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Integration of user tools with DESHL v4.0

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1 Introduction

1.1 Executive Summary

This document, "Integration of user tools with DESHL v4.0", is deliverable D-JRA7-4.3 from Task T4.4 "Tool integration with DESHL v4.0" in Work Package 4 of DEISA JRA7 [1]. The document reports on a beta release of version 4.1 of the DESHL. At the time of writing only a beta release is being made available since further systems testing is required before a stable release can be made.

JRA7 task T4.4 tested DESHL v4.0 against the DEISA production infrastructure, updated and delivered DESHL training material, determined how to add secure keystore password storage to the DESHL and investigated speeding up file transfer from a user's workstation or PC by means of integrating the DESHL with GridFTP. In addition, a SAGA Sessions-based API has been built to allow easier integration of the DESHL with the DEISA eSA3 Life Sciences portal. Further user-requested improvements to the DESHL have also been made. All this has resulted in the preparation of the DESHL v4.1 release.

1.2 Document Structure

Section 1 of this document contains the executive summary, references, table of acronyms, etc. while section 2 provides brief background information on the DESHL. Section 3 describes the scope of DEISA JRA7 Task T4.4 and indicates where the DESHL software can be obtained from. Section 4 highlights the major changes since v4.0. Section 5 itemises the issues that have been fixed since v4.0. Finally section 6 lists the known issues with DESHL v.4.1 at the time of writing.

1.3 References and Applicable Documents

- [1] DEISA Annex I – "Description of Work", November 5th 2003.
- [2] "JRA7 Quality Plan v3.0", DEISA JRA7 Report, Deliverable ID DEISA-JRA7-1.3, May 2006.
- [3] UNICORE, <http://unicore.sourceforge.net>.
- [4] Open Grid Forum (OGF) Simple API for Grid Applications Core Working Group (SAGA-CORE-WG), http://www.ogf.org/gf/group_info/view.php?group=saga-core-wg
- [5] Open Grid Forum (OGF) Simple API for Grid Applications Research Group (SAGA-RG), http://www.ogf.org/gf/group_info/view.php?group=saga-rg
- [6] ARCON Client Library, http://sourceforge.net/project/showfiles.php?group_id=102081&package_id=127938
- [7] DEISA JRA7 development web site, <http://forge.nesc.ac.uk/projects/deisa-jra7/>
- [8] "Installation and User Manual for DESHL 4.1" (This document is not a DEISA EU deliverable but is available under Docs at [7]. The DESHL v4.1 software release can also be downloaded from [7].)

- [9] "Final design for DESHL v4.1" (This document is not a DEISA EU deliverable but is available under Docs at [7]. The DESHL v4.1 software release can also be downloaded from [7].)
- [10] GridFTP, http://www.globus.org/grid_software/data/gridftp.php
- [11] NICE EnginFrame, <http://www.nice-italy.com/main/index.php?id=141>
- [12] "Final Design for DESHL v2.0", DEISA JRA7 Report, Deliverable ID D-JRA7-3.7, November 2005.
- [13] "Functional scope for DESHL v4.0", DEISA JRA7 Public Report, Deliverable ID DEISA-JRA7-3.11, July 28th 2006.
- [14] "Functional scope for DESHL v3.0", DEISA JRA7 Public Report, Deliverable ID DEISA-JRA7-3.9, December 22nd 2005.
- [15] "DESHL v4.0", DEISA JRA7 Public Report, Deliverable ID DEISA-JRA7-3.12, November 14th 2006.

1.4 Document Amendment Procedure

The document procedure is covered in the JRA7 Quality Plan [2].

1.5 List of Acronyms and Abbreviations

AJO	Abstract Job Object
API	Application Programming Interface
CA	Certification Authority
CLT	Command Line Tool
DEISA	Distributed European Infrastructure for Supercomputing Applications
DESHL	DEISA Services for the Heterogeneous management Layer
eDEISA	The EU-funded DEISA extension
eSA3	The eDEISA 3 rd Service Activity –Extended Resource Management
FZJ	Forschungszentrum Juelich
GPFS	Global Parallel File System
GUI	Graphical User Interface
HPC	High Performance Computing
JRA	DEISA Joint Research Activity
JRA7	DEISA Seventh Joint Research Activity
NJS	Network Job Supervisor
OGF	Open Grid Forum
PC	Personal Computer
SA3	DEISA 3 rd Service Activity – Resource Management
SA4	DEISA 4 th Service Activity – User Support
SAGA	Simple API for Grid Applications

