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Multipath Routing Protocol for Effective Local Route Recovery in Mobile Ad Hoc Network (Manet)

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***Abstract* — In mobile Ad hoc network, frequent mobility during the data transmission of data causes route failure which results in route discovery. In this we propose multipath routing protocol for effective local route recovery in mobile Ad hoc networks. In this protocol each source and destination pair establishes multiple paths in single route discovery and they are cached in their route caches. The cached routes are sorted on the basis of their bandwidth availability. In case of route failure in the primary route, a recovery node which is an over heading neighbor, detects it and establishes a local recovery path with maximum bandwidth from its route cache. This proposed technique improves network performance and it prevents frequent collision.**

***Index Terms*—Local Route Recovery, Ad Hoc Network, MANET, Multipath Routing.**

I. INTRODUCTION

In mobile ad hoc networks, frequent mobility during the transmission of data causes route failure which results in route rediscovery. Propose multipath routing protocol for effective local route recovery in Mobile Ad hoc Network (MANET). In this protocol, each source and destination pair establishes multiple paths in the single route discovery and they are cached in their route caches by sorting on the basis of their bandwidth availability. In case of route failure in the primary route, a recovery node which is an overhearing neighbor, detects it and establishes a local recovery path with maximum bandwidth from its route cache.

Provide new theoretical results for the route recovery management technique to avoid the frequent collision and degradation in the network performance, providing useful insights into the differences in performances between MP-LRR and MLAR. Simulation and theoretical results show that MP-LRR has greatly improved network performance over MLAR.

In mobile Ad hoc network, frequent mobility during the data transmission of data causes route failure which results in route discovery. In this we propose multipath routing protocol for effective local route recovery in mobile Ad hoc networks. In this protocol each source and destination pair establishes multiple paths in single route discovery and they are cached in their route caches.

II. LITERATURE SURVEY

In this paper Mobile ad hoc Networks (MANETs) are self -configuring, dynamic networks in which nodes are free to move. The issues related to MANET routing are unpredictable of environment, unreliability of wireless medium, resource constrained nodes and dynamic topology. These issues may result in faults such as transmission errors, node failure, link failure, route breakages, congested nodes or links.

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Traditional on-demand routing protocols produce a large amount of routing control traffic by blindly flooding the entire network with (RREQ) packets during route discovery.The routing overhead associated with the dissemination of routing control packets can be quite huge, especially when the network topology frequently changes.

In this, proposed multipath routing protocol for effective local rout recovery in mobile adhoc network (MANET). In this, in case of route failure in the primary route, the recovery node detects it and establishes a local recovery path with maximum bandwidth from its route cache.

The route recovery management technique is handled to avoid the frequent collision and degradation in the network performance. By simulation results, we have shown that the proposed approach improves network performance.

III. MOBILE AD HOC NETWORK

Mobile Ad hoc Network is most popularly known as MANET. It is a self-configured network of mobile routers (and associated hosts) connected by wireless links and this union forms a random topology. Routers move randomly free. Topology changes rapidly and unpredictably. These networks may operate in standalone fashion or may be connected to the larger internet.

3.1 Characteristics of Manet

1. Quick deployment
2. Strength
3. Flexibility
4. Essential support for mobility

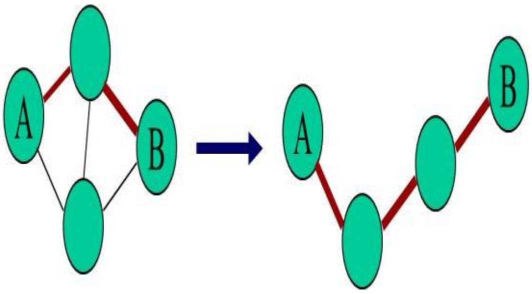

Figure 3.1: Mobility of Nodes

3.2 Application

1. Emergency situations like naturals or human-induced disaster
2. Military conflicts

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3. Wireless mesh
4. Sensor networks
5. Collective and distributed computing
6. Hybrid network

IV. SCOPE OF THE PROJECT

The main scope of the project is to establish a multiple path in a single route discovery and they are cached in their route caches by sorting on the basis of their bandwidth availability, which can be used in the case of route failure in the primary route.

