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Mobile Agent Based Congestion Control Using Aodv For Mobile Ad-Hoc Network

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ABSTRACT
A Congestion control is a key problem in mobile ad hoc networks. Tcp based congestion control mechanism is failed in mobile ad hoc network. Many approaches have been proposed to overcome these difficulties, ideas and show their interrelations. Mobile agent based congestion control Technique in aodv is proposed to avoid congestion in ad-hoc network. Some mobile agents added in ad-hoc network, which basically carry routing information and nodes congestion status. In this the mobile agents will travels through the network, it will select a less-loaded neighbor node its next hop and update the routing table according to the node's congestion status i.e. through the mobile agents, the nodes gets the dynamic network topology in time. We have design an agent based congestion control routing to avoid congestion in ad hoc network. In this we have added some mobile agents in ad hoc network, which basically help in carrying routing information and nodes congestion status. The mobile agent technique helps to attain high delivery ratio and throughput with reduced delay.

Keywords: MANET, Congestion, Mobile Agents (MA).

INTRODUCTION
"An ad hoc network is a collection of wireless mobile hosts forming a temporary network without the aid of any centralized administration or standard support services regularly available on the wide area network to which the host may normally be connected"[1,2]. Basically the mobile ad hoc networks are always considered as most promising communication networks in situations where there is rapid deployment and self-configuration are essential. The nodes which are allowed to communicate with each other without any existing infrastructure. Therefore every node in the mobile ad hoc network always acts as a router. This kind of networking is applied like conference room, disaster management, battle field communication and places where deployment of infrastructure is either difficult or costly.

The nodes are highly mobile, the network topology changes frequently and the nodes dynamically connected in an arbitrary manner. Hence, the limitation imposed on the transmission range of the nodes have lead to the development of routing policy where packets were allowed to traverse through multiple nodes thus making each nodes act as terminal as well as router. Since in mobile ad hoc networks the nodes are free to move over a certain area which results in frequent change in the network topology, therefore design of suitable routing protocol are essential to adapt the dynamic behavior of the network.

CONGESTION IN MANET

Congestion always occurs in mobile ad hoc networks (MANETs) with limited resources. In mobile ad-hoc networks, packet transmissions suffer from interference and fading, due to the shared wireless channel and dynamic topology. Congestion leads to packet losses and bandwidth degradation, and wastes time and energy on congestion recovery. A congestion-aware routing protocol preempts congestion through bypassing the affected links [3]. Several distinct congestion-related problems has been identified and tracked down, including severe throughput degradation and massive fairness problems. They has been shown to originate from the MAC, routing, and transport layers [4].

Congestion Detection in MANET

A Mobile Ad-Hoc Networks (MANET) is temporary network; the mobile devices in the ad-hoc network are communicating through wireless links without any pre-existing infrastructure. The one major issue of this network is congestion; it can take place at any intermediate nodes when data packets are traveling from source to destination. The congestion mainly occurs in mobile ad-hoc networks due to limited availability of resources. In such networks, packet transmissions suffer from interference and fading, due to the shared wireless channel and dynamic topology. Transmission errors also cause burden on the network due to retransmissions of packets in the network. Recently, there have been increasing demands for support of multimedia communications in MANETs. The large amount of real-time traffic tends to be in bursts, are bandwidth intensive and liable to congestion. Congestion in a network may occur at certain interval of time when the incoming traffic are larger than the capacity of the network. The major issue of congestion is high data or packet losses, increasing End to End and retransmission of packets which will affect the overall network performance. Congestion basically leads to packet losses and bandwidth degradation, and wastes time and energy on congestion recovery. To minimize congestion in a network different routing algorithms have been used [5]. Congestion is a major cause for packet loss in MANETs and reducing packet loss involves congestion control running on top of a mobility and failure adaptive routing protocol at the network layer. In MANET due to Congestion non-adaptive routing may lead to the following problems:

- Long delay: It takes time for a congestion to be detected by the congestion control mechanism. In severe congestion situations, its better to use a new route. The problem with an on-demand routing protocol are the delay which takes to search for the new route.
- High overhead: In case a new route is needed, it will take processing and communication effort to discover it. If multipath routing is used, though an alternate route is immediately found, it takes effort to maintain multiple paths.
- Packet delivery ratio: The ratio of the number of delivered data packet to the destination. The greater value of packet delivery ratio means the better performance of the protocol.
  $\sum$ Number of packet receive / $\sum$ number of packet send
- Average end to end delay: The average time taken by a data packet to arrive in the destination. It also includes the delay caused by route discovery process and queue in data packets that successfully delivered to destination.
  $\sum$(arrive time – send time) / $\sum$number of connections
- Packet drop: The total no. of packet dropped during the delivering of packet from source to destination.
  Packet lost= number of packet send – number of packet received

