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A QoS Aware Vertical Handover In Mobile Network

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A QoS Aware Vertical Handover In Mobile Network

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Abstract **-** The convergence of heterogeneous wireless access technologies characterizes the 4G wireless networks. In such converged systems, the seamless and efficient handoff between different access technologies (vertical handoff) is essential and remains a challenging problem. The heterogeneous co-existence of access technologies with largely different characteristics creates a decision problem of determining the "best" available network at "best" time to reduce the unnecessary handoffs. This project proposes a dynamic decision model to decide the "best" network at "best" time moment to handoffs. The proposed dynamic decision model make the right vertical handoff decisions by determining the "best" network at "best" time among available networks based on, dynamic factors such as "Received Signal Strength(RSS)" of network and SNR(Signal-to-Noise Ratio), Link capacity(offered bandwidth) and power consumption. This model not only meets the individual user needs but also improves the whole system performance by reducing the unnecessary handoffs.

Key Words : - *4G, handoff, wireless, dynamic factors*

I. INTRODUCTION

Wireless access technologies offer users the enjoyment of internet access on the move. The IEEE 802.11n, reaches a maximum data rate of 600Mbps.WLANs are cheap to install and operate; however, their coverage area is limited to hundreds of meters only, and mobility support is minimal. The Worldwide Interoperability for Microwave Access (WiMAX) is an wireless metropolitan area network based on IEEE802.16 standard. It offers broadband wireless access that is capable of providing mobile users with quality of service (QoS) support as detailed in latest amendment.

II. MOTIVATION:

An integrated heterogeneous wireless network architecture is often referred to as Beyond 3G(B3G) or Fourth-Generation (4G) network, which could form the platform for future innovative services and application. WiMAX and WLAN complement each other in terms of coverage area , data rates, installation cost and QoS support. User might prefer switching from one wireless technology to another, i.e., to perform a vertical handover (HO), based on service cost, quality, speed and availability provided by one network or the other. For example, a fast moving user launches an online video conferencing application over a 3GPP network and performs an HO to the WiMAX network to capitalize on the guaranteed QoS support and lower access cost. Later, the user starts downloading a huge file from the internet and decides to switch to an accessible WLAN to further lower the service cost. Due to limited WLAN coverage the user might travel beyond the coverage area of the WLAN and opt to perform an HO to the WiMAX to continue downloading the file. The decision for best network may be based on static factors such as the bandwidth of each network interface and battery level of mobile device. However Dynamic factors must be considered in handoff decisions for effective network usage. For example, information on current network conditions such as received signal strength (RSS) can help in improving whole system performance; current user conditions, such as a mobile host's moving speed can eliminate certain networks that do not support mobility, from consideration. However, the variations of these parameters and distributed VHO decisions might cause the instability of VHO decisions, which is inefficient in utilizing network resources due to frequent handoffs.

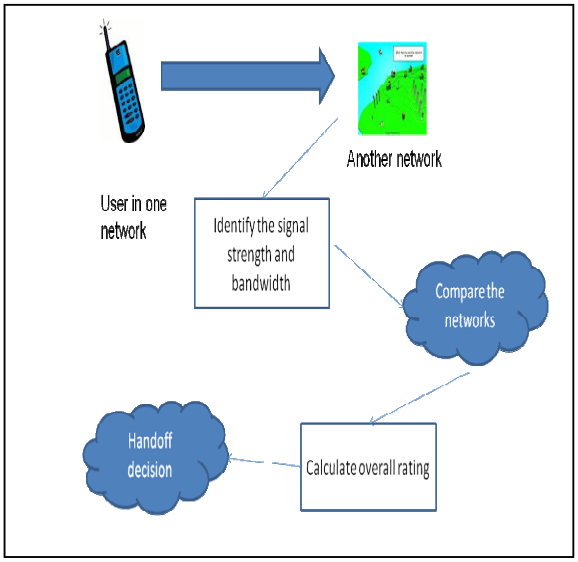

Fig.1. Overall architecture.

In this paper, we propose a dynamic decision model to make the right vertical handoff decisions by determining the "best" network at "best" time among available networks based on, dynamic factors such as "Received Signal Strength (RSS)" of network and "velocity " of mobile station as well as static factors. Thus this model not only meets the individual needs but also improves the whole system performance by reducing the unnecessary handoffs. In this project, we propose a service history-based VHO algorithm to reduce unnecessary handoffs and call dropping probability in addition to QoS parameter considerations. Simulation results show that the proposed VHO algorithm outperforms existing algorithms.

