Cloud Computing Essentials

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Introductory Topics

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1 Introduction to Cloud Computing

Cloud Computing: Common Terms and Definitions

- Cloud services such as Gmail, Hotmail, Salesforce
  - are hosted on hardware at another location
  - the hardware is somebody else's responsibility
- Cloud services are accessible on demand
  - from any device using a web browser
  - an Internet connection
  - These are features of cloud computing not definitions of cloud computing

Cloud Computing: Common Terms and Definitions

- Elasticity
  - add or remove cloud services any time
  - Add or remove user accounts at any time
- Virtualization
  - multiple installed operating systems
    - run simultaneously on a single computer system

Cloud Computing and Virtualization

- Virtualization
  - hides physical hardware details
  - from a virtual machine
- Virtualization is a technology
- Cloud computing is a business model

Cloud Computing and Virtualization

- Cloud computing can use
  - self-provisioning web portals
  - where administrators can create their own virtual machines in the cloud
    - IaaS
- An existing physical or virtual server
  - Can be migrated to the cloud to save configuration time.

Early Examples of Cloud Computing

- Time-sharing
  - on expensive mainframe computers stems from the 1960s
    - and was the first form of shared resource pooling
- The 1980s and 1990s saw
  - application service providers (ASPs) offering hosted solutions

Early Examples of Cloud Computing

- Cloud services vs ASPs
  - Cloud clients don't buy software to be hosted by ASPs
  - cloud clients pay to use software offered by the provider

Cloud Computing Deployment Models

- Cloud computing is a business concept where software is delivered to clients
  - over the Internet,
  - so there is minimal local hardware and software to maintain
- Private clouds
  - are designed within a specific organization.

Cloud Computing Deployment Models

- Community clouds
  - are designed for multiple organizations
    - sharing the same computing needs
- Public clouds
  - are available to any public subscriber on the Internet
- Hybrid clouds combine
  - a company's local private cloud with a provider's public cloud
  - often for authentication purposes.

Positive Indicators for Cloud Readiness

- Because of elasticity
  - cloud services are best suited for businesses that grow and shrink often
  - or whose IT workloads are unpredictable
- Investing in local hardware, software, and licensing, as well as IT support, can be costly
  - most of this gets shifted to the cloud provider
- Similar to utilities such as water and electricity
  - with cloud computing you
    - pay only for the services you use.

Negative Indicators for Cloud Readiness

- Predictable workloads better utilize costly computer hardware
- Companies that
  - do not grow or shrink dynamically do not need to scale their computer resource usage
- Legal or regulatory requirements
  - might disallow the use of cloud resources
- Cloud reliability may not be enough
  - for mission-critical systems related to
    - law enforcement, military, or emergency services.

Cloud Service Categories

- Anything as a Service (XaaS) is a generic term for any computing service
  - delivered over a network
- Software as a Service (SaaS)
  - is for end users and
  - delivers a web app over the
    - Internet to a user using a web browser

Cloud Service Categories

- Platform as a Service (Paas)
  - Is for software developers
  - Allows the use of virtual machine environments with specific development environments and back-end databases
- Infrastructure as a Service (Iaas)
  - is for IT administrators
  - and includes cloud servers, cloud storage, cloud backup, and so on

2 Business Perspectives

Cloud Computing and Outsourcing

- Cloud services
  - Are reachable over a network using a web browser
  - and use provider hardware and expertise for IT solutions
- Outsourcing uses
  - outside expertise, whether it is IT related or not,
    - to complete a specific business task.

Cloud Computing and Outsourcing

- Cloud solutions
  - allow rapid elasticity,
  - whereas outsourcing takes more time to make contractual changes.
- The outsourcing of IT tasks
  - allows tailor-made customer solutions.
- Vendor-lock is possible for both cloud computing and outsourcing

Characteristics of Clouds and Cloud Services from a Business Perspective

- Scaling cloud services
  - to meet your business needs
  - is done quickly via cloud provider web pages
- The redundancy of Internet links ensures
  - the likelihood of your data always being available.

Characteristics of Clouds and Cloud Services from a Business Perspective

- Cloud providers take care of
  - redundant servers,
  - load balancing,
  - and data storage.
- Data confidentiality
  - protects data from unauthorized users
    - via encryption.
- Data integrity
  - protects data from being tampered with

How the Characteristics of Cloud Computing Enhance Business Value

- Cloud computing
  - shifts capital expenses to operating expenses.
- Without cloud computing,
  - a business must purchase, install, configure, and maintain server computer systems.

How the Characteristics of Cloud Computing Enhance Business Value

- With Cloud
  - Businesses can focus on the timely realization of opportunities
    - before their competitors do since they are not focused on the IT infrastructure.
- Data collaboration is facilitated
  - when data is stored in the cloud.

