Lab Handouts for FermiGrid 201: Scripting and Running Grid Jobs

Conventions in all labs:

```
command_I_type
output_I_get
```

Jargon I should know

<username> --you should substitute your Unix user name.

Lab 1: Making Credentials for Job Submission:

A. Simple example that should work for everyone at Fermilab:

```
kinit -r 168h <username>@FNAL.GOV
ssh -l <username> fnpcsrv1.fnal.gov
source /usr/local/vdt/setup.sh
kx509
kxlist -p
voms-proxy-init -noregen -voms fermilab:/fermilab
voms-proxy-info -all
```

B. Step by step with explanation of the intermediate results:

1. Kinit

```
kinit -r 168h <username>@FNAL.GOV
Password for timm@FNAL.GOV:
```

We use the -r 168h option to get a ticket that is the maximum renewable lifetime, 168 hours.

You can be sure that the kinit worked by issuing the command

```
klist -f
Ticket cache: /tmp/krb5cc_2904_TRW0g5
Default principal: timm@FNAL.GOV

Valid starting     Expires            Service principal
03/17/08 11:46:55  03/18/08 13:46:55  krbtgt/FNAL.GOV@FNAL.GOV
     renew until 03/24/08 11:46:50, Flags: FRIA
03/17/08 11:46:56  03/18/08 13:46:55  afs@FNAL.GOV
     renew until 03/24/08 11:46:50, Flags: FRA
```

Note the Flags:F above, showing that the ticket is forwardable. This is required so you can forward your kerberos credentials to the grid submission host in the next step. If you are coming from a NAT private net, you also have to add the "-n" option to kinit to get an addressless ticket.

WRQ (Attachmate) Reflection X software can also be used on Windows machines to create a Kerberos credential and forward it to the grid submission host.

2. ssh

```
ssh -l <username> fnpcsrv1.fnal.gov
```

(it should print the message of the day and give you a shell prompt). For this lab, everyone has been given the bash shell.

3. Setup file

```
source /usr/local/vdt/setup.sh
```

For those who prefer tcsh, there is also a /usr/local/vdt/setup.csh.

This puts all the Grid software utilities in your PATH. Compare the PATH before and after the setup is done.

```
 echo $PATH
/usr/krb5/bin:/usr/kerberos/bin:/opt/condor/bin:/opt/condor/sbin:/usr
/local/bin:/bin:/usr/bin:/usr/X11R6/bin
bash-3.00$ source /usr/local/vdt/setup.sh
bash-3.00$ echo $PATH
/usr/local/vdt-1.8.1/apache/bin:/usr/local/vdt-1.8.1/srm-v1-
client/sbin:/usr/local/vdt-1.8.1/srm-v1-
client/bin:/usr/local/vdt-1.8.1/wget/bin:/usr/local/vdt-1.8.1/gums/sc
ripts:/usr/local/vdt-1.8.1/cert-
scripts/bin:/usr/local/vdt-1.8.1/glite/sbin:/usr/local/vdt-1.8.1/glit
e/bin:/usr/local/vdt-1.8.1/edg/sbin:/usr/local/vdt-1.8.1/prima/bin:/u
sr/local/vdt-1.8.1/mysql/bin:/usr/local/vdt-1.8.1/logrotate/sbin:/usr
/local/vdt-1.8.1/ant/bin:/usr/local/vdt-1.8.1/jdk1.5/bin:/opt/condor/
sbin:/opt/condor/bin:/usr/local/vdt-1.8.1/gpt/sbin:/usr/local/vdt-1.8
.1/globus/bin:/usr/local/vdt-1.8.1/globus/sbin:/usr/local/pacman-3.21
/python/python/bin:/usr/local/pacman-3.21/bin:/usr/local/vdt-1.8.1/vd
t/sbin:/usr/local/vdt-1.8.1/vdt/bin:/usr/krb5/bin:/usr/kerberos/bin:/
opt/condor/bin:/opt/condor/sbin:/usr/local/bin:/bin:/usr/bin:/usr/X11
R6/bin
```

How to tell what software is installed in any VDT-based installation? This is the output from fnpcsrv1, which actually is a Compute Element (*CE*) installation and thus has more than a regular Client software.

```
bash-3.00$ vdt-version
You have installed a subset of VDT version 1.8.1g:
    Apache HTTPD 2.2.4
    gLite CEMon Client (INFN release from 2006-05-19) 1.7.2
    gLite CEMon Server (INFN release from 2006-05-19, plus RAW
dialect) 1.7.1
    CA Certificates v33 (includes IGTF 1.18 CAs)
```

```
Condor/Condor-G Developers Series 6.9.4
EDG Make Gridmap 3.0.0
Fetch CRL 2.6.2
Generic Information Provider 1.0.15 (Iowa 15-Feb-2006)
Globus Toolkit, pre web-services, client 4.0.5
Globus Toolkit, pre web-services, server 4.0.5
Globus Toolkit, web-services, client 4.0.5
Globus Toolkit, web-services, server 4.0.5
GLUE Schema 1.3
GPT 3.2
Gratia Condor Probe 0.27.5c-1
Gratia Metric Probe 0.27.5c-1
Java SDK 1.4.2_16
Java 5 SDK 1.5.0_13
KX509 20031111
Logrotate 3.7
MonALISA 1.6.22
MyProxy 3.9
MySQL 4.1.22
MySQL Connector/J 5.0.6
OSG Resource and Service Validation (RSV) 1.5.1
Pegaus Worker Package 2.0.1
PPDG Cert Scripts 2.5
PRIMA Authorization Module 0.7
PRIMA Authorization Module For GT4 Web Services 0.1.2
RLS, client 3.0.041021
SRM V1 Client 1.25
SRM V2 Client 2.2.0.5
syslog-ng 2.0.4
Apache Tomcat 5.0.28
UberFTP 1.24
Wget 1.10.2
```

4. kx509

kx509 uses your Kerberos Ticket Granting Ticket to make a Grid Certificate and store it in your Kerberos credential cache.

