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# Two-way Ranking Based Service Mapping in Cloud Environment

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**Abstract-** In the recent times, a large number of cloud services are being made available by the enormous cloud service providers (CSPs). The services are made available by the CSPs with a variety of Quality of Service (QoS) attributes. Service mapping is the process of allocating the service requesting customers (SRCs) to an appropriate CSP among available. The availability of enormous CSPs and their variety of QoS attributes complicates the process of service mapping. In the literature, it is considered as a multi-criteria decision-making (MCDM) problem and rank based selection of suitable CSP is proposed for the service mapping. Ranking of CSPs is evaluated based on their offered QoS attributes value and the QoS attributes value desired by the SRC. Cloud is analogous to the business model where service provider-customer relationship is established. In the business perspective, preference of both the participating entities (i.e. CSPs and SRCs) regarding their offered and desired QoS attributes must be considered during service mapping. Therefore, this paper proposes a novel two-way ranking based cloud service mapping framework (TRCSM). Ranking of both the participating entities is evaluated in the framework during service mapping by considering the QoS attributes value offered by them as well as desired by their counterpart. Analytic Hierarchy process (AHP) has been used to evaluate the ranking score of both the CSPs and SRCs in TRCSM. The service mapping process used in TRCSM is depicted through a case study in the paper. Sensitivity analysis has been performed to validate the stability of the participating entities in the mapping process. The execution time of the service mapping algorithm used in the framework has been evaluated in the extensive simulation experiments. Results prove the time reasonability of service mapping algorithm used in the proposed framework.

**Keywords:** Analytic Hierarchy Process, Cloud service ranking, Cloud Computing, Quality of service, Service Measurement Index.

## 1. Introduction

Cloud computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources that can be rapidly provisioned and released with minimal management effort or service provider interaction [1]. These resources are typically related to storage, computing, networking, software applications and web services etc. Cloud computing has revolutionized the way of performing computing activities. Individuals or organizations are no more required to own the necessary computing infrastructure for implementing the desired computing services. Instead, computing services are made available to them as commodity services by the cloud service providers (CSPs). Service requesting customers (SRCs) pay only for the usage of services. The responsibility to develop and maintain the computing services rest with the CSPs. Cloud services are broadly classified as Software as a Service (SaaS), Platform as a Service (PaaS), and Infrastructure as a Service (IaaS) [3].

Presently, the number of CSPs has grown enormously due to rapid increase in the number of SRCs in the cloud environment. Different CSPs offer cloud services with different QoS attributes value such as availability, reliability, performance, security etc. QoS attributes are used for the objective assessment of CSPs. In cloud, same service may be offered by multiple CSPs with different QoS attributes. For example, if a CSP ensures the service reliability, another CSP may ensure performance for the same service. Similarly, different CSPs may have different parameters of providing the cloud services. For example, Atlantic.Net, Google and ElasticHosts follow different pricing criteria (per second, per minute and burst pricing respectively) for providing the cloud services [4]. A SRC may have the preference for one pricing criteria over others while obtaining the cloud service. Therefore, in the presence of large scale CSPs with different QoS attributes value it becomes difficult to select a suitable CSP for a SRC. In literature, rank based selection of a suitable CSP for a SRC is proposed in which the relative ranking of the available CSPs is evaluated based on their offered QoS attributes value and the QoS attributes value desired by the SRC. The top rank CSP is allocated to the SRC.

Cloud is analogous to the business model where CSPs earn for providing the services while SRCs pay for the usage of the service. Traditionally, every commercial organization wants to develop a flexible and agile business process to enhance the performance [5]. A business process represents the transaction of a business

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