

| IBM ISV and Developer Relations

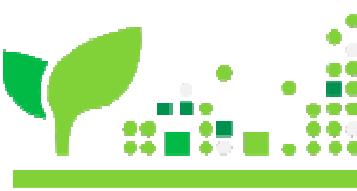
Foundations of IBM Cloud Computing Architecture

Test 032

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Lee Zhang

IT needs to address these business challenges

Ngành CNTT cần phải đáp ứng yêu cầu/thách thức của khinh doanh, quản lý



Doing more with less (Thu nhiều chi ít)

Reduce capital expenditures and operational expenses

Reducing risk (giảm rủi ro)

Ensure the right levels of security and resiliency across all business data and processes

Higher quality services (chất lượng cao trong dịch vụ)

Improve quality of services and deliver new services that help the business grow and reduce costs

Breakthrough agility (Nhanh chóng)

Increase ability to quickly deliver new services to capitalize on opportunities while containing costs and managing risk

Cloud computing is one choice of models to address these challenges.

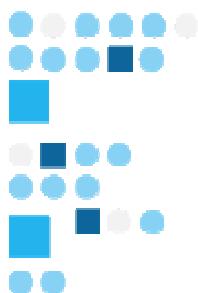
Cloud computing delivers IT & business benefits

ĐT đám mây mang các lợi ích cho CNTT và kinh doanh

Virtualized ►

Ảo hóa

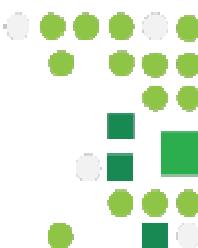
- Higher utilization
- Economy of scale benefits
- Lower capital expense
- Lower operating expense



Standardized ►

Chuẩn hóa

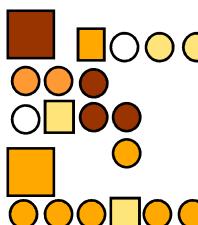
- Easier access
- Flexible pricing
- Reuse and share
- Easier to integrate



Automated ►

Tự động

- Faster cycle times
- Lower support costs
- Optimized utilization
- Improved compliance
- Optimized security
- End user experience



Doing more with less

Higher quality services

Breakthrough agility
Reducing risk

Cloud Computing Definition

Định nghĩa điện toán đám mây

National Institute of Standards and Technology (NIST) definition:

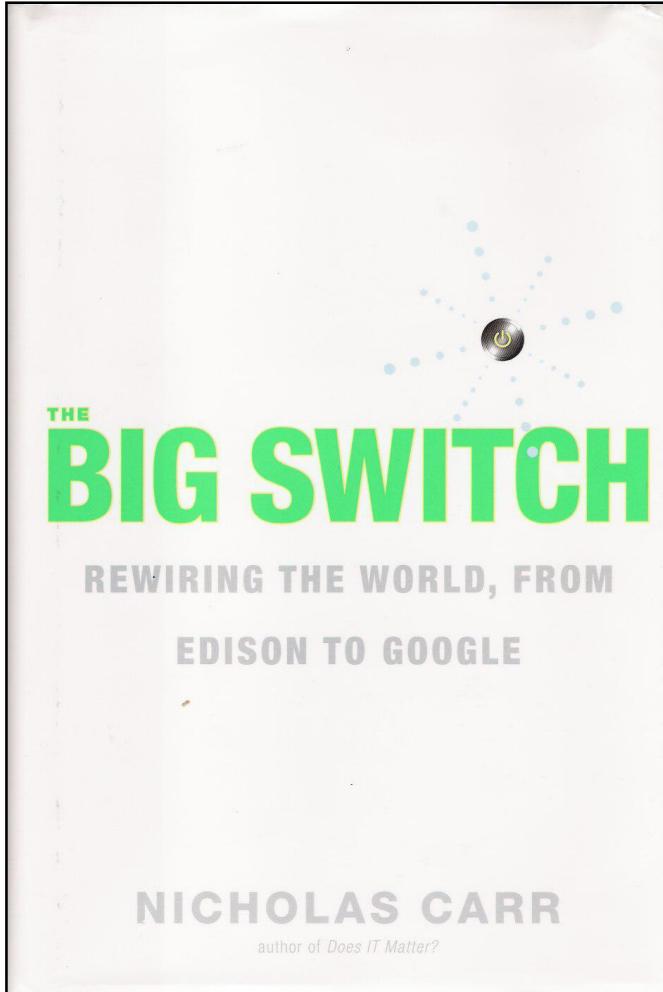
“Cloud computing is a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (for example, networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction.”

Cloud is a delivery and consumption model

Điện toán đám mây là một loại hình phân phối và tiêu dùng

Cloud Computing Perspective

Triển vọng của điện toán đám mây



- June 2009 – Newsweek listed this book as one of the 50 books to read today
- Compares cloud computing of this century to electricity of last century
- <http://www.amazon.com/Big-Switch-Rewiring-Edison-Google/dp/0393062287>



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Background Information

Objectives

mục tiêu

- **Certification: IBM Certified Solution Advisor – Cloud Computing Architecture v1**
- **Test 032: Foundations of IBM Cloud Computing Architecture v1**
- **Number of questions: 48**
- **Time allowed in minutes: 75**
- **Required passing score: 66% (32 out of 48)**

Sections các phần chính

1. Cloud Computing Concepts and Benefits

Các lợi ích và khái niệm của điện toán đám mây

2. Cloud Computing Design Principles

Các nguyên tắc thiết kế điện toán đám mây

3. IBM Software Cloud Computing Architecture

Phần mềm IBM cho Kiến trúc điện toán đám mây

Technical sales certification

IBM Certified Solution Advisor - Cloud Computing Architecture

Showcase your advanced skills for a competitive advantage

- Certification Topics
 - Cloud Computing Concepts and Benefits
 - Cloud Computing Design Principles
 - IBM Software Cloud Architecture
 - Audience: Technical Sales
(i.e., architects, system integrators, technical sales people, application developers)
 - Test Availability
 - Authorized Prometric testing centers worldwide
- *IBM Certified Solution Advisor – Cloud Computing Architecture V1

<http://www-03.ibm.com/certify/certs/50001101.shtml>





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Section 1 – Cloud Computing Concepts and Benefits

Phần 1 - Các lợi ích và khái niệm của điện toán đám mây

Cloud Computing Attributes

Các tính chất của ĐTĐM

- **Virtualization** (ảo hóa): IT resources can be shared between many computing resources (physical servers or application servers).
- **Provisioning** (cung cấp/thu hồi nhanh): IT resources are rapidly provisioned (or de-provisioned) based on consumer demands.
- **Elastic Scaling** (mềm dẻo): IT environments scale up and down by any magnitudes as needed to satisfy customer demands
- **Service Automation Management** (quản lý dịch vụ tự động): IT environments that provide the capability to request, deliver, and manage IT services automatically.
- **Pervasiveness** (mọi nền tảng): Services are delivered through the use of the Internet and on *any* platform.
- **Flexible Pricing** (giá linh hoạt): Services are tracked with usage metrics to enable multiple payment models.

Virtualization

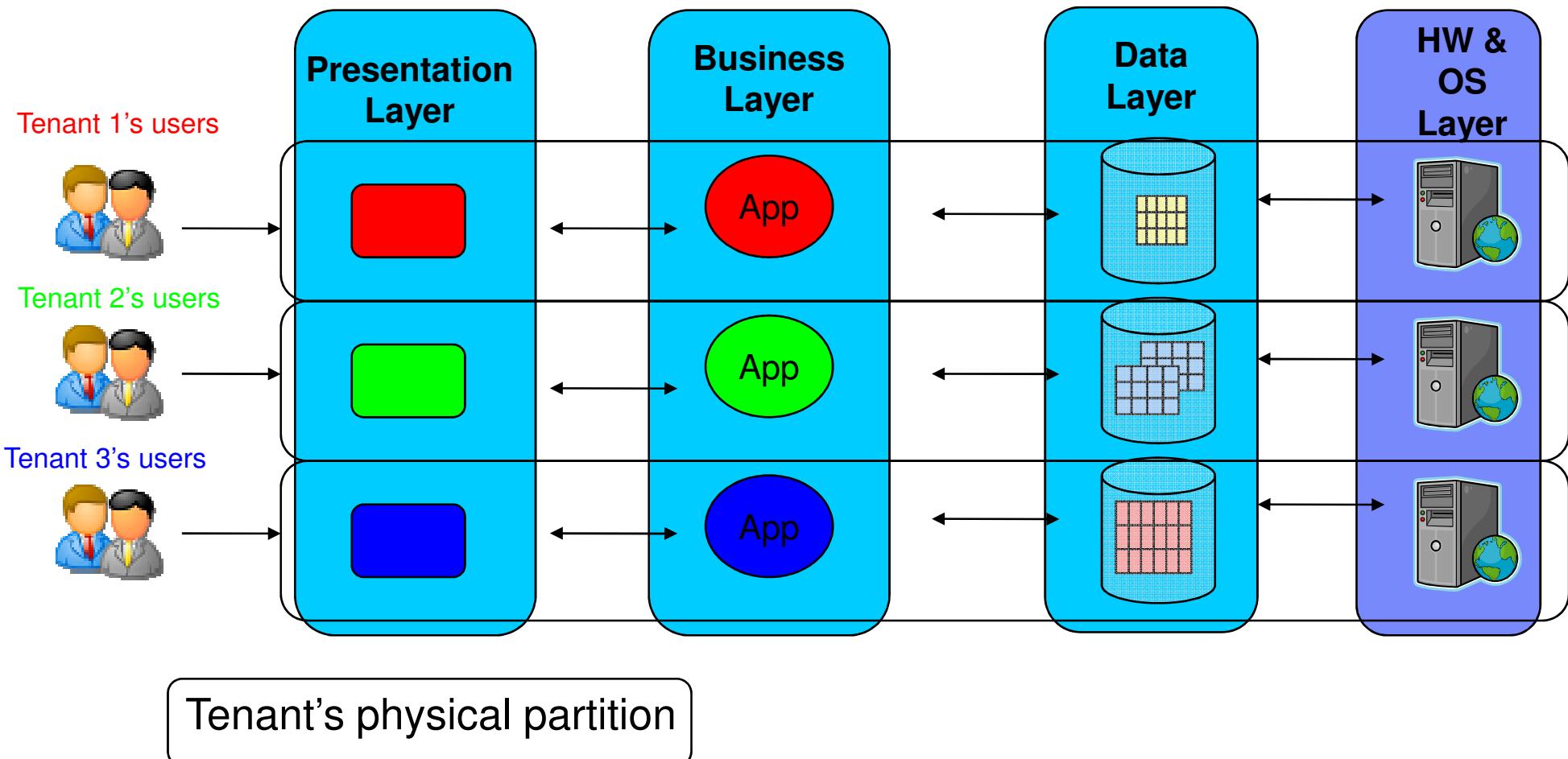
Ao hóa

- Computing resources (application servers, physical servers, databases, storages, services) are dynamically created, expanded, compacted, or moved as demand varies.
- Under-utilized physical servers are consolidated into a smaller number of more fully-utilized physical servers.
- Virtualization is a key infrastructure element for cloud computing because it
 - Provides important advantages in sharing, manageability, and isolation of computing resources.
 - Reduces costs significantly via server consolidations and optimal resource utilization.
 - Provides a way for provisioning a computing resource dynamically and automatically.

Traditional / ASP Model Architecture

Kiến trúc truyền thống hay kiến trúc cung cấp dịch vụ ứng dụng

Application Service Providers host each tenant's application in dedicated hardware, middleware and operating system



ASP Model

Mô hình cung cấp dịch vụ ứng dụng ASP

Benefits (lợi ích)

- Little or no application re-design is required.
- Faster time to market and lower up front cost compared to shared middleware model
- Isolation for better security and availability for tenants
- Higher degree of HW and OS customization is provided than in a shared environment
- Simpler backup and Disaster Recovery for each tenant
- Easy to enable additional common Multi-Tenancy capabilities (Access control, Metering)

Cost Implications (tác động giá thành)

- Poorest scalability in number of tenants per server
- Highest Operational Costs.

