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Qos Enabled Vertical Handover in Vehicular 4g Networks

A. Rengarajan[*1], S. Rajasekaran[2] and P. Kumaran[3]

SUMMARY

This paper intends to propose the use of Vehicle Access Wave Standards. It can drive various number of Information Technology services which are accessible for vehicles through IEEE 802.11 and IEEE 1609. This vehicle becomes an essential service handover. One of the service handover is Media Independent Handover which is based on vertical handoff scheme. Vertical handoff scheme to connect different access networks for interacting (both safety and user application related information), VANET and vehicular users are used. At the time of intermingling, coinciding occurs in the area of heterogeneous networks. To eradicate this coinciding, VUs are allowed to do vertical handoff between several access networks. This vertical handoff plays a dynamic role in guaranteeing user quality of services and achieving enrichment of system performance. This vertical handoff scheme is functional in MIH. This MIH based vertical handoff scheme is used to upkeep multimedia services through inter-technology nodes. It is executed through NS3. From the performance analysis, dissimilar performance parameters such as number of throughput, delay, power consumption, and handoff are analyzed in heterogeneous wireless networks. Moreover to heighten these parameters, a new technique is proposed. This technique will heighten the performance parameters by selecting only one network during vertical handoff session, and also the MOP is used to denote multiple number of vertical handoff measures that will select the best available network over and done with enhanced parameter values such as latency of network should be least in the wireless network. This proposed work is simulated using NS3. The simulation outcome illustrations that the minimized handoff latency, maximum QoS and minimal cost during handover.

Keywords: Multiple Optimization Problem; Vertical handoff; Media Independent Handover; VANET (Vehicular Ad-hoc Network; QoS (Quality of Service)

1. INTRODUCTION

Vehicular Networks are based on the purposeful Intelligent Transportation Systems (ITS). The gripping research area of VANET's is ad-hoc network. This VANET related research and applications are well-known considerations. In VANET, vehicular users can link different access networks for handover both safety and user application associated information. To upkeep this VU communication, the diverse access technologies such as UMTS, WLAN and WiMAX are possible to integrate heterogeneously. At the time of intermingling, intersecting arises in the area of various networks. Vehicular users may select the best network to connect this interacted area of various access networks. For VUs having read one network, vertical handoff, i.e., shifting from one to another can be executed for communication continuation or QoS enhancement. Performance analysis of VANET through simulation has been reviewed in the literatures in recent years. In the review, the authors work on VANET simulation scenario built on network simulator (NS3) shows the effect of vehicle velocity, the distance between vehicles on the packet loss and throughput of the VUs. Though, in exercise, multiple access networks may heterogeneously combined in VANET. Thus estimating user communication performance scenario is highly desired [1]-[4]. In the security of

[*1] Professor, CSE, Veltech Multitech Engineering College, Chennai, Tamilnadu, India
[2] Junior Research Fellow, Veltech Multitech Engineering College, Chennai, Tamilnadu, India
[3] Ph.D. Scholar, CSE, Anna University, Chennai, Tamilnadu, India
E-mail: rajasekaran009@gmail.com

vehicular network, developed actual techniques can have the potential to provide the public safety on the roads. These vehicular networks need an appropriate security design that will protect them from dissimilar kind of security outbreak.

Vehicular Network

To make a mobile network, Vehicular ad hoc network is used. In a MANET, VANET are used as carriages mobile nodes [2]. These contributing cars in the VANET switch into a wireless node or router and these contributing carriages having network about 110 to 330 meters of respectively other can link and make a network with an extensive range. In case signal range doesn't cover the carriages range, other carriages can be added the link between the vehicles. By this way, a mobile Internet is made. For safety reasons, it can be evaluated in the first systems with police and fire vehicles. It is used to connect with each other by fit in this technology. An automotive corporation such as Daimler Chrysler, GM, BMW, Toyota, and Ford encourages this kind of tenure.

Necessitates for Handover

The next-generation wireless network is wished-for as a connection of dissimilar wireless networks being LTE, WiMAX and Wi-Fi. These networks can provide the greatest facility to the mobile users anywhere anytime. So, challenge across various access networks is supporting terminal seamless handoff. It is one of the most critical factors for next-gen wireless network [6], [7]. The vertical handoff also named as Heterogeneous handoff method. It is usually designated in three stages: first one is handoff initiation, and the second is handoff decision and the last one is handoff execution. In the first phase of heterogeneous handoff method i.e. handoff initiation, all the essential information's are gathered from applicant networks. This phase is named as handoff initiation (network discovery) phase. And the second phase of hand- off method is hand- off decision phase. Using this phase, it can be calculated as how to perform the handoff by evaluating and selecting the most proper access network. All the processes are done in the hand- off decision phase. It is also termed as network selection phase [8]. The third one is handoff execution phase which is used to vary the channels and to combine with the objective network [10], [12]. It is the intelligent part of vertical handoff process. Thus, handoff decision phase plays a vital role in the heterogeneous handoff method.

