### Supporting Experiment Workflows in GENI

GENI Experiment Workflow and Services Working Group

> Jeannie Albrecht Williams College

#### **Revisiting Experiment Workflow**

- One of the key purposes of this working group is to focus on "Experiment Workflow"
- How can we make it "easy" for a researcher or user to run an experiment on GENI?
- Solutions must address tasks associated with slice management, resource discovery and configuration, and experiment control (some potential overlap with other WGs)

2

### PlanetLab Experience

- PlanetLab taught us many things about experiment control and maintenance
  - · For novice researchers, it's often not "easy"
- Several challenges must be overcome in wide-area distributed environments:
  - Acquiring and configuring "optimal" resources
  - Managing a long-running experiment or service
  - Detecting and recovering from failures
  - Monitoring experiments in real-time
- Many researchers resort to brittle, custom-built, application-specific scripts to accomplish these tasks

#### Things to Consider

- Experiment control requirements:
  - Extensible experiment specifications
  - Resource discovery and slice configuration
  - Support for potentially multi-phased execution
  - Support for experiment composition
  - Experiment maintenance and monitoring



# General Design Goals

- Extensibility
  - · Define a general set of APIs for controlling experiments
  - Novice vs. experienced researchers
  - Long-running services vs. Short-lived experiments
  - Support evolution
- Robustness
  - · Resources will fail
  - Researchers will run buggy/broken code
- Scalability
- Experiments may run on thousands of resources (or more)
- Usability
  - We need to make GENI "easy to use"

#### My Goals

- I teach at Williams College
  - Top ranked liberal arts college
  - CS students are bright, ambitious, and like to tinker
- Distributed systems courses are often not taught to undergrads (why?)
- Goal I: Use GENI as a learning laboratory
  - Help my students appreciate, understand, and experiment with real distributed systems
  - Bring tech-richness of big universities to a small college
- Goal 2: Lower the entry barrier for research in distributed systems
  - Involve undergrads!
  - Skilled undergrads  $\rightarrow$  Smarter grad students and software developers

# **One Potential Solution: Gush**

- Gush (GENI User Shell)
  - Scalable experiment control framework for deploying and maintaining GENI experiments
  - Extension of Plush, which was initially designed for PlanetLab application control
  - Uses XML for describing experiments and resources
  - Exports APIs for interacting with resource managers and measurement services
  - Supports three UIs: graphical, command-line, programmatic (currently XML-RPC)

### Visualizing Experiments & Resources





### Describing Experiments

7

#### Issuing Commands to Resources

Bile Edit	Plush	
World Viev	W Application View Resource View Host View	
interestation 7	HOST Fame	Disconnected
Presentation of the second s		Disconnected
Internation & securit rate when		Disconnecteu
production of a solution of the solution of th		Connected
planetlab12 millennum berkeley edu		Disconnected
planetab 1. csail mr. eou		Disconnected
planetlab1 cs duke edu		Connected
planetlab5 millernium berkeley.edu		Disconnected
planetlab2.cs.duke.edu		Disconnected
planetlab3 millennium berkeley.edu		Disconnected
planetlab3.csail.mit.edu		Disconnected
planetlab11 millennium berkeley edu		Disconnected
planetlab2.mnlab.cti depaul.edu		Disconnected
planetlab4 millernium berkeley.edu		Connected
planetlab6 csail mit.edu		Disconnected
planetlab5 csall mit edu		Disconnected
planetlab3.ucsd.edu		Disconnected
planetlab4 cs duke edu		Disconnected
planetlab-1 cs princeton edu		Disconnected
planetlab7 millennium berkeley.edu		Disconnected
A T		
Output		
ucsd_plush	Øplanetlab-4.csail.mit.edu	
PID TTY	STAT TIME CONMAND	
16403.7	Rsi 0.00 ./dient -c./ -0.5 -P.15415 -b.abrechtestreigth.ucsd.edu.15001 R 0.00 pr. m.	
	is work paras	
ucsd_plushi	Øplanetlab1.cs.duke.edu:	
PID TTY	STAT TIME COMMAND	-
238882	Rai 0.00 //citem =c./ =0.0 =P.10.910 =D wored/Mestrength.0050 edu 15001	
ucsd_plushs	Øplanetlab 4. millennium, berkeley, edu:	
PID TTY	STAT TIME COMMAND	
256262	Kal 0.00 ./client -c./ -0.5 -F 15415 -b addrecht@strength.ucsd.edu 15001	
ACANDY.	e soo baar	

### Connecting to Resources



### **Future Plans**

- Get feedback from my students regarding usability
- Involve undergrads in development of Gush
  - Currently working with a freshman
  - Two students will work on Gush this summer (hopefully)
- Future goals:
  - Develop API for interacting with Clearinghouses to find resources on behalf of researchers
  - Need to interact with other WG services (perhaps describe resources using RSpecs)
  - Plug in external debugging, measurements, monitoring tools

# Questions?

13