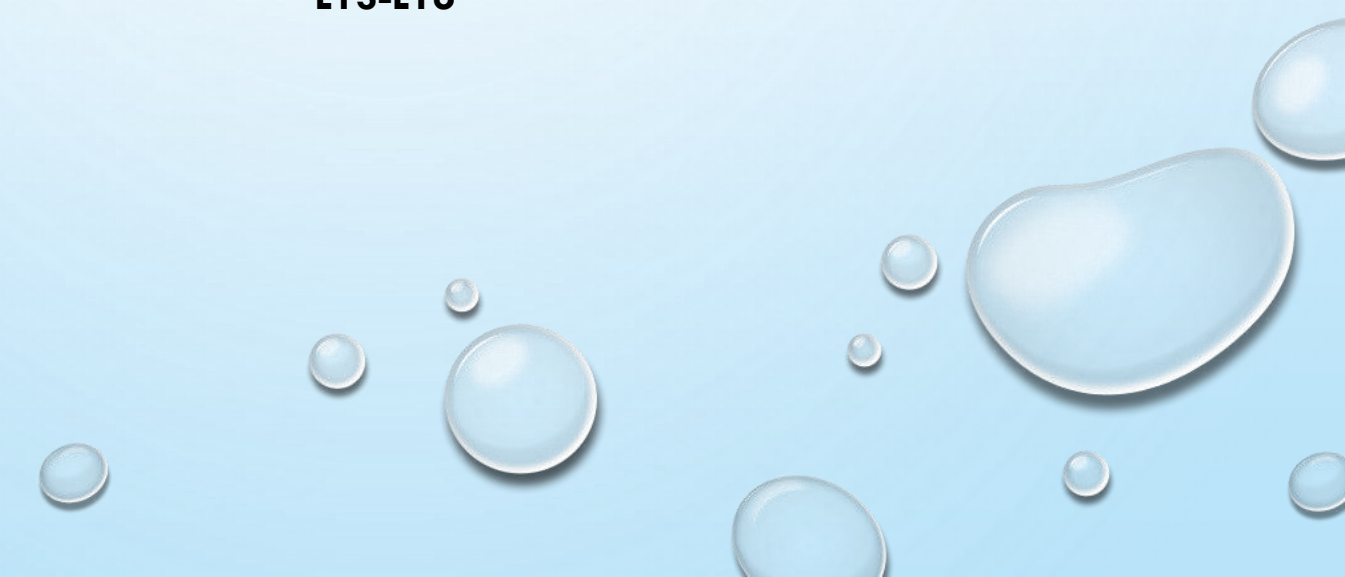




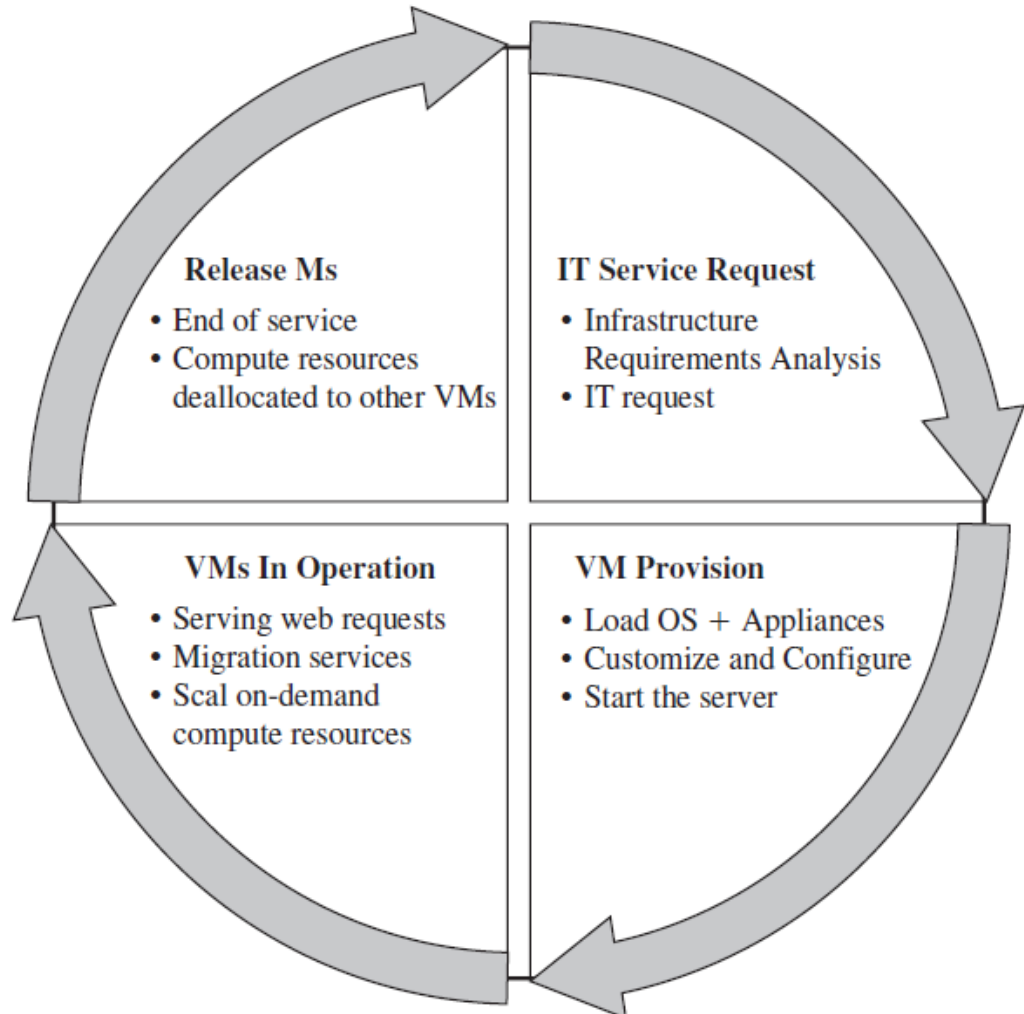
# **VIRTUAL MACHINES PROVISIONING AND MIGRATION SERVICES**

**L13-L16**



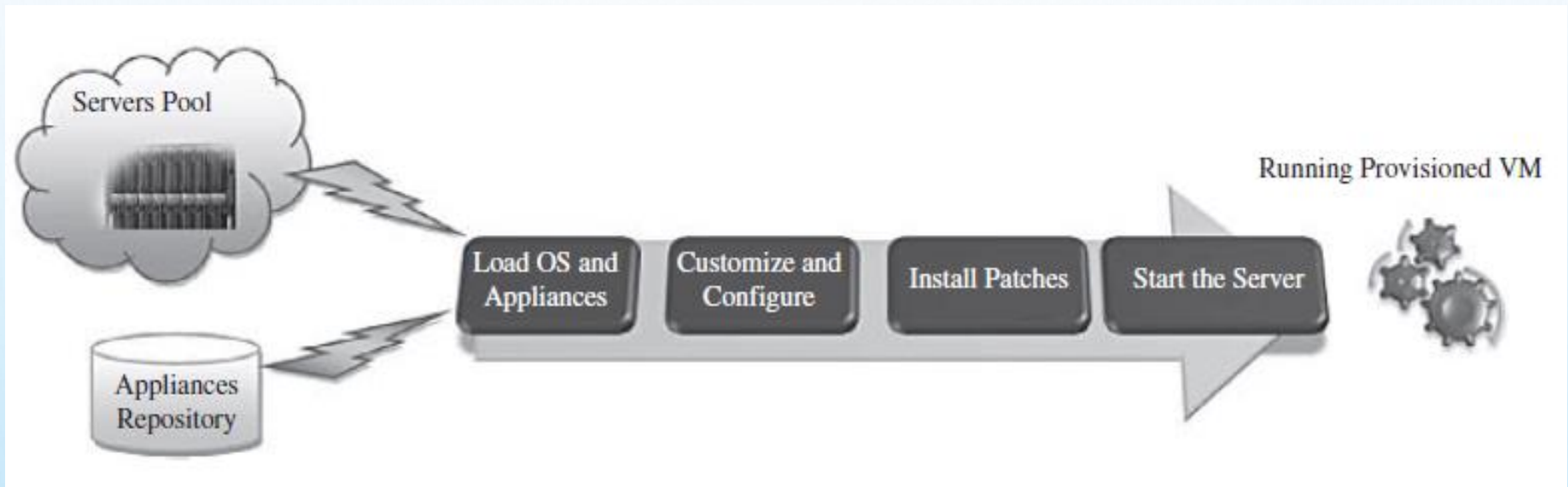
# VIRTUAL MACHINES PROVISIONING AND MANAGEABILITY

## Virtual Machine Life Cycle



**Fig: Virtual Machine Life Cycle**

# VM PROVISIONING PROCESS



**Fig: Virtual machine provision process**

# MIGRATIONS TECHNIQUES

- Live Migration and High Availability
  - VMware Vmotion
  - Citrix XenServer XenMotion
- Regular/Cold Migration
- Live Storage Migration of Virtual Machine

# MIGRATIONS TECHNIQUES

(CONTD..)