Mobile Agent

A mobile agent is defined as a program that represents a user in the MANET. They are capable of migrating autonomously from one node to another to perform some computations on behalf of the user. The mobile agents are effective choice for many applications for several grounds including improvements in delay and bandwidth. The periodical updates consume more amounts of bandwidth and power in the MANET. The construction of

MANET using mobile agents [6]. Here, the mobile agents are used by the nodes to communicate with others. Some of the benefits of the mobile agents are as:

- Bandwidth saving: moving the agent to the source reduces consummation of the bandwidth. Resulting data is transmitted to the clients. It reduces the data before transmission.
- Reduction of delay: the communication delay could be reduced because an agent carries the series of service request packets across the MANET. There is no need to send the service request packets separately.
- Dynamic deployment: the mobile agent can be used for automation of software installations and upgrades.
- Reduction of completion time: reduction of the network connection time is also an important factor to send an agent and receiving results back.
- Asynchronous communications.
- Load balance.

DESCRIPTION OF MOBILE AGENT BASED CONGESTION CONTROL IN AODV

Mobile Agent (MA)

Each node has the routing table that stores k fresh routing information records from itself to every node S: [S,{(Tci, NHi, ANi, NPi)L(Tcm, NHm, ANm, NPm)}] , where Tc1 > Tc2 >L> Tm . We call m the number of entries [7]. For each i(1 £ i £ m) , Tci are time of visiting the adjacent node ANi , NHi are the number of hops and NPi are the number of MAs on ANi . When MA with the history (S,Tc, NH, AN, NP) visited the node N , the routing information on that node [S,{(Tci, NHi, ANi, NPi)L(Tcm, NHm, ANm, NPm)}] are updated to (1, 1, 1, 1)}] [;{(, ; ,), (, , , ,) Tcm− NHm − ANm− NPm − S Tc NH AN NP Tci NHi ANi NPi NPi.

Queue Length Estimation

Our goals are to acquire macroscopic network statistics using a heuristic approach. We compute the traffic rates as follows: Let the value *Lo* represent the offered load at the queue of node *i* and it is defined as

$$L_{oi} = \frac{AR_i}{SR_i}$$

where ARi is to aggregate arrival rate of the packets produced and forwarded at node i while SRi are the service rate at node i , i.e., SRi = 1/T where T is the computed exponentially weighted moving average of the packets' waiting time at the head of the service queue. The distribution of the queue length PR (Q1) (essentially this is the probability that there are Ql packets in the queue) at the node is computed as

$$PR(Q_1) = (1 - L_{oi})L_{oi}^1$$

For *N* distinct queues, the joint distribution is the product

Channel Contention Estimation

IEEE 802.11 MAC with the distributed coordination function (DCF). It have the packet sequence as request-to-send (RTS), clear-to-send (CTS), data and acknowledgement (ACK). The amount of time between the receipt of one packet and the transmission of the next are
called a short inter frame space (SIFS). Then the channel occupation due to MAC contention would be
OCC RTS CTS SIFS acc C = *t* + *t* + 3*t* + *t*
Where tRTS and *tCTS* is the time consumed on *RTS* and *CTS* , respectively and *tSIFS* are the *SIFS* period. *tacc* are the time taken due to access contention. The channel occupation is mainly dependent upon the medium access contention, and the number of packet collisions. That are, *Cocc* are strongly related to the congestion around a given node. *Cocc* can become relatively large if congestion is incurred and not controlled, and it can dramatically decrease the capacity of a congested link.

