## Globus Procedures on LONI Systems

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- Overview of HPC
- Introduction to vi
- LONI Programming Environment
- Ready to use LONI Systems





#### BUT WHICH ONE

### LINUX

- Eric
- 2 Louie
- Oliver
- Painter
- Poseidon
- Queenbee

## **AIX**

- Bluedawg
- 2 Ducky
- 3 Lacumba
- Weptune
- Zeke
- How do I manage data and jobs on the LONI systems?
- Do I need to login to all systems or
- Is there a tool to manage this





- Globus Toolkit for building computing grids.
- Provides
  - Grid Resource Allocation Manager (GRAM) for managing jobs
  - ② GridFTP, a more reliable and high performance file transfer for Grid computing applications

```
http://www.cct.lsu.edu/~apacheco/tutorials/globus.php
http://www.cct.lsu.edu/~apacheco/tutorials/globus.pdf
```





- Access to LONI Account
  - Apply for LONI accounts at https://allocations.loni.org
- Active LONI Grid Certificate
- Login to qb1.loni.org

Add globus to your environment and resoft

```
[apacheco@qb1 ~]$ soft add +globus-4.0.8-r2
[apacheco@qb1 ~]$ resoft
```





#### How To Request for a Grid Certificate

## Request LONI Grid Certificate

```
[apacheco@qb1 ~]$ grid-cert-request
A certificate request and private key is being created.
You will be asked to enter a PEM pass phrase.
This pass phrase is akin to your account password,
and is used to protect your key file.
If you forget your pass phrase, you will need to
obtain a new certificate.

Generating a 1024 bit RSA private key
```

#### To recreate a certificate

```
[apacheco@qb1 ~]$ grid-cert-request -force
```





- .globus directory will be created in the home directory with three files: usercert\_request.pem,userkey.pem and usercert.pm
- email usercert\_request.pem file to ca@loni.org
   [apacheco@gb1 ~]\$ cat \$HOME/.qlobus/usercert\_request.pem | mail ca@loni.org
- Copy the signed certificate you receive from LONI administrator to ~/.globus/usercert.pem





#### Certificate Information

```
[apacheco@qb1 ~]$ grid-cert-info
Certificate:
    Data:
        Version: 3 (0x2)
        Serial Number: 340 (0x154)
        Signature Algorithm: md5WithRSAEncryption
        Issuer: C-US, O-Louisiana Optical Network Initiative, OU=loni.org, CN=LONI CA
blah blah blah
```

## Distinguished Name

```
[apacheco@qb1 ~]$ grid-cert-info -subject 
/C=US/O=Louisiana Optical Network Initiative/OU=loni.org/OU=sys.loni.org/CN=Alexander P
```

#### Issuer Hash

```
[apacheco@qb1 ~]$ grid-cert-info -issuerhash a3bf9f3c
```





#### More Details/Help

```
[apacheco@qb1 ~]$ grid-cert-info -help
grid-cert-info [-help] [-file certfile] [-all] [-subject] [...]
Displays certificate information. Unless the optional -file
argument is given, the default location of the file containing the
blab blab blab
```

## Generating a valid proxy.

#### [apacheco@gb1 ~]\$ grid-proxy-init





- Globus provides globus-url-copy, a scriptable command line tool that can do multi-protocol data movement.
- Supports: gsiftp:// (GridFTP), ftp://, http://, https://, and file:///
- Usage:

transfer a file from queenbee to oliver

```
[apacheco@qb1 globus-tutorial]$ globus-url-copy \
gsiftp://qb1.loni.org/home/apacheco/globus-tutorial/100mbfile \
qsiftp://oliverl.loni.org/home/apacheco/100mbfile
```

create a 1GB file and transfer to zeke with verbose (-vb)
 option

[apacheco@qb1 globus-tutorial]\$ dd count=1000 bs=1024k if=/dev/zero \ of=/work/apacheco/lqbfile



```
1000+0 records in
1000+0 records out

[apacheco@qbl globus-tutorial]$ globus-url-copy -vb \
file:///work/apacheco/lgbfile \
gsiftp://zeke.loni.org/mnt/lpfs.nfs302/apacheco/lgbfile

Source: file:///work/apacheco/
Dest: gsiftp://zeke.loni.org/mnt/lpfs.nfs302/apacheco/
lgbfile

1020264448 bytes 29.87 MB/sec avg 35.00 MB/sec inst
```

## Create a directory to store a filename

```
[apacheco@qb1 ~]$ globus-url-copy -vb -cd \
gsiftp://ericl.loni.org/home/apacheco/100mbfile \
gsiftp://qb1.loni.org/home/apacheco/createdirectory/100mbfile
Source: gsiftp://ericl.loni.org/home/apacheco/
Dest: gsiftp://qb1.loni.org/home/apacheco/createdirectory/
100mbfile
104857600 bytes 58.82 MB/sec avg 58.82 MB/sec inst
```

