Achieving Reliability in Link State Protocol using Efficient Flooding and Traffic Splitting

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ABSTRACT
To find out the shortest path from source to destination, Link State Routing Protocol (LSRP) uses the Open shortest path first algorithm, in OSPF if there is change in network topology, the LSRP generates the Link State Advertisement (LSA) packets. This LSA packet is send to every neighbor node except from which it accept. This mechanism is called the Flooding mechanism , due to this flooding mechanism all the node's will have the same database. If there are N nodes in the network then there is N (N-1) LSA packets are required for database synchronization. In this proposed System, it just not tied to reduce the number of LSA packets flooded into the network by constructing the minimal spanning tree but also it uses the traffic splitting mechanism to send the data. Also to achieve the stability in network it add the extra flooding link at the node, who have the degree of one. So this proposed method , minimize the LSA Overhead.

General Terms
IP wired Network

Keywords
Open Shortest Path First (OSPF), Link State Routing Protocol Link State Advertisement (LSA), Equal cost Multipath (ECMP), Flooding.

1. INTRODUCTION
Most of the network application uses the Link State Routing Protocol (LSRP) to find the shortest path from source to destination, so whenever one of the node (i.e. router) in the network goes down, there is change in the Link state occurs, in this case a link state advertisement (LSA) is generated & flooded in the network. Here flooding means the LSA packet is generated by one of the node (i.e. router) & send to it's neighbor node, then each node sends the received packet to it's all node except from which it receive the packet, because of this, all the nodes in the network have the same database.

If the network contains the N number of nodes then it requires the N(N-1) LSA packets for the flooding, so as the number of nodes in the network increases then number of LSA packets extremely increases and there is the overhead of the LSA, because it requires more bandwidth & CPU utilization for processing the large number of the LSA packets & it cause the instability of the network. So it require the algorithm which reduces this LSA overhead.

Algorithm for reducing the LSA overhead is to shift the paradigm of flooding. It shifts the flooding paradigm from a per-interface to a per-neighbor- nodes [1], which minimize the number of LAS packets flooded, but there is the problem of isolation, which shown in the fig.1. This method is not just thinking of reducing the LSA packets but it also concentrates on splitting the traffic for better utilization of network resources.

As shown in fig. 1 the dotted lines represent the non-flooding links (which will not used for transferring LSA packets) & the solid links represents the flooding links, but this configuration leads to the isolation situation i.e. if one of the link from A-C,C-F fails then there is different groups are formed, this situation is called the isolation situation[9]. To avoid this situation there is need to purpose the efficient flooding mechanism, which guarantee the stability of the network.

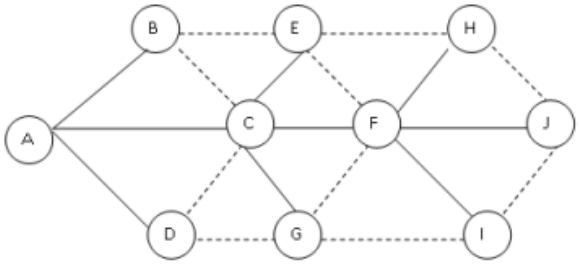

Figure1: The Flooding Limitation (Misconfiguring)

2. LITERATURE SURVEY
In this literature survey, going to study some existing protocols with the help of a single example with consideration of hop by hop forwarding mechanism. As in proposed protocol or in all survey protocols OSPF is used so will start our survey with the same protocol.

Open shortest path first (OSPF) is one of the most popular routing protocol in today's network. Concept behind OSPF is to forward packet with the help of shortest path only from any source to any destination. In OSPF, with the help of hello packet, nodes will come to know about neighbors. Then with the help of Dijkshtra's algorithm, it will calculate shortest path from each and every node to another, but the major problems are the chosen path which is not robust under change in traffic or network state.

In ECMP, First it will check whether it have equal cost path is present to destination. If paths are present then it will send through multiple paths which have equal cost to destination, but ECMP will not calculate current flow on link at runtime.

Next protocol is Load balanced shortest path routing using OSPF (LB-SPR) with the help of two phase forwarding mechanism. It is optimized for arbitrary traffic pattern. When a packet arrives to its source router it will forward the packet to next intermediate router with the help of current load on the link along with the preference of shortest path, then intermediate router send to the destination router with the help of current load on the link along with the preference of shortest path. Likewise this protocol forwards the packet in two phases. First phase is from source node to intermediate node and second is from intermediate node to destination node. Process of changing next intermediate is happening on

each intermediate node. The major consideration is to find out next intermediate node with the consideration of current load on link.

