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Chapter X

Connection Admission Control in Wireless Systems

Tuna Tugcu, Georgia Institute of Technology, USA

Abstract

Connection Admission Control (CAC) is the process that decides which connection requests are admitted to the system and allocated resources. CAC in wireless networks differs from wireline networks due to mobility and scarcity of wireless resources, and the physical properties of the radio channels. In this chapter, the basic issues in CAC for wireless systems are discussed in the context of resource management and trade-off between blocking and dropping rates. Though it is not among the topics of this chapter, quality of service (QoS) provisioning is also briefly mentioned due to its relationship with CAC. Following the discussion of the common and different points of CAC in both wireline and wireless systems, admission control in next-generation wireless systems is explained.

Introduction

Connection Admission Control (CAC) is the heart of a telecommunications system since it both determines the system's throughput and affects user satisfaction. During the past few decades, research has focused on improving CAC in wireline networks to increase

throughput without impairing user satisfaction. However, the mobility of users, the shortage of wireless resources, and the physical properties of the radio channels in wireless systems add new dimensions to the complexity of the problem. Since the scarce radio resources constitute the bottleneck in wireless systems, CAC schemes for wireless systems generally focus on the management of the radio resources rather than the resources in the wireline portion of the system.

Efficient management of the scarce radio resources in wireless systems is vital to the overall performance of the system. The CAC process, which follows the paging process, is a crucial part of resource management. It is the CAC scheme that decides which connection requests are admitted into the system and granted resources. The CAC scheme must consider the impacts of accepting requests on the other connections in the same and surrounding cells. These impacts result from both the interference caused by the new connections and the possible future handovers to the surrounding cells.

The CAC schemes in wireless systems differ from their counterparts in wireline networks by taking care of user mobility. A wireless system must be able to convey the connection of an active user (i.e., a user with an ongoing connection) from one cell to the other when the user moves between cells. To avoid service interruption during such handover operations, the system needs to employ prioritization or reservation schemes to keep connection dropping and blocking rates at reasonable levels. Once a connection request is admitted, the system must do its best to keep the connection alive.

CAC also plays a significant role in providing quality of service (QoS). Future telecommunication systems like 3G and Next-Generation Wireless Systems (NGWS) aim at providing integrated services such as voice, high-bandwidth data, and multimedia with QoS support. CAC must consider QoS requirements during connection set-up and handovers. In the case of NGWS, QoS requirements must be translated between the subsystems in the case of vertical handoffs. CAC needs to work hand in hand with resource management to achieve this task.

In this chapter, the basic issues in CAC for wireless systems are discussed. To provide a thorough discussion of admission control, we start by addressing the issues common to CAC in both wireline and wireless systems. Then, we focus on issues that are specific to wireless systems. This discussion is followed by admission control in NGWS. We finally conclude by summarizing the important points in admission control.

CAC and Resource Management

The wireless spectrum constitutes the bottleneck in wireless systems. CAC is the process of deciding which connection requests are admitted into the system and allocated these scarce resources. Efficient management of the radio resources determines the upper limit on the performance of the overall system. To achieve greater efficiency, the topics of wireless spectrum assignment to the cells, admission of new and handover connections into the system, and QoS provisioning should be considered together.