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Modeling and Performance Analysis of iBurst, HiperMAN and GSM

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***Abstract*— In this paper, we propose a bandwidth-efficient multicast mechanism for heterogeneous wireless networks. Reducing the bandwidth cost of an Internet Protocol (IP) multicast tree by adaptively selecting the cell and the wireless technology for each mobile host to join the multicast group. The mechanism enables more mobile hosts, leads to the wireless bandwidth. Besides, the paths in the multicast, connecting to the selected share more common links to save the wireless bandwidth. This supports the dynamic group membership and offers mobility of group members. Moreover, the mechanism requires no modification to the current IP multicast routing protocols. The wireless technology for each mobile host in the heterogeneous wireless networks as an optimization problem. As part of heterogeneous wireless networks we have considered iBurst, HiperMAN and G.S.M technologies. The simulated result shows that the proposed mechanism will be effective in terms of bandwidth for multicast mechanism of heterogeneous wireless system.**

I. Introduction

The current wireless cellular networks typically deployed are homogenous networks, collection of similar kind of technology, based on macro-plan process. In the homogenous network based stations, planning and developing by user generally comprises of a terminal which depends on power levels, antenna patterns, receiver noise floors and connectivity of data packets. On the other hand, heterogeneous network, collection of dissimilar networks are evolved generally comprises of different kinds of terminals depends on power levels, antenna patterns, receiver noise floors and connectivity of data packets. The architecture of heterogeneous wireless network system comprises of iBurst, HiperMAN and GSM technology.

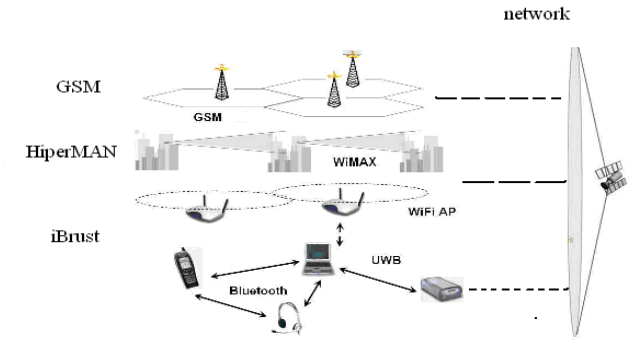


Fig 1.1 Architecture of heterogeneous wireless networking system

A) iBurst:

iBurst is a wireless broadband technology developed by ArrayComm. It optimizes the use of its bandwidth with the help of smart antennas. iBurst is a mobile broadband wireless access system that was first developed by ArrayComm, and subsequently adopted as the High Capacity – Spatial Division Multiple Access (HC-SDMA) radio interface standard (ATIS-0700004-2005) by the Alliance for Telecommunications Industry Solutions (ATIS).The HC-SDMA interface provides wide-area broadband wireless data-connectivity for fixed, portable and mobile computing devices and appliances. The protocol is designed to be implemented with smart antenna array techniques to substantially improve the radio frequency (RF) coverage, capacity and performance for the system. The problems ArrayComm are trying to solve can be compared to multiple conversations in a single location, or communications across long distances. In a crowded room, people find it easy to focus the person they are speaking to and effectively ignore other conversations. Conversely, if a person can try to get the attention of someone down the street, by cupping their hands around their mouth, directing their voice to improve the odds of being heard and understood.

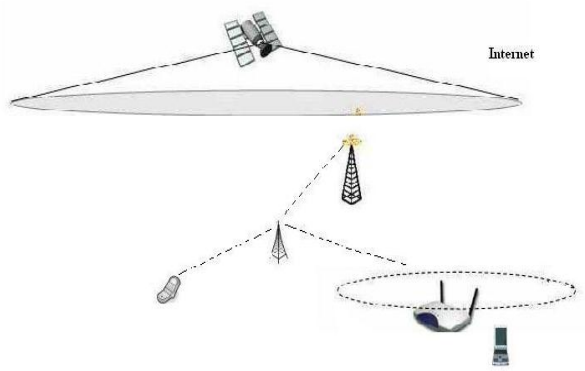


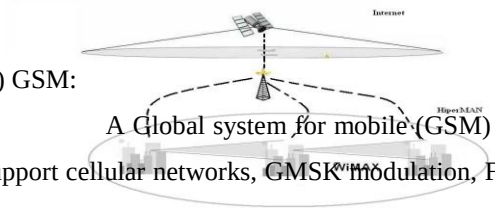
Fig 1.2 iBurst architecture

B) HiperMAN:

