

Inventing the Future of Eastern North Carolina: Building a Flexible, Heterogeneous Cloud Infrastructure Using Enterprise Systems Technology

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North Carolina Agricultural and Technical State University

Explore. Discover. Become.





NC Agricultural and Technical State University, Greensboro, NC USA

In 1890, Congress enacted the Second Morrill Act that mandated “a separate college for the colored race.” The Agricultural and Mechanical College for the Colored Race (now N.C. A&T) was established as that school in the state of North Carolina by an act of the General Assembly ratified on March 9, 1891. Originally operating in Raleigh as an annex to Shaw University, the college made a permanent home in Greensboro with the help of citizens such as Dr. DeWitt (a black dentist), C. Benbow, and Charles H. Moore.

In 1915, state legislators changed the college’s name to the Agricultural and Technical College of North Carolina; and in 1967, they elevated it to university status.

We current are third in our State in research funding, behind the University of North Carolina and North Carolina State University.

We also graduate more African Americans with engineering degrees than any other school in the world.

My home is the Information Technology Department in the School of Technology





A little geography....

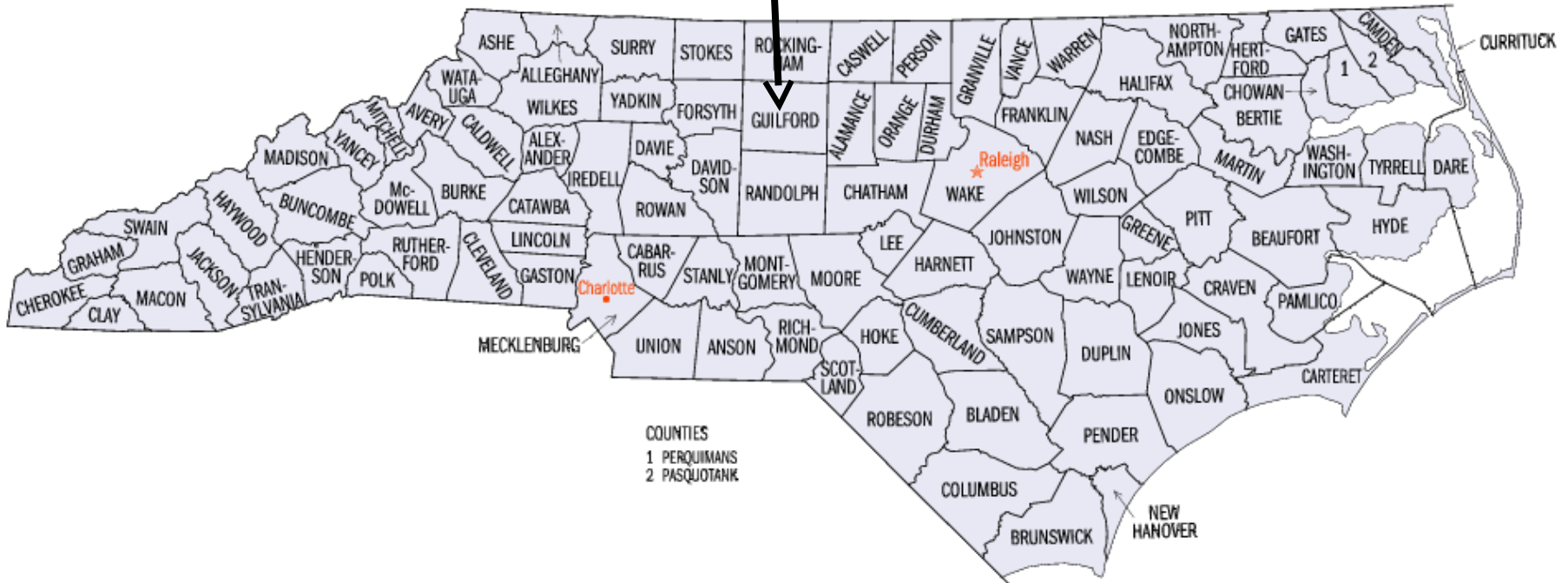


ME!





NC A & T State University





Eastern North Carolina



Why Eastern NC?



