MOBILE RELAYS FOR PREDICTION-ASSISTED TO HANDOVER SCHEME IN LTE NETWORKS

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Abstract: **The 3rd Generation Partnership Project (3GPP) Long Term Evolution (LTE) defines a wireless network standard for high packet transmission rate and low packet latency provisions. Handover is one of the important features for helping user equipments (UEs) to roam between LTE networks. However, LTE networks adapt a make-before-break handover procedure, which may cause a brief disconnection, therefore results in the packet transmission delay and packet loss problems. In propose a moving direction prediction-assisted handover scheme for LTE networks to lower the number of handovers. We first track the location of user equipments (UEs) to predict their moving direction. By referencing previous locations, the next moving direction of UEs is estimated with the cosine function in order to determine the candidate E-UTRAN NodeBs (eNBs) for handover. Then, a target eNB is selected from the candidate eNBs through an angle-based dynamic weight adjustment scheme. By selecting a proper target eNB for handover, thus the quality of network transmission can be enhanced. Simulation results demonstrate the ability of the proposed scheme in reducing 17% average handover times, compared with the standard handover procedure, thereby reducing 12% average number of packet loss and 5% average packet delay time.**

I. INTRODUCTION

Over the past few years, there has been an overwhelming growth in the use of computer vision in mission-critical applications. The dissemination of live video feeds (or more generally vectors of still images) offers invaluable insights into the underlying process being monitored or controlled. A flagship examples entails real-time video streaming for the sake of enhancing situational awareness in mission-critical operations. Live video feed is believed to offer significant improvement in the decision-making capabilities in the wake of unexpected events. In fact, the use of real-time video and vision-based data streaming for raising contextual awareness levels has been recently earning substantial interest a few other related domains such as telemedicine, paramedics, emergency & first response , law enforcement, and tactical operations. By nature, real-time video streaming applications are typically delay-intolerant. Needless to say that video streaming (whether in raw format, thermal, or infrared) is also bandwidth-hungry. From a wireless networking perspective, it is indeed always desirable to capitalize as much as possible on the economies of scale brought forward by off-the-shelf standardized technologies. Hence, the natural technology candidates are LTE and Wi-Fi. Nonetheless, there are unfortunately some inherent deficiencies in LTE and Wi-Fi systems which render them less attractive, particularly for applications of mission-critical nature.[6][7][8][9]

A. SHORTCOMINGS OF STANDARDIZED TECHNOLOGIES

LTE as a cellular technology is ubiquitous but only to a limited extent. It is straightforward to argue that there will be situations and circumstances where proper LTE service does not exist. Examples include remote onshore industrialized sites, offshore oil rigs, or deep mining pits. In fact, even in urbanized areas where coverage does exist, field personnel may have to be deployed in hard-to-reach areas where LTE does not penetrate deeply enough. Another interesting example where LTE is highly likely to fall short is massively crowded events. In such contexts, the sheer scale of the load that LTE networks have to withstand has an adverse effect on the bandwidth and delay performance for mission-critical applications. One may argue that mission critical applications are typically granted preemption on the radio access network (RAN) interface by mobile operators.[10][11]

B. AUTONOMOUS COOPERATIVE ROUTING

As a result, there is an obvious need for infrastructure independent ad hoc networking with strong support for mobility. Clearly, this can be articulated as a quest for a high throughput low-latency mobile ad hoc network (MANET). Consequently, proprietary tailor-made MANET technologies are resurfacing again as viable propositions for mission-critical operations. Undoubtedly, multihop MANET research literature has a mature legacy of work that is at least a couple of decades old. However, the need for significantly more bandwidth per user, ultra low end-to-end (e2e) latency, and tangibly better scalability calls for going back to the drawing board. This is true since classical routing schemes are plagued by protocol overheads which have the tendency to substantially throttle the end-to-end performance of the MANET.[1]

