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Comparative Study performance of TCP Variants for MANET and WSN's Routing Protocols

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ABSTRACT

In the wireless network, Mobile ad hoc network and wireless sensor network are the types of network, who's communicating nodes can change their topology dynamically, whereas each can connect at a instant of time. It is a self deployed, and independent from the fixed infrastructure. It doesn't works on any centralized module coordinator. For the transmission of the data we have to use a protocol called TCP which may have different type of versions. It is very difficult to decide, what the best version of TCP is best for particular routing protocol. The available TCP versions are New Reno, Tahoe, SACK, FACK, Vegas etc. In this research work, we are comparing the performance of DSDV and AODV routing protocols on WSN and MANET by using different TCP Version like TCP New Reno, TCP SACK and TCP FACK. For performing this activity, we are using network simulator-2. Performance calculation has been done on the basis of four performance matrices like PDR, E2E Delay, normalized routing load and instantaneous throughput. To obtaining the values of these parameters we are using AWK scripts.

Keywords: - MANET, WSN, PDR, E2E delay TCP AODV, DSDV.

1. Introduction:-

Wireless network: - A wired network uses cable for connecting devices through the internet like a Ethernet port on the network router on the end and computer or other device to the other end. A network that uses radio waves to connect electronic devices to the internet and its applications are wireless networks [1]. In a wireless network radio waves are used for communication between devices instead of wired or any other cable, like when you are using Wi-Fi hotspot from your mobile device to connect the internet. Mobility provide by the wireless network which help to access internet at any place where network is available. In wireless network configuration or setup work is easier than wired network, also it is more expandable than wired network, and you can easily expand it with the help of equipments. Mobility provides freedom of movement and the ability to extend applications. Devices that share information in the form of e-mail messages, web pages, and database records, streaming video or voice. Some different type of wireless networks are used depends on their criteria and demand of scalability.

Wireless Local Area Networks (WLANS): A university campus, office, library or other particular building are some of those local areas where WLANS allow user to gain access to the internet. Due to short area distance the number of user are also small but internet speed is high. Some standards of WLANS are IEEE 802.1, HiperLAN, Wi-Fi.

Wireless Personal Area Networks (WPANS): A mobile device that share information with the help

of Infra Red (IR) and Bluetooth (IEEE 802.15) are the current technologies of WPANS. Bluetooth allow connectivity of personal devices with moderate internet speed in small area around 30 feet approximate while IR requires a direct line of site with short range.

Wireless Metropolitan Area Networks (WMANS): WLANS allows to access internet with in a building while WMANS technology allows gaining access of internet in metropolitan area such as different building in a city. With the high speed of internet performance in a city some standards that WMANS are used like Proprietary, IEEE 802.16 and WIMAX.

Wireless Wide Area Networks (WWANS):- A large area such as cities or countries maintained this type of network, for that it uses multiple satellite or antenna sites. Because of large area it is difficult to maintain it and performance is also low. Some standards of WWANS are Cellular 2G, 2.5G, 3G and CDPD.

Transmission Control Protocol (TCP):- TCP is an important transport layer protocol where we have to required reliable transmission. By the use of TCP, application programs can exchange the data to each other. In a communication network it is an important protocol for establishing and maintaining the network conversation. TCP provides reliable, ordered and error checked delivery of data stream between applications. With the IP (Internet Protocol), it can be defines how data packet can be exchange between computers. It is a connection oriented protocol, where connection has to be established and maintain until the communication is not finished. In a communication network TCP works on a transport layer where it provides host-to-host connectivity [2]. A protocol stack is appeared due to network congestion or other un-predictable network behavior there for data packets are lost in the network. TCP consists of different types of protocols such as HTTP, HTTPS, SMTP, TELNET and other protocols which are included in TCP. Some applications which do not need reliability they may use the connectionless (user datagram protocol) UDP.

TCP is available in various types of such versions are New Reno, SACK, FACK, RTCP Vegas etc..We have taken following three versions New Reno, SACK, FACK.

TCP New Reno: - New Reno is the upgraded version of TCP Reno. The working of TCP Reno is very well in case of small packet loss but it does not performs good when we have multiple packets losses and another problem is that in case of small window it will never receive the duplicate acknowledgement. Due to above reasons New Reno has come with slight modification. It has ability to detect the multiple packet losses and fast retransmission when multiple packets are received by it.