4.1 Problems in the Networks

Wireless Mobile ad hoc Networks (MANETs) are self -configuring, dynamic networks in which nodes are free to move. The issues related to MANET routing are unpredictable of environment, unreliability of wireless medium, resource constrained nodes and dynamic topology. These issues may result in faults such as transmission errors, node failure, link failure, route breakages, congested nodes or links.

Traditional on-demand routing protocols produce a large amount of routing control traffic by blindly flooding the entire network with (RREQ) packets during route discovery. The routing overhead associated with the dissemination of routing control packets can be quite huge, especially when the network topology frequently changes.

Previous versions of multipath routing protocols cache multiple routes to a destination in a single route discovery. However, in the presence of mobility, multipath protocols incur additional packet drops and delay due to their dependency on potentially stale routes from caches. Protocols using either limited broadcast or local error recovery have focused on reducing packet drops and not on utilizing the available bandwidth efficiently during route recovery.

4.2 Solution

Proposed hybrid technique involves multipath discovery and local error-recovery. Whenever a link or a route break is occurring, a local error recovery is performed which in turn invokes the alternate route selection. An effective alternate route is selected from the route cache which is more consistent and having greater available bandwidth. Hence it avoid the packet drops and delay in transmission of data to the destination.

Moreover, the multipath routing protocol tries to find disjoint nodes, disjoint link and non-disjoint routes. The route recovery technique is handled to avoid the frequent collision and degradation in the network performance.

In this, proposed multipath routing protocol for effective local rout recovery in mobile Adhoc network

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(MANET). In this, in case of route failure in the primary route, the recovery node detects it and establishes a local recovery path with maximum bandwidth from its route cache. The route recovery management technique is handled to avoid the frequent collision and degradation in the network performance. By simulation results, we have shown that the proposed approach improves network performance.

V. PROPOSED TECHNIQUE

5.1 Multipath Routing

Multipath routing is defined as a routing technique of using multiple alternative path through a network which can yield a variety of benefits such as fault tolerance, increased bandwidth or improved security.

An effective multiple alternative path selected from the route cache which is more consistent and having greater bandwidth availability.

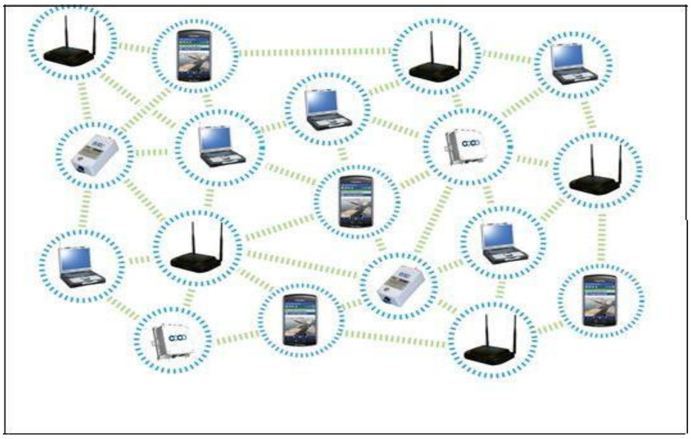

Figure 5.1: Establishing Multiple Paths among Mobile Nodes

5.2 Components in Multipath Routing

1. Route discovery
2. Route maintenance
3. Traffic allocation

Multipath routing protocol also tries finding the followings such as

1. Disjoint nodes
2. Disjoint links
3. Non –disjoint nodes

5.3 Bandwidth Measurement

Let us consider N routes *(n1, n2... nN)* are discovered between source and destination nodes. With the help of time slots in the destination node, the route of maximum bandwidth (B) can be found out as follows

$B = Min(T/2, Tbi)$

Where,

T= Number of total time slots in every route

Tbi= Number of free time slots in the bottleneck link of route

5.4 Steps Involved in Multipath Routing Technique

Step 1: Whenever a data packet needs to forwarded by the source node to the destination and no route is found in the cache, then the source floods the route request (RREQ) packets to the entire network.

