Globus for Administrators and Users – Tutorial

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Slides adapted from Jarno Laitinen, Florian Zenner (LRZ), Marius Joldos (UTCN)

Contents

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Outline

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Conventions Used & Other Info

- Slides location: on session page of the conference
  - An updated version will be provided after the class if that will prove necessary
- Markers
  - A = administrative task
  - C = user task
  - What you should type is marked as

To type

```
Something to type...
```

- Questions. Who..
  - ..might install Globus in future (not just use it)?
  - ..is familiar with Globus, but expects to hear about GT5?

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A Installation: Where to Find GT5?

- GT 5.2.5 download available at http://toolkit.globus.org/toolkit/
  - Documentation, Downloads and Support
- Source available
  - Builds on Ubuntu, Apple OS X, RedHat, Fedora Core, Debian, SuSE, FreeBSD, and Solaris
  - IGE/EGCF Releases
  - Repositories for Fedora, Red Hat, Debian and Ubuntu
    - rpms and debs

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Setup Today

- Every attendee has it own instance
- Facts
  - VM instances (aka 'personal host') on StratusLab
  - Globus installed from IGE/EGCF packages (repo-deb.ige-project.eu)
  - User certificates (/home/ige_userXYZ/.globus/)
  - Every participant received an individual username (e.g. ige_user001, ige_user002 etc.)
- Download link for the ssh keys file:

  http://www.egcf.eu/trainings/egcf2014.tar.gz.enc
- Unpack the archive with the commands
  - `openssl aes-256-cbc -d -in egcf2014.tar.gz.enc -out egcf2014.tar.gz`
  - `tar -xzf egcf2014.tar.gz`

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(A/C) Login to your hands-on machine

- Ready to login
- Windows? Download Gsissh-Term (NGS product, adapted by IGE/EGCF): http://tinyurl.com/gsissh-term-2014
  - some extra steps are needed for the case above (see next slides)
- Linux/Unix? You can login from a command line terminal using (ignore in this case slides using Gsissh-Term)

To type

```
ssh -i egcf2014/user-ssh-keys/ige_userXYZ/ige_userXYZ_id_rsa \
      -l ige_userXYZ <personal host>
```

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Your hands-on machines

- Provided by EGCF
- Hosted on the StratusLab cloud
- Hostnames: `onevm-XYZ.lal.in2p3.fr`
  - ... where XYZ in
    `147,151-153,156,157,159,165,168,171,174,175,178,185`
  - For example, `onevm-147.lal.in2p3.fr`
- MyProxy servers: `myproxy.utcluj.ro`, `myproxy.lrz.de`
- Another GT5 server: `gt5-ige.drg.lrz.de`

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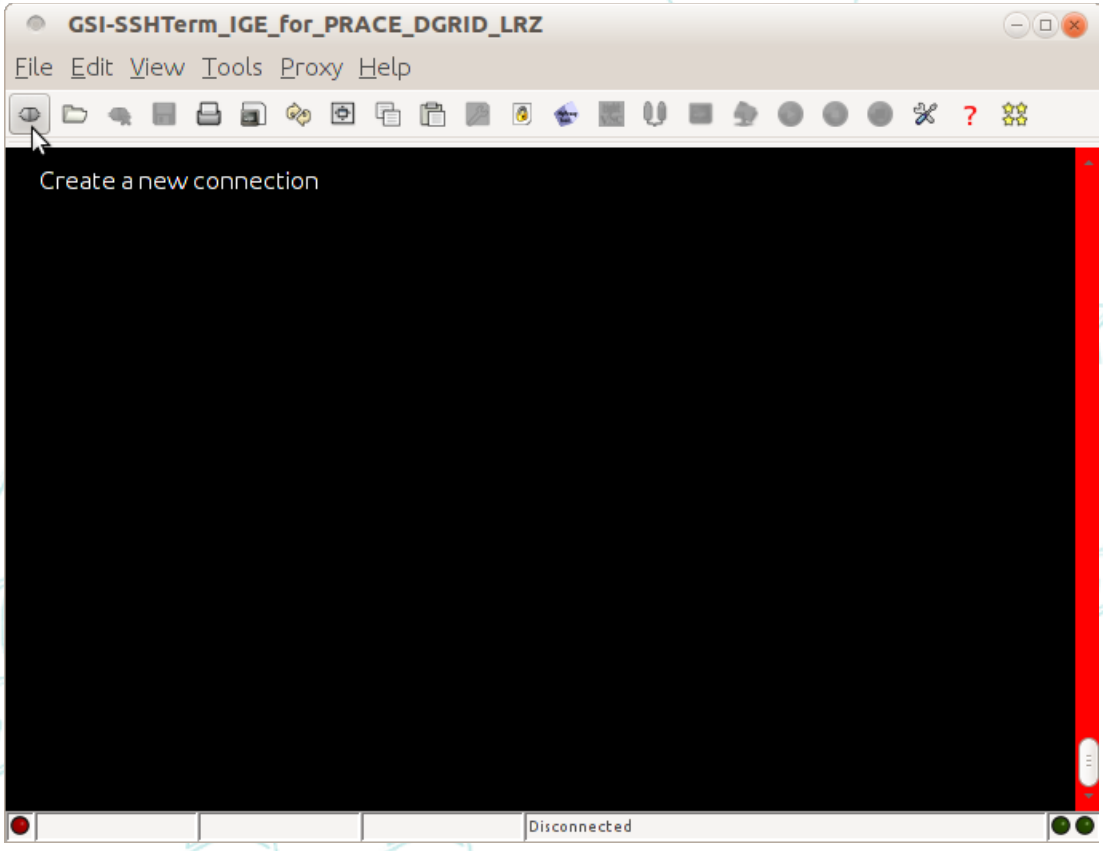
C GSISSH-Term: Create A New Connection

- Login to your tutorial host and user (e.g. `onevm-147.lal.in2p3.fr`, as user `ige_user001`)



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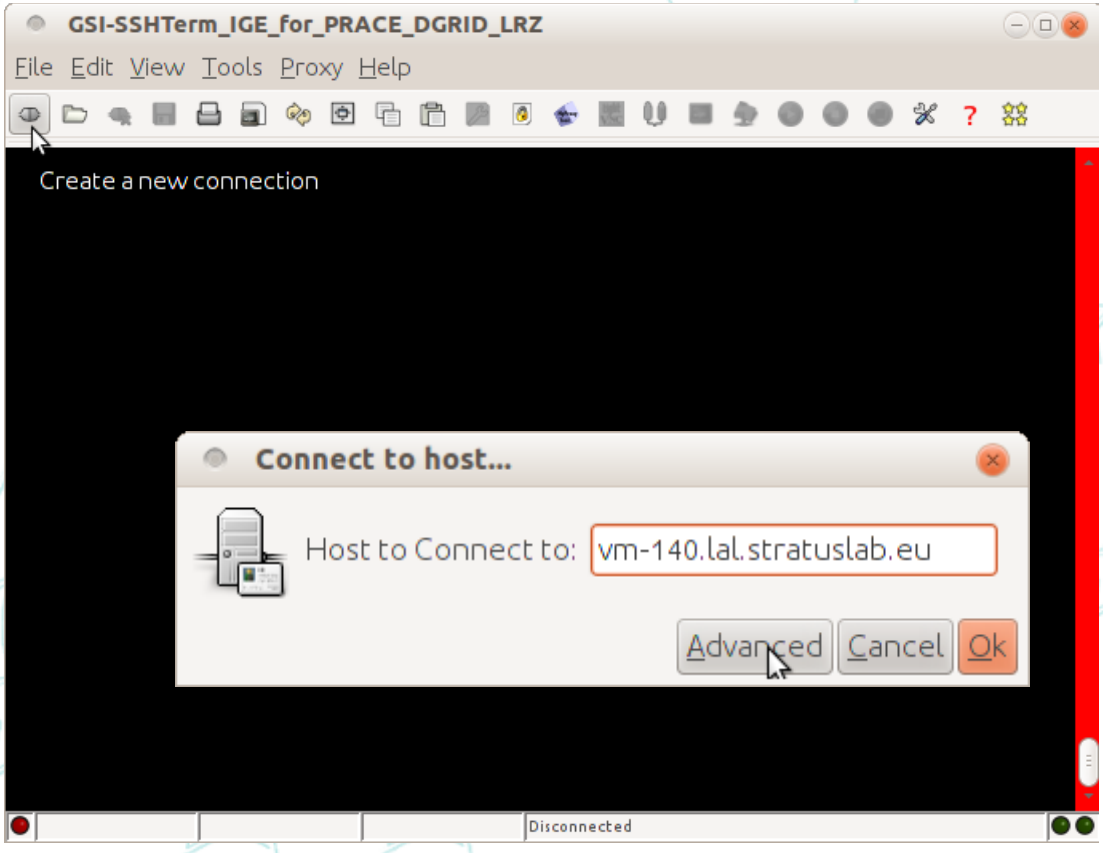
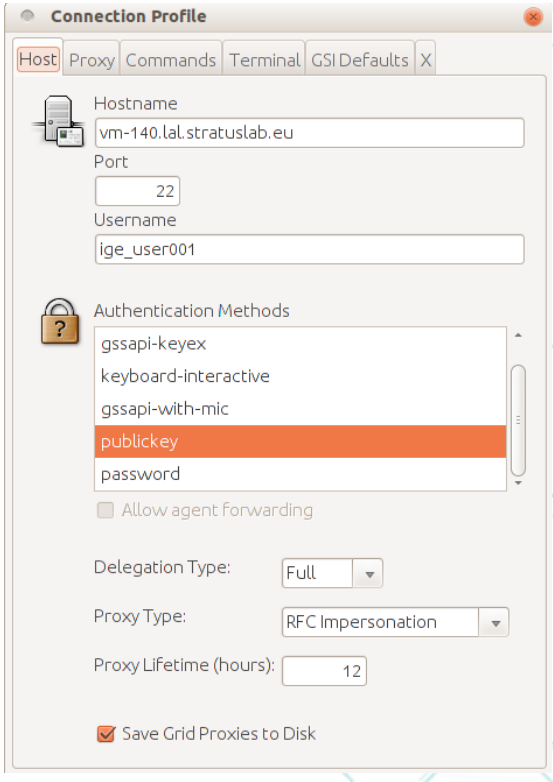
- Login to your tutorial host and user (e.g. `onevm-147.lal.in2p3.fr`, as user `ige_user001`)



