International Journal of Advanced Information Science and Technology (IJAIST) ISSN: 2319:268
Vol.2, No.7, July 2013 DOI:10.15693/ijaist/2013.v2i7.33-38

System Architecture Of Mobile Networks And Its Parameter Analysis

S.Chandrika R.RaniHemaMalini

Abstract

In this paper a system was designed for single user and multi user in both GSM and CDMA. The comparisons of those systems with continuously varying user positions in a dynamic atmosphere are considered. Modeling users movements is an important facet in unintended network simulation which includes the definition of the simulated area in that users movements take place, and the principles for modeling users that moves beyond the simulated area and the variety of nodes within the simulated area and the allocation of nodes at the simulation are also considered in the mobility model. The energy per bit to noise power spectral density ratio at units for single user and eleven for multi user makes the bit power zero due to channel interferences.

I. INTRODUCTION

An ad hoc network is a collection of wireless mobile nodes (or routers) dynamically forming a temporary network without the use of any existing network infrastructure or centralized network administration. The routers are in liberty to move arbitrarily and organize them arbitrarily which makes the network's wireless topology may change quickly. This kind of network may be operated as a stand-alone fashion or may be connected to the Internet. This is a multihop network with good mobility and the size of network is large network with heterogenous combination of devices. This combination of devices need variable bandwidth and low power constraints are the major challenges for routing protocols. Some form of routing protocol is in general compulsory in such an environment, because hosts that may wish to interchange packets might not be able to communicate directly.

Mobile users will want to communicate in situations in which no fixed wired infrastructure is available. For example, a group of researchers en route to a conference may meet at the airport and need to connect to the wide area network, students may need to interact during a lecture, or firefighters need to connect to an ambulance en route to an emergency scene. In such situations, a collection of mobile hosts with wireless network interfaces may form a temporary network without the aid of any established infrastructure or centralized administration. Because nowadays many laptops are equipped with puissant CPUs, astronomically immense hard disk drives, and good sound and image capabilities, the conception of composing a network among these researchers, students, or members of a rescue team, who can facilely be equipped with the contrivances mentioned above, seems possible. Such networks received considerable attention in recent years in both commercial and military applications, due to the attractive properties of building a network on the fly and not requiring any preplanned infrastructure such as a base station or central controller.

A. *Applications of ad hoc wireless networks*

The field of wireless networking emerges from the integration of personal cellular networks, computing technology and the Internet. This is due to the incrementing interactions between communication and computing, which are transmuting information access from "anytime everywhere" into "all the time, anywhere." At present, an astronomically immense variety of networks exists, ranging from the well-kenned infrastructure of cellular networks to non-infrastructure wireless ad hoc networks. The following are the applications of ad hoc wireless networks:

- Community network
- Enterprise network
- Home network
- Emergency response network
- Vehicle network
- Sensor networ

Adhoc networksare well suited for the use in odd situations where no infrastructure is available or to deploy a new one. The major use of mobile ad hoc networks is in business environments where the need for collaborative computing might be more important outside the office environment than inside, such as in a business meeting outside the office to brief clients on a given assignment. Work has been going on to introduce the fundamental concepts of game theory and its applications in telecommunications. Game theory originates from economics and has been applied in various fields. Game theory deals with multi person decision making, in which each decision maker tries to maximize his or her utility. The user cooperation is necessary for the operation of ad hoc networks, which can be analyzed with the help of game theory.

B.Review of Literature

A MANET is a collection of wireless nodes that can dynamically form a network to exchange information without using any pre-existing fixed network infrastructure. The special features of MANET bring these technology great opportunities together with severe challenges.

Interference effects constrain scalability performance of ad hoc networks as Gupta and Kumar (Gupta & Kumar, 2000) showed that the throughput capacity of a fixed wireless network decreases when the number of total nodes ***n*** increases. More specifically, they showed that the node throughput decreases approximately like $1/\sqrt{n}$. Grossglauser and Tse (Grossglauser & Tse, 2001) presented a two-phase packet forwarding technique for mobile ad hoc networks (MANETs), utilizing multiuser diversity (Knopp & Humblet, 1995), in which a source node transmits a packet to the nearest neighbor, and that relay delivers the packet to the destination when this destination becomes the closest neighbor of the relay. The scheme was shown (Grossglauser & Tse, 2001) to increase the throughput capacity of MANETs, such that it remains constant as the number of users in the network increases, taking advantage that communication among nearest nodes copes the interference due to farther nodes.