North Carolina unemployment rates, county-by-county

Select a month

Vance – 13.5

Warren – 13.1

Halifax – 13.2

Orange 6.0

Nash 12.0

Edgecombe 14.2

Dare 15.3

Wilson 12.7

Wake (Capital) 7.6

March 2012 Unemployment Numbers*

444,977 individuals or 9.60% of North Carolinians were unemployed in the month of March.

And... Lower per capita income; lower median income; higher incarceration, much less population density, less education, etc., than the State as a whole





“One of the promises of cloud computing is that it will allow diverse users to access the same infrastructure to do substantively different things.” C. Seay, et al.

Needed:

A robust, flexible, scalable, reliable, secure infrastructure to be used by multiple entities meeting multiple needs- especially folks who do not have a lot of money





Definitions (somewhat subjective)

Cloud computing: transparent user access to computing resources

High Performance Computing: Dedicated computing resources for processor-intensive applications

Enterprise Computing: An organizational perspective of computing resources

For my purposes, “cloud computing” is inter-organizational Enterprise Computing

Enterprise computing is heterogeneous, but its foundation is often a mainframe (which today translates to IBM’s System z architecture)





MAINFRAME????? Do people still use those?

Uhhh..... Yeah, because they are:

Infinitely scalable

Virtually bulletproof when it comes to security

Can process tens of thousands of transactions a second

Extremely reliable

Capable of massive virtualization of Linux





There is a serious need to replace the current mainframe workforce

The reports of the death of the mainframe were greatly exaggerated

Universities began to phase out mainframe-related courses

But the impact of the mainframe on business has remained constant and has expanded (with the advent of Linux)

The result has been a mainframe workforce that is approaching retirement





The NC A & T Heterogeneous Cloud Infrastructure



**IBM blades, HP,
Dell, Sun Servers
IRC Bldg**



IBM z9 – IRC Bldg

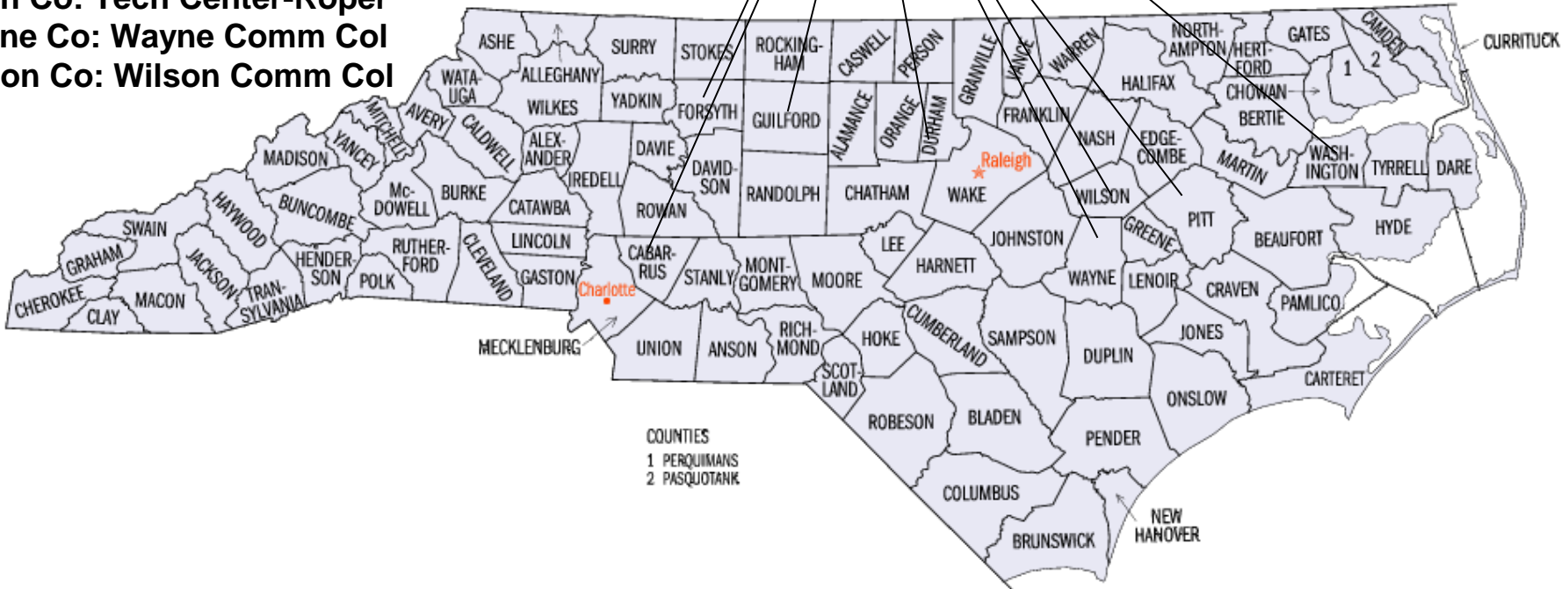
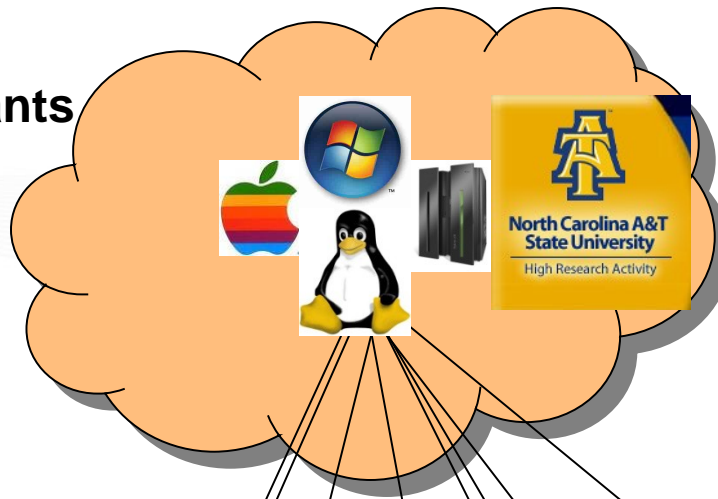


