International Journal For Technological Research In Engineering
Volume 3, Issue 7, March-2016 *ISSN (Online): 2347 - 4718*

VERTICAL HANDOFF DECISION IN HETEROGENEOUS WIRELESS NETWORKS

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Abstract: During the Vertical Handoff process, Handoff Decision is the most important step that affects the normal working of wireless communication. A wrong handoff choice or choice of a non-ideal system can bring about undesirable impacts, for example, higher costs, poor administration experience, debase the nature of administration and even break off current correspondence. The main objective of this paper is to select the efficient network under which vertical handoff is performed in heterogeneous wireless networks. To evaluate this, some MADM (Multi Attribute Decision Making Process) Algorithms has been used. These algorithms considers different attributes (e.g., bandwidth, BER, Jitter, Delay) present in conversational traffic conditions. The MATLAB software has been used to determine the efficient network for performing Handoff Decision process.
Keywords: Vertical Handoff Process; MADM Algorithms; Bandwidth; BER; Jitter; Delay.

I. INTRODUCTION

The growing consumer demand for access to wireless applications and services anyplace and anytime, is accelerating communication technological improvement towards the joining of different wireless access advancements, called Fourth Generation (4G) wireless frameworks. These wireless systems allow for global roaming and seamless mobility over a diverse range of heterogeneous wireless networks. Mobile Stations (MS) in a normal 4G network will be outfitted with numerous interfaces, and will have the required intelligence to settle on enhanced decisions to have the capacity to associate with an variety of Access Networks (AN) to give rich mixed media administrations. The Access Networks (AN) include different types of cellular networks, such as Code Division Multiple Access (CDMA), Global System for Mobile Communication (GSM), General Packet Radio Services (GPRS), Bluetooth-based Wireless Personal Area Network (WPAN), IEEE 802.11 Wireless Local Area Network (WLAN), IEEE 802.16 Worldwide Interoperability for Microwave Access (WiMAX), and Satellite networks. These wireless networks frequently have overlapping coverage in the same administration zones, and can offer inventive administrations in light of client requests. A definitive objective of such a domain is to give straightforward, continuous access to a wanted administration whenever, autonomous of device, areas, and accessible networks, while additionally keeping up satisfactory client involvement in a cost-effective way. In order to provide seamless mobility, one of the design issues is the handoff support.

The term "handoff" corresponds to the procedure of transferring a mobile station control from one Base Station BS1 or channel to another BS2 as found in fig.1. Handoff is the component by which a Mobile Station (MS) keeps its association dynamic, when it relocates from the scope range of one BS to another. In cell systems, such a point of connection is known as a Base station (BS) and in wLAN, it is called an Access Point (AP). A handoff process comprises of two stages, for example, handoff initiation and execution. In the principal stage, a decision is made with respect to the choice of another base Station, or access point, to which the MS will be exchanged. In the execution stage, new radio connections are formed between the BS/AP and MS.

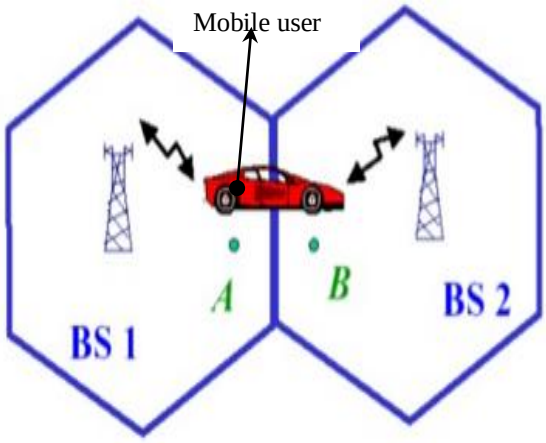

Fig.1. Handoff Process.

