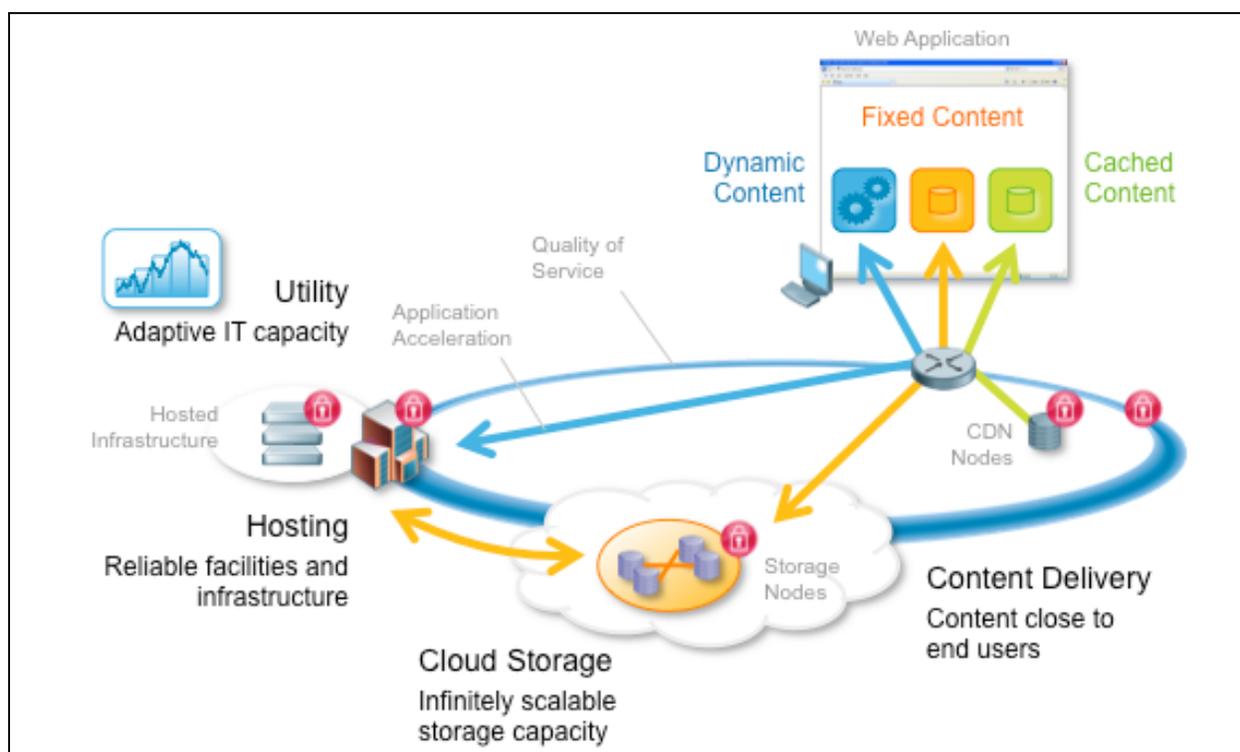


Initiative: NC Education Cloud
Project Coordinator: Phil Emer

Introduction and Objective

We will create the NC Education Cloud (NCEdCloud) to provide a highly reliable, highly available, server infrastructure supporting the K-12 education enterprise statewide. Specifically, we will facilitate migration from LEA-hosted server infrastructure to cloud-hosted infrastructure as a service. The primary objective of the NCEdCloud is to provide a world-class IT infrastructure as a foundational component of the NC education enterprise. Moreover, the NCEdCloud will provide for:

- Equity of access to compute and storage resources;
- Efficient scaling according to aggregate NC K-12 usage requirements;
- Consistently high availability, reliability and performance;
- A common infrastructure platform to support emerging instructional and data systems;
- Sustainable and predictable operational cost.



