



# EGEE-II

## AFS POOL ACCOUNT USERS

GSSKLOG AND LCMAPS EXTENSION TO SUPPORT AFS  
USERS AS EGEE POOL ACCOUNT USERS

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Abstract: This paper describes the extensions to the gssklog and lcmsaps packages that make possible the utilization of AFS users as LCMAPS/VOMS pool account users. This work has been performed in the framework of the integration of ENEA-GRID and EGEE infrastructure.

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## Table of contents

<b>1. INTRODUCTION.....</b>	<b>4</b>
1.1. PURPOSE .....	4
1.2. DOCUMENT ORGANISATION .....	4
1.3. ENEA-GRID AND EGEE .....	4
1.4. INTEGRATING ENEA-GRID AND EGEE.....	4
<b>2. LCAS/LCMAPS .....</b>	<b>6</b>
2.1. USER MAPPING AND POOL ACCOUNTS .....	6
2.2. LCMAPS AND AFS: A PATCH TO LCMAPS_AFS MODULE.....	7
2.3. AFS TOKEN DISCUSSION .....	8
<b>3. GSSKLOG .....</b>	<b>10</b>
3.1. STANDARD GLOBUS UTILIZATION.....	10
3.2. VOMS & LCMAPS CASE AND THE PATCH TO GSSKLOG .....	10
3.3. DETAILS IN PATCHED GSSKLOGD UTILIZATION .....	11
3.4. DETAILS IN THE PATCH IMPLEMENTATION .....	12
3.5. INTEGRATION INTO EGEE SITE .....	14
<b>4. CONCLUSION.....</b>	<b>15</b>
<b>5. REFERENCE/AMENDMENT/TERMINOLOGY .....</b>	<b>16</b>
5.1. REFERENCES .....	16
5.2. DOCUMENT AMENDMENT PROCEDURE.....	17

## TABLE OF TABLES

## 1. INTRODUCTION

### 1.1. PURPOSE

This paper describes how lcms and gssklog packages have been modified so that AFS users can be used as pool account users. This work has been done in the framework of ENEA participation into EGEE/EGEE II project, in order to implement the integration between ENEA-GRID and EGEE infrastructure.

### 1.2. DOCUMENT ORGANISATION

This paper consists of a short introduction describing the motivation of the development performed, followed by two sections dedicated respectively to lcms and gssklog, containing the description of how both packages have been modified.

### 1.3. ENEA-GRID AND EGEE

ENEA (the Italian Agency for Energy, Environment and New Technologies [1]) is a funded partner in EGEE/EGEE-II projects, inside the SA1 activity. ENEA participation in EGEE is focused in integrating ENEA-GRID resources into EGEE infrastructure.

ENEA-GRID [2] has been developed since 1998 with the purpose to integrate the main computational resources inside the institution into a unique infrastructure providing an unified user environment and an homogeneous access method. ENEA computational resources are distributed over WAN (6 computing centres in Northern, Central and Southern Italy) connected by GARR, the Italian Research and Academic Network, and consist at present of about 100 hosts with a total of 650 cpu, with a variety of Operating Systems and Architectures (AIX, Linux 32/64, IRIX, MacOS X, Windows). The most relevant resource is at the moment an IBM p575 with 192 processors (AIX operating system). The installed storage is about 15 TB and the number of registered users exceeds 600.

GRID functionalities in ENEA-GRID (unique authentication, authorization, resource access and discovery) are provided using “mature”, multi-platform components that constitute ENEA-GRID middle-ware. These components are a distributed file system, AFS/OpenAFS [3], a resource manager, LSF Multicluster (Job Forwarding Model) [4] and an unified user interface based on Java and Citrix technologies [5].

### 1.4. INTEGRATING ENEA-GRID AND EGEE

The goal of the integration activity between ENEA-GRID and EGEE would be an implementation where the overall ENEA-GRID infrastructure is seen from the EGEE infrastructure as a single local EGEE site. This goal can be implemented at the moment with some restrictions and the implementation has to face two main difficulties. The first is the unavailability of EGEE Glite middle-ware [6] for many of the platforms in ENEA-GRID and this has been partially solved using a grid-gateway approach [7,8], as it will be described in a report which is now in preparation. The second is the problem of the user management compatibility which is the object of the present paper.