STEP 2: If the non-duplicate RREQ packets reaches the intermediate nodes, it attaches the node ID to the packet and continues broadcasting.

STEP 3: If the duplicate packets are received, instead of dropping all the duplicate packets, only those that are received from the longer routes are dropped thus minimizing the packet drop.

STEP 4: Even if, route information to the destination is present in the route cache of intermediate node, it has no permission to send a Route Reply (RREP) back to source and permission is given only to the destination node.

STEP 5: The destination node upon receiving all RREQ packets attaches the route code and feeds it back as RREP packets. Let n RREP packets are generated for the paths p1,p2,....,pn. The route code is to recognize the available bandwidth. The RREP with route code Rc1 has a maximum available bandwidth and RREP with route code Rc2 has next maximum bandwidth availability and so on. The priority condition for bandwidth selection is as follows:

$B1>B2>B3>B4........>Bn$

Where $B1.B2,B3,....Bn$ are the available bandwidth of the routes.

STEP 6: After the intermediate node receives RREP packets, they store the routes p1,p2,....pn in their route caches and then forward them to subsequent nodes.

STEP 7: Upon reception of RREP packets, the source node selects the primary route based on the route code.

STEP 8: In case of route failure in the primary route, the recovery node detects it and establishes a local recovery path with maximum bandwidth (which is the first available path) from its route cache.

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5.4.1 Route Recovery Technique

During the data transmission, the node mobility and low battery power are the issues causing route breakage. To handle this, a local recovery mechanism is triggered which is based on the establishment of recovery nodes. The sequence of steps involved in route recovery technique is as follows:

The nodes that overhear transmitted data on the k sequence of nodes in the primary nodes are selected as recovery nodes In case the primary route attempts transmission of the data packet to the failed route, the recovery node detects it and initiates route recovery phase

The recovery nodes listen to the retransmission and then waits for overhear acknowledgement. If no overhear acknowledgement is heard, then the recovery nodes forwards Vary Route(VR) packet to the that attempts retransmission

When node receives VR, it updates the route cache and forwards the Ack to recovery node. When the recovery node receives node receives the Ack, it chooses the first route in its route cache since it has the maximum bandwidth and use that recovery route to retransmit the data packet. In case the first route is busy or cannot be established, it fetches the next route from the cache and so on.

5.4.2 Route Recovery Management

The network may possess many recovery nodes in the dense environment. In case of route failure, all the existing recovery nodes attempts route recovery, by sending VR simultaneously. These results in frequent collisions and degradation of the network performance.

Every node has a various contention window (C) dimensions as per the overhearing count's number. If the number is large the node C dimension is small. These reveals that the recovery node related to the primary route is more stable than other routes. The recovery nodes elects C in a random manner and waits for time t. In case recovery node hears VR message sends by another recovery node, the timer is stopped. If VR is not sent by any node within the time interval t, then the recovery node forwards VR for the purpose of route discovery.

The mobility of recovery node causes it to misunderstand that route as failed even though original route is available to transmit the data. If recovery node forwards VR message to a node which connects to the subsequent node well, it discards the VR and further recovery node is conscious about its misjudgment because it does not receive the Ack.

5.5 ADVANTAGES OF MULTIPATH ROUTING

1. Reduces packet drops
2. Reduces the recovery time
3. Reduces overhead
4. Utilizes bandwidth efficiently

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VI. System Implementation

6.1 Network Simulator – 2.34

Ns-2 (from network simulator) is a name for series of discrete event network simulators. These simulators are used in the simulation of routing protocols, among others, and are heavily used in ad-hoc networking research, and support popular network protocols, offering simulation results for wired and wireless networks alike Ns-2 was built in C++ and provides a simulation interface through OTCL, an object oriented dialect of TCL. The user describes a network topology by writing OTCL scripts, and then the main Ns-2 program simulates that topology with specified parameters. The Ns-2 modules included within are nodes ,links, simple link objects, packets, agents, and applications.