II. EXISTING SYSTEM

In the 802.11 standard, a handoff procedure consists of scanning, authentication, and reassociation. For the scanning, passive scanning and active scanning are defined. An ST adopting the passive scanning should receive APs' beacon frames, which are transmitted every beacon interval. Typically, a beacon interval is 100 ms. On the contrary, an STA with the active scanning should broadcast probe request frame(s) in a channel and then wait for probe response frames, with which nearby APs receiving the probe request(s) reply. The scanning STA may conduct the scanning procedure in all available channels. It implies that the scanning time increases in proportion to the number of the available channels. After selecting the most appropriate AP via the scanning procedure, the scanning STA proceeds with the subsequent handoff procedure including authentication and reassociation. Usually, it is known that active scanning is more beneficial than passive scanning in operational time. Therefore, we deal with only active scanning in this paper. For active scanning, the 802.11 standard specifies two configurable parameters determining how long an STA should wait for probe responses after sending a probe request, namely, MaxChannelTime and MinChannelTime. MinChannelTime is the minimum time that a scanning STA stays in a scanned channel, whereas MaxChannelTime is the maximum. if a scanning STA detects busy channel during Min- ChannelTime after broadcasting probe requests, the STA stays more in the channel until MaxChannelTime. [5][6][7]

However, the 802.11 standard does not specify what values are sufficient for Min/MaxChannelTimes. Typical commercial 802.11 devices apply 20 and 40 ms to MinChannelTime and MaxChannelTime, respectively. Large values of Min/MaxChannelTimes improve the possibility that a scanning STA finds nearby APs successfully even in a channel with heavy contention. However, it leads to a long scanning delay. Therefore, it is important to determine appropriate Min/MaxChannel Times. Aggressive 1 and 10 ms for Min/MaxChannelTimes, respectively, in the 802.11b WLANs are recommended. Along with the Min/MaxChannelTimes, the number of employed channels is another major factor influencing the overall scanning delay. proposed a scanning scheme employing the neighbor graph containing the list of channels occupied by neighboring APs. Due to the neighbor graph, a scanning STA can scan in a reduced number of channels. The neighbor graph is also beneficial to reducing processing time overhead required for authentication and security operations as a serving AP propagates STAs' contexts to its neighboring APs in advance to cache the context related to the scanning.

A. OBSERVATIONS ON PACKET LOSSES

I performance is configured to generate UDP packets every 10 ms in an uplink or downlink direction, respectively. I observe uplink and downlink packets separately. In all the figures here, the *y*-axis represents the time intervals between two consecutive packets. The *x*-axis indicates the packet sequence number that insert in the payload of UDP packets. Downlink UDP packets when the MWNIC scanning is employed. The host continuously sends UDP packets to the laptop computer. We can observe the latency marked with There is two reasons for this. First, a single packet is lost during channel switching operation. Second, the new AP accepting the scanning STA defers packet transmission until successful STA's channel switching. Immediately after the packet transmission with the delay marked with the packets buffered at the new AP rush toward the laptop computer with very short intervals. Can find another latency mark with. However, it has nothing to do with the handoff itself since the delay is caused by retransmission trials due to channel error. Consequently, we find only a single packet loss during MWNIC scanning. Downlink UDP packets when background scanning is performed. In contrast to the results shown can observe a big hole due to consecutive 16 UDP packet losses. The packet losses begin from the 100th UDP packet. The delay marked with (1) is incurred by a channel error. The delays marked with (1) and (2) is caused by UDP packet losses at the laptop computer and an AP, respectively, during the MWNIC scanning. Consequently, UDP packets are forwarded to the host with two packet losses while the scanning STA performs the proposed handoff operation. In contrast, shows those 22 UDP packets are lost during a background scanning. From the figures so far, we can find out that the MWNIC scanning significantly reduces packet losses compared with the background scanning.[2][3]

III. PROPOSED SYSTEM

A. HANDOFF PROCESS

The Handoff is the process of transferring the ongoing session between mobile STA and corresponding node from one point of attachment to another point of attachment or the same. Due to the mobility of devices, the handoff is an essential aspect in WLAN and cellular networks. Scanning also called probing is the first phase of handoff process and it is the process of selecting a suitable AP from neighbouring APs to handoff. Detection phase is considered the first phase of handoff in some works. Need for the handoff is determined by the detection phase as shown in the fig-2. RTS/CTS mechanism is used after failed frames to overcome probable radio fading or collisions in a burdened cell. The station conform the out of range status after various unanswered requests and starts the search phase. Suggested another approach in which STA starts search phase directly by excluding the reason for failure of collisions because above detection procedure is long as shown in and if the selected AP by search phase is current one then handoff will not be executed. [4][5]

