A PERFORMANCE EVALUATION STUDY OF SELECTED TCP PROTOCOLS ON WIRELESS AD-HOC NETWORKING ENVIRONMENTS

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Introduction

- In the present time many people prefer to use the modern wireless mobile devices for their day today use.
- Wireless networking is very flexible in usage and it can support more than one device in one instance and it also covers larger geographical area.
- With the development of this networking process, people started to face for many problems with respect to their network connectivity with compared to the wired network connectivity.
- The major issue caused by this wireless connectivity is the connectivity speed. Because in wired connectivity most of the time has a constant speed where as in wireless connectivity the connection speed changes frequently.
- Therefore many researchers around the world are interested in finding the network issues with respect to the wireless connectivity in different scenarios. Previous research studies investigating the performance of the transport layer protocols have just looked at the TCP protocol without considering much of its properties.
- In this study we investigate the performance of the TCP and two of its well known properties TCP/Tahoe and TCP/Reno.
- With the two chosen protocols we carryout simulation based experiments to investigate the performance of TCP/Reno and TCP/Tahoe, under different testing conditions.
- We also consider the well known adhoc networking protocols such as AODV,DSR and DSDV for the simulation based experiments. Our simulation based experiments indicate that DSDV performs well rather than AODV and DSR.

Methodology

- TCP-Tahoe and TCP-Reno are used as the testing protocols for this work
- NS2 used for implementation and testing performance under varying conditions
- Ad-hoc network is considered
  - Nodes make intermediate connectivity among themselves
  - Assigned node works as source node for the implementation and also another assigned node be the destination node
- Linux Ubuntu 18.10 used as the operating system
  - core i3 CPU
  - 4GB RAM
- network performance metrics
  - Throughput: Defines the rate of something can be processed; it means in the network, the amount of effective message delivery over a communication channel, perhaps the delivery over a physical or logical link

$$Throughput = \frac{Number\ of\ received\ packets}{Last\ Packet\ sent\ Time\ -\ First\ packet\ sent\ Time}$$

  - Packet loss: For one reason or another, the packets are dropped from node. This causes unreliable delivery in the network. packet loss happens in the wireless network more than the wired network because of sharing media among nodes.

$$PacketLoss = \sum Send\ Packets - \sum Received\ Packets$$

  - Packet Delivery Ratio (PDR): It is referred to the number of packets effectively delivered to an endpoint as compared to the amount of packets that has been sent out by the sender

$$PDR = \frac{\sum Total\ number\ of\ Received\ Packets}{\sum Total\ number\ of\ Send\ Packets}$$

  - Delay: Delay is the time faced by a packet to move or travel across the network from one node to another

$$Delay = Tr - Ts$$

Where Tr - receiving time of that packet , Ts - sending time of a particular packet

$$Mean\ Delay = \frac{Total\ Delay}{N}$$

Where N - total number of packets received during simulation time

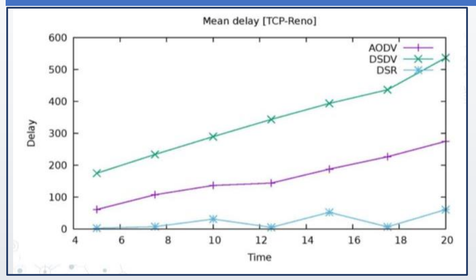
Experimental Setup

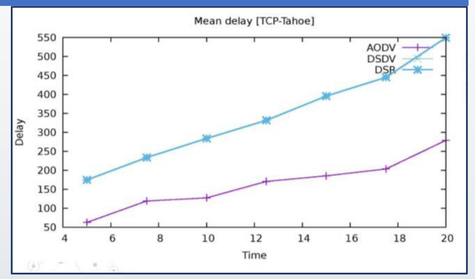
- Creating dataset for the performance evaluation
  1. Building mobile nodes movements source file by varying time
     - 50 mobility nodes , 1000m x 1000m of area size, min speed: 10.00ms-1 , max speed: 50.00ms-1 , avg speed: 23.72ms-1 , Uniform speed
     - Time Duration (Minutes) – 5, 7.50, 10, 12.50, 15, 17.50, 20
- Creating 6 Difference operation files as follows

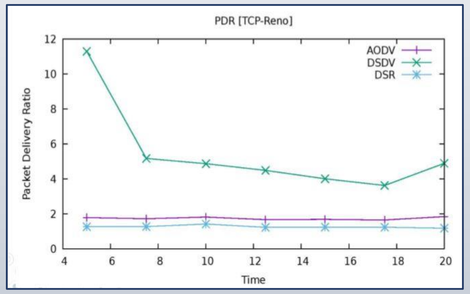
Packet Type	Routing Protocol
TCP-Reno	AODV
	DSDV
	DSR
TCP-Tahoe	AODV
	DSDV
	DSR

