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Subnet Hybrid Gateway MANET Protocol on the Basis of Dynamic TTL Value Adjustment

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Abstract: Mobile ad hoc network is without infrastructure and without base station wireless network and decentralized way for a large network thier number of nodes dynamically, therefor, the connection established between source node to destination node is very difficult. The challenge is interconnecting ad hoc network to the internet seems from the needs to inform ad hoc nodes about available gateways in an extremely challenging scenario while a making a minimum consumption of the source network resources. Then an efficient gateway discovery of an ad hoc network becomes one of the central factors to enable the economic consumption of hybrid ad hoc network in future mobile and wireless network. In mobile ad hoc network have multihop, therefore, several reachable gateways for mobile node at any period of time. If the mobile node receives gatways advertisement from more than one gateway. It has to determine which gateway to use for connecting to the network. Most existing protocol choose the gateway which is closer in terms of the number of physical hops. This study has focused on design an efficient and adaptive subnetting hybrid gateway discovery mechanism on the basis of dynamic TTL value adjustment such that congestion and unnecessary overhead is reduced. Selecting the gateway on the basis of one and two parameters will increase the performance and throughput of the network. The main objective of adaptive gateway discovery to determine the optimal TTL value in terms of number of hops to determine the proactive area, nodes outside this area follow the reactive approach. Consequently, for achieving a good trade off between performanceand network operating expense.

Key words: AODV, TTL, PDR, MANET, RREQ, RREP, hybrid gateway

INTRODUCTION

A Mobile Ad Hoc Network (MANET) is the cooperative engagement of a collection of mobile hostswithout the required intervetionof any centralized access point. It is infrsturctureless, self organized and spontaneous networks. Mobile ad hoc network represents complex distributed system that comprises wireless mobile clients that can freely and dynamically self organized into arbitrary and temporary some issue of mobile ad hoc network like that routing, self organization, medium access control, quality of service and entry efficiency. Several existing protocols for handling issues of mobile ad hoc network. There are three different approaches of gateway discovery-proactive, reactive and hybrid. Proactive discovery is started by the gateway itself.

Gateway periodically broadcasts a gateway and advertisement a nature to inform about its bearing. Upon receipt upon the advertisement, the mobile station update their routing table and forward the advertisement to other mobile station. Reactive initiated by mobile station that determine its needs to access the net. The mobile station broadcast a PREQ with an I_flag set, i.e., a PREQ_I which is processed entirely by the gateway the MANET. Hybrid-to minimize the disadvantage of the proactive and reactive gateway approach is used hybrid approach is used, it is a combination both proactive and reactive approach. Interconnection between the MANET and the internet was purposed by wakikawa by Belding-Royer. It mainly describes the proactive and reactive discovery mechanism and the reactive gateway discovery mechanism Jonsson on AODV.

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Rout discovery: Rout discovery whenever a mobile client (source) determines that it requires a route to another client. It broadcasts a Route Request (RREQ) message and specify a timer to wait for receipt of the Rout Reply (RREP). A client that receives a RREQ create a reverse route entry for the source in its routing table. Then, it checks to see whether, it has received a RREQ with the same originating IP address and RREQ ID within the last path_discovery_time. If such a RREQ has been picked up, the node discards the newly received RREQ. RREQ in order to prevent duplicate RREQ for being forwarded if RREQ is not thrown out the node continues to treat it as fallows or it has unexpired route to the destination is unicast a RREP back to the beginning. Otherwise, it rebroadcasts the RREQ. If a RREP is generated any intermediate node on the way back to the source create a forward route entry for the destination in its routing table and forward the RREP towards the beginning. If source does not receive any RREP before the RREQ timer expire it broadcast a new RREQ with an increased Time to Live (TTL) value. This technique is called expanding ring search and continuesuntil either a RREP is received or a RREQ with the maximum TTL value is broadcast.

Route discovery for the internet access: MANET can reply to the RREQ, it will rebroadcasted until its TTL value reaches zero. When the number of RREQ expire a new RREQ message is broadcast with a long TTL value. Yet, the fixed node can not receive the RREQ message, the source will never receive the if a web wide search has been done without receiving any corresponding RREP. In that instance the source must find a route to gateway and broadcast its data packet towards the gateway which will forward them toward the specified node.RREP message, it is waiting for assumption for this problem has been solved by beginning and destination assumed the fixed node.

