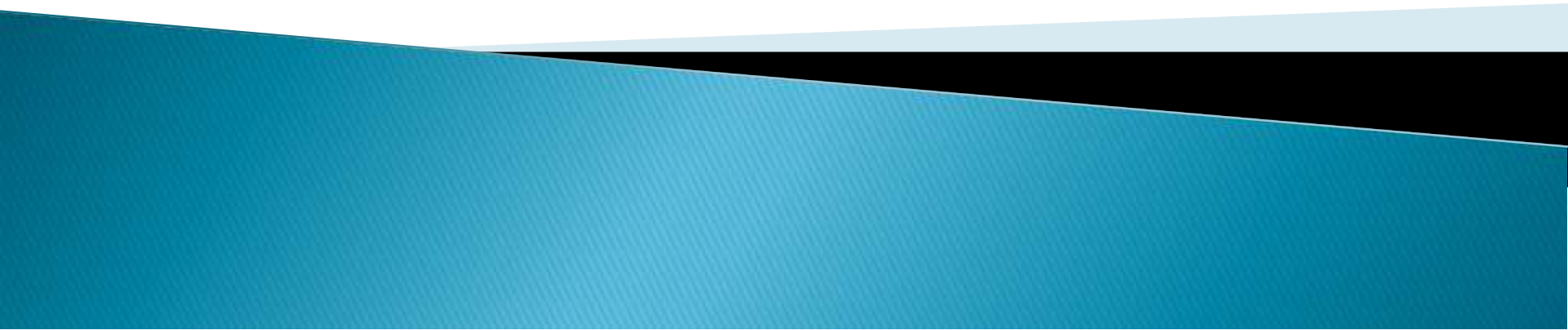


Cloud Computing– 18IS6DECCM

Module–I

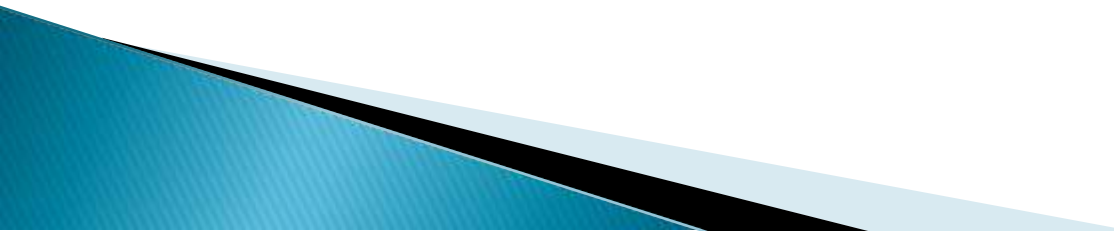


Module-I

First Drive

Introduction

Cloud Computing –

- Provides a major shift in small and medium business and enterprise IT.
 - It is primarily driven by **Internet**, and requires rapid provisioning, High scalability and Virtualization environment.
 - It provides abstraction for the business and is handled by the actual owners.
 - It provides Flexibility, Stability, Rapid provisioning, Scalability, Reliability and Green solution
- 

Grid Computing

A grid is made of number of resources and layer with different level of implementation.

- Information grid
- Compute grid
- Service grid
- A mix of them

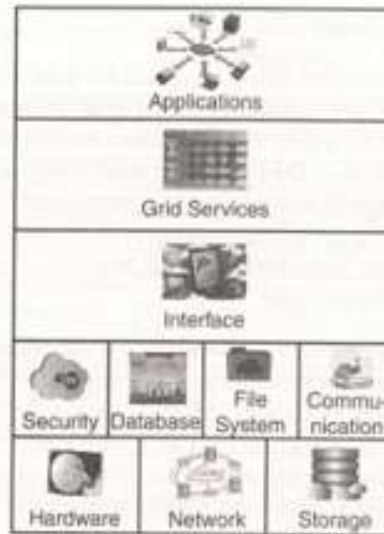
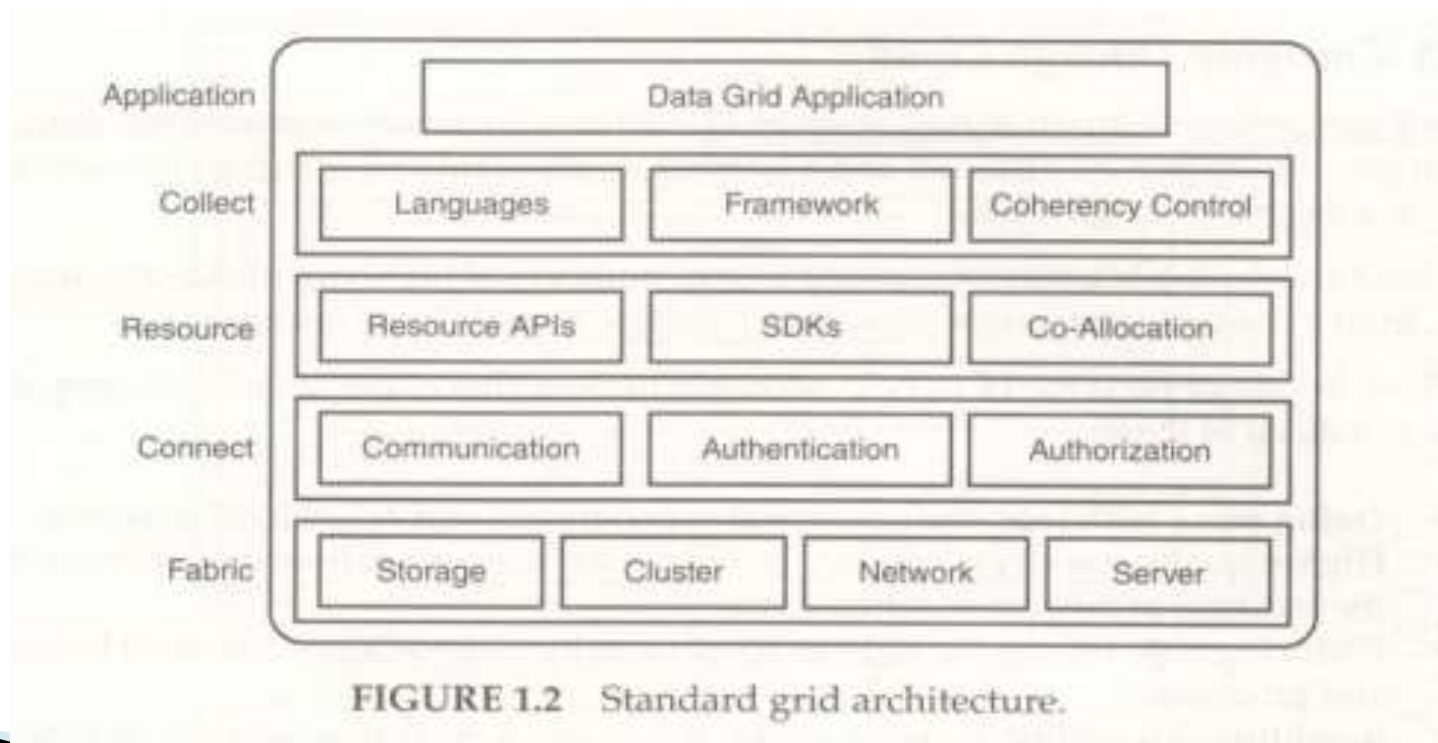


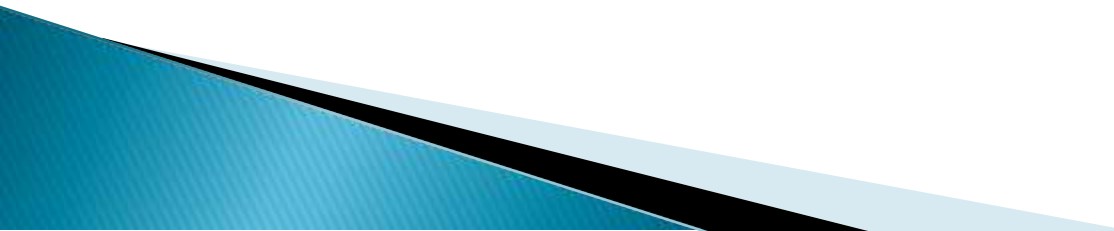
FIGURE 1.1 Simple grid architecture.