Ns-2 is a discrete event simulator targeted at networking research. Ns provides substantial support for simulation of TCP, routing, and multicast protocols over wired and wireless (local and satellite) networks.

Ns-2 began as a variant of the REAL network simulator in 1989 and has evolved substantially over the past few years. In network research area, compare with other software, Ns-2 saves a lot of money and time.

Network simulations also particularly useful in allowing the network designers to test the new network in protocols or to change the existing protocol in a controlled and reproducing manner.

6.2 TCL

TCL (originally from "Tool Command Language"), is a scripting language. TCL gained acceptance on its own. It is commonly used for rapid prototyping, scripted applications, GUIs and testing. TCL is used on embedded systems platforms, both in its full form and in several other small foot-printed version. It is interpreted string processing language for issuing commands to interactive language.

6.2.1 SCRIPT STRUCTURE OF TCL

```
Set ns [new simulator]
# [Turn on tracing]
# Create topology
# Setup packet loss, link dynamics
# Create routing agents
# Create:
# - multicast groups
# - protocol agents
# - application and/or setup traffic sources
# Post- processing process
# Start simulation
```


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6.2.2 TCL FEATURES

TCL's features include

All operations are commands, including languages structures. They are written in prefix notation.

Commands are commonly variadic

Everything can be dynamically redefined and overridden.

All data types can be manipulated as strings, including source code.

Event-driven interface to sockets and files. Time-based and user-defined events are also possible.

Variable visibility restricted to lexical (static) scope by default, but uplevel and upvar allowing process to interact with the enclosing function's scopes.

- All commands defined by TCL itself generate error messages on incorrect usage.
- Extensibility, via C,C++, JAVA and TCL.
- Interpreted language using byte code.
- Full Unicode (3.1) support, first released 1999.
- Cross-platform: windows API, Unix, Linux, Macintosh, etc.
- Close integration with windowing (GUI) interface Tk.

Digital logic simulators often include a TCL scripting interface for simulating Verilog, VHDL and System Verilog Hardware Languages.

VII. RESULT AND DISCUSSION

7.1 Simulation Results

7.1.1 Performance Metrics

We compared our MP-LRR protocol with MLAR protocol. We evaluate mainly the performance according to the following metrics.

- *Average end-to-end delay*

The end to end delay is averaged over all surveying data packets from the source to the destination.

- *Average packet delivery ratio*

It is the ratio of the number of packets received successfully to the total number of packets sent.

- *Drop*

It is the number of packets dropped during the data transmission.

- *Control Overhead*

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The control overhead is defined as total number routing control packets normalized by the total number of receiving data packets.

7.2 Based on Nodes (Speed-Constant)

X axis – Nodes & Y axis – Delay(s)

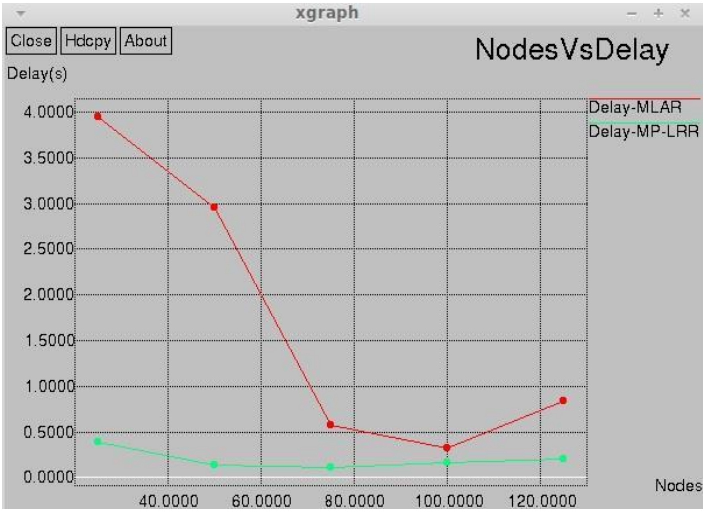

Figure 7.2.1: The average end-to-end delay of the proposed MP-LRR protocol is less When compared to the MLAR protocol.

