Implementation of advanced VHO algorithm for seamless connectivity in HWN using MATLAB

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Abstract

Presently, various wireless technologies are in place which forms the Heterogeneous Wireless Network (HWN) and provides the connectivity to the mobile users by integrating with each other. The Mobile device that is entered in heterogeneous network can be connected with multiple wireless technologies and maintain seamless connectivity in highly dynamic environment, but the efficiency of these technologies depends upon this connectivity to the user and this introduces here the concept of handover as a vertical handover. The most essential requirement for Seamless vertical handover is that the Received Signal Strength (RSS), which should always be good. During the vertical handoff procedure the decision of handoff is very important step because it can affect the normal working of the communication system. An incorrect handoff decision or selection of a non-optimal network can result in undesirable effects such as higher costs, poor service experience, call drop and may degrade the Quality of Service (QoS) current communication. The main problem in HWN is available bandwidth (BW), which is limited and the number of users is growing rapidly, so it's a real challenge to maintain the received signal strength in a healthy stage.

In this paper the proposed, cost-effective exhaustive approach is explained for seamless vertical handover and mobility management. The objective of this paper is to determine the conditions under which vertical handoff should be performed in heterogeneous wireless networks.

Keywords

HWN, RSS, QoS, BW

1. Introduction

A seamless handoff is defined as a handoff scheme that maintains the connectivity of all applications on the mobile device when the handoff occurs also provides continuous end-to-end data service in various handoff events.

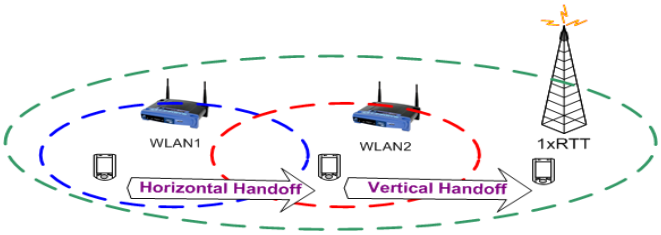

Fig1: Difference between Horizontal handover and Vertical Handover

In this process number of network interfaces involved and handoff can be characterized into either vertical or horizontal, as depicted in Figure 1 Handoff is occurred in WLAN and 1xRTT. A horizontal handoff occurs between two network access points that use the same technology and interface like the handoff is done between two WLAN technologies as shown in figure 1.[9]

2. Vertical Handover

It is a handoff/ handover procedures in which mobile node have the services from the different network technology. This kind of handoff also called as intra system handoff.

- **Vertical handover procedure**

VHO is classified into 3 steps [4]

i. Handover Collecting Information

In this Phase, all the required information for VHO decision is gathered on the basis of some criteria related with the user

preferences like cost, security; network as latency, coverage and terminal like battery, velocity.

ii. Handover Decision

In this Phase, select the best RAT based on aforementioned information and informs the handover execution about that.

iii. Handover Execution

In Handover Execution phase the resources of old RAT is released and the active session for the user will be maintained and continued on the new RAT.

- **VHO Design parameters**

  Parameters are considered for designing of the VHO algorithms [10]

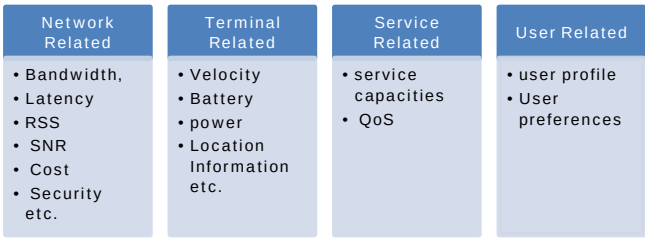

Fig2: Design Parameters

3. Previous Work

- **Hasswa Algorithm**

The Hasswa et al. algorithm [2] which is a traditional and a simple algorithm explained in figure 3.

A Transport and Application Layer Architecture for vertical Mobility with Context-awareness (Tramcar) is developed by Hasswa A., Nasser N., and Hassanein H [2]. The goal behind this project is to present a novel cross-layer framework for smart vertical handover control and mobility management.

The success of a vertical handover (VHO) is defined by the ratio of the number of successful handover to the total number of handover initiated. Such a success depends on the gap between the handoff triggering point and signal link loss point at which the communication breaks up.

- **Omar Algorithm**

Omar K., and Omar A., [1], developed a new approach to improve VHO in heterogeneous networks environment by using mechanism produced independently by IEEE and 3GPP namely media independent handover (MIH). VHO algorithm provided by this mechanism supports both types, imperative and alternative call. Figure 4 shows Omar et al. algorithm [1], which provides advancement in VHO procedure, if there are two VHO simultaneous sessions, one due to user Profile and the other due to RSS going down, the first session will execute (high priority) and the second session if there is no imperative session active in under process, otherwise it will wait in queue.

