Comparative Analysis of TCP FRCP for Congestion Control Mechanism in Mobile Ad-hoc Network Protocols

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Abstract:
There are tremendous works on improving TCP and TFRC in MANET. However, TCP variation comes into form of TCP RENO, TCP NEW RENO etc. We have not discussed them because we were more interested in the behaviors of unmodified existing TCP and TFRC. TCP friendly rate control protocol is necessary part of the congestion management in Mobile Ad-hoc Network. In our research, we have done experimentation on the various aspects of Mobile Ad-hoc network protocols with TRFC mechanism to find the best solution and issues related to the network. In our research have done the comparative analysis of protocols of the MANET which have integrated with the TCP friendly protocol concept. In particularly, we have done a comparative study of ad-hoc network with TFRC. Our research is very helpful in finding the errors and congestion hit environment and their effects on the communication of the network.

Keywords: *Mobile Ad-hoc Networks, AODV, TCP Friendly Rate Control Protocol.*

1. TCP Friendly Rate Control Protocol

In response to the problems of TCP and UDP, a new transport protocol was proposed by the Internet Engineering Task Force (IETF), namely TCP-Friendly Rate Control protocol. The prime objectives of TFRC are to be friendly to TCP flows and at the same time maintain the smoothness of the changing rate to avoid severe performance degradation. TFRC is envisioned to be the choice of transport protocol for inelastic applications.
Some related documentation provides good solution for it. Research is to gain deep understanding on the performance of transport protocols by using different MANET routing protocols. In addition, it also intends to identify the relationship between transport protocols and routing protocols. As such, three sub-objectives have been established. Firstly, to investigate the performance of TFRC and TCP using different routing protocols in terms of throughput, packet loss and jitter. Secondly, to identify whether or not routing protocols have an influence on transport protocols and finally to identify which routing protocols work well with which transport protocols.

2. Objectives

To achieve or set proposed scheme and ideas, we will target our objectives given below:

- To achieve better solution for congestion control mechanism, analysis of congestive network and normal network will be consider.
- To provide exact idea of the network behavior, analysis study with simulation of MANET protocols will be done.
- To find the performance of the MANET protocols under congestion control mechanism such as TCP friendly rate control protocols.

3. Methodology for research

Our research has focused on providing better comparative analysis of the MANET protocols. We have started with simple network of the Mobile Ad-hoc Network with factors like Delay, Throughput. Further we process done is in following Phases:

1st Phase: This phase contained the basic functionality and layout of network using servers and ad-hoc devices.

2nd Phase: In this phase, we have implemented different tasks to network by configuring the task management through task manger in OPNET. After configuring tasks, we will configure the traffic type i.e. FTP and HTTP. After all configurations of applications, finally we will configure the profile for different scenarios. Protocols used is AODV.

3rd Phase: In this phase, we have implemented a congestive hit network into the normal network with different scenarios containing variation in number of mobile nodes. Variation of Mobility and Dense network has been considered for the experimentation.

4th Phase: We have implemented TCP Friendly Rate Control Protocol with default values to find the congestion avoidance analysis.

5th Phase: We have finally analyzed the results of Protocols by implementing the comparative study.

There are different kinds of parameters for the performance evaluation of the routing protocols of MANET with and without congestion control mechanism. Below is the node architecture for normal ad-hoc device in figure 1.

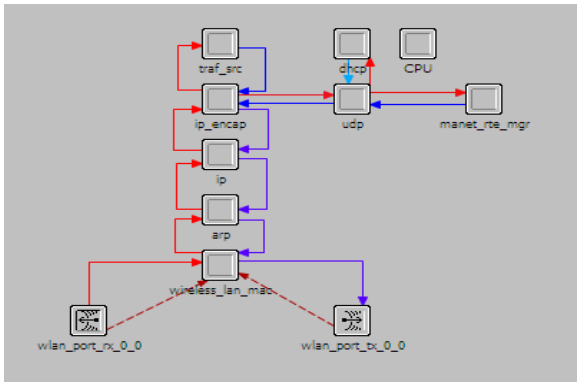

Fig 1: Node architecture of normal TCP

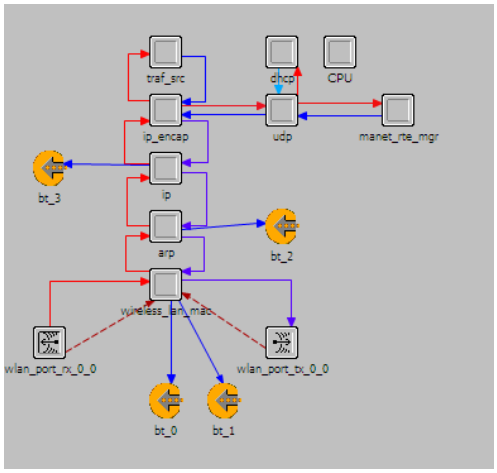

Fig 2: Node architecture changes for TCP variance

Above are the changes done in node architecture for TCP friendly rate control mechanism.
Performance of network decreases after congestion scenario (scenario shown in below figure).