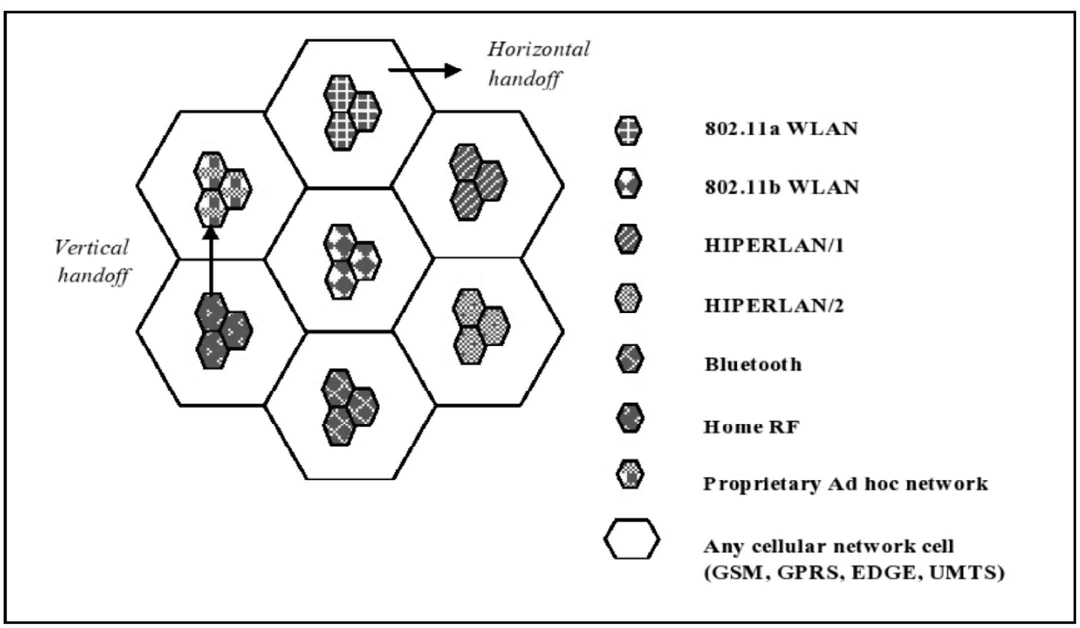

Figure 1: Overview of Handoff classifications

Horizontal Handover

To upkeep the similar network technology, the horizontal handover process is used. The horizontal handover is the handoff process of a terminal of mobile among access points shown in Figure-2 below. E.g., the changeover of the transmission signal is examined as a horizontal handoff procedure from the base station of IEEE 802.11b to a physically adjacent base station of IEEE 802.11b. Figure-2 Describes how hand off process takes place between the same networks. Normally, certain quality link condition constraints being SNR, RSSI, and so on drip under a defined handoff threshold are considered by horizontal hand off decision [9].

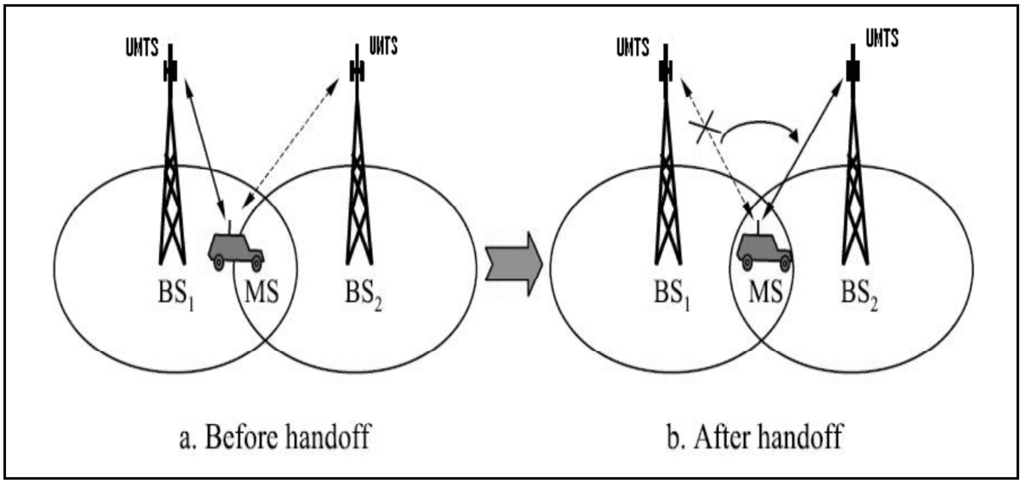

Figure 2: Before and after handoff of Horizontal

Vertical Handover

To upkeep the dissimilar network technologies; the vertical handover process is used. The Vertical Handover is the handoff procedure of a terminal of the mobile between access points having dissimilar network technologies as shown in Figure-3. E.g., the changeover of transmission signal is defined as a vertical handoff method from the base station of IEEE 802.11b to the coincided cellular network Table I.

