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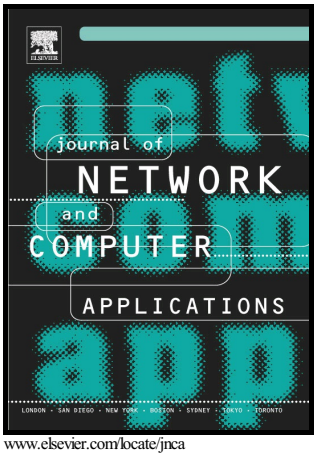

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Dynamics of Service Selection and Provider Pricing Game in Heterogeneous Cloud Market

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Abstract

This paper studies price competition in a heterogeneous cloud market formed by public providers and a cloud broker, all of which are also known as cloud service providers (CSPs). We formulate the price competition between CSPs as a two-stage noncooperative game. In stage I, in which CSPs set their service prices to maximize their revenues, we model the pricing game using the noncooperative static game. We provide sufficient conditions for the existence and uniqueness of Nash equilibrium prices, which can be obtained using an iterative algorithm. The convergence properties of the iterative algorithm are characterized using the contract mapping theorem. In stage II, given the prices set by CSPs, cloud users can select the services that provide them the best payoff in terms of performance (i.e., delay) and price. We apply an evolutionary game to study the evolution and dynamic behavior of cloud users. Furthermore, we use the Wardrop equilibrium and replicator dynamics to determine the equilibrium and its convergence properties of the service selection game. To attract users to the equilibrium, we implement the service selection algorithms using population evolution and reinforcement learning approaches. Numerical results illustrate that our game models can provide comprehensive understanding of the heterogeneous CSPs market and service selection in cloud computing.

Keywords: Cloud Computing, Pricing, Service Selection, Nash Equilibrium,

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