Survey Paper on Efficiency of Vertical Handoff Using RSS

Navnath Bangar¹, Sagar Mane², Rushikesh Parve³, Prof. Shital Thakare⁴

¹,²,³,⁴ CSE, Bharti Vidyapeeth college of Engineering

Abstract: The development of wireless communication is increasing day by day due to the advancement of cellular and broadband technologies. Everyone around the world likes to have best services through best network. Therefore, the aim of NGWNs is to provide a good quality of services between various access networks. To access different networks, there must be a decision algorithm to decide which is the best network for a user for a specific application. This paper presents an Overview of handoff types, handoff process, the criteria involved in VHD, Existing work on the vertical handoff with comparison tables, Analysis various research issues and this paper is about the implementation of the VHD algorithms designed to satisfy these RSS.

Keywords - Vertical Handoff Decision (VHD), Next Generation Wireless Networks (NGWNs), Horizontal Handoff (HHO), Vertical Handoff (VHO), MH, SINR, Vertical Handover, WiMAX, Wi-Fi.

I. INTRODUCTION

Communication is always necessary in building relations to mankind, when two persons meet they need some medium to interchange their views but due to distance barriers some tools are required to communicate each other. At the end of 19th century, Recknowled scientist Graham Bell laid the first stone in the field of communication using different tools regardless of distance. He invented first wired base telephony equipment. It was the solution for the voice communication for the people how far apart they are. After this radio based communication systems Era started. It was an extension of wired based networks. In the beginning, it was developed for some special purposes like military and police usage. With the passage of time these systems emerged to allow common peoples to communicate with each other, rather than using wired based network. After this the age of faster communication and capabilities of voice get started and evolved into new telecommunication system. 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 Wi-Fi, WiMAX 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 parameter i.e. RSS are evaluated to take decision of the best network among available.

II. RESEARCH BACKGROUND

2.1 Handoff in heterogeneous:

Handoff (HO) is the mechanism by which an ongoing connection between a mobile terminal or mobile host (MH) and a correspondent terminal or correspondent host (CH) is transferred from one point of access to the fixed network to another.
2.2 Handoff Types:
2.2.1 Horizontal Handover
In Horizontal handover, the users use the same network access technology and mobility perform on the same layers. In horizontal handover, the on-going calls are to be maintain and although the change of IP address because of the mobile nod movement.

2.2.2 Vertical Handover
In vertical handover, the user can move between different network access technologies. In vertical handover, the mobility performs between the different layers. In vertical handover, the mobile node moves across the different heterogeneous networks and not only changes the IP address but also change the network interface, QoS characteristics etc.

2.2.3 Downward and Upward Vertical Handover
When user move form network with lower cell size and higher bandwidth to network with larger cell size and usually lower bandwidth is called downward-vertical handover, for example WPAN to PAN. On the other handover that is performed with higher cell size and usually lower bandwidth is called upward-vertical handover.

2.2.4 Microcellular Handover
This handover technique is mostly used in populated areas to meet high system capacity by reuse of frequency. there are three Base Stations in three streets. The Base Station 1 and Base Station 3 have line-of-sight (LOS) whereas Base Station 2 and Base Station 1 has no-line-of-sight (NLOS). Therefore, we can say that there is LOS handover between Base Station 1 and Base Station 3 whereas between Base Station 2 and Base Station 1 there is NLOS handover. When the Mobile Station misplace the LOS because of turning the corner with his current Base Station in NLOS then Received Signal Strength reduced. This RSS reducing effect called the corner effect. In this situation, fast handover algorithms are requires to avoid from call dropping because RSS drop quickly due to corner effect. LOS attempts to decrease the unnecessary handover between the Base Stations whereas NLOS must be as speedily as possible because of corner effects.

2.2.5 Multilayer Handover
In multilayer handover, the microcells are superimposed with macrocell to decrease the number of handover and to raise the system capacity. For GSM900 the microcell and macrocell have area range...
from 500 meters to 35 Km. In multilayer handover, according to speed, users are consigned with each layer. To decrease the number of handover microcell layer is allotted to slow user where as macrocell allotted to fast user. When microcell becomes congested then in this situation macrocell not only work for fast user but also work for slow users. Handover calls are pour out to macrocell when the microcell layer distributes all of it channels to slow users. When the load in microcell decreases then it is feasible for microcell to allocate channels to new user. This sort of handover is known as take-back.

