QoE-oriented cross-layer downlink scheduling for heterogeneous traffics in LTE networks

ABSTRACT

With the soaring demands for high speed data communication, as well as transmission of various types of services with different requirements over cellular networks, having a decent radio resource management is considered vital in Long Term Evolution (LTE) system. In particular, satisfying the Quality of Service (QoS) requirements of different applications is one of the key challenges of radio resource management that needs to be dealt by the LTE system. In this paper, we propose a cross-layer design scheme that jointly optimizes three different layers of wireless protocol stack, namely application, Medium Access Control (MAC), and physical layer. The cross-layer optimization framework provides efficient allocation of wireless resources across different types of applications (i.e., real-time and non real-time) run by different users to maximize network resource utilization and user-perceived quality of service, or also known as Quality of Experience (QoE). Here, Mean Opinion Score (MOS) is used as a unified QoE metric that indicates the user-perceived quality for real-time or multimedia services notably video applications. Along with multimedia services, the proposed framework also takes care of non-real-time traffic by ensuring certain level of fairness. Our simulation, applied to scenarios where users simultaneously run different types of applications, confirms that the proposed QoE-oriented cross-layer framework leads to significant improvement in terms of maximizing user-perceived quality as well as maintaining fairness among users.

Keyword: Cross layer scheduling; Downlink packet scheduler; LTE; Quality of experience; Quality of service