Chapter 1
Applications of Virtualization Technology in Grid Systems and Cloud Servers

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ABSTRACT

Grid systems and cloud servers are two distributed networks that deliver computing resources (e.g., file storages) to users' services via a large and often global network of computers. Virtualization technology can enhance the efficiency of these networks by dedicating the available resources to multiple execution environments. This chapter describes applications of virtualization technology in grid systems and cloud servers. It presents different aspects of virtualized networks in systematic and teaching issues. Virtual machine abstraction virtualizes high-performance computing environments to increase the service quality. Besides, grid virtualization engine and virtual clusters are used in grid systems to accomplish users' services in virtualized environments, efficiently. The chapter, also, explains various virtualization technologies in cloud severs. The evaluation results analyze performance rate of the high-performance computing and virtualized grid systems in terms of bandwidth, latency, number of nodes, and throughput.

1. INTRODUCTION

Virtualization technology is executed by a process unit (e.g., a single program and an operating system) inside a program environment, namely jail or sandbox, running in a physical machine, namely hosting machine. A powerful hosting machine can be used to provide a set of the virtual machines (VMs) interconnected by one or multiple virtual networks. A virtual network scenario emulates behaviors of the

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same scenario implemented with real computer systems. The main advantage of virtualization technology is that the main processes running in virtual machines behave, almost, truly as they are running on a real environment (Uhlig et al., 2005; Kim & Forsythe, 2010; Sahoo, Mohapatra, & Lath, 2010; Wang, Iyer, Dutta, Rouskas, & Baldine, 2013). This approach can be used in computer networks (e.g., grid systems and cloud servers) to reduce equipment and management costs compared to real scenarios. In this case, the hosting machine is used to implement the entire network to save financial costs of all the real equipments and infrastructure (e.g., wire and hubs) (Adabala et al., 2005; Di Costanzo, De Assuncao, & Buyya, 2009; Liang & Yu, 2015; Chen, Zhang, Hu, Taleb, & Sheng, 2015; Han, Gopalakrishnan, Ji, & Lee, 2015). Figure 1 illustrates the main elements of a virtual network laboratory: backbone, headquarters, regions, and sites. Backbone is a network to transport all the traffic among headquarters and regions. Headquarters are the central sites that involve main organization servers and applications. Regions contain one or more sites to manage the activity of desirable organization. Finally, sites indicate different offices of the organization and its end-users (Galán, Fernández, Ruiz, Walid, & de Miguel, 2004).

This chapter describes various applications of virtualization technology in grid systems and cloud servers. The chapter, initially, focuses attention on network virtualization, virtualized projects of computing systems, and virtualization technology

Figure 1. A schematic of virtual network laboratory