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AN EFFICIENT ALL PATH ROUTING ALGORITHM

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Abstract: In computer networks, the data is transferred in the form of packets. To transfer a packet, there must be a known path. Traditionally single path routing algorithms were used. But that increases traffic load on that link and in case that path breaks down due to any reason then complete communication will stop. Multipath routing may be an alternate of this solution. There are so many multipath routing algorithms like edge disjoint or node disjoint. Through every multipath routing some specific paths are found out, so some path are still unused. So all path routing is used from which all path are find out, due to which efficiency of link increased and utilization of all links also grown up.

Keywords- OSPF, multipath routing, all path routing ,

1. Introduction:

When a packet is sent from source to destination the route must be known by the packet. In internet the task of finding the path is done by routing algorithm on network layer. The most commonly used algorithm is OSPF which implements Dijkstra algorithm. The advantage of OSPF is that there is no hop limit. As it implements Dijkstra which gives the shortest path due to which the cost of sending packets will be less as compared to any other path. [1] But the disadvantage is it find out only a single path which lead to traffic congestion, increase in delay and so on. The way to overcome this problem is to find out multiple paths. Traditionally multiple paths were used only as a backup path. If the primary path has any problem like link failure only then the alternate path was used. No parallel utilization of path is performed. That was implemented only on the stationary traffic. [2] Advantages of finding multiple path are increase in reliability and increase in fault tolerance. [3] According to different algorithm different multiple paths are achieved but not all paths will get. There is probability the find paths are not effective in all condition. Multipath routing was first proposed by Maxemchuk to divide the load between source and destination in packet switching network. The method was shown to distribute load among several paths that increase the overall utilization of network and decrease in delay, better performance and so on. After that the multipath routing is implemented on different networks like ATM, B-ISDN etc. But through multipath routing some paths are remained unknown. To use those paths or increase the efficiency of routes all path routing can be used. [4]

This paper presents the all path routing algorithm which will provide all the possible loop free paths between every source and destination pair. All path routing algorithm gives the packet address of viable next hop according to choice or condition.

2. Related Work:

The first path routing algorithm finds out multiple paths between every source and destination pair that is not necessarily loops free every time. This routing algorithm is designed around a set of loop-free invariant conditions and uses inter-nodal synchronization that spans no more than one hop. Using simulations, the performance of the routing algorithm, in terms of control message overhead and convergence times, is compared with other algorithms. The multiple next-hop choices that MPATH makes available at each node can be used

for traffic load-balancing and minimizing delays in the network. [5]

Multipath algorithm implements the idea to transfer the packet to viable next hop that will not necessarily the part of the shortest distance. To maintain the next viable next hop that use a data structure to maintain the next hop list. That algorithm is mainly used for the link failure. In case there is any link failure occurs that will give the alternate path. [6]

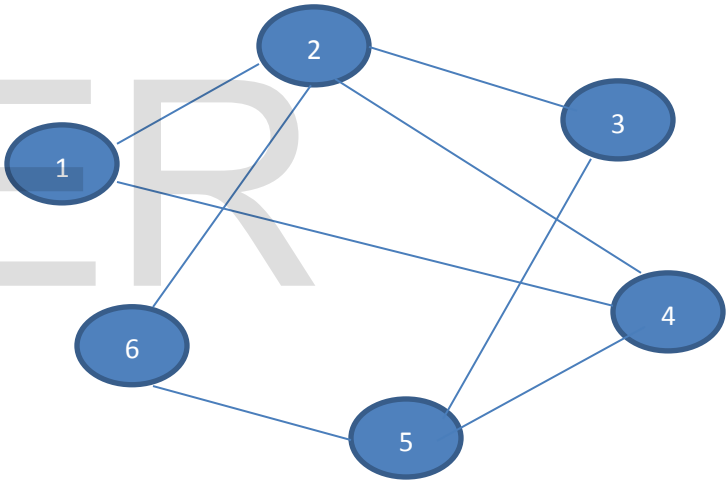
Node disjoint routing algorithm is used as the extension of OSPF algorithm. This algorithm uses the Dijkstra algorithm for finding the shortest path and stores it. The node containing in shortest path are removed with their link and then again Dijkstra algorithm is applied to get the alternate path. The problem with this algorithm is that mostly after two or three paths the network becomes disconnected. And the path chosen by this are not sure minimum cost path. To overcome this Suurbelle Algorithm is used. [7]