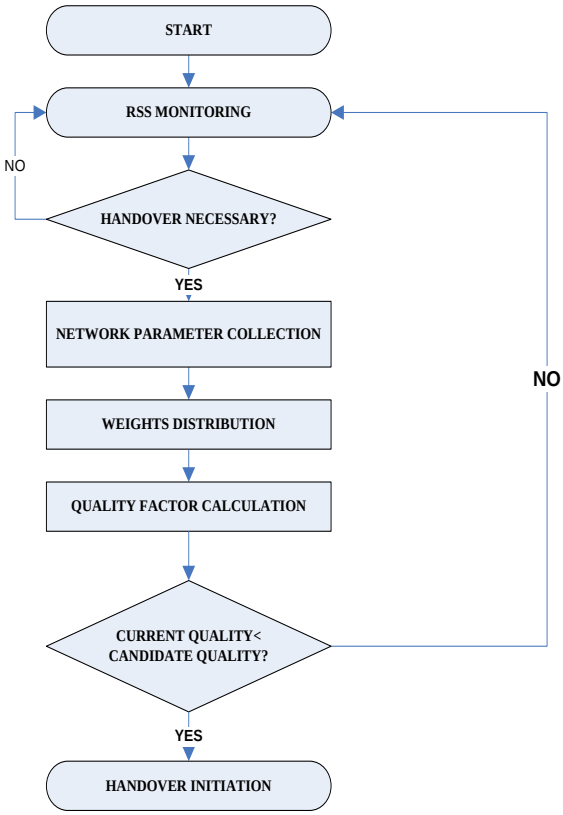

Fig3: Hasswa et al. VHD heuristic algorithms

In the imperative case, optimum of RATS (list of priorities) will be selected. When the first choice form the list of RATs priorities could not be satisfied with Sufficient of Resource (SoR) the AC will automatically move to another RAT in the list and to look for satisfying requirements of another RAT and so on until finding available resources, otherwise the session is rejected. Finally, selected RAT based on rules and preferences of operators by PoS in the destination network. In the alternative case, the session will take the same path of imperative session if it is due to user profile otherwise there is no need to list of priorities step because the RAT selected on behalf of user selection therefore the session will be rejected from the first time when SoR are not available for user selection session.

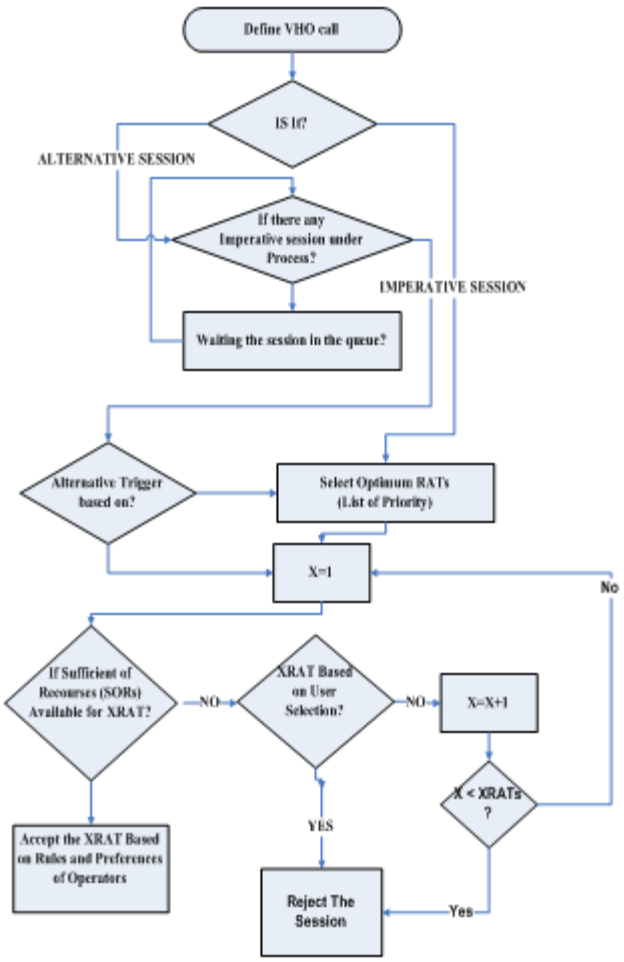

Fig4: Omar et al. Algorithm

4. Proposed Algorithm

Step 1 Search all network and initial all network parameters
Step 2 Check the current RSS value if RSS value is less than min_rss value go to Step 5.
Step 3 Check user criteria (Cost, Latency, Data rate, Security) if any of them is in satisfactory level than go to step 8.
Step 4 Invalid Call, go to Step 12.
Step 5 Compare user criteria between RATs except existing RAT.
Step 6 If sufficient of resource (SoR) available go to step 11.
Step 7 No changes of RAT go to step 12.
Step 8 Compare all user (Cost, Latency, Data rate, Security) criteria of all RATs.
Step 9 If sufficient of resource (SoR) available go to step 11.
Step 10 No changes of RAT go to step 12.
Step 11 Select the satisfied RAT.
Step 12 Reject the session.

