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Impact of Routing Overhead On Performance of ZRP & TORA Under Varying Transmission Range

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Abstract- In this paper we describes and analyzes the impact of routing load on the performance evaluation of Zone Routing Protocol (ZRP) and TORA, which are hybrid mobile ad-hoc protocols which fragments the network into overlapping routing zones, allowing for the use of independent protocols within and between the zones. ZRP performance better than other protocols, but increase network load by use of useless control packets and decrease of network performance.

Keywords- ZRP (zone resolution protocol), IARP, IERP, BRP, PDR, TORA, MANETs (Mobile Ad-Hoc Networks), NS-2.33 simulator.

1. INTRODUCTION

In day to day communication, wireless networks have continued to play extravagant roles it is having various applications like military applications, industrial applications and even in personal area networks. Due to different value attributes like simplicity of installation, reliability, cost, bandwidth, total required power, security and performance of the network it is very popular in different applications in various fields. They also make use of fixed infrastructures [7] such as cordless telephone, cellular networks, Wi-Fi, microwave communication, Wi- MAX, satellite communication and RADAR etc like as wired networks. Due to user base of independent mobile users, need for efficient and dynamic communication in emergency/rescue operations, disaster relief efforts, and military networks and also for different applications [3], [11], the next generation wireless ad-hoc networks are widely used. As the network occupies a large geographical region without fixed topology which may vary dynamically and unpredictably? Thus these type of networks improve the scalability of the network, when compared with the infrastructure-based wireless networks because of its decentralized nature. Due to the minimum configuration and quick operations [13], [16], ad-hoc network provides better performance, in various fields such as natural

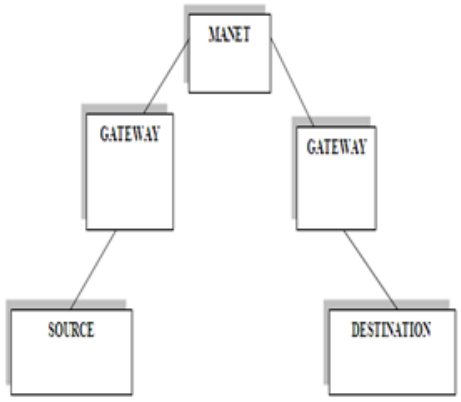

Fig.1: Infrastructure based wireless network

disasters, military conflicts etc, The classification of Adhoc networks can be done on the basis of their applications: Mobile Adhoc Networks (MANETs), Wireless Mesh Networks (WMNs) and Wireless Sensor Networks (WSN).AMANET is a network which is a collection of mobile nodes [4]; these nodes are struggling to come up with the normal effect of radio communication channels, multi-user interference, multi-pathfading, shadowingetc.

2. MANET

MANET (Mobile Ad-hoc Network) is a type of Ad-hoc network with rapidly changing topology, having a large span and connect hundreds to thousands of nodes [1].Similarly, Reconfigurable Wireless Networks (RWN) refers to Ad-hoc networks which are large and that can be deployed without infrastructure rapidly and having highly mobile nodes [2].Nodes in a MANET are highly mobile, the topology changes frequently and there is dynamically connection of nodes. Velocity of the nodes decides the rate of change. Transmission power is limited, if the devices are small. Hence there is small radio coverage of nodes. Number of neighbor nodes, are limited by low transmission

