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MULTIPLE ATTRIBUTES BASED VERTICAL HANDOVER DECISION ALGORITHM FOR NEXT GENERATION NETWORKS

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ABSTRACT

Presently we are in the age of mobile and information technology. As there is a rapid increasing communication demand there is a big challenge to minimize the communication delay. In case of a mobile network switching time between the networks is high compare to transmission delay. The objective of this paper is to provide an optimal network selection algorithm that allows mobile users to choose the Best Access Network (BAN) with seamless manner. 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 signaling cost and delay [1].Here we have considered the heterogeneous network having LTE and Wi-Fi standards. This algorithm combines two Multi Attribute Decision Making (MADM) methods such as Analytic Network Process (ANP) method to find the weights of the available networks, and the Grey Relational Analysis (GRA) method to rank the alternatives [6].Here we considered the multiple attributes like Bandwidth, security, Cost and delay. Model is simulated using MATLAB to provide the priority based reduced number of attributes for hand off decision. This algorithm can even be extended for different attributes.

Keywords: Hand off, MADM, ANP, GRA, LTE, and Wi-Fi.

I INTRODUCTION

The next generation wireless networks have most desirable feature in its ability to move seamlessly over various access network regardless of the network infrastructure it is using. Handoff mechanism is the process of Switching the channels associated with the current connection while a call is in progress. While crossing a cell boundary or by degradation in quality of service of the signal in the current channel handoff is initiated. Poorly designed handoff schemes tend to generate very heavy signaling traffic and, thereby, a dramatic decrease in the quality of service (QoS) [3].

Hands off mechanisms are classified into two types, Horizontal hand off and vertical hand off. In case of horizontal hand off there is a Switching the connection between two similar network types like between two cells

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of LTE or Wi-Fi network. Similarly in case of vertical hand off the connection is switching between two dissimilar networks like LTE and Wi-Fi.

As shown in figure1, during horizontal hand off; connection is switching between two Wi-Fi networks and for vertical hand off; connection is switching between Wi-Fi and Cellular network.

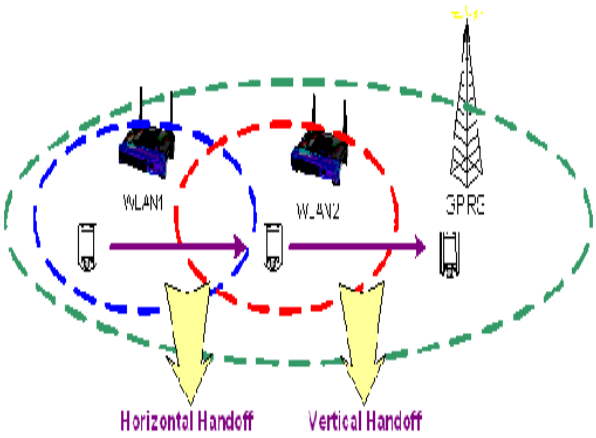

Fig.1 Hand off Mechanism

The rest of the paper is organized as follow. A related work to this paper is described in section II. Section III provides proposed model. Simulation setup is presented in section IV. Section V provides simulation results and the paper is concluded in section VI.

II RELATED WORK

An RSS based Hand off mechanism with SG faltering has introduced in order to minimize the number of hand off decisions. Here the received signal strength coming from multipath fading can be smoothened by using SG based filter. As a result of which drastic fluctuations in the RSS can be minimized. AS a result of which there is reduced number of hand off decisions [4].

As Handoff is the process of changing the channel associated with the current connection while a call is in progress [1].

Each application requires different QoS, so the network selection may vary accordingly. To achieve this goal and to select the best network for a mobile terminal when moving from one network to another, it is necessary to have a good decision making algorithm which decides the best network for a specific application that the user needs based on QoS parameter [5].

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The various handoff strategies used for executing handoff may in general be classified into: Mobile-Controlled Handoff (MCHO), Network-Controlled Handoff (NCHO), and Mobile-Assisted Handoff (MAHO). In MCHO, the mobile node continuously monitors the signal of access points and initiates the handoff procedure when some handoff criteria are satisfied. NCHO is a centralized hand off process in which network makes handoff decisions based on measurements of the signal quality of mobile stations at a number of base stations (BS). In MAHO a mobile node measures the signal strength of surrounding base stations and then decides whether or not to initiate the hand off procedure. MCHO has a low complexity in terms of network equipment. However, latency and loss of large number of packets during inter-subnet handoff can be high. Handoff decision in MAHO is made by the network for coordination among mobile nodes and global optimization. However, in heterogeneous wireless access networks only the mobile nodes have the knowledge about the kind of interfaces they are equipped with, so the network dependency on the mobile node is high. Therefore, MCHO with some assistance from the networks is better suited for implementing vertical handoff [2].

Many attributes are used to decide Quality of Service parameter in the Hand off mechanisms like Jitter, Band Width; Delay Loss. ANP and GRA based approaches are used to simulate the multiple attribute hand off mechanism [6].

Multi Attribute Decision Making (MADM) is used to select a target network from a set of adjacent networks that have many attributes to be considered for the handoff process. Vertical handover decision schemes using Simple Additive Weighting (SAW) for network selection is proposed, it uses the overall score of a candidate network to select target network, and the score determined by the weighting sum of all the parameters values [7].

The other popular traditional Multi Attribute Decision Making (MADM) methods are: 2) Technique for Order Preference by Similarity to Ideal Solution (TOPSIS); 3) Analytic Hierarchy Process (AHP); 4) Grey Relation Analysis (GRA).

III PROPOSED MODEL

Hand off decisions can be made based on the multiple attributes as a result of which we have to take all these attributes into consideration before handoff. As the number of attributes increases hand off decision becomes more complex.

