

Survey for Promoting GENI at Four-Year Colleges

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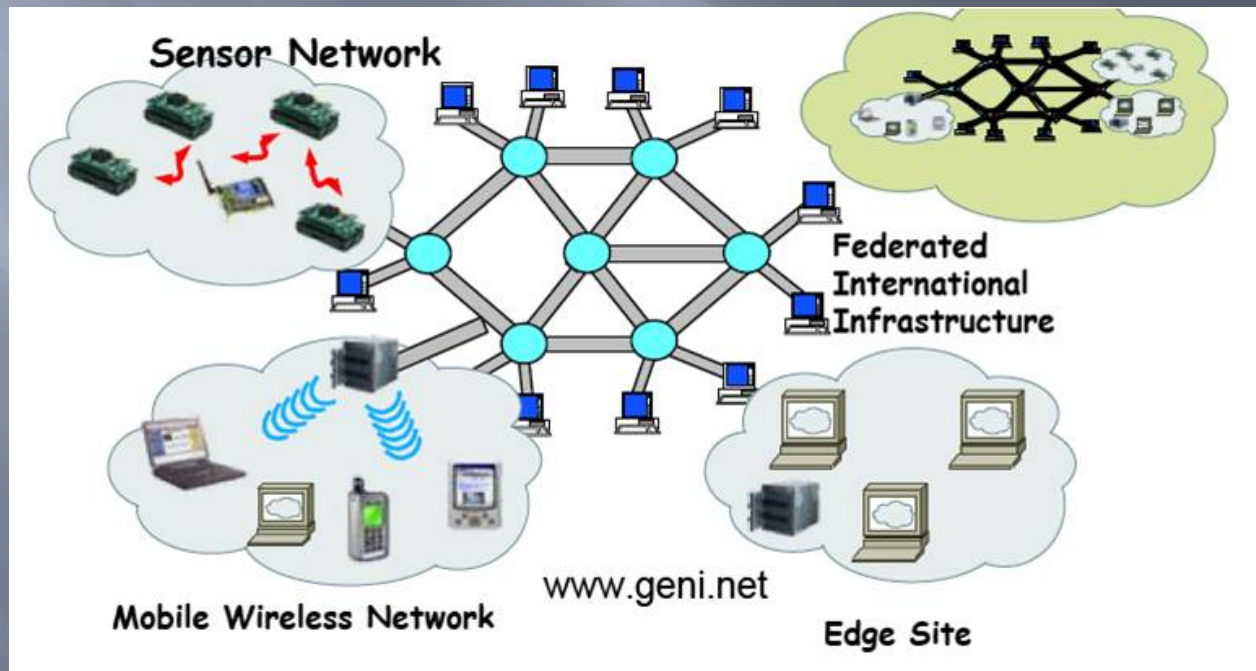
Center for IT Research
Langston University

Topics of Discussion

- ▣ What GENI is about?
- ▣ Why GENI?
- ▣ How GENI?
- ▣ LU and GENI?
- ▣ Survey for GENI @ 4-YR
- ▣ Findings
- ▣ LU and GENI Future

Global Environment for Network Innovation

The Global Environment for Network Innovations (GENI) is a unique virtual laboratory for at-scale networking experimentation Innovations.



What is GENI?

GENI prototype facility is composed of a diverse set of substrate technologies:

- ▣ National scale fiber optic backbones
- ▣ Regional optical networks
- ▣ Programmable core switches and resources
- ▣ Campus networks
- ▣ Metropolitan wireless
- ▣ Mobile networks
- ▣ Sensor networks.

Why GENI?

- ▣ Virtual laboratory for exploring future internets at a global scale,
- ▣ Creates major opportunities to understand, innovate and transform global networks and their interactions with society.

How GENI?

- ▣ Dynamic and adaptive
- ▣ Opening up new areas of research at the frontiers of network science and engineering
- ▣ Increasing the opportunity for significant socio-economic impact.
- ▣ Supporting at-scale experimentation on shared, heterogeneous, highly instrumented infrastructure.

How GENI? Con't:

- ▣ Enabling deep programmability throughout the network, promoting innovations in network science, security, technologies, services and applications.
- ▣ Providing collaborative and exploratory environments for academia, industry and the public to catalyze groundbreaking discoveries and innovation.

