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A Novel Economic Sharing Model in a Federation of Selfish Cloud Providers

Abstract:

This paper presents a novel economic model to regulate capacity sharing in a federation of hybrid cloud providers (CPs). The proposed work models the interactions among the CPs as a repeated game among selfish players that aim at maximizing their profit by selling their unused capacity in the spot market but are uncertain of future workload fluctuations. The proposed work first establishes that the uncertainty in future revenue can act as a participation incentive to sharing in the repeated game. We, then, demonstrate how an efficient sharing strategy can be obtained via solving a simple dynamic programming problem. The obtained strategy is a simple update rule that depends only on the current workloads and a single variable summarizing past interactions. In contrast to existing approaches, the model incorporates historical and expected future revenue as part of the virtual machine (VM) sharing decision. Moreover, these decisions are not enforced neither by a centralized broker nor by predefined agreements. Rather, the proposed model employs a simple grim trigger strategy where a CP is threatened by the elimination of future VM hosting by other CPs. Simulation results demonstrate the performance of the proposed model in terms of the increased profit and the reduction in the variance in the spot market VM availability and prices.