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Handover Schemes in Wireless Networks: Its Advancements and Trends

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Abstract*: *Heterogeneous Network (HetNet) are widely employed networks. These networks bear the responsibility of providing services to customers. But, there are some complexities that occur because of changing the base stations of different regions. To sustain the stability of the services, handover is required to be placed in the network which transfers the request from initial access point or parent station to another. An important study has been conducted to attain better and effective communication results in HetNets. This review displayed a literature survey that recognizes the approaches utilized to execute a handover. Along with this, the whole procedure of HO is also given. This paper may help n analyzing different mechanisms in future research.

Keywords: Heterogeneous Network, handover, VHO process, handover management.

I. INTRODUCTION

Different access of wireless networks for example WLAN (Wireless Local Area Network) using WiFi and ad-hoc network, WMAN (Wireless Metropolitan Area Network) using WiMax standard, forms Het Nets [1]. Recently, because of union of several transmission networks and applications of mobile devices having multi-mode, therefore several communication paths generated between the core network and mobile user devices. There are distinct wireless technologies. Moreover, in today's world, meeting all the requirements of the user is not possible for a single wireless technology. Thus, wireless Het-Nets are emerged as an inevitable trend to provide ubiquitous services. It raises the requirement for a solitary unified approach that can integrate and enables the terminals of the mobile to roam between access networks seamlessly and efficiently [2]. The term "handover" or "handoff (HO) [3] is referred to the procedure in which a MS (mobile station) is transferred to one BS (base station) from another. For instance, handover is when an ongoing vocal sound or video call is seamlessly transferred from a channel to another through the core network. To be more specific, it is the procedure of applying the other communication channels linked to the existing connection during an underway communication call or session. Handover is categorized into horizontal (HHO)and vertical handover (VHO). There are some important competencies of VHOs over HHOs which are given below:

1. VHOs should be arises among different access technologies.
2. Several network interfaces are employed in the procedure of VHOs.
3. It includes many IP addresses.
4. Unlike in horizontal handover, the parameter of QoS can be modified and considered multiple parameters.
5. VHO arises in multiple wireless connections

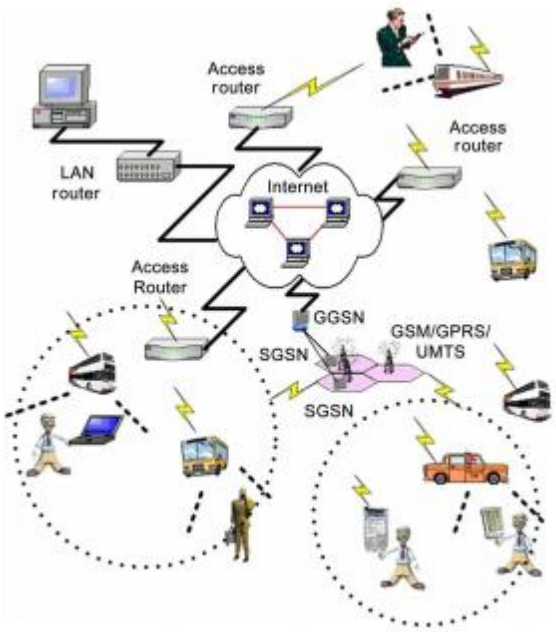

Figure 1: Architecture of a wireless Het Net

Further, performing handover in wireless Het Net is linked to the QoS offered to end users by the network. Received Signal Strength Indicator (RSSI), bandwidth or Signal to Interference plus Noise Ratio (SINR) are important factors that are taken into consideration while taking a HO decision to choose the optimal target radio link access. In this access, a series of issues can affect the decision to choose the goal best radio link. Based on this assumption, context-awareness is defined in [4,5] which considers the information that presents the users' situation and network status concerning the time, network provider, location, location, user activity. The context-aware is more diversified in wirelessly connectivity Het Net.

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Thus, the network performance indicator is impacted either through the network performance, the last users equipment and described context. These approaches are complementary used to ensure network performance and the best-perceived service. In brief, poor network performance can disturb the consumer experience but the better functioning quality does not involve good quality of fulfillment of the end-user.
Therefore, the consideration of context-awareness in this kind of networks is very important. However, the procedure of HO includes three main stages: initiation process, selection of network, and the HO execution. One of the essential issues is how to select dynamically the best access network which can satisfy the mobile user requirements [6].

II. VERTICAL HANDOVER SCHEME

In this network, mobile consumer has to perform handover (HO) in different domains to keep the stability in the information connection and quality of services. In general, the procedure of vertical handover (VHO) is further distributed into three phases that are delineated below [7]:

- **Handover decision**

The decision of handover includes selecting the goal fact of attachment. It also decides at what time the handover will take place in the network.

- **Radio link transfer**

This process contains the growth of the links with novel attachment points.

- **Channel Assignment**

In this phase, channel resources are allocated. The algorithms designed for VHO conclusion helps in selecting the optimum network for the terminals of mobile to connect between all the existing applicants.

Handover Management in Het Net

The major aspect of handover management is in developing the solutions supporting scenarios of mobility. This mechanism helps MT to manage the continuity in connection when it transfers from one BS (access router or point of attachment) to other. The features of the handover technique are described.

Handover management procedure

Handover method is described into three aspects by various works [8, 9]:

Handover Data Collection: It is used to gather all the required information to decide the requirement of HO that should be further initiated. It should be considered a system discovery phase or initiation stage.

Handover Decision: This network selection determines whether and how to implement handover by using appropriate access networks while considering user preferences.

Handover Execution: in this process, the handover is executed within the channels decided in the proviso phase to maintain the continuity in the communication.