Langston University's Part in GENI

- ❑ Provide a survey of research and educational experiments of interest to 4- year universities, and the substrate resources required to enable them.
- ❑ Focus on spiral-1 and 2 substrate technologies and identify which research experiment(s) from the survey could be supported in GENI spiral-1 and 2.
- ❑ Provide use-case scenarios of research experiment(s) identified for spiral-2, this will include the specifics of one of the GENI prototype control frameworks and is limited to the substrate resources in that cluster.

Survey for GENI @ 4-year

- ▣ Survey of researches being performed at some four-year non-research universities, including minorities and other universities and colleges.
- ▣ Identify key concepts and services supported by the current GENI specifications.
- ▣ Based on each research description and the GENI key concepts identified, we selected those researches from 4-year universities that could be of interest for future experimentation with GENI.

Research Method: Phase I

The first step was gathering information from Websites on all kinds of researches conducted at 4-year universities

The information gathered included:

- ▣ University name
- ▣ Field of study
- ▣ Professor contact information
- ▣ Research Description
- ▣ Website

Research Method: Phase I

After surveying the non-research universities, we grouped the universities by their ethnicity nature. This resulted in four different groups:

- ▣ Regular Universities
- ▣ (HBCU) Historically Black College Universities
- ▣ (HIS) Hispanic Serving Institutions
- ▣ (TCU) Tribal College Universities

Data Collected: Phase I

- ▣ **The survey showed a total of:**
 - ▣ 39 HBCU's
 - ▣ 10 HIS's
 - ▣ 1 TCU
 - ▣ 52 other universities
- ▣ **This results to a total of :**
 - ▣ 102 different non-research universities
 - ▣ 106 total researches when all ethnicities combined

Research Method: Phase II

- ❑ The next step was to merge all the universities by their research being performed by comparing the description of the research.
- ❑ While comparing the research we were able to discover that many of the researches fell into certain fields of similar studies.
- ❑ This allowed us to merge the similar individual fields of study to come up with seven main research groups that contained the similar researches as the subgroups.

Research Groups

BEHAVIOR & HEALTH	
UNIVERSITIES	RESEARCH
<p>National Hispanic-Spalding- California State LA-Bradley - Johnson C. Smith-Northeastern State OK-Lincoln University, MO- California State Fullerton- Florida International -Nova Southeastern- Northeastern Ohio -Xavier Louisiana-Elizabeth City State - Morehouse College-New Mexico Highlands -University of Puerto Rico -Alcorn State - Delaware State-Norfolk State - Spelman College -Virginia State-</p>	<p>Child development, psychology, health psychology, physical and behavioral science, understanding aging, knowledge of public safety, biomedical, enhance medicine, nutrition, behavior of humans and animals, improve vision, auditory neuroscience, skeletal and cardiovascular disease, and minority health.</p>

Research Groups

ENVIRONMENTAL	
UNIVERSITIES	RESEARCH
Stetson- Northern Arizona - Butler -Central Oklahoma- Langston University- Trinity College-Savannah State Saint Mary's College of California- Gallaudet -Shorter College- University of the Virgin Islands- Western Illinois -Oklahoma Panhandle State -Northern Arizona -Florida International - Eastern Kentucky -Sitting Bull College-Eastern Kentucky -	Examining different animals and species, animal tests, understanding human society, study nature and plants, forestry, different plants, production of agriculture and estuarine vegetation mix, drinking water, and ecosystem.

Research Groups

ENGINEERING & SCIENCE	
UNIVERSITIES	RESEARCH
Bowie State -Clark Atlanta - Howard -Florida A&M - Barber Scotia College- Livingstone-Lincoln University, MO-Prairie View A&M - Bradley -University of Central Florida-Central Michigan - Western Michigan -University of Alaska-Santa Clara - Southeastern Oklahoma State - Central Florida- Tuskegee- Bluefield State -	Improve aviation, supercomputers, nanotechnology, radioactive nuclear, develop solar and renewable energy, fuel, engineering skills, and improve use of bioenergy.