When to use this model

- Single tenant applications with no Services Orientation.
- Unknown market demand does not justify upfront development costs.
- Customers require dedicated servers model (regulation / standards)

Virtualization

Ảo hóa

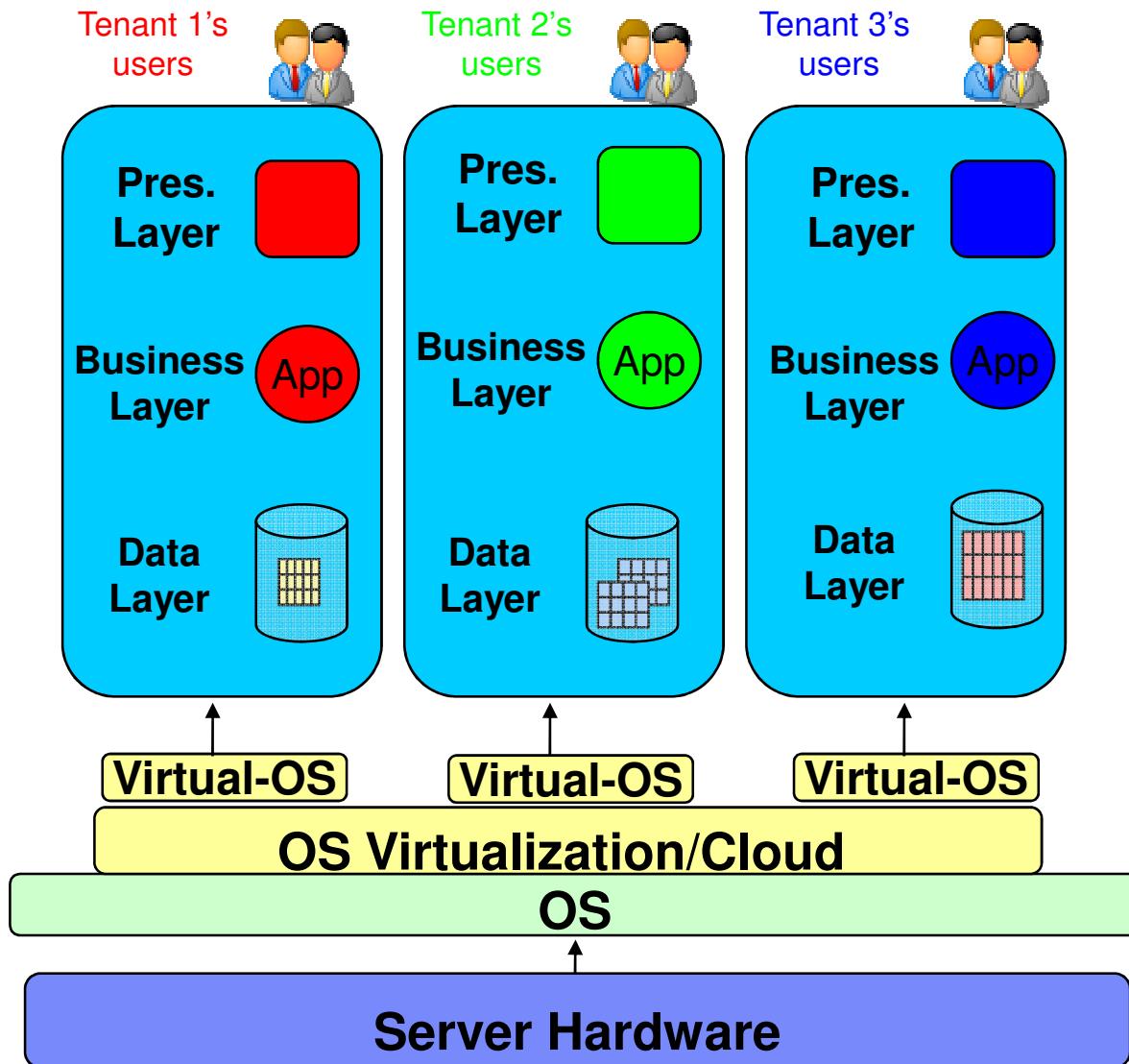
OS Virtualization (hệ điều hành)

- The concept is based on a single host OS instance
- Leaner more efficient architecture for management and updates.
- Intended for organizations that are consolidating or deploying multiple virtual servers on a single Linux or Windows physical server
- Examples:
 - **VMware, Xen, Amazon AMIs**

Hardware Virtualization (phần cứng)

- Designed to support multiple types of OSs on a single server
- Characterized by technology that virtualizes hardware resources in order to manage and dedicate them to Virtual Machines on the server
- Examples:
 - **IBM Power Systems**
 - **LPARS**

OS Virtualization (ảo hóa hệ điều hành)



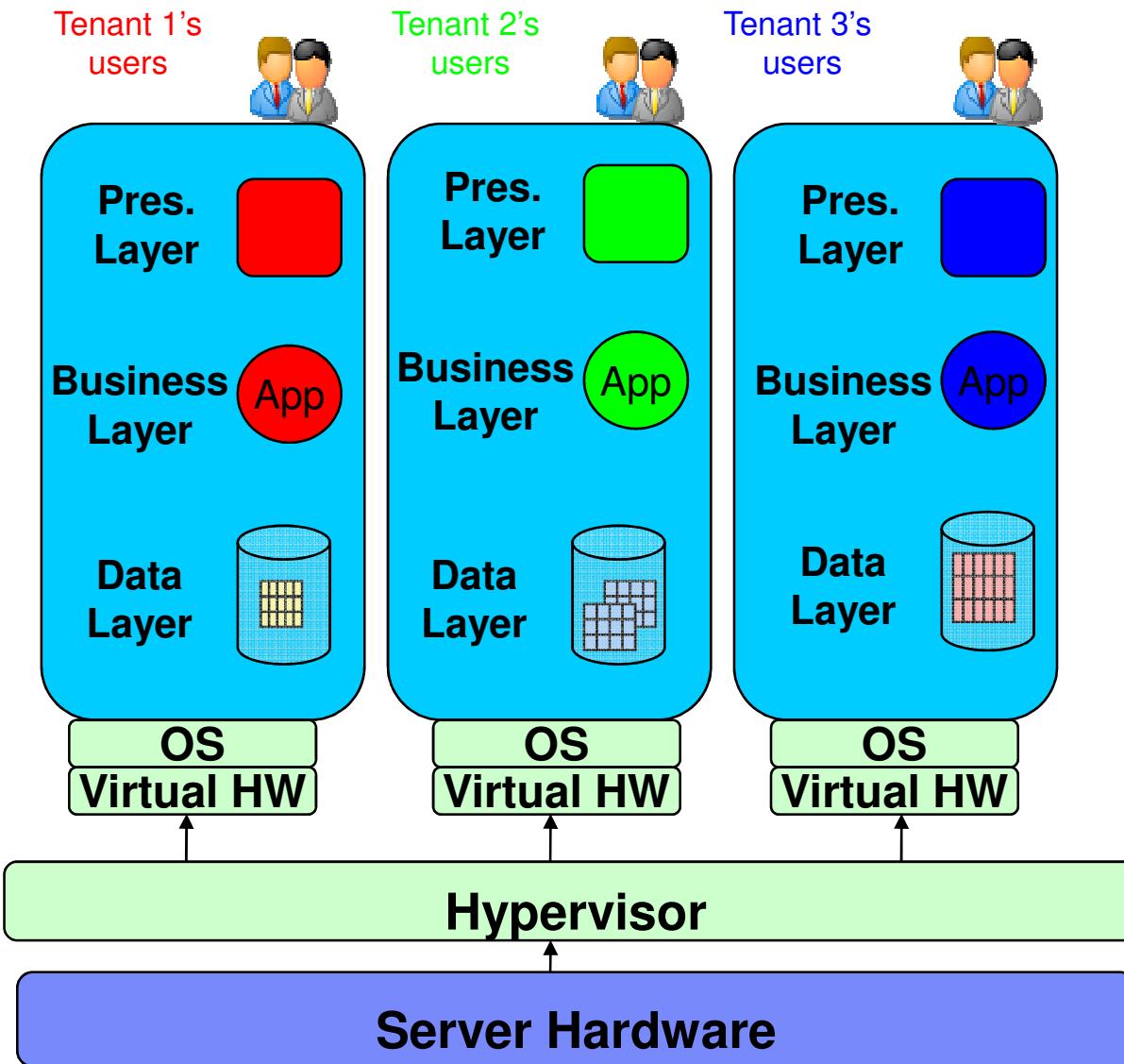
Pros (lợi):

- With a single OS, update all Virtual OS's by updating the host OS 1 time
- Provision applications dynamically using application templates
- Flexible resource management allows you to change hard drive, CPU, and memory resources in real time!

Cons (hại):

- Single OS server
- A single application has two OSs to traverse to CPU / IO;
- May be some integration issues with shared OS components (DLL's)
- Network latency issues

Hardware Virtualization (ảo hóa phần cứng)



Pros

- Fewer OS integration issues
 - No shared os components or directories
- Can configure different OS's and OS Versions in each partition

Cons:

- Each OS takes space in memory,
- The duplicate OSs consume hard drive space and must be licensed and managed separately.

Virtualization Models (các mô hình ảo hóa)

Benefits (lợi ích)

- Little or no application re-design is required.
- Faster time to market and lower up front cost compared to shared middleware model
- Isolation for better security and availability for tenants
- Higher degree of HW and OS customization is provided than in a shared environment
- Simpler backup and Disaster Recovery for each tenant
- Easy to enable additional common Multi-Tenancy capabilities (Access control, Metering)

Cost Implications (tác động giá thành)

- Lower scalability in number of tenants than shared middleware
- Greater administration overhead than sharing
- Higher deployment costs if Mediation is used in conjunction with Virtualization.

When to use this model

- Single tenant applications with Services Orientated Architecture.
- Anticipated scale does not justify shared middleware development.
- No incumbent multi-tenant competitor – hard to compete if one exists.

Multitenancy (nhiều người thuê)

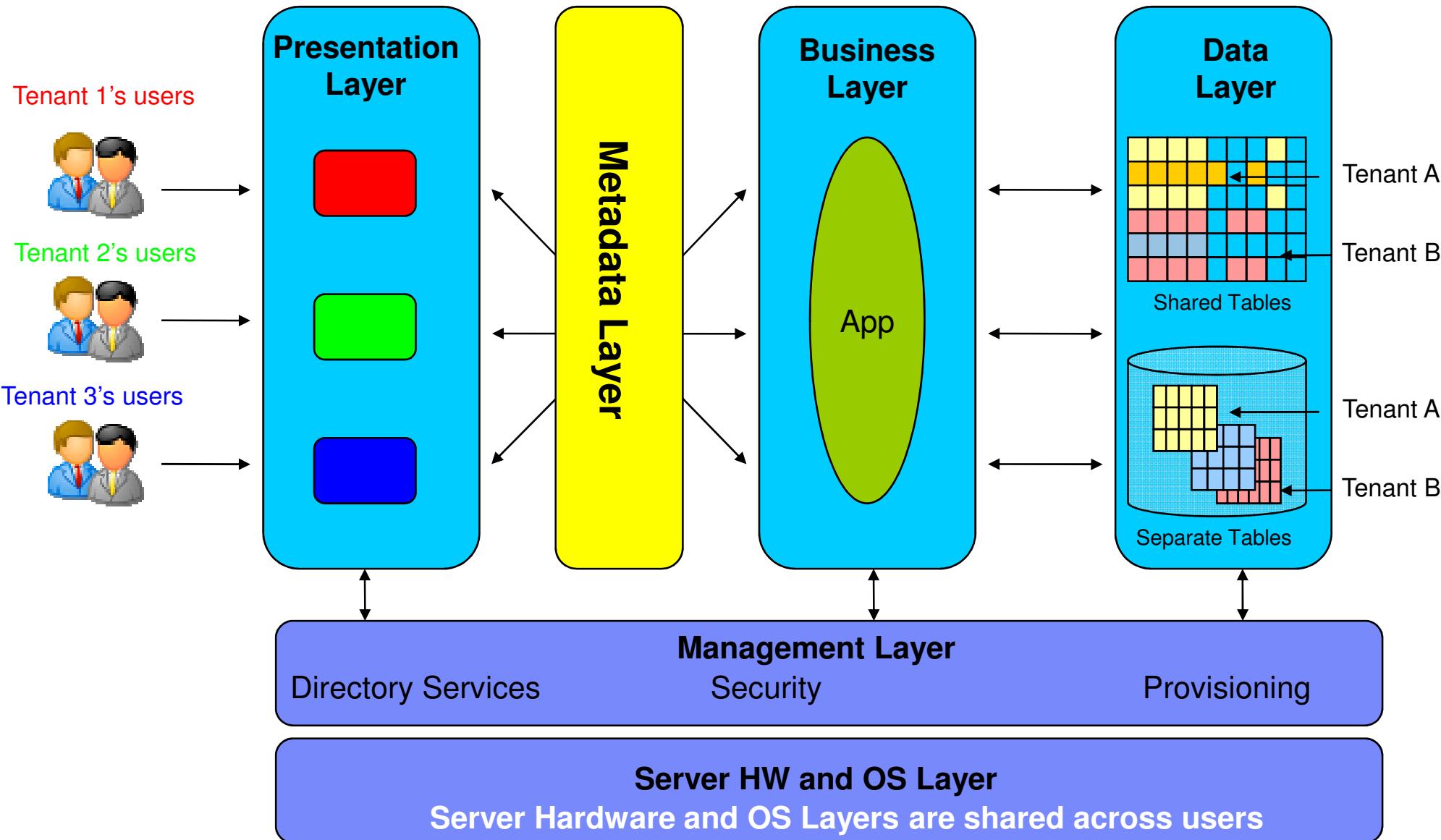
- Multitenancy: a single instance of software runs on a server, serving multiple clients (tenants).
- Multitenancy vs Multi-instance: In a Multitenancy environment, multiple customers share the same application, running on the same operating system, on the same hardware, with the same data storage mechanism. The distinction between the customers is achieved during application design, so that customers do not share or see each other's data. Contrast this with multi-instance where one or the other of these components is abstracted so that each customer application appears to be running on a separate physical machine.
- Benefits of Multitenancy.
 - Cost savings: Multitenancy allows for cost savings over and above the basic economies of scale achievable from consolidating IT resources into a single operation. An application instance usually incurs a certain amount of memory and processing overhead, which can be substantial when multiplied by many customers, especially if the customers are small. Multitenancy reduces this overhead by amortizing it over many customers.
 - Efficiency: Peak demand by individual tenants can be more easily accommodated because processing power can be "borrowed" from other tenants in that application instance that are experiencing processing lulls.
- Concerns with multitenancy
 - Data Privacy
 - Complexity of Customization

