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Vertical Handoff Algorithm between IEEE 802.11 WLAN & CDMA Network

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Abstract: ***Next generation wireless communications will integrate multiple wireless access networks. Global information access to the user will be provided by the wireless networking. Now a day's wireless networking is becoming an important and popular way to provide the global information access to the user while roaming among the heterogeneous wireless network. Everyone wants the quality of services anywhere & anytime. There is high probability that signal coverage of these coexisting networks overlaps with each other. For a user roaming among these networks, it is desirable that his or her mobile device can have anytime connectivity, and therefore vertical handoff becomes an important issue.Vertical handoff plays an important role in heterogeneous networks. In this paper, a prediction based vertical handoff decision algorithm has been proposed based on mobility. The major issue in the heterogeneous networks is the vertical handoff from one wireless network to the other wireless network. Vertical handoff is a process of transferring a connection from one base station to other base station when moving across different access technologies.To achieve high performance, a user may want to choose the best network to connect to. However, properties such as signal coverage area, maximum data rate, monetary cost, and power consumption on end devices vary largely among these networks. Handovers occur due to the movement of the mobile user from one area to another area. Handovers are used to prevent an on going call to be disconnected. If we don't use handovers then whenever a user leaves the area of a particular cell then its on going call is immediately disconnected. The process of handovers requires a number of parameters e.g. what is the handover scheme we are using, how many channels are free. In the handover process we should also keep the QoS up to the standard. The objective of this paper is to determine the conditions under which vertical handoff should be performed in heterogeneous wireless networks.***
The main objective is to implement efficient & effective handoff scheme between two heterogeneous network ie. 802.11 WLAN & CDMA.

Keywords: CDMA , 4G, Vertical Handoff, WLAN

I. INTRODUCTION

In recent years, wireless networks have emerged and played key roles in modern telecommunications. Communication is always necessary in building relations to mankind, when two persons meet they need some medium to interchange their views but due to distance barriers some tools are required to communicate each other. Nowadays many different types of networks communicate among themselves to form heterogeneous - networks. Due to different network access technologies, topologies, and implementations, one network might not be able to provide continuous coverage and required QoS parameters to a mobile user during an entire session. That is why handing over between different wirelesses networks appears as one of the fundamental solutions in today's heterogeneous wireless systems.The large numbers of heterogeneous mobile networks are integrated in the fourth generation (4G) mobile communication networks, for this integration of heterogeneous mobile networks vertical handoff scheme is needed. The main aim of seamless mobility is to provide the simple and vertical handoff. Vertical handoff is used to allow the mobile nodes to move freely across heterogeneous wireless mobile networks without loss of the quality-of-service (QoS). The vertical hand of scheme is divided into three steps [1]. First, the mobile node should have the knowledge about the wireless networks in order to know which wireless network is reachable this step is called as network discovery. Second step is handoff decision, in this step the mobile has to decide which network is suitable to handoff and this step is evaluated by considering the parameters associated with the other wireless networks. The last step is handoff execution, in this step the mobile node decides to move to other wireless network which is selected in the second step.

The vertical handoff may not only take place at the cell edge. It could occur at any time depending on the network condition and user preference such as in a situation of network congestion. The decision to trigger a vertical handoff according to the system performance and QoS parameters becomes the main part of vertical handoff process[2] [3].Therefore, an effective and efficient vertical hand off decision algorithm is needed to improve the system performance. Traditionally in a homogeneous network, handoff decision strategy is relatively simple based on received signal strength and network coverage. In heterogeneous networks, the problem is far complicated since handoff decision depends on various network quality-of-service (QoS) parameters. The vertical handover is a very important capability in the future wireless communication era, where an integrated network grouping multiple technologies will try to offer a global broadband access to mobile users.

HANDOFF METHODS

Horizontal Handoff

A Horizontal handoff is a handoff between two network access points that use the same network technology and interface. For example, when a mobile device moves in and out of various 802.11b network domains, the handoff activities would be considered as a horizontal handoff, since connection is disrupted solely by device mobility.

Vertical Handoff

A Vertical handoff is a handoff between two network access points, which are using different connection technologies. For example, when mobile device moves out an 802.11 network into a CDMA network, the handoff would be considered a vertical handoff.

In this paper, we have varied the parameters like bandwidth, node interest, quality of interest, received signal strength indication, & network coverage.

II. HANDOFF PARAMETERS

We use set of parameters that can be used to make the vertical handoff.

2.1. Bandwidth

Different networks have different bandwidth, in an overlay network. Network bandwidth refers to the volume of data being transmitted across a network at any given point in time. When a MH moves into the coverage of a network with a higher bandwidth, it may connect to the higher bandwidth network via a downward handoff. When the MH moves out of its coverage, it can again connect to the original connection via an upward handoff.