HiperMAN is an acronym for High Performance Radio Metropolitan Area Network. HiperMAN provides broadband Fixed Wireless Access at radio frequencies. HiperMAN is aiming principally for providing broadband Wireless Internet access, while covering a large geographic area. The standardization focuses on broadband solutions optimized for access in frequency bands below 11 GHz (mainly in the 3.5 GHz band). HiperMAN is optimized for packet switched networks, and supports fixed and nomadic applications, primarily in the residential and small business user environments

Fig 1.3 HiperMAN

C) GSM:



A Global system for mobile (GSM) was developed by the Group Special Mobile founded in Europe in 1982 and it is support cellular networks, GMSK modulation, FDMA for 124 up channels and 124 down channels and the link frequency is 890-

915 MHz for uplink and 935-960MHz and the Channel of bandwidth 200kHz and 8 radio-carrier analog-signals TDMA for user access in each deployed channel and also users time-slices of 577µs and maximum is 14.4kbps.

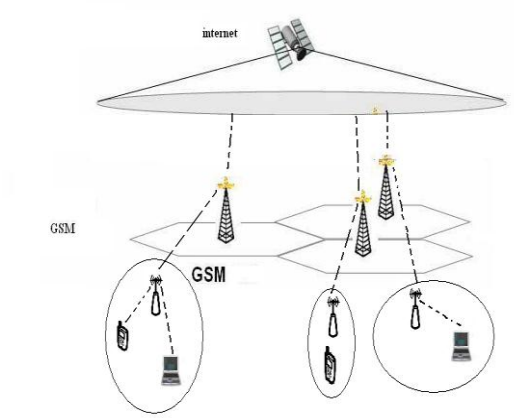


Fig 1.4: GSM Architecture

II. Multicast Modeling:

A) iBurst:

iBurst technology is a wide-area mobile broadband technology offering a unique combination of high speed, wide range and high base station capacity. It is a pure Internet Protocol, end-to-end system built on two primary components: base stations deployed by a network operator, and wireless modems or PC cards designed for the iBurst network. Unlike voice networks such as cellular GSM, CDMA and 3G standards. Burst technology has been designed from the ground up to provide pure data and with the incorporation of Intelli Cell technology it is able to provide the wireless data more efficiently than the voice based cellular networks. Burst have installed over 260 base stations and No telephone lines are required making installation quick, simple, and allows mobility within coverage areas. Voice over IP (VOIP) protocols are allowed, unlike the cellular technologies where they are stopped or degraded. Unused bandwidth data may be carried over to the following month (limited to the monthly data allocation and/or the amount of any Bandwidth Booster)

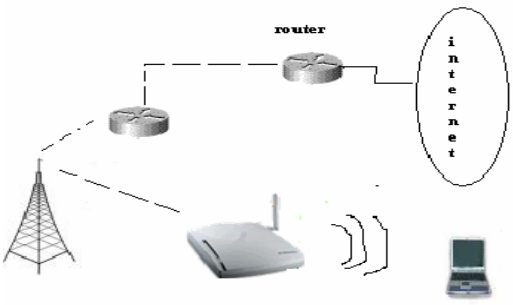


Fig 2.1 iBurst Multicast Modeling

B) HiperMAN:

HiperMAN is reference model and the OSI and IEEE family cover the Logical Link control and MAC (Medium Access Control) and the Physical Layer (PHY). HiperMAN specifies two types of bursts they are:

1) LBR-HBR data burst: this data burst consists of a low bit rate stream a synchronization and training sequence, and a number of high bit rate data blocks. 2) LBR data burst: This burst consists of a low bit rate par only containing receiver identification. HiperMAN has two types of services:

a) HC – UNITDATA.REQ: This service primitive is used for sending data. (Here Source Address, Destination Address, MSDU, User Priority, MSDU life time.

b) HC – UNIDATA.IND: This service primitive indicates incoming data. (Here Source Address, Destination Address, MSDU, User Priority, MSDU life time. it divides the medium access of different competing nodes into three phases Prioritization,.Contention,Transmission. HiperMAN has two types of Basic modes of Operation. Centralized Mode, Direct mode.