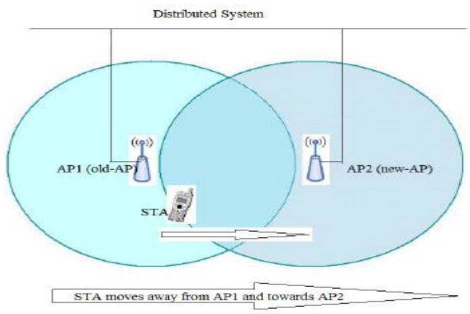

Figure 1. Hand off process

Handoff affects the quality of service directly. Handoff occurs if the signal quality falls below a predefined threshold level. The Quality-of service (QoS) and capacity of the network may be affected due to handoff. There are some requirements to reduce the adverse effect of handoff such as handoff latency must be as low as possible, the total number of handoff should be minimal.

B. HANDOFF PROCEDURE IN WLAN

In WLAN handoff is the mechanism of transferring the ongoing connection from one AP to another due to poor signal quality. Handoff is the process of disassociating from the prior-AP and establishing a connection with the posterior-AP. The necessity of handoff is detected if the received signal strength (RSS) from current AP falls below the certain threshold level. The L2 handoff of WLAN is hard-handoff and divided into three phases: scanning, authentication, and re-association. The complete handoff process can be classified into two different logical steps, (1) Discovery (scanning), (2) Re-authentication. An authentication and re-association to the posterior AP are collectively called Re-authentication. The handoff latency or delay is the sum of delay incurred by search and re-authentication phase. The overall handoff delay is the sum of the delays incurred by m individual phases given by following equation:

$$Handover\ Delay = \sum_{i=1}^{m} Delay_i$$

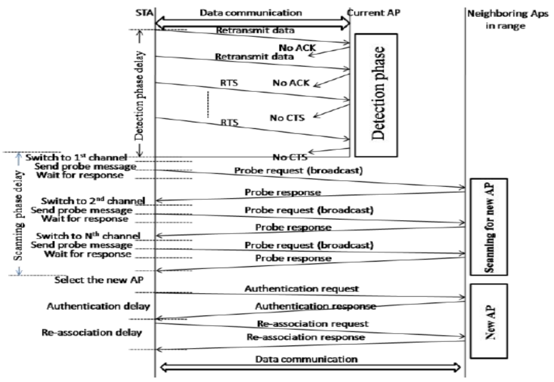

Figure 2. Possible Handoff scenarios in The IEEE 802.11 WLAN

C. DISTRIBUTED HANDOFF MECHANISM

To reduce the handoff latency in IEEE 802.11 based WN, an efficient MAC layer handoff protocol is presented. In example of Distributed Handoff scheme, to scan all the available channels, a mobile node selects several neighbouring nodes before it starts initiating the MAC layer Handoff process. All channels are grouped and these groups are scanned by selected neighbouring nodes separately. In each node the number of scanning channels is reduced and minimized the scanning latency. A mobile node requires nodes in a certain range to help it scan the available channels as soon as the handoff process is initiated. These nodes help the mobile device by forming (or organizing into) a temporary group. Each node requires scan only some of channels which are distributed to nodes in a group. A big problem of probing (or scanning) is divided into small problems and all these problems can be executed simultaneously. Received signal strength (RSS) can be measured by STA. In this scheme predefine the three RSS levels: RSSL, RSSH, RSSG Threshold to trigger handoff is RSSL By using the assistant nodes to form a temporary handoff group RSSH is used. Before starting the handoff process by STA, it ensure the existence of assistant nodes RSSH little higher than RSSL. Received signal strength (RSS) can be measured by STA. In this scheme predefine the three RSS levels: RSSL, RSSH, RSSG Threshold to trigger handoff is RSSL By using the assistant nodes to form a temporary handoff group RSSH is used. Before starting the handoff process by STA, it ensure the existence of assistant nodes RSSH little higher than RSSL. To define the largest distance from the STA to its neighbour nodes RSSG is used. This scheme consist three main components, group construction, distributed scan mechanism and cache scheme. When the RSS is lower than RSSH, grouping process is triggered in group construction. STA inspects neighbour nodes in range r as the assistant nodes; so, nodes N0, N1, N2, N3, and N4 are selected in the given example as shown in given fig-3 [27]. AP information based on the result of distributed scan mechanism can be stored in the cache structure, since it is also possible for assistant nodes to re-associate with the same AP after a short time interval due to closeness of the assistant nodes to the STA. The assistant nodes will save the new AP in its caching structure with a lease time *Tlease* in the response of the broadcasted message with the new AP from STA to all assistant nodes.[1]

