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Analyze the Effect of Base Station and Node Failure and Recovery on the performance of Wimax

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Abstract----In this paper the effect of Base and node failure and Recovery is analyzed on the performance of Wimax by using different modulation techniques in a network. To analyze the performance opnet modeler is used. The performance is compared in terms of Delay, throughput and Load. The result shows that when base station fails then the performance Decrease and when node fail then performance increase. The result also shows that when different modulation techniques in different cells are used in same network then there is no change in performance.

Keywords: Wimax, OPNET, Wireless Network, IEEE 802.16, IPTV.

I. INTRODUCTION

At the moment wireless equipment has turned into the most energizing at our surrounding environment, many types of techniques are used to make a communication through wireless network like MANET, VANET, Wi-Fi, Bluetooth, Wimax etc. As per increasing the popularity of Broadband web wireless systems [1], Wimax have used in the field of wireless technology. Wireless Interoperability for Microwave Access is the latest technology for Wireless Communication which belong to the IEEE 802.16-2004 and IEEE 802.16e-2005 standard and was designed with much influence from Wi-Fi [2],[3], [6]. IEEE 802.16 supports two types of transmission duplexing: Time Division Duplexing (TDD) and Frequency Division Duplexing (FDD) and support both full and half duplex stations [4], [5], [11], [14].

WiMAX is illustrate the principles of orthogonal frequency division multiplexing (OFDM) which is a suitable modulation/access technique for non–line-of-sight (LOS) conditions with high data rates.

The IEEE 802.16 suite of standards (IEEE 802.16-2004/IEEE 802-16e-2005) [7], [8] characterizes inside its degree four PHY layers, any of which can be used with the media access control (MAC) layer to develop a broadband wireless system [9], [14]. The PHY layers defined in IEEE 802.16 are [3], [5], [7], [10]:

• ***WirelessMAN SC***: a solitary transporter PHY layer expected for frequencies ahead of 11GHz requiring a LOS condition. This PHY layer is part of the original 802.16 specifications.

•***WirelessMAN SC***: a single-carrier PHY for frequencies between 2GHz and 11GHz for point-to-multipoint operations.

• ***WirelessMAN OFD***: a 256-point FFT-based OFDM PHY layer for point-to-multipoint operations in non-LOS circumstances at frequencies from 2GHz and 11GHz. This PHY layer, finalized in the IEEE 802.16-2004 terms, has been acknowledged by WiMAX for permanent operations and is often referred to as fixed WiMAX.

• ***WirelessMAN OFDMA****:* a 2,048-point FFT-based OFDMA PHY for one point to many point ooperations in NLOS conditions at frequencies between 2GHz and 11GHz. The main principle of IEEE 802.16 innovation was to provide last-mile broadband wireless access as an alternative to cable, digital subscriber line service. In WiMAX the communications is done in two way i.e. Management message and Data messages. Management messages are used to govern communications parameters necessary to maintain wireless links, and data messages carry the data to be transmitted over wireless links.

II. FUNDAMENTAL WIMAX CONCEPTS

WiMAX networks have five fundamental architectural components [10], [12], [14]:

- ***Base Station (BS)*:**

The BS is the node that logically connects wireless subscriber devices to operator networks. The BS maintains communications with subscriber devices and governs access to the operator networks. A BS consists of the infrastructure elements necessary to enable wireless communications, i.e., antennas, transceivers, and other electromagnetic wave transmitting equipment. BSs are typically fixed nodes, but they may also be used as part of mobile solutions—for example, a BS may be affixed to a vehicle to provide communications for nearby WiMAX devices.

- ***Subscriber Station (SS)*:**

The SS is a stationary WiMAX-capable radio system that communicates with a base station.

- ***Mobile Station (MS)*:**

An MS is an SS that is intended to be used while in motion at up to vehicular speeds. Compared with fixed (stationary) SSs, MSs typically are battery operated and therefore employ enhanced power management. Example MSs include WiMAX radios embedded in laptops and mobile phones.

- ***Relay Station (RS)*:**

RSs are SSs configured to forward traffic to other RSs or SSs in a multi-hop Security Zone. The RS may be in a fixed location (e.g., attached to a building) or mobile (e.g., placed in an automobile).

