Improvement of Quality of Service In Wireless Communications Using Kalman Filter

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Abstract - In Wireless/Mobile networks various kinds of encoding schemes were used for transmission of data over a bandwidth. The desired quality and generated traffic varies with the requirement with this bandwidth. A generic video telephony may require more than 40 kbps whereas a low motion video telephony may require about 25 kbps for data transmission. From the designing point of view these requirements demands for an alternative resource planning, especially for bandwidth allocation in wireless networks. In wireless network where bandwidth is a scare resource, the system may need to block incoming user if all of the bandwidth has been used to provide highest quality of service to existing users. However this bandwidth resource planning may be unacceptable for larger application. A degradable approach to multiple users can be made on bandwidth allocation to reduce the blocking probability without degrading the quality of service to existing users. This paper aims towards a realization of a wireless/mobile network using W-CDMA multi access technique supporting multilevel quality of services. The bandwidth allocation to multiple users is adjusted dynamically according to the required network condition so as to increase bandwidth utilization. The paper analyzes the performance deriving the degradation period ratio, mean degradation time and degradation state for the implemented wireless network. The proposed work is aim to implement on Matlab tool for its functional verification considering various mobility patterns.

Keywords - Kalaman Filter, QoS, Wireless Communication.

I. INTRODUCTION

Cellular wireless technology today has become the prevalent technology for wireless networking. Not only mobile phones but also other types of devices such as laptops and Personal Digital Assistant (PDA) can connect to Internet via cellular infrastructure. These mobile devices are often capable of running multimedia applications (e.g., video, images). Therefore, cellular networks need to provide quality of service (QoS) guarantee to different types of data traffic in a mobile environment. A call admission control (CAC) scheme aims at maintaining the delivered QoS to the different calls (or users) at the target level by limiting the number of ongoing calls in the system. One major challenge in designing a CAC arises due to the fact that the cellular network has to service two major types of calls: new calls and handoff calls. The QoS performances related to these two types of calls are generally measured by new call blocking probability and handoff call dropping probability. In general, users are more sensitive to dropping of an ongoing and handed over call than blocking a new call. Therefore, a CAC scheme needs to prioritize handoff calls over new calls by minimizing handoff-dropping probability.

The packet-level dynamics can be exploited for designing efficient call admission control methods. The call admission control (CAC) and the adaptive channel adaptation (ACA) mechanisms are generally treated as the network layer (above layer-2) functionalities in the wireless transmission protocol stack (Figure 1.1). The scheduling and the adaptive modulation and coding (AMC) are layer-2 and layer-1 (i.e., physical functionalities, respectively.

II. QUALITY OF SERVICE

Guaranteeing the QoS requirements is a challenging task with wireless communication. One of the key elements in providing QoS is an effective resource allocation policy, which not only ensures meeting QoS of newly arriving calls, if accepted but also not deteriorating the existing on-going services. These enhancements will enable a better mobile user experience and will make more efficient use of the wireless channel.

As the performance of a system with given physical resources(e.g., the available bandwidth of radio spectrum) depends heavily on resource management schemes including multiple access techniques, the call admission control policies and the congestion control schemes, to make efficient use of the available bandwidth while providing high quality of service(QoS) to simultaneous services with different requirements, efficient resource management schemes have to be devised.

III. APPROACH

In this paper work an optimal degradation strategy by adaptive resource allocation algorithm to maximize bandwidth utilization and attempted to achieve fairness in multi user communication. the system performance, in terms of bandwidth utilization or service provider's, can be improved significantly by allowing QoS degradation. However, the impact of quality degradation on individual users, which is crucial to QoS provisioning is observed. For example, even though the users can tolerate some quality degradation, it is still desirable to provide them higher QoS when more resources become available. Thus, some performance metrics, which reflects the average quality level that a user receives, should be considered. In this approach degradation period ratio to represent the time a user receives degraded quality is considered. In addition to this degradation ratio, another new performance metric, the frequency of switching between different quality levels is also taken into account because users may feel more disturbed by frequent switches between different quality levels than by poor and steady quality. It is shown numerically that degradation ratio does not suffice to reflect the QoS guarantees given to individual users. Frequent switching of QoS level may be even worse than a large degradation ratio.

