

Cross-layer design in AMC/ARQ-based wireless systems with cooperative relaying

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Description: Recently, there have been a great deal of research efforts on cross-layer design in wireless networks (see, e.g., [1, 2, 3] and references therein). Furthermore, the past decades gave birth to a large number of innovative techniques at the physical layer (PHY) to overcome the impact of wireless fading channels and to support the diverse quality-of-service (QoS) requirements for heterogeneous mobile users. Among them, the rate-adaptive modulation and coding (AMC) scheme (see, e.g., [4] and references therein) is a promising technique that has received significant research attention. Even though AMC is mainly used to improve the spectral efficiency of a link for a given set of QoS requirements, its unique nature for enhancing upper-layer protocol design has spurred the development of cross-layer approaches to integrate the QoS provisioning protocols at higher layers with AMC implemented at the physical layer.

Many recent works focus on cross-layer designs combining AMC schemes with an automatic repeat request (ARQ) protocol at the data-link layer (see, e.g., [5], [6], and references therein). Cooperative relaying has recently emerged as a powerful spatial diversity technique for improved performance (see, e.g., [7], [8], and references therein). In cooperative ARQ protocols, relays can help the source to transmit its packets to the destination. Performance improvement brought by cooperation is due to a better average SNR of the relay-destination link compared with that of the source-destination link. It is also due to spatial diversity since the best relay is selected. This technique and its influence on the QoS provisioning performance at higher layers is an open problem that remains to be investigated.

PFC - Infinitely persistent Type-I Hybrid FEC/ARQ for wireless relaying: Aims at investigating the effects of using cooperative ARQ for wireless relay systems using AMC at the PHY layer and infinitely persistent type-I HARQ at the DLC layer.

Project objectives: The student taking up this project is expected to fulfil the following goals:

- Acquire a reasonable amount of knowledge on modern wireless communication techniques at the physical and data link control layers such as AMC and cooperative ARQ.
- Understand the key bibliographic references in the area of cross-layer design in AMC/ARQ-based wireless systems.
- Understand the key bibliographic references in the area of cooperative relay networks.
- Extend the available cross-layer designs in AMC/ARQ-based wireless systems to the case of cooperative relay systems.
- Implement the developed cross-layer designs into an existing MATLAB simulation platform.
- Write a technical report describing the work done.
- Make an oral presentation of the project.

Tools: MATLAB for programming and LaTeX for report writing.

Pre-requisites: general knowledge of communication theory and mobile communication networks.

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