Total Congestion Metric

The Total Congestion Metric (TCM) could be estimated from the obtained queue length and the channel contention.
TCM = *PR* (*Q*1) +*Cocc*

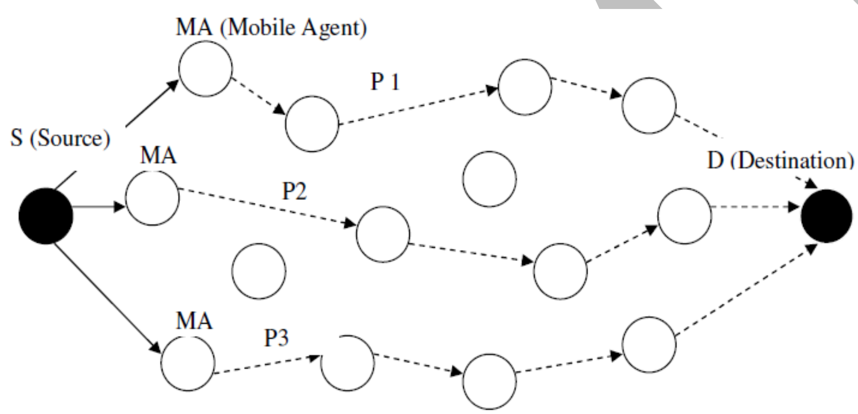


Figure: Agent Based Congestion Routing Architecture

$$PR(Q_{11}, Q_{12} \cdots Q_{1N}) = \prod_{i=1}^{N} (1 - L_{oi}) L_{oi}^{li}$$

Step 1: The source S checks the number of available one hop neighbors and clones the Mobile Agent (MA) to that neighbors.

Step 2: The Mobile Agent selects the shortest path of the route to move towards the destination D as given in the figure 1 such as P1, P2 and P3.

Step 3: The MA1 moves towards the destination D in a hop by hop manner in the path P1 and MA2 in P2 and MA3 in P3 respectively.

Step 4: Then the MA1 calculates the Total Congestion Metric (TCM), TCM1 of that path P1 and similarly MA2 calculates the TCM2 of P2 and MA3 calculates the TCM3 of P3.

Step 5: Now the destination D sends the total congestion metrics TCM1, TCM2 and TCM3 of the paths P1, P2 and P3 respectively to the source.

Step 6: Now the source selects path using min (TCM1, TCM2, and TCM3) and sends the data through the corresponding path which has the minimum congestion.

MOBILE AGENTS TECHNIQUE

Mobile agents are software entities that act on behalf of their creators and move independently between the several hosts. In general, a mobile agent executes on a machine that hopefully provides the resources or the services that are needed to do its work. If a machine does not contain the needed resources or services, the mobile agent are transfer itself to a new machine. Lange and Oshima [8] enumerate several beets of using mobile agents. Of particular interest to MANET routing are.

• Mobile agents are able to upgrade protocols in use by moving to a destination and setting up communications operating under revised policies.
• After being dispatched, mobile agents become indecent dent of the process that created them and can operate asynchronously and react dynamically and autonomously to environmental changes.
• Mobile agents can reduce network load and latency by running remotely. Recently, a number of mobile agent systems has been developed to address applications in areas including telecommunication services, E-commerce and personal assistance. Included among these are Agent TCL [9] (later D'Agents), ARA [10], Concordia [11], and Aglets [12]. All such systems provide common functions including agent migration, inter-agent communication and security. One potential drawback of using mobile agents is that the agents require an "execution environment" in which to run. This has become less of an issue in recent years as mobile devices become more capable and the execution environments become somewhat leaner.

Routing Using Mobile Agents

Early work on routing in dynamic networks using mobile agents by Kramer et al. [13] concentrated on route discovery using agents to continuously track the network topology and update routing tables at all mobile hosts reached. When a route is requested, the agents are sent to discover routes to the destination. These agents analyze the routing tables on the hosts they arrive at and either return a discovered route to the sender or move on to another machine if no route is found. Unfortunately, this method increases network load.

Mobile Agent Technology

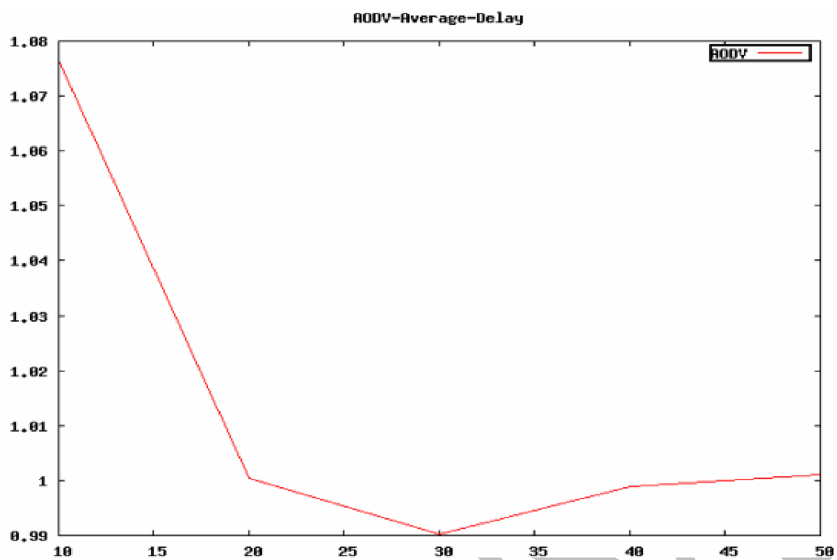
Mobile Agents are the novel way of building distributed software system. Traditional distributed systems are built out of stationary programs that pass data back and forth across a network [14]. They are usually kept at the certain state. They are able to exchange information for its owners and other nodes in order to work together.