- ***Operator Network*:**

The operator network encompasses infrastructure network functions that provide radio access and IP connectivity services to WiMAX subscribers. These functions are defined in WiMAX Forum technical specifications as the access service network (radio access) and the connectivity service network (IP connectivity).

To make a communication IEEE 802.16 used a four primary topologies networks i.e. point-to-point, point-to-multipoint, multi-hop relay, and mobile.

III. RELATED WORK

In 2010 Will Hrudey *et al* [4] used the OPNET Modeler to engineer simulation sequences and explore the impact of channel bandwidth, time division duplex (TDD) frame size, advanced antenna systems support, and retransmission schemes movie to a Mobile WiMAX subscriber while streaming a feature-length. The performance was compared by using PLR, end-to-end (E2E) packet delays, and packet jitter matrices

In 2009 Thomas Wiegand et al, described brief overview of SVC [9] when deployed in IPTV services is provided. It described the efficiency of various types of SVC analysis of the complexity of the various SVC tools. It also described how the different SVC features such as efficient methods for graceful degradation, bit rate adaptation and format adaptation, can be mapped to application requirements of IPTV services. It is discussed how such mappings can lead to improved content portability, management and distribution as well as an improved management of access network throughput resulting in better quality of service and experience for the users of IPTV services.

IV. EXPERIMENTAL SETUP

In this experiment the Effect of node and base failure on VOIP and Video conferencing over Wimax is analyzed by using different mobility patterns (random way point, given and static). OPNET Simulator 14.5 [7] was used to analyze the performance of Wimax. In this experiment 8 cells are taken. The radius of each cell is 2 km. In each cell there is one Base station and 20 mobile nodes are taken

as shown in fig 4.1. These nodes are circularly placed. In these scenarios some nodes are having VOIP application and other have Video conferencing. The BS connected to the IP backbone via a DS3 WAN link. The base stations are connected to Router through ppp_DS3 link. The Backbone Cloud is also connected to VOIP and video conferencing server through Ethernet link. In this experiment to analyze the effect firstly some nodes are failed and recovered at different time and then some base station is failed and recovered at different time. In these scenario different modulation techniques are used firstly all nodes have 16qam3/4 as uplink and 64 qam3/4 as downlink in one scenario. In other scenario, nodes in 2 cells have qpsk3/4 and other have 16qam3/4. In one more another scenario, nodes in 3 cells have qpsk3/4 and other have 16qam3/4 as downlink modulation techniques and for uplink 64qam3/4 is used. These scenarios are repeated by using different mobility patterns (random way point, given way and static).

V. RESULTS

Here the result of Voip and VoD over Wimax is calculated by changing Mobility patterns of Nodes under Node and base station failure and recovery. Fig. 1 to Fig. 18 represents the result of Delay, Throughput and Load.

1.1 Delay

It represents the end-to-end delay of all the packets received by the WiMAX MACs of all WiMAX nodes in the network and forwarded to the higher layer. Figures show the result of Delay.

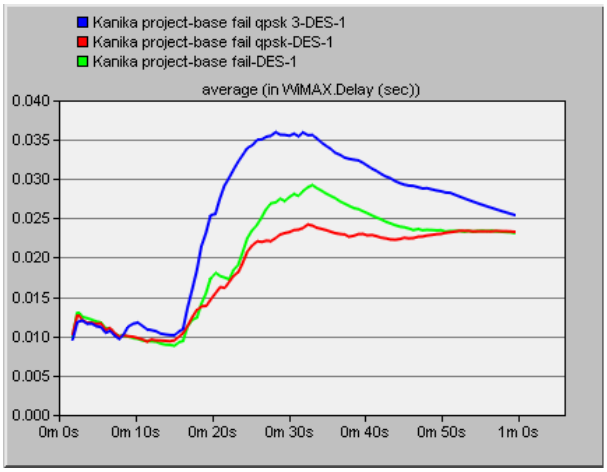

Fig.1 shows the delay result for different mobility patterns when base fail and recover.