Benefits of Grid Computing

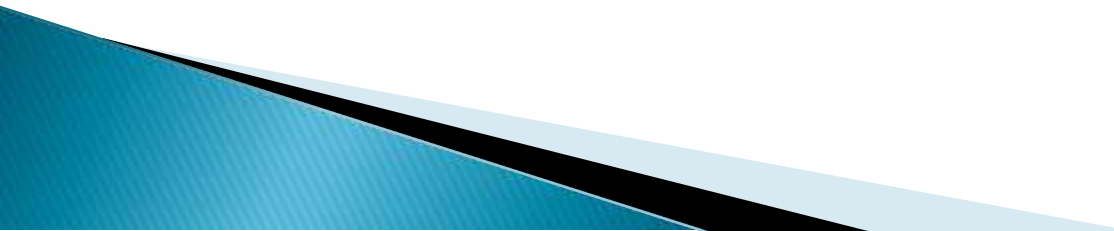
- ▶ Storage/ Data/ Information
- ▶ System Management
- ▶ Metering, Billing and SW licensing
- ▶ Security * Authentication * Authorization * Integrity



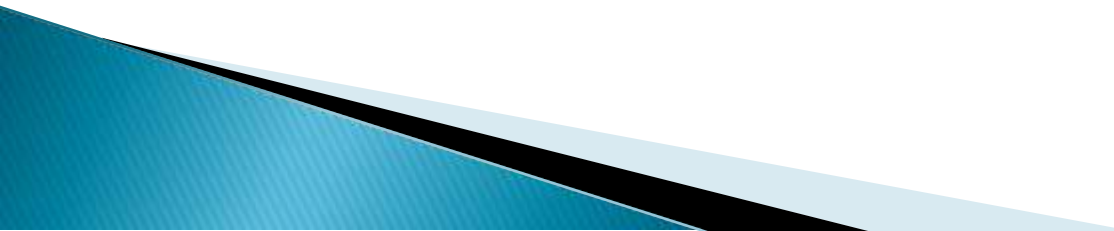
1.2 Essential

- ▶ * **Cloud Computing** –Is the means of delivering any, and all information technologies, from computing power to computing infrastructure, application, business process and collaboration –to end user as service wherever and whenever it is needed.
 - ▶ * **Cloud Computing** –Is a set of Hardware, Software, Network, Storage, Service and interface that combine to deliver computing as a service.
 - ▶ **Emerging Through Cloud:**
 - ▶ Cloud Computing is an emerging style of IT delivery in which application, data and IT recourses and rapidly provisioned and provided as standardized offering to user over the web in a flexible pricing model.
- 

Emerging Through Cloud

- ▶ Cloud Computing – Is managing large number of highly virtualized resources such that, they resemble a single large source.
 - ▶ Cloud Computing can help IT business challenges as
 - * Do more with less
 - * High quality service
 - * Reducing Risk
 - * Breakthrough agility
- 

Benefits

- ▶ * Cloud Computing– can reduce IT cost and complexity.
 - ▶ * Allows to acquire service without understanding the under laying technologies
 - ▶ * Dynamic scalable resources (CPU, Storage or Bandwidth)
 - ▶ * Resources multiplexing
- 

Why Cloud ?

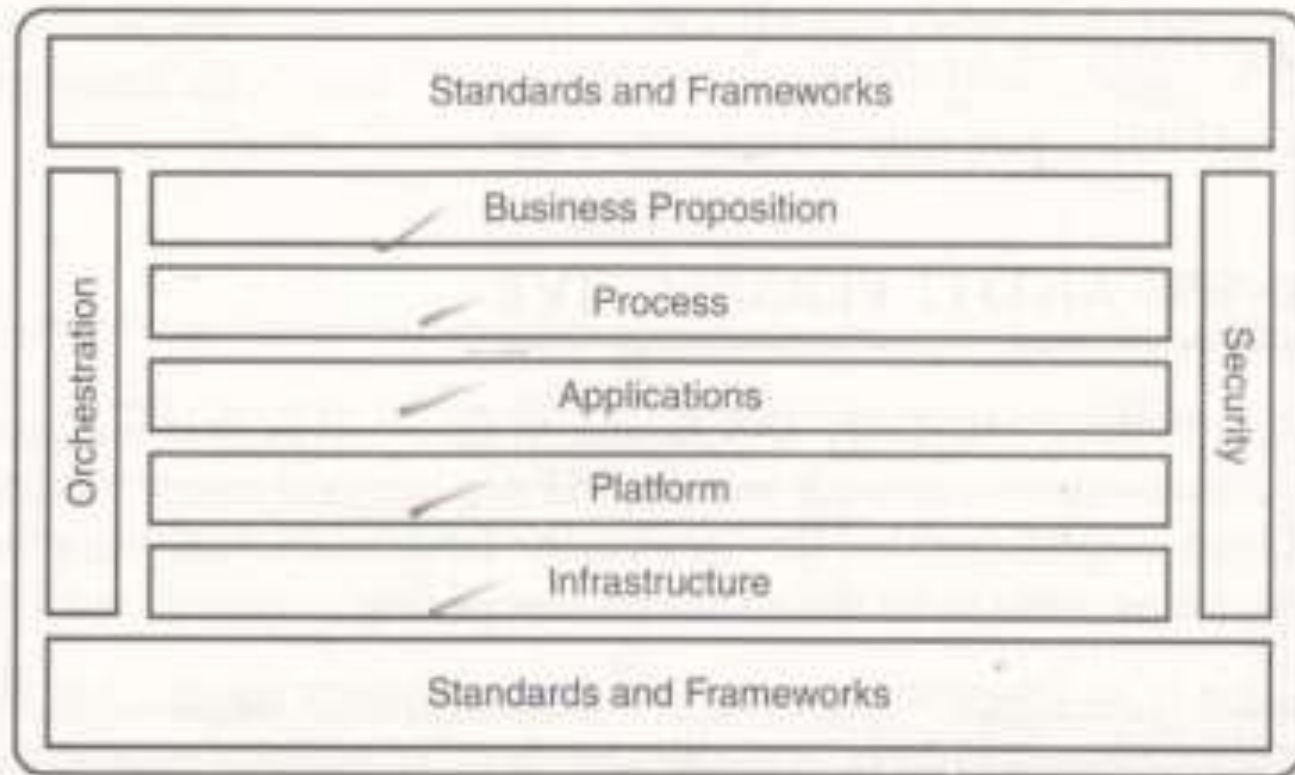
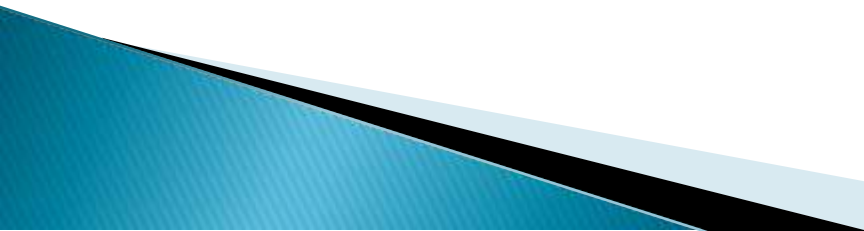


FIGURE 1.3 Basic cloud computing model.