Gateway discovery: The reactive routing approach is the basic approach described by Bouk *et al*. (2012) RREP and RREQ message are expanded with new flag (I) which is used differentiate control message used to discover routes to the internet from usual RREP and RREQ. We refer to the new message as RREP_I and RREQ_I. A source willing to transmit with a node in the fixed network will first try to contact it within the ad hoc network doing an extended ring search if no response is obtained after a network wide search then the source tries to obtain a route toward the internet, so it broadcast a RREQ_I to the MANET multicast address. When a gateway receives a RREQ, it consults its routing table for the destination IP address definedin the RREQ message. If the address is not found the gateway sends a RREP_I back to the originator of the RREQ. While in dynamic mobile node adefault route, although, it has not requested it. And so, the source will select one of the gateways and will send information to the fixed node through the gateway. If the mobile node is to communicate with internet later the default path is already planted and othertime consuming gateway discovery process can be deflected. Three different gateway discovery approaches based on the dynamic adaptation of the TTL of gateway advertisement.

Hybrid subnet gateway discovery: The blended approach is hybrid proactive/reactive method for gateway discovery for mobile nodes in a certain range around the gateway, proactive gateway discovery is used while mobile nodes residing outside the range use reactive gateway discovery to obtain data about the gateway. The gateway will periodically flood TTL limited GWADV message which will only be forwarded up to a few hops away from the gateway. The source within the flooding area upon reception of the GWADV message will behave as a proactive approach. Those nodes beyond the number of hops will found default routes proactive using the same RREQ_I based reactive scheme describe before, so, this approach is some how a swap off between reactive and proactive approach. The TTL of the gateway advertisement message as the parameter to adjust depending on the network condition the higher the TTL, the higher the overhead due to periodic advertisement and lower the overhead related with the reactive discovery of the internet gateways that is the higher the TTL the higher the proactive of the approach. In fact a TTL = 0 correspond totally reactive approach where as a TTL network diameter corresponds to a completely proactive scheme. The different criteria to define when the TTL should be corrected and the rate at which neighbors change or the mean duration of the links can be an indication of the network mobility. In addition, they do not capture one of the key parameters according to our model which is the number of sources. For a gateway to aware of the total number of sources communicating with nodes in the internet it is commanded for some some kind of signalling mechanism facilitating such information to the gateway. However, that would incur an extra overhead and it is something which can require changes the routing protocol, so, we resolve to use super matrics being able to convey the require information without any additional overhead and being locally computed in real scenarios, If mobile degree increased probability of packet loss is likewise increase in such case active controlpacket receive warning message and adaptively reduces data packet into smaller size to minimize the probability of data packet loss. It performed in way subnet where frequent data packet losses are detected or frequent control packet update occurs.

Literature reveiw: Interconnection between the MANET and the internet was purposed by Belding-Royer. It primarily describes the proactive and reactive gateway discovery mechanisms. Perkins proposed MIP-MANET based on AODV. MIP-MANET provide internet access by using mobile IP with foreign agent, care of address and reverse tunnelling. However, MIP-MANET suffers from high overhead of foreign agent advertisement message and here a visiting node can hand off from its current foreign agent to new one if it is to hop closer.

Bouk *et al*. (2012) suggested a hybrid gateway discovery An approach where the TTL of the agent (gateway) advertisements are limited to a certain bound. Guests outside the boundary have to discover gateways, reactively.

Chaba *et al*. (2012) proposed two advertisements scheme based on observation of traffic and mobility pattern to avoid generating unnecessary routing overhead in MANET. This allows nodes with more opportunity to take the shortest path to the gateway but the scheme relies on a source routing protocol which limits the applicability and scalability of their solution.

Network performance may degrade in case by Iwata *et al*. (1999) if TTL is not adjusted properly and adjustment of the TTL value requires special intelligence. Kumar and Chaudhary (2012) provide an implementationof the three internet gateway discovery method, namely reactive, proactive and hybrid which is based on AODV routing protocol. It is established on the number of physical hops metrics only to select the gateway.

Palani and Ramamoorthy (2012) proposed an adaptive gateway discovery scheme which controls the TTL value of agent advertisements, according to mobile node internet traffic and their relative distance from internet gateway with which they are registered.

Kumar *et al*. (2010a, b) use interface queue length along with hop count to take a path to a gateway however, this approach plays well but for proactive gateway discovery mechanism. The impact of traffic load and node mobility is examined in terms of two metrics namely throughput and average end to end consider the optimal TTL value calculation before passing its proactive gateway advertisement.