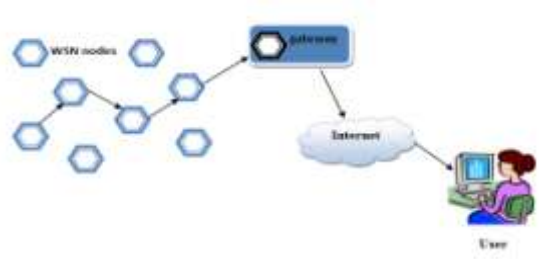
TCP Selective Acknowledgments (SACK):- TCPSACK is stands for TCP with Selective Acknowledgments. It is an extension of TCP RENO. This variant of TCP is totally works around the various problems like detection of multiple lost packets, and re-transmission of more than one lost packet per RTT, which is facing by TCP New-RENO and TCP RENO. It retains initiate slow and fast retransmits parts of RENO. If packet loss is not detected by modified algorithm, It coarse grained timeout of Tahoe to fall back on. Selective acknowledgement TCP is always requires that segments should be acknowledged selectively not be acknowledged cumulatively. If there are no such segments outstanding then it sends a new packet**.** Thus more than one lost segment can be sent in one RTT.

TCP Forward Acknowledgments (FACK):- it is a type of algorithm that is geared at conjunction controlling. It is works on top of selective acknowledgement options. The information which is provided by FACK algorithm uses information provided by SACK to add more precise control to the injection of data into the network during recovery – this is achieved by explicitly measuring the total number of bytes of data outstanding in the network. FACK decouples congestion control from data recovery thereby attaining more precise control over the data flow in the network. The main idea of FACK algorithm is to consider the most forward selective acknowledgement sequence number as a sign that all the previous un-(selectively)-acknowledged segments were lost. This observation allows improving recovery of losses significantly.

Wireless Sensor Network (WSN):- A type of wireless network consist number of numerous sensor nodes those are linked together and connected for performing same task cooperatively.WSN has small infrastructure or no infrastructure. WSN provide facility for monitoring Environmental conditions like temperature, sounds, pressure etc. It has wide range of application to science, transportation, civil infrastructure and security [4]. Wireless sensor network perform distributed networking with the help of sensor nodes which are linked together, but it depends on construction. A sensor network consists small or large number sensor nodes, these nodes are depends on size because different size of nodes works efficiently in different network. WSN has three main components are:-

- Sensor nodes
- Gateway
- Software

Sensor nodes design has microcontroller which control monitoring, a radio transceiver for generating radio waves and different type of wireless communicating devices.[8] A routing algorithm performed like it performed in ad hoc network. A sensor node performs their task together and passes their data result through the gateway to the application user with the help of software.



2. Simulation Parameters and Experimental Results

In order to analyze and compare the performance of AODV and DSDV routing protocol, we have taken following performance matrices. The purpose of the simulations is to compare the efficiency of these routing protocols based on different simulation parameters. The focus is to concentrate on following four performance metrics:

- Packet delivery ratio
- End-to-End delay
- Throughput
- Normalized Routing Load

Packet Delivery Ratio: It is ratio of number of packets successfully delivered to the destinations to the total packet generated by sources.

End-to-End delay: It is the time taken by a packet to travel from source to destination in any network. It is combination of delays in the whole process of transfer from source to destination.

Throughput: It is the rate of successfully transmitted data packets in a unit time in the network during the simulation.

Normalized Routing Load: It is the number of routed packets transmitted per data packet delivered at the destination.

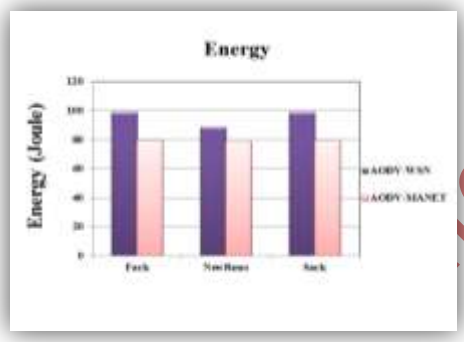
We have created a wireless scenario of 10nodes randomly scattered in an area 1074x595. The Table-4 indicates the simulation parameters.

