A Review on Call Admission Control in Wireless Network

[1]Shirishkumar N. Mahajan, [2]N. C. Patil

Department of E & TC, (M.E.)
D.N. Patel COE, Shahada, Dist. Nandurbar, MH, India

***ABSTRACT*: Call Admission Control (CAC) is necessary for the QoS provisioning in WCDMA environment. CAC scheme is a critical component to be considered for satisfying diverse Quality of service (QoS) requirements needed for future mobile networks. An attempt is made to suggest a new call admission control scheme in a distributed manner, considering the load conditions in all neighboring cells. Radio resource management (RRM) plays a major role in Quality of Service (QoS) provisioning for wireless communication systems. The performance of RRM techniques has a direct impact on each user's individual performance and on the overall network performance. Arriving (new and handoff) calls are granted/denied access to the network by the call admission scheme (CAC) based on predefined criteria, taking the network loading conditions into consideration. Traffic of admitted calls is then controlled by other RRM techniques such as scheduling, handoff, power and rate control schemes. This CAC scheme gives preference to high priority calls, such as soft handoff calls by reserving some guard channel to reduce hand off failures. This Paper provides a comprehensive survey of CAC schemes in modern wireless networks.**

***KEYWORDS*: Load Estimation, Queuing, SIR, Soft Handoff, WCDMA.**

INTRODUCTION

As more people from all over the world are using wireless, the world requires more from the wireless communication technologies. It is much excited because Third-Generation (3G) wireless data services and applications like wireless email, web, digital picture taking/sending and assisted-GPS position location applications, video and audio streaming, TV broadcasting and wireless networks are performing more recently. In these cases CDMA technology matches well. Rather than any other commercial mobile technologies, CDMA provides better capacity for voice and data communications constantly which allows more subscribers to connect any time and it is the most common platform to build 3G technologies. As its name involves CDMA is a "spread spectrum" technology which permits more users to reside in the same time and frequency distributions in a given band or space. To distinguish CDMA (Code Division Multiple Access) from others which are in the same spectrum it allocates distinctive codes for each communication. When compared with the other technologies CDMA allows more people to share the airwaves at the same time.

The wide-band CDMA (W-CDMA) technology has been appeared as the major air interface for 3G wireless systems which provides a transmission rate of 144Kbps to 2Mbps and enables multimedia services like the broadband wired networks. Wideband CDMA can support services with higher rate when it measured up with the narrow-band CDMA. It is adaptable to distribute multimedia traffic. On the other hand, a new medium access control protocol (MAC) is required to manage packet access efficiently in wideband CDMA wireless networks..WCDMA has two basic modes of operation: Frequency Division Duplex (FDD) and Time Division Duplex (TDD). In the FDD mode, uplink and downlink transmissions use different frequency bands while for the TDD mode, uplink and downlink transmissions can be implemented on unpaired bands but separated by a guard period. In this paper DS-CDMA (FDD) is considered [1, 3].

The measurement of the resource capacity in a spreadspectrum system is distinct from that for conventional TDMA/FDMA systems. In conventional TDMA and FDMA systems such as IS-54 (TDMA) and GSM (hybrid TDMA/FDMA), the number of traffic channels is fixed. It is determined by the number of time slots in the TDMA system or by the number of non overlapping frequencies in the FDMA system. The spread spectrum system, such as WCDMA, does not have a fixed number of channels. Instead, the capacity of the CDMA system is limited by the total interference the system can tolerate.

Such a system is referred to as an interference-limited system. Each additional active mobile user will increase the overall level of interference. Normally, the interference level increases rapidly when the system load reaches a certain level. Users with different traffic profiles and attributes such as the service rate, the signal to- Interference ratio (SIR) requirement, media activity, etc. introduce different amounts of interference to the system. These factors are especially important in 3G wireless networks that support multimedia services [2, 13]. The coverage of WCDMA is assumed uplink limited in high-load scenarios. Referring to [11], the capacity of DS-CDMA networks depends on the reverse link (uplink) rather than the forward link (downlink). Uplink call admission control strategies play a very important role in the performance of CDMA systems as it directly controls the number of users in a cell and thus limit the interference in the systems.

RELATED WORK

A call admission control algorithm is needed to limit the interference by controlling the number of accepted flows. The CAC is performed for the uplink and downlink transmissions separately because the traffic load can be asymmetric. The new user is admitted into the system only if the both uplink and downlink admission control requirements are fulfilled. Some algorithms are more CDMA-oriented and consider the SIR as the determinant parameter in accepting or not accepting a new call. Those

algorithms are commonly called Interference-CAC (ICAC) [1]-[6]. The interference-based schemes can be further classified into three types.

Wideband Power-Based CAC: This method computes the increase in the interference (power) caused by the establishment of a new user in the cell in uplink and accepts the call only if the total interference does not exceed a predefined threshold.

