Performance Evaluation of Multiple TCP Connections over Different Routing Protocols in MANET

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***Abstract*—A MANET [1, 2] (mobile ad-hoc network) is a self organizing system of mobile routers and associated hosts connected by wireless links. In this ad-hoc network with multiple devices it is reasonable to expect that there will be multiple TCP connection simultaneously. Due to the mobility of nodes routing protocols proposed for the wired network does not work for this wireless scenario with the same efficiency. This means that we need a routing protocol that quickly adapts to topology changes. The main classes of routing protocols are Proactive, Reactive and Hybrid. In this paper we have attempted to compare the performance of Dynamic Source Routing (DSR), Destination Sequenced Distance Vector (DSDV) and Ad hoc On Demand Distance Vector (AODV) routing protocols over multiple TCP connections. We have done this evaluation by means of simulation using Network Simulator 2**

Keywords- MANET; DSDV; DSR; AODV; NS-2; TCP.

I. INTRODUCTION

A mobile ad hoc network is a collection of wireless nodes that can dynamically be set up anywhere and anytime without using any pre-existing network infrastructure. It is an autonomous system in which mobile hosts connected by wireless links are free to move randomly and often act as routers at the same time.

An important and essential issue for mobile ad hoc networks is routing protocol design that is a major technical challenge due to the dynamism of the network. Node failures and arbitrary movement of nodes break the routes and lead the frequent operation of rebuilding routes that consume lots of the network resources and the energy of nodes. Many efforts have been made to design reliable routing protocols that enhance network stability.

TCP/IP is the most widely used transport protocol for data services such as file transfer (ftp), email and www browsing. Due to this reasons, its use over mobile ad-hoc networks is a certainty. TCP primarily designed for wired networks, faces performance degradation when applied to the ad-hoc scenario. Earlier work focused on comparing the performance of different routing protocols with a single TCP connection [3]. In this paper we going to study the performance of multiple TCP connections over various ad-hoc routing protocols using NS-2 [4, 5] which is a discrete event simulator developed at Berkeley University.

II. MANET ROUTING PROTOCOLS

In this section we briefly describe three different routing protocols, DSDV and DSR, AODV which we evaluate. DSDV is a proactive routing protocol while DSR and AODV is a reactive routing protocol.

A. DSDV Protocol

DSDV [6] is a hop-by-hop distance vector routing protocol. Each mobile node maintains a routing table that stores for all reachable destinations the next-hop and number of hops to reach that destination, and the sequence number assigned by the destination. The routing table's updates are time-driven and event-driven, in which each mobile node transmits periodically its tables to its neighbors, periodically broadcasting routing updates. This transmission takes place also in case of topology change.

B. DSR Protocol

The DSR protocol is an on-demand routing protocol, based on the concept of source routing. Each data packet follows the source route stored in its header, giving the address of each node through which the packet should be forwarded in order to reach its final destination.

C. AODV Protocol

AODV [7] Discovers routes on-demand. It uses traditional routing tables, one entry per destinations that are dynamically established at each intermediate node. AODV attempts to improve on DSR by maintaining routing tables at the nodes, so that data packets do not have to contain routes.

III. PREVIOUS WORK

Most of the previous work is limited on performing simulations for ad hoc networks with a single TCP connection. Our work differs in that we use multiple TCP connections. We observe and comment on the behavior of each protocol.

IV. SIMULATION ENVIONMENT

We have used network simulator ns 2.35 for simulation, most widely used network simulator and freely available. We simulated network for an area of 500 m *500 m. The version of TCP used is TCP Tahoe [8, 9]and the node moves as per the "Random Waypoint" mobility model with a uniform speed of 0 to 5 m/s. Throughput have been calculated for 1, 4, 8, 14, 20 TCP connections. Same process was repeated for 15, 20, and 30 nodes in topology with each of the three routing protocols that are DSR, DSDV, and AODV. In our simulation, the packet size is 512 bytes and ACK is was 40 bytes.

V. SIMULATION RESULT AND PERFORMANCE EVALUATION

In this section we present our simulation observations that compare the performance of the protocols that we described in section 2.

A. Throughput

In Fig. 1, Fig. 2 and Fig. 3, we show the variation of TCP Tahoe cumulative throughput versus the number of TCP connections for the three routing protocols, i.e., DSR, DSDV and AODV respectively. As can be seen from these figures for the three routing protocols, the throughput initially increases with the increase in number of TCP connections till it reaches a peak and then falls off with a further increase in the number of TCP connections. Reason for this is as very less TCP connection does not use the available bandwidth completely. When we increase the number of TCP connection up to a limit for the optimal use of the available bandwidth. Further increase in the number of TCP connection decreases the throughput as the routing overhead increases with increase.

