

On Queueing and Multi-Layer Coding

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Abstract

A single-server queue concatenated with a multi-level channel encoder is considered. The main focus of this work is on minimization of the average delay of a packet from entering the queue until completion of successful service. Tight bounds are derived for the average delay for different numbers of coded layers. Numerical optimization is applied to find the optimal resource allocation minimizing the average delay. Delay bounds are also derived for continuous layering (single user broadcast approach). The optimizing power distribution of the minimal delay is approximated, and numerically evaluated. It is demonstrated that code layering may give pronounced performance gains in terms of delay, which are more impressive than those associated with throughput. This makes layering more attractive when communicating under stringent delay constraints.