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Dissertation

Title	<i>SLA MANAGEMENT IN A COLLABORATIVE NETWORK OF FEDERATED CLOUDS: THE CLOUDLEND</i>
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Defense Date	20 November 2016
Abstract	Cloud services have always promised to be available, flexible, and speedy. However, not a single Cloud provider can deliver such promises to their distinctly demanding customers. Cloud providers have a constrained geographical presence, and are willing to invest in infrastructure only when it is profitable to them. Cloud federation is a concept that collectively combines segregated Cloud services to create an extended pool of resources for Clouds to competently deliver their promised level of services. This dissertation is concerned with studying the governing aspects related to the federation of Clouds through collaborative networking. The main objective of this dissertation is to define a framework for a Cloud network that considers balancing the trade-offs among customers' various quality of service (QoS) requirements, as well as providers' resources utilization. We propose a network of federated Clouds, CloudLend, that creates a platform for Cloud providers to collaborate, and for customers to expand their service selections. We also define and specify a service level agreement (SLA) management model in order to govern and administer the relationships established between different Cloud services in CloudLend. We define a multi-level SLA specification model to annotate and describe QoS terms, in addition to a game theory-based automated SLA negotiation model that supports both customers and providers in negotiating SLA terms, and guiding them towards signing a contract. We also define an adaptive agent-based SLA monitoring model which identifies the root causes of SLA violations, and impartially distributes any updates and changes in established SLAs to all relevant entities. Formal verification proved that our proposed framework assures customers with maximum optimized guarantees to their QoS requirements, in addition to supporting Cloud providers to make informed resource utilization decisions. Additionally, simulation results demonstrate the effectiveness of our SLA management model. Our proposed CloudLend network and its SLA management model paves the way to resource sharing among different Cloud providers, which allows for the providers' lock-in constraints to be broken, allowing effortless migration of customers' applications across different providers whenever is needed.