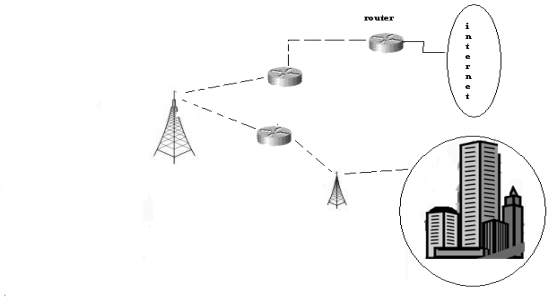


Fig 2.2: HiperMAN Multicast Modeling

C) GSM:

GSM system consists of 3 subsystems. They are 1.BaseStation Sub system (BSS): A GSM network comprises many BSSs, each BSS contains a BSC and several BTS's. Each BSS is controlled by the Base Station Controller (BSC).The Bs performs all functions necessary to maintain radio connections to an MS, coding /decoding of voice and rate adoption to from the wireless network part.

2. Base Station Transceiver Stations (BTS): A BTS comprises all radio equipment such as antennas, signal processing, amplifiers necessary for radio transmission. A BTS can form a radio cell and is connected to MS via the Um interface.

3. Base Station Controller (BSC): The BTS are manages by the BSC. It reserves radio frequencies, handles the handover from one BTS to another with in the BSS an also performs paging of the MS.

4. Mobile Station (MS): The MS consists of all user equipment and software needed for communication with a GSM network like hardware,. Software and the SIM (subscriber Identity Module) which stores all user specific data. Apart from the telephone interface, as MS also offers other types of interfaces to users such as computer modems IrDA or Bluetooth. The sim card contains such as card type, serial number, a list of subscribed services, a personal identity number(pin), a pin unblocking key (PUK), an authentication key and the International Mobile Subscriber Identity(IMSI).unit (PDU) configuration is analyzed. Afterwards a performance evaluation based on several MAC configuration examples is provided.

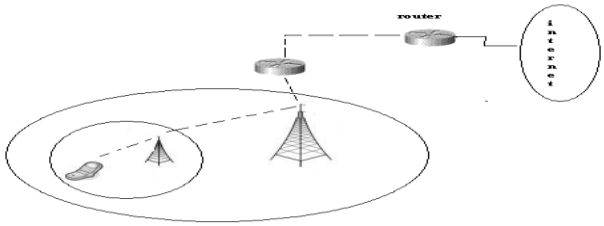


Fig 2.3 GSM Multicast Modeling

III. Performance.

Upon observing the iBurst, HiperMAN and GSM basing on the parameters like frequency, bandwidth, technology and security under some circumstances are summarized as tabular data.

A) iBurst: iBurst is combination of wide range, High speed and High capacity of base station and it supports purely internet protocol. iBurst technology is mainly based on HC-SDMA. The security can be enhanced by implementing the AES algorithm. Under different values of frequency the technology has been observed and shown in the Table 3.1.

Frequency	Bandwidth	Technology	Security
1.8, 1.9 and 2.1 GHz	5MHz	HC-SDMA	AES

Table 3.1: iBurst Technology Performance

B) HiperMAN: HiperMAN technology is mainly based on Wi-MAX. The security can be enhanced by implementing the RSA algorithm. Under different values of frequency the technology has been observed and shown in the Table 3.2.

Frequency	Bandwidth	Technology	Security
450 and 870 MHz	8.75/10.00 MHz	WiMAX	RSA

Table 3.2: HiperMAN Performance

C) GSM: GSM communicates at global Level and it supports 2G and 3G also. The capabilities of standard GPRS supports high frequency, Band width, technology, security when compare to iBurst, HiperMAN. The observations are presented in Table 3.3.

