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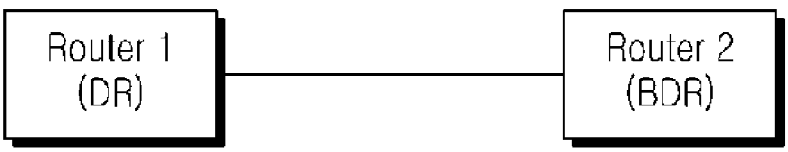
(54) **Title**: METHOD OF REMOVING THE REDUNDANT INFORMATION AND COMPRESSING AN OSPF HELLO PACKET ON A STABLE NETWORK

[Fig. 10]



(57) **Abstract**: The present invention proposes a method to compress Open Shortest Path First (OSPF) hello protocol packet on a stable network. The proposed invention removes redundant information in the hello packets sent by routers by entering into hello packet compression mode. The routers enter into hello packet compression mode after negotiating with each other router on the network. The invention by optimizing the hello packet sends only relevant information via the hello packet.

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Description

METHOD OF REMOVING THE REDUNDANT INFORMATION AND COMPRESSING AN OSPF HELLO PACKET ON A STABLE NETWORK

Technical Field

[1] The present invention in general relates to the field of routing protocols. More particularly, the present invention relates to a method to compress Open Shortest Path First (OSPF) hello protocol packet on a stable network.

Background Art

[2] In the existing art, routers in a stable network periodically send hello packets on all interfaces, including virtual links, to establish and maintain neighbor relationships. Hello packets are multicast on physical networks that have a multicast or broadcast capability, which enables dynamic discovery of neighboring routers. These hello packets carry redundant information after adjacency establishment and hence routers can optimize the hello packet by sending relevant information alone, removing redundant information.

[3] FIG 1 depicts the routers sending hello packets containing redundant information after adjacency establishment in the existing Open Shortest Path First version 2(OSPFv2). As shown

[4] Routers send hello packet with redundant information at every hello interval on the network. FIG 2 depicts the hello packet in the existing OSPFv2.

[5] Hello packet sent by all the routers is of length 56 bytes ((($n\times4$)+44) bytes).

[6] FIG 3 depicts the routers sending hello packets containing redundant information in the existing Open Shortest Path First version 3(OSPFv3). The hello packet sent by the routers contains redundant information after adjacency establishment. FIG 4 depicts the hello packet in the existing OSPFv3. These hello packets are sent at every hello interval by all routers on the network. The hello packet sent by all routers is of length 48 bytes ((($n\times4$)+36) bytes).

Disclosure of Invention

Technical Problem

[7] Based upon the foregoing there has been felt the need for the method that compresses the hello packet by removing redundant information. The present invention has been designed to address these needs.

Technical Solution

[8] An aspect of the present invention is to provide a method of removing redundant in-

formation from a hello packet on a stable network after adjacency with neighbors.

[9] Another aspect of the present invention is to provide a method of optimizing the hello packet by sending only relevant information on a stable network after adjacency with neighbors.

[10] Further aspect of the present invention is to provide a method of compressing the hello packet on a stable network after adjacency with neighbors.

[11] Further aspect of the present invention is to provide a method by which the routers on a network send compressed hello packet only if all the neighboring routers support the compressed hello packet mode.

[12] The proposed invention relates to removal of redundant information from a hello packet and optimizing the hello packet by sending only relevant information via the hello packet. The invention provides a method of removing the redundant information and compressing the hello packet by using a reserved option bit C in the hello packet.

[13] A router on a network sends the hello packet using the option bit C to neighboring routers to know whether all the neighboring routers can support hello packet compression mode. If any of the neighboring routers does not support the hello packet compression mode, the network switches to the standard protocol with no compressed hello packets. However, if all the neighboring routers acknowledge to support the hello packet compression mode, routers on the network start sending the compressed hello packets. Any change in the network triggers the routers to switch back to the standard protocol without compressed hello packets.

[14] Accordingly the invention explains a method of removing the redundant information and compressing an OSPF hello packet on a stable network after adjacency with neighbors comprising the steps of:

[15] sending the hello packet using a new bit option by a router to neighbouring routers to seek a compressed hello packet mode operation ;

[16] acknowledging the packet by the neighbouring routers for supporting the compressed hello packet mode operation; and

[17] sending compressed hello packets by the routers on the network.

