Virtualization and Cloud Computing

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Virtualization

In computing, a process of creating a illusion of something like computer hardware, operating system (OS), storage device, or computer network resources is Virtualization.

NIST Cloud Computing

According to **NIST SP 800-145**[8]
"Cloud computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction."

What is required for Cloud Computing

By Cloud Provider

1. Fast scalability . Quick addition and removal of servers
2. Service to customers should not be denied.
3. SLA should not be Violated
4. Efficient Resource Utilization

Constraints with physical machines :

- High Provisioning time.
- Lower Resource Utilization.
- Space, Power, Cooling.
- Low fault tolerance
- Less Isolation - misbehaving application can affect all others.
- High downtime.

Virtualization

Concept is not new.
The concept came from Multi Programming – Each Process thinks it has complete control on all of the resources.
– Virtual Memory
– CPU Sharing
In Multi Programming CPU is shared among processes but in virtualization CPU is shared among OSs.

The Traditional Server Concept

–Easy to conceptualize.
–Fairly easy to deploy.
–Single OS image per machine.
–Easy to backup.

But,

- If the File server fills up, or the Exchange server becomes overtaxed, then the System Administrators must add in a new server.
- Unless there are multiple servers, if a service experiences a hardware failure, then the service is down.
- Difficult to replicate.
- Not very scalable.
- Redundancy is difficult to implement.
- Expensive to acquire and maintain hardware.
- Running multiple applicatons on same machine often creates conflict.

