Nordic Testbed for Wide Area Computing and Data Handling

6/3/02

THE NORDUGRID INFORMATION SYSTEM

Draft*

Abstract

This document intends to give an overview of the Grid information system being implemented within the NorduGrid Project. Another purpose of the document is to serve as a user reference by giving a detailed description of the available Grid information.

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1. Introduction

A stable, robust, scalable and reliable information system is a cornerstone of any kind of Grid system. Without a properly working information system it is not possible to construct a functional Grid. The Globus project[1] has laid down the foundation of a Grid information system with their LDAP-based Monitoring and Discovery Service (MDS). The NorduGrid[2] information system is built upon the Globus MDS.

The information system described below forms an integral part of the NorduGrid Testbed Architecture[3]. In our Testbed, the NorduGrid MDS plays a central role: all the information related tasks, like resource discovery, Grid monitoring, authorized user information, job status monitoring, are entirely implemented on top of the MDS. This has the advantage that all the Grid information is provided through an uniform interface in an inherently scalable and distributed way due to the Globus MDS. Moreover, it is sufficient to run a single MDS service per resource in order to build the entire system. In the NorduGrid testbed, a resource does not need to run dozens of different (often centralized) services speaking different protocols: the NorduGrid Information System is purely Globus MDS-built, using exclusively the LDAP protocol.

The design of a Grid information system is always a question of how to represent the Grid resources (or services), what kind of information should be there, what is the best structure of presenting this information to the Grid users and to the Grid agents (i.e. brokers). These questions have their technical answers in the so-called LDAP schema files. The Globus Project provides an information model. However, we found such a model unsuitable for representing computing clusters, since, unfortunately, the Globus schema is rather single-machine oriented. The European DataGrid project (EDG)[4] has suggested a different, Computing Element (CE)-based model, which was evaluated by the NorduGrid[5]. The EDG's CE-based schema fits better for computing clusters, nevertheless, its practical usability was found to be very questionable because of the inadequate way of implementation of the crucial technical details.

Due to the lack of a suitable schema, NorduGrid has decided to design its own information model (schema) in order to properly represent and serve its testbed. A working information system, as a part of the NorduGrid architecture, has been built around the schema. The implementation of this information system is successfully deployed[6]. NorduGrid hopes that in the not-so-far future, a usable common Grid information model will emerge. We hope that the experience of the NorduGrid users gained at our working system will provide a useful feedback for this process.

The next section, which contains the NorduGrid information model, is followed by a detailed one-by-one description of the available attributes; the latter section serves as a reference manual, too.

2. The information model

The NorduGrid testbed (see the "Architecture proposal"[3]) consists of different resources (they can be referred as services), located at different sites. The list of implemented Grid services at the moment involves computing resources (Linux clusters operated by PBS[7]), Storage Elements (the current implementation is basically some disk space with GridFTP server), and Replica Catalogs. The designed information model naturally maps these resources onto a LDAP-based MDS tree, where each resource is represented by an MDS subtree.

In this tree, each NorduGrid resource operates a separate Grid Resource Information Service (GRIS) (for an explanation of GRIS, GIIS, VO terms, see[8]). The various resources (GRISes) can be grouped together to form Virtual Organizations (VO), which are served by the Grid Index Information Services (GIIS) (i.e., in the present testbed configuration the resources within a Nordic country are grouped together to form a VO). The structure created this way is called a hierarchical MDS tree.

The NorduGrid schema is a true mirror of our architecture: it contains information about computing clusters (*nordugrid-cluster* objectclass), storage elements (*nordugrid-se* objectclass) and replica catalogs (*nordugrid-rc* objectclass). In Figure 1, a part of the NorduGrid MDS tree[6] is shown.

Figure 1. The Norway branch of the NorduGrid MDS tree

The clusters provide access to different PBS queues, which are described by the *nordugrid-pbsqueue* objectclass (Figure 2 shows a queue example).