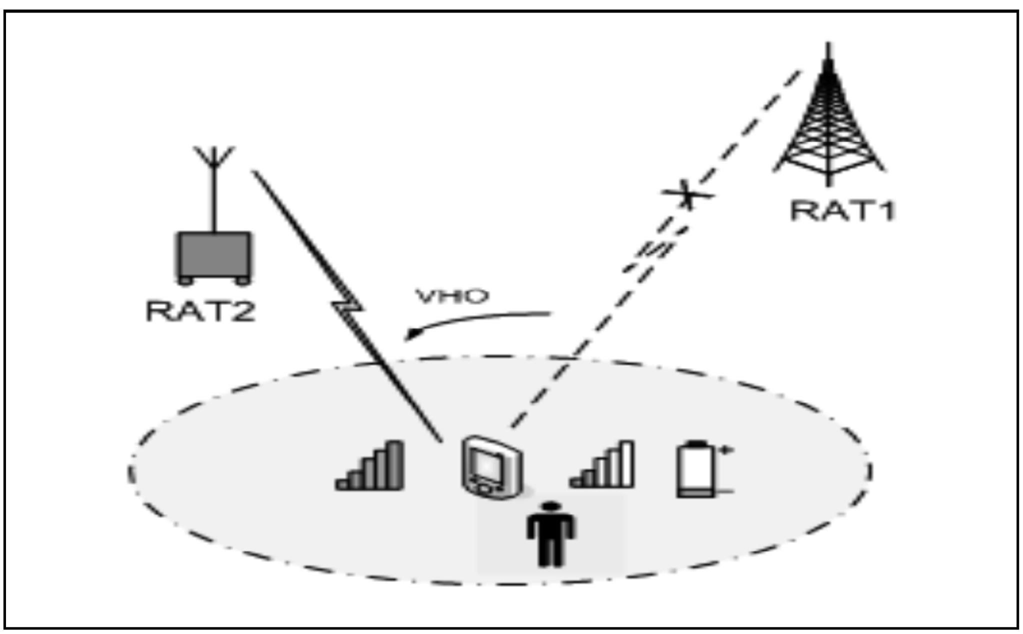

Figure 3: Vertical Handoff

Table I
Difference between vertical and horizontal handover

Parameter	*Horizontal handover*	*Vertical Handover*
IP address	Changed	Changed
Access Technology	No change	Changed
Network Interface	No change	Can be changed
QoS Parameter	No change	Can be changed

Figure 3 describes how to hand off takes place between the dissimilar networks. Table-I describes the basic difference between horizontal and vertical handover function.

Vertical Handoff Decision

In overall, the three key steps are incorporated in the VHO process. First one is system discovery. Second one is handoff decision and third one is handoff execution. The mobile stations are equipped with frequent interfaces in the step of system discovery. By using these interfaces, Utilizing these interface, the network and service accessibility in all the networks can be elected. These wireless networks are used to broadcast the constant data rates for dissimilar services. The outcome will be based on various constraints or handoff metrics with the accessible bandwidth convey power, delay, access cost, jitter, battery status of the mobile device and the user's favourites. Lastly, to re-route the connection from the current network and the fresh network is a unified manner, handoff execution phase is used [13], [15].

Output A: The stable statuses show that the quality of link, WLAN is suitable and there is no pending requisite handoff.

Output B: The unstable state-Alert shows that the WLAN signal is fading and approaching the transition region. To allow the application for making handoff and HDE is used for growing buffer size and possibly update upper layer protocols such as to adapt the TCP congestion, window size or other techniques in handoff to increase the performance analysis.

Output C: Poor mean Handoff which shows that a handoff is wanted and the handoff process to the overlay network (UMTS) is implored.

Handoff Procedure

The four phases of the entire signalling procedure of vertical handoff:

(1) Scanning of the new network interface;

(2) Invention of the new access router;

(3) Entry of the fresh network;

(4) The Routing intelligence apprising

The MN can transmit or receive information data packets over the new network interface, once these procedures are performed.

2. LITERATURE SURVEY

Vertical Handover Survey

The performance of Vertical handoff of VUs in a VANET scenario has dissimilar integrated UMTS and WLAN which have calculated based on network simulator 2 (NS2) [2]. To access both networks and MIH-based vertical handoff scheme, Multi-mode nodes are accessed and are executed in NS2 [10]. The VANET based study and applications have established huge attentions. In VANET, VUs can be attached dissimilar access networks for conveying both user and safety application related information. To guarantee the user QoS and to achieve enhancement in terms of system performance, vertical handoff plays a vital role. So it must be reviewed and valued thoroughly. VANET is an effective tool for estimating the performance. Due to the long period and high cost, the approach may not be practicable [9]; alternatively, to make the process of vertical handoff and to estimate the performance and the simulation can be done in VANET. Performance analysis of VANET through simulation has been reviewed in the literature in recent years [15] and in this review, the authors work on VANET simulation scenarios built on network simulator (NS3) and shows the effects of vehicle velocity, the distance between vehicles on the packet loss and throughput of VUs. Though, in exercise, multiple access networks may heterogeneously combined in VANET, thus estimating user communication performance below such scenario is highly desired. Also in previous works, the mobility is extremely simplified, which may strictly bind the simulation performance of the accuracy and efficiency [11].

Attributes	*MeNB*	*Pico Cell*	*HeNB*	*Wi-Fi*
Base Station Installation	Mobile Operator	Mobile Operator	Subscriber	Customer
Site Acquisition	Mobile Operator	Mobile Operator	Subscriber	Customer
TransmissionRange	300-2000m	40-100m	10-30m	100-200m
Band License	Licensed Band	Licensed Band	Licensed Band	Unlicensed Band
System Bandwidth	5,10,15,20 MHz	5,10,15,20 MHz	5,10,15,20 MHz	5,10,20 MHz
Transmission Range	Up to 1 Gbps	Up to 300 Mbps	100 Mbps – 1 Gbps	Up to 600Mbps
Power consumption	High	Moderate	Low	Low

Problem Statement

We can consider the several major challenges for cellular networks of next generation to improve the cell coverage. They are network latitude; better QoS machinery and universal frequency reuse which makes the distance between transmitters and receivers closer.

