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Review on an Intelligent Approach for Improving Handoff in Heterogeneous Wireless Sensor Networks

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Abstract: ***The number of wireless users nowadays has widely increased. These users expect great things from the constantly developing wireless networks. This rapid increase in the number of wireless subscribers increases the quality of the service anytime and anywhere. Heterogeneous communication environment is one feature among the various features of the wireless sensor networks (WSN). Heterogeneous network concept has been introduced so that the demands of the networks traffic capacity and data rate is satisfied. Heterogeneous networks consist of multiplatform networks which have various radio access technologies. Different heterogeneous networks range from wireless WAN, LAN, MAN, PAN and Wi-Max. Various types of networks in wireless technologies have different parameters and specifications. Thus they also have different Quality of Service (QoS). So for users moving from one network to another network handoff is required. In cellular telecommunications the term handoff or handover means the process of transferring an ongoing call or data session from one cell to another. This paper review an improved vertical handover decision using multi-criteria metrics in the environment of heterogeneous network consisting of three network interfaces WLAN, WCDMA, and Wi-MAX. The paper proposes a handoff decision scheme which helps to choose the correct network. Fuzzy logic is applied to deal with imprecise information.***

Keywords: Handoff, WSN (Wireless Sensor Network), Heterogeneous Network, Fuzzy Logic.

I. INTRODUCTION

Wireless sensor networks are infrastructure less with small sensing wireless distributed nodes. They have dynamic topology and are application oriented. WSN is made up of thousands of wireless nodes that are distributed in a geographical area. These distributed nodes sense the current status of its region and supplies it further. The final information is supplied to the central node for further processing. The central node removes the redundant information. The sensor nodes used can be static or mobile according to the application requirements. One or more than one base stations (BS) are used together within the network. A base station may be static or mobile. Sensor nodes monitor the networks after being deployed. As soon as an event occurs, the surrounding sensor nodes detect it. They generate a report and the report is transmitted to the BS through wireless links. The BS processes the report and generates final report to the external world for further processing [3]. Heterogeneous network concept has been introduced to meet the growing demand of data rate and traffic of mobile communications. Heterogeneous networks should essentially have mobility feature. They must be able to roam freely throughout the network and must be able to connect to various radio access technologies [1]. This invokes some challenges such as handoff decision making and mobility management. Providing seamless handover is one of the key issues to be looked upon in wireless networks [5]. Making suitable handoff decision according to different parameters of access points in heterogeneous wireless network provides a scope of research. Various wireless network technologies differ from each other in terms of bandwidths, latencies, frequencies, etc. At present there is no single technology that can provide high bandwidth, low latency and cost effective services to each and every mobile user. So enabling seamless handoff communications and providing support for well organised handoff between different

technologies plays crucial role [5]. Mobility management is composed of two components: location management and handover management. In location management the systems can track locations of mobile users. Handover or handoff management is the process through which users keep their connections active while moving from one base station to other [8]. There are two types of Handoff scenarios may arise: Horizontal handoff and Vertical handoff.

a) Horizontal Handoff

It is a handoff carried out when mobile user moves between same networks. It is also called as intra system handoff. Horizontal handoff is based on single parameter like RSS, SNR (Signal to noise ratio) e.g. WLAN to WLAN [2].

b) Vertical Handoff

It is a handoff carried out when mobile user moves between two different or heterogeneous networks. It depends upon number of parameters. It is also called as intersystem handoff. e.g. WLAN to WWAN. Vertical handoff is used to maintain QoS [2]

The handoff process contains three steps:

Step 1: System Discovery is the step in which the system periodically monitors the states of the networks to determine the network to which handoff can be carried out. The mobile node should know which wireless systems can be reached.

Step 2: Handoff decision is the step in which the mobile node evaluates vertical handoff parameters associated with a new network. Based on several parameters like RSS, availability of free channel and service charges, the mobile devices determine which network it should connect to.

Step 3: Handoff execution is the step in which the node decides to handover to other network then execution is carried out. The connections are rerouted from the existing network to the new network in a seamless manner. Handoff execution means a successful handover to other network. [5]

II. Related Work

G. Mahardhika et al; [1], proposed heterogeneous network concept to satisfy the demands of network's traffic capacity and data rate. They proposed that it consists of multiplatform networks with various radio access technologies. Conventionally, a mobile user may roam and accomplish the vertical handover using single criteria, such as RSS. Single criteria vertical handover decision, however, may cause inefficient handoff, unbalanced network load, and service interruption. That paper proposed an improved vertical handover decision using multi-criteria metrics in the environment of heterogeneous network consisting of three network interfaces WLAN, WCDMA, and Wi-MAX.