2.3 Handover Initiation Techniques
On the bases of Received Signal Strength (RSS) from current and neighbouring Base Station (BS), it is determined that when to request the handover. illustrated that as a result of signal propagation characteristic, when the Mobile Station (MS) move away from Base Station (BS1) its signal strength become weaker whereas its signal strength become stronger as the MS get closer to Base Station (BS2). By removing temporary geographical and environmental factors and by using averaging window we can find the averaged received signal over time.

Here we also briefly discuss four different handover initiation techniques.

• Relative Signal Strength
• Relative Signal Strength with Threshold
• Relative Signal Strength with Hysteresis
• Relative Signal Strength with Hysteresis and Threshold

2.3.1 Relative Signal Strength(RSS):
The performance of the handoff algorithm is based on Relative Signal Strength (RSS) metrics. In which the signal strength of neighbouring Base Stations are compared and handoff is enabled.

Drawbacks:
• Too many unnecessary Handoffs.
• Call drops occur frequently.
• Ping-Pong Effect.

2.3.2 RSS with Threshold:
Relative signal strength with threshold introduces a threshold value to overcome the Ping-Pong effect. The handoff is initiated if existing BS RSS is lower than the threshold value and the new BS RSS is stronger than the threshold value.

Drawbacks:
• The mobile will delay the handoff until the current signal will crosses the threshold.
• Call drops occur due to time delay.

2.3.3 Cost Based Algorithm:
Cost function based VHD algorithms combine metrics such as the security, available bandwidth, monetary costs, power consumption, etc. in a cost function so as to make a handover decision.

Drawbacks:
• Missing detailed information such as normalization method and weights assignment to make the algorithm realistic

2.3.4 Bandwidth Based Algorithm:
Bandwidth based VHD algorithms consider available bandwidth for a mobile terminal or traffic demand as the main criterion.

@IJRTER-2017, All Rights Reserved
Drawbacks:
- Difficulty in acquiring available bandwidth information.
- Reduced reliability because of the changing available bandwidth.

2.4 Comparative study of existing methods

<table>
<thead>
<tr>
<th>ALGORITHMS</th>
<th>APPLICABLE NETWORK</th>
<th>INPUT PARAMETERS</th>
<th>HANOVER TARGET</th>
</tr>
</thead>
<tbody>
<tr>
<td>RSS based VHD</td>
<td>Heterogeneous Network</td>
<td>RSS</td>
<td>Network with Stable RSS</td>
</tr>
<tr>
<td>Bandwidth based VHD</td>
<td>Heterogeneous Network</td>
<td>Bandwidth, RSS</td>
<td>Network with highest Bandwidth</td>
</tr>
<tr>
<td>Cost function based VHD</td>
<td>Heterogeneous Network</td>
<td>Cost, Bandwidth and security</td>
<td>Network with highest overall performance</td>
</tr>
</tbody>
</table>

III. HANDOFF MECHANISM

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.

- 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.

![Figure 2. Vertical Handoff Decision Making](image)

3.1 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 $RSS_{NEW} > RSS_{OLD}$
- RSS with Threshold T: If $RSS_{NEW} > RSS_{OLD}$ and $RSS_{OLD} < T$
- RSS with Hysteresis H: If $RSS_{NEW} > RSS_{OLD} + H$
RSS, Hysteresis and Threshold: If $RSS_{NEW} > RSSOLD + H$ 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 Wi-Fi to WiMax was analyzed by the proposed scheme. When the MN moves out of the signal coverage of Wi-Fi, 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 predicative 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.

### 3.2 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:

Where:

$$ R = W \log_2 \left(1 + \frac{\sigma^2}{\gamma} \right) $$

- $R$ is the maximum achievable data rate
- $W$ represents the bandwidth of the carrier
- $\gamma$ 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.
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.

![Flow diagram of handover](image)

*Figure 3. Flow diagram of handover*

IV. RSS Based on VHD Algorithm

In this, the handoff decisions are made by comparing RSS (received signal strength) of the current network with the preset threshold values. These algorithms are less complex and may be combined with other parameters such as bandwidth, cost etc. to have a better handover decisions. We describe here three RSS based algorithms in the following sections.