Fig1 shows that when qpsk 3 cells are used than delay is high which is 0.025 and for qpsk 2 cell and for without qpsk cell delay is 0.023

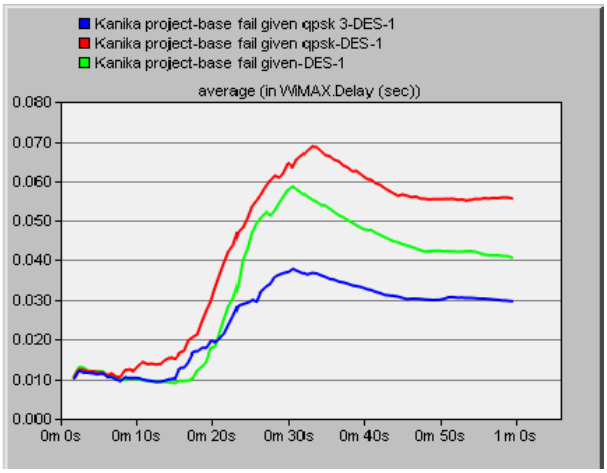

Fig.2 shows the delay result for different mobility patterns when base fail and recover.

Fig2 shows that when qpsk 3 cells are used than delay is 0030 and for qpsk 2 cell delay is 0.060 and for without qpsk cell delay is 0.040

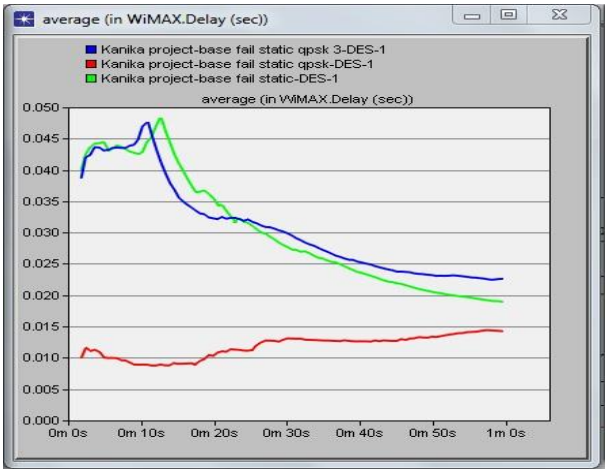

Fig. 3 shows the delay result for different mobility patterns when base fail and recover.

Fig3 shows that when qpsk 3 cells are used than delay is 0.024 and for qpsk 2 cell delay is 0.014 and for without qpsk cell delay is 0.019

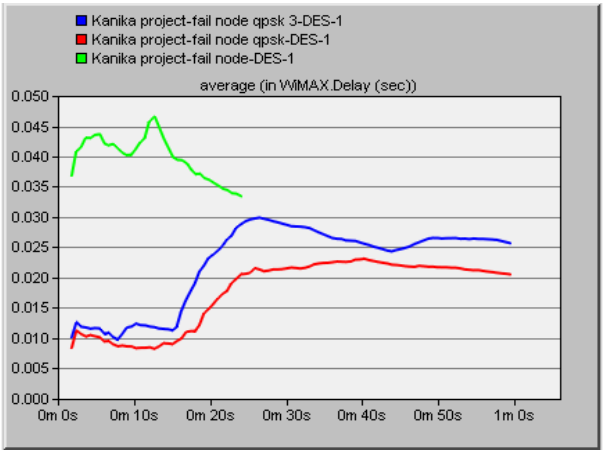

Fig. 4 shows the delay result for different mobility patterns when node fails and recover.

Fig4 shows that when qpsk 3 cells are used than delay is 0.026 and for qpsk 2 cell delay is 0.021 and for without qpsk cell delay is 0.033

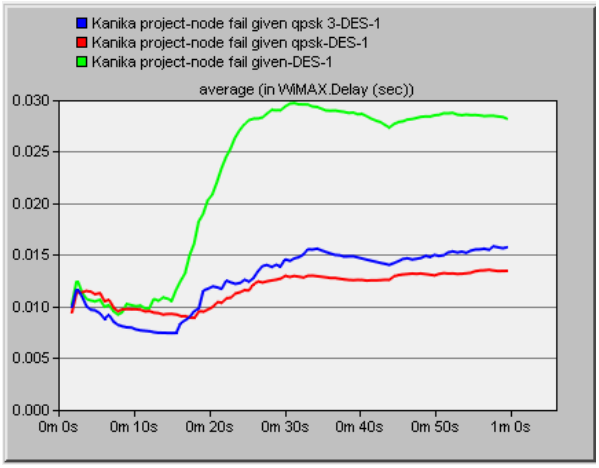

Fig. 5 shows the delay result for different mobility patterns when node fails and recover.