Traditional Server Concept

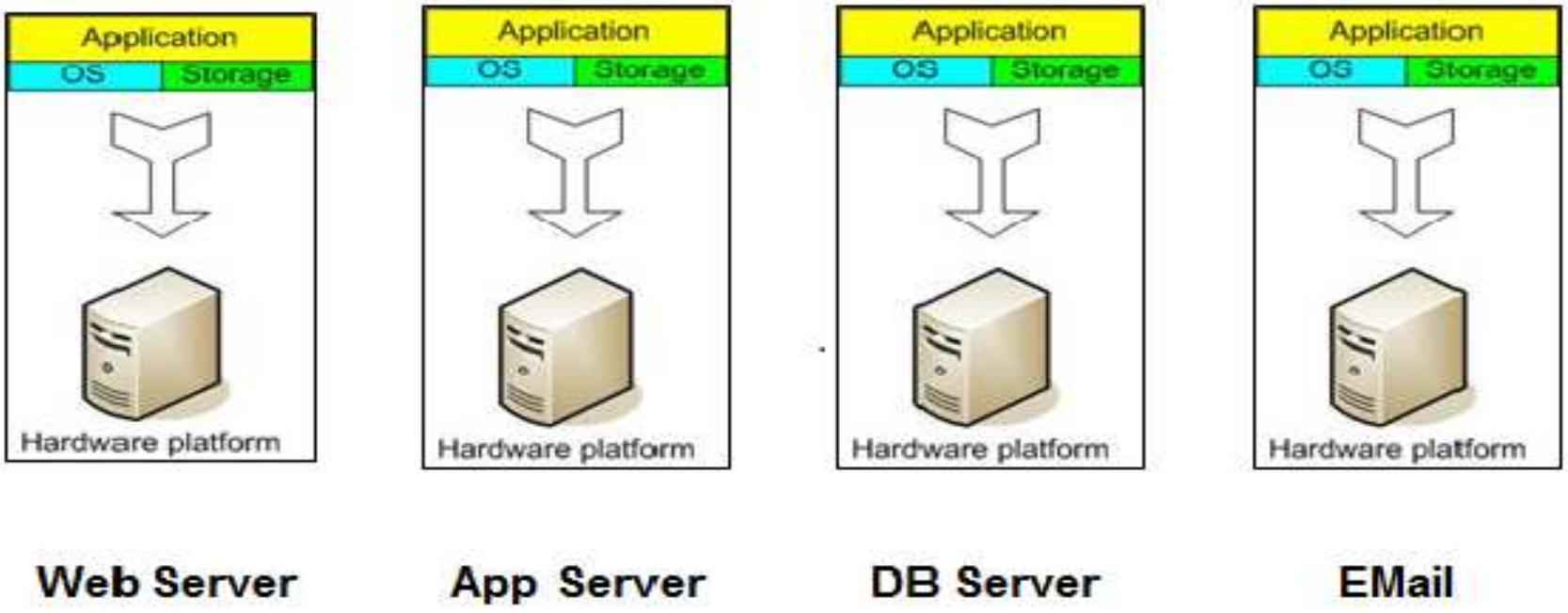

Figure: Traditional Server Concept [9]

And if something goes wrong ...

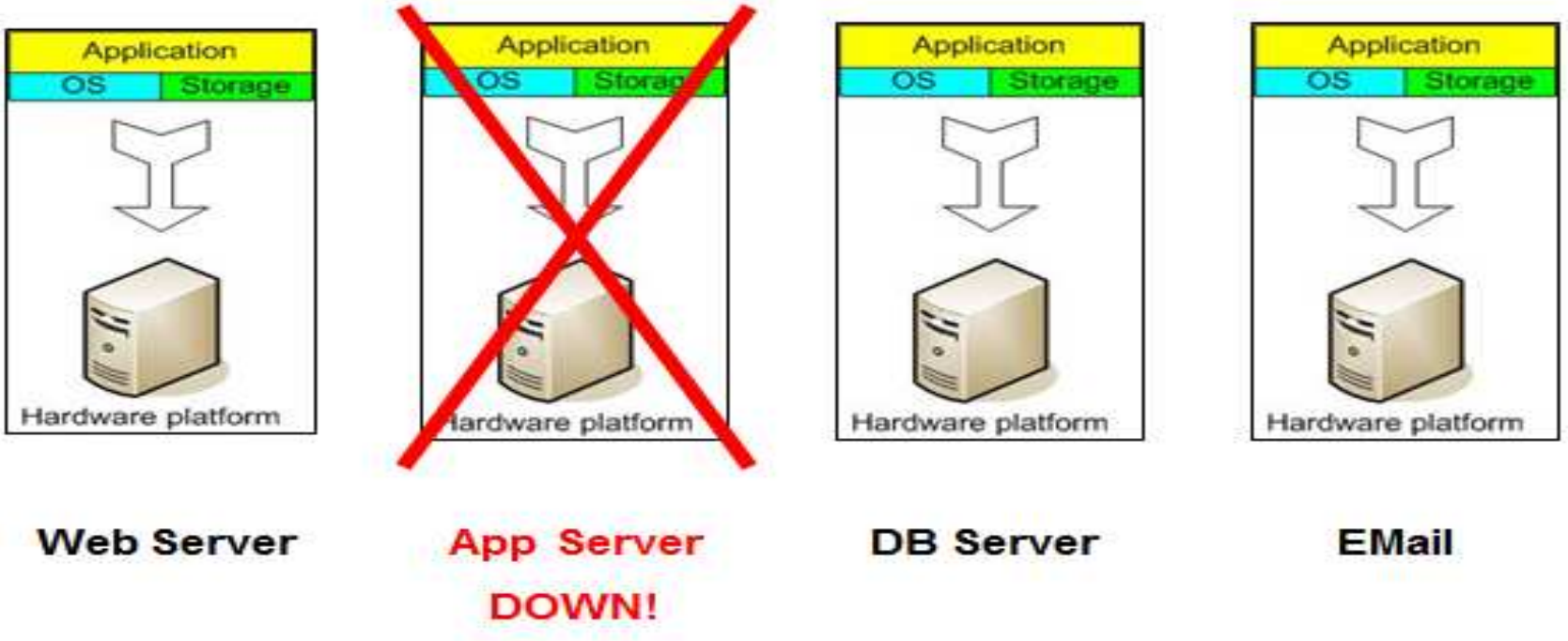

Figure: And if something goes wrong [9]

The Virtual Server Concept

- Tough to conceptualize.
- Virtual servers can still be referred to by their function i.e. email server, database server, etc.
- If the environment is built correctly, virtual servers will not be affected by the loss of a host.
- Virtual servers can be scaled out easily.