***Throughput-based CAC*:** A throughput-based CAC algorithm computes the increase in the load caused by the establishment of a new user in the cell in uplink and accepts the call only if the total load does not exceed a predefined threshold.

***Signal to noise interference ratio-based CAC*:** This algorithm computes the minimum required power for the new user and accepts it if it is not below a predefined minimum link quality level.

CAC schemes have been designed either for the uplink (as in [12, 15]) or the downlink (as in [19, 20]). In the uplink, transmit power constraint is more serious than in the downlink since the MS is battery operated. On the other hand, CAC in the downlink needs information feedback from MSs to the BSs for efficient resource utilization. Applying CAC for both links jointly is crucial since some calls might be admissible in one of the links and non-admissible in the other, particularly for asymmetrical traffic. Jeon and Jeong have proposed in [21] a joint CAC scheme for both the uplink and downlink. The call request is admitted only if it is admissible in both

uplink and downlink. The asymmetry between uplink and downlink traffic, which is one of the characteristics of some multimedia services such as Web browsing, has been taken into account by adjusting the allocated bandwidth to each link in the CAC based on the traffic characteristics in each link.

The call admission control (CAC) method and the resource reservation estimation (RRE) method which are suitable for the wideband code division multiple access (W-CDMA) systems were proposed by Huan Chen et al. [5]. Their CAC method gives special treatment to high priority calls such as handoff calls by pre-reserving a certain amount of channel margin in opposition to the interference effect. Jyoti Laxmi Mishra et al. [7] have evaluated various types of call admission control algorithm. The objective of their research was to improve the same algorithm with multiclass users and multiservice using fuzzy logic.

The fuzzy based CAC scheme for wideband CDMA cellular system is used to meet the disputes in CAC due to user mobility, limited radio spectrum, heterogeneous and dynamic nature of multimedia traffic and QoS constraints have been studied and its performance was examined by S.Malarkkan and V.C.Ravichandran [8]. The fuzzy approach overcomes measurement errors, mobility and traffic model uncertainty, and avoid the necessities of complex mathematical relations among various design parameters.

Seong-Jun Oh et al. [4] have studied the radio resource allocation problem of distributed joint transmission power control and spreading gain allocation in a DS-CDMA mobile data network. The network consists of K base stations and M wireless data users. The data flows which are the users are considered as best-effort traffic, in the sense that there are no prespecified restrictions on the quality of the radio channels. They are interested in designing a distributed algorithm that maximal (or near-maximal in some reasonable sense) aggregate throughput, subject to peak power constraints.

S. Malarkkan and V.C. Ravichandran [9] have presented functioning of call admission control and resource reservation method based on the mobility of the users in WCDMA cellular systems. In order to assure the handoff dropping probability, the mobility of the user was calculated based on a realistic mobility model. The mobility calculation scheme was used to quote the set of candidate cells into which the mobile may move in the near future and calculates the similar value for each candidate cell.

Bazil Taha Ahmed et al. [10] have specified the uplink capacity and the interference statistics for a W-CDMA 3-D Airto- Ground (AG) cellular like network assuming imperfect power control and finite transmitted power. The free space model of propagation was used to calculate the intercellular interference. The uplink capacity has been considered for various frequencies and situations. It has been shown that the effect of rain was to reduce the uplink capacity and the maximum permissible cell radius. Also it was shown that, the frequency of operation should be lower or equal to 2 GHz. For a frequency of operation of 2 GHz, the cell capacity can reach 70 voice users or 46 data users when the cell radius is 350km. The new contribution of their work was the study of the effect of an imperfect power control and the finite transmitted power on the uplink capacity of the Air-Ground system for various values of outage.

PERFORMANCE EVALUATION

Bit error rate(BER): The value of the bit-energy-to-noise-density ratio *Eb* / *No* corresponds to the signal quality, since it determines the bit error rate, BER.

The blocking probability : The blocking probability is the probability that a new call is denied access to the system, while

The forced termination probability : The forced termination probability is the probability that a call that has been admitted will be terminated prior to the call's completion.

The Grade of service is considered here to evaluate the system performance and defined as:

$GoS_j = \alpha * P_{hj} + P_{nj}$

where $P_{hb,I}$ is the handoff blocking probability, and Pnb,i is the new call blocking probability of calls belonging to traffic of type.

CONCLUSION

This paper provides through outline of Call admission control for wireless network. CAC in wireless networks has been receiving a great deal of attention due to the growing popularity of wireless communications and the central role that CAC plays in QoS

provisioning in terms of the signal quality, call blocking and dropping probabilities, packet delay and loss rate, and transmission rate. CAC has been developed for a single service environment. In the third generation and beyond wireless systems, multimedia services such as voice, video, data, and audio are to be offered with various QoS profiles. Hence, more sophisticated CAC schemes are developed to cope with these changes.

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