Foundations of Cloud Computing

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Agenda

- Introduction to Cloud Computing
- Overview of IBM Certification
  - Job Role and Test Name
  - Test Sections
    - Concepts and Benefits
    - Design Principles
    - Architecture
- Customer requirements & IBM Offerings
- Q & A
Why Cloud Computing

1.2 zettabytes (1.2 trillion GB) exist in the “digital universe
- 50% YTY growth
- 25% of data is unique; 75% is a copy

32.6 million servers worldwide
- 85% idle computer capacity
- 15% of servers run 24/7 without being actively used on a daily basis

$12.3 billion in the US spent annually on maintenance for unused software
- 10% of all software purchased becomes shelfware
- More than $100 worth of installed but unused software per PC

Between 2000 and 2006:
- Storage grew 69x
- Servers grew 6x
Virtual machines growing 42% per year

Internet connected devices growing 42% per year
But IT budgets are growing less than 0.8% per year

Reinvent Business
Rethink IT
Economics of Computing are Changing
Cloud computing…

Cloud computing is a **new consumption and delivery model** inspired by consumer Internet services. Cloud computing exhibits the following 5 key characteristics:

- On-demand self-service
- Ubiquitous network access
- Location independent resource pooling
- Rapid elasticity
- Pay per use

A **user experience and a business model**

- Standardized offerings
- Rapidly provisioned
- Flexibly priced
- Ease of access

An **infrastructure management and services delivery method**

- Virtualized resources
- Managed as a single large resource
- Delivering services with elastic scaling

Cloud is an **Evolution**

**CLOUD**
Dynamic provisioning of workloads

**SHARE RESOURCES**
Common workload profiles

**AUTOMATE**
Flexible delivery & Self service

**STANDARDIZE**
Operational Efficiency

**VIRTUALIZE**
Increase Utilization

**Traditional IT**
Private, on-premise cloud

All resources are local and dedicated. All cloud management is local.
Public – with Dedicated Model

Resources can be dedicated, but off-premise. Customer administrators can manage the catalog and policies. Can specify security policy, isolation, integrity and customize compute requirements.
Hybrid Cloud: Managing Multiple Clouds

Enterprise Data Center

Public / Off Premise Cloud

Resources are on & off premises and managed through Federated Services Management - Customer administrators can manage their catalog and policies.
Spectrum of Deployment Options for Cloud Computing

Private Cloud
Enterprise Data Center
Enterprise owned and operated

Managed Private Cloud
Enterprise Data Center
Third-party operated

Hosted Private Cloud
Enterprise
Third-party hosted and operated
Customer/IBM owned and IBM operated (single tenant)

Shared Cloud Services
Enterprises
Cloud Services delivered privately to Enterprises / virtual separation of tenants
IBM owned and operated (multi-tenant)

Public Cloud Services
Users
Cloud Services delivered publicly to end users / secure, enterprise-class
IBM owned and operated (multi-tenant)

Private
IT capabilities are provided “as a service,” over an intranet, within the enterprise and behind the firewall

Public
IT activities / functions are provided “as a service,” over the Internet

Hybrid
Internal and external service delivery methods are integrated
What is different about cloud computing?

**Without cloud computing**

- Workload A
  - Software
  - Hardware
  - Storage
  - Networking

**With cloud computing**

- Virtualized resources
- Automated service management
- Standardized services
- Location independent
- Rapid scalability
- Self-service

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**Workload A**
- Software
- Hardware
- Storage
- Networking

**Workload B**
- Software
- Hardware
- Storage
- Networking

**Workload C**
- Software
- Networking
- Storage
- Networking
# Cloud Components and services

<table>
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<tr>
<th>Components supply</th>
<th>Infrastructure services</th>
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| **Services**      | **Platform as a Service (PaaS)**
| IT and business consulting, systems integration, outsourcing, and other services used to develop and support cloud services and infrastructure | Customers *use programming languages, tools and platforms* to *develop and deploy applications on multi-tenant, shared infrastructure* with *ability to control deployed applications and environments* *without the need to manage or control* the underlying resources |

| **Software**      | **Infrastructure as a Service (IaaS)**
| Application, platform, information management, system management, development tools, and other software used to set-up and operate cloud services and infrastructure | Customers *use processing, storage, networks*, other computing resources with *ability to rapidly and elastically provision and control* resources to deploy and run software and services *without the need to manage or control* the underlying resources |

| **Hardware**      | **Software as a Service (SaaS)**
| Servers, storage and networking hardware used to build cloud services and infrastructure | Customers *use applications* (Eg, CRM, ERP, E-mail) *from multiple client devices through a Web browser* on *multi-tenant and shared* infrastructure *without the need to manage or control* the underlying resources |

| **Software Process as a Service (BPaaS)** | **Business services** |
| Customers consume *business outcomes* (Eg, payroll processing, HR) by accessing business services *via Web-centric interfaces* on *multi-tenant and shared* infrastructures *without the need to manage or control* the underlying resources |
Workloads may be at different levels of readiness for cloud.
Cloud Computing – Behind the scenes
IBM Certified Solution Advisor  
(Cloud Computing Architecture V1)

