GENI Experiment Control Using Gush

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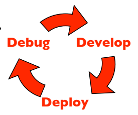
GEC 4

Overview

- How do we actually use GENI?
- Goal: Develop abstractions and tools for addressing the challenges of managing distributed applications
  - Make it easy for a range of users to run a variety of experiments on GENI
- Talk outline
  - Summarize existing work and design of Gush
  - Describe implementation/integration plan and timeline

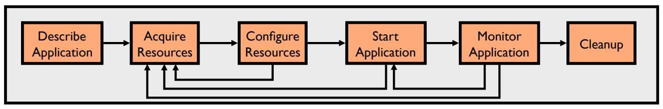
Running an Experiment

- Suppose we have written our software, we have created our slice, and we are ready to deploy on PlanetLab for the first time
- We could…
  1. Connect to each of the 800+ PlanetLab machines
  2. Download software (no common file system)
  3. Install software
  4. Run application and analyze performance
  5. Check for errors on each machine
  6. When we find an error, we start all over…
- Or we could use Gush



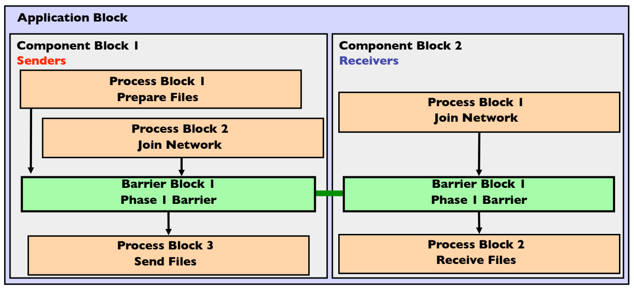
Gush

- A distributed application management infrastructure
  - Extends functionality of Plush to support experiment control on GENI
  - Designed to simplify deployment of distributed applications
  - Provides abstractions for configuration and management
  - Allows users to "remotely control" computers running distributed applications worldwide

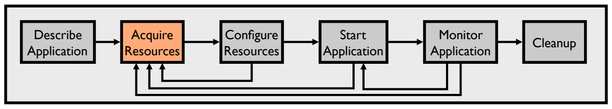


Step 1: Describe Application

- Describe experiment using application "building blocks"
- Create customized control flow for distributed applications
- Application specification blocks are described using XML

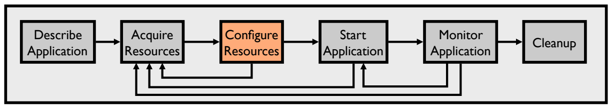


Step 2: Acquire Resources

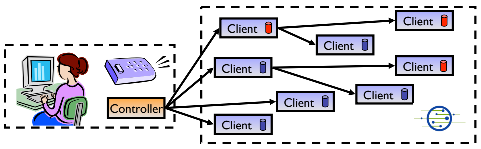


- How can we find "good" machines?
  - We want machines with specific characteristics
  - PlanetLab services perform *resource discovery* to find machines that satisfy our requirements (e.g., SWORD)
- Gush interfaces directly with these services
  - Eventually Gush will talk directly to GENI Clearinghouses to find resources

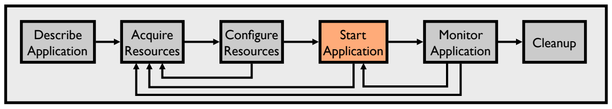
Step 3: Configure Resources



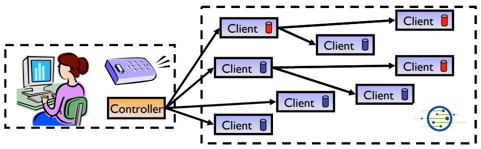
- Connect to and configure selected resources
  - Optionally create a tree for achieving scalability in communication
  - **Controller** "remotely controls" the **clients** on our behalf
  - Install software on clients (some are senders, some are receivers)