**Mac, Dell, HP, thin-clients
School of Technology**



Current Participants

- Cabarrus Co: Cox Mill HS
- Durham Co: Hillside HS
- Pitt Co: Farmville Cent HS
- Forsyth: Atkins Tech HS
- Guilford: Northern, Southern, Smith, Dudley, Weaver
- Wash Co: Tech Center-Roper
- Wayne Co: Wayne Comm Col
- Wilson Co: Wilson Comm Col





Beaufort County

Health Dept
Middle School 1 & 2
High School
Admin Ofcs

Bertie County

Health Dept
Middle School 1 & 2
High School
Admin Ofcs

Craven County

Health Dept
Middle School 1 & 2
High School
Admin Ofcs

Duplin County

Health Dept
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Admin Ofcs

Edgecombe County

Health Dept
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Admin Ofcs

Franklin County

Health Dept
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Admin Ofcs

Granville County

Health Dept
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Admin Ofcs

Lenoir County

Health Dept
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Admin Ofcs

Martin County

Health Dept
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Washington County

Health Dept
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Admin Ofcs

Chowan County

Health Dept
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Gates County

Health Dept
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Hyde County

Health Dept
Middle School 1 & 2
High School
Admin Ofcs

Wilson County

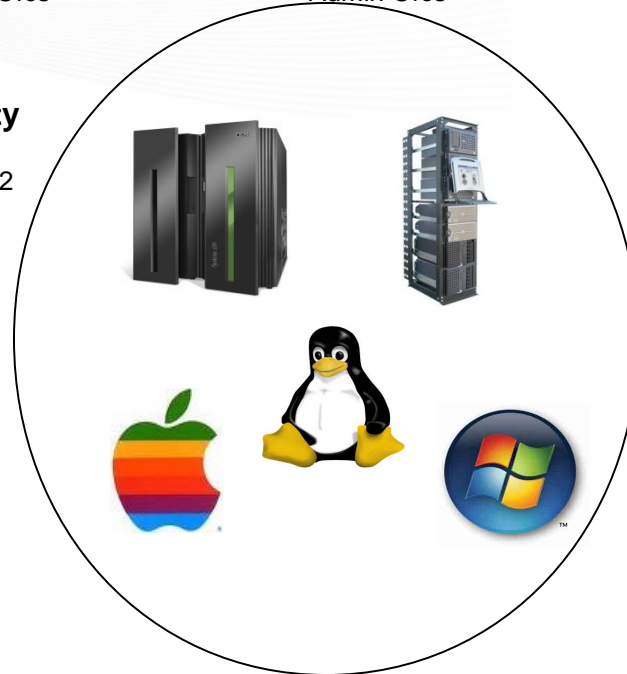
Health Dept
Middle School 1 & 2
High School
Admin Ofcs

Pasquotank County

Health Dept
Middle School 1 & 2
High School
Admin Ofcs

Perquimins County

Health Dept
Middle School 1 & 2
High School
Admin Ofcs



The Cloud
One Infrastructure;
many users

Greene County

Health Dept
Middle School 1 & 2
High School
Admin Ofcs

Halifax County

Health Dept
Middle School 1 & 2
High School
Admin Ofcs

Nash County

Health Dept
Middle School 1 & 2
High School
Admin Ofcs

Pitt County

Health Dept
Middle School 1 & 2
High School
Admin Ofcs

Hertford County

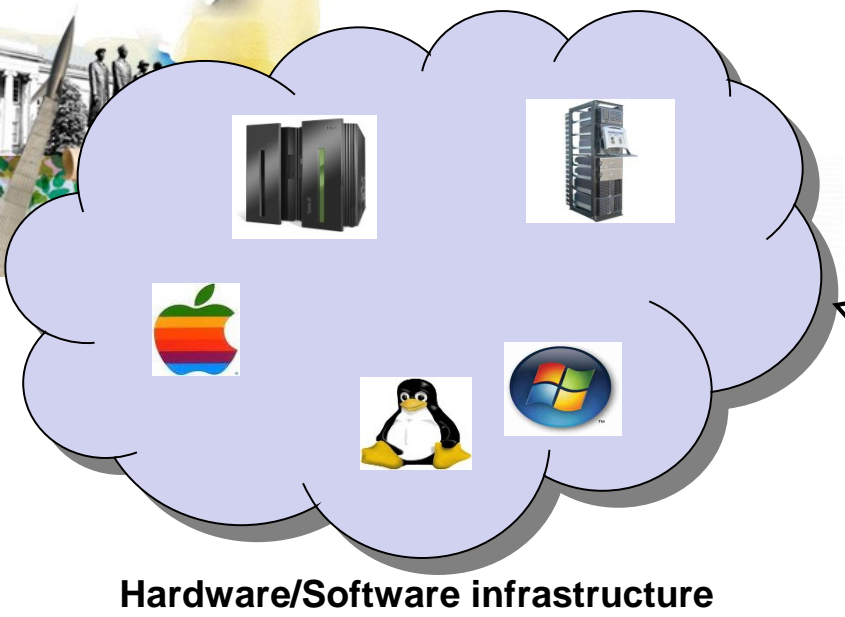
Health Dept
Middle School 1 & 2
High School
Admin Ofcs

