

1. Installing signed certificates

Follow the instructions for “Obtaining Signed Certificates” at <http://www.cis.uab.edu/cs633/software/> (also included with this homework on WebCT) and download the files `userkey.pem` and `usercert.pem`. Create a directory “.globus” (note the period before globus) in your home directory on one of the Vulcan machines (`vulcan[1-8].cis.uab.edu`) and copy the two PEM files to this directory. Change the permission of the file `userkey.pem` to have read-only privileges for the user using the command “`chmod u+r-wx,go-rwx $HOME/.globus/userkey.pem`”. Create a directory called `.globus/certificates` and download the CA certificates and signing policy file from: <http://www.cis.uab.edu/cs633/software/>.

2. Setting up environment variables

Bash Shell

On `vulcan[1-8].cis.uab.edu`, edit `.bash_profile` file and **add the following lines to the end** of your `.bash_profile` file.

```
##  
## The following lines are required to use Globus Toolkit  
export GLOBUS_LOCATION=/netbin/globus  
export PATH=${GLOBUS_LOCATION}/bin:$PATH  
export LD_LIBRARY_PATH=${GLOBUS_LOCATION}/lib:$LD_LIBRARY_PATH  
export GLOBUS_TCP_PORT_RANGE=45000,45999  
. ${GLOBUS_LOCATION}/etc/globus-user-env.sh  
## End Globus Toolkit specific initialization  
#
```

After saving the changes to the `.bash_profile` file type `source .bash_profile` at the command prompt or logout and login again. This should setup the appropriate environment variables required to use the Globus Toolkit (type `globus-hostname` at the command prompt and it should print the complete hostname, *i.e.*, `vulcan1.cis.uab.edu`).

C Shell

If `cs` is your default shell then add the following lines **to the end** of the file `.cshrc` in the home directory:

```
#  
## The following lines are required to use Globus Toolkit  
setenv GLOBUS_LOCATION /netbin/globus  
setenv PATH ${GLOBUS_LOCATION}/bin:$PATH  
setenv LD_LIBRARY_PATH ${GLOBUS_LOCATION}/lib:$LD_LIBRARY_PATH  
setenv GLOBUS_TCP_PORT_RANGE 45000,45999  
source ${GLOBUS_LOCATION}/etc/globus-user-env.csh  
## End Globus Toolkit specific initialization  
#
```

3. Creating a proxy certificate

Type `grid-proxy-init -verify -debug` at the command prompt. You will be prompted to enter the pass phrase, enter the same pass phrase that you used while downloading the userkey (Step 1). If the proxy certificate is created you will see a message:

```
Proxy Verify OK  
Your proxy is valid until: <Day> <Month> <Date> <Time> <Year>
```

To find out more about the different options supported by `grid-proxy-init`, use `grid-proxy-init -help`.

4. Obtain information about the generated proxy certificate

You can find out information about the proxy certificate using the `grid-proxy-info` command. Type `grid-proxy-info -all` to obtain distinguished name (DN) of subject, DN of issuer, type of proxy, key strength, full path to the proxy file, and time left. If you type `grid-proxy-info -help` you will find the list of other options you could use.

5. Submitting jobs using pre Web Services based GRAM

After you have created a proxy certificate you can submit jobs to a host running the GRAM server. You will be using `Everest.cis.uab.edu` and `Olympus.cis.uab.edu` as the GRAM servers. Use the following commands to submit jobs (try the same for `Olympus.cis.uab.edu` also):

1. To authenticate with the GRAM server
`globusrun -a -r everest.cis.uab.edu`

2. To submit a RSL command
(details about RSL can be found at http://www.globus.org/toolkit/docs/2.4/gram/rsl_spec1.html)
`globusrun -o -r everest.cis.uab.edu '&(executable=/bin/date)'`

3. To submit any command interactively
`globus-job-run everest.cis.uab.edu /bin/date`

4. To submit any command in batch mode
`globus-job-submit everest.cis.uab.edu /bin/date`

This will return a URL that looks something like this:
`https://everest.cis.uab.edu:48349/12925/1139940775`

To check the status of the job use:
`globus-job-status <URL>`
E.g., `globus-job-status https://everest.cis.uab.edu:48349/12925/1139940775`

To check the output produced use:
`globus-job-get-output <URL>`
E.g., `globus-job-get-output https://everest.cis.uab.edu:48349/12925/1139940775`

5. To submit a sequential job to the SGE queue (enter the following on one line)
`globus-job-submit everest.cis.uab.edu/jobmanager-sge -x "&(jobType=single)" /home/puri/a.out`

Use `globus-job-status` and `globus-job-get-output` to monitor the status and look at the output.

