Multi-Attribute Network Selection Scheme using Analytic Hierarchy Processing and Entropy Weighting in Heterogeneous Wireless Network

Nikhil Chaudhari[#1], Vivek Jog [*2]

[#*]*Department of Computer engineering,*
Smt. Kashibai Navale College of Engineering,
Pune, Maharashtra.

***Abstract*— Seamless session continuity is the main objective in heterogeneous wireless network. To fulfil this need seamless session continuity IEEE proposed 802.21 media independent handover framework. Scope 802.21 is only to initiate and execute the handover process, but it does not give any perspective about network selection problem. In this paper we blend two different multi-attribute decision making schemes analytic hierarchy process (AHP) and entropy weighting (EW) to select best network among the available networks. We mainly concentrated to network selection phase to reduce processing delay during handover.**

***Keywords*— Heterogeneous wireless network, vertical handover, media independent handover, analytic hierarchy process, entropy weighting.**

I. INTRODUCTION

In the heterogeneous wireless network session continuity is main goal. To fulfil these requirements for seamless VHO the Media Independent Handover IEEE 802.21 (MIH) mechanism was produced by IEEE group to provide seamless VHO between the different types of technologies (3GPP and non-3GPP). Since no handover decision is made within MIH [3], much research is done for handover decision making. Media independent handover framework allow mobile node to seamlessly handover to another network. This seamless handover is also called as soft handover, in soft handover a new connection is made before breaking the old connection.

Types of handover:

1) Horizontal handover
2) Vertical handover

Horizontal handover is performed if there are two base sations that are using same radio access technology. This type of mechanism use radio signal strength as a criteria for handover decision. It is triggered when mobile node expirince the distortion in radio signal. It normaly occurs when cell node travels from one cell to other.

While when mobile node with multiple radio interfaces is roaming through heterogeneous wireless network vertical handover is carried out to maintain the session contynuty. Verticle handover is done in the network with diffrant access technology.

The handover system has three phazes:

Handover intiation, handover decision making, handover execution.

A. Handover initiation
In this phase collection of the network information is done.

B. Handover decision making
In this phase available criterias are compaired with each other to rank the networks

C. Handover execution
In this phase network link is switched from current network to target network.

Aim of this paper is mainly select the best target network from available visiting networks. i.e. handover decision phase. Proposed scheme must select target network from available visiting network, and maintain the continuity of the on-going session of user by switching over it.

II. RELATED WORK

Various literatures proposed different handover decision strategies.

In literature [3] the network selection strategy is presented which devises the network selection problem as morkove decision process.

In [5] the vertical handoff decision is formulated as fuzzy logic based multi-attribute decision making (MADM).

In literature [4] Simple Additive Weighting SAW, Technique for Order Preference by Similarity to Ideal Solution(TOPSIS), Grey Relational Analysis (GRA) and Multiplicative Exponent Weighting (MEW)are compared for vertical handover decision.

In [8] vertical handoff decision scheme is proposed to avoid the processing delay and power consumption and their objective is to reduce the overload and the processing delay in the mobile terminal.

In [7] a handoff decision scheme distributed vertical handover decision making uses the MADM to reduce the processing delay. In [10] the paper is mainly used to decrease the processing delay and to make a in heterogeneous wireless environment.

In [12] Sourabh Kumar, Md. Aabid and Dr. Vidushi Sharma discribes the fuzzy logic based decision making in next generation of wireless network. Author considers cellular

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network, WiMAX and WiFi as scenario of HWN, network selection is carried on the basis of parameters such as received signal strength (RSS), bandwidth, coverage and preferred network. And finally conclude with simulation analysis of given decision making algorithm.