On the other hand, detailed and straightforward models for interference computation in dense ad hoc networks have not been extensively studied. Grid models have been proposed to compute interference (Gobriel et al., 2004), (Liu & Haenggi, 2005), which take advantage of the regular placement of the nodes. This orderly topology is a good starting point for static networks; however, it does not apply for MANETs. Also, some previous works have assumed a transmission or a reception range for communication among nodes without considering the effect from the entire network (Tobagi & Kleinrock, 1975), (Deng et al., 2004). This approximation can be good for low density networks, but it may imply in inaccurate results for dense networks. One problem with such approximation is the difficulty in finding an analytical description for the random topology inherent to ad hoc networks. In other cases, analytical models use graph theory (Rickenbach et al., 2005), (Qinyun et al. 2005).

C.Need for Study

Interference reduction is the foremost goals of topology control in wireless ad-hoc networks. The proposed work presents a receiver-centric interference model featuring two main advantages. The first advantage is it reflects the fact that interference occurs at the intended receiver of a message. Second advantage is the interference measure is robust with respect to addition or removal of single network nodes. Regarding both of these aspects our model intuitively corresponds to the behavior of interference in reality. Based on this interference model, the work show the Quality of service will be improved in mobile ad-hoc network and the through put can be increased with realization of BER and Ebno.

D.Quality of Service and Bit Error Rate

The Quality of Service(QoS) and Bit Error Rate (BER) gives Eb/N0 (the energy per bit to noise power spectral density ratio) is an important parameter in data transmission / digital communication. Eb/N0 is a normalized signal-to-noise ratio (SNR) measure, also known as the "SNR per bit". Eb/N0 is especially useful when comparing the Bit Error Rate(BER) performance of different digital modulation schemes without taking bandwidth into account.

Eb/N0 is equal to the SNR divided by the "gross" link spectral efficiency in (bit/s)/Hz, where the bits in this context are transmitted data bits which include error correction information and other protocol overhead. When Forward Error Correction (FEC) is being discussed, Eb/N0 is usually used to refer to the energy per information bit (i.e. the energy per bit net of FEC overhead bits) and to relate actual transmitted power to noise is represented by Es/N0.The noise spectral density N0, usually expressed in units of watts per hertz, can also be seen as having dimensions of energy, or units of joules, or joules per cycle. Eb/N0 is therefore a non-dimensional ratio.

SINR is Signal to Interference plus Noise Ratio that is calculated as $SINR = P / (I + N)$ where P is signal power, I is interference power and N is noise power.The quality of wireless connections is measured by Signal to Interference plus Noise Ratio. The energy of a signal fades with respect to distance is commonly defined by path loss. But unlike wired networks (where the existence of a wired path between sender s and receiver r determines the correct reception of a message), a wireless communication network has to take a lot of environmental parameters into account (e.g. the background noise, interfering strength of other simultaneous transmission), this aspect is easily represented by SINR.

The BER are analyzed utilizing stochastic computer simulations. If a simple transmission channel model and data source model is surmised, the BER may withal be calculated analytically. An example of such a data source model is the Bernoulli source.

E.Factors affecting the BER

In the receiver side of all communication system, BER is affected by, interference, transmission channel noise, distortion, bit synchronization problems, wireless multipath fading, attenuation, etc.Improvement in BER can be obtained by increasing the signal strength without creating bit errors and cross talk. By line coding and channel coding schemes or by robust modulation and redundant forward error correction codes the BER may be improved further.

The transmission BER is the number of detected bits that are erroneous before error rectification, divided by the total number of transferred bits (including redundant error codes). The information BER is approximately identical to the decoding error probability. The decode error probability is the number of decoded bits that remain erroneous after the error rectification, divided by the total number of decoded bits (the utilizable information). Normally the transmission BER is more astronomically immense than the information BER. The information BER is affected by the vigor of the forward error rectification code.

F.Objectives & Hypotheses

The analysis of 2G and 3G systems is measured against Signal to Interference Ratio (SINR) or EbNo. The bit error rate or bit error ratio (BER) is the number of bit errors divided by the total number of transferred bits during a studied time interval. BER is a unit less performance measure, often expressed as a percentage.

The BER is given by

$$\mathrm{BER} = \frac{1}{2}\,\mathrm{erfc}(\sqrt{E_b/N_0})$$

The signal to interference ratio is given by

SINR= Desired Signal power / (Interference Power + Noise power)

BER and SINR are inversely proportional.

