International Journal of Scientific & Engineering Research, Volume 3, Issue 12, December-2012
ISSN 2229-5518

A Network Detection and Selection Scheme in Heterogeneous Wireless Network

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Abstract- Next-generation wireless networks will provide different wireless radio access technologies(RAT) like WiFi, WiMAX and GSM to mobile user. It provide seamless mobility with high speed connectivity. Like for phone calls user preffered UMTS and WiFi hotspot for web browsing. To enable connectivity during handoff, all the available networks need to known by mobile user. When multiple access networks are present, mobile user may have problem in selecting which network to connect and how to authenticate with that network. This paper will purposed new set of parameters that refers to key performance indicator when deciding on admitting, dropping or handover of mobile users from one network to another.

Keywords- Handoff, Heterogeneous networks, RAT, WiFi, WiMAX,GSM

1. Introduction

Future generation networks are seemed to be a combination of multiple heterogeneous networks which includes wireless local area networks(WLANs) such as IEEE 802.11a/b/g, wireless personal area networks(WPANs) such as Zigbee and Bluetooth, wireless metropolitan area networks(WMANs) such as WiMax, and wireless wide area network(WWANs) such as universal mobile telecommunication network (UMTS), general packet radio service(GPRS) and code division multiple access(CDMA),[1] etc. In future communications, it is probable that mobile users will have access to multiple networks simultaneously. Being able to access many networks is a benefit but need a mechanism to decide which network is best at every instant.

In homogeneous networks (comprising of only one type of networks), the selection of network is based only on simple parameter that is channel quality represented by measure of received signal strength. On the otherside, in heterogeneous networks, the selection of network is more complex and depend on numerous parameters. Users getted benefit only by selecting the most fascinating network from the set of detected available networks. There are various parameters that can be adapted to choose about the "best" access.

When there are various networks present at the users area, the mobile user must select the one network among them to whom it should connect. To connect to many network interfaces the user must have a multi-mode terminal device. Basically network selection in a wireless ambience can be portioned to different sub parts: firstly opting which interfaces to be power on secondly opting for network to be connect, if any and Opt for access point (AP) to connect, if any and finally for application: choose the interface to be use on a multi-RAT terminal.

The scope of this paper is to go through the earlier existing network selection schemes and concern amongst heterogeneous networks and resolve a new algorithm for network detection and selection with an adorn set of parameters to consider during the selection operation.An entire analysis needs to be concern about most important paradigms are 1. Terminal capabilities- This indicate the support of multi-interface capability like power constraint of the terminal equipment. Also consider different aspects to whom user is sensitive like service cost or connection cost, whether the user is authorization to connect or not. Bandwidth-Basically bandwidth available at the target networks, scarcity of bandwidth cause congestion. A considerable parameter for handover decision. Received signal Strength(RSS)-one of the most important parameter in handover decision. Also helps in eliminating interference between networks. Speed and direction of mobile equipment . AAA(Authentication, Authorization, Accounting) for the new network.

The classical horizontal handover[3] decision for homogeneous network is

- RSS: selecting the new base station (BS)
  If RSS(new) > RSS(old)
- RSS with Threshold T: opting the new BS
  if RSS(new) > RSS(old) and RSS(old) < T
- RSS with Hysteresis H: selecting the new BS
  if RSS(new) > RSS(old) + H.
- RSS, hysteresis and Threshold: selecting the new BS if RSS(new) > RSS(old) + H and RSS(old) < T

Following fig-1.1[1] shows the difference between Horizontal and vertical Handover