The Virtual Server Concept

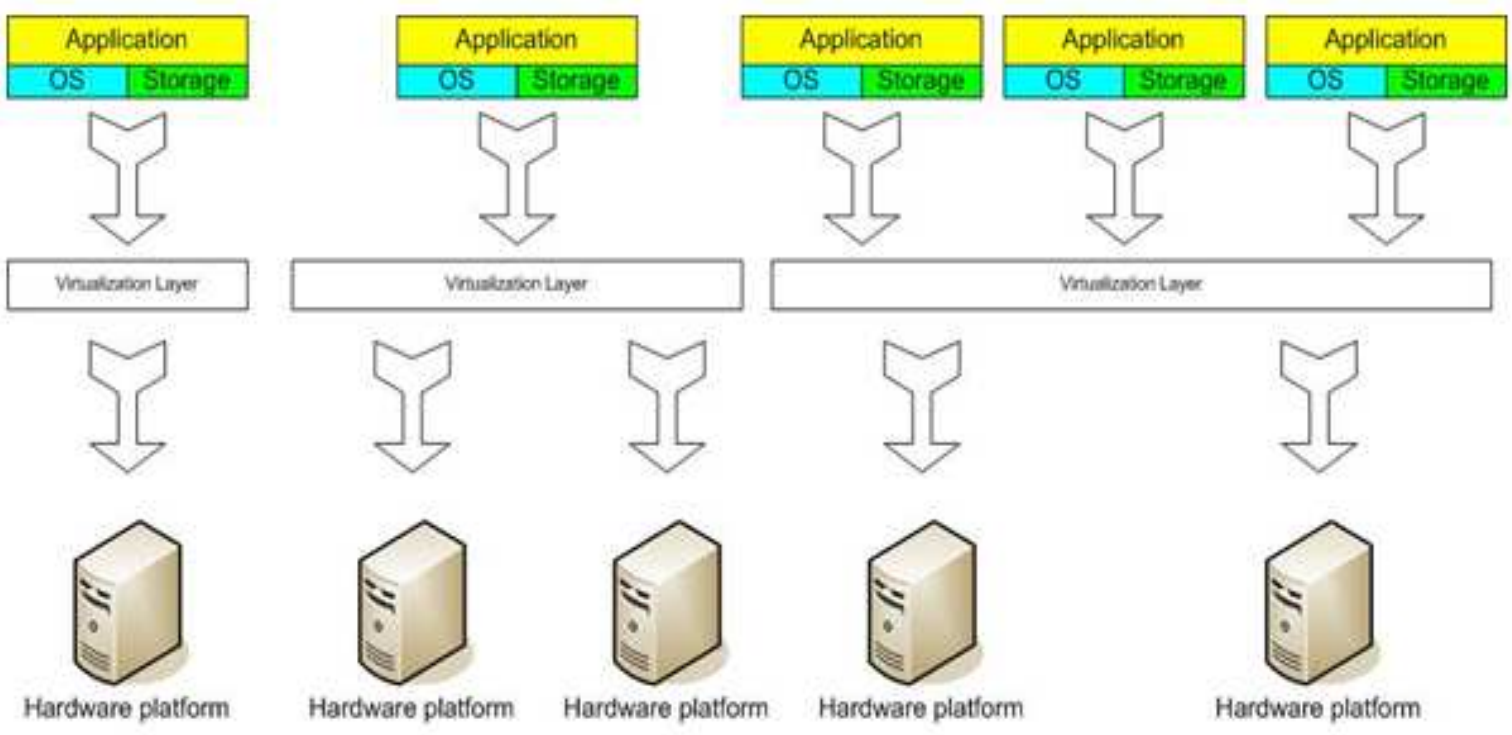

Figure: The Virtual Server Concept [9]

