

Regression Testing for NCCS Computers

Yasmin Jackson
Alabama A&M University
Research Alliance in Math and Science
National Center for Computational Sciences
Mentor: Dr. Arnold Tharrington

http://www.csm.ornl.gov/Internships/rams_06/abstracts/y_jackson.pdf



Abstract

The National Center for Computational Science's (NCCS) mission is to be a national leader in capability computing. NCCS computing resources are Phoenix, the Cray X1E with 1040 multi-streaming vector processors; Jaguar, the Cray XT3 with 5294 nodes each with a 2.4 GHz AMD Opteron processor; and RAM, the SGI Altix with 256 Intel Itanium2 processors running at 1.5 GHz. The NCCS computational environment is under continuous modification, and a critical aspect to achieving NCCS mission is quality control of the NCCS computers. The project objective is to assist in implementing a regression test suite and regression testing for NCCS for the purpose of quality control. One such suite is Message Passing Interface (MPI) regression testing. MPI has emerged as the standard for parallel programming in the scientific community and it is critical to have a systematic method of quantifying the performance of the MPI on NCCS computers. Specifically, this suite will be used in upgrading the Jaguar computer from its present computational rate of 25 to 250 Teraflops. Specific subtasks for this project include learning the programming language Python; learning about the hardware, productivity tools, and scientific applications associated with High Performance Computing (HPC); becoming acquainted with Fortran because nearly all of the scientific applications are written in Fortran; and learning the UNIX/LINUX operating system.

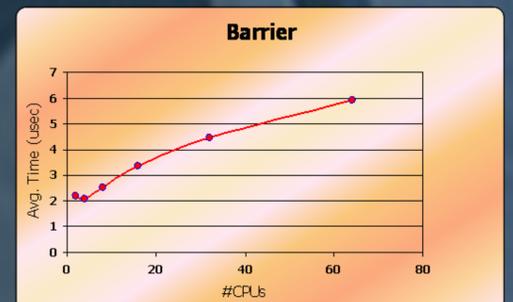
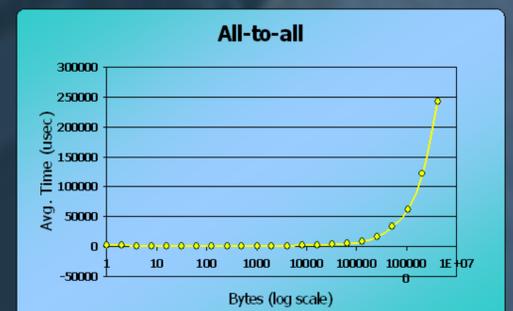
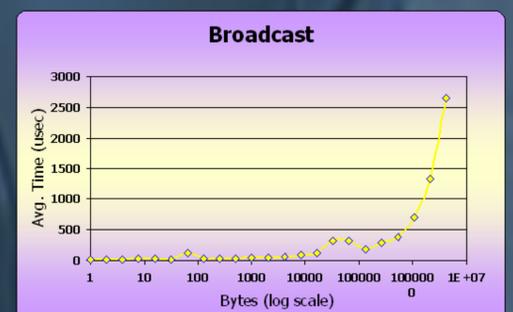
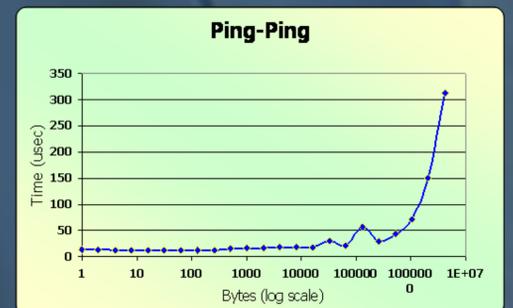
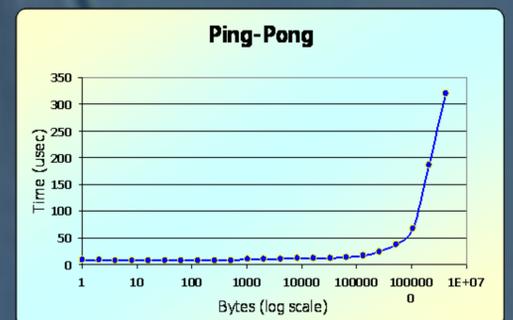
Background

- Computational advances in technology an ongoing process
- Need to perform tests and analyze data on large scale ever-increasing
- Requires efficiency in high performance parallel computing
- Computing resources relied upon for accuracy and expeditious computational rate
- Constant advances produce need to upgrade system software to sustain level of integrity
- Modifications could possibly introduce new problems
- Regression testing required for quality control

What is Regression Testing?

