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Enhancing Quality of Service in 4G Networks using Network Simulator

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Abstract:

The huge increase in the growth of user needs on a single convergence platform has brought researchers to explore various aspects/features of Fourth Generation (4G) Mobile Communication System. Selection of application as per the user preference based on QOS(Quality Of Service) is one of the salient feature of 4G.In this research, we deal with 4G networks where selection of an application is based on Rank of the distance function. Where the Rank of the distance function has been calculated for various available services/access technologies, dynamic users in terms of handoff.

Keywords: QOS; 4G; Bandwidth

1. Introduction

In mobile communications systems, after 2G AND 3G, the Fourth Generation (4G) was originally expected as ultra-high speed broadband wireless system. In addition 4G will be a convergence platform providing clear advantages in terms of bandwidth, coverage, power consumption and spectrum usage. It is worth mentioning that the 4G systems [1] are expected to co-exist and inter-work with existing 2G and 3G mobile communication systems as well as satellite, wireless LAN, IEEE 802.16e MAN or WiMax networks, all interconnected through the service provider's IP backbone networks and the internet as shown in Figure 1.

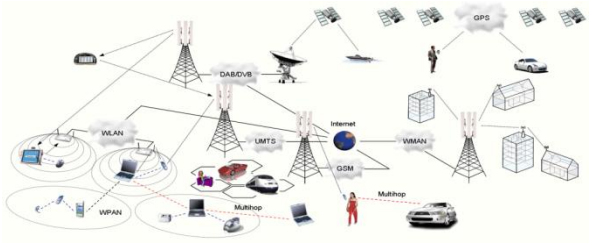


Figure 1 the Heterogeneous Networks

This interconnected network has lead to the evolution of a new paradigm for future communications, namely "Always Best Connected" (ABC), in comparison to typical 2G and 3G concept of "Always Connected", the user will always be connected through the best network, getting the benefit of the best service and access technology.

To realize the above mentioned benefits, each terminal used in 4G networks, need to support multimode, multi-access and reconfiguration capabilities.

1.1 History Of Mobile Communication 1G To 3G

First of all, this family is the wireless telephone family. It is just starting to compete with the wireless Internet family that includes Wi-Fi [2] and the other 802 wireless IEEE standards. But it is a completely different set of standards. The only place the two are likely to merge is in a marriage of phones that support both the cellular and Wi-Fi standards.

a) 1st Generation

The big boom in mobile phone service really began with the introduction of analog cellular service called Analog Mobile Phone Service (AMPS) starting in 1981. This generation is 1G, the first for using cell technology that let users place their own calls and continue their conversations seamlessly as they moved from cell to cell. Each phone call uses separate radio frequencies or channels. You probably had a 1G phone, but never called it that.

b) 2nd Generation

The next generation, quick on the heels of the first, is digital cellular. One standard uses a digital version of AMPS called D-AMPS using Time Division Multiple Access (TDMA). A competing system also emerged using Code Division Multiple Access (CDMA). As you might suspect, the two are incompatible but you can have a phone that works with both. Europe embraced yet a third standard called GSM, which is based on TDMA [3]. Digital transmissions allow for more phone conversations in the same amount of spectrum. They also lay the groundwork for services beyond simple voice telephone calls. Data services such as Internet access, text messaging, sharing pictures and video are

c) 3rd Generation

3G has proven to be a tough generation to launch. The demand for greater bandwidth right now has spawned intermediate generations called 2.5G and even 2.75G. One such standard is General Packet Radio Services (GPRS), which is an extension of the GSM digital cellular service popular in Europe. It offers download speeds up to 144 Kbps.

3G phones and services are just starting to come into their own. One service you'll find is called EV-DO, which stands for Evolution Data Only. EVDO has download speeds up to 2.4 Mbps, which is faster than T1, DSL or Cable broadband service. There is also an evolution that includes voice called EVDV which is in the works.

d) 4G SYSTEMS

The approaching 4G (fourth generation) mobile communication systems are projected to solve still-remaining problems of 3G (third generation) systems and to provide a wide variety of new services, from high-quality voice to high-definition video to high-data-rate wireless channels. The term 4G is used broadly to include several types of broadband wireless access communication systems, not only cellular telephone systems

This paper presents an overall vision of the 4G features, optimizing the network, integration of mobile communication. The features of 4G systems might be summarized with one word—integration. The 4G systems [4] are about seamlessly integrating terminals, networks, and applications to satisfy increasing user demands