Belding-Royer demonstrates how general ad hoc networks can be linked up to the internet using ad hoc on demand distance vector routing for Ipv6 (AODVV6). Here, also gateway discovery techniques are either reactive or proactive. Zaman *et al*. (2013) suggested a proactive gateway discovery method in which gateway periodically sends HELLO messages that carry a special option called PROAGW option. The drawback of this approach is that MANET's flooded with routing messages. Mane and Nigvekar (2012) suggested a resolution in which mobile nodes can access the internet via stationary gateway nodes or access node. The effect of the mobile can access the internet via. a stationary gateway node or access node. The effect of the mobile terminal speed and the number of gateways along the network performance are studied and compared. Patel and Kumar (2013) proposed and adaptive gateway discovery approach that has been primarily designed to reduce congestion problems in ad hoc network and that helps real time application to maintain their QoS parameters even in the presence of high traffic. This approach limits the transmission range where the gateways periodically send an advertisement message and they are propagated around a special zone. If a mobile node wants internet connectivity and it is outside the gateway transmission range and the propagation zone of the gateway advertisements, it should send a message to the group of gateways in the ad hoc network. The gateways should respond sending back a reply and the routing protocol of the mobile node chooses the reply of the gateway which offers the best route towards internet in terms of number of hops accordingly to the normal operation of the AODV routing protocol.

Zaman *et al*. (2013) proposed an adaptive gateway discovery scheme. Most of the proposals of proactive gateway discovery schemes, the interval of emission of MRA messages (Modified Router Advertisement) is set to a constant value T. This interval is dynamically configured in this approach. The optimal value of T depends on the network conditions such as the load, the node mobility and the number of traffic sources. Here, the gateway sets the T taking into account the number of received MRA message which are retransmitted by the gateway's neighbors. However, when the gateway receives few MRA packets from its neighbors, it must decrease the T to ensure that node keep a valid route the gateway when they necessitate to be linked up to the internet.

Nordstorm *et al*. (2011) review the existing solution to interconnect MANETs to the internet but find them lacking in robustness and flexibility, researchers analyze reasons for routing failure is usually an interconnection scheme's inability to express indirection. Another problem concerns state replication where a route update fails to repeat all the routing state needed to forward the packet to internet gateway. The above problems are thoroughly analyzed and suggest a resolution that offers rich and flexible internet connectivity. The proposed solution works for any MANET routing protocol and has support for multiple gateways and multi-homing. Simulations show that, when employed in combination with AODV routing, the proposed solution provides up to 20% delivery ratio improvement.

Nordstrom *et al*. (2011) proposed a load adaptive access gateway discovery scheme which dynamically resizes the range of proactive access gateway advertisements and reduces access gatewaya cquisition latency. The computation of proactive area involves that gateway access gateway periodically broadcast access gateway advertisements containing its load information. These adverts are limited with a hop neighborhood using a TTL field. For setting the area dynamically, access gateway should know the following information the number of the network nodes the number of root nodes that require internet connectivity and the size of the mesh. It is assumed that the access gateway estimates the size of the network and number of nodes. The initial proactive area is estimated utilizing the following equation. The proctive range increases and falls according to the web traffic which is approximated by the Access Gateway (AG) during time interval this approach brings into account the load of the network while calculating the TTl value dynamically but it does not address the problem of periodically of GW_Adv messages.

Rani and Dave (2007) proposed to gateway load balancing strategies for integration of internet and MANET which are based on load balanced routing protocols called WLB-AODV and modified AODV. Zhao *et al*. (2005) proposed the dynamic gateway concept that act as an interface between the MANET and the net. Zhao *et al*. (2005) proposed the dynamic gateway concept that act as an interface between the MANET and the net. These dynamic gateways can use mobile IP and DSDv protocol when they communicate withthe internet and solve the load balancing problem. The concept of a dynamic gateway involves thevarying number of gateways which sometimes work as gateways and sometimes behave as non gateway node but this method requires a lot of complexity.

Shin *et al*. (2005) suggested a load based gateway selection scheme to spread the traffic load over multiple internet gateways, the concept of a proxy route reply and solicited agent advertisement messages are adaptively delayed according to internet gateways load.

Rani and Dave (2007) proposed a new metric Aggregate Interface Queue Length (ALQL) in AODV in order to deal with load balancing issues. It indicates that the modified code can execute safer than the conventional AODV.

