Cloud Computing
Foundation Technologies and Research Challenges

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Cloud Computing

- A new IT consumption and delivery model
- Users: High Quality Experience
  - Flexibility and choice
  - Lower costs
  - Rapidly Provisioned
  - Appearance of infinite computing resources
  - Enhanced security and reliability
  - Easy access to “best in class” functions
  - Sharing
- Suppliers: Improved Economics
  - Lower operating costs via standards and automation
  - Improved capital efficiency
  - Rapid, flexible services enhancements

Changes in Consumption
- Self Service
- Flexible pricing

Changes in Delivery
- Standardized
- Virtualized
- Automated
Layers of Cloud Computing

Infrastructure-as-a-Service

- Servers
- Networking
- Data Center Fabric
- Storage

Shared virtualized, dynamic provisioning

Platform-as-a-Service

- Middleware
- Web 2.0 Application Runtime
- Java Runtime

Development Tooling

Application-as-a-Service

- Financials
- Collaboration
- Industry Applications

CRM/ERP/HR

Business Process-as-a-Service

- Industry Processes
- Business Travel

Procurement

Collaboration

Customers use applications

Customers use business outcomes

Customers use programming languages, tools and platforms to develop and deploy applications on multi-tenant, shared infrastructure

Foundation Layer: Provides processing, storage, network resources to customers and other layers
Key Challenges

- Scalability: harness compute powers spread across a large number of distributed resources
- Efficiency: keep management complexity constant
- Flexibility: create, deploy update IT services significantly faster than possible with today’s technology
- Optimized: performance, power and availability
Foundation Technologies for Clouds
Our Focus

• Virtualization and Image Management
  – Pre-built software stack packaged inside virtual machine image designed to run on a VM hypervisor
  – Rapid provisioning, durable asset

• Resource management and Automation
  – Instance management (start, stop, suspend, resume, etc)
  – Manage multiple resources (CPU, memory, disk space and software license limits)
  – Understand application topologies spanning multiple virtual machines

• Isolation and connectivity management
  – Manage isolation and connectivity of virtual resources.
  – Move connectivity and isolation management from physical to virtual
  – Configure resources form high level policy
Summary

- Cloud Computing brings value to both IT users and provides
  - Flexibility and economics
- Technologies for Infrastructure clouds
  - Resource Virtualization (storage, compute, network)
  - Image management, Resource Management, Isolation and Connectivity
- IBM Research Review
  - Automated image creation and composition tools.
  - Scalable image maintenance services
  - Image analytics
    - index the software contents of images in the library and provide analytics like search, license discovery, etc on the collection, greatly enhancing the customer experience with the cloud.
  - VM Placement, Admission Control, Power management
- Other
  - Olive.org
  - RC2