Different Reason for adopting cloud

- ▶ * Massive, Web-scale abstracted infrastructure
- ▶ * Dynamic allocation, scaling, movement of application
- ▶ * Pay per use or Pay as you use or Pay for what you use
- ▶ * No long term commitments
- ▶ * Operating System, Application architecture independent
- ▶ * No Hardware or Software to install

Benefits at Business and IT sector

- * Accelerate innovation project that can lead to new revenues
 - * Make IT an enabler of, not barrier to, rapid innovation.
 - * Provide an effective and creative service delivery model.
 - * Deliver service in a less costly and high quality business model, while providing service access ubiquity.
 - * Create a sustainable competitive differentiation.
 - * Rapid deploy application over the business and leverage new technologies to delivery service when, where and how clients wants them before competitors do.
 - * lower IT barriers to launch new business services.
 - * Build and integrate modular services – in record time –by leveraging ‘rentable ‘ IT service capabilities, pay only for what you use.
- 

1.5 Business and IT perspective

1.6 Cloud and Virtualization

Cloud service efficiency is achieved by

- * Virtualizing
- * Standardizing
- * Automating
- * Virtualizing – Server/Storage/ Network
- * Automation – Self service portal
 - – Automated provisioning
- * Standardization through
 - Service catalogue ordering
 - Flexible pricing, Utility pricing, Variable payments, Pay-by-consumption with metering and subscription models

Virtualization

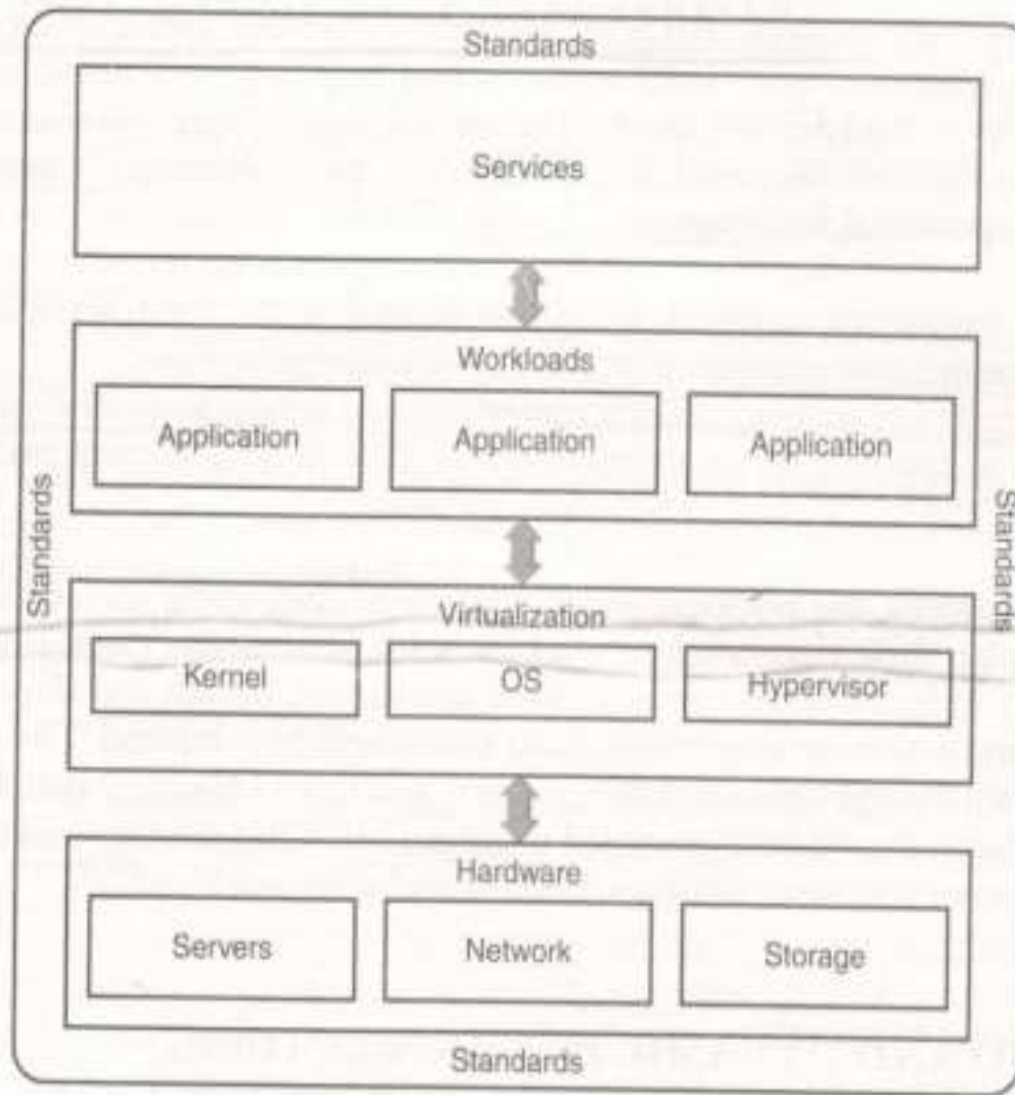
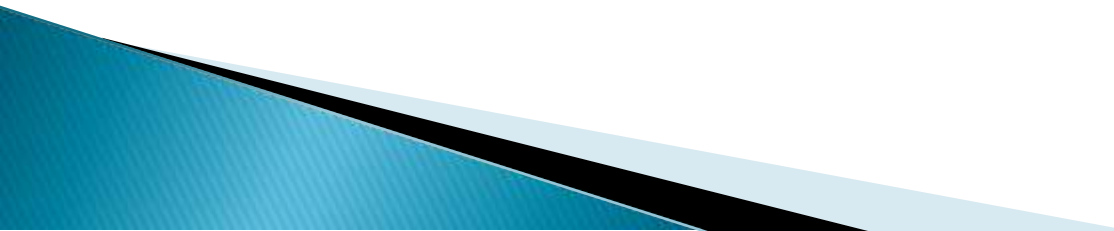


FIGURE 1.4 Datacenter clouds.

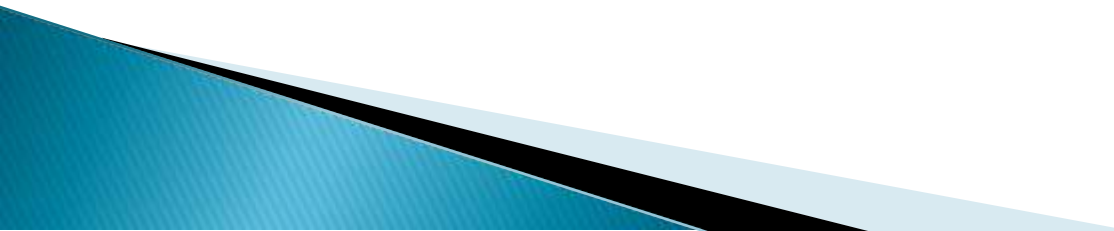
Cloud Service Requirements

- ▶ Most cloud computing vendors offer point solution and product offering.
 - ▶ Advantage of Cloud computing offering
 - ▶ * A proven service management system embedded with cloud service to provide visibility, control and automation across IT and business service.
 - ▶ * Service targeted at certain infrastructure workloads to help accelerate standardization of service, supporting significant productivity gains and rapid client payback on their investment.
- 

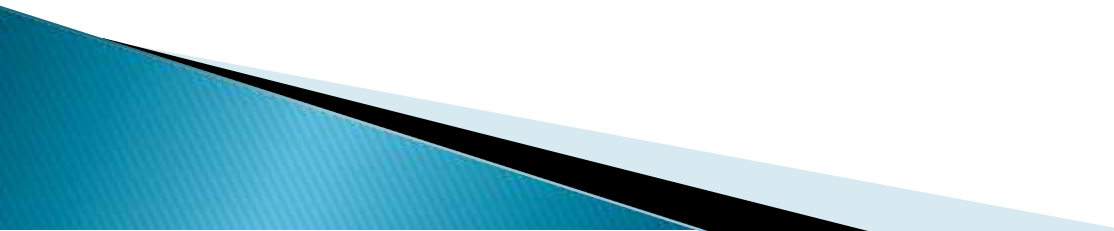
Cloud and Dynamic Infrastructure

- ▶ Cloud computing – Allows clients to access standardized IT resources to deploy new application, service, computing resource rapidly without re-engineering their entire infrastructure, thus making it dynamic.