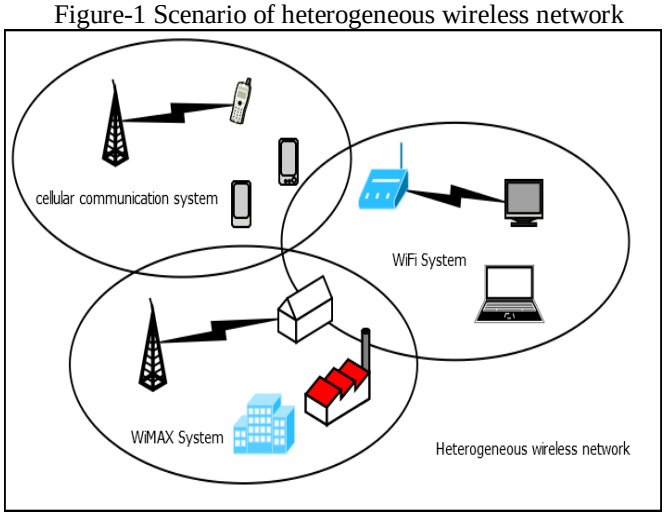
In [13] Venkata Sai Krishna.M and L.Rajesh uses fuzzy logic for deciding the target network in nex generation of networks. fuzzy logic based network selection is divide into three stages first initiation of handover process second is selection of suitable network selection and last ranking of the selected network. Radio signal strength (RSS) and qulity of service (QoS)are the parameter used to consider the handover initiation.

In [11] a distributed network selection scheme using the SAW method to avoid the drawbacks. In [14] the paper provides the four steps integrated strategy for MADM based network selection to solve the problem.

III. SCENARIO OF HETEROGENEOUS WIRELESS NETWORK

Scenario of heterogeneous wireless network in which network selection will take place is shown in figure 1. Heterogeneous wireless network has WLAN, WiMAX and 3GPP.

Figure-1 Scenario of heterogeneous wireless network



IV. MULTI-ATTRIBUTE NETWORK SELECTION SCHEME

Within the approach, the subjective weights' vector of attributes is obtained using AHP. While the objective weights' vector of attributes is calculated by using EW. These two weighting technique are often taken as two multi-attribute decision makers. Particularly, AHP is corresponding to a subjective decision maker, whereas the EW is pictured as an objective decision maker.

Network selection algorithm is based on multi-attribute decision making (MADM). The objective and subjective weighting method are synthesized, and then an integrated attribute weights' vector is obtained. Finally we consider integrated attribute weights. Approach considers that the distinction between users' preference and functional execution of network can't be excessively extensive, which can promise that the users' cannot select the network with poor execution relying upon their preferences.

Our system consists of two phases of Multi-attribute decision making (MADM):

- Analytic hierarchy process (AHP)
- Entropy weighting method (EW)

Where analytic hierarchy processing (AHP) is used to synthesize subjective weights and entropy weighting (EW) used to synthesize objective weights, to make multi attribute decision making.

In order to always select a reasonable network, it is necessary to take a large number of factors into consideration simultaneously. Among all the factors, network attributes compose a large category, which are generally used as decision criteria to characterize different aspects of a network's capabilities. Since these criteria have different measurement units, utilities and inexactness, their values need to be adjusted before combining together. [3report stg1] Multiple attribute decision making (MADM) is sometimes applied to decisions involving multiple objectives or multiple attributes. [2] We use AHP for subjective requirements and EW for objective requirements.

A. Analytic hierarchy processing (AHP)

The idea behind AHP is to decompose a complicated problem into a hierarchy of simple and easy to solve sub-problems.

There are three steps involved in the process:

1) Decomposition – the problem is structured as a hierarchy of multiple criteria, where the top level is the problem to be resolved, the subsequent levels are the decision factors, and the solution alternatives are located at the lowest level.
2) Pair wise comparison – at each level the elements within the same parent are compared to each other, and presented in a square matrix.
3) Weight calculation – the weights of the decision factors are computed by calculating the Eigen vector of the square matrix.

B. Entropy weighting method (EW)

The entropy weight method is an objective method, which calculates the entropy weight of index according to the information entropy of the index.

