Introduction to SweGrid

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Getting a certificate

• Terena eScience Portal
  – Issues personal certificates
  – Trusts the universities to validate the identity of the user
  – Login using normal university id
  – Certificate and private key stored in browser
  – Must be exported and converted to be used for accessing grid resources.
http://dl.dropbox.com/u/2888586/videos/terena1.mp4
Grid authorisation

• To use SweGrid resources
  – Must be member in SweGrid VO
  – Must be member of a SweGrid VO group

• Membership is acquired by clicking on the following link:
  – https://voms.ndgf.org:8443/voms/swegrid.se
  – Follow the instructions

• To be added to a SweGrid VO group please send an email to support@swegrid.se
  – Specify your DN as shown in the Terena portal or from the arcproxy –info command
  – Specify the SNIC project number
Creating a X509 grid certificate

- Convert PCKCS12 certificate from browser to a X509 certificate
- OpenSSL is used for conversion
- Results in 2 files
  - usercert.pem – Public certificate
  - userkey.pem – Private key
Creating a X509 grid certificate

$ openssl pkcs12 -nocerts -in usercert.p12 -out userkey.pem
Enter Import Password:
MAC verified OK
Enter PEM pass phrase:
Verifying - Enter PEM pass phrase:

userkey.pem

$ openssl pkcs12 -clcerts -nokeys -in usercert.p12 -out usercert.pem
Enter Import Password:
MAC verified OK

usercert.pem

chmod 400 userkey.pem
http://dl.dropbox.com/u/2888586/videos/export_convert_cert.mp4
Client installation

• A client software is required to use SweGrid resources
• SweGrid uses the NorduGrid ARC middleware
  – Available Linux/Mac OS X/ (Windows)
  – Latest version 11.05 (1.0.0)
http://dl.dropbox.com/u/2888586/videos/installing_arc_macosx.mp4
Client configuration

• The NorduGrid ARC client has to be configured to use the SweGrid Resources
  – Where, what?

• The configuration also specifies
  – Default timeouts
  – Logging levels
  – Blacklisting of resources
  – Resource aliases

• Configuration file at $HOME/.arc/client.conf
[common]

# Default services.
# Services to be used if none is given on the commandline can be
# specified using the 'defaultservices' attribute. Setting this here
# will override the default services set in the system configuration.
# The value of this attribute should follow the format:
# <service_type>:<flavour>:<service_url>
# where <service_type> is type of service (e.g. computing or index),
# <flavour> specifies type of middleware plugin to use when contacting
# the service (e.g. ARC0, ARC1, CREAM, UNICORE, etc.) and <service_url>
# is the URL used to contact the service.

defaultservices=index:ARC0:ldap://index1.swegrid.se:2135/Mds-Vo-
name=SweGrid,o=grid index:ARC0:ldap://index1.swegrid.se:2135/Mds-Vo-
name=SweGrid,o=grid

# Rejected services.
# The attribute 'rejectservices' can be used to indicate that a certain
# service should be rejected.
#rejectservices=computing:ARC1:https://bad.service.org/arex
# Specify the broker used in resource discovery. The default broker is
# the 'Random' broker.
#brokername=FastestQueue
# Some brokers takes arguments and these can be specified by using the
# 'brokerarguments' attribute.
#brokerarguments=

# Set the period of time the client should wait for a service to respond
# when communicating with it. The period should be given in seconds.
#timeout=50

# Path to the job list file can be specified with the joblistfile
# attribute. This file will be used by commands such as arcsub, arcstat,
# arcsync etc. to read and write information about jobs. The default
# location of the file is in home directory in the .arc directory with
# name jobs.xml
#joblist=/home/user/run/jobs.xml
#joblist=C:\run\jobs.xml
# The location of credentials can be specified by using the 'proxypath',
# 'keypath' or 'certificatepath' attribute, in case they are located
# in a non-standard location.
#proxypath=/tmp/my-proxy
#keypath=/home/username/key.pem
#certificatepath=/home/username/cert.pem

# The location of the directory containing CA-certificates can also be
# specified.
#cacertificatesdirectory=/home/user/cacertificates

