RADNET Protocol enhancement by implementing RED routing algorithm using NS2 for Wireless Adhoc Networks

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Abstract — The science of networking and the advancements in the mobile devices enabled the capability of communicating with each other even in the absence of pre-existing communication infrastructure. These networks require specialized routing protocols due to their ad hoc nature. Significant research had been done on the different protocols for Congestion Control. This research work aims to enhance the performance of RADNET protocol in WANET by using RED routing scheme. Simulation work has been done using network simulator NS-2. The paper proposes early congestion detection and adaptive routing in WANET by enhancing the performance of RADNET protocol using RED routing technique. To evaluate the effectiveness and for generating lower disturbance in the shared communication medium, the simulated performances of Enhanced RADNET protocol with traditional RADNET protocol is compared.

Keywords— WANET; RADNET Protocol; RED Routing; RED algorithm

I. INTRODUCTION

As the importance of computers in our daily life increases it also sets new demands for connectivity. The wired solutions have been around for a long but there is increasing demand on working wireless solutions. Wireless communication between mobile users is growing more popular than ever before. This growth is due to the technological advancements in the field of computers and communicating devices. It has enabled all communicating devices (like laptops, mobile phones, tablets, wireless modems, etc.) to be equipped with radio interfaces to communicate on fly. Wireless networking enhances the utility of carrying a computing device. It provides the mobile user with versatile and flexible communication and continuous access of networked services. Mobile Ad hoc Networks as an infrastructure-less wireless communication systems described by [1]. WANET's routing is one of the key research areas for researchers. Each and every routing protocol of WANET has its own characteristics and performance level. So, it is very important to identify the key routing protocol to be adopted for selected scenario for better performance. In the [4] authors discussed the following list of challenges, shows the inefficiencies and limitations that have to be overcome in a MANET environment:

1. Limited wireless transmission range: In wireless networks the radio band will be limited and hence data rates it can offer are much lesser than what a wired network can offer. It requires the routing protocols in wireless networks to use the bandwidth always in an optimal manner by keeping the overhead as low as possible.
2. Routing Overhead: The nodes often change their location within network. This generates some stale routes in the routing table which leads to unnecessary routing overhead.
3. Battery constraints: This is one of the limited resources that form a major constraint for the nodes in an ad hoc network. The devices used in these networks have restriction on the power source in order to maintain portability, weight and size of the devices. By increasing the power and processing ability makes the nodes bulky and less portable so only MANET nodes has to optimally use this resource.
4. Asymmetric links: Mostly wired networks rely on the symmetric links which are always fixed but this is not a case with Adhoc networks as the nodes are mobile and constantly changing their position within network.
5. Time-varying wireless link characteristics: A wireless channel is susceptible to a variety of transmission impediment such as path loss, interference, fading and blockage.

6. Broadcast nature of the wireless medium: The broadcast nature of the radio channel is transmissions made by a node are received by all nodes within its direct transmission range. If a node is receiving data then no other node in its neighbourhood apart from the sender should transmit.
7. Packet losses due to transmission errors: An ad hoc wireless networks experiences a much higher packet loss due to factors such as high bit error rate (BER) in the wireless channel and it increased collisions due to the presence of hidden terminals, location dependent contention, presence of interference, frequent path breaks due to mobility of nodes, unidirectional links and the inherent fading properties of the wireless channel.
8. Mobility-induced route changes: A network topology in ad hoc network is highly dynamic due to the movement of nodes and hence an on-going session suffers frequent path breaks.

II. PROTOCOL DESCRIPTION

A. RADNET is an open communication protocol which defines the structure of information to be communicated across a known hardware and electronic interface. It defines the method of communication between instruments and software which presents that information to the end user. It is a format of the data contained within a UDP datagram. UDP messages are outlined in RFC's 768, 862-865, 867, and 1119. RADNET is split into three functional areas: header, body and footer. These three areas are not evident when examining a RADNET message, and are not interdependent.

B. RED (Random Early Detection) provides portable computers with an in- expensive wireless network connection which uses a mechanism of early detection of packet drop, without waiting to queue overflow. Such mechanism informs both, the sender to reduce the packet transmission rate and the receiver to not to send excessive acknowledgement packets. It can reduce considerable amounts of delay time if network length is more; sender and receiver are at sufficient distance. RED is best suited for congestion avoidance.

III. IMPLEMENTATION

The routing algorithm in RADNET uses drop tail queue for data transmission which causes inefficient data transmission and congestion in the network. RED (Random Early Detection) is well suited for congestion avoidance and it manages the buffer efficiently as it uses a mechanism early detection of packet drop without waiting to queue overflow.

The ns-2 simulator stands for Network Simulator version 2. This is a discrete event simulator for networking research. It works at packet level and provides support to simulate bunch of protocols like TCP, UDP, FTP, HTTP and DSR. It also simulates wired and wireless networks. NS2 is primarily UNIX based & uses TCL as its scripting language and is a standard experiment environment in the research community.