C GSISSH-Term: Chose Your “ssh” Private Key

- on the tab ”Host” chose “publickey” in “Authentication Methods”
- choose your user’s private ssh key from the uncompressed ssh keys directory



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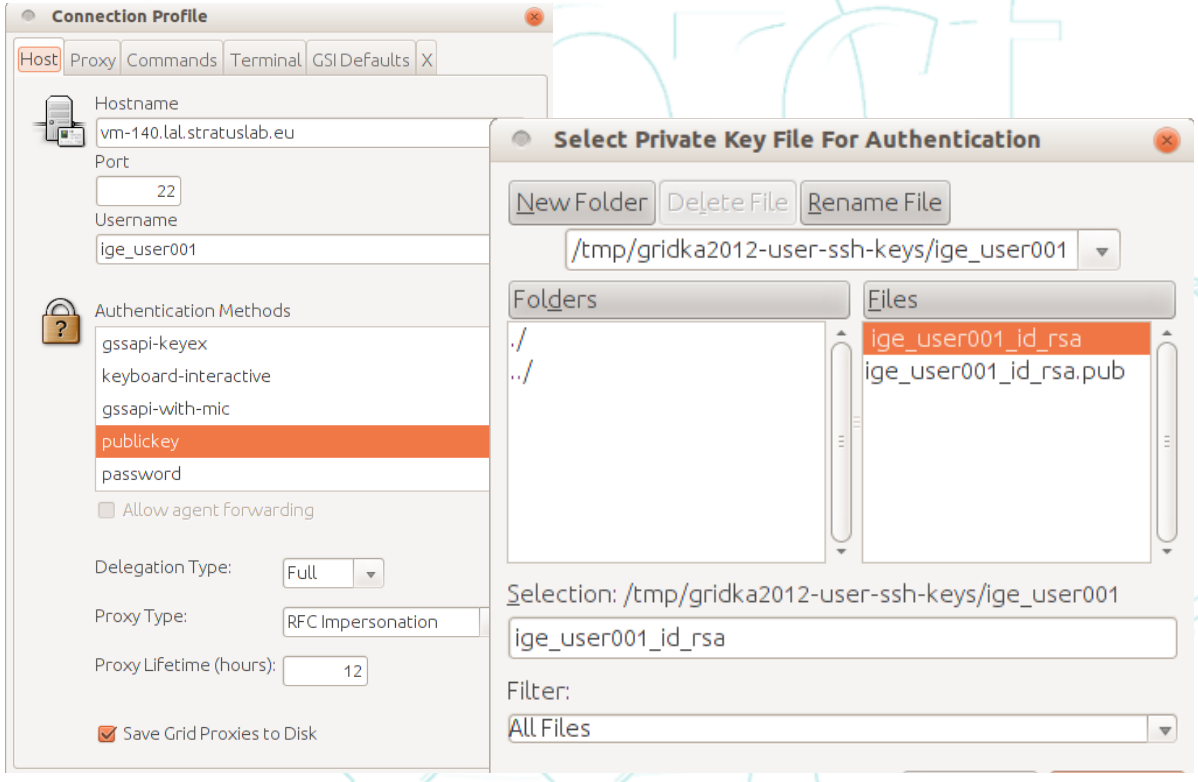

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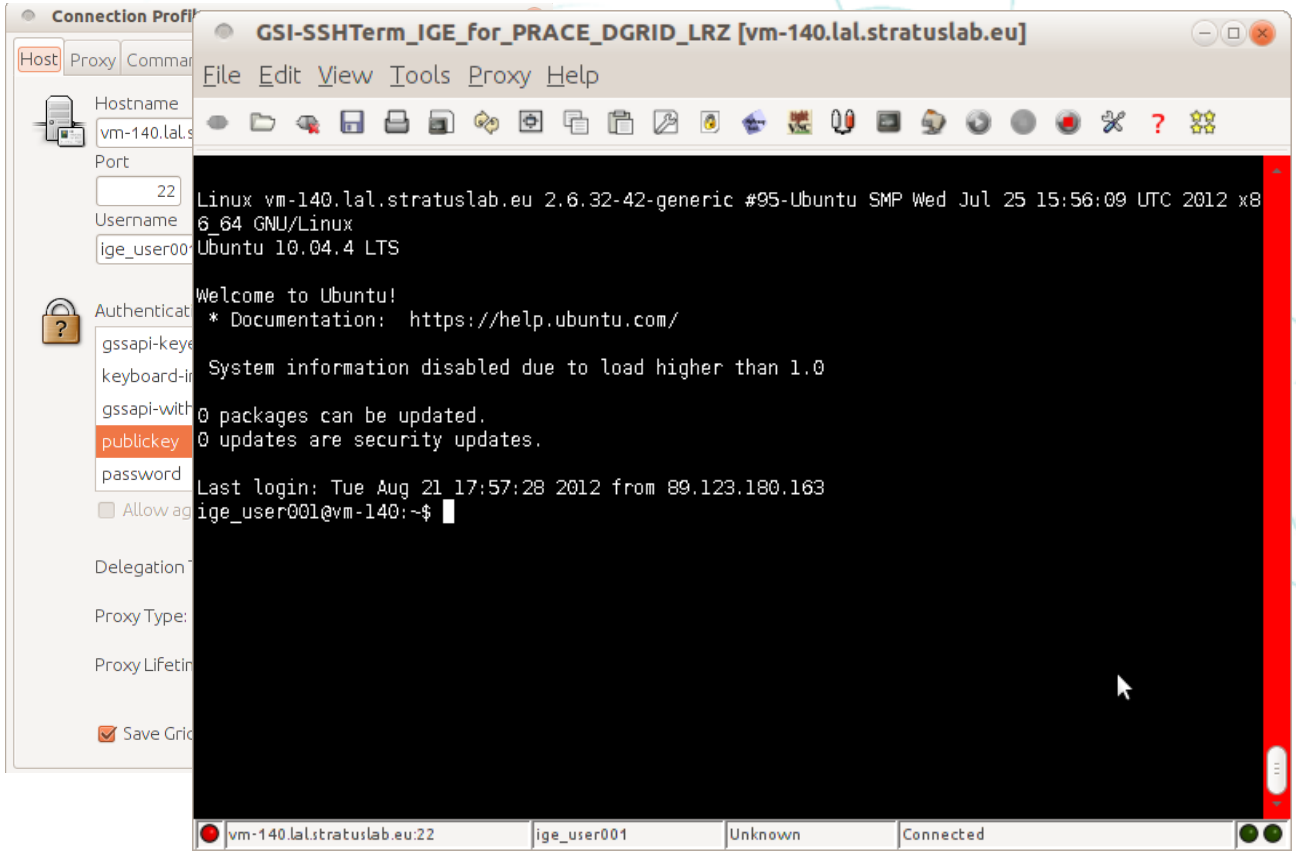