Robust technology infrastructure will support data-driven decision-making, for the development of and access to online instructional resources, and to transition the focus of district technical resources from infrastructure to users and instruction. Furthermore, prudent one-time investments in technology infrastructure service platforms buy down long-term IT costs, providing sustainable funding for new instructional and leadership programs.

Goals and Target Outcomes

In creating the NCEdCloud we aim to improve service reliability, increase efficiency, and decrease long-term IT costs, while re-aligning local technical resources away from supporting and managing infrastructure and toward supporting contemporary instructional and administrative systems and services. As this recommendation is related to the deployment and support of technology infrastructure, we make no claims related to educational outcomes. We do however enumerate project outcomes here.

Goal	Details	Targets
Increase IT reliability	<p>All servers hosted in data centers with reliable and resilient power, cooling, and network.</p> <p>Data backed up and distributed across at least 2 data centers</p> <p>All server infrastructure secured physically and logically</p>	<p><u>99.9%</u> server uptime</p> <p>All Critical data recoverable according to backup/recovery SLA.</p> <p>Monthly security audits of all compute and storage resources.</p>
Increase IT efficiency	<p>Leverage server virtualization to deploy logical servers</p> <p>Provide single server instances to support common services across LEAs</p> <p>Automatically scale server and storage resources to meet demand.</p>	<p>80% utilization of infrastructure resources</p>
Decrease cost	<p>Purchase infrastructure as a service</p> <p>Pay based on usage for all non-persistent services</p> <p>Shift power, cooling, backup and the like to the cloud</p>	<p>Cut aggregate server infrastructure costs in <u>half</u></p>
Increase number of LEA technical staff supporting instruction	<p>Transition server hosting and management to cloud providers</p> <p>Transition to steady state</p>	<p>Free up on average <u>one</u> technical FTE per LEA</p>

Specific strategies will be defined to address each of the goals as part of the formal planning process. The target completion for the measurable goals outlined here is 36 months from the initiation of the project. More granular interim milestones will be defined during the project planning process.

Activities - Key Elements, Roles and Partners

The NCEdCloud initiative is at its core an outsourcing program. The NCEdCloud program transitions LEA server and storage infrastructure to commercial cloud providers and establishes an NCEdCloud administrator to oversee the commercial providers and to manage the process of moving services into and out of the cloud. The key elements of the program are:

- Planning
- Cloud Deployment
- Pilot Migrations
- Statewide Migration
- Measurement and Monitoring
- Cloud Administration
- Statewide Application and Content Licensing

The NC School Connectivity Initiative (SCI) built the foundation for the NCEdCloud program both in terms of providing network infrastructure to all LEAs and in terms of establishing a rigorous project planning and deployment methodology. We apply the mature planning and deployment methodology established with the SCI here. In the paragraphs that follow we summarize each of the program elements.

Planning

As with all IT initiatives the deployment of the NCEdCloud will require careful planning. The planning team will comprise a group of infrastructure experts overseen by the Manager of Connectivity Services at the NC Department of Public Instruction and supported by Friday Institute and the MCNC Client Network Engineering Group. The planning team will be tasked with developing an implementation and operating plan for the NCEdCloud. The planning process will include an onsite survey of infrastructure and infrastructure support resources at each of the 115 NC LEAs. Project planning will begin October 1, 2010 and will require 6-9 months to complete.

Cloud Deployment

Upon completion of the planning process, the planning team will present the community-vetted implementation and operating plan to the NC State Board of Education for review and approval. Upon approval of the plan the NCEdCloud team will transition from planning to deployment. The initial deployment elements will be related to building a relationship with one or more commercial cloud providers. The cloud deployment phase will likely require a competitive procurement process and as such the development of one or more requests for proposal. The data collected during the LEA infrastructure site surveys will serve as the basis for the scope of cloud RFPs in terms of types and numbers of server instances. The team will work with the selected cloud provider(s) to roll out a combination of reserved (persistent) and on-demand

server instances and storage resources to meet the aggregate needs of the NC K-12 education enterprise. As part of the rollout process the NCEdCloud team will manage the development of any middleware required to integrate the cloud with LEA directory, authorization, and authentication systems. We estimate that the cloud deployment phase will require 6 months and on the order of \$7.5M. Costs include deployment administration, middleware development, and one-time costs for initial server instantiation.

