



NORDUGRID-MANUAL-1

25/10/2009

ARC CLIENTS

User's Manual

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Chapter 1

Introduction

The command line user interface of ARC consists of a set of commands necessary for job submission and manipulation and data management. This manual replaces the older version of `NORDUGRID-MANUAL-1` and is valid for ARC versions 0.9 and above. Command line tools semantics is the same as in earlier versions of ARC, roughly following that of basic Linux commands and most common batch system commands. One obvious difference is change of the legacy prefix from “ng” to the more appropriate “arc”. This is not only a cosmetic change: **behaviour of the commands also have changed**, as did their functionalities and options.

Users are strongly discouraged from modifying their old scripts by simply replacing “ng” with “arc”
– results may be unpredictable.

Chapter 2

Commands

2.1 Job submission and management

The following commands are used for job submission and management, such as status check, results retrieval, cancellation, re-submission and such. The jobs must be described using a job description language. ARC supports the following languages: JSDL [1], xRSL [2] and JDL [3].

2.1.1 arbsub

The `arbsub` command is the most essential one, as it is used for submitting jobs to the Grid resources. `arbsub` matches user's job description to the information collected from the Grid, and the optimal site is being selected for job submission. The job description is then being forwarded to that site, in order to be submitted to the Local Resource Management System (LRMS), which can be, e.g., PBS or Condor or SGE etc.

arbsub [options]

(ARC 0.9)

Options:

<code>-c, --cluster</code>	<code>[-] url</code>	explicitly select or reject a specific site (cluster)
<code>-i, --indexurl</code>	<code>url</code>	URL of an index server
<code>-e, --jobdescrstring</code>	<code>filename</code>	string describing the job to be submitted
<code>-f, --jobdescrfile</code>	<code>filename</code>	file describing the job to be submitted
<code>-j, --joblist</code>	<code>filename</code>	file where the job IDs will be stored
<code>-D, --dryrun</code>		add dryrun option to the job description
<code>-x, --dumpdescription</code>		do not submit – dump transformed job description to stdout
<code>-t, --timeout</code>	<code>time</code>	timeout for queries in seconds (default 20)
<code>-d, --debug</code>	<code>debuglevel</code>	debug level, FATAL, ERROR, WARNING, INFO, DEBUG or VERBOSE - default WARNING
<code>-U, --unknownattr</code>		allow unknown attributes in the job description
<code>-v, --version</code>		print version information
<code>-?, --help</code>		print help page

The `-c` and `-i` arguments accept “urls” of the format GRID:URL,
 e.g. for index servers:
 ARC0:ldap://grid.tsl.uu.se:2135/mds-vo-name=sweden,O=grid
 CREAM:ldap://cream.grid.upjs.sk:2170/o=grid
 or clusters:
 ARC0:ldap://grid.tsl.uu.se:2135/nordugrid-cluster-name=grid.tsl.uu.se,Mds-Vo-name=local,o=grid

As a shorthand `-f` can be omitted if the job description file is put last on the commandline.

A simple “Hello World” job could look like:

arcsub -c ARC0:ldap://grid.tsl.uu.se:2135/nordugrid-cluster-name=grid.tsl.uu.se,Mds-Vo-name=local,o=grid -f job.jsdl

Assuming that the url represents an ARC0 cluster that the user is authorized to submit to and job.jsdl is the file below.

```
<?xml version="1.0" encoding="UTF-8"?>
<JobDefinition
  xmlns="http://schemas.ggf.org/jsdl/2005/11/jsdl"
  xmlns:posix="http://schemas.ggf.org/jsdl/2005/11/jsdl-posix">
  <JobDescription>
    <JobIdentification>
      <JobName>Hello World job</JobName>
    </JobIdentification>
    <Application>
      <posix:POSIXApplication>
        <posix:Executable>bin/echo</posix:Executable>
        <posix:Argument>'Hello World'</posix:Argument>
        <posix:Output>out.txt</posix:Output>
        <posix:Error>err.txt</posix:Error>
      </posix:POSIXApplication>
    </Application>
    <DataStaging>
      <FileName>out.txt</FileName>
      <CreationFlag>overwrite</CreationFlag>
      <DeleteOnTermination>>false</DeleteOnTermination>
    </DataStaging>
    <DataStaging>
      <FileName>err.txt</FileName>
      <CreationFlag>overwrite</CreationFlag>
      <DeleteOnTermination>>false</DeleteOnTermination>
    </DataStaging>
  </JobDescription>
</JobDefinition>
```

2.1.2 arcstat

arcstat [options] [job ...]

