International Journal of Technical Research and Applications e-ISSN: 2320-8163,
www.ijtra.com Volume 2, Issue 4 (July-Aug 2014), PP. 67-71

VERTICAL HANDOVER AMONG HETEROGENEOUS NETWORKS USING COMBINATION OF DIFFERENT PARAMETERS TOGETHER

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***Abstract*— Handover is the process of switching among the available services without any interruption. Vertical handover is a technique of switching from one type of a network to another type of network (e.g., from WiFi to WiMAX). Seamless handover between different access technologies is a great challenge as it needs to obey different performance of QoS and security constraints. Service users are becoming more demanding regarding roaming capabilities across different networking technologies such as WiFi, WiMAX, and CDMA as they claim service continuity with QoS requirement and good security features. Vertical Handover Decision (VHD) algorithms need to be designed to provide the required Quality of Service (QoS) to a wide range of applications while allowing seamless roaming among a number of access network technologies. This paper is about the implementation of the VHD algorithms designed to satisfy these requirements. A combination of 3 parameters i.e. Data Rate, SINR and RSS are evaluated to take decision of the best network among available.**

***Key words*— MH, SINR,Vertical Handover, WiMAX ,WiFi.**

I.INTRODUCTION

Today's user wants to use internet services without any interruption while moving from place to place. He also doesn't want to compromise with the quality of service while switching from one network to another.

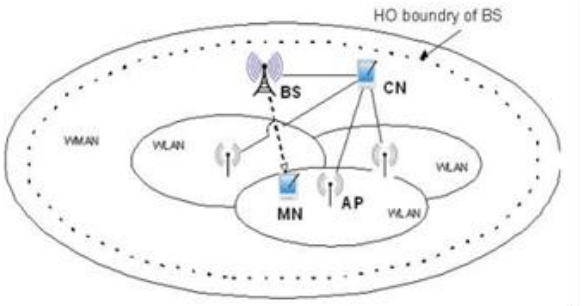

Fig 1. Heterogeneous Networks

Fig 1 shows an example today's scenario of heterogeneous network that involves number of WLANs and WMAN. This type of network consists of services from number of service providers. Different services having different parameters like data rate, signal strength, noise in the data and so many. Supporting seamless roaming between heterogeneous networks is a challenging task since each access network may have different mobility, QoS and security requirements. The handover process stresses performance bounds by introducing delays due to discovery, configuration, authentication and binding update procedures associated with a mobility event. The ability to change access link for better QoS in different wireless communication networks is known as seamless vertical handover. To achieve this object, the Media Independent Handover (MIH) IEEE 802.21 standard has been proposed to permit the exchange of entities belonging to different access networks and assists the handover decisions by defining the set of functional components to be executed.

Handover is the process of maintaining a user's active sessions when a mobile terminal changes its connection point to the access network for example, a base station or an access point. Depending on the access network that each point of attachment belongs to, the handover can be either horizontal or vertical. A horizontal handover takes place between points of attachment supporting the same network technology, for example, between two neighbouring base stations of a cellular network. On the other hand, a vertical handover occurs between points of attachment supporting different network technologies, for example, between an IEEE 802.11 access point and a cellular network base station. A handover process can be split into three stages: handover decision, radio link transfer and channel assignment. Handover decision involves the selection of the target point of attachment and the time of the handover. Radio link transfer is the task of forming links to the new point of attachment, and channel assignment deals with the allocation of channel resources.

A. Horizontal versus vertical handovers

We define a horizontal handover as a handover between base stations that are using the same type of wireless network interface. This is the traditional definition of handover for homogeneous cellular systems such as cellular telephony systems, wide-area data systems, and wireless local area networks. We also define a new type of handover, a vertical handover, between base stations that are using different wireless network technologies. The terms horizontal and vertical follow from the overlay network structure that has networks with increasing cell sizes at higher levels in the hierarchy.

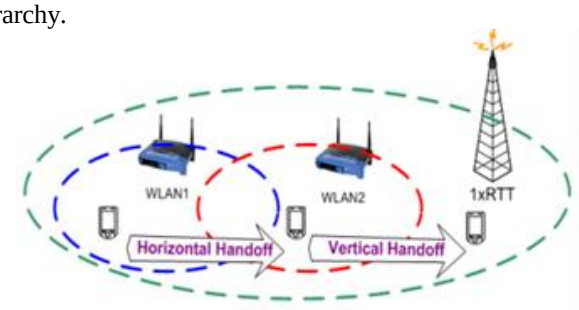

Fig 2. Horizontal vs vertical handovers.