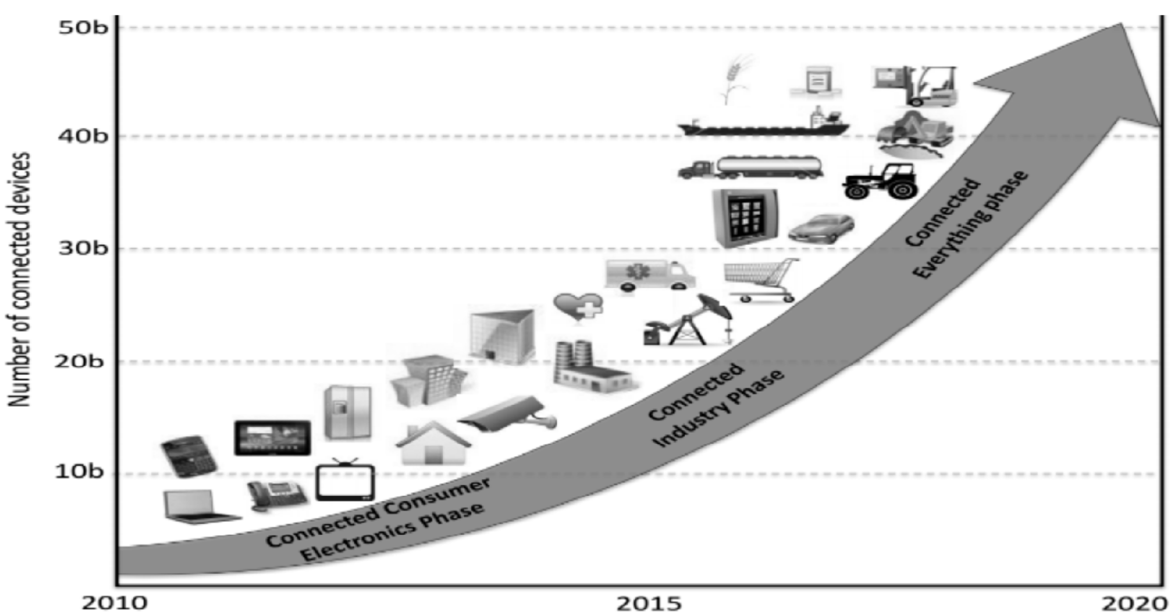

Figure 4: Rapid increases of devices in network

The complete wireless accessing device plays a vital role to encounter the condition and to adopt the Vertical Handoff to enhance the QoS due to demand in future generation.

3. OUR APPROACH

To encounter the QoS enhancement in Wireless Access technologies, our main motive is to part the signal in the small data rate signal to large data rate signal portion. As we all see that the Wi-Fi and LTE fits to unlicensed and licensed band structure accordingly. By comparing these licensed and unlicensed small cells, we can conclude with this i.e. the small cell fits to licensed bands which consists of 3GPP, 3GPP2, WiMAX, and unauthorized small cells (e.g. Wi-Fi) [8]. To achieve QoS enhancement, flawless continuity over the large-scale networks for handoff, mobility and enhanced security, we will offer care for legacy. In the enlargement of the indoor analysis, our main motive is to focus on cell placement. In this we have to study Pico cells to progress the capacity of the network. By removing the coverage holes in a homogeneous system, these Pico cells are generally positioned. The Pico cells coverage areas are usually differs among 40 m to 75 m. The Pico cells are made up of Omni directional antenna. To provide the well indoor coverage to the UE's, can take the Omni directional antenna with 5dBi antenna gain. Low power compact base stations are elucidated using Pico cell and outdoor short range BS are described by using microcell.

Using short range BS we can enhance the coverage for both short and long distance users whereas the macro coverage is insufficient. To offer huge capacity area, the metro cell is modelled. In the case of Wi-Fi, we can access points which are working in the unlicensed band as well. To provide enhanced spectrum efficiency and coverage, handoff capabilities are proposed. While the base station of other macro cell or MeNB signal is powerless. A femto cell offers the high data rate, enhanced QoS and to communicate with the distance macro cell base station such as Wi-Fi.

Our Motivation

- Higher data rate and enhanced QoS to subscribers
- Removing coverage gap in macro cell footprint
- Reducing Macro cell load
- Mitigate spectrum underutilization problem.

Comparisons among different radio base stations in LTE

Table II. Difference between radio base stations in LTE

4. SYSTEM MODULES

Antenna Patterns

The equation of azimuth antenna pattern of the single cell is demonstrated as:

$$A(\theta) = -\min\left[12\left(\frac{\theta}{\theta_{3dB}}\right)^2, A_m\right]$$

Where $\theta 3_{dB}$ = 70 degrees, A_m = 20 dB. The patterns of the azimuth antenna for UEs and HeNBs are considered to be Omni directional.

Path Loss Models

The deployments of the Path loss models are specified below. When the Tx-Rx parting is larger than or equal to 1m, the path loss models can put on, otherwise the following formula can be used with no surveillance, which offers unique results to the 2 GHz capacities.

PL (dB) = 38.46 + 20 log10R + 0.7d2D

Where the distance between the cells are denoted as D in m

Deployment

The deployment of path loss models are proposed as follows,

- R is the Tx-Rx separation in UE to HeNB.
- UE is inside the similar house as HeNB. Using the losses of free space and penetration which are produced due to internal walls and floors, the path loss is displayed during that time. Due to internal walls, the loss is executed as a log-linear value and is equal to 0.7dB/m.
- In UE to HeNB, UE is outside during that times the path loss modeling takes into account of d2D, indoor is the distance inside the house.
- In UE to HeNB, UE is inside the different house as HeNB during that time d2D, Low, 1 and Low, 2 are the penetration losses of outdoor walls for the two houses.

Handover Request Procedures

- Acknowledgement procedure of Handover Request
- Transfer procedure of SN Status
- Release procedure of UE Context

Figure 5 stretches Sequence diagram of the X2-based handover below which displays the communication of the objects of the X2 model in the simulator. When the UE or eNodeB is changed to another RRC state, the shaded labels specify the moments. Within the handover procedure, two timers are also displayed by the figure: to maintain the handover leaving timer, the source eNodeB is used, at the same time to maintain the handover joining timer, the target eNodeB is used.

