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A Novel Approach for Optimal Network Selection inHeterogeneous Wireless Networks

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***Abstract*-Today Communication industry concentrates more on the live information transfer without altering the existing infrastructure and hence requires a single convergence platform of all networks' access. The next generation systems support multimode, multi-access and reconfigurable devices to support inter-working of heterogeneous networks. The network selection is user-centric and based on multiple QOS (Quality of Service) parameters like bandwidth, cost, security level, call drop probability etc., to select appropriate networks. The proposed algorithm uses a distance function to generate an ordered list of various access technologies called networks in a particular region according to multiple user preferences and level of interest. Further level of customization is done with user preference in terms of giving priority to few parameters and is implemented by weighted distance function.**

Keywords **-** Multimode, Multi-access, User-centric, QOS, Heterogeneous networks, and distance function.

1. INTRODUCTION

During the past ten years, the proliferation of high-speed networks and new multimedia services has driven the broadband telecommunication networks to the focus of research, development and activities worldwide. An accelerating factor in the IT markets is and will be the concept of mobility [5]. Mobility can be defined as a possibility for a nomadic user to use his network resourcesfreely in any place and in any time. Incorporating mobility into broadband systems require inter-working of the available network services as he roams between different access technologies. This interconnected network has lead to the evolution of a new Paradigm for future communications, namely "Always BestConnected" (ABC)[1], in comparison to typical 2G and 3G concept of "Always Connected". This new paradigm makes the user always be connected through the best network, getting the benefit of best service and access technology.

All-IP based networks become the backbone of heterogeneous environment. Section II presents the different scenarios of the existing system and In Section III, the architecture of heterogeneous environment is presented. In Section IV the proposed algorithm is presented. Section V presents the conclusion.

2. EXISTING SYSTEM

As Cellular Communication evolves from First Generation with cell phone technology encompassed analog standards introduced in 1980s it follows as., The Second Generation comprises digital cellular technology with TDMA (GSM, iDEN...) and CDMA (IS-95). In the existing Third Generation communication, Networks provide the ability to transfer voice and non-voice data over the same network simultaneously. 3G EVDO network currently averages 400 to 700 kbps with peak rates upto 2Mbps. It facilitates low latency data transmission and trade off occurs in the range of coverage. It provides short range wireless communication like Bluetooth (around 10 meters), Wi-Fi (around 100 meters and above) .Thus the QOS constraint has to be compromised to achieve digital voice and data communication.

3. ARCHITECTURE OF HETEROGENEOUS NETWORKS

4G will provide the first opportunity for Broadband access remote locations without an infrastructure to support cable or DSL access. It can provide all available services to even highly mobile people by total convergence of the wireless mobile and wireless access communication in a ubiquitous manner.

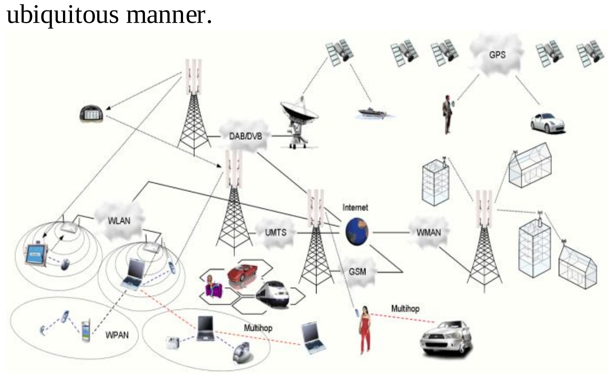

Figure 1. Heterogeneous network

It is not just IP end-to-end communication but over-the-air packet switching. Mobile IPv6 protocol provides seamless connection between mobile nodes. Faster hand-off is accomplished due to high speed transmission. 4G communication ranges at 100 Mbps while moving and 1Gbps while stationary. The major advantage of Next Generation Networks (NGN) is the inter-operability of different standards hampering global mobility and service portability.

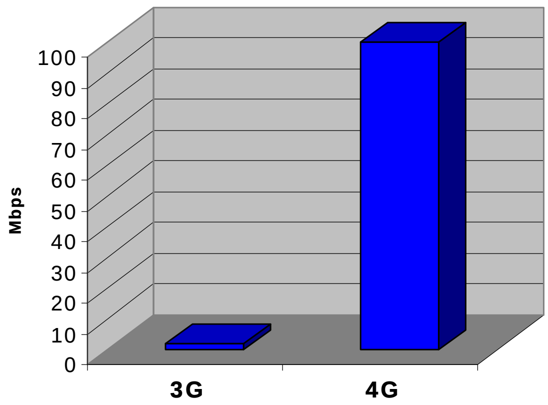

Figure 2. Third Generation Vs Fourth Generation Data rates

4. PROPOSED SYSTEM

The basic concept is the assumption is that every user is unique. The user demands the selection of service among the available networks according to his/her requirements. Thus a novel network discovery and selection scheme has to be proposed such that the selected network satisfies the current session's QOS requirements. The proposed algorithm works on the user-specified parameters. For seamless service, hand-offs are carried out intelligently based on the user's choice of network. Also, the network discovery and selection are proposed to take place in specified time with lower latencies.

