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Facebook-based cloud resource sharing☆

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ABSTRACT

Sharing cloud resources between groups of users is a challenge. Cloud providers do not commonly support users in sharing their spare dedicated resources with others. In developing countries, it is often too expensive for people to acquire a virtual machine of their own. Users may, therefore, wish to manage costs and increase computational resource usage by sharing their instances with others. This paper presents a container based cloud resource bartering (CRB) model for sharing user's computational resources through a social network. In our approach, we have integrated a Facebook account with the computational cloud to enable tenants to share their unused cloud resources with other users. The performance of the proposed prototype is evaluated under different workloads. Based on our experimental results we conclude that the proposed model is well suited for the creation of a low-cost social cloud in developing countries.

1. Introduction

Developing countries face many social and economic challenges. Education is often seen as a key means of reducing the levels of poverty and re-enforcing economic growth in such countries. Unfortunately, due to a lack of funding, governmental and non-profit charitable institutes are not able to provide sufficient learning resources to students. Many institutes have limited access to basic research and development resources. This often significantly compromises the educational progression of students in developing countries. Emerging technologies tend to be expensive, at least initially and therefore may require considerable funding to be put in place before students can even begin to benefit from working with them. Cloud computing is one such technology that requires significant investment. It is increasingly becoming a vital part of the research infrastructure in many data-intensive fields. In developing countries specifically in most educational institutes, cloud resources are not commonly made available to students and researchers because of the associated costs. If such countries are to develop and grow, then new ways of providing access to emerging technologies need to be found.

This paper focuses on how cloud resources can be made available to students in developing countries using an existing Facebook account. The major contribution of this paper is to present a container based cloud resource bartering (CRB) model for sharing cloud resources among users in emerging economies. The main aim is to break down several barriers that currently prevent students and small-scale communities from accessing the latest technology in such regions. To solve this problem, we have designed a cloud resource bartering (CRB) model that supports container based resource sharing among

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users. The proposed CRB model has been implemented and deployed on Facebook. Linux container (LXC) based sharing in EC2 may help the user to share a part of the complete resource with other tenant users. This is likely to also help the landlord users to manage the cost of renting their computational resources.

In this paper, we employ a range of different workloads to test the stability of container-based virtualization which enables the social community to share virtualized containers with each other. In addition to this, we have evaluated the implemented model and examined the stability and performance of shared cloud resources. For this purpose, we installed different workloads in LXC containers created in EC2 instance and observed its stability among a shared community. Our results show satisfactory performance of shared instance under different workloads. A community-based survey was carried out to gather qualitative feedback from real end users of the system. The result of this analysis confirms that social networks can play a vital role in cloud resource bartering and such approaches can work well in developing countries.

The contribution of the paper is twofold; firstly, the CRB creates a trusted community environment on Facebook, where users can share their idle compute resources with others. Secondly, CRB requires the sharer and the tenant to both view and accept the Social service level agreement (SSLA) before sharing. It also keeps a list of SSLA violation details and black list the users who have not followed the terms and conditions mentioned in SSLA. Both of these features have a novelty with respect to sharing resources on a social network according to the understanding of the author. To the best of our knowledge, it is the first effort in this direction.

The paper is organized as follows. Section 2 provides a comprehensive related review. Section 3 presents the methodology and implementation details of the CRB model. Section 4 demonstrates the effectiveness of the system through a detailed performance evaluation. Finally, Section 5 concludes the discussion and provides some pointers to future work.

2. Related work

The importance of social networking has been observed in various scientific domains as a means of facilitating teamwork across different locations. Increasingly social networks are being used to synchronize research communities as well. One such example is My Experiment [1] a platform for biologists, that creates a virtual research environment for sharing scientific workflows among collaborators. Similar scientific projects are Kepler [2] and Galaxy [3]. There are many projects that are integrating Grid computing and social networking technologies. For example, PolarGrid [4] shares polar ice sheet information and resources amongst members by using a web portal. This portal extracts data and shares information in multiple social networks to support global collaborations with the help of OpenSocial [5]. In the context of social networking, a number of techniques have been proposed for resource sharing. For example, the Automated Service Provisioning Environment (ASPEN) [6] is one such system that provides an integration of Web 2.0, social networking and cloud computing technologies. ASPEN exposes applications and shares data within an enterprise using a social network.

The models described previously focus on the specific research communities they serve and on the social aspects of collaboration between researchers. We can, therefore, suggest that existing social networks are potentially suitable platforms for sharing cloud resources in a more general way. There are many good examples of cloud and social networks working together, but in most cases, the cloud is simply hosting the applications of social networks, for example, a user can develop a Facebook application hosted by Amazon's AWS service.

There is some literature related to creating a cloud infrastructure leveraging Social networking. A prototype is proposed in [7] for an economics based posted price model in a social cloud and an auction-based model in the computing cloud. The proposed model is for the storage of resources in the cloud, but this work is not implemented for any commercial cloud platform at present. The cloud offers far greater prospects in terms of shared processing power but there is a clear need for an application that can help users to share their resources with their friends by using a sharing model (e.g. resource bartering).

For scientific projects which require large-scale computing resources, one useful aspect of collaboration is the sharing of resources among project members. Social Cloud [8] represents a framework for Social Cloud computing with a focus on collaboration and resource sharing within a scientific community. The Social Cloud supports individuals or institutions by allowing them to contribute spare capacity by means of virtual machines leased through the social network. Members of the Social Cloud can contribute, request, and use virtual machines from other members. A Virtual organization is formed among groups of members. Current work on the social cloud does not, however, support an established economic model for resource sharing. Such models might, for example, include an incentive mechanism that encourages a more diverse group of participants. Previously, however, a range of different economic models have been created for Grid and cloud resource sharing [9–11] as a means of encouraging interaction among producers and consumers.

Numerous computing platforms including distributed databases, clusters and grids are using market-based resource management systems. These systems adopt economic models such as an auction, bartering, commodity, and price based models. Economic models can be divided into two important categories based on whether the exchange methods use pricing[1] or bartering.[2] The industry has successfully adopted many pricing methods for resource sharing [12] but bartering models have not been popular because of lack of trust among rational users[3] (Cloud provider or Grid resource providers). In large dis-

[1] The exchange value of resources is computed relative to a common form of currency.

[2] Bartering allows users to exchange resources without money changing hands.

[3] A rational user can be a buyer or seller of resources.