What is Multitenancy ?

- **The ability to deliver software to multiple client organizations (or tenants) from a single, shared instance of the software**
 - Customizations made for one tenant are contained within metadata
 - e.g. Cascading Style Sheets for UI branding
 - Each tenant runs the same application code
- **Consumer applications are usually excluded from discussions of multitenancy**

Multi-tenancy Through Shared Middleware

Hardware, OS and Application server layers are shared, to varying degrees, across users.
Data Layer comprises Shared Databases with either shared or separate tables.



Shared Middleware Model

Benefits

- Ability to scale to additional tenants quickly
- Cost effective since the infrastructure is shared by all tenants
- Less overhead than a virtualized or mediated approach
- Requires less storage

Cost Implications

- Requires application redesign or code changes of existing single tenant code
 - Time to Market impact of re-architecting applications for multi-tenancy
 - Higher upfront costs when code changes are necessary
- Skilled programmers required to implement
- Added complexity is necessary to provide features such as backup and restore customized for each tenant

When to use this model

- Single tenant applications Services Orientated Architecture.
- Market demand justifies upfront development costs.
- Customer / Competitive price point demands shared middleware

Technical Challenges – Shared Middleware Model

■ Access Control – Data Privacy

- Sharing application resources (e.g. database tables, web services, J2EE artifacts) so that users for one tenant only see data/services for that tenant

■ Complexity of Customization

- Database
 - Additional fields for business object for each tenant (e.g Purchase Order)
- User interface
 - Look and feel changes via configuration only
 - Enable additional fields when displaying business objects
- Business logic
 - Different business rules for processes in the application (e.g. calculating discounts)

Technical Challenges – Shared Middleware Model

- **Isolation**
 - **Data:**
 - a tenant should not have any access to the data belonging to any other tenant
 - **Management:**
 - a tenant can only configure, monitor and manage his own instance without interfering with other instances
 - **Performance:**
 - a tenant's instance's performance should not be affected by the load on any other tenant's instance
- **Interference**
 - **Tenant and Operating System**
 - A tenant's instance should not be able to interfere with the OS running the instance such as by making unauthorized access to the file system and network ports, be able to crash the OS etc.
 - **Tenant and middleware**
 - Should not be able to interfere with the middleware running the instance such as by making unauthorized access to middleware components, deployment configurations or by crashing middleware.
 - **Tenant with another tenant**
 - a tenant should not be able to interfere or disable code supporting another tenant's instance

Dynamic Infrastructure

- Dynamic Infrastructure is an information technology paradigm concerning the design of DataCenters so that the underlying hardware and software can respond dynamically to changing levels of demand in more fundamental and efficient ways than before.
 - Cloud computing is a way to establish a dynamic infrastructure, specifically to optimize the IT infrastructure through virtualization and energy-efficient initiatives to achieve more with less.
 - Dynamic infrastructure helps to virtualize all resource servers, storage, desktops, and applications and proactively handle energy management across the business. This helps to reduce cost, resolve power and cooling issues, free up staff, and better manage and automate operations, which enables customers to dynamically adjust their IT to meet changing demand levels and new business requirements.

Elasticity

- A user can create, launch, and terminate server instances as needed. This user pays by the hour for active servers, hence the term "elastic".

Automation

- Automation is a key infrastructure management attribute for cloud computing because, without the benefits of automation, the complexity of a cloud environment is increased significantly and added costs are generated - costs high enough to cancel out the cost savings derived from cloud computing in the first place.
- Automation provides the following benefits:
 - standardization and automation for deployment and management of IT services.
 - the ability to maintain or improve quality and cost per IT service.
 - a management stack that is easier to handle and provides for smoother workload migration.
 - the ability to be audit proof and integrated with process governance.
 - the ability to reduce costly manual interventions.
 - the ability for IT to reduce the skill requirements needed for deploying and managing IT services.
 - reduced errors caused by manual processes.

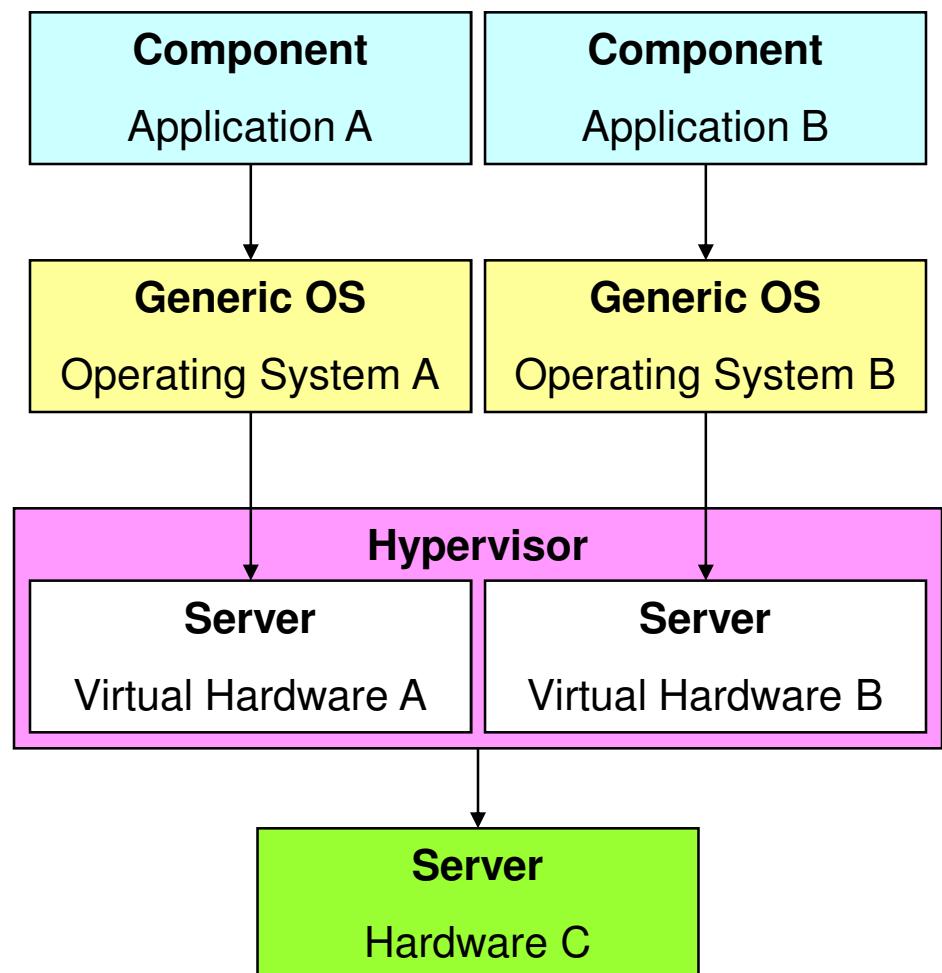
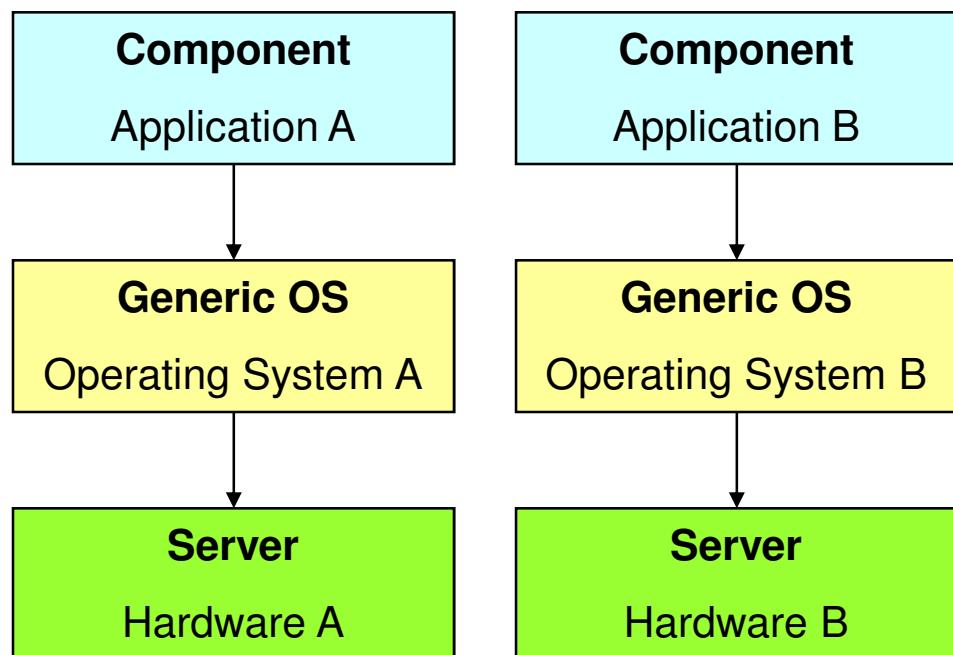
Provisioning

- Provisioning is an automated process that handles computing resource management processes.
- Provisioning helps optimize availability by maintaining configurations and managing changes to resources.
- Provisioning is used to capture and rerun scenarios of highly complex tasks; thus, minimizing the potential for human errors.