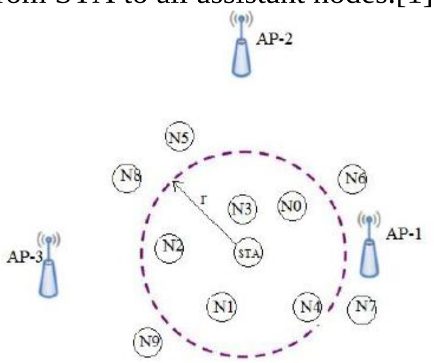

Figure 3. Distributed Handoff Mechanisms

Only the latest AP is saved in the cache, and the old AP is usually overwritten. When the assistant node wants to initiate handoff, in the first it will try to re-authenticate with the AP stored in the cache during the Tlease time. Scanning time is saved if the AP accepts the assistant node and directly can re-associate with the AP. If the Tlease time is expired then the assistant node should start a complete distributed handoff mechanism. Channels are grouped and assigned to the closest neighbour nodes to scan instead of scanning of all channels by STA only and each node scan only a few channels.

D. PRE-ACTIVE SCANNING SCHEME

Scanning phase is the most time consuming phase, it has more than 90% of the overall handoff total delay. By using the Pre-active Scanning scheme which works during normal connectivity, we can reduce the handoff delay time in detection and search phase. In Pre-active scan STA start execution phase directly without delay in the detection and search phase, it has advantage of traffic load sharing and STA take decision to start handover to new AP which is providing higher quality than the previous AP. Traffic load is increased in this scheme due to reserve time to broadcast “Probe Request” frame and wait for “Probe Response” frame from (to) neighbour APs in range. Throughput is decreased and traffic load is increased in the Pre-active scan scheme.[3][4][5]

E. DISTANCE MEASUREMENT TECHNIQUE

The Hexagonal cell concept is used to accelerate the handoff process. The position of mobile node is obtained by using GPS or some other localization technique in terms of coordinates (r, θ). It is well known fact that power of radio frequency signal is inversely proportional to the square of distance. The mobile node can update the values of (r, θ) in regular intervals and maintain a cache. Now, the instantaneous distance Ri between mobile node and APs is calculated by using

$$R_i = \sqrt{r^2 + D^2 - 2rD\cos\left((2i-1)\frac{\pi}{6} - \theta\right)}$$

Where, $D = \sqrt{3}R$

When the distance between mobile node and current AP is greater than a fixed threshold level then the handoff process is initiated and the AP which is nearest is selected for association by mobile node. There is no need of handoff when the mobile node is in the in-circle of the cell while the circum-circle defines the range of individual AP.[10][11]

IV. NETWORK SIMULATOR (NS2)

- NS is an object oriented discrete event simulator
  – Simulator maintains list of events and executes one event after another
  – Single thread of control: no locking or race conditions
- Back end is C++ event scheduler
  – Protocols mostly
  – Fast to run, more control
- Front end is OTCL
  – Creating scenarios, extensions to C++ protocols
  – fast to write and change

A. EVENT SCHEDULAR

In this Event scheduler while we processing many data’s at a time it will process one by one (i.e) FIFO concept, so there is no congestion while transferring the packets.