SAGA-CORE-WG	Open Grid Forum SAGA Core API Working Group
SAGA-RG	Open Grid Forum SAGA Research Group
SSL	Secure Socket Layer
TSI	Target System Interface
UNICORE	Uniform Interface to Computing Resources
URI	Uniform Resource Identifier

2 Background

The DESHL (**DEISA Services for the Heterogeneous management Layer**) has been developed by the DEISA Joint Research Activity JRA7 [1]. It provides standards-based access for users and their applications to manage jobs and transfer files in the DEISA heterogeneous supercomputing infrastructure. In the extended heterogeneous DEISA infrastructure, sites have different HPC resources but all sites provide access to those resources via UNICORE [3].

DESHL release v4.1 contains the DESHL client, implemented as a layered stack with a SAGA-inspired API ([4], [5]) at the top and the UNICORE ARCON client [6] at its base. The DESHL client can be used for data staging operations to, from and within the DEISA environment, and to submit, monitor and terminate jobs running on DEISA resources. Issuing a certificate for access to a DEISA site is the task of the certificate authority associated with the user's national location. These certificates are then held locally, and the DESHL client is configured via a single configuration file to allow seamless access to all such configured sites.

The DESHL v4.1 release and its supporting documentation are publicly available and can be downloaded from the DEISA JRA7 development site at [7]. The supporting documentation includes this document as well as the Installation/User Manual [8] and the design document [9].

3 Scope of DEISA JRA7 Task T4.4

The scope for JRA7 Task 4.4 'Integration of user tools with DESHL v4.0' was agreed after consultation with from DEISA SA3, SA4, eDEISA eSA3 and following feedback from DESHL users in particular from DEISA training events.

The task scope included production testing of DESHL v4.0 against the DEISA infrastructure, production and delivery of DESHL training material, the addition of secure keystore password storage, an investigation into faster file transfer from a local workstation or PC onto the DEISA infrastructure through integration of the DESHL with GridFTP[10], standards monitoring and participation, the addition of a SAGA Sessions-based API for easier integration of the DESHL with the eSA3 Life Sciences portal, improved DESHL exception handling and execute permissions set automatically on transfer of a file using the DESHL.

The DEISA eSA3 task is developing a Life Sciences portal using the NICE portal framework, EnginFrame [11]. As part of this, eSA3 has developed a prototype version of this portal that uses the DESHL to access the DEISA UNICORE infrastructure. The addition of the SAGA Sessions interface to the DESHL allowed easier integration of the NICE portal framework with the DEISA UNICORE infrastructure.

Tackling Task T4.4 has resulted in a new release of DESHL that is named v4.1. The major changes and additions in DESHL v4.1 are listed in section 4 of this document, with section 5 listing the feature requests and bugs addressed in the release.

For this new release the DESHL design document [9] has been updated to include descriptions of the newly added features, that is, the secure keystore password storage, the integration with GridFTP, the integration with the latest version of the roctopus Grid Access Library and its improved exception handling. This updated design document is included in the v4.1 release bundle. The original DESHL v2.0 design is presented in DEISA JRA7 deliverable "Final Design for DESHL v2.0" [6].

The DESHL javadoc has also been updated for these new additions, with the DESHL SAGA interface as far as possible now compliant with SAGA Core v1.0 and including the SAGA Sessions API. The DESHL Installation/User manual [8] has been similarly updated to explain how to use the new functionality available.

At the time of writing a beta release of DESHL v4.1 is publically available from the DEISA JRA7 NeSCForge development site at [7]. The release is contained in an executable jar that can be run as a GUI installer or from the command line. It can be found under the DEISA JRA7 'Files' tab. The instructions for running the installer can be found at the same site. The Installation/User manual [8] can be found under the 'Docs' tab.

4 Major Changes in v4.1

This section describes the major changes in DESHL v4.1.

4.1 Secure keystore password storage

The most notable of the outstanding DESHL issues has been the secure storage of a user's keystore password. (See Feature Request 149 on the DEISA JRA7 issue tracker at [7] and Key Objective 3 in [13].) In previous releases a DESHL user has had to type the password for their keystore every time they issued a DESHL command. If a user did not wish to do this every time they invoked a DESHL command then the password had to be stored unencrypted in a DESHL configuration file. This was not secure. In DESHL v4.1 this mechanism has therefore been replaced.