[18] Sending the compressed hello packets involves the step of sending a modified hello packet by the router with fixed length if the routers in the network are adjacent and receive a hello packet with the new bit set from each of the other routers in the network. Each router in the network sends the hello packet with the new bit set until each of the router receives a response from the neighboring routers. The response from the neighboring routers is received by a router before a configured interval. Said router sends a hello packet with a reset new bit if the router does not support the hello packet compression mode. The routers in the network switch back to a standard OSPF hello protocol if any router on the network does not support hello packet compression mode.

[19] These and other aspects, features and advantages of the present invention will become more apparent from the ensuing detailed description of the invention taken in conjunction with the accompanying drawings.

Advantageous Effects

[20] Various embodiments of the present invention provide the following advantages. The new hello packet carries no redundant information on the network. Further, the size of the new hello packet is reduced by a factor of ((4 bytes × n) + 20 bytes) thereby optimizing the hello protocol.

Brief Description of Drawings

[21] FIG 1 depicts the routers sending hello packets containing redundant information in the existing Open Shortest Path First version 2(OSPFv2).

[22] FIG 2 depicts the hello packet in the existing OSPFv2.

[23] FIG 3 depicts the routers sending hello packets containing redundant information in the existing Open Shortest Path First version 3(OSPFv3).

[24] FIG 4 depicts the hello packet in the existing OSPFv3.

[25] FIG 5 depicts hello packet optimization for OSPFv2.

[26] FIG 6 depicts optimized hello packet for OSPFv2.

[27] FIG 7 depicts hello packet optimization for OSPFv3.

[28] FIG 8 depicts optimized hello packet for OSPFv3.

[29] FIG 9, 10, and 11 depict an example for the present invention.

Mode for the Invention

[30] The preferred embodiments of the present invention will now be explained with reference to the accompanying drawings. It should be understood however that the disclosed embodiments are merely exemplary of the invention, which may be embodied in various forms. The following description is not to be construed as limiting the invention and numerous specific details are described to provide a thorough understanding of the present invention, as the basis for the claims and as a basis for teaching one skilled in the art how to make and/or use the invention. However, in certain instances, well-known or conventional details are not described in order not to unnecessarily obscure the present invention in detail.

[31] Accordingly, the present invention describes the use of an extra option bit in the hello packet for both Open Shortest Path First version 2 (OSPFv2) and Open Shortest Path First version 3 (OSPFv3) to enter in to hello packet compression mode on a stable network, reducing hello packet size on the stable network at every hello interval after adjacency with neighbors. The hello packets are compressed by a factor of ((4 bytes × n) + 20 bytes) from each router on the network at every hello interval (reducing the size of the hello packet by a minimum of 50%).

[32] According to one embodiment of the invention, the routers on the network send a hello packet with the new option bit C set on forming adjacency with the neighboring routers. Each router in the network sends the hello packet with the new option bit C set until each of the router receives a hello packet with the option bit C set sent by all the neighboring routers in the network. The reply from the neighboring routers has to be received by a router before the router dead interval (only in case of DR not sending hello packet with option bit C set). If a router does not support the hello packet compression mode it sends a hello packet with the option bit C reset. If a router not supporting hello packet compression mode is detected, then all the routers in the network switch back to standard OSPF hello protocol.

[33] Thus, routers on the network by entering hello packet compression mode, exchange modified hello packets with all the other routers on a stable network except DR (which sends complete hello packet with C bit set). Any change in the network trigger the routers to switch back to standard OSPF hello protocol.

[34] Table 1

[Table 1]

DN	O	DC	C	N/P	MC	E	MT

[35] Table 1 shows the new option bit C in OSPFv2 hello option field .An implementation should set C bit in the first bit of the option field to indicate that the router is willing to enter in to hello packet compression mode.

[36] Table 2

[Table 2]

																	C	DC	R	N	MC	E	V6

[37] Table 2 shows the new option bit C in OSPFv3 hello option. An implementation should set C bit in the seventh bit of the option field to indicate that the router is willing to enter in to hello packet compression mode.

[38] FIG 5 depicts hello packet optimization for OSPFv2. As shown in the figure, the hello packet sent by all the routers (Backup Designated Router (BDR), Designated Router Others (DRO)) other than the Designated Router (DR) is of fixed length-24 bytes. FIG 6 depicts optimized hello packet for OSPFv2.