B. PACKETS

It is the collection of data, whether header is called or not all header files where present in the stack registers.

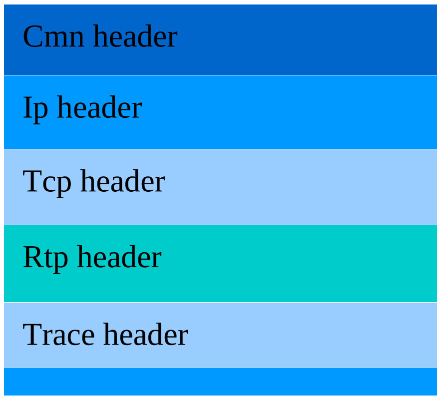

Figure 4. Packets Size

(i) Turn on Tracing

Trace packets on individual link Trace file format

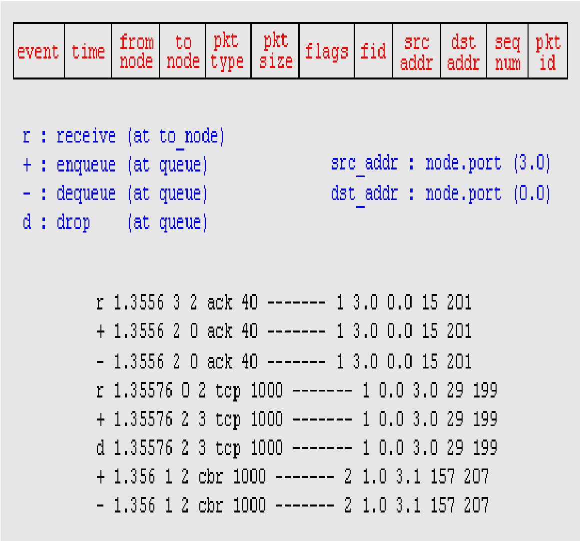

Figure 5. Turn on Tracing

(ii) Create Network Topology (Physical Layer)

The Physical Layer is the first and lowest layer in the seven-layer OSI model of computer networking. The implementation of this layer is often termed PHY. The Physical Layer consists of the basic hardware transmission technologies of a network. It is a fundamental layer underlying the logical data structures of the higher level functions in a network. Due to the plethora of available hardware technologies with widely varying characteristics, this is perhaps the most complex layer in the OSI architecture

(iii) Transport Connection (Transport Layer)

Transport layers are contained in both the TCP/IP. This is the foundation of the INTERNET. The OSI model of general networking. The definitions of the Transport Layer are slightly different in these two models. This article primarily refers to the TCP/IP model, in which TCP is largely for a convenient application programming interface to internet hosts, as opposed to the OSI model of definition interface. The most well-known transport protocol is the (TCP). It lent its name to the title of the entire internet protocol suite TCP/IP. It is used for connection-oriented transmissions, whereas the connectionless user datagram suite (UDP) is used for simpler messaging transmissions. TCP is the more complex protocol, due to its stateful design incorporating reliable transmission and data stream services.

C. GENERATE TRAFFIC (APPLICATION LAYER)

In TCP/IP, the Application Layer contains all protocols and methods that fall into the realm of process-to-process communications via an Internet Protocol (IP) network using the Transport layer protocols to establish underlying host-to-host connections.

In the OSI model, the definition of its Application Layer is narrower in scope, explicitly distinguishing additional functionality above the Transport Layer at two additional levels: session layer and presentation layer OSI specifies strict modular separation of functionality at these layers and provides protocol for each layer.

D. CODE OVERVIEW

In this document, we use the term "interpreter" to be synonymous with the OTcl interpreter. The code to interface with the interpreter resides in a separate directory, tclcl. The rest of the simulator code resides in the directory, ns-2. We will use the notation ~tclcl/hfilei to refer to a particular hfilei in the Tcl directory. Similarly, we will use the notation, ~ns/hfilei to refer to a particular hfilei in the ns-2 directory. There are a number of classes defined in ~tclcl/. We only focus on the six that are used in ns: The Class Tcl contains the methods that C++ code will use to access the interpreter. The class Tcl Object is the base class for all simulator objects that are also mirrored in the compiled hierarchy. The class TclClass defines the interpreted class hierarchy, and the methods to permit the user to instantiate Tcl Objects. The class Tcl Command is used to define simple global interpreter commands.

