

A Study of RSS based Vertical Handover Decision Algorithms

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Abstract— The vertical handover decision algorithms (VHD) are the major parameter in heterogeneous wireless networks. These algorithms are designed in such way that they provide quality of service to various applications. In this paper we studied the RSS based vertical handover decision algorithms. We also offers a comparison of these VHD algorithms.

Keywords— *Wierless Networks, Vertical Handover, Heterogeneous Networks*

I. INTRODUCTION

Now day's due to increasing demand of consumers for accessing the communication services at any place and any time is growing the technological improvement towards the integration of various wireless technologies. [1] Upcoming 4th generation (4G) systems are deals with heterogeneous networks comprised from various different technologies and more resourceful user terminals that are visor with multiple network interface cards, which allows users to connect to and handover between networks of various radio access technologies in the process called as 'Vertical Handover'. [2]

In 4G network scenario, mobile terminals which having multiple interfaces are able to select the most appropriate access link from available alternative links with no understandable interruption to an ongoing conversation. For achieve this objective the upcoming media independent handover technology (IEEE 802.21) creates a framework to support for enabling vertical handover [3], but IEEE 802.21 provides only the overall framework so that actual algorithms are need to be designed.

Recently various vertical handover decision algorithms are proposed J. McNair, F. Zhu [1] suggests a tutorial on the design and performance issues in vertical handover. They also give comparisons of several vertical handover algorithms. In [1] author proposes a framework which compares the performance analysis of various vertical handover algorithms. Later surveys are traced on various mathematical models which are useful for vertical handover.

In our paper we offer a classification of RSS based vertical handover algorithms and comparative analysis of these algorithms.

The paper is organized as follows. In the section II, we focused on vertical handover. Section III summarizes RSS based VHD algorithms. Finally, Section IV concludes the paper with some open research problems.

II. VERTICAL HANDOVER

The process of handover is nothing but maintaining user's ongoing session when mobile terminal changes its point of attachment. These points of attachments are nothing but the base stations or access points [2]. The handover mechanism can be classified into two types depending upon access network. The handover can be 'Horizontal handover' when it occurs between two access points of same network. When handover occurs between attachment points which supports different network technology then it referred as 'Vertical handover'.

To perform the successful handover three major steps are must be followed: handover decision, radio link transfer and channel assignment [1]. Selection of appropriate attachment point and time of handover are involve in handover decision, the task of radio link transfer is to form the links to the new access point and channel recourses are allocated by channel assignment.

Vertical handover decision algorithms needs for mobile terminals for selection of best network for connection from all available networks.

A. Vertical handover decision criteria

There are several parameters are proposed in research literature which is used in vertical handover decision algorithms

Available bandwidth is measures available data communication recourses in bits per seconds. It also indicates

the traffic condition in the accessing networks. It is important for applications which are delay sensitive.

Power consumption is a critical issue when battery of mobile terminal is low, in such case it is needful to handover to such attachment point which extends the battery life.

Monetary cost for various there would be different charging policies, so that in some cases cost of network service should be the major consideration in making handover decision.

Security integrity and confidentiality are the most important issues in some applications. So that in such cases a network with high security is selected instead of network which provide low security.

Received signal strength (RSS) is commonly used criteria it is very simple to measure and it is relative to the quality of service. Most of the horizontal handover algorithm uses RSS as decision criteria.

B. Classification of Vertical handover decision algorithms

There are numerous ways to classify vertical handover decision algorithms. In this paper we selected three groups to divide vertical handover decision algorithms on the basis of criteria used for handover decision and we focused on RSS based vertical handover decision algorithms.

RSS based algorithms in this section RSS is used as main criteria of handover decision. There are number of methods are developed to compare the RSS of currently attached access point with all other available point of attachments [29, 48, 54]. The relative RSS is not useful for vertical handover decision because RSS from different types of network are cannot be compared directly because varieties of technologies are used in various networks. In vertical handover decision generally bandwidth is combined with RSS.

Bandwidth based algorithms bandwidth available for mobile terminal is main criteria of this group. Some algorithms use both RSS and bandwidth in the handover decision process.

Cost function based algorithms in this group various parameters like monetary cost, bandwidth, security and power consumption are taken in account. The handover decision is taken by comparing these parameters for accessing network [1, 13].

C. Performance parameters for Vertical handover decision algorithms

There is various performance parameters are used to compare vertical handover decision algorithms.

Handover delay it is nothing but time interval between initialization and completion of the handover process. For

delay sensitive sessions like voice it is important to reduce the handover delay.

Number of handovers If handovers are occurred frequently, it causes wastage of network resources.

Handover failure probability it can be occurred when accessing network does not have sufficient network resources to complete the handover request. In the earlier cases handover failure is depend up on channel availability of accessing network [12] but it recently depends on the mobility of user.

Throughput is nothing but data rate delivered to the mobile nodes on network. Handover to a target network with highest throughput is always suggested.

III. RSS BASED VERTICAL HANDOVER DECISION ALGORITHMS

These type of vertical handover decision algorithms compares received signal strength of current accessing network with the target network. Because of simple nature of hardware requirement for measurement of received signal strength, lot of literature is available in this area. [3, 9]. We studied three received signal strength based algorithms in this section and summarize them.

A. An RSS threshold based dynamic heuristic

Akyildiz and Mohanty [12] suggested WLAN to 3G handover decision method. This method is based on comparison between current received signal strength (RSS) and dynamic received signal strength threshold (S_{dth}) when mobile node is connected to access point of WLAN. A dynamic received signal strength threshold (S_{dth}) is calculated by,

$$S_{dth} = RSS_{min} + 10\beta \log_{10}\left(\frac{d}{d - L_{BA}}\right) \quad [12] \quad (1)$$

In this equation RSS_{min} is nothing but minimum level of RSS which is required for mobile node to connected and communicate with access point. The path loss coefficient is represented by β . Length of WLAN cell is represented by d . L_{BA} is shortest distance between point at which handover is initialized and WLAN boundary. Where, ϵ is zero-mean Gaussian random variable.