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A Globus environment variables

- Environment vars for bash shell:

```
export GLOBUS_LOCATION=/usr
export GLOBUS_TCP_PORT_RANGE=20000,25000
export GLOBUS_USAGE_OPTOUT=1
```

- Globus environment should be loaded automatically. As root:

To type

```
cat /etc/profile.d/ige.sh
```

- consult the above file to see specific environment settings
- Test:

To type

```
echo $GLOBUS_LOCATION
```

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A CA certificates

- To authenticate certificates the **Certificate Authority (CA)** files are needed.
- Globus requires files:
  - `<hash>.0` and
  - `<hash>.signing_policy`
    - The unique `<hash>` is a digest of the **subject name** of the CA
- CA files can be found e.g. via search-by-country functionality on http://www.eugridpma.org/
- Here, certificates are already installed. Check with

To type

```
ls -l /etc/grid-security/certificates
```

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C Host & User Certificates

- The host certificate is already installed. Check with

To type

```
cat /etc/grid-security/hostcert.pem
```

- As user ige_userXYZ (type `su ige_userXYZ`):

To type

```
grid-cert-info
```

(equals : `openssl x509 -in $HOME/.globus/usercert.pem -text -noout`)

- Create proxy. As user ige_userXYZ:

To type

```
grid-proxy-init
```

- To view information about the generated proxy (e.g. DN, validity time):

To type

```
grid-proxy-info
```

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C Certificate security issues

- The proxy file is readable only by your account
- Default location: `/tmp/x509up_$UID`
- By default valid for 12 hours (`-valid <h:m>`)
- For security reasons you can delete your proxy on the machine when you do not need it anymore: `grid-proxy-destroy`

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C Store Credentials On MyProxy

To type

```
myproxy-init -l <your last name> -s gt-ige.utcluj.ro
```

- It will prompt for the passphrase of your private key (It will not use your existing proxy credentials)
- Will prompt twice for new passphrase to protect your uploaded credential on the MyProxy server
- Don't use the same passphrase as for your private key

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C MyProxy Tools

- To view status of the proxy at MyProxy server:

To type

```
myproxy-info -l <your last name> -s gt-ige.utcluj.ro
```

- To remove the proxy from MyProxy server:

```
myproxy-destroy -l <username> -s myproxy.lrz.de
```

- To destroy local credential

```
grid-proxy-destroy
```

- To view your proxy status at the client machine:

```
grid-proxy-info
```

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C Retrieve proxy certificate. And Some Tips

- To retrieve proxy from MyProxy:

To type

```
myproxy-logon -l <your last name> -s gt-ige.utcluj.ro \
  -t <lifetime>
```

- lifetime of proxy in hours (by default 12 h). This cannot be greater that what was set with -t in myproxy-init `grid-proxy-info`
- Default MyProxy server can be set with environment variable `MYPROXY_SERVER`: `export MYPROXY_SERVER=<set myproxy host here>`
- Credential lifetime on myproxy: `-c <hours>` (default one week=168h)
- Proxy lifetime of from MyProxy retrieved proxies: `-t <hours>` (default: 12 h)

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A grid-mapfile

- Check you certificate's Distinguished Name (DN):

To type

```
grid-cert-info -subject
```

- Check your DN settings in grid-mapfile:

To type

```
cat /etc/grid-security/grid-mapfile
```

- Info: when you need to delete an entry:

```
grid-mapfile-delete-entry -dn "<Distinguished Name>" -ln <user>
```

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A GSI-OPENSSH: Config and Startup

- In sshd_config (server) and in ssh_config (client)

To type

```
cd /etc/gsissh/
```

- See that port 2222 is used (to exit from `less` type 'q'):

To type

```
sudo less sshd_config
```

- As root (using sudo), edit `ssh_config` and add the option

To type

```
GSSAPIDelegateCredentials yes
```

- Start the service

To type

```
sudo service gsissh start
```

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C GSI-OPENSSH: gsissh client

- Usage of command line client:
- Syntax: `gsissh [-p <port>] host`. Use full host name
  - Debug: `-v` or `-vv`
  - By default it uses the port set in `/etc/ssh/ssh_config`
- Login as first local account found in grid-mapfile

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C GSI-OPENSSH: gsissh client

- As your user ige_userXYZ:

To type

```
grid-proxy-init #(if not yet done)
grid-proxy-info
gsissh -p 2222 localhost
exit
```

To type

```
gsissh -p 2222 gt5-ige.drg.lrz.de
grid-proxy-info
```

To type

```
gsissh -p 2222 onevm-168.lal.in2p3.fr
```

- Create a 10MB file there and return to your personal machine

To type

```
dd if=/dev/zero bs=1024 count=10000 of=10MB
exit      # from onevm-168.lal.in2p3.fr
exit      # from gt5-ige.drg.lrz.de
```

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C Java Webstart GSISSH-Term

- establish a ssh connection to the IGE machine "*gt5-ige.drg.lrz.de*"
- use the proxy saved in "*gt-ige.utcluj.ro*"
  - remember your myproxy user name and password (establish during steps on slide 16)
- on your local operating system open Java Webstart GSISSH-Term
  - surf to http://tinyurl.com/gsissh-term-2014
- there appear two "digital signature cannot verified" windows, which you have to accept