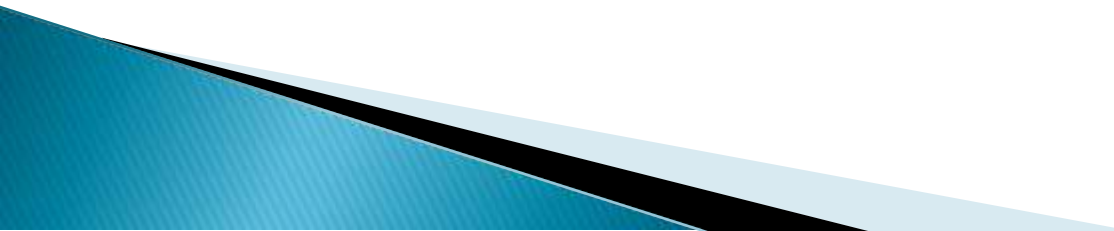
Cloud dynamic infrastructure is based on an architecture that combines the following initiative.

- ▶ * Service management – Provides visible control and automation across all business and IT assets to deliver high value service
 - ▶ * Asset management – Maximize the value of the critical business and IT asset over their lifecycle with industrial tailored asset management solution.
 - ▶ * Virtualization and Consolidation – Reduce operating cost, improves responsiveness and utilizes resources more fully.
 - ▶ * Information infrastructure – Help business achieve information compliance, availability, retention and security objectives.
- 

Cloud and Dynamic Infrastructure

- ▶ * Energy Efficiency –Addresses energy, environment and sustainability challenges and opportunities across the business and IT infrastructure.
 - ▶ * Security –Provide end-to-end industry customize governance, risk management, and compliance for business.
 - ▶ * Resilience – Maintain continuous business and IT operation while rapidly adapting and responding to risk and opportunities.
- 

1.9 Cloud Computing Characteristics

- ▶ Cloud computing uses commodity based hardware as its bases and commodity based software container system.
 - ▶ **Cloud Computing Barriers** – There are four major barriers to adoption of cloud services.
 - ▶ * **Security** – Data security – Limited Knowledge of location of stored data.
 - Belief that multiple tenant platform are less secure compared to single tenant platform.
 - Virtualization is a relatively new technology.
 - Limited capability of monitoring access to application in the cloud.
- 

Cloud Computing Barriers


- **Governance and regulatory compliance**
 - – Data privacy
 - – Quality of Service(QoS) –Availability, Reliability and performance
 - – Service Level Agreement (SLA)
- **Integration and Interoperability**
 - – Identifying and migrating appropriate application to the cloud is made complicated by interdependences–With no standard API
 - – It is worse if service involves multiple vendors.
- **Whether the workload are suitable**
 - – What application are suitable to be deployed.



Cloud Adoption

- Business function that suit cloud deployment are low-priority business application.
- Cloud favours traditional web based application and interactive application.
- Cloud on technical characteristics support application that are modular and loosely-coupled, Isolated workload, Single virtual appliances workload, software development and testing.
- Application that need significantly different infrastructure throughout the day/ throughout a month or seasonal demand / during the end of quarters close or holiday shopping season.
- Application with mission-critical, data sensitive, core business application, high level of auditability and accountability are not suitable for cloud as they cant share high important data, processing power and hardware with third party.
- Application that run 24x7x365 with steady demands and application consume significant amount of memory, cache and database or dataset.
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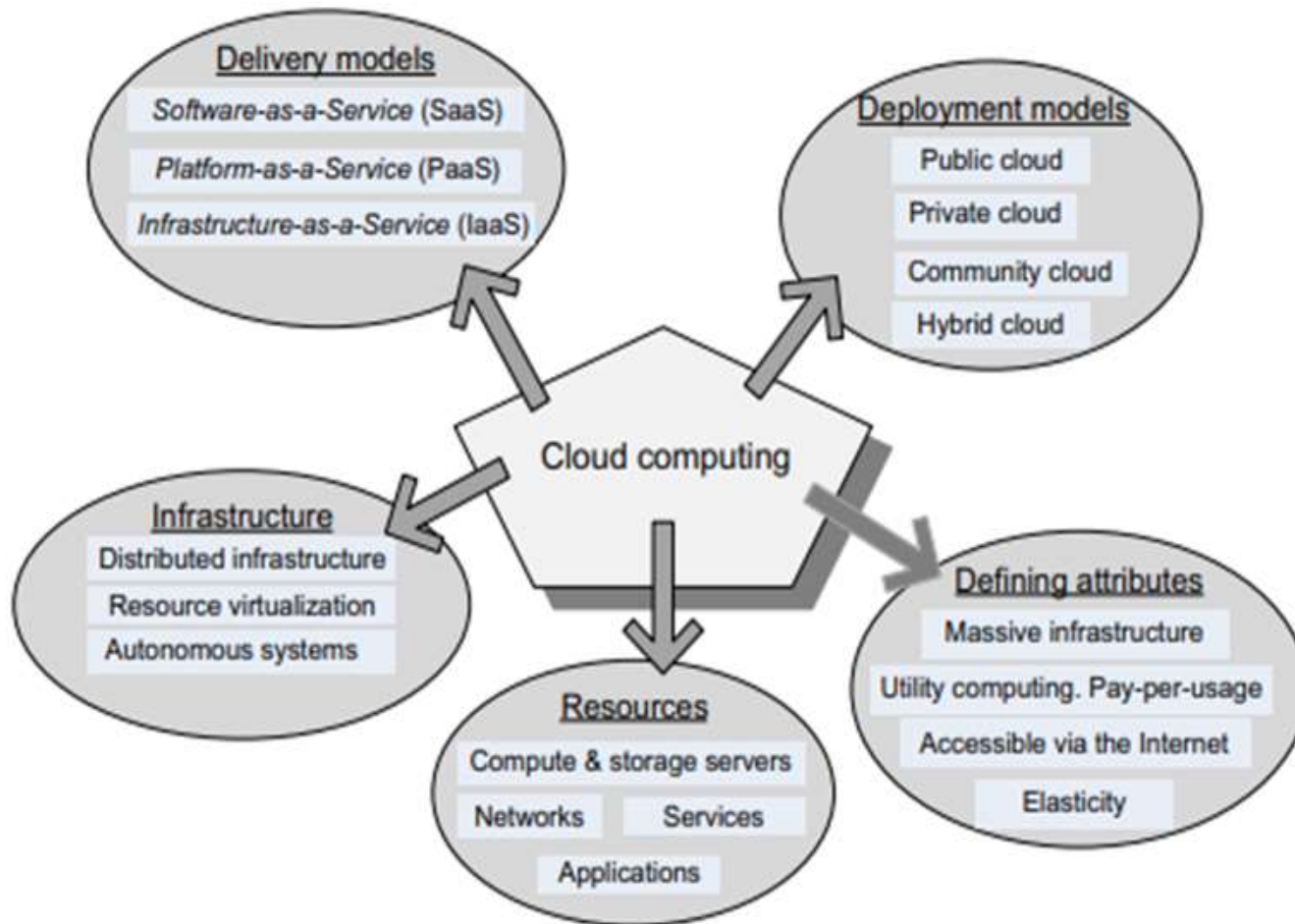
Cloud Rudiments

- ▶ High-level capabilities of any cloud include
 - ▶ * Resource aggregation and integration
 - ▶ * Application service
 - ▶ * Allocation engine
 - ▶ * Reporting and accounting
 - ▶ Cloud feature to bring agility and transparency with increase in utilization.
 - ▶ * Self-service
 - ▶ * Dynamic workload management
 - ▶ * Resource automation
 - ▶ * Changeback, Showback and Metering
 - ▶ * Open Architecture
 - ▶ * Image pools
 - ▶ * Role-based access administration
 - ▶ * virtualization
- 

