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MECHANIZING WIRELESS LAN (WLAN) USING COMPRESSION TECHNIQUES

Shweta Singh
KIET Group of Institutions
Ghaziabad, India

Anil Kumar Ahlawat
KIET Group of Institutions
Ghaziabad, India

Arun Kumar Tripathi
KIET Group of Institutions
Ghaziabad, India

***Abstract*—Wireless technology comes under the new revolutionized technologies in today's era, contributing largely to establish communication in between the two or more connected devices. Wireless network provides an ideal environment to access network within enterprises. Performances of wireless LAN (WLAN) depends for say onto the services provided to support mobile devices communicating through Access Point (AP). The paper provides simulation on campus WLAN in consideration with OPNET IT GURU EDUCATIONAL VERSION 14.5. Performance for the connected devices in a WLAN focuses onto minimizing the Delay factor and improving to the Quality of Service (QoS) factor on basis of certain measuring parameters concerning to security factor to change the format of data transferred so far.**

Keywords—**: *Collision count, Utilization, WLAN, TCP Connection, Congestion, RTS, CTS, Media Access Delay, CSMA/CA, Decompression, Compression, Mobility, Retransmission, Throughput***

I. INTRODUCTION

IEEE 802.3 gave a standard that provides the facility to number if users to efficiently access in wireless environment, by introducing wireless technology into numbers of users performing their tasks in an "anywhere at any time" criteria. WLAN [1] facilitates numbers of user to access the network or to perform data transfers in a non-wired environment along within the limited geographical area, hence opting its place in houses, offices, buildings, colleges, etc.

Since, WLAN is easy to use and install, its easy installation and usage provided it to be concerned under revolutionary commercialized technology used. Commercials usually use WLAN to stay connected through their customers at any time. Communication link in between devices involved in a network is generally established through the passage of radio frequency signals including AP [1], [2] as an intermediary. Devices such as laptops, mobile phones, even smart phones may be allowed to connect as routers through APs, equipped with Wireless Network Interface (WNI) [3] that makes possible to send and receive the radio frequencies.

The architecture of WLAN includes following four factors, namely:

A. Stations

The components in WLAN environment should be equipped with WNI controllers (WNICs). These WNICs helps the components to communicate in a wireless environment. Devices would be laptops, smart phones.

B. Basic Service Set

The Basic Service Set (BSS) is a set of all devices that are communicating with each other. There are generally two basic BSS, probably Independent BSS (ad-doc network with no AP); Dependent BSS (also known as infrastructure BSS). Components working in Independent BSS are not allowed to connect with any other basic service.

C. Extended Service Set

A set of all BSSs is an Extended Service Set (ESS). AP in ESSs is made to stand unique along with the ESS ID called SSID.

D. *Distribution System*

APs in ESS are connected via Distribution System (DS). The concept of DS is generally focused to provide wider geographical area while roaming between calls.

The IEEE 802.11 [4] provided us with two basic modes to operate on i.e. infrastructure and ad-hoc. Infrastructure type of mode generally consists of a prior set architecture in which the devices are bound to access the dedicated AP. Unlike to the infrastructure mode, ad-hoc mode provides mobile devices to move across the limited geographical area and allows them with a facility to demonstrate temporary networking environment. Users can easily connect to and are allowed to release that AP at any time.

1) Infrastructure: The most basic mode that allows devices to communicate through a fixed structure in a network. APs are usually made fixed in this mode such that they easily provide a wireless environment to the connected devices within a concerned geographical area.