Frequency	Bandwidth	Technology	Security
850 MHz 900 MHz	200MHz	GSM	Public key

Table 3.3: GSM Performance

IV Performance Analysis

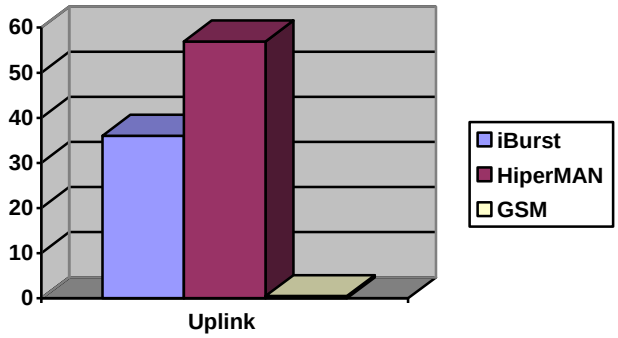
The performance of the three technologies involved with heterogeneous system is analyzed basing on their characteristics.

Uplink:

Technology	Uplink
iBurst	36
HiperMAN	56.9

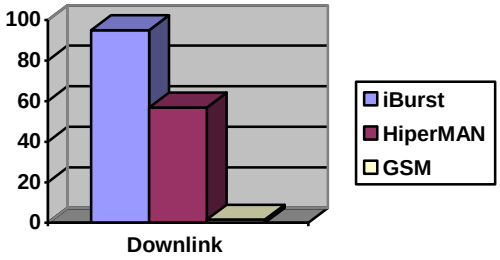
System	Frequency	Bandwidth	Technology	Security
iBurst	1.8, 1.9 and 2.1 GHz	5MHz	HC-SDMA	RSA
HiperMAN	450 and 870 MHz	8.75/10.0 MHz	WiMAX	AES
GSM	850 MHz 900 MHz	200MHz	GSM	Public key Algorithms

GSM	0.5



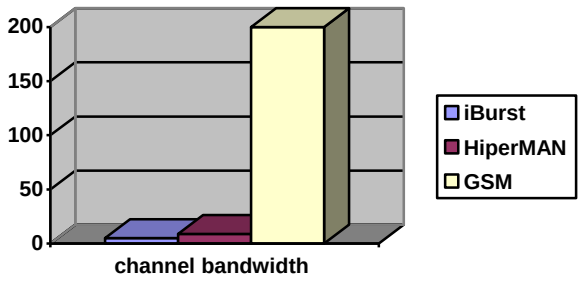
Downlink:

Technology	Downlink
iBurst	95
HiperMAN	56.9
GSM	1.6



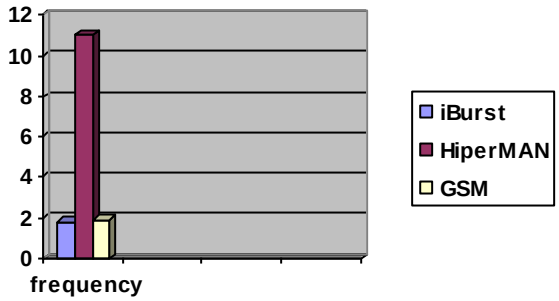
Channel Bandwidth

Technology	Channel bandwidth
iBurst	5MHz
HiperMAN	8.75MHz
GSM	200MHz



Frequency

Technology	Frequency
iBurst	1.8GHz
HiperMAN	11GHz
GSM	850 MHz 900 MHz



V.Conclusion

We model the selection of the cell and the wireless technology for each mobile host as an optimization problem to find the optimal solution for network planning in small wireless networks, iteratively reduces the total bandwidth cost of the protocol, which supports the dynamic group membership and mobility of members. Moreover, the protocol requires no modification on the current IP multicast. Further, the performance of the heterogeneous wireless system in terms of bandwidth, frequency, uplink and downlink are analyzed. Finally, we conclude that, basing on the simulated results the proposed system can work effectively to save the network bandwidth.

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