The dynamic RSS threshold is useful for reduction in false handover and restricts the handover failure below the limit. In this algorithm probability of handover failure from 3G network to WLAN is assumed as zero because 3G network is considered to be available all the time, and so that with respect to mechanism a handover is always desirable

when the mobile node enters to the coverage region of WLAN.

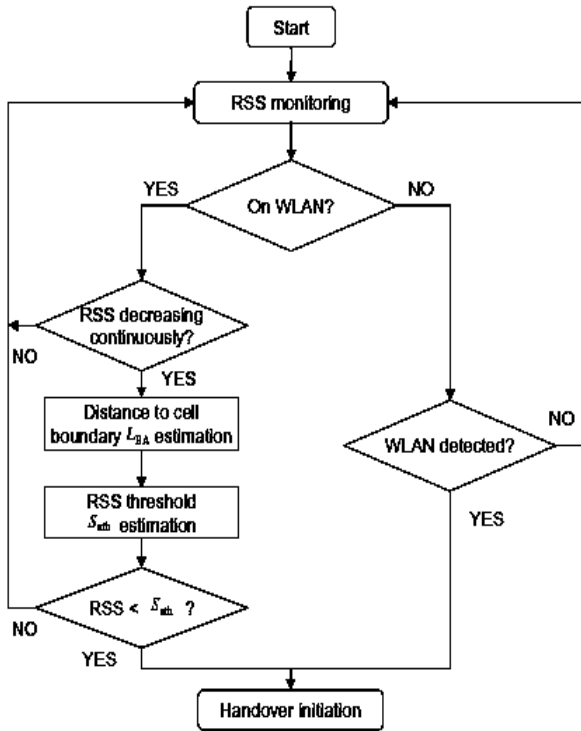


Fig. 1 Akyildiz and Mohanty's heuristic [12]

B. A travelling distance prediction based heuristic

Yan et al. [13] proposed a method to eliminate a unnecessary handovers. This algorithm consider the time for which mobile node is in WLAN cell. This method calculates WLAN travelling time and then estimates the time threshold. A handover is initialized when WLAN coverage is available and calculated travelling time inside WLAN cell is greater than time threshold. The travelling time is calculated as,

$$t_{WLAN} = \frac{R^2 - l_{os}^2 + v^2(t_s - t_{in})^2}{v^2(t_s - t_{in})} \quad [13] \quad (2)$$

In this R is radius of WLAN cell. l_{os} is a distance between RSS sample point and WLAN access point. V is mobile node's velocity. Time at which RSS samples are taken is represented by t_s . Where t_{in} is time of mobile node's entry in WLAN coverage.

This method minimizes unnecessary handovers, and handover failures. But the major drawback of this method is that it increases handover delay because this method is based on sampling and averaging of RSS points.

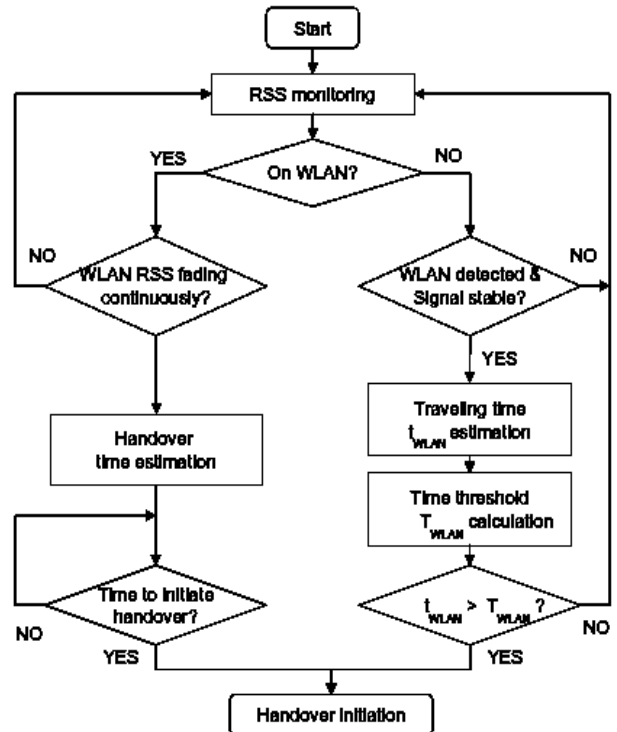


Fig. 2 Yan et al.'s VHD heuristic [13]

Table 1
Summary of RSS based VHD algorithms [1]

Heuristic	Area of application	Key points	Advantages	Drawbacks
Akyildiz and Mohanty's heuristic [12]	In between WLAN and 3G	In this method dynamic RSS threshold is estimated and then it is compared with current RSS	This method reduces the false handover and also minimizes handover failure probability	This method causes wastage of network resources.
Yan et al.'s heuristic [13]	In between cellular networks and WLAN	In this method dynamic time threshold is estimated and compare with travelling time within the WLAN	This algorithm reduces failure of handover and also minimizes the unnecessary handovers.	This method increases handover delay.

IV. CONCLUSION

The RSS based VHD algorithms are very simple and normally used between WLAN and 3G networks. In this type of algorithms the main parameter is RSS so that target network can be selected with most stable RSS. But the major drawback of these types of algorithms is they reduce the reliability because of fluctuating RSS. So the future work is desired to improve the performance of VHD algorithms in terms of quality of service of application.

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