RESULTS ANAYSIS:

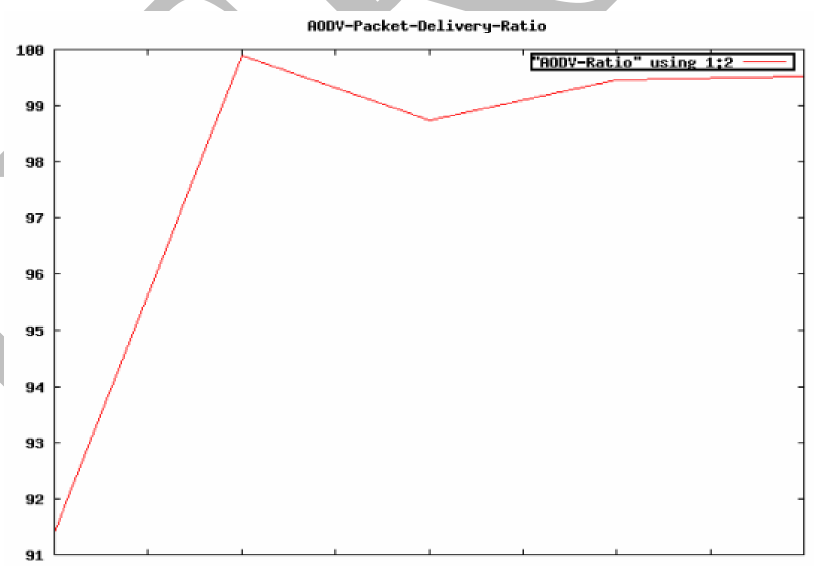
In this section. We assess the performance of our proposed mobile agent congestion control using aodv routing and aodv through the packet delivery ratio the ratio of the number of delivered data packet to the destination, average end to end delay the average time taken to arrive in the destination it also includes the delay caused by route discovery in aodv and mobileagent and packet drop the total no of packet dropped during the delivery of packet from source to destination. Through this we can anayse the performance of the both of them that we have represented in the following graph.

And after that we have also cdone the comparision of the aodv and mobile agent through this comparision we can recognise which one better and will help in improving the performance of the mobile adhoc network by removing the congestion from the network.

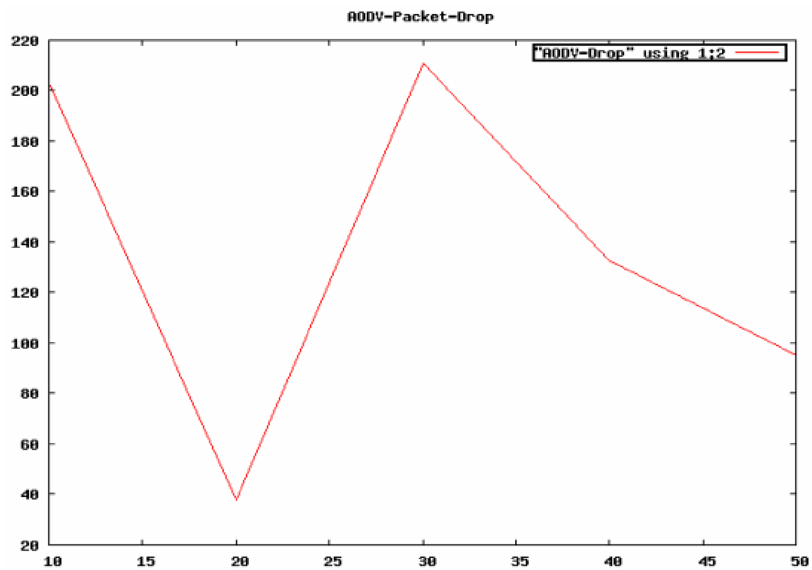
1. This graph is between average end to end delay and the speed of the mobile nodes. The average time taken by data packet to arrive inthye destination depends upon the speed of the nodes.
2.