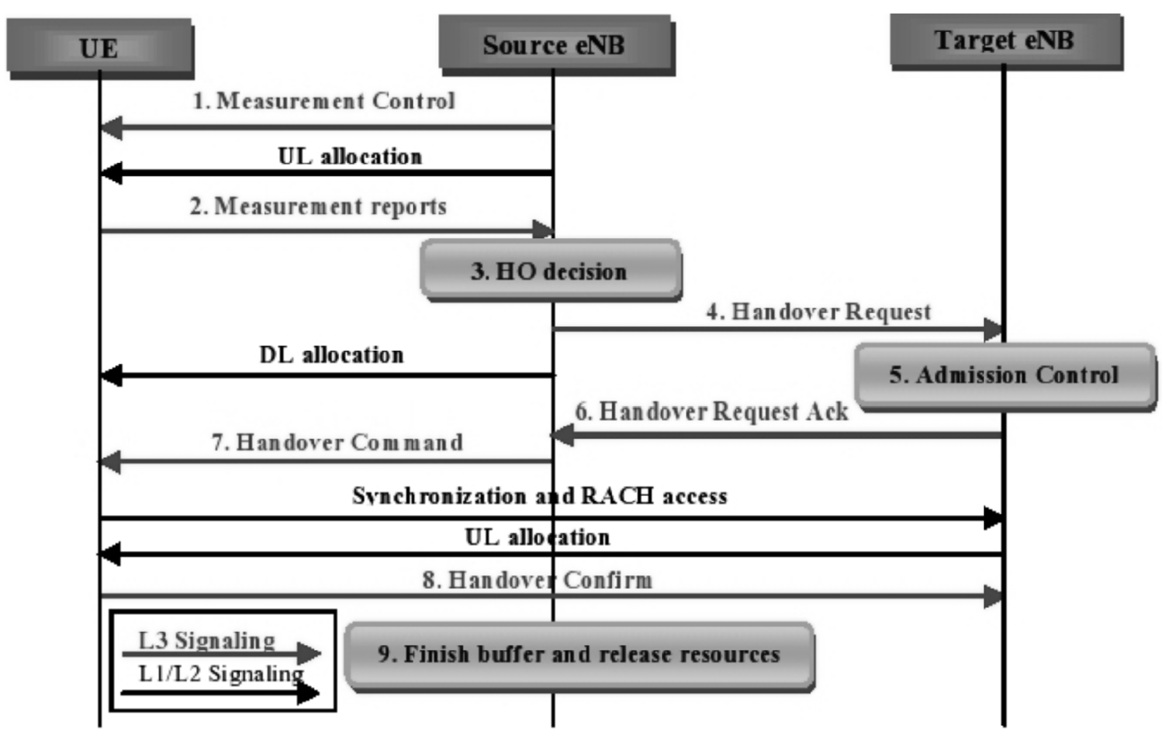

Figure 5: Sequence diagram of the X2-based handover

Though, in the present version of LTE module, there is no good handling of handover failure. In order to evade handover failure, users must adjust the simulation correctly. Or else unpredicted behaviour may happen. To know this detail and for certain tips about this matter, refer the session of the tuning simulation algorithm through handover process of the Consumer Documentation. The entity of the X2 model is the one that practices services from: The X2 interfaces,

- On the topmost point-to-point devices, they are executed as Sockets.
- To transmit/receive X2 messages, X2 interfaces of X2-C and X2-U interfaces to the peer eNB are used and also interfaced the application of S1.

To catch certain information desirable for the Elementary Actions of the X2 messages, X2 interface is used and it delivers these service systems to:

- The RRC entity (X2 SAP)
- To transmit/receive RRC messages

In the X2 message, the X2 entity transmits the RRC message as a transparent container. This message of RRC is transmitted to the UE. Figure-6 gives execution Model of X2 object and SAPs displays the implantation ideal of the X2 entity and its connection by all the other units and facilities in the protocol load. In the beginning of the handover method, the RRC entity is achieved. In the Handover Management sub module of the eNB RRC entity, this RRC entity of handover method is implemented [9]. Some Admission Control events are achieved by the target eNB. This process is executed in the Admission Control sub module. This sub module will take any handover request originally.