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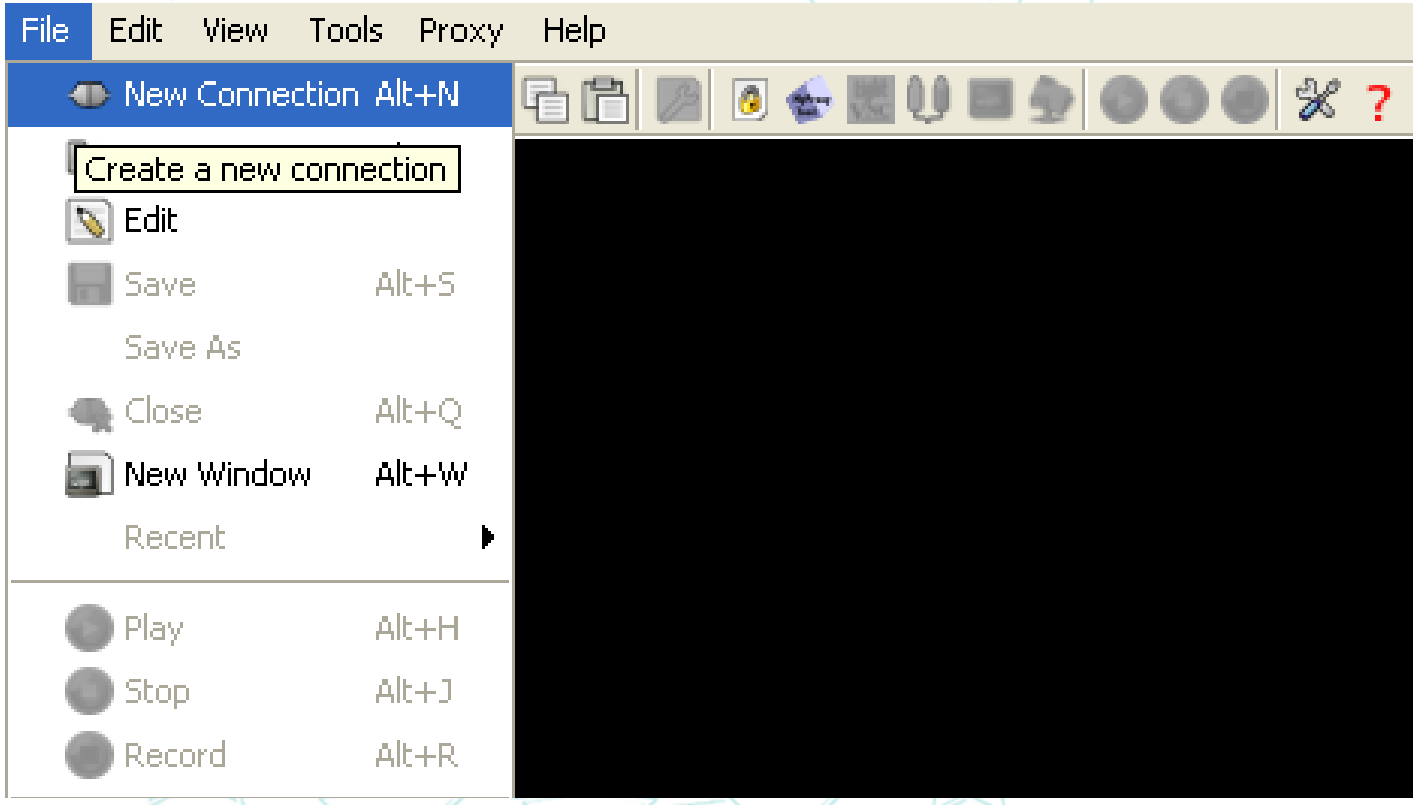
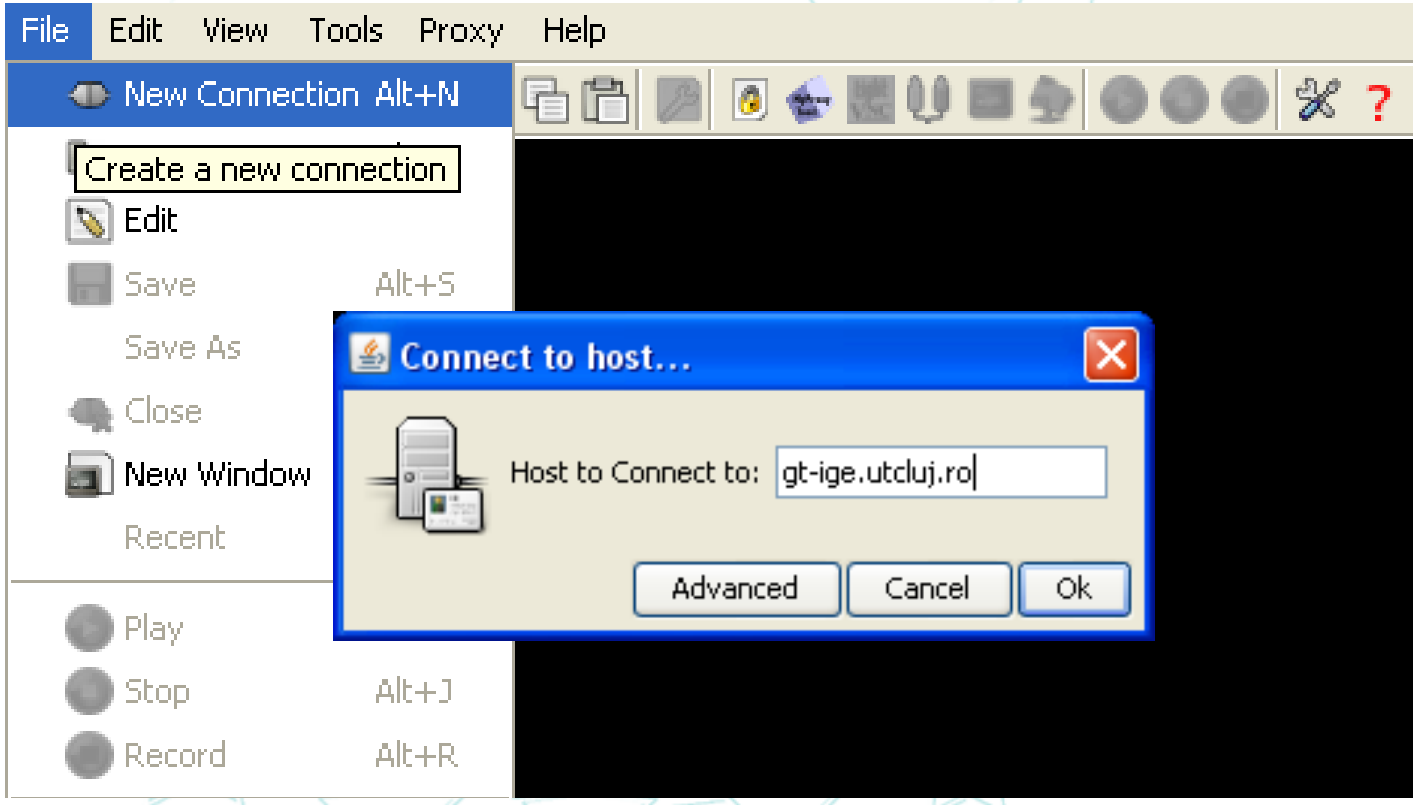
C GSISSH-Term: start-up

- Login to IGE grid (host `gt5-ige.drg.lrz.de`, as user `ige_userXYZ`)



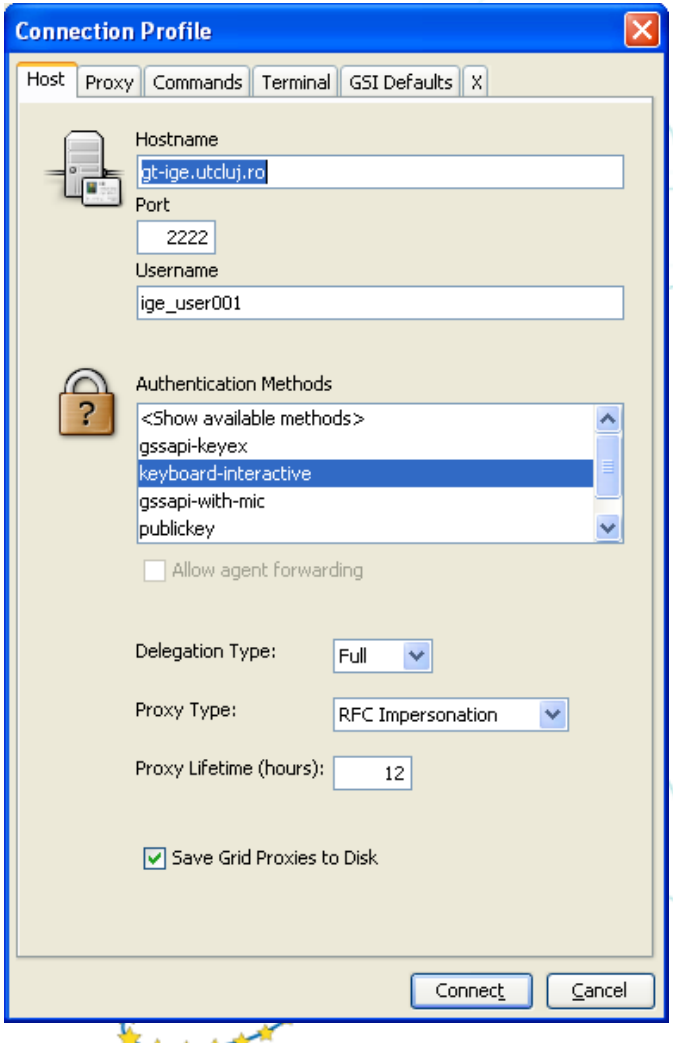
C GSISSH-Term: start-up

- Login to IGE grid (host `gt5-ige.drg.lrz.de`, as user `ige_userXYZ`)



C Using Myproxy with GSI-SSH TERM

- Tab “Gsi-Defaults”/“Authentication order”: “Disk Proxy”, “Other Methods”, “.pem”, “Browser”