# Alias definition. Instead of typing the whole URL on the commandline use a alias
# instead.
[alias]
#arco=computing:ARC0:ldap://grid.tsl.uu.se:2135/nordugrid-cluster-name=grid.tsl.uu.se,Mds-Vo-name=local,o=grid
#arc1=computing:ARC1:https://interop.grid.niif.hu:2010/arex-x509

Non-default certificate locations
Non-default CA certificate locations
Client verification - arcinfo

```
host-95-193-81-219:~ jonas$ arcinfo
Execution Service: arc-ce01.pdc.kth.se
  URL: ARC0:ldap://arc-ce01.pdc.kth.se:2135/nordugrid-cluster-
  name=arc-ce01.pdc.kth.se,Mds-Vo-name=local,o=Grid
  Queue: easy
  Hälsotillstånd: ok

...

Execution Service: siri.lunarc.lu.se
  URL: ARC0:ldap://siri.lunarc.lu.se:2135/nordugrid-cluster-
  name=siri.lunarc.lu.se,Mds-Vo-name=local,o=Grid
  Queue: arc
  Hälsotillstånd: ok
```

Displays a list of authorised resources
Creating a proxy certificate

- **arcproxy** is used to create a shortlived proxy certificate for use with the SweGrid resources
- By default a 12 hour proxy is created
- Make sure proxy is long enough to cover any transfers to external sources
- "-c" is used to set validity time
  - `arcproxy -c "validityPeriod=24 hours"`
  - Creates a 24 hour proxy certificate
Creating a proxy certificate

$ arcproxy -c "validityPeriod=24 hours"
Your identity: /O=Grid/O=NorduGrid/OU=lunarc.lu.se/CN=Jonas Lindemann
Enter pass phrase for /Users/jonas/.globus/userkey.pem:
..++++++
+++++++  
Proxy generation succeeded  
Your proxy is valid until: 2011-06-30 07:30:33

$ arcproxy --info
Subject: /O=Grid/O=NorduGrid/OU=lunarc.lu.se/CN=Jonas Lindemann/CN=1236174628
Identity: /O=Grid/O=NorduGrid/OU=lunarc.lu.se/CN=Jonas Lindemann
Time left for proxy: 23 timmar 51 minuter 53 sekunder
Proxy path: /Users/jonas/x509_up501
Proxy type: X.509 Proxy Certificate Profile RFC compliant restricted proxy
Beskrivning av jobb

• Jobb beskrivs i ”Extended Resource Specification Language” eller XRSL
• XRSL-files contains a set of attribute definitions
• All definitions enclosed in ( )
• Operators can be used to define attribute relationships
  – An XRSL file usually starts with an & (and) and defines the default relationship between all attributes in the file
XRSL exempel

Default relationship

&(executable="/bin/echo")(arguments="Hello, World!")

Attribute definitions
Specifying executable and arguments

• An executable specified without any directory separators is treated as a local file transferred to the remote system and executed
  – (executable="myexecutable")

• If executable begins with a leading “/” it is treated as a local file on the remote system
  – (executable="/bin/echo")
Handling job input and output

• Output from an application can be specified with the `stdout` and `stderr` attributes

• Input to an application is specified by the `stdin` attribute
Handling job input and output

&
(executable="/bin/ls")
(arguments="-la")
(stdout="stdout.txt")
(stderr="stderr.txt")

Stdin.txt has to be transferred to the resources, which is done in the **inputFiles** attribute.

&
(executable="myapp")
(stdout="stdout.txt")
(stderr="stderr.txt")
(stdin="stdin.txt")
(inputFiles=("stdin.txt" ""))
Naming jobs

• To make it easier to handle submitted jobs a job can be given a meaningful name using the jobName attribute
• This name can be used reference jobs from the command line tools

&
  (executable="myapp")
  (stdout="stdout.txt")
  (stderr="stderr.txt")
  (stdin="stdin.txt")
  (inputFiles=("stdin.txt" ""))
  (jobName="job0001")
Input- and output files

• Most jobs need input files for running
• Jobs often produce output files that need some kind of handling
• Input files are defined using the `inputFiles` attribute
• Output files are defined using the `outputFiles` attribute
• Input/output files can reference external URL:s
Input and output files

