A Mechanism Design Approach to Resource Procurement in Cloud Computing

ABSTRACT
We present a cloud resource procurement approach which not only automates the selection of an appropriate cloud vendor but also implements dynamic pricing. Three possible mechanisms are suggested for cloud resource procurement: cloud-dominant strategy incentive compatible (C-DSIC), cloud-Bayesian incentive compatible (C-BIC), and cloud optimal (C-OPT). C-DSIC is dominant strategy incentive compatible, based on the VCG mechanism, and is a low-bid Vickrey auction. C-BIC is Bayesian incentive compatible, which achieves budget balance. C-BIC does not satisfy individual rationality. In C-DSIC and C-BIC, the cloud vendor who charges the lowest cost per unit QoS is declared the winner. In C-OPT, the cloud vendor with the least virtual cost is declared the winner. C-OPT overcomes the limitations of both C-DSIC and C-BIC. C-OPT is not only Bayesian incentive compatible, but also individually rational. Our experiments indicate that the resource procurement cost decreases with increase in number of cloud vendors irrespective of the mechanisms. We also propose a procurement module for a cloud broker which can implement C-DSIC, C-BIC, or C--OPT to perform resource procurement in a cloud computing context. A cloud broker with such a procurement module enables users to automate the choice of a cloud vendor among many with diverse offerings, and is also an essential first step toward implementing dynamic pricing in the cloud.