The DESHL client has itself now been separated into a client and a persistent server to enable the password for a user's keystore to be stored more securely. This server reads the passwords from masked standard input and stores the passwords in memory for the duration of a DESHL session. Such a session lasts until the user explicitly terminates the server. This facility means that a user no longer needs to type their keystore password every time a DESHL command is invoked.

4.2 Exception handling

The October 2006 DESHL v4.0 release did not include the latest version of the Roctopus library. The latest version of Roctopus has improved exception handling and so this has been integrated to help further improve exception handling. (See Bug 376 in the issue tracker at [7].)

4.3 Faster file transfer

It is known that the speed of file transfers between a user's local workstation and the DEISA UNICORE infrastructure using the DESHL is restricted. In DEISA JRA7 Task T4.4 an investigation took place to understand if the DESHL can use GridFTP [10] to improve these transfer times. The concern here has been whether this use case fits

with the DEISA infrastructures intended use of GridFTP. This issue is further described in the non-functional requirement NR-4 in [14], where it explains that the DESHL relies on the UNICORE ARCON client library to transfer files to and from a user's local work workstation and the DEISA UNICORE infrastructure. Unfortunately, this ARCON library cannot take advantage of faster underlying transfer mechanisms such as GridFTP. This topic is also described in Feature Request 155 in the DEISA JRA7 issue tracker at [7].

To remedy this DESHL v4.1 now provides a GridFTP based file transfer in order to provide a faster file transfer from the user's workstation to the DEISA network. This is currently provided as a standalone command to gauge its usefulness – in future it may be integrated behind the scenes in deshl copy.

4.4 Execute permissions

In previous versions of the DESHL when files were transferred, a file's execute permissions were not preserved. This is recorded as Bug 178 in the DEISA JRA7 Issue Tracker at [7]. A work-around has been put in place whereby the user documentation explains how to run a chmod script via the DESHL after such a transfer. This chmod script changes the execute permissions. However as noted in Bug 390 in the DEISA JRA7 Issue Tracker at [7], users are still not happy with this.

In DESHL v4.1, therefore, any file copied with the DESHL automatically has the user execute permissions set. A user can still run a subsequent chmod job via the DESHL to further modify the permissions associated with a file.

4.5 Scripting improvements

User training sessions have highlighted that, for many, the real value of the DESHL is the ability of a user to interact with the DEISA infrastructure through the use of simple scripts such as bash scripts. JRA2 have already used this mechanism to run jobs at DEISA sites and retrieve results. Unfortunately, there is currently very little documentation on how to exploit the DESHL in this fashion.

The Installation/User Manual [8] for DESHL v4.1 and the DESHL material for the DEISA User training sessions have been modified to partially address this issue. Further work, however, is still required.

4.6 SAGA Standards compliance

The handling of security context in the DESHL needed to be updated to comply with the Sessions part of the OGF SAGA Core API [4]. Moreover the existing parts of the DESHL Client library that are based on the SAGA Core API were reviewed for compliance with the recently available Version 1 of the SAGA Core API. Where appropriate the relevant parts of the DESHL Client Library have been updated to comply with Version 1 of the SAGA Core API.

5 Fixed Issues

The following issues from the DEISA JRA7 project [7] tracker have been fixed in DESHL v4.1 since the v4.0 release report [15].

5.1 Feature requests provided in v4.1

These are the feature requests that have been integrated into the v4.1 release.

149 Unencrypted passwords in the DESHL client configuration file

This release separates DESHL into a client and server with the server reading the passwords from masked standard input and storing the passwords in memory. It is still possible for the user to store their password in the config file.

155 Data staging from local workstation to the DEISA Unicore/GPFS

A basic GridFTP based command has been added to DESHL. Allows files to be uploaded and downloaded to and from the DEISA GPFS using GridFTP.

172 Typing password each time a DESHL command is executed is inconvenient

The passwords only have to be typed in the first time the server starts.

220 Quickstart documentation

The DESHL now has a GUI installer and the user manual [8] has been improved.

373 Use of shortcuts in output

The use of shortcuts in job submission and management has been included in this release.

