*IOSR Journal of Electronics and Communication Engineering (IOSR-JECE)*
*e-ISSN: 2278-2834,p- ISSN: 2278-8735.Volume 12, Issue 4, Ver. III (Jul.-Aug. 2017), PP 07-12*
*www.iosrjournals.org*

# Vertical Handoffs in 5$^{th}$ Generation Wireless Networks

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***Abstract:*** *The communication system is different type of method are used, there are wireless communication and wire communication. In wireless communication different generation is 1G to 4G. In is paper we study that tutorial on vertical handoff methods in the evolving 5G wireless communication networks. The 5G Network haveIntegration architectures for various wireless access networks are described. Here main intention handoff methods of 5G and classification, desirable handoff features, the handoff process, and multimode mobile terminals are discussed. A section is devoted to some recently proposed vertical handoff techniques. We propose a vertical handoff decision algorithm that determines whether a vertical handoff should be initiated and dynamically selects the optimum network connection from the available access network technologies to continue with an existing service or begin another service.*

***Keywords:*** *Vertical handoff in 5G wireless communication, Evaluation of Network, Mat lab*

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Date of Submission: 17-07-2017 Date of acceptance: 28-07-2017

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## I. Introduction

The wireless communication evaluations stated in 1971, after that different type of communication technic are arrived. In that 1st Generation to 4th generation, the 1$^{st}$generation technic only has voice communication, 2$^{nd}$ generation voice and data communication is possible, and at a time only one voice or data communication is possible. After that 3$^{rd}$ generation wireless communication stated, in 3$^{rd}$ generation both voice and data communication is there. And data rate is speed to 2$^{nd}$ generation communication system. offer that 4$^{th}$ generation, in that date rate is very high and area coverage is more. In this paper we study that who implement the next generation of network and what are the parameter are used. In next generation of wireless communication system is have high data rate multimedia services to end users since the networks have characteristics that complement each other. The evolution of 5$^{th}$ generation networks will increase the growth in development of a diverse range of high-speed multimedia services, such as location-based services, mobile entertainment services, e-commerce, and digital multimedia broadcasting. The design and development of 5$^{th}$ generation wireless communication networks will allow seamless intersystem roaming across heterogeneous wireless access networks and packet-switched wireless communications. A major challenge of the 5$^{th}$ generation wireless networks is seamless vertical handoff or inter-system handoff across the multi-service heterogeneous wireless access networks as vertical handoff is the basis for providing continuous wireless services to mobile users roaming across the heterogeneous wireless networks. Multimode mobile terminals will have to seamlessly roam among the various access networks to maintain network connectivity since no single network can provide ubiquitous coverage and high quality-of-service provisioning of applications. Users will increasingly expect all their services to be accessible anywhere and from any device.

## II. Heterogeneous Wireless Acess Networks

The 5$^{th}$ generation of cellular or wireless communications is expected to be purely IP-based and consist of access networks and a converged core network. The evolving 5G network will seamlessly integrate various types of wireless access networks including the following:

- Wireless personal area networks, such as Bluetooth, that provide range-limited ad hoc wireless service to users.

- Wireless local area networks, such as 802.11x (Wi-Fi), that provide high-throughput connections for stationary or quasi-stationary wireless users without the costly infrastructure of 3G.
- Wireless metropolitan area networks, such as 802.16, that provide wireless services requiring high-rate transmission and strict quality of service requirements in both indoor and outdoor environments,
- Wireless wide area networks, such as Universal Mobile Telecommunications System, that provide long-range cellular voice and limited-throughput data services to users with high mobility.
- Regional/global area networks.

The signal strength of heterogeneous wireless access networks typically different terms, coverage, data rate, latency, and loss rate etc. Therefore, each of them design is practically support a different set of specific services and devices. However, these networks will coexist and use a common IP core to offer services ranging from low-data-rate non-real-time applications to high-speed real-time multimedia applications to end users since the networks have characteristics that complement each other. The limitations of these complementary wireless access networks can be overcome through the integration of the different technologies into a single unified platform (that is, a 4G system) that will empower mobile users to be connected to the 5$^{th}$ Generation system using the best available access network that suits their needs.

## III. Vertical Handoffs In 5G Wireless Networks

Mobility management is a main challenge in the evolving multi-service 5G heterogeneous network. The 5$^{th}$ generation heterogeneous consists of two components: location management and handoff management. And Location management tracks and locates the mobile terminal (MT) for successful information delivery.

