Year	Subject Title	Sem	Sub. Code
2018-19 Onwards	CLOUD COMPUTING	III	18MIT34C

- **UNIT-III:** Cloud offerings: Introduction – introduction storage, retrieval archive and protection-cloud analytics – testing under cloud – information security – virtual desktop infrastructure-storage cloud. Cloud Management: Introduction – resiliency – provisioning – asset management-cloud governance – high availability and disaster recovery – charging models – usage reporting, and metering. Cloud Virtualization Technology: Introduction – virtualization demand – virtualization benefits – server virtualization – virtualization for x86 architecture – hypervisor management software – virtual infrastructure requirements. (Chap 5,6,7)

TEXT BOOK

- 1. Dr. Kumar Saurabh "Cloud Computing-Unleashing Next Gen Infrastructure to Application", 3rd Edition, Wiley India Pvt Ltd, 2014.

- "Cloud Computing" Prepared by **Dr.P.Sumathi**

5. Cloud offerings

Chapter Topics

5.1 Introduction

5.2 Information Storage, Retrieval, Archive and Protection

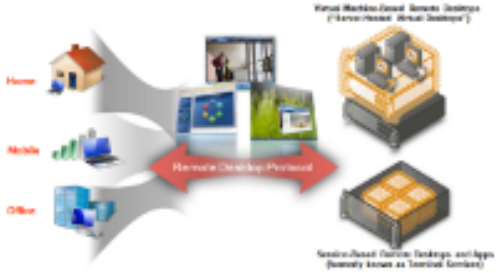
5.3 Cloud Analytics,

5.4 Testing under cloud,

5.5 Information Security,

5.6 Virtual Desktop Infrastructure,

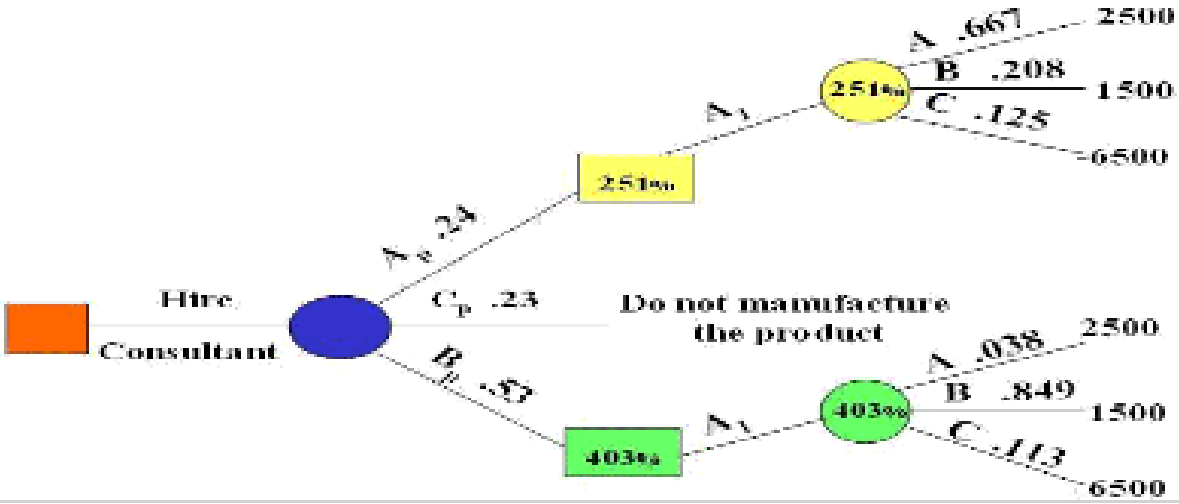
5.7 Storage Cloud.



5. Cloud offerings

5.1 Introduction

- Until now, organizations could not fully or quickly synthesize and interpret all the information out there- they had make decisions based largely on instinct.
- But now, there is **software** that can capture organize and process all the data scattered throughout an organization, and turn into actual intelligence. This enables organizations to make **better business decisions.**



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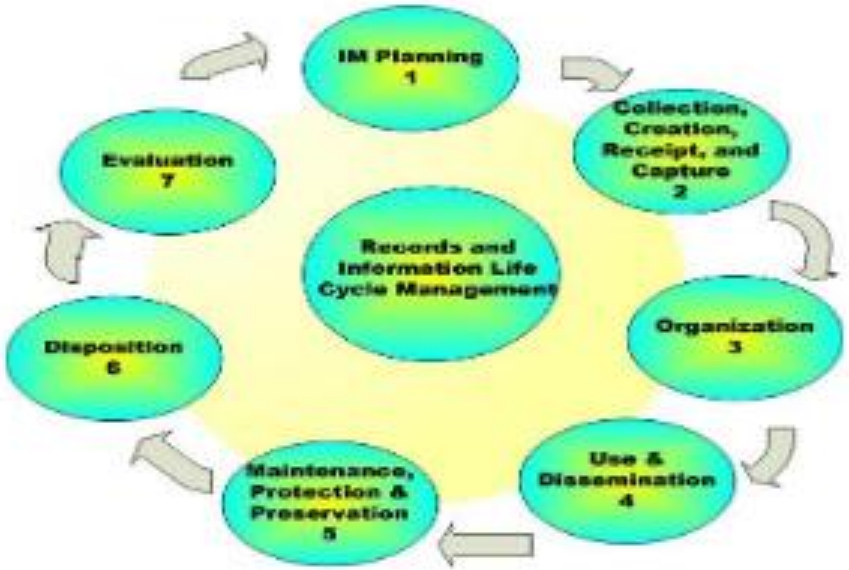
5.2 Information Storage, Retrieval, archive and protection

- Organization process, manage, move, protect and archive various business data according to unique characteristics such as age, usage, patterns, compliance and archiving policies, security and disaster protection rules and values.
- **Information LifeCycle Management (ILM)** is a growing concern and practice.



Information lifecycle management (ILM) is a best practice for managing data throughout its lifecycle. It is the effort to oversee data, from creation through retirement, in order to optimize its utility, lower costs, as well as minimize the legal and compliance risks that may be introduced through that data.

- ILM involves storage optimization as well as strategies to improve data quality and security. Finally, a strong information lifecycle management practice will proactively control data retention and disposal in accordance with business policy.

What are the benefits of information lifecycle management?

- Due to the incredible volume of data that the typical organization creates, data management techniques are vital to prevent storage costs from spiraling out of control. ILM controls data growth and minimizes costs while supporting greater application performance.
- ILM also prevents out-of-compliance conditions and reduces legal liability by ensuring that data is stored securely and is not retained for longer than is needed. Data that is kept too long costs the organization unnecessarily and creates liability. It also enforces compliances policy, thereby preventing audit fines.

What activities are involved in information lifecycle management?

- The main activities are database archiving, test data management, data privacy/data masking, and data/application retirement. However, any systemic application of rules to business data or attempts to minimize, simplify, or increase the security of data can fall under the general procedures of ILM.

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5.2 ILM Objectives

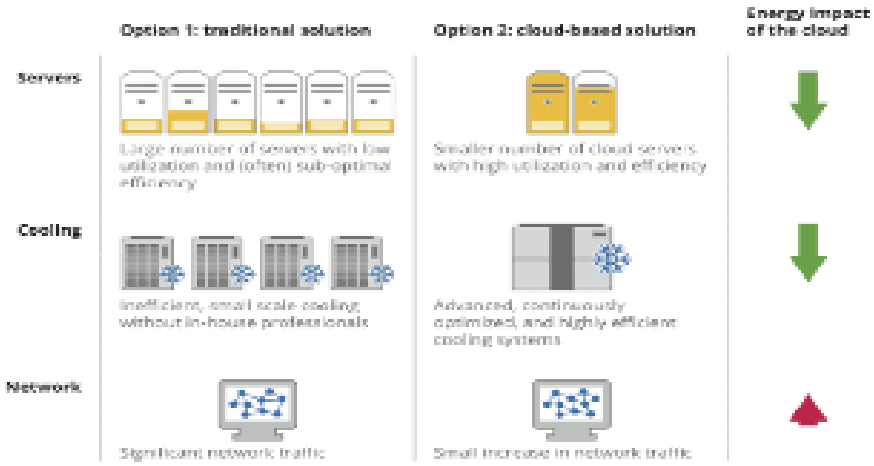
- Cost reductions
  - Controlling demand for storage
- Better system performance and personal productivity
  - Doing the storage activities "right"
- Increased effectiveness
  - Doing the "right " storage activities

5. Cloud offerings

5.2 ILM Objectives

Ways to generate, enhance and sustain higher savings

- Activities for gaining initial saving
  - Reduce the amount of used storage as a result of initial clean up
- Activities for maximizing saving
  - Reconfigure the current storage environment effectively improving the available to raw utilization
- Activities for sustaining savings
  - Develop storage architecture governance model



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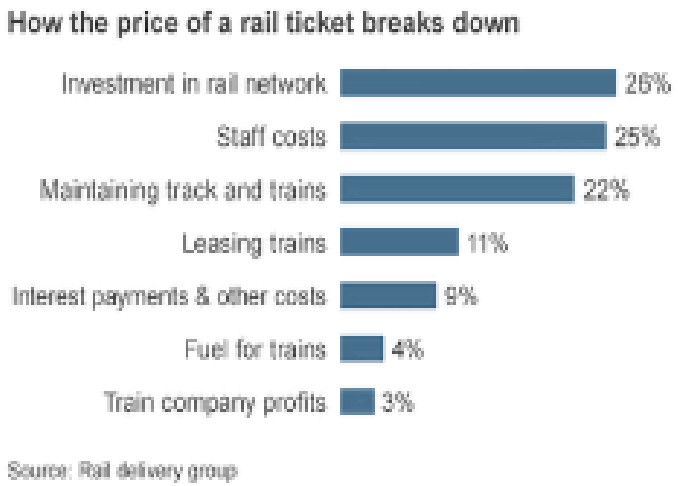
5.2 ILM Objectives

Cost Components

- Operating cost categories
  - personal, facilities, storage hardware
  - maintenance, storage software
  - maintenance, outages



- Investment cost categories
  - new hardware required, new software required, hardware refresh, transition services

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5.2 Information Management Points

- Data
- Information
- ILM
- Information Taxonomy
- Information Classes
- Value Driven data Placement
- Storage Process
- Storage service
- Enterprise Class of Service (CoS)

5. Cloud offerings

5.2 Information Management points

- Storage service
- Enterprise Class of Service (CoS)
- Storage Tier
- Tiered Storage Infrastructure
- Utility based Service Delivery

5.3 Cloud Analytics

- **What is cloud analytics?**

Cloud analytics is the use of remote public or private computing resources known as the cloud, to analyze data on demand. Cloud computing analytics helps streamline the business intelligence process of gathering, integrating, analyzing, and presenting insights to enhance business decision making.

(or) Cloud analytics is a marketing term for businesses to carry out analysis using cloud computing. It uses a range of analytical tools and techniques to help companies extract information from massive data and present it in a way that is easily categorised and readily available via a web browser

- **How cloud analytics works**

Cloud analytics works by allowing a business to use the advanced data analytics tools available on cloud analytics platforms to analyze vast quantities of data. Businesses can then report and store those findings for repeat use. Cloud analytics offerings are typically offered as a subscription or pay on a volume of data or query basis. Cloud analytics has proven to be a faster way to gain business-critical insight for decision making.

- **Advantages of cloud analytics**

Advantages of cloud analytics include helping businesses more efficiently process and report data findings, enhance collaboration, and provide decision-makers faster access to business intelligence.

Cloud analytics tools

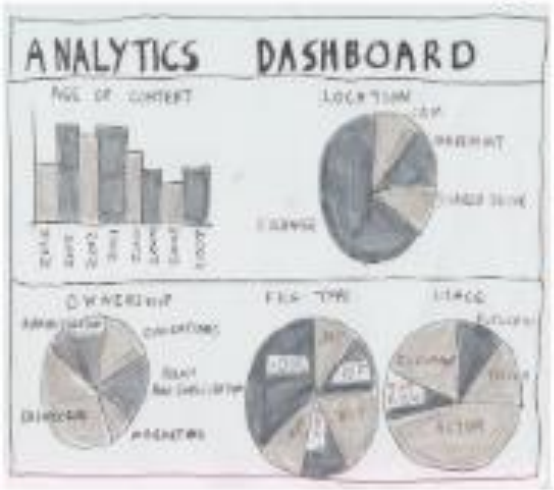
- **AWS Analytics products:**
- Amazon Athena run interactive queries directly against data in Amazon S3
- Amazon EMR deploy open source, big data frameworks like Apache Hadoop, Spark, Presto, HBase, and Flink.
- Amazon Redshift fully managed, petabyte-scale data warehouse to run complex queries on collections of structured data.

- **Google Cloud Analytics Products:**
- Google BigQuery Google's fully managed, low cost analytics data warehouse.
- Google Cloud Dataflow unified programming model and a managed service for executing a range of data processing patterns including streaming analytics, ETL, and batch computation.
- Google Cloud Dataproc managed Spark and Hadoop service, to process big datasets using the open tools in the Apache big data ecosystem.
- Google Cloud Composer fully managed workflow orchestration service to author, schedule, and monitor pipelines that span across clouds and on-premises data centers.
- Google Cloud Datalab interactive notebook (based on Jupyter) to explore, collaborate, analyze and visualize data.
- Google Data Studio turns data into dashboards and reports that can be read, shared, and customized.

5. Cloud offerings

5.3 Cloud Analytics

- **Cloud analytics** is the new offering in the new era of cloud computing.
- This will help **consulting domain** and will ensure the better results.
- It provides user with better **forecasting techniques** to analyze and optimize the service lines and provides a higher level of accuracy.



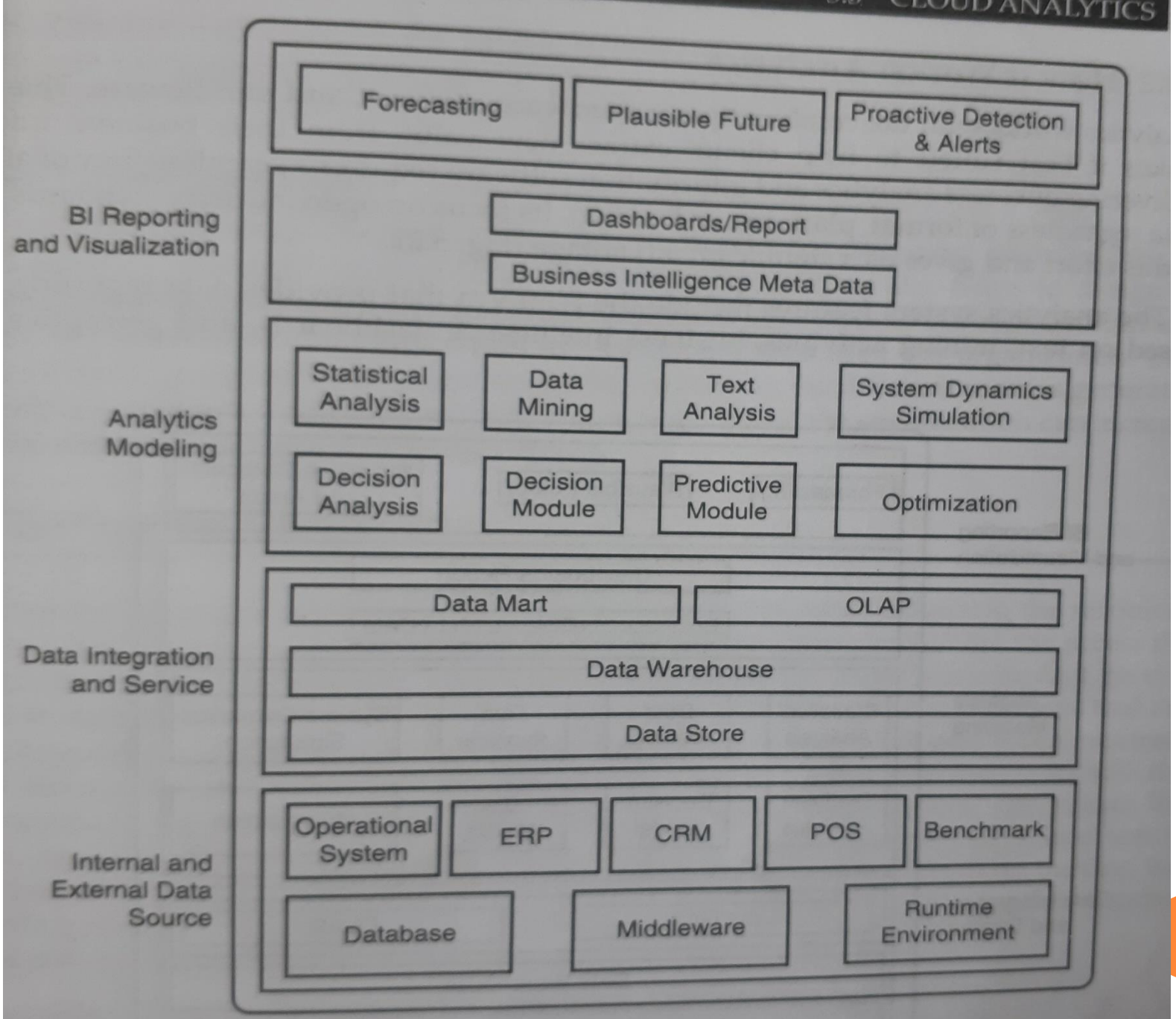
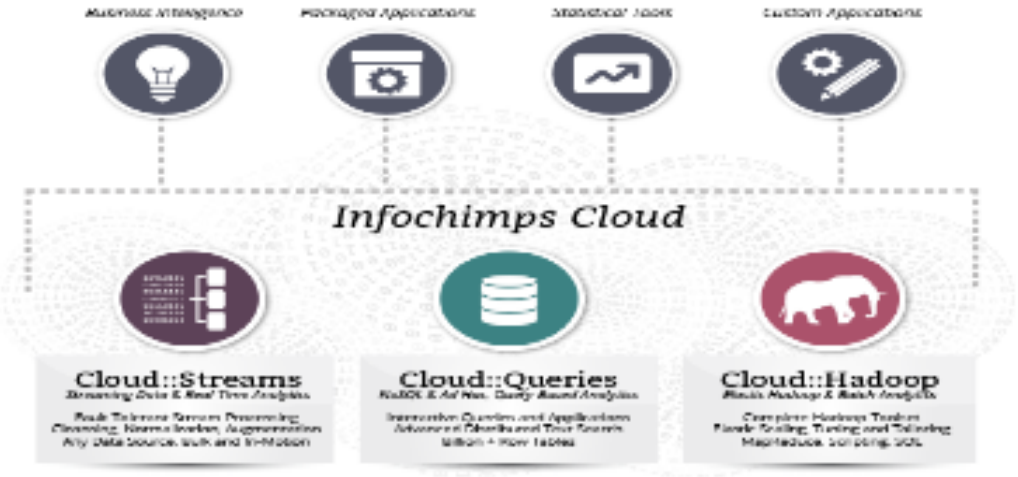


FIGURE 5.1 Cloud analytics.