K. Vasu et al; [6] proposed that **n**ext generation networks were envisioned to be heterogeneous in nature with an increase in demand towards omnipresent services in wireless networks. Various networks have widely different characteristics; it was difficult to maintain the quality of service QoS after executing a handoff from one network to another network. Maintaining the QoS, based on applications, during the handoff in heterogeneous networks needs an intelligent handoff decision mechanism. That article proposed a QoS-aware fuzzy rule-based vertical handoff mechanism that makes a multi-criteria-based decision, found to be effective for meeting the requirements of different applications in a heterogeneous networking environment. The QoS parameters considered were available bandwidth, end-to-end delay, jitter, and bit error rate. A new evaluation model was proposed using a non-birth–death Markov chain, in which the states correspond to the available networks. Simulation results showed that compared to other vertical handoff algorithms, the proposed algorithm gives better performance for different traffic classes.

R. Deb et al; [11] proposed that for the development of the wireless networks the design of seamless and efficient vertical handover was an essential issue. Next generation wireless communications would rely on integrated networks which consist of

multiple wireless technologies. Thus, the integration of vertical handover with other wireless technologies, such as WLAN, Wi-Fi, Wi-Max, UMTS or 3G, has been attracting research community. Seamless vertical handover between different access technologies is great challenge because it needs to obey different performance constraints. This paper proposed a new algorithm that has better performances compared with other algorithms. New proposed approach provided better performance.

H. Gill et al; [2] proposed that in wireless technologies, there were various types of networks having different parameters and their specifications and thus having different QoS. When the MS moves from one network to another network, process was known as vertical handoff. They designed the simulation model having eight parameters for vertical handoff between WWAN and cellular network with the help of Fuzzy Logic Tool Box, which is also named as FQDA (Fuzzy Logic Quantitative Decision Algorithm) and Simulink of MATLAB platform. The results showed the improved performance and reduced complexity. In that work only 81 rules had been used as compared to 6561 rules needed for 8 attributes.

Y. Nkansah et al; [7] proposed that the integration of diverse but complementary cellular and wireless technologies in the next generation of wireless communication system requires the design of intelligent vertical handoff decision algorithms to enable seamless terminal, personal and network mobility and to provide for continuity and transfer of existing sessions. That paper provided an adaptive multiple attribute vertical handoff decision algorithm that enables wireless access network selection at a mobile terminal using fuzzy logic concepts and genetic algorithm.

III. VERTICAL HANDOFF DECISION ALGORITHM PROCEDURE

There are issues that need to be addressed in vertical handoff decision algorithm. The algorithm should be reliable because inaccurate vertical handoff may cost excessive usage of resources. The algorithm should act as network balancer. The algorithm should be accurate so that it reduces the network blocking probability. Multicriteria decision making is appropriate method for vertical handover decision because there are various networks as decision alternatives [1]. Multicriteria decision making also provides flexibility. Several criteria can be considered to decide the best network. Several methods of vertical handover decision algorithm are available. They may be classified into following five categories:

a) RSS (Received Signal Strength) Based

RSS based method is an ordinary handover decision algorithm. It uses RSS as handover trigger. It is the main criteria to decide handover. RSS based methods are least complex but its accuracy is also least

b) Multicriteria

Multicriteria based algorithms do not support fuzzy decision and they have less handover failure.

c) Context-aware

Context-aware strategies use the quality of signal and the circumstances of mobile user & network to decide handoff.

d) Cost-function

Cost-function strategies have two approaches: network related and user related cost function. Several metrics involved in user related cost function are like time unit, user bit rate and time unit.

e) Fuzzy Logic

There are three steps in fuzzy logic strategy:

Step 1: Fuzzification is the process of transforming crisp values into grades or membership for linguistic terms of fuzzy sets. It's the assignment of an input variable to fuzzy sets.

Step 2: Design if-then rules to implement the vertical handoff.

Step 3: Defuzzification is the process in which the membership functions are defuzzified in output value. It's the process of producing quantifiable result in fuzzy logic, given fuzzy sets and corresponding membership degrees. They are typically needed in fuzzy control systems.