2.2. Received signal strength indication

In an IEEE 802.11 system RSSI is the relative received signal strength in a wireless environment, in arbitrary units. RSSI is an indication of the power level being received by the antenna. Therefore, the higher the RSSI number, the stronger the signal. RSSI can be used internally in a wireless networking card to determine when the amount of radio energy in the channel is below a certain threshold at which point the network card is clear to send (CTS). Once the card is clear to send, a packet of information can be sent. The end-user will likely observe a RSSI value when measuring the signal strength of a wireless network through the use of a wireless network. If an MH finds the strength of the received signal from a network is below a threshold or below the strength of signal from another network, the MH may decide to change the network.

2.3. Quality of service (qos)

Vertical handoff decision can be based on the service an MH is using. Every service requires a certain level of QoS. If MH is using a more demanding service, like internet telephony, it may do a downward handoff the high bandwidth service. On the other hand, if the MH is using a service like web browsing, it may not decide to handoff if it meets the required QoS and avoid the necessary complications required for handoff.

2.4. Network interest & network coverage

Network conditions, like congestion and traffic load may be deciding factor of a vertical handoff. Even if a MH can connect to a higher bandwidth network, but the network may be saturated and have high packet loss. In that case, the MH may decide against a handoff. Network coverage & network interest should be proper.

III. VERTICAL HANDOFF ALGORITHM

Vertical handoff refers to a network node changing the type of connectivity it uses to access a supporting infrastructure, usually to support node mobility. A Vertical handoff is a handoff between two network access points, which are using different connection technologies. For example, when mobile device moves out an 802.11b network into a GPRS network, the handoff is called a vertical handoff. We have considered two network first one is CDMA network & second is WLAN 802.11. Vertcal handoff algorithm is explained by considering some conditions as follows. First we considered, currently nodes are present in CDMA network .

If node bandwidth is less than 15 ORing with node interest is less than 0.5 ORing with node quality of service is less than 0.5 ORing with node received signal strength indication is less than -70 ORing with node network coverage is less than 150. Here We have considered various parameters & compared with some threshold values. If above condition is satisfied then node will change network i.e. from one to another network & vice versa.

IV. RESULTS

In the simulation of vertical handoff algorithm, parameters of random nodes are varying. We use two networks first one is CDMA and Second is WLAN . We use some threshold value of various parameters. By comparing these parameters, the node will choose current network.

For creating nodes first we have to create user datagram Protocol agent i.e. UDP after creating UDP, it attach to node. Then create constant bit rate ratio i.e. CBR traffic source. It attach to UDP. Connect traffic source to traffic sink. At last create link between nodes. We Use Ad hoc on demand distance vector protocol i..e AODV. The Nam file of node formation in which network animation of various nodes are shown.

4.1 Implementation of vertical handoff algorithm

```
101376
Data Received after secure handoff 396
KEY ECHANGED BETWEEN NETWORKS:256 via the PKI ALGORITHM
Node 9 parameters, Data:124
Bandwidth:3.3570651539401455 MHz, Node Current Network Interest:0.3699007045337
679, QOS:0.9211410986823687l, RSSI:-47.628307701928688 dB, Network Coverage:64.
30699930121511, Current Network: WLAN
Bandwidth:42.415611977882499 MHz, Node Current Network Interest:0.3198418711878
723, QOS:0.5823290481987481, RSSI:-15.721753757317437 dB, Network Coverage:189.
210359771834, Current Network: CDMA
SECURE HANDOFF APPLIED, Changing network of node 9 to CDMA, with Encrypted data
31744
Data Received after secure handoff 124
KEY ECHANGED BETWEEN NETWORKS:1024 via the PKI ALGORITHM
Node 10 parameters, Data:316
Bandwidth:47.550554819195789 MHz, Node Current Network Interest:0.7029141037272
202, QOS:0.8773413444298046, RSSI:-36.650139042944716 dB, Network Coverage:217.
4114846146719, Current Network: CDMA
KEY ECHANGED BETWEEN NETWORKS:256 via the PKI ALGORITHM
Node 11 parameters, Data:378
Bandwidth:49.22071468514423 MHz, Node Current Network Interest:0.54252855365282
26, QOS:0.27740124300081245, RSSI:-21.767214793137843 dB, Network Coverage:56.8
1408835128605, Current Network: WLAN
Bandwidth:42.863322982835257 MHz, Node Current Network Interest:0.7311559844441
```

