Parweb

Kyle Chipps, Ben Johnson, Jacob Potter
Introduction

• Parweb
  • Web framework for cluster computing interfacing
• High Performance Computational Science Laboratory at WMU
  • Dr. John Kapenga.
Cluster Computing

What is a cluster?

- Collection of computers
  - Shared resources
- Computational speed
- Nodes
  - Head
  - Individual resources
- Special Applications
  - Parallel Prog.
  - GPU Prog.
The HPC Lab and Thor

High Performance Computing Cluster at Parkview (Thor)

• 22 Computing Nodes
• Torque
• Applications in Education/Research
  • CS, Physics, Chemistry, etc.
Resources on cluster managed by TORQUE

- Terascale Open-source Resource and Queue Manager
- Manages jobs
- Distributes resources
- TORQUE scripts
  - Like Bash scripts but with extra parameters.
  - Users currently write own scripts
Problems with Thor

• Users need knowledge:
  • SSH/CLI
  • SCP/SFTP
  • UNIX/Linux
  • Text Editor
  • Job Control (Torque)

• Learning Curve
Goal for Thor

Solution: Parweb
• Web interface
• Automatically:
  • Generates/Runs Scripts
• Input data upload
• View/download results
• Eliminate learning curve
Design Decisions

● Our Choices:
  ○ Ubuntu 14.04.1
  ○ Rails 4.1.2
  ○ Apache 2.4.7
  ○ Phusion Passenger 4.0.50
  ○ Devise 3
  ○ Capistrano 3.9
Design Decisions

Ruby on Rails
  • Ruby: Programming Language
  • Rails: MVC Framework for Ruby
  • Easy setup and configuration
  • Built-in:
    • Security
    • Testing
    • Database management
Design Decisions

- Other options:
  - Windows
  - Nginx
  - IIS
  - Puma
  - Laravel (PHP)
  - Django (Python)
  - ASP.NET MVC
ParWeb Design

- ParWeb- Web Framework
- Application to be run on cluster
  - Ex: Flu epidemic simulations, gene sequencing
- Parweb used to make interface
  - Connects user to application via web browser
Details

- Interface on web server separate from cluster
  - Security
  - Resources
- SSH Keys
  - Secure communication between web server and cluster
- Portability for future systems
Typical ParWeb Workflow

Login

User

Admin

Upload

Output

Run Jobs

User Admin
Implementation MVC Overview

- Rails-MVC Framework
- View
  - Upload/download
  - Add/delete users
  - Job creation
- Controller
  - Authentication
  - Torque Commands
  - User Interaction
- Model
  - Job and Users
Testing

• Testing in Rails
  • Extremely easy (one command)
  • Exclusively test each component of MVC

• New Rails Applications
  • Working application
  • Multiple Environments
  • Testing skeleton
Testing in Rails

/test

- controllers
  - Find what a controller does given a set of data
- fixtures
  - Testing environment
- helpers
  - For testing views
- integration
  - Test any number of controllers
- mailers
  - Email tests
- models
  - Check database interaction
Testing Parweb

- **Fixtures**
  - Added sample data to test against
- **Controller Tests**
  - Creating/Modifying Users
  - Adding Jobs/Interaction with Torque
- **Model**
  - Include fixture
  - Test using asserts against data
Rails and Security

- Session Hijacking
- Cross-Site Request Forgery (CSRF)
- User Authentication
- File upload and download
- Cross-site scripting (XSS)
- SQL Injection
CSRF - Countermeasures

To prevent this:
- protect_from_forgery

Malicious link example:
<img src="http://www.parweb.com/jobs/1/destroy">
Session Hijacking

To prevent this:
• reset_session

http://website.com/<script>document.cookie="sessionid=xyz";</script>
XSS Prevention

- Rails uses the *whitelist* methodology
- Anything passed to a view is html escaped
Sanitizing user input

- Not just on web forms but anything that is uploaded to our server (test data, input files, etc.)
User Authentication

• Easy to get wrong ... so we used Devise
• Authentication features
  • Hash and salt passwords
  • Password expiration
  • Password reset
• Timeout Functionality
  • Block brute force attempts
Maintenance

- Limit the use of unnecessary/hard to maintain bundles
- Code standards
- Published under GPLv2
- Dr. Kapenga will decide who takes this project on next
Coming in Release 2

- Scaffolding to create new Rails apps for any cluster program made
- Security enhancements
- Users have the ability to adjust TORQUE parameters
- So much more!
Summary

• A new, more appealing, way to submit jobs that will run on the cluster
• A fully functional and well tested Ruby on Rails framework
• Hopefully others will adopt our framework and be able to make it fit their needs
Questions?