While studying all above protocols it has been observed that they have not fully concentrated on utilization of resources and LSA overhead. While proposing the new protocol design, it fully concentrated to reduce the LSA packets with traffic splitting. The following table shows the tabular information.

Table 1:Literature Survey

Sr	Protocol	Concept	Limitations
1	OSPF (mid of 1980)	1.It uses Shortest path algorithm to reach destination .[4] 2.Use Flooding mechanism to synchronise routing database. [4]	**1.Less utilization of resources.[6]** **2.Does not think about the load on link.[4]** **3.This protocol is not used for arbitrary traffic pattern.[7]** **4.Not minimizing LSA packets**
2	ECMP	1.It split traffic over equal cost multiple paths. [3] **2.Tried to utilize resources [3].**	**1.Does not think about the load on link. [8]** **2.This protocol is not used for arbitrary traffic pattern. [5]** **3.Not minimizing LSA packets**
3	LB-SPR	**1.It is optimized for arbitrary traffic pattern. [7]** 2.Uses Signalling mechanism of OSPF protocol whenever network topology changes. [7] **3.When a packet arrives to its source router, its chose its intermediate router which depends on current load. [7]**	1.Since LB-SPR is using OSPF signalling, it inherits its recovery speed whichis insufficiently low.[7] 2.It required more time to find out next intermediate node with the consideration of current load on link. [7] **3.Not minimizing LSA packets**
4	MSPF	**1.Increase reliability by avoiding the isolation situation.[2]** **2.Reduces the LSA Packets. [2]**	1.Though it takes multiple shortest paths but database synchronization is still a big issue.

3. PROPOSED MODEL

In this model, proposed algorithm for achieving the reliability by avoiding the isolation of group and traffic splitting mechanism with the help of equal distance multiple paths for sending data packets (distance in terms of hops). Add the additional link in the network to achieve the stability. As shown in fig .1 (A,B,D),(C,E,G),(F,H,I,J) are the isolated group. Isolated group consist of the one node of degree more than one & the other nodes having the degree one, so we add the link to all the node whose degree is one, therefore we add the link at the node B-E, D-G, H-J , G-I. At time of adding link we give the highest priority to the group which have large number of nodes having degree one.

Algorithm for adding link:

Step 1: compute the minimum spanning tree.

Step 2: find the node of degree 1.

Step 3: if the group exists in the network go to step 4 else go to step 5

Step 4: add the link

Step 5: stop to add the link.

After adding the flooding link calculate the minimum shortest path from source to the destination , if the network has the equal cost multiple path then, send the data on the multiple path, in that way, it reduces the LSA overhead & traffic also. Every node checks the status of its neighbor node by using the Hello Mechanism. Suppose G=<V,E> where V is set of vertices & E is the set of edges & if the A-C link gets down then node B & D sends LSA packets through additional links B-E & D-G so all the router in the network achieve the synchronization.

Algorithm for the equal distance multiple path [3]:

1. S is the set of settled nodes, the tree database in other words. The nodes whose shortest distances from the source have been found. It contains the nodes in the shortest path in the end.
2. Q is the set of nodes unexamined, organized as candidate database in other words, normally minimum priority queue.
3. d is an estimate of the shortest distance from source to each vertex ,w is the weight of the edge between u and *v* (that is, w[u; *v*]), the link's cost in other words.
4. p stores the predecessor of each node on the shortest path from the source.
5. EXTRACT-MIN operation deletes the minimum element of data structure and returns it.
6. DECREASE KEY[*v*, Q] operation updates the key of element *v* within minheap Q and Update the heap if the heap property becomes violated.

Algorithm 1 Pseudocode [3]

1. For each v € G.V do
2. D{v}= inf
3. P[v]= NULL
4. End for
5. S= NULL
6. Q=G.V
7. While Q and W[Q[1]≠inf] do
8. u=EXTRACT-MIN(Q)
9. S=S U {u}
10. For each *v* adjacent to u do
11. If d[*v*] ≥ d[u]+w[u,*v*]
12. d[*v*]=d[u]+w[u, *v*]
13. p[*v*]=u
14. DECREASE_KEY[*v*,Q]
15. End if
16. End for
17. End while

In this way it compute the equal distance multiple path for sending the data & it try to reduces the traffic as well as the LSA overhead.

4. CONCLUSION

In this paper, proposed the algorithm for reducing the LSA overhead by adding the flooding link between the isolated groups to increase the reliability with traffic splitting method to better utilization of the network resources. In future work,

we will focus on the congestion control, and the different methods of the traffic splitting to achieve optimal traffic engineering and reliability in link state routing protocol.

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