Pilot Migrations

In parallel with cloud deployment and based on the implementation plan the team will orchestrate a group of carefully selected pilot migrations of LEA and DPI infrastructure to the NCEdCloud. The pilots will include representative hardware platform types, persistent and on-demand resource allocations, and services that extend across LEA boundaries. The primary goal of the pilots is to validate planning assumptions and to fine-tune migration and steady-state support processes. We estimate that pilot migrations will require 3 months. Costs will include DPI pilot administration, cloud administration, and one-time cloud provider migration fees.

Statewide Migration

With lessons learned from the pilot migrations, we will manage a 30-36 month statewide migration of LEA server and storage infrastructure to the NCEdCloud. Work will include directory integration and network provisioning to support the unique requirements of each infrastructure and service migration. In some cases shared applications will be migrated to the cloud and users will be transitioned to the cloud service together. In other cases individual resources will be turned up, tested, and transitioned on an LEA-by-LEA basis. During the migration project contemporary systems supporting innovation in instruction and leadership will be designed from the beginning as cloud services. Existing LEA infrastructure arrangements, licensing agreements, and federal e-rate guidelines, may impact the migration timeline and schedule. We estimate that the 30-36 month statewide migration will cost \$6M. Direct costs include project management, cloud administration, and cloud provider one-time migration fees.

Measurement and Monitoring

A significant benefit of procuring infrastructure-as-a-service is that the provider will be held to account through a service level agreement (SLA) that specifies commitments related to service availability, performance, and support responsiveness. The NC Education Cloud will be instrumented for measurement and monitoring in order to manage to the SLA. Data collected through this instrumentation will also be used to scale resource allocations for both new and existing services. Finally, the NCEdCloud will also collect data related to user access. User access data can inform assessment systems developed in support of core RttT goals. The deployment team will coordinate instrumentation of the NCEdCloud with the cloud service provider during cloud deployment and service migration, as appropriate. Instrumentation costs are included in deployment and migration project budgets.

Cloud Administration

DPI will manage a contract with a cloud administrator. DPI will review the details of the NCEdCloud service with the NC K-12 community at least annually to optimize offerings, support opportunities for federal e-Rate support, and to add or remove cloud providers. In order to provide for sustainability of the NCEdCloud moving forward DPI will expand the existing

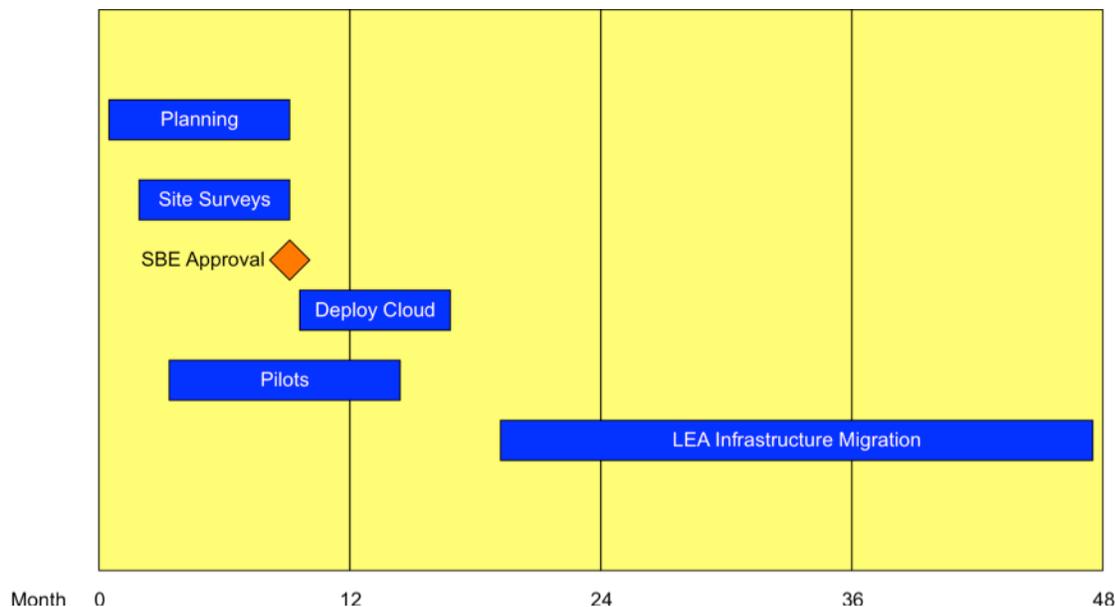
Client Network Engineering support contract with MCNC to cover LEA engineering support and will contract with an appropriate provider for cloud operations.