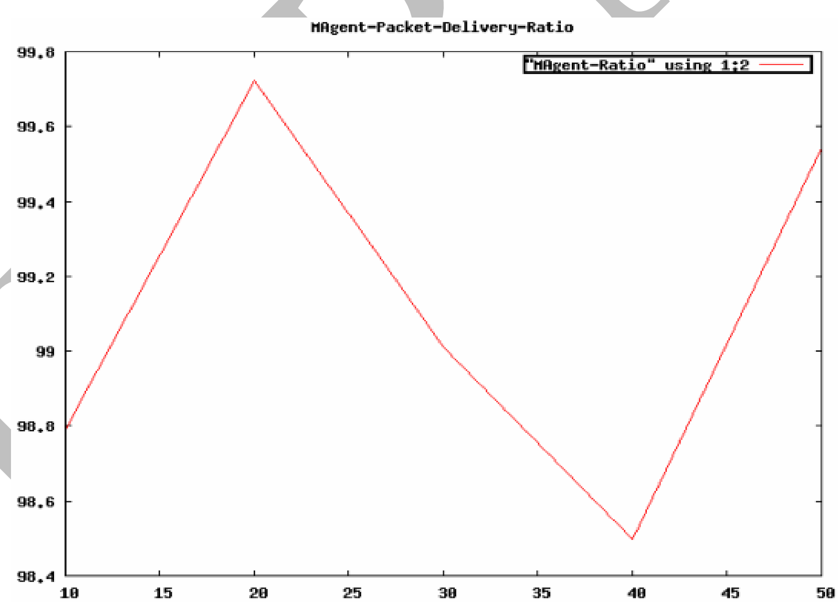
3. In this graph shows the AODV packet delivery ratio graph where no of packets delivered from source to destination depends upon the speed of the graph.



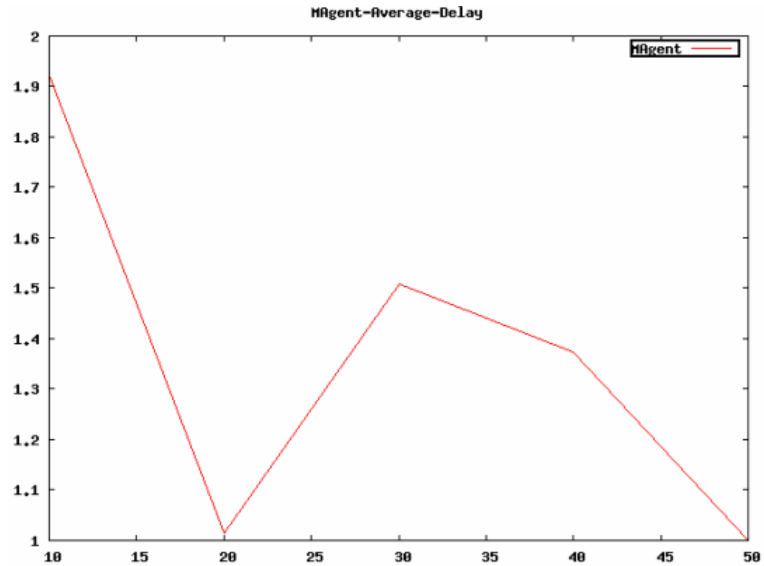
4. In this graph AODV packet drop graph shows the no of packet drops. The packet drops or loss occur when the packets are delivered from source to destination which basically depends on the speed of the nodes.