The Virtual Server Concept

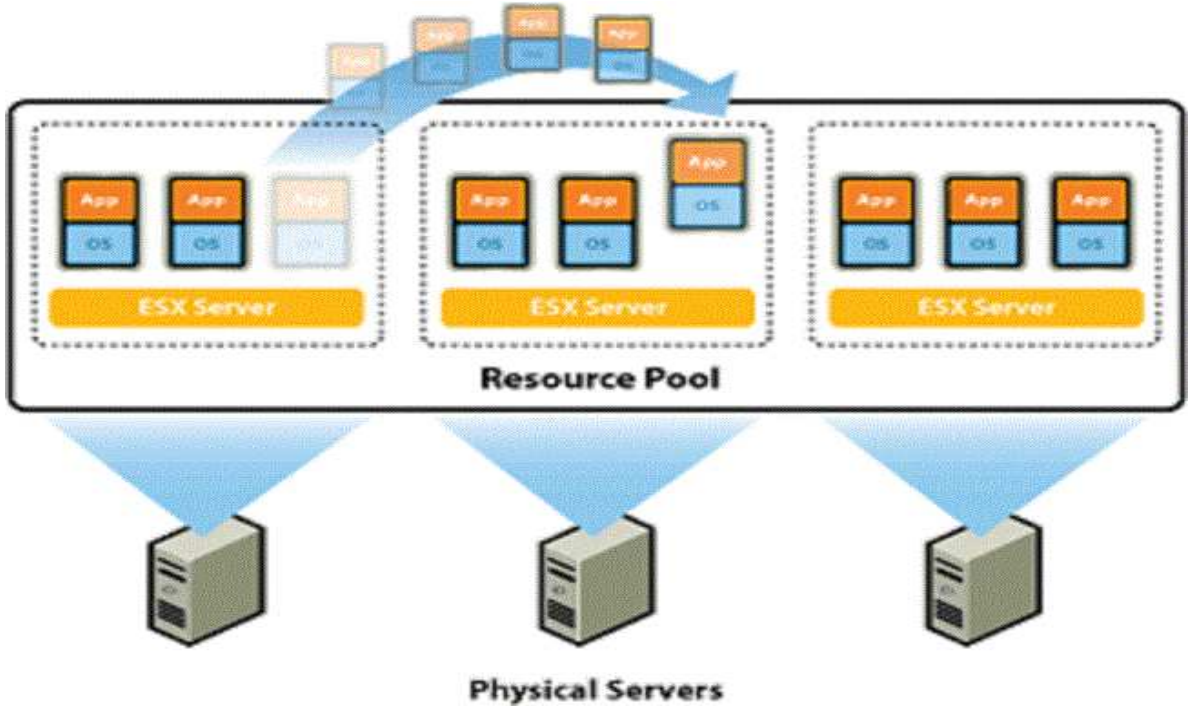

Figure: The Virtual Server Concept

Benefits of using Virtual Machines

- Instant provisioning - fast scalability
- Live Migration is possible
- Load balancing and consolidation in a Data Center is possible.
- Low downtime for maintenance
- Security and fault isolation