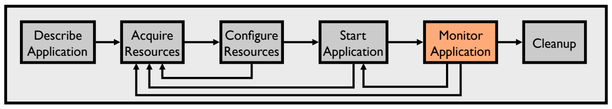
Step 4: Start Application



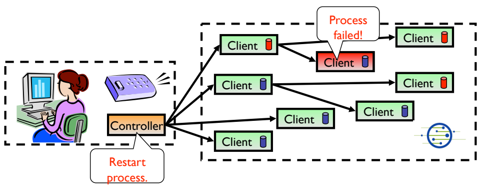
- Controller issues commands to clients telling them to start running our application
  - Senders begin running sender processes
  - Receivers begin running receiver processes



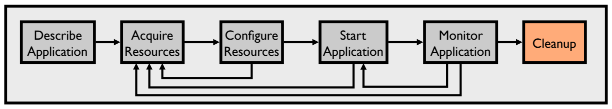
Step 5: Monitor Application



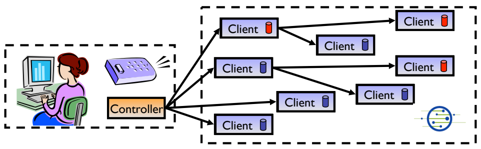
- We want to make sure the processes keep running
- Gush clients monitor experiment processes for failures
  - If a failure is detected, client notifies controller
  - Controller decides to tell client to restart failed program or process



Step 6: Cleanup

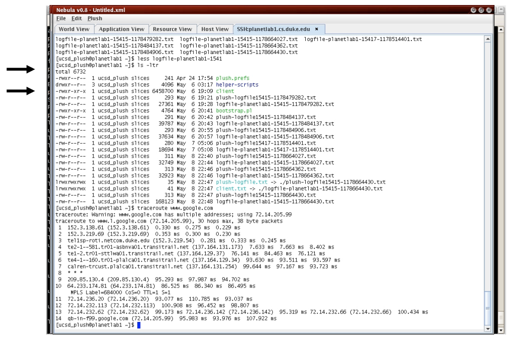


- Gush clients make sure all programs exited cleanly
- Remove logs and software from remote machines
- Disconnect clients from controller