Klist before kx509:

```
bash-3.00$ klist
Ticket cache: /tmp/krb5cc_2904_At9741
Default principal: timm@FNAL.GOV

Valid starting     Expires            Service principal
03/17/08 11:55:57  03/18/08 13:46:55  krbtgt/FNAL.GOV@FNAL.GOV
        renew until 03/24/08 11:46:50
03/17/08 11:55:58  03/18/08 13:46:55  afs@FNAL.GOV
        renew until 03/24/08 11:46:50
```

```
bash-3.00$ kx509
```

```
bash-3.00$ klist
Ticket cache: /tmp/krb5cc_2904_At9741
Default principal: timm@FNAL.GOV

Valid starting     Expires            Service principal
03/17/08 11:55:57  03/18/08 13:46:55  krbtgt/FNAL.GOV@FNAL.GOV
        renew until 03/24/08 11:46:50
03/17/08 11:55:58  03/18/08 13:46:55  afs@FNAL.GOV
        renew until 03/24/08 11:46:50
03/17/08 12:04:06  03/18/08 13:46:55
kca_service/siskiyou.fnal.gov@FNAL.GOV
        renew until 03/24/08 11:46:50
03/16/08 12:04:08  03/24/08 11:46:50  kx509/certificate@FNAL.GOV
```

5. kxlist -p

kxlist -p reads the certificate out of your Kerberos credential and writes it in *PEM* format into a separate file, by default /tmp/x509up_<nnnn> where <nnnn> is the number corresponding to your unix UID.

```
bash-3.00$ kxlist -p
Service kx509/certificate
issuer= /DC=gov/DC=fnal/O=Fermilab/OU=Certificate
Authorities/CN=Kerberized CA
subject= /DC=gov/DC=fnal/O=Fermilab/OU=People/CN=Steven C.
Timm/CN=UID:timm
serial=7FB955
hash=03c202fc
bash-3.00$ ls -lrt /tmp/x509up_u2904
-rw-------  1 timm oss 1981 Mar 17 12:09 /tmp/x509up_u2904
```

A KCA certificate contains both the public and private key and thus can be used anyplace on the grid that a proxy would be used, such as submitting jobs and transferring files. Here is an example of what a KCA certificate file looks like in *PEM* (Privacy Enhanced Mail) format—a base-64 encoded representation of the public and private keys.