The problem of providing adaptive QoS in a wireless/ mobile network would be similar to that in its wired counterpart if we do not consider user mobility. In a wireless/mobile network, a user may move across different cells or administration domains. Thus, we have to consider the user-perceived QoS not only during his stay in a single cell, but in all cells he may traverse throughout the connection lifetime. Moreover, the potential dropping due to such cell crossings (i.e., handoffs) has to be taken into account. The forced-termination (or dropping) probability is a widely used metric to represent the compromise of QoS due to user mobility. This probability should be made as small as possible because admitting a user and then terminating his session before its completion would make the user even unhappier. In order to reduce this probability, many admission control algorithms give handoff users priority over new users. In this work, the adaptive bandwidth allocation for QoS provisioning in wireless/mobile networks is presented. For a code division multiple access (CDMA) system, the wideband CDMA canbe used for service degrade/upgrade; for a time division multiple access (TDMA) system (e.g., Bluetooth), service degrade/ upgrade can be achieved by an adequate assignment of time slots (i.e., polling policy)

IV. QOSIN WIRELESS COMMUNICATION

In this paper, we exploit the adaptive bandwidth allocation for QoS provisioning in wireless/mobile networks .An analytical model for a wireless/mobile network with multilevel degradable QoS is provided. This model includes two very important QoS metrics degradation on ratio and upgrade/degrade frequency—both of which are necessary for QoS provisioning. Moreover, our analytical model includes user mobility to enable the study of its impact on user perceived QoS .Our work not only provides an analytical frame work for predictive or adaptive bandwidth allocation algorithms, but also helps decide the operation region based on some desired criteria. It should be noted that our scheme can be applied to various wireless architectures.

V. LIMITATIONS

MANY real-time applications can use different encoding schemes according to their desired quality and generate traffic with different bandwidth requirements. For example, generic video telephony may require more than 40 Kbps, but low-motion video telephony requiring about 25 Kbps may be acceptable [1]. From the standpoint of a system administrator, this property provides an alternative for resource planning, especially for bandwidth allocation in wireless networks. In wireless networks where the bandwidth is a scarce resource, the system may need to block incoming users if all of the bandwidth has been used upto provide the highest QoS to existing users. In a system with degradable QoS, a user may receive different levels of QoS during the entire duration of his connection, depending on the loads of cells he traverses. Even if a user receives the highest level of QoS when he is admitted to a cell, the QoS may still be degraded when some other base stations on his "path" decide to degrade his QoS in order to accept more users.

In fixed bandwidth allocation if some number of users is transmitting information through channel new user wants to enter into that network he has to wait to some amount of time to transmit information. So transmission delay is more. Throughput is also very small. At this instant channel is less efficient. Blocking probability is also high.

VI. RESULT ANALYSIS-PARAMETER SETTING

We are considering three images of resolution 256*256.Assuming 1 group is equal to 3 users. We are considering 1 pixel having number of bits is equal to 8.From each user 1 pixel data is sending and this data modulated with pseudo random noise sequence of Spread factor is equal to 31 after this ovsf spreading is used to spread the data. The spreading factor is equal to 8. This data is modulated using Bpsk modulation. This is pass band transmission model. We are considering two groups are in the network. We have presented an analytical framework for adaptive bandwidth allocation in cellular mobile networks. The numerical results obtained from the model have shown that the ABA can minimize handoff call dropping probability, while some calls might experience service degradation below an acceptable level.We assume that the 6 users are in the channel having bandwidth that is sufficient for all of them. But allocated bandwidth for all users is different. Assuming total bandwidth is W.Assuming first 2 users having allocated bandwidth (b1) = 30% of WThird user having allocated bandwidth (b2) = 25% of $W4^{h}$ and 5^{th} users having allocated bandwidth (b3) =20% of W 6^{th} user having allocated bandwidth (b4) = 15% of W Available bandwidth=7% of W Minimum bandwidth required for a call is equal to 15% of W. If a new user requests to enter in the channel then first two users bandwidth is degraded by 15% and this bandwidth is allocated to new user. But quality of first two users is degraded by 15% of W. In a system with degradable QoS, a user may receive different levels of QoS during the entire duration of his connection, depending on the loads of cells he traverses. Even if a user receives the highest level of QoS when he is admitted to a cell, the QoS may still be degraded when some other base stations on his “path” decide to degrade his QoS in order to accept more users. We are primarily interested in quality-degradable connections as long as the resultant quality is within the user specified QoS profile. The only QoS requirement we discuss here is the bandwidth. For example, it can be a video streaming application with multiple transmission rates depending on the encoding schemes and resolution. We assume that there are 4 different quality levels. The bandwidth requirement of the ith quality level is denoted as bi and b1>b2>b3>b4. With such a degree of freedom, a base station may try to degrade the quality levels of some existing users in order to admit more users so as to improve the overall system performance. For example, we may be able to achieve high bandwidth utilization and maintain a small blocking and/or forced termination probability. if a user receives level-i QoS for Ti seconds

Assuming T1= (W/ (b1*100))*10;

T2= (W/ (b2*100))*10;

T3= (W/ (b3*100))*10;

T4= (W/ (b4*100))*10;

The above bandwidth allocation is achieved using adaptive bandwidth allocation method. If another user requests to enter in the network the same algorithm is applied to improve channel utilization but degradation of existing users increased. This algorithm can be applied until every user achieves minimum bandwidth (b1).