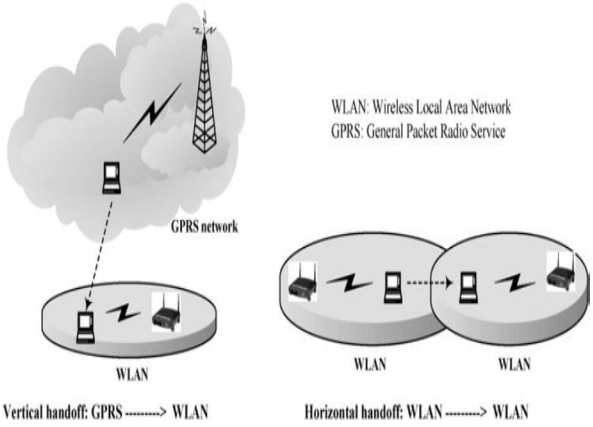


Fig 1.1 Vertical handoff Vs. Horizontal handoff

Different technologies contribute different attributes like bandwidth, cost of service, quality of service. Having the prior knowledge about different networks the users can be connected as long as possible by selecting the optimum network and save money and energy. In a heterogeneous network the main aspects to be considered are automatic radio access technology (RAT) and minimize number of desired handovers. To tackle these problems , several solutions can be applied: like fuzzy logic, for diminish the handovers and fulfil the users requirements[2], cost functions, this parameter is considered for selecting best among the alternative RATs [3], policy based algorithms which basically combine different policiesbut this increase complexity.

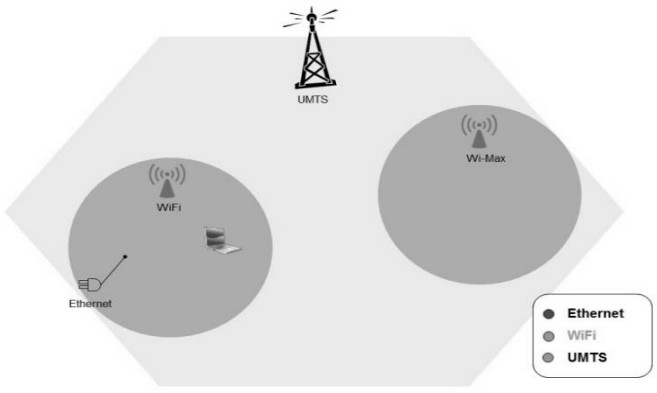


Fig 1.2 Test bed in Heterogeneous Network

To select the network to which to connect as shown in fig 1.2 initially the network detection has to be done. Network detection implies the accessible networks within that area. Network detection is first step to be performed during vertical handover (vertical handover refers the handover between access points of two different networks like GSM to WiFi). When the networks are detected successfully then network selection is performed. In heterogeneous networks RAT selection play an imperative role in the operation of the complete network. The important steps in network selection are shown in fig 3[4]

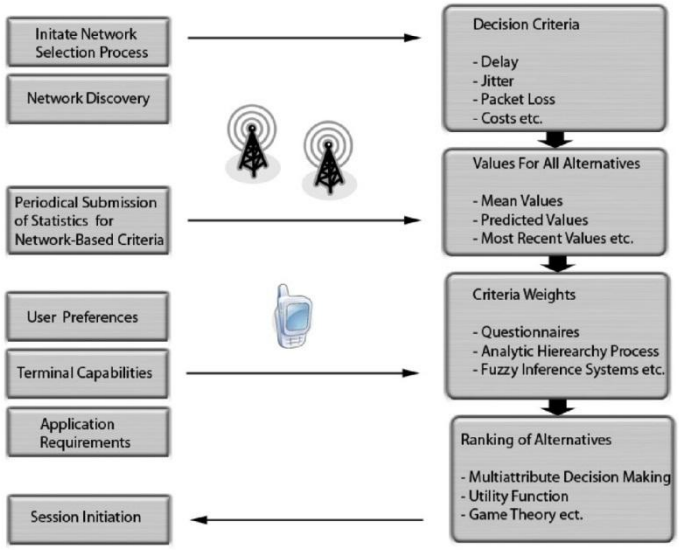


Fig:1.3Main steps in Network Selection

2. Related Work

The first scheme is analysed is TAILOR[5](Intelligent Handover Decision Model for Heterogeneous Networks). Cell-id concepts can be applied only on GSM, GPRS, WCDMA networks. The purposed scheme uses MCHO(mobile-controlled handover) that enables the mobile terminal to choose the optimum network which fulfils required network conditions, costs, mobile user preference. The handover process is basically divided into three parts: network scanning, handover decision and handover execution. TAILOR scheme centred on cell-id concept(Fig: 2.1) which basically reduce energy consumption in continuous interface activation.