5. Cloud offerings

5.3 Cloud Analytics

- It also helps to apply **analytics principles** and best practices to analyse different business consequences and achieve new levels of optimization.
- This can combine **complex analytics** with the newer software platforms and will lead towards the **predictable business out of every business insight**

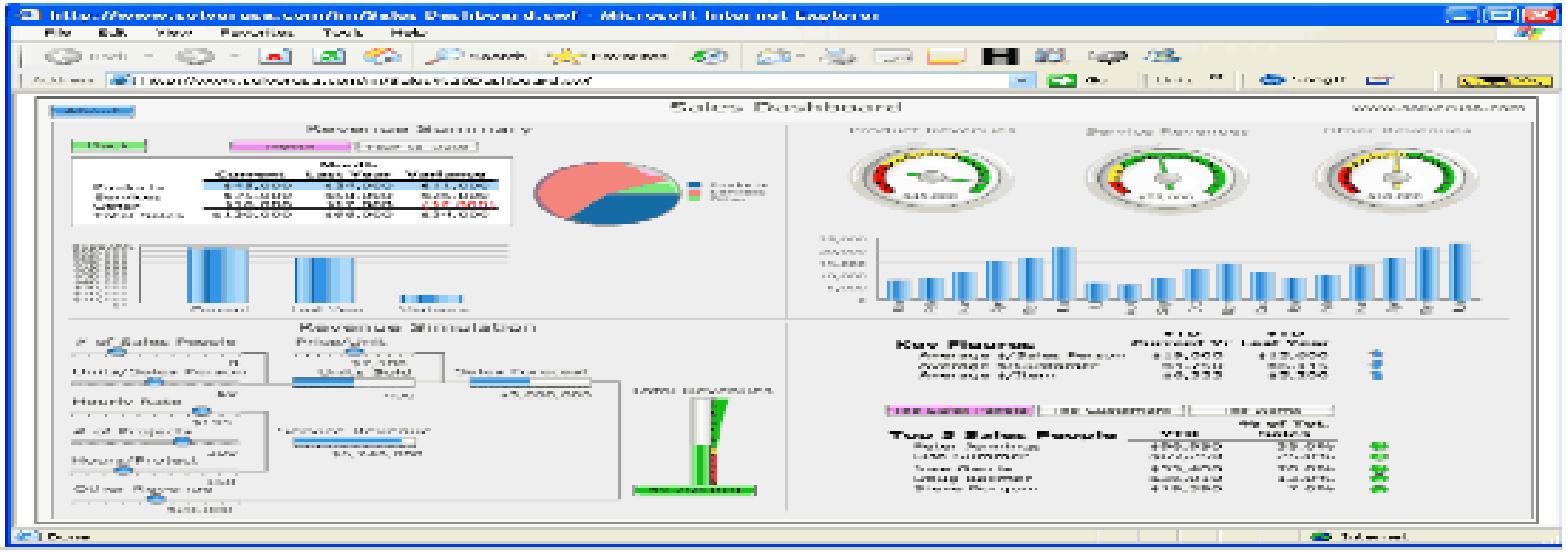


5. Cloud offerings

5.3.1 Cloud Business Analytics Competencies

Cloud analytics is supported by different types of competencies

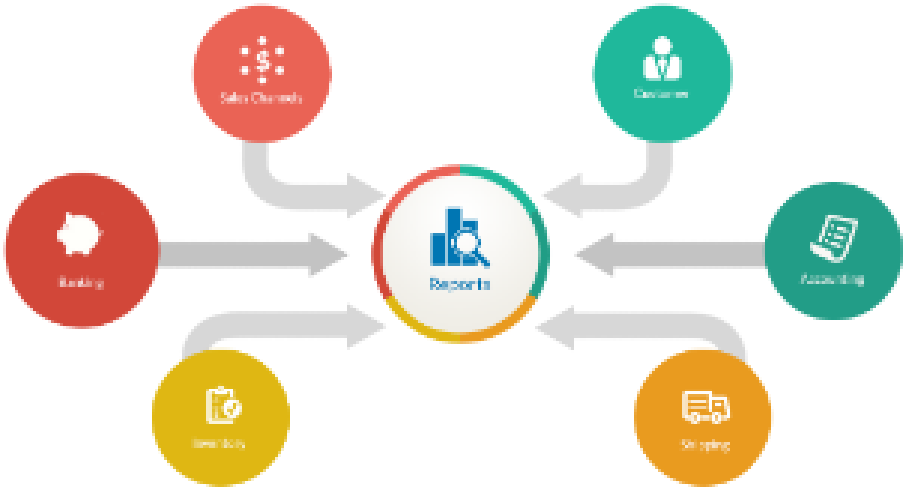
1. **Cloud Business analytics strategy** that helps client Analytics and optimization - provides different type or modelling techniques, deep computing and simulation techniques to check different types of " what if" analysis to increase performance.

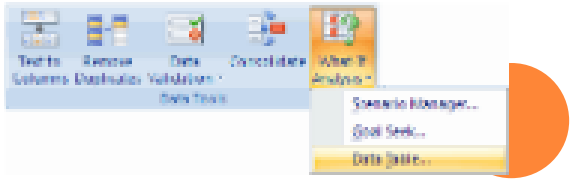


5. Cloud offerings

5.3.1 Cloud Business Analytics Competencies

2. Business management and performance management helps increase performance by providing accurate and on-time data reporting.





5. Cloud offerings

5.3.1 Cloud Business Analytics Competencies

Cloud analytics is supported by different types of competencies

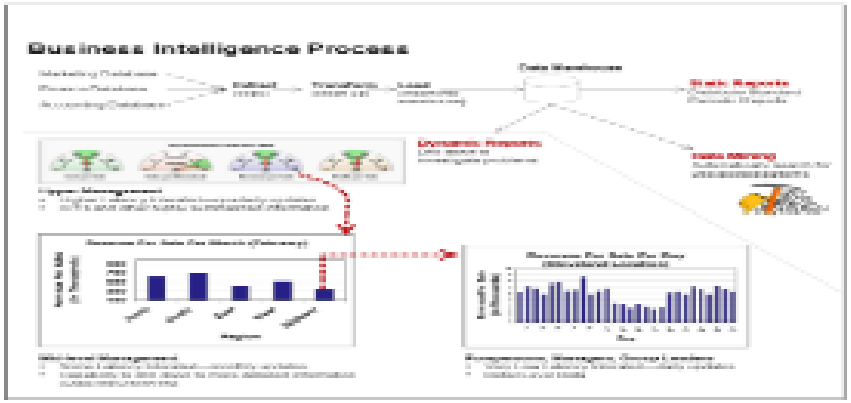
3. Enterprise information management that lets the user to apply different architecture related to data extraction, archival, retrieval, movement and integration.

4. Content management that includes different service architecture, technology architecture and process related to capturing, storing, preserving, delivering and managing the data. It also provides access in the global environment and makes it easy to share data with stakeholders across the globe

5. Cloud offerings

5.3.2 How it Works: Analytics

- Analytics works with the combination of hardware, services and middleware. This expertise makes it best suited to help clients extract new value from their business information.



- Delivering business analytics and information software requires a seamless flow of all forms of data regardless of format, platform and location.
- Its focus on open industry standards is key to this effort, and gives us a significant advantages.

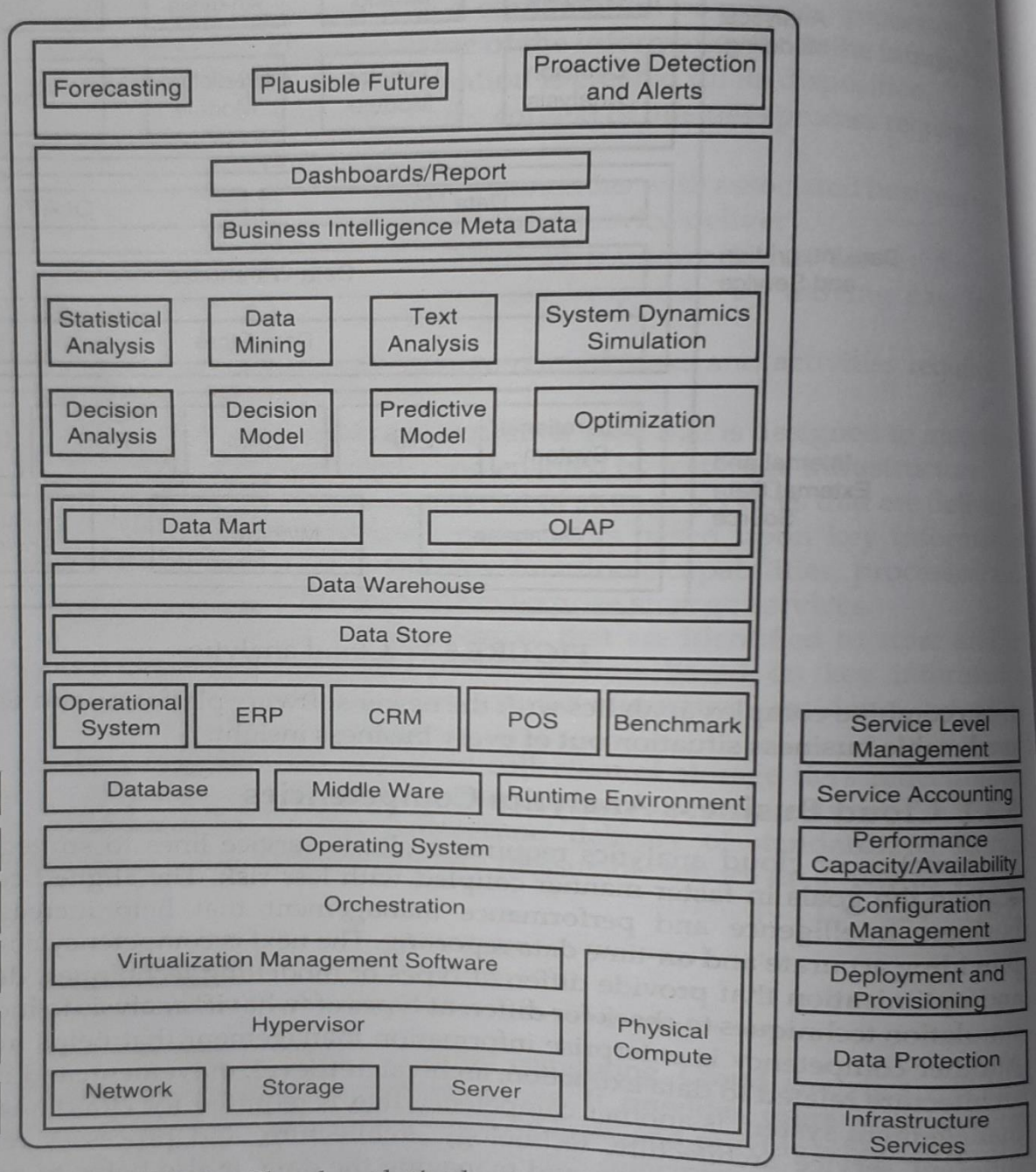
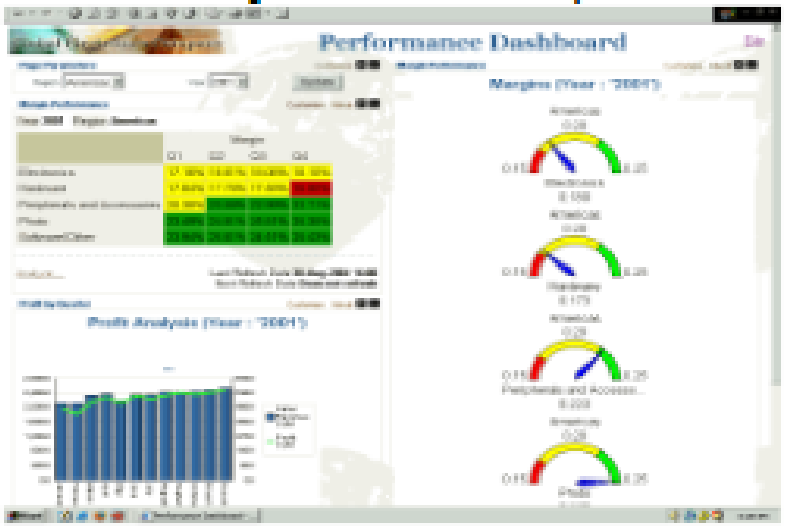


FIGURE 5.2 Cloud analytics business outcomes.

5. Cloud offerings

5.3.2 How it Works: Analytics

- The system features include the platform that provides data reporting, analytics based on text, mining activities, business intelligence, dashboard and perceptive analytics techniques.



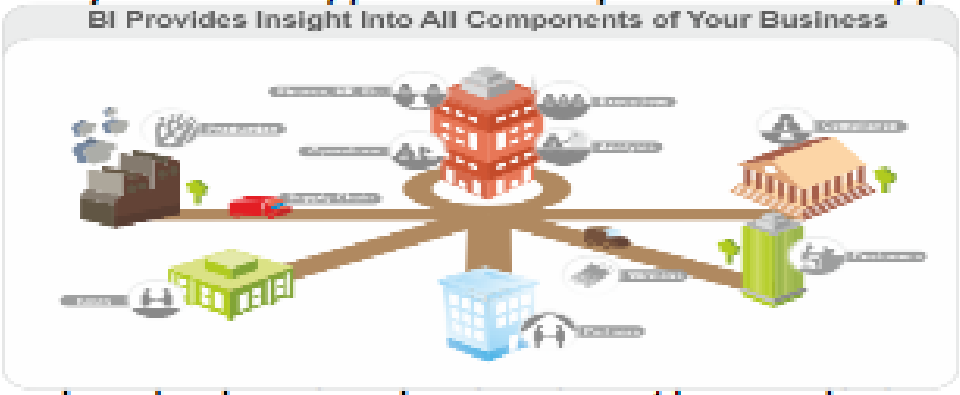
- This also takes care of the storage optimization and different high-performance data-warehouse management techniques

5. Cloud offerings

5.3.2 How it Works: Analytics

Analytics Business Outcomes

- Analytics systems help to get the right information as and when required, identify how to get it and point out right sources to get it.



- Therefore, analytics also helps in designing the policies faster based on the information available in the organization as decision-makers work with the exploration services available within the organization.

5. Cloud offerings

5.3.2 How it Works: Analytics

Analytics Business Outcomes

- This also helps in gauging the business results by measuring the different metrics generated with the help of analytics.

- This gives the option through which the organization can increase the profitability, reduces cycle times and reduce defects

5. Cloud offerings

5.4 Testing under Cloud

- Testing under cloud provides a **good return on investment** on moving typical testing environment to cloud.
- It allows flexibility to play with the surrogate of the real system without the actual risk.

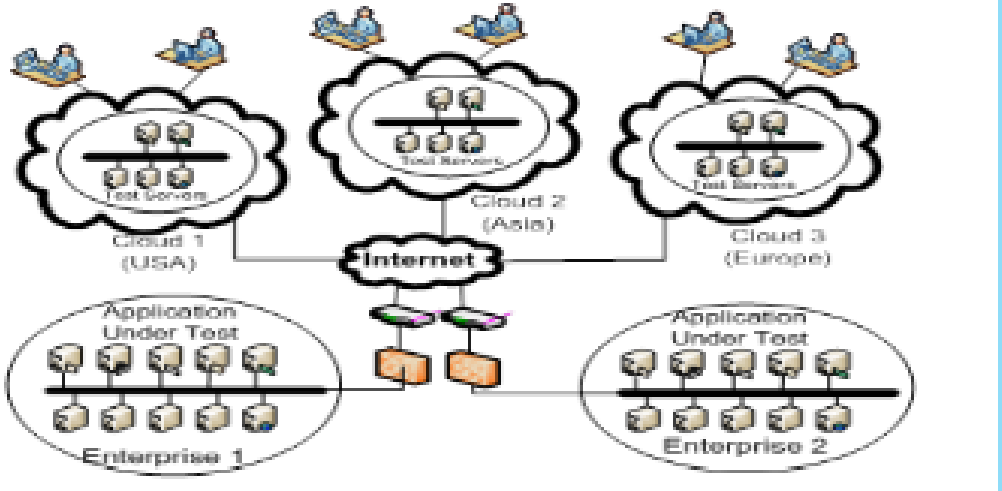


Figure 2: Typical application testing from multiple cloud service provider

5. Cloud offerings

5.4.1 Benefits

- **Cut capital and operational costs** and not affect mission critical applications.

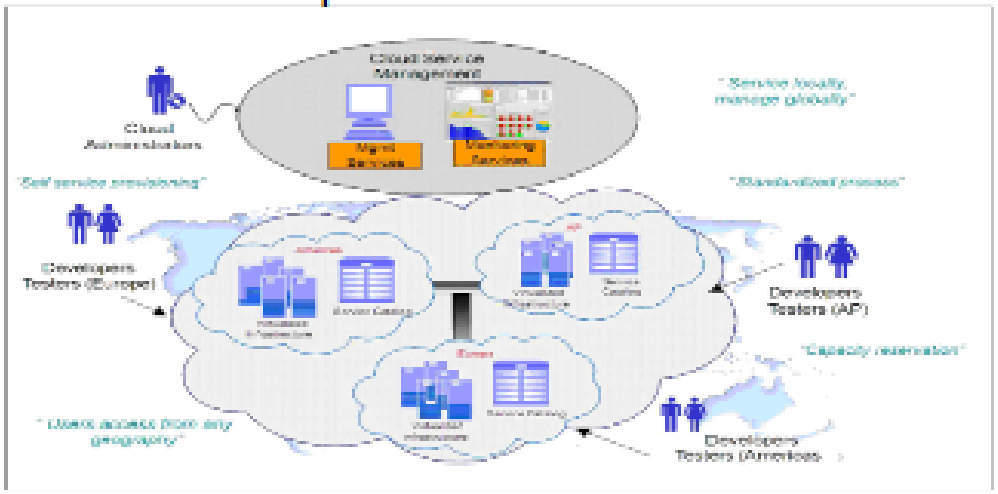
- Offer new and innovative services to clients, and present an opportunity to speed cycle of innovation and improve solution quality

- Facilitate a test environment **based on request** and provide request-based service for storage, network and OS

5. Cloud offerings

5.4.2 Value proposition

- Business test cloud delivers an **integrated**, **flexible** and **extensible** approach to test resource services and management with rapid time to value.

