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Various Handoff Strategies Using Fuzzy Logic

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Abstract
In a highly integrated ubiquitous heterogeneous wireless environment, the selection of a network that can fulfill end-users' service requests while keeping their overall satisfaction at a very high level is vital; a wrong selection can lead to undesirable conditions such as unsatisfied users, weak QoS, network congestions, dropped and/or blocked call sand wastage of valuable network resources. The selection of these networks is performed during the handoff process when an MS switches its current PoA to a different network due to the degradation or complete loss of signal and/or deterioration of the provided QoS. Traditional schemes perform the necessity of handoffs and trigger the network selection process based on a single metric such as RSS

Key Words: Handoff, Fuzzy Logic, Qos , PoA

I. Introduction

Over the past few years, there have been several exciting innovations in wireless network technology [1]. As can be seen from Figure 1.1, the current trends and demands in the area of wireless communications are to deliver real-time multimedia applications over heterogeneous wireless networks with guaranteed Quality of Service (QoS). The consumer demand, to access such applications and services anywhere and anytime, is continuously on the rise. New technological developments, such as the Fourth Generation(4G) wireless systems [2, 3] and their integration, offer these rich services and applications at high data transfer rates and allow for global roaming and seamless mobility over a diverse range of heterogeneous wireless networks [4-6]. Mobile Stations (MSs) in a typical 4G network will be equipped with multiple interfacesand will have the required intelligence to make improved decisions to be able to connect to a variety of Access Networks (ANs) in order to provide rich multimedia services. These access networks include different types of cellular networks such as Code Division Multiple Access (CDMA), Global System for Mobile Communication (GSM), High Speed Downlink/Uplink Packet Access (HSDPA/ HSUPA), General Packet Radio Services (GPRS) [7, 8], Bluetooth-based Personal Area Network (PAN) [9], IEEE 802.11 Wireless Local Area Network (WLAN) [10], IEEE 802.16 Worldwide Interoperability for Microwave Access (WiMAX) [11], Vehicular Ad-hoc Network (VANET) and Satellite networks. These wireless networks often have overlapping coverage in the same service areas and can offer innovative services based on user demands. The ultimate goal of such an environment is to provide simple, uninterrupted accesses to any type of 2 desired service at any time, independent of devices, locations and available networks,[12] while also maintaining satisfactory user experience in a cost-efficient manner. The wireless technologies in a heterogeneous wireless network are usually different from each other from a technological point of view. Most of them usually differ in terms of, but not limited to their offered bandwidths, operating frequencies and costs, coverage areas and latencies. Currently, no single wireless technology claims to provide cost-effective services, which offers high bandwidths and low latencies to all mobile users in a large coverage area. This is where the need for well-organized vertical handoffs (VHOs) between heterogeneous wireless technologies becomes evident. The term "handoff" or "handover" [13] refers to the process of transferring a mobile station from one base station or channel to another. One example is a seamless transfer of an ongoing voice or video conversation from one channel served by a core network to another. More clearly, handoff is the process of changing communication channel (frequency, data rate, modulation scheme, spreading code, or their combination) associated with the current connection, while a communication session (or call) is in progress.

The rest of the paper is organized as follows. Section II outlines the literature review of Handoff system with blocking codes. Sections III describe the performance parameter. Proposed technique is described in Section IV. Simulated results of Handoffare discussed in Section V. The conclusions are given in Section VI.

