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Seamless Inter-System handover between WiMax-3G using MIH

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Abstract: Heterogeneous networks are concrete its way towards the everywhere wireless access abilities which provide the automatic handovers for any moving devices in the heterogeneous networks combining different access technologies. In this paper, intend to present a possible Mobile WIMAX□3G Network Interworking architecture based on the 3G standards and propose the seamless inter system handover scheme which enables the service continuity with low handover latency and packet loss. This approach of enabling handover feature is purely based on the IEEE 802.16e Mobile WiMAX & 3G Standards.

Keywords: Vertical handover, interworking architecture, 3G and WiMAX, Mobility and QoS

I. INTRODAUCTION

When Mobile Node (MN) during its movement changes its Access Point (AP), we called it a handover. If this AP belongs to same network as was previous then we say it a Horizontal handover and if two APs between which MN switches belongs to different technologies we called it vertical handover. Emerging wireless technologies come up with different challenges in heterogeneous environment.

Every technology has its own pros and cons, e.g., WiMAX is best suited for high bandwidth applications and long coverage area, whereas WiFi has high bandwidth but less coverage area and cellular technologies like 3G/GPRS is not better for real time applications as it has limited data rates but as far as coverage area is concerned it is best among three.

The integration of three networks, 3G, WiMAX and Wifi to provide seamless mobility and QoS guarantee is challenging issue. Seamless Mobility can be attained by connecting between diverse access technologies while connection there should be uninterrupted and continuous session transfer from one technology to another. Seamless mobility delivers continuity and transparent access as user move between different interfaces, environment and networks. 802.21 provide seamless mobility support in heterogeneous networks.

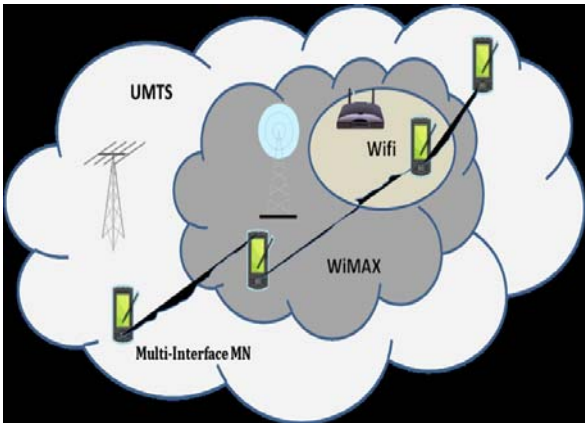

Figure 1. Mobile node seamlessly moving between different technologies

With the more utilization of real time applications such as VoIP and video conferencing, now the challenge arises how to provide QoS support with seamless mobility in heterogeneous environment. To measure QoS in any environment we use different parameters, i.e., throughput, Packet error rate, jitter and handover latency. In this paper we propose a vertical handover approach using 802.21 MIHF, adding QoS layer to MIH to provide guaranteed delivery of real time application packets.

II. RELATED WORK

A. Handover from WIMAX Access Network to 3G Network:

Before the handover is initiated, the mobile is connected to the 3GPP services through WIMAX access network. When the MS enters to an overlapped zone, the MS can measure signal quality from the 3GPP neighboring cells. If the triggering conditions for vertical handovers are satisfied, the handover decision is then taken. The target 3G will be notified the forthcoming handover from the WIMAX network via the HO request message routed through the core network. The MS will perform the GPRS

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attach procedure with the 3G. Mobility management contexts are established at the MS and SGSN. The MIP registration between the HA and new GGSN/FA can be updated after the PDP context is activated between GGSN and MS.

Three stages that handover procedure has to go through: initiation, preparation, and execution. In the initiation process, important changes in the link quality are reported. The handover procedure works as follows:

The MIH mobile subscriber (MS) or subscriber station (SS) is pre-configured to generate triggers towards the network based on the degradation of current signal quality or on the necessity of switching between access technologies to support higher QoS requirement or low cost. The pre-configuration of these thresholds is usually set by the PoS (Point-of-Service) which is in this case is the WIMAX BS/PoS. When the connection is established, the PoS issue a configuration message to be sent to the mobile subscriber. This message states the thresholds for the connection parameters under which the device generates a report and send a confirmation message to the WIMAX BS/PoS.