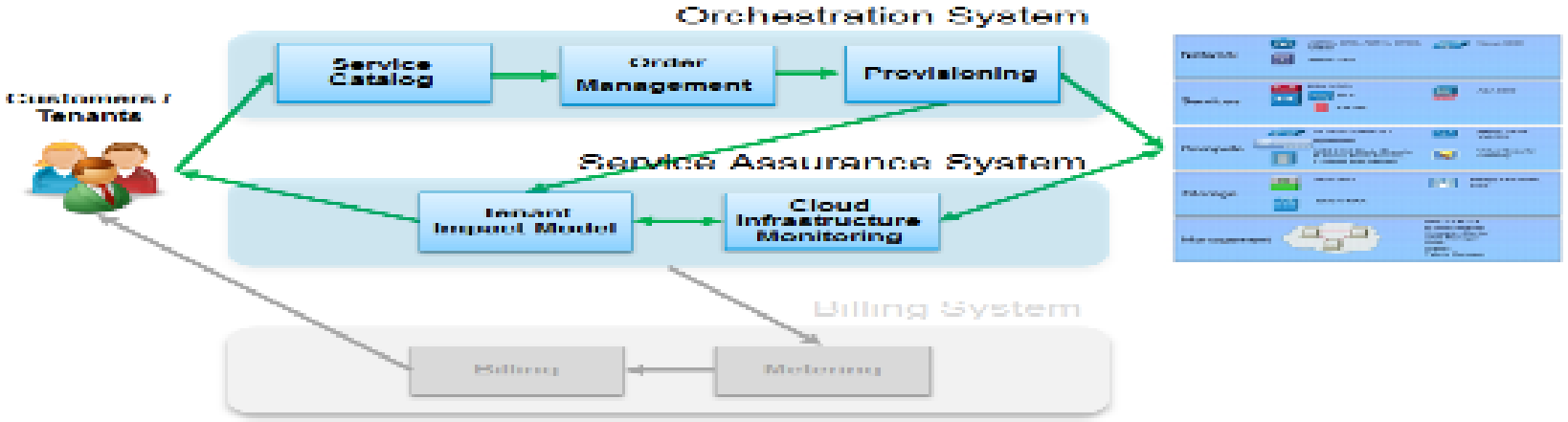


- This is an end-to-end set of services to **strategize**, design and build request-driven delivery of test resources in a cost-effective, efficient manner.

5. Cloud offerings

5.4.2 Value proposition

- These test tools allow you to **orchestrate** and build your services and development projects and allow you to catalogue and organize all of the various software assets that you have.



- These can be administrators, development team leads or project team members that you give permission

5. Cloud Offerings

5.4.3 Biggest Benefitters

With ability to deploy virtual environments quickly and automatically and redirect capacity as needed, cloud computing offers an ideal solution for **testing** and **development.**

Virtual environments provide the sensory experience of being in a computer generated, simulated space.

5.4.4 Cloud offering key themes

tasked with serving two main constituencies:

1. **Application teams:** Delivery of production internal and/or external applications according to service-level requirements in a cost-effective manner. Application infrastructures are often deployed in silos and provisioned for peak demand, resulting in capacity capabilities far beyond their normal requirements.
2. **Development teams:** Development departments are usually driven by user needs for frequent delivery of new features. Development teams often want to quickly test new ideas and/or features in a realistic environment. However, there is often a significant delay between requests to IT for new environments and actual delivery (often can be several weeks). Development teams frequently request and then hesitate to return IT environments into the centralized pool due to the fear of losing access to resources needed for their development cycles.

ue to the history of delivering

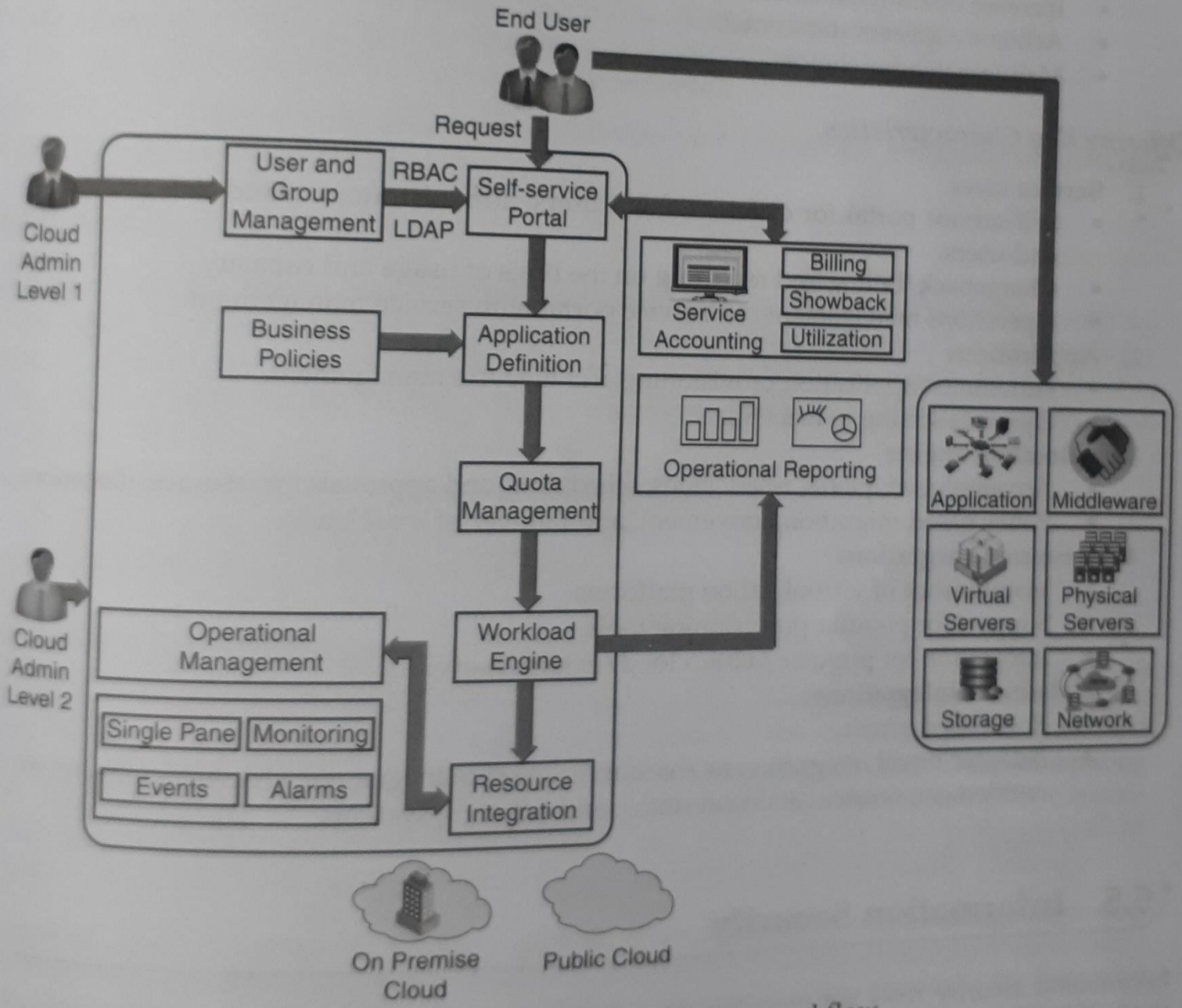


FIGURE 5.3 Cloud orchestration workflow.

Benefits

1. **Increase agility and innovation**
   - Enable self-service delivery (within minutes).
   - Deliver on SLAs.
   - Simplify process for 'what-if' experimentation.
   - Gain control over public cloud usage.
2. **Decrease costs**
   - Increase utilization.
   - Increase operational efficiency (100 servers per admin).
   - Achieve a greener datacenter.
   - Maintain vendor choice.

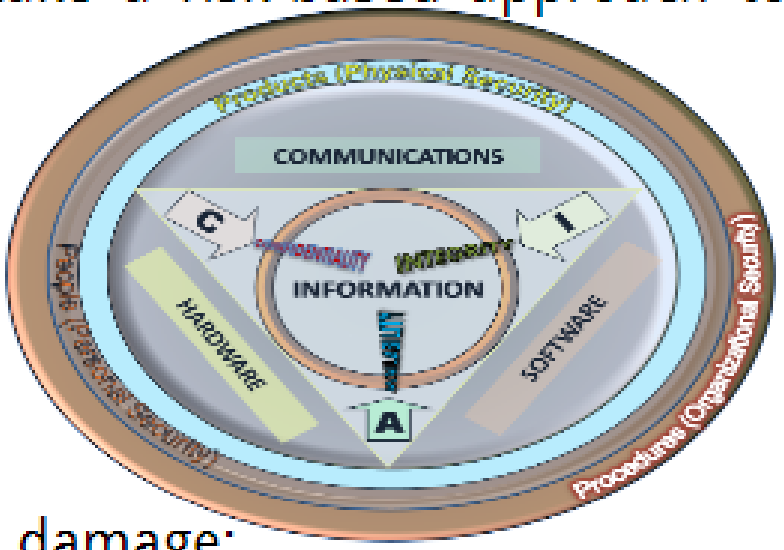
Offering Key Characteristics

1. **Service layer**
   - Self-service portal for different cloud users: administrators, cloud de
     end-users.
   - Chargeback/billing and reporting on the basis of usage and capacity.
   - Operations management self-service portal with service managemen
2. **Applications**
   - Automated application provisioning and lifecycle management.
   - Dynamic scaling to meet SLAs.
3. **Allocation engine**
   - Account-based quotas, reservations, scheduling, and approvals for reso
   - Policy based migration, movement, and failover of workloads.
4. **Resource integrations**
   - Maintenance of virtualization platforms.
   - Support for popular provisioning tools.
   - Integration for popular public cloud/external services.
5. **Datacenter integrations**
   - Role-based access.
   - Adapter-based integration to accounting, asset management, chang
     entitlement, service catalog systems, and ticketing systems.

5. Cloud offerings

5.5 Information Security

Information security risks are potential damages to information assets. Successful organizations take a risk-based approach to information security



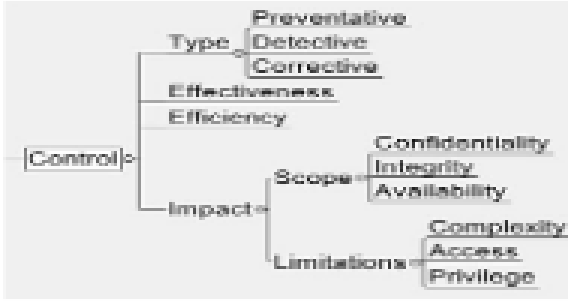
Risk can be quantified by expected damage:

- Value of asset
- Vulnerabilities
- Threats

5. Cloud offerings

5.5 Information Security

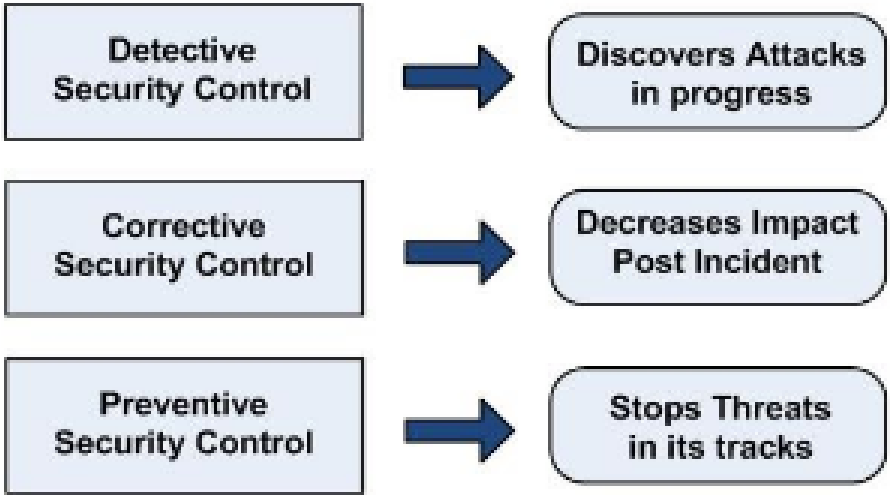
Security controls are safeguards or countermeasures to avoid or minimize information security risks:



- Must be effective- mitigate the give risk
- Should be adaptive: Adapt to changing risks

Three main types of controls

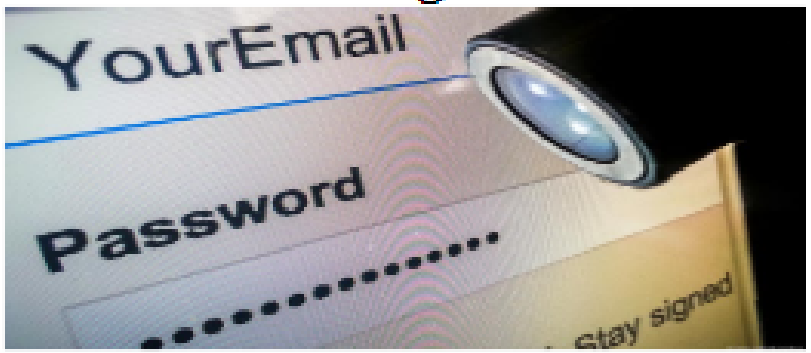
- Preventive
- Detective
- Corrective



5. Cloud offerings

5.5.1 Expectation of Privacy

Consumer expectation is that security should be built into services themselves. Large number of potential cloud consumers still avoid purchases due to fear of financial information being stolen. Expectation drives regulation.



Enterprises must shore-up their weakest supply chain partners:

- more evenly distributed security responsibilities
- increased transparency from the start to finish
- Erased burden of customer-facing unit

5. Cloud offerings

5.5.2 Security Challenges

5.5.3 Security compliance

- need for policies and procedure to meet compliance requirement - medical

5.5.4 Identity-based protection

- identifying true and authentic user

5.5.5 Data Protection @ Cloud

5.5.6 Application Security @ cloud deployment

5. Cloud offerings

5.6 Virtual Desktop Infrastructure

- **Virtual desktop infrastructure** provides end-user virtualization solutions.
- This is designed to help **transform distributed IT** architectures into **virtualized**, open-standard-based framework **leveraging centralized IT services.**
- The notion behind the virtual desktop infrastructure is to run **desktop operating systems** and applications inside virtual machines that reside on the servers in the data center. This is called **Virtual desktop**. User access a Virtual desktop through their desktop PC.

5. Cloud Offerings

5.6 Virtual Desktop Infrastructure

VDI delivers solution that

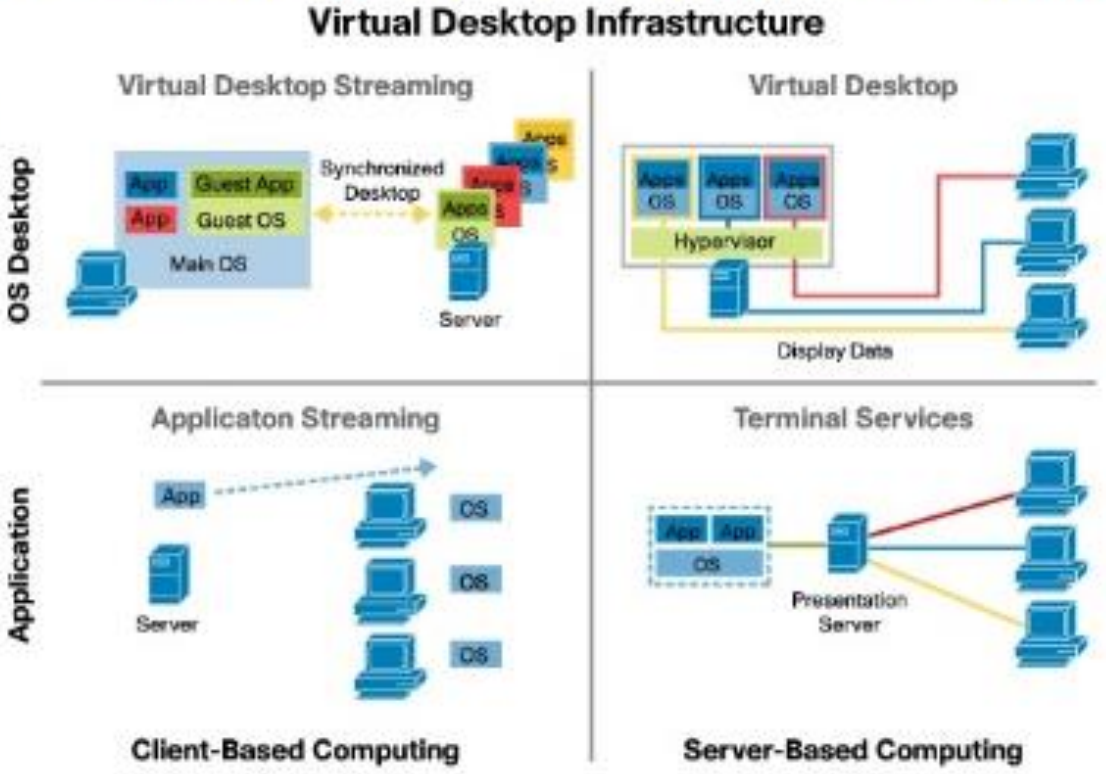
- consists of optional portal interface, thin-client and PC with client components or web browser.
- delivers a common, standard-based, resilient IT infrastructure that is security-rich , scalable and provides single-point, consistent access from a wide choices of client devices.