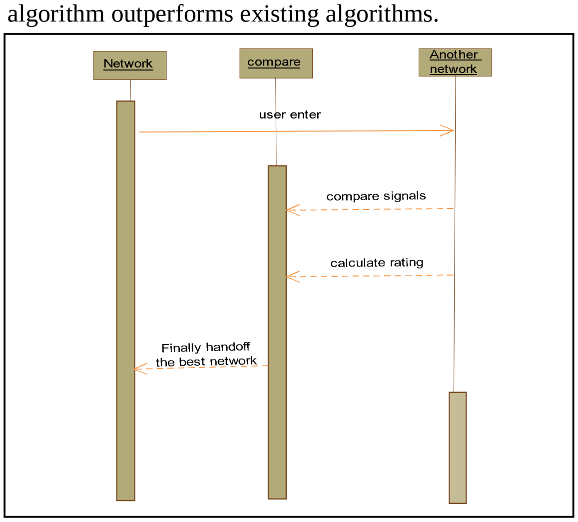

Fig.2. Hand-off to the best network.

Some of the advantages of our proposed paper are the reduction in call drop, avoidance of frequent handoff and provision of best services.

III. RELATED WORK

Recently, there has been much research activities directed toward WiMAX-WLAN interworking architecture and HO procedures. Chen et al. [4] introduced a Vertical Handoff Translation Centre to the interworking architecture to improve the QoS experienced by applications during an HO. Several papers discuss HO decision mechanisms to avoid performing unnecessary or unwise HOs [11]. Sun et al. [5] attempted to improve the reauthentication procedure by transferring the MSK from the serving network to the target network using MIH services. Thus, when HO is performed, MS derives lower level keys without invoking the time-consuming full EAP-AKA protocol. This approach greatly improves the performance but introduces security risks. Al Shidhani and Victor C.M. Leung in [1] proposed fast and secured HO reauthentication protocols, which avoid contacting authentication servers in the 3GHN during HOs. The proposed protocols achieve drastic reductions in reauthentication delay and signaling traffic.

3.1. Network Discovery

The objective of this module is to identify all the Candidate Networks from all the available networks and assign them priority. A candidate network is a network whose received signal strength is higher than its threshold value and its velocity threshold is greater than the velocity of mobile station.

Let N= {n1,n2,n3………nk} is the set of available network interfaces.

VT={vt1,vt2,vt3,…….vtk} is the set of threshold values of velocities for a mobile station for the respective networks.

RSST={rsst1,rsst2,rsst3,…………rsstk} is the set of threshold values of received signal strengths of respective networks.

RssDiff={RssDiff1,RssDiff2,….RssDiffk} is the set of values of difference between the received signal strength and its threshold value.

The priority is based on RssDiff where higher the RssDiff, higher is the priority. It is so because higher RssDiff indicate that the MS is more nearer to the BS of that network and hence the MS can stay for more time in the cell of the respective network before asking for another handoff. Thus it makes possible to reduce the unnecessary handoffs and improve the overall performance of the system.

3.2. Hand-off decision

A Handoff Management Center (HMC), monitors the various inputs collected from the network interfaces and their base stations (BS), analyzes this information and takes handoff decisions. It also provides the connection between the network interface and the upper layer applications. HMC is composed of five components: Network Analysis (NA), Network Discovery (ND), Dynamic decision (DD), system monitor(SM) and Handoff manager & executor (HME). NA is responsible for monitoring the status of each network interface (i.e. offered bandwidth, user charges, power consumption of network interface) and analyzing based on the calculated score function. SM monitors and reports system information (i.e. current remaining battery and user preferences) to NA module. ND module discovers all the available networks at fixed time intervals. It monitors the velocity of mobile station (MS) and the Received signal strength (RSS) of the base station (BS), selects the candidate networks and assigns them priorities. Finally, the DD module takes the decision, for selecting "Best" network to handoff, based on the inputs from NA and ND modules. The Priority Phase is used to remove all the unwanted and ineligible networks from the prospective candidate networks. The Normal phase is used to accommodate user-specific preferences regarding the usage of network interfaces. The user preferences are expressed in terms of weight factors. Finally, the Decision Phase is used to select the "Best" network and executing the handoff to the selected network.

3.3. Hand-off Execution:

Calculate a dynamic *score "DScore"* by multiplying the *priority* of each candidate network with its static score "*S*". Select the network with the highest value of "*DScore*".

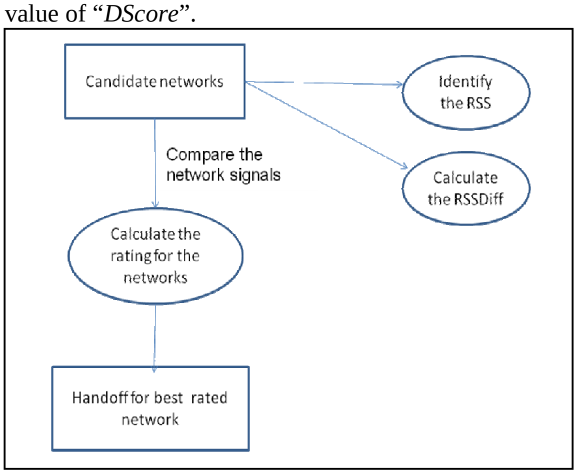

Fig. 3. Dataflow diagram.