bash-3.00$ more /tmp/x509up_u2904.


```
-----BEGIN CERTIFICATE-----
MIIEHDCCAwSgAwIBAgIDf7lVMA0GCSqGSIb3DQEBBAUAMHgxEzARBgoJkiaJk/Is
ZAEZEwNnb3YxFDASBgoJkiaJk/IsZAEZEwRmbmFsMREwDwYDVQQKEwhGZXJtaWxh
YjEgMB4GA1UECxMXQ2VydGlmaWNhdGUgQXV0aG9yaXRpZXMxFjAUBgNVBAMTDUtl
cmJlcml6ZWQgQ0EwHhcNMDgwMzE2MTcwNDA4WhcNMDgwMzI0MTY0NjUwWjB+MRMw
EQYKCZImiZPyLGQBGRMDZ292MRQwEgYKCZImiZPyLGQBGRMEZm5hbDERMA8GA1UE
ChMIRmVybWlsYWIxDzANBgNVBAsTBlBlb3BsZTEXMBUGA1UEAxMOU3RldmVuIEMu
IFRpbW0xFDASBgoJkiaJk/IsZAEBEwR0aW1tMFwwDQYJKoZIhvcNAQEBBQADSwAw
SAJBANqTl3Ejbwh/6HVfoashckzjRMeYuDGTH0kcPlShfK1Enbiy/huOGIP9we+7
```

```
9D0d95bInYCj0DRfoYgV3p7juYMCAwEAAaOCAW8wggFrMAwGA1UdEwEB/wQCMAAw
DgYDVR0PAQH/BAQDAgWgMBEGCWCGSAGG+EIBAQQEAwIHgDAxBglghkgBhvhCAQ0E
JBYiQ2VydGlmaWNhdGUgaXNzdWVkIGJ5IEZlcm1pbGFiIEtDQTAeBgNVHRIEFzAV
gRNuaWdodHdhdGNoQGZuYWwuZ292ME8GCWCGSAGG+EIBCARCFkBVUkw6aHR0cDov
L2NvbXB1dGluZy5mbmFsLmdvdi9zZWN1cml0eS9wa2kvRk5BTC1DZXJ0LVBvbF9L
Q0EucGRmMB8GA1UdIwQYMBaAFBJT0J1M1p6+IFosFxbOMuDVdmzYMB0GA1UdDgQW
BBQOdv1HoDDRSkyQaasUNSSthav6JTAXBgkrBgEEAYF6KgEECgQIRk5BTC5HT1Yw
OwYDVR0RBDQwMoENdGltbUBmbmFsLmdvdqAhBgYrBgEFAgKgFzAVGwhGTkFMLkdP
VgIBATAGGwR0aW1tMA0GCSqGSIb3DQEBBAUAA4IBAQAasyO34GrIECoNqLID6mcJ
3/cecyO38njDXoapqYR5RtusSnymvlrleInvQpe6WTRZdc9UPjgWUd4BOFuzbYVX
sj8GFdTyjrL7t631MOLkRCS/4pibBhjdGgZLWWytlre39TtftmI8ItJjvdt00dzV
lBVSbU9t2y+/1VgmgipHQKggsS5JjapZkf2qooHvcR+6aZ8kKM3Pi9ZXSwVHbTk2
uMUjv+1T+1LWfskCsw8UWuI88stV9xL5bfSKYj1469exOO8MJ9RkcEoSehxgqNb
UeuXiv8KjBKsKg2E2z+0+L5+woxl614rMRpY+ePbToLxq2rrJLPi2iX/+3HOkodL
-----END CERTIFICATE-----
-----BEGIN RSA PRIVATE KEY-----
MIIBOwIBAAJBANqTl3Ejbwh/6HVfoashckzjRMeYuDGTH0kcPlShfK1Enbiy/huO
GIP9we+79D0d95bInYCj0DRfoYgV3p7juYMCAwEAAQJBAJWTSp9x0BnQ7hLkTo39
ZWqYXAj6yZGjTFWLrlvb5qXqewHyfS5ekKLTDNidbm/qnZK44Fu9g5R7YsaK83j5
mAECIQDt8TEShaKwxOgZg5mEqao9KZqjOaV6onUwEOoWjwtwQQIhAOsqKLHzd2vB
zbDw3ub12trdNKCQb380lOqPHNZg3zjDAiB7oniSHDgFy7qiDzxEr3gSobyFFZ4D
U8i6ef94S0lxQQIgHRNmWrI2lr0smG7/sGC/gYYOJrgVAQ5YRzQQpbTuhI8CIQCe
m/ZGf+rlHBctXjN7H701j6ZhYtiwXWrDmIOX73fjvw==
-----END RSA PRIVATE KEY-----
```


6. voms-proxy-init

This is used to present your certificate to a *VOMS* (Virtual Organization Management Service) server which will then digitally sign the certificate, verifying that you are a member of the Virtual Organization.

```
voms-proxy-init -noregen -voms fermilab:/fermilab
Cannot find file or
dir: /home/condor/execute/dir_11128/userdir/glite/etc/vomses
Your identity: /DC=gov/DC=fnal/O=Fermilab/OU=People/CN=Steven C.
Timm/USERID=timm
Cannot find file or
dir: /home/condor/execute/dir_11128/userdir/glite/etc/vomses
Contacting  voms.fnal.gov:15001
[/DC=org/DC=doegrids/OU=Services/CN=http/voms.fnal.gov]
"fermilab" Done
Creating proxy ..................................... Done
Your proxy is valid until Tue Mar 18 00:47:12 2008
```

Note that the error "Cannot find file or dir: /home/condor/execute/dir_11128/userdir/glite/etc/vomses" can be ignored. It is an artifact of the way VOMS is built. The vomses file that really gets used is /usr/local/vdt/glite/etc/vomses.

7. voms-proxy-info -all

This includes all the information about your proxy. You should always include the output of

this command in any question about why a grid job won't submit or run.

```
bash-3.00$ voms-proxy-info -all
WARNING: Unable to verify signature! Server certificate possibly
not installed.
Error: Cannot find certificate of AC issuer for vo fermilab
subject   : /DC=gov/DC=fnal/O=Fermilab/OU=People/CN=Steven C.
Timm/USERID=timm/CN=proxy
issuer    : /DC=gov/DC=fnal/O=Fermilab/OU=People/CN=Steven C.
Timm/USERID=timm
identity  : /DC=gov/DC=fnal/O=Fermilab/OU=People/CN=Steven C.
Timm/USERID=timm
type      : proxy
strength  : 512 bits
path      : /tmp/x509up_u2904
timeleft  : 11:47:46
=== VO fermilab extension information ===
VO        : fermilab
subject   : /DC=gov/DC=fnal/O=Fermilab/OU=People/CN=Steven C.
Timm/USERID=timm
issuer    :/DC=org/DC=doegrids/OU=Services/CN=http/voms.fnal.gov
attribute : /fermilab/Role=NULL/Capability=NULL
attribute : /fermilab/accelerator/Role=NULL/Capability=NULL
attribute : /fermilab/astro/Role=NULL/Capability=NULL
attribute : /fermilab/cdms/Role=NULL/Capability=NULL
attribute : /fermilab/hypercp/Role=NULL/Capability=NULL
attribute : /fermilab/ktev/Role=NULL/Capability=NULL
attribute : /fermilab/miniboone/Role=NULL/Capability=NULL
attribute : /fermilab/minos/Role=NULL/Capability=NULL
attribute : /fermilab/minos/ukminos/Role=NULL/Capability=NULL
attribute : /fermilab/mipp/Role=NULL/Capability=NULL
attribute : /fermilab/nova/Role=NULL/Capability=NULL
attribute : /fermilab/numi/Role=NULL/Capability=NULL
attribute : /fermilab/patriot/Role=NULL/Capability=NULL
attribute : /fermilab/test/Role=NULL/Capability=NULL
attribute : /fermilab/theory/Role=NULL/Capability=NULL
timeleft  : 11:47:46
```