On a standard EGEE site GRID users are mapped to the local UNIX users by the LCAS/LCMAPS [9] components of Glite middle-ware while ENEA-GRID users are managed using AFS resources (recently migrated to Kerberos 5), so the main object of the activity described in this paper has been to reach a full compatibility between AFS user management and EGEE local user support.

LCAS/LCMAPS packages provide some integration for AFS users but not in a sufficient way for this implementation, as it will be discussed in Section 2 of this report, where a solution will also be presented.

Moreover EGEE authentication is based on X509 certificates, which have been extended to incorporate Virtual Organization information using VOMS system [10]. While AFS and X509 compatibility is managed by the existing gssklog package [11] a new development was required to add support also to VO extension, as it will be described in Section 3 of this report.

## 2. LCAS/LCMAPS

LCAS (Local Centre Authorization Service) and LCMAPS (Local Credential Mapping Service) [9] are packages developed during EDG project to manage the authorization and mapping of the GRID users to the local UNIX users. EGEE project has incorporated these services into the Computing Element portion of the Glite middle-ware.

### 2.1. USER MAPPING AND POOL ACCOUNTS

GRID user authentication relies on X509 certificates. Each user belongs to a Virtual Organization (VO), to a group within that VO and, optionally, can have also a specific role and capability. Management of the membership to VO has been implemented by using extended X509 certificates, containing VO informations, and the VOMS Service (Virtual Organization Membership Service) [10].

The mapping of GRID users to local UNIX users was implemented in globus by the grid-mapfile, a file which contains for each user both the distinguished name (DN) from the X509 certificate and the userid on the local UNIX system.

To overcome the scalability problems of this approach and to make an explicit use of the VO membership, the LCMAPS service has extended the globus user mapping by introducing the concept of mapping to local pool accounts.

Local pool accounts are a set of predefined local UNIX users having userids formed by a prefix, based on the VO name, and a suffix which is a fixed format integer up to the maximum number of accounts defined in the pool:

e.g. for ENEA Virtual Organization a valid set of 20 pool account users consists of the following userid: enea001, enea002, ..., enea020.

When a GRID job is dispatched by the Resource Broker on a Glite Computing Element to be executed, LCAS and LCMAPS services manage the authorization and job mapping operations. In particular when LCMAPS service considers a GRID user belonging to a given VO it can dynamically assign to him an available pool account userid.

In order to support both the standard globus user mapping and the pool account mapping the LCMAPS service can examine both the usual globus grid-mapfile (/etc/grid-security/grid-mapfile) and a VO specific grid-mapfile (/opt/edg/etc/lcmsaps/gridmapfile).

The syntax of the former file has been extended so that pool account prefixes can be provided (a pool account prefix is marked by an initial dot) and the syntax of the latter has been defined so that each line contains the name of the VO followed by the pool account prefix, always with a dot as first character.

Additionally, the syntax of these files has been extended to support also the specification of group, role and capability in a VO which corresponds to the mapping to a specific pool account, as in the following example 2.

To summarize LCMAPS service supports:

1. The standard globus X509 certificate, where the /etc/grid-security/grid-mapfile contains  
["*distinguished\_name*" *local\_userid*]  
e.g. "/O=dutchgrid/O=users/O=sara/CN=Dutch User" griduser

2. The management of the extension of X509 certificate holding VO information [VOMS service] where the /opt/edg/etc/lcmsaps/gridmapfile file contains  
["VO\_data" .voms\_pool\_account\_prefix]  
e.g. "/VO=enea/GROUP=/enea" .enea  
and/or  
e.g. "/VO=enea/GROUP=/enea/info/ROLE=SoftwareManager" .eneam
3. Also a mixed situation where the user does not belong to a VO but wants to be able to be mapped to a pool account is also supported. In this case the /etc/grid-security/grid-mapfile contains  
["distinguished\_name" .voms\_pool\_account\_prefix]  
e.g. "/O=dutchgrid/O=users/O=sara/CN=Dutch User" .dteam

The description of the syntax of the input files defining the user mapping implemented by the LCMAPS service has been illustrated with some details as a similar syntax will also be used in the implementation of the patch to gssklog package described in Section 3 of this report.