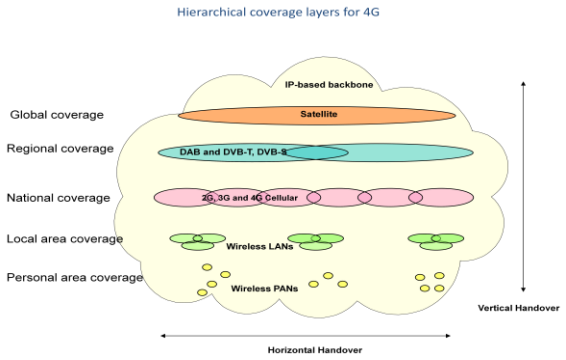


Figure 2 Hierarchical Coverage Layers of 4G

2. LITERATURE SURVEY

The problem with the existing algorithms is the use of user centric approach, where the bandwidth is not utilized properly and cell delay and cell loss too is more in this system which uses Distance function. It is a common observation that, while accessing any network or service, a user demands low billing rate, high bandwidth and data rate, adequate security, low call drop etc. With the increase in number of quality parameters required by the user, the complexity of the network selection is likely to increase. Multi-parameter selection technique is required to meet user needs in terms of automatic network selection during handover. Attempts have been made in recent studies using static net work interface priority, received signal strength, cost function. Various algorithms have also been proposed using different criterion for optimum network selection, such as, best network selection, score function, vertical handoff decision in and terminal controlled mobility management. In this paper, optimal network selection is suggested using distance functions. Several distance functions have also been proposed earlier. We focus on the Spearman footrule [5]. To use the distance function, all the parameter values are normalized so that they take on values in the range of zero and one. These values are assigned such that the higher the value, better it is for the user.

With the reference of the paper S. Frattasi, H. Fathi, F. Fitzek, M. Katz, R. Prasad, "A Pragmatic Methodology to Design 4G: From the User to the Techn01ology", in Proceedings of the 5th International Conference on Networking (ICN), IEEE, Reunion Island, France, April 17-21, 2005. I have found that a new way of designing a network on the basis of user preferences and the methods favouring the user to select a particular service for particular in terms of handoffs, power requirement, call cost and bandwidth

With the reference of the paper S. Frattasi, H. Fathi, F. Fitzek, K. Chung, R. Prasad,"4G: The User-Centric System", Mobile e-Conference (Me), Electronic Conference,August, 2004. I came to know that who how a user centric approach is used to define services on the basis of user requirements with some distance function, which uses the weighted distance function to calculate the rank of the service.

With the reference of the paper E. Gustafsson, A. Jonsson, Always Best Connected, IEEE Wireless Communications, February 2003. How a mobile communication from 2G and 3G i.e. "Always Connected" becomes the "ABC(Always Best Connected)".where the 2G and 3G able to provide the best effort service and which may be lagging behind the effective service sometimes . The main thing for a service provide should do is superb/good service, and it should fail in providing the service to the user.

From all the papers I have observed that it is able to provide only the best effort service which user sometimes unable to receive the service. So, in order to provide the Always Best Connected service to user we moving for the algorithms such as SFF (Static First Fit) & DFF (Dynamic First Fit) [6].

With the help of SFF & DFF we are able to use the max bandwidth of the system and which also reduces the cell loss and cell delay.

3. PROPOSED SYSTEM

Distance Function: It is a common observation that, while accessing any network or service, a user demands low billing rate, high bandwidth and data rate, adequate security, low call drop etc. With the increase in number of quality parameters required by the user, the complexity of the network selection is likely to increase. Multi-parameter selection technique is

required to meet user needs in terms of automatic network selection during handover. Attempts have been made in recent studies using static network interface priority, received signal strength, cost function. Various algorithms [7] have also been proposed using different criterion for optimum network selection, such as, best network selection, score function, vertical handoff decision in and terminal controlled mobility management. In this paper, optimal network selection is suggested using distance functions. To use the distance function, all the parameter values are normalized so that they take on values in the range of zero and one. These values are assigned such that the higher the value, better it is for the user.