Under the queue entries, the *nordugrid-authuser* and the *nordugrid-pbsjob* entries can be found, grouped in two distinct subtrees (the branching is accomplished by the *nordugrid-info-group* objectclass). The *nordugrid-authuser* entry contains all the user-dependent information of a specific authorized Grid user. Within the user entries, Grid users can find out, among other things, how many CPUs are available for them in that specific queue, what is the disk space their job can consume, what is their effective queue length (taking into account the local Unix mappings), etc. The *nordugrid-pbsjob* entries (see Figure 3 for an example) describe the Grid jobs submitted to the cluster. The detailed job information includes the job's unique Grid identifier, the certificate subject of the job's owner, and the job status.

The NorduGrid information system has been designed to be able to effectively serve the User Interface (UI; job status query commands, free resource discovery utilities), the brokering agent (in our architecture it is integrated with the UI's job submission command) and a general Grid user. The information content can be accessed either directly with a simple LDAP search, or via the User Interface commands, or through the LdapExplorer-enabled NorduGrid website.

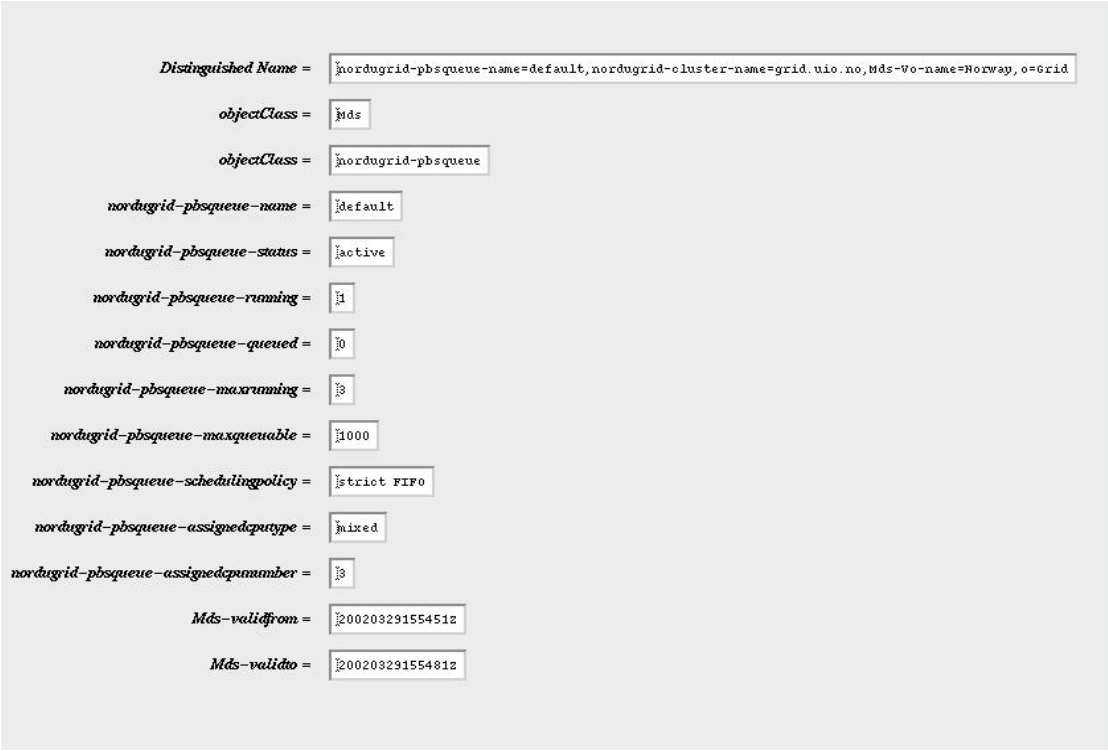

Figure 2. A queue entry in the NorduGrid MDS

3. Description of the attributes

3.1. nordugrid-cluster information

The following attributes can be used to describe a NorduGrid cluster. A cluster entry is linked to the MDS-tree with the *nordugrid-cluster-name* attribute. The *nordugrid-cluster-name*, *nordugrid-cluster-contactstring* and the *nordugrid-cluster-gridarea* are the minimum required attributes.