To have a better performance always a trade-off to be considered.In telecommunication field the major challenges is to convey the information as efficiently as possible through limited bandwidth, though some of information bits are lost in most of the cases and signal which is sent originally will face fading. To reduce the bit error rate the loss of information and signal fading should be minimized. In our thesis we analyze two modulation techniques,

II . METHODOLOGY ADOPTED

In order to achieve these results, Discrete MATLAB simulations is used.

A.Discrete MATLAB simulations.

Performance evaluation and simulation is done by using matlab for 2G and 3G system with different number of users for various signal strengths.Analysis of GSM and CDMA system also done to improve the performance of the system.

B.Parameter analysis Introduction

Setting up a multi-hop wireless network is a grueling exercise mainly because determining suitable positions for placing a node that satisfies the multi-hopping requirement is a non-trivial task. Nodes must be placed such that there are pairs of nodes which are

(a) In communication range of each other,
(b) In interference range of each other, and
(c) Outside interference range of each other.
This constitutes a typical multi-hop wireless network setup.

Usually the communication distance between a pair of wireless nodes operating in 2.4 GHz frequency range and using off-the shelf IEEE 802.11b wireless NICs is around 200 feet; the interference range for the same would be about 500 feet depending on the sensitivity thresholds set on different types of adapters. Even these distances vary dramatically due to several external factors, like multi-path interference, noise in the channel. Hence larger the physical distance among the nodes, more tedious and time-consuming is the task of setting up a multi-hop topology.

III . SIMULATION AND PERFORMANCE EVALUATION

The system model was designed for single user and multi user in both GSM and CDMA. The comparisons of these systems are shown below where the user positions will be changing continuously in a dynamic environment. Therefore, modeling users' movements is an important aspect in ad hoc network simulation. This includes the definition of the simulated area in which users movements take place, and the rules for modeling users that moves beyond the simulated area; The number of nodes in the simulated area, and the allocation of nodes at the simulation start up; and the mobility model, itself. Typically, simulation studies assume a number of users that moves inside a closed rectangular area. Closed here stands for a constant number of users inside the simulated area. Rules are defined for users arriving at the edges of the area. For example, in [127] the network model consists of 30 nodes in a 1500 m· 300 m closed rectangular area.

A.BER of GSM System

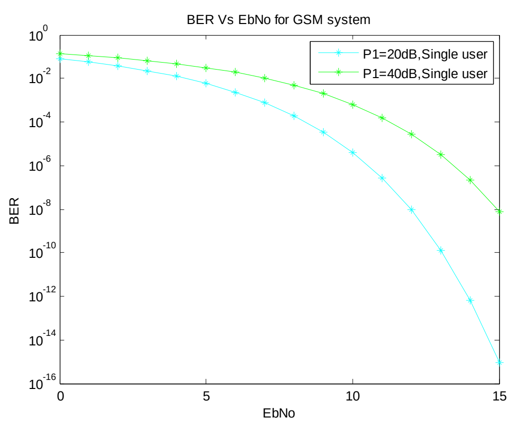

Figure:1a GSM Single user case

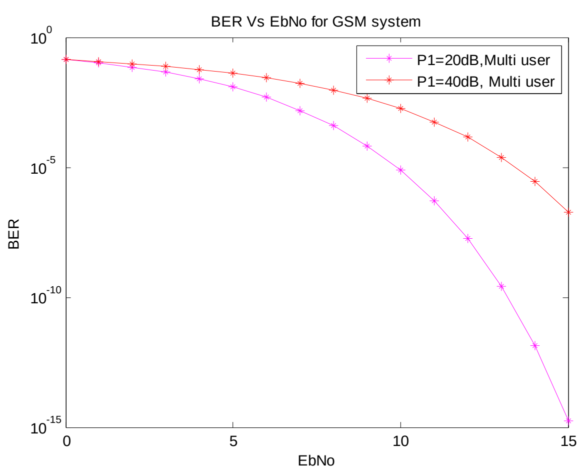

Figure: 1b GSM Multi user case

In the above figure BER Vs SINR value is plotted. P1 denotes BTS transmit power. Single user denotes only one user exists in a particular cell and BER is calculated for that particular user and there are no interferers. Apart from the desired user many other users (Multi user) also exist in the same cell who is the interferers. BER is calculated for the desired user considering all users as interferers. BER increases in GSM because of the two types of interferences