## 2.2. LCMAPS AND AFS: A PATCH TO LCMAPS\_AFS MODULE

In LCMAPS framework the support for AFS users as local pool account users has to be examined. AFS users require an AFS token and gssklog [11] service is capable to grant an AFS token on the basis of the content of an X509 certificate, as it will be described in Section 3 of this report.

LCMAPS has been implemented as a modular service and a lcmsaps\_afs module exists already with the purpose to obtain an AFS token for the local mapped user using a call to gssklog.

The problem with the existing lcmsaps\_afs module implementation is that it works only for statically defined users and it does not work for pool account users.

In order to provide the compatibility with pool account user mapping, lcmsaps\_afs module has been modified by adding to the gssklog call the parameter -principal *userid* which permits to provide dynamically the userid for which the token has to be granted. The correct userid is retrieved from the context where the module is run by the LCMAPS service.

In this way LCMAPS service is now able to make use of AFS users as local pool account users.

The utilization of lcmsaps\_afs module is performed by customizing the LCMAPS policy file lcmsaps.db (the complete standard path is /opt/edg/etc/lcmsaps/lcmsaps.db) according to the EDG LCMAPS documentation [12].

An example of policy file compatible with AFS is the following:

```
# module definitions
```

```
.....
```

```
lcmaps_afs = "lcmaps_afs.mod -lifetime 8:00 -server 43p.frascati.enea.it"
```

```
# policies
```

```
voms:
```

```
vomsextract -> vomslocalgroup
```

```
vomslocalgroup -> vomspoolaccount
```

```
vomspoolaccount -> posixenf | vomslocalaccount
```

```
vomslocalaccount -> posixenf
```

```
#
```

```
# plugin lcmaps_afs has to run after the lcmaps_posix_enf.mod plugin has been
```

```
# run successfully
```

```
#
```

```
posixenf -> lcmaps_afs
```

```
standard:
```

```
localaccount -> posixenf | poolaccount
```

```
poolaccount -> posixenf
```

```
posixenf -> lcmaps_afs
```

### **2.3. AFS TOKEN DISCUSSION**

It must be remarked however that, due to the structure of job management architecture of the Glite Computing Element, the AFS token obtained by gssklog is a "user based" token and not a "pag based" token.

This is a consequence of the fact that authorization and user mapping are performed by processes (LCAS/LCMAPS) which are independent from the process which provides the job submission (edg-gatekeeper).

The reliability of the utilization of a "user based" token is so delegated to the Computing Element middle-ware architecture, which indeed implements mechanisms assuring the uniqueness of the association between GRID user certificate and local UNIX userid.

The value of the token lifetime can be adjusted in order to match the requirements of Computing Element operation and the application requirements. At present token life time has been fixed to the default ENEA-GRID value (25 hours). Token renewal mechanisms on the Computing Element can be envisaged, as they are already supported by LSF, but have not implemented yet.



### 3. GSSKLOG

Gssklog package has been developed by Doug Engert to provide a service capable to grant an AFS token using a GSS (Generic Security Service) implementation [11]. It has been used together with Globus Toolkit GSSAPI to obtain an AFS token from a X509 certificate.

The package include a daemon, called `gssklogd`, and a client, `gssklog`.

The daemon `gssklogd` runs on a server machine where the AFS cell keyfile is available and requires a service certificate and a service key.

The association between X509 certificate and the AFS userid is defined in the `afsgrid-mapfile`. The syntax of this file is similar to the syntax of the usual `globus grid-mapfile` and consist of lines containing the distinguished name of the GRID user followed by the AFS userids. Several AFS userids are admitted on the same line and the user can select one of them by passing the `-principal` argument when invoking the `gssklog` client.

#### 3.1. STANDARD GLOBUS UTILIZATION

In the standard `globus` utilization of the `gssklogd/gssklog` service, the GRID user, who has its proxy file generated by the call to `grid-proxy-init` command, invokes `gssklog` client passing the name of the server where `gssklogd` daemon is running.

In the communication between client and server the security context is established on the basis of the content of the proxy certificate and the server daemon is able to retrieve the distinguished name of the user from that information. The daemon is thus able to make use of the content of the `afsgrid-mapfile` to assign the proper AFS userid for the AFS token generation.

#### 3.2. VOMS & LCMAPS CASE AND THE PATCH TO GSSKLOG

In the case of EGEE the VOMS service is used and the GRID user generates its proxy certificate by the call to `voms-proxy-init` command instead of invoking `grid-proxy-init`. The information concerning the Virtual Organization extension are stored inside the proxy certificate exploiting an extension of the standard X509 certificate.