Fig . 1(a)

```
405504
Data Received after secure handoff 396
KEY ECHANGED BETWEEN NETWORKS:1024 via the PKI ALGORITHM
Node 9 parameters, Data:124
Bandwidth:42.415611977882499 MHz, Node Current Network Interest:0.3198418711878
723, QOS:0.5823290481987481, RSSI:-15.721753757317437 dB, Network Coverage:189.
210359771834, Current Network: CDMA
Bandwidth:19.784301239896706 MHz, Node Current Network Interest:0.9125158498658
544, QOS:0.65051384579879878, RSSI:-14.337888211634889 dB, Network Coverage:178
98889551087218, Current Network: WLAN
SECURE HANDOFF APPLIED, Changing network of node 9 to WLAN, with Encrypted data
126976
Data Received after secure handoff 124
KEY ECHANGED BETWEEN NETWORKS:192 via the PKI ALGORITHM
Node 10 parameters, Data:316
Bandwidth:47.550554819195789 MHz, Node Current Network Interest:0.7029141037272
202, QOS:0.8773413444298046, RSSI:-36.650139042944716 dB, Network Coverage:217.
4114846146719, Current Network: CDMA
KEY ECHANGED BETWEEN NETWORKS:192 via the PKI ALGORITHM
Node 11 parameters, Data:378
Bandwidth:42.863322982835257 MHz, Node Current Network Interest:0.7311559844441
864, QOS:0.53863855284871271, RSSI:-58.805022727141633 dB, Network Coverage:159
80639637438878, Current Network: CDMA
KEY ECHANGED BETWEEN NETWORKS:256 via the PKI ALGORITHM
```

Fig . 1 (a) & (b) Handoff between two network

In above two fig . 1(a) & (b) we consider node 9 . In fig 1 (a) BW is 3.3570 MHz ,node current N/w interest is 0.369, QOS is 0.921141 RSSI is -47.62030dB & N/W coverage is 64.30699 so current N/W is WLAN.
After handoff BW is 42.4156MHz, node current N/W interest is 0.319841, QOS is 0.582322904, RSSI is -15.7217db, N/W coverage is 189.21035 & current N/W is CDMA. In both fig. Stored data same ie. Data is 124. In above two fig . 1 (b), same node no. 9 went to again CDMA to WLAN network.