Fig 6.1 indicates different users are in different users are in different level based on bandwidth allocation .The level1 has highest bandwidth .When group1 (G1) enters into network the level 1 users are falls into level 4 .This bandwidth degradation is applicable to existing users reaches to minimum bandwidth for a call to be continued.

Fig 6.2 Images to be Transmitted

Fig 6.2 shows the original image considered for the three users in a group. Three users selects the image information which have then proposed using the communication system for transmitting the three images chosen are colored(256 level) bit map images.

Fig 6.3 shoes the gold code generator due to correlation value obtained from comparison of two pn sequences with one varying in time shift version.

The code generated is used as a spread code and is used for user1

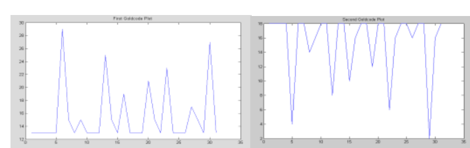

Fig 6.3 &6.4 first & second gold code plot

Fig 6.4 shows the gold code generator due to correlation value obtained from comparison of two pn sequences with one varying in time shift version. The code generated is used as a spread code for user2

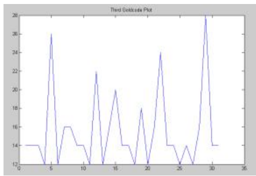

Fig 6.5 second gold code plot

Fig 6.5 shows the gold code generator due to correlation value obtained from comparison of two pn sequences with one varying in time shift version.

The code generated is used as a spread code and is used for user3

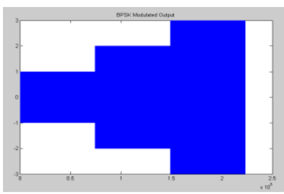

Fig 6.6 Bpsk modulated output

Fig 6.6 shoes the bpsk modulated data bundled with various power levels used before transmission. The three user data are modulated with sinusoidal carrier of o to (2*pi) sampled at 100 points. The user bandwidth data are processed for transmission over the wireless channel.

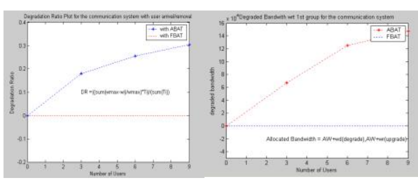

Figure 6.6 .6.7 Bandwidth Degradation plot for the communication system

Figure 6.6 illustrates the performance plot for degradation in bandwidth allocated with respect to increase in number of users for fixed bandwidth allocation technique (fbat),adaptive bandwidth allocation technique (abat).The plot illustrates with increase in number of users the degradation eventually increases number for abatwhere as the fbat method the degradation is not applicable.Figure 6.7 shows the degradation the proposed two methods abat, fbat with respect to group of users in the plot it is observed that the degradation for abat system varies where as remain constant in case of fbat system.

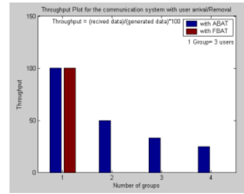

Figure 6.8 Throughput plot for the FBAT and ABAT system

Figure 6.8 shows the throughput analysis for two systems namely abat,fbat methods.

Incase of abat method, it could be observed that the throughput remains decreased with increment in number of users where as it could be completely eliminated in case of fbat system.

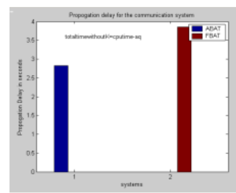

Figure 6.9 Propagation Delay comparison plot for the two implemented system

Figure 6.9 shows the propagation delay observed for the two systems fbat and abatsystems the propagation delay is considerably less for 12 users over constraint bandwidth. There is a decrement of about 40% in propagation delay compared to fbat system.

The BPSK signal is filtered using Kalman filter which is an estimated filter in order to remove unwanted disturbances from the signal.

