Cloud Computing

VIRTUALIZATION TECHNOLOGY

7. Cloud Virtualization Technology

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7.1 Introduction

- Virtualization represents the logical view of data representation- the power to compute in virtualized environments.
- It is a technique that has been used in large mainframe computer for 30+ years. It is used to manage a group of computers together- instead of managing resources separately.

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7.2 Virtualization Defined

Virtualization is an abstraction layer (hypervisor) that decouples the physical hardware from the operating system to deliver greater IT resources utilization and flexibility

Virtualization can bring the following benefits

- save money
- increased control
- simplify disaster recovery
- business readiness assessment

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7.2.1 Why Virtualization?

Here are some reasons for going for virtualization

- lower cost of infrastructure
- Reducing the cost of adding to that infrastructure
- Gathering information across IT set up for increased utilization and collaboration
- Deliver on SLA response time during spikes in production
- Building heterogeneous infrastructure that are responsive

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7.2.2 Infrastructure Virtualization Evolution

- The objective of virtualization is to reduce complexity in building and managing IT infrastructure.
- Virtualization has been in operation in mainframe computers
- different machines can run different operating systems and multiple applications on the same physical computer.
- Each virtual machine encapsulated and segregated, and contains a complete system including CPU, Memory and network devices to prevent conflict and allow single physical machine to safely run several different OS and applications on the same hardware

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7.3 Virtualization Benefits,

1. **Traditional benefits**
   a. server consolidation
   b. “Green IT” - reduced power and cooling- carbon print
   c. Reduced hardware costs
2. **Additional Benefits**
   a. increased availability/business continuity and disaster recovery
   b. maximized hardware resources
   c. reduced administration and labour costs
   d. efficient application and desktop software deployment and maintenance
   e. reduced time for server provisioning
   f. increased security on the desktop client level
   g. dynamic and extensible infrastructure to rapidly address new business requirements

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7.3.1 Current Virtualization Initiatives

Here is a list of different virtualization initiative actively pursued in industry today

- Virtual CPU and Memory
- Virtual Networking
- Virtual Disk
- Consolidated management
- Vmotion
- Svmotion
- Dynamic load balancing
- Logical partitions(LPARs)
- Logical Domains (LDOM)
- Zones

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7.3.2 Workplace (Virtual Terminal Service)

- Virtual terminal services such as Citrix Workplace allows office user access to the desktop, including the full outlook clients, network shares, etc as if they were in the office.
- Traditional VPN solutions only allow access to the resources themselves, not the “ look and feel”
- Through Citrix XenApp, a single instance of an application can be published and presented to multiple, concurrent end-users from a single shared source. Published applications can be distributed across presentation servers in the Citrix farm to allow for redundancy and high availability in the event of server hardware failire

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7.4 Server virtualization

Server virtualization covers different types of virtualization such as client, storage and network .

Server Virtualization

Server virtualization is the **masking of server resources**, including the number and identity of individual physical servers, processors, and operating systems, from server users. The server administrator uses a software application to divide one physical server into multiple isolated virtual environments. The virtual environments are sometimes called virtual private servers, but they are also known as guests, instances, containers or emulations.

There are three popular approaches to server virtualization:

- the virtual machine model,
- the paravirtual machine model, and
- virtualization at the operating system (OS) layer.