Veres *et al*. (2001) proposed estimation of the available bandwidth at a node based on passive listening of the wireless medium. In this, a virtual MAC layer is applied to emulate MAC layer operations inactual time. A drawback of this solution is its overhead in resources such as CPU time and battery.

Gafur *et al*. (2012) proposed an efficient local route repairing approach on the footing of the TTL value as considers a traditional route recovery technique does not always provide optimal path. In this report, they say if there is any link breakage in the mesh, the alternative route to the destination can be inferred with a guaranty that it is not a suboptimal route. Although, this report does not worry about the computation of the TTL value from the level of breakage in the actual networking scenario.

MATERIALS AND METHODS

Proposed protocol: The hybrid gateway routing protocol for mobile ad hoc network which exploit the best feature. Adopting the methodology employed for implementation.

In the first step of methodology subnet creation and maintenance of protocol. The protocol is divided into several pieces including the bootstrapping of the protocol, how a node joins asubnet, how a node determines that there is disconnect from the "subnet masters", the procedure a node follows once disconnect has been detected and finally, how routing is accomplished both intra-subnet and inter-subnet (Fig. 1).

In the second step of methodology each subnet have divided into four node into on the basis of subnet working-subnet head node in each subnet, subnet gateway node, subnet head backup, subnet node. In third step deigns thr working of above four nodes.

- Subnet head node: the subnet head is the master node in the subnet
- Gateway node: a gateway is any node that link between two subnets
- Subnet head backup: the backup subnet head is a mirror of the subnet head and takes over in the event of a subnet head failure
- Subnet nodes: a subnet node is any node in the subnet and may also be a subnet head, a backup subnet head or a gateway node

In the fourth step of methodology packet handling. This study will detail how a node in the subnet will react to each of the different types of packets that are

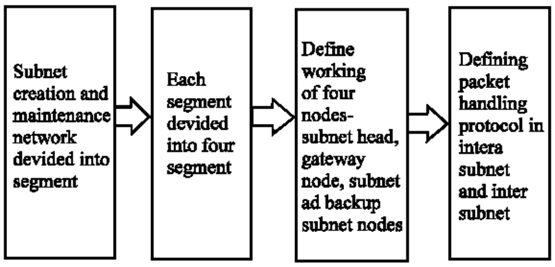

Fig. 1: Methodology of subnet creation

Fig. 2: Each node act as subnet head

welcomed by this protocol. Such premises are common when making inter domain routing.The node IDs are unique throughout the integral network. This is a valid assumption in that we canonly apply the physical address (i.e., MAC address) of each node as its node ID which assures asure promise of uniqueness. The domain Ids are unique across the whole network.

Subnet creation and maintenance protocol: The subnet creation and maintenance protocol is represents a different way of looking at sub netting inside of a MANET. The protocol is divided into several pieces including the bootstrapping of the protocol and the first assumption is that each node has a unique identifier. This identifier is generated from some internal information such as a hash of the nodes primary processor identifier and the MAC address from the primary interface of the node. When a node first comes to life that is to say when a node is booted, the node is not a member of any subnet. The node will create a new subnet and be the head of that subnet.

Subnet formation: In the begning each node is subnet head. In Fig. 2 initially the network contains only single node subnet and this state is acieved when the nodes in the network boot up for the first time. Node is considered as subnet head each node broad cast (SH) Subnet Hello packet. Figure 3 shows the nodes will each broadcast an initial Subnet Hello packet (SH). This packet is the basis for detrmining both the nodes in the subnet and links between the subnet recieving a SH packet node generate