We divide vertical handovers into two categories: an upward vertical handover is a handover to a wireless overlay with a larger cell size (and lower bandwidth per unit area), and

downward vertical handover is a handover to a wireless overlay with a smaller cell size (and higher bandwidth per unit area). A vertical handover may be to an immediately higher or lower overlay, or the mobile host may "skip" an overlay. For example, a mobile may hand off from an in-room network directly to a wide-area network, or vice versa.

There are some important differences between the horizontal handover problem and the vertical handover problem that affect our strategy for implementing vertical handovers:

- In horizontal handover systems, a mobile host performs a handover from cell A to cell B while moving out of the coverage area of cell A into the coverage area of cell B. In our system, this is not necessarily the case. For example, when a user performs an upward vertical handover from an in-room cell A to an in-building cell B, the user is moving out of the coverage of cell A. However, when a user performs a downward vertical handover from cell B to cell A, the user is not moving out of the coverage of cell B. This implies that downward vertical handovers are less time-critical, because a mobile can always stay connected to a upper overlay while handing off to a lower overlay.
- Many network interfaces have an inherent diversity that arises because they operate at different frequencies. For example, a room-size overlay may use infrared frequencies, a building-size overlay network may use one set of radio frequencies, and a wide-area data system may use another set of radio frequencies. Another way in which diversity exists is in the spread spectrum techniques of different devices. Some devices use Direct Sequence Spread Spectrum (DSSS), while others use Frequency Hopping Spread Spectrum (FHSS).
- In a network of homogeneous base stations, the choice of "best" base station is usually obvious: the mobile chooses the base station with the highest signal strength after incorporating some thresholding and hysteresis. In a multiple-overlay network, the choice of the "best" network cannot usually be determined by channel-specific factors such as signal strength because different overlay levels may have widely varying characteristics. For example, an in-building RF network with low signal strength may yield better performance than a wide-area data network with high signal strength. There are also considerations of monetary cost (some networks charge per minute or byte) that do not arise in a homogeneous handover system.

The vertical handover process involves three main phases, namely system discovery, vertical handover decision, and vertical handover execution. During the system discovery phase, the mobile terminal determines which networks can be used. These networks may also advertise the supported data rates and Quality of Service (QoS) parameters. Since the user's are mobile, this phase may be invoked periodically. In the vertical handover decision phase, the mobile terminal determines whether the connections should continue using the existing selected network or be switched to another network. The decision may depend on various parameters including the type of the application (e.g., conversational, streaming), minimum bandwidth and delay required by the application, access cost; transmit power, and the user's preferences. During the vertical handover execution phase, the connections in the mobile terminal are re-routed from the existing network to the new network in a seamless manner. This phase also includes the authentication, authorization, and transfer of a user's context information.

VHD algorithms help mobile terminals to choose the best network to connect among all the available networks.

II.SYSTEM METHODOLOGY

A. Handover management process

Handover management process in a mobility scenario is the procedure to maintain continuous connection in active mobile terminal while moving from one access link (base station or access router) to another. Handover management process has been described in several works which involve three phases as shown in Fig. 4

- Handover Information Gathering: use to collect all information desired to initiate the handover. Also known as system discovery or handover initiation phase.
- Handover Decision: use to determine when and how to perform the handover by selecting the best access link available and by giving instructions to the next phase, (i.e. handover execution). Also known as system or network selection.
- Handover Execution: In this phase terminal changes service conforming to the details resolved during the decision phase.

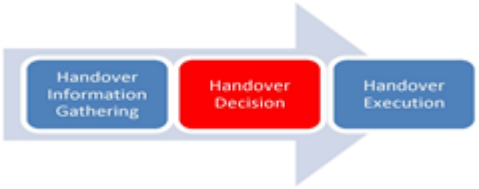

Fig 3. Handover management Process

B. RSS based handover strategy

RSS, means received signal strength. Earlier handover decisions were taken place by considering RSS of the mobile node.