In general, handoff management is performed in three steps: Handoff initiation, target network selection and handoff signal processing. In the Handoff process there are two different handoffs are present. one is horizontal handoff (HHO) or intra-system handoff, which takes place between attachment points supporting the same network technology and the another one is Vertical Handoff (VHO) or inter-system handoff, which occurs between attachment points supporting the different network technologies. Vertical and Horizontal Handoff differs by based on their parameters which are mentioned in TABLE I

Table 1: VERTICAL AND HORIZONTAL HANDOFF PARAMETERS

Parameters	Horizontal Handoff	Vertical Handoff
Access Technology	Not Changed	Changed
QoS Parameters	Not Changed	May be Changed
IP Address	Changed	Changed

Network Interface	Not Changed	May be Changed

The vertical handoff procedure can be separated into three primary steps, namely handoff initiation, handoff decision, and handoff execution. In the Initiation Phase the information such as RSS, bandwidth, link speed, throughput, jitter, cost, power, client inclinations and network membership and so on are given to the distinctive layers. Based on this data handoff will be started in a fitting time. In the Decision Phase the decision may depend on various parameters which have been collected during handoff initiation phase. In the Execution Phase existing connections should be re-routed to the new system in a consistent way. This stage likewise incorporates the confirmation and approval, and the exchange of client's setting data.

II. LITRATURE SURVEY

In this chapter, a comprehensive survey of different approaches to make vertical handoff decisions is provided.

A. RSS Based Algorithms

RSS is used as the main decision criterion in this group. A large number of studies have been conducted in this area. Some RSS based VHO algorithms are discussed below:

Zahran et al (2006) proposed an algorithm for handoff between 3G networks and WLANs by combining the RSS measurements either with an estimated lifetime (expected duration after which the mobile station will not be able to maintain its connection with the WLAN) or the available bandwidth of the WLAN candidate.

In the first scenario, when the MS moves away from the coverage area of a WLAN into a 3G cell, a handoff to the 3G network is initiated. The handoff is triggered under the conditions that (i) RSS average of the WLAN connection falls below a predefined threshold, and (ii) the estimated lifetime is less than or equal to the handoff delay.

Mohanty & Akyildiz (2006) proposed a handoff decision method from WLAN to 3G based on comparison of the current RSS and a dynamic RSS threshold (S_{dth}) when the MS is connected to WLAN access point. S_{dth} (in dbm) is calculated as

$$S_{dth} = RSS_{\min} + 10\beta \log\left(\frac{d}{d - L_{BA}}\right) + \in ---(1.1)$$

B. Multi Attribute Based Decision Algorithms

Multiple Attribute Decision Making algorithms are used for network ranking. They include Simple Additive Weighting (SAW), Technique for Order Preference by Similarity to Ideal Solution (TOPSIS), Analytic Hierarchy Process and Grey Relational Analysis (AHP and GRA), Multiplicative Exponent Weighting (MEW) and Elimination and Choice Translating Priority (ELECTRE) as given in Zhang (2004).

In SAW, the overall score function of a candidate network is determined by the weighted sum of all the parameter values. The score function of each candidate network i is obtained by adding the normalized contributions from each parameter r_{ij} multiplied by the importance weight assigned w_j of parameter j . The selected network is

$$A^{*}_{SAW} = \arg\left(\max_{i \in M} \sum_{j=1}^{N} w_j r_{ij}\right) \quad (1.2)$$

Where N is the number of parameters and M denotes the number of candidate networks.

III. PROPOSED WORK

In this project in order to analysis and evaluate the handoff decision making process, one of the Multi Attribute Decision making algorithms are used. The multi attribute decision making process consider the situation which involves several attributes or criteria's and these are conflicting in nature. This project involve the selection of best network for performing handoff process, MADM Algorithm is used instead of MODM algorithm and their advantage and disadvantage are listed in the TABLE II. The MADM consider criteria which are non commensurable in nature (i.e.) the criteria's are measured in different units. It consider the normalization process, because the units are defined in different scale. The whole given information is normalized and based on that decision making is done.

Table 2: MADM ALGORITHM

Algorithms	Advantages	Disadvantages
MADM	1. low packet delay 2.High available Bandwidth 3. user satisfaction is increased.	1. Require extra coordination between MS and BS.

For analyzing the Handoff process we consider the topology shown in fig.2.This topology will be having different types of network along which the mobile user moves from source to destination.

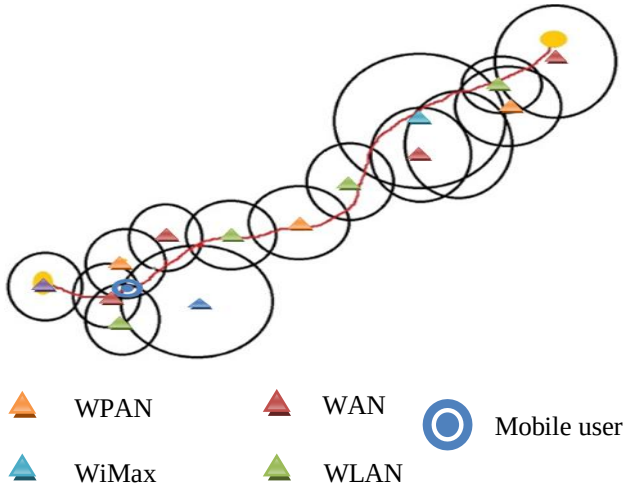

Fig.2. Topology.