- ★ Process of testing changes to computer programs to ensure that older programming still works with new changes
- ➔ **Purpose:** to detect unexpected faults in code modification that may affect previously tested functions
- ➔ **Reliable way to ensure modifications did not introduce new errors in code or to check if modifications successfully eliminated existing errors**
- ➔ **Process:** involves building sequence of tests using Message Passing Interface software
- ➔ **Consequences:** If component of solution changed, then all other components which relied upon it may have also been significantly affected.

Results

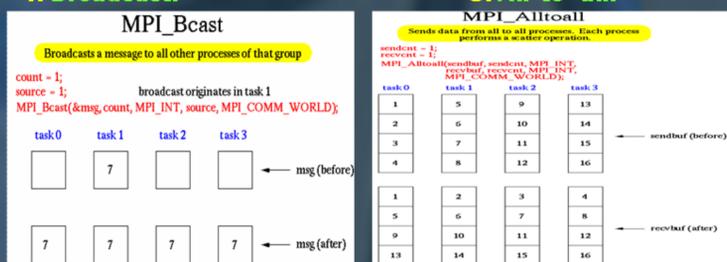


Software

- Python**
 - object-oriented scripting language
- Fortran 90**
 - programming language used in nearly all science and engineering applications
- Message Passing Interface (MPI)**
 - standard for communication among nodes running a parallel program on a distributed memory system

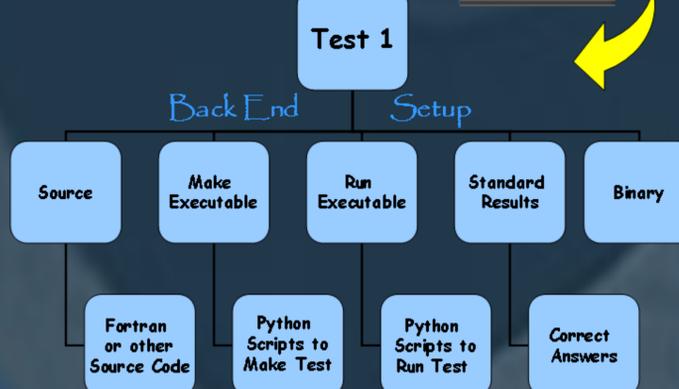
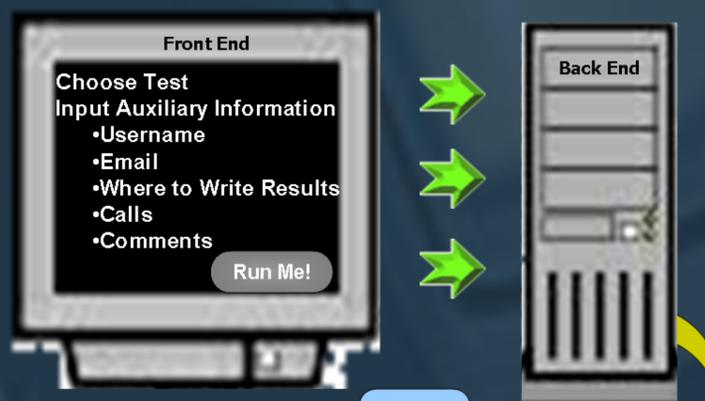
Types

1. **Ping-Pong:** half-duplex communications method where data transmitted one direction and acknowledgment returned at same speed in opposite direction
2. **Ping-Ping:** protocol that sends message to another computer and waits for acknowledgment
3. **Barrier:** creates a barrier synchronization in group
4. **Broadcast:**
5. **All-to-all:**



Example Test Setup

Graphical User Interface (GUI)



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