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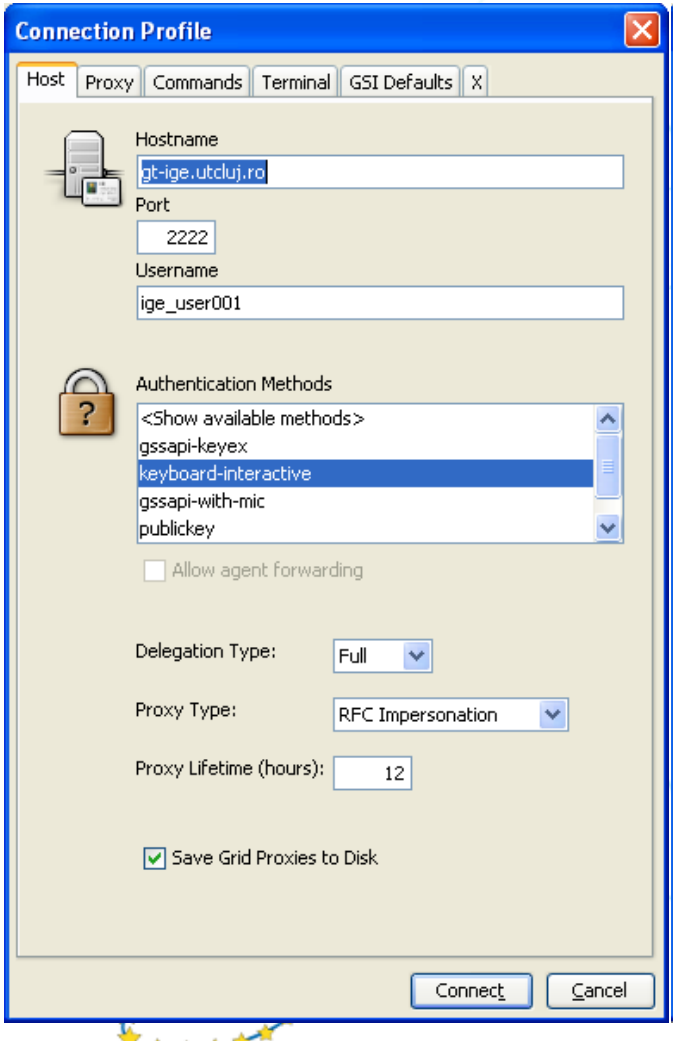