nordugrid-cluster-aliasname

> **Alias name of the cluster.**

nordugrid-cluster-architecture

> **Architecture of the machines in the cluster, this is the 'machine type' determined as '`uname -m`', examples: *i686, alpha.***

nordugrid-cluster-contactstring

> **The Globus-type contact string of the NorduGrid cluster, example: *grid.quark.lu.se:2119/jobmanager-ng.***

nordugrid-cluster-cpudistribution

> **The CPU distribution over the nodes given in the form of <n>cpu:<m> where <n> is the number of CPUs per machine and <m> is the number of such computers, an example: *1cpu:3,2cpu:4,4cpu:1* represents a cluster with 3 single CPU machines, 4 dual machines and one computer with 4 CPUs.**

nordugrid-cluster-gridarea

> **Absolute path of the Grid working area, this is the directory under which the session directories are created.**

nordugrid-cluster-gridspace

Unallocated disk space on the Grid working area (megabytes).

nordugrid-cluster-homogeneity

True/False flag indicating the hardware homogeneity of the cluster.

nordugrid-cluster-localse

Distinguished Name of a storage element considered to be 'local' to the cluster, this is the 'preferred' storage element of the cluster, example: *nordugrid-se-name=grid.quark.lu.se,Mds-Vo-name=Sweden,o=grid.*

