

Assignment: Simulating Grid Architecture Using Globus Toolkit

Objective

This assignment will help you to understand the core concepts of grid computing architecture, including resource sharing, job submission, security, and data transfer, using the Globus Toolkit.

Learning Outcomes

- Understand and explain the grid computing architecture
- Set up and configure Globus Toolkit services
- Demonstrate secure and efficient job and data management
- Analyze real-world applications of grid computing

This is a group assignment. Arrange a group of five students. For this assignment, you are required to submit the following: -

- 1- A report of 3-5 pages explaining the architecture, setup, observations, and lessons learned.
- 2- Setup screenshots and configuration files
- 3- Job submission scripts and outputs
- 4- Data transfer results (e.g., graphs comparing speed)
- 5- Security configuration and test results

Tools Required

- Two or more virtual machines (Ubuntu recommended)
- Globus Toolkit (use online guide to install)
- GridFTP (for data transfer)
- GRAM (for job management)
- GSI (for security infrastructure)
- Condor or SLURM as local schedulers

Part 1: Setup and Configuration

1. Install Globus Toolkit on three or more VMs, i.e. VirtualBox or VMware (local or cloud-based like AWS).
2. Configure Globus services:
 - GridFTP server

- GRAM (Grid Resource Allocation Manager)
 - GSI (Grid Security Infrastructure) – To create certificates
3. Establish trust between the machines using host certificates.

Expected Outcome: Nodes are connected with Globus services and are capable of secure communication.

Part 2: Simulating Grid Resource Sharing

1. Simulate organizations: i.e VM1 = Organization A, VM2 = Organization B.
2. Share computer resources by installing a scheduler (like Condor) on each VM.
3. Submit a compute job from Organization A to Organization B using GRAM.
4. Monitor and report on resource usage and job execution.

Expected Outcome: Successfully executed jobs across organizations, showing the grid concept of resource sharing.

Part 3: Simulating Data Grid

1. Transfer a large data file (e.g., a video or dataset) from one node to another using GridFTP.
2. Time and compare this transfer with a normal FTP or SCP transfer.
3. Demonstrate parallel streams or security features in GridFTP.

Expected Outcome: Efficient and secure data transfer between nodes using grid technologies.

Part 4: Security Demonstration

1. Configure and use GSI certificates for user authentication.
2. Try job submission and data transfer with and without valid certificates, and record the results.
3. Explain how GSI enhances grid security.

Expected Outcome: Demonstration of secure and insecure communication scenarios.