(ARC 0.9)

Options:

-a, --all		all jobs
-i, --joblist	<i>filename</i>	file containing a list of jobIDs
-c, --cluster		show information about a site (cluster)
-s, --status	<i>statusstr</i>	only select jobs whose status is <i>statusstr</i>
-i, --indexurl	<i>url</i>	URL of an index service
-q, --queues		show information about clusters and queues
-l, --long		long format (extended information)
-t, --timeout	<i>time</i>	timeout for queries (default 20 sec)
-d, --debug	<i>debuglevel</i>	debug level is one of FATAL, ERROR, WARNING, INFO, DEBUG or VERBOSE
-v, --version		print version information
-h, --help		print help page
Arguments:		
job ...		list of job IDs and/or jobnames

The `arcstat` command returns the status of jobs submitted to the Grid. Then `-c` and `-i` accept arguments in the GRID:URL notation explained in the description of `arcsub`.

Different sites may report slightly different job states, depending on the installed software version.

2.1.3 arccat

It is often useful to monitor the job progress by checking what it prints on the standard output or error. The command `arccat` assists here, extracting the corresponding information from the execution cluster and pasting it on the user's screen. It works both for running tasks and for the finished ones. This allows a user to check the output of the finished task without actually retrieving it.

arccat [options] [job ...]

(ARC 0.9)

Options:		
-a, --all		all jobs
-i, --joblist	<i>filename</i>	file containing a list of job IDs
-c, --cluster		show information about clusters
-s, --status	<i>statusstr</i>	only select jobs whose status is <i>statusstr</i>
-o, --stdout		show the stdout of the job (default)
-e, --stderr		show the stderr of the job
-l, --gmlog		show the grid manager's error log of the job
-t, --timeout	<i>time</i>	timeout for queries (default 20 sec)
-d, --debug	<i>debuglevel</i>	debug level is one of FATAL, ERROR, WARNING, INFO, DEBUG or VERBOSE
-v, --version		print version information
-h, --help		print help page
Arguments:		
job ...		list of job IDs and/or jobnames

The `arccat` command can return the standard output of a job (`-o` option), the standard error (`-e` option)

and the errors reported by the Grid Manager (-l option).



2.1.4 arcget

To retrieve the results of a finished job, the **arcget** command should be used. It will download the files specified by the **outputfiles** attribute of job description to the user's computer.

arcget [options] [job ...]

(ARC 0.9)

Options:

-a, --all		all jobs
-i, --joblist	<i>filename</i>	file containing a list of jobIDs
-c, --cluster	<i>[-]textemname</i>	explicitly select or reject a specific site (cluster)
-s, --status	<i>statusstr</i>	only select jobs whose status is <i>statusstr</i>
-D, --dir	<i>dirname</i>	download directory (the job directory will be created in this directory)
-k, --keep		keep files on gatekeeper (do not clean)
-t, --timeout	<i>time</i>	timeout for queries (default 20 sec)
-d, --debug	<i>debuglevel</i>	debug level is one of FATAL, ERROR, WARNING, INFO, DEBUG or VERBOSE
-v, --version		print version information
-h, --help		print help page

Arguments:

job ...	list of job IDs and/or jobnames
---------	---------------------------------

Only the results of jobs that have finished can be downloaded. The job can be referred to either by the **jobID** that was returned by **arcsub** at submission time, or by its name, if the job description contained a job name attribute.