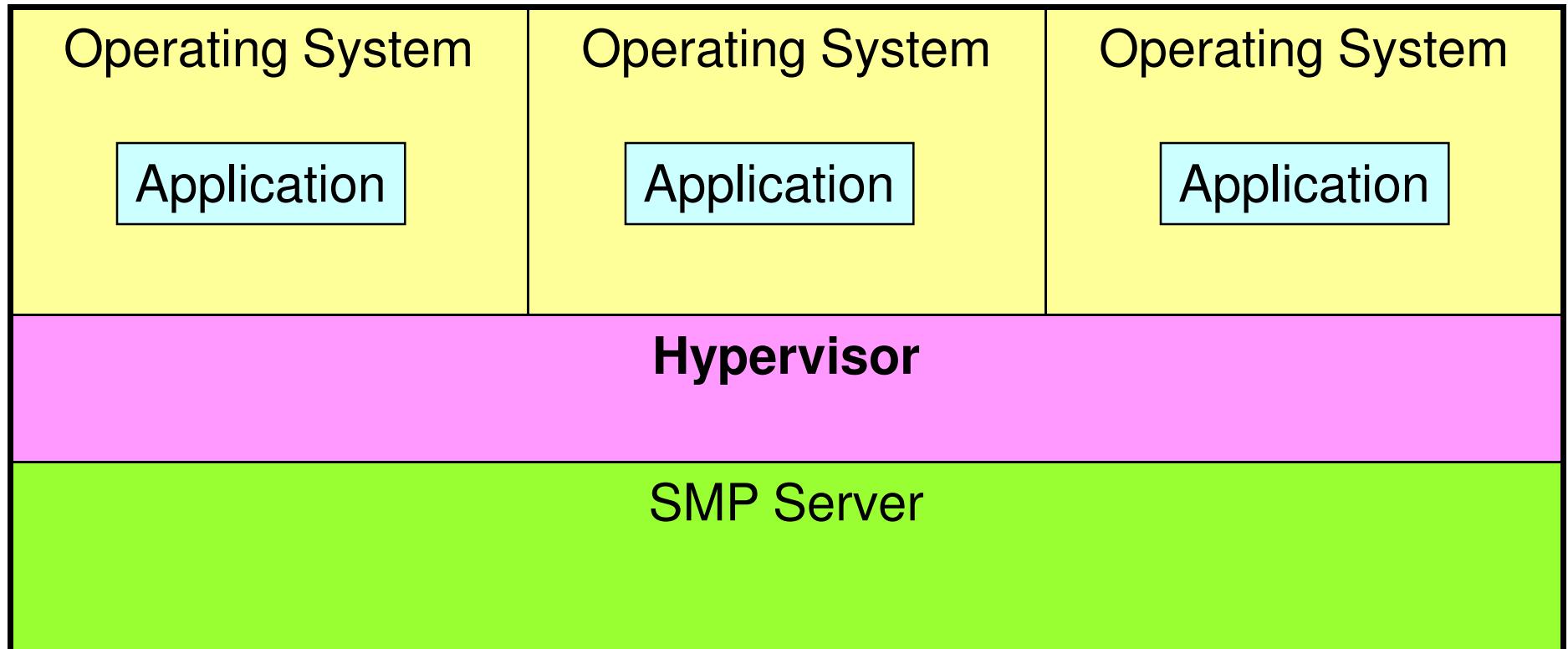
Hypervisors

- **Virtualization software that allows multiple operating systems to run on the same computer concurrently.**
- **Use a thin layer of code in software or firmware to achieve fine-grained, dynamic resource sharing.**
- **Provide the greatest level of flexibility in how virtual resources are defined and managed.**
- **Primary technology of choice for system virtualization.**

Non-virtualized vs. Virtualized Systems

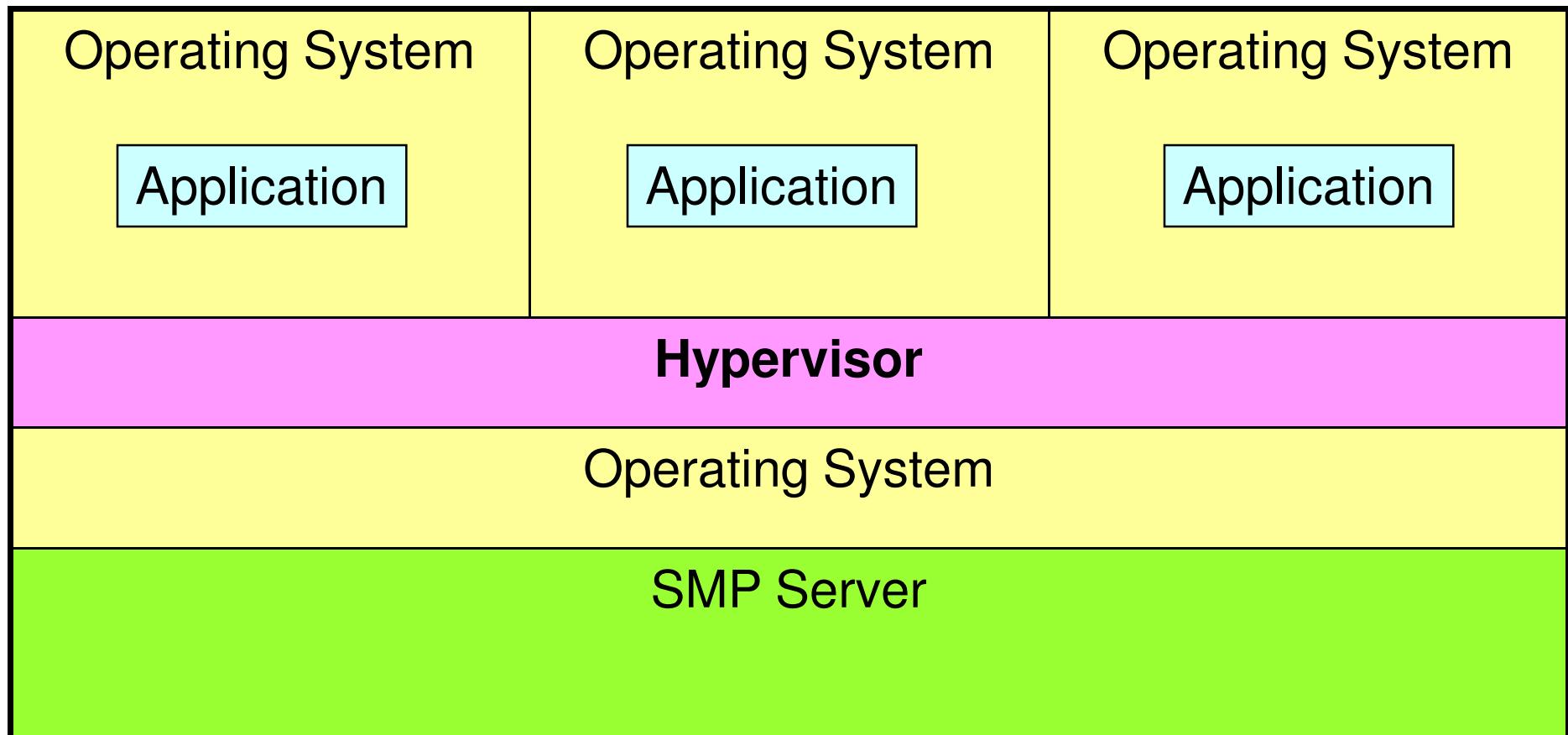


Bare Metal Hypervisors



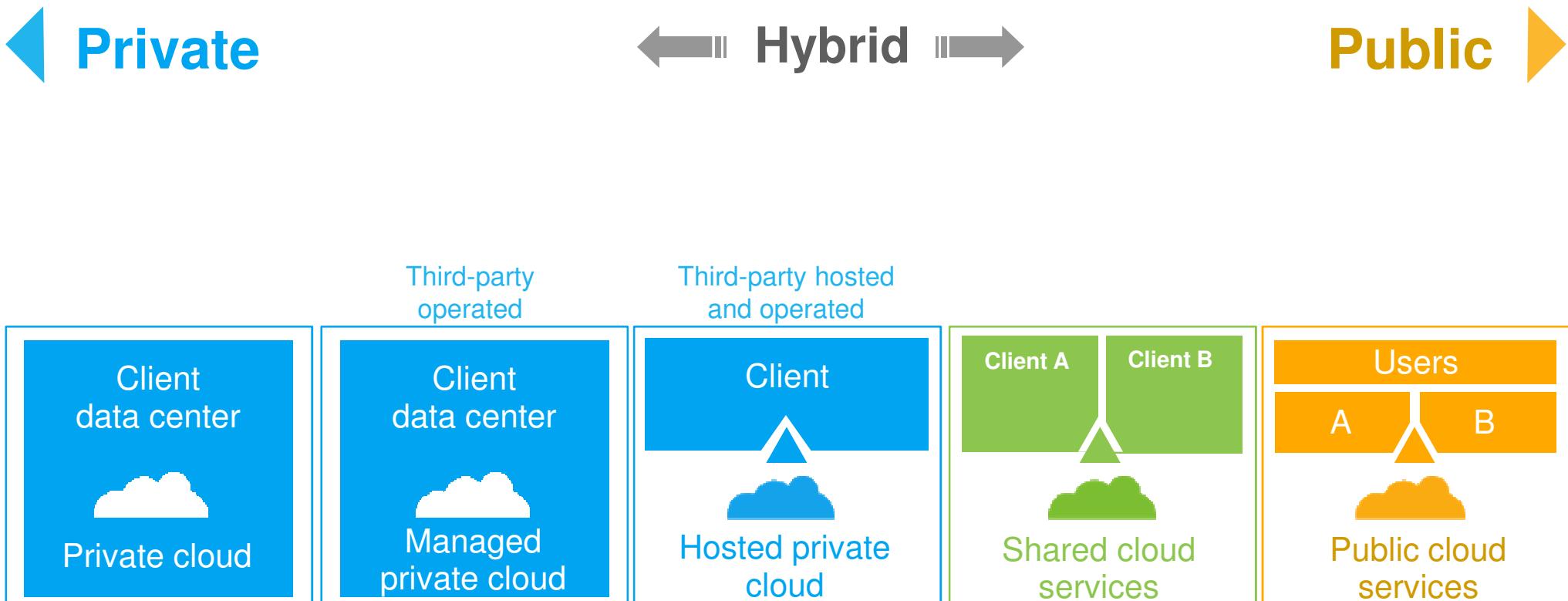
Bare metal hypervisors run directly on the system hardware.

Hosted Hypervisors



Hosted hypervisors run on a host operating system that provides virtualization services, such as I/O device support and memory management.

There is a spectrum of deployment options for cloud computing



Cloud Delivery Models

Private
Cloud

Enterprise
Data Center



Managed
Private
Cloud

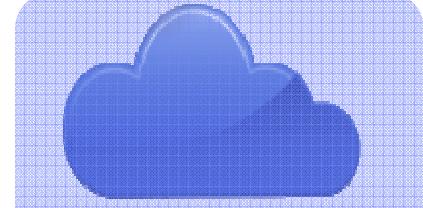
Enterprise
Data Center



3rd party
operated

Hosted
Private
Cloud

Enterprise



3rd party
hosted &
operated

Shared
Cloud
Services

Enterprises



Public
Cloud
Services

Users



Gartner Says IT Organizations Will Spend More Money on Private Cloud... <http://www.gartner.com/it/page.jsp?id=1239813>
IDC - Cloud Computing to Drive \$6.4 Billion in Server Hardware Spending by 2014, <http://www.idc.com/getdoc.jsp?containerId=prUS22440510>

Public Cloud

- Obtaining an instance of a cloud computing environment via a public cloud is easy and inexpensive because hardware, application, and bandwidth costs are covered by the provider.
- Computing resources in a public cloud can be scaled to meet the needs of the cloud users.
- A public cloud can use flexible pricing models. No resources are wasted because the cloud users pay for what they use on an as-needed basis, without the requirement to invest in additional internal infrastructure.
- A public cloud helps businesses shift the bulk of the costs from capital expenditures and IT infrastructure investment to a utility operating expense model. A public cloud also helps isolate the end-users from the complexity of IT operations and management.

Public Cloud

- Public cloud or external cloud describes cloud computing in the traditional mainstream sense, whereby resources are dynamically provisioned on a fine-grained, self-service basis over the Internet via Web applications/Web services. These Web applications/Web services originate from an off-site third-party provider who shares resources and bills on a fine-grained utility computing basis.
- Public clouds are where IT activities/functions are provided "as a service" over the Internet, which allows access to technology-enabled services without knowledge of, expertise with, or control over the technology infrastructure that supports them. Therefore, public clouds are also called "external clouds".

Private Cloud

- Private cloud and internal cloud are neologisms that some vendors have recently used to describe offerings that emulate cloud computing on private networks. These (typically virtualization automation) products claim to "deliver some benefits of cloud computing without the pitfalls", capitalizing on data security, corporate governance, and reliability concerns.
- Private clouds are where activities and functions are provided "as a service" over a company's intranet. Private clouds are built by an organization for its own users, and everything is delivered within the organization's firewall (instead of the Internet). The private cloud owner does not share resources with any other companies, so multitenancy is not an issue. Therefore, private clouds are also called "internal clouds".

Private Cloud

- A private cloud is owned by an enterprise and can only be accessed by internal users.
- A private cloud is deployed internally behind the corporate security firewall.
- A private cloud is operated and maintained by either the enterprise's IT operations or by a 3rd party cloud service provider.
- By totally owning a cloud computing environment, an enterprise can provide and govern computing resources (physical servers, application servers, storage space, applications, services, etc.) in an efficient, compliant, and secure manner. At the same time, by using a private cloud, an enterprise can also achieve significant cost saving from the infrastructure's consolidation and virtualization.