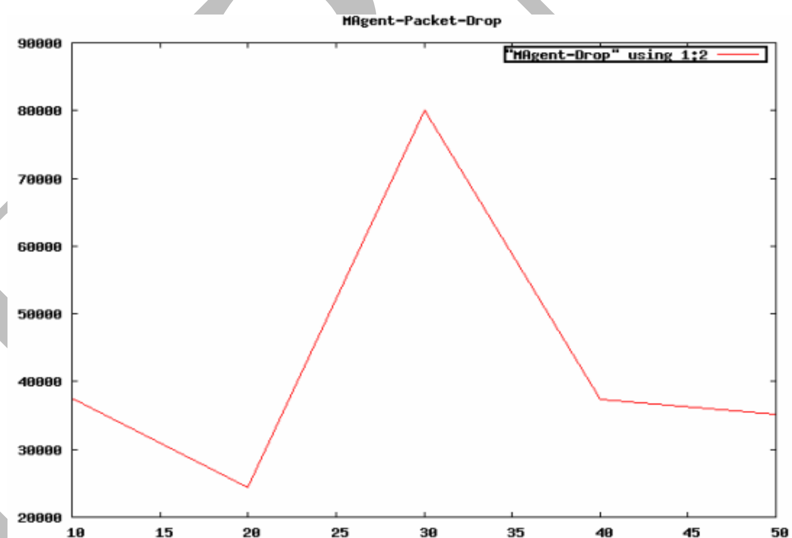
5. In this fig: MOBILE AGENT packet delivery ratio graph shows that the no of packets deliverd from source to destination.



6. In this fig: MOBILE AGENT average delay graph shows the time taken by data packet to arrive in the destination which also includes the other delay.

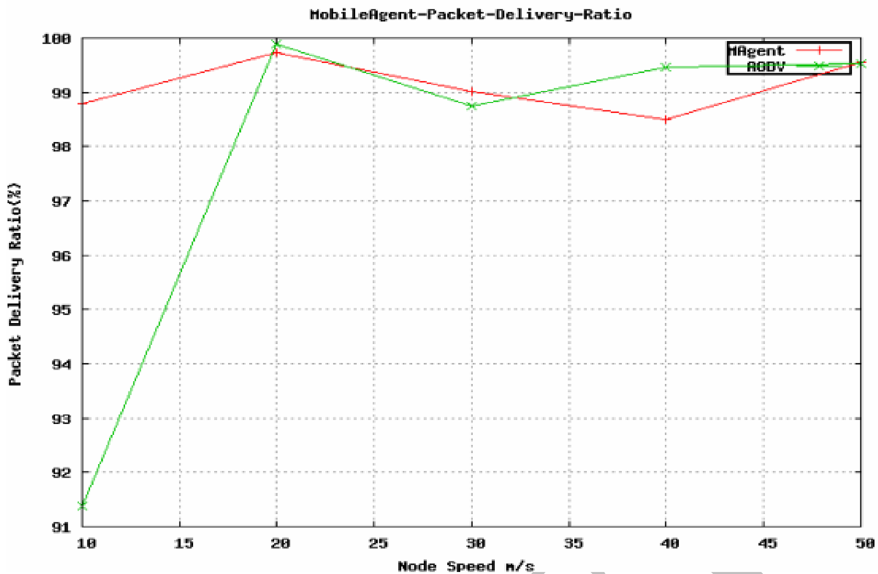


7. In this fig: MOBILE AGENT packet drop graph shows packet drop depends upon the speed of the nodes. It defines the total no of packet drops during delivery from source to destination

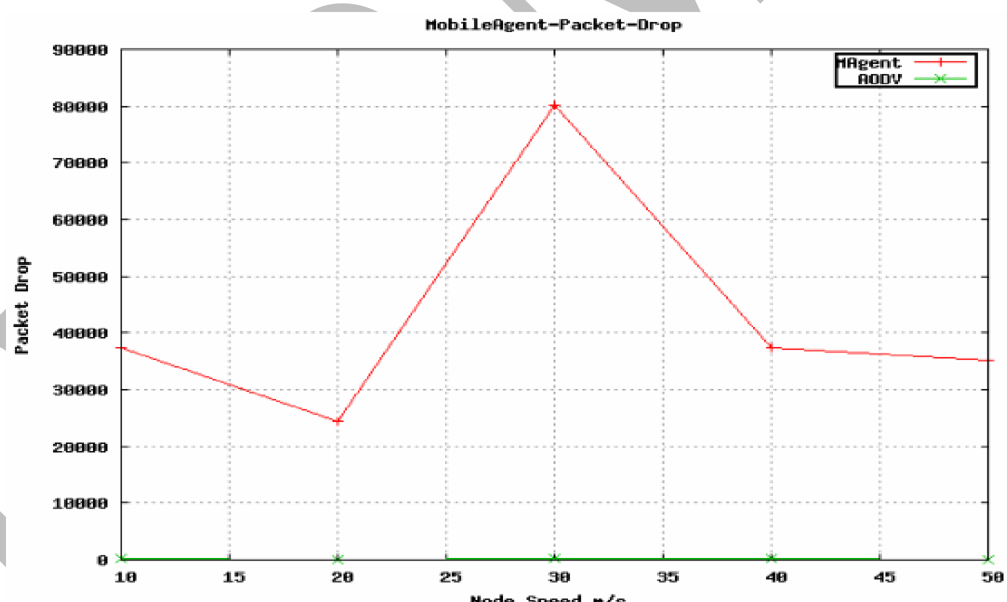


COMPARISION BETWEEN THE AODV AND THE MOBILE AGENT CONGESTION CONTROLUSING AODV ROUTING PROTOCOL.

