Preface

This monograph collectively reports my research results on communication networking technologies since 2004, when next generation networking technologies for the future Internet and cross-layer design and optimization for high-performance wireless networks were among hot research topics in the community. Numerous research works have been conducted on these two topics, resulting in many new approaches and proposals published in the literature. This monograph is only a small leaf of this ever-growing tree, which focuses on some major networking issues of the future Internet.

Organization

This monograph begins with an introduction to major networking modes and their effect on the Internet development in Chaps. 1–2. Here "networking mode" is a general term used to collectively refer to the principle and methodology of networking.

Then in Chaps. 3 and 4, a new structure favorable for all-optical packet switching (AOPS) is discussed. This structure tries to simplify the current network structure such that an all-optical network can be realized simply by using optical processing technologies available today or in the near future, since the all-optical network node cannot all-optically process complex networking operations such as routing and congestion control.

Chapter 5 discusses a new quality of service (QoS) provisioning approach, which tries to overcome the weaknesses of the currently popular schemes, i.e., the scalability problem of IntServ and the coarse QoS granularity of DiffServ. A cost model corresponding to granular services is discussed in Chap. 6.

Chapters 7–9 formulate partially the famous end-to-end arguments, which are among the most influential principles for Internet design. The arguments suggest a design principle of putting the application-level functions at the network edge rather than inside a network as much as possible in order to simplify network design and implementation. However, in the development of some new types of networks, some function displacement into the network has become an option to improve network

performance. These chapters discuss how to estimate both the performance gain and the implementation complexity that is potentially offered by a function displacement from the network edge into the network.

Inspired by the theoretical results reported in Chaps. 7–9, an approach decoupling the congestion control from the popular Transmission Control Protocol (TCP) is discussed for multi-hop wireless networks and all-optical networks in Chap. 10. This is studied because the original TCP fails to perform well in these kinds of networks, and incremental modification cannot solve this problem completely.

Chapters 11–12 discuss how to exploit the multiple-input-multiple-output (MIMO) technology to enable simultaneous transmissions at the medium access control (MAC) level at the same frequency from different nodes to improve network performance in centralized wireless networks. This approach is easier to implement in mobile terminals than other MIMO approaches.

Due to the ever-growing concern about global warming, green networking has become a hot research topic recently. This means that energy efficiency is also an important issue that should be addressed simultaneously in network design. Therefore, Chap. 13 conducts a brief survey of green networking strategies from a quantitative perspective.

Finally, this monograph is summarized in Chap. 14 with a brief discussion about possible developments of networking technologies for the future Internet.

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