An IBM Certified Solution Advisor - Cloud Computing Architecture V1 is a person who can

- Clearly explain the benefits and underlying concepts of cloud computing.
- Demonstrate how customer can realize the benefits of cloud computing within their environment
  - Identify cloud computing architecture and design principles
  - Map customer’s requirements to the IBM Software Cloud Computing offerings

Test 000-032: Foundations of IBM Cloud Computing Architecture V1

<table>
<thead>
<tr>
<th>SECTIONS</th>
<th>Areas / topics</th>
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| Concepts and Benefits | ✓ Conceptual knowledge of Cloud Computing principles.  
✓ Working knowledge of how to implement Cloud Computing concepts and the various types of clouds and the various types of “Cloud as a service” offerings.  
✓ Conceptual knowledge of various Cloud Computing business models.  
✓ Working knowledge of key concerns and how they are addressed in Cloud Computing such as security, performance, etc.  
✓ Conceptual knowledge of the IBM Software Cloud Computing offerings such as LotusLive, IBM Tivoli Service Automation Manager, IBM Smart Business Development and Test Cloud, IBM WebSphere CloudBurst Appliance, IBM DB2 & Informix and IBM HW Solutions for Cloud Computing |
| Design Principles   |                                                                                                                                                                                                               |
| Architecture        |                                                                                                                                                                                                               |
Foundations of IBM Cloud Computing Architecture V1

- Job Role - IBM Certified Solution Advisor - Cloud Computing Architecture V1
  - More info
    http://www-03.ibm.com/certify/certs/50001101.shtml

- Test 000-032:
  - Number of questions: 48
  - Time allowed in minutes: 75
  - Required passing score: 66%

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<th>Sections</th>
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Cloud Computing Concepts and Benefits

- **Realize the terms** -
  - Delivery models - Private, Public, Hybrid cloud
  - Service models – SaaS, PaaS, IaaS
  - Service Providers – ASP, ISP, xSP
  - Virtualization, Provisioning, Elastic scaling, Automation, Pervasiveness, Flexible Pricing,
  - Multitenancy, Multi-instance
  - Grid computing, Utility computing, Cluster env,
  - Dynamic Infrastructure, Energy Mgmt, ITIL


**Cloud Computing Design Principles**

- **Realize the terms** -
  
  - 5 layers of cloud computing
  - Hardware - Processing Unit, Storage, Network
  - Network Mgmt & performance
  - User security strategy
  - Cloud web technologies
  - Billing models

**Cloud Computing Architecture**

- **Realize the terms** -
  
  - IBM Cloud Reference Architecture
  - Steps to create cloud instance
  - Hypervisor, Storage, Security
**Cloud computing layers**

- **Client** – Remote access clients - Desktop, Laptop, Smartphone, Tablet etc., with software to access cloud computing like operating systems, and browsers.

- **Application** – cloud application services which can be acquired on-demand. Example: email, documents, file sharing.

- **Platform** – A computing platform with and/or solution stack as a service.

- **Infrastructure** – delivers computer infrastructure typically a platform virtualization environment, as a service, ex. compute, storage etc.,

- **Server** – The physical computer hardware software that are specifically designed for the delivery of cloud services.
Principles of Hardware used in cloud computing

- **Processing unit** – CPU, RAM must support following
  - Elasticity: ability to meet changing requirements of visualized resources
  - Migration: Ability to move visualized assets from one processing unit to another

- **Storage must support**
  - Rapid provisioning and de-provisioning of virtual assets.
  - Migration of virtual assets
  - Security measures to keep one customer from accessing another customers data

- **Network** – based on variety of specialized hardware
  - Storage Area Network (SAN)
  - Hardware management network
  - Application network
    - Customer network
    - Management Network
Principles Guiding IBM Cloud Architecture

An architectural principle is an overarching guideline or paradigm driving decisions across the entire architecture development process. IBM established three principles that guide IBM cloud architects in defining the detailed components of each module:

- **Efficiency principle.** Design for cloud-scale efficiencies and time-to-deliver/time-to-change metrics when realizing cloud characteristics such as elasticity, self-service access and flexible sourcing.
  - **Objective:** drive down costs per service instance hour and time to response by orders of magnitude.

