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Handover Algorithms in 5G network: A Survey

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Abstract

The constant increase in demand of seamless wireless communication is in turn fastening the development of next generations in communication technology. The latest form of technology, 5G wireless technology is scheduled to be released beyond 2020. The system is still in its research stages. To overcome the flaws of the past generations, and provide a harmonious Vertical Handover (VHO) two important networking frameworks are proposed viz. IP Multimedia Systems (MIP) with Session integrated Protocol (SIP) and IEEE 802.21 Media Independent Handover (MIH). The paper states the idea of involving these frameworks and implementing our own Imperative Alternative Media Independent Handover for Vertical Handover using MIH frameworks based on Fuzzy Logic. This provides low connection failure probability (session rejection probability) and quite economical for enhancing VHO in heterogeneous environment of wireless networks. Our proposed algorithm helps reduce the probability of session rejection by around 75%, thereby enhancing the quality and security of connection.

Keywords – *Vertical handoverscenario ,VHOconnection failure, HENMIH.*

I. INTRODUCTION

The proposed 5th generation mobile network (5G) is nowadays a trending topic in the field of communication technology (industrial and academic). The system is supposed to be released beyond 2020 and expected to be low cost and low power, being more safe and reliable than the preceding generations. The optimisation and effective execution of handover is a very important aspect of radio resource management. The affective execution of handover plays a vital role in the reliability and efficiency if the total system. The efficient working of the system helps seamless call execution and delivery in turn enhancing the quality of call connection.

II. LITERATURE REVIEW

As proposed by Omar Khattab[1] and et.al two different mechanisms independently operated by IEEE and 3GPP; namely, Media Independent Handover (MIH) and Access Network Discovery and Selection Function (ANDSF), respectively. These mechanisms enable a seamless Vertical Handover (VHO) between the different types of technologies (3GPP and non-3GPP), such as GSM (Global System for Mobile Communication), Wireless Fidelity (Wi-Fi), Worldwide Interoperability for Microwave Access (WiMAX), Universal Mobile Telecommunications System (UMTS) and Long Term Evolution (LTE). In this paper, we overview these mechanisms and show their components, benefits and drawbacks. Then we present our Imperative Alternative MIH for Vertical Handover (I

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AM 4 VHO) approach based on the approaches that have been studied in the literature with better performance (packet loss and latency), less connection failure (probability of reject sessions), less complexity and more exhaustive for enhancing VHO heterogeneous wireless networks environment.

Further author discuss about simulation results in his another paper entitled " " One challenge of wireless networks integration is the ubiquitous wireless access abilities which provide the seamless handover for any moving communication device between different types of technologies (3GPP and non-3GPP) such as Global System for Mobile Communication (GSM), Wireless Fidelity (Wi-Fi), Worldwide Interoperability for Microwave Access (WiMAX), Universal Mobile Telecommunications System (UMTS) and Long Term Evolution (LTE). This challenge is important as Mobile Users (MUs) are becoming increasingly demanding for services regardless of technological complexities associated with it. To fulfil these requirements for seamless Vertical Handover (VHO) two main interworking architectures have been proposed by European Telecommunication Standards Institute (ETSI) for integration between different types of technologies; namely, loose and tight coupling. On the other hand, Media Independent Handover IEEE 802.21 (MIH) is a framework which has been proposed by IEEE Group to provide seamless VHO between the aforementioned technologies by utilizing these interworking architectures to facilitate and complement their works. The paper presents the design and the simulation of a Mobile IPv4 (MIPv4) based procedure for loose coupling architecture with MIH to optimize performance in heterogeneous wireless networks. The simulation results show that the proposed procedure provides seamless VHO with minimal latency and zero packet loss ratio.

The authors Radhwan Mohamed Abdullah[2] and et.al discussed in proposed paper entitled, 'Enhanced handover decision algorithm in HWN' that transferring a huge amount of data between different network locations over the network links depends on the network's traffic capacity and data rate. Traditionally, a mobile device may be moved to achieve the operations of vertical handover, considering only one criterion that is the Received Signal Strength (RSS). The use of a single criterion may cause service interruption, an unbalanced network load and an inefficient vertical handover. In this paper, author proposed an enhanced vertical handover decision algorithm based on multiple criteria in the heterogeneous wireless network. The algorithm consists of three technology interfaces: Long-Term Evolution (LTE), World-wide interoperability for Microwave Access (WiMAX) and Wireless Local Area Network (WLAN). It also employs three types of vertical handover decision algorithms: equal priority, mobile priority and network priority. The simulation results illustrate that the three types of decision algorithms outperform the traditional network decision algorithm in terms of handover number probability and the handover failure probability. In addition, it is noticed that the network priority handover decision algorithm produces better results compared to the equal priority and the mobile priority handover decision algorithm. Finally, the simulation results are validated by the analytical model.