When the numbers of TCP connections are large, the cumulative throughput decreases with an increase in the number of nodes in the ad-hoc network. As with the increase in the number of nodes the routing overheads also increases.

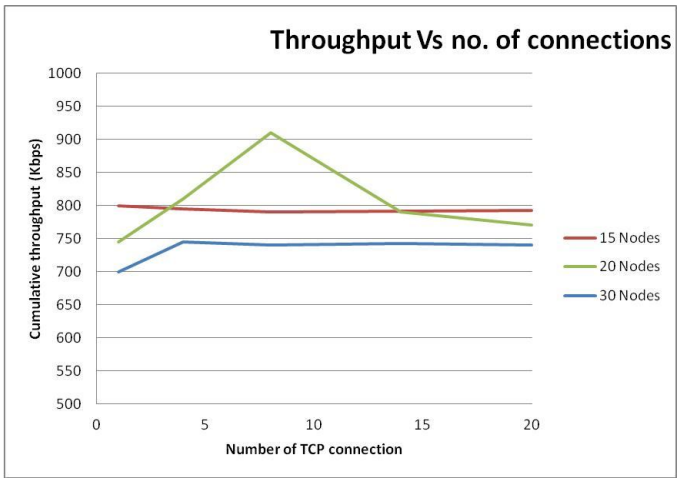

Fig. 1 Simulation result for DSR

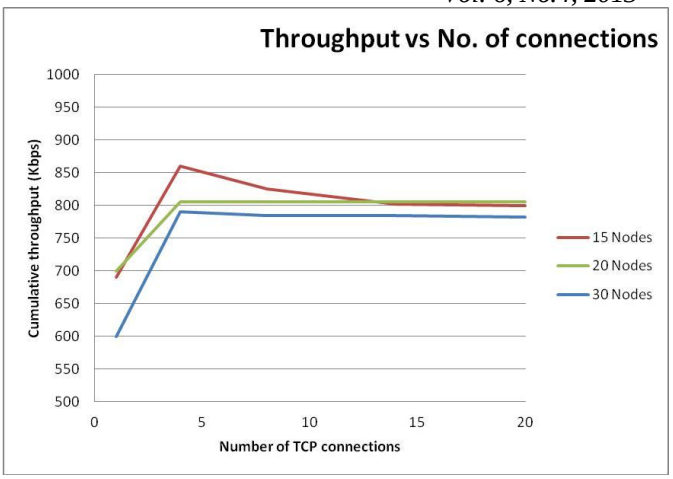

Fig. 2 Simulation result for DSDV

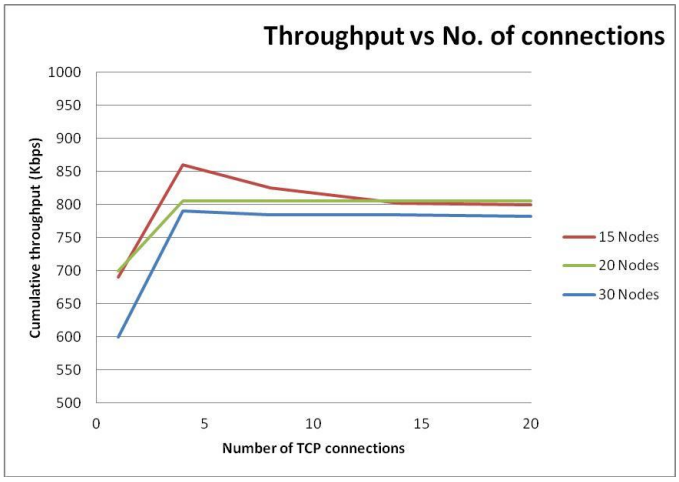

Fig. 3 Simulation result for AODV

CONCLUSION

This paper presents the results of a multiple TCP connection over various ad-hoc routing protocols i.e. DSR, DSDV, AODV. Results shows that the throughput increases with the increase in number of TCP connections up to optimum limit. Further increase in the number of TCP connection decreases the throughput as routing overhead increases with number of connections. Throughput also decreases with the increase in the number of nodes.

FUTURE SCOPE

Much research is going on and there are many issues that remain to be solved. Due to limited time, we have only focused on one proactive (DSDV) and two reactive (DSR, AODV) routing protocols. However there are many other protocols that could be subject to further studies.

- Comparing more routing protocols, like OLSR, ZRP, WRP, TORA.

- Use other mobility models like random walkthrough.
- Study the energy efficiency of the routing protocols.
- Use other performance metrics like fairness coefficient.

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