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2) *Peer-to-Peer:* The Peer-to-Peer (P2P) [5] mode is implemented a kind of Independent BSS i.e. Stations are provided with ad-hoc networking such that they are allowed to move within limited geographical area. Advantage to the ad-hoc networking is that no single device is set as co-ordinator i.e. responsible to provide the permission to other stations in establishing communication in with other connected devices.
Hence P2P provides devices with facility to communicate in an environment free from any central AP that will be responsible to set priorities for devices that are eager to communicate.
Rest of the paper will consider the following sections to be underlined. Section 2 will underline towards the WLAN and its considerations consisting of factors that includes the Mobility factor (factors that need to be concerned while dealing with mobility in WLAN), also what effects doe's compressions and decompressions will male to secure the data packet. Section 3 represents the simulation environment consisting of possible scenarios that can occur to communicate within mobile devices. Section 4 underlines the analysis of retransmissions attempted and throughput factors in simulation scenarios in comparison to the compressed and uncompressed formats of data transferred. Section 5 and 6 consists of conclusion and futuristic scope.

II. MOBILITY ARCHITECTURE

WLAN is an ad-hoc networking technique that facilitates numbers of user to work in a non-wire environment, with more flexibility to operate onto devices. Devices such as mobile phones and laptops, formally known as mobile devices, are always delighted to communicate with other devices supporting mobility factor. Devices involving mobility factor in a WLAN are free to move within a limited ranged geographical area while stay connected to any of the best possible AP with maximum radio frequency maintained with.
A technique known as Career Sense Multiple Access/Collision Avoidance (CSMA/CA) [5], [6] came into discussion board while dealing with WLAN environment. The technique is based on the three basic protocols to access channel in the network relying on the usage of the MAC [6] technique. The three protocols can be more understood as following:

A. Distribution Co-ordination Function (DCF): Basic technique relying on IEEE 802.11 standard employing CSMA/CA approach is DCF. Devices under this approach are assumed to wait and sense the channel till channel is available to send shorter Request to Send (RTS) and Clear to Send (CTS) messages.

B. Point Co-ordination Function (PCF): When DCF is set to an environment consisting devices with priority it is categorised under PCF. Under this scheme, every device is given with the priority that enables to access the channel.

Following can be few important considerations taken to be with care while working in a wireless network. These may be as categorised:

1) The Hidden Terminal Problem: The hidden terminal problem is a major issue generally faced with the mobile devices while communicating in a wireless environment, as in this problem the devices are unable to discover each other's availability and start communicating in an unknown environment. And, this criteria leads to a collision factor occurring to the network. To overcome with this issue, it is recommended generally to introduce RTS/CTS messages that help stations to know about the other existing devices, about every communication that will be taking place. RTS/CTS are short messages that are sent before the communication is to take place in between the devices, it confirms to other devices so that no or minimum collisions will occur.

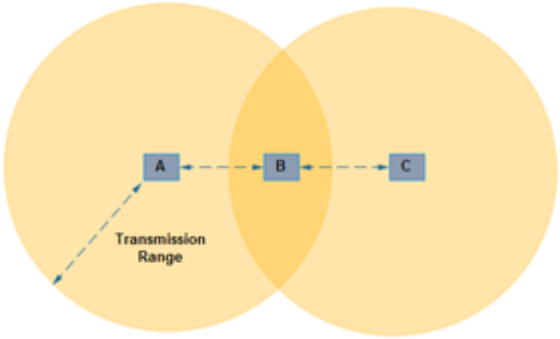

Figure 1. Hidden Terminal Problem

2) The Exposed Terminal Problem: The hidden terminal problem can still face collisions occurring with the devices that are still unknown about the existence of each other. Exposed terminal problem is an extended or advanced version to hidden terminal problem. Unlike to hidden terminal problem, devices in this are likely to know the existence of each other device in a network. RTS/CTS messages help other devices to communicate into the network with a strategy being followed.