&
(executable="myapp")
(stdout="stdout.txt")
(stderr="stderr.txt")
(stdin="stdin.txt")
(inputFiles=
   ("stdin.txt" "")
   ("datafile1.dat" "")
   ("datafile2.dat" "")
)
(outputFiles=
   ("outputfile1.dat" "")
   ("outputfile2.dat" "")
)
Input and output files

&
(executeable="myapp")
(stdout="stdout.txt")
(stderr="stderr.txt")
(stdin="stdin.txt")
(inputFiles=
   ("stdin.txt" "http://www.swegrid.se/example/stdin.txt")
   ("datafile1.dat" "gsiftp://swegrid.se/storage/datafile1.dat")
   ("datafile2.dat" "rc://swegrid.se.se/datafile2.dat")
)
(outputFiles=
   ("outputfile1.dat" "srm://swegrid.se/storage/outputfile1.dat")
   ("outputfile2.dat" "srm://swegrid.se/storage/outputfile2.dat")
)
Input and output files

&
(executable="myapp")
(stdout="stdout.txt")
(stderr="stderr.txt")
(stdin="stdin.txt")
(inputFiles= 
("/" "")
)
(outputFiles= 
("/" "")
)
Specifying resource usage

• To be able to choose the right resource attributes for walltime and memory and disk can be specified using `wallTime` and `memory` attributes

• Walltime can be specified using several units:
  – 1 week, 3 days, 2 days, 12 hours, 1 hour, 30 minutes, 36 hours, 9 days, 240 minutes, 240
  – If no unit is specified “minutes” is the default
Specifying resource usage

```plaintext
&
(executable="myapp")
(stdout="stdout.txt")
(stderr="stderr.txt")
(stdin="stdin.txt")
(wallTime=240)
(memory>=500)
(inputFiles=
   ("stdin.txt" "")
   ("datafile1.dat" "")
   ("datafile2.dat" "")
)
(outputFiles=
   ("outputfile1.dat" "")
   ("outputfile2.dat" "")
)
```
Runtime-environments

• Runtime environment are special scripts that are executed on the resource to setup applications or special environments for jobs
  – Specified using the `runtimeEnvironment` attribute
• Shields users from differences between resources
• Can also be queried from the information system
• Supports versioning
  – Ask for a specific version x.y
  – Ask for at least version x.y
Runtime-environments

&
(executeable=run.sh)
(arguments=inputfile.dat)
(inputFiles=(inputfile.dat ""))
(outputFiles=(outputfile.dat ""))
(wallTime=240)
(runTimeEnvironment>=MYAPP-1.42)

!/bin/sh
myapp $1

"myapp" is made available by the RE MYAPP-1.42

Require that MYAPP should be 1.42 or higher
Job debug information

• Sometimes more information about the job is required for debugging

• **gmlog** attribute can be used to specify that diagnostic information should be returned from the job.

• Information is stored in the directory specified by the attribute.
Job debug information

- **description** - contains the parsed and transformed XRSL description transferred to the resource.
- **diag** - front-end and job information.
- **errors** - complete log of job activity.
- **input** - job input files.
- **local** - local job information specific to resource management system.
- **output** - job output files.
- **status** - job status. FINISHED/FAILED etc.
Job debug information

&
(executable=run.sh)
(wallTime="5 minutes")
(stdout="stdout.txt")
(stderr="stderr.txt")
(gmlog="gmlog")

Creates a directory "gmlog" containing the files described earlier.
Job submission

• When the job description has been created and the needed files are available the job can be submitted to a grid resource using the \texttt{arcsub} command

• Job submission procedure:
  – Parse XRSL definition.
  – Query information system for available resources taking in any constraints defined in the XRSL definition such as memory, wallTime and runtime environments.
  – Submit job to selected resource. Transferring any files local to the submission directory (if any).
arcsub

• General syntax:

    arcsub [options] [filename …]

    filename is xrsl-files for a single or many jobs

• Important switches

    --cluster=[-]cluster specifically select or reject a cluster (-)

    --debug=debuglevel set the desired debug output information

    --timeout=seconds set the timeout value for when to give up on a resource or information resource.
Submission example

```bash
#!/bin/sh
echo "Hello, grid"
```