The determination rules for traditional RSS based handover are classified by,

- RSS only : If $RSSNEW > RSSOLD$
- RSS with Threshold T : If$RSSNEW > RSSOLD$ and $RSSOLD < T$
- RSS with Hysteresis H : If $RSSNEW > RSSOLD + H$
- RSS, Hysteresis and Threshold: If $RSSNEW > RSSOLD + H$ and $RSSOLD < T$
- Dwell timer: If one of the above conditions is satisfied, then the timer is set to be active. If the timer expires and the condition still holds, the handover procedure is initiated.

In a smart triggering scheme was proposed, which based on Received Signal Strength Indication (RSSI) predication.

The RSSI could vary when the MN moves, due to the effect of shadowing and fading. An exponential average of smoothing predication method was adopted to predicate the RSSI. When the predicated RSSI is below the predefined Link Going down (LGD) threshold, and the long-term trend of RSSI is going downward, a Pre-Trigger event will be generated. A move out

case from WiFi to WiMax was analyzed by the proposed scheme. When the MN moves out of the signal coverage of WiFi, and a Pre-Trigger event was generated to trigger the handover initiation.

Another RSSI-based predicative link trigger mechanism was proposed. The handover procedure may fail due to too early or too late to trigger. The required handover time is estimated at first, and then a predicative link trigger mechanism is executed once the filtered sample power is less than a predefined predication start threshold. The threshold is determined by the required handover time. If the value is less than the minimum power level, the handover procedure is initiated. Both proposed the predicated method to initiate the handover procedure, but do not take into consideration the QoS parameters. In addition, the RSSI is an optional parameter from the value 0 to Max, which is a vendor independent and hard to compare with one another.

C. SINR based vertical handover strategy

A SINR-based handover algorithm was proposed to support QoS requirement. The maximum achievable data rate is determined by Shannon capacity formula. And the total down-link throughput would be determined by the residence time and the maximum achievable data rate, when the MN moves from serving network to candidate network. The handover occurs at where the MN gets the maximum down-link throughput. Another SINR-based handover decision was proposed to support both soft handover and fast cell selection.

Both RSS and SINR-based measures belong to signal measurement approach. When we focus on the signal boundary of a cell, a single-metric handover triggering may be unsuitable for the network environment.

In this project three parameters namely RSS, SINR and data rate are combined together to decide the best network of which service can be used among the number of networks which are available. The Shannon capacity determines the maximum achievable data rate for a given Signal to Interference and Noise Ratio SINR and carrier bandwidth as:

$$R = w \log_2\left(1 + \frac{\sigma}{\Gamma}\right) \quad (1)$$

Where:

- R is the maximum achievable data rate
- W represents the bandwidth of the carrier
- y is the received SINR at a MT
- r is the gap in decibel between channel capacity and encoded QAM, minus the gain caused by coding.

III.ALGORITHM AND FLOW OF PROCESS OF HANDOVER

Algorithm represented below in the form of flowchart works as follows.

Whenever a node will move from one network to another, the moment it will get service from both or available network services, it will start collecting parameters from all available networks.

After getting parameters, node will calculate and compare the parameters. After comparing node will decide which network parameters are providing the best downlink throughput and less noise data.

After this decision, node will continue with that network service. This process will continue whenever a mobile node will move among network to network.

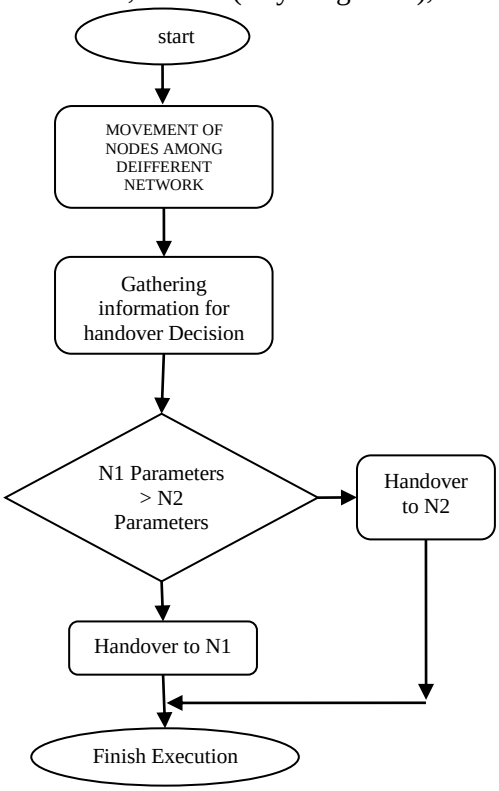

Fig 4. Flow chart of the Algorithm

IV.SIMULATION & RESULTS

After implementing the algorithm mentioned in the paper above following result are obtained.