2.1.5 arckill

It happens that a user may wish to cancel a job. This is done by using the **arckill** command. A job can be killed almost on any stage of processing through the Grid.

arckill [options] [job ...]

(ARC 0.9)

Options:

-a, --all		all jobs
-j, --joblist	<i>filename</i>	file containing a list of jobIDs
-c, --cluster		show information about clusters
-s, --status	<i>statusstr</i>	only select jobs whose status is <i>statusstr</i>
-k, --keep		keep files on gatekeeper (do not clean)

<code>-t, --timeout</code>	<i>time</i>	timeout for queries (default 20 sec)
<code>-d, --debug</code>	<i>debuglevel</i>	debug level is one of FATAL, ERROR, WARNING, INFO, DEBUG or VERBOSE
<code>-v, --version</code>		print version information
<code>-h, --help</code>		print help page
Arguments:		
<code>job ...</code>		list of job IDs and/or jobnames

Job cancellation is an asynchronous process, such that it may take a few minutes before the job is actually cancelled.

2.1.6 arcclean

If a job fails, or you are not willing to retrieve the results for some reasons, a good practice for users is not to wait for the Grid Manager to clean up the job leftovers, but to use **arcclean** to release the disk space and to remove the job ID from the list of submitted jobs and from the Information System.

arcclean [options] [job ...]

(ARC 0.9)

Options:

<code>-a, --all</code>		all jobs
<code>-j, --joblist</code>	<i>filename</i>	file containing a list of jobIDs
<code>-c, --cluster</code>	<code>[-]</code> <i>textemname</i>	explicitly select or reject a specific site (cluster)
<code>-s, --status</code>	<i>statusstr</i>	only select jobs whose status is <i>statusstr</i>
<code>-f, --force</code>		removes the job ID from the local list even if the job is not found on the Grid
<code>-t, --timeout</code>	<i>time</i>	timeout for queries (default 20 sec)
<code>-d, --debug</code>	<i>debuglevel</i>	debug level is one of FATAL, ERROR, WARNING, INFO, DEBUG or VERBOSE
<code>-v, --version</code>		print version information
<code>-h, --help</code>		print help page

Arguments:

<code>job ...</code>	list of job IDs and/or jobnames
----------------------	---------------------------------

Only jobs that have finished can be cleaned.

2.2 Data manipulation

ARC provides basic data management tools, which are simple commands for file copy and removal, with eventual use of data indexing services.

2.2.1 arcls

The **arcls** is a simple utility that allows to list contents and view some attributes of objects of a specified (by an URL) remote directory.

```
arcls [options] <URL>
```

(ARC 0.9)

Options:

-h		short help
-v		print version information
-d	<i>debuglevel</i>	debug level is one of FATAL, ERROR, WARNING, INFO, DEBUG or VERBOSE
-l		detailed listing
-L		detailed listing including URLs from which file can be downloaded and temporary cached locations
-m		display all available metadata

Arguments:

URL	file or directory URL
-----	-----------------------

This tool is very convenient not only because it allows to list files at a Storage Element or records in an indexing service, but also because it can give a quick overview of a job's working directory, which is explicitly given by job ID.

Usage examples can be as follows:

```
arcls rls://rc.host:38203/logical_file_name
arcls -l gsiftp://lscf.nbi.dk:2811/jobs/1323842831451666535
arcls -L srm://grid.uio.no:58000/srm/managerv1/johndoe/log2
```

Examples of URLs accepted by this tool can be found in Section 3, though **arcls** won't be able to list a directory at an HTTP server, as they normally do not return directory listings.