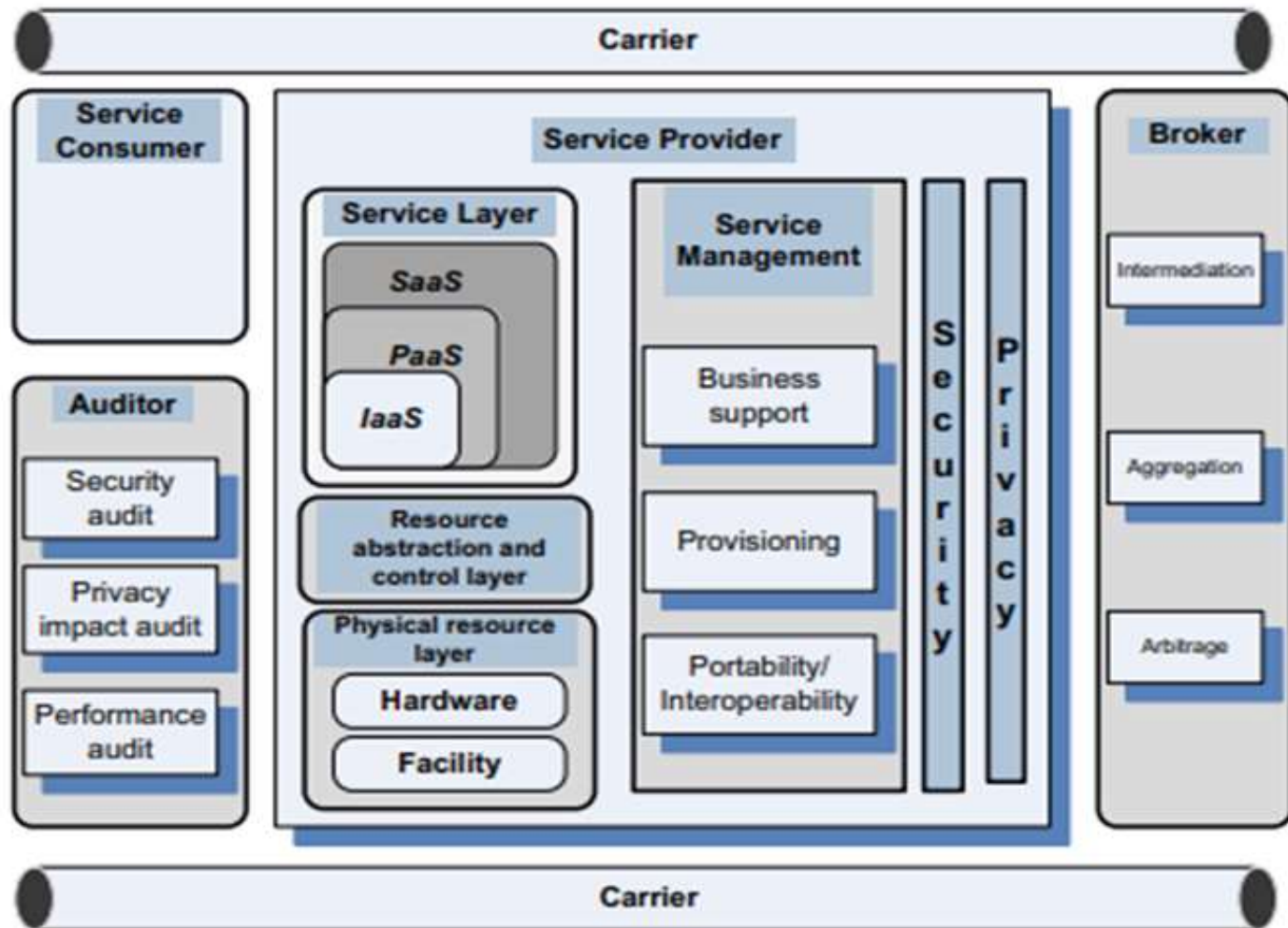
Cost Saving with cloud

- ▶ Faster Time-to-Market (Missed business opportunity)
- ▶ Public cloud Interfaces
- ▶ Automated Scaling
- ▶ Business Transparency
- ▶ Benefits
 - * Increase agility on the IT datacenter resource and innovation
 - *