Handoff management maintains the active connections for roaming Mobile Terminals as they change their point of attachment to the network. Handoff is the mechanism by which an ongoing connection between an MT and a correspondent terminal is transferred from one point of attachment to the network to another. That is, handoff is the mechanism by which an MT keeps its connection active when it migrates from the coverage area of one network attachment point to another. In cellular voice telephony and cellular data networks, such a point of attachment is called an access point, and in wireless local area networks, it is called a base station.

The 5$^{th}$ generation communication network using handoff method. Itcan be classified using the network type involved into horizontal handoff and vertical handoff cases as an MT moves within or between different overlays of a WON. Horizontal handoff is a handoff that occurs between the APs or BSs of the same network technology. In other words, a horizontal handoff occurs between the homogeneous cells of a wireless access system. For example, the changeover of signal transmission of an MT from an IEEE 802.11g AP to a geographically neigh bouring IEEE 802.11g AP is a horizontal handoff process. The network automatically exchanges the coverage responsibility from one point of attachment to another every time an MT crosses from one cell into a neighboring cell supporting the same network technology. Horizontal handoffs are mandatory since the MT cannot continue its communication without performing it. Vertical handoff is a handoff that occurs between the different points of attachment belonging to different network technologies. For example, the changeover of signal transmission from an IEEE 802.11g AP to the BS of an overlaid cellular network is a vertical handoff process. Thus, vertical handoffs are implemented across heterogeneous cells of wireless access systems, which differ in several aspects such as received signal strength bandwidth, data rate, coverage area, and frequency of operation. The implementation of vertical handoffs is more challenging as compared to horizontal handoffs because of the different characteristics of the networks involved. In general, there are two types of vertical handoff: upward and downward. An upward vertical handoff is a handoff to a wireless overlay with a larger cell size and lower bandwidth. A downward vertical handoff is a handoff to a wireless overlay with a smaller cell size and larger bandwidth. Thus, a mobile device performing an upward vertical handoff disconnects from a network providing smaller coverage area and higher access speed to a new one providing broader coverage but lower access speed), while a mobile device performing a downward vertical handoff disconnects from a network providing broader coverage area and lower access speed to a new one providing limited coverage but higher access speed.

The vertical handoff process may be divided into three phases:

- Network discovery
- Handoff decision

### 1. Network discovery

The 5th generation wireless communication is searching a mobile terminal for reachable wireless networks during the network discovery process. A multimode serviceis reachable if advertisements can be heard by the Mobile Terminal. The simplest way to discover reachable wireless networks is to always keep all interfaces on. It is critical to avoid keeping the idle interface always on since keeping the interface active all the time consumes the battery power even without receiving or sending any packets.

**2. Handoff decision**

Handoff decision is the ability to decide when to perform the vertical handoff and determine the best handoff candidate access network. Horizontal handoff decisions mainly depend on the quality of the channel reflected by the RSS and resources available in the target cell. A handoff is made if the RSS from a neigh bouring BS exceeds the RSS from the current BS by a predetermined threshold value.

**Next Generation Multimode Terminals**

The evolution toward 5th generation networks will necessitate a user-centric approach where users can access different access networks and services using a single device equipped with multiple radio interfaces. Terminals and devices capable of supporting different types of access technologies are being designed. The next generation of mobile terminals includes devices capable of supporting multiple access systems by incorporating several interface cards and appropriate software for switching between multiple interface technologies. An intelligent multimode terminal should be able to decide autonomously the active interface that is best for an application session and to select the appropriate radio interface as the user moves in and out of the vicinity of a particular access technology. The decision regarding the switching of the interface and the handoff of the active sessions to the new active interface may be decided based on network conditions, QoS requirements of the running applications, and user preferences. Requirements that need to be fulfilled in order to design intelligent multimode terminals include:

- The terminal should operate with minimum inputs from the user. From the perspective of a user experience, it is preferable to carry out these decisions in an automated manner rather than querying the user every time a new interface becomes available or an old interface disappears.
- Radio access interfaces should be selected based on network conditions, QoS requirements of applications, and user preferences.
- The requirements of applications should be determined and then a decision made whether an application could benefit from changing interfaces.

Traffic should be balanced while changing the active interface in a way that is transparent to the user, that is, as seamlessly as possible.

The multimode terminal must be capable of:

- Detecting the availability of access networks.
- Finding, receiving and processing measurements regarding the characteristics of available access networks.
- Accessing, modifying and storing the user profile.