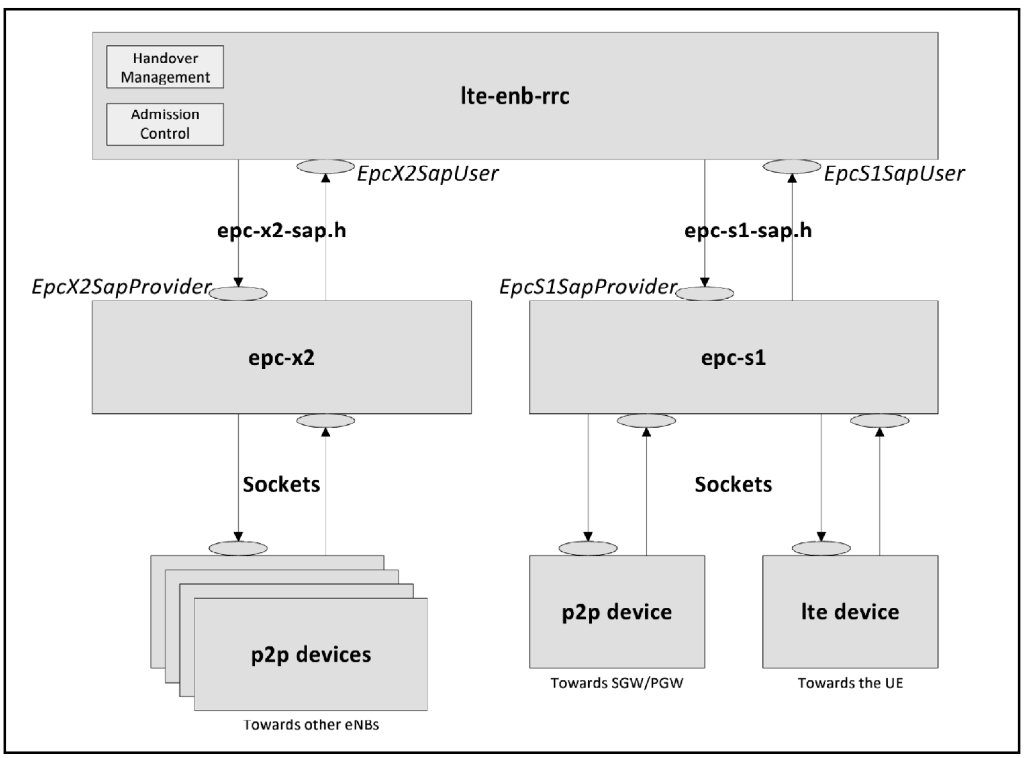

Figure 6: Implementation model of X2 entity and SAPs

Design Issues

In contrast, the mobility between UMTS and WIFI is mentioned to partly intersecting handover and when the speed of the terminal of mobile is high, handover must be finished quickly to preserve the direct link. This affects large drop of packet and data rate, whereas the handover ensues between the UMTS and WIFI network [3], [10]. So, providing an efficient handover management and seamless service systems to subscribers in vertical handover is the aim of our process. Below Figure-7 shows issues in design of vertical mobility architecture.

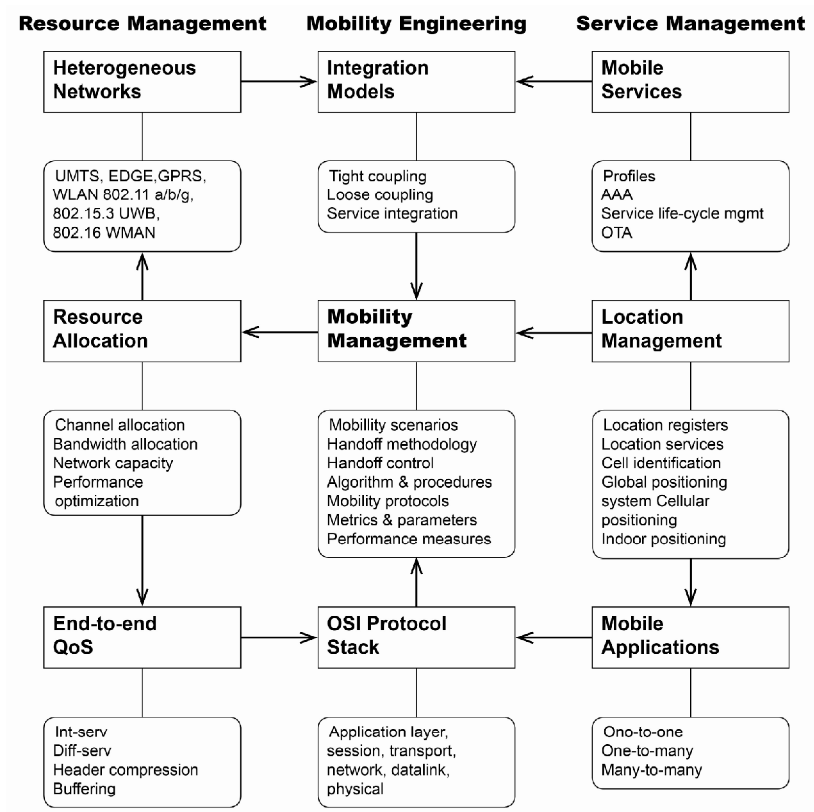

Figure 7: System architecture design issues in Vertical mobility

PROPOSED VERTICAL HAND-OFF

In our proposed work, the two stages of handoff procedure are stated as follows: Handoff of Layer 2(L2) and Layer 3(L3). The real transfer of means of communication connecting flanked by two unlike network crossing points is handoff of L2. To care the L2 handoff, L3 handoff is used by executing packet defending and rerouting. When MNs move within the same domain, they do not alter their IP addresses, in our system model. IP packets are addressed to an MN. Through the Internet, these MNs are routed to the WGW and next to the MN during the Intra-Mesh Router. To come across the next-hop (to where the WMR must ahead the data), the WMR checks the terminus IP address of a received packet. The physical interface is used to show the third piece. Within the substantial crossing point, the WMR supposed to be used to ahead the data. The WMR will practice the fixed next-hop to onward the data, if the target of the IP address absent in the stand list [19], [20].

New Access Router Discovery

By the scanning process of new network interface, a new BS or AP is sensed once. The second process is that the MN attempts to learn the information of WMR. The MN requests the new information of WMR from the information presently related with WMR by the use of new 802.11 APID or 802.16 BSID [18]. That present related WMR is as well named as earlier WMR (PWMR) in handoff method. The MN is demanding toward handoff among Inter Mesh Routers within dissimilar domains, as soon as the MN obtains the PrRtAdv communication which comprises a dissimilar HA’s IP address as of its individual [19].

Novel Network Admission

In common, the part of the new network entry process is new network interface scanning. We place the innovative system crossing point scrutinizing to an entity phase based on the different effect to the vertical handoff. It is chiefly fretful so as to how the connection layer association is locate up subsequent to the novel system crossing point examining and a handoff choice in this stage.

