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SEAMLESS MOBILITY FOR HETEROGENEOUS WIRELESS NETWORKS BASED ON TOPSIS METHOD

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ABSTRACT

Wireless technology has become the most exciting area in telecommunications and networking. In a heterogeneous environment are growing and portable policies frequently have in-built provision for multiple boundaries. The decision algorithm for choosing the best access network has to consider users' requirements for bandwidth, cost, power consumption and the current context such as security and QoS guarantees. The proposed a multi attribute decision making (MADM) devices such as the technique for order preference by similarity to an ideal solution (TOPSIS). This study focuses on three network alternatives such as WIFI, WIMAX and UMTS and three evaluation criteria such as bandwidth, Delay and cost to select the appropriate network.

Keywords:TOPSIS method, Heterogeneous Network, Seamless, Handoff, Multiple AttributeDecision Making.

I. INTRODUCTION

The evolution toward the NGWNs will require a user-centric method anywhere operators can access dissimilar systems and services using a solitary device equipped with multiple radio interfaces such as WPAN, WLAN, WMAN (e.g., mobile WiMax), and WWAN (e.g., UMTS). Terminals and devices capable of supporting different types of access technologies are being designed to eventually replace simple cellular phones, Personal Digital Assistants, Smart Phones, and all other current mobile devices. Multiple access schemes by integrating several boundary cards and suitable software for transferring among several boundary machineries. A quick multimode terminal must be able to decide separately the active boundary that is best for an application term and to select the suitable radio interface as the user moves in and out of the area of a particular access technology. The decision concerning the transferring of the interface and the handoff of the active terms to the original active boundary may be decided based on network conditions, Qos necessities of the running applications, and customer preferences. The objective of achieving seamless integration of the heterogeneous wireless access networks in the NGWN is to offer seamless service continuity and a seamless mobility experience to the mobile user (that is, to make the transition from one access network to another as transparent as possible to the user). From the user's perspective, the seamless

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mobility experience makes the physical movement transparent, preserves the application-level connectivity unaltered and conceals the heterogeneity of the NGWN that is conceived as an intelligent system capable of handling its available resources to provide the best service to the user deprived of any user interference [3]. Horizontal handoff or intra-system handoff is a handoff that transpires among the APs or the BSs of the matching network equipment. In further words, a horizontal handoff transpires among the uniform cells of a wireless access cataloguing. For example, the switch of signal transmission of an MT from an IEEE 802.16e BS to a biologically neighbouring IEEE 802.16e BS is a horizontal handoff procedure [5]. The network repeatedly exchanges the coverage accountability from one point of addition to another every time an MT crosses from single cell into a neighbouring cell supporting the similar network technology. Horizontal handoffs are obligatory since the MT cannot continue its statement without performing it.

II. HANDOFF PROCESS

Both horizontal and vertical handoff processes may be divided into three sequential phases [11] network discovery, handoff decision, and handoff execution. Several handoff algorithms exist that can be used to complete the ongoing handoff process.

2.1 Network Discovery

Network discovery is the process where a mobile terminal (MT) equipped with multiple interfaces searches for reachable wireless access networks. As the multimode MT moves across the network, it has to discover other available access technologies in its surroundings which might be preferable to the currently used access network. For example, a multimode MT using a UMTS access network in an NGWN system needs to discover when mobile WiMAX access networks become available and possibly handoff to a mobile WiMAX if this is more preferable to the operator and/or user, or if the radio signal from its serving UMTS cell starts to deteriorate significantly. The network discovery phase collects information about the network, mobile devices, access points, and user preferences to be processed and used for making decisions in the handoff decision phase.

2.2 Handoff Decision

Handoff decision is the ability to decide when to perform the horizontal or vertical handoff and determine the best handoff candidate access network. It includes access network selection and drives the handoff execution. Suppose an MT that is using a UMTS cell has discovered its available neighbour WiMAX cells. The next issue is whether the MT needs to initiate a handoff to a discovered WiMAX cell. Several vertihcal handoff decision algorithms exist that can be used to make the correct decision to handoff the ongoing connection.

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Handoff metrics are used to indicate whether or not a handoff is needed. In traditional horizontal handoffs which happen in homogeneous networks, only information obtained from the radio-link layer such as the RSS and channel availability are considered for handoff decisions. A handoff is made if the RSS from a neighbouring BS exceeds the RSS from the current BS by a predetermined threshold value.