When the mobile user moves from the source to destination, handoff process has to be done efficiently without any break in connection. For analyzing the Handoff process we considered only one part of this topology which is mentioned in the figure 4

Fig.3. Coverage area considered for analyzes.

In the above topology, the mobile user is currently covered by 4 different networks like WPAN, WLAN, WAN, WiMax. These network will be having different parameter values. For determining the efficient network, we considered only four parameters like Bandwidth, Jitter, Delay, BER that are considered only in the conversational traffic. These values for four different network are mentioned in the TABLE III.

Table 3: VALUES FOR SENSITIVITY ANALYSIS.

	Network 1	Network 2	Network 3	Network 4
BandWidth	1000	300	25000	11000
Delay	15	10	25	35
Jitter	5	10	15	10
BER	0.0001	0.0001	0.00001	0.000001

IV. RESULT AND DISCUSSIONS

The decision problem can be concisely expressed in the decision matrix, where the capabilities of each user are presented. Delay represents the end to end delay. The vertical handoff decision is done by analyzing various MADM algorithms. The following steps are the modules in which the vertical handoff is done in this project

- Calculation of weights per class using AHP method,
- Network selection is done by using SAW.

A. Calculation of weights per class using AHP Method

For calculating the weights for each traffic classes, the AHP Matrix for each traffic are to be decided. For this project AHP matrix for each traffic has been chosen as show in TABLE IV

Table 3: AHP MATRIX FOR EACH TRAFFIC CLASS

Conversational Traffic	BER	Delay	Jitter	Bandwidth
BER	1	1/9	1/9	1
Delay	9	1	1	9
Jitter	9	1	1	9
Bandwidth	1	1/9	1/9	1
Streaming Traffic	BER	Delay	Jitter	Bandwidth
BER	1	1/5	1/9	1/9
Delay	5	1	1/5	1/5
Jitter	9	5	1	1
Bandwidth	9	5	1	1
Interactive Traffic	BER	Delay	Jitter	Bandwidth
BER	1	5	9	5
Delay	1/5	1	5	1
Jitter	1/9	1/5	1	1/5
Bandwidth	1/5	1	5	1
Background Traffic	BER	Delay	Jitter	Bandwidth
BER	1	9	9	5
Delay	1/9	1	1	1/5
Jitter	1/9	1	1	1/5
Bandwidth	1/5	5	5	1

By using this AHP matrix weights for each traffic has been calculated and the consistency ratio (CR) is also obtained. TABLE V shows the weights for each traffic under different criteria's.

Table 4: WEIGHTS FOR CONVERSATIONAL TRAFFIC CLASS AND CONSISTENCY RATIO (CR)

Traffic Class	BER	Delay	Jitter	Band Width	CR
Conversational	0.05	0.45	0.45	0.05	0.00

The weight values will indicate us which parameters has to be taken care (i.e.) the higher value parameter is very important in the corresponding traffic condition. In this traffic delay and jitter has higher value of weight, which indicate that these parameters are very important parameter in conversational traffic.

B. Network selection by SAW algorithm.

By using the weights and the Sensitivity values the network are given priority. Based on the priority the network will be selected. The mobile user in figure 4 will be connected to effective Network based on the values calculated by using SAW. In the conversational traffic, the networks selected as mentioned in the figure 5.

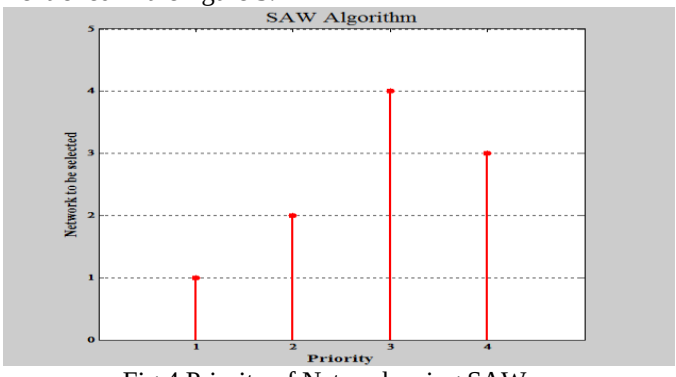

Fig.4 Priority of Network using SAW.