Hybrid Cloud

- A hybrid cloud environment consisting of multiple internal and/or external providers "will be typical for most enterprises". By integrating multiple cloud services, users may be able to ease the transition to public cloud services while avoiding issues such as PCI compliance.
- Hybrid clouds are where the external and internal service delivery methods are integrated. Rules and policies are established by the organization based on factors such as security needs, criticality, and underlying architecture so that activities and tasks are allocated to external or internal clouds as appropriate.

Hybrid Cloud

- A hybrid cloud model is prevalent in the industry today as it helps enterprises achieve substantial savings from investments in the infrastructure required to provide resources via public clouds. At the same time, a hybrid cloud also provides secure ways for enterprises to keep and protect sensitive data under their own control of private clouds.

Virtual Private Cloud

- A virtual private cloud can help quickly create an economical and functional computing environment and provide additional security measures and system management tools.

Public vs. Private vs. Hybrid

■ Public Cloud

- Service provider lets clients access the cloud via the Internet
- Made available to the general public or a wide industry group

■ Private Cloud

- The cloud infrastructure is used solely by the organization that owns it
- May reside in-house or off premises

■ Hybrid Cloud

- Composed of two or more clouds that remain unique entities but that can interoperate using standard or proprietary protocols

IaaS – Infrastructure as a Service

- IaaS delivers computer infrastructure, typically a platform virtualization environment, as a service.
- Utility computing relates to the business model in which application infrastructure resources, hardware, and/or software are delivered.
- Cloud computing relates to the way we design, build, deploy, and run applications that operate in a visualized environment, sharing resources and boasting the ability to dynamically grow, shrink, and self-heal.

PaaS – Platform as a Service

- PaaS delivers a computing platform and/or solution stack as a service, often consuming cloud infrastructure and sustaining cloud applications. It facilitates deployment of applications without the cost and complexity of buying and managing the underlying hardware and software layers.
- A computing platform describes some sort of hardware architecture or software framework (including application frameworks), that allows software to run. A PaaS delivers a computing platform as a service.

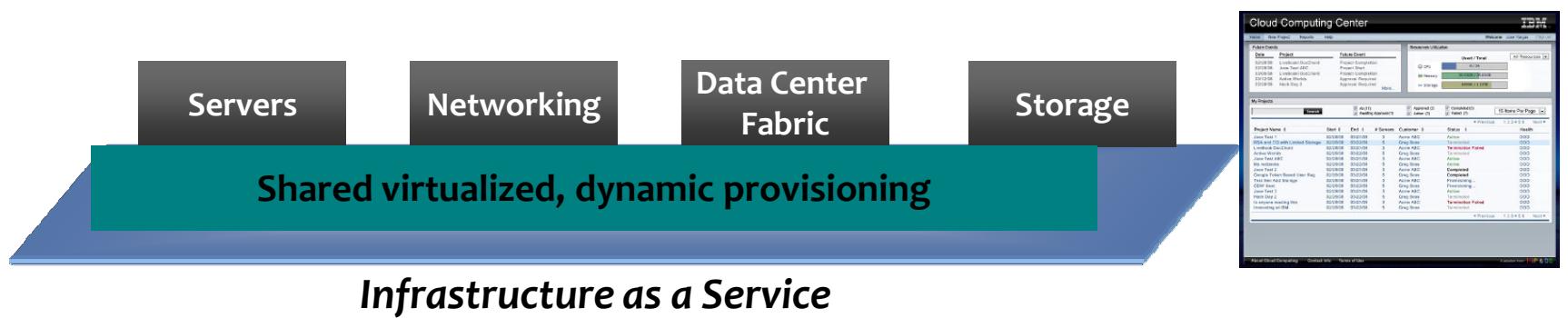
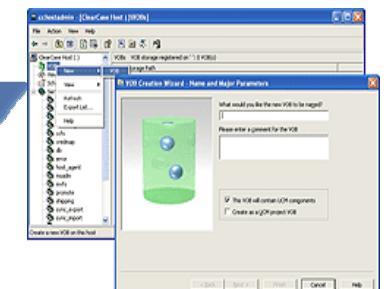
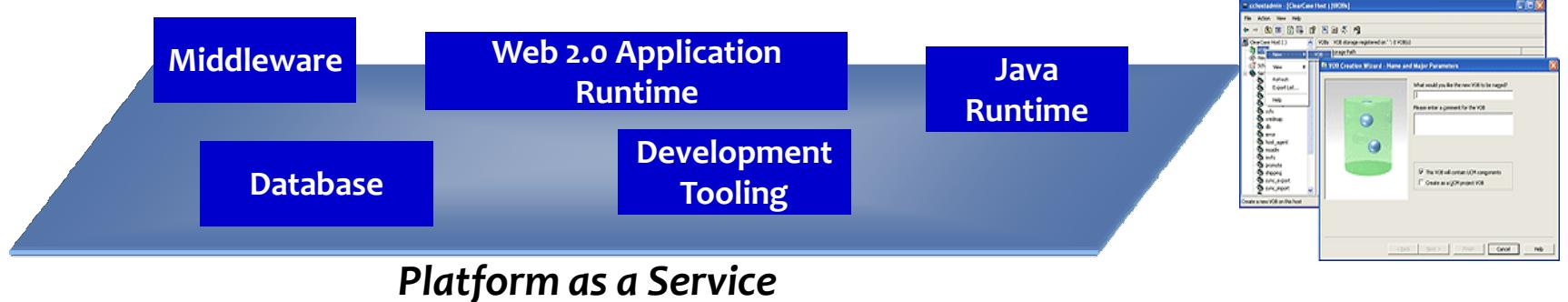
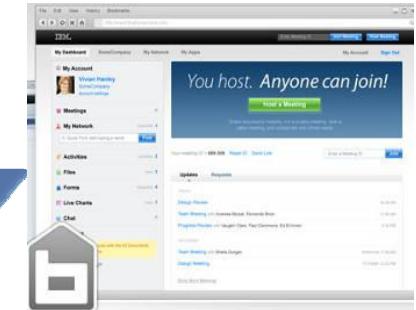
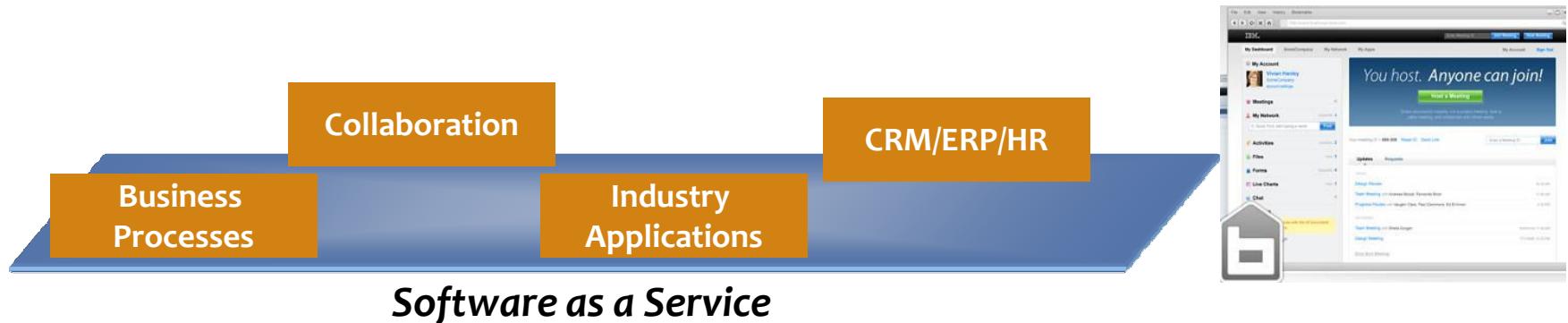
SaaS – Software as a Service

- Deliver software as a service over the internet, eliminating the need to install and run the application
- Tenancy: the same environment can be shared among many customers or users.
- Payment method: the SaaS is normally modeled as pay-as-you-go, which is different from traditional licensed applications.
- Application management: the SaaS provider is responsible for managing the computing environment.
- Application upgrade: the SaaS provider can upgrade the application or release new features seamlessly, in contrast to the traditional and costly software upgrade.

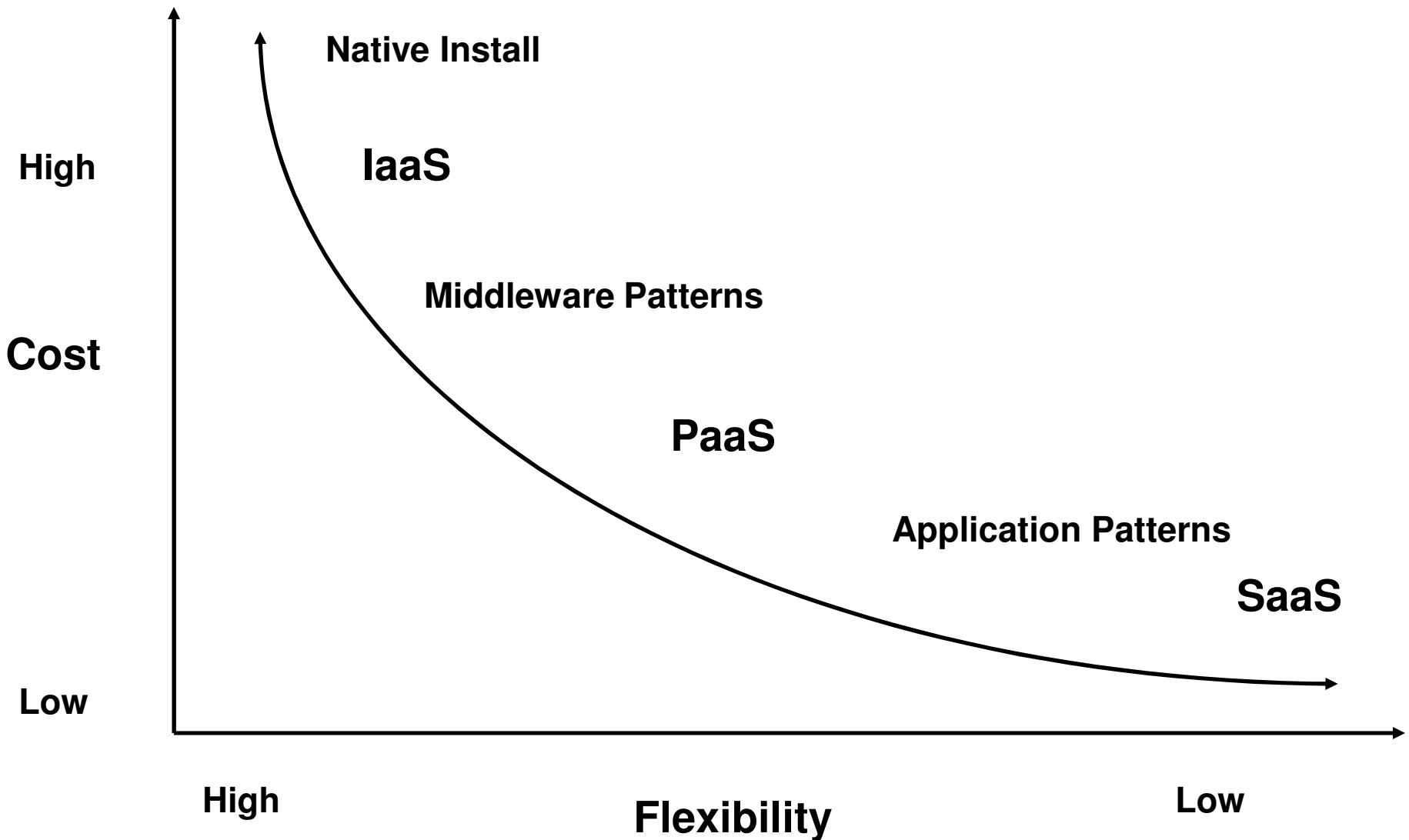
IaaS vs. PaaS vs. SaaS

- IaaS delivers computer infrastructure (normally a virtual machine) as a service.
- PaaS delivers computing platform (eg, middleware platform and solution stack) as a service.
- SaaS delivers software (applications) as a service over the Internet.