397 Update SAGA Host List of example scripts during installation

The full SSL URI is substituted into the example scripts.

434 Get AJO logging via the DESHL

When a job is cleaned up the AJO log is added to the DESHL log.

459 Adding password to configuration file

To use the DESHL without having to type a password at each command invocation, a password no longer needs to be added to the configuration file.

472 Installation - src unchecked

Only the required DESHL component and the Docs are now checked.

477 Overwriting of log file

With the new client/server mode the log will persist for the life of the server.

483 A little more explanation to enter the SSL URI would be helpful

The installer has been modified to help with this.

522 NeSCForge public DEISA JRA7 web page to point to the FZJ training slide pack Oct 06

Now points to the latest March 2007 training slide pack.

523 Update http://forge.nesc.ac.uk/docman/?group_id=32 to point to the FZJ training Oct 06

Now points to the latest March 2007 training slide pack.

525 Certificates section in the primer is too much information

The certificates section of the DESHL v4.1 Installation/User manual [8] has been reduced and further information added to its appendix.

5.2 Bugs fixed in 4.1

These are the bugs that have been fixed for the v4.1 release.

174 Copy with option 3(recursive) does not create subdirectories

This has been fixed. Only when sub-directories are empty will the recursive copy from the local file space to the remote site not create these empty sub-directories.

178 Copying an executable does not preserve execute permissions

The Roctopus API now provides a method for setting the execute permissions on remote files. For this release all files copied or moved singly to the remote file space have the execute permission set. Recursive copy or move does not recursively set the execute permission.

262 Client hangs

Fixed.

265 User Manual - File Space

The documentation [8] has been improved and the readability of options fixed as Feature Request 368 in v4.0

376 Improvements to Roctopus error reporting

Latest Roctopus libraries are included in v4.1

378 Specifying invalid site to list command gives unhelpful error message

This is improved in this release. User is informed host/alias is not in configuration.

390 Copying an executable does not preserve execute permissions

All files copied or moved to the remote site have the execute permission automatically set.

441 Problem debugging jobs with no "Standard Output" and no "Standard error".

When a job is fetched the AJO logging is included in the DESHL log.

443 Documentation issues from Dietmar Erwin testing of DESHL v4.0

Installation/User manual [8] has been updated.

445 Error messages can be confusing

This has been improved.

450 Documentation: job submission issues

Installation/User manual [8] has been updated.

454 Submit long option not implemented?

This has been removed from the user documentation [8] since it is not implemented.

458 Long option not correctly implemented

This has been removed from the user documentation [8] since it is not implemented.

462 Blank lines in SAGA scripts

The addition of blank lines lets users make their scripts more readable.

464 exists: java.lang.NullPointerException

This no longer occurs.

473 isDir fails with missing /

Working.

474 isFile fails with missing /

Working.

496 GridFTP - third party library logging to standard out

This has been fixed.

552 File transfer into uspace seems to be failing

This has been resolved. For an explanation see Bug 560 below.

560 Staging into uspace fails

Both of these have been documented in the Installation/User manual [8] as an issue with Windows editors on PCs. Use of an editor (e.g. GNU Emacs) that can store files in a UNIX compatible format solves this bug.

6 Known Issues

At the time of writing, the following are outstanding bugs and Feature Requests. Please note that a number of the listed bugs are related to a current issue with accessing the DEISA_HOME and DEISA_DATA storages on the GPFS. It is hoped that it will be possible to close the related bugs once this problem is resolved. In addition a number of the user-prompted feature requests are concerned with variations on finding out the name of particular UNICORE vsite. This functionality is currently being investigated with a view to its inclusion in the DESHL in the very near future.

6.1 Feature Requests

148 JVM start-up overhead for each DESHL CLT command invocation

While the latest release separates the DESHL into a client and server, the client is still implemented in Java and requires a JVM start up for each command.

158 Directory Export

Export of directories from DESHL to local storage is not currently supported. However, export of individual files is supported.

183 How do I find out the name of a particular Unicore vsite?

This is currently not available through the DESHL. The user has to discover this themselves.

246 Alternative configuration via gateways.xml

This would allow the DESHL to pick up the Unicore client configuration, but doesn't include the Vsite information so would require a fix for 183.

247 Access via default home site

Allow the user to nominate a default site to be used if a site is not specified in a command.