&
(executable=run.sh)
(wallTime="5 minutes")
(stdout="stdout.txt")
(stderr="stderr.txt")

```
$ arcsub job.xrsl
Jobb insänt med jobb-id:
gsiftp://jeannedarc.hpc2n.umu.se:2811/jobs/72941309304631877972352
```
$ arcsub --debug=INFO job.xrsl
INFO: Loading configuration (/opt/local/nordugrid/etc/arc/client.conf)
INFO: Configuration (/opt/local/nordugrid/etc/arc/client.conf) loaded
INFO: Loading configuration (/Users/jonas/.arc/client.conf)
INFO: Configuration (/Users/jonas/.arc/client.conf) loaded
INFO: Använd proxyfil: /Users/jonas/x509_up501
INFO: Använd certifikatfil: /Users/jonas/.globus/usercert.pem
INFO: Använd nyckelfil: /Users/jonas/.globus/userkey.pem
INFO: Använd CA-certifikatkatalog: /opt/local/nordugrid/etc/grid-security/certificates
INFO: Proxy successfully verified.
INFO: Loaded JobDescriptionParser ARCJSDLParser
INFO: Loaded JobDescriptionParser JDLParser
INFO: Loaded JobDescriptionParser XRSLParser
INFO: String successfully parsed as nordugrid.xrsl.
INFO: Found 7 targets
INFO: Loaded Broker Random
INFO: Broker Random loaded
INFO: Överföring från file:/Users/jonas/testjobs/job1/run.sh till
gsiftp://svea.c3se.chalmers.se:2811/jobs/2637713093054121886422578/run.sh
INFO: Reell överföring från file:/Users/jonas/testjobs/job1/run.sh till
gsiftp://svea.c3se.chalmers.se:2811/jobs/2637713093054121886422578/run.sh
INFO: ftp_write_thread: eråll och registrera buffrar
INFO: buffer: läs filslut : 1
INFO: buffer: skriv filslut: 1
INFO: buffer: fel : 0
INFO: job.Resources.QueueName = svea
Jobb insänt med jobb-id: gsiftp://svea.c3se.chalmers.se:2811/jobs/2637713093054121886422578
7 targets found in the information system
svea.c3se.chalmers.se chosen by broker
Job submission successful
INFO: Loading configuration (/opt/local/nordugrid/etc/arc/client.conf)
INFO: Configuration (/opt/local/nordugrid/etc/arc/client.conf) loaded
INFO: Användare proxyfil: /Users/jonas/.arc/x509_up501
INFO: Användare certifikatfil: /Users/jonas/.globus/usercert.pem
INFO: Användare nyckelfil: /Users/jonas/.globus/userkey.pem
INFO: Användare CA-certifikatkatalog: /opt/local/nordugrid/etc/grid-security/certificates
INFO: Proxy successfully verified.
INFO: Loaded JobDescriptionParser ARCJSDLParser
INFO: Loaded JobDescriptionParser JDLParser
INFO: Loaded JobDescriptionParser XRSLParser
INFO: String successfully parsed as nordugrid:xrsl.
INFO: Found 1 targets
INFO: Loaded Broker Random
INFO: Broker Random loaded
INFO: Óverföring från file:/Users/jonas/testjobs/job1/run.sh till gsiftp://siri.lunarc.lu.se:2811/jobs/3202613093055832039744533/run.sh
INFO: Reell överföring från file:/Users/jonas/testjobs/job1/run.sh till gsiftp://siri.lunarc.lu.se:2811/jobs/3202613093055832039744533/run.sh
INFO: ftp_write_thread: eråll och registrera buffrar
INFO: buffer: läs filslut : 1
INFO: buffer: skriv filslut: 1
INFO: buffer: fel : 0
INFO: job.Resources.QueueName = arc
Jobb insänt med jobb-id: gsiftp://siri.lunarc.lu.se:2811/jobs/3202613093055832039744533

Introduction to SweGrid and SweStore
Joblist files

- By default ARC stores information about submitted jobs in $HOME/.arc/jobs.xml
- Location of the joblist file can be changed using the -j or --joblist=joblistfile switches
- Useful when submitting parameter sweeps.
  - Single sweep stored in a special joblist file
Job status information

