

Chapter 8

User Based Call Admission Control Algorithms for Cellular Mobile Systems

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ABSTRACT

Call admission control in mobile cellular networks has become a high priority in network design research due to the rapid growth of popularity of wireless networks. Dozens of various call admission policies have been proposed for mobile cellular networks. This chapter proposes a classification of user based call admission policies in mobile cellular networks. The proposed classification not only provides a coherent framework for comparative studies of existing approaches, but also helps future researches and developments of new call admission policies.

1. INTRODUCTION

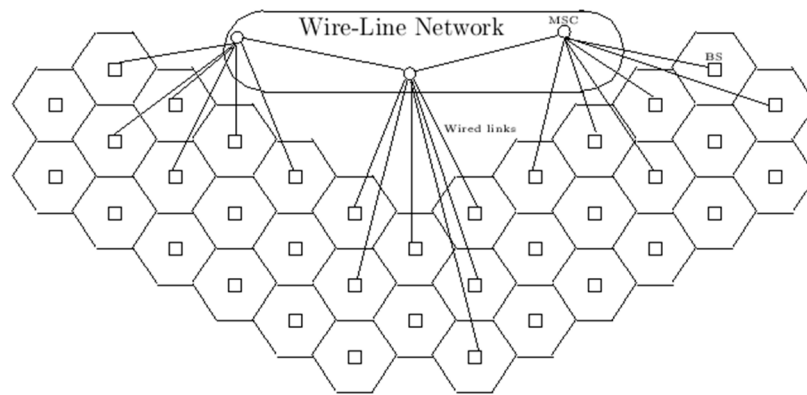
The frequency spectrum allocated to the mobile communication networks is very limited. This means that the frequency channels have to be reused as much as possible in order to support the many thousands of simultaneous calls that may arise in any typical mobile communication network (Katzela & Naghshineh, 1996). Thus, the efficient management and sharing of channels among numerous users become an important issue. In cellular networks the geographical area covered by the network is divided into smaller regions called cells. Each cell

is serviced by a base station, located at its center. The base station is used to service the users located at that cell. A number of base stations are again linked to a central server called mobile switching center, which also acts as a gateway of the mobile communication network to the existing wire-line networks such as PSTN, or internet. A base station communicates with users (mobile stations) through wireless links and with mobile switching centers through dedicated links. The model of such a network referred to as *cellular network* is shown in figure 1 (Das & Sen & Jayaram, 1998).

We assume that the network uses a fixed channel assignment algorithm, which means that each base station has a fixed number of channels (capacity).

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Figure 1. System model of cellular networks



This capacity is interpreted in terms of bandwidth and is independent of used multiple access technology such as FDMA, TDMA, or CDMA. In order for a mobile user to be able to communicate with other user(s), a connection usually must be established between the users. The establishment and maintenance of a connection in cellular networks is the responsibility of the base stations. In order to establish a connection, a mobile user must first specify its traffic characteristics and quality of service (QoS) requirements. This traffic specification may be either implicit or explicit depending on the type of services provided by the network. For example, in a cellular phone network, the traffic characteristics and QoS requirements of voice connections are known a priori to the base station, and therefore, they are usually specified implicitly in a connection request. The next generation wireless networks are expected to eventually carry multi-media traffic such as voice, mixed voice and data, image transmission, email and etc. The traffic characteristics and the QoS requirements of connections for these services may not be known a priori to the base station. In these networks, mobile users must specify explicitly the traffic characteristics and the QoS requirements as a part of the connection request. Then, the base station determines whether it can meet the requested QoS requirements and, if possible, establish a connection.

When a call is originated and attempted in a cell, one channel allocated to the base station is used for the communication between the mobile station and the base station as long as channel is available. When all channels in a cell are in use while a call is attempted, then it will be blocked and cleared from the system. When a call gets a channel, it will keep the channel until its completion, or until it moves out of the cell, in which case the used channel will be released. When the mobile station moves into a new cell while its call is ongoing, a new channel needs to be acquired in the new cell for further communication. This process is called *handoff* and must be transparent to the mobile user. During the handoff, if there is no channel is available in the new cell for the ongoing call, it is forced to terminate before its completion.

When a user moves from one cell to another, the base station in the new cell must be responsible for all the previously established connections. A significant responsibility involves allocating sufficient resources in the cell for maintaining the QoS requirements of the established connections. If sufficient resources are not allocated to the handoff calls, the QoS requirements may not be met, which in turn may result in forced termination of the connection. Since the forced termination of established connections is usually more objectionable than rejection of a new con-

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