263 Wildcards

Allow wildcards in file paths.

369 Provide a list of all DEISA gateways

It would be good to have a list of known gateways presented in the installer for the user to choose from.

370 Inclusion of the DESHL in the DEISA primer

In the coming 12 months from May 2007, the DESHL is expected to be included in the DEISA primer.

371 Existence of Config.csv file or problem with permissions

DESHL error reporting does not distinguish between the config.csv file being missing and the situation where this file has the wrong access permissions.

387 Consistency of references to file in JSDL files and SAGA scripts

File naming convention is different for job submission staging files and those used with data staging commands.

393 Use of DEISA HOME and DATA for core and non-core users

The DESHL documentation needs to be updated to explain the differences in the use of DEISA_HOME and DATA by core non-core DEISA users.

395 Get a list of all vsites connected to a single UNICORE gateway

It would be useful if the DESHL could list all the vsites connected to a single UNICORE gateway.

435 Data staging sanity check

In the JSDL input facility it would be useful if a check could be made on the names of the files to be staged to ensure they exist before the operation is activated.

442 Is it possible to obtain the NJS names of the Deisa sites?

See Bug 395

449 Is it really necessary that the command names (isDir, isFile, ...) are case sensitive.

Currently the DESHL commands are case sensitive. It would be useful if this were not the case.

452 Job submission function issues - more steps needed compared to UNICORE GUI

The UNICORE GUI does not require the user to go through as many stages when executing a job.

453 Job identifiers and scripting - should id be returned as a result and not printed?

On a successful job submission, the job identifier is printed to the console. To support scripting this should be returned as a result.

455 Status must return well defined return code

To support scripting Status must return a well-defined return code

456 Fetch improvements

A number of further options should be added to the Fetch command.

457 Jobs - how to tell which are submitted by DESHL

It is not possible to tell which jobs have been submitted by DESHL and which by the UNICORE GUI.

465 Difficulties diagnosing errors – storage

Sometimes it is easier to diagnose problems by looking at the UNICORE output.

466 Difficulties diagnosing errors - disk space

Sometimes it is easier to diagnose problems by looking at the UNICORE output.

467 Difficulties diagnosing errors - blank lines

Sometimes it is easier to diagnose problems by looking at the UNICORE output.

468 Difficulties diagnosing errors - site name

Sometimes it is easier to diagnose problems by looking at the UNICORE output.

471 Use of JRA7 in internal names

Should the term JRA7 be used in the DESHL internal names.

478 DESHL needs to be accessible from the DEISA web site at www.deisa.org

There are links from www.deisa.org to the DESHL development site but are these sufficient.

479 DESHL is not mentioned in the DEISA primer

In the coming 12 months from May 2007, the DESHL is expected to be included in the DEISA primer.

480 A statement on DESHL support is needed.

The DESHL documentation needs to state how user support can be obtained in the long term.

484 A config.csv which contains all possible resources via all DEISA gateways

Supplying this with the installation may be helpful for testing purposes.

524 Links to DESHL need to be made more prominent on www.deisa.org

The existing DESHL links are from the DEISA JRA7 pages and so are embedded quite far into the DEISA web site and hence are not very prominent.

526 DESHL for dummies

Some users have said that a very basic guide on the DESHL would be useful.

527 Job ids are too long.

Some users say that the unique job ids are too long even with short-cuts.

531 More readable job ids

Job reference strings should be something more readable like "hostname.user.id".

532 Debugging with DESHL is difficult

Advanced debugging when a job submission fails need to be done through Unicore.

544 SAGA now has a different take on job states

DESHL Job states need to be updated to comply with the latest SAGA definitions.

553 Test with DEISA Test User (DTU) accounts before training sessions

Access to these accounts prior to training sessions would be helpful.

6.2 Bugs**226 When copying to full disks, on error stray jobs left**

This needs to be fixed in Roctopus.

236 Can not recursively copy a directory from a DEISA machine to a local disk.

This appears to be an Arcon [6] issue and occurs with move as well, the command is currently disabled.

237 Can not overwrite a local file during an overwrite copy from a DEISA machine

DESHL should print an appropriate error message until this is fixed.

256 Installer Bugs

There are useability issues with certain window managers and JVM combinations. The installer can be used from the command line if necessary.