## Live Migration and High Availability

- aka hot or real-time migration
- **Defined** as the movement of a virtual machine from one physical host to another while being powered on.
- Without any noticeable effect from the end user's point of view (a matter of milliseconds).
- **Advantages**
  - Facilitates proactive maintenance in case of failure, because the potential problem can be resolved before the disruption of service occurs.
  - Load balancing in which work is shared among computers in order to optimize the utilization of available CPU resources

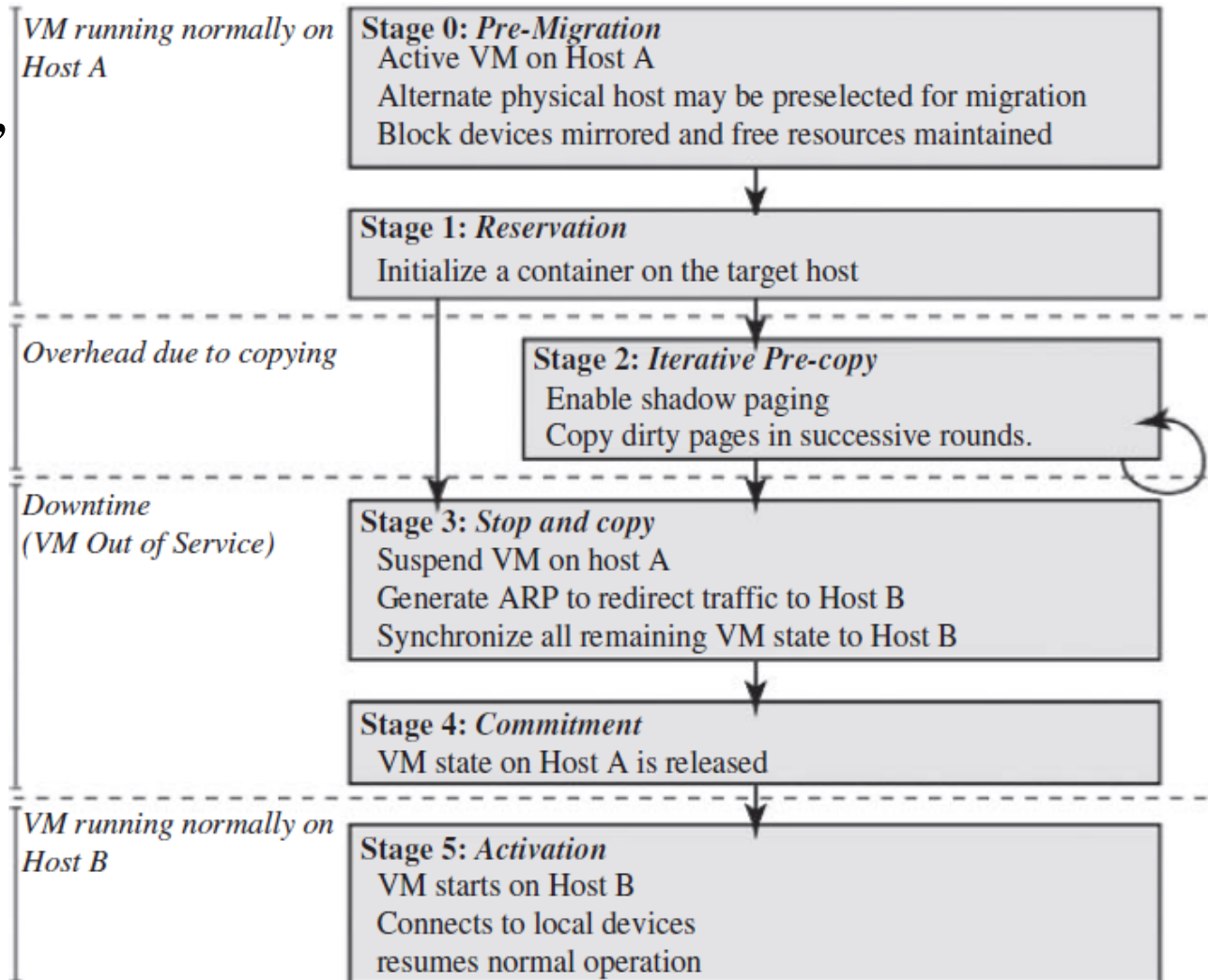


# MIGRATIONS TECHNIQUES

## (CONTD..)

### Live Migration Anatomy, Xen Hypervisor Algorithm

**Xen hypervisor:** Explain live migration's mechanism and how memory and virtual machine states are being transferred, through the network, from one host A to another host B



**Fig: Live migration timeline**

# MIGRATIONS TECHNIQUES

## (CONTD..)

**The migration process has been viewed as a transactional interaction between the two hosts involved:**

- **Stage 0:** Pre-Migration. An active virtual machine exists on the physical host A.
- **Stage 1:** Reservation. A request is issued to migrate an OS from host A to host B (a precondition is that the necessary resources exist on B and on a VM container of that size).
- **Stage 2:** Iterative Pre-Copy. During the first iteration, all pages are transferred from A to B. Subsequent iterations copy only those pages dirtied during the previous transfer phase.
- **Stage 3:** Stop-and-Copy. Running OS instance at A is suspended, and its network traffic is redirected to B. As described in reference 21, CPU state and any remaining inconsistent memory pages are then transferred. At the end of this stage, there is a consistent suspended copy of the VM at both A and B. The copy at A is considered primary and is resumed in case of failure
- **Stage 4:** Commitment. Host B indicates to A that it has successfully received a consistent OS image. Host A acknowledges this message as a commitment of the migration transaction. Host A may now discard the original VM, and host B becomes the primary host
- **Stage 5:** Activation. The migrated VM on B is now activated. Post-migration code runs to reattach the device's drivers to the new machine and advertise moved IP addresses

# MIGRATIONS TECHNIQUES

## (CONTD..)

### Live Migration Vendor Implementations Examples

#### VMware Vmotion

- a) Automatically optimize and allocate an entire pool of resources for maximum hardware utilization, flexibility, and availability.
- b) Perform hardware's maintenance without scheduled downtime along with migrating virtual machines away from failing or underperforming servers

#### Citrix XenServer XenMotion

- a) Inherited from the Xen live migrate utility, which provides the IT administrator with the facility to move a running VM from one XenServer to another in the same pool without interrupting the service.
- b) Also, balance the workloads on the virtualized environment.



# MIGRATIONS TECHNIQUES

## (CONTD..)

### **Regular/Cold Migration**

- Cold migration is the migration of a powered-off virtual machine.
- With cold migration, you have the option of moving the associated disks from one data store to another.
- The virtual machines are not required to be on a shared storage.

### **Live v/s Cold migration**

- Live migration needs a shared storage for virtual machines in the server's pool, but cold migration does not;
- In live migration for a virtual machine between two hosts, there would be certain CPU compatibility checks to be applied; while in cold migration this checks do not apply.

# **MIGRATIONS TECHNIQUES**

## **(CONTD..)**

### **Cold Migration Process:**

- The configuration files, including the NVRAM file (BIOS settings), log files, as well as the disks of the virtual machine, are moved from the source host to the destination host's associated storage area.
- The virtual machine is registered with the new host.
- After the migration is completed, the old version of the virtual machine is deleted from the source host

# MIGRATIONS TECHNIQUES

(CONTD..)

## **Live Storage Migration of Virtual Machine:**

- This kind of migration constitutes moving the virtual disks or configuration file of a running virtual machine to a new data store without any interruption in the availability of the virtual machine's service.

## **Migration of Virtual Machines to Alternate Platforms:**

- Ability to migrate virtual machines from one platform to another.
- For example, the VMware converter that handles migrations between SX hosts; the VMware server; and the VMware workstation.
- The VMware converter can also import from other virtualization platforms, such as Microsoft virtual server machines

# VM PROVISIONING AND MIGRATION IN ACTION

- Deployment scenario
- Installation
- Environment, software and hardware
- Adding managed servers and provisioning VM

# VM PROVISIONING AND MIGRATION IN ACTION (CONTD..)

## Deployment Scenario

ConVirt deployment consists of at least one ConVirt workstation, where ConVirt is installed and ran, which provides the main console for managing the VM life cycle, managing images, provisioning new VMs, monitoring machine resources, and so on.

Two essential deployment scenarios for ConVirt:

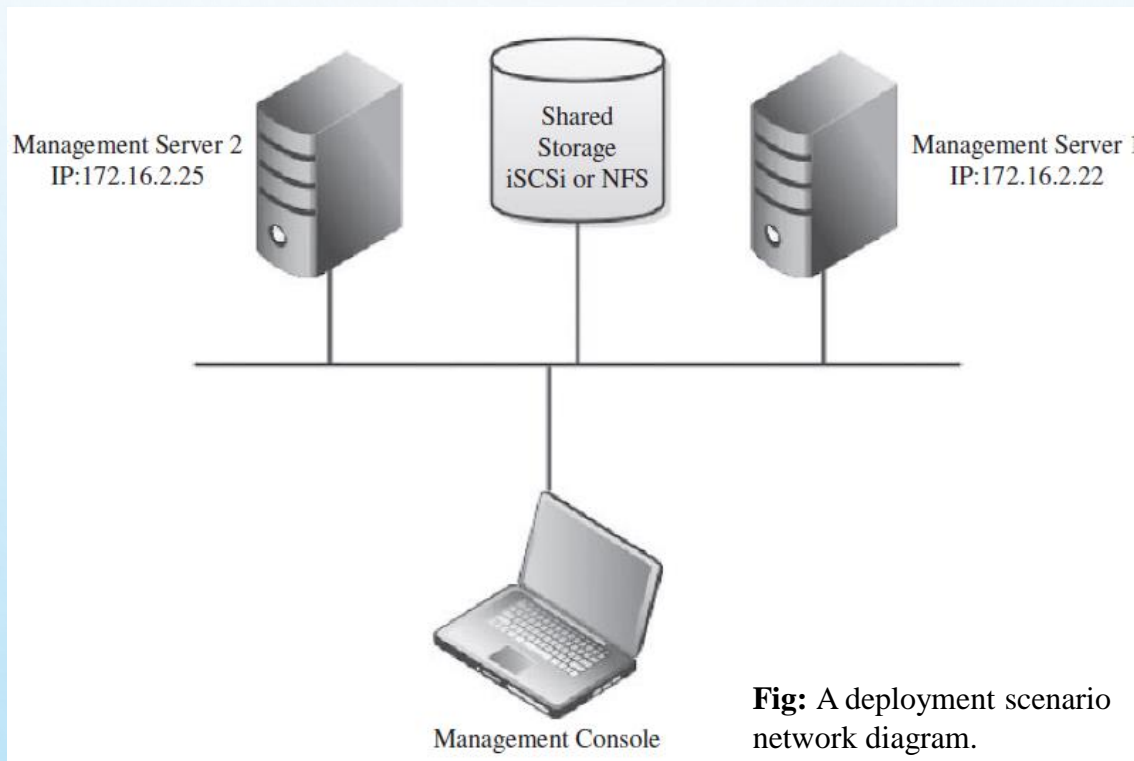
1. Basic configuration in which the Xen or KVM virtualization platform is on the local machine, where ConVirt is already installed;
2. An advanced configuration in which the Xen or KVM is on one or more remote servers.