• Status of submitted jobs can be queried using the `arcstat` command

• Queries the status of the jobs in the `$HOME/.arc/jobs.xml` file

• Similar to the `qsub` and `showq` command on conventional HPC resources
Job status information

$ arcstat gsiftp://siri.lunarc.lu.se:2811/jobs/3202613093055832039744533
  Jobb: gsiftp://siri.lunarc.lu.se:2811/jobs/3202613093055832039744533
  State: Finished (FINISHED)
  Avslutningskod: 0

$ arcstat -a
  Jobb: gsiftp://jeannedarc.hpc2n.umu.se:2811/jobs/72941309304631877972352
    State: Failed (FAILED)
    Job Error: Job submission to LRMS failed

  Jobb: gsiftp://svea.c3se.chalmers.se:2811/jobs/2637713093054121886422578
    State: Finished (FINISHED)
    Avslutningskod: 0

  Jobb: gsiftp://siri.lunarc.lu.se:2811/jobs/3202613093055832039744533
    State: Finished (FINISHED)
    Avslutningskod: 0

Queries all jobs in jobs.xml file
$ arcstat --long
gsiftp://siri.lunarc.lu.se:2811/jobs/32026130930555832039744533
Jobb: gsiftp://siri.lunarc.lu.se:2811/jobs/32026130930555832039744533
State: Finished (FINISHED)
Avslutningskod: 0
Ägare: /O=Grid/O=NorduGrid/OU=lunarc.lu.se/CN=Jonas Lindemann
Queue: arc
Used Slots: 1
Stdout: stdout.txt
Stderr: stderr.txt
Submitted: 2011-06-29 01:59:48
End Time: 2011-06-29 02:05:34
Used CPU Time:
Used Wall Time: 1 minut
Results must be retrieved before: 2011-07-09 17:12:14
Proxy valid until: 2011-06-29 11:45:20
Entry valid from: 2011-06-29 02:11:13
Entry valid for: 1 minut 30 sekunder
Job status information

• The **--joblist** switch can be used by the **arcstat** command as well

```
arcstat --joblist=job_sweep1
```

Query status of jobs contained in the “job_sweep1” file
Job status information

• Using the `--status=statusstring` switch only jobs with status = statusstring will be listed.

```
$ arcstat --all --status=FAILED
Jobb: gsiftp://jeannedarc.hpc2n.umu.se:2811/jobs/72941309304631877972352
  State: Failed (FAILED)
  Job Error: Job submission to LRMS failed
```
Retrieving finished jobs

• Finished jobs can be retrieved using the `arcget` command
• Syntax: `arcget [options] [job]`
• By default jobs are downloaded in a directory with the same name as the last part of the jobid
• Directory for download can be specified using the `--dir=downloaddir`
Retrieving finished jobs

```
$ arcget
gsiftp://siri.lunarc.lu.se:2811/jobs/3202613093055832039744533
host-95-193-81-219:job1 jonas$ ls
3202613093055832039744533 job.xrsl run.sh
```

Explicitely with job reference

```
$ arcget job0001
```

Using jobname from XRSL
Retrieving finished jobs

$ arcget --all --dir ./job_sweep1
Results stored at ./job_sweep1/198512965106411445114039
Results stored at ./job_sweep1/221412965106421926028190
Results stored at ./job_sweep1/265812965106431621700746
Results stored at ./job_sweep1/293912965106452076344440

Storing jobs in special directory

$ arcget --all --usejobname --dir ./job_sweep2
Results stored at ./job_sweep2/job0001
Results stored at ./job_sweep2/job0002
Results stored at ./job_sweep2/job0003
Results stored at ./job_sweep2/job0004

Using job names and a separate directory
Killing running/queuing jobs

• **arckill** can be used to kill running or queuing jobs
  • Same switches in principle as **arcstat**
  • `-a/--all` kill all jobs
  • `-j/--joblist` use specific joblist file when killing jobs
  • `-s/--status` kill only jobs with a specific status
Killing jobs

