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Short Communication

Virtualization Technology: Overview and Example

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Virtualization technology overview

Virtualization technology is not new. It is used in the past in the 70's as a solution to minimize cost and utilize resources for the huge infrastructure in mainframe computers [1-3]. In the 80's, expensive mainframes replaced minicomputers with low costs, so the virtualization technology disappeared in this period. In the last decade, virtualization technology is returned as a solution for some challenges facing networking technologies and data centres [4]. These challenges are security, availability, reliability, cost, space, and power consumption. Virtualization supports the server consolidation approach, which uses a set of provisioned VMs into a minimum number of physical servers to optimize resources and minimize the number of physical servers [5-7]. The consolidated servers are easier management and cheaper in terms of enormous infrastructure space and power consumption. Also, if any failure has happened in the virtual machine (VM), it will not affect other VMs. Moreover, the performance of any VM is not affected by the performance of other VMs. In addition, it is easier to migrate and protect VMs if there is any failure takes place [1].

There are two types of virtualization; full virtualization and para-virtualization [2,4,8]. Full virtualization provides an abstraction of underlying physical hardware and creates a complete virtual system for guest OS. The hypervisor does not modify guest OS, so it is not aware of virtualization. Also, full virtualization supports the migration and isolations of VMs. On the other hand, para-virtualization offers all the preceding features except that the hypervisor modifies the guest. For that reason, the guest will be aware of virtualization, so the overhead of performance in a virtualized environment is accepted [9].

Virtualization platform example (Xen)

Xen is an open-source virtualization platform [4]. It is considered as a popular VMM in cloud computing. It is used as a hypervisor for both virtualization types: full-virtualization and para-virtualization. The architecture of Xen is depicted in Figure 1. Xen hypervisor consists of the physical machine Dom0 (host machine), and other VMs, which are called guests ($DomU_1$, $DomU_2$, ..., $DomU_n$). The OS of Dom0 accesses and controls the VMM interface, which allows the users to create and manage VMs. The hypervisor, Xen, has two tools for managing the VMs.

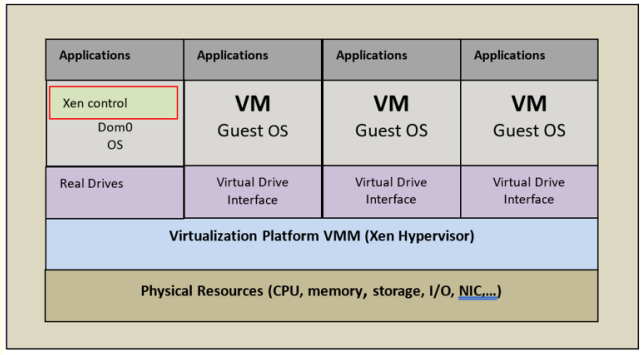

Figure 1: Para-virtualization using Xen.

- Send tool is considered the Xen controller daemon in par-virtualized environments [10]. It is used for creating new domains, migration, and destroying fields. Also, it uses an HTTP server to control and interact with these domains. The Linux command-line for Xend daemon after booting into Xen is: xend start.

- xm tool, is the Xen command-line interface. It controls the scheduling parameters. The scheduling parameters are used to control physical CPUs' capacity, which are allocated to VMs. Also, XM offers functionality to create, destroy, save, pause, stop, shutdown, and migrate VMs. Moreover, it provides dynamic resource allocation, and the mapping of virtual CPUs are mapped to physical CPUs.

Again, virtualization improves resource utilization in the cloud infrastructure [7,8,13]. Efficient resource allocation can be achieved by setting the optimal configuration for the deployed VMs. The nature of the users' applications determines the VMs configurations.

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