3 Technical Perspectives

Public and Private Clouds

- Public clouds
  - Are available to all Internet users
  - Charge their customers subscription and metered usage fees
  - offer limited control of resources and security
  - are considered more secure than private clouds.

Public and Private Clouds

- Private clouds
  - are for the exclusive use of a single organization
  - imply the use of private networks
  - might track and charge resource usage
    - to departments within the organization

Public and Private Clouds

- SaaS, PaaS, and IaaS offer varying types of computing services
  - to public and private cloud users
- SaaS offers
  - applications to end users over the network
- PaaS provides
  - building blocks for application developers (APIs)
    - that take the form of web services,
      - often using standards such as XML and JSON

Public and Private Clouds

- IaaS provides
  - server virtualization,
  - which allows multiple virtual machines to run a single piece of server hardware
    - Each virtual machine is completely independent of another
- IaaS provides
  - content distribution networks (CDNs),
    - which use DNS to direct end users to the nearest web site content.
- Both public and private cloud resource usage
  - must be managed, monitored, and metered for billing or chargeback

Cloud Computing Deployment

- Network bandwidth
  - measures the speed at which data is sent over a connection.
- Latency
  - measures network transmission delay
- Cloud servers use
  - host-based firewalls
- Provisioning of cloud resources is expedited
  - through the use of automation and self-service web portals

Cloud Computing Deployment

- Federation allows
  - SSO for applications that might be hosted across multiple cloud providers
  - The identity source can be an organization's local user accounts or cloud identities
- Standardization allows
  - cloud components to interoperate with other cloud components
    - even between different cloud providers

Cloud Computing Risks and Challenges

- High bandwidth and low latency
  - are desirable for optimal application performance
- Cloud data access is also optimized
  - with high-bandwidth, low-latency network connections
- Virtual servers can be configured
  - with one or more CPUs;
  - some applications are processor intensive
- An organization's data might need to be
  - synchronized between different cloud applications
  - or between a cloud application and a locally hosted application.

Risks and Challenges

- Business data can be
  - imported to the cloud for use by cloud software
  - it can be exported from the cloud for use elsewhere
- The network distribution of cloud clients
  - means traditional firewall methods may not be enough;
  - cloud providers have the resources to properly handle
- network security
  - with host-based firewalls,
  - private networks,
  - third-party audits, and so on.

Impact on Application Development and Architecture

- PaaS gives
  - developers building blocks used to create custom cloud solutions
- The cloud
  - allows rapid provisioning of virtual machines and storage
    - used to create, test, and deploy these custom cloud solutions
      - that can be deprovisioned when not needed.

4 Adopting Cloud Computing

Steps Leading to Successful Cloud Adoption

- Pilot low-risk applications in the cloud
  - rather than mission-critical or complex applications
- Applications whose data requires collaboration
  - Can benefit from cloud storage.
- Internal IT staffers are involved in
  - evaluating cloud solutions
  - Evaluating application migration
  - Monitoring cloud deployments.

Steps Leading to Successful Cloud Adoption

- Multiple cloud providers should be evaluated
  - to find the best fit that meets the business needs
- For larger organizations
  - a private cloud might offer better solutions than a public cloud

Vendor Roles and Capabilities

- Cloud consumers (subscribers)
  - use the services offered by cloud providers.
- Cloud carriers
  - provide connectivity between the cloud subscriber and the cloud provider
- The service offerings of providers include
  - virtualization, software libraries, software packages, self-service portals, and management portals.

Vendor Roles and Capabilities

- Cloud services work only if the network is available
- Components of a contingency plan
  - Redundant network connections
  - Local in-house application hosting
  - Additional cloud providers

Organizational Capabilities for Realizing Cloud Benefits

- Internal IT staff responsibilities will shift
  - from provisioning on-premises servers
  - to provisioning scalable cloud services
- Internal IT staff
  - must monitor the performance and reliability of cloud services

Organizational Capabilities for Realizing Cloud Benefits

- Modularizing applications into reusable components
  - makes applications quicker to develop
  - and increases their life span
- Selecting the appropriate cloud services
  - that increase business value and negotiating the related SLAs (if possible) are critical skills

Migrating Applications to the Cloud

- An organization's on-premises servers
  - might be migrated to virtual machines in the cloud
- Replacing an application
  - with a functional cloud equivalent
    - might facilitate the adoption of a cloud solution
- Complex applications
  - can be broken into smaller reusable cloud components
  - that can be migrated separately from one another

5 Operating Cloud Computing

Changes on IT Service Management

- Cloud adoption means
  - Some internal IT processes will change
  - IT process changes will vary from org to org
- The provisioning speed of computing services to Cloud
  - necessitates changes
  - compared to the traditional method of planning, purchasing, installing, and maintaining IT systems