## Transfer files from a directory recursively



[apacheco@qb1 globus-tutorial]\$ globus-url-copy -vb -r -cd \ gsiftp://qb1.loni.org/home/apacheco/globus-tutorial/ \ gsiftp://oliver1.loni.org/home/apacheco/createdirectory/



## Moving Files using Globus III

```
Source: gsiftp://qb1.loni.org/home/apacheco/globus-tutorial/
Dest: gsiftp://oliver1.loni.org/home/apacheco/createdirectory/
200mbfile
209715200 bytes 34.48 MB/sec avg 34.48 MB/sec inst
100mbfile
104857600 bytes 27.03 MB/sec avg 27.03 MB/sec inst
```

- You can adjust the tcp buffer size and buffer size using the options -tcp-bs and -bs
- Use parallel streams for transfer with −p option

```
[apacheco@qb1 globus-tutorial]$ globus-url-copy -p 4 -vb \
    file:///work/apacheco/1gbfile \
        qsiftp://zeke.loni.org/mnt/lpfs.nfs302/apacheco/1qbfile
```

- On the LONI machines, -p 5 -tcp-bs 2097152 is recommended for a reasonable performance (not necessarily the most optimized set of option numbers).
- multiple transfers from a script file using the -f switch (example in job submission section)



## • Job Submission using globus-job-run.

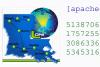
## • Run a simple command on a LONI machine

```
[apacheco@qbl ~]$ globus-job-run louiel.loni.org /bin/date
Thu Oct 21 14:57:19 CDT 2010

[apacheco@qbl ~]$ globus-job-run louiel.loni.org /bin/hostname
louiel.loni.org
```

## Run a shell script with arguments using globus

```
[apacheco@qb1 ~]$ globus-job-run oliver1.loni.org -s random-generator.sh 4 7
2377875
2910657
8458138
1522082
```



```
[apacheco@qb1 ~]$ globus-job-run bluedawg.loni.org -s random-generator.sh 4 7 5 5 138706 1757255 3086336 5345316 CENTER FOR COMPUTATION & TECHNOLOGY
```

#### Job Submission II

- -np N : number of processing elements
- -stdin [-I|-s] file : standard input
- -stdout [-I|-s] file : standard output
- -I[ocal]: file is relative to working directory of job (DEFAULT)
- -s[tage] : file relative to job request is staged to job host
- -x rsl-clause : RSL extension capability



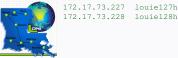


# Execute commands on remote machine using input from staging machine

```
[apacheco@qb1 ~]$ globus-job-run louiel.loni.org -stdin -s /etc/hosts -l /bin/cat
# Do not remove the following line, or various programs
# that require network functionality will fail.
127.0.0.1 localhost.localdomain localhost
204.90.40.60 eta.hpc.lsu.edu eta
208.100.92.71 lollu01.sys.loni.org
....
10.192.92.247 gbib20-1
10.192.92.248 dbib20-2
```

## Execute commands on remote machine using input from local machine

```
[apacheco@qb1 ~]$ globus-job-run louiel.loni.org -stdin -l /etc/hosts -l /bin/cat # Do not remove the following line, or various programs # that require network functionality will fail.
127.0.0.1 localhost.localdomain localhost
204.90.40.60 eta.hpc.lsu.edu eta
208.100.92.71 l6llu01.sys.loni.org
208.100.92.72 l6llu02.sys.loni.org
.....
```





Execute commands and write output on staging machine

```
[apacheco@gb1 ~]$ globus-job-run louie1.loni.org -stdout -s hellohosts \
-stdin -s /etc/hosts -l /bin/cat
[apacheco@qb1 ~]$ head -4 hellohosts; tail -2 hellohosts
# Do not remove the following line, or various programs
# that require network functionality will fail.
127.0.0.1
               localhost localdomain localhost
204.90.40.60 eta.hpc.lsu.edu eta
10.192.92.247 gbib20-1
10.192.92.248
               abib20-2
```

- Job submission using globus-job-submit
- submit a job to the scheduling jobmanager

```
[apacheco@gb1 ~]$ globus-job-submit oliver1.loni.org/jobmanager /bin/date
```

https://oliver1.loni.org:50886/26507/1288375416/

globus-job-status checks status of jobmanager

[apacheco@gb1 ~]\$ globus-job-status https://oliver1.loni.org:50886/26507/1288375416/



DONE

globus-job-get-output gets output of the job

[apacheco@qb1 ~]\$ globus-job-get-output https://oliver1.loni.org:50886/2650

Fri Oct 29 13:03:36 CDT 2010

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## Submit an openmp parallelized code on

eric (PBS)

```
[apacheco@qb1 ~]$ globus-job-run eric1.loni.org/jobmanager-pbs \ -np 1 -m 10 -p loni_loniadmin1 -q single -stdin \ -s /home/apacheco/dft/flux-full.dat -stdout \ -s flux-eric1-parallel.dat -s /home/apacheco/dft/fdft.parallel
```