Research Groups

INFORMATION TECHNOLOGY	
UNIVERSITIES	RESEARCH
Florida Memorial - Grambling State- Jackson State - University of Texas at El Paso- Northern Arizona -Gonzaga- Bradley - Mercer - Tuskegee- Hampton- FAMU- Clark Atlanta - Morgan State- Langston -	Integration of new technologies, internet technologies improvement, improve software applications, software development, software engineering, web applications and security, distributed team based software development, and improve science through technology.

Research Groups

CHEMISTRY & BIOLOGY	
UNIVERSITIES	RESEARCH
South Florida - Southwestern Oklahoma State - Jackson State - Central Michigan - Luther College - Western Michigan - Delaware State - John Brown - Alabama State - Virginia State - K-State at Salina - Northern Kentucky - Spelman -	Creating medicine, better chemical techniques, chemistry, oil into biodiesel, determining hydrogen storage, improving nanotechnology, environmental toxicants affecting brain and microbiology

Research Groups

MATH & PHYSICS	
UNIVERSITIES	RESEARCH
Samford- Troy- Bradley- Roosevelt- Saint Mary's College of California- Ohio Wesleyan - South Carolina State - Florida A&M- Northeastern Illinois -	Algorithms, quantum computing, astronomy, astrobiology and comets, develop equation of single stage to orbit rocket ,knowledge of outer space, understanding physics, and astrophysics

Research Groups

INFORMATIVE & MISCELLANEOUS	
UNIVERSITIES	RESEARCH
Colorado State - University of South Florida- Barry - Bennett College- Murray State - Western State College of Colorado- Northwood - Marian-	Institutional developments, leadership and training, data collecting, economy, anthropology, music recruitment, and business

Research Groups Ranking

- ▣ After reviewing the new research groups, we were able to rank the groups by the top researches being performed at these universities down to the least popular researches

The following ranking results are:

(1.) BEHAVIOR & HEALTH

23 out of 106 Researches



(2.) ENVIRONMENTAL

19 out of 106

The following ranking results are:

(3.) ENGINEERING & SCIENCE

18 out of 106 Researches



(4.) INFORMATION TECHNOLOGY

15 out of 106

The following ranking results are:

(5.) CHEMISTRY & BIOLOGY

14 out of 106



(6.) MATH & PHYSICS

9 out of 106



(7.) INFORMATIVE & MISCELLANEOUS

8 out of 106

Research Method: Phase III

- ▣ We then added eight additional columns, which are concepts supported by GENI infrastructure.
- ▣ Based on each research description, these new columns were answered with a YES, NO, or N/A depending if that research line was appropriate with the concept introduced or if the research supported the concept.

Definition of Each Concept:

1) Large-scale network: research infrastructure that will allow researchers to breakout of today's Internet circumscribed research environment.



Definition of Each Concept:

2) Virtualization and Resource Sharing:

Multiple researchers can work simultaneously or over time in the infrastructure.



Infrastructure

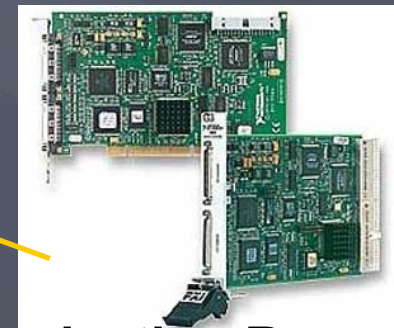
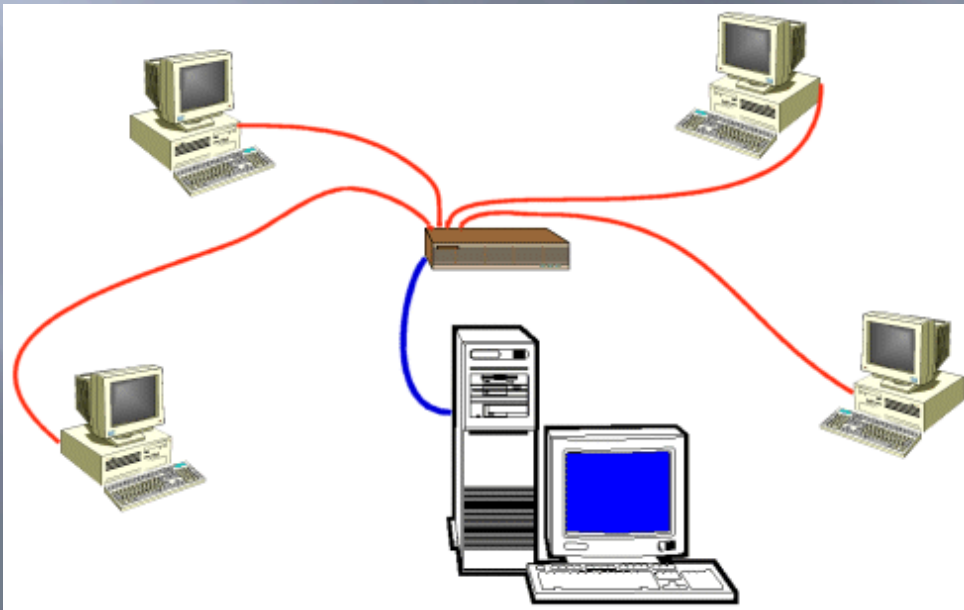
Researchers