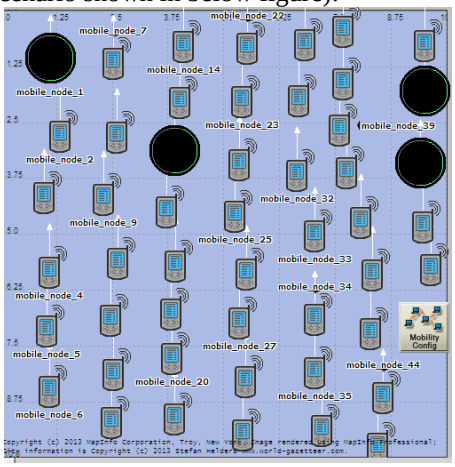

Fig 3: Congestion network scenario

To avoid affects of congestion, TCPFRC approach of AODV protocol has been implemented by introducing logging modules on medium access layer which use to monitor average metric value used by network while communication. It maintains an average value for delay and number of hops.

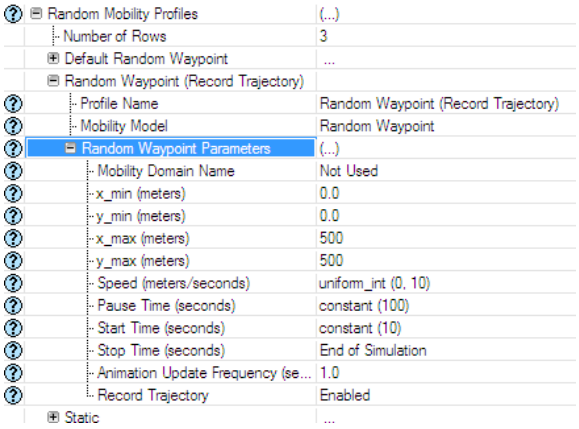

Fig 4: Mobility configuration for the simulation

The mobility profile for the simulation is shown above in figure 4.

4. Experimentation done with TCP variation

We have started our experimentation of mobile ad-hoc protocol AODV with 50 nodes. Following are the parameters used in simulation.

Parameters	Value
Simulator	OPNET
Simulation Time	900 sec
No of nodes	50
Routing Protocol	AODV
Traffic Model	CBR
Pause Time	100 sec
Speed	11 mps

Table 1: Parameters used in simulation

Below are the results for normal network, normal network with congestion scenario and finally congestion avoidance scenario respectively in figure 5 and figure 6.

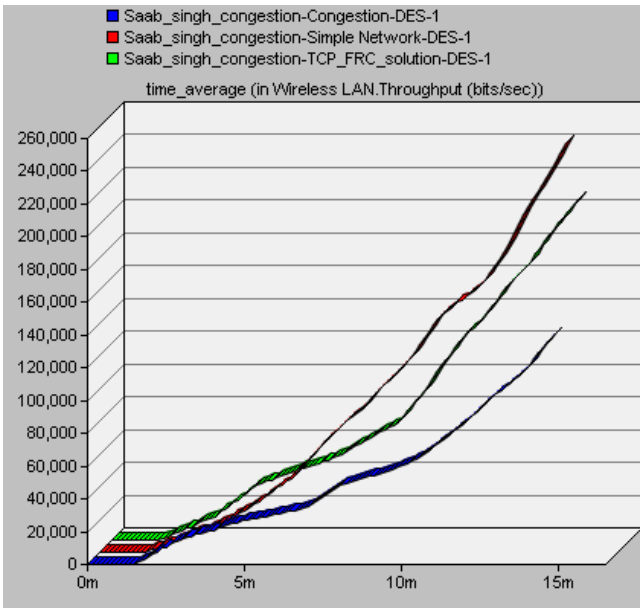

Fig 5: Throughput comparison of three scenarios

The performance of network is compared in above figure (Figure 5) and it show that the upper orange line of the throughput for normal AODV scenario. Blue line in bottom shows the decrease in the throughput in case of congestion scenario. Red line in middle shows the normalization process of the network as in case of avoidance of the congestion with TCP friendly rate control. It is clear from the graph that avoidance of congestion in case of TCPFRC scenario.

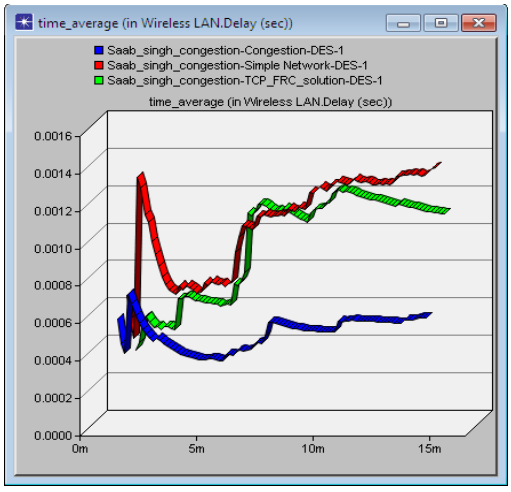

Fig 6: Delay variation for three scenarios

The performance of network is compared in above figure (Figure 6) and it show that the red line shows` the delay of the normal network and blue line shows the decrease in the delay which is in case of congestion delay will be less and will increases according to the usage. Orange line shows the delay normalization process with TCPFRC variation of TCP.

4. Conclusion and Future Scope

This paper explains different variation of TCP variants for avoidance of congestion. Paper shows the normalize process by TCP based variant known as TCP Friendly Rate Control. Throughput decreases due to congestion and recovery takes place with implementation of TCP variant. Node architecture has been modified for avoidance of traffic.

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