Chapter 16
Information Technology Resources Virtualization for Sustainable Development

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ABSTRACT

Today, business organizations seem to be involved in the processes of sustainable development. Therefore, not only economic indicators of performance are considered but also the environmental responsibility is equally important. The environmental responsibility covers social responsibility and natural environment responsibility. The latter demands taking into account promotion of sustainable use of renewable natural resources, reducing the emissions and wastages, decrease of energy consumption. The first part of the paper includes presentation of benefits resulting from IT (Information Technology) resources virtualization, grid computing and cloud computing development. The second part contains a model of IT governance for sustainability.

INTRODUCTION - GENERAL PERSPECTIVE OF VIRTUALIZATION

Modern computer systems are now sufficiently powerful to present users with the illusion that one physical machine consists of multiple virtual machines, each one running a separate and possibly different instance of an operating system. Today, virtualization can apply to a range of system layers, including hardware, operating system and high-level language virtual machines.

Virtual machine concept was in existence since 1960 when it was first developed by IBM to provide concurrent, interactive access to a mainframe computer (Cala & Zielinski, 2007). The fundamental idea behind virtualization is to introduce an additional layer of indirection in accessing resources so that a lower-level resource can be transparently mapped to multiple higher-level resources or vice versa. Each level has its own virtualization control layer which is responsible for management and enforcement of mapping

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between level n and n+1 of virtualized resources. So virtualization decision may be performed during the system configuration phase or even in the run-time. The lowest layer of the hierarchy represents physical resources. The virtualization of resources is a powerful tool for creating advanced data network services. A major advantage of the virtualization of network functionality through abstraction techniques is increased flexibility in service creation, provisioning and differentiation.

The main purpose of the infrastructure-level virtualization is to provide an abstracted view of a collection of discrete computer, data, application, network and storage resources for the purpose of hiding complexity and improving flexibility and productivity. An important beginning to the virtualization process is to recognize that series of components could be better managed if they are abstracted. As these abstractions are crafted in an appropriate and ultimately productive manner, the predominant interactions remain with the individual components. In this way, virtualization also provides both an opportunity and the means to abstract away complexity. It offers customers the opportunity to build more efficient IT infrastructures. Virtualization is seen as a step on the road to utility computing. With virtualization, the logical functions of the server, storage and network elements are separated from their physical functions (e.g. processor, memory, controllers, disks and switches). In other words, all servers, storage and network devices can be aggregated into independent pools of resources. Elements from these pools can then be allocated, provisioned, and managed, manually or automatically, to meet the changing needs and priorities of one's business (Minoli, 2005).

BACKGROUND - INFORMATION TECHNOLOGY INFRASTRUCTURE VIRTUALIZATION

Virtualization is a broad term encompassing a set of several deployment and management features and could be defined as a technique used to abstract the physical characteristics of the resources of a system from other systems, applications or users interacting with those resources (IBM, 2008). The virtualization can make a single physical resource appear to be multiple logical resources, or multiple physical resources appear to be a single logical resource.

Virtualization is viewed as:

- **File virtualization:** Multiple files aggregated into a large file, presents integrated file interface,
- **Software virtualization:** Enabling users to use more-efficient, high-performance hardware to support hundreds of applications and several operating systems in a single system. Applications are used in data path, or in "plug-and-play" way from host view,
- **Desktop virtualization:** Providing the access from anywhere for convenience and to ensure business continuity and disaster recovery,
- **Workstation virtualization:** Enabling the centralized control of data and the efficient administration of them among multiple users in different locations,
- **Storage virtualization:** Enabling users to centralize data storage to protect data, improve security and disaster recovery, and accelerate data backups, while desktop virtualization enables moving of data, applications, and processing away from desktop PCs onto secure, cost-efficient virtualized network resources, replacing PCs with virtualized thin-client computers (Moore, 2006).

Storage virtualization automates tedious and extremely time-consuming storage administration tasks. This means the storage administrator can perform the tasks of backup, archiving, and recovery more easily and in less time. Storage virtualization is commonly used in file systems,