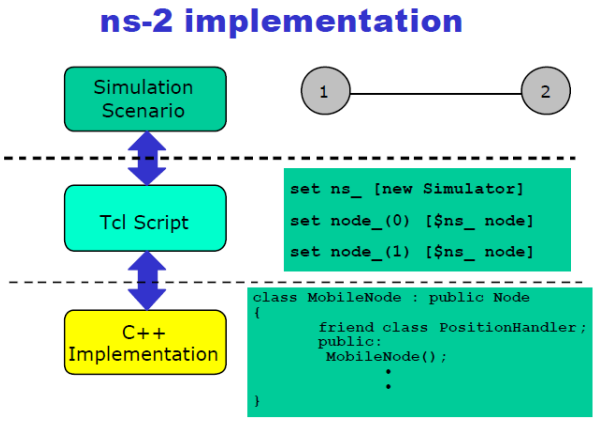


Fig 1: NS2

NS2 simulator is adopted in this work to evaluate the performance of the proposed methodology and compare the traditional Radnet Protocol with the proposed Enhanced Protocol. The parameter values of simulation are as shown in table**.**

To evaluate and compare the effectiveness of these routing protocols in a WANET, extensive simulations have been performed in NS2.34. Each simulation is carried out under a constant mobility. The simulation parameters for node density are listed in Table 1.

Table 1: Network Scenario

Parameters	**Value**
Simulator	NS2
Channel	Channel/Wireless Channel
Radio Propagation Model	Propagation/Two ray ground
Network Interface	Physical/Wirelessphy
MAC	MAC/802_11
Interface Queue	Queue/Drop Tail/Pri-queue
Antenna	Antenna/Omni antenna
Link layer	LL
Interface queue length	50
Routing Protocol	Radnet
Simulation Time	100s

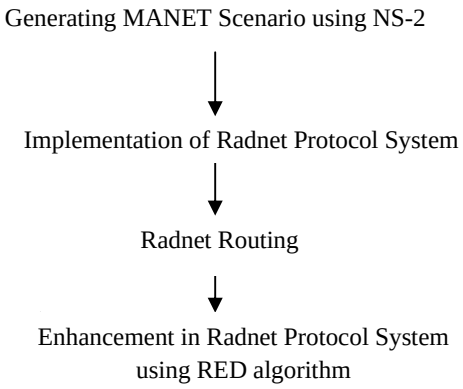
Nodes in Wireless Adhoc environment pose significant shared communication medium constraints such as finite memory, number of access channels and bandwidth to the development of effective communication protocols. Furthermore, multihop message forwarding multiplies the amount of simultaneous transmissions, which augment both channel contention and network congestion, increasing interference and reducing protocol performance.

With these issues in mind, we have tried to enhance a variation of WANET which we called interest centric mobile ad-hoc network or simply RADNET in which every participant node appends in the network layer an Active Prefix (AP) composed of a prefix and an application interest, which the Radnet protocol uses for node identification, message addressing, probabilistic message forwarding, and name search in a distributed way. To evaluate the effectiveness of Radnet for generating lower disturbance in shared communication medium, thus enabling resource savings, and reducing message overheads, we compared the simulated performances of Enhanced RADNET protocol (RP) by changing probabilistic message forwarding to opportunistic message forwarding scheme.

IV. PROBLEM FORMULATION

The intent of proposed work is to design wireless ad-hoc network delineating various intermediate nodes between source & destination. And to analyze protocol performance among dynamic set of nodes for WANET in relation to control bit ratio, packet delivery ratio, average number of hops and end to end delay.

The following flow chart demonstrates the flow in which the proposed work will approach to desired results.



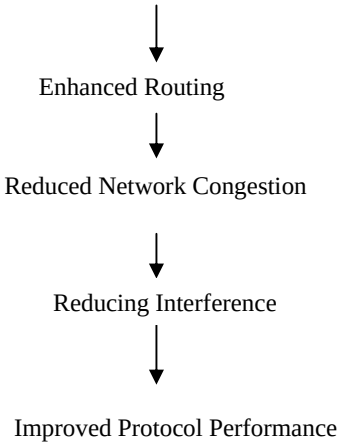


Fig 2: Flow Chart

```
Packet_delay=0; \\ initialization of packet delay variable to zero
\\calculate the expected delay on the basis of number of hops
TraverseCal_delay= 0.25*no_of_hops
Queue_free = Queue_Size
Queue_occupied; \\ calculate packet delay
Packet_delay = now –pkt_trans_time; \\ now is current time If
(Queue_free >0.5* Queue_size && pkt_delay <= cal_delay)
{
\\ set packet drop probability to 0
P=0;
}
Else if (Queue_free< 0.2* Queue_size && Queue_free>=2)
{
P= (1/Queue_free);
If (P>0.5)
P=0.5; \\ update the packet dropping probability to 0.5 if it is exceeding by 0.5
}
Else
{
P=0;
}
```

Fig 3: Algorithm

V. RESULTS

To simulate the real moving behaviours of the nodes in a mobile ad hoc network, ns2 simulator is used. The evaluation has been conducted with some specific number of nodes that will be randomly scattered in a specific region with specific number of connections. This simulation evaluates protocol using the performance metrics like Control Bit Ratio, Packet delivery Ratio, End to End Delay and Average Number of Hops.