Definition of Each Concept:

3) Slice ability: An experiment is a research-defined use of a slice; an experiment runs in a slice. A slice is a substrate-wide network of computing and communication resources capable of running an experiment or a wide-area network services

Substrate-Wide Network



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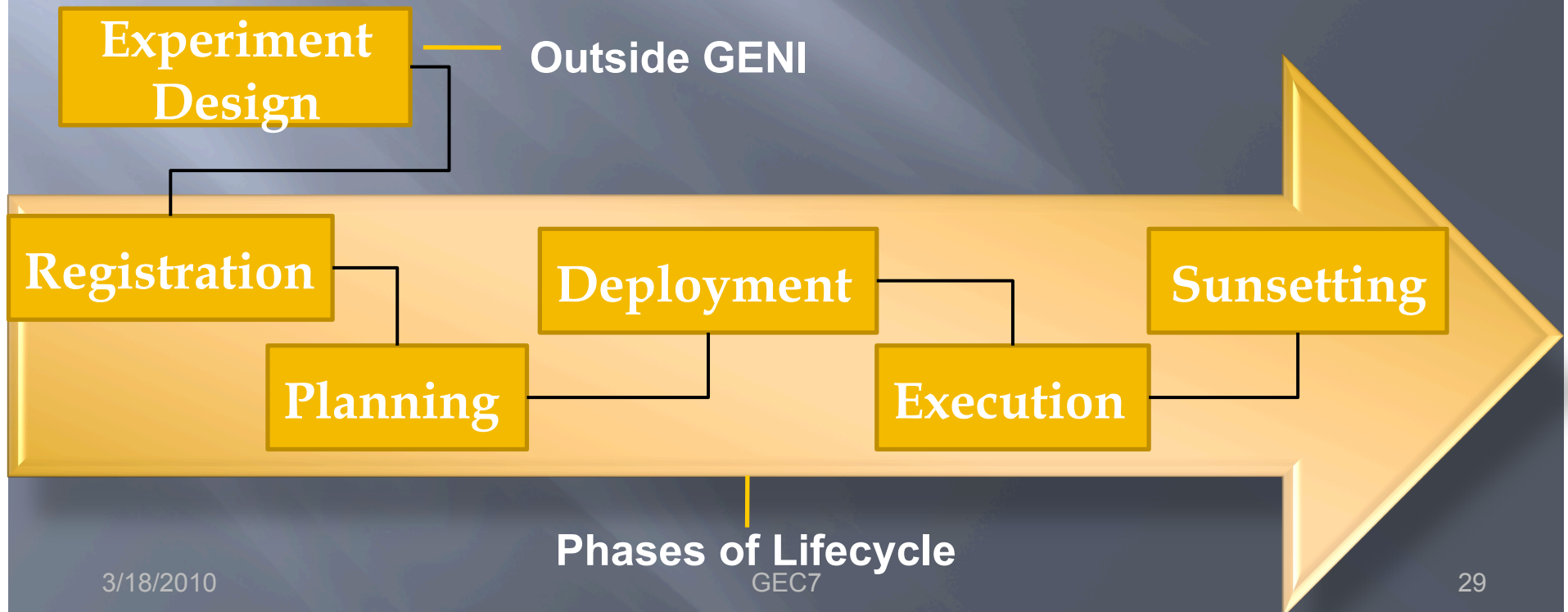
Computing

GEC7

Communication Resources

Definition of Each Concept:

4) Experiment Lifecycle: Services and tools required to support experiment life cycle are provided. This includes services and tools for experiment registration, planning, deployment, and execution.