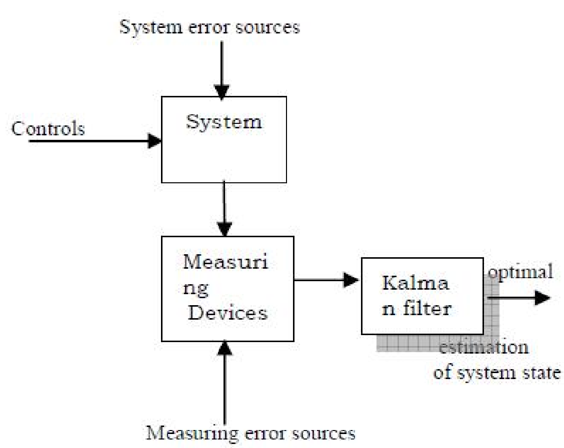

Fig 6.10 Block Diagram of Kalman Filter

The Kalman Filter is an estimator for what is called the "linear- quadratic problem", which focuses on estimating the instantaneous "state" of a linear dynamic system perturbed by white noise. Statistically, this estimator is optimal with respect to any quadratic function of estimation errors. It is a Recursive Data Processing Algorithm.

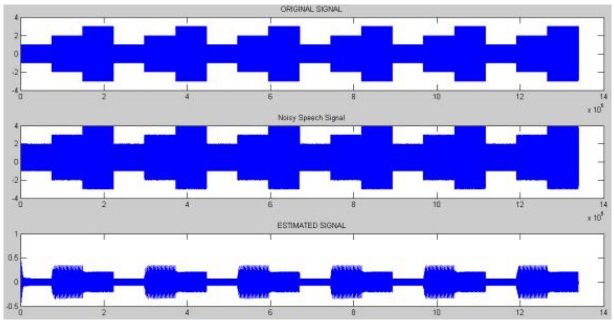

Fig 6.11 Original Signal with Noise

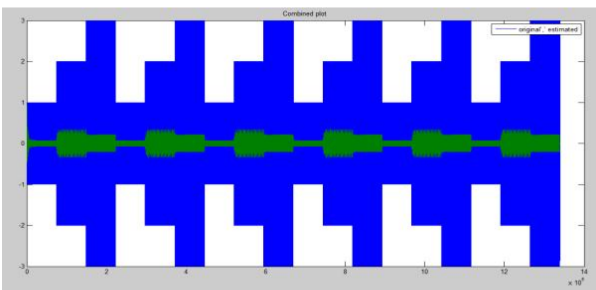

Fig 6.12.Signal with Estimated Filter

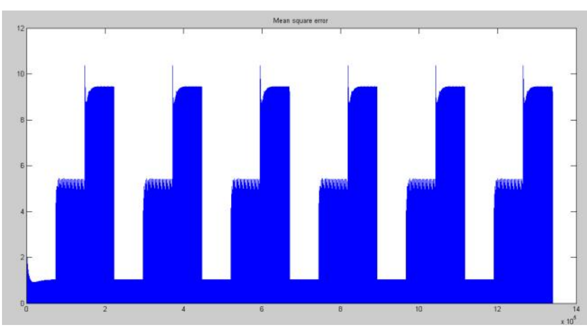

Fig 6.13 Mean Square Error

VII. CONCLUSION

In this paper, we derived an analytical model for a wireless network which uses adaptive bandwidth allocation to provide users multilevel QoS. Four performance metrics Throughput, transmission time delay, degraded bandwidth, degradation ratio are observed.. The performance plots obtained gives that with increase in load with respect to time the through put level falls down because of increase in compression level which could be controlled by adaptive band width allocation method. With increase in demand for transmitting data over a constraint bandwidth new algorithm is to be implemented to overcome the resource constraints observed in wireless communication although the various technique where proposed in last for proper resource allocation they get constrained once the cell capacity is reached. Hence they require a advanced algorithm for proper utilization and scheduling of resources to handle more number of user with the constrained bandwidth. In this paper work an approach is made to overcome the resource constraint bydegrading the qos

provided to each user the system is implemented following wcdmaArchitecture with cellular communications where each cell constitute of 3 users communicating simultaneously.

The performance is evaluated over wcdma architecture by adding or removing different group of users to evaluate the algorithm efficiency. The metrics used to evaluate the performance are throughput, propagation delay, degradation ratio allocated bandwidth degradation is observed to outperform the existing fixed bandwidth allocation technique with more number of users it is seen that the delay for proposed abat method get reduced by 40% compared to fbatmethod.and finally the Signal is filtered using kalman filter and the mean square errir is calculated.

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