[39] Modified hello packet contains no redundant information like

[40] Network mask

[41] Hello interval

[42] Hello dead interval

[43] Hello options

[44] Hello priority

[45] DR and BDR

[46] Neighbor lists

[47] as shown in figure 6.

[48] Figure 6 shows a modified hello packet whose details are as below

[49] "2" : represents OSPFv2 protocol.

[50] "1" : represents hello packet type.

[51] Packet length : The length of the OSPF protocol packet in bytes. This length includes the standard OSPF header.

[52] Router ID : The Router ID of the packet s source.

[53] Area ID : A 32 bit number identifying the area that this packet belongs to. All OSPF packets are associated with a single area. Most travel a single hop only. Packets travelling over a virtual link are labelled with the backbone Area ID of 0.0.0.0.

[54] Checksum : The standard IP checksum of the entire contents of the packet, starting with the OSPF packet header but excluding the 64-bit authentication field. This checksum is calculated as the 16-bit one's complement of the one's complement sum of all the 16-bit words in the packet, excepting the authentication field. If the packet's length is not an integral number of 16-bit words, the packet is padded with a byte of zero before check summing. The checksum is considered to be part of the packet authentication procedure; for some authentication types the checksum calculation is omitted.

[55] AuType : Identifies the authentication procedure to be used for the packet.

[56] Authentication : A 64-bit field for use by the authentication scheme.

[57] FIG 7 depicts hello packet optimization for OSPFv3. Figure shows DR, BDR and DROs. As shown, the hello packet sent by all routers other than DR is of fixed length-16 bytes. FIG 8 depicts optimized hello packet for OSPFv3.

[58] Modified hello packet contains no redundant information like

[59] interface id

[60] Hello interval

[61] Hello dead interval

[62] Hello options

[63] Hello priority

[64] DR and BDR

[65] Neighbor lists

[66] As shown in figure 8,

[67] "3" Represents OSPFv3 protocol.

[68] "1" represents hello packet type.

[69] Packet length : The length of the OSPF protocol packet in bytes. This length includes

the standard OSPF header.

[70] Router ID : The Router ID of the packet's source.

[71] Area ID : A 32 bit number identifying the area that this packet belongs to. All OSPF packets are associated with a single area. Most travel a single hop only. Packets travelling over a virtual link are labelled with the backbone Area ID of "0".

[72] Checksum : OSPF uses the standard checksum calculation for IPv6 applications: The 16-bit one's complement of the one's complement sum of the entire contents of the packet, starting with the OSPF packet header, and prepending a "pseudo-header" of IPv6 header fields. The "Upper-Layer Packet Length" in the pseudo-header is set to value of the OSPF packet header's length field. The Next Header value used in the pseudo-header is 89. If the packet's length is not an integral number of 16-bit words, the packet is padded with a byte of zero before checksumming. Before computing the checksum, the checksum field in the OSPF packet header is set to "0".

[73] Instance ID : Enables multiple instances of OSPF to be run over a single link. Each protocol instance would be assigned a separate Instance ID; the Instance ID has local link significance only. Received packets whose Instance ID is not equal to the receiving interface's Instance ID are discarded.

[74] "0" : These fields are reserved. They must be "0".

[75] The present invention is explained with reference to an example as follows. As shown in FIG 9 one router (Router 1) in the network keeps sending hello packet with option bit C set as it is not adjacent to any other router. In FIG 10 router 2 comes up on the network. DR election takes place. Router 1 becomes DR and Router 2 becomes BDR on the network. Once adjacency is formed between DR and BDR, both DR and BDR sends hello packet with C option bit set if hello packet compression mode is supported. Once DR and BDR receive hello packet with the option bit C set from each other, both DR and BDR enter into hello packet compression mode removing redundant information from the network. In FIG 11, router 3 comes up on the network and becomes DRO on the network. DR and BDR switches back to standard OSPF protocol with redundant information on detecting a new router on the network. DRO becomes adjacent with DR and BDR on the network. All the three routers on the network start sending hello packet with the option bit C set after forming adjacency with each other. Once all the three routers receive hello packet with option bit C set from each other, they enter into hello packet compression mode removing redundant information from the network.

[76] Although the present invention has been fully described in connection with the preferred embodiments thereof with reference to the accompanying drawings, it is to be noted that various changes and modifications are possible and are apparent to those skilled in the art. Such changes and modifications are to be understood as included

within the scope of the present invention as defined by the appended claims unless they depart there from.

