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# Program Ultra-Dispatcher for launching applications in a customization manner on cloud computing

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ABSTRACT

Cloud computing is an emerging computing paradigm that can abstract various computer resources and make the resources as services easily accessible to people. Meanwhile, cloud computing provides people with the resources in a pay-as-you-go style, i.e. charging for the use of resources. However, cloud computing cannot make people use everything in a cloud without caring about their own investments and resources. While cloud computing nowadays only cares about how to rent resources to people, people need a solution capable of combining their own resources and the rented resources to get the maximum benefit, i.e. the solution to customize a cloud according to people's needs.

In this paper, the PROgram Ultra-Dispatcher (PROUD) is proposed for launching applications in a customization manner on cloud computing. The PROUD allows people to configure using their own computers or Virtual Machines (VMs) in clouds to run applications, no matter the applications are installed in people's computers or VMs in clouds. The PROUD allows people to regulate a rule for determining what computer or VM is capable of running the application according to available run-time information such as CPU utilization, available memory, network activity, disk space or I/O activity, etc. Furthermore, the PROUD allows people to setup preference to affect the decision procedure of choosing a capable computer or VM. Functioning as a program loader in people's computers, the PROUD has high interoperability among VMs to work well without a limitation in using the same Cloud Service Provider's VMs. Because people usually rent parts of pay-as-you-go resources in clouds such as a couple of VMs, the PROUD is justified to be a solution capable of combining their own resources and the rented resources to get the maximum benefit. Currently, the PROUD is implemented on Windows XP with a script file written in a portable language, so the PROUD has high portability among Windows platforms and high acceptability to people who are familiar with Windows platforms. The PROUD is given experiments in this paper to identify its practicability, overhead, and performance.



## 1. Introduction

Cloud computing (Lucky, 2009; Leavitt, 2009; Dikaiakos et al., 2009; Pallis, 2010; Armbrust et al., 2009; Buyya et al., 2009; Li et al., 2011) is an emerging computing paradigm emphasizing the Service-oriented Architecture (SoA) (Youseff et al., 2008). In the SoA, cloud computing abstracts various computer resources and makes the resources as services easily accessible to people. Meanwhile, cloud computing provides people with the resources in a pay-as-you-go style, i.e. charging for the use of resources. Cloud computing can give people any computer resource they need. Because a cloud has many networking computers, cloud computing can speed up the construction of a message exchange platform in an industry if the industry has not had any platform yet. Because a cloud has stable power sources, periodical backup procedures, and many Information Technology (IT) experts, cloud computing can conserve the cost of equipment maintenance in a company if the company has abandoned most obsolete computers and fired its Management Information System (MIS) crew. Because a cloud has various online software suites, cloud computing can stimulate the productivity of software in a department if the department has trained its members to do everything on the Internet through a browser. However, cloud computing has not been practical as our expectation, except giving people a crowd of dreams.

Although people have been deeply attracted by cloud computing, they maybe already have a usable network infrastructure composed of several servers in their industries. People cannot just shutdown the servers today and use the platforms provided by a Cloud Service Provider (CSP) tomorrow. People have made many investments in their computers and owned some IT experts. People neither want to idle the computers nor likely fire their

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colleagues to hurt the friendship without a justifiable reason. Besides, people probably have been familiar with the existing software in their computers or furthermore have paid a very high price for a long-term license of the software. People unlikely shift the daily software such as word processors or account utilities that have been installed in their computers for a couple of years, and immediately get used to do everything on the Internet through a browser. No matter how promising cloud computing is, people still have to care about the utilization of their own investments and resources.

Thanks to virtualization technology (Sugerman et al., 2001; Uhlig et al., 2005; Chaudhary et al., 2008), people nowadays can use the Infrastructure as a Service (IaaS) on cloud computing by renting Virtual Machines (VMs) from CSPs. In VMs, people can setup their familiar Operating Systems (OSs), construct their familiar network topologies, and install their familiar software. The remaining problem is how people can smartly utilize pay-as-you-go resources in clouds to cooperate with the existing resources at home, office, company, department, industry, etc. At the premise of keeping the productivity of the existing software and computers owned by people, people need pay-as-you-go resources in clouds to work as a helper on demand because CSPs charge for the use of resources such as CPU time, memory space, disk space, and network bandwidth. However, people currently do not have any available solution that can customize a cloud to work cooperatively with their own software and computers. In other words, people cannot control the use of applications at run time among their computers and VMs in clouds according to their needs, e.g. load balance, priority or location of applications, preference for specific computers, and privacy or security consideration. Because the pay-as-you-go resources in clouds should be used economically to benefit people, people need a solution capable of combining their own resources and the rented resources to get the maximum benefit. Due to lacking a solution capable of customizing a cloud according to people's needs, people either waste money to buy redundant resources in a cloud and idle their own resources, or refuse to utilize any resource in a cloud but suffer the shortage of their own resources to degrade the productivity.