In the activity described by this report, a patch has been applied to the `gssklogd` daemon so that it is able to understand the content of the VO extension part of the proxy certificate. In order to do that VOMS API [10] has been used and their utilization requires that VO certificate information are also made available to the daemon.

Knowing the VO information, the daemon has to know what are the admitted pool account userid for the given VO or the admitted local accounts for the given VO/Group/Role/Capability if any, so that LCMAPS service can be supported. This has been implemented by extending the syntax of the `afsgrid-mapfile` in analogy with the syntax of `globus grid-mapfile` (`/etc/grid-security/grid-mapfile`) and VO `grid-mapfile` (`/opt/edg/etc/lcmsaps/gridmapfile`) that have been described in Section 2. The new `afsgrid-mapfile` is essentially a merge of these two files.

The patch has retained the compatibility with the standard `globus` utilization and supports also the “mixed” case described in Section 2.1, where a GRID user without VO information requires to be associated to a local pool account userid.

### 3.3. DETAILS IN PATCHED GSSKLOGD UTILIZATION

The new information required by the patched version of the gssklogd daemon are: the name of the directory containing the VO certificates, the list of accepted VO and the corresponding valid normal and pool account userids. These information are provided in the following way:

- a) The name of a directory containing the certificates of the Virtual Organizations:

this information is provided by a new argument parameter [-V] in the invocation of the daemon; the VO certificates need a regular update and the update implementation in the framework of an EGEE site is discussed in section 3.4.

- b) The syntax of the afsgrid-mapfile has been extended to include pool accounts and VOMS extensions with VO/Group/Role/Capability information:

the afsgrid-mapfile is a merge of */etc/grid-security/grid-mapfile* and */opt/edg/etc/lcms/gridmapfile*

When gssklogd receive a valid certificate (containing or not the VOMS extensions), it performs a match between such credentials and the content of afsgrid-mapfile:

If VOMS extensions are present, the server rebuild a string with these information and the comparison is done using the higher number of available fields (sorted by decreasing importance):

- VO Name
- VO Group
- Role
- Capabilities

In case of failure, the application tries again to perform the match, deleting at every iteration the less significant field.

If no VOMS extension is present, the previous iteration is performed using only the certificate's Distinguished Name (DN).

eg: An example is the following afsgrid-mapfile:

```
"/VO=enea/GROUP=/enea/ROLE=SoftwareManager/Capability=NULL" .eneam
```

```
"/VO=enea/GROUP=/enea/ROLE=SoftwareManager" .eneam
```

```
"/VO=enea/GROUP=/enea/Role=NULL/Capability=NULL" .enea
```

```
"/VO=enea/GROUP=/enea" .enea
```

```
"/C=IT/O=INFN/OU=Personal Certificate/L=ENEA-INFO/CN=Carlo Scio" .eneam
```

and gssklogd receives a gssklog request for the principal eneam001 with the following credential (DN + VOMS extension):

```
DN : "/C=IT/O=INFN/OU=Personal Certificate/L=ENEA-INFO/CN=Carlo Scio"
```

```
VOMS : VO = enea ; GROUP = enea ; ROLE = slave
```

Since VOMS extensions are present, the server builds this string for comparison:

```
"/VO=enea/GROUP=/enea/ROLE=Slave"
```

The first attempt in the matching loop is unsuccessful, as the role “slave” is not present in the afsgrid-mapfile, so the next attempt is with the string: “/VO=enea/GROUP=/enea/”

Also this second attempt is unsuccessful as the afsgrid-mapfile allows only users with VO=enea and GROUP=enea to be matched by the pool account .enea and not .eneam.

The last attempt is performed using the certificate's Distinguished Name (DN) and this attempt is successful as it matches the last line of the afsgrid-mapfile of the example.

Previous afsgrid-mapfile syntax remains supported.