Fuzzy logic and cost function strategies are highly complex. But they have high accuracy and network efficiency [1][2].

Table I shows their comparison:

TABLE 1: Comparison of Vertical Handover decision Algorithms

Heuristic	Advantages	Disadvantages
RSS Based	Low complexity	Low reliability and no user consideration
Multicriteria	Low handover failure	No support on fuzzy decision
Context-Aware	High throughput	Additional delay on handover information gathering process
Cost-Function	High user satisfaction	High complexity
Fuzzy-Logic	High reliability	High complexity

There are three types of priority in the vertical handover decision algorithm:

a) Equal Priority

Equal priority multi-criteria handover algorithm improved the number of handoffs by 46.60.

b) Mobile Priority

Mobile priority method emphasizes on mobile parameter (speed class and traffic type).Mobile priority multi-criteria algorithm improved the number of handoffs by 90.41% and improved the balance index by 0.09%

c) Network Priority

Network priority emphasizes network occupancy. Network priority multi-criteria method improved the number of handoffs by 84.60%, balance index by 18.03%, and average blocking probability by 20.23%.

Each priority has a certain weightage as given in Table II

TABLE II Priority Weightage

Priority Type	**RSS**	**Traffic Class**	**Speed**	**Network Occupancy**
Equal Priority	0.25	0.25	0.25	0.25
Mobile Priority	0.1	0.4	0.4	0.1
Network Priority	0.1	0.1	0.1	0.7

IV. CONCLUSION

In this paper we have reviewed various vertical handover decision algorithms. New parameters for vertical handoff continuously emerge. Using new metrics makes vertical handoff decision process complex. The metrics which are best suitable for the vertical handoff decisions are highlighted.. A generalized vertical handoff decision algorithm was also proposed that seeks to optimize a combined cost function. Network priority multicriteria vertical handover decision algorithm improves network performance on the basis of number of handoffs. It has best performance of balance index and average blocking probability. Vertical handover algorithms can be optimized by combining multicriteria method with other vertical handoff methods (like cost-function or fuzzy logic). Such combination of many strategies will improve performance of the network.

References

1. G. Mahardhika, N. Ismai and R. Nordin, "Vertical Handover Decision Algorithm Using Multicriteria Metrics in Heterogeneous Wireless network", journal of computer networks and communications, 2015.
2. H. Gill and S. Baghla, "A New Fuzzy Simulation Model for Vertical Handoff in Heterogeneous Networks", International journal of electronics and communication engineering, 2014, volume 1, issue 6.
3. R. Seema and R. Goyal, "A Survey on Deployment Methods in Wireless Sensor Networks", International journal of advanced research in computer science and software engineering, 2013, volume 3, issue 7.
4. A. Khandakar, "Step by Step Procedural Comparison of DSR, AODV and DSDV Routing Protocol", International conference on computer engineering and technology, 2012, volume 40.
5. R. Sharma and R. Khola, "Fuzzy Logic Based Handover Decision System", International journal of ad hoc, sensor & Ubiquitous computing, 2012, volume 3, No. 4.
6. V. Kantubukta, "QoS-aware Fuzzy Rule Based Vertical Handoff Decision Algorithm Incorporating a New Evaluation Model for Wireless Heterogeneous Networks", 2012.
7. Y. Nkansah, "Vertical Handoff Decision Algorithms Using Fuzzy Logic and Genetic Algorithm", 2010.
8. P. Israt, "A Fuzzy Logic-Based Adaptive Handoff Management Protocol for Next-Generation Wireless Systems", 2009.
9. H. Fayyazi and M .Sabokrou, "An Evolvable Fuzzy Logic System for Handoff Management in Heterogeneous Wireless Networks".
10. M. Murshed, "Performance Improvement of Vertical handoff algorithm for QoS Support over heterogeneous wireless networks", Conference in research and practice in Information Technology (CRPIT), Volume 113.
11. R. Deb, M. Islam, and J. Uddin, "Performance improvement of seamless vertical handover in heterogeneous wireless networks", second international conference on machine learning & computer science (IMLCS), 2013.
12. S. Lee, K. Sriram, K. Kim and J. Lee, "Vertical handoff decision algorithms for providing optimized performance in heterogeneous wireless networks", IEEE transactions on Vehicular technology, 2008.

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