

Realizing an IaaS Marketplace : a broker based approach

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Abstract

A competitive marketplace can realize the advantages of cloud computing. The requirement of marketplace frameworks, which become a meeting point for demand and supply, has gained momentum with the recent technological advancements of cloud computing. This paper discusses a model architecture of broker based IaaS cloud marketplace that enables single platform for the development, selling of IaaS products and shopping for customers interested in services. We propose a broker for IaaS marketplace which selects the right cloud provider that satisfies the customer requirements. The broker also monitors the performance of the provider for each customer and shifts the customer to another provider if the performance is not good. Fuzzy inference systems have been used for making both the aforesaid decisions. The paper also throws light on the kind of experimental requirements that will be faced for this work.

Keywords: Cloud Computing, Cloud Marketplace, Fuzzy Inference System

1 IaaS Marketplace

Cloud computing will thrive if many providers can instantiate compatible clouds with diverse implementations. There are a number of basic motivations for such a marketplace:

1. **Avoiding vendor lock-in.** Customers will feel confident to accept cloud computing if they can switch between vendors as their requirements, or a provider's offerings changes. Today's cloud vendors provide highly differentiated products, making the prospect of migrating any non-trivial workload between clouds a daunting one.
2. **Equal participation of small providers.** A marketplace of clouds will enable many small service providers to participate. This is important to target smaller customers with specialized needs who are best addressed in a retail manner rather than a wholesale fashion. Due to incompatibility among the cloud providers, migration becomes a difficult task. Marketplace of compatible cloud providers can largely resolve the issue of vendor lock-in.
3. **Optimal selection of Cloud Provider.** Quality of Service(QoS) parameters of various services provided by the cloud providers differ. This leads to ambiguity in the mind of the customer for the selection of the cloud provider. A wrong selection of cloud provider can affect the customers and may lead to financial losses, vendor lock-in and loss of reputation of the business hosted on cloud. Some parameters like minimum availability, bandwidth and cost are most important from the customer point of view for running his business uninterrupted.
4. **Trustworthiness of Cloud Provider.** All cloud providers guarantee certain QoS parameters, but the customer cannot just trust these offerings of the provider without due consideration to the reputation of the provider. Marketplace considering the trustworthiness of the provider will surely benefit the selection process of provider.

2 Objectives of the broker based IaaS Marketplace

The previous section motivated us to develop a broker based Cloud marketplace with objectives to develop:

1. A brokering algorithm to select the best suitable provider which satisfies the given customer requirements through QoS parameters and trust of the provider.
2. An mechanism to calculate the degree of SLA violation (DSV) by periodic VM (virtual machine) monitoring.
3. An mathematical model to calculate trustworthiness of a provider based on the DSV values.
4. A decision making system for dynamic VM migration based on DSV values.

3 Broker based IaaS Marketplace

The cloud marketplace consists of a broker and a set of compatible providers associated with the broker. The cloud providers are interested in providing cloud services to the customers and competing with each other to gain maximum customers. In this paper, we consider IaaS marketplace only, the same work can be extended to other kinds of marketplaces (e.g SaaS marketplace)

The central part of our cloud marketplace is broker module. The various sub-modules encompassed in broker are given in Figure 1.

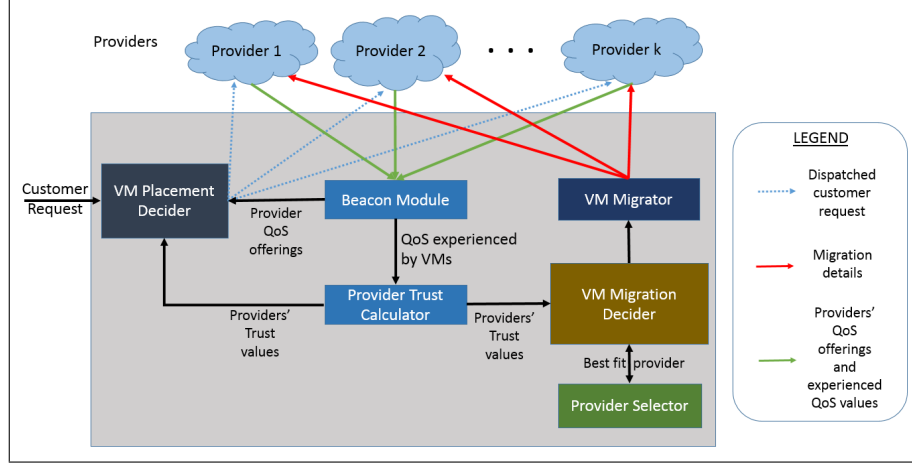


Figure 1: Architecture of broker

The sub-modules of the broker are described as under:

1. **VM Placement Decider.** This module uses fuzzy inference logic to decide the provider depending upon the customer requirements. The fuzzy inputs given by the customer are used to create the Fuzzy Inference System (FIS). The FIS is of Mamdani-type having the membership functions for availability, bandwidth, cost and trust that are created on the fly for particular customer request. The provider's offerings are the input to the FIS which calculates the fitness of the provider as per customer requirements vis-a-vis providers offering.
2. **Beacon Module.** This module acquires the VM details from the central repository and beacons the provider to collect the actual experienced QoS parameters mentioned in the SLA.
3. **Provider Trust Calculator.** The calculation of trust values of each provider using the DSV values for each VM is done in this module.
4. **VM Migration Decider.** This module takes the decision of migrating a VM to another provider depending on the degree of SLA violation. The output of a Mamdani type FIS is used for this decision making.
5. **VM Migrator.** This module finds the best fit provider using provider selector module and the VM is migrated to the chosen provider.

4 Experimental Requirements

Realization of an IaaS marketplace demands extensive experimentation. For this purpose the following would be needed :

- A set of IaaS providers with data centers in multiple geographical locations.
- An API supported by each provider which allows the broker to create VMs on behalf of the customer.
- A module for fetching the current QoS offerings by the providers and monitoring of the QoS parameters experienced by the VMs running on the providers. This monitoring can be done by collecting relevant data from the providers themselves or by using third party monitoring tools like QoS-MONaaS¹.
- Set of APIs to migrate a VM from one provider to another. Migration should involve the least possible down time.
- Production data sets related to customer requests for VM creation.
- Production data sets related to SLA violation by IaaS providers.

¹Luigi Romano, Danilo De Mari, Zbigniew Jerzak, and Christof Fetzer. A novel approach to QoS monitoring in the cloud. In Data Compression, Communications and Processing (CCP), 2011 First International Conference on, pages 45-51. IEEE, 2011