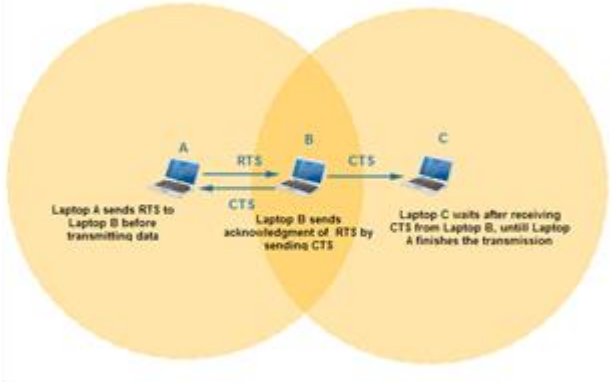

Figure 2. The Exposed Terminal Problem

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3) RTS/CTS Mechanism: RTS/CTS mechanism is a methodology to be used in wireless environment when it is needed to communicate within mobile devices. The devices are recommended to begin their communication with RTS/CTS messages that establishes the basis for communication in between stations. The delivery mechanism includes the ACK type messages to be communicated for each successful delivery of data packets. Fig. 2 represents the complete process for RTS/CTS mechanism.

4) Quality of Service (QoS): The QoS [7] is a measuring unit that helps the users to choose the most appropriate application or service to use. The more the measurement of QoS is, the more the efficient service is. The QoS can be made effected by considering the parameters such as bandwidth, retransmissions attempted, collisions, loss of packets, etc.

Mobility [8] factor in WLAN provides the users with the capability to move through a limited geographical area so that mobile devices communicate through AP along with the movement through the trajectories. The devices may communicate with the server that is either fixed or wireless (with mobility), both the server and devices can move at a time in a WLAN environment consisting if mobility factor.

The performance of devices communicating in WLAN environment along with the mobility factor can consist fairly following considerations:

A. Data Rate: For a certain service if 100% data rate is assumed to happen, it may be partially true as it may possibly provide by only 50% to 75% of the maximum data rate for that service. The data rate can by either maximum in range or may be minimal in range.

B. Fragmentation: The fragmentation process or the fragmentation threshold is generally a process that allows the communicating devices to divide the data packets into one smaller part so that the divided threshold is allowed to take the minimal bandwidth onto the network. The threshold property is generally divided into smaller configurations so that a coke point situation is never occurred while accessing the channel.

C. Segment Size: The segment or segment size is consisting of numbers of segments that need to be transmitted while taking into the TCP connection [8] to access the channel. The congestion window is generally taken into consideration with respect to the segment size.

Due to an incremental growth in national, regional, and even metropolitan areas, it is far more important to efficiently use the bandwidth and space requirements so that data is kept and transferred securely. While transferring the large amount of data it is generally more recommended reducing the packet size up to an extent so that less bandwidth [9] is consumed and to accomplish the security factor to the transfer that has taken place.

To accomplish with the reduction factor, method known as compression and decompression techniques [10], are used that helps in changing the format of data packets by applying the algorithms so that any intruder is unable in extracting the information kept into the data packet. To define an environment handling multiple applications running at numbers of servers, such as ftp, http, etc., a configuration regarding all applications is required.

The compression technique usually reduces the data packet size, uses less bandwidth and fulfils the network requirements efficiently.

III. Simulation Environment

Simulation is implemented to measure the characterised parameters in WLAN environment with stations either in simultaneous movement along with the servers, even. To simulate WLAN, 15 wireless stations are made to move across in a campus range such that each station is allowed to roam through a set trajectory while accessing one of the applications. The key problem is to measure the performances regarding mechanism (RTS/CTS), out of two, is best suited with fewer retransmissions taken and along with the increased throughput value. Comparisons are made in between the two environments i.e. one with no compression-decompression technique and other with consisting technique.

This section underlines the possible scenarios to overcome the above discussed issues in WLAN with mobility factor.

A. First Scenario: Without RTS/CTS Mechanism

In this scenario, 15 wireless stations are taken to communicate with the server exchanging the applications in between. The stations are allowed to communicate in no RTS/CTS mechanism i.e. the stations are purely unknown about the existence of every other station in that network. Two servers onto two applications are allowed to move into the network providing the stations with different set of radio frequencies to be accessed with.