X axis – Nodes & Y axis – Delivery ratio (bits /sec)

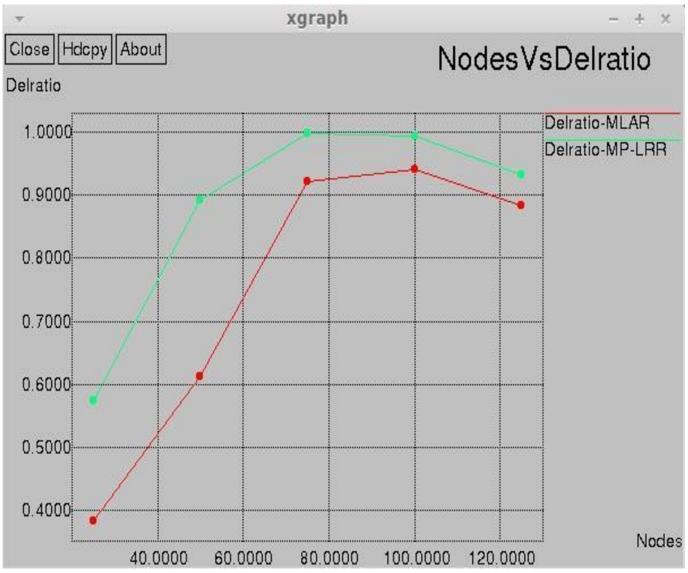

Figure 7.2.2: The Packet delivery ratio for MP-LRR increases, when compared to MLAR, Since it utilizes robust links

X axis – Nodes & Y axis – Drop (Packets)

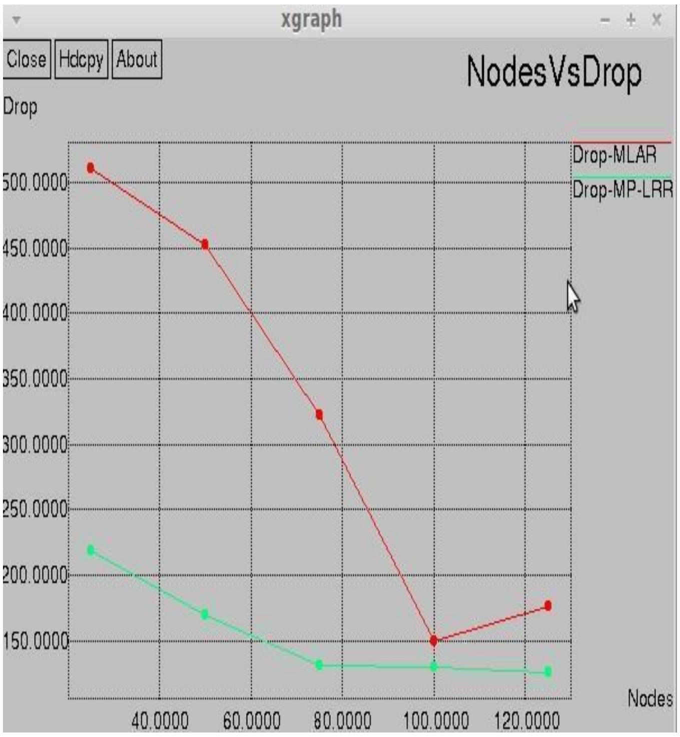

Figure 7.2.3: The packet drop for MP-LRR is less, when compared to MLAR.