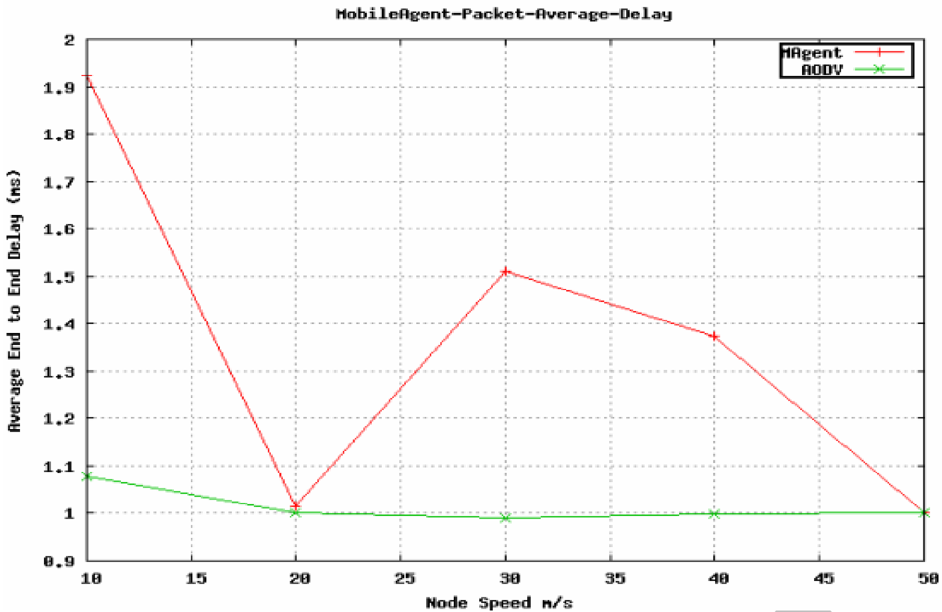
8. In this fig: Packet Delivery Ratio the ratio of the number of delivered data packet to the destination. As from the following graph determines the packet delivery ratio is greater in mobile agent as compared to the AODV**.** In mobile agent we can see that packet delivery ratio is much much greater than AODV.The greater value of packet delivery ratio means the better performance of the protocol. Hence Mobile Agent Congestion Control Routing Protocol performance is better than the AODV



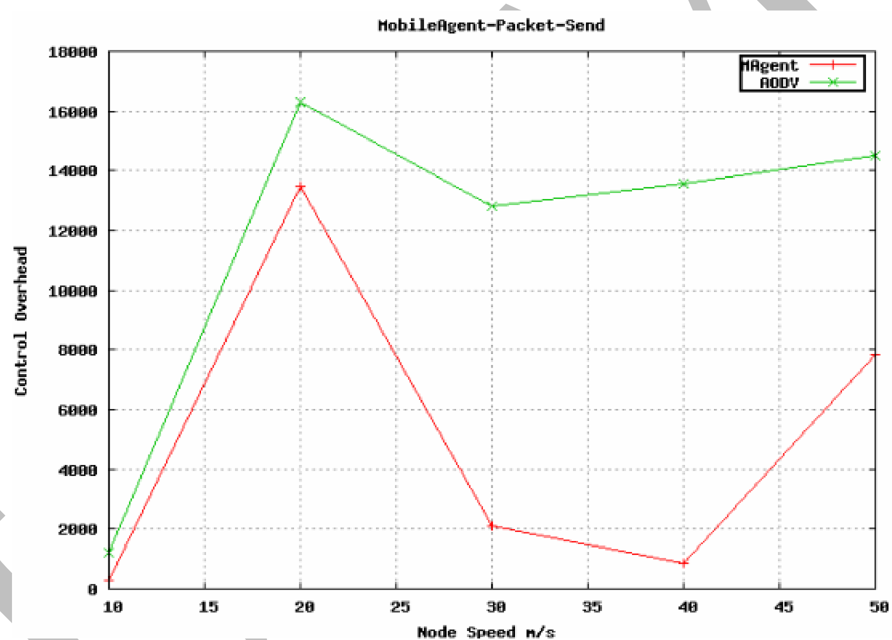
9. In this the packet drop graph between the AODV and Mobile Agent. This shows the total no. of packet dropped during the simulation. Hence in AODV the packet drop is much higher than the Mobile Agent and through this we can determine that in mobile agent the packet drop or loss is less than the AODV. The greater the value of packet drop means lesser the performance i.e. in AODV the packet drop is higer but in Mobile Agent the packet drop is less so, lesser the packet drop better the performance.



