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A STUDY OF VERTICAL HANDOVER ALGORITHM IN HETEROGENOUS WIRELESS NETWORK

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ABSTRACT

Recently, the mobile devices are equipped with various wireless interfaces in heterogeneous environments which combine a large number of radio access technologies. The evolution of these technologies will allow users to benefit simultaneously from these radio access technologies. So that the most important challenge is how to choose a most suitable network access for mobile user which can be used as long as possible for communication. To achieve this goal, I have proposed a new approach to select the network interface by using multi attribute decision making algorithm in this paper.

Objectives: ***To select the optimal wireless network interface by using multi attribute decision making algorithms.***

Keyword: AHP, Handoff, Heterogeneous Wireless Network, Interruption Time, Vertical Handoff

I. INTRODUCTION

Now a days, mobile communication technologies are changing rapidly as a result of this increasing number of heterogeneous networks. As mobile communication technology increasing, maintaining of the network performance and the efficient handover that meet users Quality of Service (QoS) requirements[1]. The user required different types network that fulfils the Quality of Services.

Heterogeneous network is a network connecting with different computers with different operating system and protocols. The increase in smart phones needs service continuity completely. For such seamless mobility an ongoing application session should be maintained continuously such that an acceptable quality of service perceived by the user is sustained. Seamless homogeneous handover has been important part of cellular networks, whereas IEEE 802[10] based wireless networks, i.e. IEEE 802.11(Wi-Fi)[7] and IEEE 802.16(WiMAX)[6].For heterogeneous handover the IEEE 802.21 media independent handover working on group progresses for establishment of generic SAPs and service primitives which allow to trigger and indicate the need for handover.[2]

To reach seamless mobility support in a heterogeneous roaming environment is one of the most challenging issues. In heterogeneous wireless network seamless handoff is divided into two parts: Horizontal handoff (HHO) and vertical handoff (VHO).

Horizontal handoff or handover is that handover in the same type of mobile network interface. In other word

handover happening between two mobile devices within the same network.

In vertical handoff network node changing type of connectivity it uses to access a supporting infrastructure, usually to support node mobility[3]. To provide the seamless handoff various multi attribute decision algorithm are given by various researchers.

II. RELATED WORKS

A number of research works focus on coverage area, bandwidth, positioning system between heterogeneous network system. Various decision algorithms are used to select the network interface in a heterogeneous network. Some of them are

(1) Fuzzy Logic, fuzzy logic is proposed to represent inaccurate conditions of the heterogeneous networks and adapt dynamically to evaluate multiple attributes simultaneously.

(2) Tradition RSS or strongest signal first in this model RSS is the only affecting factor of selecting the network. The handover decision is initiated, if the RSS of the current radio access network $RSS_{serving}$ is lower than pre-defined handover threshold THO and the RSS value of the alternate network RSS_{alt} is higher than the current access network plus a hysteresis margin H[4].

(3) AHP (Analytic Hierarchy Process) decomposes the network selection problem into sub-problems and assigns a weight value to each sub-problem. Then the network with highest performance score is selected.

III. PROPOSED WORK

For any access network, the problem is selecting the best access at a given time. There are too many parameters that can be utilized to decide about best access and they will be presented below. When there are many networks available in the user area, the user should select one network to be connected to and receive the service he wants. In order to be able and have choice of connecting to any network he should have a multi-mode terminal with many network interfaces. Basically network selection in a wireless environment that can be divided into different sub problems:

- ✓ Selecting which interface to power on
- ✓ Selecting which network to attach, if any
- ✓ Selecting which AP to attach, if any
- ✓ For application: which interface to use on a multi-RAT terminal

The purpose of the project is to examine various network selection mechanisms and propose a new algorithm for network selection to an enhanced set of parameters to consider during the selection procedure.

1. Collect the information about parameters of all AP (access point) or BS (base station).
2. Normalized these parameters, normalization function is given by

$$N(x) = \frac{(x - x_{min})}{(x_{max} - x_{min})}$$

3. The normalized function for RSS is given by

$$N_{RSS} = \frac{(RSS_x - RSS_{TH})}{(RSS_{max} - RSS_{TH})}$$

Where RSS_x is the actual strength of the candidate base station, RSS_{TH} is the threshold signal strength and

RSS_{max} maximum RSS that can be received from a candidate base station.

4. For Delay the normalized function is

$$N_D = 0.00001 - \frac{D_x}{D_{TH}}$$

Where D_x is the actual delay by the candidate base station and D_{TH} is threshold delay.

5. The normalized function for bandwidth (BW) is given by

$$N_{BW} = \frac{B_x}{B_{max}}$$

Where B_x is the required bandwidth of the mobile station and B_{max} is the maximum bandwidth that can be provided by the base station.

6. The normalizedfunction for cost

$$N_c = 1 - \frac{C_x}{C_{TH}}$$

Where C_x is the operating cost of the network to which the candidate base station belongs to, C_{TH} is the threshold cost, above which it is considered that the network is expensive.