6. To submit an MPI job to the SGE queue (enter the following on one line)
`globus-job-submit everest.cis.uab.edu/jobmanager-sge -x "&(jobType=mpi)(count=4)" /home/puri/psum`
or
`globus-job-submit everest.cis.uab.edu/jobmanager-sge -np 4 -x "&(jobType=mpi)" /home/puri/psum`

Use `globus-job-status` to check the status and `globus-job-get-output` to obtain the output. You can also use `globusrun` or `globus-job-run` instead of `globus-job-submit`, for example:

`globusrun -r everest.cis.uab.edu/jobmanager-sge "&(jobType=mpi)(executable=/home/puri/psum)(count=4)(stdout=/home/puri/out)(stderr=/home/puri/err)"`
or
`globus-job-run everest.cis.uab.edu/jobmanager-sge -np 4 -x "&(jobType=mpi)" /home/puri/psum`

Note that `globus-job-run` prints the standard output and error messages on the screen while `globusrun` will not display output sent to standard output and error streams (hence you need to redirect output and error streams to a file on the host side and then copy it to the client). Also note that you need to specify `/home/<userid>/out` for Everest and `/shared/home/<userid>/out` for Olympus, where `<userid>` is your userid. When `globus-job-submit` is used, standard output can be obtained using the command `globus-job-get-output`. Use `globusrun -help` and `globus-job-run -help` to see more options.

6. File transfer using GridFTP

You can copy files using the proxy certificate using `globus-url-copy`, here is an example to copy a file `/home/puri/output.txt` from `everest.cis.uab.edu` to your localhost:
`globus-url-copy gsiftp://everest.cis.uab.edu/home/puri/output.txt file:///tmp/output.txt`

You can also perform third party file transfer using GridFTP, for example:
`globus-url-copy gsiftp://everest.cis.uab.edu/home/puri/output.txt`
`gsiftp://olympus.cis.uab.edu/shared/home/<userid>/newoutput.txt` (this must be on one line and replace `<userid>` with your userid).

7. Submitting jobs using Web Services based GRAM

1. Submitting a simple command to fork job manager
`globusrun-ws -submit -s -F everest.cis.uab.edu -c /bin/uname -a`
2. Submitting a simple command to SGE job manager
`globusrun-ws -submit -s -F everest.cis.uab.edu -Ft SGE -c /bin/uname -a`

Notice the difference in the output.

3. Submitting a simple RSL file to fork job manager

```
globusrun-ws -submit -s -F everest.cis.uab.edu -f job.xml
```

4. Submitting a simple RSL file to SGE job manager

```
globusrun-ws -submit -s -F everest.cis.uab.edu -Ft SGE -f job.xml
```

5. Submitting a simple RSL file to SGE job manager in batch mode

```
globusrun-ws -submit -batch -o jobstatus.epr -S -F everest.cis.uab.edu -Ft SGE -f job.xml
```

6. Checking status of batch job

```
globusrun-ws -status -job-epr-file jobstatus.epr
```

Use the following text for the file job.xml:

```
<job>
  <executable>/bin/cat</executable>
  <directory>${GLOBUS_USER_HOME}</directory>
  <argument>input.fas</argument>
  <fileStageIn>
    <transfer>
      <sourceUrl>gsiftp://olympus.cis.uab.edu/home/puri/input.fas</sourceUrl>
      <destinationUrl>file:///${GLOBUS_USER_HOME}/blastinput.fas</destinationUrl>
    </transfer>
  </fileStageIn>
  <fileCleanUp>
    <deletion>
      <file>file:///${GLOBUS_USER_HOME}/blastinput.fas</file>
    </deletion>
  </fileCleanUp>
</job>
```

8. Destroy proxy certificate

Use grid-proxy-destroy to remove the proxy certificate.