2.2.2 arccp

The **arccp** is a powerful tool to copy files over the Grid. It is a part of the A-REX, but can be used by the User Interface as well.

```
arccp [options] <source> <destination>
```

(ARC 0.9)

Options:

-h		short help
-v		print version information
-d	<i>debuglevel</i>	debug level is one of FATAL, ERROR, WARNING, INFO, DEBUG or VERBOSE
-y	<i>cache_path</i>	path to local cache (use to put file into cache)
-p		use passive transfer (does not work if secure is on, default if secure is not requested)
-n		do not try to force passive transfer
-i		show progress indicator
-u		use secure transfer (insecure by default)

-r	<i>recursion_level</i>	operate recursively (if possible) up to specified level (0 - no recursion)
-R	<i>number</i>	how many times to retry transfer of every file before failing
-t	<i>time</i>	timeout in seconds (default 20)
-f		if the destination is an indexing service and not the same as the source and the destination is already registered, then the copy is normally not done. However, if this option is specified the source is assumed to be a replica of the destination created in an uncontrolled way and the copy is done like in case of replication
-T		do not transfer file, just register it - destination must be non-existing meta-url

Arguments:

source	source URL
destination	destination URL

This command transfers contents of a file between 2 end-points. End-points are represented by URLs or meta-URLs. For supported endpoints please refer to Section 3.

arccp can perform multi-stream transfers if **threads** URL option is specified and server supports it.

Source URL can end with "/". In that case, the whole fileset (directory) will be copied. Also, if the destination ends with "/", it is extended with part of source URL after last "/", thus allowing users to skip the destination file or directory name if it is meant to be identical to the source.

Usage examples of **arccp** are:

```
arccp gsiftp://lscf.nbi.dk:2811/jobs/1323842831451666535/job.out \
      file:///home/myname/job2.out
arccp gsiftp://aftpexp.bnl.gov;threads=10/rep/my.file \
      rc://;threads=4@grid.uio.no/lc=Collection,rc=Catalog/zebra4.f
arccp http://www.nordugrid.org/data/somefile gsiftp://hathi.hep.lu.se/data/
```

2.2.3 arcrm

The **arcrm** command allows users to erase files at any location specified by a valid URL.

arcrm [options] <source>

(ARC 0.9)

Options:

-h		short help
-v		print version information
-d	<i>debuglevel</i>	debug level is one of FATAL, ERROR, WARNING, INFO, DEBUG or VERBOSE
-c		continue with meta-data even if it failed to delete real file

Arguments:

source	source URL
---------------	------------

A convenient use for `arcrm` is to erase the files in a data indexing catalog (RC, RLS or such), as it will not only remove the physical instance, but also will clean up the database record.

Here is an `arcrm` example:

```
arcrm rc://grid.uio.no/lc=Collection,rc=Catalog/badfile
```

2.2.4 arcac1

This command retrieves or modifies access control information associated with a stored object if service supports GridSite GACL language [4] for access control.

arcac1 [options] get|put <URL>

(ARC 0.9)

Options:

<code>-d, -debug</code>	<i>debuglevel</i>	debug level is one of FATAL, ERROR, WARNING, INFO, DEBUG or VERBOSE
<code>-v</code>		print version information
<code>-h</code>		short help

Arguments:

<code>get</code>	<i>URL</i>	get Grid ACL for the object
<code>put</code>	<i>URL</i>	set Grid ACL for the object
<i>URL</i>		object URL; curently only gsiftp and sse URLs are supported

ACL document (an XML file) is printed to standard output when `get` is requested, and is acquired from standard input when `set` is specified*. Usage examples are:

```
arcac1 get gsiftp://se1.ndgf.csc.fi/ndgf/tutorial/dirname/filename
arcac1 set gsiftp://se1.ndgf.csc.fi/ndgf/tutorial/dirname/filename $<$ myacl
```

2.2.5 arctransfer

The `arctransfer` This command is not implemented.

*In ARC $\leq 0.5.28$, `set` should be used instead of `put`

Chapter 3

URLs

File locations in ARC can be specified both as local file names, and as Internet standard *Uniform Resource Locators (URL)*. There are also some additional URL *options* that can be used.