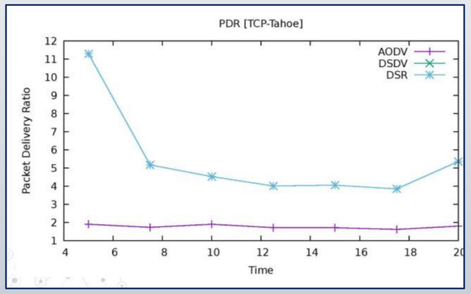
- Extracting required columns from trace files
- Use the extracted column data for calculations on behalf of the network parameters
- Repeat the process on basic of the difference time durations

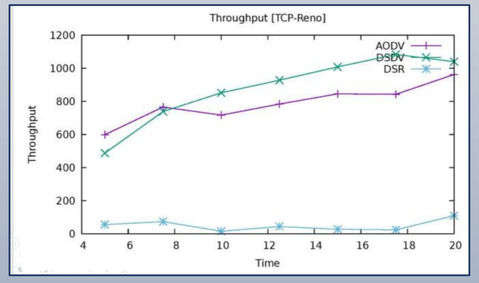
Results

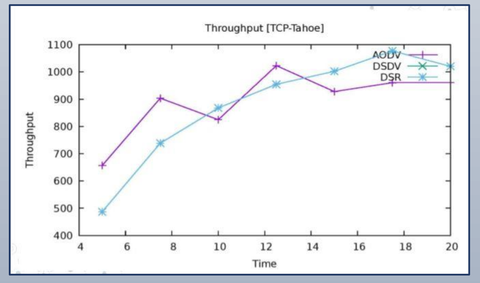


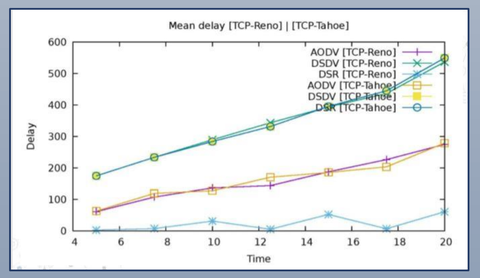


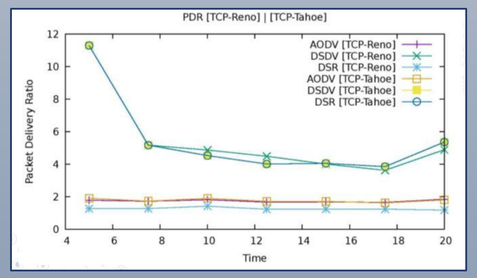


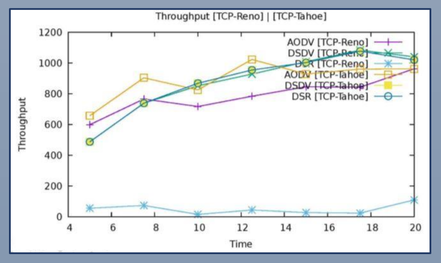












Packet Type	Routing Protocol	Drop Rate(%)	Delivery Ratio (%)
TCP-Reno	AODV	5.969 %	94.031 %
	DSDV	1.649%	98.351%
	DSR	3.156 %	96.844 %
TCP-Tahoe	AODV	6.177 %	93.823 %
	DSDV	1.762%	98.238%
	DSR	1.759 %	98.241 %

Discussion and Conclusion

- The goal of this research was to evaluate network performance of TCP under different traffic behavior and rank various techniques for network performance within that context.
- For this study two protocols of TCP were selected as TCP-Reno and TCP-Tahoe
- The 50 nodes are placed on the area size of 1000m x 1000m with minimum speed of node as 10 ms-1, maximum speed of node as 50 ms-1, average speed of node as 23.72 ms-1 and with uniform speed over the simulation time as 5min, 7.5min, 10min, 12.5min, 15min, 17.5min and 20min.
- Mobile nodes continuing to deliver data from source nodes to their respective destinations.
- PDR, Throughput and Mean delay were used to clarify the results (Network performance metrics).
- According to considered scenario TCP-Reno with DSDV routing protocol performance better than TCP-Tahoe (Routing Protocols - AODV, DSR and DSDV) and TCP-Reno (Routing Protocol - AODV, DSR)
- Consider on packet delivery ratio and throughput, DSDV performs well on them rather than AODV and DSR.
- Finally, conclude that DSDV with TCP-Reno performs better.

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