University System of Maryland Community Cloud: VCL-based Academic Cloud

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Introduction: Academic Cloud

- Academic Clouds provide integrated computational services for K-20 education
  - Wide spectrum of users: students, faculty, researchers, staff
- Current cloud business models do not have sustainable price-point or diversity, and most do not address the capabilities that K-20 academic environments require.
- At present, for a variety of reasons, most academic institutions do not use cloud beyond simple applications like email or search engines.
- Cloud challenges related to security, privacy, data management, provenance, and building of next generation “smart” services have grown in importance.
Services on Academic Cloud

- **Teaching** and other academic IT support services
  - Services are situation, domain, user, and environment aware

- **Research**-level computational, storage and networking “smart” (research, data and scientific workflow smart) services in support of the research mission of the university

- Other Smart IT services
  - Outreach related IT services
  - Continuing Education IT services
  - IT services needed to administer the institution.
Smart Cloud Services

- Clouds provide users with the power to seamlessly provision the hardware, operating systems, and application, software.
- Can provision more complex resources – such as a “room”, a “lab”, a “building”, a “microscope”, etc.
- “Smart” depends on the service level and environment.
  - For IaaS, smart may refer to automatic failure recovery, resource exhaustion compensation, and cyber-attack resilience.
  - SaaS smartness includes ability of the users to construct services that understand their domain, and offer content, support and protection self-tailored to their workflows.
Designing a Smart Academic Cloud

1. Access to a **robust system** of hardware, software and network connectivity
2. Access and management application program interface (**API**)
3. **User-friendly** interface that allows location independent access, appropriate identity authentication and authorization.
4. Privacy and **Security** management
5. Provenance meta-data, reliability and fault-tolerance mechanisms, and domain specific attributes.
Some Technical Requirements

- Allow users to build, save, modify, and run their own virtual computing work environments and applications
- Offer on-demand or batch processing capabilities
- Administrator access
- Around the clock time and place independent access
- Device Independence
- Interoperable with other clouds
- Reliability, Security, policy compliance, and fault-tolerance
- Ability to deliver a broad range of capabilities
  - from desktops, to classroom, to lab and server clusters, to high-performance computing and “BigData” services.
Some Non-Functional Requirements

- Sustainable funding model
- Comprehensive performance and usage data (i.e., provenance)
- Auditable and open data records
- Software tracking and license compliance
- Enterprise/user defined and managed access and security and privacy policies, priorities, and compliance capabilities
- Seamless login with enterprise identity management system.
- Provide physical and computer security for the system
- Seamless integration with their data and networking resources
- Import/Export control compliance
USM Academic Cloud

- Academe-Industry partnership
  - University of Maryland Baltimore County, University System Maryland
  - NC State University
  - IBM

- Our aim is to utilize the computer capacity at UMBC’s Center for Hybrid Multicore Productivity Research (CHMPR), the Maryland Research Education Network (MDREN) managed by USM and of the NCSU VCL facility, to define cloud services that K-20 needs.

- **Integrated platform** to serve as a customer-centered Cloud service system for State of Maryland.

- Enable users to initiate their own self-scheduling, self-managing and self-executing images but appropriately monitored and provisioned **services on demand**.
Users Accessing from USM network

- Desksops/Laptops
- Inter-disciplinary research teams

Users Accessing via Mobile Devices

Other Maryland Communities

VCL Community Cloud

Virtual Lab Computers

IBM iDataPlex

Virtual Computing Lab (VCL) Scheduler

USM Cloud Access

POLICY

Integrated User Interface
Challenge 1: Engineering

1. Technology selection
2. “Smart” operational environment
3. Determine appropriate metrics

Planned Activities

- Installation of VCL at UMBC and initially at four distributed sites in Maryland
- SaaS development tool set
- Extension of VCL service capabilities (including cache management node)
Challenge 2: Science

1. Education-appropriate services.
2. What constitutes a “smart” service?
3. Identifying what education communities would benefit most.

Planned Activities

• Development of cloud capacity and performance metrics
• Collection and analysis of the Science-of-Academic-Cloud data, parameters, measures, workflows, etc.,
• Development of operational profile.
Challenge 3: Policies and Human Component

1. Usability, security, privacy, cost, academic licenses, accessibility of services, practices
2. Policies, use of provenance data and services, compliance, etc.
3. Includes education and winning over of the human component, users.

Planned Activities

• Development of Capacity Planning Tool
• Development of Interfaces
• Development of a policy and license assessment framework
• Development of educational and training materials, dissemination of results via conferences, and delivery of relevant workshops and boot camps.
Summary

• Academic Cloud needed for Institutions to effectively use cloud computing services
• Need policies to manage and consume services on Academic Cloud
• USM Cloud, a collaboration between UMBC, USM, NCSU and IBM
  – Community cloud for Maryland students
  – Research on open issues of academic clouds
Thank You

Would you like to be part of this collaboration, then Contact Us

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