II. Literature Review

In [52], the authors have proposed a vertical handoff decision (VHD) algorithm that maximizes the overall battery lifetime of the mobile terminal in the same coverage area and also aims at equally distributing the traffic load across the networks. This algorithm when implemented in multiple Vertical Handoff Decision Controllers (VHDC) located in the access networks can provide the VHD function for a region covering one or multiple APs or BSs. In [53], a decision method called ALIVE –HO(adaptive lifetime-based vertical handoff) is proposed which is based on the Received Signal Strength (RSS).This parameter is used to estimate coverage of the wireless network and the best network is selected using vertical handoff algorithms. ALIVE- HO algorithm dynamically adopts to the Mobile Terminals (MT) velocity to decrease the unnecessary number of handoffs and ping pong effect but the probability of handoff increases with the distance from the AP. It is also established that the number of unnecessary handoffs using ALIVE handoff algorithm is less than that of algorithms based on traditional RSS hysteresis. According to the authors, the simplest method to increase RSS is to increase the transmit power, which needs further investigation, since an increase in transmit power might lead to an increase in interference leading to a decrease in QoS.

Both QoS parameters and handoff metrics are required for vertical handoff decision [54]. The handoff metrics and QoS parameters are categorized under different groups (e.g., bandwidth, latency, power, price, security, reliability, availability). Various vertical handoff decision mechanisms have been proposed recently. In [55], the handoff decision mechanism is formulated as an optimization problem. Each candidate network is associated with a cost function. The decision is to select the network which has the lowest cost value. The cost function depends on a number of criteria, including the bandwidth, delay and power requirement. Appropriate weight factor is assigned to each criterion to account for its importance. In [56] an Active Application Oriented (AOO) vertical handoff decision mechanism is proposed. The decision mechanism considers the QoS parameters required for the applications (e.g., minimum and maximum bandwidth requirement for voice service). Each candidate network is associated with a utility function. The chosen network is the one which provides the highest utility value. The utilization function is a weighted sum of various normalized QoS parameters.

The decision about access network selection in a heterogeneous wireless environment can be solved using specific multiple attributedecision making (MADM) algorithms such as Technique for Order Preference by Similarity to Ideal Solution (TOPSIS), Weighted Product Model (WPM),Weighted Sum Model (WSM), Analytic Hierarchy Process (AHP), andGrey Relational Analysis (GRA). An integrated AHP and GRA algorithm for network selection is presented in [57] with a number of parameters. In[58], Pahlavanet al. present a neural networks-based approach to detect signal decay and making hand off decision. Stevenset. al have selected parameters such as band width, delay, jitter and biterr or rate (BER)to conduct their comparisons of some of the prominent decision algorithms in literature, that is, simple additive weighting (SAW), technique for order preference by similarity to ideal solution (TOPSIS) ,multiplicative exponent weighting (MEW) and the grey relational analysis (GRA). Good performance improvement of SAW and GRA over several verticalh and off decision algorithms has been obtained. The GRA decision algorithm provided aslightly higher band width and lower delay for inter active and background traffic classes while MEW,SAW and TOPSI Sprovided almost similar performance In[59], Chanetal. Propose a mobility management in a packet-oriented multi-segment using Mobile IP and fuzzy logic concepts.

Hand over is separated in to initiation, decision and execution phases. MIP issued in the execution phase, fuzzy logic is applied to the initiation and fuzzy logic and multiple objective decision making concepts are applied during the decision phase to select an optimum network. W. Zhang ,in[60], proposes that the vertical hand off decision is formulated as a fuzzy multiple attribute decision-making (MADM)problem. Fuzzy logic isused to represent the imprecise in formation of some attributes of the networks and the preferences of the user.In [61], Pramod Goyaland S.K. Saxena proposes the Dynamic Decision Model, for performing the vertical hand off to the“ Best” inter face at the “best” time moment, successfully and efficiently. They proposed Dynamic Decision Model for VHO which adopts three phase approach comprising Priority phase, Normal phase and Decision phase. In[62], a Markov decision process (MDP) approach for vertical hand off decision making problem is proposed. This MDP approach takes in to account multiple fact or such as user preference, network conditions and device capability. Although there have been various vertical hand off decision algorithm sproposed, most of them applied through Fuzzy logic theory based quantitative decision algorithm (FQDA) has an advantage over tradditional fuzzy logic algorithm which there is no need to establish a data base to store rule bases.