X axis – Nodes & Y axis – Overhead (Packets)

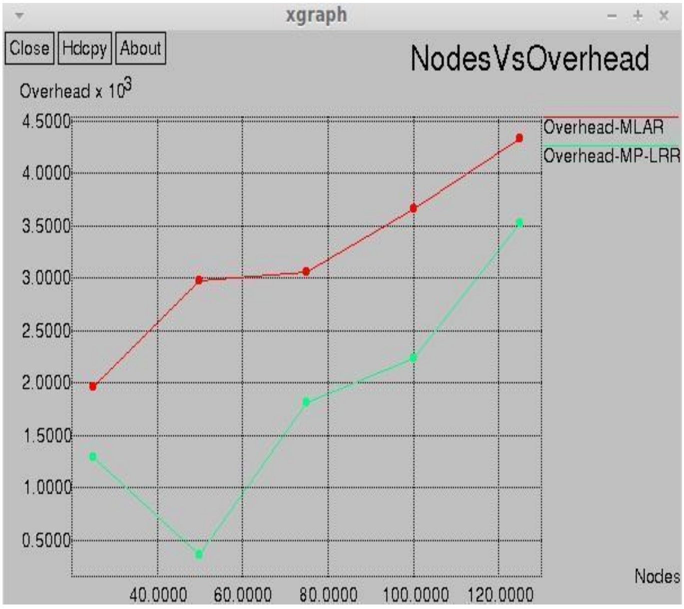

Figure 7.2.4: The Overhead for MP-LRR is less, when compared to MLAR.

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7.3 Based on Speed (Node-Constant)

X axis – Speed (m/s) & Y axis – Delay(s)

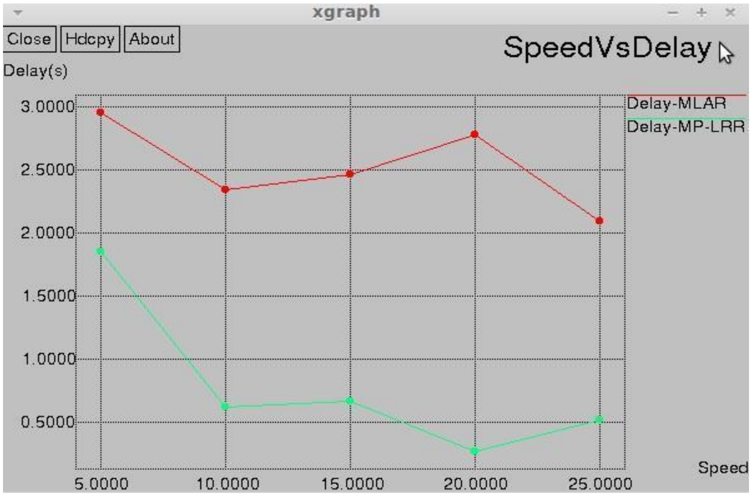

Figure 7.3.1: The average end to end delay of proposed MP-LRR protocol is less
When compared to MLAR protocol.

X axis – Speed (m/s) & Y axis – Delivery ratio (bits /sec)

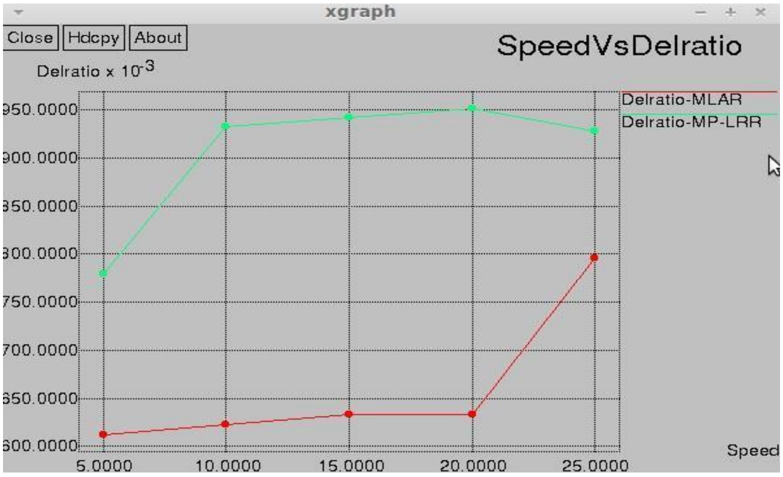

Figure 7.3.2: The packet delivery ratio for MP-LRR increases,
When compared to MLAR, since it utilizers robust links.