Definition of Each Concept:

5) Leasing Resources: Having privileges on experiments created, including the ability to add researches to the experiment; control the privileges they have, and start and stop the experiment.



Experiment



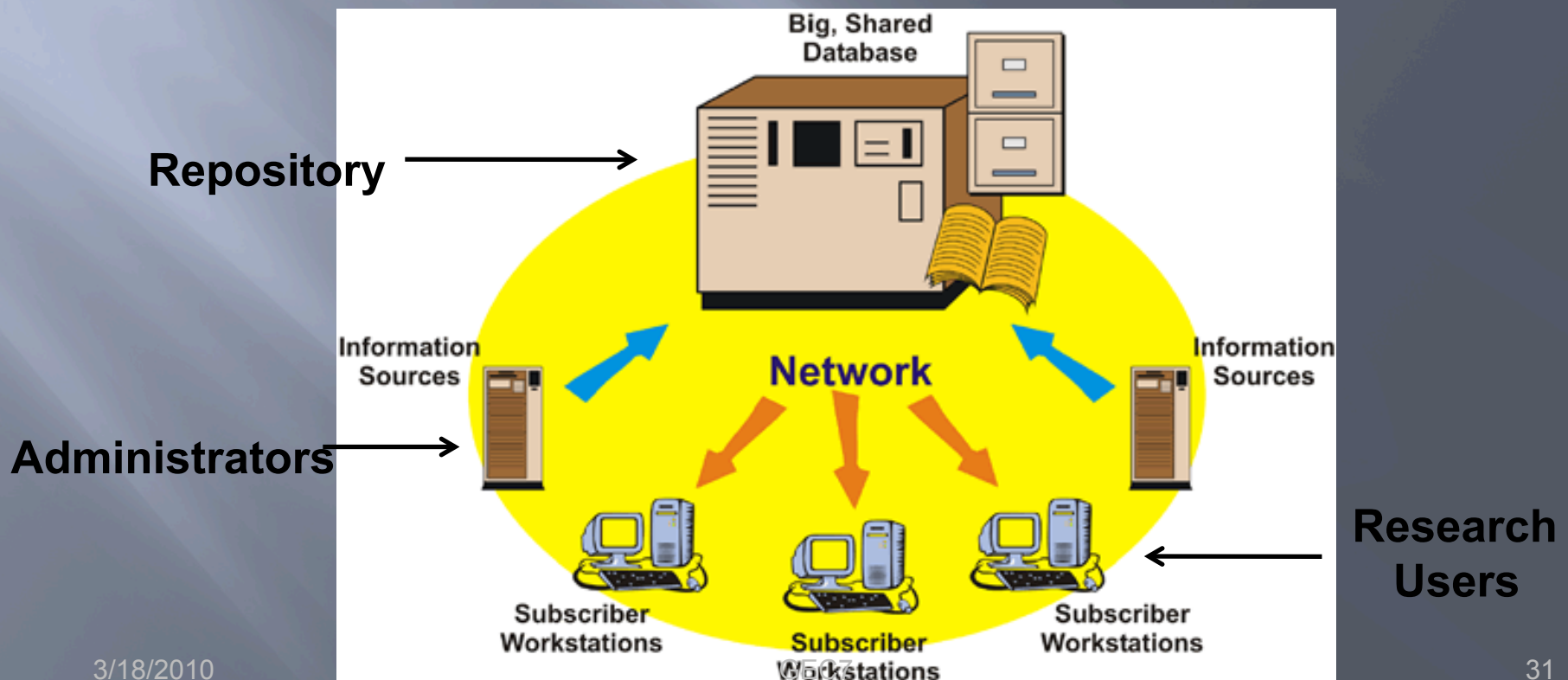
Control



**Researches from
Users**

Definition of Each Concept:

6) Experiment Specification Language: Language for describing experiments. Existing experiments are stored in the system repository. They can be browsed, retrieved, modified and reused later by other users.



