DISTRIBUTED RESOURCE ALLOCATION AND PERFORMANCE OPTIMIZATION FOR VIDEO COMMUNICATION OVER MESH NETWORKS BASED ON SWARM INTELLIGENCE

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ABSTRACT

Mesh networking technologies allow a system of communication devices to communicate with each other over a dynamic and self-organizing wired or wireless network from everywhere at anytime. Large-scale mesh communication networks involve a large number of heterogeneous devices, each with different on-board computation speeds, energy supplies, and communication capabilities, communicating over the dynamic and unreliable networks. How to coordinate the resource utilization behaviors of these devices in a large-scale mesh network remains a challenging task. And an effective solution to this type of problems needs to meet the following three requirements: distributed, asynchronous, and non-convex.

In this work, based on swarm intelligence principles, we develop a set of distributed and asynchronous schemes for resource allocation and performance optimization for a wide range of mesh networking-based applications, including particle swarm optimization (PSO) with convex mapping, decentralized PSO, distributed and asynchronous PSO, and energy efficient DAPSO. Our extensive experimental results in distributed resource allocation and performance optimization demonstrate that the proposed schemes work efficiently and robustly. Compared to existing algorithms, including gradient search and Lagrange optimization, the proposed approach had the advantage of faster convergence and the ability to handle generic network utility functions. Compared to centralized performance optimization schemes, the proposed approach significantly reduces communication overhead while achieving similar performance. The distributed algorithms for resource allocation and performance optimization provide analytical insights and important guidelines for practical design of large-scale video mesh networks.