Initially RADNET is implemented on a WANET scenario in NS2 and different performance parameters are calculated, then RED algorithm is implemented and checked on that same WANET scenario in NS2 & results are calculated. The results are compared and presented in graphical form. Results have been analyzed by taking parameter iteration on x-axis & performance metrics on y-axis.

From Fig. 4, it is clear that control bit ratio of Enhanced RADNET protocol is greater than RADNET as indicated by red line in the graph and with passage of time it is increasing. This shows that even in longer transmission, control bit ratio remains higher.

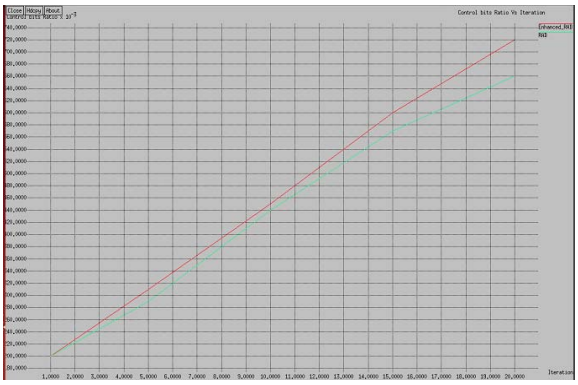


Fig 4: Control Bit Ratio

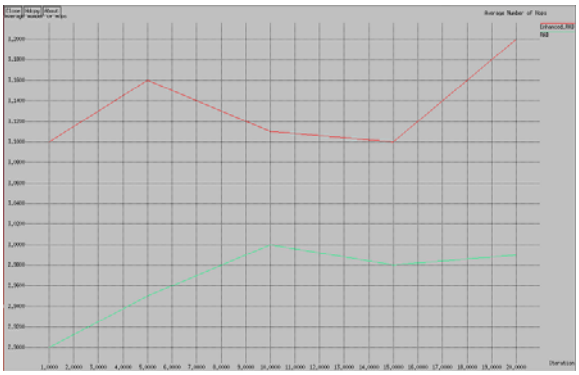


Fig 5: Average Number of Hops

In fig 5, the red line is showing the improved average number of hops of enhanced RADNET protocol.

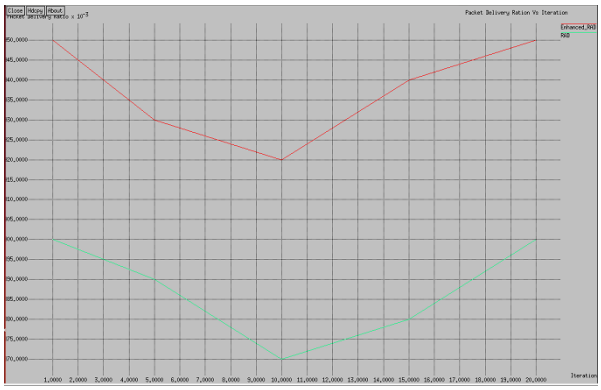


Fig 6: Packet Delivery Ratio

The enhanced RADNET protocol results in less packet loss for WANET nodes as the packet delivery ratio is considerably increased as depicted in Fig. 6 in compared to RADNET. It has been observed using iteration as a parameter for 50 nodes the packet delivery ratio is high for enhanced RADNET and low for RADNET.

Fig. 7 depicts end to end delay characteristics of the protocols. In all scenarios considered, it is observe that enhanced RADNET has the lowest delay and thus protocol performance increases as it gives low latency in WANET scenario.

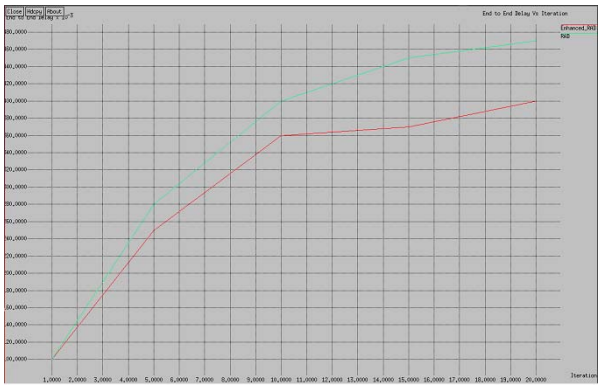


Fig 7: End to End Delay

VI. CONCLUSION

The existing RADNET protocol has network congestion problems. For this reason enhancement in the RADNET protocol has been done by implementing RED algorithm in RADNET. Hence for different performance metrics, the enhanced RADNET protocol is compared with traditional RADNET protocol. NS2 based simulation has confirmed the advantages of enhanced RADNET and demonstrated reduction of end to end delay and improvement in control bit ratio, average number of hops, packet delivery ratio over traditional RADNET. Simulation results depict that enhanced RADNET protocol helps to improve the overall performance of the WANET by decreasing network congestion & channel contention.

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