The 'Test Connection' button has been removed.

266 Move - Null Pointer Exception

Under certain conditions, probably related to DEISA_HOME move fails.

267 Remove fails

This is related to the ongoing issue with usage of DEISA_HOME.

271 Listing extended job stats causes stdout output

When this is requested, the stout and stderr for the jobs are erroneously retrieved to the outcome directory even though they were not requested.

359 Invalid SAGA job definition

It is possible for the user to create an invalid job definition by omitting required SAGA directives or giving bad values.

377 Directory copy between sites throws exception if no file present in directory

Directories cannot be copied between sites.

392 Queued executing sub jobs appear with GUI but not for main job

Once a job has been submitted from the DESHL it is not possible to distinguish if it is in a pending queue or if it is actually executing. This is an ARCON Client [6] issue and cannot be rectified.

394 Client hangs when TSI is unavailable

If the TSI at a remote site is unavailable then a command will hang until the remote TSI is restarted.

433 Copy on a remote site hangs

Copy with an NEC Unicore site hangs. This may be the DEISA_HOME issue again.

436 SAGA Hostlist needs full gateway address

The full gateway address must be included.

437 Local file copy between \$HOME and \$DEISA_HOME

The well-reported DEISA_HOME issue.

438 Job submission at SARA

This is related to interactions with the ssh plug-in. A restart rectified this.

439 File copies between SARA and CINECA

The well-reported DEISA_HOME issue.

440 Problem with relative/absolute path when submitting the chmod.sh job.

The well-reported DEISA_HOME issue.

444 On line help should match written documentation

The on-line help text should be identical to the written documentation.

- 446 Copy/Move fails when \$HOME and \$DEISA_HOME are the same**
The well-reported DEISA_HOME issue.
- 451 Job submission syntax issues**
Naming conventions, use #ROOT and capitalisation need to be consistent and clarified.
- 460 DEISA_HOME and DEISA_DATA storages are not usable with copy/remove**
The well-reported DEISA_HOME issue.
- 461 Intermittent problem with fork**
DESHL error logs reported that fork was unavailable. This appeared once for a user and they were unable to replicate it.
- 463 Wrong time with -f on status or jobs**
Occasionally the wrong time is displayed in job status.
- 469 Documentation Issues from Denis Girou**
Many of the issues have been dealt with in [8] but a number are still outstanding.
- 470 helloworld job**
The options for this example Fortran MPI are different on different platforms.
- 475 Move failure at CINECA**
The DEISA_HOME issue.
- 476 Remove failure at CINECA**
The DEISA_HOME issue.
- 492 Documentation - section 6.3 Copy in user/install for DESHL v4.0 says DESHL file system**
An update to [8] is needed.
- 493 GridFTP - Globus proxy created with loose permissions**
There is no way in Java to protect the Globus proxy with appropriate permissions.
- 494 GridFTP - Requires unlimited strength encryption**
Documentation needs to be clear about how to deal with this.
- 495 GridFTP - Requires naming convention for CA certificates.**
The Certification Authority certificates must be named using their hash for them to be acceptable to the Globus library.
- 497 GridFTP - Can suffer from clock skew**
If the clock on the user machine is faster than that of the GridFTP server then the user's proxy will get rejected.
- 498 GridFTP - Proxy generation configuration hard coded**
The configuration for generating a proxy is currently hard-coded in the DESHL.
- 499 GridFTP - only supports basic file transfer functionality**
The current DESHL gridftp only supports basic file transfer capabilities.

500 Keystore code duplicated

There is no duplicate code in the DESHL for dealing with keystores. This could be refactored.

508 Delay in job status being updated following terminate

Following a job termination, the job status can take some time to reflect this.

516 Documentation - chmod in the user manual

More explanation on using this command is needed.

530 Move treating a file as a directory and failing

This appears to working ok. Further investigation required.

543 GridFTP - must name upload file, can't just give parent directory.

A clearer description in the user documentation is needed.

551 SAGA Hostlist not getting read

This only occurs for some users. Submission with -q gets around this. It maybe related to Bug 436.

758 Submit long option not implemented?

Noted in documentation that long options do not work.

761 Token file needs to readable by user only

Its is theoretically possible, although difficult, for another user on a multiuser machine to do a 'man in the middle' attack on the server if the token and port number can be obtained.