Pamlico County

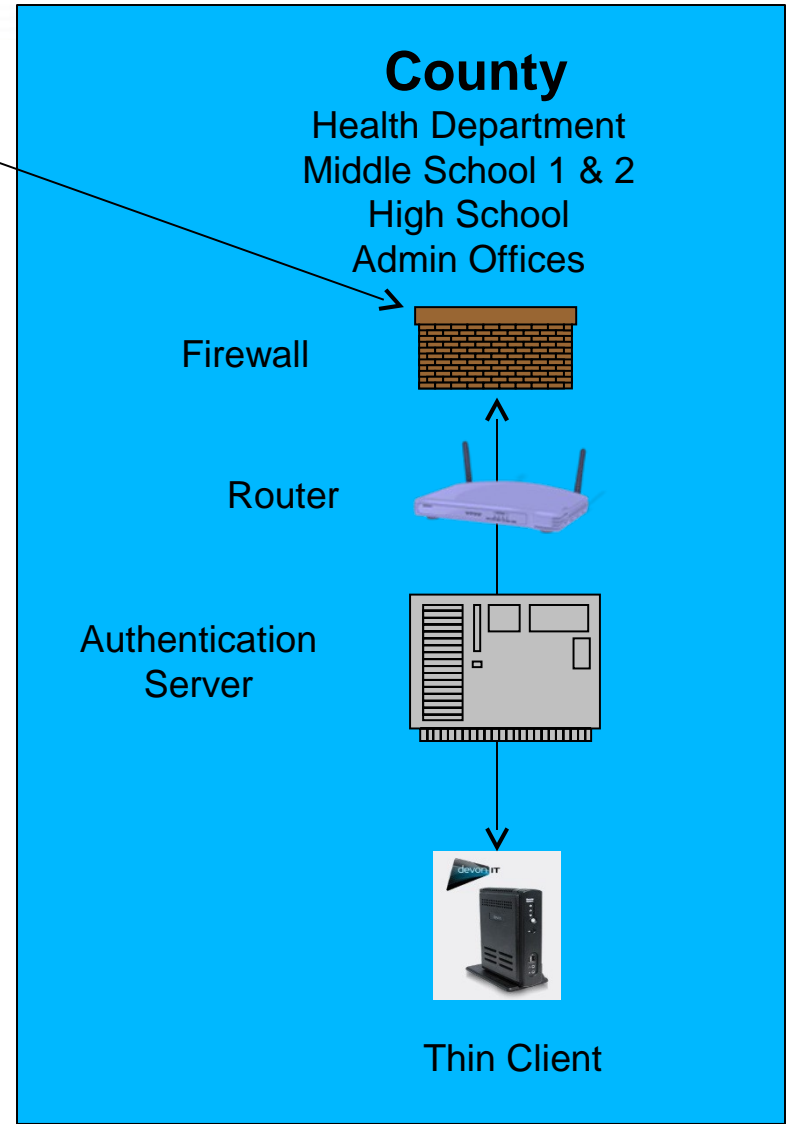
Health Dept
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High School
Admin Ofcs