IaaS vs. PaaS vs. SaaS: Layers of Cloud Computing



IaaS vs. PaaS vs. SaaS Tradeoffs



Hosted Service

- An application service provider (ASP) is a business that provides computer-based services to customers over a network. Software offered using an ASP model is also sometimes called on-demand software or software as a service (SaaS). The most limited sense of this business is providing access to a particular application program (such as customer relationship management) using a standard protocol such as HTTP.
 - An ASP provides a cloud computing service, more specifically a SaaS.
- An Internet service provider (ISP) is a company that offers its customers access to the Internet.
- A hosted service provider (xSP) is a business that delivers a combination of traditional IT functions such as infrastructure, applications (SaaS), security, monitoring, storage, Web development, Website hosting and email, over the Internet or other wide area networks (WANs). An xSP combines the abilities of an ASP and an ISP.
- A service provider might not provide any cloud computing capability. For example, an ISP is not considered to be a cloud computing service.

Grid Computing

- Grid computing is a type of parallel and distributed system that enables the sharing, selection, and aggregation of geographically distributed "autonomous" resources dynamically at run-time depending on their availability, capability, performance, cost, and users' quality-of-service requirements.
- Grid computing is "a form of distributed computing and parallel computing, whereby a 'super and virtual computer' is composed of a cluster of networked, loosely-coupled computers acting in concert to perform very large tasks." So the goal of grid computing is to divide a single and large task among many loosely-coupled computers.
- Grid computing might run in a cloud computing environment. The main difference is that, whereas grid computing is comprised of many computers working together to achieve one goal, cloud computing is aimed to provide computing resources for independent tasks.

Utility Computing

- "Utility computing is the packaging of computing resources, such as computation and storage, as a metered service similar to a traditional public utility (such as electricity, water, natural gas, or telephone network). This system has the advantage of a low or no initial cost to acquire hardware; instead, computational resources are essentially rented. Customers with very large computations or a sudden peak in demand can also avoid the delays that would result from physically acquiring and assembling a large number of computers."
- "Utility computing relates to the business model in which application infrastructure resources – hardware and/or software – are delivered.
 - While cloud computing relates to the way we design, build, deploy and run applications that operate in a visualized environment, sharing resources and boasting the ability to dynamically grow, shrink, and self-heal."

Energy Savings in Cloud Computing

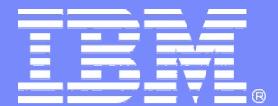
- **Physical systems require energy even when they are not fully utilized. Furthermore, this energy is turned into heat, which must be removed from the DataCenter. Additionally, energy may be more expensive in some places than others.**
- **Maximizing CPU usage by allowing rapid consolidation of VMs to shut down surplus systems results in savings on cooling. Multiple virtual assets can share the same physical resources to better utilize energy. As requirements diminish, even on an hourly basis, virtual assets can be consolidated allowing physical assets to be shut down. Then when requirements increase, physical assets can be brought online to meet demand.**
- **Cloud computing also allows for the ability to move visualized assets to run on physical assets in a location where energy is cheaper (such as closer to a generation station) or where cooling is easier. Virtual assets can be quickly migrated to take advantage of changes in energy pricing/availability.**

Cloud vs. Cluster

- Cloud computing is Internet-based computing; whereby, shared resources, software, and information are provided to computers and other devices on-demand, like a public utility.
- A computer cluster is a group of linked computers, working together closely so that in many respects they form a single computer. The components of a cluster are commonly – but not always – connected to each other through fast local area networks.
- Outline differences between clouds and clusters.
 - The two are not opposites, and there can be overlaps in functionality. Cloud indicates that a group of resources is shared, through virtualization and multi-tenancy.
 - On the other hand, clustering describes how a set of assets (physical or visualized) work together as a single system. The goal of cluster computing is to perform autonomous computing, working together to fulfill a certain task. Cloud computing is systems working independently.

Processes

- Companies that are implementing a cloud environment need to analyze their existing processes to determine the areas where it can be automated in an efficient way when offered as a cloud service.
- Approvals play an essential role in the core operations of every business. As a rule, most approvals represent the delegation of authority to carry out an activity, for example provisioning of computing resources.
- It is critical to understand and document how approvals are obtained today to see where opportunities for automation and efficiency improvements can be introduced.
- Customer's existing business approval processes may contain several manual approval steps that may slow down the overall provisioning process. In a cloud environment where IT services are rapidly provisioned and provided as standardized offerings, these manual approval steps should be identified and automated.



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Section 2 – Cloud Computing Design Principles

Phân 2 – Các nguyên tắc thiết kế ĐTĐM

Cloud Architecture

Kiến trúc của đám mây

- Cloud architectures are designs of software applications that use Internet-accessible on-demand services. Applications built on cloud architectures are such that the underlying computing infrastructure is used only when it is needed (for example to process a user request), draw the necessary resources on-demand (like compute servers or storage), perform a specific job, then relinquish the unneeded resources and often dispose themselves after the job is done. While in operation, the application scales up or down elastically based on resource needs.

Wikipedia Cloud Computing layers

Các lớp của ĐTĐM theo Wikipedia

- **C – client**
- **A – application**
- **P – platform**
- **I – infrastructure**
- **S – server**

Wikipedia Cloud Computing layers

Các lớp của ĐTĐM theo Wikipedia

Client (khách)

a cloud client consists of computer hardware and/or computer software that relies on cloud computing for application delivery, or that is specifically designed for delivery of cloud services and that, in either case, is essentially useless without it. Examples include some computers, phones and other devices, operating systems and browsers.

Application (ứng dụng)

cloud application services or "Software as a Service (SaaS)" deliver software as a service over the Internet, eliminating the need to install and run the application on the customer's own computers and simplifying maintenance and support.

Platform (nền tảng)

cloud platform services or "Platform as a Service (PaaS)" deliver a computing platform and/or solution stack as a service, often consuming cloud infrastructure and sustaining cloud applications. It facilitates deployment of applications without the cost and complexity of buying and managing the underlying hardware and software layers.

Infrastructure (hệ tầng)

cloud infrastructure services or "Infrastructure as a Service (IaaS)" delivers computer infrastructure, typically a platform virtualization environment, as a service. Rather than purchasing servers, software, DataCenter space or network equipment, clients instead buy those resources as a fully outsourced service.

Server (máy chủ)

the servers layer consists of computer hardware and/or computer software products that are specifically designed for the delivery of cloud services, including multi-core processors, cloud-specific operating systems and combined offerings.

Hardware used

- **Processing Unit: CPU and RAM**
 - **Elasticity:** ability to meet changing requirements of visualized resources. As an example, a processing unit may need to support multiple visualized resources with competing requirements for processing power and RAM.
 - **Migration:** the ability to move visualized assets from one processing unit to another.
- **Storage**
 - **Rapid provisioning and deprovisioning of virtual assets**
 - **Migration of virtual assets**
 - **Security measures to keep one customer from accessing another customer's data**
- **Network**
 - **Different networks have different requirements, and this means that there may be a variety of specialized hardware. For example, fiber channel hardware may be used to implement a storage area network (SAN) processing unit and centralized storage, while ethernet hardware may need to support different speeds.**
 - **Single networking hardware components may also support multiple networks. For example, a management network and customer network may share the same physical ethernet switch.**

Networking

- Network Hardware: must be able to support the various networks used in the cloud environment.
- Management networks
 - Virtual server management networks: virtual assets may require a set of dedicated management networks. These may be used to administer, monitor, and migrate the virtual asset.
 - Virtual server provisioning networks: a set of dedicated provisioning networks may be required for the various provisioning tools.
 - Used to access provisioning tools (e.g., for requesting the provisioning of a virtual asset);
 - Used by provisioning tools to provision and configure virtual assets.
- Hardware management networks: A set of networks used to manage the physical infrastructure (blades, blade chassis, switches, storage, and Power Distribution Units)
- SANs: provide access to centralized storage.
- Customer data management networks: provide users with access to visualized assets.
- Network management/monitoring components: used to administer the network and monitor the health of the network. They are tied into cloud monitoring components to provide an overall view.
- Virtual local area networks (VLANs): VLANs can be used to separate different networks and provide security features to prevent unauthorized access to customer or administrator data.

Data Center

- DataCenter is a facility used to house computer systems and associated components, such as telecommunications and storage systems. It generally includes redundant or backup power supplies, redundant data communication connections, environmental controls (e.g., air conditioning, fire suppression) and security devices.

Data Center Clouds

- **Formed by connecting two or more Data Center clouds over a WAN**
- **Examine bandwidth to avoid network data loss and latency**
 - Latency is proportional to number of interfaces a packet transits from source to destination (ie, the number of switches)

Security

- **Privileged User Access:** access control measures need to be employed to protect sensitive data
- **Regulatory Compliance:** external audits and security certifications should be conducted to ensure the security and integrity of data in the clouds
- **Data Location:** locations of where data is stored must be taken into consideration in terms of local authority's privacy laws, jurisdictions, etc.
- **Data Segregation:** data encryption techniques must be used to segregate different sets of data in a multi-tenancy situation
- **Recovery:** systems back-up and data recovery must be implemented in the clouds

Web Service

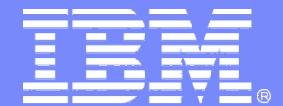
- Cloud service providers use existing Web technologies such as PHP, AJAX, REST API, SOAP, XML, HTML5, and others to develop a dynamic Web front-end for its end-users to see and order their cloud service offerings.
- In the SaaS model, end-users will only need access to the applications that are being offered as opposed to the infrastructure platforms that the applications are running on. Generally, these applications are provided in the form of a Web application. In some cases, cloud service companies provide wrapper Web service APIs that give its users the ability to integrate with other applications on the Web.
- Some of the leading cloud companies provide basic building-block type Web services that fulfill some of the core needs of accessing cloud computing environments. These services include storage, computing, messaging, datasets, ordering new cloud services, and modifying existing cloud services.

Performance

- **Software and Service Delivery**
 1. Response time
 2. System management & maintenance planning
 3. Proactive communication – notifications regarding maintenance activities
 4. System monitoring – key-performance-index (KPI)
- **System Scalability**
 1. Ability to respond to large volumes of service requests & users
 2. Ability to handle high volumes of services during peak demands
 3. Ability for system expansion with minimal costs
 4. Consistent service quality and system performance
 5. Reliability as service request volumes grow
- **High Availability**
 1. Facilities with reliable power, cooling, and network infrastructure
 2. High-availability infrastructure, including networking, server infrastructure, and software
 3. N+1 redundancy
 4. 24/7 operational capability

Billing

- **Subscription – magazines, newspapers**
- **Resource-based**
- **Utility – electricity, water**



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Section 3 – IBM Software Cloud Computing Architecture

Some IBM Options.....

- The IBM Smart Business Development & Test on the IBM Cloud features IBM Rational Software Delivery Services delivered over IBM's secure, scalable cloud.
- The IBM Smart Business Development and Test Cloud provides an on-premises cloud behind your firewall, built by IBM Services.
- IBM CloudBurst offers pre-integrated hardware, storage, virtualization and networking to create an on-premises cloud environment.

IBM Smart Business Development and Test Cloud

- **IBM Smart Business Development and Test on the IBM Cloud** is designed to provide you with rapid access to a security-rich, cloud-based enterprise-class development and test environment. Our standardized development and test environment on the IBM Cloud can help you realize faster application deployment with reduced capital and operational costs. You have virtually no infrastructure to maintain and benefit from pay-as-you-go pricing for your development and testing resources. And, you can set up more accurate test environments in minutes versus weeks using standardized configurations.

IBM Smart Business Development & Test Cloud

The screenshot shows the homepage of the IBM Smart Business Development & Test Cloud. At the top, there's a navigation bar with the IBM logo, the text "IBM Smart Business", and "Register | Sign in". Below the navigation bar, the main title "Development & Test" is displayed in large, bold, black font. To the right of the title is a graphic consisting of overlapping yellow and orange triangles forming a stylized 'X' or asterisk shape. Below the title is a horizontal menu bar with five items: "Overview" (highlighted in blue), "Control panel", "Account", "Support" (highlighted in orange), and "About".

Reduce capital spending, contain operational costs, and shorten development cycles with IBM Smart Business Development and Test on the IBM Cloud.

Get started

Customers [Sign in]

Power your development & testing environment with cloud computing. Cloud computing enables speed to market and cost savings.

