A Directed Acyclic Graph Based Efficient Technique for Multipath Routing

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Abstract—Nowadays the demand of network is increasing rapidly. The rationally growing applications of such network requirements also demands fast recovery from network or link failures. Multipath routing is one of the most promising routing schemes to accommodate the diverse requirements of the network. Load balancing and improved bandwidth are the two main advantages of the multi path routing. Cheo introduced a reliable multipath routing scheme known as directed acyclic graphs. The property of directed acyclic graph is that they enable multipath routing with all possible edges while ensuring guaranteed recovery from single point of failures. We have used the concept of DAG in our proposed method.

Keywords—Multipath Routing, Increased bandwidth, Directed Acyclic Graphs, Recovery from link failure.

I. INTRODUCTION

Multipath routing, sometimes called traffic dispersion [8], has been one of the most important current directions in the area of routing. The current routing is based on the single path routing - between a source and a destination, the single minimum-cost path tends to be selected although different cost metrics may yield different paths. Though in a practically well-connected network there may exists several paths between a source-destination pair. The concept of multipath routing is to give the source node a choice at any given time of multiple paths to a particular destination by taking advantage of the connectivity redundancy of the underlying network. The multiple paths may be used alternately, the traffic uses or runs on one path at a time.

Multipath routing has drawn extensive attention in MANETs and WSNs recently. The deployment of a large number of nodes in a network makes the multipath routing a nature and promising technique to cope with the frequent topological changes and consequently unreliable communication services.

Advantages of Multipath Routing:

- Optimum Load Balancing: Load balancing is also a very important advantage of the multi path routing. In this scheme, we can send the data using the parallel channels in such a way that the load is properly balanced at each path [8].
- Delay time is reduced: The delay time is minimized in multipath routing because alternate routes are identified during route discovery [4].
- Increased Bandwidth: By splitting data to the same destination into multiple streams while everyone is routed through a different path the effective bandwidth can be accumulated. This scheme is chiefly favourable when a node has multiple low bandwidth links but it requires a bandwidth that is greater than the one which an individual link can provide [4].

Link-independent (node-independent) DAGs satisfy the property that any path from a source to the root on one DAG is link-disjoint (node-disjoint) with any path from the source to the root on the other DAG. A polynomial time solvable algorithm is proposed in [1] computes link-independent and node-independent DAGs. Author [2,3] first proposes a modified version of the popular AODV protocol that allows us to discover multiple node-disjoint paths from a source to a destination. The proposed method [4] extracts the resource redundancy and diversity in the underlying network. It provides benefits such as fault tolerance, recovery from link failure, load balancing, security, bandwidth aggregation, and improvement delay metric. The spread scheme is proposed in work done in [6]. The SPREAD is based on two principles, one is secret sharing and the other one is multipath routing. Connection less multipath routing is proposed in [5].

Problem domain:

Most of the present multipath routing methods use multiple routing tables. Also it is clear that when multiple routing tables are employed then a packet has to carry in its header the routing table to be used for forwarding. Therefore, when the corresponding forwarding edge is not available, then in that case the packet needs to be dropped. So dropping is forced due to the potential looping of packets when transferred from one routing table to another.
II. BLOCK DIAGRAM OF THE PROPOSED MODEL

Proposed model is shown in figure-1.

![Block Diagram]

III. PROPOSED METHODOLOGY

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1. Initialize R and B to contain only the root node d. Initialize the partial order of the nodes on the red and blue DAGs to be empty.

2. Find a cycle (d, v1, ..., vk, d). Let vk → d be the red chain and v1, v2, ..., vk → d to be the blue chain. Then link the blue chain to B and the red chain to R. Update the precedence relation with d < v1 < v2 < ... < vk on the red DAG.

3. Find a path (x, v1, ..., vk, y) that connects any two distinct nodes x and y on R and any k nodes not on R, k >= 1, such that x < y on R on there does not exist an order between x and y on R, Let y → vk → vk-1 ... v1→x be the red chain and x → v1 → v2 ... vk → y be the blue chain. Add a blue chain to B and the red chain to R. Update the precedence relation with x < v1 < v2 < ... < vk < y on the red DAG. Note that: (i) if y = d, then vk < y ignored; and (ii) if y = d and/or x = d, y → vk and/or x → v1 in the red and blue chain above respectively.

4. If B does not span all the nodes in G then goto step 3.

5. Compare a global order that consistent with the partial on the red DAG. Here x precedes y are denoted in the global order as x < y.

6. For every link i→j (i != d, j != d) that is not on the DAG; If i < j then add i → j to the red DAG and i → j to the blue DAG. Otherwise add i → j to the blue DAG and i → j to the red DAG. For every edge i → d that is not on the DAGs, add i → d either to the red or the blue DAG randomly.

Outcomes:
- Load balancing
- Bandwidth aggregation
- Congestion reduction
- Recovery from link failure
- Less packet drop rate

IV. CONCLUSION
As the cost of hardware devices decreased and there is steady increase in resource availability voice over IP and other multimedia data streaming is increased. In such applications high bandwidth is expected besides faster recovery from single point of failures. To achieve high bandwidth and recovery from the failure, a good solution multipath routing can be used. We will implement and present these features in our next paper.

REFERENCES