The following transfer protocols and metadata servers are supported:

ftp	ordinary <i>File Transfer Protocol (FTP)</i>
gsiftp	GridFTP, the Globus [®] -enhanced FTP protocol with security, encryption, etc. developed by The Globus Alliance [5]
http	ordinary <i>Hyper-Text Transfer Protocol (HTTP)</i> with PUT and GET methods using multiple streams
https	HTTP with SSL v3
httpg	HTTP with Globus [®] GSI
ldap	ordinary <i>Lightweight Data Access Protocol (LDAP)</i> [6]
rls	Globus [®] <i>Replica Location Service (RLS)</i> [7]
lfc	LFC catalog and indexing service of EGEE gLite [8]
srm	Storage Resource Manager (SRM) service [9]
file	local to the host file name with a full path

An URL can be used in a standard form, i.e.

```
protocol://[host[:port]]/file
```

Or, to enhance the performance, it can have additional options:

```
protocol://[host[:port]][:option[:option[...]]]/file
```

For a metadata service URL, construction is the following:

```
protocol://[url[|url[...]]@host[:port]][:option[:option[...]]/  
lfn[:metadataoption[:metadataoption[...]]]
```

For the SRM service, the syntax is

```
srm://host[:port]][:options]/[service_path?SFN=]file
```

Versions 1.1 and 2.2 of the SRM protocol are supported. The default *service_path* is srm/managerv2 when the server supports v2.2, srm/managerv1 otherwise.

The URL components are:

<code>host[:port]</code>	Hostname or IP address [and port] of a server
<code>lfn</code>	Logical File Name
<code>url</code>	URL of the file as registered in indexing service
<code>service_path</code>	End-point path of the web service
<code>file</code>	File name with full path
<code>option</code>	URL option
<code>metadataoption</code>	Metadata option for indexing service

The following options are supported for location URLs:

<code>threads=<number></code>	specifies number of parallel streams to be used by GridFTP or HTTP(s,g); default value is 1, maximal value is 10
<code>cache=yes no renew copy</code>	indicates whether the GM should cache the file; default for input files is yes . renew forces a download of the file, even if the cached copy is still valid. copy forces the cached file to be copied (rather than linked) to the session dir, this is useful if for example the file is to be modified.
<code>readonly=yes no</code>	for transfers to file:// destinations, specifies whether the file should be read-only (unmodifiable) or not; default is yes
<code>secure=yes no</code>	indicates whether the GridFTP data channel should be encrypted; default is no
<code>blocksize=<number></code>	specifies size of chunks/blocks/buffers used in GridFTP or HTTP(s,g) transactions; default is protocol dependent
<code>checksum=cksum md5 adler32 no</code>	specifies the algorithm for checksum to be computed (for transfer verification or provided to the indexing server). This is overridden by any metadata options specified (see below). If this option is not provided, the default for the protocol is used. checksum=no disables checksum calculation.
<code>exec=yes no</code>	means the file should be treated as executable
<code>preserve=yes no</code>	specify if file must be uploaded to this destination even if job processing failed (default is no)
<code>guid=yes no</code>	make software use GUIDs instead of LFNs while communicating to indexing services; meaningful for rls:// only
<code>overwrite=yes no</code>	make software try to overwrite existing file(s), i.e. before writing to destination, tools will try to remove any information/content associated with specified URL
<code>protocol=gsi gssapi</code>	to distinguish between two kinds of httpg . gssapi stands for implementation using only GSSAPI functions to wrap data and gsi uses additional headers as implemented in Globus IO
<code>spacetoken=<pattern></code>	specify the space token to be used for uploads to SRM storage elements supporting SRM version 2.2 or higher
<code>autodir=yes no</code>	specify if before writing to specified location software should try to create all directories mentioned in specified URL. Currently this applies to FTP and GridFTP only. Default for those protocols is yes
<code>tcpnodelay=yes no</code>	controls the use of the TCP_NODELAY socket option (which disables the Nagle algorithm). Applies to http(s) only. Default is no

Local files are referred to by specifying either a location relative to the job submission working directory, or by an absolute path (the one that starts with **"/**"), preceded with a **file://** prefix.