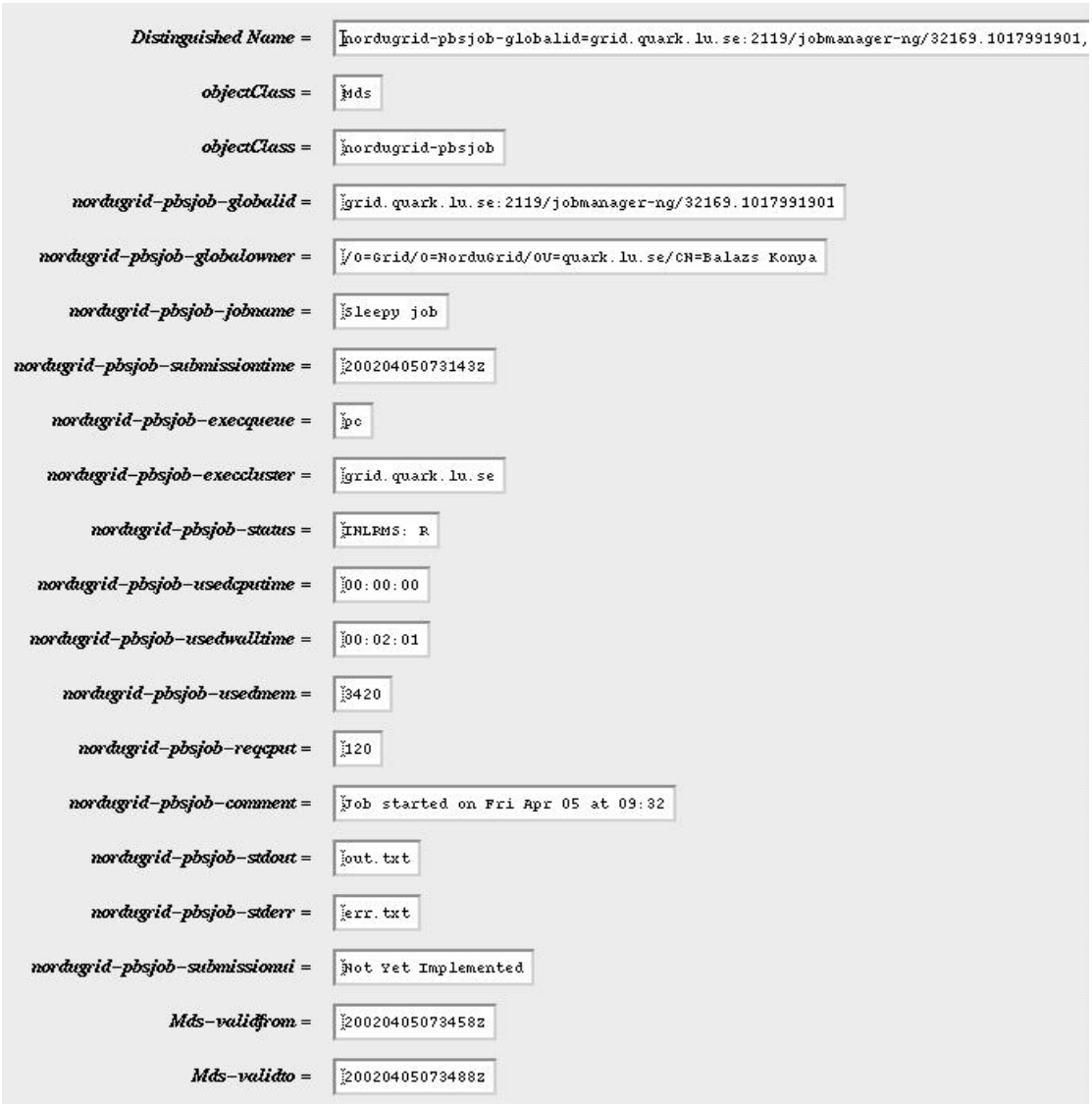

Figure 3. A running Grid job as it is represented in the NorduGrid information system

nordugrid-cluster-lrms-config

Additional remarks of the site manager on the specific configuration of the Local Resource Management System, an example: *single jobs per CPUs.*

nordugrid-cluster-lrms-type

Type of the Local Resource Management System, examples: *OpenPBS, PBSPro* (at the moment these are the supported ones).

nordugrid-cluster-lrms-version

Version of the LRMS software, example: *2.3.12*.

nordugrid-cluster-middleware

Installed middleware packages on the cluster

nordugrid-cluster-name

The name of the cluster specified as the domain name of the front-end machine.

nordugrid-cluster-nodecpu

The CPU type of the nodes (model name + MHz), in case of a homogeneous system this is read from the /proc/cpuinfo of the front-end. For an inhomogeneous system the cluster manager sets this value as the slowest processor in the cluster, example: *Pentium III (Coppermine) 1001 MHz.*

nordugrid-cluster-nodememory

Memory installed on each node (megabytes); in case of an inhomogeneous clusters, the smallest memory value is expected to be specified.

nordugrid-cluster-opsys

Operating system of the cluster, determined by '`uname -sr`', example: *Linux 2.4.3-20mdk*

nordugrid-cluster-runtimeenvironment

Pre-installed software environments available on the cluster, for a complete description see [9].

nordugrid-cluster-support

E-mail contact address for Grid support.

nordugrid-cluster-totaljobs

Total number of active Grid jobs on the cluster. Completed jobs with status "FINISHING" or "FINISHED" are not considered as active Grid jobs.

nordugrid-cluster-totalcpu

Total number of computing CPUs in the cluster (the front-end CPUs are only counted if they can be allocated for Grid jobs).

3.2. nordugrid-pbsqueue information

The following attributes map the PBS queue information to the MDS. An absence of an attribute means that the corresponding PBS queue parameter is not set in the cluster. A queue entry is linked to the tree via the *nordugrid-pbsqueue-name* attribute. The *nordugrid-pbsqueue-name* and the *nordugrid-pbsqueue-status* attributes are the required ones.

nordugrid-pbsqueue-assignedcpunumber

Number of processors assigned to the queue.

nordugrid-pbsqueue-assignedcputype

Type of the assigned processors. This attribute is only for descriptive purposes and does not necessarily need to contain the detailed 'physical characteristics' of the CPUs, simplified values like 'single', 'dual', 'athlon', 'intel' are possible.

nordugrid-pbsqueue-defaultcputime

Default CPU time assigned to this queue (minutes). This is the CPU time request assigned to the jobs by default.

nordugrid-pbsqueue-maxcputime

Maximum CPU time allowed in this queue (minutes).

nordugrid-pbsqueue-maxqueuable

Maximum number of jobs allowed to reside in the queue waiting for execution.

nordugrid-pbsqueue-maxrunning

Maximum number of jobs allowed to run simultaneously taken from this queue.