In this algorithm priority is not given to any session as in Omar algorithm, according to the availability of the optimum RATs handover is occurred. Algorithm first checks all the networks and parameters required for the handover procedure. After collecting the information it checks the RSS value of current RAT (Radio Access Terminal), if this value is not less than min_rss required then it executes the alternative session in which handover decision is take place according to the user preferences. Before any decision it also checks the selected RATs satisfies all user criteria and provides sufficient resources. If sufficient resources are available then it will select the satisfied RAT else there will be a no change in a RAT and it will reject session.
If the RSS value is less than min_rss required value then imperative session will be executed, in which user criteria compared without comparing the criteria of the current RAT and depending on the SoR selection of RAT is done else there is no change in RAT and it terminates the session .

5. Simulation/Experimental Results

- **MATLAB simulation of Hasswa Algorithm**

Fig5: Results of Hasswa Algorithm

Figure 5 explains the working of the Hasswa algorithm which is the simple algorithm. In this implementation RSS value is consider as a base parameter depending on the RSS value handoff decision take place. When user clicks on the move button provided on the screen the device (located in red circle) starts moving from one location to next location. Here RSS value consider according to the distance of a mobile device to network area. In figure 5 the device is located in T3, and traversed from T1 to T2 to T3 and so on. While traversing, only three nearby networks are considered for

handoff decision. Here T3, T2, T7 networks are considered. As located in red circle now device is in T3 network but still T2 providing signal strength as the RSS value of T2 is more than the T7 and T3.

- **MATLAB simulation of Omar Algorithm**

Figure 6 explains the working of the Omar algorithm which is based on IM4VHO. In this implementation RSS value as well as traffic BW utilization and link quality is consider as a base parameter depending on the RSS value imperative session or alternative session is executed to take the handoff decision take. When user clicks on the move button provided on the screen the device (located in red circle) starts moving from one location to next location. Here RSS value consider according to the distance of a mobile device to network area. In figure 6 the device traversed from T1 to T2 to T3 and so on, and now it is located in T4. While traversing, only three nearby networks are considered for handoff decision. Here T5, T6, and T7 networks are considered.

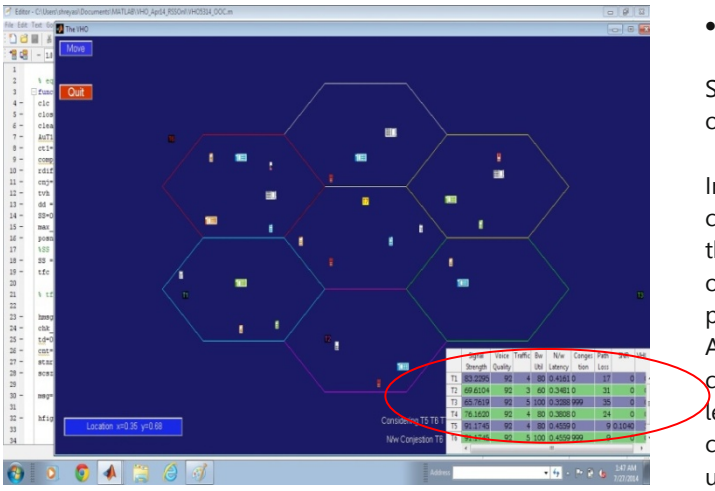

Fig6: Design of Omar Algorithm

As located in red circle now device is in T4 network but due to the signal strength and other user parameters the handoff is take place to T5 network. This is shown using blue circle (See Table at right side of the figure).

- **Matlab-Simulation Result for proposed algorithm**

The Proposed algorithm primarily based on MIH to execute VHO, same as Omar et al. algorithm [1]. However, first it Checks the current RSS value and depending on the RSS value it introduces the definition of VHO type and gives priority to imperative sessions over alternative sessions. So the success rate of this algorithm is more than the Hasswa et al. [2] algorithm and average time required for VHO call is less than Omar et al. algorithm [1]. It achieves less failure of connection due to using the optimum RATs. Figure 7 shows the implementation of the proposed algorithm.

