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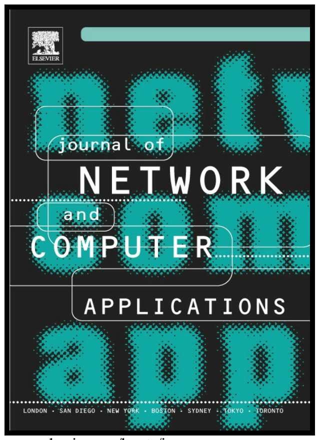

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A Survey on Cloud Federation Architectures: Identifying Functional and Non-Functional Properties

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Abstract

The cloud computing paradigm as originally conceived has reached a plateau of evolution, exposing several limitations that compromise the main features of the paradigm: resource contention, interruption of services, lack of interoperability in data representation, quality of service degradation, and others. Consequently, several new approaches to its use and optimization have been implemented to maintain continuity of technology. In this way, multiple clouds organizations have been formed with the objective of maximizing the use of cloud computing, in particular small- and medium-sized cloud providers who present difficulties to maintain all properties of the paradigm have mobilized themselves into organizations to maximize their revenues. Such organizations, formally called inter-clouds, have been gaining attention, where solutions like hybrid clouds, multi-clouds, and cloud federations are the main elements in the academic-scientific and industrial world. In particular, cloud federations are well behaved because organizations governed by a contract can be interesting and useful in many critical environments. However, there is a lack of works dedicated only to clouds federations. In addition, the existing works are not able to describe federations as unique inter-cloud entities to highlight specific properties and characteristics. In this paper, we present the desired functional and non-functional properties for cloud federations through the identification of the main architectures in the literature, and we evaluate these architectures based on the described properties.

Keywords: Cloud Computing, Interconnected-Clouds, Cloud Federation

1. Introduction

Cloud computing [1, 2] has emerged as the answer to the search for delivering computing as a utility, like electricity and water. In this model, interested parties consume computing power provided by entities focused on this service, only paying for what was consumed. The consumption of computing power turned the expenses related to the acquisition of capital goods into operational expenditure. In other words, the costs that stakeholders would have to acquire and maintain the necessary equipment to satisfy their needs is translated into the cost of operation, because there is no (or little) need to keep their computing infrastructures. This behavior allows the democratization of computing, since small businesses, such as *startups*, may almost instantly acquire computing power equivalent to large-scale companies.

A set of features are commonly highlighted as reasons to adopt Cloud computing: *a) elasticity*: automatically and transparently allocate or deallocate resources to meet the needs of customer demand [2]; *b) multi-tenancy*: using virtualization technologies, computing assets present in clouds are shared among stakeholders; *c) self-service*: resource allocation and management capabilities are offered by clouds, avoiding the need for specific technical knowledge from customers; and *d) charging model*: called *pay-as-you-go* [1, 3], this model charges only for computing power the customer actually utilizes.

Another peculiarity of the paradigm is related to how resources are supplied through services at different levels [4]. There are three canonical classes of services in clouds [2]. *Infrastructure as a Service (IaaS)* –

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