5. IMPLEMENTING MIH-BASED VERTICAL HAND-OFF SCHEME AND MULTI-MODE IN NS3

MIH-Based Handover Strategy

IEEE 802.21 Working Cluster proposes the framework of MIH to avoid the performance detraction of network selection and vertical handover due to the heterogeneous characteristics of access networks, and to achieve seamless handover when user terminals roam among heterogeneous networks. In the framework, a new protocol layer, i.e., MIH layer between data link layer and network layer is proposed which has several elements comprising MIH function, service access points, MIH users, etc. Figure 9 shows the MIH-based information interaction between a MN and an access point (AP).

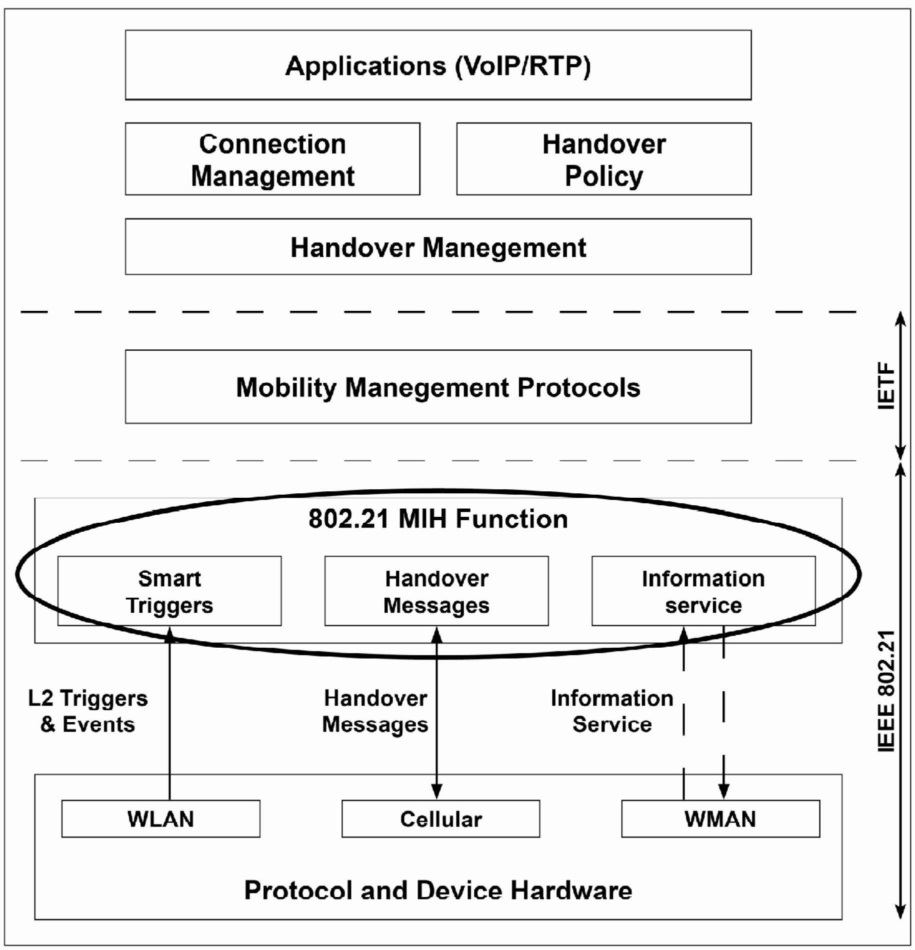

Figure 8: Overall Architecture Diagram

To execute MIH-based vertical handoff in varied networks, a heterogeneous network handover platform comprising of MIH modules must be established. The handover platform of MIH module mainly composed of both MIHF module and MIH User module. When MN enters the coverage area of one particular network, it must be able to spot the network information in time, this can be attained by ND mechanism, i.e., users

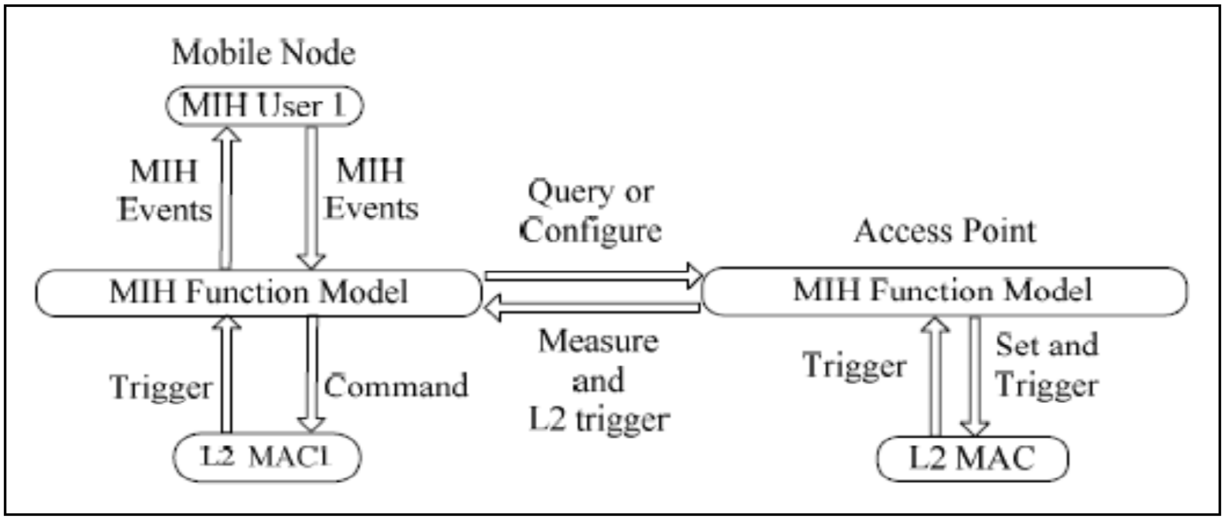

Figure 9: MIH-based information interaction between a mobile Node and an Access Point

notice route advertisement messages periodically broadcasted by the network in a heterogeneously integrated network of various access networks [16]. Based on which, the users controls whether a handover must be performed or not. If yes, consistent control commands will be sent to low layer to start handoff.