E. Class Tcl

The class Tcl encapsulates the actual instance of the OTcl interpreter, and provides the methods to access and communicate with that interpreter. The methods described in this section are relevant to the ns programmer who is writing C++ code. The class provides obtain a reference to the Tcl instance;

- invoke OTcl procedures through the interpreter;
- retrieve, or pass back results to the interpreter;
- report error situations and exit in an uniform manner,
- Store and lookup "TclObjects".
- Acquire direct access to the interpreter. We describe each of the methods in the following subsections.

V. SIMULATION AND RESULTS

Can observe the latency marked with There are two reasons for this. First, a single packet is lost during channel switching operation. Second, the new AP accepting the scanning STA defers packet transmission until successful STA's channel switching. Immediately after the packet transmission with the delay marked with the packets buffered at the new AP rush toward the laptop computer with very short intervals. Find another latency mark with. However, it has nothing to do with the handoff itself since the delay is caused by retransmission trials due to channel error. Consequently, we find only a single packet loss during MWNIC scanning.

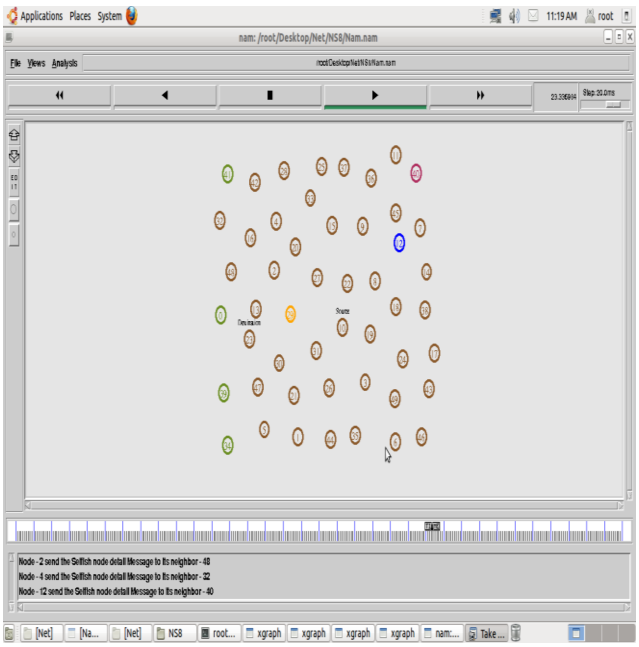

Figure 6. Communicate node for handoff operation

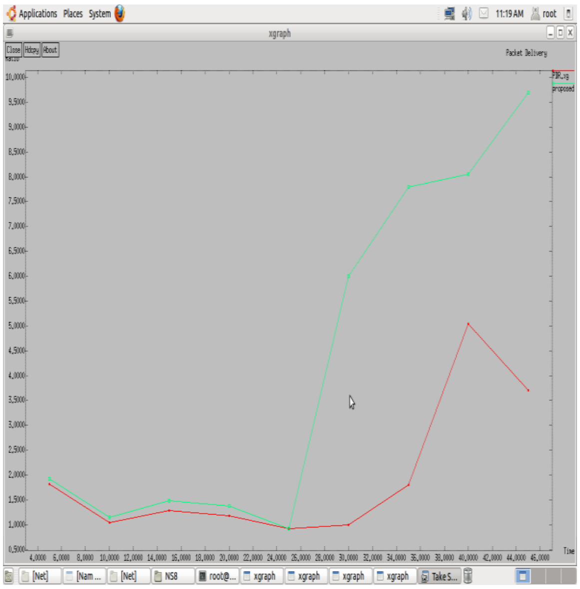

Figure 7. Comparison of Existing and proposed PDR

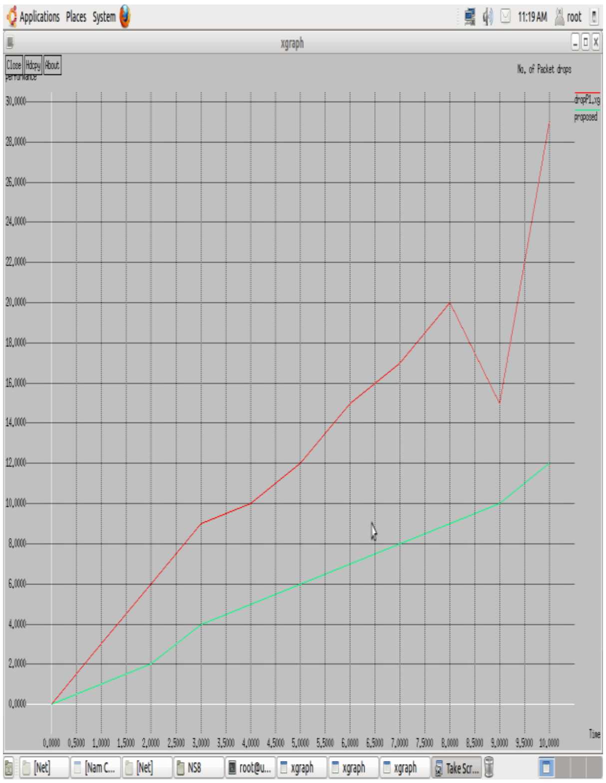