nordugrid-pbsqueue-maxuserrun

Maximum number of jobs a local Unix user can run simultaneously from this queue.

nordugrid-pbsqueue-mincputime

The required minimum CPU time request for this queue.

nordugrid-pbsqueue-name

The queue name.

nordugrid-pbsqueue-queued

Number of jobs waiting for execution in the queue.

nordugrid-pbsqueue-running

Number of running jobs in the cluster belonging to this queue.

nordugrid-pbsqueue-schedulingpolicy

Implemented scheduling policy of the queue, examples: *FIFO* (the default PBS scheduler), *Maui*

nordugrid-pbsqueue-status

Status of the queue, possible values: active, inactive

3.3. nordugrid-pbsjob information

The Grid jobs in the NorduGrid system are represented by the following attributes. The attribute values are determined from the PBS and the Gridmanager[10] status information files. The PBS attributes are obviously only available in the information system for the time the job is in the realm of the Local Resource Management System (i.e. the job has been submitted, being queued or running in the PBS). The job entry is linked to the MDS tree under the corresponding *nordugrid-pbsqueue* via the *nordugrid-pbsjob-globalid* attribute. The required attributes are the *nordugrid-pbsjob-globalid*, *nordugrid-pbsjob-globalowner* and the *nordugrid-pbsjob-status*.

nordugrid-pbsjob-comment

The comment message coming from the PBS system, an example: *Job started on Tue Apr 02 at 17:20*

nordugrid-pbsjob-errors

Possible error message from the Grid system (from the Gridmanager running on the front-end). The presence of this attribute indicates a failure in the Grid job execution. Example: *JOB FAILURE:*

nordugrid-pbsjob-execcluster

The name of the Grid cluster (the domain name of the front-end machine) where the Grid job is managed, example: *grid.quark.lu.se*.

nordugrid-pbsjob-execqueue

The name of the execution queue of the Grid job.

nordugrid-pbsjob-globalid

The global job identifier string; this ID uniquely determines the Grid job on the NorduGrid Testbed, an example:
grid.quark.lu.se:2119/jobmanager-ng/10972.1017760800

nordugrid-pbsjob-globalowner

The Subject Name of the job owner. A Grid user can easily find own jobs on the Grid by searching for the nordugrid-pbsjob-globalowner='SN'. An example: */O=Grid/O=NorduGrid/OU=quark.lu.se/CN=UserName*

nordugrid-pbsjob-jobname

The job name specified by the user with the 'jobname' RSL attribute, example: *My Test Run*

nordugrid-pbsjob-queuerank

This attribute shows the Grid job's actual position in the PBS queue. For example, *nordugrid-pbsjob-queuerank = 4* means that the job sits in the queue and has the fourth position there. The queue position is calculated assuming a strict FIFO (first come first serve) scheduler

nordugrid-pbsjob-reqcput

The CPU time request of the job (minutes). This attribute takes into account the default_cputime, if the latter was set for the PBS queue. This means a job can have *reqcput* attribute even if was not specified in the job options. Jobs are usually canceled after their *reqcput* is exceeded.

nordugrid-pbsjob-sessiondirerasetime

The date in a Globus MDS time format (GMT), when the session directory of the Grid job will be removed. In the NorduGrid Testbed, Grid jobs are executed in their individual session directories created by the Gridmanager. The session directory is removed when the 'lifetime' has passed after the job completion. The *sessiondirerasetime* attribute tells the user the date when the session directory will be removed. This attribute appears after the job reached the FINISHED state. An example: *20020403161012Z (*meaning April 3, 2002, 16:10:12)

nordugrid-pbsjob-status

The status of the Grid job. Possible values: *ACCEPTED, PREPARING, SUBMITTING, INLRMS, FINISHING, FINISHED* and *CANCELLING* (see [10] for a description of the job states).

The job has successfully executed if it reached the FINISHED state and there is no nordugrid-pbsjob-errors attribute in the MDS.