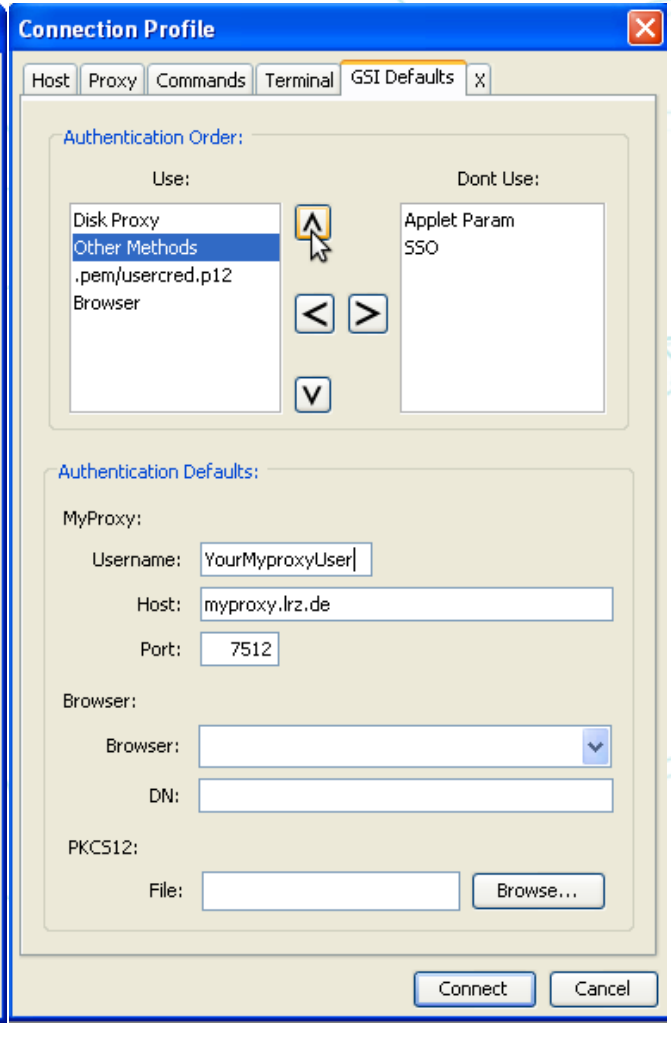

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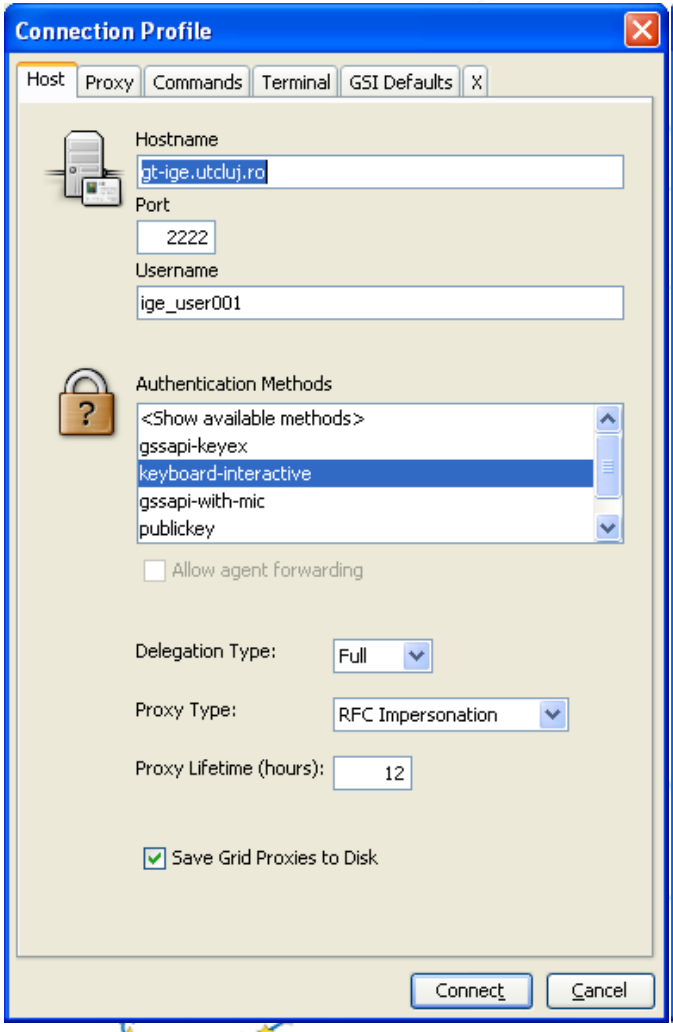
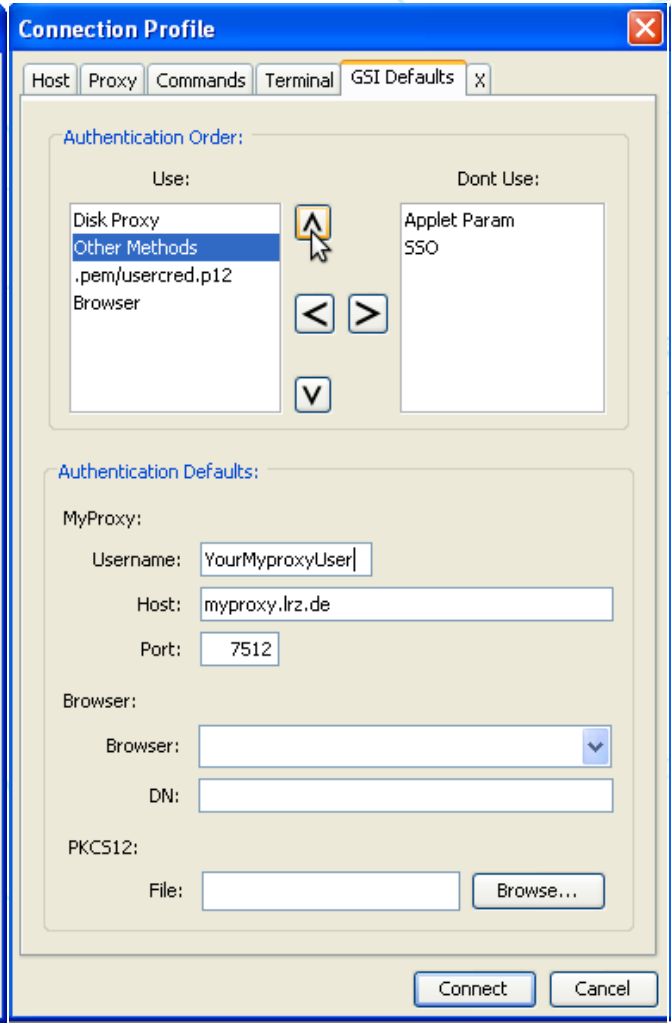
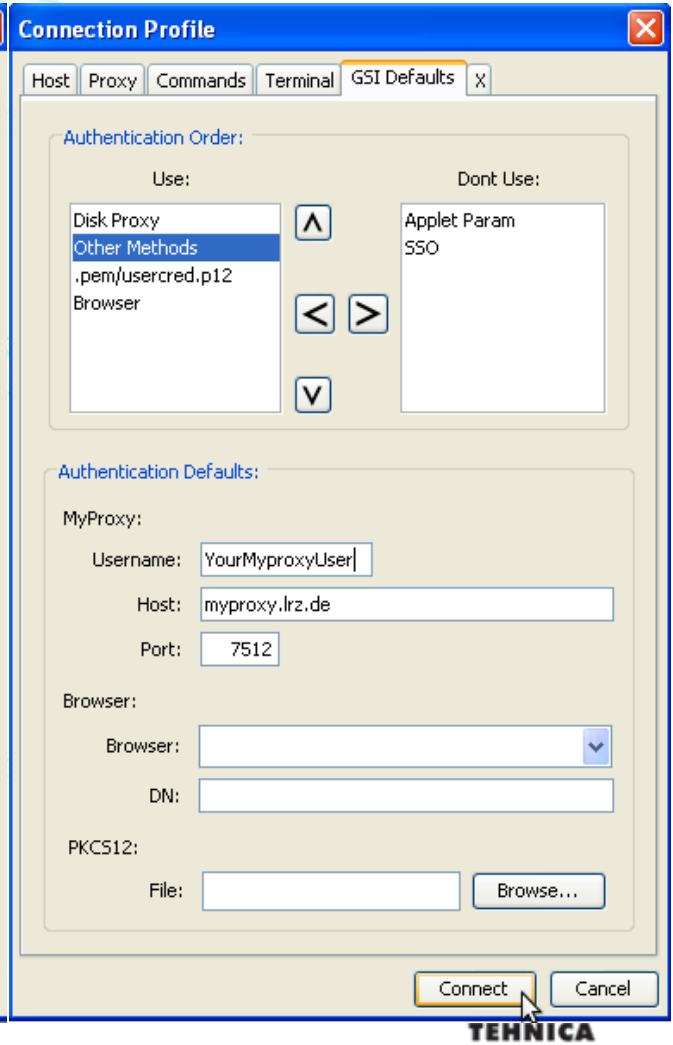
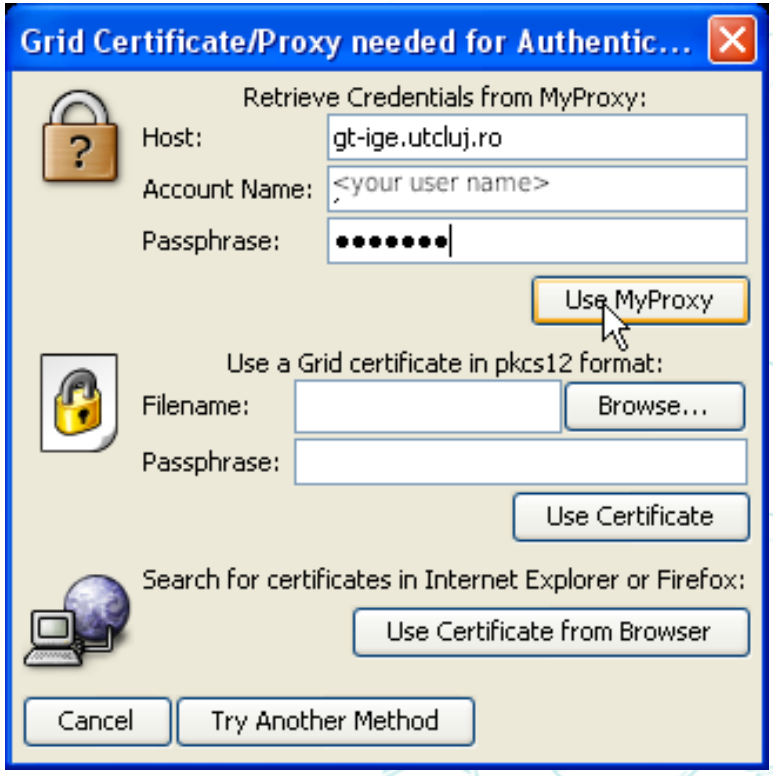






C Using Myproxy with GSI-SSH TERM

- You are logged in



C Using Myproxy with GSI-SSH TERM

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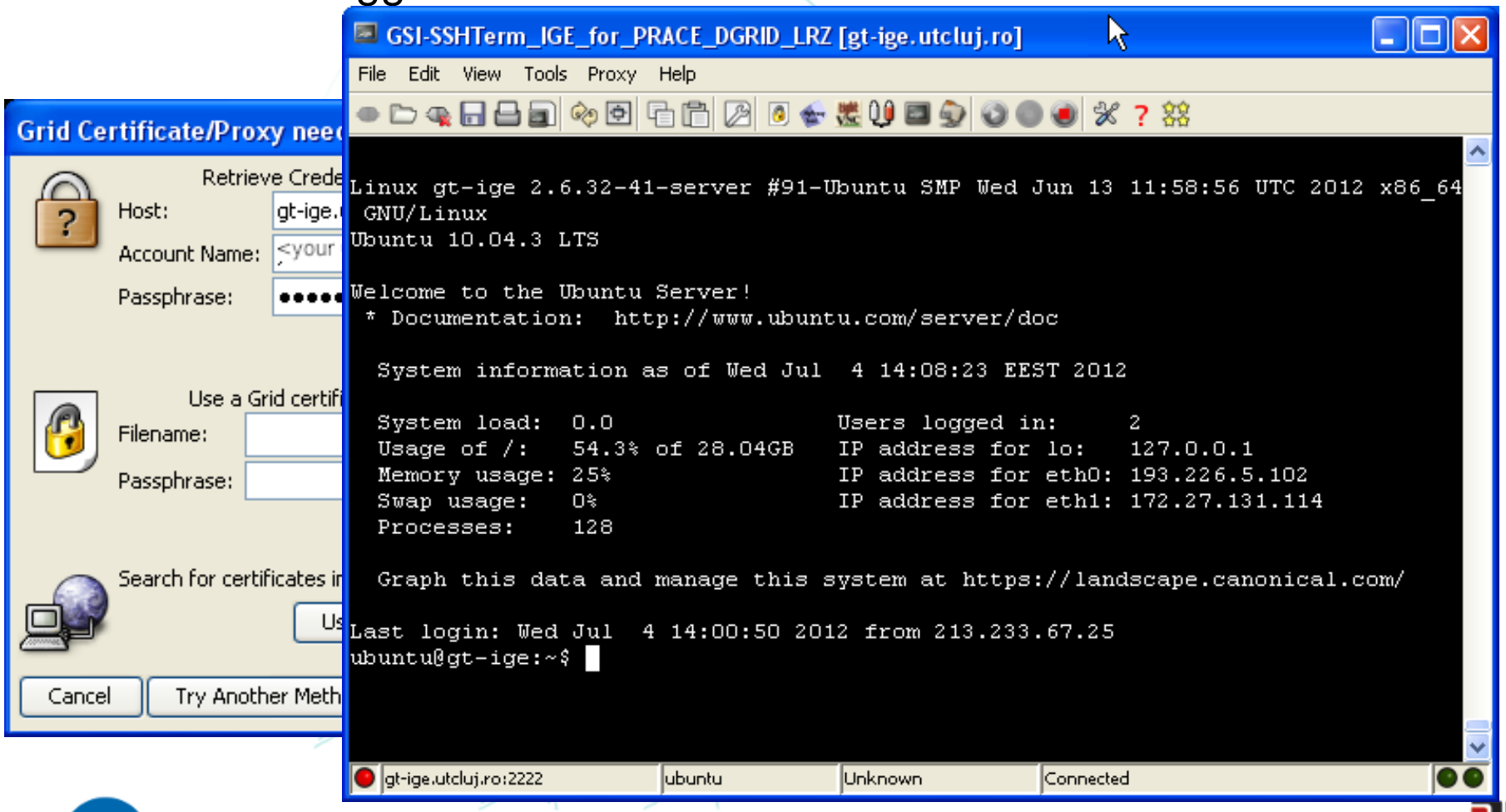