5. Cloud offerings

5.6.1 Architecture Overview

Virtual Desktop Infrastructure creates a framework that offers many advantages:

- cost reductions
  - flexibility
- security
- availability
- efficiency



5. Cloud offerings

5.6.2 Enterprise Level

- VDI provides a enterprise level or grade solution.
- It introduces a new method of delivering and managing user desktop environments.

5. Cloud offerings

5.6.3 Client access

- Virtual Desktop manager (VDM) helps user to connect their desktop to servers

5.6.4 Desktop Virtualization services

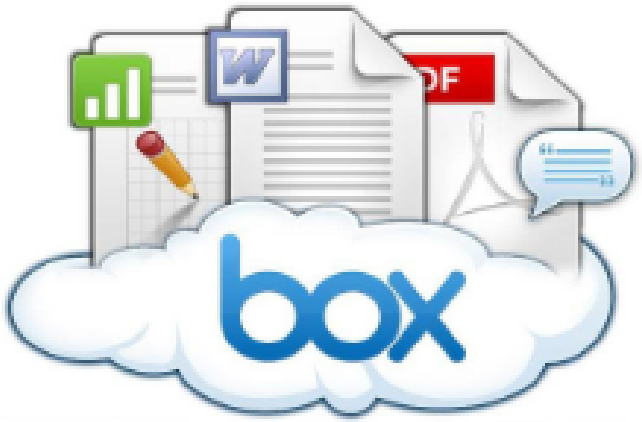
5.6.5. Desktop Management

5.6.6. Pool Management for VDI

5. Cloud offerings

5.7 Storage cloud

Storage management in cloud can help organizations to address their challenges around data and storage management in their clouds :



- Availability of data at all times
- Storage resource and utilization
- Application performance
- Longer restore times
- Higher storage costs
- Low productivity of storage personnel
- Increased risk of data loss and downtime

5. Cloud offerings

5.7.1 Value proposition

5.7.2 Challenges

- data availability, security

5.7.3 Business Drivers

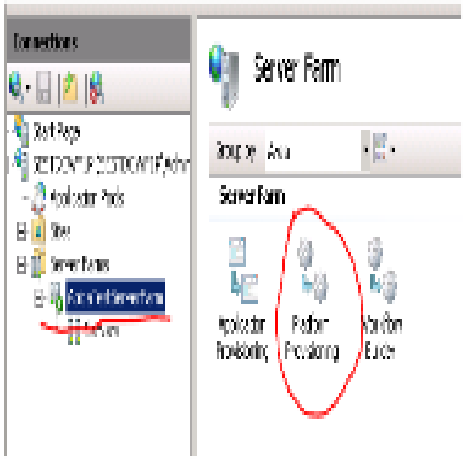
5.7.4 Benefits

5.7.5 Product/Solution overview

5.7.6 Product/solution description

CHAPTER 6: CLOUD MANAGEMENT

Chapter Topics



6.1 Introduction

6.2 Resiliency,

6.3 Provisioning,

6.4 Asset management,

6.5 Cloud governance,

6.6 High availability and disaster recovery,

6.7 Charging models, usage reporting, billing and metering.

6.1 Introduction

To provide value, IT cost model has to be:

- Equitable
- Controllable
- Repeatable and predictable
- Simple
- Comprehensive

6.1.1 Service- based Model

Service-based model offers cost-transparency and cost-reductions options

6.2 Resiliency

- Resiliency is the capacity to rapidly adapt and respond to risks, as well as opportunities.
- This maintains continuous business operations that support growth and operate in potential adverse conditions.
- The reach and range step of the assessment process examines business driven, data-driven and event -driven risks.
- The resiliency blueprint includes different layers- facilities, technology, applications and data, processes
- The framework enables people to examine business, understand what areas of vulnerabilities that might exist and quickly pinpoint areas of concern and help them understand what actions they can take to reduce the risk associated with those areas.

6.2.1 Resiliency capabilities

The framework combines multiple parts to mitigate risks and improve business resilience

- From a facilities perspective, you may need to implement power protection
- from security perspective- to protect applications and data
- From process perspective- you may implement identification and documentation of most critical business process
- From organizational perspective- geographical diversity, backup of workstation data
- From strategy and vision perspective, you would want to have a crisis management

Cloud provisioning

- Cloud provisioning is the allocation of a cloud provider's resources and services to a customer.

- Cloud provisioning is a key feature of the cloud computing model, relating to how a customer procures cloud services and resources from a cloud provider. The growing catalog of cloud services that customers can provision includes infrastructure as a service, software as a service and platform as a service, in public or private cloud environments.

6.3 Provisioning

Provisioning process is a service that uses group of compliant processes called " solution Realization"

- provisioned products are servers built with all the software and infrastructure required to support a business application.
- Standard solutions are defined so that standard workflows can be derived
- server hardware is assembled, cabled and connected to the network and SAN before work orders are released.

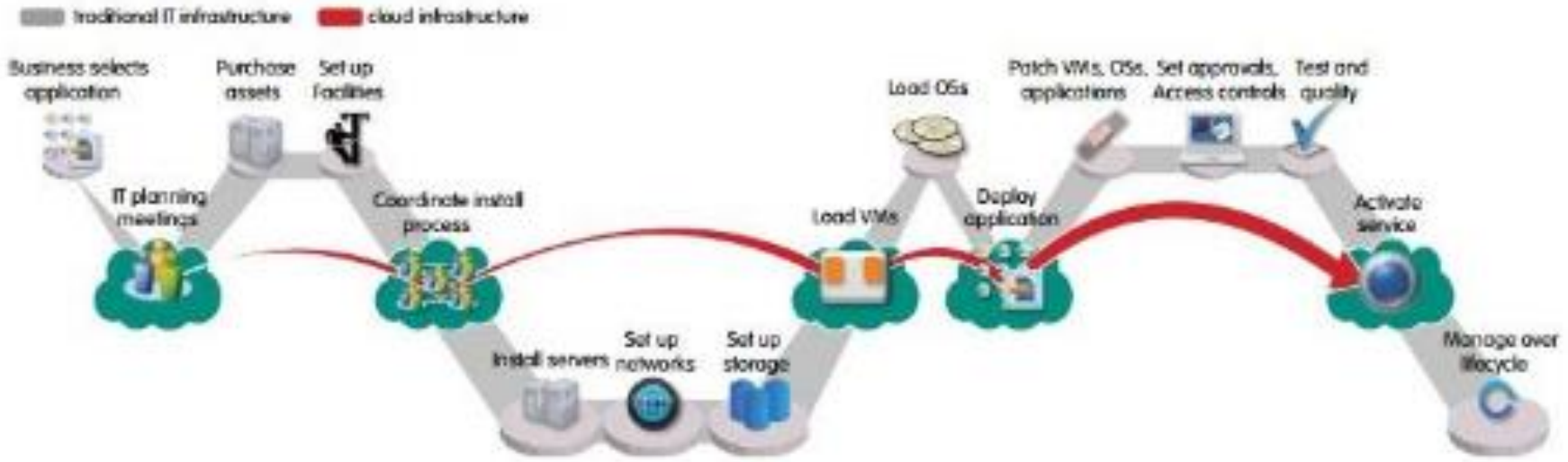


Figure 1: Using Cloud Infrastructure Can Speed and Simplify the Provisioning Process

6.3.1 Characteristics

Each process has the owner who is responsible for the successful implementation of the product

6.3.1 Approach

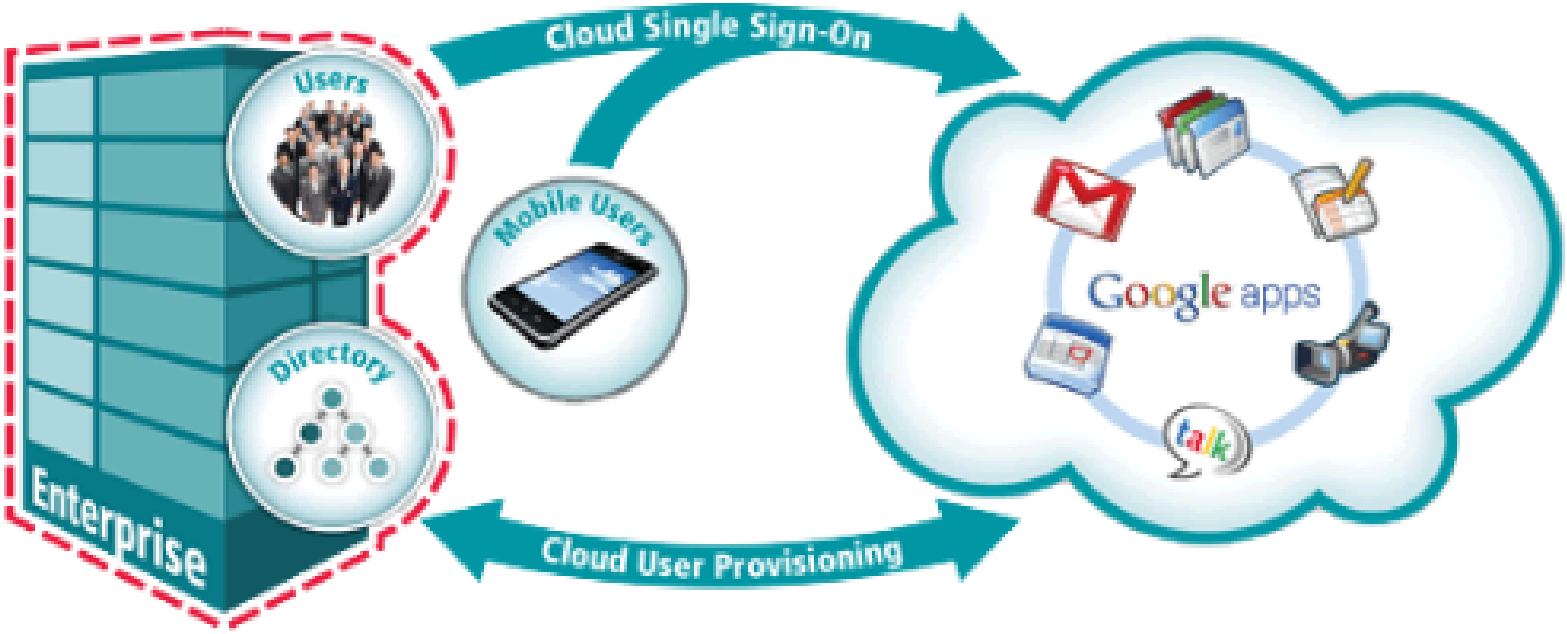
The approach involves the following activities

- Planning precedes execution
- Validating build specification precede building
- Packaged software installation on respective servers
- Having servers racked , stacked, cabled and connected to storage and networks precedes issuing work-orders

6.3.3. Benefits

Here are some benefits of provisioning

- ability to measure progress of all the work related to one RfS
- continuous improvement activities based on process measurements
- Isolation of the build, install, configure, and customise tasks from requirements design, and hardware setup activities
- Role players performing a finite set of repeatable activities



Asset management

- Cloud asset management is a component of **cloud management services** focused exclusively on the management of a business's physical cloud environment, such as the products or services they use.

6.4 Asset management

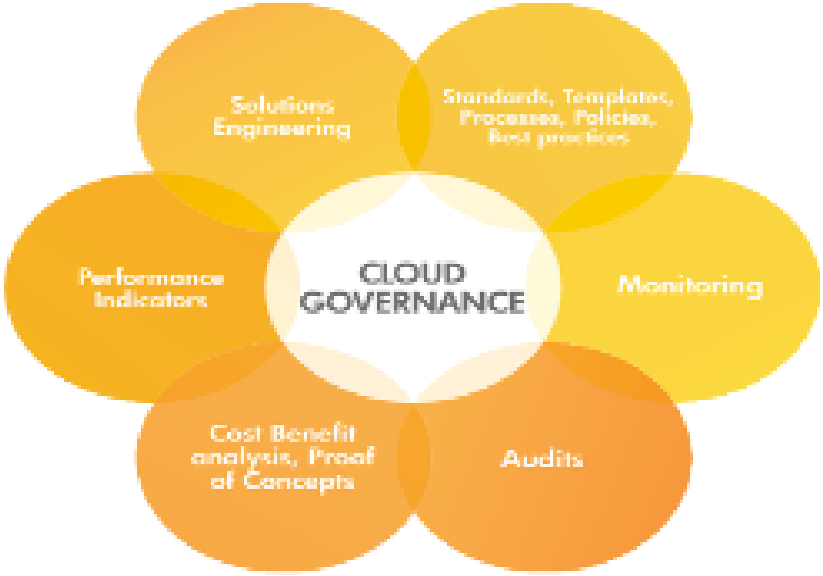
Asset management and change management interact regularly. The asset management strategy includes

- Software packaging
- Incident management
- Pool Management
- Release management
- configuration management
- Systems management
- Operational readiness Management
- Backup management

6.5 Cloud Governance

Cloud Governance is broken down into the following

- Regulation of new service creation
- Getting more use of services
- Enforcing standards and best practices
- Service change management and service version control



6.6 High availability and disaster recovery

High availability(HA) and disaster recovery (DR) are important factors for cloud deployments.

- Mean time between failures
- Mean time to recover
- High availability
- Continuous operations
- Continuous availability
- Availability management

6.7 Charging models, usage reporting, billing and metering.

Charging models are approaches taken to recover expenses.

Instance Type	RAM (GB)	# of Virtual Cores	Local Disk (GB)	Price ($/hr)
Standard Extra Small	1	1	30	**$0.04**
Standard Small	2	2	60	**$0.08**
Standard Medium	4	2	120	**$0.16**
Standard Large	8	4	240	**$0.32**
Standard Extra Large	16	4	480	**$0.64**
Standard Double Extra Large	32	8	960	**$1.28**

6.7.2 Benefits

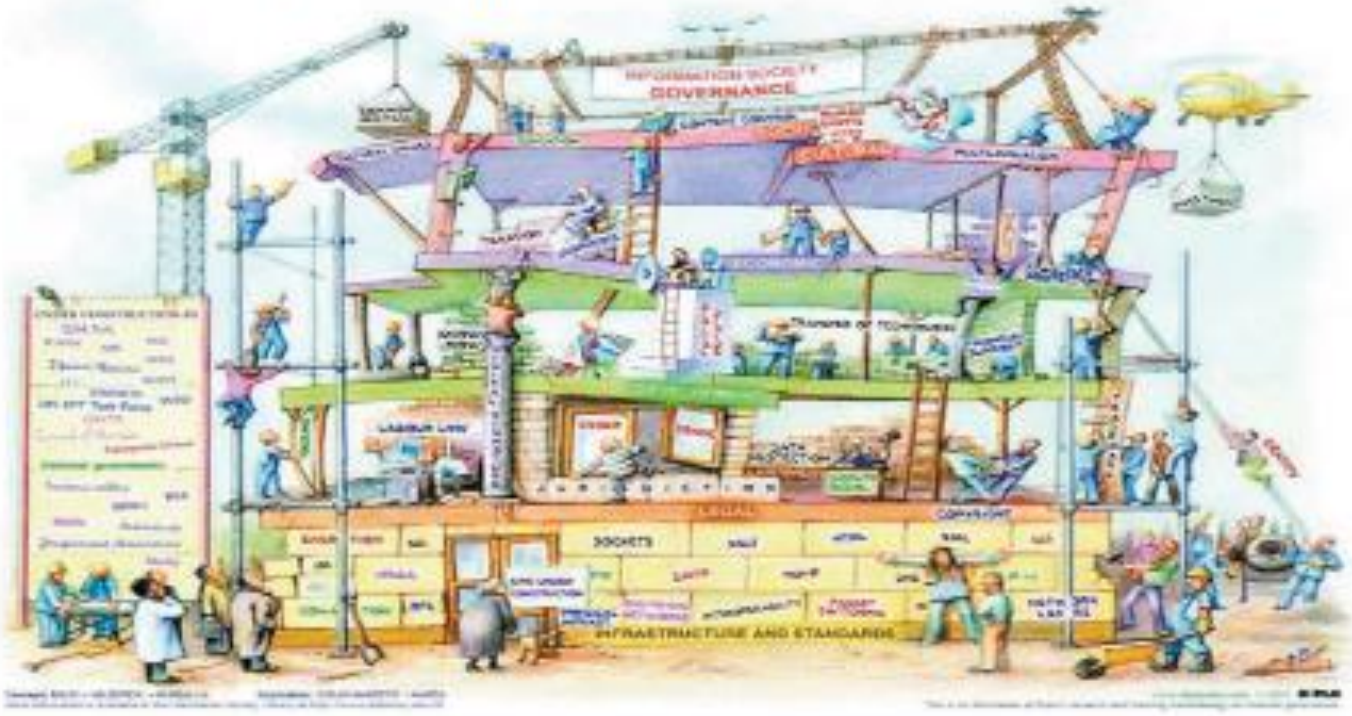
Charging models build transparency to enterprise cost and help companies to figure out increase resources and also weed out wastes.

6.7.3 Cloud Chargeback models

- Standard subscription-based model
- Pay-per use model
- Premium pricing model
- Hybrid model
- Allocation-based
- Flat Fee
- Usage-based
- Product or service based
- Activity-based
- Market based

6.7.4 IT infrastructure Governance

Governance in a shared infrastructure becomes a paramount, as resources shared by all business units require some level of policies and control mechanisms that define boundaries and upload business unit requirements.