Current proposals about IaaS on cloud computing are announced for anything but not for giving people a way to customize a cloud according to people's needs. They (Shi and Zhan, 2009; Spillner and Schill, 2009; Li et al., 2009; Wada et al., 2009; Van et al., 2009) target mechanisms used by CSPs to deal with Quality of Service (QoS) problems in order to guarantee the Service Level Agreement (SLA) with people; however, they do not care that running certain software on people's nearby computers can give people more comfortable experience than running it in clouds. They (Li et al., 2009; Chen et al., 2009; You et al., 2009; Brandt et al., 2009; Kim et al., 2010; Sadhasivam et al., 2009) design mechanisms used by CSPs to maximize the resource utilization in clouds, e.g. mechanisms for load balance or VM migration in order to further save CSPs' money; however, they do not care about whether people's computers are underutilized or not. They (Li et al., 2009; Anandasivam et al., 2009; Kesavan et al., 2008; Dalheimer and Pfreundt, 2009; Gong et al., 2009; Fito et al., 2010) design mechanisms used by CSPs to calculate resources in clouds and charge precisely for the use of resources; however, they do not care that people may waste money to accidentally overuse resources in clouds. They (Scheifler and Gettys, 1986; Richardson et al., 1994, 1998; Wood et al., 1997; ITU-T T.128; Citrix Systems; Teadici; Calyam et al., 2009; Lamberti and Sanna, 2008; Zhang et al., 2006; Beaty et al., 2009; Lubonski et al., 2005) design mechanisms used by CSPs to smartly deliver data or computation results from a VM in a cloud to people through a browser or specific client software; however, they do not give people facilities capable of smartly choosing a VM in a cloud for running applications on behalf of people at run time. Accordingly, it is time to stand at people's side rather than a CSP's side by granting people a way to customize a cloud according to their needs, i.e. controlling the use of applications at run time among people's computers and VMs in clouds.

In this paper, the PROgram Ultra-Dispatcher (PROUD) is proposed for launching applications in a customization manner on cloud computing. The PROUD allows people to configure using their own computers or VMs in clouds to run an application, which is useful for the application that has a limited license or the legacy application that cannot be found to install in other computers or VMs. The PROUD allows people to regulate a rule for determining what computer or VM is capable of running the application according to run-time information such as CPU utilization, available memory, network activity, disk space, etc., which is useful to implement a user-decided load balance policy among people's computers and VMs in clouds. Besides working with objective run-time information, furthermore, the PROUD allows people to setup preference to affect the decision procedure of choosing a capable computer or VM, which can be made to favor people's computers to avoid overusing pay-as-you-go resources in clouds or favor VMs in clouds to speed up application execution if people's computers are slow. Functioning as a program loader in people's computers, the PROUD has high interoperability among VMs to work well without a limitation in using the same CSP's VMs, which is flexible for people to use VMs offered by different CSPs. Because people usually rent parts of pay-as-you-go resources in clouds such as a couple of VMs, the PROUD is justified to be a solution capable of combining their own resources and the rented resources to get the maximum benefit. Currently, the PROUD is implemented as a proof of concept to run on Windows XP with a script file written in a portable language, so it not only has high portability among Windows platforms (operating systems used by CSPs to hold VMs are not limited to Windows) but also has high acceptability to people who are familiar with Windows platforms. The PROUD is given experiments in this paper to identify its practicability, overhead, and performance.

This paper is organized as follows. Section 2 has the related works. Section 3 introduces the PROUD. Section 4 explains the PROUD implementation. Section 5 conducts experiments with the PROUD. Section 6 has discussions. Finally, Section 7 concludes this paper.

## 2. Related works

Because cloud computing is a young paradigm emerging at recent years, current proposals about IaaS on cloud computing mainly focus on designs or mechanisms used by CSPs in order to guarantee QoS requirements of applications, improve the utilization of VMs, accurately calculate the use of resources, and facilitate accesses to resources in clouds. Designed from the viewpoint of a CSP, current proposals hardly care about people's needs. Current proposals try to make everything in clouds as a service to accommodate various applications, but do not give people a way to customize a cloud for controlling the use of applications at run time among people's computers and VMs in clouds according to people's needs.

### 2.1. Quality of service

Shi and Zhan (2009) propose a cloud computing architecture, a model involving business considerations, for calculating numbers of servers, routers, and communication bandwidth through considering