Source

Server Virtualization

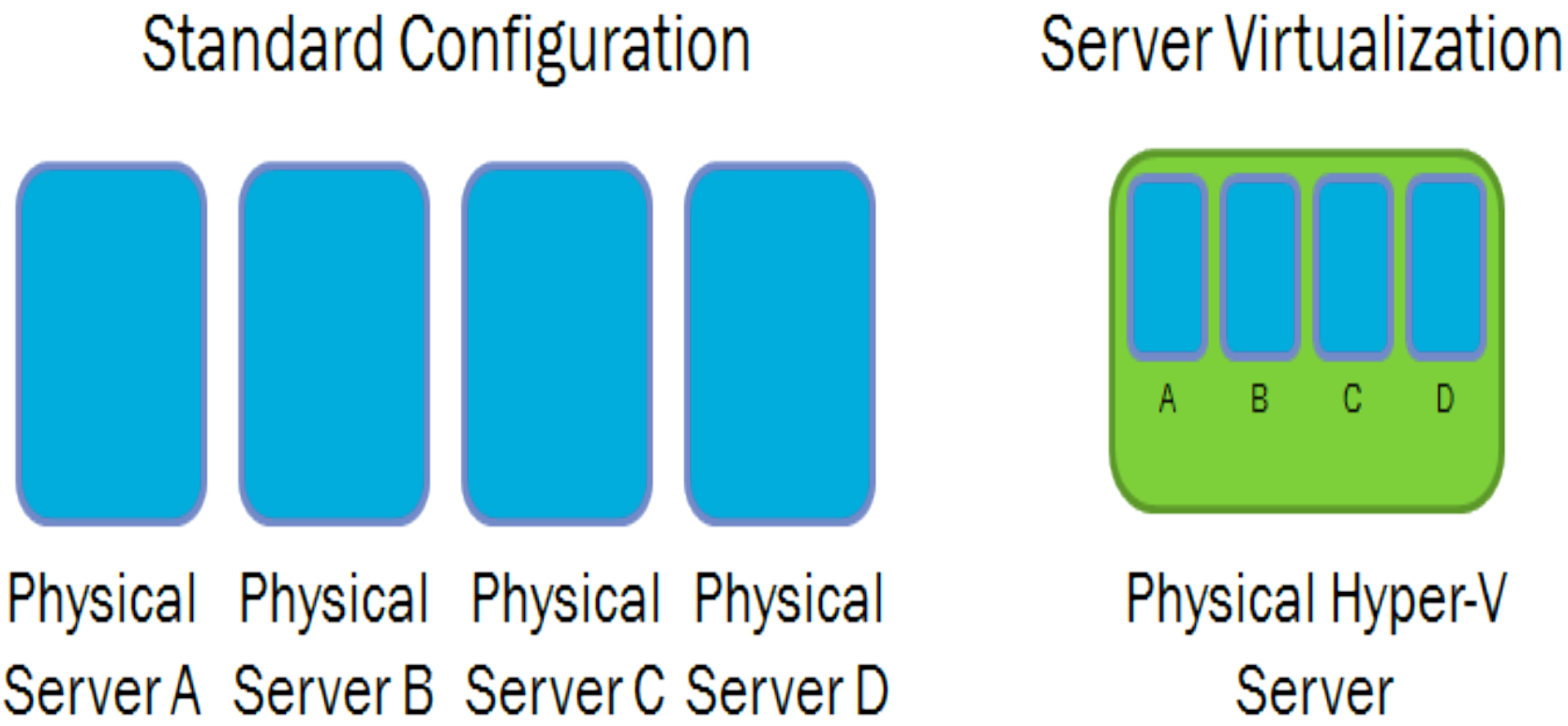

Image Source

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7.4.1 Virtual Machine

Often called Virtual environment or container. A Virtual machine (VM) is a server environment that does not physically exist but is created within another server .

For user interacting with a VM is seen or presented as a physical machine providing access to an operating system and machine resources like CPU memory, hard disk and network

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7.4.2 Virtualization Technologies

Two major types of virtualization technologies widely used are

- Hardware Virtualization
  - virtualizes the server hardware
- OS virtualization
  - virtualizes application environment

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7.4.3 Hardware Virtualization

- Hardware virtualization is also known as Hypervisor based virtualization, bare-metal Hypervisor, TYPE 1 virtualization or simply hypervisors
- It has a virtualization layer running immediately on the hardware, which divides the server machine into several virtual machines or partitions. with guest operating systems running in each of the machines
- This approach provides binary transparency because the virtualization environment products themselves provide transparency to the operating system, and applications and middleware that operate above it
- Examples
  - IBM LPARs
  - Open Source KVM
  - Sun LDoms
  - HP IVM
  - Citrix Xen Server

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7.4.4 OS Virtualization

- OS level virtualization or Type-2 creates virtual environments within a single instance of an operating system.
- These virtual environments created within an OS are called containers

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7.5 Virtualization for x86 ARCHITECTURE ,

- Virtualization on INTEL and AMD processors poses certain challenges. This is because of different vendors and their different operating ways
- Virtualization on x86 architecture requires placing a virtualization layer under the OS to create and manage the virtual machines
- Hardware-based Virtual machines or paravirtualization is a way to overcome this

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7.5.1 Hardware based Virtual Machine (HVM)

- Hardware based Virtual Machine or Hardware assisted Virtualization (HAV) is done possible by using new features developed by Intel and AMD
- These new features include Intel Virtualization Technology (VT-x) and AMD's AMD-V

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7.5.2 Paravirtualization

- Also known as OS-assisted Virtualization is used to overcome challenges posed by earlier versions of Intel and AMD
- It involves modifying the OS kernel to replace non-virtualizable instructions with hypercalls that communicate directly with the hypervisor

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7.6 Hypervisor Management Software

For each hypervisor, there is a companion layer of hypervisor management software that provides range of function such as

- Create VM
- Delete VM
- Move VM

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7.6.1 Hypervisor

- Hypervisor is the foundation for virtualization on server , enabling hardware to be divided into multiple logical partitions and ensure isolation among them
- It also support ethernet transport mechanism. It also supports Virtual SCSI to provide support virtual storage

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7.7.Logical Partitioning (LPAR).

One single system can be logically divided in multiple partitions. Each such partition can host a standalone AIX/Linux server. Each such partition is called a LPAR

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7.7.1 Categories of LPAR

- Dedicated
- Shared
- Capped
- Uncapped
- Dynamic LPAR

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7.7.3.LPAR Type

- VIO
- AIX/Linux

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7.7.3. Workload Partitions

Workload Partition is a new software based virtualization approach. They enable the creation of multiple virtual environments inside of a single instance.

They can be used to save administrative overhead when consolidating system

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7.7.4 Live Application Mobility.

Workload partitions can be moved from one system to another without restarting the application or causing significant disruption to the application end user. This process is called Live Application Mobility

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7.7.5 Live Migration

The movement of virtual machine from one physical host to another while continuously powered up is called Virtual Machine Mobility.

This provides protective maintenance.

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7.8 VIO Server

The means to share physical IO resources among partition is known as Virtual IO. This is needed to overcome insufficient physical IO resources in case of smaller systems

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7.9 Virtual Infrastructure Requirements

- Virtualization products have strict requirements on backend infrastructure components including storage, backup, system management, security and Time Sync.
- Ensuring that these components are of required configuration is critical for successful implementation

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7.9.1 Server Virtualization Suitability assessment

One of the key advantages of virtualization is greater utilization of physical server resources. To ensure that existing servers will operate in a shared environment, detailed hardware inventory and performance utilization information must be obtained and analyzed for assesment purposes.

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7.9.2 Detailed Design

virtualization introduces many changes into the environment, and ensures that the platform can co-exist and interact with existing infrastructure.

The purpose of detailed design to set naming and security standards, define the disk and network structure. It includes the following

- Security and Administrative Model
- Back up methodology
- VMware service console configuration
- implement tables and configuration setting

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7.10 Summary

This chapter focuses on server virtualization and also covers other flavours of virtualization. It also covers software components used for managing virtualization process entirely

THANK YOU!