Any file in .pem format can be examined with the openssl set of commands, and many other tools are wrappers around this tool.

```
openssl x509 -in /tmp/x509up_u2904 -noout -text
bash-3.00$ openssl x509 -in /tmp/x509up_u2904 -noout -text
Certificate:
    Data:
        Version: 3 (0x2)
        Serial Number: 8370517 (0x7fb955)
        Signature Algorithm: md5WithRSAEncryption
        Issuer: DC=gov, DC=fnal, O=Fermilab, OU=People,CN=Steven
C. Timm/CN=UID:timm
        Validity
```

```
            Not Before: Mar 17 17:42:12 2008 GMT
            Not After : Mar 18 05:47:12 2008 GMT
        Subject: DC=gov, DC=fnal, O=Fermilab, OU=People,
CN=Steven C. Timm/CN=UID:timm, CN=proxy
        Subject Public Key Info:
            Public Key Algorithm: rsaEncryption
            RSA Public Key: (512 bit)
                Modulus (512 bit):
                   00:b3:2a:f0:29:19:7a:c9:da:58:d9:ea:c8:94:9d:
                   5e:1c:be:02:38:6c:b6:c0:0c:38:20:91:de:0e:d2:
                   e8:5e:ca:2d:53:f6:6c:b2:5a:11:9a:fb:c2:30:9c:
                   cf:53:50:dc:85:e4:dc:da:ee:89:43:37:23:48:d6:
                   67:ea:6a:8b:15
                Exponent: 65537 (0x10001)
        X509v3 extensions:
            1.3.6.1.4.1.8005.100.100.5:
              0...0...0...0......0.....0.....0~1.0..
..&...,d....gov1.0..
..&...,d....fnal1.0...U.
..U....People1.0...U....Steven C. Timm1.0..
..&...,d....timm....U.e0c.a0_1.0..
..&...,d....org1.0..
:.0"..20080317174712Z..
20080318054712Z0...0.......http/voms.fnal.gov0
+.....Edd.1...0....!..fermilab://fg6x1.fnal.gov:
150010....#/fermilab/Role=NULL/Capability=NULL.//fermilab/accele
rator/Role=NULL/Capability=NULL.)/fermilab/astro/Role=NULL/Capab
ility=NULL.(/fermilab/cdms/Role=NULL/Capability=NULL.
+/fermilab/hypercp/Role=NULL/Capability=NULL.
(/fermilab/ktev/Role=NULL/Capability=NULL.-/fermilab/miniboone/R
ole=NULL/Capability=NULL.)/fermilab/minos/Role=NULL/Capability=N
ULL.1/fermilab/minos/ukminos/Role=NULL/Capability=NULL.
(/fermilab/mipp/Role=NULL/Capability=NULL.
(/fermilab/nova/Role=NULL/Capability=NULL.
(/fermilab/numi/Role=NULL/Capability=NULL.
+/fermilab/patriot/Role=NULL/Capability=NULL.
(/fermilab/test/Role=NULL/Capability=NULL.*/fermilab/theory/Role
=NULL/Capability=NULL0...0..
.S>..E......0.......U.8....0...U.#..0....i..>..
+.....Edd
.....0i1.0..0...0..y.......Tz0
..&...,d....org1.0..
0902141559 01Z0_1.0..1 0...U....Certificate Authorities1.0...U...
..&...,d....org1.0..
.........
0................'.....Sx..D....o..'w.Y.G...Bg../......".....).v
....ZWB.-.....\S$,..e..(.C*.@x...o..]..k........f.W0.Z..v.
+v..j...t.rg.........0..0...`..*.H..L.....0:..U...3010/.-.
```

```
+.)http://pki1.doegrids.org/CRL/1c3f2ca8.crl01..U............S#.
_BO:.b.5u..
6._.qps....s...^..:~............-...m.!.~...JM.fO>.....#D=)s.
($.=.....`...@.[.Mg...r/e$.Z...?Z.
7..D^..~...S~N2....P.M..@Aw.i.p
..........h......H.X<.....Cj...2.....(.M....../s|..7.......f?
W....~-....O..q.W...6...R...V.?.f^..:......j`.|
O..:.!....J..W..X.r#rs+......
            X509v3 Key Usage: critical
                Digital Signature, Key Encipherment, Data
Encipherment
            1.3.6.1.4.1.8005.100.100.6:
                03
    Signature Algorithm: md5WithRSAEncryption
        98:e8:19:5f:a5:a8:e6:b5:1f:1e:45:e1:7e:7e:45:0e:8c:17:
        00:23:68:81:66:d3:f1:7a:ad:37:80:9b:9b:e3:5d:0e:ec:96:
        50:7d:97:67:53:aa:23:1f:53:ac:7c:8e:d9:5f:57:ff:7f:a9:
        7d:c7:8b:04:c8:60:bd:cf:37:d1
```

C. Fun with voms-proxy-init

1. Why the -noregen option?

The -noregen option is used when you have an existing proxy or certificate (such as a KCA certificate) and just want to add a VOMS attribute to it. If you are generating a proxy from a certificate/key pair as is done with most other certificate authorities, the -noregen option should not be used.