# VM PROVISIONING AND MIGRATION IN ACTION (CONTD..)

## Installation

- Installing ConVirt on at least one computer.
- Preparing each managed server to be managed by ConVirt.
- Starting ConVirt and discovering the managed servers you have prepared.



**Fig:** A deployment scenario network diagram.

# VM PROVISIONING AND MIGRATION IN ACTION (CONTD..)

**Environment**

**ConVirt 1.1**

**Software**

**Linux  
Ubuntu 8.10**

**Hardware**

**3 machines,  
Dell core 2  
due  
processor,  
4G RAM**

# VM PROVISIONING AND MIGRATION IN ACTION (CONTD..)

## Adding Managed Servers and Provisioning VM

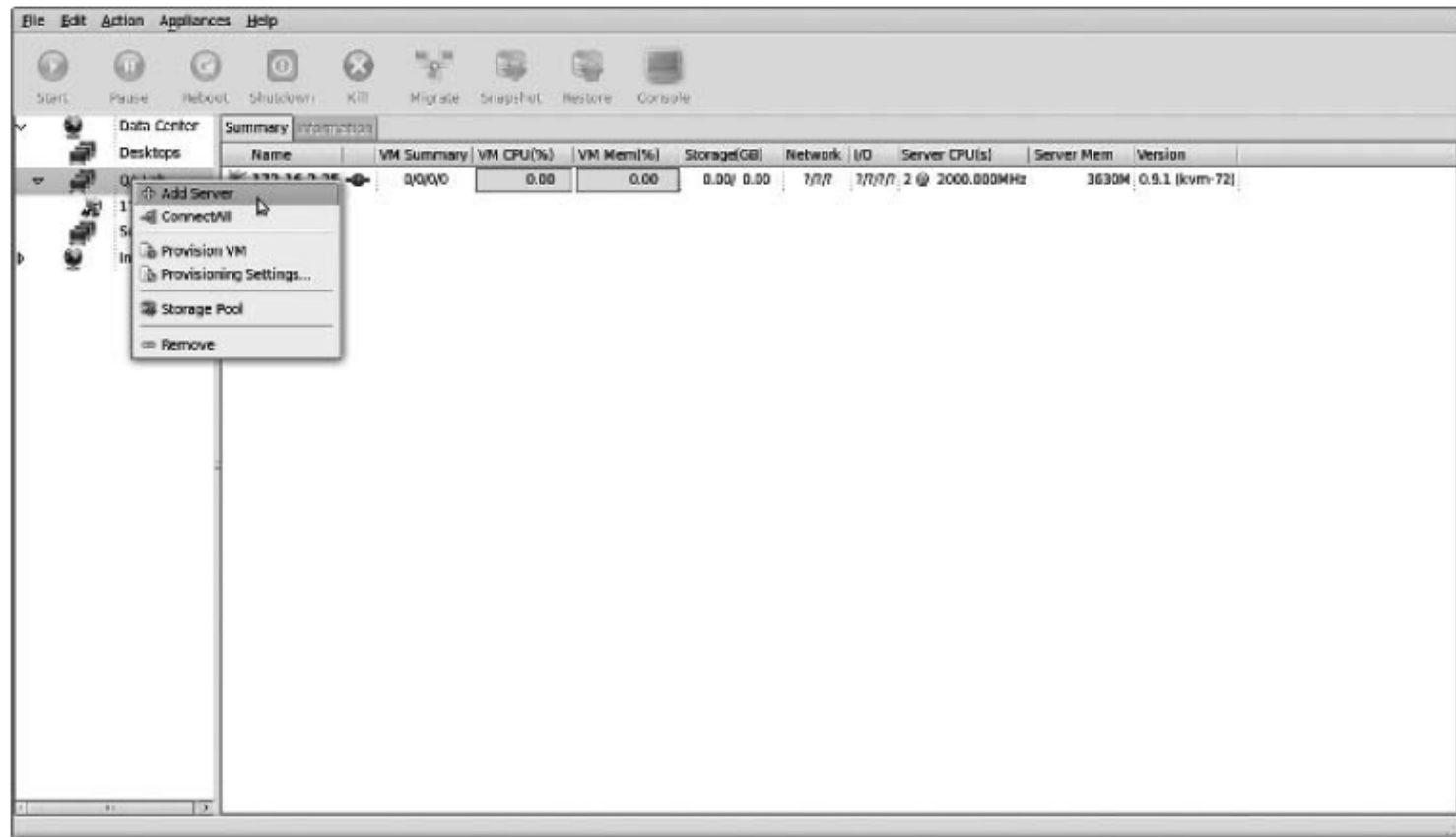


FIGURE 5.8. Adding managed server on the data centre's management console.

# VM PROVISIONING AND MIGRATION IN ACTION (CONTD..)

## Adding Managed Servers and Provisioning VM

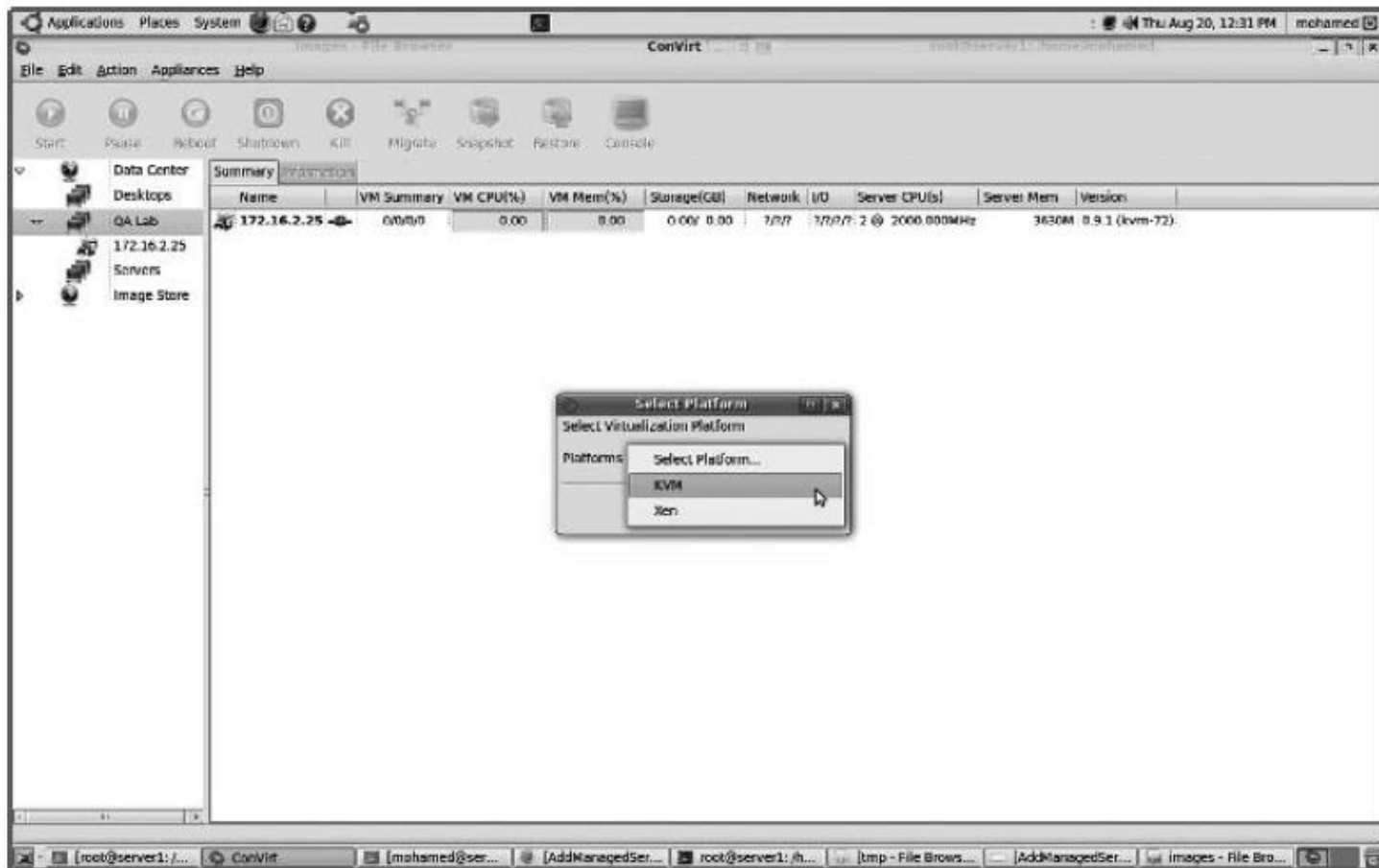


FIGURE 5.9. Select virtualization platform.

