EDUCAUSE BRIEF

Spotlight on Cloud Computing Series

Community Clouds

This brief summarizes the EDUCAUSE webinar "Spotlight on Cloud Computing: Community Clouds," held June 23, 2010. The speakers were Don Welch, President and CEO of Merit Network, a nonprofit organization formed in 1966 to design and implement a computer network between public universities in Michigan, and John Moore, Director of Advanced Services Development at MCNC, a nonprofit organization that operates the North Carolina Research and Education Network (NCREN).

Community cloud-based applications and resources can reduce costs, improve performance, ease troubleshooting, and enhance privacy and control. Two major regional networks, in Michigan and North Carolina, are representative examples of community cloud projects.

Lessons from North Carolina

Universities, K–12 systems, community colleges, and regional network providers have been planning for, experimenting with, and delivering cloud-based services. Much of that work has been domain-centered, but a broader conversation explores how best to leverage cloud computing technology for education. Experiences through the North Carolina Research and Education Network (NCREN), based at MCNC, offer valuable perspectives.

The idea of community clouds provides a good framework for this conversation. Several questions need clarification first:

- Which aspects of cloud technology make sense to organize a community around?
- How can we best answer whether it is better to build or buy technology?
- How can we leverage past successes in community computing and apply them to cloud computing?

The National Institute of Standards and Technology (NIST) offers a succinct definition of cloud computing:

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

Essential Characteristics, Service Models, and Deployment Models

The NIST definition also includes "essential characteristics," "service models," and "deployment models." One characteristic that distinguishes a cloud service from other managed services is "rapid elasticity," or the ability to scale on demand. Deployment models define relationships between customers, providers, and brokers, and speak also to ownership and control of the service.

Service Models. The different service models build on each other. The base is infrastructure as a service (IaaS), which builds to platform as a service, on which software as a service is built. The closer you get to the base, the more control you have. This discussion focuses mostly on IaaS, which can be outsourced or built in-house.

Deployment Models. NIST defines four different deployment models. This presentation focuses on the second:

- *Private cloud.* The cloud infrastructure is operated solely for an organization. It may

be managed by the organization or a third party and may exist on or off premises.

- *Community cloud.* The cloud infrastructure is shared by several organizations and supports a specific community with shared concerns. It may be managed by the organizations or a third party and may exist on or off premises.
- *Public cloud.* The cloud infrastructure is available to the general public or a large industry group and owned by an organization selling cloud services.

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- *Hybrid cloud.* The cloud infrastructure consists of two or more clouds (private, community, or public) that remain unique entities bound by standardized or proprietary technology that enables data and application portability.

Implementation Models. Among the different implementation models of the community cloud, two have been used successfully by regional consortia. In one model, participants supply resources to build the cloud. Community aggregators, such as regional or national research and education (R&E) network providers, may participate. The service is jointly managed. A high-speed network linking all the participants is required.

A second model adds commercial providers, either to supplement community-provided resources or to provide an alternative. Community resources can provide 24 × 7 access, while commercial providers might support scaling. In general, the addition of a commercial provider adds flexibility to community clouds.

A third alternative, using brokers, is discussed below.

What Do We Need to Move Forward?

The work of building community clouds hinges on several criteria.

Standards. Shared sets of standards enable interoperability between community members and commercial providers. Standardized service avoids "vendor lock-in." If too many standards are under development, that is tantamount to having no standards.

Pre-standard Pilots. Test projects are needed now, before standards exist, to evaluate concepts relevant to community clouds. Proprietary implementations might be needed to prove concepts, particularly in settings with statewide licensing or opportunities for many participants to buy technologies from the same vendor.

Brokers. In other cases, a third model—using brokers—might be necessary. A broker function could provide interim solutions. In this model, the broker provides a consistent interface to the user; the back-end addresses the differences between vendor implementations.

How Can We Leverage Past Successes?

Successful models can provide instructive insights. One is the organization of regional and national networks (Regional Optical Networks, or RONs, and National Research and Education Network, or NRENs). The main service provided has been IP networking. Factors contributing to these networks' success include:

- *They provide a flexible, hierarchical aggregation model.* RONs aggregate user demand and provide commodity bandwidth at the regional level. NRENs aggregate regional demand and provide research bandwidth at the national level. This model's flexibility allows adding services over time.
- *They exploit standardized service.* RONs and NRENs purchase service from multiple commercial vendors and from upstream providers. That protects against vendor lock-in. The networks have also been effective in organizing aggregated purchasing power.
- *They add value as an intermediary.* In terms of the way they are organized, RONs and NRENs have clear value propositions. They typically provide high-touch customer support and often play a convener role.