power, hence

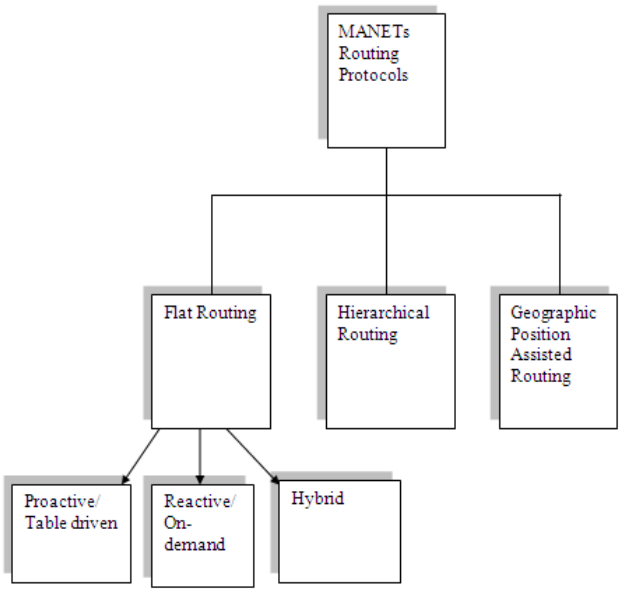

Fig2: Classification of MANET Routing Protocols

Rate of change in the topology as the node moves increases. The links are unreliable due to interference and fading, which further lead to high operating frequency in an urban environment. Low bandwidth links is characterization of Ad-Hoc networks. Some of the links may be Unidirectional, due to differences in transmission capacity. Thus due to this, we have link instability and mobility of nodes there is frequent change in topology and difficulty in routing. Here, it is important to check out important difference to approaches related to conventional routing: In wired networks, there is presence of link which is bi- directional. If a node X can send packets to a node Y, we know that node Y can send packets back to node X, and a reverse path can be entered. In wireless network, this may not be happen as we have the great influence of physical location and the individual power resource upon a capacity of transmission nodes and signalstrength. The protocols are IP based that are used in routingthe MANET and various approaches may be use like unicast, multicast or hybrid approaches and IP services can be allowed to interact as a completely separate entity.

1. **Introduction toZRP**

Zone routing hybrid protocol (ZRP) [14] was first introduced by Haas and Pearlman, in which whole network area is divided into several small zones to perform its operation. Zone size or radius does not depend on distance or radius; it depends on the number of hops and applicable in a wide variety of mobile Ad-hoc network with diverse mobility across a large span [15]. A separate strategy to find out a new route between nodes, which are lying within or outside the zone, is used by ZRP. There are four elements available in ZRP: MAC level function, IARP, IERP and BRP. IARP, proactive approach is used to discover a new route within the zone and links are considered as unidirectional in this case. It uses IERP, on-demand routing approach, to communicate with the nodes, which may be located outside the zone [8].

Routing zone topology and proactive maintenance which improve the routing efficiency and the globally reactive routing using query/reply mechanism improves the quality ofdiscovering in ZRP [12].The important parameter of ZRP is zone radius. For slowly moving nodes and high demand of route scenarios, a large routing zone is more suitable. In fixed topology, network zone would be infinitely large. Pure proactive routing protocols are best suited in fixed Internet. Smaller routing zone is suitable for minimum nodes and where demand of route is low. When zone size is exactly one, than ZRP works as a normal flooding protocol.ZRP employs MAC protocol and NDP (NeighborDiscoveryprotocol) respectively [13] in order to identify the direct neighbor nodes and the other nodes within the zone.

Intra zone Routing Protocol (IARP) Intra zone Routing Protocol (IARP) is an important part ofZRP routing protocol. It is a family of limited-depth, linkstate, proactive routing, but not a specific routing protocol. It establishes new route for nodes, which are located in thesame zone. From neighbor to neighbor, IARP efficientlyguides route queries outward through border-casting andrelaying queries blindly.

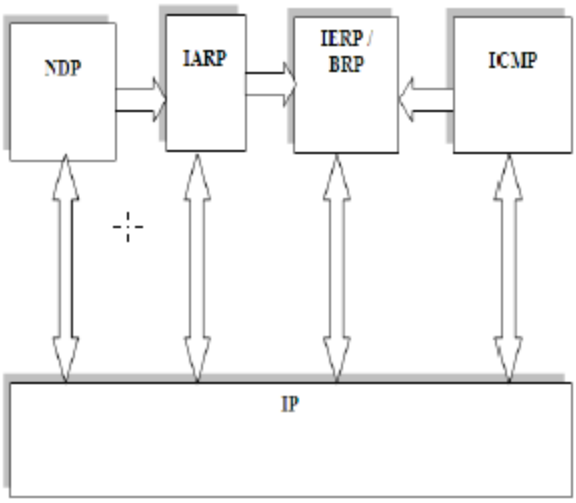

Fig. 3.A complete tree diagram of route maintenance

2. **Inter zone routing protocol (IERP)**

To communicate with the nodes of different zones, ZRP uses Inter zone routing protocol (IERP). To find out a new route, it follows reactive approach. Instead of sending queries to other nodes by traditional flooding, IERP uses BRP for increase in efficiency. IERP provides the local support based on the routing information of IARP [14], for unidirectional links. To discover the global route and facilitates the services to maintain the routes based on local connectivity of Intra zone routing protocol, Inter zone routing protocol is used.

3. **Border cast Resolution Protocol (BRP)**

The Border cast Resolution Protocol, or BRP, is used in the ZRP and used to direct the route requests initiated by the global reactive IERP to the peripheral nodes. Due to this it maximizes the efficiency by removing redundant queries, by utilizes the map provided by the local pro-active IARP to constructs border cast tree. As it is packet delivery service, thus it is not so much a routing protocol, unlike IARP and IERP.

