Dynamics and Convergence of Resource Prices in Market-Oriented Overlay Networks

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Abstract. Overlay networks use computational powers available at the edges of the Internet to provide large-scale computing and networking environments. In this paper, we consider market-oriented overlay networks in which peers trade resources and services through a common currency. From the perspective of market economics, the dynamics and convergence of resource prices in such networks is investigated by simulation and mathematical modeling, and the results are briefly reported in this short paper.

Keywords: Overlay networks, resource markets, mobile agents, peer-to-peer networks.

1 Introduction

Our model of market-oriented overlay networks consists of three types of peers: (1) service agents that implement specific network services, (2) resource platforms that provide execution environments and supporting facilities for service agents, and (3) users that use services provided by service agents. In this model, peers trade resources and services by exchanging a common currency. For example, a peer (a platform) provides its resources to a service agent and receives the price from the service agent; the peer later uses the earnings to buy services available in the network.

When rationally designed, resource or service providing peers set prices for own resources/services to maximize their monetary income. As in financial markets, high rates of inflation or deflation of resources and services could disrupt the market and are not preferable, whereas it is in general a challenging task to maintain stable prices without central authority. This paper reports our recent results obtained from simulation and analytical studies to understand price dynamics in such networks.

2 Results

A variant of our previously published models [1][2] was used to simulate price dynamics in peer-to-peer resource markets. The conditions satisfied at Nash

Equilibria that lead to long-term price stability were mathematically analyzed and identified. Figure 1 shows representative results from our simulation and analytical studies, demonstrating that the theoretical results correspond well with the simulation results at steady-states. Further simulation and analysis are currently being conducted to understand the price dynamics in dynamic network environments.
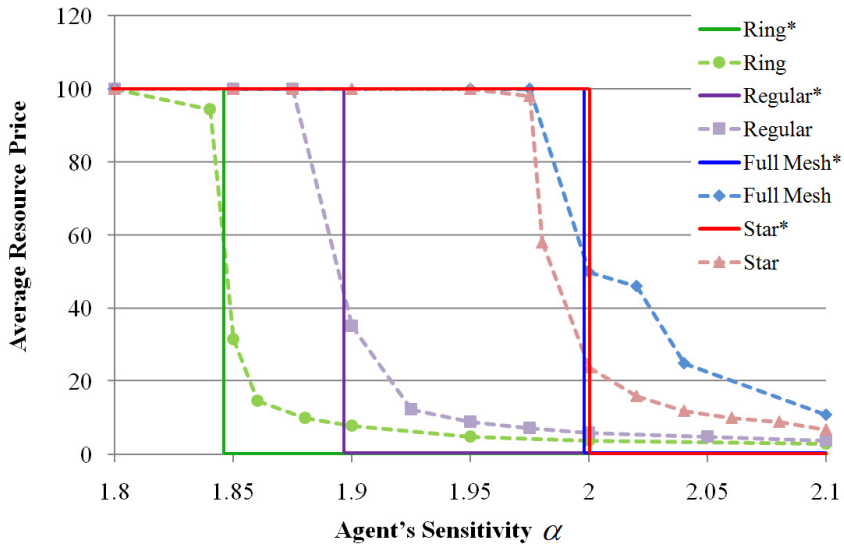

Fig. 1. Resource price dynamics investigated through simulation and theoretical studies. The vertical axis represents the average resource prices in the network of platforms, and the horizontal axis a model parameter that determines the agent behavior (see [2]). Typical network topologies are assumed, including ring, regular, full mesh, and star topologies. For each network, the dashed line represents the simulation results, and the solid line the theoretical ones.

References

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