Key Goals for Community Clouds

Several goals for community clouds can propel us forward:

- *Find flexible, effective aggregation models.* Such models might be based on different subcommunities, such as K–12 or higher education, and leverage existing organizations.
- *Help drive standards and foster commoditization.* Direct participation in the standards process is important, but meanwhile, support interim solutions.
- *Find ways to add value in the middle.* Community clouds can provide customer value through service customization and support. They can also provide "glue" services, such as federated identity management.

A pressing challenge is the ability to dynamically scale, which assumes available capacity. Who can best assume the cost for idle resources? Large vendors have figured this out. Can mid-tier vendors do the same? Community partners probably cannot manage it.

We can use the successful R&E networking model as a guide for building community clouds, capitalizing on our ability to aggregate flexibly, leverage purchasing power, and develop ways to add value. Also, we can build clouds on top of the existing R&E network infrastructure. However, we need standards, we need to influence those standards, and we need interim strategies to avoid proprietary technologies and vendor lock-in.

Perspective from Michigan

Some reasons to select the community cloud model appear in the Merit Network.

For this discussion, cloud services can be considered broadly as "shared services above the campus." This definition encompasses any layer of the "IT stack," from system infrastructure to application infrastructure to plain information to business processes.

Where does "community" fit into the cloud computing framework? Gartner recently presented cloud computing as a matrix with access and control as its axes. If access is open and control is with a third party, it is a public cloud. If you consolidate the service in central IT on campus, it is an internal cloud. If vendors hold both control and access, it might be a private cloud.

A community of different participants can be an effective compromise. In organizations controlled by their members, control is shared. Other benefits include economies of scale. The more participants, the more compromises needed.

A community cloud offers an effective compromise through streamlined contracting, with enough economies of scale to keep costs reasonable

We do many things well within regional networks, but want to extend that to cloud computing while avoiding pitfalls. Currently, for example, some regional networks that do not own their own infrastructure are losing their state subsidies. As their costs rise, it might be difficult for them to provide the same level of service.

Decision Criteria

The decision process followed by members of Merit in deciding whether to meet service needs internally or in the various clouds is instructive.

- *Licensing.* As you move up the IT stack, many issues revolve around contracting and licensing. Contracting for cloud service can help, as the cloud provider handles many of those details, but larger cloud providers have clout in licensing. A campus should make sure those terms are optimized for them. A community cloud offers an effective compromise through streamlined contracting, with enough economies of scale to keep costs reasonable.
- *Economies of Scale.* Cloud providers can realize economies of scale, including cost savings that the community can pass on to participants. Also, community clouds can bring expertise and support for multiple technologies to institutions without those skills. And services can often be tailored to participants' requirements.

- *Standardization.* The community cloud provides a real advantage in standardization because networks must make choices about standards affecting participants. In the cloud, a third party determines the standards.
- *Investment.* Sometimes institutions spend money on necessary costs that don't provide strategic solutions. We must differentiate between an essential investment and a strategic one. Cloud computing gives new options for strategic deployment of resources.
- *Performance.* The capacity and costs associated with access to and storage of data are common concerns. Community clouds can have a significant performance advantage over the public cloud by providing their partners with both high-performance bandwidth and latency.
- *Troubleshooting.* Community clouds can streamline troubleshooting by migrating responsibility for the troubleshooting from individual institutions to the network.
- *Privacy.* The academic community is sensitive to issues of information privacy and ownership and applicable laws. The steps that community clouds take to ensure the integrity of data and its protection can give university administrators and their legal counsel desired assurances.
- *Control.* Partners in a community cloud influence its administration and operations, share control of that cloud, and have a strong voice in ownership of data. Similarly, they shape key decisions about the business model, policies, and technology upgrades. The cloud also alleviates vendor lock-in, supports integration of technologies, and makes migration to better solutions easier.
- *Risk Management.* Moving solutions above campus raises issues of risk management, control, troubleshooting, and ownership. Members in community clouds often understand risk management better and have more control through the cloud than working on their own.

The community cloud can be a good option if participation is based on the institution's needs and culture and reflects the institution's requirements for infrastructure, business processes, and data management.

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