

Designing Self-Organized Wireless Networks - Is It Possible?

Abstract:

The size of the Internet continues to increase with the mainstream adoption of the broadband mobility, connecting a myriad of devices and sensors at homes and businesses and the use of IPv6. All this, in conjunction with short and dynamic flows of information, is adding to the spatio-temporal complexity of the network topology and dynamics. We present a brief overview of the role that self-organization can play in this new era of complexity.

In this talk, we specifically focus on the "small-world" and "scale-free" models to describe the nature of complex networks, such as Internet, World Wide Web (WWW), social networks, biological systems, etc., that have been successfully applied to the wireline networks. We apply these models to wireless networks to achieve scalability, self-organization, and robustness. However, application of these models to wireless networks is non-trivial due to the challenges introduced by the limited range of the mobile nodes. To address these problems and to illustrate the potential of these new approaches, we consider a specific scenario of relay based access network. We decompose the problem into topology generation and connection establishment and routing, with the overall objective to minimize the number of hops, to achieve load-balancing, and to increase robustness and reliability. Our results show that the small-world and scale-free concepts can indeed be captured in wireless networks as well.

We conclude the paper with a discussion on open issues for research in self-organization of networks in general, and the key challenges that lie ahead.