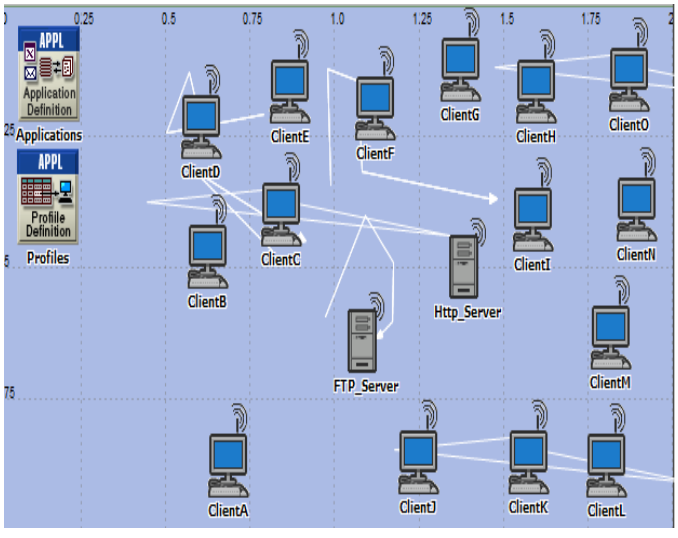

Figure 3. Stations communicating in WLAN with Mobility

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B. Second Scenario: With RTS/CTS Mechanism

This scenario is fully equipped with the RTS/CTS mechanism while establishing the communication in between the stations. Stations are enabled with sending shorter RTS/CTS messages before they need to communicate. The exchange of RTS/CTS messages prior to transfer data packets will prevent the collisions to take place while accessing the channel within a multiple device scenario.

Fig.3 represents an environment that includes stations communicating in WLAN environment with mobility depicting the two scenarios: (i) Without RTS/CTS Mechanism and (ii) With RTS/CTS Mechanism.

IV. Analysing the Simulation

This section is underlining the key concepts that need to be taken into consideration while dealing with WLAN environment. The scenarios taken to implement WLAN highlighted for two parameters i.e. retransmissions attempted and throughput consisting compression and decompression techniques for once. These two parameters act accordingly to the functionality the scenarios support.

A. Retransmission Attempts: Retransmissions are usually related to either the failure of stations or either because of no surety regarding the delivery of packets to the destined devices. Larger the retransmissions take place, the more the unreliable is the network. The purpose is to take care of this factor so that there is minimum loss for the data packets while communicating, so retransmissions attempted are lowered.

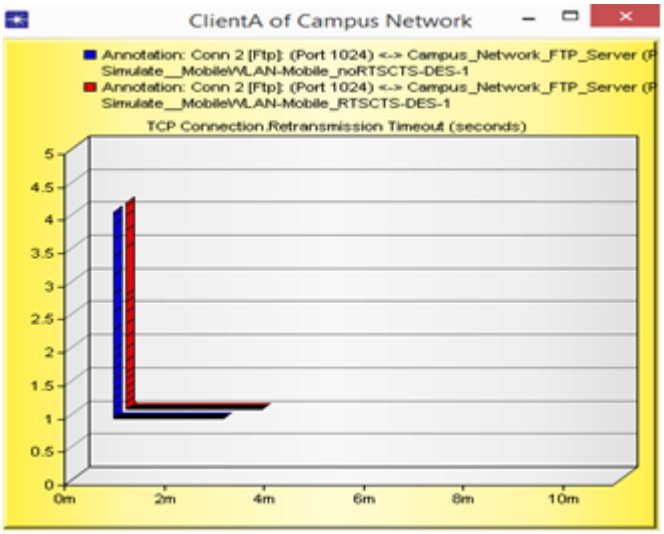

Figure 4a. Retransmission Attempts in WLAN with Mobility (no compression): Client A

Fig 4a and 4b are depicting the retransmissions attempted by devices while moving into WLAN environment. It is clearly justified by concentrating onto Fig. 4b that environment with compression and decompression reduces the numbers of attempts taken up to have a successful delivery of data packets.