VM Migration

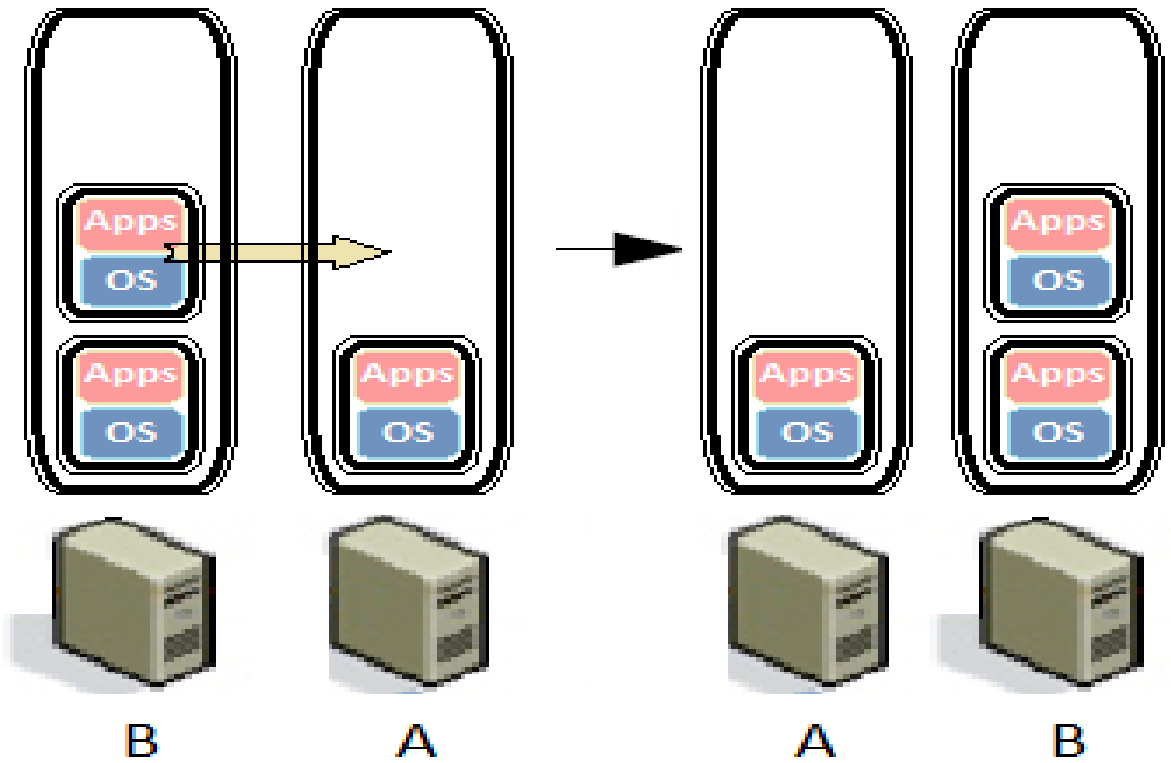

Figure: VM Migration [7]

