ISSN 2347-4289

Optimized Power Consumption And High Bandwidth Utililaization For Wireless Networks

M. Gopu

ECE dept, JEC, Chennai, Tamil Nadu, India
gopumano@gmail.com

Abstract: The availability of video streaming and other high quality multimedia applications increases the usage power in wireless terminals. In this paper an innovative bandwidth allocation method is proposed for wireless networks to reduce energy consumption. This method provides better energy efficiency by optimizing the channel allocation process. Rate of transmission of data is the significant factor which affects energy consumption. In turn, bandwidth allocation limits rate of transmission. So the efficient allocation of bandwidth with reduced blocking probability ensures reduced energy consumption. The existing methods to reduce the energy consumption have a difficulty of unexpected reduction in quality of service (QoS) and throughput. The proposed overcomes these difficulties and maintains required level of QoS and through put.

Index terms: bandwidth allocation, energy efficiency, optimization, QoS, Channel

I INTRODUCTION

Many new applications based on multimedia are introduced in mobile communication. High definition video streaming applications requires larger bandwidth and consumes more power. Mobile dives are powered by batteries and the capacity of the batteries limits the usage of these devices. Often the user needs to connect the mobile devices to power supply for recharging the batteries. Because of this reason energy consumption needs to be optimized. Energy efficiency has become a primitive factor in deciding the performance of wireless communication. This paper proposes an algorithm to optimize the energy usage based on efficient bandwidth allocation procedure. By proper scheduling of the transmission rate this new bandwidth allocation method maximizes energy efficiency. Though the existing bandwidth allocation procedures ensure connectivity and Quality of service (QoS) they are not designed to minimize power consumption in any respect. The algorithms introduced in the recent past addresses these issues but with a compromise on QoS. The method introduced in this paper makes an attempt to find a solution to the above problem. The remaining part of the paper is organized as follows. Section II describes the available methods and challenges, section III explains the proposed method and section IV concludes

II. EXISTING METHOD

Many algorithms were propounded to allocate bandwidth during runtime [1].[2]. The bandwidth allocation procedure is based on many parameters. Few algorithms are based on the overall capacity of the system. Mobility, interference levels and priority requirements are also considered as important factors in bandwidth allocation procedure. The dynamic bandwidth allocation procedure finds a compromise between these factors. The connection admission control [3] procedure is an algorithm used extensively to optimize the bandwidth allocation. It allocates the bandwidth based on the maximum capacity requirement of a particular application. Priority allocation methods [4] are also often used in wireless applications which allocates channel depending on the priority assigned by the provider. The user or application with higher priority gets the required bandwidth first. Prediction based algorithms are introduced to reserve bandwidth before any user request. All the three algorithms mentioned above are aimed at improving the bandwidth allocation procedure. But these methods do not cater to the needs of reducing the energy consumption. Adaptive transmission rate mechanism and Automatic power off mode during idle state are the new techniques introduced to reduce the energy consumption in mobile devices. The rate of transmission can be varied based on the selected application. Bit transmission has to be optimized to reduce power requirements and thereby achieve high energy efficiency. Here the quality of service may get reduced due to reduction in transmission rate. Automatic power off mode reduces power consumption but introduces technical glitches.

III PROPOSED METHOD

This paper identifies a unified approach to optimize the energy consumption by efficient bandwidth allocation. Quality of Service (QoS) is also maintained at the required level. Energy consumption can be greatly reduced by reducing the transmission rate. From the previous studies and analysis it very clear that the transmission rate alters the power requirements. If the transmission rate is reduced and the transmission takes longer duration but the power consumption reduces. This method explains a new way to allocate bandwidth during runtime. The basic bandwidth allocation remains the same.

A. Bandwidth allocation

During runtime the bandwidth allocated to a particular user is monitored and the variation in the usage of bandwidth is indicated. In a multi channel environment the requirement of bandwidth varies with user. Also every application consumes different amount of bandwidth. For a particular application a fixed amount of bandwidth is allocated[4]. Usually maximum bandwidth that may be required for that particular application will be allotted. But during runtime the requirement of the bandwidth varies. At a given instant the allocated bandwidth is not completely utilized by the application. This variation in the usage of allotted bandwidth can be monitored and whenever the channel is free it can be given to other user or application which is in need of bandwidth. This bandwidth optimization controls the transmission rate thereby reduces power consumption. In a heterogeneous environment the base station allocates bandwidth using a particular type of algorithms. Every

ISSN 2347-4289

mobile communicates with base station through a control channel and specifies its requirements for the bandwidth. The request of the user is processed by the control station and accordingly the bandwidth is allocated. This allocated channel is maintained until the user closes the application[5]. This process is initiated every time a user sought a new application.

