Policy Driven Negotiations for Managing Virtualized Services on the Cloud

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In recent years, virtualized service delivery models have emerged where businesses purchase IT components, like software, hardware or network bandwidth, as services from providers distributed globally. The service is often delivered remotely to the consumer via a computing grid or cloud. It is possible in these scenarios that neither the hardware infrastructure, nor the software; and not even the people running these services belong to the organization that uses the service.

One consequence of this development is that the consumers have more choices of service providers that they can select from. However, at present most of the services are delivered as web services providing a singular functionality. Often, the onus is on the consumer to procure these web services individually and then integrate them per the requirements. There has been some work in creating brokers that would perform this functionality. However, such brokers work only on a fixed, linear description of service functionality which often fails to capture the complete requirements of the service needed, and the flexibility a consumer might have.

In order to be able to take advantage of virtualized service models, it is imperative for the consumer to be able to identify all the constraints or assertions of a service that need to be met along with its functional requirements. These constraints typically can be classified as hard and soft constraints. Hard constraints are non-negotiable and have to be met by service providers. Soft constraints help to define the desired service attributes on which the consumer is willing to negotiate. Often, the same parameter will have both a hard and a soft constraint (for instance, a desired software version vs. the minimum version needed for the task, a desired amount of memory vs. the minimum needed for the task etc.). In this work, we show how a policy driven approach can both capture such constraints, and also guide the negotiation between the consumers and the providers.

For instance, consider a consumer who wishes to procure a computing service to perform CPU intensive tasks. Their policies would be specified as:

HARD REQUIREMENTS: SINGLE PROCESSOR, SPEED AT LEAST 1MHZ
MINIMUM STORAGE NEEDED: 100 GB
COST: AT MOST $2/HR

SOFT REQUIREMENTS: SINGLE PROCESSOR SPEED 2MHZ
STORAGE NEEDED: 500 GB
COST $1/HR

The consumer's requirements policy would specify the soft constraints. When the provider's service policy manager reviews the requirements and finds that it can't meet them, it will try and negotiate. The consumer's response to the counterproposals meeting its hard requirements would

be guided by the policy which ranks the constraints. For instance, the policy might ask it to prefer a speedier processor over more disk storage, or to accept disk storage as close to the minimum need as possible to keep the cost low.

We have proposed an integrated lifecycle of services delivered on the cloud [1]. Policies can be defined for each phase to automate its actions. In this paper we review our proposed service lifecycle and present a methodology to capture soft and hard policy constraints of the service requirements. We develop ontologies [2] using semantically rich languages such as RDFS and OWL2 (standardized by W3C) to capture the constraints and requirements, Policies are also developed using languages such as AIR which leverage the semantic web ontologies. Our system allows the consumers to add to their RFP the desired requirements. If such a service neither exists nor can be composed, our system allows the policies to guide the negotiations between the consumer and provider(s) to see if a service exists (or can be composed from existing services) that meets the hard constraints of the consumer, and approaches as close to possible on the desired requirements.

References:

[1] *Karuna P Joshi*, Tim Finin, Yelena Yesha, "Integrated Lifecycle of IT Services in a Cloud Environment", in Proceedings of The Third International Conference on the Virtual Computing Initiative (ICVCI 2009), Oct 2009.

[2] *Karuna Joshi*, OWL Ontology for Lifecycle of IT Services on the Cloud, http://www.cs.umbc.edu/~kjoshi1/IT_Service_ Ontology.owl