Changes on IT Service Management

- IT staff will ensure
  - Cloud services are available and reliable through performance monitoring
- responsibility of cloud providers
  - ensure servers, disk space, web sites, and other infrastructure
  - are readily available to users

Changes on IT Service Management

- ITIL service management phases affected by cloud computing
  - Service Strategy
  - Service Design
  - Service Operation
  - Service Transition
- Some IT processes will change significantly
- Others, such as security entitlements, might not
  - Users must still be given access to aspects of cloud services related to their job roles

Impact of Cloud Computing on ITIL

- ITIL maps IT processes to business needs
- The use of cloud services
  - demands changes in IT processes
  - in each service management phase
- Processes that will change
  - Service Strategy Phase
  - Demand Management
  - Service Portfolio Management
  - Financial Management

Impact of Cloud Computing on ITIL

- For example, Demand Management
  - Relates to how cloud customers can
    - Quickly appropriate new computing resources
  - How these demands can be efficiently met

Impact of Cloud Computing Using ITIL

- Processes impacted by cloud adoption
  - Service Design Phase
  - Service Catalog Management
  - Service Level Management
  - Supplier Management
  - Capacity Management
  - Availability and Service Continuity Management
  - Information Security Management

Impact of Cloud Computing Using ITIL

- A good example is Capacity Management
  - IT services must be available
    - according to SLA metrics
    - in a timely manner
    - and at a low cost

Impact of Cloud Computing Using ITIL

- Must change for a successful cloud implementation
  - Service Operation Phase
  - Request Fulfillment
  - Event Management
  - Incident Management
  - Problem Management
  - Access Management

Impact of Cloud Computing Using ITIL

- Example
  - Incident Management
    - includes making sure that
      - cloud IT services are always available to users

Impact of Cloud Computing Using ITIL

- Processes that must adapt to a cloud environment
  - Service Transition Phase
  - Change Management,
  - Service Asset and Configuration Management
  - Knowledge Management
  - Deploy
  - Decommission
  - Transfer
- For example, with Change Management processes such as Software Distribution
  - the responsibility for this falls on the cloud provider
  - where traditionally internal IT staff handled this

6 Governing Cloud Computing

Challenges in Integrating Cloud into Existing Governance Framework

- Cloud solutions must fit into
  - Regulatory and legal structures

- Risk management
  - Prioritizes business continuity
  - Compliance standards
    - must be followed even if using cloud solutions
    - the Sarbanes-Oxley Act (SOA)
    - Payment Card Industry Data Security Standard (PCI DSS)

Challenges in Integrating Cloud into Existing Governance Framework

- The auditing changes with cloud adoption
  - of in-house IT systems or
  - of cloud provider systems and processes
- Service level agreements (SLAs)
  - must be aligned with business needs
- The legal implications of
  - a provider's failure to meet SLA stated items
    - must be considered

Challenges in Integrating Cloud into Existing Governance Framework

- Cloud network security and data storage security
  - must fit within an acceptable risk framework
  - Sometimes this is dictated by industry-specific regulations or legislation
- Primary cloud computing risks include
  - cloud providers going out of business or
  - being unreachable across a network
  - as well as government or law-enforcement action upon a cloud provider.

Challenges in Integrating Cloud into Existing Governance Framework

- The licensing of software running in virtual servers
  - may differ from running on physical servers

Explain the Implications for Direct Cost and Cost Allocations

- Yearly budget cycles
  - are not compatible with cloud solutions
    - since cloud solutions can be rapidly provisioned and de-provisioned;
    - new financial management skills must be put into practice
- Because of cost variability with cloud computing
  - ceiling limits on OPEX can be put in place to control costs

Explain the Implications for Direct Cost and Cost Allocations

- CAPEX converted to OPEX
  - might not appear to yield benefits right away
  - because of the timeframe over which capital assets are depreciated

How to Maintain Strategic Flexibility

- Plan for future undesirable scenarios
  - by coming up with options for each scenario
- Exit strategies
  - are contingency plans should a cloud provider becomes unavailable
- Cloud providers going out of business
  - present potential business disruptions that must be planned for

How to Maintain Strategic Flexibility

- Impediments to network connectivity to cloud providers
  - present another potential business disruption that must be planned for
- Hosting IT services
  - with another cloud provider or in-house can maximize business continuity
    - if there are problems with a specific cloud provider

How to Maintain Strategic Flexibility

- Hybrid cloud solutions
  - Can augment business continuity
  - Augment flexible response to business needs
  - normal business IT workloads
    - might be hosted on a private cloud
  - Peak business IT workloads
    - could be provisioned as needed in a public cloud

How to Maintain Strategic Flexibility

- If a provider SaaS solution becomes available
  - consider a functional equivalent offered by another provider
  - or consider hosting in-house