

Performance Comparison of Reservation MAC Protocols

Halid Hrasnica

Chair for Telecommunications, Dresden University of Technology

Mommsenstr. 13, 01062 Dresden, Germany

Phone: +49 351 463-33474 Fax: +49 351 463-37163

E-mail: hrasnica@ifn.et.tu-dresden.de

Abstract

Recent and future communications networks have to provide QoS guarantees for a rapidly growing number of various telecommunication services. This can be ensured by application of an efficient MAC layer. Various communication technologies, such as cellular networks and PLC (PowerLine Communications) access networks, apply reservation MAC protocols, providing a good network utilization, which is important for networks with limited data rate, and realization of different QoS guarantees. In this investigation, we compare the performance of so-called one-step reservation protocols, represented by slotted ALOHA and active polling, with a hybrid two-step reservation protocol. All three protocols are investigated in their extended variants, including piggybacking, signaling over data channels and dynamic backoff mechanism. The protocols are implemented within a simulation model representing an OFDMA/TDMA (Orthogonal Frequency Division Multiple Access/Time Division Multiple Access) scheme, which is outlined as a suitable solution for the PLC networks. Nevertheless, the achieved results can be generalized and interpreted for any other multiple access scheme, as well as for other communication technologies (e.g. wireless). To investigate the protocol performance under possibly realistic traffic conditions, we consider different source models to represent the characteristics of internet based data traffic, which is mainly expected in the access networks, such as PLC. The subscribers of an access network behave differently, depending on their communications requirements, which causes varying traffic characteristic. To observe networks with the different subscriber behavior, we define a traffic mix, which is represented by the source models with different traffic characteristics and varying data rates. The two-step protocol achieves always a near to full network utilization and the shortest signaling delay, compared with both one-step protocols. The advantage of the two-step protocol can be also observed under different traffic conditions. However, the performance of the two-step protocol depends strongly on its realization variant, particularly on number of so-called pre-request micro-slots used during the first protocol phase. The fairness between the subscribers belonging to the same traffic class is ensured in all three investigated MAC protocols. However, a performance variation can be observed between different traffic classes.