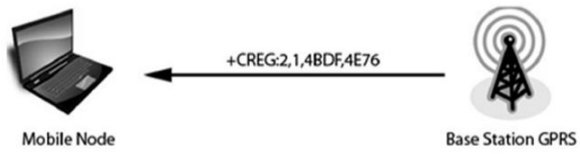
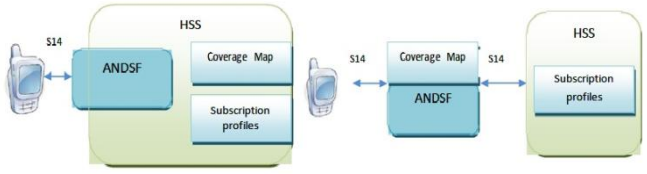


Fig:2.1 Network discovery using cell-id

The base station continuously transmit the information of mobile users to the network. The transmitted message includes

- Mobile country code (MCC) - Every network operator has unique country code.
- Mobile Network Code (MNC) – this determine the network operator.
- Location Area Code (LAC) – the cluster of cells handled by network operator in that area.
- Cell Id (CI) – the particular cell-id on which it operates.

one of the famous technique is Evolved Packet Core (EPC) for network discovery selection technique. The idea behind this technique is Subscription Profile Based ANDSF[6] which is also one of selection parameter. The fig 2.2 explains the Subscription Profile ANDSF[6].



The first case integrate ANDSF and HSS which provides faster response to mobile user. In case two ANDSF and HSS are separate and provide integration of network detection and selection. The functionality of ANDSF is Location Enabler.

3. Network Discovery and Selection parameter

Here two network simulation are executed. First is between WLAN and WiMax[6-9] and second is between WLAN and LTE-A,GPRS,UMTS.

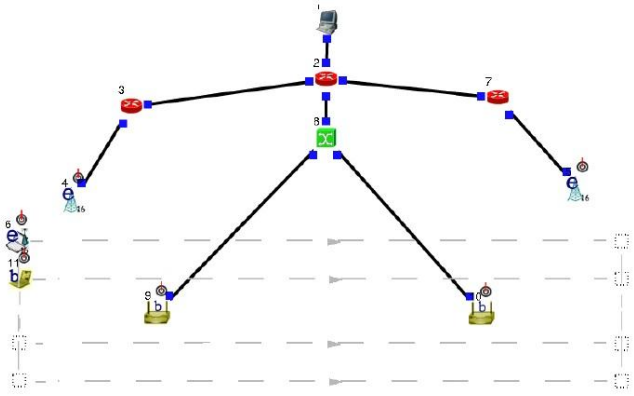


Fig3.1 WiFi/WiMAX mobile network topology

Different WiMAX, WLAN and LTE-A features are shown in following Table 3.1

	WLAN	**WIMAX(802 .16e)**	**LTE-A**
Bandwidth(MHz)	20	1.25 to 20	40
Data (Mbit/s)	802.11b(1 1)	180	1024
Bit/Hz	2,7	3,75	Up to 30
Duplexing		TDD,FDD	
Multiple access	CSMA/CA	OFDMA	OFDMA
Coverage	Small(dep ends on how much power you put)	Mid (1-5km)	Ubiquitio us
Moblity	Portable	Nomadic/Full	Nomadic/ Full
Targeted Market		Consumer class Semi-Mobile Wireless access	Mobile wireless access
Frequency Band	2.4,3.6 and 5 GHz	<6 GHz	There are 43 band portions considred(6)

Table 3.1 MAC characteristics of WiMAX,WLAN and LTEA

4. Proposed Network Detection and Selection scheme

The process of network detection and selection starts at mobile terminal. As the networks are discovered, the list of discovered networks and user demands are send to network operator. The network operator eliminate the networks which are not accessible to mobile user and finally update the list. If there is only one network present then connect to that network otherwise compare the network proficiency with user requirements. If user demands are not fulfilled then a new search of network has been done.

If any network satisfies the user requirements then it checks whether the mobile user is in power saving mode or not. Mobile terminal acquire knowledge of power consumption of different network. And if power mode is on then the

network list is updated considering least power consuming network otherwise it will continues by considering QOS and request to connect.

