USM Community Cloud: VCL based Academic Cloud

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In an educational and/or research environment, cloud computing systems must be exceptionally flexible and adaptable because they are serving a wide spectrum of users including students, faculty, researchers, and staff. An academic cloud must be designed as an integrated tool that delivers computational services capable of supporting everyone from a novice user up to the most sophisticated expert researcher. Most of the current commercial cloud services were not designed for academic environments. The business model that commercial services have is not at the sustainable price-point, does not have diversity, and often not even the capability that K-20 academic environments require. While we know how to build cloud platforms, at least their infrastructures, very well; we are still unable to use them efficiently in different domains. Cloud challenges related to security and privacy, data management, provenance, and building of next generation "smart" services have grown in importance.

A cloud computing installation should provide every user with the power to seamlessly provision the hardware, operating systems, and application, software, and in general, more complex resources – such as a "room", a "lab", a "building", a "microscope", etc., across a network to provide a rich set of customizable "smart" information technology (IT) services or IT assisted services. In this context "smart" depends on the service level and environment. In the case of infrastructure, smart may refer to automatic failure recovery, resource exhaustion compensation, and cyber-attack resilience (and by implication increased availability of the services). In the case of domain oriented services and functions at SaaS level, smartness may include, in addition to self-provisioning, an ability of the users to construct services that do understand their domain, and offer content, support and protection (if needed) that is self-tailored to their workflows.

Whether a cloud computing system implementation (or a hybrid) is applied toward education/research or commercial use, a cloud computing based system should be designed around a service-oriented architecture. This design should be able to allocate resources flexibly and on-demand in a location and device independent, secure and deterministic way (if that is desired), incorporate technical efficiency and scalability through relative centralization of infrastructure, efficiently manage cloud services, and allow either explicit or implicit self-provisioning by users to reduce administration overhead.

In this paper we describe the Academic Cloud that is being built as a joint collaboration between University of Maryland Baltimore County, University System Maryland, NC State University and IBM. This academe-industry partnership is based on existing academic research discovery findings and technology, and focused on advancing the Apache VCL platform so that it can serve as a customer-centered "smart(er)" cloud service system for the State of Maryland. In this paper we will also detail the following areas of research that the USM cloud will be concentrating upon:

a) **Engineering**: Installation of VCL at UMBC and at distributed sites in Maryland, SaaS development tool set, and Extension of VCL service capabilities (including cache management node)

b) **Science**: Development of cloud capacity and performance metrics; collection and analysis of the Science-of-Academic-Cloud data, parameters, measures, workflows, etc., and development of operational profile.

a) **Policies and Human Element**: Development of Capacity Planning Tool; development of interfaces; development of a policy and license assessment framework, and development of educational and training materials, dissemination of results via conferences, and delivery of relevant workshops and boot camps.