In vertical handoffs, many network characteristics have an effect on whether or not a handoff should take place. Traditional handoff decision metrics based on the received signal strength indication (RSSI) and other physical layer parameters used for horizontal handoff in cellular systems are insufficient for the challenges of the next generation heterogeneous wireless systems. The RSS alone cannot be used for vertical handoff decisions because the RSSs of different networks cannot be compared directly due to the different characteristics of the overlay heterogeneous wireless networks involved. In order to perform intelligent handoff decisions in the next generation heterogeneous wireless environment and provide seamless vertical handoff, the following metrics are suggested in addition to the RSS [11, 12].

(a) Quality of service: Handing off to a network with better network conditions and higher performance would usually provide improved service levels.

Network conditions: Network-related parameters such as traffic, available bandwidth, network latency, and congestion (packet loss) may need to be considered for effective network usage.

System performance: To guarantee the system performance and provision of improved service levels, a variety of parameters can be measured and employed in the handoff decision, such as the RSS, channel propagation characteristics, path loss, interchannel interference, signal-to-noise ratio (SNR), and the bit error rate (BER).

(b) Cost of Service: The cost of services offered is a major consideration to users since different network operators and service providers may employ different billing plans and strategies that may affect the user's choice of access network and consequently handoff decision.

(c) Battery power: Battery power may be a significant factor for handoff in some cases since wireless devices operate on limited battery power. For example, when the battery level decreases, handing off to a network with lower power requirements would be a better decision.

(d) Security: The ability of a network (including operator networks and corporate networks) to resist attack from software virus, intruders and hackers, and toprotect network infrastructure, services and confidentiality and integrity of customers' data is a major issue and could sometimes be a decisive factor in the choice of a network. The most

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significant source of risks in wireless networks is that the technology's underlying communications medium, the airwave, is open to intruders. A network with high encryption is preferred when the information exchanged is confidential.

(e) Mobile terminal conditions: Mobile terminal conditions include the screen size, portability/weight, performance (processing power, memory, and storage space), bandwidth requirements, networks supported, and dynamic factors such as velocity, moving pattern, and location information. The velocity attribute has a necessary effect and larger weight on vertical handoff decision than in horizontal handoff. Handing off to an embedded network in an overlaid architecture of heterogeneous networks is discouraged when traveling at a high speed since a handoff back to the original network will occur very shortly afterward when the mobile terminal leaves the smaller embedded network.

(f) User preferences: User preferences (such as preferred network operator, preferred technology type, preferred maximum cost) can be used to cater special requests for one type of network over another. For instance, if the target network to which a mobile node

performs a handoff does not offer high security, the user may still decide to use the current network. Depending upon coverage, a user may wish to use a secure and expensive access network (such as UMTS) for his official e-mail traffic but may still opt for a cheaper network (for example, WLAN) to access web information.

(g) Application types: Different types of applications or services such as voice, data and multimedia applications require different levels of data rate, network latency, reliability, and security. Data-intensive applications such as video streaming will perform better when higher bandwidth is available. Real-time applications will need low network latency while non-real-time applications will not be so sensitive to network latency.

2.3 Handoff Execution:

This phase executes the vertical handoff procedure to associate the mobile terminal with the new wireless access network. Handoff execution requires the actual transfer of data packets to a new wireless link in order to reroute a mobile user's connection path to the new point of attachment. It can be implemented by protocols such as Mobile IP and Stream Control Transmission Protocol. Many proposals have been made for implementing handoffs while roaming across heterogeneous wireless networks. These approaches operate at different layers of the Internet protocol stack. We shall review some of these approaches in the next section.

III. MULTIPLE ATTRIBUTE DECISION MAKING ALGORITHM

Multiple attributes decision making (MADM) contracts through the problem of selecting an alternative since a finite and countable set of alternatives that are characterized in terms of their multiple attributes. A typical MADM

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problem is formulated as [6]. Where {A1, A2… Am} denotes m alternatives, and {C1, C2… Cn} represents n criteria or attributes. The selection is usually based on maximizing a multiple attributes utility function. The decision around access network collection in a heterogeneous wireless atmosphere can be resolved using explicit multiple attributes decision making (MADM) processes such as:

Table 1: Parametric Values of Alternatives

	Bandwidth	Delay	Cost
WIFI	20	60	10
WIMAX	30	62	20
UMTS	15	50	8

3.1 TOPSIS Method

The TOPSIS (Technique for Order Preference by Similarity to Ideal Solution) was principal developed by [7]. TOPSIS is comparatively simple and fast, with a logical technique of [8]. It has been proved as one of the best methods in addressing the rank problem issue. The basic knowledge of TOPSIS is that the best selection would be ended to be bordering to the ideal and furthest from the non – ideal [10]. Such ideal and negative-ideal resolutions stay calculated by since the added over all alternatives by [9]. The procedure of TOPSIS method is as follows:

Step 1: Stabilization of the calculation matrix: the process is to transmute dissimilar scales and units between several criteria into common quantifiable elements to allow comparisons across the criteria. Assume a_{ij} to be of the calculation matrix R of alternative j below evaluation measure i then an element rij of the standardized estimation matrix R can be calculated by many normalization methods to achieve this objective.

$$r_{ij} = \frac{a_{ij}}{\sqrt{\sum_{i=1}^{n} a_{ij}^2}} \quad (1)$$

i = 1, 2, 3….n j = 1, 2, 3,...m

Table: 2 Normalized Decision Martix

Networks	**Bandwidth (kbps) (A1)**	**Delay (ms) (A2)**	**Cost (A3)**
Wi-Fi (X1)	0.512	0.602	0.421
WIMAX (X2)	0.769	0.622	0.842
UMTS (X3)	0.384	0.502	0.377

Step 2: Construction of the weighted stabilized decision environment: The weighted regularized decision matrix can be calculated by multi-plying the regularized evaluation matrix rij with its supplementary weight w_j to acquire the result

$u_{ij}=r_{ij}w_j$ (2)

i=1,2,3………n, j=1,2,3,..m

Table 3: weigthes decision matrix

Networks	**Bandwidth (kbps)(A1)**	**Delay(ms) (A2)**	**Cost (A3)**
Wi-Fi (X1)	0.205	0.181	0.126
WIMAX (X2)	0.307	0.187	0.253
UMTS (X3)	0.154	0.151	0.101

Step 3: Determination of the positive and negative ideal solutions: the positive ideal solution B^+ designates the utmost desirable alternative and the negative ideal solution B^- designate the least desirable alternative.

$B^+=(u_1^+, u_2^+, \ldots, u_n^+)$ (3)

B^+= [0.307 0.171 0.187 0.150 0.253]

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$B^{-} = (u_1^-, u_2^-, \dots, u_n^-)$ (4)

B^{-} = [0.154 0.026 0.151 0.037 0.101]

Step 4: Calculation of the disaffectionmeasure: the disaffection from the positive and negative ideal for every alternative can be reserved by the n-criteria Euclidean distance.

$S_i^+ = \sqrt{\sum_{j=1}^{n} (u_{ij} - u_j^+)^2}$ j=1,2,3…..m (5)

$S_i^* = [0.162 \;\; 0 \;\; 0.217]$

$S_i^- = \sqrt{\sum_{j=1}^{n} (u_{ij} - u_j^-)^2}$ j=1,2,3…..m (6)

$S_i^- = [0.059 \;\; 0.219 \;\; 0]$

Step 5: Summation of the relative closeness to the ideal solution: the relative closeness of the ith alternative with deference to ideal solution C_i is defined as

$C_i = \frac{s_i^-}{s_i^+ + s_i^-}$ j=1, 2, 3..m (7)

$Ci = [0.267 \;\; 1 \;\; 0]$

Step 6: Ranking the importance a set of alternatives then can be preference ranked rendering to the descendent order of.

IV. RESULT AND SIMULATION DISCUSSION

In this simulation, the set A represents three candidates' networks which are UMTS, WIFI and WIMAX. The set C represents three attributes which stay cost per byte (CB), available bandwidth (AB), and packet delay (D). We are consist of the three networks, in fig: 1 show the wifi has lower bandwidth, the delay and cost very high. WiMax has higher bandwidth, lesser delay and cost. UMTS bandwidth is very low and its delay and cost has increased very highly.

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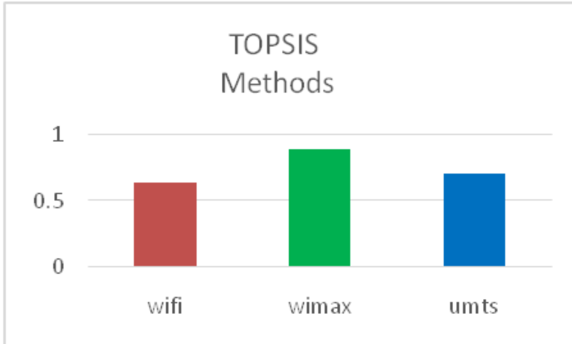

Figure: 1 Topsis method

For TOPSIS, WiMax shows higher values for handoff decision making. So, WiMax can be selected as a better choice for roaming after successful handoff.