Fig 5 shows that when qpsk 3 cells are used than delay is 0.016 and for qpsk 2 cell delay is 0.013 and for without qpsk cell delay is 0.028

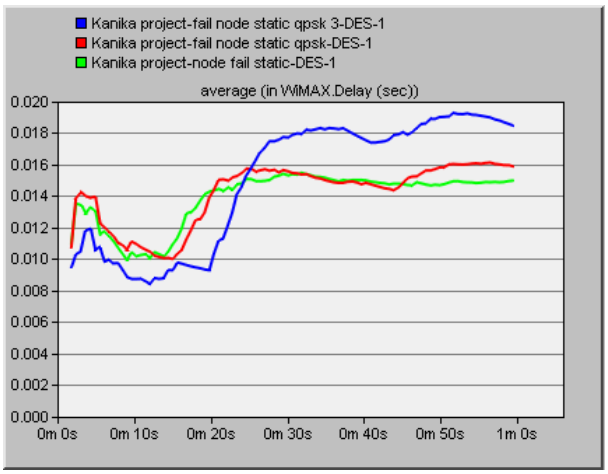

Fig.6 shows the delay result for different mobility patterns when node fails and recover.

Fig6 shows that when qpsk 3 cells are used than delay is 0.019 and for qpsk 2 cell delay is 0.016 and for without qpsk cell delay is 0.01

1.2 Throughput

Represents the total data traffic (in packets/sec) forwarded from WiMAX layers to higher layers in all WiMAX nodes of the network.

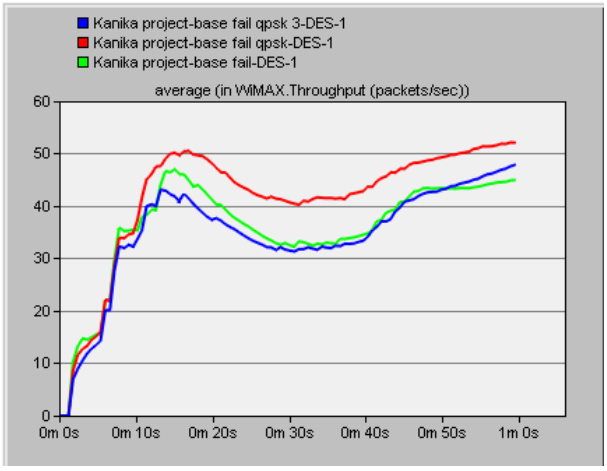

Fig. 7 shows the result throughput for different mobility patterns when base fail and recover.

Fig7 shows that when qpsk 3 cells are used than throughput is 48 and for qpsk 2 cell throughput is 52 and for without qpsk cell throughput is 45 packets per second

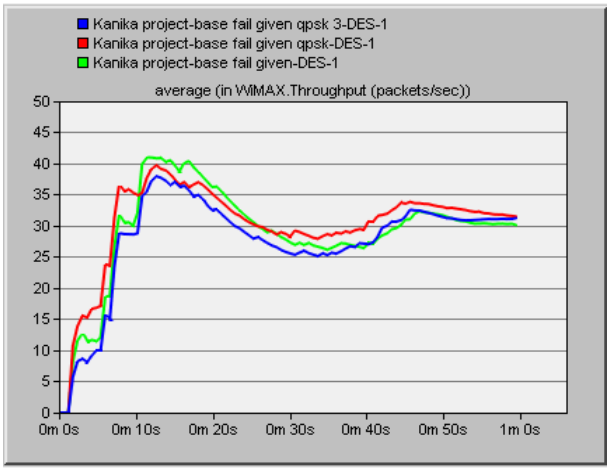

Fig. 8 shows the throughput result for different mobility patterns when base fail and recover.