- **Lightweight principle.** Support lean and lightweight service management policies, processes and technologies with an eliminate-standardize-optimize evolutionary approach.
  - **Objective:** radical exploitation of standardization in cloud environments to reduce management costs.

- **Economies-of-scale principle.** Identify and leverage commonality in cloud service design.
  - **Objective:** Optimize sharing of management components and infrastructure across cloud services to reduce capital expense, operating expense and time to market.
Common Cloud Management Platform Reference Architecture

Cloud Service Consumer
- Consumer End user
- Partner Clouds
- Consumer Business Manager
- Customer In-house IT
- Consumer Administrator

Cloud Service Provider
- Business-Process-as-a-Service
- Software-as-a-Service
- Platform-as-a-Service
- Infrastructure-as-a-Service

Virtualized Infrastructure – Server, Storage, Network, Facilities

Common Cloud Management Platform
- BSS (Business Support System)
  - Offering Mgmt
  - Order Mgmt
  - Accounting & Billing
  - Contract Mgmt
- OSS (Operational Support System)
  - Service Request Management
  - Provisioning
  - Monitoring & Event Management

Service Provisioning
- Metering, Analytics & Reporting
- Service Offering Catalog
- Service Delivery Catalog
- Service Templates
- Configuration Mgmt
- Virtualization Mgmt

Service Delivery Portal
- Service Delivery Portal
- Service Development Portal

Service Development Tools
- Service Development Portal
- Image Creation Tools

Service Security Manager
- Security & Resiliency
- Service Operations Manager
- Service Transition Manager
- Service Business Manager

API
- User Interface

Developer
- Developer
Cloud Realization via Service Management (ITIL)

Service Strategy

- Cloud Ready?
- ROI

For locating and requesting services

Service Design

Self-service portal, automation engine and catalog

Service Operations

Managing cloud services

Service Transition

Deploying cloud services

Automated provisioning and image management

Continual Service Improvement

Monitoring, security and metering
Customer requirements & IBM Offerings

Map requirements to IBM Offerings -

- IBM Cloud offerings for private, public and hybrid.
- Rational – RAFW, Jazz C/ALM
- WebSphere – Hypervisor, CloudBurst
- Tivoli – TPM, TSAM, ITM, ISDM, TFIM, TSPM, TSRM, TAMIT, CCMDB, TSPC, TSM, TADDM, NetCool/Omnibus
- IM – Cognos, InfoSphere, Informix, DB2 enterprise
- Lotus – LotusLive meetings, Events, Connections, iNotes, Mobile
Multiple entry points to Deploy and manage Cloud Based Services

**IBM Tivoli Service Automation**

- Flexible software solution to support user-driven service requests and automated resource deployment
- Self-service user interface for service requests for improved responsiveness and efficiency
- Workflow support to manage the approval process of usage
- Automates provisioning of IT resource deployment for efficient operations and to address fluctuating business requirements
- Interoperable with existing hardware to leverage available resources and previous investment

**IBM Service Delivery Manager**

- Pre-configured service management solution optimized for managing virtual environments and cloud deployments
- Pre-integrated solution, delivered as virtual images for faster installation and time to value
- Performance monitoring for ongoing services and VMs
- Usage and accounting tracking for chargeback capabilities
- Management server ready for High Availability
- Energy Management for tracking and optimizing operational costs

**IBM CloudBurst**

- Integrated hardware, software and service solution optimized for cloud
- Pre-integrated bundle with software, hardware, storage, network and QuickStart services for rapid time to value

**Self contained** Managed-from and managed-to environment to accelerate cloud computing pilots
# Workloads mapped to IBM Smart Business portfolio offerings

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<th>Infrastructure compute</th>
<th>Infrastructure storage</th>
<th>Business services</th>
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<td>Lotus Live Lotus iNotes</td>
<td>Smart Business Dev and Test on the IBM Cloud</td>
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<td>IBM Info Protection Svcs</td>
<td>BPM BlueWorks</td>
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<td>IBM Smart Business Services</td>
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<td>Smart Business Expense Reporting Blackberry Ent Svcs</td>
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<td>IBM Smart Business Systems</td>
<td>IBM Smart Analytics System</td>
<td>IBM CloudBurst™ family</td>
<td>Smart Business Desktop Cloud for Mobile Devices</td>
<td>IBM Information Archive</td>
<td>IBM Information Archive</td>
<td>Smart Business for Small or Midsize Business (backed by the IBM Cloud)</td>
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<tr>
<td>Consulting Services</td>
<td>IBM Infrastructure Strategy and Design for Cloud Computing IBM Strategy &amp; Change Services for Cloud Adoption IBM Strategy &amp; Change Services for Cloud Providers</td>
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**LotusLive Offerings**

**Web Conferencing**

- **LotusLive Meetings**
  LotusLive Meetings is a full-featured online meeting service that integrates Web, audio and video conferencing.