6.7.5 Basic Requirements

- Fairness
- Control
- Repeatability
- Simplicity

CHAPTER 7: CLOUD VIRTUALIZATION TECHNOLOGY

7. Cloud Virtualization Technology

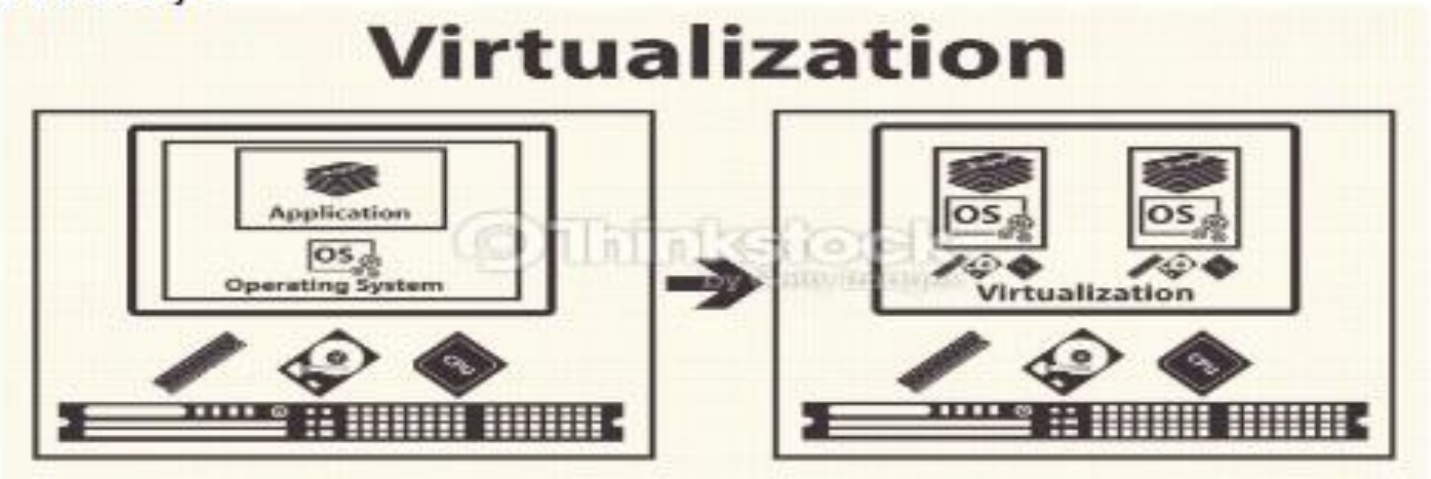
Chapter Topics

7.1 Introduction
7.2 Virtualization defined,
7.3 Virtualization benefits,
7.4 Server virtualization,
7.5 Virtualization for x86 architecture,
7.6 Hypervisor management software,
7.7 Logical partitioning,
7.8 VIO server
7.9 Virtual infrastructure requirements.
7.10 Summary

7. Cloud Virtualization Technology

7.1 Introduction

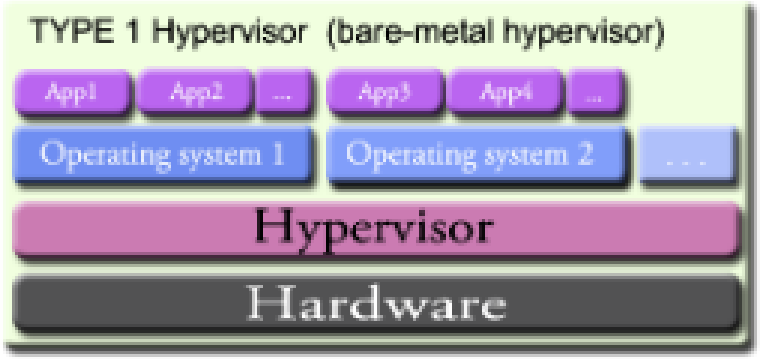
- Virtualization represents the logical view of data representation- the power to compute in virtualized environments.
- It is a technique that has been used in large mainframe computer for 30+ years. It is used to manage a group of computers together- instead of managing resources separately.



7. Cloud Virtualization Technology

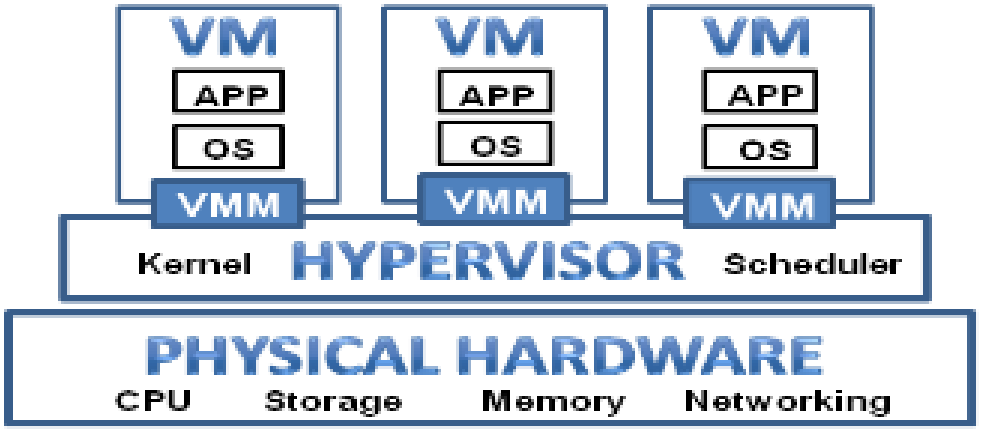
7.2 Virtualization Defined

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



Virtualization in Cloud Computing

Virtualization is the "creation of a virtual (rather than actual) version of something, such as a server, a desktop, a storage device, an operating system or network resources".

In other words, Virtualization is a technique, which allows to share a single physical instance of a resource or an application among multiple customers and organizations. It does by assigning a logical name to a physical storage and providing a pointer to that physical resource when demanded.

What is the concept behind the Virtualization?

Creation of a virtual machine over existing operating system and hardware is known as Hardware Virtualization. A Virtual machine provides an environment that is logically separated from the underlying hardware.

The machine on which the virtual machine is going to create is known as Host Machine and that virtual machine is referred as a Guest Machine.

How does virtualization work in cloud computing?

Virtualization plays a very important role in the cloud computing technology, normally in the cloud computing, users share the data present in the clouds like application etc, but actually with the help of virtualization users shares the Infrastructure.

The **main usage of Virtualization Technology** is to provide the applications with the standard versions to their cloud users, suppose if the next version of that application is released, then cloud provider has to provide the latest version to their cloud users and practically it is possible because it is more expensive.

To overcome this problem we use basically virtualization technology, By using virtualization, all severs and the software application which are required by other cloud providers are maintained by the third party people, and the cloud providers has to pay the money on monthly or annual basis.

Traditional Architecture

Virtual Architecture

Access to the virtual machine and the host machine or server is facilitated by a software known as Hypervisor. Hypervisor acts as a link between the hardware and the virtual environment and distributes the hardware resources such as CPU usage, memory allotment between the different virtual environments.

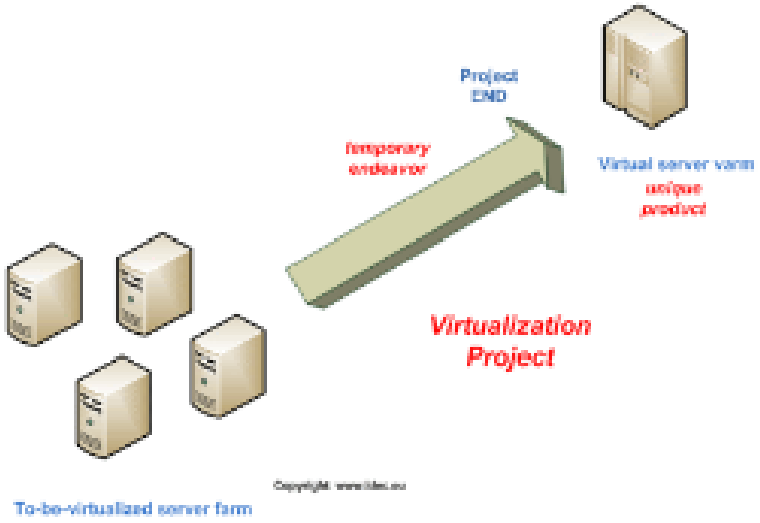
Previously, there were computers that ran an Operating System (OS) and application on top of the OS, but now, with the help of virtualization software like Hypervisor, one can create multiple Virtual Machines (VMs) on a single computer and install OS on them and run all of them at the same time.

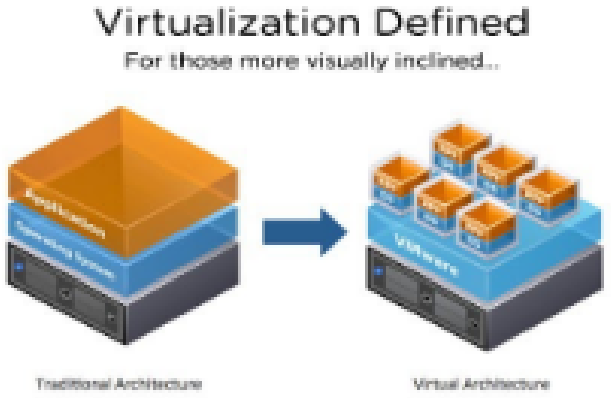
7. Cloud Virtualization Technology

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

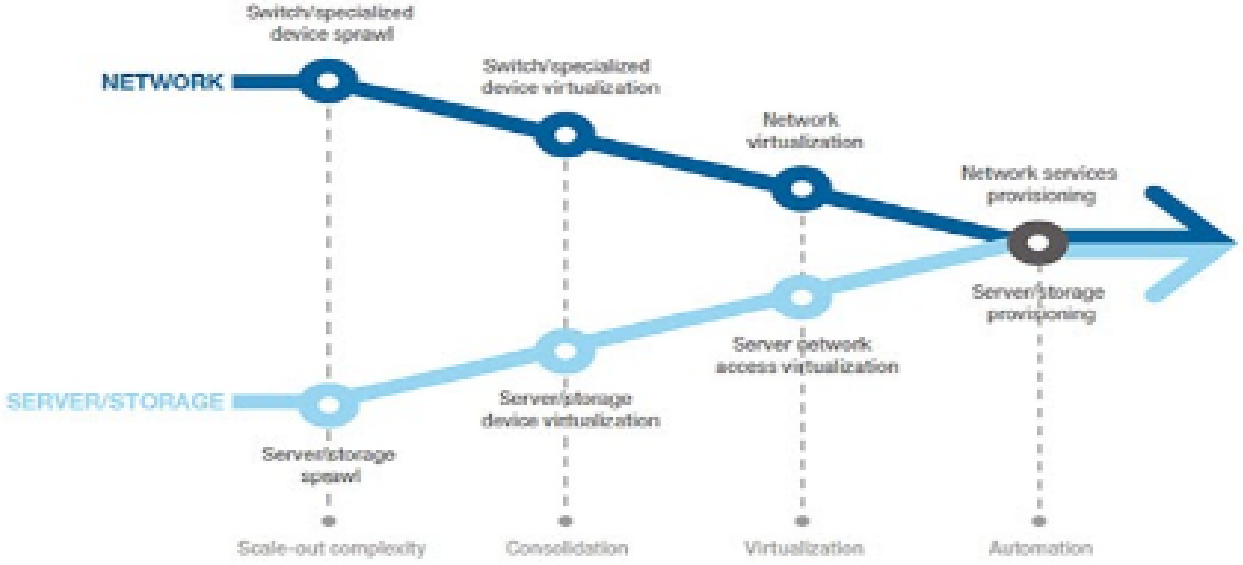




7. Cloud Virtualization Technology

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



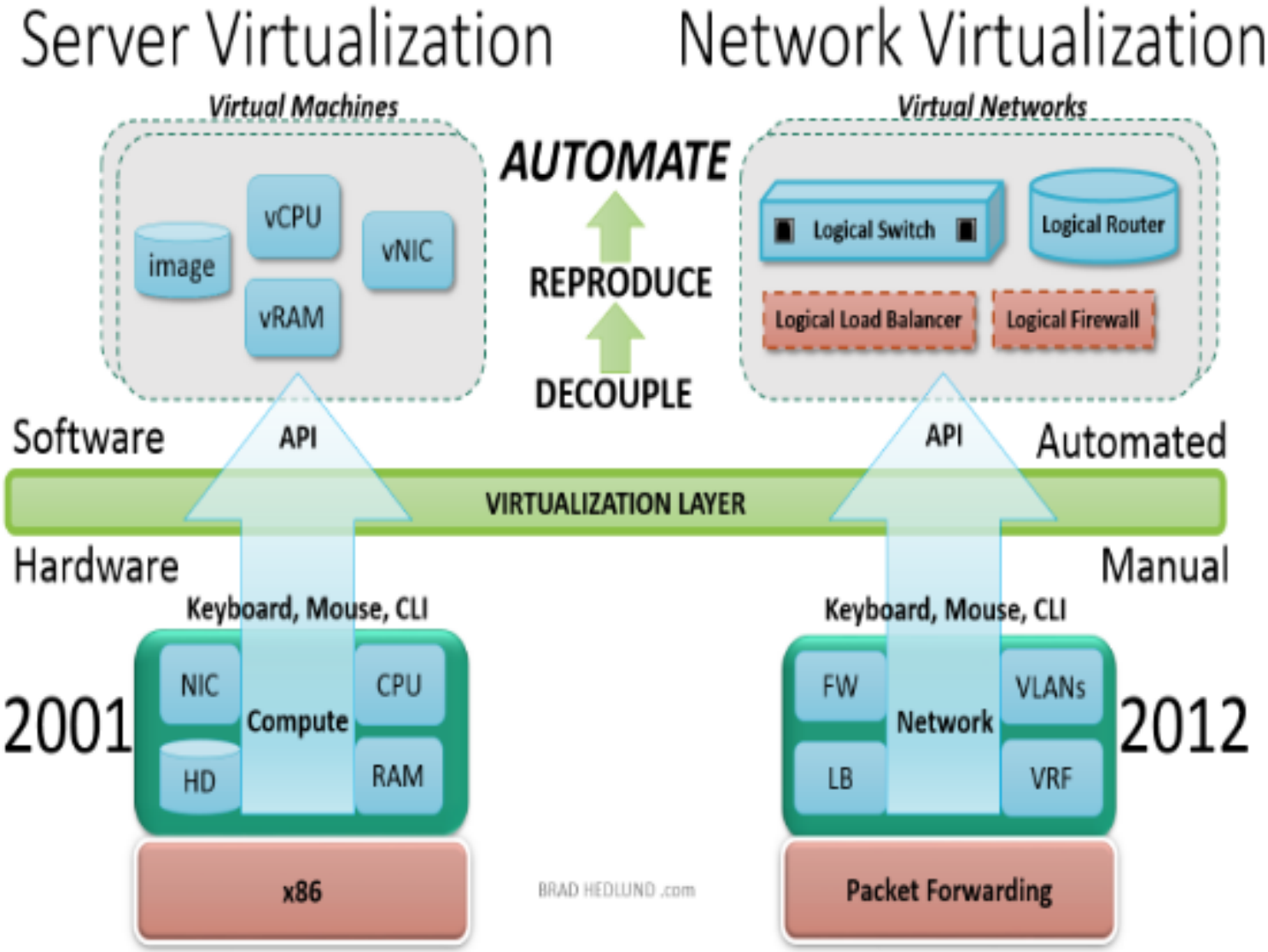
7.3 Virtualization Benefits,

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

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


Server Virtualization
Network Virtualization
Virtual Machines
Virtual Networks
AUTOMATE
REPRODUCE
DECOUPLE
image
vCPU
vNIC
vRAM
Logical Switch
Logical Router
Logical Load Balancer
Logical Firewall
Software
API
API
Automated
VIRTUALIZATION LAYER
Hardware
Manual
Keyboard, Mouse, CLI
Keyboard, Mouse, CLI
2001
NIC
CPU
Compute
HD
RAM
FW
VLANs
Network
LB
VRF
2012
x86
Packet Forwarding
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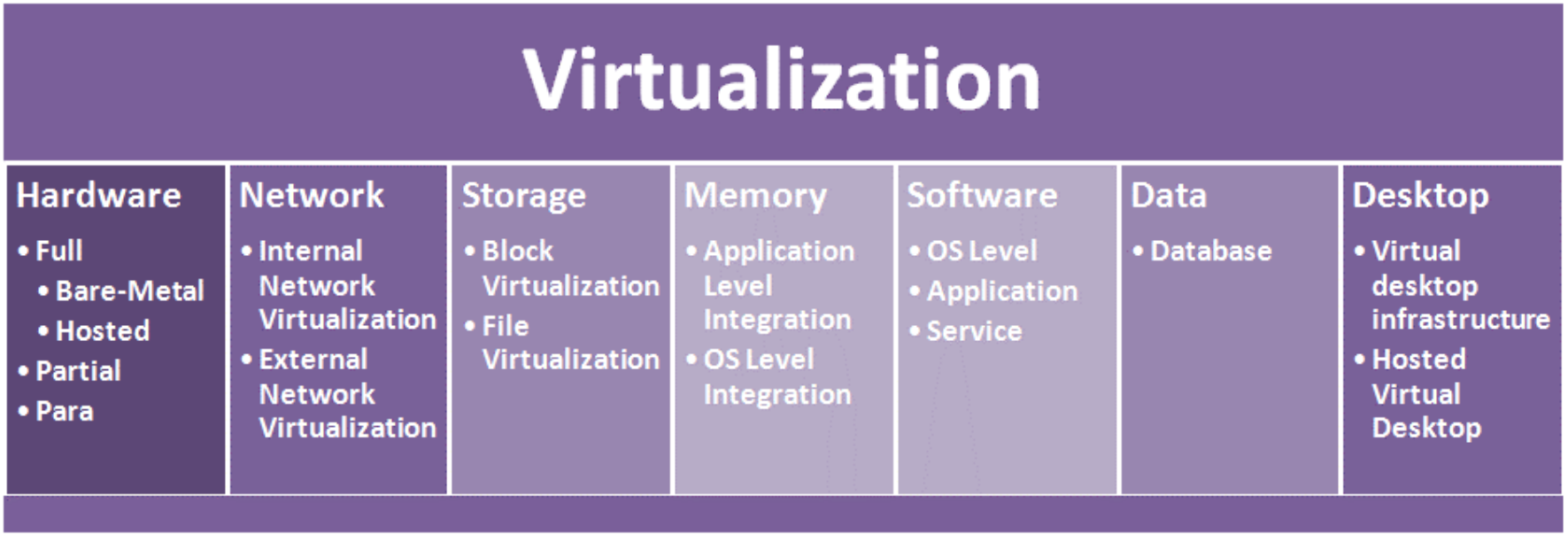
7. Cloud Virtualization Technology

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 failure.