INLRMS means the job is under the control of the Local Resource Management System, its sub-state can be 'queuing', 'running' or 'exiting from PBS' showed as *INLRMS: Q, INLRMS: R, INLRMS: E* respectively.

The time when the job has completed is shown together with the FINISHED state in Globus MDS time format (GMT): *FINISHED at: 20020402161013Z*

nordugrid-pbsjob-stderr

The name of the file which contains the standard error.

nordugrid-pbsjob-stdin

The name of the file which contains the standard input.

nordugrid-pbsjob-stdout

The name of the file which contains the standard output.

nordugrid-pbsjob-submissiontime

The submission time of the job in Globus MDS time format (GMT), example: *20020402145851Z*

nordugrid-pbsjob-submissionui

The domain name of the machine (User Interface) from which the job was submitted.

nordugrid-pbsjob-usedcputime

Consumed CPU time of the job in seconds.

nordugrid-pbsjob-usedmem

Memory usage of the job (kilobytes).

nordugrid-pbsjob-usedwalltime

Consumed wall-time of the job in seconds.

3.4. nordugrid-authuser information

Grid Users with access to a queue of a NorduGrid cluster are represented in the information system with a *nordugrid-authuser* entry linked beneath the appropriate queue of the cluster. These entries have been introduced in order that the MDS would be able to answer the typical (and by far not trivial) questions of Grid Users:

What are the (free) resources the Grid cluster can provide for me? How many CPUs are available for me? What is the size of the disk space I can write to?

This kind of information is user-specific, therefore it is not possible to find a common single number which fits all the Grid Users. The *nordugrid-authuser* objectclass with its attributes makes it possible to present a user-dependent view of a NorduGrid cluster.

The user entries are linked to the information tree via the *nordugrid-authuser-name* attribute; this one and the *nordugrid-authuser-sn* are the required attributes. In order that the information provider scripts could produce reliable attribute values, the PBS systems on the clusters are requested to be configured following the NorduGrid instructions [11].

nordugrid-authuser-diskspace

The free disk space (megabytes) available for the jobs of an authorized user.

nordugrid-authuser-freecpus

The number of processors (number of jobs) that are freely available for a specific user. For example, if the *nordugrid-authuser-freecpus = 3* for a certain user, then at the moment of the query, the cluster is ready to immediately run three of the user's jobs, however the fourth job has to wait in the queue.

nordugrid-authuser-name

A locally unique (on the specific Grid cluster) human-readable identification string for the Grid user. In the present implementation it is chosen as the Common Name of the authorized user plus a unique local (serial) number. An example: *John Smith_3*

nordugrid-authuser-queuelength

The queue length experienced by the user taking into account the local user mapping. For example, if the *nordugrid-authuser-queuelength = 3*, then the user's job would would be placed fourth in the queue if it was submitted at the time of the query. The *queuelength* parameter tells the user the number of jobs sitting in the queue in front of her/his possible submission.

nordugrid-authuser-sn

The Subject Name of the authorized user. An LDAP search with objectclass=nordugrid-authuser & nordugrid-authuser-sn='SN' returns all the free resources (given in the nordugrid-fauthuser-freecpus attribute) accessible by the user of the NorduGrid testbed.

3.5. nordugrid-se information

The Storage Element information entry is linked to the MDS tree through the *nordugrid-se-name* attribute. The *nordugrid-se-name* and the *nordugrid-se-baseurl* are the required attributes. The *nordugrid-se-authuser* is a multi-valued attribute.

nordugrid-se-aliasname

Alias name of the Storage Element.

nordugrid-se-authuser

Distinguished Name of an authorized user.

nordugrid-se-baseurl

Contact URL of the Storage Element.

nordugrid-se-freespace

Free space available in the SE (in megabytes).

nordugrid-se-name

Domain name of the machine hosting the Storage Element.

nordugrid-se-type

Type of the SE, at the moment 'gsiftp-based' is the only supported option.

3.6. nordugrid-rc information

These are the attributes for describing a Replica Catalog (RC).

nordugrid-rc-aliasname

Alias name of the RC.

nordugrid-rc-authuser

DN of an authorized user of the replica catalog.

nordugrid-rc-baseurl

URL of the Replica Catalog.

nordugrid-rc-name

Domain name of the machine hosting the Replica Catalog.