2 . What does the syntax -voms fermilab:/fermilab mean?

The first part, fermilab: merely points to the name of a VOMS server in the vomses file. The name is arbitrary but is usually chosen to match the name of the VO. Here is the standard vomses entry for the Fermilab VO—it would be all on one line normally:

```
"fermilab" "voms.fnal.gov" "15001"
"/DC=org/DC=doegrids/OU=Services/CN=http/voms.fnal.gov"
"fermilab"
```

The five fields are entry label, hostname of VOMS server, port of VOMS server, Distinguished Name (*DN*) of VOMS server service certificate, and name of VO. In some older vomses files there is a sixth number (either 22 or 32) for Globus version but this is now obsolete.

The second part, /fermilab, is the Fully Qualified Attribute Name (*FQAN*) that you would like VOMS to assign to your proxy. The simplest is the top level group, /fermilab. But as seen above, there can be any combination of groups and roles. For instance, /fermilab/minos/Role=Production.

A nonstandard vomses file can be defined with the -vomses or the -userconf options.

Notice in the output from A.7 above there were two different validity times, one for the base

proxy and one for the VOMS attribute. The base proxy can be lengthened with the -valid option; the voms attribute can be lengthened by the -vomslife attribute, but not longer than the VOMS server maximum allowed time.

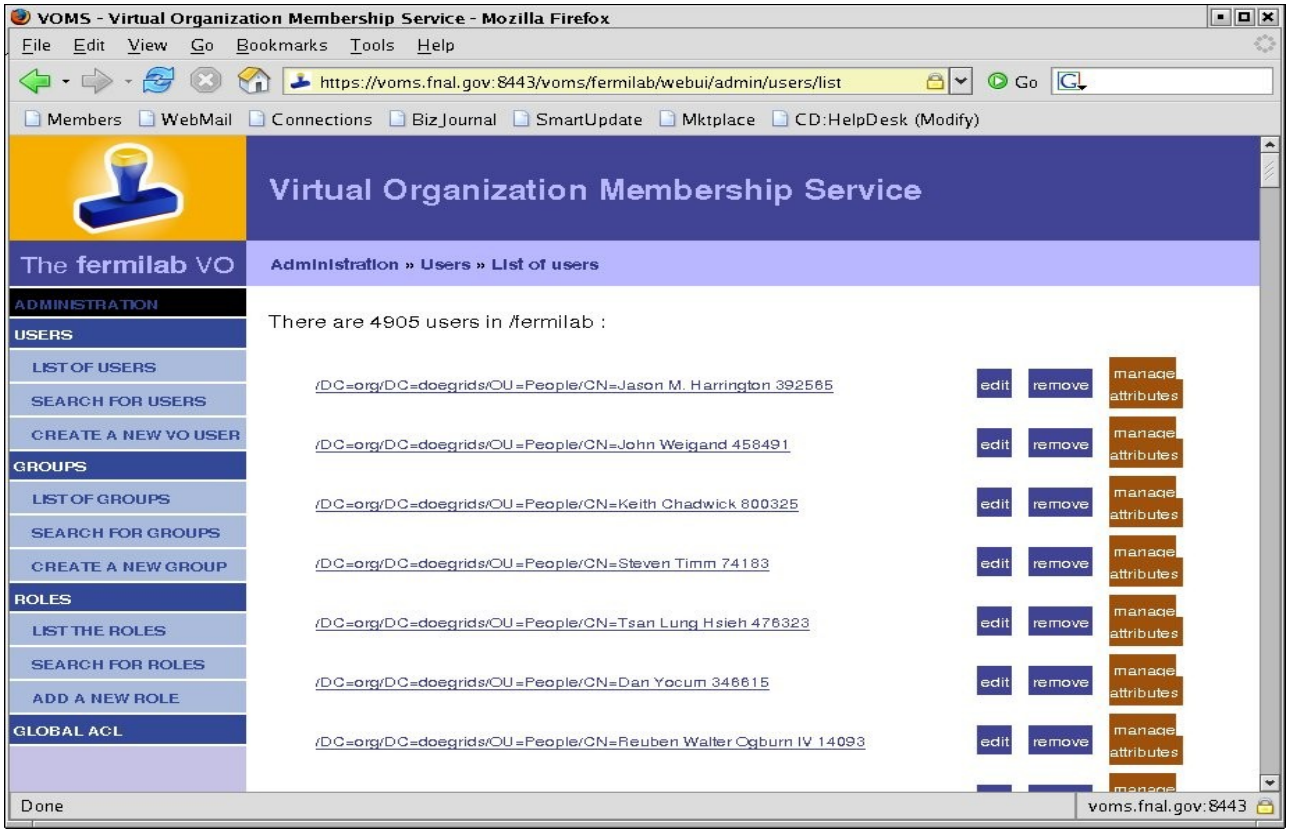
D. Why do we have to do the kx509/kxlist sequence, can't we make it shorter?