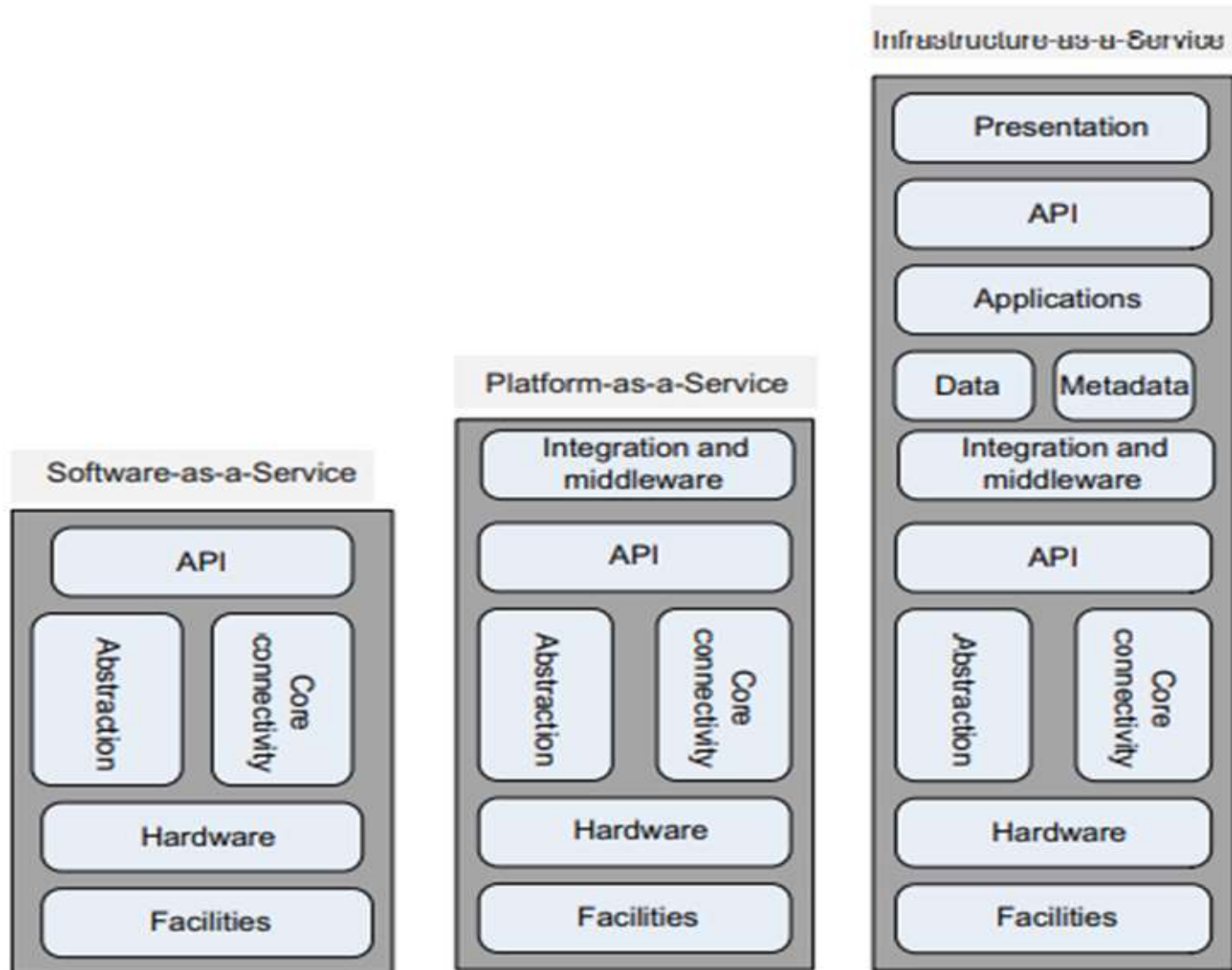
Cloud Computing Entities



NIST Reference Model



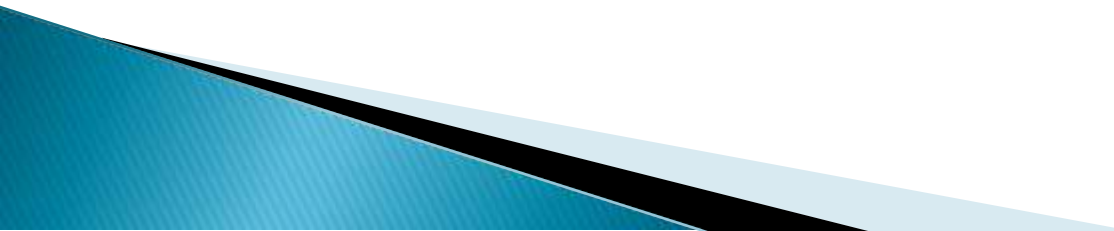
Cloud Delivery Model



Cloud Computing

- ▶ **Cloud Computing** – Is an emerging style of computing where application data, and resources are provided to user as service over the web. The service provided may be available globally, always on, low at cost, on demand, massively scalable, 'pay-as-you-grow'. Consumers of a service need to care only about what the service does for them, and not on how it is implemented. Cloud computing is a technology that allows users to access software, application, store information, develop and test new software, create virtual servers and more all over the internet.

Cloud Characteristics

- ▶ Cloud carries the basic infrastructure characteristics that are helpful to deploy cloud service in a fast and cost effective way. The following characteristics set apart cloud from computing techniques.
 - ▶ * On-Demand Service
 - ▶ * Ubiquitous Network Access
 - ▶ * Location Independent Resource Pooling(Multi-Tenant)
 - ▶ * Rapid Elasticity
- 

Cloud Model

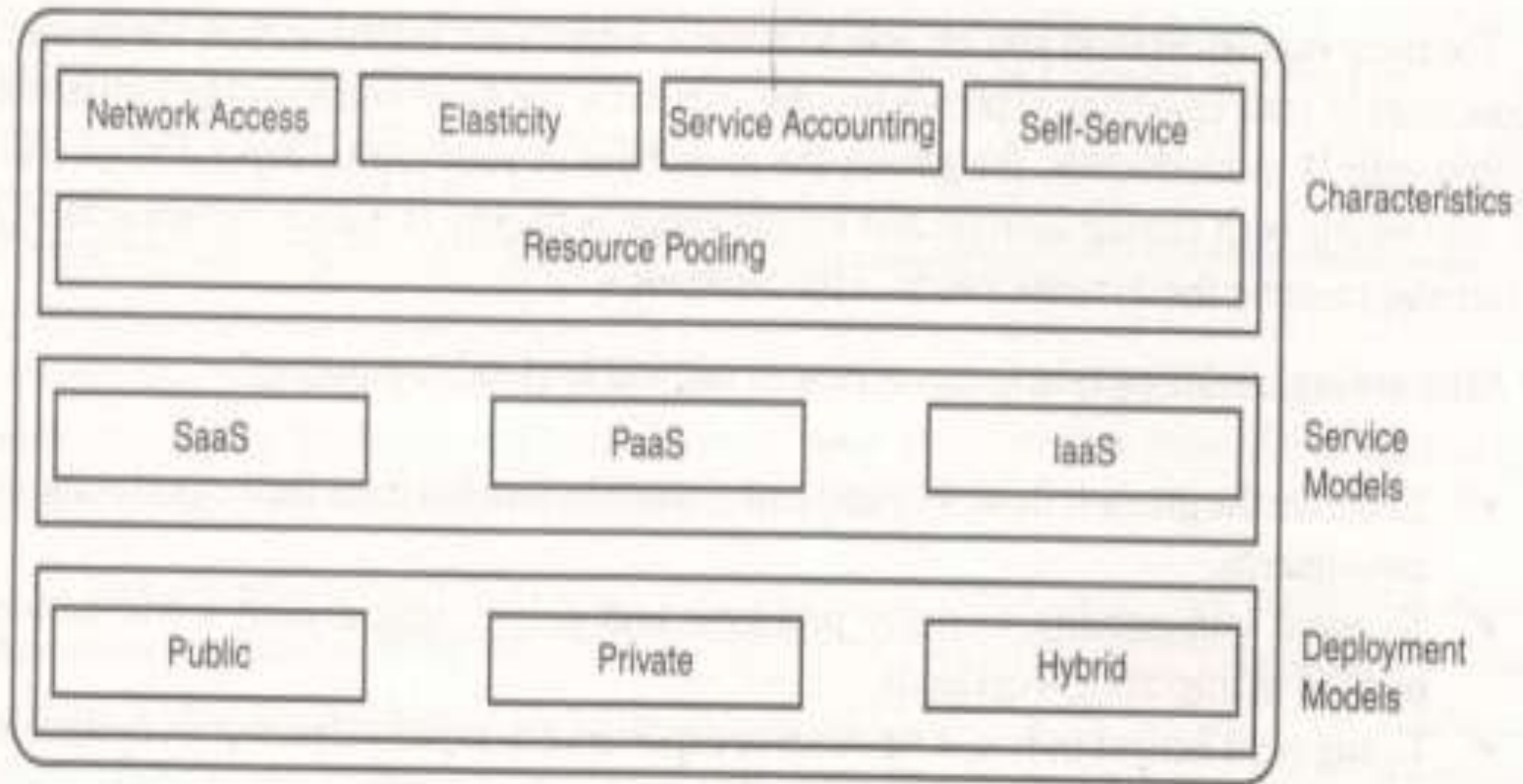
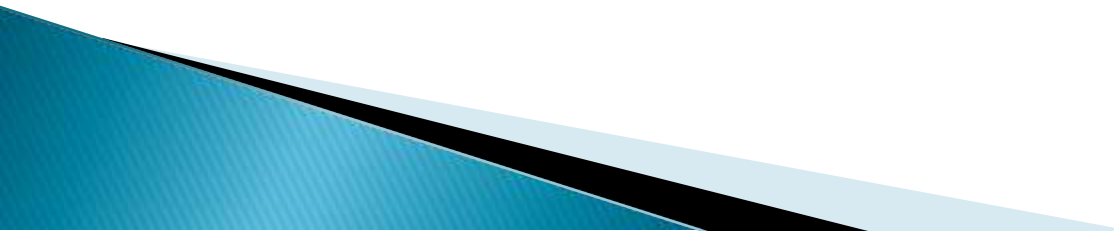


FIGURE 2.1 Cloud model.

Measured Service

- ▶ Resource usage can be monitored, controlled, and reported, providing transparency for both provider and the consumers of the utilized service.
- ▶ Standardization and virtualization is key to reduce infrastructure costs.
- ▶ Why are organization taking action now to migrate to cloud computing?
 - ▶ * To derive flexibility and cost reduction benefits.
 - ▶ * To avoid vulnerability to costly problems and delays arising from a trail-and-error method of migrating workloads.
 - ▶ * To augment limited in-house resource to smoothly migrate workloads to a cloud computing environment.
- ▶ Cloud vendors can address client's challenges by
 - ▶ * Prioritizing workload for cloud adoption based on business impact and risk.
 - ▶ * Maximizing business returns by identifying application that are well suited for cloud computing and have high business impact,
 - ▶ * Addressing problematic workloads to improve their propensity for cloud computing.
 - ▶ * Help avoid costly implementation issues.
 - ▶ * Avoid inadequate performance of highly complex and integrated workload.
 - ▶ * Deliver an actionable roadmap to successfully migrate application to cloud.
 - ▶ * Accelerating cloud initiatives.
- ▶ **Cost Factor**– Virtualization and Standardizing.