Types of Virtualization:

Operating system Virtualization
Server Virtualization –> divided into Hardware and OS Virtualization
Storage Virtualization
Data Virtualization
Software Virtualization
Network Virtualization

https://www.tutorialspoint.com/virtualization2.0/virtualization2.0_overview.htm

Hardware Virtualization:

When the virtual machine software or virtual machine manager *(VMM) is directly installed on the hardware system* is known as hardware virtualization.

The main job of hypervisor is to control and monitoring the processor, memory and other hardware resources.

After virtualization of hardware system we can install different operating system on it and run different applications on those OS.

Usage:

Hardware virtualization is mainly done for the server platforms, because controlling virtual machines is much easier than controlling a physical server.

Operating System Virtualization:

When the virtual machine software or virtual machine manager *(VMM) is installed on the Host operating system* instead of directly on the hardware system is known as operating system virtualization.

Usage:

Operating System Virtualization is mainly used for testing the applications on different platforms of OS.

Server Virtualization:

When the virtual machine software or virtual machine manager *(VMM) is directly installed on the Server system* is known as server virtualization.

Usage:

Server virtualization is done because a single physical server can be divided into multiple servers on the demand basis and for balancing the load.

Software Virtualization

It provides the ability to the main computer to run and create one or more virtual environments. It is used to enable a complete computer system in order to allow a guest OS to run.

For instance letting Linux run as a guest that is natively running a Microsoft Windows OS (or vice versa, running Windows as a guest on Linux).

Data Virtualization

Without any technical details, you can easily manipulate data and know how it is formatted or where it is physically located. It decreases the data errors and workload.

Storage Virtualization:

Storage virtualization is the *process of grouping the physical storage from multiple network storage devices so that it looks like a single storage device.*

Storage virtualization is also implemented by using software applications.

Usage:

Storage virtualization is mainly done for back-up and recovery purposes.

Network Virtualization

It is intended to allow network optimization of data transfer rates, scalability, reliability, flexibility, and security. It also automates many network administrative tasks. Network virtualization is specifically useful for networks that experience a huge, rapid, and unpredictable traffic increase.

The intended result of network virtualization provides improved network productivity and efficiency.

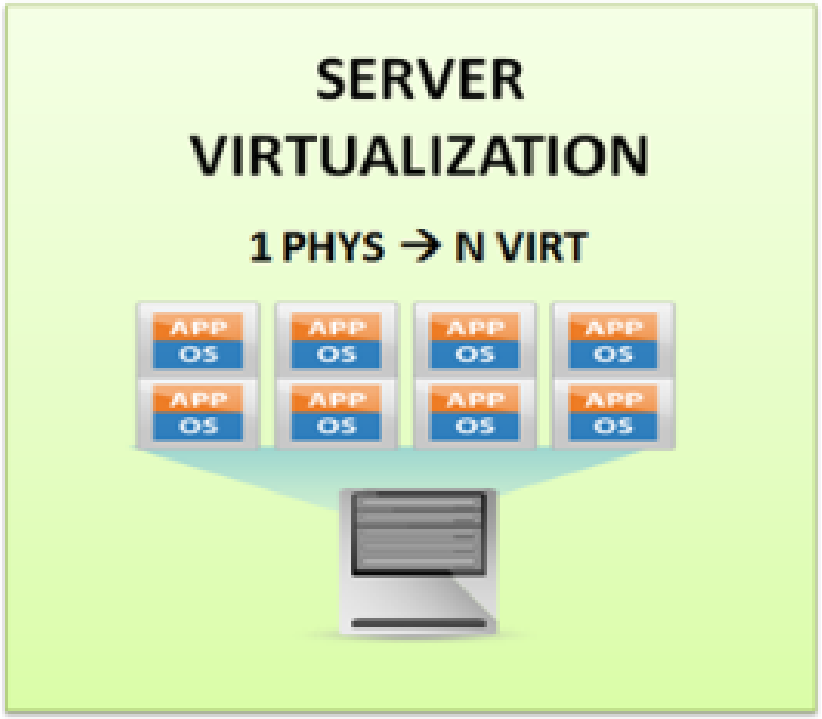
Two categories:

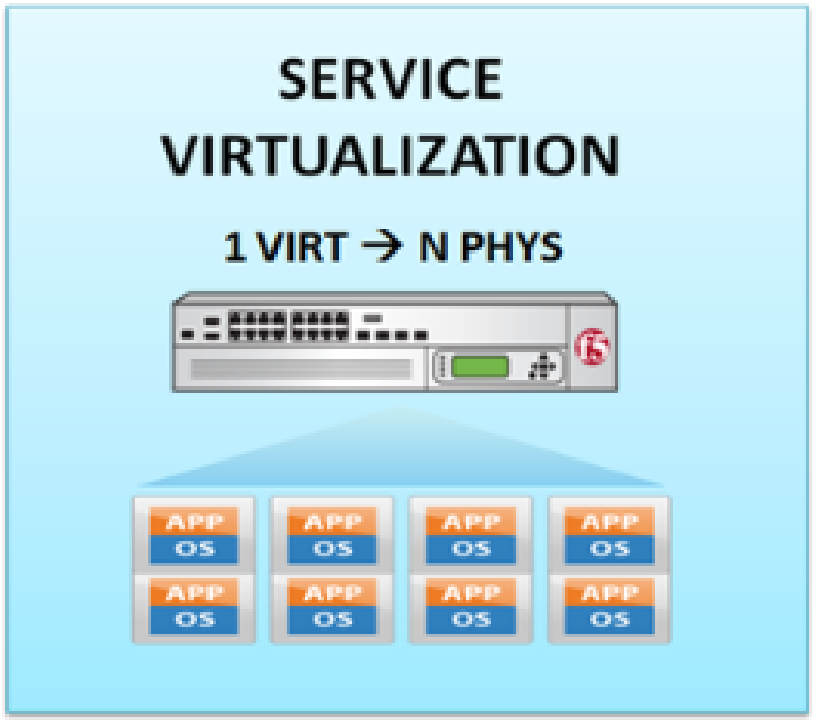
- **Internal:** Provide network-like functionality to a single system.
- **External:** Combine many networks or parts of networks into a virtual unit.

7. Cloud Virtualization Technology

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.

Server Virtualization

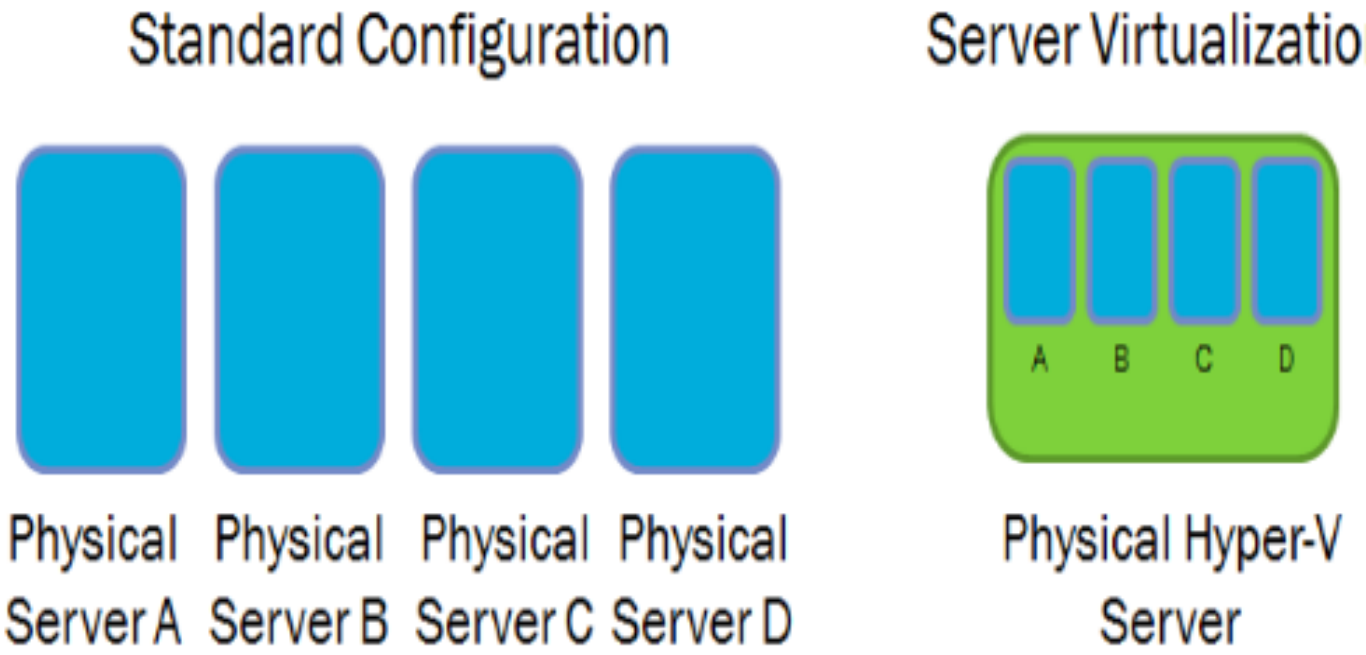
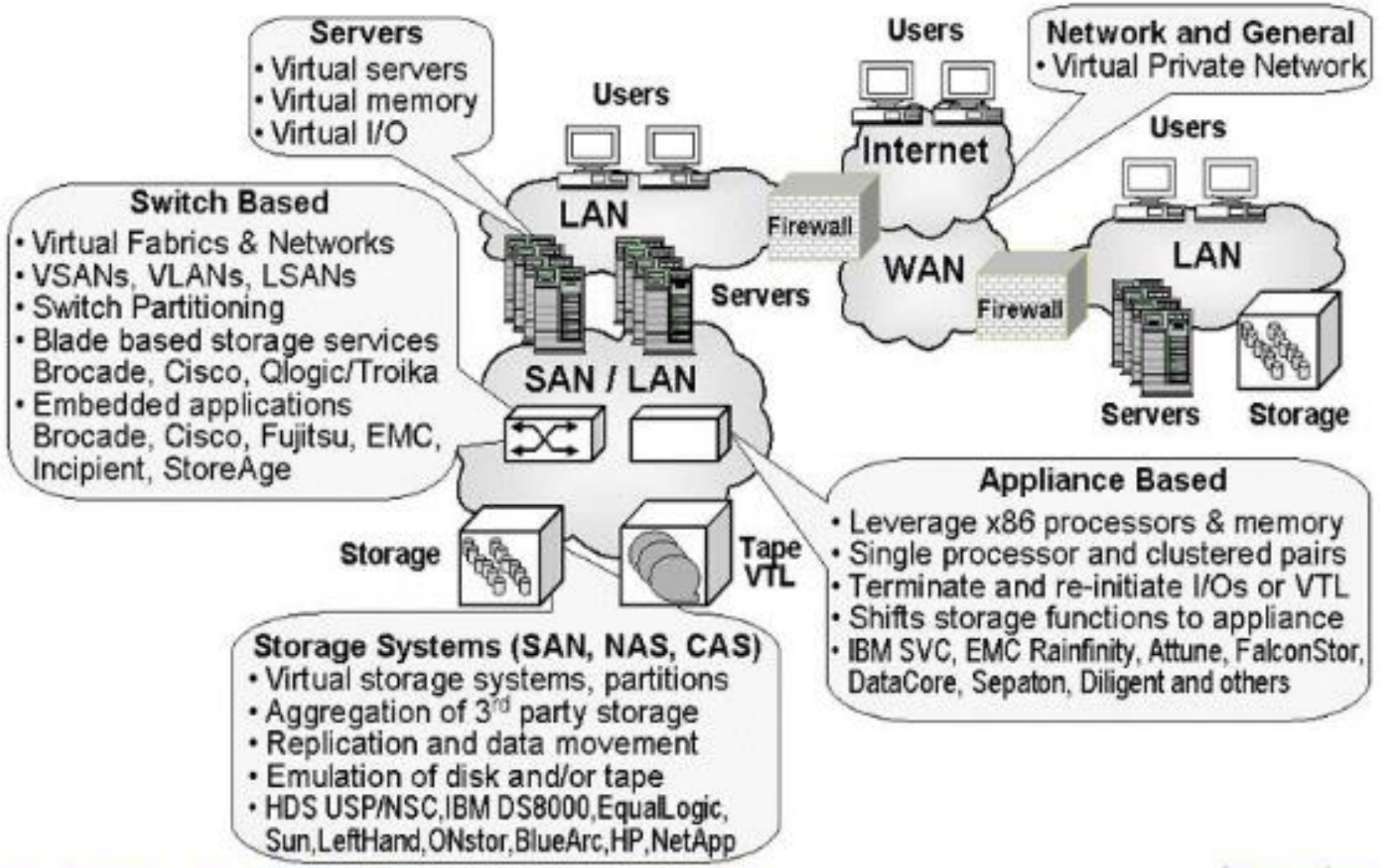


Image Source

Many faces of virtualization – Various Locations



7. Cloud Virtualization Technology

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.

7. Cloud Virtualization Technology

7.4.2 Virtualization Technologies

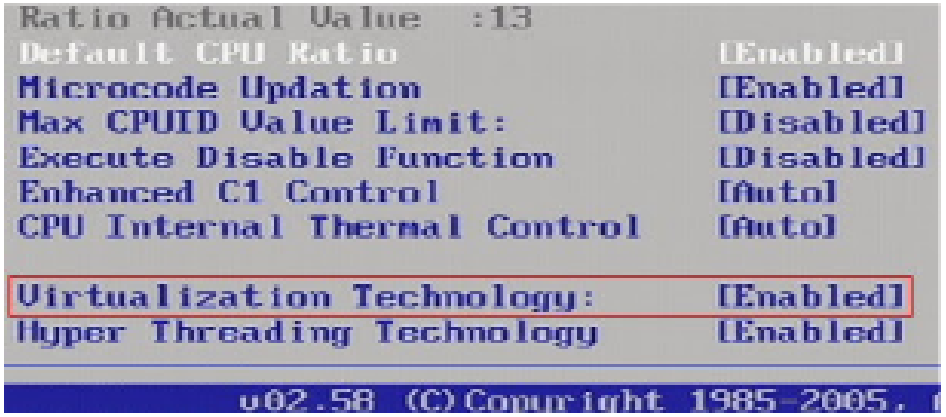
Two major types of virtualization technologies widely used are

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

7. Cloud Virtualization Technology

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



7. Cloud Virtualization Technology

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

7. Cloud Virtualization Technology

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

The Paravirtualization Spectrum

V Virtualized

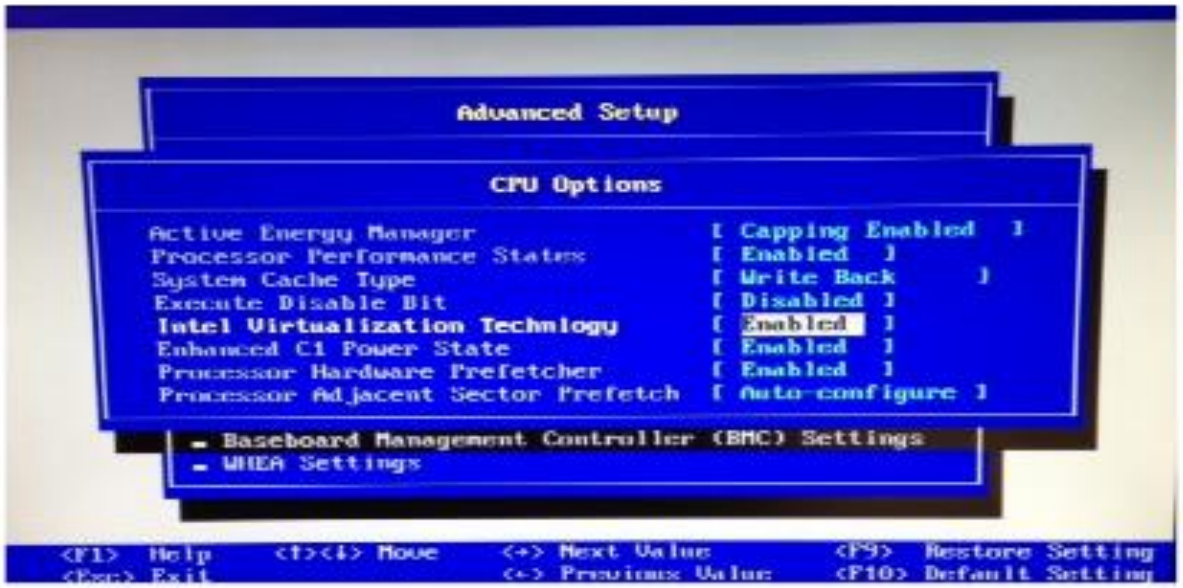
P Paravirtualized

	Disk / Network	Interrupts, Timers	Emulated Motherboard, Legacy boot	Privileged instructions and pagetables	
Full Virtualization (FV)	V	V	V	V	HVM mode
FV with PV disk, network	P	V	V	V	
PVHVM	P	P	V	V	
PVH	P	P	P	V	PV mode
Full Paravirtualized (PV)	P	P	P	P	

7. Cloud Virtualization Technology

7.5.1 Hardware based Virtual Machine(HVM)

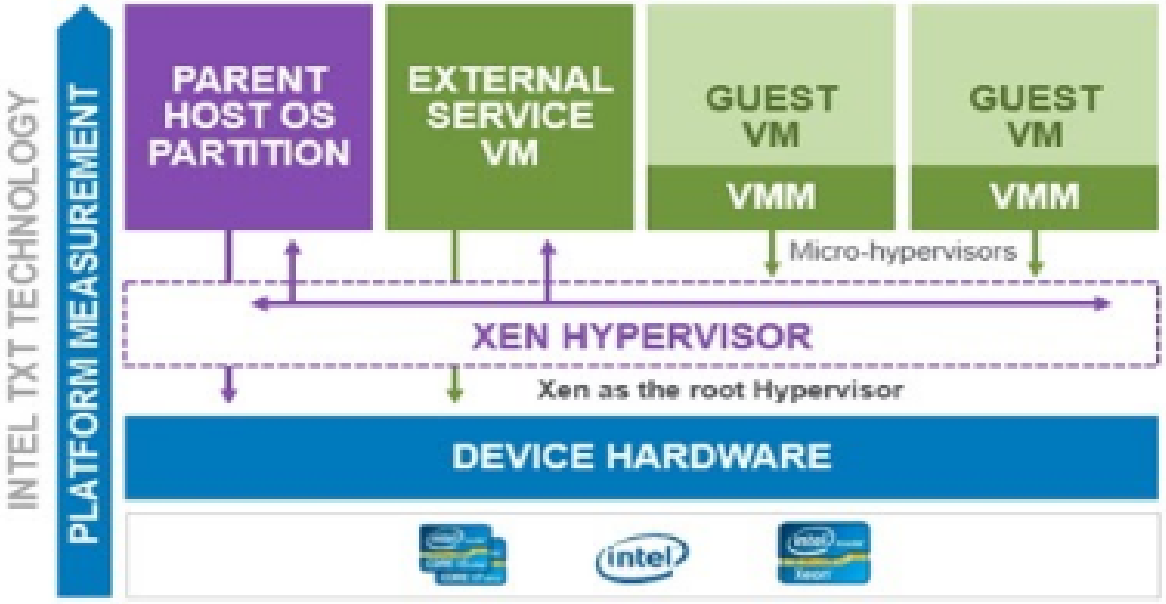
- Hardware based Virtual Machine or Hardware assisted Virtualization (HAV) is done possible by using new features developed by Intel and AMD
- These new features include Intel Virtualization Technology (VT-x) and AMD's AMD-V