Fig8 shows that when qpsk 3 cells are used than throughput is 32 and for qpsk 2 cell throughput is 32 and for without qpsk cell throughput is 30 packets per second

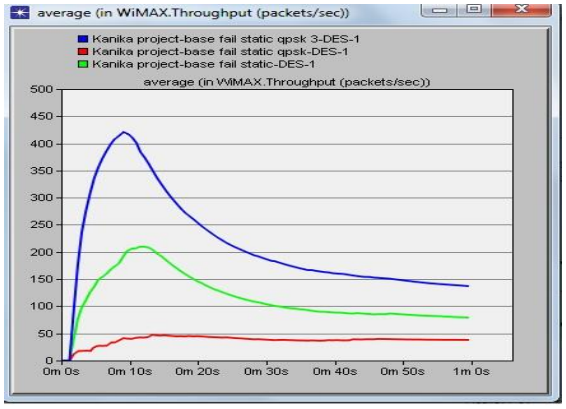

Fig. 9 shows the throughput result for different mobility patterns when base fail and recover.

Fig9 shows that when qpsk 3 cells are used than throughput is 149 and for qpsk 2 cell throughput is 49 and for without qpsk cell throughput is 85 packets per second

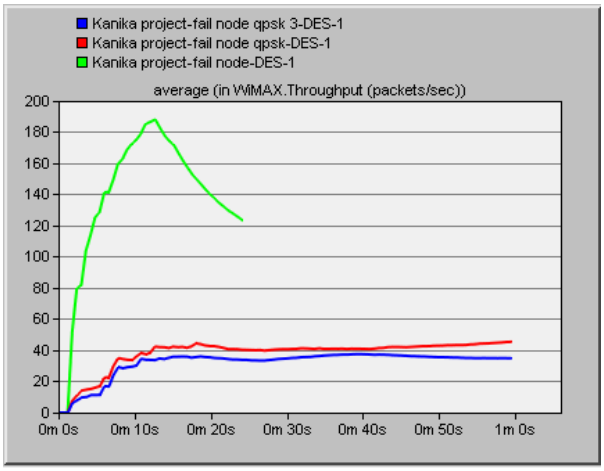

Fig 10: shows the throughput result for different mobility patterns when node fails and recover.

Fig10 shows that when qpsk 3 cells are used than throughput is 35 and for qpsk 2 cell throughput is 45 and for without qpsk cell throughput is 121 packets per second

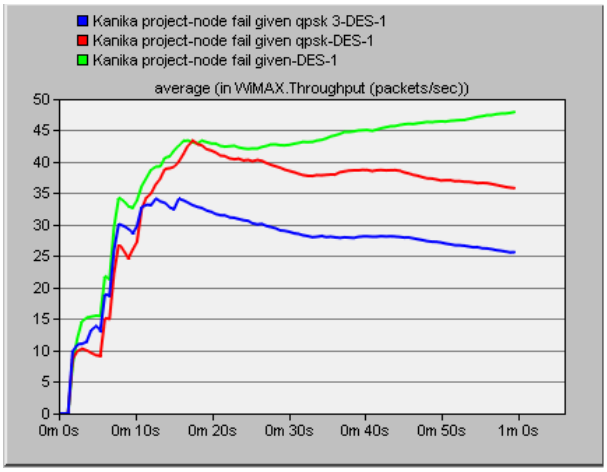

Fig. 11 shows the throughput result for different mobility patterns when node fails and recover.

Fig11 shows that when qpsk 3 cells are used than throughput is 25 and for qpsk 2 cell throughput is 36 and for without qpsk cell throughput is 49 packets per second

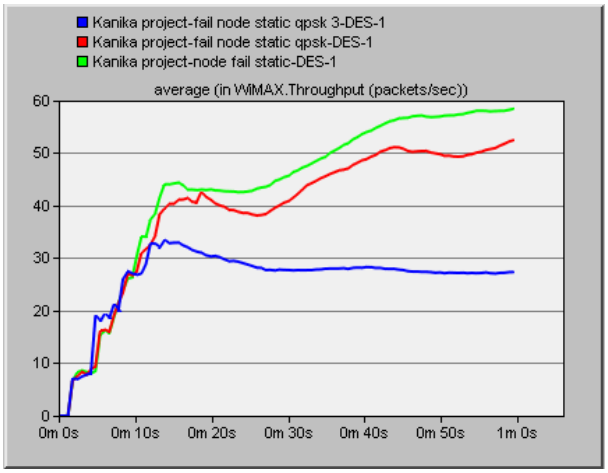

Fig. 12 shows the throughput result for different mobility patterns when node fails and recover.