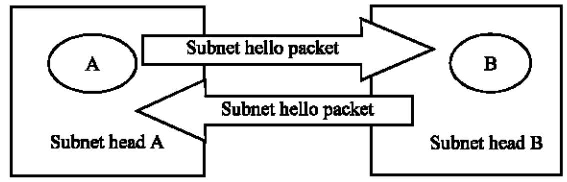

Fig. 3: Each node broad cast subnet hello packet

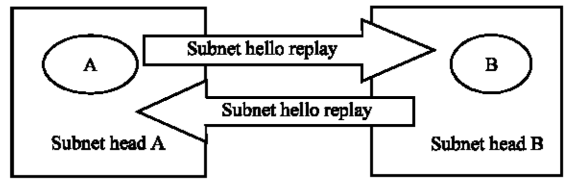

Fig. 4: Each node reply subnet hello packet

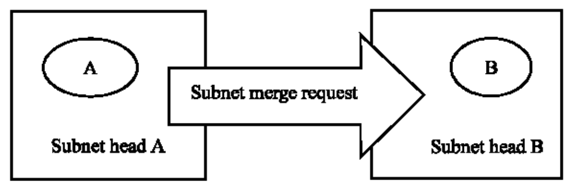

Fig. 5: Subnet head a send smr packet

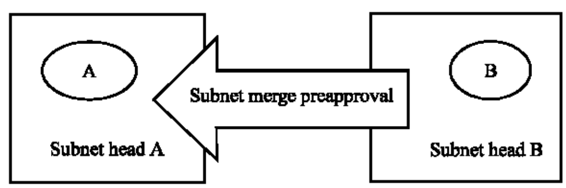

Fig. 6: Subnet head B send SMP packet

Subnet Hello Reply Packet (SHR) if both node is not same member of subnet. In Fig. 4, the Subnet Hello Reply packet (SHR) is generated by a node, n when n receives a SH packet from a node in the same subnet as n. The SHR packet for each node is propagated back to the subnet head for that nodes subnet if node in same subnet then rebroadcast SH packet and wait a specified amount of time. In Fig. 5, the node will send out a Subnet Merge Request Packet (SMR). The SMR packet is sent to a subnet gateway and is always forwarded upto the subnet head in the recieving subnet. The receiving subnet head then must make the decision of whether or not to merge with the requesting subnet. In Fig. 6, the recieving subnet head then must make the decision of whether or not to merge with the requesting subnet. If the decision to merge is reached, then the recieving subnet head will send a Subnet Merge Preapproval packet (SMP) back to the original subnet. In Fig. 7 upon recieving a SMP packet the

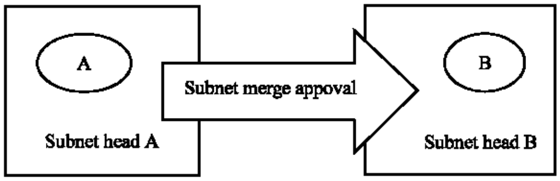

Fig. 7: Subnet head A send SMA packet

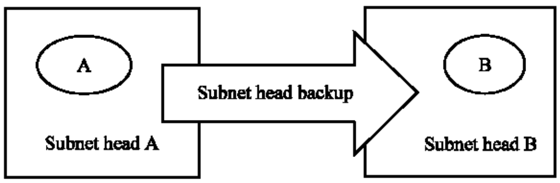

Fig. 8: Subnet head A send SBH packet

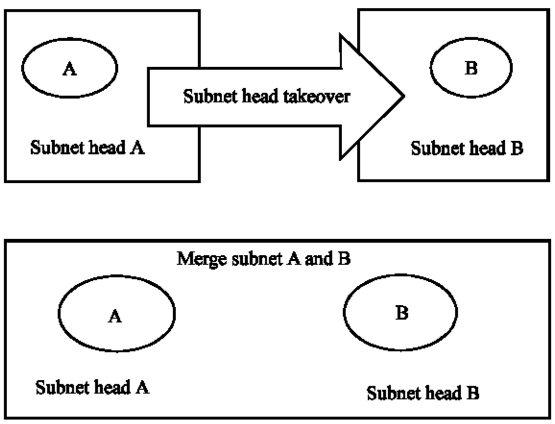

Fig. 9: Subnet head A send SHT packet and merge subnet A and B

requesting bnet head must now decide to merge, then a Subnet Merge Approved packet (SMA) is sent. At this point if requesting subnet head will either be the new subnet.

Head of the merged subnet or will become the new backup subnet head for the merged subnet in Fig. 8, if the requesting subnet head will remain the subnet head, then a Subnet Head Backup packet (SBH) will be sent out to the subnet.

In Fig. 9, if requesting subnet head will become the backup subnet head and will sent out a Subnet Head Takeover packet (SHT) and merge subnet A and B and SHT instructs all nodes to set the backup subnet head to be the current subnet head and to set thesubnet head as the subnet head node that originated the SHT packet.

Node roles: Eachnode in the protocol must have the ability to keep certain data structures that are appropriate for the purposes of that node. Each subnet in the simple subnet protocol will contain nodes that must occupy the various offices. The node may receive one or more offices in the subnet. Presuming that the subnet contains N nodes, then Table 1 gives a listing of the various roles that nodes may receive in this protocol.