# VM PROVISIONING AND MIGRATION IN ACTION (CONTD..)

## Adding Managed Servers and Provisioning VM

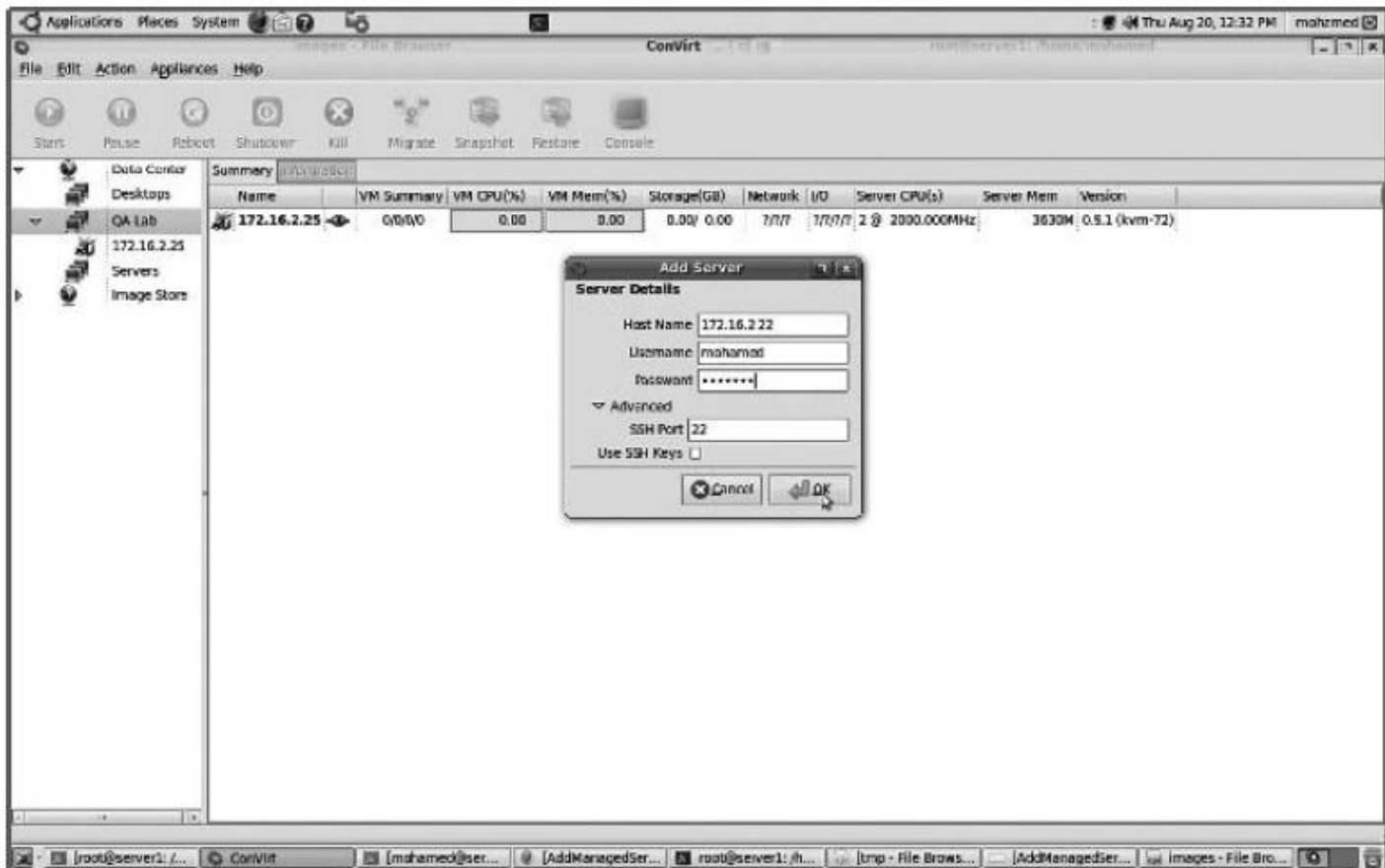


FIGURE 5.10. Managed server info and credentials.



# VM PROVISIONING AND MIGRATION IN ACTION (CONTD..)

## Adding Managed Servers and Provisioning VM

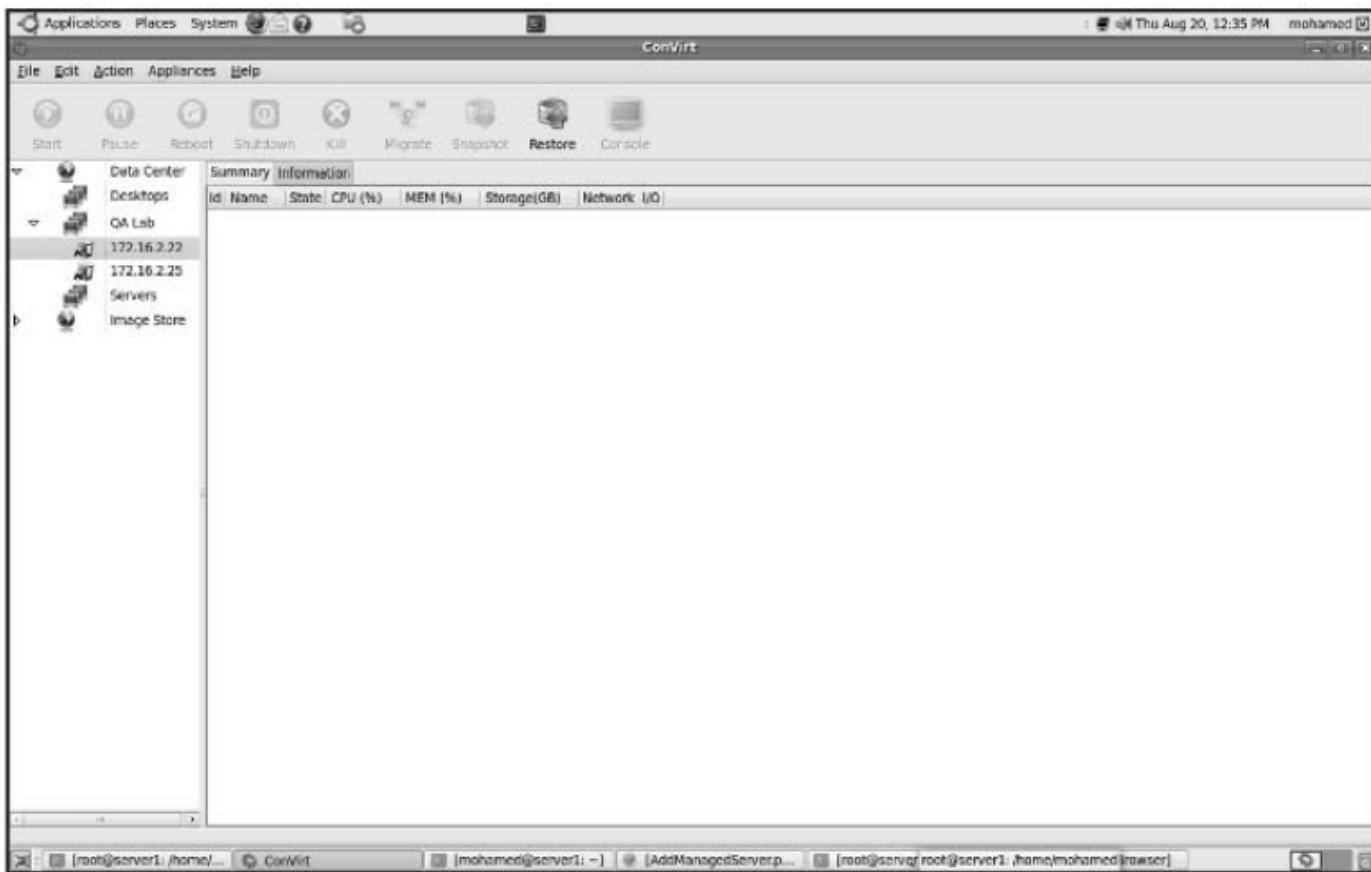


FIGURE 5.11. Managed server has been added.

# VM PROVISIONING AND MIGRATION IN ACTION (CONTD..)

## Adding Managed Servers and Provisioning VM

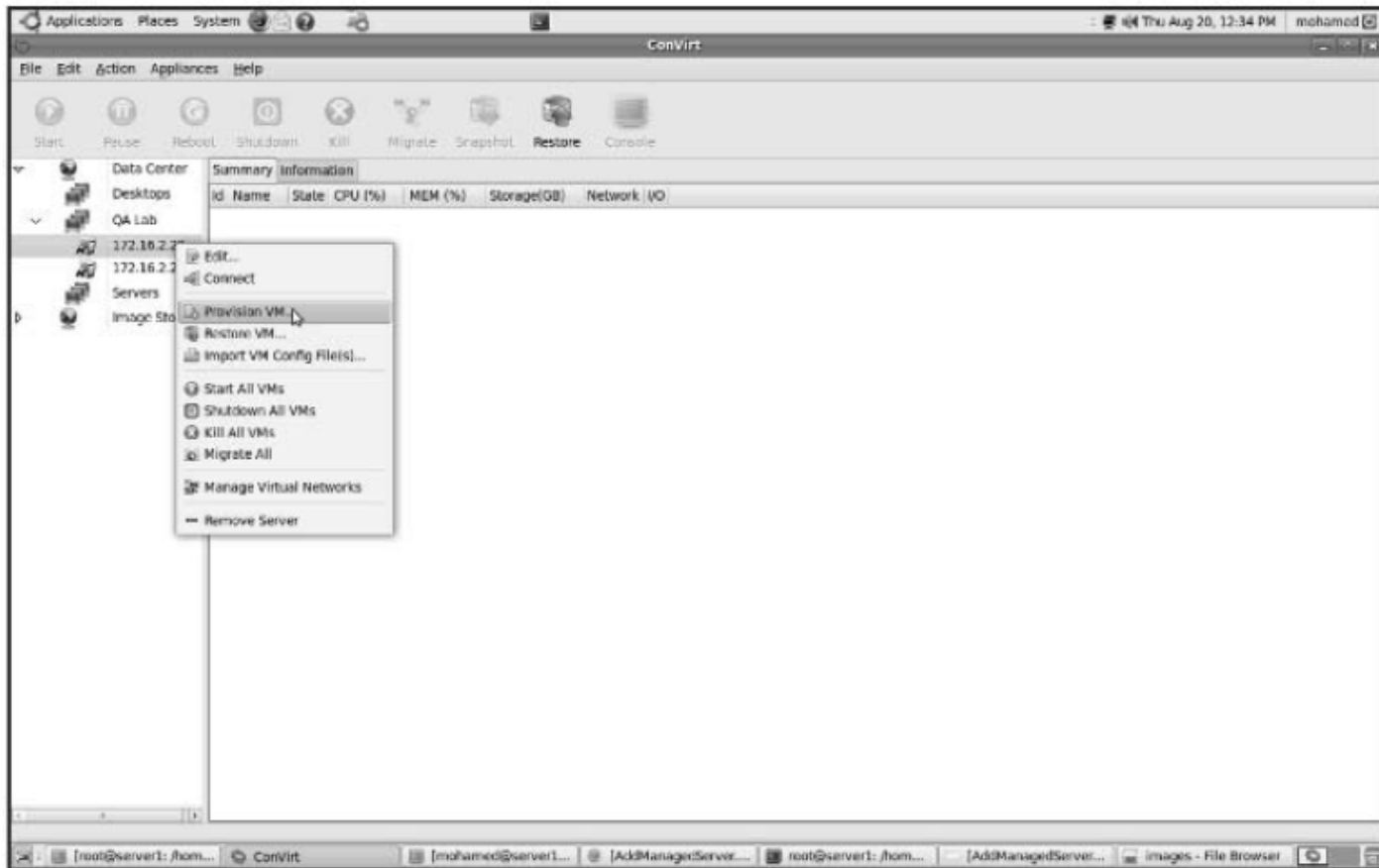


FIGURE 5.12. Provision a virtual machine.

