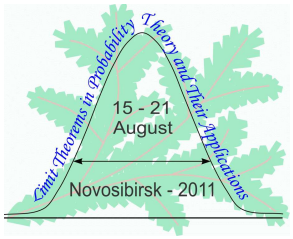

Fluid Limits for an ALOHA-type Model with Impatient Customers

Maria Frolkova, Serguei Foss and Bert Zwart [1]

ALOHA-type protocols are intended to govern star networks where multiple customers machines send data packets to the hub machine. Simultaneous transmissions are not possible because they interfere. On the other hand, the customers have no possibility to check whether there is a transmission going on hence collisions are unavoidable. If a transmission has failed, the customer waits for a randomly selected time interval and tries to transmit again, this is the basic idea of ALOHA protocols. Wi-Fi, mobile phone and satellite networks are examples of systems operating under such protocols.

In this work we build upon the conventional centralized slotted ALOHA model. We allow customers to renege before transmission completion, and assume that there are several customer classes each characterized by a patience time distribution. We focus on the scenario which would lead to overload in the absence of impatience. Our main result is that, under a proper (fluid) scaling, the per-class workload process converges in distribution to the unique solution of a deterministic differential equation. We also show that the fluid limits for distinct initial conditions converge to the same value as time tends to infinity.

[1]MF is with CWI, Amsterdam, The Netherlands and Sobolev Institute of Mathematics, Novosibirsk, Russia. E-mail: M.Frolkova@cwi.nl. SF is with Heriot-Watt University, Edinburgh, UK and Sobolev Institute of Mathematics. E-mail: s.foss@hw.ac.uk. BZ is with CWI, EURANDOM, VU University Amsterdam, and Georgia Institute of Technology. E-mail: Bert.Zwart@cwi.nl.