Handoff all current information to the "Selected network" if different from current network. After the decision making, a normal handoff is done to the "best network" at the "best time interval". This results in avoidance of frequent handovers and lesser call drop. Thus best service is provided.

4. DYNAMIC DECISION PROCESS

4.1. Priority Phase: (Network Discovery)

1. Add all the available network into candidate list
2. Scan all the networks and record their Received Signal Strength(RSS)
3. Record the velocity of the mobile station (MS)
4. Remove the networks which do not satisfy the required RSS and velocity criteria.
5. Calculate and assign the priorities to all the candidate networks based on the difference between RSS and its threshold value RSST.
6. Continue with Normal Phase

4.2. Network Analysis Phase

7. Collect current system status from SM component and determined the weight factors.
8. Collect information on every wireless interface in the candidate list.
9. Calculate static score "*S*' using a *Cost function* for every network.
10. Continue with Decision Phase

4.3. Decision Phase: (Network Selection and Execution)

11. Calculate a dynamic *score "DScore"* by multiplying the *priority* of each candidate network with its static score "*S*"
12. Select the network with the highest value of "*DScore*"
13. Handoff all current information to the "Selected network" if different from current network.

5. CONCLUSION AND FUTURE WORK:

Recent advances in wireless access technologies open the doors for global, continuous, and on the move wireless mobile internet access. In this paper, we proposed decision model to make the right vertical handoff decisions by determining the "best" network at "best" time interval among available networks based on, dynamic factors such as "Received Signal Strength (RSS)" of network and "velocity " of mobile station as well as static factors. Thus this model not only meets the individual needs but also improve the whole system performance by reducing the unnecessary handoffs.

No specific mechanisms to handle authentication errors and failed validation during HOs are supported in our proposed protocols.

REFERENCES:

[1] Ali Al Shidhani and Victor C.M. Leung, "Fast and Secure Reauthentications for 3GPP Subscribers during WiMAX-WLAN Handovers" IEEE transactions on dependable and secure computing, vol. 8, no. 5, september/october 2011

[2] A. Al Shidhani and V.C.M. Leung, "Local Fast Re-Authentication for 3G-WLAN Interworking," Security Comm. Networks, vol. 1, no. 4, pp. 309-323, July/Aug. 2008.

[3] The Third Generation Partnership Project (3GPP), www.3gpp.org, 2010.

[4] Y.-C. Chen, J.-H. Hsia, and Y.-J. Liao, "Advanced Seamless Vertical Handoff Architecture for WiMAX and WiFi Heterogeneous Networks with QoS Guarantees," Computer Comm., vol. 32, no. 2, pp. 281-293, Feb. 2009.

[5] H.-M. Sun, S.-M. Chen, Y.-H. Chen, H.-J. Chung, and I.-H. Lin, "Secure and Efficient HO Schemes for Heterogeneous Networks," Proc. IEEE Asia-Pacific Services Computing Conf., pp. 205-210, Dec. 2008

[6] A. Al Shidhani and V.C.M. Leung, "Reducing Re-Authentication Delays during UMTS-WLAN Vertical Handovers," Proc. IEEE 19th Int'l Symp. Personal, Indoor and Mobile Radio Comm. (PIMRC '08), pp. 1-5, Sept. 2008.

[7] 3GPP, 3GPP Technical Specifications, 3G Security; Security Architecture (Release 7), 3GPP TS 33.102 v7.0.0, Dec. 2005.

[8] S.-H. Lee, N.-S. Park, and J.-Y. Choi, "Secure Handover for Mobile WiMAX Networks," IEICE Trans. Information and System, vol. E91-D, no. 12, pp. 2875-2879, Dec. 2008.

[9] S.-H. Lim, K.-S. Bang, O. Yi, and J. Lim, "A Secure HO Protocol Design in Wireless Networks with Formal Verification," Lecture Notes in Computer Science, pp. 67-78, Springer, 2007.

[10] L. Eastwood, S. Migaldi, Q. Xie, and V. Gupta, "Mobility Using IEEE 802.21 in a Heterogeneous IEEE 802.16/802.11 Based, IMTAdvanced (4G) Network," IEEE Wireless Comm., vol. 15, no. 2, pp. 26-34, Apr. 2008

[11] Z. Dai, R. Fracchia, J. Gosteau, P. Pellati, and G. Vivier, "Vertical HO Criteria and Algorithm in IEEE 802.11 and 802.16 Hybrid Networks," Proc. IEEE Int'l Conf. Comm. (ICC '08), pp. 2480-2484, May 2008.

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