## IV. Recently Proposed Vertcal Handoff Techniques

The 5th generation communication Vertical handoff decision has recently received much attention. In that different type of vertical handoff decision algorithm are proposed in the research literature. In that first category is based on the traditional strategy of using the RSS combined with other parameters, and in this paper is show that the optimal value for the dwelling timer is dependent on the difference between the available data rates in both networks. The second category combines several metrics such as bandwidth and service cost for handoff decision.the authors propose a policy-enabled handoff across a heterogeneous network environment using different parameters such as available bandwidth , power consumption, and cost.

The cost function fn of the network n is given by:

$$f_n = w_b \cdot \ln(1/B_n) + w_p \cdot \ln(P_n) + w_c \cdot \ln(C_n) \ \left(\sum w_i = 1\right),$$

where*wb*, *wp*, and *wc*are the weights of the parameters. The cost function is estimated for the available access networks and then used in the handoff decision of the MT. The cost function-based vertical handoff decision algorithm for multi-services handoff was presented in [9]. The selection of the optimal network, *n_opt*, is based on

$$n\_opt = argmin(f^n) \ \forall \ n,$$

where*fn*is the handoff cost function for network *n,* and is calculated as

$$f^n = \sum_s \left(\prod_i E^n_{s,i}\right) \sum_j f_{s,j}(w_{s,j})\, N(Q^n_{s,j}),$$

The about given N(Qns;j) is the normalized QoS parameter, in that Qns;j, representing the cost in the jth parameter to carry out services on network n, and the fs;jis represented as fs;j (ws;j). In fs;j (ws;j) is the jth weighting function for service s and Ens;i is the ith network elimination factor of service s. The available network with lowest cost function value becomes the handoff target. However, only the available bandwidth and the RSS of the available networks were considered in the handoff decision performance comparisons. In 5$^{th}$ generation communication is have multimode terminal. In multimode terminal is in a better position to make handoff decisions since it has access to information relating to its capabilities, and knowledge of surrounding access networks and user profiles. This calls for the development of a terminal management system responsible for detecting available access networks and for making optimal network selection based on all gathered information. Optimal operation of the 5G network system can be achieved through the joint contributions of the management systems possessed by both the network and the Mobile Terminal. A network management system will be responsible for joint management of the heterogeneous network resources and the provision of QoS to users. A TMS possessed by the MT will be responsible for the intelligent monitoring of the MT's status, for detecting available access networks in the vicinity of the MT, for making optimal access network selection, and for interaction with the NMS. In present a mobile terminal architecture for devices operating in heterogeneous environments, which incorporates intelligence for supporting mobility and roaming across access networks.

## V. A Vertical Handoff Decision Algorithm

In 5$^{th}$ generation communication system, we describe our proposed vertical handoff decision algorithm that possesses many desirable features, and prove the viability and implementation of our proposal by a performance evaluation.

**Overview of the Vertical Handoff Decision Algorithm**

The overview of the Vertical handoff decision algorithm is shown in figure below .the vertical handoff in a heterogeneous wireless environment depends on several factors. A handoff decision in a next generation wireless network environment must solve the following problem: given a mobile user equipped with a contemporary multi-interfaced mobile device connected to an access network, determine whether a vertical handoff should be initiated and dynamically select the optimum network connection from the available access network technologies to continue with an existing service or begin another service. Consequently, our proposed vertical handoff scheme consists of two parts:
(a) A Fuzzy Logic Handoff Initiation Algorithm which uses a fuzzy logic inference system (FIS) to process a multi-criteria vertical handoff initiation metrics,
(b) An Access Network Selection Algorithm which applies a unique fuzzy multiple attribute decision making access network selection function to select a suitable wireless access network.
Then the two-part algorithm is executed for the purpose of finding the optimum access network for the possible handoff of the already running services to the optimum target network.

- A *fuzzifier*which transforms the crisp inputs into degrees of match with linguistic values.
- A *fuzzy rule base* which contains a number of fuzzy IF-THEN rules.
- A*database* which defines the membership functions of the fuzzy sets used in the fuzzy rules.

The access network selection scheme involves decision making a process of choosing among alternative courses of action for the purpose of attaining a goal or goals in a fuzzy environment. It can be solved using FMADM which deals with the problem of choosing an alternative from a set of alternatives based on the classification of their imprecise attributes. The multiple attribute defined access network selection function selects the best access network that is optimized to the user's location, device conditions, service and application requirements, cost of service and throughput. The block diagram shown in Figure describes the vertical handoff decision algorithm.