Deliver your next development project on time and on budget

IBM Smart Business Development and Test on the IBM Cloud addresses your development and test needs with a competitive edge. The flexible provisioning offered by this solution means you can get the IT resources you need, on demand, at a predetermined cost. Capital expenditures are limited or eliminated. Operational costs are contained and predictable. IT personnel no longer need to spend precious cycles deploying, configuring, and maintaining your development and test environment.

IBM Cloudburst

- **What does IBM Cloudburst provide?**
 - Self-Service Portal – allows Developers self-service access to IT infrastructure
 - Service Catalog – provides list of pre-engineered services that Developers can chose from
 - Automation – automatically provisions required server, storage and software when needed by Developers; without human intervention. Automatically de-provisions unused capacity, making it available for other users and increasing efficiency of data center assets
 - Built-in Virtualization – leverages the full capacity of server technology up to hundreds of virtual machines
 - Single Product – services included so can be deployed from single installation. No need to spend hours of IT operations staff time architecting, configuring, assembling and building from many servers, storage and software products
- **What are the IBM Cloudburst configuration details?**
 - Base Hardware Configuration:
 - 1 42U rack
 - 1 BladeCenter Chassis
 - 1 3650M2 Management Server, 8 cores, 24GB Ram
 - 1 HS22 CloudBurst Management Blade, 8 cores, 48GB RAM
 - 3 managed HS22 blades, 8 cores, 48GB RAM
 - DS3400 FC attached storage
 - Cloud Software Configuration:
 - IBM CloudBurst service management pack
 - IBM Tivoli Provisioning Manager v7.1
 - IBM Tivoli Monitoring v6.2.1
 - IBM Systems Director 6.1.1 with Active Energy Manager; IBM ToolsCenter 1.0; IBM DS Storage Manager for DS4000 v10.36; LSI SMI-S provider for DS3400
 - VMware VirtualCenter 2.5 U4; VMware ESXi 3.5 U4 hypervisor

Rational Jazz

- Jazz allows for Collaborative Application Lifecycle Management (C/ALM)
- Jazz is made up of:
 - **Rational Team Concert:** a complete agile collaborative development environment providing agile planning, source code management, work item management, build management, and project health, along with integrated reporting and process support.
 - **Rational Requirements Composer:** Helps teams to define requirements more effectively and manage them efficiently across the project lifecycle to gain better business outcomes through light-weight requirements practices
 - **Rational Quality Manager:** Provides quality assurance teams with the means to track and manage the quality lifecycle.

RAFW – Rational Automation Framework for WebSphere

- RAFW can be viewed as an integration between Rational Build Forge and WebSphere CloudBurst. RAFW for WebSphere reduces the complexity of managing your WebSphere environment. The automation framework for WebSphere is designed specifically to automate installation and patching, configuration change management, and application deployment. It supports the WebSphere application server and WebSphere portal products.
- The automation framework for WebSphere has the following installable components:
 - Framework server - you install this in your Rational Build Forge environment
 - Target Systems - these are automatically set up on WebSphere nodes.
- The framework server stores WebSphere configuration data, media for installation, and a library of WebSphere actions in a central location, enabling remote administration of application and portal servers located anywhere in your network.
- Integration with Rational Build Forge delivers additional value. You can schedule and automate action execution, track and audit WebSphere configuration changes, and use projects to integrate WebSphere actions with other application processes.

http://www.ibm.com/developerworks/websphere/techjournal/0912_brauneis/0912_brauneis.html

WebSphere Application Server Hypervisor

- **WebSphere Application Server Hypervisor edition is built on the virtual appliance model.** The core operating system is optimized for WebSphere Application Server following WebSphere tuning best practices, allowing for a uniquely valuable runtime environment. The WebSphere Application Server and its environment is automatically configured and tuned according to WebSphere best practices at first startup. Hypervisor Edition is packaged as an Open Virtualization Format (OVF) compliant package allowing for rapid introduction into server virtualization environments running hypervisors, such as IBM PowerVM or VMware ESX.
- **WebSphere Application Server Hypervisor Edition follows in the tradition of the WebSphere Application Server family and is built to accommodate a flexible and changing customer environment. This single virtual image allows for quick deployment of application foundation topologies, and can be instantiated as any of the following profiles through a new configuration interface.**
 - Deployment manager
 - Cluster member
 - Standalone Sever
 - Job manager
 - AdminAgent
 - IHS (IBM HTTP Server)
- **This virtual image also allows customers to optionally configure Feature Packs on system startup. This ala carte model allows Feature Packs to be simply and rapidly tested in a customer environment.**
- **WebSphere Application Server Hypervisor Edition also brings simplified maintenance to WebSphere environments in the cloud. IBM maintains and updates the full OVF compliant image with each fixpack, including the core operating system.**

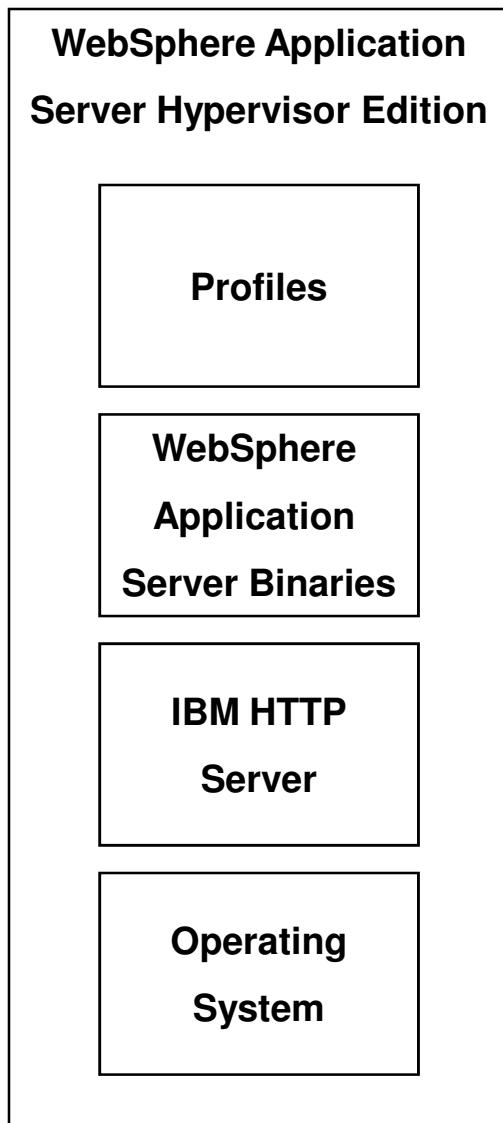
WebSphere CloudBurst Appliance

- **IBM WebSphere CloudBurst Appliance Version 2.0 is a new hardware appliance that provides access to WebSphere virtual images and patterns for easily, quickly and repeatedly creating application environments that can be securely deployed and managed in a private cloud.**
 - Capability to use multiple virtual images in a single pattern
 - Support for new WebSphere Application Server Hypervisor Edition for Red Hat Enterprise Linux Server
 - Availability of new WebSphere Process Server Hypervisor Edition
 - Availability of WebSphere Application Server Hypervisor Edition - Intelligent Management Pack
 - Speeds application deployment and dramatically reduces setup time for WebSphere environments from weeks to minutes with pre-defined patterns and virtual images
 - Increases agility through removal of manual processes that hinder productivity
 - Creates a cost-efficient, robust test environment with virtualized cloud-based resources using IBM Implementation Services for Cloud Computing
 - Ensures security in a shared environment serving as a secured, tamper-resistant vault for images and credentials
 - Integrates fully with development and service management tools from IBM Rational® and Tivoli® for end-to-end support

WS CloudBurst vs. WS Hypervisor vs. IBM CloudBurst

- The WebSphere CloudBurst appliance provides virtual images that are immediately available for use or can be customized. The images are WebSphere Hypervisor Edition images.
- Think of the WebSphere CloudBurst appliance as the “dispenser” of software environments into a private cloud and IBM CloudBurst as the “recipient” private cloud environment.

WebSphere Hypervisor Edition



Tivoli Products

- **IBM Tivoli Monitoring (ITM)**
- **Tivoli Provisioning Manager (TPM)**
- **Tivoli Service Request Manager (TSRM)**
- **Tivoli Service Automation Manager (TSAM)**
- **Tivoli Federated Identity Manager (TFIM)**
- **Tivoli Security Policy Manager (TSPM)**
- **Tivoli Storage Productivity Center (TSPC)**
- **Tivoli Usage and Accounting Manager (TUAM)**

Tivoli - IBM Tivoli Monitoring (ITM)

- IBM Tivoli Monitoring software helps you optimize IT infrastructure performance and availability.
- Monitor and manage system and network applications on a variety of platforms and keeps track of the availability and performance of all parts of an enterprise.
- Provide a common, flexible and easy-to-use browser interface and customizable workspaces to facilitate system monitoring.
- Detect and recovers potential problems in essential system resources automatically.
- Include, as part of the system monitoring software package, easy-to-use warehouse and advanced reporting capability
- Offer lightweight and scalable architecture, with support for IBM AIX®, Solaris, Windows®, Linux® and IBM System z® monitoring software

Tivoli - Tivoli Provisioning Manager (TPM)

- Help organizations optimize efficiency, accuracy and service delivery by automating best practices for data center provisioning activities.
- Help automate best practices for common data center provisioning activities in support of change and release management processes, helping to optimize efficiency, accuracy and service delivery
- Discover and track data center resources to enable highly accurate server provisioning and software deployments
- Automatically provision software and configurations to Unix, Linux and Windows servers
- Optimize availability by maintaining configurations and managing changes to resources

Tivoli - Tivoli Service Request Manager (TSRM)

- Automated request fulfillment system through integrated service desk and service catalog
- Manage both call-based and catalog-based requests in one solution with integrated service desk software and service catalog
- OCG Gold Level ITIL v3 Certification for Incident Management, Change Management and Request Fulfillment Management
- Employ change and configuration management software features, such as easy drag and drop screen, workflow customization and simple configuration tools for on-the-fly changes

Tivoli - Tivoli Service Automation Manager (TSAM)

- Enable users to request, deploy, monitor and manage cloud computing services.
- Offer an integrated management capability that addresses the lifecycle changes of a cloud service
- Included in IBM CloudBurst™ to help provide an easy to deploy private cloud package
- Integrate with IBM WebSphere® CloudBurst to speed the delivery of WebSphere-based services
- Originally built from TSRM + TPM + additional features

Tivoli - Tivoli Federated Identity Manager (TFIM)

- Simplify application integration using many forms of user credentials and facilitate secure information sharing between trusted business partners and divisions within an organization
- Improve the end-user experience by moving to user-centric, federated SSO identity management that puts customers, partners and suppliers in control of asserting trust, determining where sign-on is occurring and which user attributes to share
- Use open standards and specifications to enable greater collaboration across the business ecosystem
- Improve visibility into who is connecting to services and mainframe applications and help meet compliance requirements with a stand-alone identity service

Tivoli - Tivoli Security Policy Manager (TSPM)

- Centralize security policy management and fine-grained data access control for applications, databases, portals and services
- Automate, manage and enforce data-level access for applications and services
- Manage security policies and entitlements throughout the policy life cycle, from authoring and publishing to enforcing and updating
- Enforce policies at run time, strengthening your organization's security posture
- Use federated policy management to help bridge the gap between business and IT approaches to security policy

Tivoli - Tivoli Storage Productivity Center (TSPC)

- Improve time to value, as well as reduce the complexity of managing the storage environments by centralizing, simplifying and optimizing storage tasks associated with storage systems, storage networks, replication services and capacity management
- A single integrated solution designed to help improve your storage TCO and ROI by combining the assets, capacity, performance and operational management
 - IBM Tivoli Storage Productivity Center Basic Edition
 - IBM Tivoli Storage Productivity Center for Data
 - IBM Tivoli Storage Productivity Center for Disk
 - Tivoli Storage Productivity Center for Disk Midrange Edition
 - Tivoli Storage Productivity Center for Replication
 - IBM Tivoli Storage Productivity Center Standard Edition

Tivoli - Tivoli Usage and Accounting Manager (TUAM)

- Collect, analyze and bill based on usage and costs of shared Microsoft® Windows®, UNIX®, Linux®, IBM i5/OS® and VMware® computing resources
- Deliver detailed information and reports about the intricate use of shared resources while masking the underlying complexity
- Transform raw IT data into business information for cost allocation that spans business units, cost centers, applications and users
- Consolidate a wide variety of usage data with Data Collectors and a powerful “business rules driven” capability
- Integrate with Tivoli Service Automation Manager to capture service usage data to enable accurate billing for services consumed

Information Management

- Informix Dynamic Server: the IBM Information Management database product that offers the highest OLTP performance at low cost and requires no administration
- DB2 for z/OS: the IBM Information Management enterprise class database product that is scalable and optimized for SOA, CRM, and data warehousing
- IBM InfoSphere Information Server: the IBM Information Management product that enables customers to integrate and manage data from multiple diverse sources

IBM Smart Analytics Cloud Offering

- IBM InfoSphere Change Data Capture: the IBM Information Management BI solution that enables the customers to consolidate their data, make better business decisions, and reduce cost
- Cognos 8 Business Intelligence: the IBM Information Management BI solution that enables the customers to monitor all of their data across the organization via reports, analysis, scorecards, plans, etc.
- IBM Smart Analytics System Family: the IBM hardware & software (appliance) offerings that provide an end-to-end solution for a customer's BI needs.
 - System 5600 – System X
 - System 7700 – Power 7 System
 - System 9600 – System z

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Information Management Smarter planet Software for a Smarter planet IBM

Smart Analytics Family

Faster Time to Value, Faster Business Results

The diagram illustrates the Smart Analytics Family hierarchy. At the bottom is the **1050 New** solution, based on System x, designed for cost-effective analytics and reporting. Above it is the **2050 New** solution, also based on System x, offering optional Solid State Disk to reduce latency. The middle tier consists of the **5600 Refreshed** solution, based on System x, designed for business analytics workloads. The top tier is the **7700 Refreshed** solution, based on POWER7 Servers, capable of scaling to hundreds of terabytes of data and extracting insights from untapped information. The **9600** solution, based on System z, is at the top, featuring advanced query and workload management, a database optimized for system z, and a disk controller optimized to reduce data latency. A blue arrow on the right points upwards, labeled "Mid-Size" and "Enterprise".