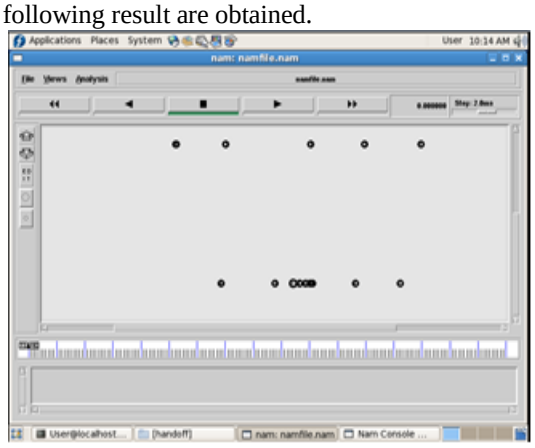

Fig 6. Mobile Nodes in two different Networks

Above figure shows number of mobile nodes forming different networks. The available networks are having different parameters.

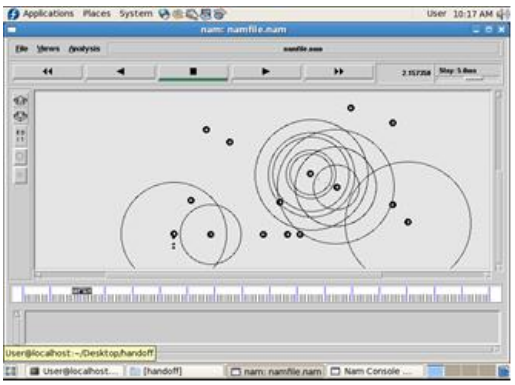

Fig 5. Movement of mobile Nodes among different networks

Figure above shows the movement of mobile nodes among the available networks and also continuing the service use.

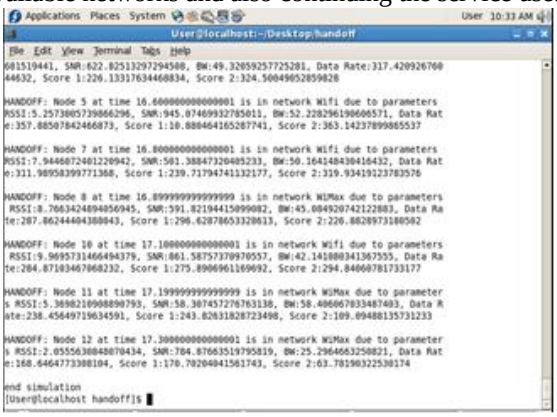

Fig 6. Calculation of Parameters of two networks by mobile node.

The above figure show the result of the first phase in the vertical handover procedure i.e. information gathering. The parameters specified in the algorithm of both the networks are calculated and compared to choose the best service when mobile node is in the range of both the networks. On the basis of the result of calculation the best network is chosen.

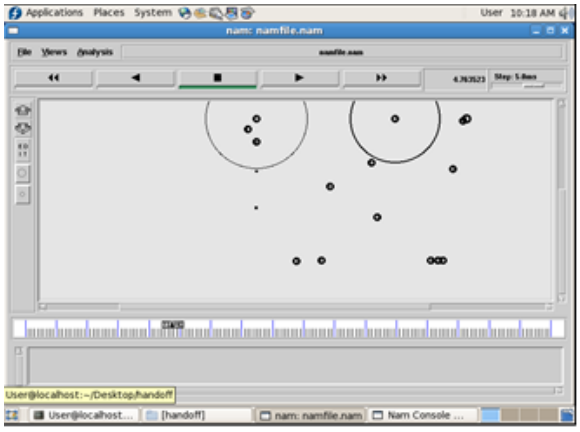

Fig 7. Switching of Service by mobile node

Figure above shows the execution of the vertical handover. In this phase mobile nodes, depending upon the calculation of the various parameters decides which networks service to be used.