4.1 Simulation Discussion

The results is the process and the eight node is using and simulation is the process and consider is implement signal strength and coverage area horizontal and vertical handover process in network signal is the used and node process delay in dynamic decision handover algorithm packet radio time, process, cost, signal strength, simulation time handover drop is another network activation for trough connection for handover seamless heterogeneous wireless network signal connections. After paralleled through both these networks, WiMax has low-slung evolution time and also in height reward. Therefore WiMax gets best for actuality selected for handoffs. The average value has been calculated. This will be valuable when here are extra states and more activities. For each and every transition the average reward can be obtained and compared to predict the optimal network for handoff decision making

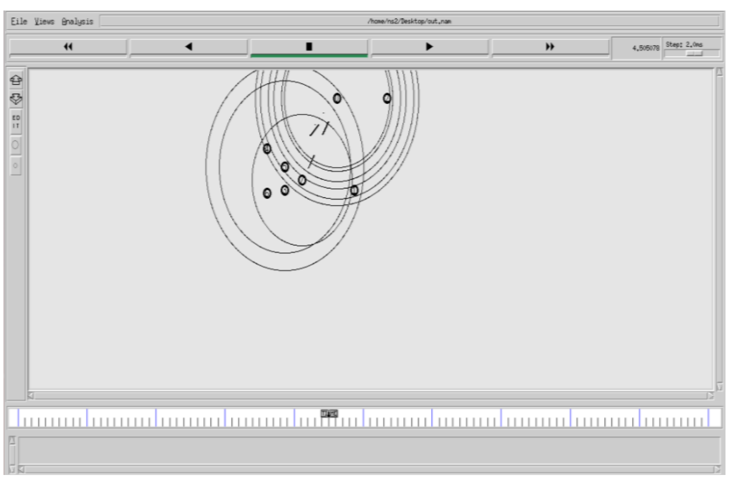

Figure 2: Node creation for connection one to another

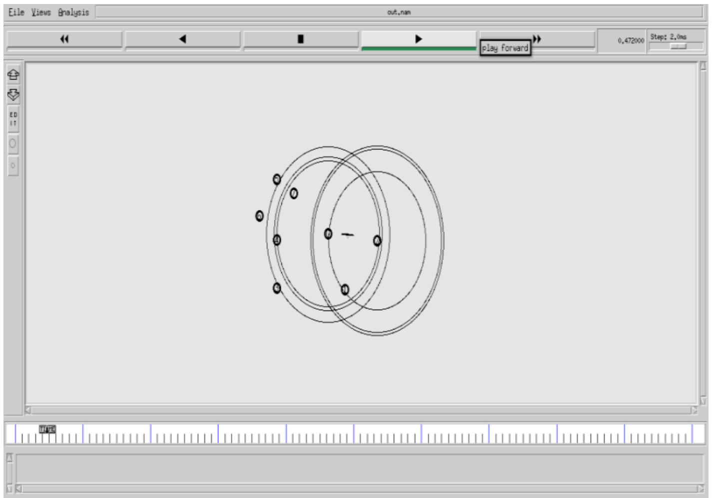

Figure 3: Packet data send mobile terminal

In TOPSIS process we have taken a whole duration of call for analyzation. Other MADM methods use only context aware calculation for finding the desired networks to handover.

V. CONCLUSION

Network collection in heterogeneous networks since several criteria is a complex issue. An implementation of a seamless vertical handoff technique TOPSIS Methods for the handoff evolution district between the WIFI, WIMAX and UMTS cellular network is presented. Upholding the Qos requirements for dissimilar traffic classes unfluctuating later handoff requires the selection of the greatest network amongst the obtainable networks. In this paper a methodology based on TOPSIS Method is proposed for selecting a network during vertical handoff process. Three different networks are used such as WIFI, WIMAX and UMTS. Bandwidth, delay and cost are used as measures for selecting the best network. Thus the simulation results expression that TOPSIS ranks the networks from the best to the worst and the best network is selected for handoff.

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