Further the authors Niall Maher[4] and et.al stated in their research thatin principle, each mobile terminal (node) is, at all times connected to a network and within range of at least one network access point on that network.The area serviced by a Base Station (BS) is identified as its cell. As a mobile node moves it will handover its connection from one cell on a network to another cell. Most network selection approaches use an evaluation of network performance to determine when handover should take place.Traditional handover initiations are based on RSS. Such approaches have evolved by proactively predicting RSS values, though still making use of static handover triggering thresholds. Other criteria that are now taken into account in handover initiations include; bandwidth, latency, link quality and Quality of Service (QoS). Such network selection approaches are limited as they do not consider how the predictable nature of mobility can be used to influence network selection. We propose to weigh the relative importance of the dynamic performance metrics together with

predictable movement patterns in order to optimise network selection. The dynamic selection will be weighed against the probability selection and from this the best path will be selected in order to optimise performance.

The authors Heecheol Song[5] and et.al discussed in a paper entitled, 'Analysis of Vertical Handover Latency for IEEE 802.21-enabled Proxy Mobile IPv6" that low handover latency and IP session continuity are envisioned to be important factors for realizing next-generation all-IP heterogeneous wireless networks. To meet these constraints of the next generation networks, Proxy Mobile IPv6 (PMIPv6) has been considered as one of the IP mobility management protocols in recent years. Much research about the performance analysis of PMIPv6 has been done. However, a PMIPv6-based vertical handover and its performance analysis for heterogeneous wireless networks have not been considered yet. In this paper, we present a performance analysis of vertical handover latency for IEEE 802.21-enabled PMIPv6. Results of the performance evaluation show that the handover latency of PMIPv6 can be reduced with the IEEE 802.21.

The researchers Louta M.[6] and et.al proposed,access Network Selection (ANS) providing the most appropriate networking technology for accessing and using services in a heterogeneous wireless environment constitutes the heart of the overall handover management procedure. The aim of this paper is to survey representative vertical handover schemes proposed in related research literature with emphasis laid on the design of the ANS mechanism. Schemes' distinct features are analyzed and the authors discuss on their relative merits and weaknesses.

Dr. P. P. Karde[7] and et.al has contributed their research in wireless communication stating that,in next generation wireless network the most desirable feature is its ability to move seamlessly over various access network regardless of the network infrastructure is used. The handover between these dissimilar networks can be explored by using vertical handover algorithms. This paper focuses on the vertical handover decision methods and algorithms effectiveness. Most of the algorithms which are based on RSS values provide vertical handover with small delay at a lower rate of throughput. There are such algorithms which provide significant improvements in throughput but at a cost of higher delays. As per the need for the real time applications in next generation wireless networks there is a requirement of developing new optimized algorithms that are able to produce high throughput and minimizing signalling cost and delay.

Researcher Dr. Omar Khattab proposed improvement in the initiation phase stating, one challenge of wireless networks integration is to provide ubiquitous wireless access abilities and seamless handover for mobile communication devices between different types of technologies (3GPP and non-3GPP) such as Wireless Fidelity (Wi-Fi), Worldwide Interoperability for Microwave Access (WiMAX), Universal Mobile Telecommunications System (UMTS) and Long Term Evolution (LTE). This challenge is critical as Mobile Users (MUs) are becoming increasingly demanding for improved services regardless of the technological complexities associated with them. To fulfill these requirements for seamless Vertical Handover (VHO) two main interworking frameworks were proposed by IEEE Group and 3GPP for integration between the aforementioned technologies; namely, Media Independent Handover IEEE 802.21 (MIH) and IP Multimedia Subsystem (IMS), where each of them requires mobility management protocol to complement its work such as Mobile IP (MIP) and Session Initiation Protocol (SIP), respectively. This paper presents an improvement on the traditional Imperative Alternative MIH for Vertical Handover (I AM 4 VHO) algorithm for enhancing VHO in heterogeneous wireless networks environment. Finally, the numerical analysis of the improved algorithm shows lower VHO connection failure (probability of session rejection) compared to the traditional I AM 4 VHO algorithms.