III. Performance Parameter

describe different traffic classes and several handoff metrics that are used as inputs to the various vertical handoff algorithms. These metrics are described below:

2.1.1 Available Bandwidth: Measured in bits/sec (bps), available bandwidth is used to determine traffic-loading conditions of an AN and is a good measure of available communication resources at the BS.

2.1.2 End-to-End delay:

Total time delay between two users or applications. It is the sum of all time components above the MAC, those time components outside the considered ring and the MAC end-to-end delay between source and destination on the considered ring.

2.1.3 Jitter:

Jitter is the undesired deviation from true periodicity of an assumed periodic signal in electronics and telecommunications, often in relation to a reference clock source. Jitter may be observed in characteristics such as the frequency of successive pulses, the signal amplitude, or phase of periodic signals. Jitter is a significant and usually undesired, factor in the design of almost all communications links (e.g., USB, PCI-e, SATA, OC-48). Jitter can be quantified in the same terms as all time-varying signals, e.g., RMS, or peak-to-peak displacement. Also like other time-varying signals, jitter can be expressed in terms of spectral density (frequency content). Jitter period is the interval between two times of maximum effect (or minimum effect) of a signal characteristic that varies regularly with time.

2.1.4 Bit Error Rate: The bit error rate is the number of bit errors divided by the total number of transferred bits during a studied time interval. BER is a unitless performance measure, often expressed as a percentage.

IV. Proposed Techniques

1. Double-click the input variable service to open
the Membership Function Editor.

2. In the Membership Function Editor, enter [0 10]
in the Range and the Display Range fields.

3. Create membership functions for the input variableservice.

a. Select Edit>Remove All MFs to remove the default membership functions for the input variable service.

b. Select Edit>Add MFs. to open the Membership Functions dialog box.

c. In the Membership Functions dialog box, selectgaussmf as the MF Type.

d. Verify that 3 is selected as the Number of MFs.

e. Click OKto add three Gaussian curves to the input variable service.

4. Rename the membership functions for the input variable service and specify their parameters.

a. Click on the curve named mf1 to select it and specify the following fields in the Current Membership Function (click on MF to select) area:

In the Name field, enter poor ,In the Params field, enter [1.5 0].

b. Click on the curve named mf2 to select it and specify the following fields in the

c. Current Membership Function (click on MF to select) area:

In the Name field, enter good.

In the Params field, enter [1.5 5].

Click on the curve named mf3and specify the following fields in the Current Membership Function (click on MF to select) area:In the Name field, enter excellent.In the Params field, enter [1.5 10]

V. Simulation & Result

The performance parameter is given in Fig 1.The overall all the system is gives the idea about handoff stragies

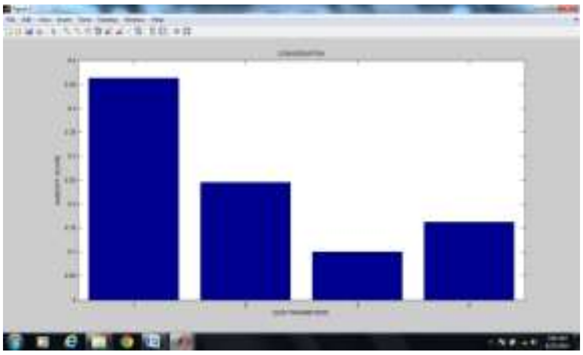

Fig 1 Handoff score/Importance weight for QOS parameters of conversation

VI. Conclusion

In a highly integrated ubiquitous heterogeneous wireless environment, the selection of a network that can fulfill end-users' service requests while keeping their overall satisfaction at a very high level is vital; a wrong selection can lead to undesirable conditions such as unsatisfied users, weak QoS, network congestions, dropped and/or blocked call sand wastage of valuable network resources. The selection of these networks is performed during the handoff process when an MS switches its current PoA to a different network due to the degradation or complete loss of signal and/or deterioration of the provided QoS. Traditional schemes perform the necessity of handoffs and trigger the network selection process based on a single metric such as RSS.

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