- **LotusLive Events**
  LotusLive Events is an online event management service, helping you create, host and manage your next online conference.

**Collaboration**

- **LotusLive Engage**
  LotusLive Engage combines file sharing, Web conferencing, instant messaging, social networking, and project management together in one place, accessible from anywhere.

- **LotusLive Connections**
  LotusLive Connections integrates you business network with file sharing, instant messaging and social networking in one place, accessible from anywhere.

**eMail**

- **LotusLive Notes**
  IBM’s most widely used software, Lotus Notes is now available as an online service called LotusLive Notes.

- **LotusLive iNotes**
  Secure, web-based service for email, calendaring and contact management.

Rational Offerings: Collaborative ALM
An evolution of jazz in the cloud

Developers link to requirements from work-items

Testers link to requirements from test plans and test cases

Analysts communicate requirements with links to development and test plans

VIRTUALIZATION + STANDARDIZATION + AUTOMATION = Cost, Flexibility, Agility@scale
# IBM Software Products for Cloud

## IBM Service Delivery Manager
- Tivoli Service Automation Manager
- Tivoli Monitoring
- Tivoli Usage & Accounting Manager
- Tivoli Netcool Performance Flow Analyzer
- Tivoli Composite Application Manager
- Tivoli Storage Manager
- Tivoli Netcool/OMNibus
- Tivoli Storage Productivity Center
- Tivoli Business Service Manager
- Tivoli Netcool Service Quality Manager

## Rational
- Rational AppScan
- Rational Team Concert
- Rational Quality Manager
- Rational Req.Composer
- Rational BuildForge
- Rational Asset Manager

## WebSphere
- WAS Hypervisor Edition
- WebSphere CloudBurst
- IBM WebSphere Commerce
- ... (Continued)

## Information Management
- InfoSphere Warehouse
- InfoSphere Info Server
- Informix Dynamic Server
- Cognos Express
- DB2
- ... (Continued)

## Lotus
- LotusLive
- LotusLive Meetings
- LotusLive Events
- LotusLive Connections
- LotusLive Engage
- LotusLive iNotes

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*Not all inclusive – example of some of the solutions for Cloud*
**What next** - Develop roadmaps and recommendations to build cloud solutions

1. **Cloud Positioning**
   - Open discussion of cloud
   - Linked to business challenges, IT drivers, barriers

2. **Cloud Workload Prioritization**
   - Select client motivators and barriers for moving to cloud
   - Prioritize workload using them

3. **Cloud Value Proposition**
   - Using case studies, understand potential returns on investment in cloud
   - Migrating workload to cloud delivery model

4. **Cloud Reference Architecture**
   - Describe foundation model for building cloud solutions
   - Understand applicability to selected workloads

5. **Assessment of Cloud-enabling Capabilities**
   - Where are you now?
   - Where do you need to be?
   - Which initiatives will be aided by closing the gap?

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**ROI analysis example - Banking (large # of servers)**

- Predicted Period Savings:
  - Total Initial Investment: $1,772,422.40
  - Net Present Value (NPV): $1,772,422.40
- Estimated ROI over 3 years:
  - 495.75% Estimated avg. annual ROI 150.49%

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**Cumulative Costs**

- Software
- Service Templates
- Common Cloud Management Platform
- Infrastructure Compute
- Infrastructure Storage
- Monitoring & Event Management
- Security & Resiliency
- Capacity & Performance Management
- Change & Configuration Management
- Incident & Problem Management
- Service Request Management
- Service Development Tools
- IT Service Level Management
- Image Lifecycle Management
- Dev/test
- Cloud Service Provider
- Cloud Services
- Cloud Service Consumer
- Cloud Service Integration Tools
- Cloud Service Developer
- Cloud Services
- Infrastructure for hosting Cloud Services and Common Cloud Management Platform
- Data center costs (Virtualized) Infrastructure –Server, Storage, Network, Facilities
- Data, information

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**Delivering Business Value through Cloud Computing**

- IT capability provided to Cloud Service Consumer

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**ROI projections from IBM Research Study 2009**

- Payback Period (months)
- Net Present Value (NPV)
- Total Initial Investment for Test Cloud

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**Cloud Workload Prioritization**

- Cloud Positioning
- Cloud Workload Prioritization
- Cloud Value Proposition
- Cloud Reference Architecture
- Assessment of Cloud-enabling Capabilities
Thank you!

For more information, please visit: http://www.ibm.com/cloud

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