Chapter 12
Application of Cloud-Based Simulation in Scientific Research

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ABSTRACT

This chapter is a review of the literature related to the use of cloud-based computer simulations in scientific research. The authors examine the types and good examples of cloud-based computer simulations, offering suggestions for the architecture, frameworks, and runtime infrastructures that support running simulations in cloud environment. Cloud computing has become the standard for providing hardware and software infrastructure. Using the possibilities offered by cloud computing platforms, researchers can efficiently use the already existing IT resources in solving computationally intensive scientific problems. Further on, the authors emphasize the possibilities of using the existing and already known simulation models and tools in the cloud computing environment. The cloud environment provides possibilities to execute all kinds of simulation experiments as in traditional environments. This way, models are accessible to a wider range of researchers and the analysis of data resulting from simulation experiments is significantly improved.

INTRODUCTION

In last couple of years, Cloud Computing has become a standard for delivering hardware and software infrastructure. It is based on a *pay-per-use* business model where resources are acquired only when really needed and customer pays only for resources actually used. Cloud computing represents the mechanism for dealing with the use of external services as part of the computational foundation (Tor-Morten, 2012). It provides scalable, distributed computer services as needed. The aim of cloud computing is to present a service layer for its users where all detailed logic is made transparent and drawn upon as needed. In general, cloud computing is recognized as an

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infrastructure where all underlying resources (storage, RAM, processors, load balancers etc.) are completely abstracted from the end user. This leads to the cloud provider/vendor to be in charge of performance, reliability and scalability. Gartner defines cloud computing as a style of computing in which scalable and elastic IT-enabled capabilities are delivered as a service using Internet technologies (Gartner, 2013). The National Institute of Standards and Technology (NIST) defines cloud computing as:

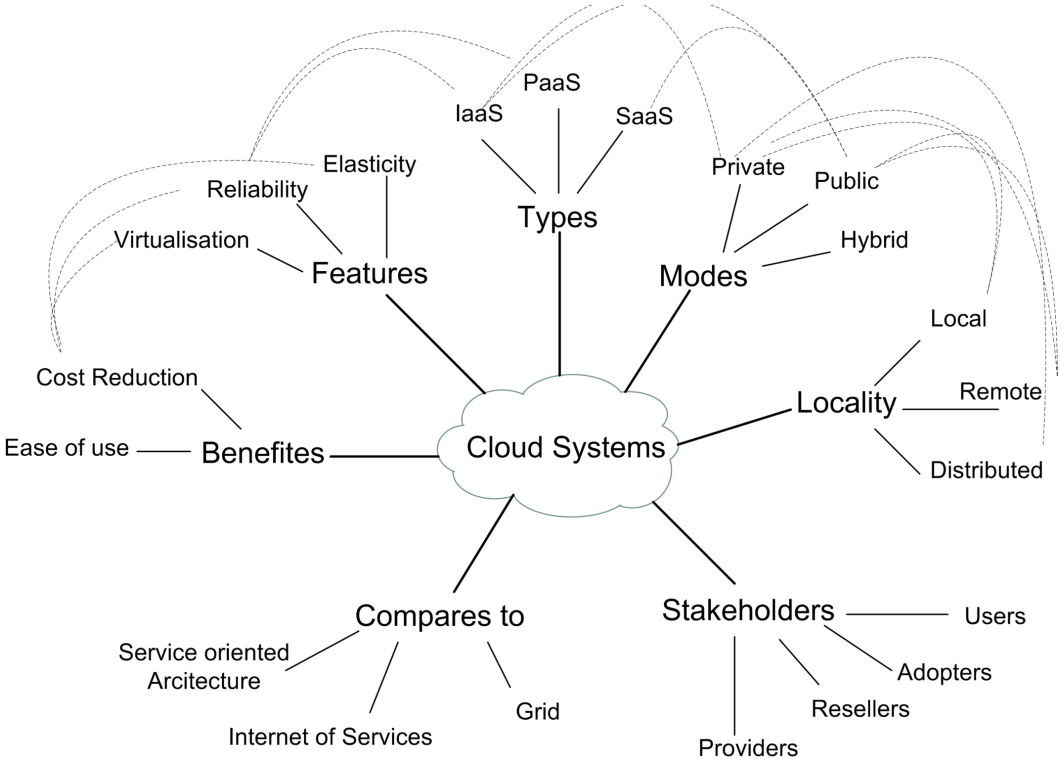
A model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction (Peter & Grance, 2011).

The same authors list three service models: Infrastructure as a Service (IaaS), Platform as a Service (PaaS) and Software as a Service (SaaS). The same source, and also other authors (Jeffery & Neidecker-Lutz, 2010) provide five essential characteristics (On-demand self-service, Broad network access, Resource pooling, Rapid elasticity and Measured Service), and four deployment models (Private, Community, Public and Hybrid cloud). The introduction of Cloud Computing had a significant impact on all segments of IT industry, including computer-based modeling and simulation.

Cloud Computing Expert Group (Jeffery & Neidecker-Lutz, 2010) provided an overview of all main aspects of Cloud Computing (Figure 1).

This chapter offers an overview of the existing cloud-based simulation software and explores the possibilities of using the existing simulation models and tools in this new environment. One of the

Figure 1. Main aspects of clouds (Adapted from [Jeffery & Neidecker-Lutz, 2010])



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