Fig12 shows that when qpsk 3 cells are used than throughput is 28 and for qpsk 2 cell throughput is 52 and for without qpsk cell throughput is 59 packets per second

1.3 Load

Represents the total load submitted to WiMAX layers by all higher layers in all WiMAX nodes of the network. Fig.11 represents the result of Load. This fig shows that when the speed is low the load is high. As the speed is increased load decreased which is true because when speed is high less data is transferred.

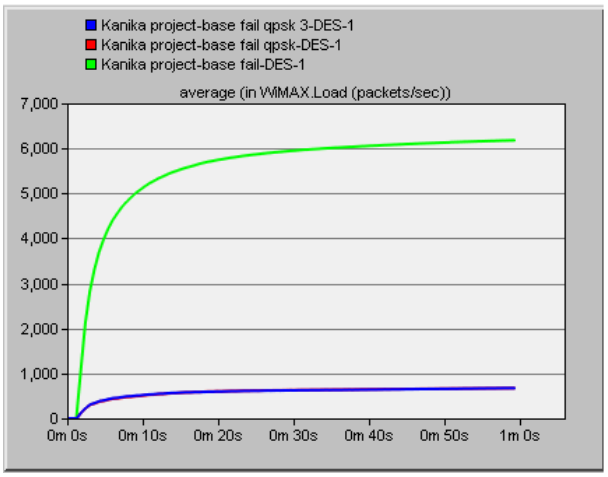

Fig. 13 shows the result load for different mobility patterns when base fail and recover.

Fig13 shows that when qpsk 3and qpsk 2 cell are used then load is 700 packets per second and for without qpsk cell load is 6100 packets per second

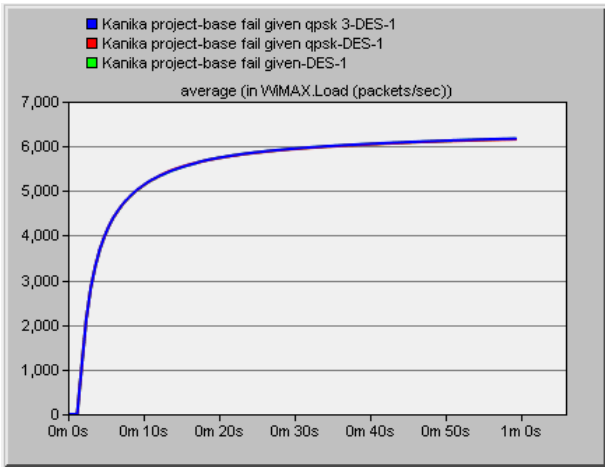

Fig. 14 shows the load result for different mobility patterns when base fail and recover.

In fig.14 load for qpsk 3 cell, qpsk 2 and without qpsk cell load is 6100 packets per second

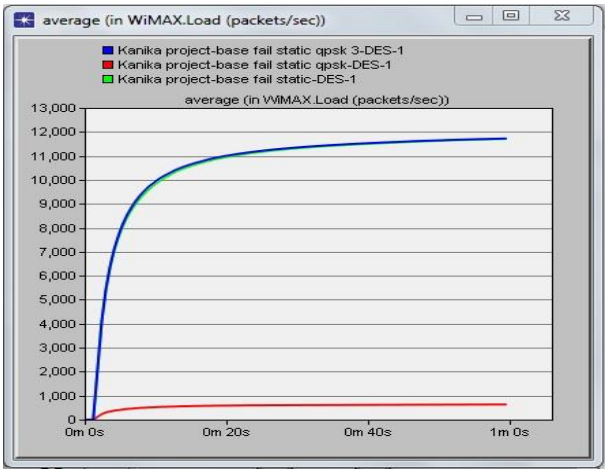

Fig 15: shows the load result for different mobility patterns when base fail and recover.