Load Balancing

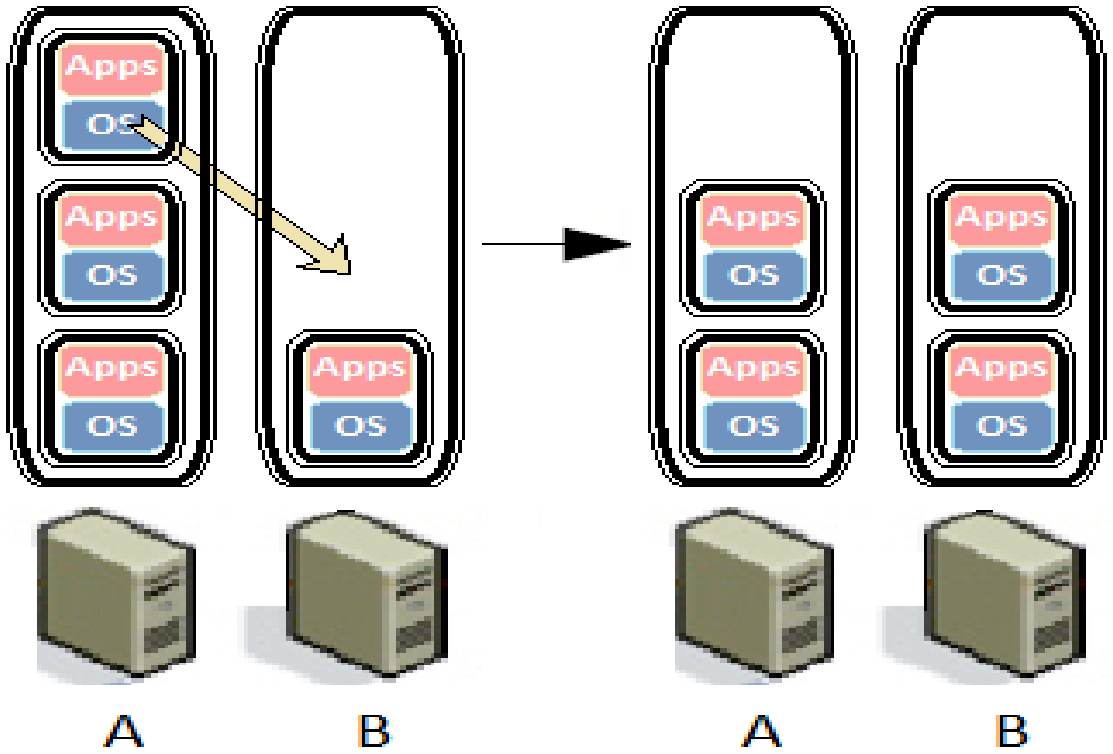

Figure: Load Balancing [7]

Consolidation

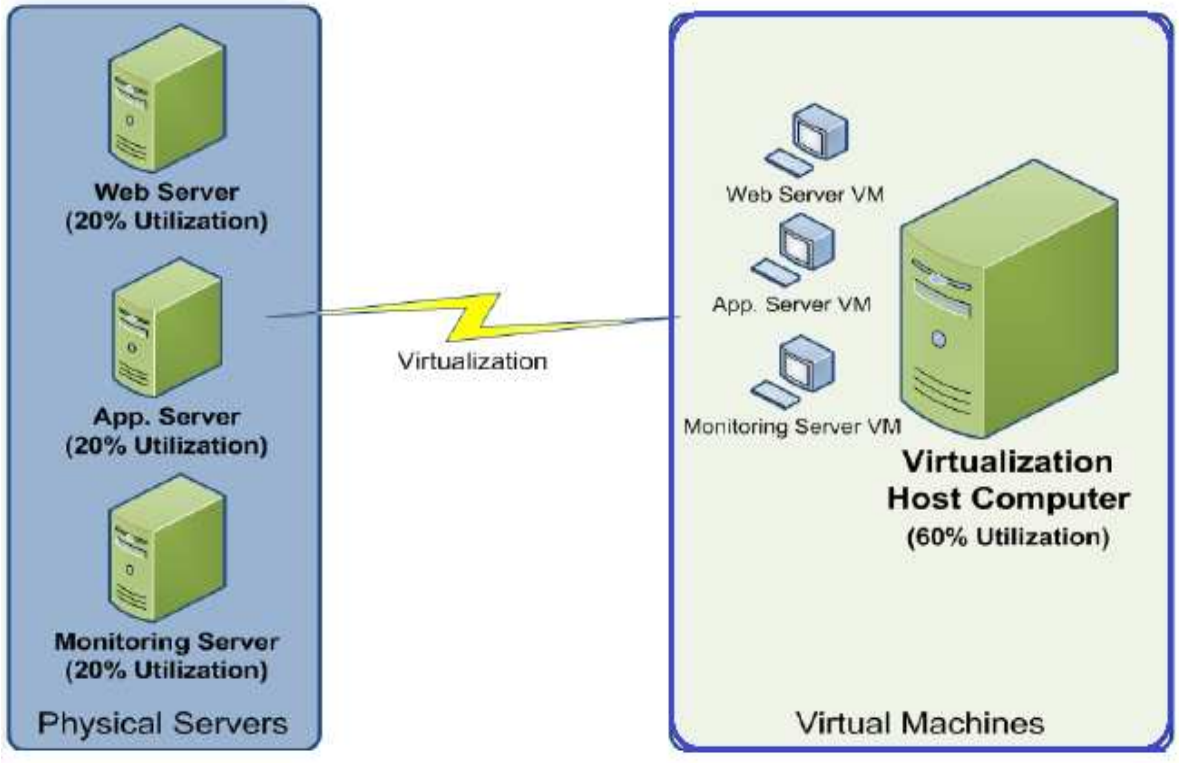

Figure: Consolidation of the servers [7]