7. Cloud Virtualization Technology

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 comr

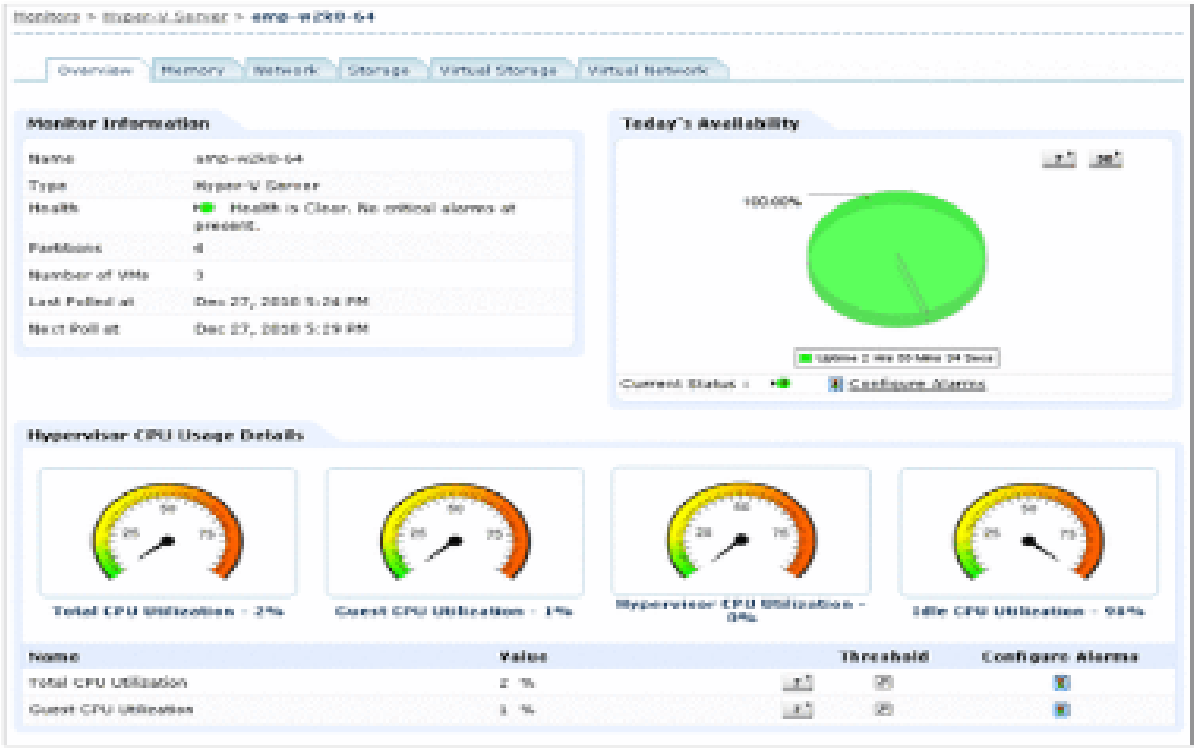


7. Cloud Virtualization Technology

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



Hypervisor

- Software that enables a user to create and run one or more virtual machines simultaneously.
- Also Known as the virtual machine monitor(VMM)

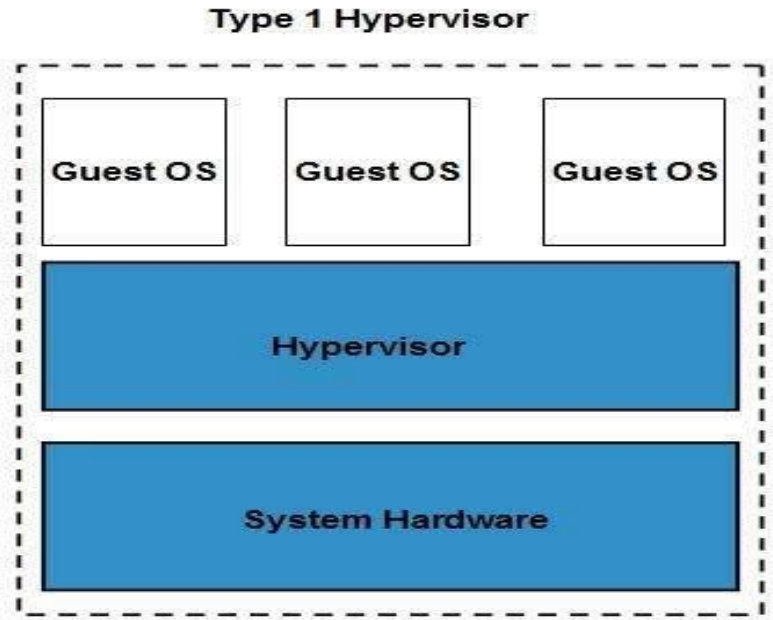
Functions:

- Isolation of VM
- Provisioning of Resources
- Starts and stops the VM
- Virtualizes all hardware resources

Types:

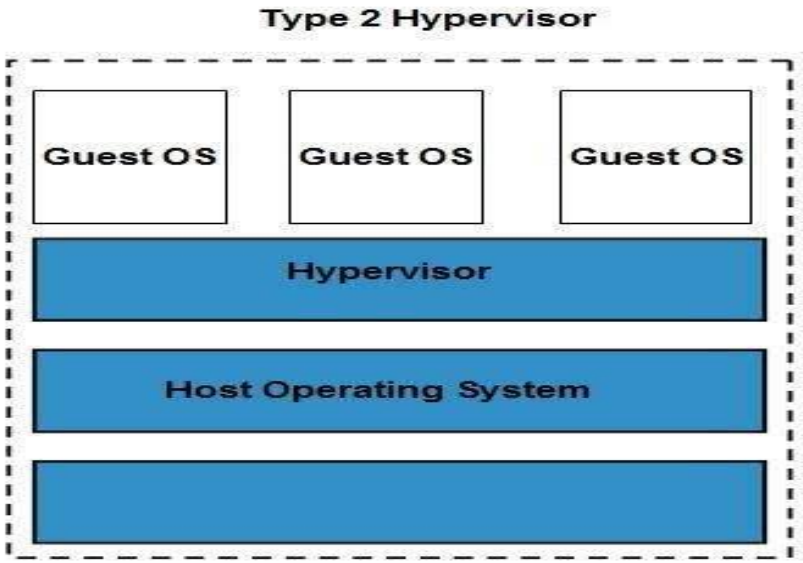
- Type 1: Bare Metal Hypervisor
- Type 2: Hosted Hypervisor

- **Type 1 hypervisor** executes on bare system. LynxSecure, RTS Hypervisor, Oracle VM, Sun xVM Server, VirtualLogic VLX are examples of Type 1 hypervisor. The following diagram shows the Type 1 hypervisor.



- The type1 hypervisor does not have any host operating system because they are installed on a bare system.

- **Type 2 hypervisor** is a software interface that emulates the devices with which a system normally interacts. Containers, KVM, Microsoft Hyper V, VMWare Fusion, Virtual Server 2005 R2, Windows Virtual PC and **VMWare workstation 6.0** are examples of Type 2 hypervisor. The following diagram shows the Type 2 hypervisor.

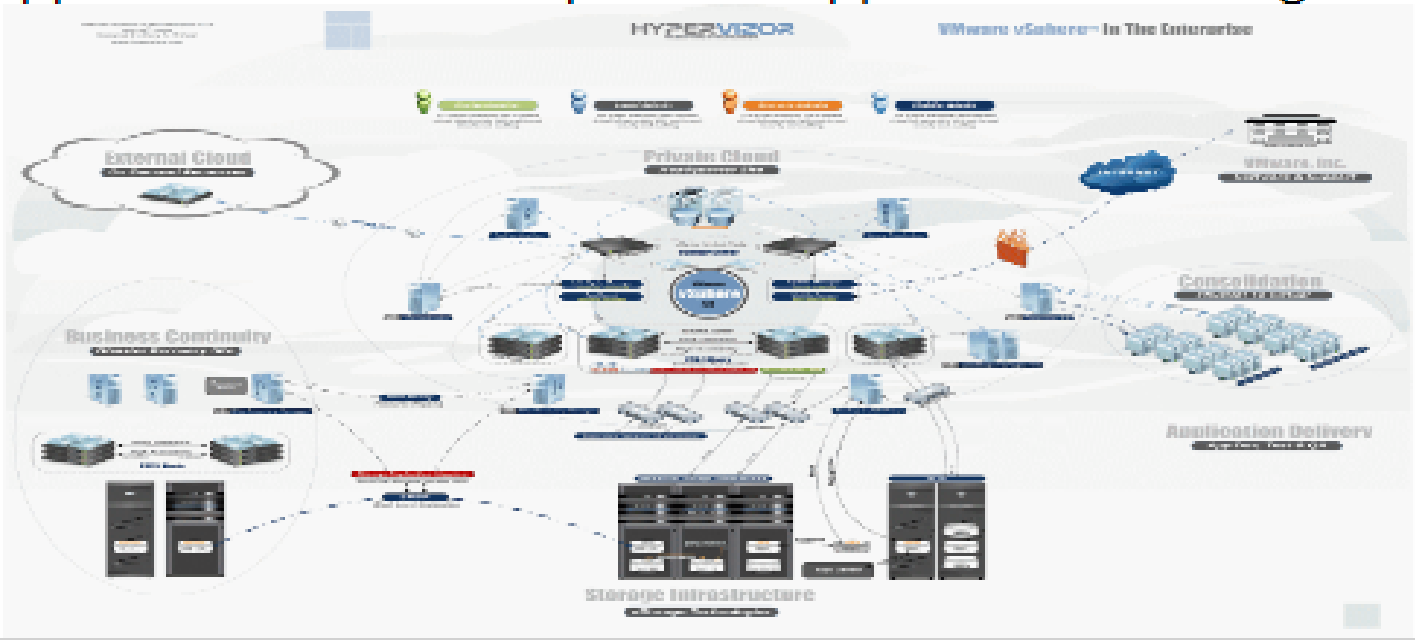


https://www.tutorialspoint.com/cloud_computing/cloud_computing_virtualization.htm

7. Cloud Virtualization Technology

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 supports ethernet transport mechanism. It also supports Virtual SCSI to provide support virtual storage.



7. Cloud Virtualization Technology

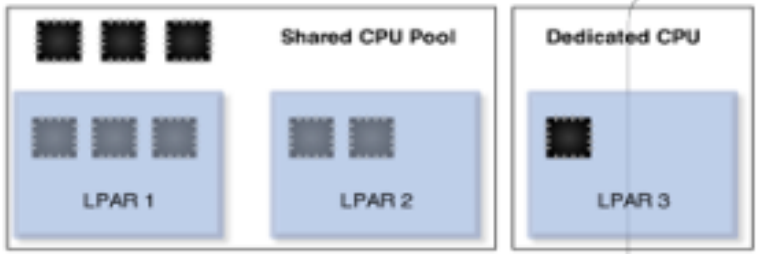
7.7.Logical Partitioning (LPAR).

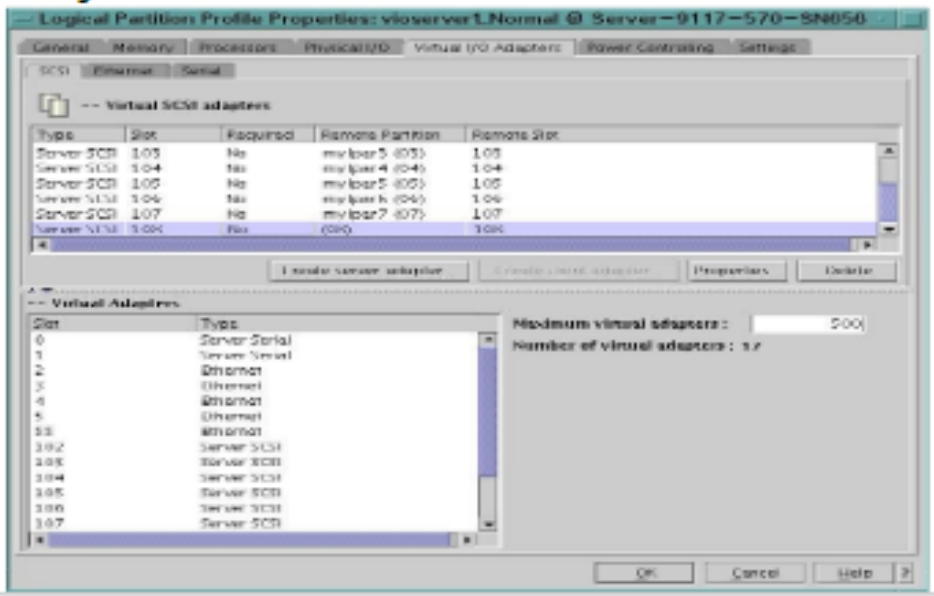
One single system can be logically divided in multiple partitions. Each such partition can host a standalone AIX/Linux server. Each such partition is called a LPAR.