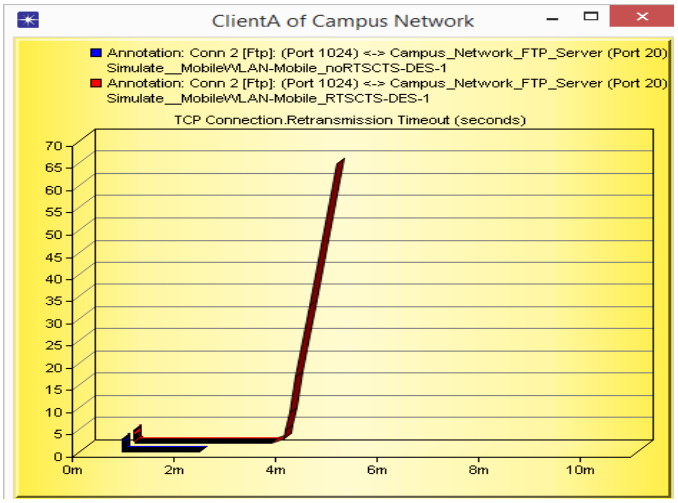

Figure 4b. Retransmission Attempts in WLAN with Mobility (with compression): Client A

Retransmissions are attempted after some time duration has elapsed, unlikely to the one with no compression technique.

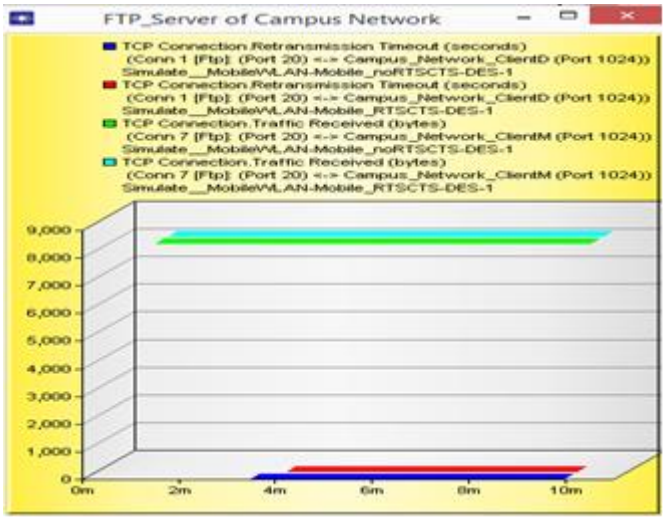

Figure 5a. Retransmission Attempts in WLAN with Mobility (no compression): FTP_Server

Figure 5b. Retransmission Attempts in WLAN with Mobility (with compression): FTP_Server

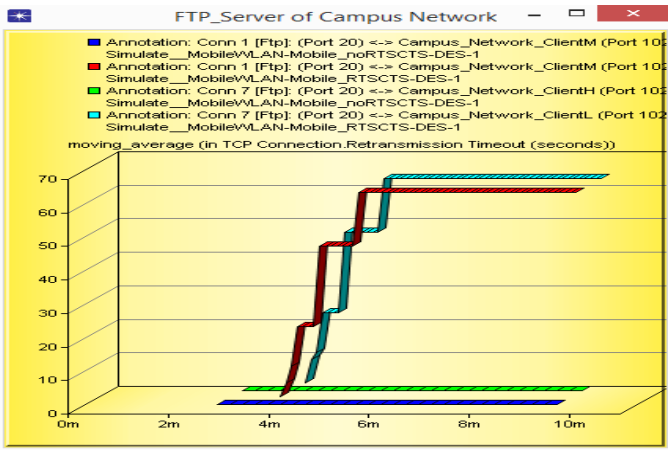

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Fig. 5a and 5b depicts the retransmissions taken place in the two environments. On looking up to a scenario with RTS/CTS mechanism in both the environments, the numbers of retransmission is decreased at the prior starting as it is obtained previously in an environment with no RTS/CTS mechanism. The compression technique used in Fig. 5b helped in reducing the numbers at the beginning, hence is leading to a convenient one.