After that it will ensure the MT speed to connect specified network. If all

these parameters are satisfied then connect to that network. Basically handover is performed when received signal strength(RSS) dropped below some threshold value but to make scheme energy efficient in allows some fall in value of RSS for few second to avoid ping pong effect[7] (rapidly switch links with either BS when the MT is exactly between the two BSs) so to reduce ping pong effect velocity of MT is also considered. So set the RSS surveillance period[7] use

$$\text{Tap(V)} = \frac{Vo(AP)}{V}.To(AP)$$

Where as V_o(AP) is average speed of MT, T_o(AP) is average surveillance period, and V is instant MT velocity. By using above formula the actual RSS surveillance period is calculated. If the MT is moving then network is selecting based on velocity[10-12] and if stationary then according to services. The purposed scheme flow chart is shown in figure 4.1

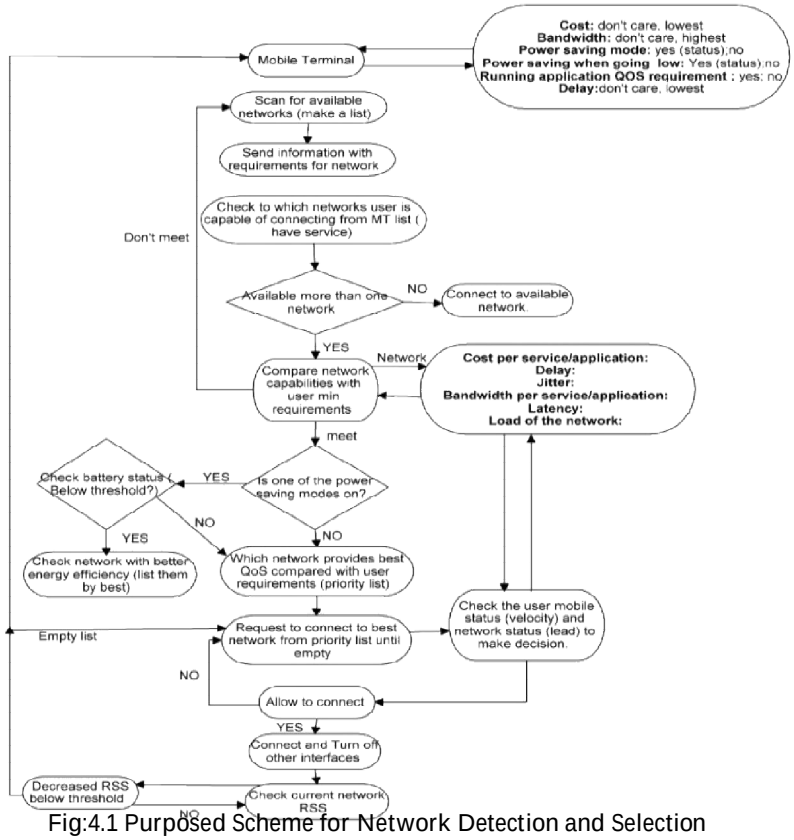


Fig:4.1 Purposed Scheme for Network Detection and Selection

5. Result

The following graph shows the result after simulation using proposed algorithim. For simulation we considered three levels of traffic: normal traffic where users intensity is average which were trying to connect, secondly busy hour where users intensity is high which were trying to connect and third emergency level where because of some even number of users is extremely high. By graph we can observe that how the proposed scheme enhance the network functionality and enhance the network capacity when various parameters are considered (e. g., prioritization procedure, considering mobile user preference and various other parameters)

6. Conclusion and future work

In future trends mobile user demands high data rate and service quality. To fulfil maximum number of user with high QOS the network selection play an important role. It is observed that heterogeneous network in which all networks can be access simultaneously advantageous in terms of high capacity, QOS, better implementation, cost to user and many more. And to make it possible the network detection and choose best among detected networks mechanisms must be introduced. The related works shows variety of schemes are present and can be simulated within existing radio access technology, but only real-time simulations can show the mechanisms success.