# VM PROVISIONING AND MIGRATION IN ACTION (CONTD..)

## Adding Managed Servers and Provisioning VM

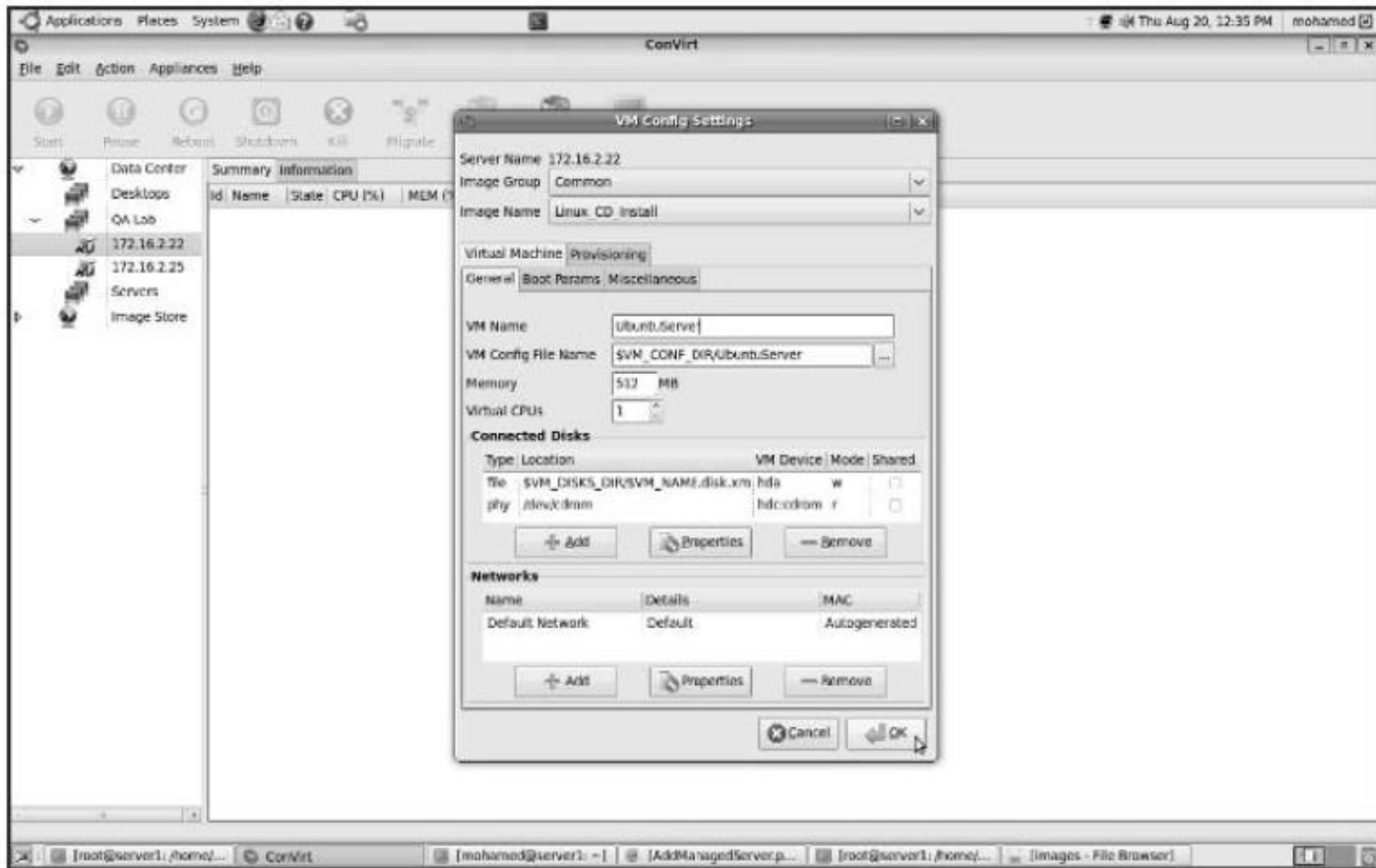


FIGURE 5.13. Configuring virtual machine.

# VM PROVISIONING AND MIGRATION IN ACTION (CONTD..)

## Adding Managed Servers and Provisioning VM

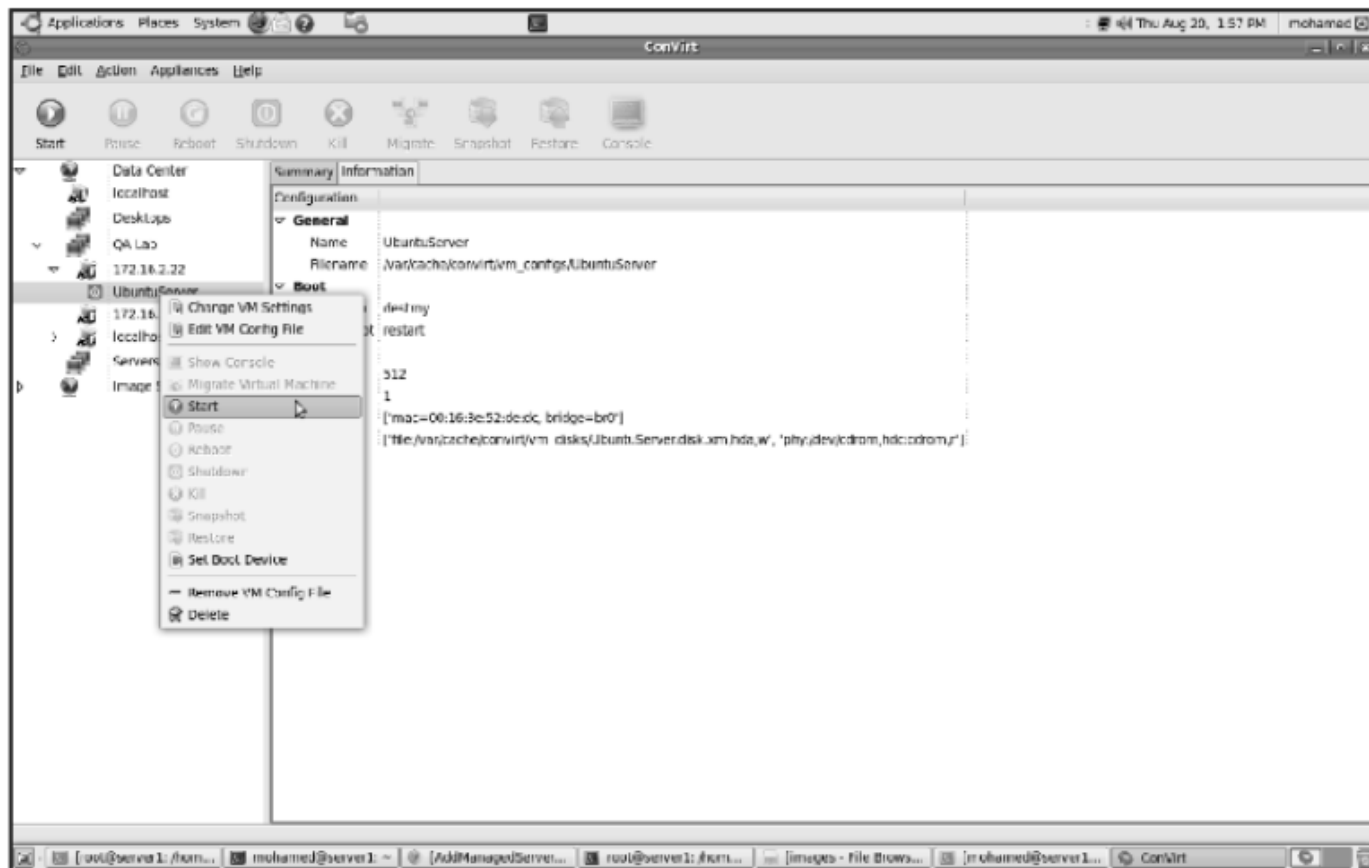


FIGURE 5.14. Provisioned VM ready to be started.