$ arckill gsiftp://siri.lunarc.lu.se:2811/jobs/3202613093055832039744533

Killing job by jobname

$ arckill job0001

Killing all jobs

$ arckill --all

Killing all jobs queued from joblist job_sweep1

$ arckill --joblist=job_sweep1 --status=INLRMS:Q
Cleaning jobs

• Jobs kept on resources for some amount of time
• If job has failed it is not necessary to download it with `arcget`, `arcclean` can then be used to initiate a job removal/cleanup
• Only finished jobs can be cleaned
• If a job exists in joblist file and can’t be find on a resource `arcclean --force` can be used
• Same options such as `--joblist`, `--status`, `--all` applies to `arcclean`
Other commands

• **arcrenew**
  – Used to renew proxy certificate of submitted jobs

• **arcresub**
  – Resubmit already submitted jobs. Job descriptions from joblist file will be reused
  – Job will get a new jobid (of course)

• **arcmigrate**
  – Moving jobs between resources (currently only A-REX)
    Requires upgrading of SweGrid resources

• **arcsync**
  – Synchronises your joblist with information system.
    Queries information system on all your jobs on resources and updates joblist
Other commands

• **arctest**
  – Submit test jobs

• **arccat**
  – Display job output (stdout/stderr)

• **arcinfo**
  – Querying information on grid resources. **--long** provides additional information on a resource such as available runtime environments

• **arcsync**
  – Synchronises your joblist with information system. Queries information system on all your jobs on resources and updates joblist
Using storage resources

• SweGrid provides > 1 Petabyte of storage in the national storage infrastructure
• Available through dCache
• dCache is a distributed storage system
  – Central metadata repository
  – srm.swegrid.se
  – Protocol is srm:// and gsiftp://
• Distributed pools located on each SNIC centre
Using SweStore

• In the future storage allocation will be handled by SNAC

• Application for storage to
  – swestore-support@snic.vr.se
  – Purpose for storage, short descriptions of the project and which type of data.
  – Max volume in TiB of storage data.
SweStore and VOMS-proxies

• To use SweStore special VOMS signed proxies are required
• Some configuration needed
Configuring VOMS

• Create a file
  – $HOME/.voms/vomses
  – Should contain:

"swegrid.se" "voms.ndgf.org" "15009"
"/O=Grid/O=NorduGrid/CN=host/voms.ndgf.org" "swegrid.se"

On one line
Creating a VOMS proxy

```
$ arcproxy -S swegrid.se:/swegrid.se/ops
Your identity: /O=Grid/O=NorduGrid/OU=lunarc.lu.se/CN=Jonas Lindemann
Enter pass phrase for /Users/jonas/.globus/userkey.pem:
................+++++
.........+++++
Contacting VOMS server (named swegrid.se): voms.ndgf.org on port: 15009
Proxy generation succeeded
Your proxy is valid until: 2011-06-29 20:09:25
```

Replace with you assigned directory/project
Storage commands in ARC

- **arccp**
  - Copy files to and from storage resources
  - Handles most grid protocols such as: http, https, httpg, ftp, gsiftp, lfc, rls, srm

- **arcls**
  - List files and directories on storage resources

- **arcrm**
  - Removing files on resources

- Most commands are similar to corresponding Linux/Unix commands with “less functionality”
Copying single files

```bash
$ arccp archive.tar.gz srm://srm.swegrid.se/ops/
```

```
$ arccp --debug=INFO srm://srm.swegrid.se/ops/jonas/GridFTP-1.0.20-linux.gtk.x86.zip ./myzipfile.zip
```

```
INFO: Loading configuration (/opt/local/nordugrid/etc/arc/client.conf)
INFO: Configuration (/opt/local/nordugrid/etc/arc/client.conf) loaded
INFO: Loading configuration (/Users/jonas/.arc/client.conf) loaded
INFO: Användar proxyfil: /Users/jonas/x509_up501
INFO: Användar certifikatfil: /Users/jonas/.globus/usercert.pem
INFO: Användar nyckelfil: /Users/jonas/.globus/userkey.pem
INFO: Användar CA-certifikatkatalog: /opt/local/nordugrid/etc/grid-security/certificates
INFO: Överföring från srm://srm.swegrid.se/ops/jonas/GridFTP-1.0.20-linux.gtk.x86.zip till file:/Users/jonas/.myzipfile.zip
INFO: Reell överföring från srm://srm.swegrid.se/ops/jonas/GridFTP-1.0.20-linux.gtk.x86.zip till file:/Users/jonas/.myzipfile.zip
INFO: Redirecting to new URL: gsiftp://philo.hpc2n.umu.se:2811/jonas/GridFTP-1.0.20-linux.gtk.x86.zip
INFO: ftp_read_thread: erhåll och registrerar buffer
```