A. User-Specific Performance Parameters

1. Bandwidth Utilization: The user chooses a service provider based on the type of data to be transmitted to utilize the bandwidth efficiently. This has to be stored in history because a hand-off is necessary when the bandwidth degrades beyond certain limit. This value is noted as Bandwidth Factor. It is also proportional to the total duration of the session.
2. Call Drop during Handoff: During Handoff, Call Drop Probability of the user may change according to the type of application. It affects the selection of hard and soft handoff. It may also affect the selection of networks in terms of priority of hand-off calls.
3. Cost of Services: User preferences are also based on billing schemes. Customized network selection scheme demands higher costs for higher QOS requirements. It is continuously updated by the user according to his/her profile.

TABLE : 1

SYMBOL	DESCRIPTION
$B_{s,u,k}$	Cost of service
U	User
S	Type of service
K	Session
P_H	Hand off blocking probability
A	Fluctuation constant
T	Mean Session duration
d(T)	Average life of power resource

4. Battery Power: Power is one of the mandatory requirements of wireless access terminal and it varies depending on the type of application. The expected duration of the current session is estimated from the mean duration of the previous sessions that performed similar type of application.
5. Minor Network parameters: Network selection may also depend on certain minor parameters such as security level. It may be well considered in data transmissions involving e-transactions where security is the most important phenomenon. Generally user prefers network with uniform Received Signal Strength and less hand-offs.

B. Weighted Distance Function

Let the set of available networks to the choices of the user are represented as, N= net (1), net (2), net (3)… The user-specified parameters are represented as P= {p (1), p (2), p(3)…The user may be more customized by selecting (say) two essential entities like P= {Bandwidth, Security level}. The analysis of the available access technologies is also made. For net1, P1= {free, low}, for net2, P2= {medium, high} and for net3, P3= {high, medium} and the ordered list is done as X_{BW}= {net1, net2, net3} and $X_{SECURITY}$= {net1, net3, net2} and then ranked according to different parameters.

TABLE2:FEATURES OF THE AVAILABLE NETWORKS

	NET1	NET2	NET3
BU Factor	Medium	Low	High
Call Drop Probability	Low	Medium	Medium
Cost of services	Fixed	Fixed	Data based
Security level	Medium	High	Low

The weighted distance function is customized with the user interest level parameter called l_Z. It is because a disaster management application is more concerned about the Bandwidth for the faster data rate rather than cost or security level.

In this multi-attribute distance function, the parameters are normalized to values ranging from zero to one. A network with billing parameter of 0.9 is better compared to that of 0.5 values.

TABLE 3 : USER-SPECIFIED PARAMETERS WITH LEVEL OF INTEREST

	USER 1	USER 2	USER 3
Appln. of Interest	Live video	E-Transacts	Multimedia
BU Factor	High (1)	Medium (0.5)	Medium (0.4)
Call Drop Prob.	Medium (0.5)	Low (1)	Medium (0.7)
Cost of service	Medium (0.6)	High (0.2)	Low (0.9)
Security level	Low (0.3)	High (1)	Low (0.3)

The proposed flow of algorithm is given as,

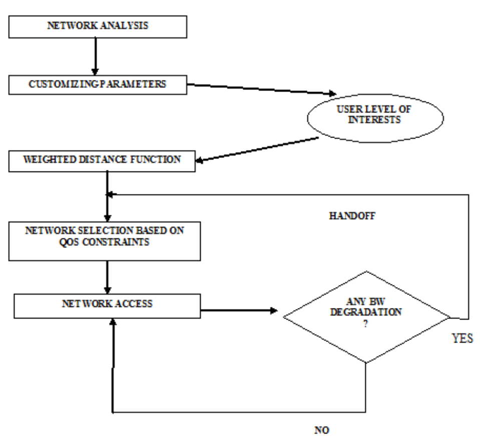

Figure 3 Flow of Algorithm

5. NETWORK SELECTION ALGORITHM

Input: Rank lists α1, α2, and α3 networks.

Output: Optimal ordered list N () based on the User-Customized parameters.

Step1: Sort respective lists α1, α2, and α3.

Step2: Assign position score for each network in each of the n lists.

Step3: For j= 1 to m
For x =1 to n
S (j) = the no. of networks whose score of parameter x is ranked below j in αx.

Step4: Sort N (j) in decreasing order where j=1 to m.

Step5: End

6. CONCLUSION

With the advent of research on moving networks in which the mobility is random, the integration of wireless technologies can improve seamless networking. It is expected to deploy in public transportations that popularize internet access via any service provider with better delivery of QOS services.

Thus, the proposed scheme uses a weighted distance function with user preferences to generate an ordered list of available service providers in a particular region. The discovery and selection process is repeated when the user moves from one region to another (i.e.) during a hand off to make the user best connected to the network.

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