B. Bandwidth utilization

There is no fixed bandwidth given to a user all the time. All the process is controlled during runtime. In this method the amount of bandwidth allocated to a user for a particular application is based on the maximum possible requirement of that application. Every user gets allocation of bandwidth based on these conditions. One important aspect that is to be considered here is not all the users utilize the complete bandwidth all the time[6]. As the maximum bandwidth is allocated to the applications, it is understood that the applications not going to occupy the full bandwidth most of the time and considerable portion of allocated bandwidth will be free. So during this process free bandwidth can be reassigned to another user by optimizing the channel allocation process. Different type of application utilizes different bandwidth. Multimedia based applications need more bandwidth compared to other data oriented services. Few services need fixed bandwidth for some time. These kind of fixed bandwidth applications like voice and online applications are not disturbed during optimization.

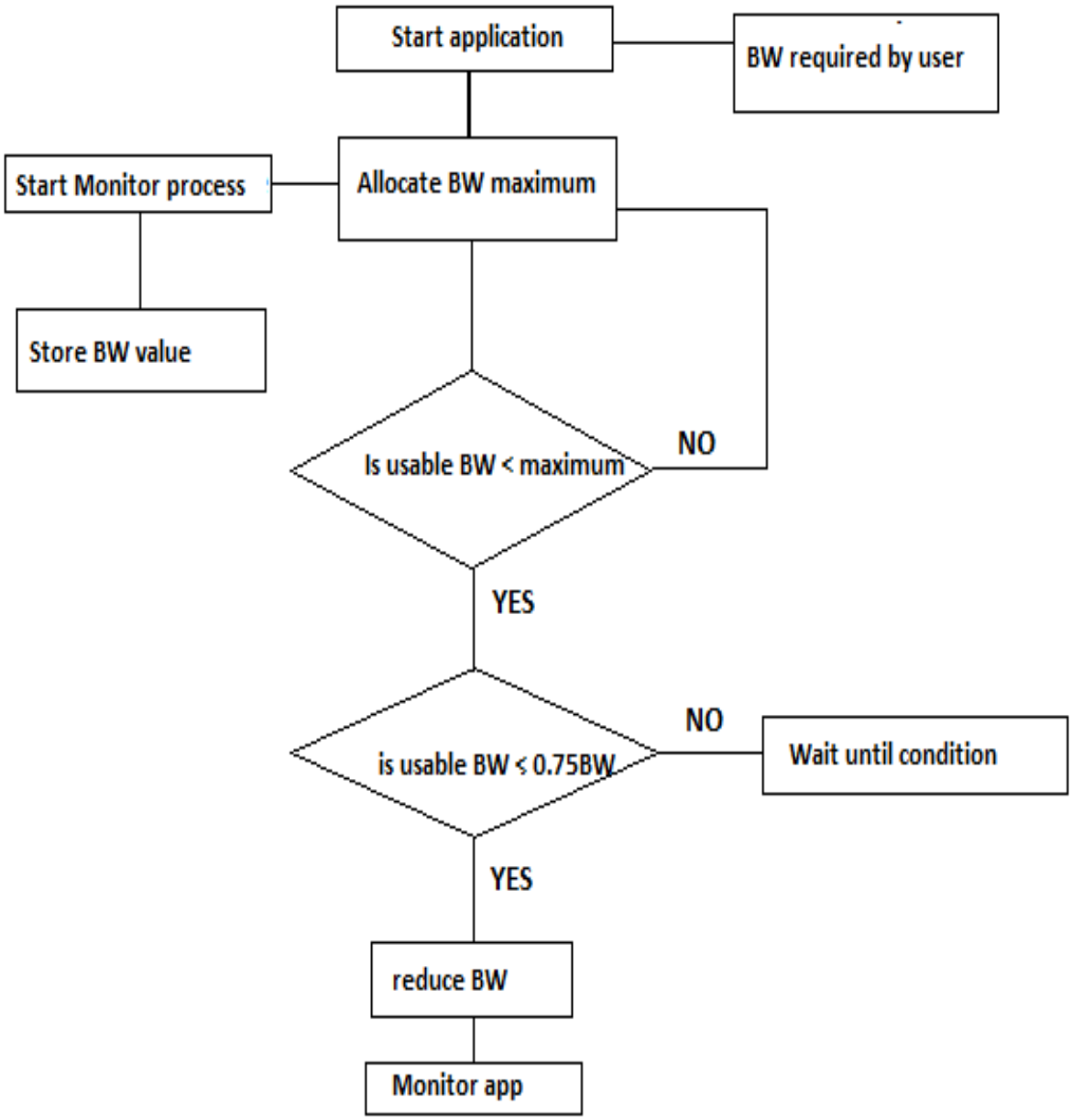

Fig 1. Simplified Flow diagram of proposed method

C. Estimation

Fig 1 shows the simplified diagram of the proposed method. Let "N" be the number of users sharing a total bandwidth B_T. This bandwidth B_T is shared among the available users n1, n2, n3… etc. The active users ' n_i' at a given time't_1' is always less than the total number of user existence (ie ' n_i' <N). The bandwidth allocation is usually done by either TDMA or CDMA method[7]. The proposed method holds good for both the methods of channel assignment. Before starting to monitor the usage of bandwidth the pre-procedure is executed in the base control station. This procedure uses prediction based algorithms to estimate the amount of bandwidth required for a particular application. The estimated values (E_i) are stored in the data base and referred by the bandwidth allocation algorithm every time a user sought a bandwidth allocation. Also the applications are grouped based on the bandwidth requirements. The applications require fixed bandwidth are grouped separately. In most of the applications the channel requirements are variable and the unused bandwidth can be re allocated to new application or users. Very few applications like voice and fixed data communication use fixed bandwidth. The fixed bandwidth application utilize only little amount of total bandwidth.

D. Re-allocation

Once a new application is started the monitoring process starts immediately. The maximum amount of bandwidth required is taken as peak value and the reference value is chosen between 75% to 90% of peak value. When a user runs an application the bandwidth used is stored as a value in a particular memory location. The point reference is created every time a value exceeds the previous values. If the bandwidth used is reduced than the 75% value of the maximum value then the monitoring algorithm initiates a subroutine to activate bandwidth reduction process. The variation in bandwidth reduces below 75% and stays within the limit for few seconds then the bandwidth reduction routine reduces the allotted bandwidth for that particular application. This bandwidth can be accumulated with the available bandwidth and can be allotted to other applications or users. This channel optimization controls the transfer rate and reduces