[77] Glossary of Terms and their definitions

[78] Open Shortest Path First (OSPF):

[79] A routing protocol designed to quickly detect topological changes in the autonomous system and converge on a new consensus of the topology after detecting a change. Routing decisions are based on the state of the links interconnecting the routers in the autonomous system. Each of these routers maintains an identical database that tracks link states in the network.

[80] Router ID : A 32-bit number assigned to each router running the OSPF protocol. This number uniquely identifies the router within an Autonomous System.

[81] Neighboring routers : Two routers that have interfaces to a common network. Neighbor relationships are maintained by, and usually dynamically discovered by, OSPF's Hello Protocol.

[82] Adjacency : A relationship formed between selected neighboring routers for the purpose of exchanging routing information. Not every pair of neighboring routers becomes adjacent.

[83] Hello Protocol : The part of the OSPF protocol used to establish and maintain neighbor relationships. On broadcast networks the Hello Protocol can also dynamically discover neighboring routers

[84] Designated Router : Each broadcast and NBMA network that has at least two attached routers has a designated Router. The Designated Router generates an LSA for the network and has their special responsibilities in the running of the protocol. The Designated Router is elected by the Hello Protocol. The Designated Router concept enables a reduction in the number of adjacencies required on a broadcast or NBMA network. This in turn reduces the amount of routing protocol traffic and the size of the link-state database.

Claims

[1] A method of removing the redundant information and compressing an OSPF hello packet on a stable network after neighbor adjacency comprising the steps of:
sending the hello packet using a new bit option by a router to neighbouring routers to seek a compressed hello packet mode operation ;
acknowledging the packet by the neighbouring routers for supporting the compressed hello packet mode operation; and
sending compressed hello packets by the routers on the network.

[2] The method as claimed in claim 1, wherein sending the compressed hello packets involves the step of sending a modified hello packet by the router with fixed length if the routers in the network receive a hello packet with the new bit set from each of the other routers in the network.

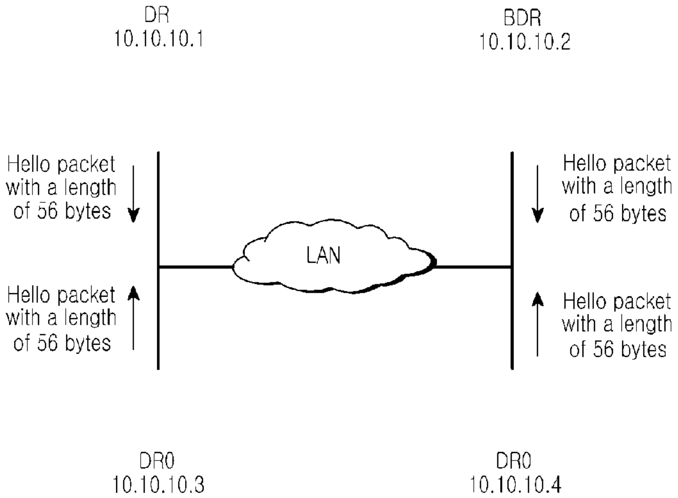
[3] The method as claimed in claim 1, wherein each router in the network sends the hello packet with the new bit set until each of the router receives a response from the neighboring routers or for router dead interval.

[4] The method as claimed in claim 1, wherein the response from the neighboring routers is received by a router before a configured interval.

[5] The method as claimed in claim 1, wherein said router sends a hello packet with a reset new bit if the router does not support the hello packet compression mode.

[6] The method as claimed in claim 1, wherein the routers in the network switch back to a standard OSPF hello protocol if the routers does not support hello packet compression mode.

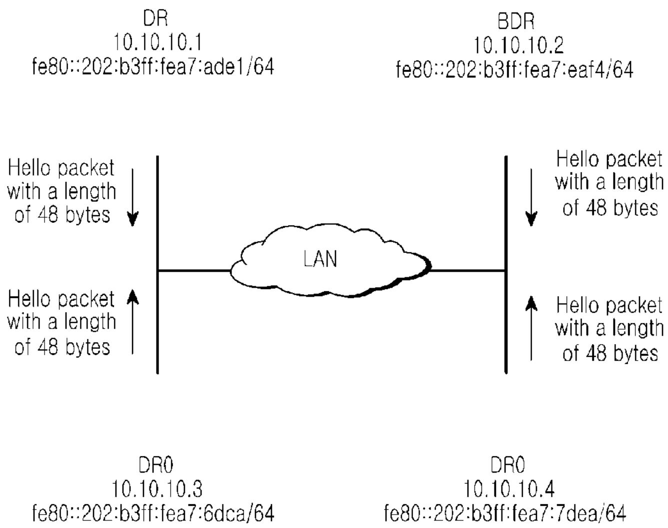
[Fig. 1]