RSS is the major factor to decide the hand off; sometimes along with this other parameters are also important. In some of the situations even though RSS is sufficient enough to go for hand off but the other attributes are not enough to provide hand off, like bandwidth at the destination network is already occupied by other nodes hence there is no free band width is available to allocate it for the new device. Due to this reason multiple attributes has to consider for the hand off mechanism.

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In this proposed model we are considering heterogeneous network constituting of LTE and Wi-Fi Standards. From [6], it is better to use the following attributes, which decides Hand off process are Bandwidth, security, Cost and delay.

The network selection problem is based on three levels ANP hierarchy. The level 1 includes three criteria QoS, security and cost, the level 2 includes four QoS parameters such as Band Width, Delay, Jitter and Loss and the level 3 includes two available networks Wi Fi and LTE. Our vertical handover algorithm consists of the four following steps:

1) Assigning level-1 weights: The ANP method is used to get a weight of the decision criteria of level 1.

2) Assigning level-2 weights: The ANP method is used to get a weight of the decision criteria of level 2.

3) Assigning weights to level-3: The weight vector of each available network is calculated by multiplication of the weight vector obtained in level 1 with the weight vector obtained in level 2.

4) Selecting the best access network: the method GRA is applied to rank the available networks and select the access network that has the highest value of performance.

This combined approach of attribute distribution method called ANP and ranking Mechanism Called GRA is used to provide the high quality hand off mechanism with minimum time delay. The proposed network model is shown in figure 2.

IV SIMULATION SETUP

We perform the simulation for background traffic class by using MATLAB in order to select the suitable vertical handover algorithm which should be used. This simulation model consists of one LTE base station with red colored star, four WiFi base stations with green colored star and a mobile node is represented with a pink color star. Other nodes are indicated by blue dots which indicate other mobile nodes which are not taking any part during the hand off mechanism.

All the node properties assigned to mobile nodes. All base station properties assigned to Wi-Fi and LTE base stations. A network scenario is created so that a mobile node is moving in the communication range between two Wi-Fi stations. Whenever a mobile node comes in the transmission rang of two Wi-Fi stations hand off decision algorithm is initiated. This algorithm is as shown below. And the simulation setup presenting the diagrammatic representation is shown in figure 2.

```
function [x] = attribute_anpgra
a = randi(5, 1, 1);
        %inverse computation
inv_a = 1/a;
BW = [1 a;inv_a 1];BW
% vertical sum calc
s1 = sum(BW(:,1));s1
```

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```
s2 = sum(BW(:,2));s2
%dividing each element
 %in the matrix by its      %collumn sum
for k = 1:2
BW(k,1) = BW(k,1)/s1;
end
for p = 1:2
BW(p,2) = BW(p,2)/s2;
end
BW
end
```

Based on the hand off decision whether to handoff or not to handoff is decided by ANP GRA based algorithm.

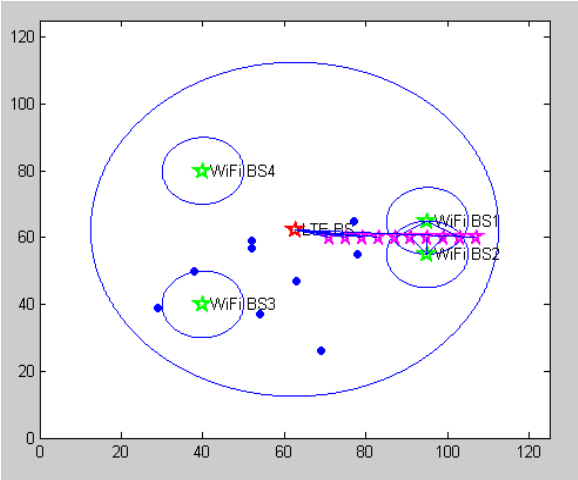

Fig. 2 Proposed Simulation Model

V SIMULATION RESULT

Simulation result provides us to which WiFi network the mobile node is to be hand off from the already connected LTE network. There are three possibilities arises like it may not be having sufficient RSS to hand off to Wi-Fi network this scenario is shown in figure 3 from simulation result.

Fig. 3 Mobile node Handoff is not necessary.

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As the RSS of Wi-Fi network is strong compare to the Available LTE network then there is a possibility of Handoff. In this case for the network shown in figure 2 there are two possible network to which handoff is to take place. This handoff possibility can be decided by the proposed simulation model. Based the network attributes mobile may handoff to Wi-Fi 1 as shown in figure 4 or WiFi 2 as shown in figure 5.

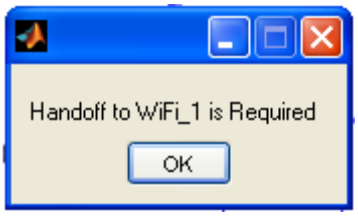

Fig. 4 Handoff to WiFi 1 decision

Fig. 5 Handoff to WiFi 2 decision

VI CONCLUSION AND FUTURE SCOPE

This paper presents a simulation model for the vertical handoff mechanism. Here we have considered LTE and WiFi heterogeneous networks. Multiple attributes are considered for the handoff decision. An ANP and GRA based algorithm is proposed for efficient vertical hand off between LTE and WiFi. This proposed algorithm considers two different WiFi network attributes before actual Handoff should take place. This can even be extended for multiple WiFi network Handoff decision at a time.

This proposed algorithm can be used for the randomized network topology. As a future scope concurrent scanning approach can be introduced to further reduce the handoff delay [8]. As a result of which better Quality Of Service can be achieved. A fuzzy logic based intelligent algorithm can be proposed to improve the QOS [9].

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