Meeting clients where their information is...

1050 New
Based on System x
...Cost-effective solutions for analytics and reporting
...Compact, appliance-like single analytics solutions

2050 New
Based on System x
...Designed for business analytics workloads
...Optional Solid State Disk – reducing data latency

5600 Refreshed
Based on System x
...Scaling to hundreds of terabytes of data
...Extract insights from untapped information

7700 Refreshed
Based on POWER7 Servers
...Advanced query /workload management
...Database designed and optimized for system z
...Disk controller, optimized to reduce data latency

9600
Based on System z
...Advanced query /workload management
...Database designed and optimized for system z
...Disk controller, optimized to reduce data latency

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LotusLive

- **Web Conferencing**

- LotusLive Events
 - LotusLive Meetings

- **Collaboration**

- LotusLive Engage
 - LotusLive Connections

- **Email**

- LotusLive Notes
 - LotusLive iNotes

Hand-Held Devices and LotusLive iNotes

- LotusLive iNotes provides support for mobile devices via IMAP IDLE.
- IMAP IDLE provides a "push" e-mail feature in LotusLive iNotes.
- LotusLive Mobile lets you access your LotusLive network and collaboration services – including webcasting services, instant messaging, and more – right from your mobile device.



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Sample Test



Question 1

- A startup unit within a company is planning to go live with a new production application. The application has a small number of users but the user base is expected to grow exponentially within a few months.
- How should the application be set up?
 - A. horizontal cluster of application servers on two different machines to serve many users.
 - B. A set of computation resources enough to handle requests from the initial user population.
 - C. A vertical cluster of application servers on the same machine to take advantage of full CPU capacity.
 - D. A set of two clustered servers in a cloud computing environment that will be able to serve all anticipated users.

Question 1

- A startup unit within a company is planning to go live with a new production application. The application has a small number of users but the user base is expected to grow exponentially within a few months.
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 - C. A vertical cluster of application servers on the same machine to take advantage of full CPU capacity.
 - D. A set of two clustered servers in a cloud computing environment that will be able to serve all anticipated users.

Correct Answer: B

Question 2

- A company has implemented a cloud computing solution that allows users to request and provision application development environments. How can automation help manage the inherent risk when many users access these environments?
 - A. By authenticating users in the system.
 - B. By implementing multi-tenancy techniques.
 - C. By establishing an audit trail and integrating with existing process governance.
 - D. By optimizing availability to maintain configurations and manage changes to resources.

Question 2

- A company has implemented a cloud computing solution that allows users to request and provision application development environments. How can automation help manage the inherent risk when many users access these environments?
 - A. By authenticating users in the system.
 - B. By implementing multi-tenancy techniques.
 - C. By establishing an audit trail and integrating with existing process governance.
 - D. By optimizing availability to maintain configurations and manage changes to resources.

Correct Answer: C

Question 3

- **Which feature of cloud computing optimizes availability by maintaining configurations and managing changes to resources?**
- A. automation
- B. elasticity
- C. provisioning
- D. virtualization

Question 3

- **Which feature of cloud computing optimizes availability by maintaining configurations and managing changes to resources?**
- A. automation
- B. elasticity
- C. provisioning
- D. virtualization

Correct Answer: C

Question 4

- **What are two ways a virtual private cloud can help businesses reduce their cost? (Choose two.)**
- A. By virtualizing key business processes.
 - B. By providing maximum control over all data and infrastructure.
 - C. By reducing infrastructure capital expenditures for short term demand.
 - D. By terminating the instances when idle and only paying for what they use.
 - E. By using their internal IT department to maintain the entire infrastructure.

Question 4

- **What are two ways a virtual private cloud can help businesses reduce their cost? (Choose two.)**
- A. By virtualizing key business processes.
 - B. By providing maximum control over all data and infrastructure.
 - C. By reducing infrastructure capital expenditures for short term demand.
 - D. By terminating the instances when idle and only paying for what they use.
 - E. By using their internal IT department to maintain the entire infrastructure.

Correct Answer: CD

Question 5

- **Which two options are an accurate characteristic of the Software as a Service cloud delivery model? (Choose two.)**
- A. It allows for the deployment of customer owned software on a public cloud.
 - B. It allows for application maintenance and upgrades to be primarily managed by the cloud provider.
 - C. It allows the sharing of application resources in a one to many environment and on a pay for use basis.
 - D. It provides access to storage and virtual machines which can be combined and layered for running applications.
 - E. It provides access to a middleware software stack and development tools hosted by the provider on the hardware infrastructure to build and run custom applications.

Question 5

- **Which two options are an accurate characteristic of the Software as a Service cloud delivery model? (Choose two.)**
- A. It allows for the deployment of customer owned software on a public cloud.
- B. It allows for application maintenance and upgrades to be primarily managed by the cloud provider.
- C. It allows the sharing of application resources in a one to many environment and on a pay for use basis.
- D. It provides access to storage and virtual machines which can be combined and layered for running applications.
- E. It provides access to a middleware software stack and development tools hosted by the provider on the hardware infrastructure to build and run custom applications.

Correct Answer: BC

Question 6

- **What is provided by the Platform as a Service cloud computing delivery model?**
 - A. Access to hosted applications.
 - B. A computing platform and a runtime environment.
 - C. A platform where virtualized machines can be hosted.
 - D. Services integrated with private networks and applications.

Question 6

- **What is provided by the Platform as a Service cloud computing delivery model?**
- A. Access to hosted applications.
- B. A computing platform and a runtime environment.
- C. A platform where virtualized machines can be hosted.
- D. Services integrated with private networks and applications.

Correct Answer: B

Question 7

- **Which statement best describes cloud architectures?**
 - A. Single tiered application design.
 - B. Design techniques to help make applications run faster.
 - C. An industry standard set of specifications for creating cloud applications.
 - D. Designs of software applications that use Internet accessible on-demand services.

Question 7

- **Which statement best describes cloud architectures?**
- A. Single tiered application design.
- B. Design techniques to help make applications run faster.
- C. An industry standard set of specifications for creating cloud applications.
- D. Designs of software applications that use Internet accessible on-demand services.

Correct Answer: D

Question 8

- In order to reduce travel cost, a company has decided to leverage the services of a public cloud to provide virtual collaboration capabilities (i.e. web conferences, video, and chat) to its employees. However the company wants to pay only for the computing resources used by its employees.
- Which billing model would meet this requirement?
 - A. utility
 - B. recurring
 - C. subscription
 - D. per user based

Question 8

- In order to reduce travel cost, a company has decided to leverage the services of a public cloud to provide virtual collaboration capabilities (i.e. web conferences, video, and chat) to its employees. However the company wants to pay only for the computing resources used by its employees.
- Which billing model would meet this requirement?
 - A. utility
 - B. recurring
 - C. subscription
 - D. per user based

Correct Answer: A

Question 9

- **What are two challenges that IBM Rational Automation Framework for WebSphere addresses when building application environments? (Choose two.)**
- A. It reduces errors due to manual execution.
- B. It reduces time consuming application build processes.
- C. It reduces manual test procedures which add time to quality testing.
- D. It improves quality of applications due to badly written requirements.
- E. It allows for collaboration on work items due to geographically dispersed resources.

Question 9

- **What are two challenges that IBM Rational Automation Framework for WebSphere addresses when building application environments? (Choose two.)**

- A. It reduces errors due to manual execution.
- B. It reduces time consuming application build processes.
- C. It reduces manual test procedures which add time to quality testing.
- D. It improves quality of applications due to badly written requirements.
- E. It allows for collaboration on work items due to geographically dispersed resources.

Correct Answer: AB

Question 10

- **How can it be determined if a server has enough capacity to handle peak workload for a virtual machine?**
 - A. Use the hypervisor to reallocate workload to ensure enough space for the virtual machine.
 - B. Measure the CPU utilization in the virtual machine to see if it is sufficiently below 100%.
 - C. Look up the physical CPU capacity of the server and compare it to the application utilization when it was not virtualized.
 - D. Measure the utilization of the server and all the virtual machines on it to see if there is enough allocation space left for the virtual machine.

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Correct Answer: D

Question 11

- **Which statement defines the IBM WebSphere CloudBurst Appliance?**
 - A. It is a device that routes messages between virtualized WebSphere application environments.
 - B. It is a device that provides cloud-based storage capabilities for applications that run on WebSphere.
 - C. It provides the ability to regulate and route application requests to virtualized WebSphere application environments.
 - D. It allows users to create, deploy, and manage virtualized WebSphere application environments in an on-premise or private cloud.

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Correct Answer: D

Question 12

- **How is data accessed and moved into and out of the IBM Smart Business Storage Cloud?**
- A. Through IBM's public cloud portal.
- B. Through new standard cloud computing protocols.
- C. Through standard file access protocols like NFS, CIFS, and FTP.
- D. Through standard block storage protocols such as Fibre Channel and iSCSI.

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Question 13

- A large enterprise is experiencing a significant increase in their data and it is putting a strain on their existing infrastructure. They are concerned about their ability to meet the demand without significant capital expenditures and are looking for a cost effective cloud based solution. They want database software that can deliver industry leading performance across multiple work loads while lowering administration, storage, development, and server costs. It should also be reliable, scalable, and optimized for SOA, CRM, and data warehousing.
- Which IBM database server offering is best suited for this client scenario?
 - A. IBM Lotus Domino Server
 - B. IBM InfoSphere DataStage
 - C. IBM DB2 Enterprise Server
 - D. IBM InfoSphere Information Server

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Correct Answer: C

Question 14

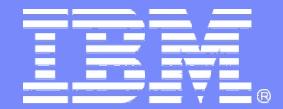
- **What is IBM's offering for online collaboration services using the cloud?**
 - A. IBM LotusLive
 - B. IBM Lotus Quicker
 - C. IBM Smart Business Cloud
 - D. IBM Smart Analytics Cloud

Question 14

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- B. IBM Lotus Quicker
- C. IBM Smart Business Cloud
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Correct Answer: A



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Appendix



URLs

- **Certification**

- <http://www-03.ibm.com/certify/certs/50001101.shtml>

- **Exam**

- <http://www-03.ibm.com/certify/tests/ovr032.shtml>

- <http://www-03.ibm.com/certify/tests/obj032.shtml>

- <http://www-03.ibm.com/certify/tests/edu032.shtml>

- **Sample Test**

- <http://public.dhe.ibm.com/partnerworld/pub/certify/sam032.pdf>

More URLs

- <http://www.ibm.com/ibm/cloud/>
- http://www.ibm.com/developerworks/websphere/techjournal/0904_amrhein/0904_amrhein.html

Thank You

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