7. Compute the weight function

$$W_i = \frac{\sigma_i}{\sum_{i=1}^{4} \sigma_i}$$

Where ∂_i is the standard deviation of the normalization function values of all candidate base stations for the given parameter 'i'.

8. Calculate the handoff occurrence of an area

$$\lambda_i(t_{z-1}) = \frac{1}{(t_{z-1}) \sum_{i=1}^{z-1} k_i}$$

Where k_i is the handoff arrival rate sequence and t_z denotes the current time epochs.

9. Then calculate the Network Selection Function (NSF)

$$f = \sum_{i=1}^{4} N_i \times W_i$$

The k^{th} network is selected if

$$NSF_k = \max(NSF_1, NSF_2, \dots\dots\dots\dots\dots\dots\dots\dots\dots NSF_n)$$

10. Remove the ping pong effects of the network.

IV. RESULT

The mobile node which are multi-mode capable, initially belongs to UMTS network and starts moving towards Wi-Max and then towards Wi-Fi and stops. We assume that the input parameters required for network selection algorithm are acquired from the network and mobile terminal.

When the mobile node moves from UMTS network towards Wi-Max network, the network selection module of mobile terminal acquires the input parameters and normalized values of these parameters are determined. Then the network selection function value is computed for the available networks. Due to complexity reasons, we have to directly considered the normalized values of the parameters. First consider the mobile which is

originally associated with UMTS network has moved towards the Wi-Max network. The NSF computation for all the networks is as shown in Table 7.1.

Table 7.1 Nsf When The Mobile is Under The Coverage of Wi Max

	RSS	BW	D	C	NSF
Wi Max	0.8	0.6	0.2	0.6	0.545
Wi-Fi	0	0.6	0.5	0.8	0.384
UMTS	0.7	0.2	0.7	0.2	0.445
Weight	0.33	0.174	0.19	0.231	

Next consider the case where the mobile terminal are moving towards the Wi-Fi network and is under the coverage of both Wi-Fi and Wi-Max networks. NSF for all three networks is as shown in Table 2. As the Wi-Fi network is having the maximum NSF value, it is selected as the target network.

Table 7.2 Nsf When The Mobile Is Under The Coverage Of Wi-Fi

	RSS	BW	D	C	NSF
Wi Max	0.5	0.6	0.3	0.6	0.401
Wi-Fi	0.8	0.6	0.2	0.8	0.460
UMTS	0.6	0.2	0.7	0.2	0.349
Weight	0.15	0.219	0.251	0.199	

V. CONCLUSION

In this research paper, innovative procedures for the decision process of vertical handover (VHO) have been introduced considering also possible architectures (including parameters and interactions) for their support. We have started with the introduction of VHO from the network operator point of view, i.e. VHO is considered a service planning problem: the network operator should choose which services are available on which network. The algorithm is taking mobility parameters like delay of the network; it supports seamless mobility and reduces unnecessary handoffs. Further the performance of the algorithm can be improved by considering a threshold on the NSF value in order to prevent frequent handoffs.

REFERENCES

[1] Yong Sun, Chao Liu, Peng Yang and Xiangming Wen, “A Smart Vertical Handoff Decision Algorithm Based on Queuing Theory”, ICACT, pp. 1217-1222, February 2014.

[2] German Castignani, Nicolas Montavont and Andr´es Arcia-Moret, “Multi-objective Optimization Model for Network Selection in Multihomed Devices ”, 10th Annual Conference on Wireless On-demand Network Systems and Services (WONS), pp. 113-115, IEEE 2013.

[3] Charles E. Perkins, “ Mobile IP”, IEEE Communications Magazines ,Vol. 35, No. 5, pp 66-82, May 2002.

[4] I-Wei Wu, Wen-Shiung Chen, Ho-En Liao and Fongray Frank Young,” A Seamless Handoff Approach of Mobile IP Protocol for Mobile Wireless Data Network, IEEE Transactions on Consumer Electronics, Vol. 48, No. 2, pp. 335-343, May 2002.

[5] Andras Kiraly and Janos Abonyi,” A Novel Approach to Solve Multiple Travelling Salesmen Problem by

Genetic Algorithm".Springer, 2011.

[6] Johnny Choque, Ramon Agiiero and Luis Munoz, "Optimum Selection Of Access Network within Heterogeneous Wireless Environment Based on Linear Programming Technique", Mobile Network Application, Vol. 16, pp 412-423, Springer 2011.

[7] Ammar A. Bathich, Modh Dani Baba, Muhammad Ibrahim," IEEE 802.21 Based Vertical Handover in Wi-fi and Wi-Max Networks",pp 140-144, IEEE 2012.

[8] Feng Qian, Zhaoguang Wang, Alexandre Gerber, Zhuoqing Morley Mao, Subhabrata Sen, and Oliver Spatscheck "Characterizing radio resource allocation for 3G networks" In Proc. of the 10th conferenceon Internet measurement, IMC '10, pages 137–150. ACM, 2010.