See http://security.fnal.gov/tools/get-cert.tar.gz. This is the get-cert.sh utility. Windows systems that are part of the Fermi domain do this automatically. On fnpcsrv1 this is installed in /usr/bin/get-cert/get-cert.sh. This utility does the kx509 and kxlist -p for you, and makes two files in /tmp, /tmp/x509up_u<nnnn> which is a PEM format proxy, and /tmp/x509up_u<nnnn>.p12 (*PKCS12*= Public Key Cryptographic Standard #12, equivalent to .pfx format in Windows) which can be imported into a web browser. With get-cert.sh -i, the utility will automatically import the certificate into the browser for you. It is necessary to have a certificate in your browser if you are going to access VOMS or VOMRS web interfaces. For that matter, it is necessary to have a KCA cert in your browser to access many Fermilab web applications such as ES+H, DOCDB, MISER, and the Leave Request System. You should make sure that the credential cache in your browser is password protected.

E. Why doesn't voms-proxy-init work sometimes?

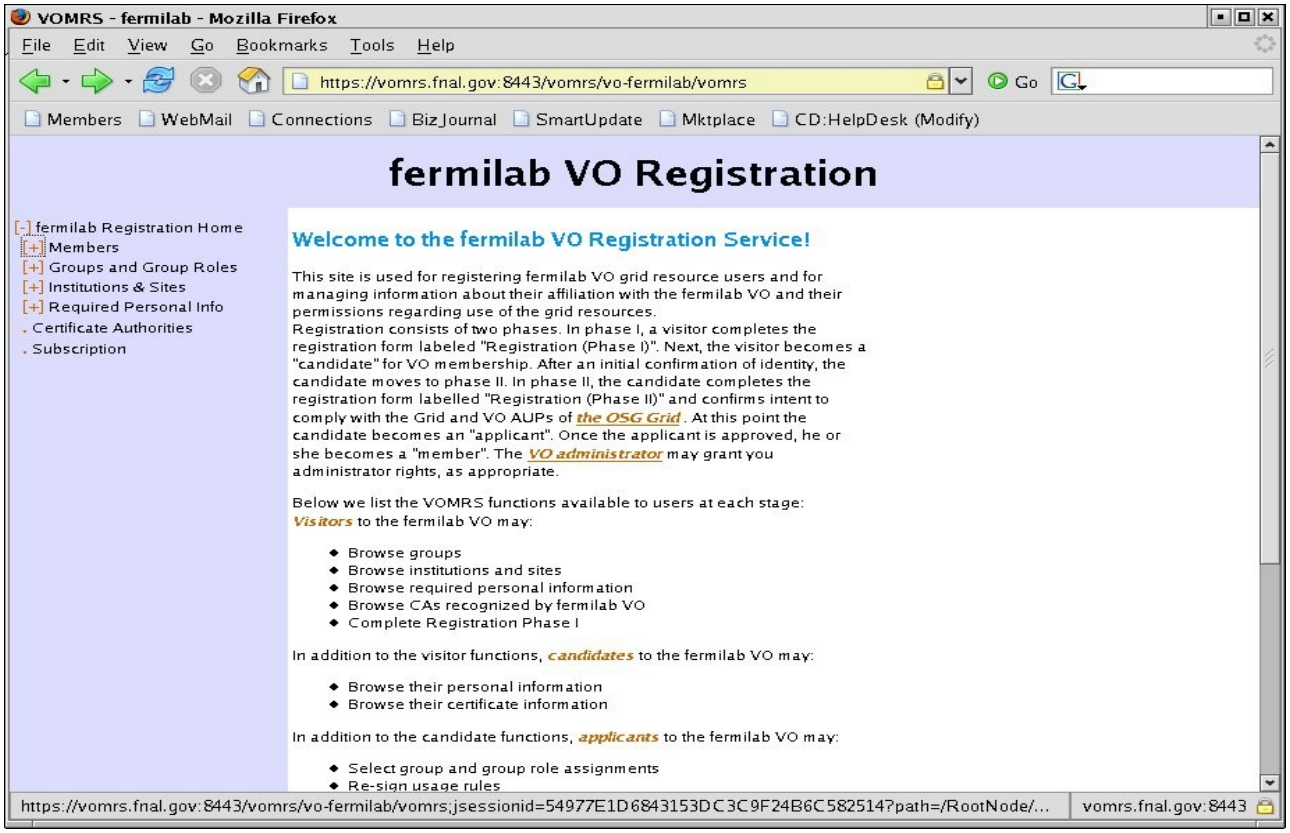
You might not be a member of the VO.
You might be requesting a role that you aren't authorized to be.
Check by going to *VOMS* server https://voms.fnal.gov:8443/voms/fermilab
`voms-proxy-init -debug` is your friend (Could be missing a vomses file.)
To join a VO that you're not in now, use *VOMRS* to request membership.
VOMS server might be down.
Could be a firewall between you and the *VOMS* server. But not here at Fermilab.

1. To access VOMS, make sure a certificate is loaded in your browser, then go to https://voms.fnal.gov:8443/voms/fermilab. Click on the left toolbar where it says “Administer the VO”, and then again where it says “List of users.” Then by a find in the browser you can determine whether you, or anyone else, is a member of the VO. Most VO's that Fermilab deals with have this information available read-all. All Fermilab-based VO's have a link to their VOMS off of the Fermilab web page. A screen shot is below:



2. To access VOMRS, make sure that a certificate is loaded in your browser and load the url https://vomrs.fnal.gov:8443/vomrs/vo-fermilab/vomrs

A screen shot of the opening VOMRS screen is below. In VOMRS you are only allowed to access the information that you have a right to change, which is only your own cert unless you are declared to be a VO or group admin.