# VM PROVISIONING AND MIGRATION IN ACTION (CONTD..)

## Adding Managed Servers and Provisioning VM

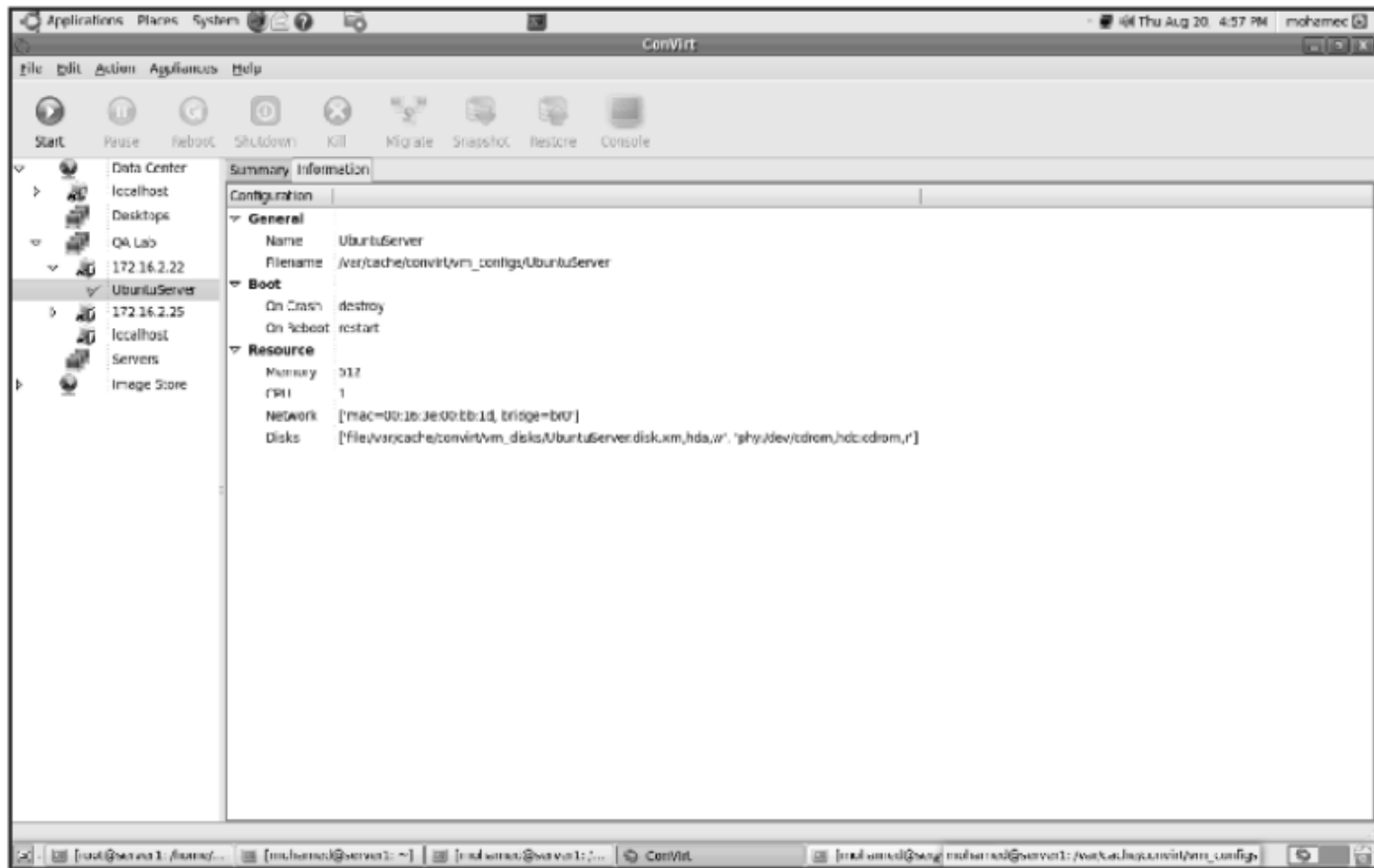


FIGURE 5.15. Provisioned VM started.



# VM PROVISIONING AND MIGRATION IN ACTION (CONTD..)

## Adding Managed Servers and Provisioning VM

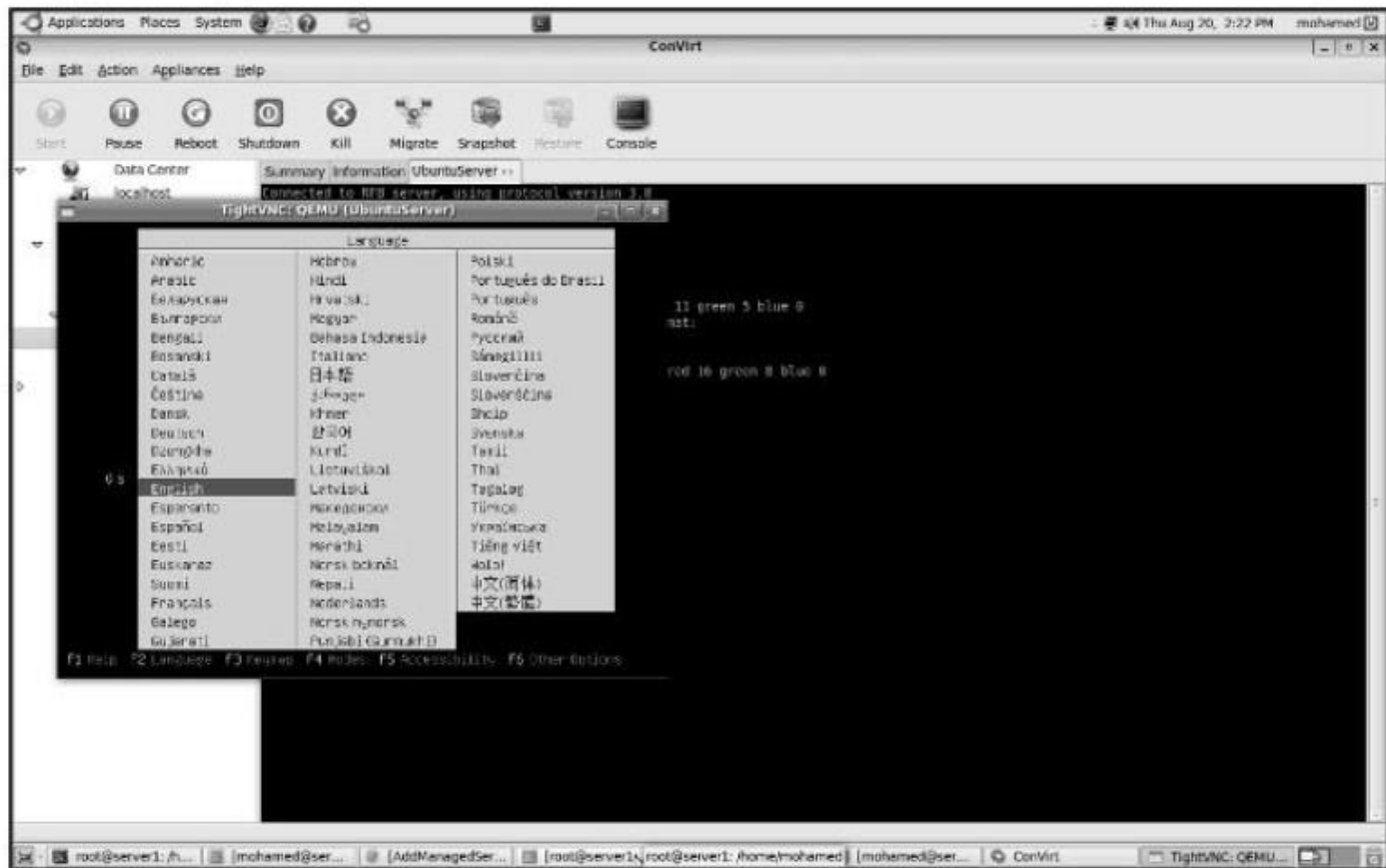


FIGURE 5.16. VM booting from the installation CD to start the installation process.

# VM PROVISIONING AND MIGRATION IN ACTION (CONTD..)

## Live Migration

- ConVirt tool allows running virtual machines to be migrated from one server to another.
- For proper VM migration the following points must be considered:
  - Shared storage for all Guest OS disks (e.g., NFS, or iSCSI).
  - Identical mount points on all servers (hosts).
  - The kernel and ramdisk when using para-virtualized virtual machines should, also, be shared. (This is not required, if pygrub is used.)
  - Centrally accessible installation media (iso).
  - It is preferable to use identical machines with the same version of virtualization platform.
  - Migration needs to be done within the same subnet.

# VM PROVISIONING AND MIGRATION IN ACTION (CONTD..)

## Live Migration Process

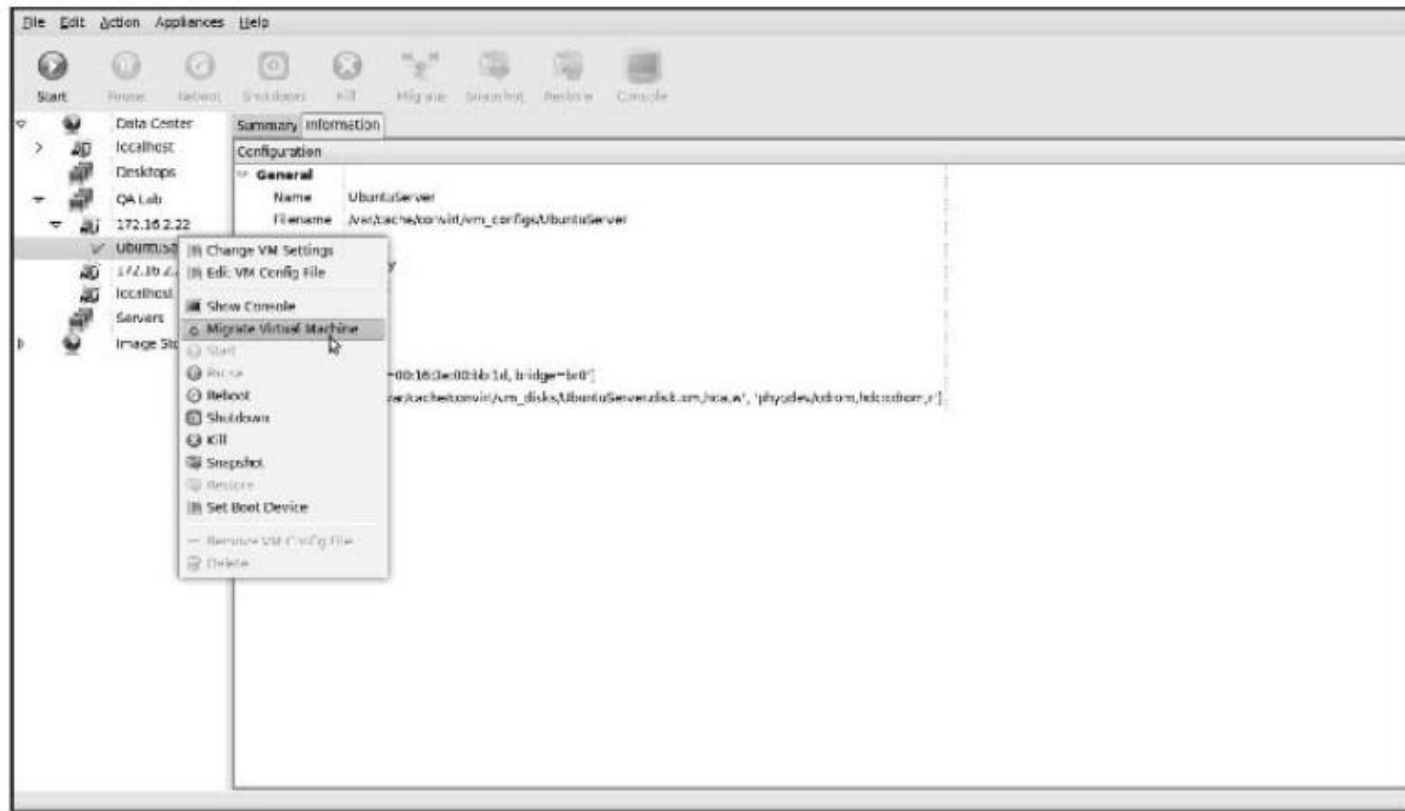


FIGURE 5.17. VM migration.