Outline

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GridFTP: Overview

- Administration
- Start-up script (xinetd)
- Firewall issues
- Client
- Globus globus-url-copy

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A GridFTP Configuration Files

- Default GridFTP server's configuration file is "*/etc/gridftp.conf*"
  - Custom configuration file could be specified with the "*-c*" option of the GridFTP server

To type

```
less /etc/gridftp.conf
```

- The start-up script file is "*/etc/init.d/globus-gridftp-server*"
  - Note the server name: "*/usr/sbin/globus-gridftp-server*"
  - Note "*-c*" option using the "*/etc/gridftp.conf*" as configuration file

To type

```
less /etc/init.d/globus-gridftp-server
```

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A GridFTP Firewall Settings

- Control process port is by default “*2811*”
  - should be open in firewall for incoming connections
- Data port range
  - Varies often from a hundred to some thousands
  - The needed amount depends on the estimated amount of the clients
- Incoming data connections
  - could be configured defining either
    - “export GLOBUS_TCP_PORT_RANGE=20000,25000” in “/etc/init.d/globus-gridftp-server”, or
    - “$GLOBUS_TCP_PORT_RANGE 20000,25000” in “/etc/gridftp.conf”
  - port range should be open in firewall for incoming connections

To type

```
sudo sh -c "echo '\$GLOBUS_TCP_PORT_RANGE 20000,25000'\
 >> /etc/gridftp.conf"
less /etc/gridftp.conf
```

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A GridFTP Firewall Settings (cont'd)

- Outgoing connections
  - could be configured using
    - the "GLOBUS_TCP_SOURCE_RANGE" environment variable defined in "/etc/init.d/globus-gridftp-server"
    - the "$GLOBUS_TCP_SOURCE_RANGE" internal variable defined in "/etc/gridftp.conf"
  - port range should be open in firewall for outgoing connections
- Data port range is also used by the Globus job submission service for file transfer

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A GridFTP: Service start-up

- Start-up GridFTP server
- The following services are already started. If not, as root, start and check status:

```
sudo service globus-gridftp-server start
sudo service globus-gridftp-server status
```

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C GridFTP: globus-url-copy

- Copy file from remote to local (as ige_userXYZ) - check if you have valid proxy with `grid-proxy-info`

To type

```
echo 'some text' > mydata
globus-url-copy -vb file:///$PWD/mydata \
  gsiftp://onevm-168.lal.in2p3.fr/~/gassGlobusonline.data
```

- Source: **local** machine: `file:///path/file`
  - `~` can be used to refer to home directory
- Target: **GridFTP** server: `gsiftp://host<:port>/path/file`
- Further protocols supported: **http://**, **https://**, **ftp://**
- Paths must be absolute.

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C GridFTP: globus-url-copy switches

- More verbose output: `-vb`
- Copy files from subdirectories (recurse): `-r`
- Create destination directories if needed: `-cd`
- http://www.globus.org/toolkit/docs/5.2/5.2.5/gridftp/user/#gridftpUser

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C GridFTP: globus-url-copy performance options

- Optimal value depends on TCP settings of kernel, latency, bottlenecks. Just try now with e.g.
  - Parallel streams : `-p 4`
  - TCP buffer size: `-tcp-bs 4m`
  - Concurrent FTP connections: `-cc 2`
- If multiple data nodes are available following might help:
  - `-stripe`
  - `-sbs 0` (so called partitioned block size)

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C GridFTP: Mode E(Extended Block)

- Can be more efficient than stream mode
- Mode E: Out of order reception of data
  - Multiple Path: `-p <number>`
- Data sending server establishes data channel
- Data port range must be open on target server (firewall!)

To type

```
time globus-url-copy -cc 10 -p 4 -vb -r \
  gsiftp://gt5-ige.drg.lrz.de//tmp/1MB \
  gsiftp://onevm-168.lal.in2p3.fr/~/
```

- Try with your training machine, too

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A GridFTP. Configure Separation of Processes

- The configuration
  - One front-end GridFTP server running on behalf of a unprivileged user
  - One back-end GridFTP server running on behalf of root, but accepting connection only from the front-end server
- Create the unprivileged "*gridftp*" user

To type

```
sudo useradd -m -c "GridFTP unprivileged user,,," \
  -s /bin/bash gridftp
```

- Make a copy of the system "*grid-mapfile*"

To type

```
sudo su -l gridftp \
 bash -c 'cp /etc/grid-security/grid-mapfile ~/.gridmap'
```

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A GridFTP. Configure Separation of Processes (cont.)

- Map all DNs to “gridftp” user

To type

```
cat > /tmp/ed.cmds << EOF
,s/ige_user[0-9][0-9][0-9]$/gridftp/g
w
q
EOF

sudo ed /home/gridftp/.gridmap < /tmp/ed.cmds
```

- Make a copy of host certificate and key for the “gridftp” user

To type

```
sudo mkdir -p /home/gridftp/.globus
sudo cp /etc/grid-security/hostcert.pem \
 /home/gridftp/.globus/usercert.pem
sudo cp /etc/grid-security/hostkey.pem \
  /home/gridftp/.globus/userkey.pem
sudo chown -R gridftp:gridftp /home/gridftp/.globus
```

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A GridFTP. Configure Separation of Processes (cont.)

- Start the back-end GridFTP server on behalf of “root”

To type

```
sudo globus-gridftp-server -port 7001 -data-node \
 -allow-from 127.0.0.1 -c /etc/gridftp.conf \
 -log-level ALL -logfile /root/gridftp.log -daemon -detach
```

- Start the front-end GridFTP server on behalf of “gridftp”

To type

```
sudo -u gridftp /usr/sbin/globus-gridftp-server -port 20000 \
 -log-level ALL -logfile /home/gridftp/gridftp.log \
 -remote-nodes localhost:7001 -c /etc/gridftp.conf \
 -daemon -detach
```

- See them running

To type

```
ps ax | grep gridftp | grep '7001\|20000'
sudo netstat -anp | grep '7001\|20000'
```

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C GridFTP. Test Separation of Processes Configuration

- Perform transfers

To type

```
globus-url-copy \
 gsiftp://`hostname`:20000/etc/group \
 gsiftp://`hostname`:20000/tmp/group-local
globus-url-copy \
 gsiftp://gt5-ige.drg.lrz.de/etc/group \
 gsiftp://`hostname`:20000/tmp/group-remote
```

- See result and logs

To type

```
ls -l /tmp/group*
sudo less /home/gridftp/gridftp.log
sudo less /root/gridftp.log
```

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Outline

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GRAM5: Overview

- Administration
  - Configuration
- Client
  - globus-job-run
  - globusrun
  - a batch job (non-blocking)
  - a batch scheduling system jobs
- GRAM5 job scripts (RSL)

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A GRAM5: configuration of available LRM (Local Resource Managers)

- Trying to start the *gatekeeper* immediately after installation, you are displayed indications of configuration of LRMs that can be used

To type

```
sudo service globus-gatekeeper start
```

- See enabled (none for now) and available LRMs

To type

```
ls -l /etc/grid-services/
ls -l /etc/grid-services/available/
```

- Configure the simple *fork* LRM — "*jobmanager-fork*"

To type

```
sudo /usr/sbin/globus-gatekeeper-admin -e jobmanager-fork-poll \
 -n jobmanager-fork
```

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A GRAM5: configuration of available LRM (Local Resource Managers) (cont.)

- Configure the default LRM — *"jobmanager"*

To type

```
sudo /usr/sbin/globus-gatekeeper-admin -e jobmanager-fork-poll \
  -n jobmanager
```

- See enabled LRMs

To type

```
ls -l /etc/grid-services/
```

- Enable the *gatekeeper*: prepare "ed" stream editor commands

To type

```
cat > ed.cmds << EOF
s/RUN=no/RUN=yes/g
w
q
EOF
```

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A GRAM5: configuration of available LRM (Local Resource Managers) (cont.)