power consumption. As explained in earlier section controlling the data transfer rate intern increases power efficiency. The energy consumption is a fundamental limiting factor of mobile devices. The battery capacity sets a limit to the usability of the technology. Transmitting the bits with high transfer rate (using more BW) increases the power dissipation. By controlling the BW allocation procedure this dissipation can be reduced. Reducing the transfer rate and increases the transmission duration of a frame, so this needs to be chosen carefully. Otherwise power savings cannot be guaranteed.

E. Performance Comparison

This proposed method provides two major advantages compared to other existing methods. First one the power savings by optimizing the transmission rate. Second it maintains the QoS within the acceptable level. In the available methods when bandwidth is reduced the QoS is compromised. Here this problem is eliminated because only the free or unused bandwidth allotted for a particular application is reverted back. If the current application from which the bandwidth is reduced need more bandwidth again it can get it back from some other application which spares the bandwidth. This way all the applications are also share the resources available during runtime. Generally the users only share the bandwidth; here even the bandwidth is shared by the application running thereby optimization is ensured.

IV CONCLUSION

Attempt has been made in this paper to reduce power consumption by controlling the transmission rate. Efficiently monitoring the bandwidth requirement of an application and re –allocating the unused bandwidth to other application which are in need of more bandwidth is presented. This optimized bandwidth allocation procedure ensures exact transmission rate to achieve good power efficiency. Also this method ensures acceptable QoS in an application. Thus this proposed method explains a way to efficiently allocate bandwidth without disturbing the QoS and to reduce power consumption.

REFERENCES

[1]. M.-H. Chiu and M. Bassiouni, "Predictive schemes for handoff prioritization in cellular networks based on mobile positioning," IEEE J. Select.Areas Commun., vol. 18, pp. 510–522, Feb. 2000.

[2]. E. Elalfy, Y. D. Yao, and H. Heffes, "Adaptive resource allocation with prioritized handoff in cellular mobile networks under QoS provisioning,"in IEEE Vehicular Technology Conference (VTC), 2001, vol. 4, pp. 2113,–2117, 2001.

[3]. W. Hou and Y. Fang, "Mobility-based call admission control schemes,for wireless mobile networks," Wireless Communications and Mobile,Computing, vol. 1, pp. 269–282, July-Sept. 2001.

[4]. L. Ortigoza-Guerrero and A. H. Aghvami, "A prioritized handoff dynamic,channel allocation strategy for PCS," IEEE Trans. Veh. Technol.,vol. 48, pp. 1203–1215, July 1999.

[5]. P. Ramanathan, K. M. Sivalingam, P. Agrawal, and S. Kishore, "Dynamic,resource allocation schemes during handoff for mobile multimedia,wireless networks," IEEE J. Select. Areas Commun., vol. 17,,pp. 1270–1283, 1999.

[6]. T. Zhang, E. Berg, J. Chennikara, P. Agrawal, J.-C. Chen, and T. Kodama,"Local predictive resource reservation for handoffs in multimedia,wireless IP networks," IEEE J. Select. Areas Commun., vol. 19, pp. 1931–1941, Oct. 2001.

[7]. X. Wang, R. Ramjee, and H. Viswanathan, "Adaptive and predictive downlink resource management in next generation CDMA networks,"in Proc. IEEE INFOCOM'2004, June 2004.