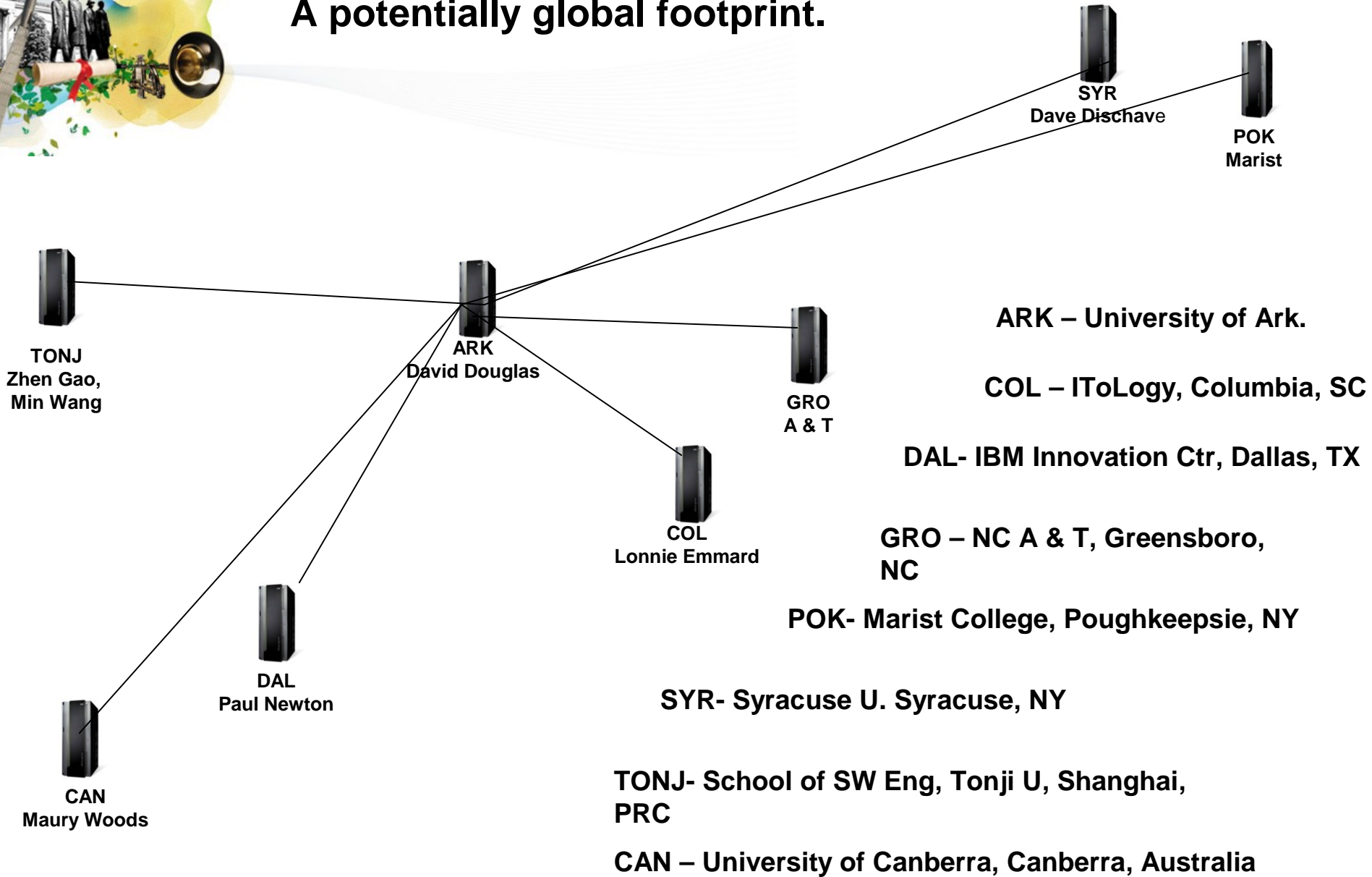
Infrastructure Connection from the County to the Cloud



Hardware/Software infrastructure



A potentially global footprint.





Projects for the A & T Cloud:

Virtual Desktops for fall 2012 are our top priority

We have sanboxes in the School of Technology up and running

We will be using an application called “Virtual Computing Lab” (VCL) created by NC State which uses open source tools to create a Citrix-like environment. vcl.ncsu.edu

NC A & T CIO Barbara Ellis has purchased IBM blade technology to house a production instance for A & T; tentative rollout for the pilot is fall 2012 (said with fingers crossed...)

Draft MOUs with Wayne Community and Wilson Community Colleges to run VCL pilots; these pilots will begin as soon as the Admins have a meeting of the minds.

We’ll get the high schools on board after the A & T pilot is underway.





Projects for the A & T Cloud:

Dynamic Linux Virtualization on the mainframe via xCAT

Banner migration to System z (didn't know Banner ran on a mainframe, did you?)

“Open” Linux access to high schools (CIPA compliant, of course)

Artificial intelligence, M/M fraud detection, business analytics, business R & D

Specific research in physics, chemistry, health management, and education





Challenges.....

Our fundamental challenges are administrative and not technical

We know how to make “smart” networks; what we are not so good at is resolving their conflicting policies