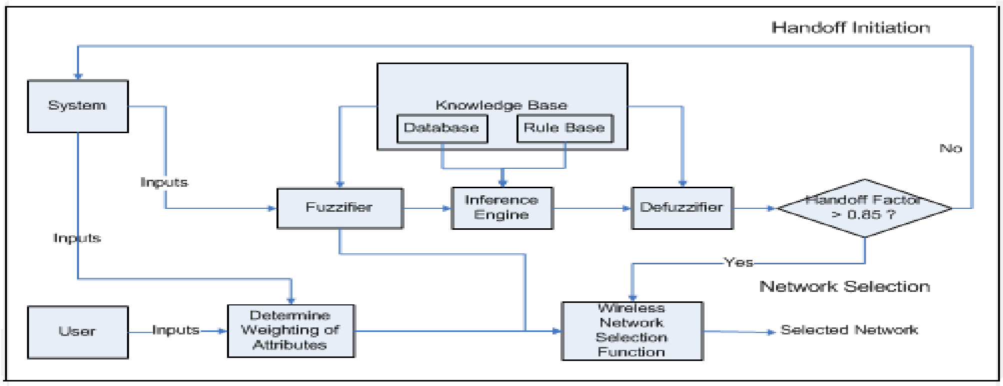


**Figure 1:** Block diagram for Vertical Handoff Decision

Vertical handoff is more complex because an MT can maintain connectivity to many overlaying networks that each offer varying QoS. Therefore, the optimal time to initiate vertical handoff requires the handoff algorithm to process a range of parameters. Computing and choosing the correct time reduces subsequent handoffs, improves QoS, and limits the data signaling and rerouting that is inherent in the handoff process. To process vertical handoff-related parameters, we use fuzzy logic, which mimics the human mind and uses approximate modes of reasoning to tolerate vague and imprecise data. Fuzzy logic inference systems express mapping rules in terms of linguistic language. A Mamdani FIS can be used for computing accurately the handoff factor which determines whether a handoff initiation is necessary between an UMTS and WLAN. We consider two handoff scenarios: handoff from UMTS to WLAN, and handoff from WLAN to UMTS.

**Handoff from UMTS to WLAN**

A fuzzy logic inference system can be implemented in the MT as a Handoff Initiation Engine to provide rules for decision making. Suppose that a MT that is connected to a UMTS network detects a new WLAN. It calculates the handoff factor which determines whether the MT should handoff to the WLAN. We use as input parameters the RSSI, data rate, network coverage area, and perceived QoS of the target WLAN network. The RSSI and data rate indicate the availability of the target network. The crisp values of the input parameters are fed into a fuzzifier in a Mamdani FIS, which transforms them into fuzzy sets by determining the degree to which they belong to each of the appropriate fuzzy sets via membership functions (MFs). Next, the fuzzy sets are fed into a fuzzy inference engine where a set of fuzzy IF-THEN rules is applied to obtain fuzzy decision sets. The output fuzzy decision sets are aggregated into a single fuzzy set and passed to the defuzzifier to be converted into a precise quantity, the handoff factor, which determines whether a handoff is necessary.

## VI. Results

The 5th generation wireless communication system is shown. In this system vertical handoff method is study. In section we implemented 5G system and we study different parameter of 5 generation wireless system.In this system we got different parameter value and we calculated energy, area coverage, and throughput of the signal.

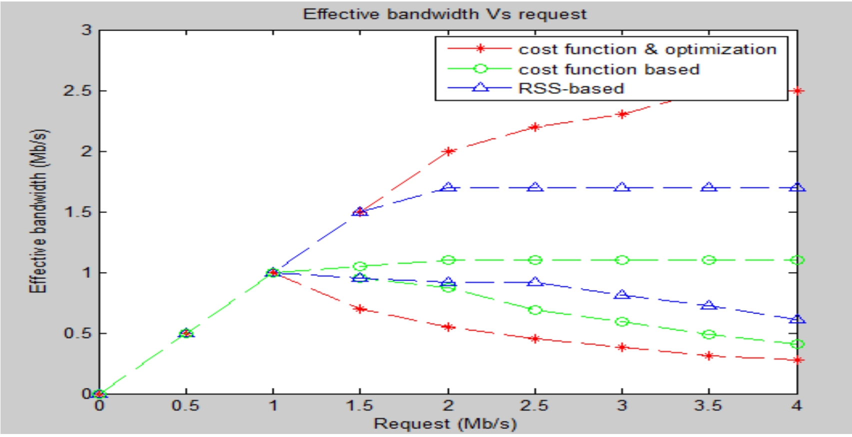


**Figure 2**: Effective bandwidth of request

RSS about two networks is shown in the figure. In this diagram RSS vs time interval of network. The system calculating LTE and Wimax. When LTE is less thenWimax the handoff will be done. And system will be Wimax mode.