6. PERFORMANCE ANALYSIS-QOS

The existing flows of QoS must be preserved efficiently by calculating approximately the attainable throughput of every traffic flow and evading the overloading channel. Depends on the IEEE 802.11e, we can go for the admission control structure which is measurement-based one. This scheme is used for service of differentiation of the EDCA. To take conclusions on reception or rejection of a stream of voice, we have to listen MNs to avail budgets from the AP for voice traffic. To get good differentiation between dissimilar access groups and high-quality fairness between real-time streams inside the similar access group, this centrally-assisted distributed admission control is supplied. The schemes of admission control and scheduling are significant in the network of 802.16 and WLAN. But the particulars of the decision of admission control scheme cannot get through the network of 802.16 and the details are given to the manufacturers [21]-[23].

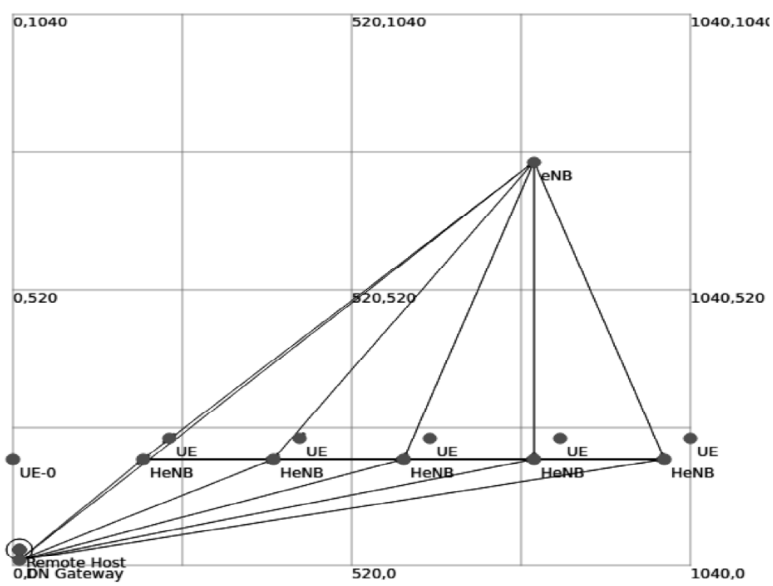

Figure 10: NS3 NetAnim .xml file output animation with 10 nodes

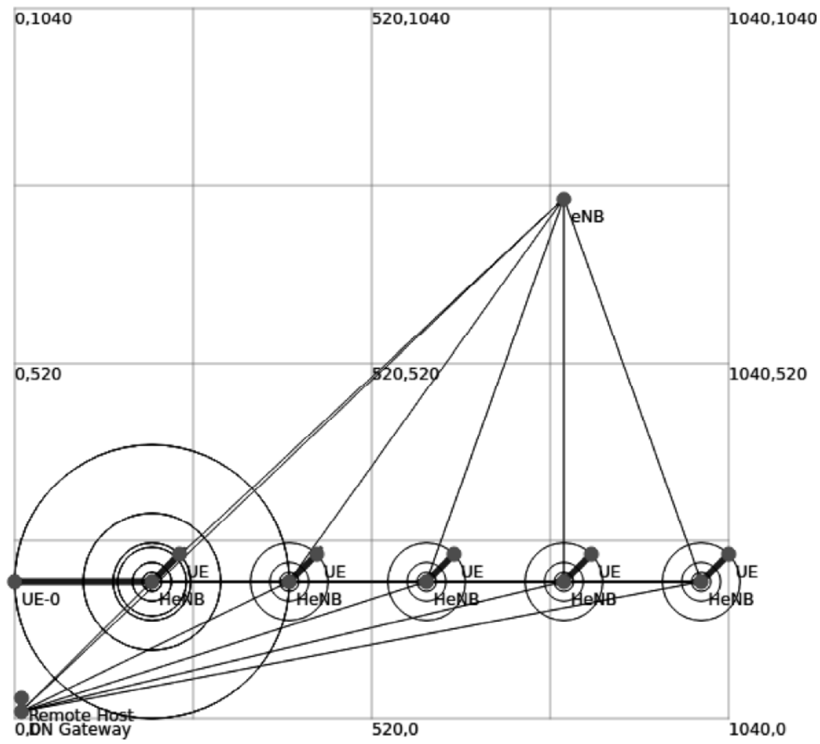

Figure 11: Simulation overview: Vertical handoff, using the constant velocity for the nodes

7. CONCLUSION

We improve an extensible simulation environment combining a simulation tool NS3. MIH-based vertical handoff scheme and multi-mode node model are established inNS3 and the communication performances of multi-mode VU sin the heterogeneously integrated network of UMTS and WLAN is evaluated. The impacts of user velocity, the strength of traffic load and the type of handoff mechanisms on the communication performance of VUs are examined. Even though, the frequent handoff resulted from high velocity of users may degrade user QoS in terms of packet loss and handoff latency. Furthermore, while the light traffic load of other users may not affect user performance severely, the heavy traffic load will degrade user performance, especially in WLAN. Comparing user performance during downward handoff and upward handoff, it is clear that the handoff latency resulted from upward handoff is much larger than that of downward handoff.

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