Benefits– Adopting Cloud

- ▶ * Self-Service Capability
 - ▶ * Resource availability
 - ▶ * Operational efficiency
 - ▶ * Hosted tools
- 

Cloud Deployment Models–Private, Public and Hybrid

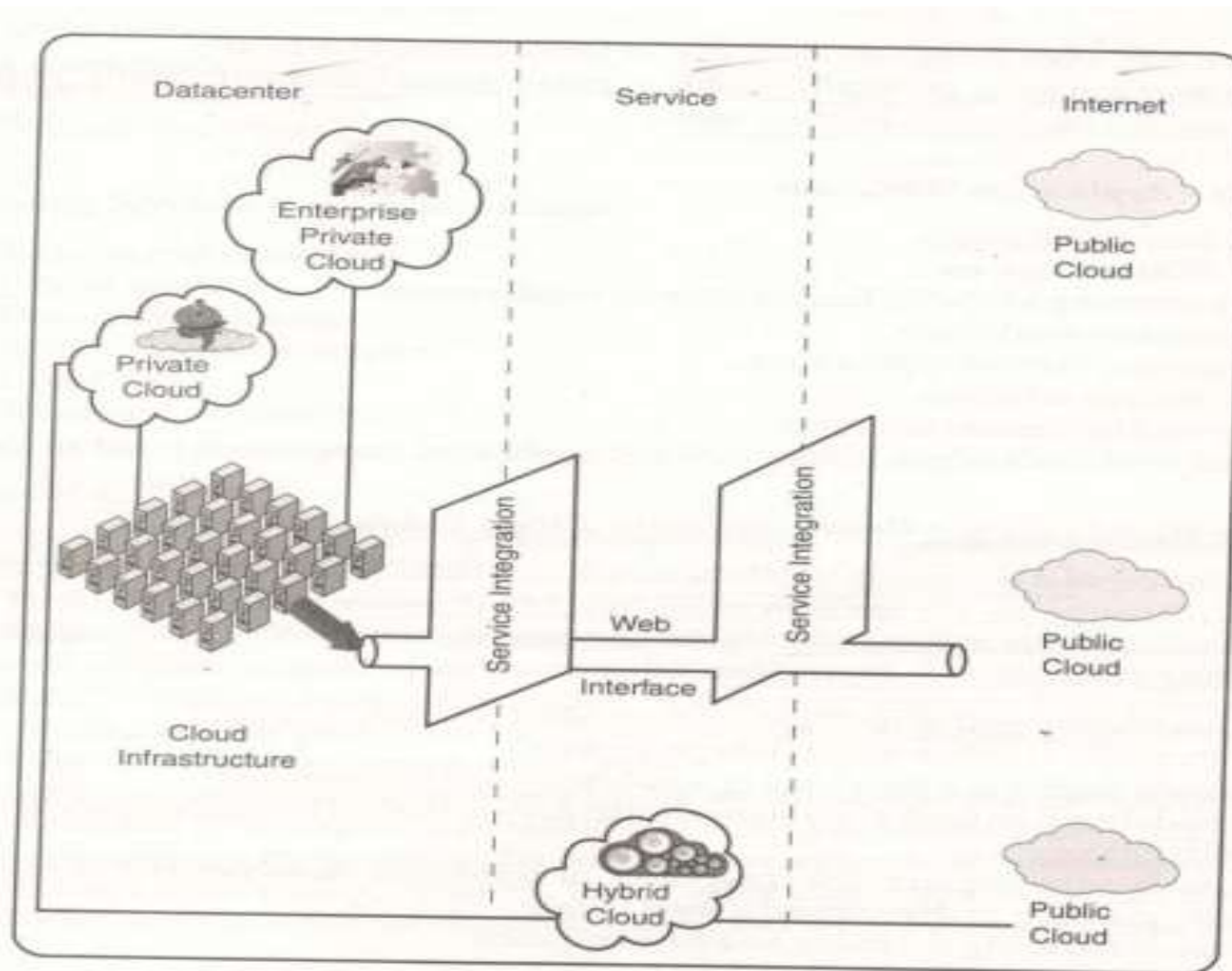


FIGURE 2.2 Private, public, and hybrid clouds.

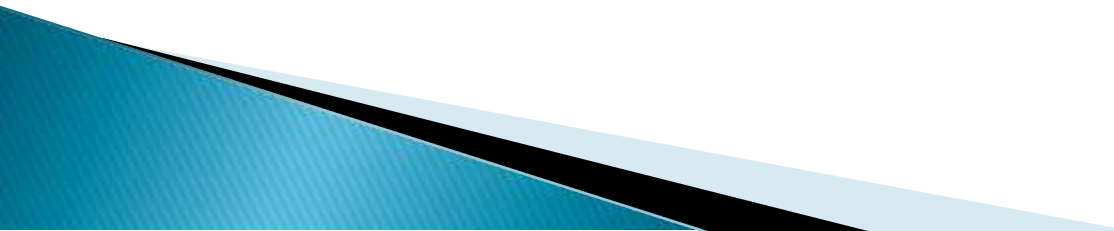
Public Clouds

- ▶ Public clouds are available to client from a third party service provider via the internet. Public cloud provide elastic, cost-effective means to deploy solution and take care of deploying managing and securing the infrastructure. Public does not mean
 - * It is available free
 - * The user data is publically visible
- ▶ Public Cloud –Application workloads
 - ▶ * Public facing web pages
 - ▶ * Public WiKi,s blogs, etc
 - ▶ * Batch processing jobs with limited security requirements
 - ▶ * Data intensive workload
 - ▶ * Software-as-a-Service application
 - ▶ * Online storage solution
 - ▶ * Online backup/ restore solutions.
 - ▶ * Isolated workloads where latency between application components is not an issues.

Application workload not ready for public cloud today

- ▶ * Workload composed of multiple co-dependent services.
- ▶ * High throughput online transaction processing.
- ▶ * Workload requiring a high level of auditability and accountability.
- ▶ * Workload based on third party software that does not have a virtualization or cloud aware becoming strategy.
- ▶ * Workloads requiring detailed chargeback or utilization measurement as required for capacity planning or department level billing.
- ▶ * Workload requiring flexibility and customization.
- ▶

Private Cloud

- ▶ Private cloud are deployments made inside the company's firewall (data center) and traditionally run by on-site servers.
 - ▶ Services in private cloud
 - ▶ * Virtualization
 - ▶ * Government and management
 - ▶ * Multi-tenancy
 - ▶ * Consistent deployment
 - ▶ * Chargeback and pricing
 - ▶ * Security and access control
 - ▶ Consuming services from public cloud
 - ▶ * Security and data privacy
 - ▶ * Ease of access
 - ▶ * Discovery of services
 - ▶ * RESTful interface support
 - ▶ * Lower cost
 - ▶ * Speed and availability
- 

High cost of privacy

- ▶ * Eliminating capital expenses and operating costs.
- ▶ * Removing undifferentiated heavy lifting by offloading datacenter operation.
- ▶ * Private clouds provide more control.
- ▶
- ▶ Hybrid Clouds
- ▶ Hybrid cloud is a combination of an interoperating public and private cloud. It offers the best of both clouds, that is scale and convenience of a public cloud. Control and reliability of on-premises software and infrastructure. The model allows elasticity, pay-as-you-go-pricing, network isolation and secure connectivity.
- ▶ Community Clouds
- ▶ A community cloud is controlled and used by group of organization that have shared interest such as a common mission.
- ▶ Shared private cloud
- ▶ Shared compute capacity with variable usage based pricing to business units that are based on service offering, accounts datacenters and it requires an internal profit centre to take over or buy infrastructure made available through account consolidations.
- ▶ Dedicated private cloud
- ▶ Dedicated private clouds has IT services catalogue with dynamic provisioning.
- ▶ Dynamic private cloud
- ▶ Allows client workload to dynamically migrate to and from the compute cloud as needed.

