



CloudExp: A comprehensive cloud computing experimental framework



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ABSTRACT

Cloud computing is an emerging and fast-growing computing paradigm that has gained great interest from both industry and academia. Consequently, many researchers are actively involved in cloud computing research projects. One major challenge facing cloud computing researchers is the lack of a comprehensive cloud computing experimental tool to use in their studies. This paper introduces *CloudExp*, a modeling and simulation environment for cloud computing. *CloudExp* can be used to evaluate a wide spectrum of cloud components such as processing elements, data centers, storage, networking, Service Level Agreement (SLA) constraints, web-based applications, Service Oriented Architecture (SOA), virtualization, management and automation, and Business Process Management (BPM). Moreover, *CloudExp* introduces the Rain workload generator which emulates real workloads in cloud environments. Also, MapReduce processing model is integrated in *CloudExp* in order to handle the processing of big data problems.

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1. Introduction

Cloud computing is an emerging computing paradigm that is continuously evolving and spreading. Many experts believe it will become the dominant IT service delivery model by the end of the decade [1]. Cloud computing is built on a wide range of different computing technologies such as high-performance computing, grid and utility computing, distributed systems, virtualization, storage, networking, security, management, automation, Service-Oriented Architecture (SOA), etc. Moreover, other concepts like Business Process Management (BPM), Service-Level Agreement (SLA), Quality of Service (QoS). This complexity presents a major challenge for researchers to conduct comprehensive cloud computing-related experiments for two main reasons: First, conducting experiments on real systems is expensive and the criticality and frangibility of the system poses many limitations and risks. Such experiments may adversely affect the system's availability, reliability, and security. Second, while simulation tools would mitigate the problems that arise from using a real system, there are no comprehensive cloud computing experimental tools that cover the wide spectrum of cloud computing components. Unfortunately, current

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