Gush User Interfaces

- Command-line interface used to interact with applications (see DEMO)
  - Provides single point of control for remotely controlling resources
- Nebula (GUI) allows users to describe, run, monitor, & visualize applications
- XML-RPC interface for managing applications programmatically



```
logfile-planetlab1-15415-1178479282.txt  logfile-planetlab1-15415-1178664027.txt  logfile-planetlab1-15417-1178514401.txt
logfile-planetlab1-15415-1178484137.txt  logfile-planetlab1-15415-1178664362.txt
logfile-planetlab1-15415-1178484906.txt  logfile-planetlab1-15415-1178664430.txt
[ucsd_plush@planetlab1 ~]$ less logfile-planetlab1-1541
[ucsd_plush@planetlab1 ~]$ ls -ltr
total 6732
-rwxr--r--  1 ucsd_plush slices     241 Apr 24 17:54 plush.prefs
drwxr--r--  3 ucsd_plush slices    4096 May  6 03:17 helper-scripts
-rwxr-xr-x  1 ucsd_plush slices 6458700 May  6 19:09 client
-rw-r--r--  1 ucsd_plush slices     293 May  6 19:21 plush-logfile15415-1178479282.txt
-rw-r--r--  1 ucsd_plush slices   27361 May  6 19:28 logfile-planetlab1-15415-1178479282.txt
-rwxr-xr-x  1 ucsd_plush slices    4764 May  6 20:41 bootstrap.pl
-rw-r--r--  1 ucsd_plush slices     291 May  6 20:42 plush-logfile15415-1178484137.txt
-rw-r--r--  1 ucsd_plush slices   39787 May  6 20:43 logfile-planetlab1-15415-1178484137.txt
-rw-r--r--  1 ucsd_plush slices     293 May  6 20:55 plush-logfile15415-1178484906.txt
-rw-r--r--  1 ucsd_plush slices   37634 May  6 20:57 logfile-planetlab1-15415-1178484906.txt
-rw-r--r--  1 ucsd_plush slices     280 May  7 05:06 plush-logfile15417-1178514401.txt
-rw-r--r--  1 ucsd_plush slices   18694 May  7 05:08 logfile-planetlab1-15417-1178514401.txt
-rw-r--r--  1 ucsd_plush slices     311 May  8 22:40 plush-logfile15415-1178664027.txt
-rw-r--r--  1 ucsd_plush slices   32749 May  8 22:44 logfile-planetlab1-15415-1178664027.txt
-rw-r--r--  1 ucsd_plush slices     313 May  8 22:46 plush-logfile15415-1178664362.txt
-rw-r--r--  1 ucsd_plush slices   32923 May  8 22:46 logfile-planetlab1-15415-1178664362.txt
lrwxrwxrwx  1 ucsd_plush slices      35 May  8 22:47 plush-logfile.txt -> ./plush-logfile15415-1178664430.txt
lrwxrwxrwx  1 ucsd_plush slices      41 May  8 22:47 client.txt -> ./logfile-planetlab1-15415-1178664430.txt
-rw-r--r--  1 ucsd_plush slices     313 May  8 22:47 plush-logfile15415-1178664430.txt
-rw-r--r--  1 ucsd_plush slices  168123 May  8 22:48 logfile-planetlab1-15415-1178664430.txt
[ucsd_plush@planetlab1 ~]$ traceroute www.google.com
traceroute: Warning: www.google.com has multiple addresses; using 72.14.205.99
traceroute to www.l.google.com (72.14.205.99), 30 hops max, 38 byte packets
 1  152.3.138.61 (152.3.138.61)  0.330 ms  0.275 ms  0.229 ms
 2  152.3.219.69 (152.3.219.69)  0.353 ms  0.300 ms  0.230 ms
 3  tel1sp-roti.netcom.duke.edu (152.3.219.54)  0.281 ms  0.333 ms  0.245 ms
 4  te2-1--581.tr01-asbnva01.transitrail.net (137.164.131.173)  7.633 ms  7.663 ms  8.402 ms
 5  te1-2.tr01-sttlwa01.transitrail.net (137.164.129.37)  76.141 ms  84.463 ms  76.121 ms
 6  te4-1--160.tr01-plalca01.transitrail.net (137.164.129.34)  93.630 ms  93.511 ms  93.597 ms
 7  calren-trcust.plalca01.transitrail.net (137.164.131.254)  99.644 ms  97.167 ms  93.723 ms
 8  * * *
 9  209.85.130.4 (209.85.130.4)  95.293 ms  97.987 ms  94.702 ms
10  64.233.174.81 (64.233.174.81)  86.525 ms  86.340 ms  86.495 ms
     MPLS Label=684000 CoS=0 TTL=1 S=1
11  72.14.236.20 (72.14.236.20)  93.077 ms  110.785 ms  93.037 ms
12  72.14.232.113 (72.14.232.113)  100.908 ms  96.452 ms  98.807 ms
13  72.14.232.62 (72.14.232.62)  99.173 ms 72.14.236.142 (72.14.236.142)  95.319 ms 72.14.232.66 (72.14.232.66)  100.434 ms
14  qb-in-f99.google.com (72.14.205.99)  95.983 ms  93.976 ms  107.922 ms
[ucsd_plush@planetlab1 ~]$
```

Current Status & Recent Activities

- Gush works with current PlanetLab XML-RPC API
  - Have written some code for geniwrapper integration (but it has not been tested)
- Preliminary user study completed
- Gush web site is "live" now (http://gush.cs.williams.edu)
  - Instructions for obtaining and using Gush
- Undergraduate student involvement at Williams
  - Gush web interface (GoogleMaps) [summer 2008]
  - Batch scheduler that uses Gush XML-RPC interface [summer 2008]
  - Gush and Nebula development [summer 2009]
- Gush in the classroom
  - "Bringing Big Systems to Small Schools: Distributed Systems for Undergraduates," SIGCSE 2009.

Summary & Next Steps

- Gush provides abstractions for managing a range of distributed applications on GENI
  - Provides three different user interfaces to meet the needs of a variety of researchers with varying levels of expertise
- Next steps
  - Continue obtaining user feedback to enhance usability and provide additional functionality
  - Develop better user and developer documentation
  - Continue to integrate with other Cluster B services (e.g., Raven)
- Long term goals
  - Enhance GUI (Nebula) functionality
  - Extend Gush to support experiments on sensor/mobile networks

Thanks!

For more info, visit

http://gush.cs.williams.edu

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