons, the BDR will forward multicast flows immediately.

4.1. Sending Hello Messages

When a new router's interface is enabled in PIM protocol, the router send hello messages with the values of DR and BDR are filled with 0x0.

When a new router sets itself BDR after receive hello messages from other routers, the router send hello messages with the value of DR is set to the IP address of existed DR and the value of BDR is set to the IP address of the router itself.

When a new router notices the existed DR and BDR is more priority than itself. The router will send hello messages with the values of DR and BDR are filled with existed DR and BDR.

When a existed router sets itself non DR and non BDR after receive hello messages from other routers, the router will send hello messages with the value of DR is set to existed DR and the value of BDR is set to new BDR.

4.2. Receiving Hello Messages

When the values of DR and BDR which are carried by hello messages are received is all set to 0x0, the router MUST elect the DR due to the algorithm of RFC4601. And elect a new BDR which are the best choice except DR.

When the value of DR which is carried by received hello messages is not 0x0, and the value of BDR is set to 0x0, the router will elect itself to BDR.

When the values of DR and BDR that carried by received hello messages are all larger than 0x0. The router will mark the existed DR, and compare itself and the BDR in message. When the router notice that it is better to be DR than existed BDR. The router will elect itself to the BDR.

When a router receives a new hello message with the values of DR and BDR are set to 0x0. The router will compare the new router with itself. If the router noticed that the new router is better to be DR than itself, the router will set the BDR to the new router.

4.3. The election of DR and BDR

When all the routers on a shared-media LAN are start to work on the same time, the election of DR is same as RFC4601. And all the routers will elect a BDR which is suboptimum to DR. The hello

messages sent by all the routers are same with the value of DR and BDR are all set.

When a new router start to work on a shared-media LAN and receive hello messages from other routers that the value of DR is set at least. The new router will not change the existed DR even if it is superior to the existed DR. If the new router is superior to existed BDR, the new router will replace the place of BDR on the LAN.

When an existed router receives hello messages from a new router, and the existed router is DR on the LAN, the existed DR router will compare the new router and all the other routers on the LAN. If the new router is superior to all the other routers, the existed DR router will treat the new router as new BDR.

When an existed router receives hello messages from a new router, and the existed router is BDR on the LAN, the existed BDR will compare itself and the new router. If the new router is superior to itself, the existed BDR will elect the new router as new BDR, and set itself for nothing. Then the old BDR will send prune message to upstream routers.

When an existed router receives hello messages from a new router, and the existed router is neither DR nor BDR on the LAN, the existed router will compare the existed BDR and the new router. If the new router is superior to all the other routers, the existed DR router will treat the new router as new BDR.

5. Deployment suggestion

If there are two and more routers on a share-media LAN, and the multicast services is sensitive due to the lost of multicast packets, the LAN should deploy the function of DR and BDR in this document.

6. Security Considerations

For general PIM Security Considerations.

7. IANA Considerations

IANA is requested to allocate OptionTypes in TLVs of hello message. Include DR and BDR.

8. Normative References

[I-D.ietf-pim-rfc4601bis]
Fenner, B., Handley, M., Holbrook, H., Kouvelas, I., Parekh, R., Zhang, J., and L. Zheng, "Protocol Independent Multicast - Sparse Mode (PIM-SM): Protocol Specification (Revised)", draft-ietf-pim-rfc4601bis-06 (work in progress), August 2015.

[RFC4601] Fenner, B., Handley, M., Holbrook, H., and I. Kouvelas, "Protocol Independent Multicast - Sparse Mode (PIM-SM): Protocol Specification (Revised)", RFC 4601, DOI 10.17487/RFC4601, August 2006, <http://www.rfc-editor.org/info/rfc4601>.

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