F. Is there a way to launch a job automatically from a cron job?

Yes. Use kcroninit to create a kcron kerberos credential, then kcron to initialize the credential, and then kx509/kxlist -p as before. Note that you get a certificate with a different subject, /DC=gov/DC=fnal/O=Fermilab/OU=Robots/CN=fnpcsrv1.fnal.gov/CN=cron/CN=Steven C. Timm/CN=UID:timm which will then have to manually be added to the VO. Each kcron invocation from a different machine will have the hostname of the machine in the robots cert. It is also possible to make special-purpose kerberos keytabs which do not require cron; this is used by CDF.
Example is below:

```
bash-3.00$ kcron exec /bin/bash
bash-3.00$ klist
Ticket cache: /tmp/krb5cc_2904_At9741
Default principal: timm/cron/fnpcsrv1.fnal.gov@FNAL.GOV

Valid starting     Expires            Service principal
03/17/08 16:01:50  03/18/08 02:01:50  krbtgt/FNAL.GOV@FNAL.GOV
03/17/08 16:01:51  03/18/08 02:01:50  afs@FNAL.GOV
bash-3.00$ kx509
```

```
bash-3.00$ kxlist -p
Service kx509/certificate
 issuer= /DC=gov/DC=fnal/O=Fermilab/OU=Certificate
Authorities/CN=Kerberized CA
 subject= /DC=gov/DC=fnal/O=Fermilab/OU=Robots/CN=fnpcsrv1.fnal.gov/C
N=cron/CN=Steven C. Timm/CN=UID:timm
 serial=7FBBA3
 hash=5c197dd
```

G. One final word of caution with voms-proxy-init

When in doubt, remove your proxy with voms-proxy-destroy before trying again or changing to a different VO. Sometimes multiple voms-proxy-init commands will tack on information to the same proxy but only the first information will be recognized.

Lab 2: Grid Submission: Globus-job-run and Globus-url-copy

In your home directory on fnpcsrv1 there is a tarball fermigrid201-jan23.tar.gz.
Untar it with the command

```
tar xvfz fermigrid201-jan23.tar.gz
```

Then execute the command

```
cd fermigrid201/lab2
```

A. Globus-job-run:

First try to run a command that is already on the remote machine:

```
globus-job-run fnpcosg1.fnal.gov/jobmanager-fork /usr/bin/id
uid=13160(fnalgrid) gid=9767(fnalgrid) groups=9767(fnalgrid)
```

B. Globus-url-copy:

This will copy the helloworld.sh script to the remote system

```
globus-url-copy file://${HOME}/fermigrid201/lab2/helloworld.sh\
gsiftp://fnpcosg1.fnal.gov/grid/data/helloworld.sh.${USER}
```

C. Globus-job-run

This will execute a chmod command on the remote system helloworld.sh script to make it executable

```
globus-job-run fnpcosg1.fnal.gov/jobmanager-fork /bin/chmod
755 /grid/data/helloworld.sh.${USER}
```

D. Globus-job-run

Run the script.

```
Globus-job-run fnpcosg1.fnal.gov/jobmanager-
fork /grid/data/helloworld.sh.${USER}
Hello world
```

E. Goodies about globus-job-run

Need to add -x '(jobtype=single)' to any PBS site.

Jobmanager-fork is for short jobs to do configuration on the Compute Element itself. To run the batch system, you need to use the appropriate job manager for the site, either jobmanager-condor, jobmanager-pbs, jobmanager-lsf, or jobmanager-sge. Any OSG site has only one of the preceding four.

Globus-job-run will block your command prompt until the I/O returns. If you want to get prompt back, use globus-job-submit instead.

Globus-job-run only for simple diagnostics. It launches one remote daemon per job. Easy way to get remote site admins mad at you, and your VO blocked from the OSG, if you use it a lot.

Lab 3: Grid Submission--Condor_submit

The files needed for this lab should have already been expanded in the previous lab.

Change to the directory with

```
cd ~/fermigrid201/lab3
```

A. Use condor_submit to submit the script file grid_recon1

```
condor_submit grid_recon1
Submitting job(s).
Logging submit event(s).
1 job(s) submitted to cluster 1704375.
```

B. Use condor_q to monitor it

```
bash-3.00$ condor_q 1704375
-- Quill: quillone@fnpcsrv1.fnal.gov : <131.225.167.47:5432> :
quillone : 2008-03-17 21:28:19-05
 ID      OWNER            SUBMITTED     RUN_TIME ST PRI SIZE CMD
1704375.0   timm            3/17 21:26   0+00:00:00 I  0   0.1
recon1

bash-3.00$ condor_q 1704375
-- Quill: quillone@fnpcsrv1.fnal.gov : <131.225.167.47:5432> :
quillone : 2008-03-17 21:28:49-05
 ID      OWNER            SUBMITTED     RUN_TIME ST PRI SIZE CMD
1704375.0   timm            3/17 21:26   0+00:00:11 R  0   0.1
recon1
```