III. RELATED WORK

To serve effective services to users, different authors have been performed by the researchers. This section delineated the literature survey is considered to understand the utilization of different technologies for handover decisions to make communication without any interruptions. The following information is categorized on the context of alertness and fuzzy neural network.

A. Fuzzy logic and neural networks based strategies (FL/ NN) [10]

Fuzzy Logic and Neural Networks are applied to recognize the different access networks where the handover could be performed. The innovative result of algorithms are established through merging FL and NN with different attributes and criteria for real and non-real applications

To fascinate the bandwidth requirement for users, VHO algorithms based on NN was proposed [11, 12]. It recognizes the RSS drop and generates HO decisions. In [12], the geolocation capabilities were combined into WLAN, to swap the location data among IP equipment and for getting information that is approaching WLAN AP in MT. For selecting the relevant time to handover, NN performs handover decision algorithms. Chan et al. this study projected a solution integrating FL where the satellite mobile and terrestrial networks function with one another. The major objective of the HO decision algorithm is to fulfill the objective by selecting a network or a segment.

Kustiawan et al. designed a algorithm of HO decision that was dependent on the fuzzy logic with channel equalization [14] method known as a Kalman filter to adequately minimize the HO initiations. There was 88.88% cut down in handover, shown by the simulation results.

Calhan et al. designed a handoff based on ANN to minimize the handoff latency. The outcome of simulation showed that cut off in handoff number and handoff delay was valid [15].

Alsamhi et al. reviewed a handoff algorithm to improve QoS in high-altitude platforms by using NN [16]. NN based VHO algorithm utilizing machine learning is introduced in [17] to obtain continuous connectivity and good connectivity of calls. The outcome showed that blocking and handoff rate was improved.

The result of performance showed an improvement of QoS anticipated by both data and audio service. The advanced selection of network algorithms was designed on the optimization of particle swarm [18]. Results reveal that the working of the system automatically minimizes the computational time and complexity.

Xiaohuan Yan et al. [19] gave a complete survey of a VHO algorithm that was developed to fulfill user needs. Several VHDA were also considered that consist of QoS-based, cost function-based, RSSI-based schemes. By using ANN a solution was proposed for difficult tasks of handoff [20]. The recommended method was capable of differentiating the existing network by matching user preferences that were predefined. Simulation study exhibits that the mechanism allowed the users to access the target network immediately and changes in throughput can be neglected precisely.

Capka et al. developed a new neural network prediction system capable of capturing certain patterns exhibited by operators transferring in a wireless environment that is presented [21]. A neural network-based method to access the model network and an adaptive parameter adjustment algorithm is presented by Chai, R., et al. [22]. Results demonstrated the allowance of the method to the users: access rapid to the network which can avoid the variation experienced in the throughput.

In [23], Nan, W., et al. designed a vertical handoff decision in HetNets based on particle swarm optimization was presented. This technique assists in decreasing the probability of blocking calls. Mubarak et al. discovered a fuzzy logic based algorithm called self- adaptive handover algorithm [24]. The output of the simulation showed a minimization in ping pong handover as well as the handover delay precisely.

B. BASED ON CONTEXT AWARENESS

In [25] author proposed planning mechanism-based context-awareness HO in Het Nets. Two combined approaches were originated by the researchers for context-awareness handover: For hiring weight of individual-level and TOPSIS for decision approach and GA that guarantees QoS needs. Another context alert of selecting the network algorithm was designed in [26]. It was access network-based adjusted WPM. To decide on the WPM and TOPSIS technique, it required a method of weight distribution for assigning weight to each condition. In [27], the author presented the basics of VHO method in different stages: HO execution, HO information, HO decision. The author classified and proposed the major VHDA in literature into various categories that depend on different parameters and metrics to figure out the optimal network to make satisfactory decisions. The author in [28] proposed a thorough survey of VHD algorithms that were made to provide and satisfy the appropriate QoS. According to X. Yan et al., the algorithm of handover decision utilized and assess tradeoffs in case of complex and efficient implementation. Savitha and Chandrasekar [29] performed a comparative analysis among WPN and SAW techniques to choose the best network. Also, the overview of techniques that reduces the break-in processing the HO algorithms is presented. Moreover, Ho's decision in Het Nets is also covered by [30-34].

Hongwei Liao et al[30] designed a VHO algorithm that utilized a fuzzy control mechanism. The simulation of the planned methods was performed in case of cost, power level, and bandwidth.

Further, Rashid A. Saeed et al [31] represented a latest technique of decreasing the break-in WiFi and WiMAX adaptation layer during the conversion of the protocol. From the evaluation, it is measured a good approach.

Z. Dai, et al. [32] designed a VHO algorithm to maintain the continuity during the communication and to enhanced the user throughput. Xu Haiboet al [33] represented the latest method to achieve seamless handover which is controlled by the terminal. In [34], the major taskshandled by the Het Net are defined.

The literature survey showed that several techniques are utilized by taking the effective handover decisions. NN and FL are proved as better approaches in case of designing an efficient approach to make a HO decision.

IV. CONCLUSION

Handover (HO) is the one of the main issue in communication between wireless networks. This study reviewed different approaches designed for handover execution. Neural networks and fuzzy logic are the frequently applied technologies to optimize the handover decision. The survey presented that introducing fuzzy logic can reduce the HO in the network.

Besides this, QoS parameters played an important role to this end. Other factor includes obtained strength of signal indicator, cost function. Optimization algorithms are employed to accomplish the optimal decision of the HO in Het Nets. The mechanisms gave better results but still, there is a scope of improvements in the techniques.

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