[9] Levent Ekiz*, Christian Lotterrnann*, David Ohmann*, Thang Trant,Oliver Klemp*, Christian Wietfeldt and Christoph F. Mecklenbrauker "Potential of Cooperative Information for Vertical Handover Decision Algorithms" IEEE Annual Conference on Intelligent Transportation Systems, pp 455-460,Oct 2013.

[10] Jui-Hung Yeh, Jyh-Cheng Chen, and Chi-Chen Lee "Comparative analysis of energy-saving techniques in 3gpp and 3gpp2 systems Vehicular Technology", IEEE Transactions on, 58(1):pp432 –448, jan. 2009

[11] Yulong Shen,Ning Xi, Qingqi Pei and Jianfeng Ma," The QoS-Ensured Vertical Handoff Decision in Heterogeneous Wireless Networks" Journal of Information Science and Engineering 30, 875-893 (2014).

[12] Ji-Su Kim and Jae-Hyun Kim," Handover Scheme using Uplink and Downlink Channel Information in IEEE 802.16e Systems", IEEE 2010.

[13] Fabio Buiati, Luis Javier Garc´ıa Villalba, Daniel Corujo, Joao Soares, Susana Sargento, and Rui L. Aguiar," Hierarchical Neighbor Discovery Scheme for Handover Optimization", IEEE Communications Letters, VOL. 14, NO. 11, NOVEMBER 2010.

[14] Ohyoung Song,Heeseong Kim, Jun Yeol Choi, Kyu Sung Ahn and Hee Yong Youn," An Efficient AP Channel Scanning Scheme for Mobility over WiMAX", ICOIN,pp 334-339, IEEE 2012.

[15] Jui-Hung Yeh, Jyh-Cheng Chen, Prathima Agrawal, "Fast Intra-Network and Cross-Layer Handover (FINCH) for WiMAX and Mobile Internet". IEEE Transactions on Boile Computing. Apr. 2009

[16] Fattah, H., Alnuweiri, H., "A New Handover Mechanism for IEEE 802.16e Wireless Networks", 2008 International Wireless Communications and Mobile Computing Conference, Aug. 2008

[17] Mohammod Sazid Zaman Khan1, Chen-Wei Tan2, Thilek Silvadorai3, and Sureswaran Ramadass, "Novel Algorithms to Ensure Smooth and Unobtrusive Handover among Positioning Systems",pp 229-234, IEEE 2012.

[18] M. S. Z. Khan, S. Alam, and M. R. H. Khan, "A Network Selection Mechanism for Fourth Generation Communication Networks," Journal of Advances in Information Technology, vol. 1, no. 4, pp. 189–196, 2010.

[19] M.Kassar, B.Kervella, G.Pujolle, "An overview of vertical handover decision strategies in heterogeneous wireless networks", Elsevier,Journal of computer communications, Vol.37, No.10, 2008

[20] McNair, J. and Fang Zhu, "Vertical Handoffs In Fourth-Generation Multi network Environments", IEEE Wireless Communications, vol.11, no. 3, 2004, pp. 8-15

[21] Meriem Kassar, Brigitte Kervella, and Guy Pujolle. 2008. An overview of vertical handover decision strategies in heterogeneous wireless networks. Comput. Commun. 31, 10 (June 2008), 2607-2620. DOI=10.1016/j.comcom.2008.01.044.

[22] C. Gu, M. Song, Y. Zhang, L. Wang, and J. Song, "Novel network selection mechanism using AHP and enhanced GA," in CNSR '09.2009,pp. 397-401.

[23] D. J. He, C. X. Chi, S. M. Chan, C. Chen, J. J. Bu, and M. J. Yin, "A Simple and Robust Vertical Handoff Algorithm for Heterogeneous Wireless Mobile Networks,"Wireless Personal Communications, vol.59, pp. 361-373, 2011

[24] P. Zhang, W. Zhou, B. Xie, and J. Song, "A novel network selection mechanism in an integrated WLAN and UMTS environment using AHP and modified GRA," in IEEE IC-NIDC, 2010, pp. 104-109.

[25] S. F. Zhu, F. Liu, Z. Y. Chai, Y. T. Qin and J. S. Wu, "Simple harmonic oscillator immune optimization algorithm for solving vertical handoff decision problem in heterogeneous wireless network,"Acta Physica Sinica, vol.61, 2012..

[26] Y. S. Guo, G. Z. Tan, A. Libda and L. Q. Ma, "A QoS-aware vertical handoff algorithm based on predictive network information,"Journal Of Central South University, vol.19, pp. 2187-2193, 2012.

[27] S. Lee, K. Sriram, K. Kim, Y. H. Kim and N. Golmie, "Vertical handoff decision algorithms for providing optimized performance in heterogeneous wireless networks,"IEEE Transactions on Vehicular Technology, vol.58, pp. 865-881, 2009.

[28] Universal mobile telecommunications system (UMTS); evolution of 3GPP system, ETSI TR 121 902 V9.0.0 2010.

[29] E. Stevens-Navarro, Y. Lin and V. W. S. Wong, "An MDP-based vertical handoff decision algorithm for heterogeneous wireless networks", IEEE Transactions on Vehicular Technology, vol.57, pp. 1243-1254, 2008