1) Adjacent Channel Interference

2) Co-Channel Interference

EbN0	P1=20 dB, Single user	P1=20 dB, Multiuser	P1=40 dB, Single user	P1=40 dB, Multi user
0	0.0786	0.1449	0.1327	0.1410
1	0.0563	0.1062	0.1092	0.1190
2	0.0375	0.0722	0.0867	0.0977
3	0.0229	0.0447	0.0658	0.0775
4	0.0125	0.0247	0.0471	0.0586
5	0.0060	0.0118	0.0314	0.0419
6	0.0024	0.0048	0.0192	0.0279
7	0.0008	0.0015	0.0105	0.0170
8	0.0002	0.0004	0.0050	0.0092
9	0.0000	0.0001	0.0020	0.0044
10	0.0000	0.0000	0.0007	0.0018
11	0.0000	0.0000	0.0002	0.0006
12	0.0000	0.0000	0.0000	0.0001
13	0.0000	0.0000	0.0000	0.0000
14	0.0000	0.0000	0.0000	0.0000
15	0.0000	0.0000	0.0000	0.0000

B. BER for CDMA System

In GSM system the adjacent cells uses different frequency channels (Frequency Reuse 3/7/9) therefore only adjacent and co-channel interference exists. But in case of CDMA and WCDMA system all the cells utilize the same frequency (Universal Frequency Reuse) and therefore interference that occurs is Intra-cell interference and Inter-cell interference. Inter-cell Interference can be reduced by designing orthogonal pseudo codes for different users.

Only Intra-cell Interference is taken into account and the above graph denotes that, BER increases when users in a cell increase.

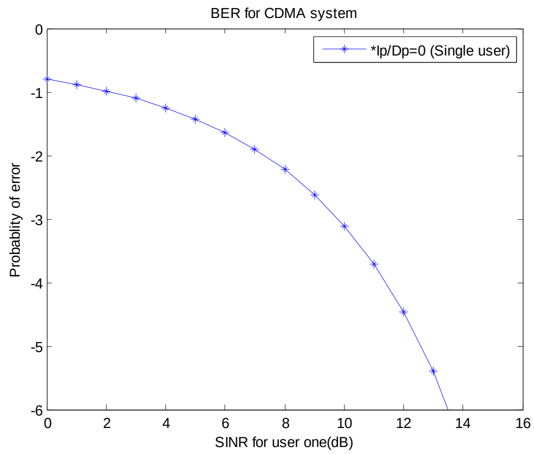

Figure: 2a Single user

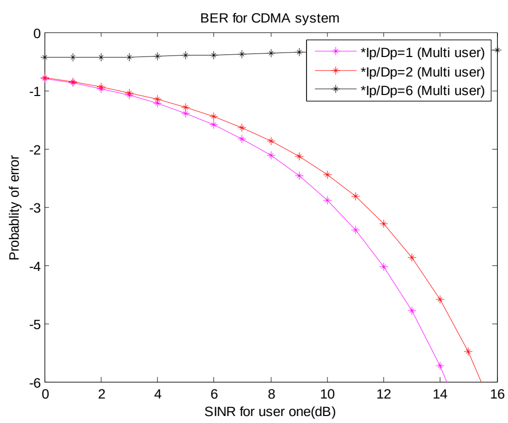

Figure 2b Multi user

In the above figure Ip denotes Interference user power and Dp denotes Desired user's power. The first case shows the value of BER when ratio of Interference power and desired power is zero which indicates the desired power is very much greater than Interference power.

When EbN0/SINR values increases the BER becomes almost zero for first three cases. But in the 4th case when Interference power is 6 times greater than desired user power BER increases for increasing SINR. Therefore in this case the SINR cannot be increased to achieve smaller BER.

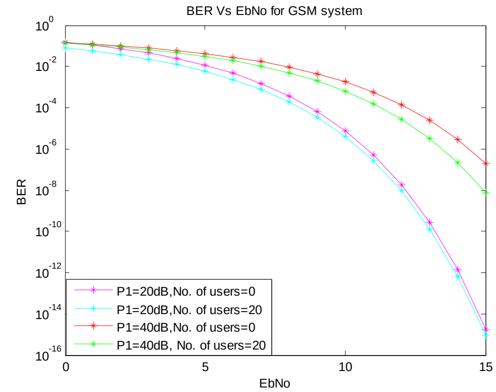

Figure2C BER of GSM system

For GSM the SINR can be high upto 30 dB and if we manage to maintain SINR above 10 dB BER will be almost zero. As there is no interference in this system the BER can be made zero.