- Enable the *gatekeeper*: run “ed” to replace “Run=no” by “Run=yes”

To type

```
sudo ed /etc/default/globus-gatekeeper < ed.cmds
```

- Start the *gatekeeper*

To type

```
sudo service globus-gatekeeper start
```

- Check the *gatekeeper* is running

To type

```
sudo service globus-gatekeeper status
sudo netstat -anp | grep 2119
```

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A GRAM5: configuration files and options

- See configuration file of "*gatekeeper*"

To type

```
less /etc/default/globus-gatekeeper
```

- See configuration file of the default LRM ("*jobmanager-fork*" for us)

To type

```
less /etc/grid-services/jobmanager
less /etc/globus/globus-gram-job-manager.conf
```

- Note the options

To type

```
-log-pattern /var/log/globus/gram_$(LOGNAME).logfile
-usagestats-targets statistics.ige-project.eu:4810
```

- More options could be found at

http://globus.org/toolkit/docs/5.2/5.2.2/gram5/admin/#gram5-cmd-globus-job-manager

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C GRAM5: Hints for client

- For logs see your home directory (`ls -lart gram*`)
- See also in `$HOME/.globus/job/`
- If your job seems to get stuck try to kill your job-manager processes:
  - `killall globus-job-manager`
- Gatekeeper log
  - See in file `/etc/default/globus-gatekeeper` line for log entry
  - It might be readable by administrators only

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C globus-job-run blocking submission

- With `globus-job-run` it is simple to submit a job
  - Blocking command: it does not release the shell until the job finishes
- Example (As user ige_userXYZ):

To type

```
globus-job-run localhost /bin/hostname
```

- It is possible to pass various parameters e.g. directing standard output or error. See `-help` or user guide http://bit.ly/c8FYK0

To type

```
globus-job-run gt5-ige.drg.lrz.de/jobmanager-pbs \
/bin/hostname
globus-job-run onevm-168.lal.in2p3.fr/jobmanager-fork /bin/hostname
```

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C Globus-job-submit non-blocking submission synopsis

- `globus-job-submit`
  - Returns to shell right after the submission and prints *job_contact_string* (https://...)
  - It is non-blocking
- `globus-job-status <job_contact_string>`
- `globus-job-get-output <job_contact_string>`
- `globus-job-clean <job_contact_string>`

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C Globus-job-submit non-blocking submission

- From your hands-on machine (as ige_userXYZ):

To type

```
globus-job-submit gt5-ige.drg.lrz.de /bin/sleep 60
```

```
https://gt5-ige.drg.lrz.de:24383/16145785939916773883l/2666570055213425/ (i.e.  <job_url>
```

To type

```
globus-job-status https://gt5-ige.drg.lrz.de:24383/161457...
```

```
ACTIVE
```

To type

```
globus-job-submit gt5-ige.drg.lrz.de /bin/ls /
globus-job-get-output <job specific url>
```

```
bin
boot
...
```

To type

```
globus-job-clean <job specific url>
```

- WARNING: Cleaning a job means
  - Kill the job if it still running, and
  - Remove the cached output on the remote resource

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C Globusrun and RSL

- `globusrun` command is the most suitable for real ”production” jobs
- It takes as a parameter a script written in Globus **Resource Specification Language (RSL)** vs. command line parameters as used on last slides
- RSL script can be passed:
  - from a command-line (enclosed in ” ”). E.g.

```
globusrun -s -r gt5-ige.drg.lrz.de
"&(executable=/bin/date)"
Thu May 23 10:18:43 CEST 2014
```

  - in an RSL file
- The simplest RSL script is specifying the executable:

```
&(executable=/bin/date)
```

  - Please store this line to a file `job.rsl`
  - The ‘&’ is needed only on the first row
  - All rows are surrounded in “()”

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C GRAM5: globusrun command line parameters

- Submission which streams (`-s`) standard output and error to the display

```
globusrun -s -r gt5-ige.drg.lrz.de -f job.rsl
Thu May 22 10:40:43 CEST 2014
```

- For a complete list of possible attributes see
  http://bit.ly/d6cQbL

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GRAM5: globusrun non-blocking operation (1)

- With `-b` option non-blocking command is sent and a contact string is then returned.
- Create the `sleep.rsl` file

To type

```
cat > sleep.rsl << EOF
&(executable=/bin/sleep)
(arguments=1000)
EOF
```

- Check the contents of the `sleep.rsl` file and edit it if you want

To type

```
cat sleep.rsl
```

- Run

To type

```
globusrun -b -r onevm-168.lal.in2p3.fr/jobmanager-fork \
  -f sleep.rsl
```

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C GRAM5: globusrun non-blocking operation (2)

- Status query:

To type

```
globusrun -status <job_contact_string>
```

  - Possible job statuses:

```
ACTIVE
FAILED
SUSPENDED
DONE
UNSUBMITTED
STAGE_IN
STAGE_OUT
UNKNOW_JOB_STATE
```

- Canceling the job:

To type

```
globusrun -k <job_contact_string>
```

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GRAM5: RSL

- Some useful RSL attributes:

```
& (rsl_substitution = (DIR "/tmp/") )
(environment = (MSG 'Hello'))
(stderr = $(DIR)/stderr.txt)
(stdout = $(DIR)/stdout.txt)
(executable=/usr/bin/env)
```

- Variables set in OS environment are not accessible in the RSL script

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C GRAM5: File staging (1)

- Possible staging steps in a job are:
  - File **stage in**: files from client to GRAM5 server
  - File **stage out**: files from GRAM5 server to client
  - File **clean-up**: remove files on GRAM5 server
- Internal or external GridFTP can be used
- To use internal file transfer mechanism (GASS) uses predefined variable

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C GRAM5: File Staging Gridftp Example

- Prepare the RSL file *test-staging.rsl*

To type

```
cat > test-staging.rsl << EOF
& (rsl_substitution = (GRIDFTP_SERVER gsiftp://`hostname`))
(executable=/bin/cat)
(arguments=input_file_1 /proc/sys/kernel/hostname)
(stdout=stdout.txt)
(stderr=stderr.txt)
(file_stage_in =
(\$(GRIDFTP_SERVER)/$HOME/input_file input_file_1))
(file_stage_out =
(stderr.txt \$(GRIDFTP_SERVER)/$HOME/stderr.txt)
(stdout.txt \$(GRIDFTP_SERVER)/$HOME/stdout.txt))
(file_clean_up = input_file_1 stdout.txt stderr.txt)
EOF
```

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C GRAM5: File Staging Gridftp Example (cont'd)

- Check the RSL file *test-staging.rsl* and change it, if needed, using an editor

To type

```
cat test-staging.rsl
```

- For host "vm-140.lal.stratuslab.eu" and user "ige_user001", the file should look like below

```
& (rsl_substitution = (GRIDFTP_SERVER gsiftp://vm-140.lal.stratuslab.eu))
(executable=/bin/cat)
(arguments=input_file_1 /proc/sys/kernel/hostname)
(stdout=stdout.txt)
(stderr=stderr.txt)
(file_stage_in =
($(GRIDFTP_SERVER)/home/ige_user001/input_file input_file_1))
(file_stage_out =
(stderr.txt $(GRIDFTP_SERVER)/home/ige_user001/stderr.txt)
(stdout.txt $(GRIDFTP_SERVER)/home/ige_user001/stdout.txt))
(file_clean_up = input_file_1 stdout.txt stderr.txt)
```

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C GRAM5: File Staging Gridftp Example (cont'd)

- Prepare the "*input_file*" file

To type

```
echo -n The job ran on host:' ' > input_file
```

- Submit the job, wait until DONE and see the results

To type

```
globusrun -o -b \
  -r gt5-ige.drg.lrz.de/jobmanager-fork \
  -f test-staging.rsl
globusrun -status <job_id>
ls -l
cat stdout.txt
```

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C GRAM5: Advanced RSL: Proxy renewal operation & dbg

- By default proxy certificate lives 12 hours
- If proxy expires and need to get results of the job:

To type

```
grid-proxy-init
globusrun -r <host> "&(restart=<job_contact_string>)"
```

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