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# Comparative Study on Secure Multipath Routing

Vinit Patel<sup>1</sup> Saumya Lahera<sup>2</sup>, Dwij Bhatt<sup>3</sup>, Jigar Patel<sup>4</sup>

B.E.Student, Dept. of Computer Engineering, MCT's RGIT, Mumbai, India<sup>1</sup>

B.E.Student, Dept. of Computer Engineering, SAKEC, Mumbai, India<sup>2,3,4</sup>

**ABSTRACT:** Multipath routing is a technique that allows for computer network communications to be sent over multiple alternate paths. This is in contrast to a single routing protocol, where a data stream is directed along a single path from a source to a destination. With multiple paths, the source and destination pair can use any number of alternate routes to achieve performance enhancements, connection stability, and potential security improvements. Multipath routing is a promising technique to increase the Internet's reliability and to give users greater control over the service they receive. There are three elements to a multipath routing namely -path discovery, traffic distribution, and path maintenance. Path discovery means finding different available paths from source to destination using pre-defined criteria. In Traffic distribution a multipath protocol may decide to forward data using only the path with is the best and keep other discovered paths as backups. Or the paths may be used concurrently. Path maintenance specifies when and how new paths are acquired if the states of currently available paths change. The main goal is to discover multiple source to destination paths with a low routing overhead during a route discovery. It is typically proposed in order to increase the reliability of data transmission.

**KEYWORDS:** Path Discovery , Traffic Distribution , Path Maintenance.

### I. INTRODUCTION

Multipath routing, sometimes called traffic dispersion , 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. However, in a reasonably well-connected network, there may exist 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, namely, traffic taking one path at a time, or they may be used concurrently, namely, traffic flowing through multiple paths simultaneously.

Multipath routing was first proposed by Maxemchuk to spread the traffic from a source in space rather than in time as a means for load balancing and fault handling in packet switching networks. The method was shown to equalize load and increase overall network utilization; with redundancy, it improves the delay and packet loss properties at the expense of sending more data through the network. Since then, the multipath routing technique has been applied to various types of networks, such as the communication networks, B-ISDN, ATM networks, etc.,

In networks all nodes are can be connected dynamically in an arbitrary manner. All nodes of these networks behave as routers and take part in discovery and maintenance of routes to other nodes in the network. Therefore, routing protocols in ad-hoc networks must be adaptive to face frequent topology changes because of node mobility. Unlike conventional wireless networks, ad hoc networks have no fixed network infrastructure or administrative support. The topology of such networks changes dynamically as mobile nodes join or depart the network or radio links between nodes become unusable. Conventional wireless networks require as prerequisites a fixed network infrastructure with centralized administration for their operation.

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## II. ELEMENTS OF A MULTIPATH ROUTING PROTOCOL

Three elements of multipath routing include path discovery, traffic distribution, and path maintenance which are explained below.

### 2.1. Path Discovery:

Since data transmission in wireless sensor networks is commonly performed through multi-hop data forwarding techniques, the main task of the route discovery process is to determine a set of intermediate nodes that should be selected to construct several paths from the source nodes towards the sink node. If the node has already received the request it drops the packet. If the node itself the target node then the route discovery is over and the node returns the path to the sender. If not then the node appends its own address to the list of traversed nodes and broadcast this updated request.

#### A. Disjoint Multipath Routing

In sensor-disjoint path routing, the primary path is available whereas the alternate paths are less desirable as they have longer latency. The disjoint makes those alternate paths independent of the primary path. Thus, if a failure occurs on the primary path, it remains local and does not affect any of those alternate paths .

#### B. Braided Multipath Routing

To construct the braided multipath, first the primary path is computed. Then, for each node on the primary path, the best path is computed while it does not include that node. Those best alternate paths are not necessarily disjoint from the primary path and are called idealized multi-paths.

### 2.2 Traffic Distribution:

In spite of path discovery of multiple paths issue, another important issue that is discussed here is traffic distribution Multipath routing algorithms that optimally split traffic into a given set of paths investigated in the context of flow control .It is worth noting that the selection of the routing paths is another major design consideration that has a drastic effect on the resulting performance .

#### A. Number of Paths

A protocol can use a single path and keep the rest as backups, or it can utilize multiple paths in a round-robin fashion, with only one path sending at a time . A protocol can choose to use a single path and keep the rest as backups, or it can utilise multiple paths in a round-robin fashion, with only one path sending at a time. If multiple paths are used concurrently to carry traffic, the protocol needs to decide how traffic is split over the paths and how to handle out-of-order packets at the destination.

#### B. Allocation Granularity

The traffic allocation strategy that is used deals with how the data is distributed amongst the paths. The choice of allocation granularity, which is important in traffic allocation, specifies the smallest unit of information allocated to each path . Some possible choices of traffic granularity include, in order of increased control overhead, per source-destination pair, per flow, per packet, per segment. With a fine granularity, load balancing can be more efficient.