[Fig. 2]

2	1	Packet length = 56	
(10.10.10.1)Router Id			
(0.0.0.0)Area Id			
Check sum		Auth Type	
Authentication			
Authentication			
10.10.10.1(network mask)			
10(hello interval)		0x2(options)	0x3(Router priority)
40(router dead interval)			
10.10.10.1(designated router)			
10.10.10.2(backup designated router)			
10.10.10.2			
10.10.10.3			
10.10.10.4			

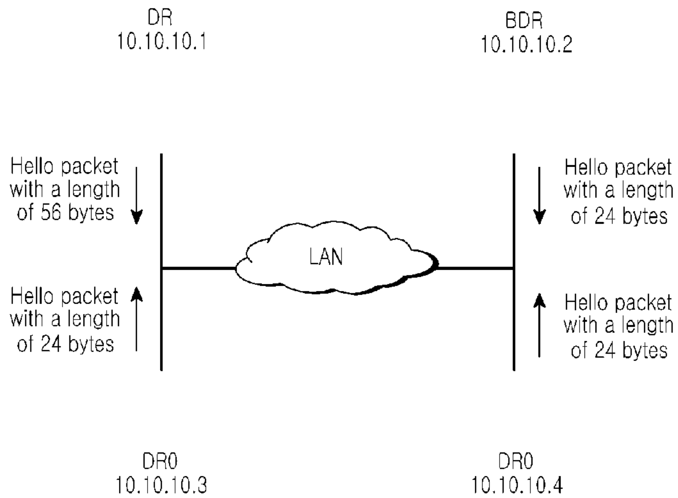
[Fig. 3]



[Fig. 4]

3	1	Packet length = 48	
(10.10.10.1)Router Id			
(0.0.0.0)Area Id			
Check sum		Instance Id	0
Interface Id			
router priority	Options		
10(hello interval)		40(router dead interval)	
10.10.10.1(designated router)			
10.10.10.2(backup designated router)			
10.10.10.2			
10.10.10.3			
10.10.10.4			

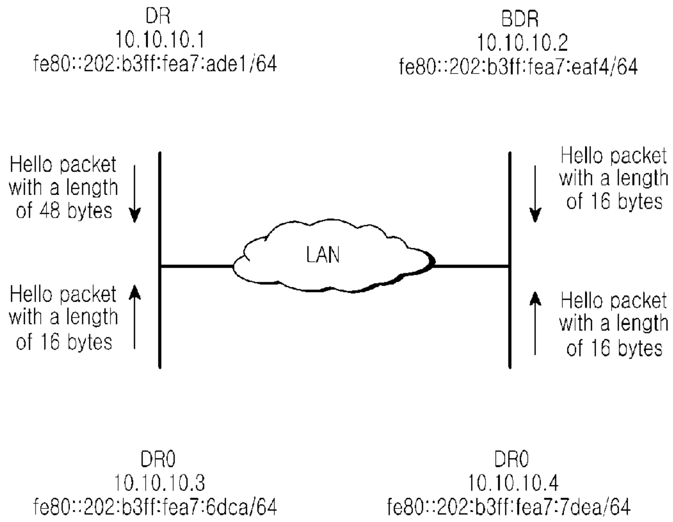
[Fig. 5]



[Fig. 6]

2	1	Packet length = 56
(10.10.10.1)Router Id		
(0.0.0.0)Area Id		
Check sum		Auth Type
Authentication		
Authentication		

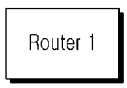
[Fig. 7]



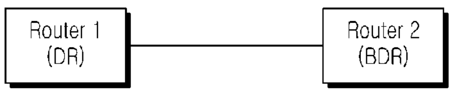
[Fig. 8]

3	1	Packet length = 16	
(10.10.10.2)Router Id			
(0.0.0.0)Area Id			
Check sum		Instance Id	0

[Fig. 9]



[Fig. 10]



[Fig. 11]