Introduction to TORA

Temporally ordered routing algorithm (TORA) is a reactive routing protocol, which is also known as link reversal protocol. In solving the existing limitations of MANETs, this protocol is effective. In MANETs, we have a problem of congestion due to the high mobility of nodes. Traditional shortest path algorithm, adaptive shortest path algorithm, and link state routing cannot work properly in mobile networks. Routing tables of dynamic nodes is difficult toupdate. Each node broadcasts a query packet and the recipients broadcast an update packet in case of TORA, thatsupports the loop-free, multiple route facilities. Better scalability is also provided by the "flat" non-hierarchical routing algorithm. Directed acyclic graph (DAG) algorithmis used to discover a new route and also uses a set of totally ordered height values at all times. In this approach, information flow is in only one direction [13]. Hence it is only unidirectional; there is no chance to fall in an infiniteloop. Route creation, route maintenance, route deletion, andoptimizing routes [15], these are four basic operationsperformed.

TORA Properties

Scattered routing: each router needs to maintain information about the adjacent routers only.

• Loop-free routing: the use of DAG ensures that information always flows in one direction [16].

• To improve the congestion, multiple routes are established [16].

• To maximize the utilization of bandwidth, minimize the communication overheads [16].

• Support of link status sensing and neighbor's delivery, reliable control packet delivery and security authentication is provided by TORA [16].

3. RESULTS and CONCLUSIONS

The following performances metrices are used to evaluateand analyze the performance of routing protocols. But inthis case, we are analyzing the graph and impact of routing overhead on ZRP and TORA.

 Packet Delivery Ratio

- Average End to End Delay
- Throughput
- Routing Message Overhead

Routing Message Overhead

It is calculated as total number of control packets transmitted. The increase in routing message overhead reduces the performance of the ad hoc network. Results showing the impact of varying transmission range (50 to200 meters) in Table 1.

Table 1: Parameter Analysis

Parameter	Transmission Range (varying)			
	50m	75 m	100 m	125m
Routing Overhead (For ZRP)	2 20.1	1 14.644	1 15.545	1 16.665
(For TORA)	8 8.371 869	6 6.1854 98	7 7.6042 19	1 10.033 06

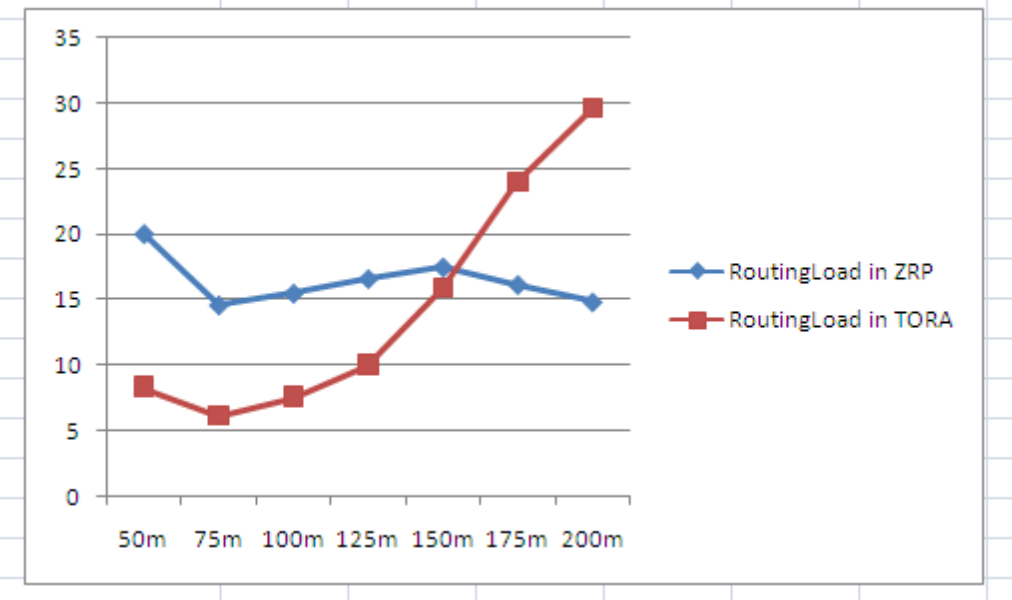

Fig 4 : Graphical Analysis of Routing Overhead

Thus we can say that as we are increasing the transmission range, the value of routing overhead decreases in case of ZRP. While in case of TORA, routing overhead varies with the transmission range, which is not desirable. As the valueof routing overhead should be less and the rest parameters analysis is done in the same way by using the NS 2.33 simulator.

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