--debug=INFO is useful for debugging file transfers

Destination file must be specified. Using "." does not work.
Recursive copying can be a costly operation. dCache is not suitable for copying a lot of files. Use larger files. Preferrable archives.

```
arccp --recursive=3 jonas2/ srm://srm.swegrid.se/ops/jonas/jonas2/
```
Creating directories

• No `arcmkdir` yet
  – Feature request pending

• Workaround

```bash
$ mkdir mydir
$ touch mydir/dummyfile
$ arccp ./mydir/ srm://srm.swegrid.se/ops/mydir/
$ arcls srm://srm.swegrid.se/ops/mydir
dummyfile
```
Listing files

$ arcls srm://srm.swegrid.se/ops/
motd.1
bla
generated
ops
motd.f343
GridFTP-1.0.20-linux.gtk.x86.zip
test23
test24
ronstestfile
ronstestfile3
testfile-put-1296854868-6468a2d5df07.txt
Listing files

$ arcls --long srm://srm.swegrid.se/ops
<Name> <Type> <Size> <Creation> <Validity> <CheckSum> <Latency>
motd.1 file 354 2008-06-05 12:28:23 (n/a) adler32:582d7718 NEARLINE
bla dir 512 2008-08-22 12:23:49 (n/a) (n/a) NEARLINE
generated dir 512 2008-11-17 15:07:39 (n/a) (n/a) NEARLINE
ops dir 512 2010-01-21 11:26:00 (n/a) (n/a) NEARLINE
motd.f343 file 436 2010-01-08 14:35:40 (n/a) adler32:0fed94f2 ONLINE
GridFTP-1.0.20-linux.gtk.x86.zip file 30479220 2011-03-09 09:49:20 (n/a)
adler32:5c67686b ONLINE
test23 file 0 2011-03-04 09:44:44 (n/a) adler32:00000001 ONLINE
test24 file 0 2011-03-04 09:45:07 (n/a) adler32:00000001 ONLINE
ronstestfile file 4 2010-11-23 17:46:13 (n/a) adler32:03cd014b ONLINE
ronstestfile3 file 4 2010-11-23 17:49:07 (n/a) adler32:03cd014b ONLINE
testfile-put-1296854868-6468a2d5df07.txt file 20 2011-02-04 22:28:47 (n/a)
adler32:1a400272 ONLINE

Improvements severely needed. Feature request pending
Querying metadata

```
$ arcls --metadata srm://srm.swegrid.se/ops/test23
/ops/test23
accessperm:rw-r-----
checksum:adler32:00000001
time:2011-03-04 09:44:44
filestoragetype:PERMANENT
group:25001
latency:ONLINE
lifetimeassigned:PT1S
lifetimeleft:PT1S
mtime:2011-03-04 09:44:45
owner:25001
path:/ops/test23
size:0
spacetokens:
type:file
```
Removing files/directories

$ arcm srm://srm.swegrid.se/ops/mydir/dummyfile

$ arcm srm://srm.swegrid.se/ops/mydir/

Trailing slash needed
Upcoming developments

• ARC Storage Explorer
  – Graphical client for SweStore resources
  – Available on Linux, Mac OS X and Windows

• Webdav based interface to storage resources
  – Simple to use web interface

• ARC Setup and Configuration tool
  – Easy setup and configuration of a ARC Client

• Python-bindings
  – ARC 11.05 changed alot
  – Will provide information on this on SNIC knowledge base web pages
## Introduction to SweGrid and SweStore

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### Introduction to SweGrid and SweStore

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To upload, drag and drop files here or into folder structure.