Statewide Application and Content licensing

In tandem with the deployment of the statewide education cloud infrastructure model we will overlay a suite of applications, tools, and content that support equitable access to the contemporary data systems, online professional development, and blended instructional delivery models defined in the core chapters of the NC RttT proposal. Specifically, we will deploy a standard and open statewide Learning Management System, a companion learning objects repository and collaboration tools. We incorporate a federated identity management approach to facilitate secure and mediated student and educator access to statewide resources. Finally, we include the development of web personalization functionality to the NC e-learning portal to further enhance and focus student access to online instructional content resources.

Implementation Timeline

The NCEdCloud planning phase will begin October 1, 2010 and culminated in the vetting and NC SBE approval of an implementation and operating plan May 2011. We will conduct LEA site surveys during the planning process. We initiate pilot deployments within 3 months of project initiation. Initial cloud infrastructure deployment follows SBE approval. During a 24-30 month roll-out window, we migrate solutions statewide, optimize e-rate filing, and deploy steady state operating procedures.



Budget

The total NCEdCloud budget is \$34.6M. Our request includes \$404,879 to support a single FTE employed at the Department of Public Instruction; \$18.1M for statewide application and content licensing; and \$16.1M in contractual support for the planning and deployment of the NC Education Cloud technology program.

Expense Item	4-year Budget
DPI Cloud Services Manager [1 FTE]	\$0.4M
Service provider contracts [including project management and planning]	\$16.1M
Statewide software/content licensing	\$18.1M
TOTAL	\$34.6M

Budget Methodology

The DPI FTE budget employs a starting salary of \$82K per year that is based on positions with similar scope and experience. Fringe is based on DPI state formulas and the first year compensation and fringe is prorated to account for job description development and standard state recruiting windows.

Application and content licensing budget is based upon budgetary quotes for commercially available products and, in some cases, includes custom development charges. We apply per seat procurement and/or development quotes according to an increasing number of students, teachers, administrators, and classrooms over the 4-year deployment window. It is important to note that we include the cost of the infrastructure required to support these applications in these budget numbers. That is, the per-seat costs here are based on the applications and content being hosted on vendor equipment. We may determine through our planning and TCO modeling that the most effective and efficient solution is to host some of these licensed products on NC Education Cloud infrastructure – in those cases the infrastructure costs would be shifted to cloud service provider contracts. Specific licensing categories include:

1. *Learning management and e-portfolio system* – provided commercially by Blackboard and Moodle Rooms among a host of others.
2. *Identity Passport* – a federated identity management and single sign-on approach that requires integration and development in order to mediate student and educator access to online resources.
3. *Learning Object Repository* – providing a data warehouse and mechanisms for managing instructional resources in an iTunes-like library.
4. *Web collaboration* – provides for multi-modal, real-time, collaboration between students and educators – enabling blended online anytime instruction and professional development. Wimba, Adobe Connect, and Elluminate are commercial options here.
5. *e-Learning portal personalization* – web development that provides learner personalization elements to the ncelearning.gov portal.