By using SAW algorithm the priority is given as 1,2,4,3 (i.e) WiMax, WAN, WLAN, WPAN. we also analyzed the network selection by varying each parameter weight from 0 to 1.

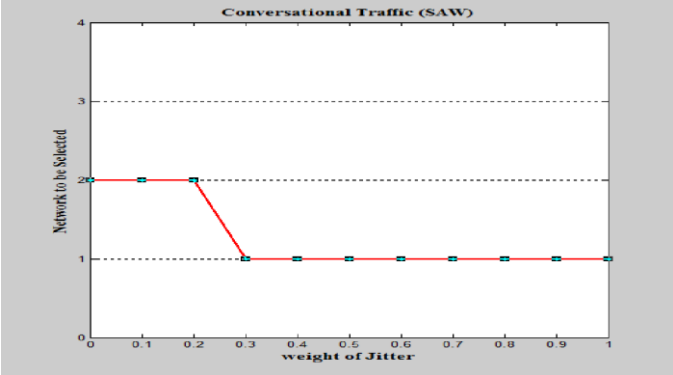

Fig.5. Varying the weight of Jitter.

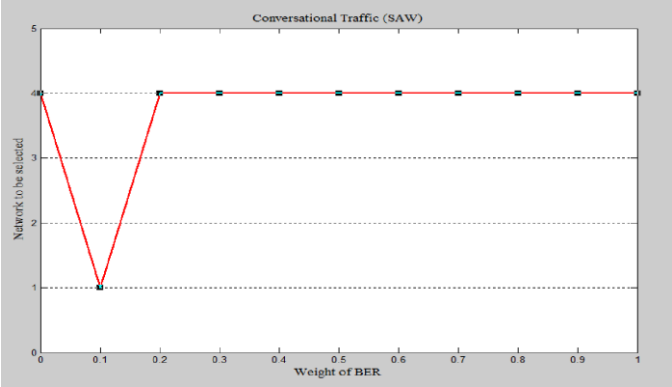

Fig.6. Varying the weight of BER.

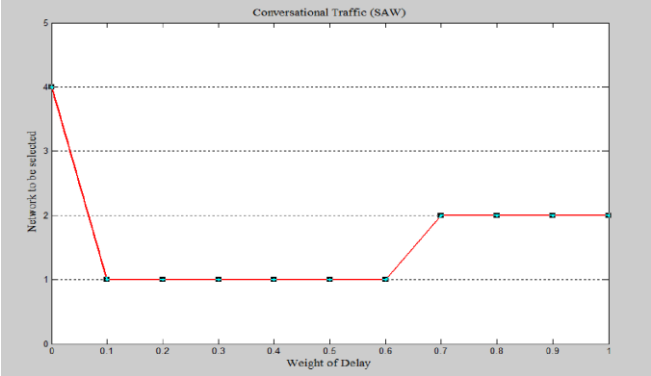

Fig.7. Varying the weight of Delay.

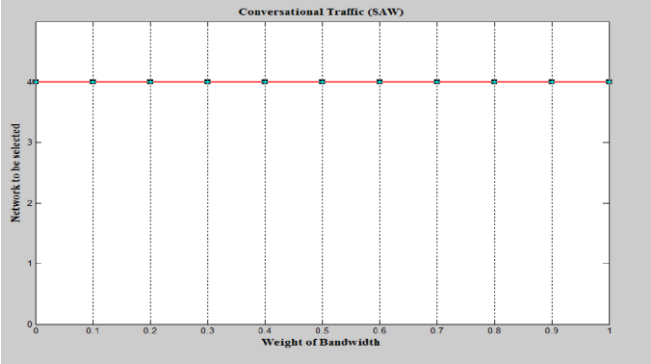

Fig.8. Varying the weight of Bandwidth.

When the weights of each parameter varies the network to be selected also varies correspondingly. From the graph obtained by varying four parameters we concluded that when the delay and BER varies the network to be selected also varies drastically. Hence for effective wireless communication Delay and BER shouldn't be varied drastically.

