Performance of P2P Networks with Spatial Interactions of Peers

Francois Baccelli
ENS, Paris

We consider a new model for peer-to-peer networking which takes the network bottlenecks into account beyond the access. This model allows one to cope with the fact that distant peers often have a smaller rate than nearby peers. We show that the spatial point process describing peers in their steady state exhibits an interesting repulsion phenomenon. We study the implications of this phenomenon by analyzing two asymptotic regimes of the peer-to-peer network: the fluid regime and the hard--core regime. We get closed form expressions for the mean (and in some cases the law) of the peer latency and the download rate obtained by a peer as well as for the spatial density of peers in the steady state of each regime. The analytical results are based on a mix of mathematical analysis and dimensional analysis and have important design implications.

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