

Multiple Working Points in Multichannel ALOHA with Deadlines

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ABSTRACT

This paper addresses the problem of maximizing the capacity of multichannel Slotted ALOHA networks subject to a user-specified deadline and a permissible probability of exceeding it. A previous paper proposed to transmit a non-decreasing number of copies of a message in successive rounds until success or deadline. This yielded a low probability of failure due to the large maximum number of copies per message, with only minimal "pollution" due to the small mean number of copies. In this paper, we examine another way of implementing variable resource expenditure in different rounds: the channels are partitioned into groups, one for each round (until the deadline), and the channels used by later rounds are operated with lower offered loads. The delay-constrained capacity with these Single-Copy Multiple-Working-Point (SC-MWP) policies is shown to be substantially higher than that with conventional ALOHA, but lower than with the optimal Multicopy Single-Working-Point (MC-SWP) scheme. Combining the two to form an MC-MWP scheme slightly improves capacity over MC-SWP. The SC-MWP approach can be more attractive when using a single transmitter per station because, unlike MC, transmission time is not prolonged. Therefore, multiple-working-point policies become more attractive when propagation delay is lower (e.g., low orbit satellites).