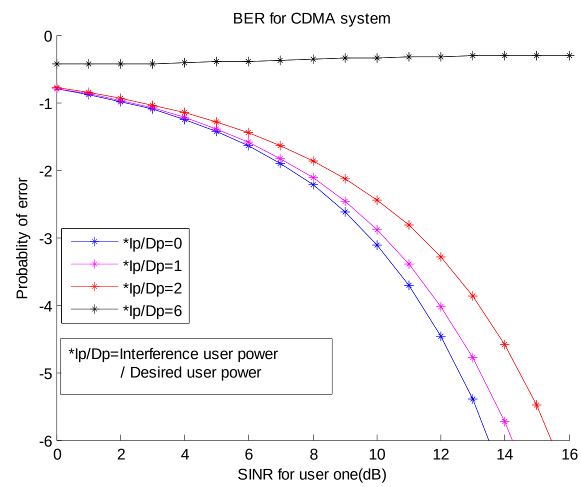

Figure2C BER of CDMAsystem

The above value indicates BER for Varying BTS transmit power and number of users.

IV. CONCLUSION

In this paper we have considered single user and multi user for 20 dB and 40 dB power levels. If P1=20 dB, Single user, When the BTS transmit power is 20 dB the BER value is 0.0786 for minimum value of SINR. In the case of Multi user BER increases to a small extent due to adjacent channel interference. If P1=40 dB, Single user, Co-Channel interference occurs and because of this BER increases. In the case of Multi user BER increases because both Adjacent channel interference and co-channel interference increases. The energy per bit to noise power spectral density ratio is above eleven for single and multi user makes the BER zero with channel interferences.

REFERENCES

[1] E.J. Weldon, with R.W. Lucky and J. Salz, *Principles of Data Communication*, McGraw-Hill Inc.,US, 1968.

[2] B. Widrow and S.D. Stearns, *Adaptive signal processing*, Prentice Hall, 1985.

[3] H.J. Kushner and D.S. Clark, *Stochastic approximation methods for constrained and unconstrained systems*, Springer Verlag, 1978.

[4] C.A. Belfiore and J.H. Park, "Decision feedback equalization," *Proceedings of the IEEE*, vol. 67, 1979, pp. 1143-1156.

[5] O. Shimbo and M. Celebiler, "The Probability of Error Due to Intersymbol Interference and Gaussian Noise in Digital Communication Systems," *IEEE Transactions on Communications*, vol. 19, Apr. 1971, pp. 113-119.

[6] J.R. Barry, "Adaptive minimum bit-error rate equalization for binary signaling," *IEEE Transactions on Communications*, vol. 48, Jul. 2000, pp. 1226-1235.

[7] L. Kovacs, J. Levendovszky, and E.C. Van Der Meulen, "A novel blind channel equalization algorithm for minimizing the peak distortion in DS-CDMA systems," *WSEAS Transactions on Communications*, vol. 6, 2007, pp. 289-294.

[8] J. Levendovszky and A. Olah, "Novel adaptive channel equalization algorithms by statistical sampling," *International Journal of Applied Science, Engineering and Technology*, vol. 2, 2006, pp. 198-205.

[9] G. Jeney, J. Levendovszky, and L. Kovacs, "Blind adaptive stochastic neural network for multiuser detection," *IEEE VTS 53rd Vehicular Technology Conference, Spring 2001. Proceedings (Cat. No.01CH37202),* IEEE, , pp. 1868-1872.

[10] J. Levendovszky, L. Kovacs, and E.C. van der Meulen, "Minimum Probability of Error-Based Equalization Algorithms for Fading Channels," *EURASIP Journal on Wireless Communications and Networking*, vol. 2007, 2007, pp. 1-12.

[11] C. Intanagonwiwat, R. Govindan, and D. Estrin, "Directed diffusion for wireless sensor networking," *IEEE/ACM Transactions on Networking*, vol. 11, 2003, pp. 2-16.

[12] W.R. Heinzelman, A. Chandrakasan, and H. Balakrishnan, "Energy-efficient communication protocol for wireless microsensor networks," *Proceedings of the 33rd Annual Hawaii International Conference on System Sciences*, IEEE Comput. Soc, 2000, p. 10.

[13] F. Xiangning and S. Yulin, "Improvement on LEACH Protocol of Wireless Sensor Network," *2007 International Conference on Sensor Technologies and Applications (SENSORCOMM 2007)*, IEEE, 2007, pp. 260-264.

[14] H.Ö. Tan and I. Körpeoǧlu, "Power efficient data gathering and aggregation in wireless sensor networks," *ACM SIGMOD Record*, vol. 32, Dec. 2003, p. 66.

[15] S. Lindsey and C.S. Raghavendra, "PEGASIS: Power-efficient gathering in sensor information systems," *Proceedings, IEEE Aerospace Conference*, IEEE, 2002, pp. 3-1125-3-1130.