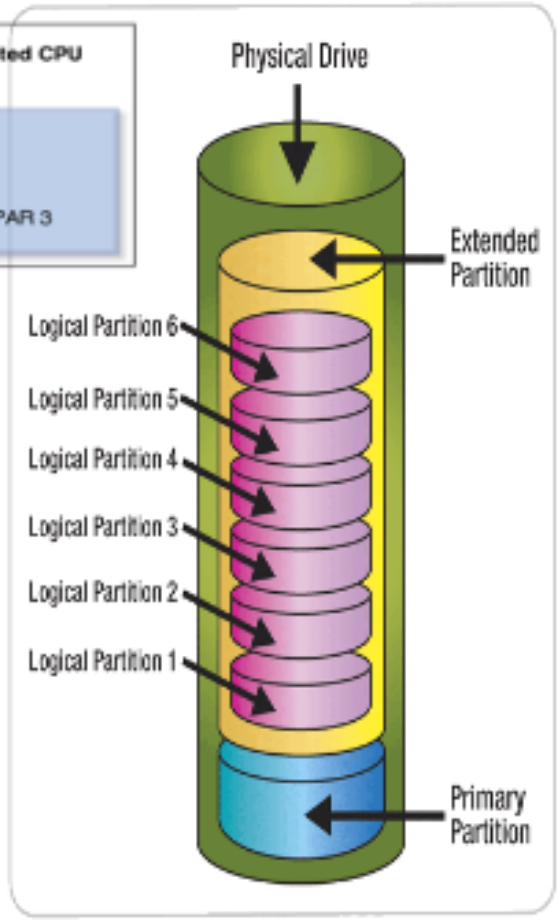
7. Cloud Virtualization Technology

7.7.1 Categories of LPAR

- Dedicated
- Shared
- Capped
- Uncapped
- Dynamic LPAR



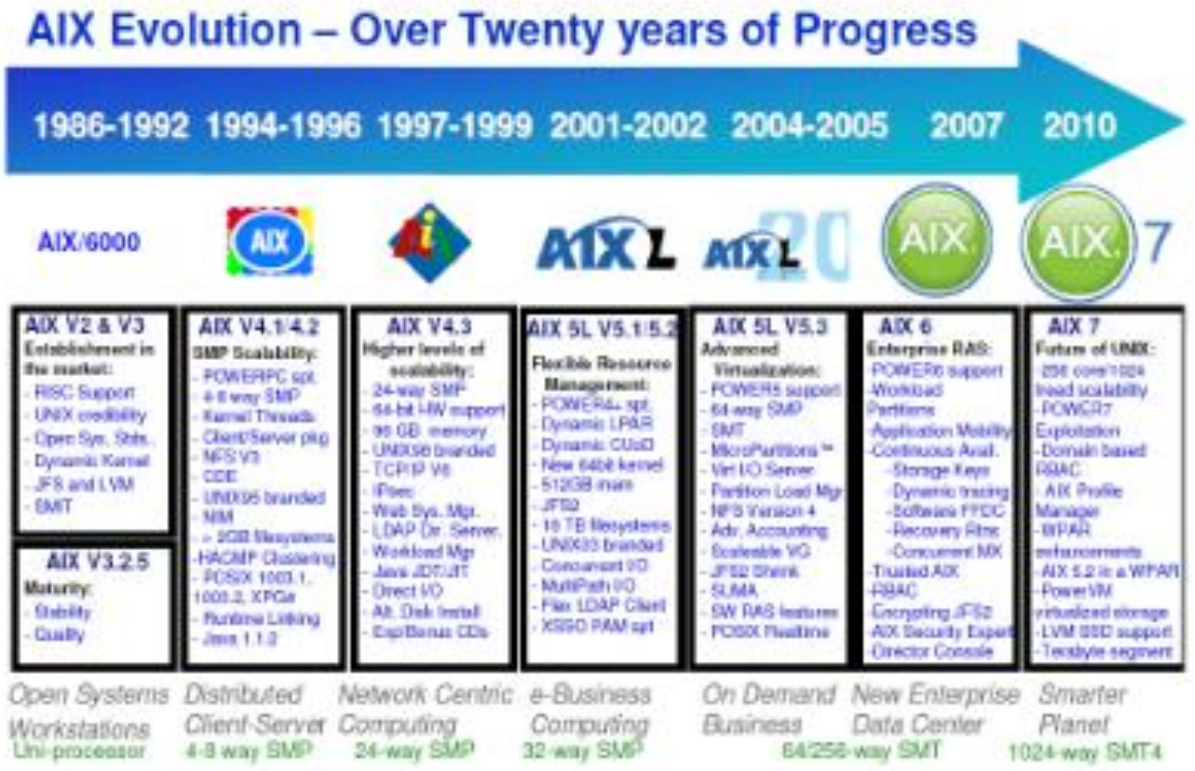




7. Cloud Virtualization Technology

7.7.3.LPAR Type

- VIO
- AIX/Linux

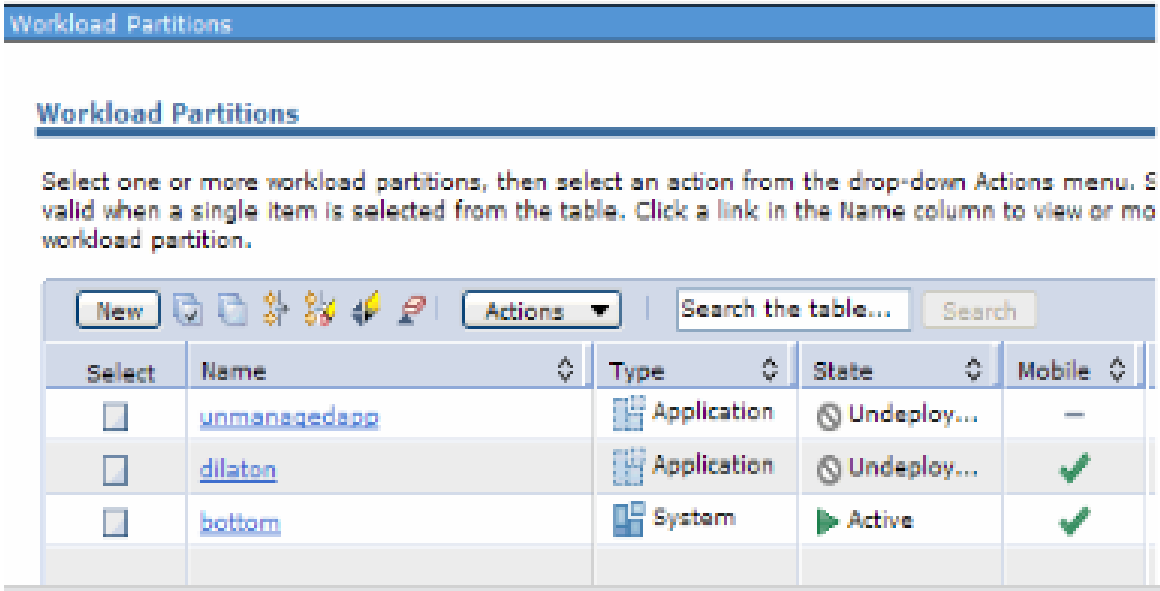


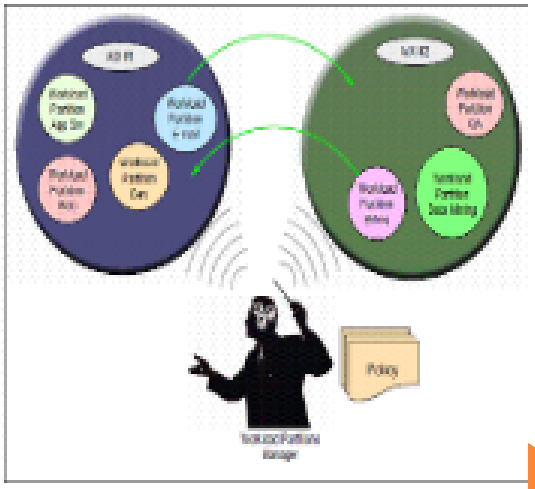
7. Cloud Virtualization Technology

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.

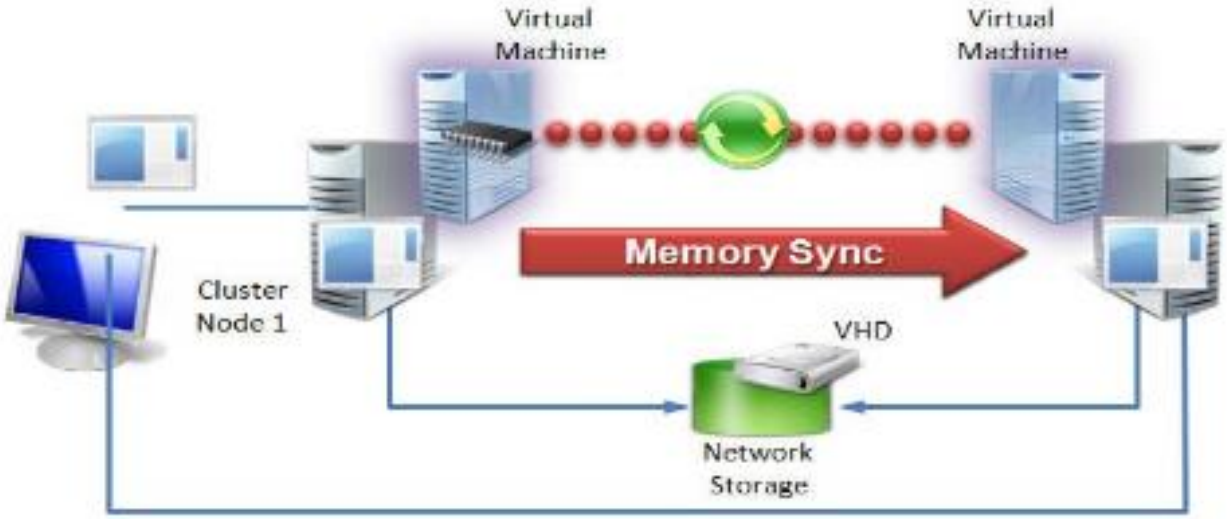




7. Cloud Virtualization Technology

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.

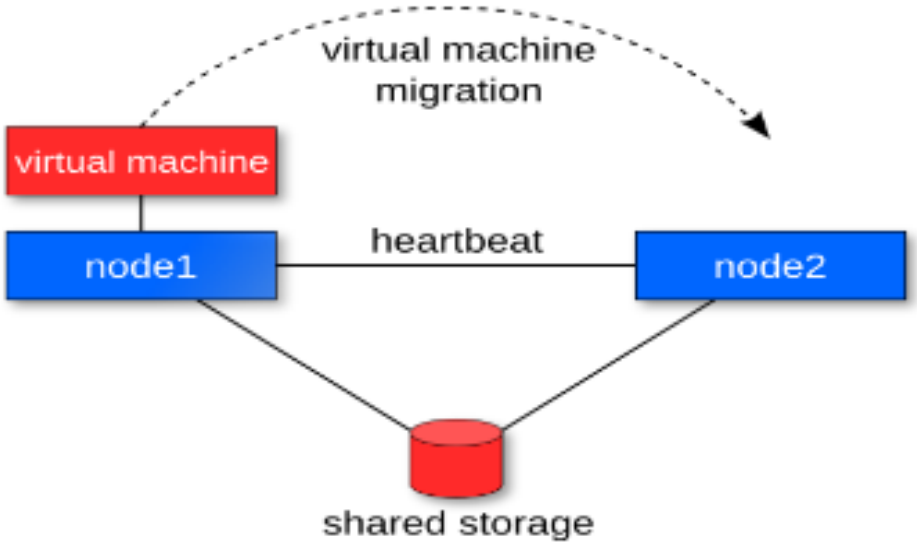


7. Cloud Virtualization Technology

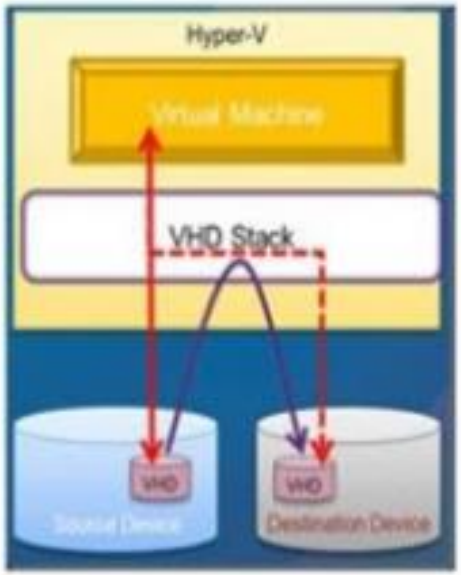
7.7.5 Live Migration

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

This provides protective maintenance.



Live Migration – Moving a Running VM without Shared Storage



standard Ethernet connection

1. Live Migration setup occurs
2. Memory pages are transferred from the source server to the destination server
3. Modified pages are transferred to destination server
4. State is transferred to destination server
5. VM brought online on destination server
6. Network cleanup occurs

7. Cloud Virtualization Technology

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.

7. Cloud Virtualization Technology

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

7. Cloud Virtualization Technology

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 assessment purposes.

7. Cloud Virtualization Technology

7.9.2 Detailed Design

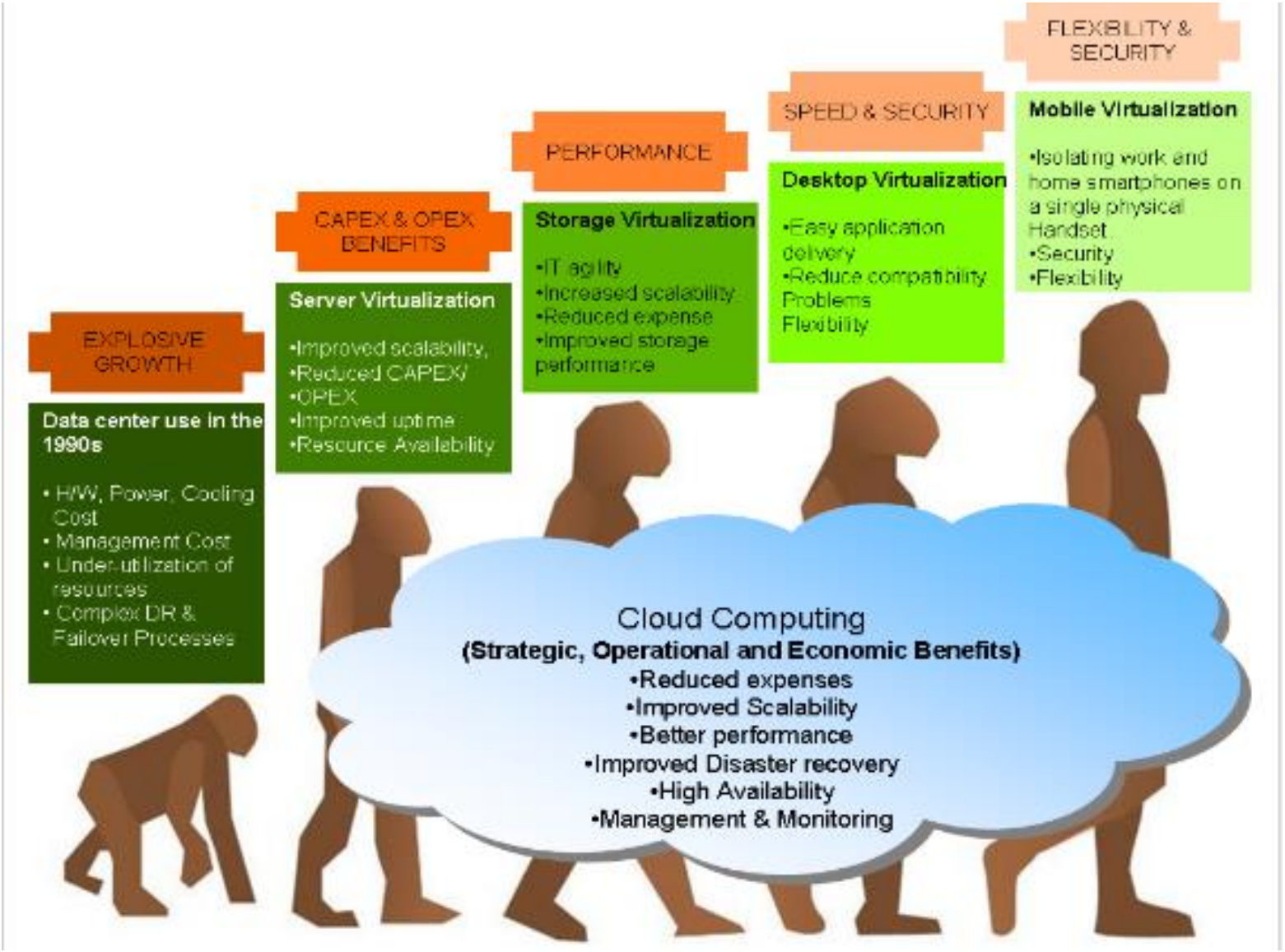
Virtualization introduces many changes into the environment, and ensures that the platform can co-exist and interact with existing infrastructure.

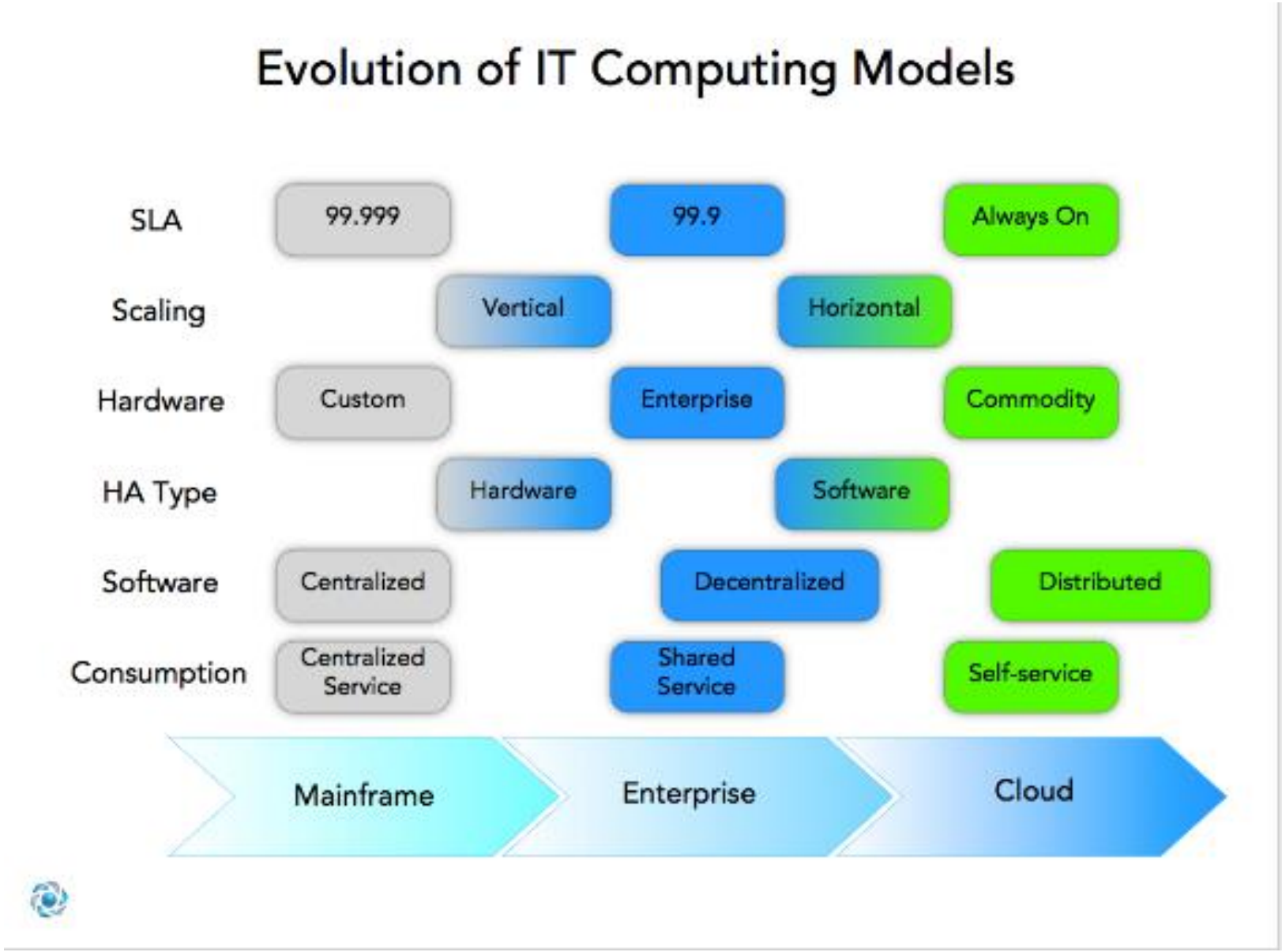
The purpose of detailed design to set naming and security standards, define the disk and network structure. It includes the following:

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

Advantages of Virtualization

- More flexible and efficient allocation of resources
- Enhance development Productivity
- It lowers the cost of It infrastructure
- Remote access and rapid scalability
- High availability and disaster recovery
- Pay per use of the IT infrastructure on demand
- Enables running multiple operating system


EXPLOSIVE GROWTH
Data center use in the 1990s
• H/W, Power, Cooling Cost
• Management Cost
• Under-utilization of resources
• Complex DR & Failover Processes
CAPEX & OPEX BENEFITS
Server Virtualization
•Improved scalability,
•Reduced CAPEX/ •OPEX
•Improved uptime
•Resource Availability
PERFORMANCE
Storage Virtualization
•IT agility
•Increased scalability
•Reduced expense
•Improved storage performance
SPEED & SECURITY
Desktop Virtualization
•Easy application delivery
•Reduce compatibility Problems
Flexibility
FLEXIBILITY & SECURITY
Mobile Virtualization
•Isolating work and home smartphones on a single physical Handset
•Security
•Flexibility
Cloud Computing
(Strategic, Operational and Economic Benefits)
•Reduced expenses
•Improved Scalability
•Better performance
•Improved Disaster recovery
•High Availability
•Management & Monitoring


Evolution of IT Computing Models
SLA
99.999
99.9
Always On
Scaling
Vertical
Horizontal
Hardware
Custom
Enterprise
Commodity
HA Type
Hardware
Software
Software
Centralized
Decentralized
Distributed
Consumption
Centralized Service
Shared Service
Self-service
Mainframe
Enterprise
Cloud