Table 1: Node role in simple subnet protocol

Roles	Description	Max. Number/Subnet of N nodes
Subnet head	The subnet head is the master node in the subnet	1
Subnet head backup	The backup subnet mirror of the head is a subnet head and take over in the event of a subnet head failure	1
Subnet gateway node	A gateway is any node that links between two subnet	N
Subnet node	A subnet node is any node in the subnet and may also be a subnet head, a backup subnet head or a gateway node	N

Performance evaluation: The simulation tools network simulator will be utilized as the simulation tool for theimplementation of my thesis NS2 is chosen as the simulator partly because of the range of feature, it provides an open source code that can be modified and extend. Network Simulator (NS) is an object oriented discrete event simulator for networking research. NS provides substantial support for simulation of TCP, routing and multicasting protocol over wired and wireless networks.

Performance matrics

Packet Delivery Ratio (PDR): PDR is defined as the proportion between the total act of data packetsreceived by the corresponding destination server on the internet and total number of data packetssent to the internet by the mobile nodes in the MANET.

Average end to end delay: It is defined as the average time needed to send a data packet from a node to a host in the internet. It is compute in msec.

Throughput: It is defined as the average rate of success full message delivered over communication channel.

Routing overhead: It defined as the total number of control packet generated at every mobile node.

RESULTS AND DISCUSSION

The simulation result in Fig. 10 shows the maximum overhead in proactive protocol and minimum overhead in