Metadata service URLs also support metadata options which can be used for register additional metadata

attributes or query the service using metadata attributes. These options are specified at the end of the LFN and consist of name and value pairs separated by colons. The following attributes are supported:

guid	GUID of the file in the metadata service
checksumtype	Type of checksum. Supported values are cksum (default), md5 and Adler32
checksumvalue	The checksum of the file

Currently these metadata options are only supported for lfc:// URLs.

Examples of URLs are:

```
http://grid.domain.org/dir/script.sh
gsiftp://grid.domain.org:2811;threads=10;secure=yes/dir/input_12378.dat
ldap://grid.domain.org:389/lc=collection1,rc=Nordugrid,dc=nordugrid,dc=org
rls://gsiftp://se.domain.org/datapath/file25.dat@grid.domain.org:61238/myfile02.dat1
file:///home/ausser/griddir/steer.cra
lfc://srm://srm.domain.org/griddir@lfc.domain.org/user/file1:guid=\
    bc68cdd0-bf94-41ce-ab5a-06a1512764dc:checksumtype=adler32:checksumvalue=123456782
lfc://lfc.domain.org;cache=no/:guid=bc68cdd0-bf94-41ce-ab5a-06a1512764d3
```

¹This is a destination URL. The file will be copied to the GridFTP server at `se.domain.org` with the path `datapath/file25.dat` and registered in the RLS indexing service at `grid.domain.org` with the LFN `myfile02.dat`.

²This is a destination URL. The file will be copied to `srm.domain.org` at the path `griddir/file1` and registered to the LFC service at `lfc.domain.org` with the LFN `/user/file1`. The given GUID and checksum attributes will be registered.

³This is a source URL. The file is registered in the LFC service at `lfc.domain.org` with the given GUID and can be copied or queried by this URL.

Chapter 4

ARC Client Configuration

Default behaviour of an ARC client can be configured by specifying alternative values for some parameters in the client configuration file. The file is called `client.conf` and is located in directory `.arc` in user's home area:

```
$HOME/.arc/client.conf
```

If this file is not present or does not contain the relevant configuration information, the global configuration files (if exist) or default values are used instead. Some client tools may be able to create the default `$HOME/.arc/client.conf`, if it does not exist.

The ARC configuration file consists of several configuration blocks. Each configuration block is identified by a keyword and contains configuration options for a specific part of the ARC middleware.

The configuration file is written in a plain text format known as INI. Configuration blocks start with identifying keywords inside square brackets. Typically, first comes a common block: `[common]`. Thereafter follows one or more attribute-value pairs written one on each line in the following format:

```
[common]
attribute1=value1
attribute2=value2
attribute3=value3 value4
# comment line 1
# comment line 2
attribute2=value5
...
```

The following blocks and respective attributes are recognized.

4.1 Block common

defaultservices

This attribute is multi-valued.

This attribute is used to specify default services to be used. Defining such in the user configuration file 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.

Example:

- plain text:

```
defaultservices=index:ARC0:ldap://index1.nordugrid.org:2135/Mds-Vo-name=NorduGrid,o=grid index
```

4.2 Deprecated configuration files

ARC configuration file in releases 0.6 and 0.8 has the same name and the same format; attributes unknown to newer ARC versions are ignored.

In $\text{ARC} \leq 0.5.48$, configuration was done via files `$HOME/.ngrc`, `$HOME/.nggiislist` and `$HOME/.ngalias`.

The main configuration file `$HOME/.ngrc` could contain user's default settings for the debug level, the information system query timeout and the download directory used by `ngget`. A sample file could be the following:

```
# Sample .ngrc file
# Comments starts with #
NGDEBUG=1
NGTIMEOUT=60
NGDOWNLOAD=/tmp
```

If the environment variables `NGDEBUG`, `NGTIMEOUT` or `NGDOWNLOAD` were defined, these took precedence over the values defined in this configuration. Any command line options override the defaults.

The file `$HOME/.nggiislist` was used to keep the list of default GIIS server URLs, one line per GIIS (see `giis` attribute description above).

The file `$HOME/.ngalias` was used to keep the list of site aliases, one line per alias (see `alias` attribute description above).

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