4.1 ALIVE-HO (adaptive lifetime based vertical handoff) algorithm: –
Zahran, Chen and Sreenan [6] proposed algorithm for handover between 3G Networks and WLAN by combining the RSS with an estimated life time (duration over which the current access technology remains beneficial to the active applications). ALIVE-HO always uses an uncongested network whenever available. It continues using the preferred network (i.e. WLAN) as long as it satisfies the QoS requirements of the application.

Two different vertical handoff scenarios are discussed: Moving out of the preferred network (MO) and Moving in to the preferred network (MI), where the preferred network is usually the underlay network that provides better and economical service. Hence, extending the utilization of the WLAN, as long as it provides satisfactory performance is the main considerations of vertical handoff algorithm design.

We observe the method through the following scenarios.

In first scenario, when the MT moves away from the coverage area of a WLAN into a 3G cell, a handover to the 3G network is initiated. The handover is done under the conditions that RSS average of the WLAN falls below predefined threshold. (MO threshold) and (b) the estimated life time is atleast equal to the required handoff signaling delay. The MT continuously calculate the RSS mean using the moving average method.

\[
RSS_{[K]} = \frac{1}{Wav} \sum_{i=0}^{Wav-1} RSS[k-i]
\]

Here \(RSS_{[k]}\) is RSS mean at time instant \(k\), and \(Wav\) is the window size, a variable that changes with velocity of the velocity of mobile terminal. Then, the lifetime metric \(EL_{[k]}\) is calculated by using

\[
EL_{[k]} = \frac{RSS_{[k]} - ASST}{S_{[k]}}
\]

ASST (Application signal strength threshold) chosen to satisfy the requirements of the active applications. \(S_{[K]}\) represents RSS decay rate. In second scenario, when the MT moves towards a WLAN cell, the handover to the WLAN is done if the average RSS is larger than MI Threshold. WLAN and the available bandwidth of the WLAN meet the bandwidth requirement of the application. Table given below shows lost frames during the handoff transition area for the received stream.

<table>
<thead>
<tr>
<th>ASST (in dBs)</th>
<th>-90</th>
<th>-89</th>
<th>-88</th>
<th>-87</th>
<th>-86</th>
<th>-85</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lost frames_100kbit/s</td>
<td>13.3</td>
<td>5</td>
<td>3</td>
<td>0.67</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Lost frames_300kbit/s</td>
<td>38</td>
<td>28</td>
<td>4</td>
<td>0.33</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

**TABLE 1.1 FRAMES LOST CORRESPONDING TO ASST**
Based on the obtained results and subjective testing, the optimal value for UDP based streaming is chosen as -86dB. By introducing EL[k] the algorithm adapts to the application requirements and reduces unnecessary handovers. Second, there is an improvement on the average throughput for user because MT prefers to stay in WLAN cell as long as possible. However, packet delay grows, due to the critical fading impact near the cell edges, which may result in severe degradation in the user perceived QoS. This phenomenon results in a tradeoff between improving the system resource utilization and satisfying the user QoS requirements. This issue can be critical for delay sensitive applications and degrade their performance. ASST is tuned according to various system parameters, including delay thresholds, MT velocities, handover signaling costs and packet delay penalties.

V. CONCLUSION

Next Generation Wireless Networks (NGWNs) has a very good ability to support wireless network access equipments to ensure a high rate of services between dissimilar wireless networks. It is essential to have decision algorithms to decide for each user of the mobile terminal, which is the most viable network at some point, for a specific application that the user needs. Therefore to make these things to be practically attainable, different algorithms have been proposed for vertical handoff technique. In this paper, a comparative analysis of one vertical handover decision process algorithms for next generation heterogeneous wireless networks has been worked out towards the emerging standard. Also, few parameters, that needs to be accounted before proceeding to vertical handover has been artistically illustrated in this literature, thereby guiding the network researchers with a comprehensive idea on user mobility and handovers, which is an integral parameter for mobile wireless communications.

REFERENCES

1. Dong Ma, Student Member, IEEE, and Maode Ma, Senior Member, IEEE10459219/12/$31.00 _ 2012 IEEE Published by the IEEE Computer Society.
2. Enrique Stevens-Navarro, Member, IEEE, Vahid Shah-Mansouri, Student Member, IEEE, and Vincent W. S. Wong, Senior Member, IEEE0018-9545/$26.00 © 2009 IEEE.