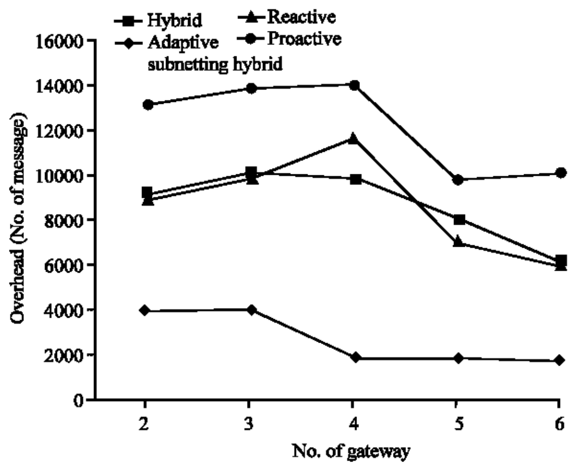

Fig. 10: Overhead gateway vs. fixed sources

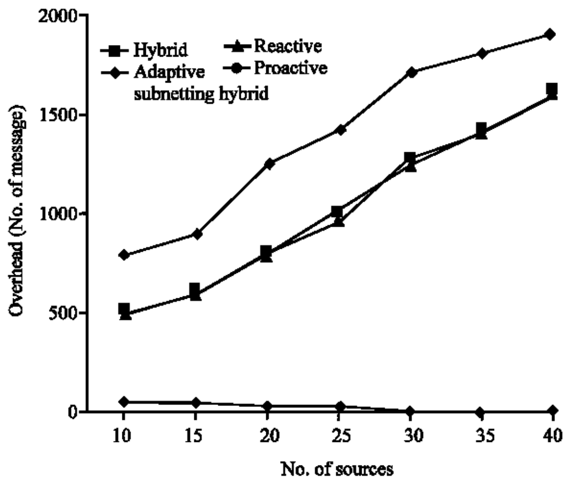

Fig. 11: Overhead fixed gateway vs. sources

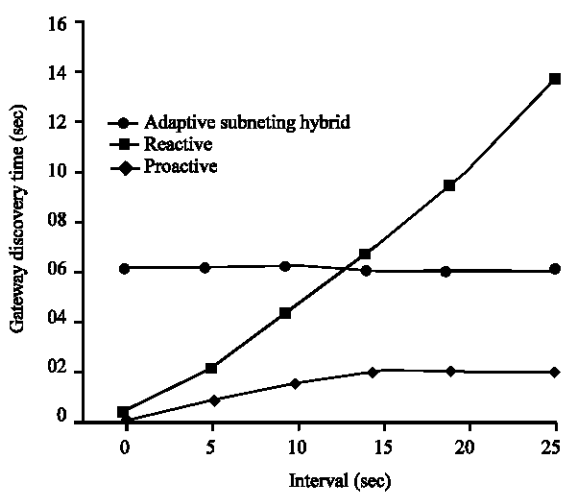

Fig. 12: Gateway discovery time vs. interval

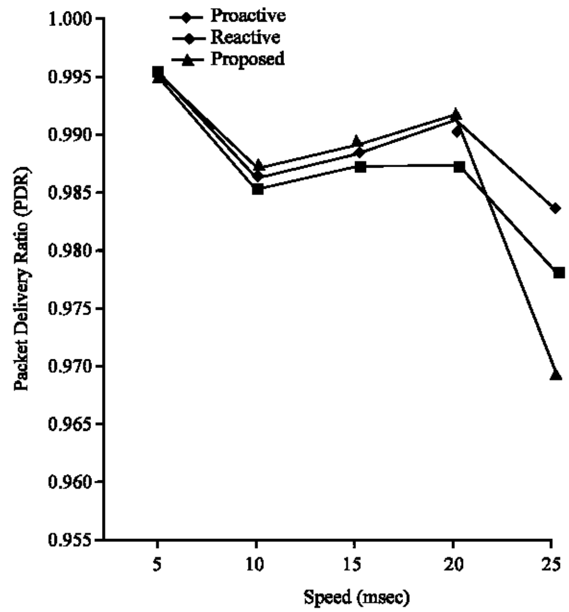

Fig. 13: PDR for varying speed

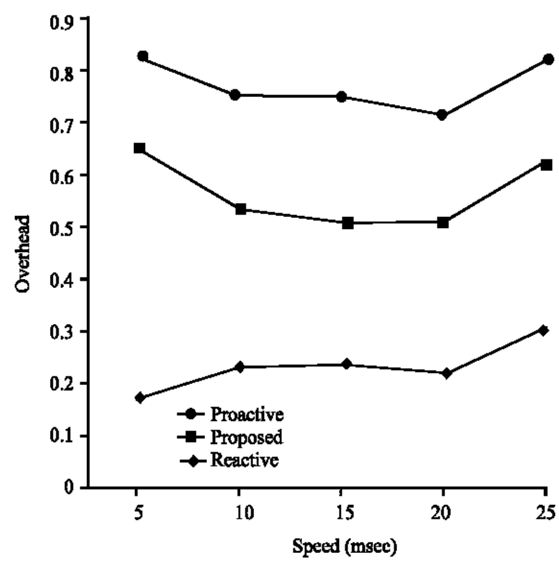

Fig. 14: Routing overhead vs. varying speed

a proposed algorithm while reactive protocol shows average performance if number of sources is determined. Figure 11 also shows minimum overhead in a proposed algorithm if gateway fixes and sources vary. Figure 12 shows the maximum gateway discovery time in proactive protocol and minimum gateway discovery time in proposed algorithm. Figure 13 shows in initial same packet delivery ratio while increases mobility, speed then minimum PDR in proposed protocol and maximum PDR in proactive. Figure 14 indicates a maximum overhead in

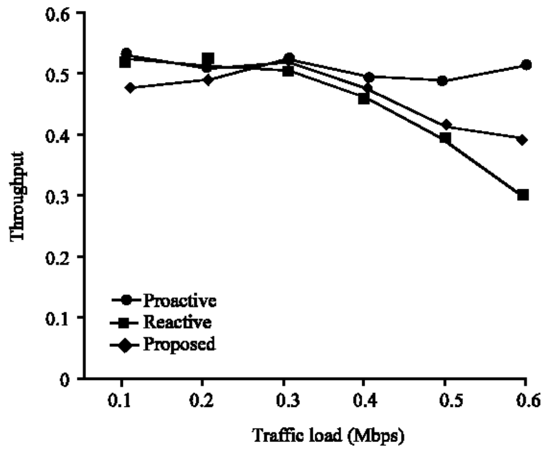

Fig. 15: Throughput vs. traffic load

proactive protocol and minimum overhead in reactive protocol according to increases speed. Figure 15 shows the maximum throughput of proposed algorithm according to traffic load increases.

CONCLUSION

The proposed model considers the current traffic condition for dynamic modification of TTL value and also focus on advertisement in particular interval such that congestion and unnecessary overhead reduced and achieve a good tradeoff between performance and network overhead the TTL value and frequency of advertisement has to be set accurately. Select optimal gateway selection on the basis of multiple metric parameters like effective queue load, timestamp factor, number of neighbors, congestion and so forth. Therefor, redused the overhead, redused the time for searching the neighbour gateway and minimum packet dilivery ration while increases mobility of nodes.

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