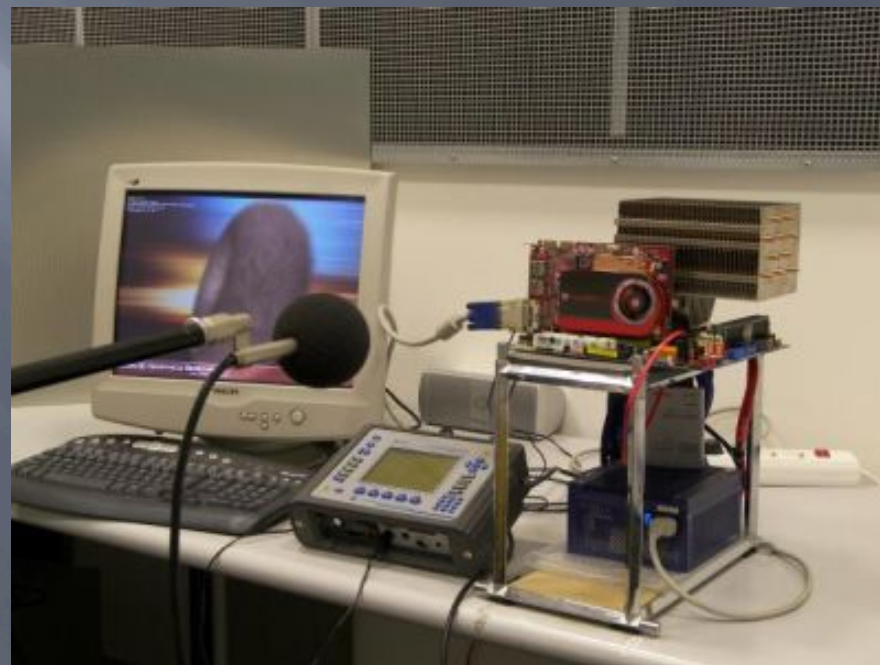
Definition of Each Concept:

7) Resource and tool Discovery: A researcher can be granted access to a test bed to conduct an experiment.



Researchers

Access



Test bed

Definition of Each Concept:

8) Wireless Emulation: An experiment to simulate nodes mobility and to emulate a wireless cellular network over the wired links.



GENI Criteria & Research Group

BEHAVIOR & HEALTH	CONCEPTS SUPPORTED BY GENI	Y/N
Child development, psychology, health psychology, physical and behavioral science, understanding aging, knowledge of public safety, biomedical, enhance medicine, nutrition, behavior of humans and animals, improve vision, auditory neuroscience, skeletal and cardiovascular disease, and minority health	Large Scale Network	Yes
	Virtualization and Resource Sharing	Yes
	Slice ability	No
	Experiment Lifecycle	Yes
	Leasing Resources	Yes
	Experiment Specification Language	Yes
	Resource and tool Discovery	Yes
	Wireless Emulation	No

GENI Criteria & Research Group

ENVIRONMENTAL	CONCEPTS SUPPORTED BY GENI	Y/N
Examining different animals and species, animal tests, understanding human society, study nature and plants, forestry, different plants, production of agriculture and estuarine vegetation mix, drinking water, and ecosystem.	Large Scale Network	Yes
	Virtualization and Resource Sharing	Yes
	Slice ability	n/a
	Experiment Lifecycle	Yes
	Leasing Resources	Yes
	Experiment Specification Language	Yes
	Resource and tool Discovery	Yes
	Wireless Emulation	n/a

GENI Criteria & Research Group

ENGINEERING & SCIENCE	CONCEPTS SUPPORTED BY GENI	Y/N
<p>Improve aviation, supercomputers, nanotechnology, radioactive nuclear, develop solar and renewable energy, fuel, engineering skills, and improve use of bioenergy.</p>	Large Scale Network	Yes
	Virtualization and Resource Sharing	Yes
	Slice ability	Yes
	Experiment Lifecycle	Yes
	Leasing Resources	Yes
	Experiment Specification Language	Yes
	Resource and tool Discovery	Yes
	Wireless Emulation	Yes

GENI Criteria & Research Group

INFORMATION TECHNOLOGY	CONCEPTS SUPPORTED BY GENI	Y/N
Integration of new technologies, internet technologies improvement, improve software applications, software development, software engineering, web applications and security, distributed team based software development, and improve science through technology.	Large Scale Network	Yes
	Virtualization and Resource Sharing	Yes
	Slice ability	Yes
	Experiment Lifecycle	Yes
	Leasing Resources	Yes
	Experiment Specification Language	Yes
	Resource and tool Discovery	Yes
	Wireless Emulation	Yes

