Teaching Cloud Computing Concepts

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What is Cloud Computing

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**Comic**

1. Let's implement cloud computing so I have something to talk about at the executive meeting.
2. Tell them we're evaluating it. That way neither of us needs to do any real work.
3. I like it when you do real work.
4. Sorry. I thought you were leading by example.
5. I hired a consultant to help us evolve our products to cloud computing.
7. It's as if you're a technologist and a philosopher all in one!
8. Blah blah platform.
What is Cloud Computing

- The Internet is NOT the cloud
- Virtualization is NOT the cloud
- Storage is NOT the cloud

- The Western Digital MyCloud is NOT THE CLOUD
Definition of Cloud Computing

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

National Institute of Standards and Technology
Characteristics of Cloud Computing

- The NIST definition lists five essential characteristics of cloud computing:
  - **On-demand self-service**
    - A consumer can unilaterally provision computing capabilities, such as server time and network storage, as needed automatically without requiring human interaction with each service provider.
  - **Broad network access**
    - Capabilities are available over the network and accessed through standard mechanisms that promote use by heterogeneous thin or thick client platforms.
  - **Resource pooling**
    - The provider's computing resources are pooled to serve multiple consumers using a multi-tenant model, with different physical and virtual resources dynamically assigned and reassigned according to consumer demand. There is a sense of location independence in that the customer generally has no control or knowledge over the exact location of the provided resources but may be able to specify location at a higher level of abstraction (e.g., country, state or datacenter). Examples of resources include storage, processing, memory and network bandwidth.
Characteristics of Cloud Computing

- The NIST definition lists five essential characteristics of cloud computing:
  - Rapid elasticity
    - Capabilities can be elastically provisioned and released, in some cases automatically, to scale rapidly outward and inward commensurate with demand. To the consumer, the capabilities available for provisioning often appear to be unlimited and can be appropriated in any quantity at any time.
  - Measured service
    - Cloud systems automatically control and optimize resource use by leveraging a metering capability at some level of abstraction appropriate to the type of service (e.g., storage, processing, bandwidth and active user accounts). Resource usage can be monitored, controlled and reported, providing transparency for the provider and consumer.
Wasn’t this what we used to call ...
Three Service Models of Cloud Computing

- SaaS – Software as a Service
  - “Software as a Service (SaaS) is a software distribution model in which applications are hosted by a vendor or service provider and made available to customers over a network, typically the Internet.”

  [Source](http://searchcloudcomputing.techtarget.com/definition/Software-as-a-Service)
Three Service Models of Cloud Computing

- PaaS – Platform as a Service
  - “Platform as a Service (PaaS) is a way to rent hardware, operating systems, storage and network capacity over the Internet. The service delivery model allows the customer to rent virtualized servers and associated services for running existing applications or developing and testing new ones.”

  http://searchcloudcomputing.techtarget.com/definition/Platform-as-a-Service-PaaS
Three Service Models of Cloud Computing

- **IaaS – Infrastructure as a Service**
  - “Infrastructure as a Service is a provision model in which an organization outsources the equipment used to support operations, including storage, hardware, servers and networking components. The service provider owns the equipment and is responsible for housing, running and maintaining it. The client typically pays on a per-use basis.”

  [http://searchcloudcomputing.techtarget.com/definition/Infrastructure-as-a-Service-IaaS](http://searchcloudcomputing.techtarget.com/definition/Infrastructure-as-a-Service-IaaS)
A Simple Business Case for Cloud Computing

- For a company to stand up a data center requires a large outlay in capital expenditures
  - Servers
  - SAN’s
  - Routers / Switches and other infrastructure
  - Air Conditioning equipment
  - Power distribution, conditioning, backup
  - Building facilities
- For a company to utilize Cloud Computing they only need to pay for the Services they need on an as-needed basis
A Simple Business Case for Cloud Computing

Data Centers are CapEx
Cloud Computing is OpEx
This Is Not Your Father’s Data Center