Table 1.1 Simulation Parameters

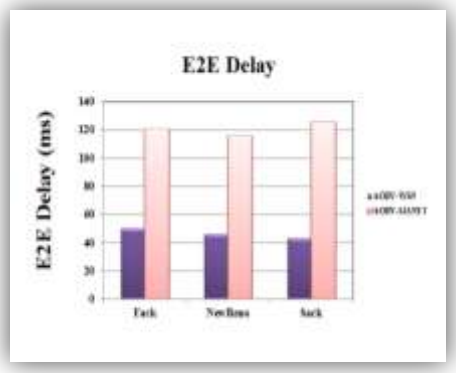
Parameter	**Value**
Network	MANET & WSN
Simulation Area	2000×2000m^2
MAC Protocol	IEEE 802.11,IEEE 802.15.4
Mobile Nodes	50
Antenna Type	Omni-directional Antenna
Propagation Model	Two Ray Ground
Routing Protocols	AODV and DSDV
Traffic Source	TCP, FTP
Simulation Time	30s
Rate	4 Packets/s

Performance of AODV Routing Protocol

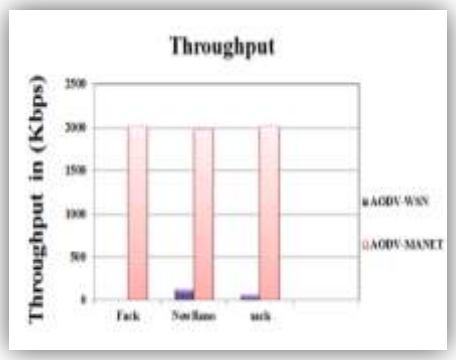
Energy



E2E Delay



Throughput

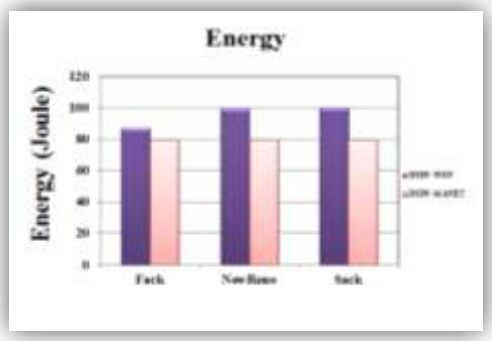


Packet Delivery Ratio

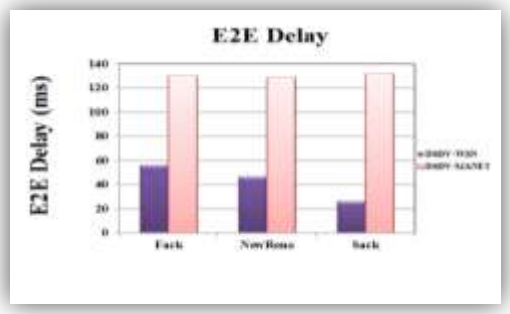
As the analysis of performance of AODV routing protocol in WSN and MANET, TCP New Reno has given very good performance on all four performance matrices then other two versions of TCP. The overall performances are showing in above graphical representations.

Performance of DSDV Routing Protocol

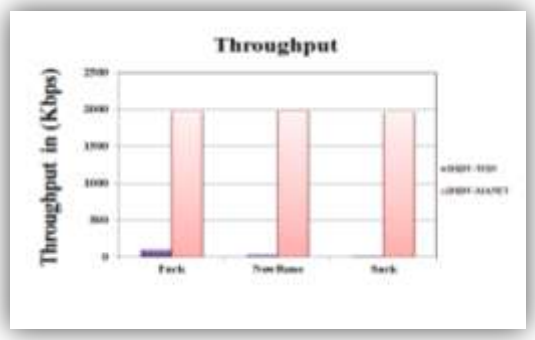
Energy



E2E Delay



Instantaneous Throughput



Packet Delivery Ratio

We are also showing the performance of DSDV routing protocol. Performance matrices are same for the DSDV. As the analysis of performance of DSDV routing protocol, TCP New Reno has also performing well accept the E2E delay and Energy cases. As showing in the E2E delay and energy results, it has give closer value to the best.

3. Conclusion

We have successfully analyzed the performance of AODV and DSDV routing for the better selection of TCP version for particular network environment. The complete simulation is successfully run on the network simulator-2. As the analysis of TCP New Reno, TCP SACK and TCP FACK performances, we can say, New Reno is the best TCP for both routing protocols because of low energy consumption, better packet delivery ration, throughput and minimum delay for the WSN and MANET.

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