An example of the start-up command for gssklogd daemon, for the case where shared voms library is used:

```
LD_LIBRARY_PATH=/opt/globus/lib:/afs/enea.it/frascati/erg/bracco/egEE/voms/api/ccapi/.libs
export LD_LIBRARY_PATH
./gssklogd -C /root/gssklog/egEE/egEE_gss_cert.pem
-K /root/gssklog/egEE/egEE_gss_key.pem
-D /root/gssklog/egEE/certificates/
-G /root/gssklog/egEE/afsgrid-mapfile
-V /afs/enea.it/grd_egEE/system/eneaaddon/vomsdir/
```

where the options -C , -K, -D, -G, providing respectively the service certificate and key, the trusted certificate directory and the afsgrid-mapfile are supported by the standard gssklogd version while the option -V for the directory containing VO certificate has been added with the described patch.

### 3.4. DETAILS IN THE PATCH IMPLEMENTATION

The modifications to the gssklogd source code have been incorporated into a patch which can be applied to the standard gssklog version 0.11 tarball [11]. The patch involves modifications to the source code of some package modules (gridmap.c, gssklogd.c/gssklogd.h, gssklogd\_afs.c) and to the configure files.

The modifications introduced by the patch are illustrated as it follows:

c) gridmap.c:

- The *globus\_gss\_assist\_vook* function has been modified in order to provide support for incomplete voms extensions (i.e strings in which the component fields VO, Group, Role and Capability could be present in a sparse way). A full comparison is performed between dynamically build strings (based on the analysis of the *vodata* C struct's fields) and every entry of the gridmap file, until the comparison succeeds (and a token is successfully returned) or the combinations' set becomes empty.
- The function *globus\_gss\_assist\_voroleok* has been deleted (as *globus\_gss\_assist\_vook* took up its responsibilities)

d) configuration:

the files 'configure.in' and 'Makefile.in' have been modified to support the new compilation options, **--with-voms-include**, **--with-voms-lib-dir** , **--with-voms-lib-type** and **--with-voms-lib-name**; the patch requires the glite package and the header files and libraries of VOMS package; it has also been added the option of statically linking the voms library, so that no Glite middle-ware is required on the machine running the gssklogd daemon.

configuration examples:

```
# configure (dynamic linking)
./configure --with-afs=/usr --with-gss-include=/opt/globus/include/gcc32dbg/ ¥
--with-gss-lib-dir=/opt/globus/lib/ ¥
--with-gss-lib-name=globus_gssapi_gsi_gcc32dbg ¥
--with-voms-include=/opt/glite/include/glite/security/voms/ ¥
--with-voms-lib-dir=/afs/enea.it/frascati/erg/bracco/cvs_infn/voms/api/ccapi/.libs¥
--with-voms-lib-name=vomsapi --enable-server --with-ccopts=-DDEBUG
```

```
# configure (voms static linking)
./configure --with-afs=/usr --with-gss-include=/opt/globus/include/gcc32dbg/ ¥
--with-gss-lib-dir=/opt/globus/lib/ ¥
--with-gss-lib-name=globus_gssapi_gsi_gcc32dbg ¥
--with-voms-include=/opt/glite/include/glite/security/voms/ ¥
--with-voms-lib-dir=/afs/enea.it/frascati/erg/bracco/cvs_infn/voms/api/ccapi/.libs/¥
--with-voms-lib-type=static --with-static=gsi22 --with-flavor=gcc32 ¥
--with-voms-lib-name=vomsapi --enable-server --with-ccopts=-DDEBUG
```

### 3.5. INTEGRATION INTO EGEE SITE

As it has been described in Section 3.3 the utilization of gssklogd requires that the daemon has access to the directories containing the VO certificates and the trusted certificate authorities. This information are available on the Computing Element at the following default locations:

- a) /etc/grid-security/vomsdir/
- b) /etc/grid-security/certificates/

All these information must be regularly updated and the Glite middle-ware on the Computing Element provide a mechanism for this update.

The gssklogd daemon requires also the afsgrid-mapfile and again also the file /etc/grid-security/grid-mapfile is regularly updated by the Computing Element middle-ware

In order to provide updated information to the gssklogd daemon, which runs on a machine different from the Computing Element for security reasons, the following approach has been implemented:

- a) A shell script has been prepared to copy the content of /etc/grid-security/vomsdir/ and /etc/grid-security/certificates/ in the AFS file space
- b) The same script creates in the AFS file space the file afsgrid-mapfile, resulting from a merge of the /etc/grid-security/grid-mapfile followed by the /opt/edg/etc/lcms/maps/gridmapfile.
- c) The script is run regularly as a cron job on the Computing Element machine.
- d) The machine where gssklogd daemon runs shares the required information with the CE using AFS file space.