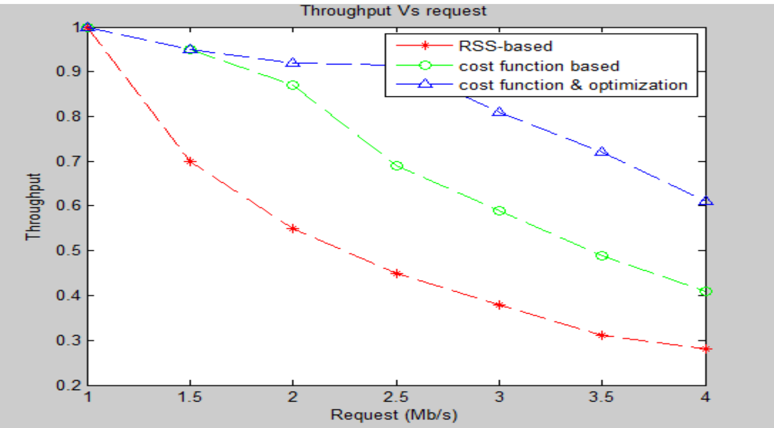


**Figure 3:** Throughput Vs request

The state of mobile station in LTE and Wimax network is shown in the figure. In this figure LTE and Wimax handoff time interval is shown. The different two signal will be taken in the system and In that proper signal will be received a system.

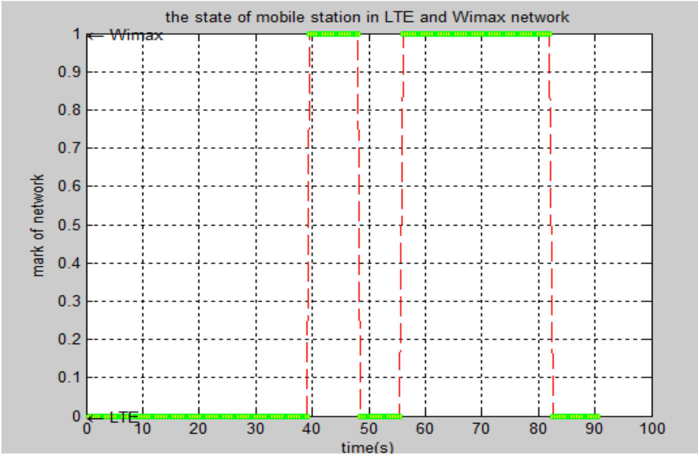


**Figure 4**: the state of mobile station in LTE and WiMAX network

Effective bandwidth Vs request is shown in the figure. In this figure different parameter,energy of the signal and perfumes of the system is shown. In this system we stated form zero and we calculated different parameter of system.

## VII. Conclusion

In this project. We study about 5Th generation system. And here we increase the speed of data rate and range of the system. This system will be takes two different signal. and handoff technic will be take place.A major challenge of the evolving 5G wireless networks is seamless vertical handoff across the multi-service heterogeneous wireless access networks. A key issue that aids in providing seamless vertical handoff is handoff decision. This chapter presents a tutorial on the different aspects of vertical handoff a 5G multi-network environment. Integration architectures for various wireless access networks, handoff classification, desirable handoff features, multimode mobile terminals, and the complete handoff decision process are described. Some recently proposed vertical handoff techniques are presented. Finally, we propose a vertical handoff decision algorithm that determines whether a vertical handoff should be initiated and dynamically selects the optimum network connection from the available access network technologies to continue with an existing service or begin another service. We prove the viability of our proposal by a performance evaluation.

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IOSR Journal of Electronics and Communication Engineering (IOSR-JECE) is UGC approved Journal with Sl. No. 5016, Journal no. 49082.

Santhosh Kamath. "Vertical Handoffs in 5th Generation Wireless Networks." IOSR Journal of Electronics and Communication Engineering (IOSR-JECE) 12.4 (2017): 07-12.