Travel time distribution on weighted networks

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Abstract

Transport in complex networks is a research area that has allowed a greater understanding of physical, social, and telecommunication phenomena, among many others. An example is a generalization of the Ehrenfest urn to complex networks, which can be applied to model a variety of phenomena, such as heat dissipation, car or airplane transportation, rumors, contagion, etc. Complex non-probabilistic networks have already been modeled with mean-field and master equation approaches, predicting results such as the occupation of the nodes and their non-homogeneous fluctuations in their asymptotic state [1,2]. We generalize this model to weighted graphs, allowing the modelization of a plethora of systems in which the transportation cost is probabilistic and non-homogeneous. We show how we can find analytical solutions for the transport of packages in this system through a mean-field and master equation approach. In addition, these simulations of these networks show that the numerical results are predicted by those analytical solutions obtained. We also study the distribution of the cost or time of travel between nodes, in an analogy with the propagation in quantum mechanics [3].

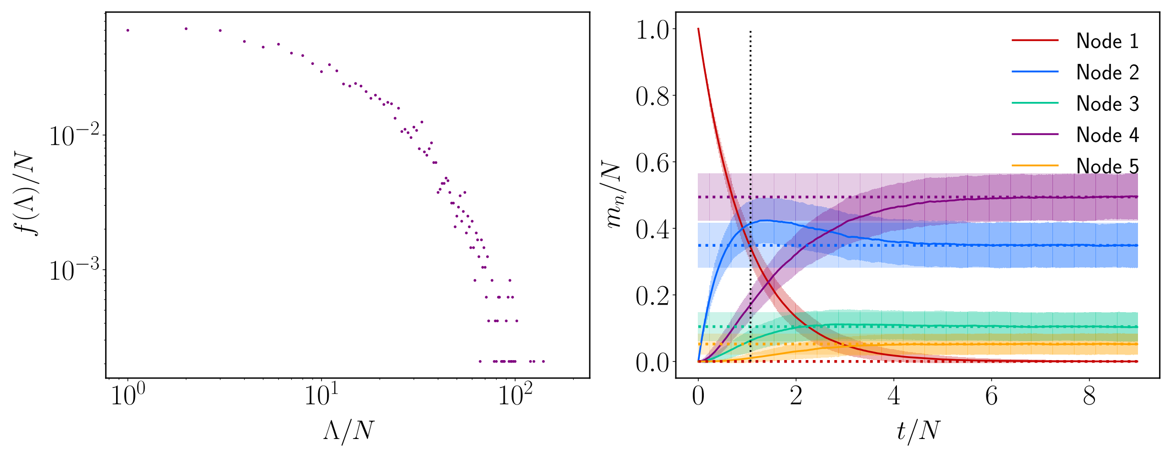

Figure 1: *Five node network with N=50 packets. (Left) Travel time distribution between two nodes. (Right) Evaluation of the average number of packets and their standard deviation in each node as a function of time with their respective asymptotic states and fluctuations obtained analytically.*

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References

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