V. CONCLUSION

In this paper, the network selection is analyzed using SAW algorithm. We also analyzed the selection of efficient network by varying the parameter values from 0 to1. When the mobile user is covered by few number of network, the selection process will be easy. But when the covered network increases then the computation process will be complicate.

REFERENCE

[1] Heterogeneous Wireless Networks: Heterogeneous-Wireless-NetworksNetworking-Protocol/dp/3836419270

[2] W. Qadeer, T. Simunic, J.Ankcorn, V. Krishnan and G. De Micheli, "Heterogeneous wireless network management", SpringerLink 2004.

[3] Wei Shen and Qing-An Zeng, "A Novel Decision Strategy of Vertical Handoff in Overlay Wireless Networks", Fifth IEEE International Symposium on Network Computing and Applications, 2006.

[4] Enrique Stevens-Navarro, Vincent W.S. Wong and Yuxia Lin, "A Vertical Handoff Decision Algorithm for Heterogeneous Wireless Networks", In Proc. of IEEE Wireless Communications and Networking Conference (WCNC'07), Hong Kong, China, March 2007.

[5] S. Mohanty, I.F. Akyildiz, A cross-layer (layer 2 + 3) handoff management protocol for next-generation wireless systems, IEEE Transactions on Mobile Computing 5 (10) (2006) 1347–1360.

[6] A.H. Zahran, B. Liang, A. Saleh, Signal threshold adaptation for vertical handoff in heterogeneous wireless networks, Mobile Networks and Applications 11 (4) (2006) 625–640.

[7] K. Yang, I. Gondal, B. Qiu, L.S. Dooley, Combined SINR based vertical handoff algorithm for next generation heterogeneous wireless networks, in: Proceedings of the 2007 IEEE Global Telecommunications Conference (GLOBECOM'07), Washington, DC, USA, November 2007, pp. 4483–4487.

[8] C. Chi, X. Cai, R. Hao, F. Liu. Modeling and analysis of handover algorithms, in: Proceedings of the 2007 IEEE Global Telecommunications Conference (GLOBECOM'07), Washington, DC,USA, November 2007, pp. 4473–4477.

[9] Xiao.C, K.D.Mann and J.C.Olivier,2001, Mobile speed estimation for TDMA-based hierarchical cellular systems, Proc.Trans. Veh.Technol,50, 981-991.

[10] Juang.R.T, H.P.Lin and D.B.Lin,2005, An improved location-based handover algorithm for GSM systems, Proc of wireless communications and networking conference, Mar.13-17, pp-1371-1376.

[11] Hasswa, N. Nasser, H. Hassanein, Tramcar: a

context-aware crosslayer architecture for next generation heterogeneous wireless networks, in: Proceedings of the 2006 IEEE International Conference on Communications (ICC'06), Istanbul, Turkey, June 2006, pp. 240–245.

[12] R. Tawil, G. Pujolle, O. Salazar, A vertical handoff decision scheme in heterogeneous wireless systems, in: Proceedings of the 67th Vehicular Technology Conference (VTC'08 – Spring), Marina Bay, Singapore, April 2008, pp. 2626–2630. X. Yan et al. / Computer Networ

[13] F. Zhu, J. McNair, Optimizations for vertical handoff decision algorithms, in: Proceedings of the 2004 IEEE Wireless Communications and Networking Conference (WCNC'04), Atlanta, Georgia, USA, March 2004, pp. 867–872.

[14] Pramod Goyal and S. K. Saxena, "A Dynamic Decision Model for Vertical Handoffs across Heterogeneous Wireless Networks", World Academy of Science, Engineering and Technology, 2008 [15]Thazin Ei and Furong Wang, "A trajectory-aware handoff algorithm based on GPS information", SpringerLink 2009

[15] B.Amutha and M. Ponnavaikko "Energy fficient Hidden Markov Model Based Target Tracking Mechanism in Wireless Sensor Networks" Journal of Computer Science 5 (12): 1085-1093, 2009 ISSN 1549-3636, 2009 Science Publications

[16] Abdelnasser Banihani, Mahmoud Al-Ayyoub and Ismail Ababneh " A Direction-Based Vertical Handoff Scheme" Journal Of Emerging Technologies In Web Intelligence, Vol. 5, No. 3, August 2013.