### 2.3 Path Maintenance:

In multipath routing, the process of route discovery can be done when one of the routes fails or it may occur after all of the routes fail. Waiting for all routes to fail before performing a route discovery would result in a delay

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before new routes are available. It should be noted that initiating the process of route discovery can make high overheads whenever one of the routes fails. When the route maintenance indicates that the source route is broken ,source can attempt to use any other route it happens to know to the destination ,or can invoke route discovery again to find the new route,

### **III BENEFITS OF MULTIPATH ROUTING**

#### *3.1 Fault tolerance:*

In the a fault tolerance system the system continue to operate properly in the event of the failure of some of its components.The original idea behind using multipath routing approach in WSN was to provide path and reliable data transmission from source to destination.

#### *3.2 Load Balancing:*

As traffic distribution is not equal in all links in the network, spreading the traffic along multiple routes can alleviate congestion in some links and bottlenecks .When a link becomes over-utilised and causes congestion, multipath routing protocols can choose to divert traffic through alternate paths to ease the burden of the congested link.

#### *3.3 QoS Improvement:*

QoS support in terms of network throughput, end-to-end latency and data delivery ratio is an important objective in designing multipath routing protocols for different types of network.

#### *3.4 Reduced Delay:*

The delay is minimized in multipath routing because backup routes are identified during route discovery .For wireless networks employing single path on-demand routing protocols, a route failure means that a new path discovery process needs to be initiated to find a new route.

This results in a route discovery delay. The delay is minimised in multipath routing because backup routes are identified during route discovery .

#### *3.5 Bandwidth aggregation:*

By splitting data to the same destination into multiple streams, each routed through a different path, the effective bandwidth can be aggregated. This strategy is particular beneficial when a node has multiple low bandwidth links but requires a bandwidth greater than an individual link can provide. End-to-end delay may also be reduced as a direct result of larger bandwidth.

### **IV COMPARATIVE STUDY**

SR NO.	ALGORITHM	ADVANTAGES	DISADVANTAGES	CONCLUSION
1.	Destination Sequence Distance Vector(DSDV)	The Protocol converge quickly via triggered updates.	Most Routing Information is not Used.	With the use of sequence number it is loop free all the time
2.	Fisheye State Routing.(FSR)	To Reduce routing updates in Ad hoc	Route Table size Still Grows linearly.	Quality of service is improved.

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		Network.		
3.	Optimized Link State Routing(OLSR)	To improve the reliability of network transmission	It is not aware of the link quality.	It enhance reliability in transmission
4.	Dynamic Source Routing (DSR)	Route Discovery And Route Maintenance both operate entirely on an on demand basis.	The route maintenance does not locally repair a broken link.	It has high reactive Services.
5.	Ad-hoc on Demand Distance Vector.(AODV)	If link breakage does not affect the ongoing transmission no Global broadcast occurs.	Difficult to Maintain Multiple routes between same pair of source and destination.	Reduces need for route maintenance.
6.	Cluster Head Gateway Switch Routing(CGSR).	To improve network performance like throughput.	Efficiency is average.	Low signalling cost can find multiple routes.
7.	Hierarchical State Routing(HSR)	It uses hierarchy information to reduce table size.	Large amount of data is to be stored.	It organizes routers into autonomy Systems.
8.	Zonal Routing Protocol	It has low overhead of message control	It increases complexity.	It has high latency in discovering routes.
9.	Greedy Perimeter Stateless Routing(GPSR)	Avoids flooding for connect /disconnects.	Hogs bandwidth since entire topology table is broadcast with each update.	It greatly reduces control overhead.
10.	Location Aided Routing(LAR)	It is similar to DSR.	It utilizes location information to discover new area of source to destination.	It performs route discovery through limited flooding.

TABLE (4. 1) COMPARISON OF DIFFERENT ALGORITHMS

### V.CONCLUSION

DSDV, OSR and FSR type of protocol finds a route on demand by flooding the network with Route Request packets. The main disadvantage of these algorithms is that it has a high latency time in route finding and Excessive flooding can lead to network clogging.

DSR and AODV type of protocol combines the advantages of proactive and reactive routing. The routing is initially established with some proactively prospected routes and then serves the demand from additionally activated nodes through reactive flooding. The choice of one or the other method requires predetermination for typical cases. The main disadvantages of such algorithms it depends on number of other nodes activated .Reaction to traffic demand depends on gradient of traffic volume.In AOA V Significant reduction in control overhead as compared to DSDV.

Hierarchical type which includes CGSR HSR and ZRP type of protocol the choice of proactive and of reactive routing depends on the hierarchic level in which a node resides. The routing is initially established with some proactively prospected routes and then serves the demand from additionally activated nodes through reactive flooding on the lower levels. The choice for one or the other method requires proper attribution for respective levels .The main disadvantages of such algorithms are that it depends on depth of nesting and addressing scheme. Reaction to traffic

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demand depends on meshing parameters.ZRP performs better than any single proactive or reactive protocol. No clear consensus on which of the two produces better clustering.

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