

The Open Cloud eXchange: Mechanisms for Efficient Cloud Markets

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Abstract

As the dependence on our society and economy on cloud computing increases, so does the realization that the academic research community cannot be shut out from contributing to the design and evolution of this critical infrastructure. In this talk, I will present the vision for an alternative vision – that of an Open Cloud eXchange (OCX) – a public cloud marketplace, where many stakeholders, rather than just a single cloud provider, participate in implementing and operating the cloud, thus creating an ecosystem that will bring the innovation of a broader community to bear on a much healthier and more efficient cloud marketplace. Specifically, I will focus on the question of how to design mechanisms that deliver verifiable SLA attributes along dimensions of performance, reliability, security, and economic utility, and how to expose tradeoffs along these dimensions to cloud customers in ways that are both practical and usable. I will overview three CloudCommons projects (<http://csr.bu.edu/cc>) aiming to develop approaches seeking to build trust in the economic utility of IaaS marketplaces. I will start by presenting a periodic model for the expressive specification of elastic cloud supply and demand. This model allows SLAs to leverage a granular representation of cloud resources, exposing flexibilities that enable providers to safely transform SLAs from one form to another for efficient workload collocation. Next, I will show that expressive SLAs facilitate the emergence of an efficient, trustworthy marketplace, by presenting three game-theoretic mechanisms for cloud resource management. The first mechanism enables selfish parties to collocate their workloads in an attempt to minimize the individual costs they incur to secure the shared cloud resources necessary to support their application SLAs. The second mechanism enables rational parties to coordinate their use of a shared resource so as to maximize their individual utilities by creating a marketplace for trading usage rights. The third mechanism enables dynamic pricing of IaaS clouds in a way that ensures efficient utilization of providers' resources, while guaranteeing rational fairness to all customers. For all these models and mechanisms, and in addition to various analytical results, I will present experimental evaluations of deployed CloudCommons prototypes and services that confirm their predicted utilities. Also, I will summarize current efforts aiming to set up an Open Cloud eXchange (OCX) prototype within the Massachusetts Green HPC Center.

This work was pursued at Boston University in collaboration with Vatche Ishakian (now at BBN Technologies), Orran Krieger (BU), Nikos Laoutaris (at Telefonica Research), Jorge Londono (now at Universidad Pontificia Bolivariana in Colombia), and Shanghua Teng (now at USC).



Short Biography:

Azer Bestavros (PhD 1992, Harvard U) is a Professor in the CS Department at Boston University, which he joined in 1991 and chaired from 2000 to 2007. He is the Founding Director of the BU Hariri Institute for Computing, which was set up in 2010 to "create and sustain a community of scholars who believe in the transformative potential of computational perspectives in research and education." He is the former chair of the IEEE Computer Society TC on the Internet, served on the program committees and editorial boards of major conferences and journals in networking and real-time systems, and received distinguished service awards from both the ACM and the IEEE. In 2010, he received the United Methodist Scholar Teacher Award for "outstanding dedication and contributions to the learning arts and to the institution" and the ACM Sigmetrics Inaugural Test of Time Award for "research whose impact is still felt 10-15 years after its initial publication." His research contributions include pioneering the push web content distribution model adopted years later by CDNs, seminal work on Internet and web characterization, and work on formal verification of networks and systems. Funded by grants totaling over \$20M, his research yielded 15 PhD theses, 6 issued patents, 2 startup companies, hundreds of refereed papers, and over 12,000 citations on Google Scholar. His current research is focused on mechanism design for efficient and secure cloud computing.

For more information, check: <http://www.cs.bu.edu/~best/>.