The efficiency of node-disjoint path routing subject to degrees of path coupling, with and without packet redundancy. Simulation has validated that, through careful path selection, node-disjoint path routing has the advantage over single path routing is it provide better delivery of packet and less delay in delivery of packet. The improvement is even more substantial when every packet is transferred over both paths. Since traffic is divided into multiple path, energy consumption is compared or less as compared to single path routing However, the energy consumption is higher than that of single path routing if both paths are used for packet delivery due to the much higher traffic load throughout the network. [8]

Multipath routing allows building and use of multiple paths for routing between a source-destination pair. It exploits the resource redundancy and diversity in the underlying network to provide benefits such as fault tolerance, load balancing, bandwidth aggregation, and improvement in QoS metrics such as delay. There are three elements to a multipath routing, namely, path discovery, traffic distribution, and path maintenance. Path discovery involves finding available paths using pre-defined criteria. A popular metric is path disjointness, a measure of resource diversity between paths. Traffic distribution strategy defines how concurrently available paths are used, and how data to the same destination is split and distributed over multiple paths. Path maintenance specifies when and how new paths are acquired if the states of currently available paths change. There are numerous multipath routing protocols proposed for wireless ad hoc networks, exploring characteristics immobility, interference, topology, etc. [3]

3. All Path Routing Algorithm:

All path routing algorithm provides all paths between every pair of source and destination. The advantage of all path routing algorithm is in every condition you have the alternate path. The all path routing used the traditional approach of node to node routing means that one node sends the data to its adjacent node only , now it will depend upon the current node what will be the next node. To implement all path routing algorithm routers must have global information of the local topology.



This is a network in which 1 is source and 4 is destination. To understand the complex graphs create the adjacency matrix of the graph. If there is link between any two nodes then the corresponding value in matrix is non zero.

Adjacency matrix of the above graph is

M=

	1	2	3	4	5	6
1	0	1	0	1	0	0
2	1	0	1	1	0	1
3	0	1	0	0	1	0
4	1	1	0	0	1	0
5	0	0	1	1	0	1
6	0	1	0	0	1	0

All paths between 1 and 4 are

1 → 4

1 → 2 → 4

1 → 2 → 3 → 5 → 4

1 → 2 → 6 → 5 → 4

There is no possibility of more than above paths. The packet can choose any path from them according to their requirements.

Characteristics of All Path Routing Algorithm:

i) Hop to Hop Routing: This algorithm uses the traditional approach of hop to hop routing. Means that next node is decided by current node only.
ii) Load balancing: Data can pass through more than one than path simultaneously. That leads to less overhead to single path.
iii) Reliability: Chances of a packet to reach their destination is increased.
iv) All Paths: Each and every path from source to destination is listed. Route can choose according to your requirement.
v) Loop free: Path accepted by packet to reach their destination is always loop free. Means a finite hop count.

Purposed work:

In this paper All path routing algorithm is presented. The main thing that must be kept in mind before implementing all path algorithm is the global information of topology. From network, link adjacency matrix is derived that gives help in finding the adjacent nodes. From that knowledge tree is created having source node as a root node.
The main condition in this algorithm is that there must not be any cycle. To implement this data structure is used for every hop.
Data structure is an array which carry adjacent node. At first all the nodes are unvisited and black in color. As the node traversed the color of nod is changed in white color and the node traversed once stored in a separate array. Due to color metric one node is traversed only once, that prevents the existence of loop.

Algorithm:

All(u,v,s,d)
s ←Source
d ← destination

1. a[u,v] ← Adjacency matrix
2. if a[u,v] !=0
   adj[u] ← v
3. in starting every node is unvisited
   color[u] ← black
   path[u]=0
4. Start from source node.
   u←s
   Color[u]←white
   Root←u
   Path[u]←u
   Path []++
5. If u==d
   Then return path[u]
   Else
   Start adj[u]
   If color [adj[u]] != white
   Child[u]←adj[u]
6. Go to step 4
7. Path[u]--;
8. Color[u]=black
9. end

Advantage and disadvantage:

All path routing increase the efficiency of the data transfer and full utilization of all links in network that leads to increase in reliability, increase fault tolerance and from this algorithm from one tree we can traverse every path for every destination. And main disadvantage of this algorithm is during implementation there must be complete knowledge of topology.

Conclusion:

All path routing algorithm provides all the possible loop free paths between every source and destination pair. That improves the efficiency of the network and complete utilization of network. That leads to less traffic load and higher reliability. This algorithm is under implementation in MATLAB. Due to dividing of the data in different paths leads to less power consumption and decrease the complexity. The maximum complexity to traverse a path from source to destination is O(v).

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