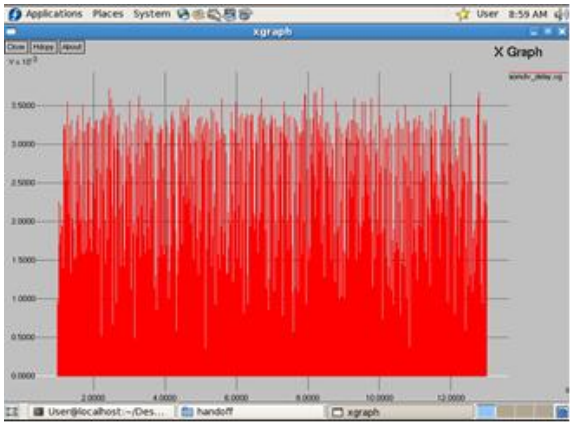

Fig 8. Network Delay Graph.

Graph Displays the delay in transferring packets from source to destination with respect to simulation time.

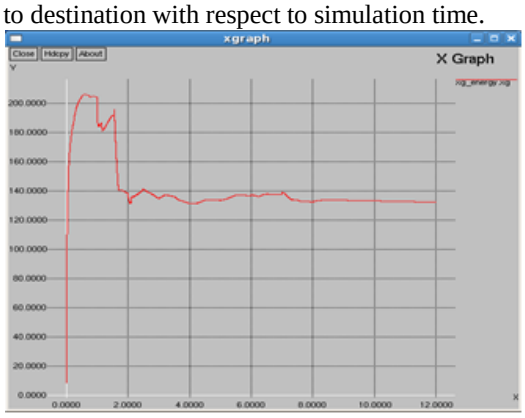

Fig 9. Energy Graph

Displays the energy required in transferring packets from source to destination with respect to simulation time

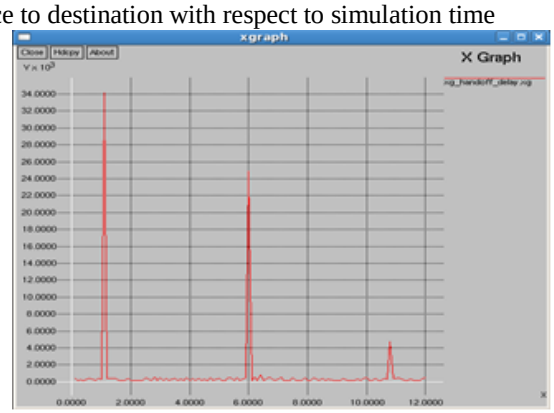

Fig 10. Handover Delay Graph.

Displays the delay in handover from source network to destination network with respect to number of handovers

Fig 11. Throughput Graph

Displays the throughput in transferring packets from source to destination with respect to simulation time.

V.CONCLUSION

The given SINR-based Media Independent Handover mechanism with QoS support for coexist heterogeneous WiMAX and WIFI networks.

- Besides supporting QoS for different traffic flow, the proposed SINR based VHD will also promote maximum achievable data rate.
- The performance of the proposed SINR based VH algorithm and RSS based VH algorithm have been evaluated in terms of the maximum downlink throughputs.

The given propose a handover scheme from WMAN to WLAN, by taking into consideration the maximum available data rate and the back-haul bandwidth of the access network. When an MN connected to a BS, with traditional RSS approach, the MN may not be easy on handover to AP for better service due to the higher transmission power of BS. On the other hand, if the MN switches to an AP simply because it detects a better signal, the handover decision could be inadvisable as the AP may be busy at the time of handover. Hence, both available data rate and the back-haul bandwidth are counted for the decision in determining the handover. Specifically, the time to start a handover is determined by considering the variations of data rate as the MN moves, and the AP with maximum available bandwidth is selected.

VI.FUTURE SCOPE

This project can be extended by implementing security aspects in the handover process. Authorisation, authentication like services can be added and make our system protective. Work on the energy consumption can also be done. Time required taking handover decision and also time required to switch among the services should be minimum. As this project is taking 3 parameters in consideration, time required to handover by taking only one parameter is greater. So work can be done on this area. Similarly the battery consumption during the process is also more. This is also to be minimized

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