Abstract

Sharing of physical (PHY) and medium access control (MAC) layer knowledge with the higher layers in wireless networks provides efficient methods of allocating network resources and applications over the Internet. Cross Layer Design (CLD) refers to protocol design done by actively exploiting the dependence between protocol layers to obtain performance gains. This thesis presents a new cross layer protocol which uses the knowledge of radio's front end impairments to build reconfigurable MAC and PHY layers and demonstrates its performance via implementation on an experimentation system. One needs to be aware that any proposed cross layer design optimizations must be carefully evaluated on experimentation systems, which are optimized to meet the requirements of the particular layer being modified. A novel contribution of the thesis is the presentation of a framework for objectively evaluating various experimentation systems. The proposed framework, which contains metrics such as cost, latency and throughput, will help designers make informed trade-off decisions between various requirements and develop systems most optimized for CLD. The thesis evaluates various platforms using the proposed framework and shows that, while these platforms have significantly accelerated the pace of PHY layer research, they are not perfectly suited for MAC layer research. To overcome this gap, the thesis presents a new hardware architecture which is specifically optimized for MAC layer requirements, such as latency, processing speed, and cost. The thesis demonstrates how availability of commercial technology and careful trade-off is making it feasible to design such a system.

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