

Chapter 8

A Resource Allocation Model for Desktop Clouds

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ABSTRACT

Cloud computing is a new paradigm that promises to move IT a step further towards utility computing, in which computing services are delivered as a utility service. Traditionally, Cloud employs dedicated resources located in one or more data centres in order to provide services to clients. Desktop Cloud computing is a new type of Cloud computing that aims at providing Cloud capabilities at low or no cost. Desktop Clouds harness non dedicated and idle resources in order to provide Cloud services. However, the nature of such resources can be problematic because they are prone to failure at any time without prior notice. This research focuses on the resource allocation mechanism in Desktop Clouds. The contributions of this chapter are threefold. Firstly, it defines and explains Desktop Clouds by comparing them with both Traditional Clouds and Desktop Grids. Secondly, the paper discusses various research issues in Desktop Clouds. Thirdly, it proposes a resource allocation model that is able to handle node failures.

INTRODUCTION

Cloud computing is a new model that promises to move IT services a step further towards utility computing, which means providing computing services as a utility service. Traditionally, a Cloud service provider (CSP), such as Amazon, employs computing resources located in data centres in

order to provide Cloud services to clients. The computing resources are dedicated to providing these services (i.e., they are made for this purpose). This type of Cloud computing is called Traditional Clouds throughout this paper. Desktop Cloud computing is a new type of Cloud computing that aims to provide Cloud capabilities by harnessing computing resources that would otherwise remain

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idle. This ambition can be achieved by combining both Cloud computing and Volunteer computing in order to form Desktop Clouds. This new type of Cloud computing is motivated by the success of Desktop Grid projects, such as SETI@home (Anderson & Fedak, 2006), in harnessing idle computing resources instead of relying on specific-made resources to form a Grid. Desktop Clouds harness non-dedicated and idle resources in order to provide Cloud services. For example, a university may wish to use its IT resources when they become idle to form a Cloud. The resources can be any type of computing nodes, normal PCs for example. The main motivation for Desktop Clouds is to reduce the expense of acquiring Cloud services.

This chapter focuses on the resource allocation mechanism in Desktop Clouds. The resource allocation mechanism in Cloud computing is concerned with the following question: how to allocate resources in a way that can maximise the profits for the service providers without affecting the performance of these servers. Maximisation of profit can be achieved by saving power consumption in the physical nodes that are employed by CSPs. The Desktop Cloud is a new Cloud type that employs idle and non-dedicated resources to provide Cloud services. However, the nodes in Desktop Clouds are prone to failure at any time without prior knowledge. A failure event in a physical node can be caused as a result of connectivity problems, crashes and so on. A failure event, in this context, includes if an owner of physical machine that is serving in a Desktop Cloud, decides to disconnect his/her machine without prior notice. Therefore, Desktop Clouds have brought a new dimension, the high failure rate of nodes, to the problem of resource allocation in Clouds. The contributions of this chapter are threefold:

- The chapter explains Desktop Clouds as being a new Cloud computing model. A comparison is given between Desktop Clouds against Traditional Clouds and Desktop Grids.

- Several research issues in Desktop Clouds are discussed. Attention is given to failures in physical nodes within Desktop Clouds.
- The chapter proposes a resource allocation model that is able to handle node failures.

The rest of the paper is organised as follows: a background section gives an overview of Desktop Clouds as a new Cloud computing model. Several advantages of Desktop Clouds are compared with Traditional Clouds and discussed. The section compares and contrasts Desktop Clouds with related large-scale systems (Traditional Clouds and Desktop Grids). The subsequent section discusses several research issues that need further attention from researchers of Desktop Clouds. An analysis of the failures in Desktop Cloud physical nodes is conducted to show the importance of having a resource allocation mechanism that can handle such failures. After that, the taxonomy of resource allocation mechanisms in the literature is described. Furthermore, a failure-aware resource allocation model is proposed, along with a discussion about its effectiveness.

Background

The success of Desktop Grids motivated the idea of applying the same concept to the Cloud. Desktop Clouds exploit computing resources of any form to build Clouds. Hence, the term Desktop comes from Desktop Grids because both Desktop Clouds and Desktop Grids are based on harnessing Desktop PCs and laptops. Similarly, the term Cloud comes from Cloud paradigm because Desktop Cloud aims to provide services based on the Cloud business model.

Several synonyms for Desktop Cloud have been used in the literature, such as Ad-hoc Cloud, Volunteer Clouds and Non-Dedicated Clouds. The literature shows that very little work has been undertaken in this direction. Ad-hoc Cloud is the idea of harvesting distributed resources within an organisation to form a Cloud (Kirby,

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