Quality of Service in 5G: fundaments, algorithms and mechanisms

As a critical step towards the next new era of mobile wireless networks, recently 5G mobile wireless networks have received significant research attention and efforts from both academia and industry. The 5G mobile wireless networks are expected to provide different delay-bounded QoS guarantees for a wide spectrum of services, applications, and users with extremely diverse requirements. Since the time-sensitive services in 5G multimedia wireless networks may vary dramatically in both a large range from milliseconds to a few seconds and diversity from uniform/constant delay-bound to different/variable delay-bound guarantees among different wireless links, the delay-bound QoS requirements for different types of services promote the newly emerging heterogeneous statistical delay-bounded QoS provisioning over 5G mobile wireless networks, which, however, imposes many new challenging issues not encountered before in 4G wireless networks. To overcome these new challenges, in this article we propose a novel heterogeneous statistical QoS provisioning architecture for 5G mobile wireless networks. First, we develop and analyze the new heterogeneous statistical QoS system model by applying and extending the effective capacity theory. Then, through the wireless coupling channels, we apply our proposed heterogeneous statistical QoS architecture to efficiently implement the following powerful 5G-candidate wireless techniques: 1) device-to-device networks; 2) full-duplex networks; and 3) cognitive radio networks, respectively, for providing heterogeneous statistical delay-bounded QoS guarantees. Finally, using the simulation experiments we show that our proposed architecture and schemes significantly outperform the existing traditional statistical delay-bounded QoS provisioning schemes in terms of satisfying the heterogeneous delay-bounded QoS requirements while maximizing the aggregate system throughput over 5G mobile wireless networks.

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