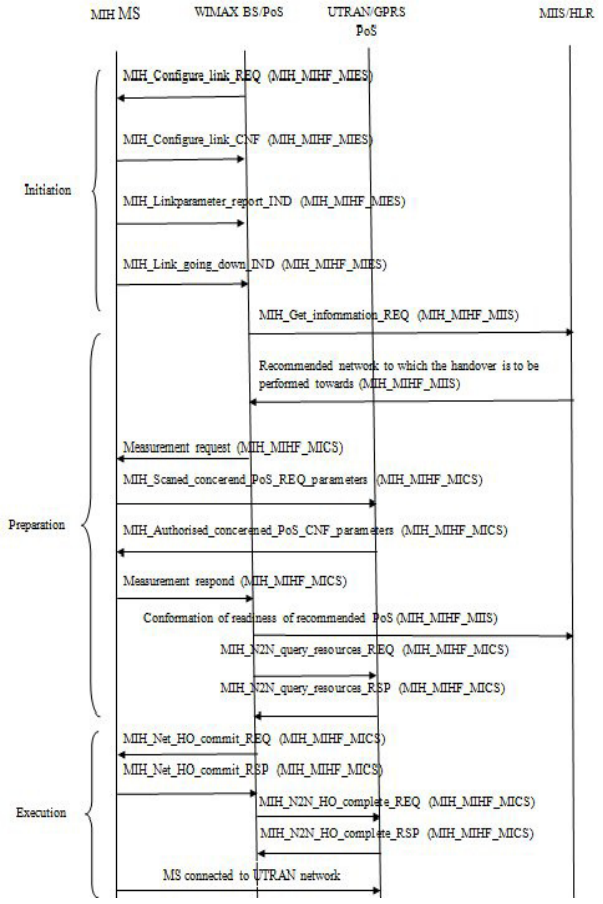

Figure 2. Vertical Handover protocol from WIMAX access network to 3G network

The mobile subscriber (MS) or SS send a periodic information messages stating signal strength measurements. The WIMAX BS/PoS will be aware of the MS status at all time. As far as QoS requirements and other significant parameters in case of crossing thresholds, the MS will generate a report to indicate changes to the PoS (MIH_linkparameters_report_IND). When deterioration in connection quality continues to reach unacceptable levels, the MS sends a message to the WiMAX BS/PoS indicates the need for a handover (MIH_link_going _down_IND). This message includes details about the time period at which the link will go down and the reason of this links weakness with a certain precision. Now the WIMAX BS/PoS is aware of the need of performing the handover and this is when the handover preparation stage starts.

Now a query to the MIIS/HLR server might be sent requesting information regarding access networks around the MS. The MIIS/HLR server database includes information about different access networks present around the MS. This information includes: network status, availability, and signal strength.

The MIIS server will send a message to the WIMAX BS/PoS indicating forcing the device to connect to a certain preset network instead of suggesting multiple networks to choose from. This step aims to optimize service in terms of network availability, cost, seamless mobility, and urgent traffic management and also will reduce the time consumed in the handover process. So the MS will not be required to perform additional scanning for networks in the surrounding and will be no need of resource availability check on candidate networks. Now, MS will skip all regular reporting actions and just report required measurements regarding to the target network i.e. UTRAN/GPRS and immediately starts establishing a connection with the new radio network.

The WIMAX BS/PoS sends an information request (MIH_Get_Information_REQ) message to MIIS/HLR server. The MIIS/HLR server is then select the GGSN and GGSN then send the request to SGSN who serve the 3G node in UTRAN/GPRS PoS. In order to be able to retrieve the address of SGSN that serves a 3G node will be stored in MIIS/HLR server. MIIS/HLR sever receives the request and then sends back a special message based on PoA (Point-of- Attachment) location where user zoning is applied, containing the target/recommended network along with its characteristic. The MS now will only scan for this specific network rather than scanning for a list of available networks. MIIS will choose this network based on multiple aspects such as resources availability, QoS, signal strength within the zone, capability of maintain active sessions, and the types of services offered.

The WIMAX BS/PoS will send an order to the MS for signal strength measurement and MS start scanning for the concerned PoA recommended by the MIIS/HLR server (MIH_Scaned_concerend_PoS_REQ_parameters). The recommended UTRAN/GPRS network work on a cellular technology and will check the network layer parameter for MS and then MAC layer which is a cellular MAC will also check the availability of MS in cellular radio. Because our MS is

MIH enabled (media independent) so MS will authorize in UTRAN/GPRS network. The recommended network PoS will send the MIH_Authorised_concerened_PoS_CNF_parameters message to MS. MS then sent back a signal strength measurement message to the WiMAX BS/PoS.

The WIMAX BS/PoS sends a confirmation to the MIIS server stating the readiness of the wireless device to execute handover. The WIMAX BS/PoS communicates with UTRAN/GPRS PoS and send a (MIH_N2N_HO_Query_Resourse) request and response. The UTRAN/GPRS PoS has to reserve required resources. Resources have to be guaranteed in both core and target networks. When the execution stage begins, the WIMAX BS/PoS orders the MS to start the handover by indicating the actions over the old and new link (MIH_Net_HO_commit_REQ). Old link resources are not needed anymore so it can be released and MS established the IP connection over the recommended 3G node in UTRAN/GPRS network and reported back to the WIMAX BS/PoS(MIH_Net_HO_Commit_RSP).WIMAX BS/PoS then sent complete handover request to the UTRAN/GPRS PoS (MIH_N2N_HO_complete_REQ).

The UTRAN/GPRS PoS has to respond WIMAX BS/PoS about complete the handover to recommended 3G node (MIH_N2N_HO_complete.RSP). Then, WIMAX releases resources if not already done and MS starts data flowing through 3G/GPRS Network. The vertical handover protocol based on MIH form 3G to WIMAX is vice-versa.

III. ACKNOWLEDGMENT

To select the best network based on the above characteristics, a model is proposed which acquires the information related to neighbor discovery, link information from 802.21 MIHF and, based on this information; it anticipates handover using Fuzzy logic. The proposed model is efficient enough to select the best interface according to traffic nature and signal strength, and it is also maintaining the state of current interface for future decision.

The 3G-WIMAX heterogeneous network has a generic problem of vertical handover. Various vertical handover protocols are present to improve the QoS during vertical handover. Among the three or four technique, the IQDE reduced the overhead and solving the services interruption for QoS improvement. But, no specific vertical handover protocol provides best solution for the 3G-WIMAX heterogeneous network for various parameters like Throughput, delay, jitter time etc.

The new technique aims to improve the throughput and reduce the overhead and time consumption while performing handover as well as allowing the MIIS server to optimize network utilization by balancing loads over available networks. This handover process will be guided by the MIIS server.

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