- Business is no longer bound to physical infrastructure
- Use “Point & Click” to add servers and storage
- IT as a Service is not that far away
  - May not need internal IT people anymore
  - No more PCs -- BYOD
- Having a Virtual Data Center (VDC) doesn’t necessarily mean you are doing Cloud Computing
  - Remember the five characteristics of Cloud Computing
  - Virtualization and Storage is only a part of Cloud Computing
So ... \textit{What Do We Need to Be Teaching?}

- Key Concepts
  - Virtualization
  - Information and Storage Management
  - Big Data Analytics, Warehousing and Management
  - Disaster Recovery and Business Continuity
  - Cloud Computing
    - Concepts
    - Implementation
- Non-Technical -- BUT CRITICAL
  - Financial Literacy
  - Negotiation Skills
  - Process Management
  - Marketing
Virtualization

- Critical for Cloud Computing providers to easily deploy services and grow those services as demand increases.
- Allows more convenient resource pooling and elasticity.
- Since most servers utilize less than 30% of their available resources, but consume rack space, electrical usage and cooling capacity, virtualization increases efficiency by use of server consolidation.
- Business continuity is improved by providing high availability and disaster recovery.
- Virtualized enterprise applications can be more easily delivered.
One of the major requirements of Cloud Computing is the ability to implement, configure and maintain storage.

Information is being collected, calculated, manipulated, consolidated and mutilated at an exponential rate.

As more data centers become “Cloud-Centric”, the demands on the storage infrastructure is tremendous.

The ability to virtualize storage is imperative.

Our students MUST be equipped with Information and Storage Management skills.
Big Data Analytics, Warehousing and Management

• One of the major requirements of Cloud Computing is the ability to analyze warehouse and maintain “Big Data”
  • Big Data is the collection, storage and, most importantly, analyze data sets that are so large that they cannot be manipulated using traditional DBMS tools.
  • The Gartner Group has established the “3 V’s” of Big Data:
    • High Volume
    • High Velocity
    • High Variety
    • There are tons of other “V’s” that are being posited, such as Value, Veracity, Volatility and Visualization
Disaster Recovery and Business Continuity

Cloud Computing, by its very nature, maintains high availability and reliability to data and applications. This presents a whole new set of infrastructure challenges in the Cloud Computing Environment.

- Backup and recovery theory
  - Key Terminology
  - Backup methods
  - Backup planning, and key terminology
- Storage technologies features such as replication and snapshots can be used for backup and disaster recovery
- Targeting sources at the backup client and storage nodes
- Backup and recovery planning
But ... *How Can We Teach Cloud Computing?*

- Classes that can be created and used:
  - Virtualization
    - VMware’s VCA-DCV (Associate-Data Center Virtualization)
    - VMware’s VCP-DCV (Professional-Data Center Virtualization)
    - VMware’s VCP-DT (Professional-Desktop Virtualization)
  - Microsoft MCITP Virtualization Administrator
  - Microsoft MCTP Virtualization Courses / Certificates
But ... *How Can We Teach Cloud Computing?*

- Classes that can be created and used:
  - Storage
    - EMC’s Information Storage and Management
    - CompTIA’s Storage+ Certification
      - No textbooks available yet, but study guides are
  - Disaster Recovery and Business Continuity
    - EMC’s Backup Recovery Systems and Architecture
  - Big Data
    - EMC’s Data Science and Big Data Analytics
But ... *How Can We Teach Cloud Computing?*

- Classes that can be created and used:
  - Cloud
    - VMware’s VCA-Cloud
    - VMware’s VCP-Cloud (Teaching Cloud Director for now)
    - EMC’s Cloud Infrastructure and Services
    - CompTIA’s Cloud+ Certification
      - No textbooks available yet, but study guides are
But ... *How Can We Teach Cloud Computing?*

- Classes that can be created and used:
  - Non-IT Type Classes
    - This is the perfect opportunity to partner with other departments on your campuses
      - Financial Literacy – Accounting
      - Negotiation Skills / Marketing / Process Management – Business
      - Processional / Interpersonal Skills – Literature and Languages
But ... *How Can We Teach Cloud Computing?*

- How can we teach our students about Cloud Computing and Information and Storage Management when we can’t go out and build a multi-million dollar data center
  - *(If you know a way to get your district to build you a multi-million dollar data center, would you please share it with us)*

- One answer is:
  - The NetLab environment using
    - The VMWare IT Academy
    - The EMC Academic Alliance
    - Custom lab pods
What is Netlab?