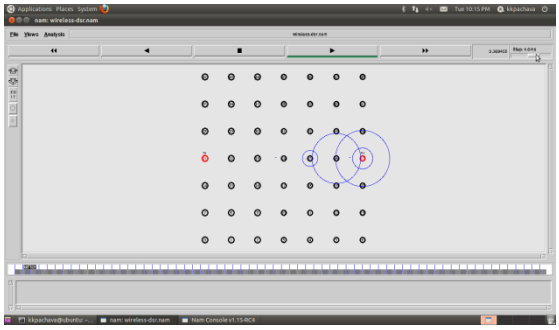
For example a network with billing parameter of 0.9 is the networks in set N are arranged in an ordered sequence with respect to the parameters in set P as per the requirements of user u for the session k. This ordered list is represented as Xp where p is a particular parameter in set P. Position of ith network in the ordered set is given by its rank in the set represented as Rank (i,p,u,k) [8]. For example, in a scenario of three networks (Net1, Net2 and Net3) and parameter set having two entities, m=4, n=2 and P= {bandwidth, security}. For Net1, P1= {free, low}. For Net2, P2= {medium, high}. For Net3, P3= {high, medium}. Now, the ordered list bandwidth= {Net1, Net2, Net3} and Xsecurity= {Net1, Net3, Net2}. As shown in this example, an ith network may have different rank in different ordered sets prepared corresponding to different parameters. More economical than the one having a value of 0.5. Let N= {net (1), net (2), net (3), net (m)} be the set of various network choices available to the user. The n numbers of user customization parameters are represented by set: P= {p (1), p (2), p (3) and p (n)}. Thus jth network in the set N is characterized by a set of parameter values written as Pj= {pj (1), pj (2), pj (3), pj (n)}.

Weighted distance Function: Another level of customization required in 4G is the preference of the user in terms of giving priority to few parameters. For example a user performing electronic transaction will be more concerned about security rather than bandwidth or cost. This level of customization is implemented by weighted distance function. In this function extra weight is added to the parameters as per the level of user interest. Another vector L = {l1, l2, l3, ln,} where lz is the user interest level in the corresponding parameter p (z) in vector P. The vector L is scaled such that. $\sum_{z=1}^{n} l_z = 1$ .The weighted ranking of the available networks can, now is written as $Rank(i,u,p,l,k) = \tau^*_{A.}$

Rank based on the distance function has been calculated for different cells. With the use of Static First Fit Algorithm and Dynamic First Fit Algorithm the Qos based can be effectively utilized.

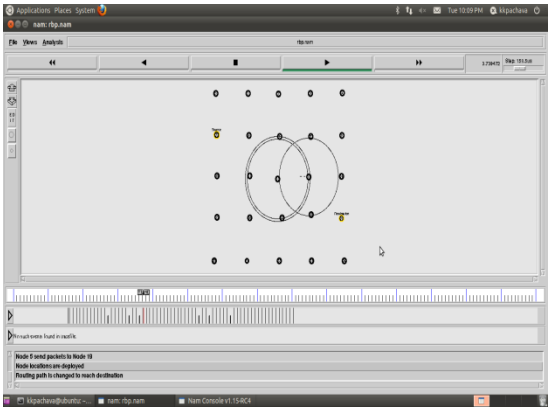
4. Simulation Results

We had already seen and found 4G systems in the future plays an important role in the mobile communication, where the selection of an application is totally based on the user. Thus in this thesis I have done one part of the application in 4G networks, and optimized its performance using the algorithms Static First Fit Algorithm(SFF) and Dynamic First Fit Algorithm(DFF), where a user may have chance to get satisfied with the results I found in favor.



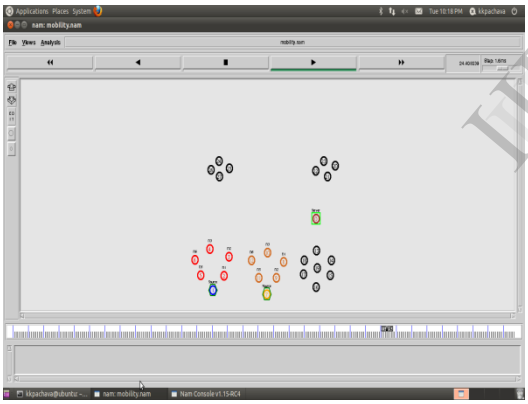
7.1a Topology for Static Routing

There had been 49 nodes which have been created and communication between a source and destination is being carried on.



7.1b Explicit Routing In Static and Dynamic Routing Environment

The communication between the entities in the intermediate state where the node will be partiall static and mobility will only be upto some extent



7.1c Topology For Dynamic Routing

This Screen shots shows the communication between entities in terms of dynamic topology which uses the channel assisgnment strategies.

5. CONCLUSIONS

Thus in this research 4G system supports multi-mode and reconfigurable devices to support inter-working of heterogeneous networks. The algorithm selects appropriate network during handoff based on user preferences and interests. The user can opt for multiple QoS parameters like bandwidth, cost of service, security level, call drop probability etc. to select appropriate networks. The proposed algorithm uses a distance function to generate an ordered list of various available access networks in a particular region according to the multiple user preferences and level of interest. In case of handoff due to the movement of the user from one region to another region, the process is repeated to find again an appropriate network from all the available networks in the new region. The results clearly show that the proposed algorithm always best connect the user, as per his preferences of QoS parameters based on delay, packet delivery ratio, bandwidth and no of packets lost thus we have optimized our performance metrics using rank based function.

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