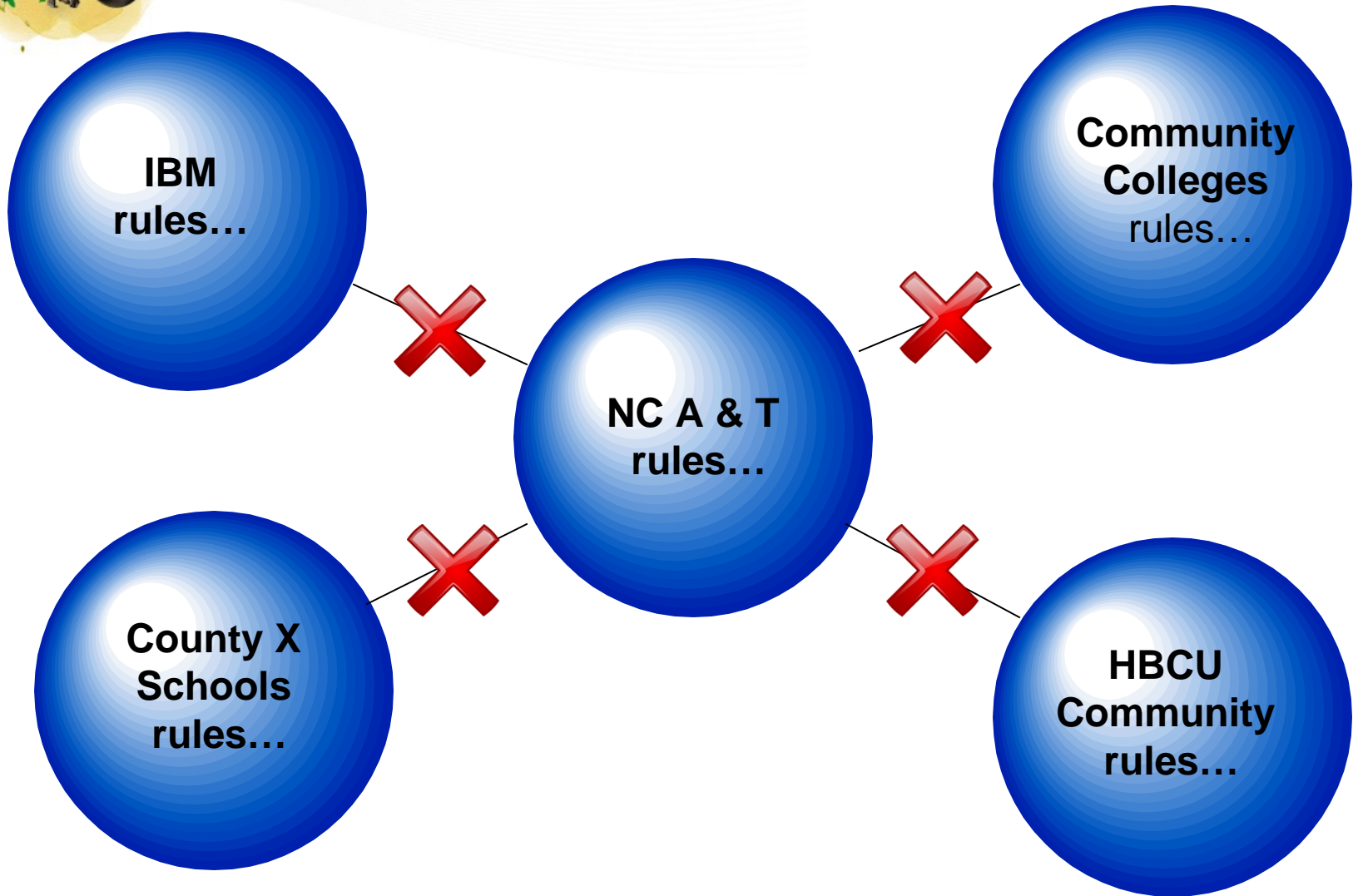
Example:

In attempting to get students to participate in the “Master the Mainframe” contest in the fall, some schools in the same county system were able to access the required port 1023 and some weren’t. This led to students at school X having a rich experience that school Y did not have- in the same school system...





The Problem: conflicting spheres of influence.





Another Challenge: Creating and maintaining a skills base

Cloud infrastructures require a broad and deep skill set:

Linux, networks, security, SW development, in our case mainframe technology, and much more

At A & T we are addressing this directly:

A full set of Linux courses through senior admin skills

A recently approved 4-course mainframe track including z/VM (for Linux virtualization)





In Conclusion

NC A & T has created a heterogeneous cloud infrastructure capable of serving the needs of diverse users.

We have worked diligently to build the administrative channels required to make this project a reality.

We are producing the workforce needed to support these types of infrastructures.

We are increasing our portfolio of projects to demonstrate the robustness of our cloud.





THANKS!!!