- It is NOT a simulator
- It IS a front-end appliance that allows you to put REAL equipment behind a control system allowing students to work on REAL labs in REAL time
Netlab Features

- Netlab allows instructors to create “Pods” for students to schedule lab time for their use 24x7
- Lab equipment can be leveraged for maximum usage ... you get more “bang for the buck” (sorry about the cliché)
- Instructors can monitor student progress and lab time used
- Netlab provides integrated lab exercises that have been developed and vetted by their industry partners
Supported Lab Environments

- Cisco Networking Academy
- EMC Academy
- VMware
- CompTIA
  - A+
  - Network+
  - Security+
  - Linux+
- ... and more on the way
  - Voice Over IP
  - Residential Networking / Home Technology
The Netlab Experience

- Hardware needed (“Reader’s Digest” version)
  - Netlab Appliance
  - For Virtualization
    - Server for vCenter
    - ESXi Servers for Pods
  - For Cisco
    - Access Switch
      - Cisco 2960-24
    - Access Router
      - Cisco 2811
    - Switch Power Outlets
      - APC AP7900
    - Routers & Switches
      - Cisco 2811’s & 2960’s
How Do I Find Out More ?
EMC Academic Alliance

- Partnering with over 600 institutions of Higher Education in over 40+ countries

- Offering a unique ‘open’ course on Cloud Infrastructure and Services
  - Focuses on concepts and principles, not products
  - Prepares students for the EMC CIS certification (#E20-002)

- Providing EMC, Customers and Partners with source to hire storage educated graduates

- Opportunity for EMC to give back as the industry leader

- Contact Kim Yohannan – kim.yohannan@emc.com

http://education.emc.com/academicalliance
Eligibility for VMware IT Academy Program

VMware Academy program open to Accredited, degree & diploma granting higher education institutions worldwide offering 2- or 4-year college programs are eligible to participate in the program.

Technical schools offering accredited degrees through distance education programs are also eligible to participate in the program.

No minimum course enrollment commitment (i.e. Academy members can scale classes as the markets and opportunity demand).

Contact Dave Nelson – davenelson@vmware.com
Now To Our Cloud Experience

If you are an EMC Academy and a VMware Academy, you have access to the following NDG Netlab+ Labs

- EMC ISM Labs
  - Introduction to Storage
  - Overview of RAID
  - Overview of LUNs
  - Overview of Network Attached Storage
  - Analyze Protocols and Performance of Network Attached Storage
  - Overview of iSCSI
  - Backup and Recovery
  - Identifying Security Vulnerabilities
  - Securing the Storage Infrastructure
  - Managing the Storage Infrastructure
Now To Our Cloud Experience

If you are an EMC Academy and a VMware Academy, you have access to the following NDG Netlab+ Labs

- EMC CIS Labs
  - Understanding RAID
  - Block-level and File-level Storage
  - Backup and Recovery Concepts
  - Replication and De-duplication
  - vSphere and vCenter: VCA-DCV
  - vSphere Datastore Implementation
  - vSwitches – Networking in the VDC
  - Benefits of vMotion and Storage vMotion
  - VMware HA and VMware FT
  - Using Converter
  - Using ThinApp
  - VMware View
  - VMware vCenter Chargeback
In Conclusion

- Cloud Computing is NOT a buzz word ...
  - Cloud Computing is exciting
  - Cloud Computing is relevant
  - Cloud Computing is essential
  - Cloud Computing is employable
  - Cloud Computing is the future