C. Look at the output files

```
bash-3.00$ ls -l grid_recon1.*
-rw-r--r--  1 timm oss    0 Mar 17 21:32 grid_recon1.err.1704375.0
-rw-r--r--  1 timm oss 1077 Mar 17 21:32 grid_recon1.log.1704375.0
-rw-r--r--  1 timm oss 3576 Mar 17 21:32 grid_recon1.out.1704375.0
```

D. Submit the second job with condor_g

```
bash-3.00$ condor_submit fnpcosg1-gridsleep-fourargs
Submitting job(s).
Logging submit event(s).
1 job(s) submitted to cluster 1704377.
```

E. Use condor_q -globus to monitor it

```
bash-3.00$ condor_q -globus 1704377
-- Quill: quillone@fnpcsrv1.fnal.gov : <131.225.167.47:5432> :
quillone : 2008-03-17 21:39:01-05
 ID      OWNER          STATUS  MANAGER  HOST        EXECUTABLE
1704377.0   timm     UNSUBMITTED condor
fnpcosg1        /home/timm/fermigr
bash-3.00$ condor_q -globus 1704377
-- Quill: quillone@fnpcsrv1.fnal.gov : <131.225.167.47:5432> :
quillone : 2008-03-17 21:39:51-05
 ID      OWNER          STATUS  MANAGER  HOST        EXECUTABLE
```

```
1704377.0   timm       PENDING condor
fnpcosg1          /home/timm/fermigr
bash-3.00$ condor_q -globus 1704377
-- Quill: quillone@fnpcsrv1.fnal.gov : <131.225.167.47:5432> :
quillone : 2008-03-17 21:41:41-05
 ID      OWNER          STATUS  MANAGER  HOST       EXECUTABLE
1704377.0   timm        ACTIVE condor
fnpcosg1            /home/timm/fermigr
```

F. For more explanation of the examples, see grid_recon1.annotated and fnpcosg1-gridsleep-fourargs.annotated, in the working directory

G. Note that if you change your executable file but leave it as the same name and submit your job again, the change will not necessarily be forwarded to the remote site. As long as any jobs are running with the original executable at the remote site, the remote executable will be cached. If you change your executable, best to change the name of the file as well. This is a “feature” of Globus.

Lab 4: FermiGrid and OSG

Change to the lab4 directory

```
cd ~/fermigrid201/lab4
```

A. Submit the example grid_pullbench. This sample gets to a worker node, finds the correct $OSG_WN_TMP directory, pulls a tarball to the worker node from mass storage which contains executable and data, untars it, runs it, and attempts to store it back into mass storage.

```
bash-3.00$ condor_submit grid_pullbench
Submitting job(s).
Logging submit event(s).
1 job(s) submitted to cluster 1704385.
```

B. Monitor the progress with condor_q to fermigridosg1 and fnpcosg1 (Note, at the moment it is necessary to use an alternate -name option in the condor_q, fg1x1.fnal.gov=fermigridosg1.fnal.gov, and fnpc3x1.fnal.gov=fnpcosg1.fnal.gov. Fnpc4x1.fnal.gov=fnpcfg1.fnal.gov, fnpc5x2.fnal.gov=fnpcfg2.fnal.gov. This will eventually change.

```
condor_q -name fg1x1.fnal.gov -pool fermigridcm1.fnal.gov
condor_q -name fnpc3x1.fnal.gov -pool fnpccm1.fnal.gov
```

C. Look at VORS (Virtual Organization Resource Selector) and try to find another OSG site that will take a job from the Fermilab VO. Screen shot is on next page.

D. Modify grid_pullbench to send the job to the other OSG site.

Supported VO Matrix - Mozilla Firefox

File Edit View Go Bookmarks Tools Help

http://vors.grid.iu.edu/vo-support-prod.html

Fermi Linux | Fermilab | FermiLinux | Linux Distros

Supported VO Matrix - OSG Production Sites - Mar 18, 03:28 GMT

Resource Name	VO Count	CDF	CMS	CompBioGrid	DES	DOSAR	DZero	Engage	Fermilab	fMRI	GADU	geant4	GLOW	GPN	GRASE	GridChem	GridEx	GROW	i2u2	iVDGL	LIGO	mariachi
AGLT2	4																X					
ASGC_OSG	NA																					
BNL_ATLAS_1	0																					
BNL_ATLAS_2	0																					
BNL_ATLAS_SE	0																					
BU_ATLAS_Tier2	8									X					X					X	X	
cinvestav	4		X			X																
CIT_CMS_T2	28		X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X
CIT_CMS_T2:srm_v1	0																					
Clemson-IT	7							X					X				X					

Done

Lab 5: Advanced Topics:

A. DAGman—Submit our sample DAG.

```
cd ~/fermigrid201/lab5/dag
condor_submit_dag ex2.dag
```

B. Globusrun WS Try the example below.

```
bash-3.00$ globusrun-ws -submit -F fnpcosg1.fnal.gov:9443 -J -c
/usr/bin/id
Delegating user credentials...Done.
Submitting job...Done.
Job ID: uuid:84e4a618-f4a0-11dc-adaf-001422086c92
Termination time: 03/19/2008 04:05 GMT
Current job state: Active
Current job state: CleanUp
Current job state: Done
Destroying job...Done.
Cleaning up any delegated credentials...Done.
bash-3.00$
```

C. If you have a DOEGrids certificate, voms-proxy-init and submit a job with that.