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III. METHODOLOGY

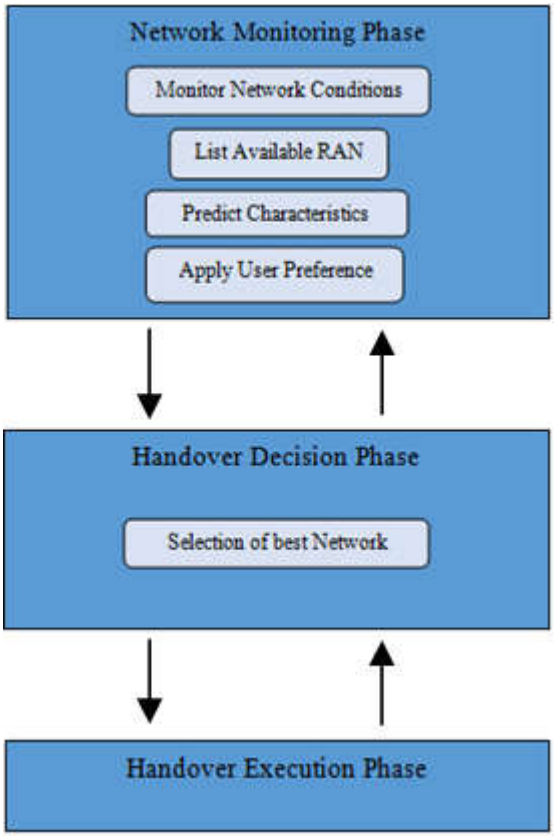

Fig.1. Flow Diagram of execution process

The process is divided into three phases: Network monitoring, Handover Decision and Handover Execution.

Network Monitoring Phase:
This phase monitors the current network conditions and provides the data gathered together with information related to current running applications on the user's mobile device and their resource requirements to the Handover decision module.

Handover Decision Phase:
Handles the network selection process and it initiated either by an automatic trigger for a handover for an existing call connection or by a request for a new connection on the mobile device.

Handover Execution Phase:
Once a new target network is selected, the connection is set up on the target candidate network (and the old connection torn-down).

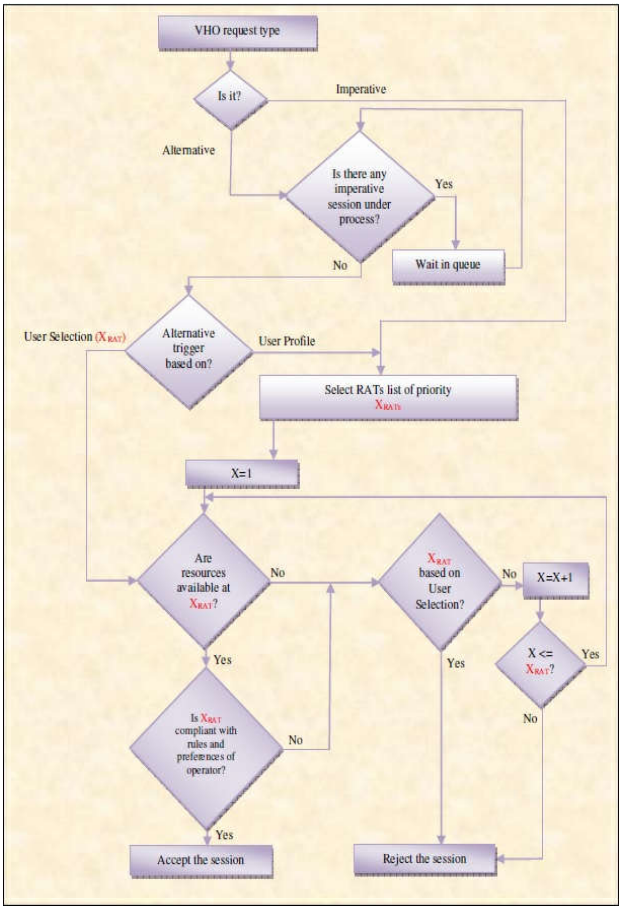

Fig. 2. Proposed Algorithm (Courtesy: I AM 4 VHO algorithm by Dr. Omar Khattab and et.al)

ALGORITHM:

In the process of vertical handover connection failure occurs when the target doesn't have sufficient resources to complete the handover while being executed. For the better execution it is important to monitor the Radio Access Technologies (RAT) list of priority. The proposed algorithm uses fuzzy logic known as Imperative Alternative Media Independent Handover. This algorithm is advantageous for providing low connection failure probability in wireless communication to improve the vertical handover.

Finally, the calculation of the proposed algorithm shows that the probability of minimizing VHO connection failure is reduced.
The algorithm to implement defines two main types of VHO: Automatically Imperative VHO (AIVHO) session and Alternative VHO session (AVHO). The AVHO consists of Automatically Alternative VHO (AAVHO) session and Manually Alternative VHO (MAVHO) session.

IV. DISCUSSIONS

The Handover Decision Module interacts with the channel module in order to get the needed RSRP measurements.

Massive infrastructure is required to build the network. Number of base station increases, if more capacity is required. Increment in users leads to increase the complexity in network management. Seamless connections throughout the network have to be provided Handovers needed. Tight resource planning strategy needed (increased number of cells impels huge number of time slots and carrier frequencies assigned per cells).Resource management needed to support resource planning.

The proposed algorithm can be used faithfully in Mobile communication for efficient connection.

V. CONCLUSION

Handover is the key technology in the research of next generation of wireless mobile communication. It ensures the continuous connection of the communication when the communication terminal crosses the cell.Handover can improve the validity and reliability of the whole communication system.In 5G application scenarios, the handover decision algorithm and the handover executing mechanism are the key factors that affect the performance of handover technology.S

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