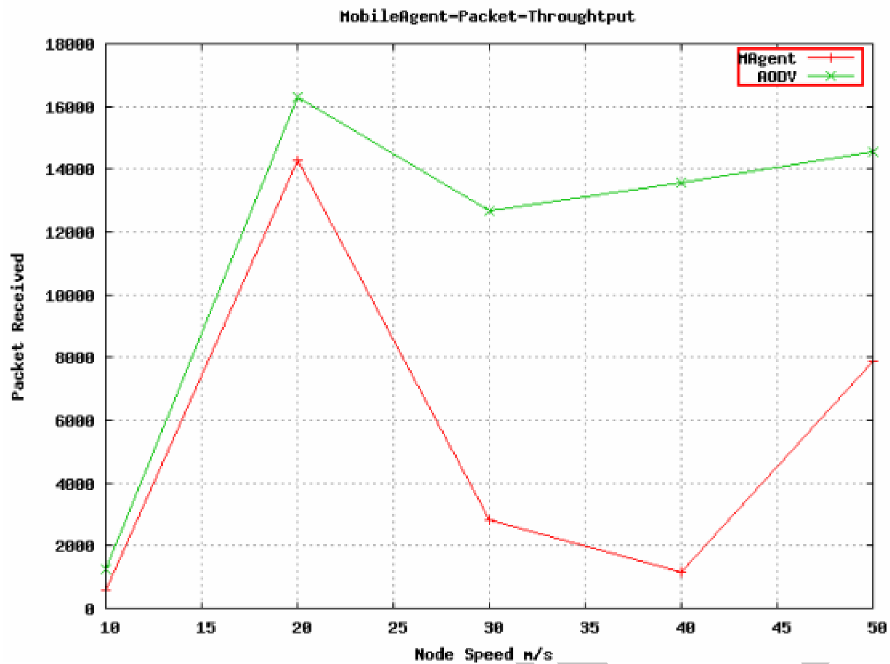
10. In this the average end to end delay is the time taken by a data packet to arrive in the destination it also includes the delay caused by route discovery process and queue in data packet transmission only the data packets that successfully delivered to destination that counted. In this fig we can see that AODV the average end t end delay is higer as compared to the Mobile Agent i.e. we can conclude that lower the average end to end delay the better the performance in this the mobile agents helps in increasing the performance.



11. This graph is between the control overhead and speed of nodes. This graph indicates packet overhead which refers to the time it takes to transmit data on a network.



12. The graph is plotted between the packet received and spped of the nodes. In this graph Mobile Agent attains the maximum throughput as compared to the AODV. Throughput is the rate of successful packet delivery from source to destination. In this the throughput also depends upon the speed of the nodes we can easily observed that from it.



CONCLUSION:

In this paper, we have developed of an agent based congestion control technique. In our technique, the information about network congestion is collected and distributed by mobile agents (MA). A mobile agent starts from every node and moves to an adjacent node at every time. A node visited next is selected at the equivalent probability. The MA brings its own history of movement and updates the routing table of the node it is visiting. The MA updates the routing table of the node it is visiting. In this technique, the node is classified in one of the four categories depending on whether the traffic belongs. The total congestion metric is applied to the routing protocol to select the minimum congested route in the network. , a mobile agent based congestion control AODV routing protocol reduces the end-to-end delay and the number of route discovery requests, balances the traffic load. By simulation results, we have shown that our proposed technique attains high delivery ratio and throughput with reduced delay when compared with the existing technique.

FUTURE WORK

Further improvement can be done by using other techniques for congestion control. Further research on congestion control can also be done by using mobile agents for improving the performance of the mobile ad hoc network

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