# VM PROVISIONING AND MIGRATION IN ACTION (CONTD..)

## Live Migration Process

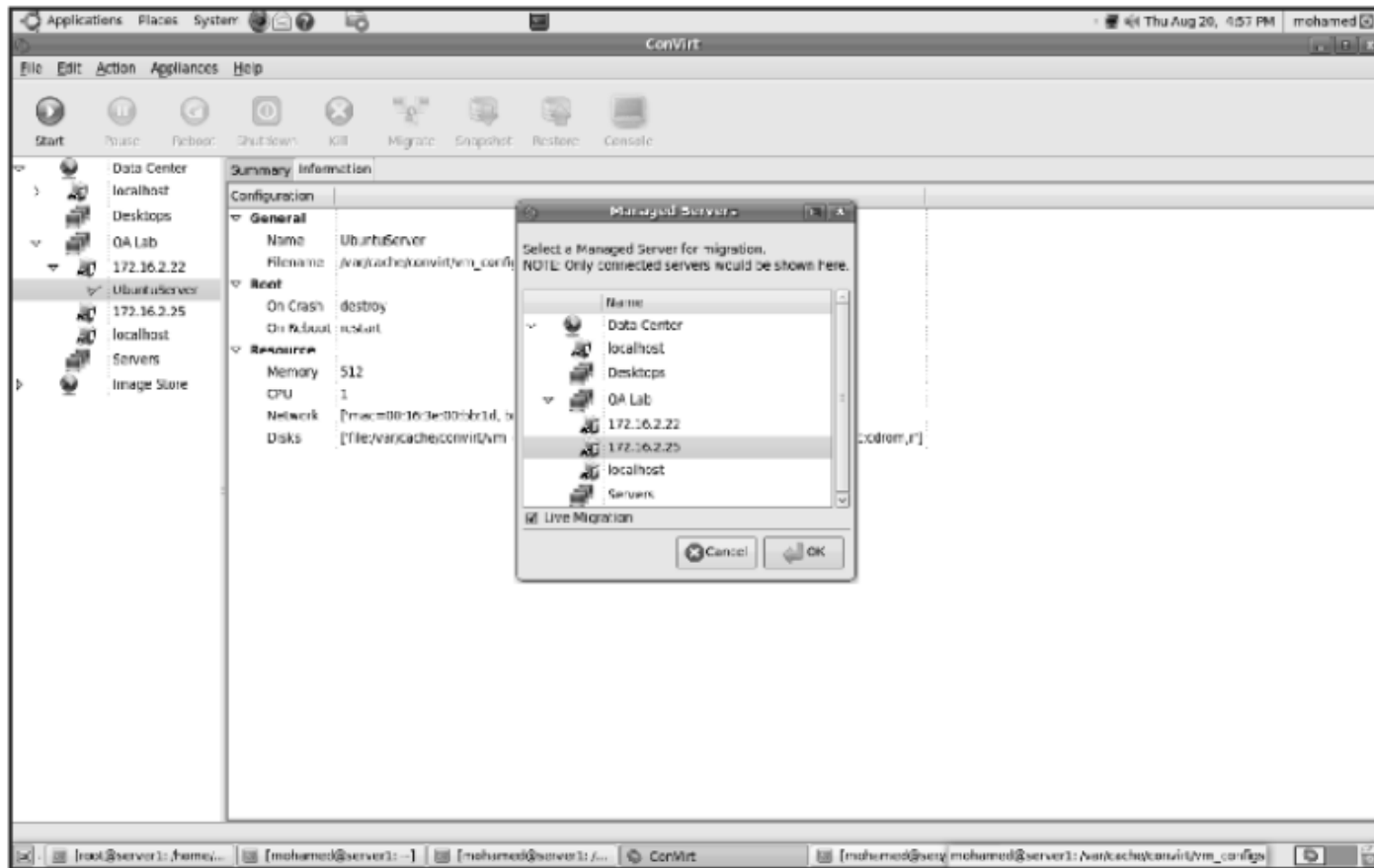


FIGURE 5.18. Select the destination managed server candidate for migration.

# VM PROVISIONING AND MIGRATION IN ACTION (CONTD..)

## Live Migration Process

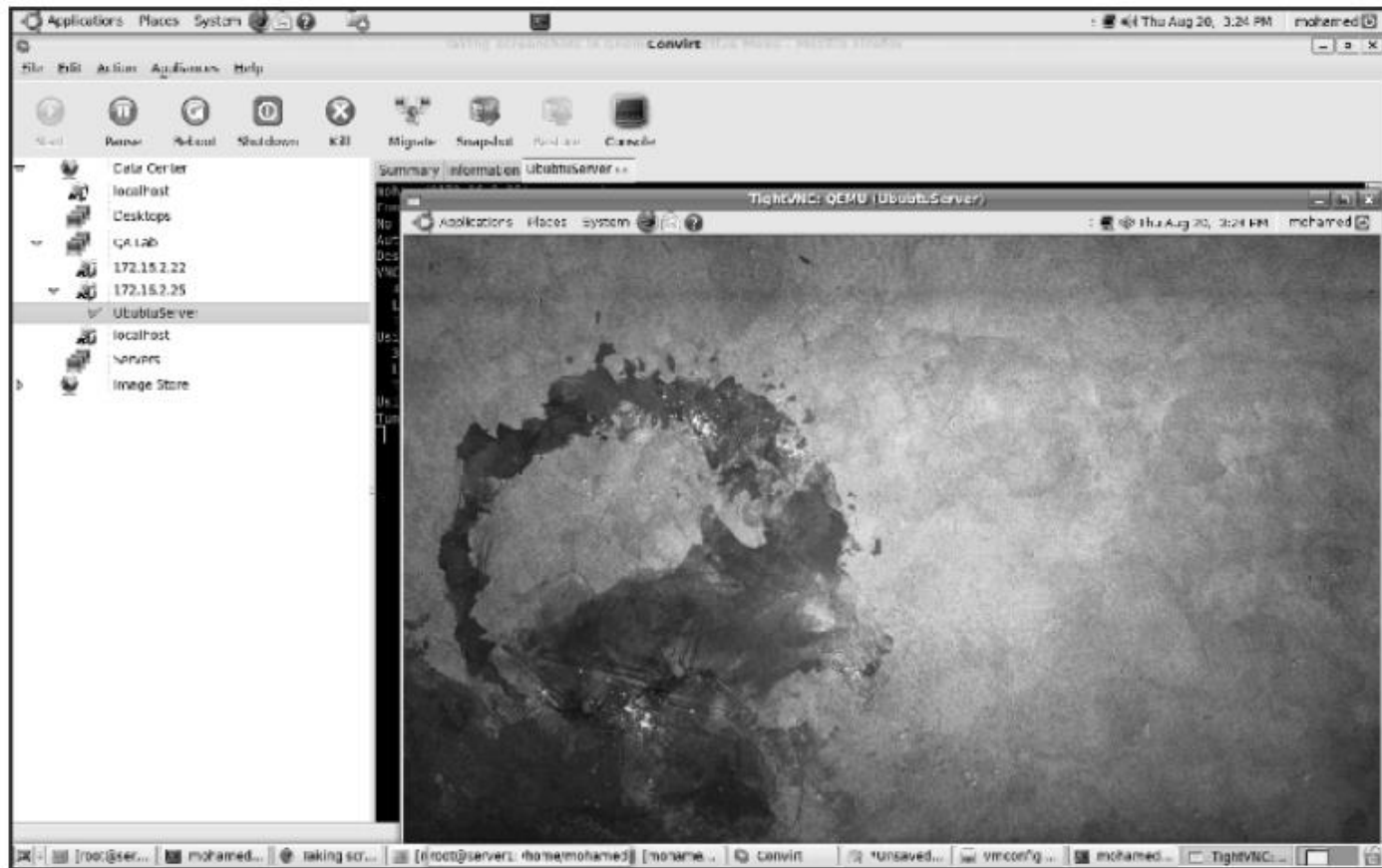


FIGURE 5.19. VM started on the destination server after migration.



# PROVISIONING IN THE CLOUD CONTEXT

- Amazon Elastic Compute Cloud (EC2)
- Open source cloud tools play an invaluable role in infrastructure as a service:
  - Eucalyptus
  - Open Nebula
- Plays a prominent role in building private, public, and hybrid cloud architecture.
- The current interface to Eucalyptus is compatible with Amazon's EC2, S3, and EBS interfaces, but the infrastructure is designed to support multiple client-side interfaces.

# PROVISIONING IN THE CLOUD CONTEXT (CONTD..)

## Amazon Elastic Compute Cloud (EC2)

- Web service that allows users to provision new machines into Amazon's virtualized infrastructure in a matter of minutes; using a publicly available API.
- Web services APIs allow users to reboot their instances remotely, scale capacity quickly, and use on-demand service when needed; by adding tens, or even hundreds, of machines.
- It is very important to mention that there is no up-front hardware setup and there are no installation costs, because Amazon charges only for the capacity you actually use.
- EC2 instance is typically a virtual machine with a certain amount of RAM, CPU, and storage capacity.