GENI Criteria & Research Group

CHEMISTRY & BIOLOGY	CONCEPTS SUPPORTED BY GENI	Y/N
Creating medicine, better chemical techniques, chemistry, oil into biodiesel, determining hydrogen storage, improving nanotechnology, environmental toxicants affecting brain and microbiology	Large Scale Network	Yes
	Virtualization and Resource Sharing	Yes
	Slice ability	n/a
	Experiment Lifecycle	Yes
	Leasing Resources	Yes
	Experiment Specification Language	Yes
	Resource and tool Discovery	Yes
	Wireless Emulation	No

GENI Criteria & Research Group

MATH & PHYSICS	CONCEPTS SUPPORTED BY GENI	Y/N
<p>Algorithms, quantum computing, astronomy, astrobiology and comets, develop equation of single stage to orbit rocket ,knowledge of outer space, understanding physics, and astrophysics</p>	Large Scale Network	Yes
	Virtualization and Resource Sharing	Yes
	Slice ability	Yes
	Experiment Lifecycle	n/a
	Leasing Resources	Yes
	Experiment Specification Language	Yes
	Resource and tool Discovery	Yes
	Wireless Emulation	n/a

GENI Criteria & Research Group

INFORMATIVE & MISCELLANEOUS	CONCEPTS SUPPORTED BY GENI	Y/N
Institutional developments, leadership and training, data collecting, economy, anthropology, music recruitment, and business	Large Scale Network	No
	Virtualization and Resource Sharing	Yes
	Slice ability	n/a
	Experiment Lifecycle	Yes
	Leasing Resources	Yes
	Experiment Specification Language	Yes
	Resource and tool Discovery	n/a
	Wireless Emulation	n/a

Findings

- ❑ After comparing each research group with the GENI concepts. We were able to narrow down on the groups that were more appropriate with the concepts.
- ❑ Although certain groups answered Yes , not every research contained in the groups supported the concepts.
- ❑ So we broke those selected groups down and applied the concepts to each research contained in that group to discover which specific researches are appropriate with the concepts.

Top 3 Researches Selected

(1.) Bowie State University (BSU):
Computer Science

Develop a supercomputer and a NASA satellite operations control center.

(2.) Tuskegee University (TU):
Business and Information Science

Improve in the areas of high performance computing, network performance, software engineering, web applications, and information security.

(3.) Langston University (LU):
Software Engineering

Developing a Distributed Team-Based Software.

Results

CONCEPTS SUPPORTED BY GENI	Research Y/N		
	(1.) BSU	(2.) TU	(3.) LU
Large Scale Network	Yes	Yes	Yes
Virtualization and Resource Sharing	Yes	Yes	Yes
Slice ability	Yes	Yes	Yes
Experiment Lifecycle	Yes	Yes	Yes
Leasing Resources	Yes	Yes	Yes
Experiment Specification Language	Yes	Yes	Yes
Resource and tool Discovery	Yes	N/A	Yes
Wireless Emulation	N/A	Yes	Yes

Conclusion

We conducted a survey research that helped identify a potential candidate from 4-year colleges and universities that can use different components of GENI to further their research.

Based on the survey the Distributed Software Engineering research supported the GENI concepts the best.

LU's Future Work in GENI

- Explore current GENI prototypes presented at GEC7 and select one of interest for our project.
- Develop a use-case scenario on “Distributed Team-Based Software Development” and conduct an experiment on the prototype infrastructure suite using the selected GENI prototype.
- Write a white paper describing the experiment, with an emphasis to how the prototype and GENI helped improve the current software development infrastructure.

Please send all questions and inputs to:

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Thank You!!

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References

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[Tiak 2008] Use Case Scenarios for promoting GENI at four-year Colleges and Minority Institutions. GENI Proposal #1610, August 2008.

Experimentation with GENI Document ID:GENI-SE-SY-TS-UC-LC-01.0 (pg. 8) 19 January 2009

The Centralized Information Repository (CIR) Model
it.ojp.gov/documents/asp/models/section3.htm