V. GRAPHS

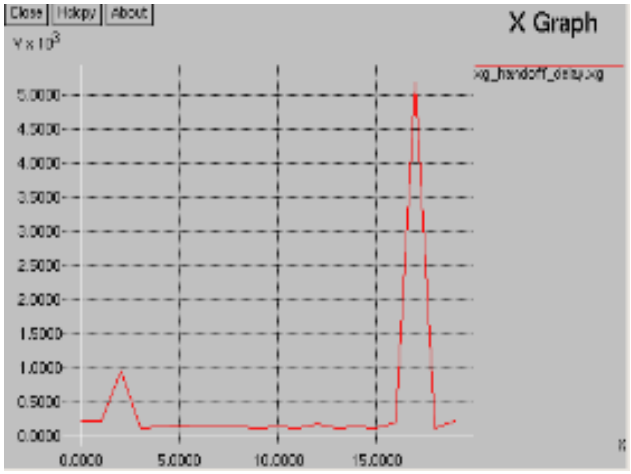

Fig 2.Handoff delay vs .time

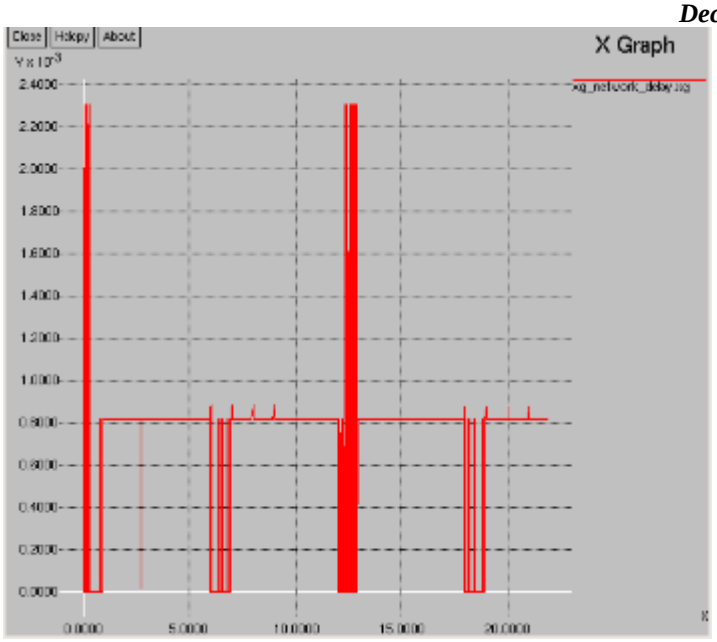

Fig. 3 Network delay vs .time

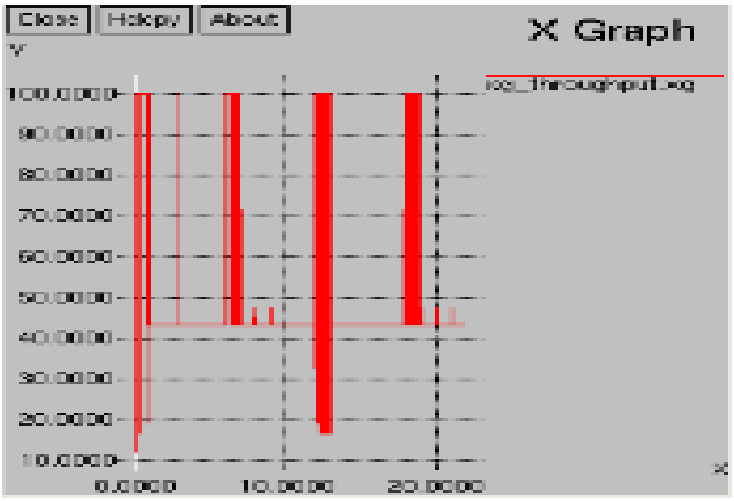

Fig.4 Throughput vs .time

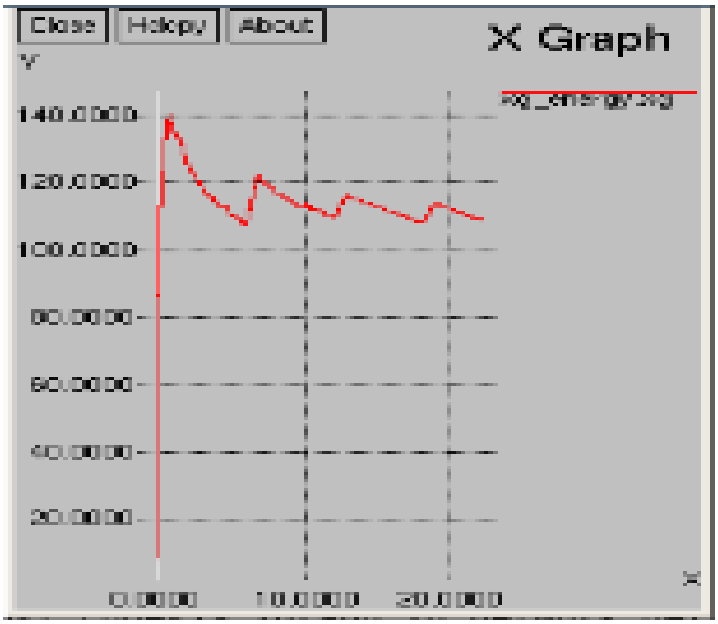

Fig. 5 Energy vs time

In fig. 2, graph is of handoff delay vs time.In this graph time is considered on X- axis & handoff delay is considered on Y-axis. In fig.3, graph is of network delay vs time. In this graph, time is considered on X- axis & network delay is considered on Y-axis. As the time increases handoff delay also increases up to the threshold value but after that it decreases. In fig.4 , the graph is between throughput vs. time . On X- axis time has taken & on Y- axis throughput has taken. As the time increases, initially throughput becomes constant after some time it starts to increases. In fig.5, the is a graph between energy vs time. On x-axis time is taken & on Y –axis energy is taken which is in joules. As time increases ,energy starts increases initially after some time it becomes constant.
the graph is between throughput vs. time .

Throughput is the amount of data transferred from one place to another or processed in a specified amount of time. Data transfer rates for disk drives and networks are measured in terms of throughput. Typically, throughputs are measured in kbps, Mbps and Gbps.

Fig. 6 Vertical handoff animation

This is animation file after applying vertical handoff algorithm. In this animation file , nodes changes its network when the condition satisfied. When play button starts , nodes will move from one network to another.

VII. CONCLUSION

In this paper, we presented a formation of random nodes by changing various parameters such as bandwidth, node current network interest, quality of services, received signal strength indication, & network coverage. With the popularity of many types of networks, issues of vertical handoff are getting more and more important. In our module , we are comparing various parameters with some threshold values. If conditions are satisfied, then node will change current network to another network. For security purpose we can use encryption & decryption code. If the parameters are chosen correctly the algorithm can perform quite efficiently and a maximum performance can be extracted from the device given an operating environment. The design & working of vertical handoff algorithm will be under NS-2 platform in the LINUX environment.

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