## 2 zeke (loadleveler)

dft.err

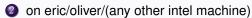
```
[apacheco@qb1 ~]$ qlobus-job-run zeke.loni.org/jobmanager-loadleveler \
 -env "GBLL NETWORK MPI=sn all.not shared.US" -stdin \
-s /home/apacheco/dft/flux-full.dat -x "&(jobType=mpi)(count=2)\
(maxWallTime=10) (queue=checkpt) (stdout=/mnt/lpfs.nfs302/apacheco/dft.out) \
(stderr=/mnt/lpfs.nfs302/apacheco/dft.err) (hostCount=1) " \
-s /home/apacheco/dft/dft.xlf
[apacheco@gb1 ~1$ cat dft.output
gsiftp://zeke.loni.org/mnt/lpfs.nfs302/apacheco/dft.out \
file:///home/apacheco/dft.out
gsiftp://zeke.loni.org/mnt/lpfs.nfs302/apacheco/dft.err \
file:///home/apacheco/dft.err
[apacheco@gb1 ~]$ globus-url-copy -vb -f dft.output
Source: qsiftp://zeke.loni.org/mnt/lpfs.nfs302/apacheco/
        file:///home/apacheco/
Dest.
  dft.out
Source: gsiftp://zeke.loni.org/mnt/lpfs.nfs302/apacheco/
Dest:
        file:///home/apacheco/
```





- copy helloworld.c from queenbee.loni.org:/home/apacheco/helloworld.c
- compile on bluedawg/zeke/(any other P5 machine) using
   mpcc helloworld.c -o helloworld
- Submit an MPI job
  - on bluedawg/zeke/(any other P5 machine)

```
[apacheco@cph1 ~]$ globus-job-run bluedawg.loni.org/jobmanager-loadleveler \
-env "GBLL_NETWORK_MPI=sn_all,not_shared,US" -x "&(jobType=mpi)(count=8)\
(maxWallTime=10)(queue-checkpt)(hostCount=1)" -1 /home/apacheco/helloworld
Hello world from 0 out of 8
Hello world from 1 out of 8
Hello world from 2 out of 8
Hello world from 3 out of 8
Hello world from 5 out of 8
Hello world from 5 out of 8
Hello world from 6 out of 8
Hello world from 6 out of 8
Hello world from 7 out of 8
Hello world from 7 out of 8
Hello world from 7 out of 8
Hello world from 8 out of 8
Hello world from 8 out of 8
Hello world from 8 tasks allocated by LoadLeveler, continuing...
```



[apacheco@qb1 ~]\$ globus-job-run eric1.loni.org/jobmanager-pbs \
-x "(jobType=mpi) (hostCount=1) (maxWallTime=10) (queue=checkpt)\
(stdoute-home/apacheco/qb1obrun.out)" -s /home/apacheco/helloworld



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#### Submit Parallel Jobs III

```
[apacheco@eric2 ~]$ cat gljobrun.out
Running PBS prologue script
User and Job Data:
Job ID: 262113.eric2
Username: apacheco
Group: loniadmin
Date: 27-Oct-2010 15:44
Node: eric052 (7032)
PBS has allocated the following nodes:
eric052
A total of 4 processors on 1 nodes allocated
Check nodes and clean them of stray processes
Checking node eric052 15:44:34
Done clearing all the allocated nodes
Concluding PBS prologue script - 27-Oct-2010 15:44:34
Hello world from 0 out of 4
Hello world from 2 out of 4
Hello world from 1 out of 4
Hello world from 3 out of 4
```





 Job submission using globusrun with Resource Specification Language (RSL) commands in a file

```
[apacheco@db1 ~]$ cat eric.rsl

& (jobType=mpi)
(hostCount=1)
(maxWallTime=10)
(queue=checkpt)
(executable=/home/apacheco/helloworld)
(stdout=/home/apacheco/gljobrun.out)

[apacheco@db1 ~]$ globusrun -r eric1.loni.org/jobmanager-pbs -f eric.rsl -b
globus_gram_client_callback_allow successful
GRAM Job submission successful
https://eric1.loni.org:50886/779/1288371858/
GLOBUS_GRAM_PROTOCOL_JOB_STATE_PENDING
```





Globus Toolkit

http://www.globus.org/toolkit/

Loni Docs: Globus Tutorial using LONI resources

https://docs.loni.org/wiki/Globus\_Tutorial\_using\_ LONI resources

Moodle: HPC105 - Getting Started with Globus Toolkit

https://docs.loni.org/moodle/



