

Chapter 13

Quality of Service in Wireless Ad Hoc Networks and New Trends

Sudhir K. Routray
Eritrea Institute of Technology, Eritrea

ABSTRACT

This chapter introduces basic needs of quality of service (QoS) of RF ad hoc networks (mainly wireless), presents the main metrics of quality of service and the QoS effects on overall performance, and briefly discusses quality of service of wireless systems with respect to the upcoming new technologies like 3GPP LTE and the role of WLAN, while representing network QoS improvement and optimization tools and their successful applications in performance analysis. The chapter focuses on IEEE 802.11e, the main revision of the 802.11 for better QoS provisioning, as well as the coordination between planning and the performance of systems for better QoS. Additionally, it addresses the current and new trends of QoS stuff for different cellular networks and their impact on the QoS of ad-hoc networks. The chapter also explores new trends of QoS of emerging networks like the WiMAX and 4G and looks to the probable hybrid networks of the future and their QoS aspects.

1. INTRODUCTION

Ad hoc networks are ubiquitous these days. Be it commercial communication related applications or security related monitoring or the location determination, in every area the importance of wireless ad hoc networks are increasing day by day. The commercial applications are the main field where the investors see the potential for big businesses.

With the growth of the wireless ad hoc networks, the competition is also growing at high speed. In the competition arena every service provider wants to give better service than its own rivals. This makes a set of criteria according to which a service can be said better or not with respect to another service. Of course in engineering these performance related parameters and performances can be measured. These measurements of the different aspects of the services are collectively known as the quality of service.

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In the beginning of the wireless communication, there was no big requirement of quality of service. Because there were no competitions among the service providers or whatever were there almost negligible. But with the improvement of the technology, the requirements and demands of the customers changed. The personal communication systems became popular in the nineties due to the PDC, TDMA and GSM (European TDMA) systems. Then the CDMA and some other systems brought the real competition between the service providers. The so called 2G system started to provide some minimum possible qualities. For voice communication the minimum bandwidth which can give uninterrupted service was set to be 16 KBPS. But this was not enough. On the GSM systems the GPRS services were started. It was a collection of non-voice services like SMS on the GSM infrastructure. The bandwidth required was more for GPRS. Since then continuously efforts are made to provide better services. Of course the ad hoc networks of the WLANs were popular before the cellular networks. Since the invention of the internet in 1989 the popularities of WLAN networks are increasing very fast. Broadband services on the WLAN have become very popular for business organizations and universities.

Ad hoc networks are difficult to manage and control. There are many important issues which comes into picture while trying to manage them properly. These issues have been addressed in the following sections. In this section some of the properties of the ad hoc networks have been given. Some common types of ad hoc networks (Perkins, 2001) have been looked at.

Normally the common understanding says that ad hoc network means wireless LAN or the WLAN. WLANs are basically of two types according to the IEEE WLAN standards. They are IEEE 802.11a (Wireless HIPERLAN) and IEEE 802.11b (well known as HIPERLAN type 2). The most popular version of ad hoc network is the WiFi or the wireless fidelity. The standards behind WiFi are the IEEE 802.11a/g/n (Perkins,

2001; Ahmad, 2005). It can provide higher data rates and better quality of service than the cellular networks like 3G with moderate mobility and limited coverage area.

Now the meaning of ad hoc networks is something different due to their use in different fields. The ad hoc networks can also be divided in to WSN (Wireless Sensor Networks) and MANET (Mobile Ad hoc NETWORK). In this broad sense the meaning of ad hoc network is very different. It includes almost all kinds of sensor and mobile networks having ad hoc infrastructure. In this chapter the quality of service of all these networks have been considered as the advanced methods of the UMTS, LTE and WiMAX helps in the improvement of the quality of service of ad hoc networks. The reason why we need to consider the UMTS, LTE and WiMAX like system is that many trends of these systems are borrowed for the ad hoc networks. It is also true that sometimes the mobile networks like UMTS work like the ad hoc networks and thus can be treated as semi-ad hoc networks. So in this chapter the ad hoc network does not mean IEEE 802.11 WLAN rather all other similar networks which show similar behavior like the ad hoc networks, whether it is cellular network or WiMAX like networks. Of course it is very common now to have hybrid networks having both the cellular as well as the ad hoc characteristics. Again the QoS support is important in both of them and thus the QoS schemes are becoming hybrid as well where it is needed.

2. WHY QUALITY OF SERVICE IS IMPORTANT?

The term quality of service means the physical parameters and settings which ensure the good quality of service. In this electronic age who does not want better quality of service in their systems. Starting from real-time communications to general services like e-mail or MMS everywhere good

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