Figure 8. Comparison of Existing and proposed Packet drop

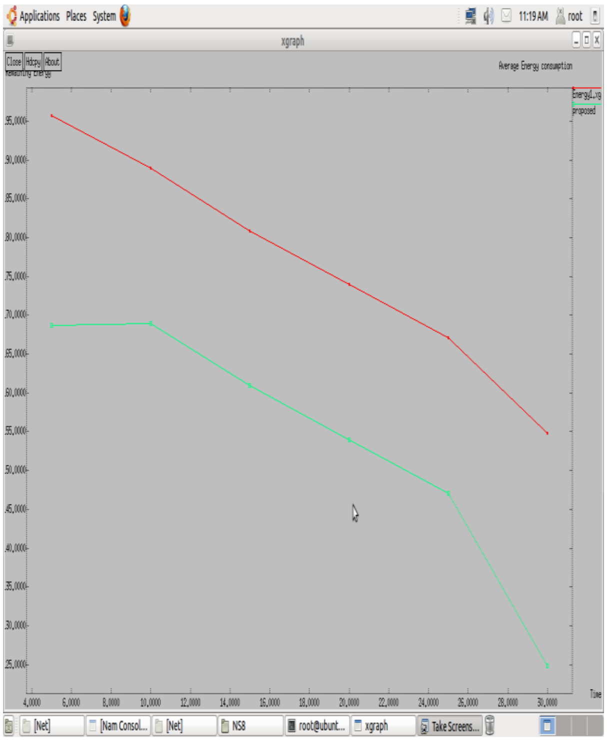

Figure 9. Comparison of Existing and proposed Energy value

VI. CONCLUSION AND FUTURE DIRECTIONS

Provided a comprehensive survey on handoff latency in IEEE 802.11 wireless LAN. In have introduced various types of handoff latency reducing techniques, also included there advantages and disadvantages. Our aim is to prepare a platform for future research on reducing the handoff latency. This report provides the understanding of handoff in IEEE 802.11 WLAN and brief description of different handoff schemes that gives the reader good foundations on handoff in IEEE 802.11 WLAN. We can provide the serial number to APs in a particular area and make a data base. Using the trajectory information and this prepared database. Reduce the handoff latency much more. Handoff latency can be reduced using the location detection in IEEE 802.11 WLAN in near future. We can detect the location of the STA using the location detection techniques in 802.11 WLAN and using this location information, we will reduce the handoff latency in near future. Can also combine the movement pattern with location information and will reduce the handoff latency in IEEE 802.11 WLAN in future. We will also reserve some fixed or adaptively changing number of channels for handoff only. By using this technique we will reduce the handoff latency and packet loss also in future.

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