X axis – Speed (m/s) & Y axis – Drop (Packets)

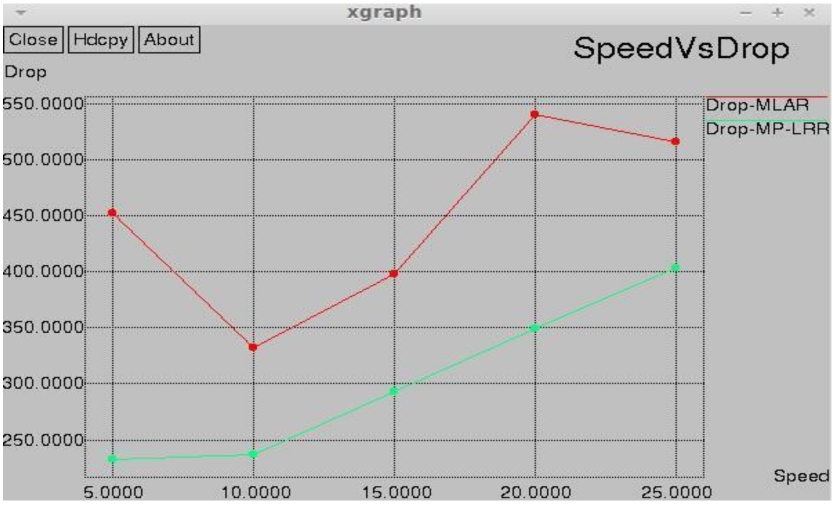

Figure7.3.3: The packet drop for MP-LRR is less, when compared to MLAR.

X axis – Speed (m/s) & Y axis – Drop (Packets)

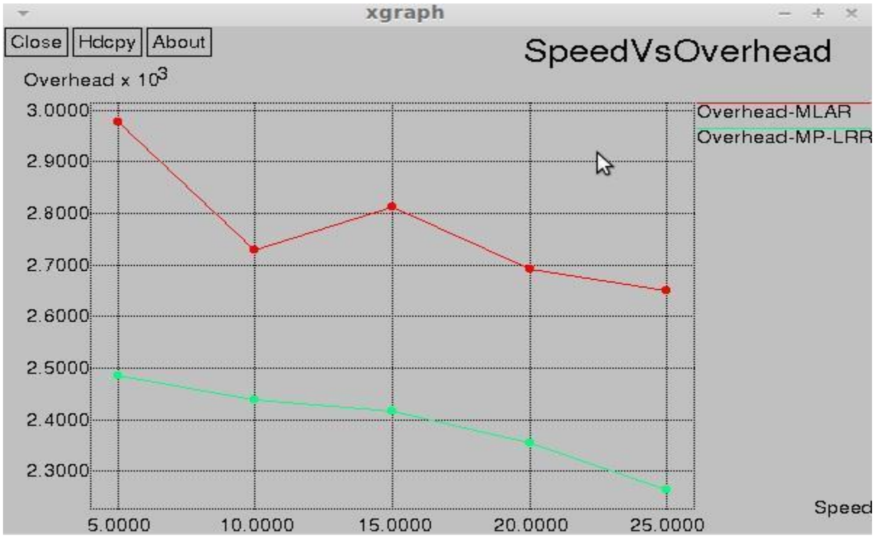

Figure 7.3.4: The control overhead of the protocols. The values are considerably less in MP-LRR

VIII. CONCLUSION

In this, proposed multipath routing protocol for effective local rout recovery in mobile Adhoc network (MANET). In this, in case of route failure in the primary route, the recovery node detects it and establishes a local recovery path with maximum bandwidth from its route cache. The route recovery

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