Cloud Models Impact

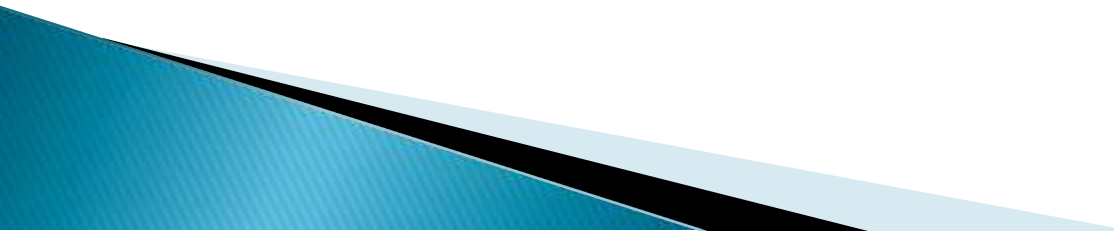
Cloud will transform the IT industry. They will profoundly affect how we live and how business operates.

Cloud Computing

- * Provide massively scalable computing resource from anywhere.
- * Simplifies service delivery.
- * Provides rapid innovations.
- * Provides dynamic platform for next generation datacenter.

It is Grids or Utility computing or Software-as-a-Service, it is also combination of all.

Public Clouds: Benefits

- * Lower barriers to entry/ upfront investment.
 - * Offer self-service for rapid-start development.
 - * Deliver new pricing models for hardware software, and service consumption.
 - * Increase or decrease capacity in minutes.
 - * Pursue new workloads and opportunities demo/ sandbox, collaboration, prototype.
- 

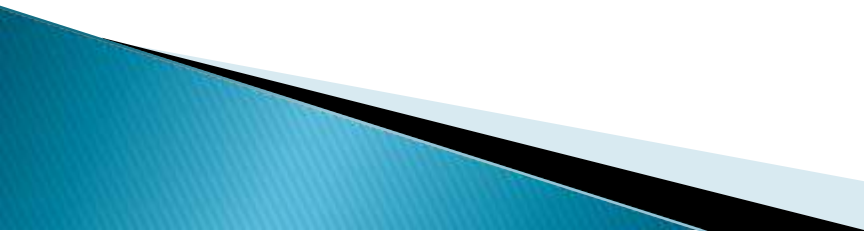
Internal Private Clouds Drive Cost Savings

With traditional infrastructure each server typically runs a single application and the hardware is sized to meet peak demands, which leads to very low average hardware utilization and high software cost due to the number of servers deployed and lack of resource sharing.

With private cloud ;

- * Reduce IT labour cost by 50% in configuration operation, management, and monitoring.
- * Improves capital utilization by 75% significantly reducing license costs.
- * Lower administration costs by 50%.
- * Reduce end-user IT support costs by up to 40%.
- * Reduce provisioning cycle times from weeks to minutes.
- * Benefits of clouds economics with security within firewall.
- * Provide self-service for rapid-start development.
- * Provides consistency of application environments.

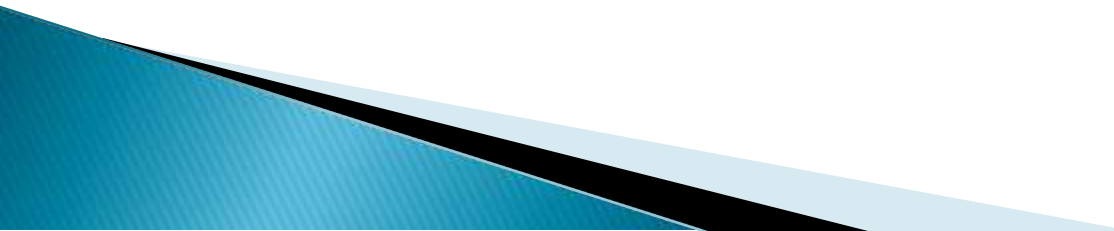
Saving and Cost Metrics

- * Virtualization
 - * Automation of resources provisioning– improves quality and productivity.
 - * There is small increase in software cost to deliver virtualization.
- 

Commoditization in Cloud Computing

Security in a Public Cloud

Security concerns considered for cloud deployment.

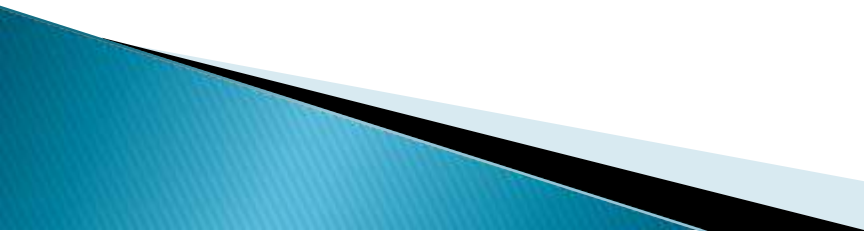
- * **Multi-Tenancy**– Security risk of one application doesn't effect other application.
 - * **Security Assessment**– By experts, assessment report shared with clients.
 - * **Shared Risk** – When service are provided from PaaS and IaaS, from different vendor
 - * **Staff Security Screening**– Checking background of employees.
 - * **Distributed Data Centers**– Disasters like hurricanes, tornadoes, landslide, earthquakes, fiber cuts cause unavailability of services.
 - * **Physical Security** –Surveillance by mantrap, card, biometric access an onsite guard.
 - * **Policies** – Incident response policy
 - * **Coding** – Secure coding practices.
 - * **Data Leakage** – Encrypt data while in flight and at rest. Incident policy to deal with any data leakages that occurs.
- 

Public Versus Private Clouds

▶ Public Cloud:

- ▶ * Is a shared cloud computing infrastructure for anyone can access.
- ▶ * Provides hardware and virtualization
- ▶ * Connected to public internet and presents a illusion of infinite elastic resources.
- ▶ * One does not require upfront capital investment.
- ▶ * Consumption based pricing, pay for resourced used.
- ▶ * Users have no say in SLA or contractual terms and condition.
- ▶ * Sensitive data is shared beyond the corporate firewall.
- ▶ * Distance may pose challenges with access performance and user application content for geographic locations.

▶ Private Cloud :

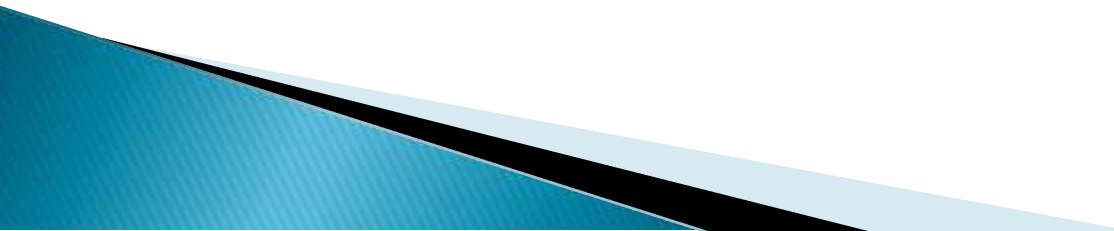
- ▶ * Cloud computing infrastructure is owned by single party.
 - ▶ * It provides hardware and virtualization.
 - ▶ * Presents elastic but finite resource.
 - ▶ * May or may not be connected to the pubic internet.
- 

Cloud Infrastructure Self-Service

- ▶ Infrastructure strategy and planning for cloud computing to the clients who are gearing for assistance in understanding business value that the cloud computing model can provide. The goal is to develop a high level vision strategy and roadmap for cloud computing, where clients evaluate their readiness for cloud computing.

Infrastructure Strategy and Planning Features

Has three major features

- * Assessment of the current environment to determine strengths, gaps and readiness.
 - * Development of the value proposition for cloud computing in the enterprise.
 - * Strategy, planning and roadmap to successfully implement the selected cloud delivery model.
- 

The Path to Cloud Computing

Stage 1: Server Virtualization– Server, Storage and Networks

Stage 2 : Distributed Virtualization– Elasticity, Rapidity, Operational improvement and efficiency.

Stage3: Private Cloud – Company introduces Self–service capabilities based on the virtualization architecture.

Stage 4: Hybrid Cloud– IT enterprise to leverage public cloud.

Stage 5 : Public Cloud – Migrating to explore infinite resources.