[Numbers in millions of US dollars]

Solution	Year 1	Year 2	Year 3	Year 4	Totals
Learning Management System	2.3	3.4	3.4	1.7	10.8
Web collaboration	1.1	1.1	1.1	1.1	4.4
Identity Management	0.6	0.3	0.2	0.1	1.2
Learning Objects Repository	1.1	0.2	0.2	0.2	1.7
Totals	5.1	5.0	4.9	3.1	18.1

Contractual support includes contracts with The Friday Institute (www.fi.ncsu.edu), MCNC (www.mcnc.org), and with various Cloud service providers.

1. **Friday Institute** contract scope includes planning and design, systems engineering and architecture, total cost of ownership modeling, and application profiling. The Friday Institute is located at NC State University and contracts with DPI are governed under the UNC General Administration-DPI Master Agreement. The 4-year contract budget is \$3.3M. The \$3.3M budget is informed by the NC state-funded School Connectivity Initiative (2005-2009) that incorporated a substantially similar scope of work for the deployment of a comprehensive K12 statewide network infrastructure.
2. **MCNC** contract scope includes LEA infrastructure and application site surveys and engineering support for LEA cloud migrations. NC Information Technology Services (NC ITS) manages an existing services agreement between DPI and MCNC that is the contract vehicle here. The 4-year contract budget is \$1.6M. The budget is based on a proportional expansion of the existing services agreement to add cloud services and systems administration subject matter expertise.
3. **Cloud provider** contracts account for \$11.2M of the contractual budget. Cloud providers will provide managed infrastructure and platform-as-a-service in support of the NC Education Cloud environment. These providers will be selected through competitive bids managed according to state of NC procurement law. Budget here is based on statewide computing and storage infrastructure estimates. For instance, there are approximately 5000 servers across NC districts. We estimate that we can deploy 1000 cloud server equivalents to achieve the goals of the program. We therefore apply a mix of small, medium, and large server costs across 1000 server instances and then apply estimated costs to migrate services to the cloud using per server and per application metrics. Rackspace, Amazon, and a host of others provide metrics for these calculations. The cloud provider contract budget calls for a substantial one-time infrastructure deployment cost and initial migration expense within 12 months of the initiation of the project. Smaller one-time migration costs extend through the remaining three years of the deployment window. Note that a 30-36 month deployment window is specified as existing contracts, e-rate process, and other practical logistical matters drive the specific rollout schedule.

[Numbers in millions of US dollars]

Provider	Year 1	Year 2	Year 3	Year 4	Total
Friday Institute ¹	0.6	1.0	1.0	0.7	3.3
MCNC ²	0.4	0.4	0.4	0.4	1.6
Various providers ³	7.3	1.3	1.6	1.0	11.2
Totals	8.3	2.7	3.0	2.1	16.1

1 Via task order per UNC system-DPI master agreement
2 Via existing DPI-MCNC services agreement
3 Multiple "cloud" providers selected via competitive procurement

Sustainability

In year 3 LEA's begin to fund NCEdCloud operations with an aggregate \$1.5M annually. Allocation of NCEdCloud costs will be usage-based. LEA fees will be paid in lieu of supporting infrastructure locally and will be a fraction (we are targeting half) of the legacy infrastructure support costs. Cost savings realized through the NCEdCloud program can be allocated to the support of new programs specified in this proposal.

Key Personnel

Phil Emer, Director Technology Planning and Policy at the Friday Institute, will serve as project coordinator. In addition to the Cloud Services Manager to be hired in support of the NCEdCloud, key DPI Staff include:

- Ed Chase, Connectivity Services Manager
- Neill Kimrey, Division Director Instructional Technology
- Jerry Bunn, Project Manager
- Mike Veckenstedt, RttT Data Systems Specialist

These key personnel will be supported by subject matter experts in enterprise IT systems, cloud computing, identity management, storage systems, and related technology areas. Subject matter experts will be engaged via contract or temporary employment agreements with the Friday Institute, NCDPI, and MCNC.