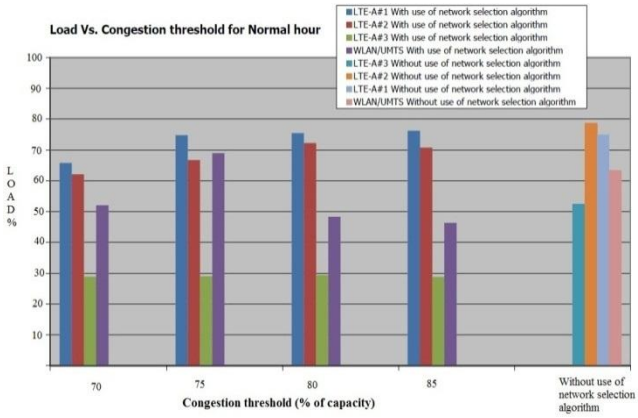


Fig:5.1 Normal Traffic

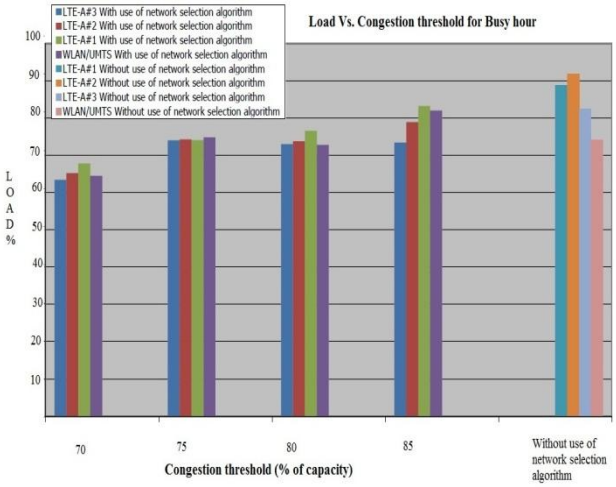


Fig:5.2 Busy Hour Traffic

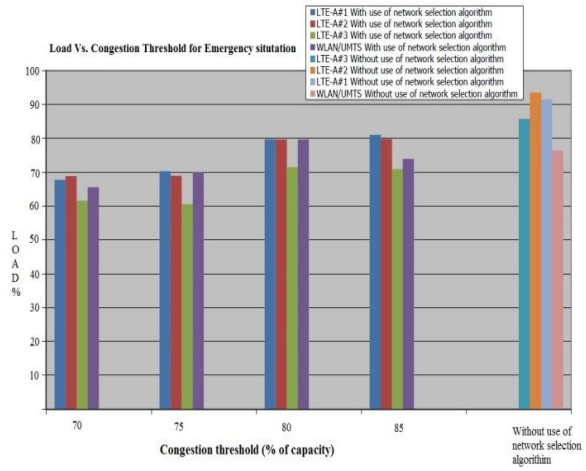


Fig: 5.3 Emergency situation traffic

References:

[1] Farhan Siddiqui, Sherali Zeadally, (2008),"An efficient wireless network discovery scheme for heterogeneous access environments", International Journal of Pervasive Computing and Communications, Vol. 4 Iss: 1 pp. 50 - 60

[2] ETSI TS 124 312 V9.1.0, "Universal Mobile Telecommunications System (UMTS); LTE; Access Network Discovery and Selection Function (ANDSF) " (2010-04)

[3] Meriem Kassar, Brigitte Kervella, Guy Pujolle (2008) "An overview of vertical handover decision strategies in heterogeneous wireless networks" Computer communications.

[4] McNair J., Zhu F. (2004). 'Vertical Handoffs in Fourth-Generation Multi-network Environments' IEEE Wireless Communications, Vol. 11, pp. 8-15

[5] Farhan Siddiqui, Sherali Zeadally, Hesham El-Sayed and Naveen Chilamkurti: " A dynamic network discovery and selection method for heterogeneous wireless networks" Int.J Internet Protocol Technology Vol.4 No.2, 2009.

[6] Marius Corici, Jens Fiedler, Thomas Magedanz, and Dragos Vingarzan: "Access Network Discovery and Selection in the Future Broadband Wireless Environment" Fraunhofer FOKUS Institute, Berlin, Germany, 2010.

[7] An Energy-Efficient Handover Scheme with Geographic Mobility Awareness in WiMAX-WiFi Integrated Networks

[8] Chung-Pyo Hong, Tae-Hoon Kang and Shin-Dug Kim, "An Effective Vertical Handoff Scheme Supporting Multiple Applications in Ubiquitous Computing Environment", Dep. Of Science, Yonsei University, Seoul

[9] E., Mino, A., Mihovska, et al., D4.4, "Impact of Cooperation Schemes between RANs—A Final Study," Deliverable 4.4 IST Project WINNER, November 2005.

[10] [3]A. Mihovska, et al., "Algorithms for QoS Management in Heterogeneous Environments," Proc. of WPMC'06, San Diego, California, September 2006

[11] P., Karamolegkos, E., Tragos, A., Mihovska, et al., "A Methodology for User Requirements Definition in the Wireless World," Proc. of IST Mobile Summit 2006, Mykonos, Greece, June 2006.

[12] Sofoklis Kyriazakos and George Karetsos, "Practical Radio Resource Management in Wireless Systems", Artech House, April 2004, ISBN 1-58053-632-8