Fig15 shows that when qpsk 3 cells are used than load is 11,000 packets per second and for qpsk 2 cell load is 8000 packets per second and for without qpsk cell load is 11,000 packets per second

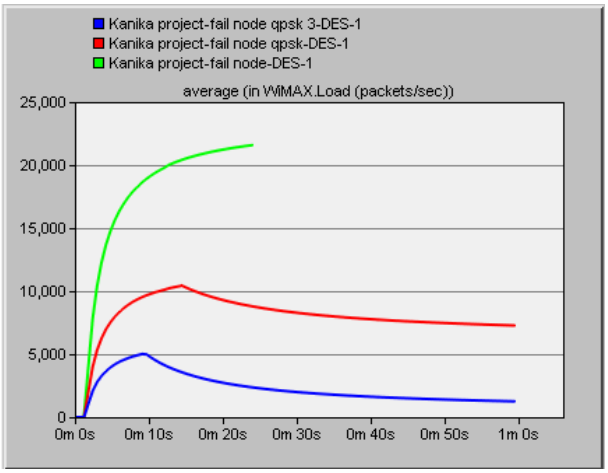

Fig 16: shows the load result for different mobility patterns when node fails and recover.

Fig16 shows that when qpsk 3 cells are used than load is 2,000 packets per second and for qpsk 2 cell load is 13,000 packets per second and for without qpsk cell load is 22,000 packets per second

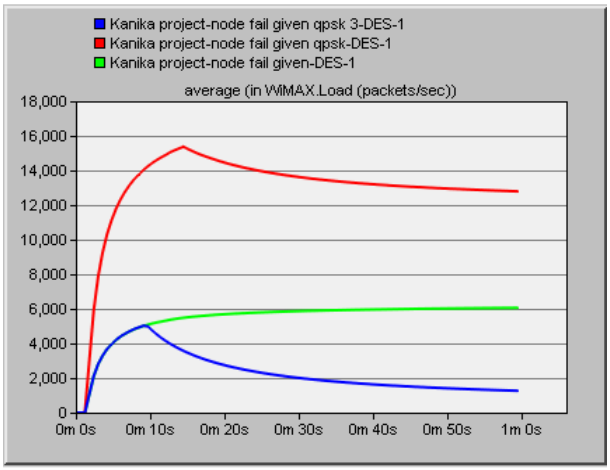

Fig. 17 shows the load result for different mobility patterns when node fails and recover.

Fig17 shows that when qpsk 3 cells are used than load is 1,600 packets per second and for qpsk 2 cell load is 6,000 packets per second and for without qpsk cell load is 15,000 packets per second

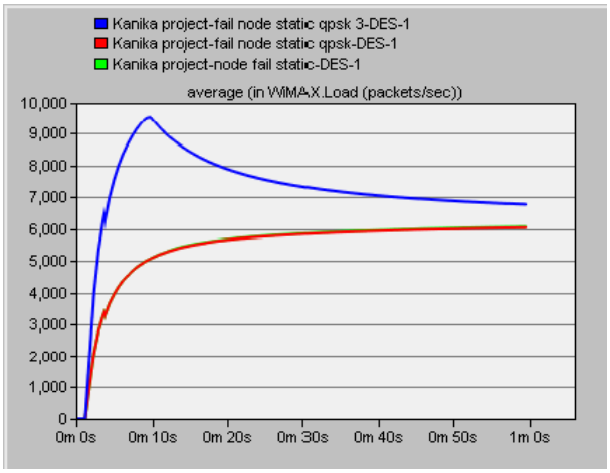

Fig. 18 shows the load result for different mobility patterns when node fails and recover.

Fig18 shows that when qpsk 3 cells are used than load is 6900 packets per second and for qpsk 2 as well as without qpsk cell load is 6000 packets per second

VI. CONCLUSION

In this paper the effect of base station and node fail and recovered at different time is analyzed over Wimax for VOIP and Video Conferencing. The comparison is done in terms of Throughput, Load and delay. To do this 8 cell is made of radius 2km. In each cell there is 20 nodes are placed randomly in which some are having VOIP application and other have Video Application. This comparison is done by changing modulation techniques in one network. The result shows that when base station fail and recovered at different time then the performance Decrease and when node fail and recovered at different time then performance increase. In future one can increase work by increasing number of node, number of cells.

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