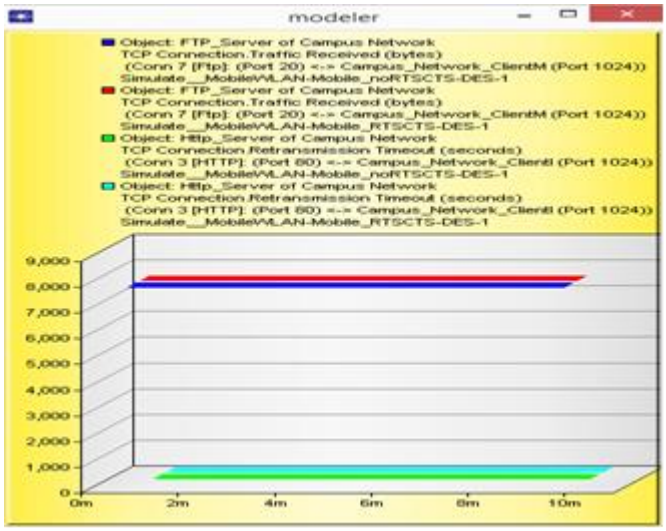

Figure 6a. Retransmission Attempts in WLAN with Mobility (no compression): Http_Server

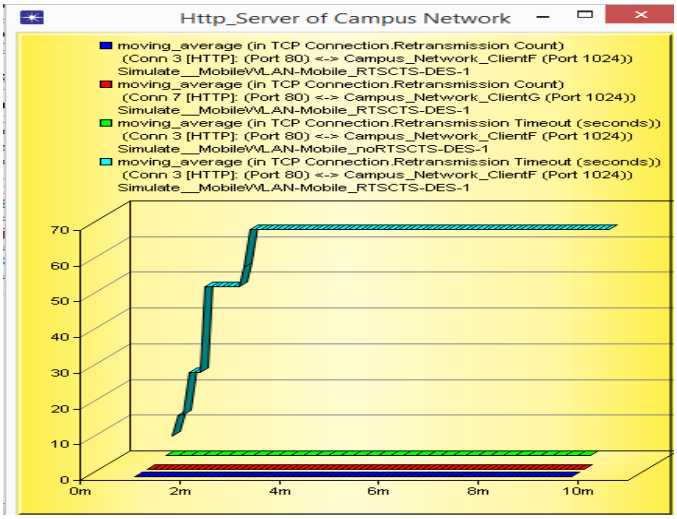

Figure 6b. Retransmission Attempts in WLAN with Mobility (with compression): Http_Server

Fig. 6a and 6b represents the attempts taken in repetitions by the devices performing in two environments. The best measured is the performance in RTS/CTS mechanism following with compression technique onto the data transfer taking place.

B. Throughput: The measurement consisting of transferring data packets to the higher level of layered architecture is justifiable to as throughput value. Throughput usually describes the value for channel utilization in a network, depicting an aspect of performances regarding the devices engaged into the communication process. The value for throughput is always expected to increase.