Figure 7 Implementation of proposed algorithm for Alternative session

- **Execution of the proposed algorithm**

Seven networks are designed each network is having their own signal source for transmission as shown in figure 7.

In proposed algorithm first VHO call get initialized, if the current network or RAT is having sufficient signal strength then the call is continued with current network. But if as object moves from one location to another there may be a possibility of deduction in the signal strength of current RAT. According to the position of the device, signal strength is calculated if the RSS value is less than minimum acceptable level then alternative session is initiated in this session other criteria like user preferences is considered. According to the user preferences new optimum RAT is selected, if the criteria dose not satisfies then will be a no change is done in RAT selection and session is rejected.

In case of imperative session the handoff decision is take place directly if signal strength is below the accepted level. In imperative session user criteria is compared with alternate RAT, and if the new optimum RAT satisfies the all user criteria and provides sufficient resource then handover takes place otherwise session is rejected.

- **Main Window of Project**

Figure 8 shows the main window of the project in which all three algorithms are called and executed by clicking on the button provided in window. Also user can have analysis of all three algorithms easily as all algorithms gives the results in a

tabular format. The project is developed in Matlab software as a simulator.

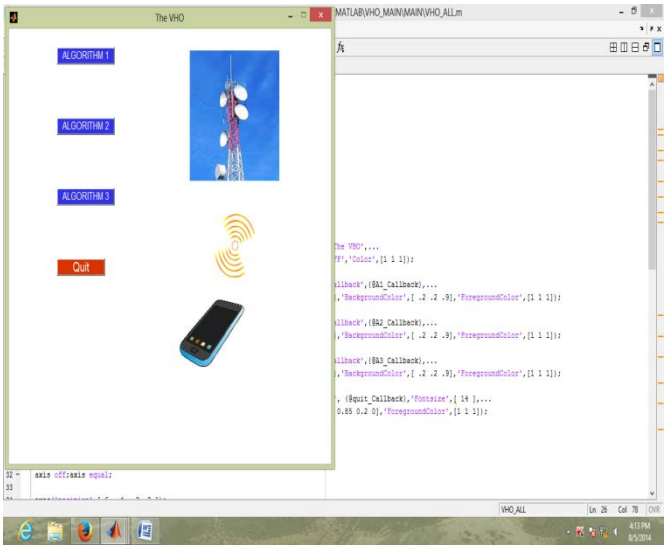

Fig8: Main Window

6. Result Analysis

Table-1 Comparative study and analysis of all three algorithms

Sr. No	Algorithm	e.g. calls	Success rate	%
1	Hasswa	35	12	34.28
2	Omar	35	26	74.28
3	Proposed	35	30	85.71

Table 1 gives the analysis of the all three algorithms by comparing the success rate of the all algorithm. From above analysis following points are concluded as -

1. Proposed algorithm is compared among the hasswa and omar.

2. Proposed algorithm is tested and found better over other two algorithm

3. The call success rate is calculated by running iteration no of times.

4. Approx. tested for 35 calls and the proper handover is carried out is as per table

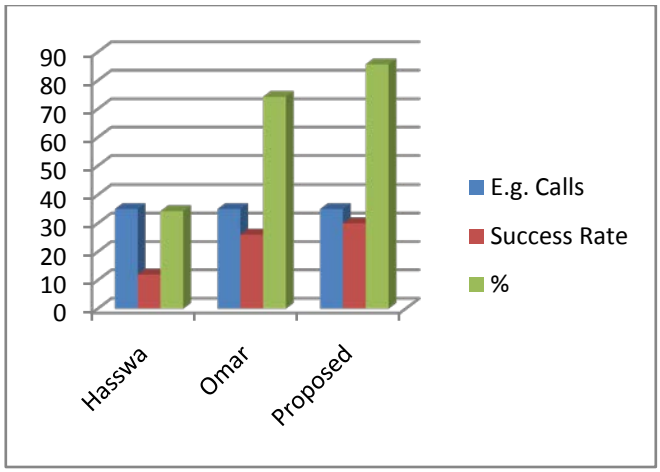

Fig9: Bar graph of Success Rate of all algorithms.

Figure 9 shows the bar graph for the comparative study of the omar and Hasswa and proposed algorithm.

7. Conclusion

The vertical handoff will remain an essential component for wireless networks due to switching of mobile users amongst heterogeneous networks. The presented VHO approach concentrates on better performance, less complexity, reduces time and is more exhaustive for enhancing VHO procedure. The Hasswa et al. [2] algorithm and another one is Omar et al. algorithm [1] are advanced procedures in VHO. In this paper both methods are presented and compared for future enhancement to reduce the handoff delay.

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