# PROVISIONING IN THE CLOUD CONTEXT (CONTD..)

## Amazon Elastic Compute Cloud (EC2)

- Amazon EC2 provides its customers with three flexible purchasing models to make it easy for the cost optimization.
  - **On-Demand instances**, which allow you to pay a fixed rate by the hour with no commitment.
  - **Reserved instances**, which allow you to pay a low, one-time fee and in turn receive a significant discount on the hourly usage charge for that instance.
  - **Spot instances**, which enable you to bid whatever price you want for instance capacity, providing for even greater savings, if your applications have flexible start and end times.

# PROVISIONING IN THE CLOUD CONTEXT (CONTD..)

## Amazon and Provisioning Services

- *Amazon Auto Scaling*, is a set of command line tools that allows scaling Amazon EC2 capacity up or down automatically and according to the conditions the end user defines.
- *Amazon Elastic Load Balancer*, is another service that helps in building fault-tolerant applications by automatically provisioning incoming application workload across available Amazon EC2 instances and in multiple availability zones.



# PROVISIONING IN THE CLOUD CONTEXT (CONTD..)

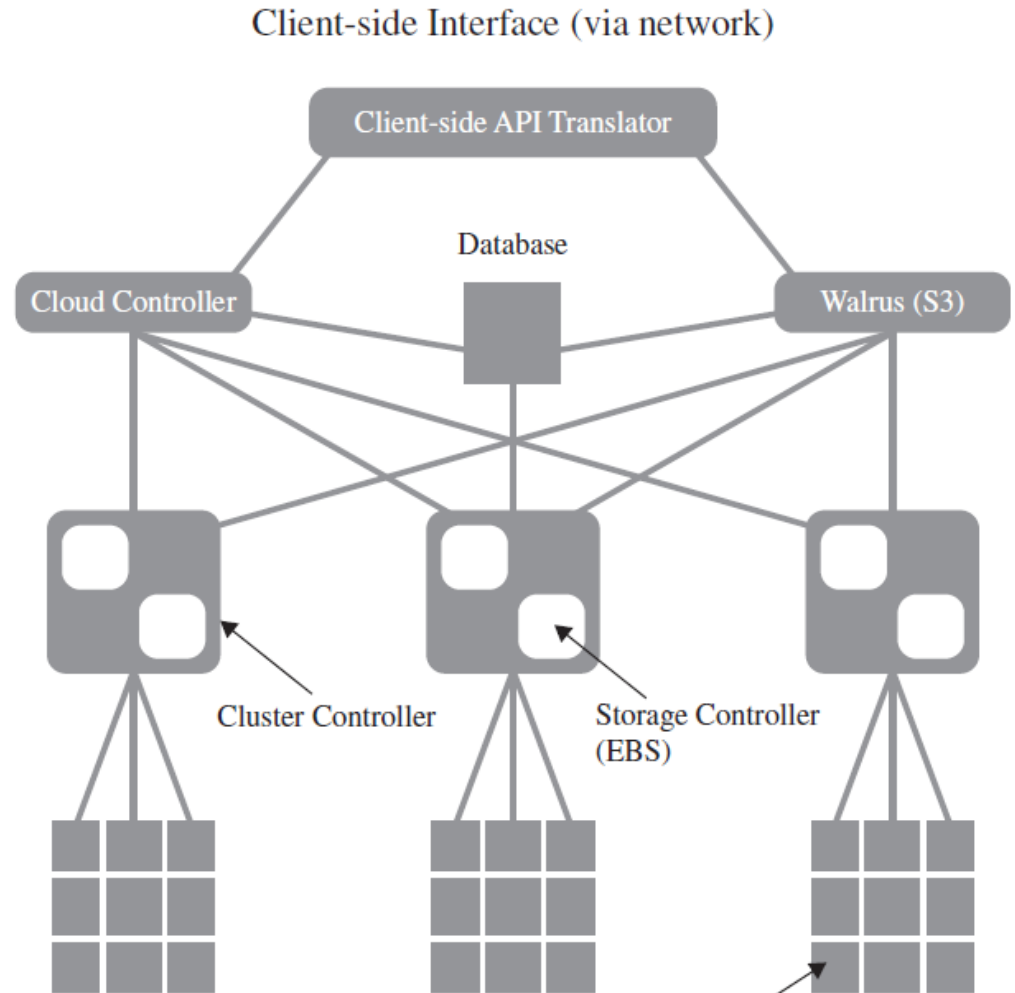
## Eucalyptus

- Is an open-source infrastructure for the implementation of cloud computing on computer clusters.
- **Eucalyptus**-----“elastic utility computing architecture for linking your programs to useful systems.”
- Features:
  - Interface compatibility with EC2, and S3.
  - Simple installation and deployment.
  - Support for most Linux distributions (source and binary packages).
  - Support for running VMs that run atop the Xen hypervisor or KVM.
  - Support for other kinds of VMs, such as VMware, is targeted for future releases.
  - Secure internal communication using SOAP with WS security.
  - Cloud administrator’s tool for system’s management and user’s accounting.
  - The ability to configure multiple clusters each with private internal network addresses into a single cloud.



# PROVISIONING IN THE CLOUD CONTEXT (CONTD..)

## Eucalyptus Architecture



**Fig: Eucalyptus high-level architecture**

# PROVISIONING IN THE CLOUD CONTEXT (CONTD..)

## Eucalyptus Architecture components

- **Node controller (NC)** controls the execution, inspection, and termination of VM instances on the host where it runs.
- **Cluster controller (CC)** gathers information about and schedules VM execution on specific node controllers, as well as manages virtual instance network.
- **Storage controller (SC)** is a put/get storage service that implements Amazon's S3 interface and provides a way for storing and accessing VM images and user data.
- **Cloud controller (CLC)** is the entry point into the cloud for users and administrators. It queries node managers for information about resources, makes high-level scheduling decisions, and implements them by making requests to cluster controllers.
- **Walrus (W)** is the controller component that manages access to the storage services within Eucalyptus. Requests are communicated to Walrus using the SOAP or REST-based interface.

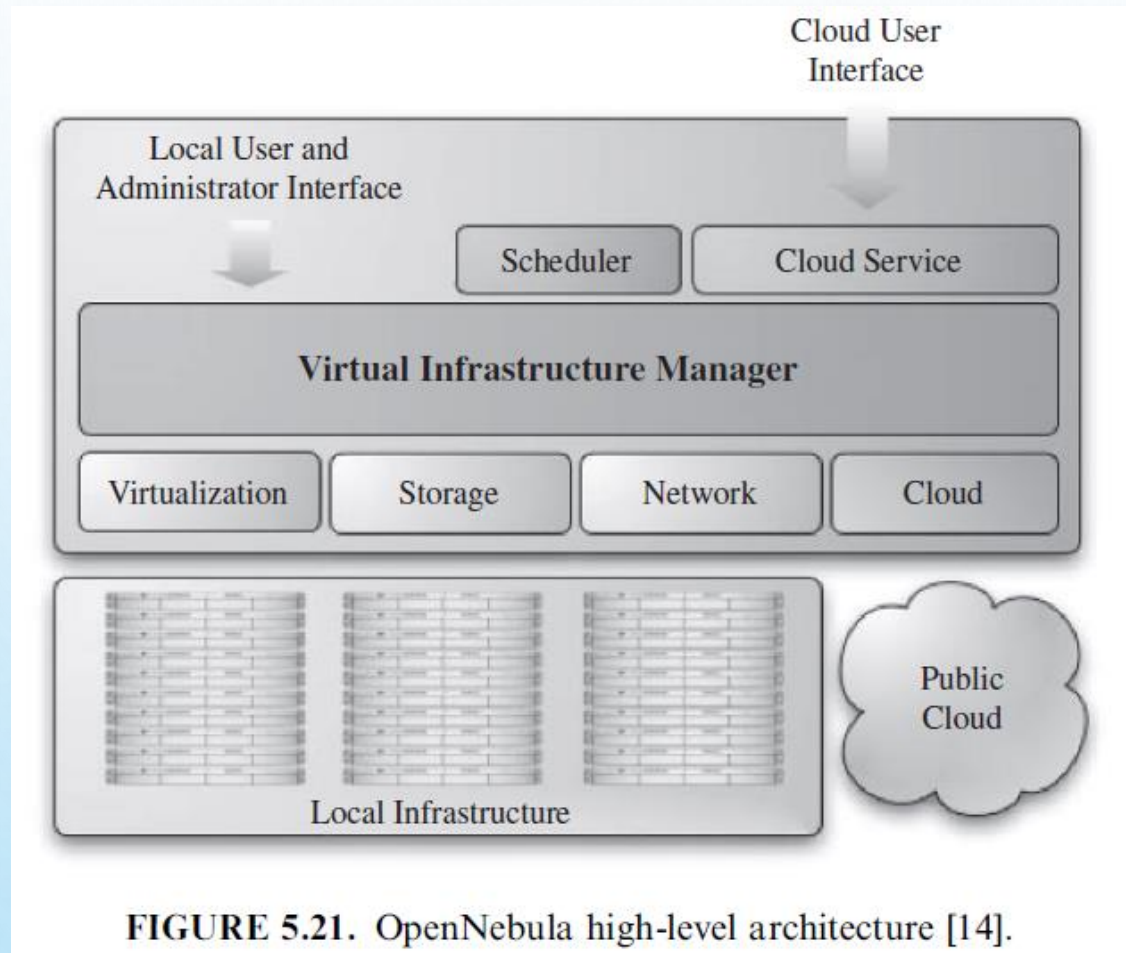
# PROVISIONING IN THE CLOUD CONTEXT (CONTD..)

## VM Dynamic Management Using OpenNebula

- open and flexible tool that fits into existing data center's environments to build any type of cloud deployment.
- Primarily used as a virtualization tool to manage your virtual infrastructure, which is usually referred to as private cloud.
- OpenNebula also supports public clouds by providing cloud's interfaces to expose its functionality for virtual machine, storage, and network management.

# PROVISIONING IN THE CLOUD CONTEXT (CONTD..)

## OpenNebula Architecture





**NEXT CLASS....**