In EW method, the weight factor is the function of differences among values of the attribute and more value differences imply that the corresponding attributes is given a larger weight that means the greater the information entropy of an index is, smaller the entropy weight of index should be similarly smaller the entropy information of an index greater the entropy weight of an index. In practice we use entropy weighting method for correcting subjective index weight and got objective weight.

Steps to determine entropy weight

1) Normalize the original data.
2) Calculate the entropy of attribute.
3) Calculate the entropy weight of index.

V. SYSTEM FLOW

. Whenever user detects new network or it fee need for handover the network selection process is initiated first step is

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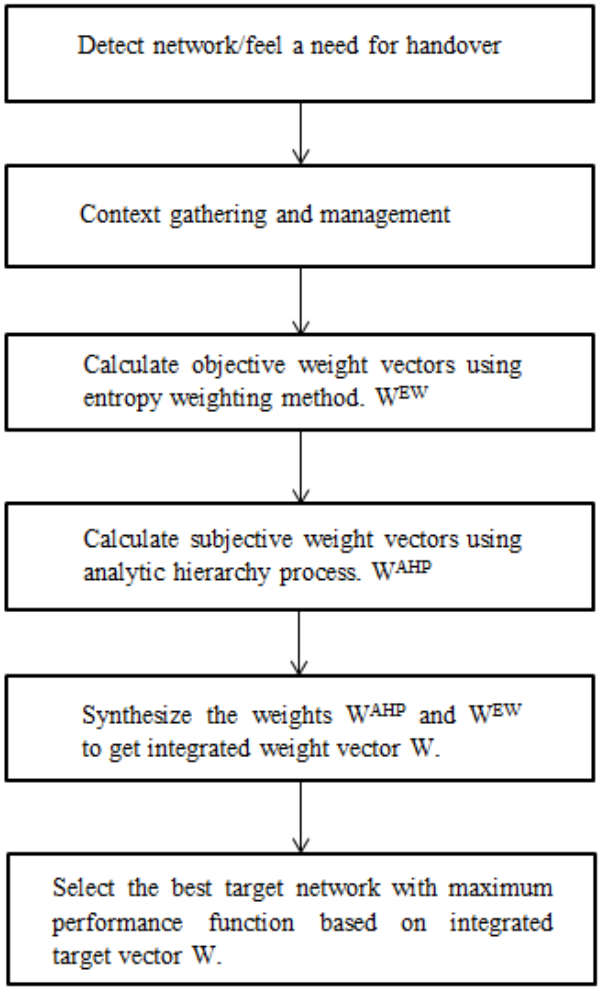
context gathering, information of network as well as user is gathered. As the information is gathered is random and different for different network normalization is done. The objective weights' vector W^{EW} is obtained based on Entropy weighting method. The user's decision matrix A^{AHP} is obtained, and then the subjective weights' vector W^{AHP} is calculated by using analytic hierarchy process. Weight vector of W^{AHP} and W^{EW} are synthesize together to form a synthesized weight vector W Fig. 2 shows the flow of the system. This weight vector is considered for the calculation of score of networks to determine the best one using network selection function.

Figure-2 System flow



So proposed network selection algorithm is expressed as follows:

Step1: Gather network and user information and apply context management to the gathered information.

Step2: calculate objective weight vector W^{EW} from objective requirements of network.

Step3: calculate subjective weight vector W^{AHP} from subjective requirements of user.

Step4: synthesize the weight vectors W^{EW} and W^{AHP} to get integrated weight vector W.

Step5: Apply network selection function to synthesized weight W.

Step6: Select the best target network with maximum performance function.

Step7: Switch to target network and resume data session.

CONCLUSIONS

We presented a novel network selection strategy based on multi attribute decision making. This network selection strategy is blend of two decision makers, namely, objective and subjective decision makers. This focuses selecting unbiased network selection that is not too user specific or network specific in heterogeneous wireless network supporting the concept Always Best Connect (ABC).

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