In order to make cron jobs securely acquire an AFS token inside a pagsh, we use Russ Allbery's k5start [13].

The described mechanism assures the update of the information required by the gssklogd daemon.

#### 4. CONCLUSION

The described patched versions of lcms\_afs module and of the gssklog service are presently in operation on the ENEA-INFO EGEE site, which consists at this date of 2 Computing Elements, one dedicated to accessing a 14 nodes Linux Cluster (CE: egce.frascati.enea.it) and one dedicated to provide access to 3 frames of IBM p690 SP4, for a total of 96 cpu (CE: egceaix.frascati.enea.it). Successful testing experiments of job submission from EGEE to other platforms inside ENEA-GRID (MacOS X, IRIX, Linux Altix) have also been performed.

The patch to gssklog package, which actually make the gssklog service VOMS aware, has also been submitted to Doug Engert [11] so that it can be examined and its inclusion inside the standard gssklog package will be discussed.

The source codes for both the patch to gssklog package and the lcms\_afs module are available at the site: <http://www.afs.enea.it/project/eneaegee/software/>.

## **5. REFERENCE/AMENDMENT/TERMINOLOGY**

### **5.1. REFERENCES**

**Table 1: Table of references**

[1]

[1]	<a href="http://www.enea.it">http://www.enea.it</a>
[2]	" <b>ENEA-GRID: a production quality grid infrastructure</b> ", GARR Meeting "Armonizzazione delle strutture di rete e delle griglie computazionali", CRUI, Roma, 15 July 2004, <a href="http://www.garr.it/incontro_griglie.htm">www.garr.it/incontro_griglie.htm</a> <a href="http://www.afs.enea.it/project/eneagrid">http://www.afs.enea.it/project/eneagrid</a>
[3]	<a href="http://www.openafs.org">http://www.openafs.org</a>
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[7]	G. Bracco et al. " <b>Integration of ENEA-GRID multiplatform resources in EGEE</b> ", SA1 Open Session "Access to other Platforms" , 4° EGEE Conference, Pisa 24-26 october 2005; <a href="http://indico.cern.ch/sessionDisplay.py?sessionId=22&amp;slotId=0&amp;confId=a0514#2005-10-27">http://indico.cern.ch/sessionDisplay.py?sessionId=22&amp;slotId=0&amp;confId=a0514#2005-10-27</a> The report " <b>The gateway approach providing EGEE/gLite access to non-standard architecture</b> " will be submitted soon. <a href="http://www.afs.enea.it/project/eneaegee">http://www.afs.enea.it/project/eneaegee</a>
[8]	G. Bracco et al. " <b>Implementing GRID interoperability</b> ", AFS Best Practice Workshop 2006, University of Michigan, Ann Arbor, 12-16/6/2006, <a href="http://pmw.org/afsbpw06/">http://pmw.org/afsbpw06/</a>
[9]	LCAS/LCMAPS packages, <a href="http://www.nikhef.nl/grid/lcaslcmaps">http://www.nikhef.nl/grid/lcaslcmaps</a>
[10]	VOMS package, <a href="http://infnforge.cnaf.infn.it/voms">http://infnforge.cnaf.infn.it/voms</a>
[11]	GSSKLOG package, D. Engert, <a href="ftp://achilles.ctd.anl.gov/pub/DEE/gssklog-0.11.tar">ftp://achilles.ctd.anl.gov/pub/DEE/gssklog-0.11.tar</a>
[12]	<a href="http://www.dutchgrid.nl/DataGrid/wp4/lcms/edg-lcms_gcc3_2_2-0.0.23">http://www.dutchgrid.nl/DataGrid/wp4/lcms/edg-lcms_gcc3_2_2-0.0.23</a>
[13]	<a href="http://www.eyrie.org/~eagle/software/kstart/k5start.html">http://www.eyrie.org/~eagle/software/kstart/k5start.html</a>

## 5.2. DOCUMENT AMENDMENT PROCEDURE

Amendments, comments and suggestions should be sent to the authors. The procedures documented in the EGEE "Document Management Procedure" will be followed: <http://egee-jra2.web.cern.ch/EGEE-JRA2/Procedures/DocManagmtProcedure/DocMngmt.htm>.