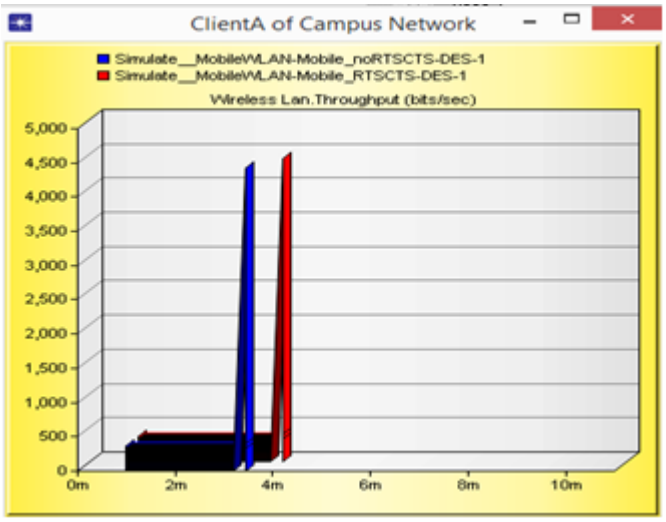

Figure 7a. Throughput in WLAN with Mobility (no compression): Client A

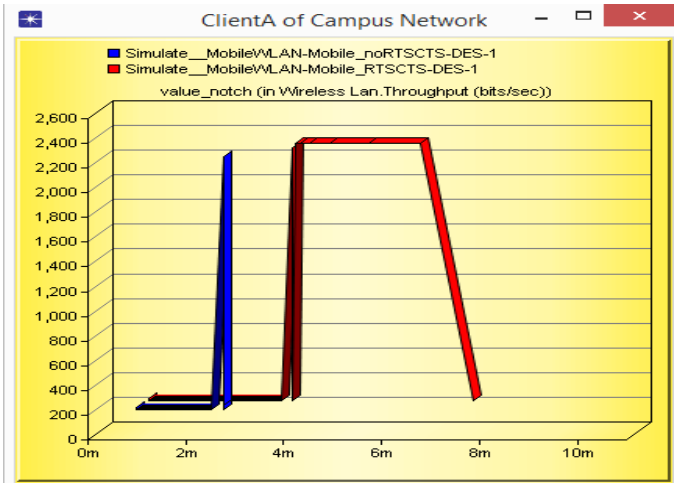

Figure 7b. Throughput in WLAN with Mobility (with compression): Client A

Fig. 7a and 7b depicts the throughput values for the two environments along with devices moving into the WLAN environment. The throughput is effectively increased in the environment consisting security regarding data packets.
While dealing with RTS/CTS mechanism it is justified by Fig. 7b that communication has now become with more ease rather working in other environment. The simulation has taken place for longer runs.

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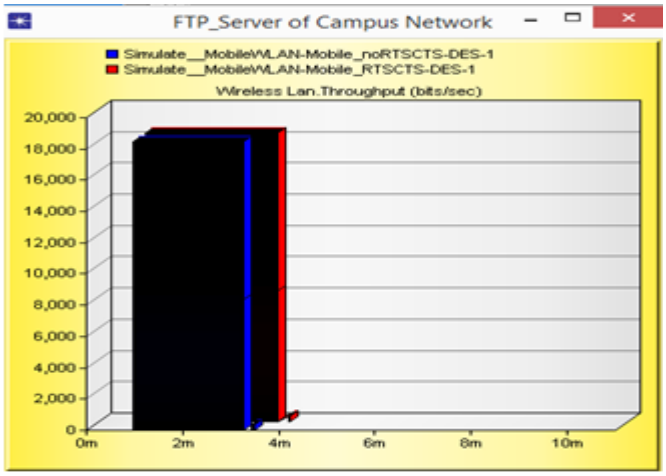

Figure 8a. Throughput in WLAN with Mobility (no compression): FTP_Server

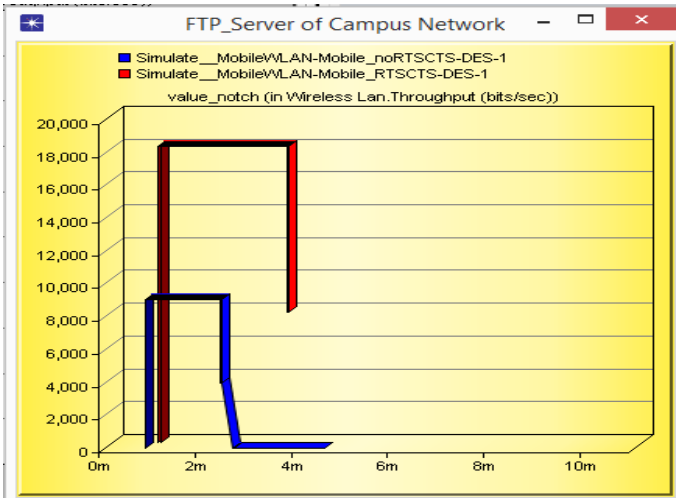

Figure 8b. Throughput in WLAN with Mobility (with compression): FTP_Server

Fig. 8a and 8b represents the throughput measurement in the two different environment sets. The two figures are seemly looks different in consideration. Fig. 8b is showing the good measurement values for RTS/CTS mechanism with compression of data packets. While dealing with environment with compression throughput is improved to an effective level, leading to a higher data transfer rates.

