

Chapter II

QoS Support in Wireless Networks

Bashar Ahmad

Johannes Kepler University Linz, Austria

Gabriele Kotsis

Johannes Kepler University Linz, Austria

ABSTRACT

Wireless communication has gained a great deal of attention in the last few years from both industry and academia. Nowadays, most computerized devices are equipped with wireless ports such as IEEE 802.11 WLAN, Bluetooth, or Infrared port. IEEE 802.11 WLAN device, in particular, is an ideal wireless communication tool for any mobile-based computer such as a notebook or PDA because of their low cost and high bandwidth. The wireless environment has some characteristics that make supporting QoS a very challenging task. These characteristics are bandwidth scarce, radio channel conditions that vary over the time, and highly packet loss. Legacy IEEE 802.11 standards such 802.11a, b, or g originally do not support QoS, thus many QoS enhancement schemes have been proposed; most of them focus on enhancing a particular part or mode of the standard. QoS support in any system is an accumulative task, as it needs to be maintained throughout all layers. The wireless multimedia application is the best example for proving the accumulative property for its QoS as the user is the final judge about whether the provided quality is satisfactory or not. In this chapter, we will study and analyze QoS support for wireless network and the target application, which will be a real-time multimedia application. First, we discuss QoS support for multimedia application. Second, a framework for classifying the QoS enhancements will be proposed. Next we will study QoS support in IEEE 802.11 and the new QoS extension IEEE 802.11e, and then we will study and classify the proposed QoS enhancement schemes according to the proposed framework. Finally, we will discuss mobility as an important issue for QoS support in wireless environment.

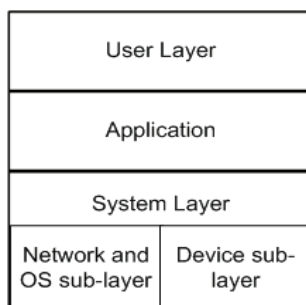
INTRODUCTION

Wireless network technology has given the ability to communicate anytime, anywhere; such a feature creates a great market opportunity in terms of business, healthcare, education, and entertainment. However, original WLAN (IEEE 802.11) standard was designed to serve on the best-effort basis, which was fine in order to provide connectivity to non-real-time applications. Nowadays, with the high increases of the data rate capability of IEEE 802.11 (11mbps for 802.11b, and 54mbps for 802.11g), it becomes possible for real-time applications such as multimedia application to be served over a wireless network; in addition, the low cost for this technology increases user demand for such types of services.

Categorizing applications based on their sensitivity to time will yield two types: real-time applications (i.e., a task has to be completed during a specific period of time; otherwise, the output or the result will not be effected), and non-real-time applications (i.e., a task does not have a deadline to be completed). An example of real-time applications is multimedia applications. To ensure synchronization for multimedia application, some requirements (e.g., bandwidth, delay, jitter, percentage of packets loss, etc.) need to be guaranteed. Such requirements are referred to as Quality of Service (QoS). Different multimedia applications require different QoS support; QoS is not a fixed value but varies from one application to another. Each application will have a range of QoS bounded by preferred QoS and acceptable QoS. The preferred QoS corresponds to ideal conditions under which the application would like to run. The acceptable QoS corresponds to the minimum acceptable situation, below which does not make sense for the application. Negotiation takes place between the application and the network service provider to decide the guaranteed QoS (Raghavan & Tripathi, 1998). Parameters such as communication delay, synchronization, and available bandwidth are very critical for a multimedia application. For instance, data transfer applications such as the video-on-demand application can tolerate some end-to-end delay, but it requires a high bandwidth and low bit-error rate. On the other hand, Internet telephony application such as VoIP requires a very low end-to-end delay but smaller bandwidth and slightly higher bit-error rate than VoD application would be acceptable (Jha & Hassan, 2002). The QoS parameters resides in three layers: user layer, application layer, and system layer (see Figure 1). Furthermore, the system layer can be divided into two sublayers: network-and-operating-system layer and device layer. Table 1 shows various QoS parameters in different layers (Bhargava, 2002; Jha & Hassan, 2002).

The developments of the modern computing environment have proposed new concepts such as mobility, heterogeneously, and perceptual QoS to provide the environment elements ability to be connected anywhere anytime. To support such a feature, a mobility function needs to be adopted. IEEE 802.11 standard supports mobility. However, the mobility function in IEEE 802.11 suffers from a high delay

Figure 1. QoS layers



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