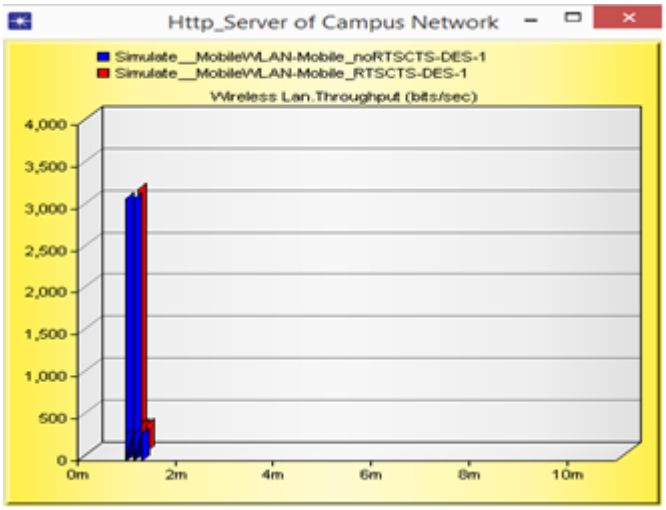

Figure 9a. Throughput in WLAN with Mobility (no compression): Http_Server

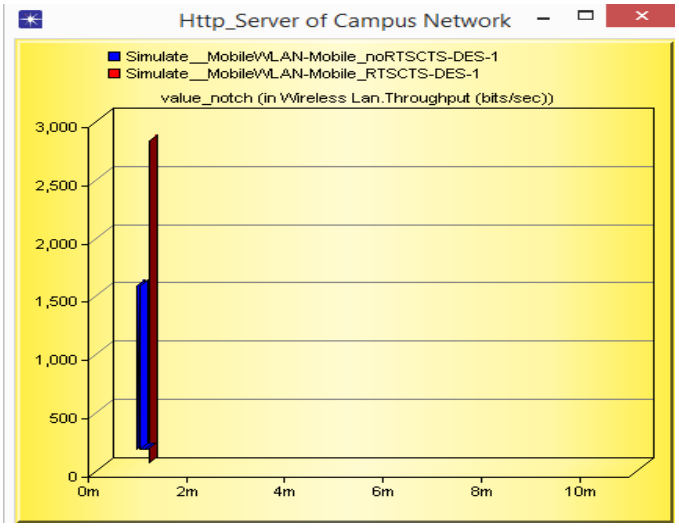

Figure 9b. Throughput in WLAN with Mobility (with compression): Http_Server

Fig. 9a and 9b depicts the throughput values for two dedicated environments dealing with mobility and compression factor in either of the environments. The throughput in Fig. 9b are most sophisticated to be seen, providing the higher data rates while dealing with transferring through a RTS/CTS based scenario.

V. CONCLUSION

The simulation is implemented on taking in consideration in respect to the devices, rather mobile devices, which are indeed tended to establish communication in WLAN environment. The scenario consists of two aspects i.e. with RTS/CTS and without RTS/CTS mechanism corresponding to having compression technique in either of these two scenarios. Compression technique when used in RTS/CTS mechanism

leads to an environment where throughput is improved and higher efficiency is obtained while transferring the data packets, as compression provides some aspects of security into the communication process by reducing the data packet size to a pre-specified code format so that any intruder is unable to fetch the data, and also lesser bandwidth is being occupied while any transfer is performed. In parallel to compression technique, a technique known as decompression is also performed to take back the data packet to its original form at the receiver's end.

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