Appendix A. nordugrid.schema

```
# attributes for the nordugrid-cluster objectclass
#
attributetype ( 1.3.6.1.4.1.11604.2.1.1.1
    NAME 'nordugrid-cluster-name'
    DESC 'The name of the cluster specified as the domain name of the frontend'
    EQUALITY caseIgnoreMatch
    ORDERING caseIgnoreOrderingMatch
    SUBSTR caseIgnoreSubstringsMatch
    SYNTAX 1.3.6.1.4.1.1466.115.121.1.44
    SINGLE-VALUE )

attributetype ( 1.3.6.1.4.1.11604.2.1.1.2
    NAME 'nordugrid-cluster-aliasname'
    DESC 'The alias name of the cluster'
    EQUALITY caseIgnoreMatch
    ORDERING caseIgnoreOrderingMatch
    SUBSTR caseIgnoreSubstringsMatch
    SYNTAX 1.3.6.1.4.1.1466.115.121.1.44
    SINGLE-VALUE)

attributetype ( 1.3.6.1.4.1.11604.2.1.1.3
    NAME 'nordugrid-cluster-contactstring'
    DESC 'The Globus contact string of the NorduGrid cluster'
    EQUALITY caseIgnoreIA5Match
    SUBSTR caseIgnoreIA5SubstringsMatch
    SYNTAX 1.3.6.1.4.1.1466.115.121.1.26
    SINGLE-VALUE )

attributetype ( 1.3.6.1.4.1.11604.2.1.1.4
    NAME 'nordugrid-cluster-support'
    DESC 'RFC822 email address of support'
    EQUALITY caseIgnoreIA5Match
    SYNTAX 1.3.6.1.4.1.1466.115.121.1.26{256})

attributetype ( 1.3.6.1.4.1.11604.2.1.1.5
    NAME 'nordugrid-cluster-lrms-type'
    DESC 'The type of the Local Resource Management System'
    EQUALITY caseIgnoreMatch
    ORDERING caseIgnoreOrderingMatch
    SUBSTR caseIgnoreSubstringsMatch
    SYNTAX 1.3.6.1.4.1.1466.115.121.1.44
    SINGLE-VALUE )
```

```
attributetype ( 1.3.6.1.4.1.11604.2.1.1.6
    NAME 'nordugrid-cluster-lrms-version'
    DESC 'The version of the Local Resource Management System'
    EQUALITY caseIgnoreMatch
    ORDERING caseIgnoreOrderingMatch
    SUBSTR caseIgnoreSubstringsMatch
    SYNTAX 1.3.6.1.4.1.1466.115.121.1.44
    SINGLE-VALUE )

attributetype ( 1.3.6.1.4.1.11604.2.1.1.7
    NAME 'nordugrid-cluster-lrms-config'
    DESC 'Additional remark on the LRMS config'
    EQUALITY caseIgnoreMatch
    ORDERING caseIgnoreOrderingMatch
    SUBSTR caseIgnoreSubstringsMatch
    SYNTAX 1.3.6.1.4.1.1466.115.121.1.44
    SINGLE-VALUE )

attributetype ( 1.3.6.1.4.1.11604.2.1.1.8
    NAME 'nordugrid-cluster-architecture'
    DESC 'The architecture of the machines of the  cluster'
    EQUALITY caseIgnoreMatch
    ORDERING caseIgnoreOrderingMatch
    SUBSTR caseIgnoreSubstringsMatch
    SYNTAX 1.3.6.1.4.1.1466.115.121.1.44
    SINGLE-VALUE )

attributetype ( 1.3.6.1.4.1.11604.2.1.1.9
    NAME 'nordugrid-cluster-opsys'
    DESC 'The operating system of the machines of the cluster'
    EQUALITY caseIgnoreMatch
    ORDERING caseIgnoreOrderingMatch
    SUBSTR caseIgnoreSubstringsMatch
    SYNTAX 1.3.6.1.4.1.1466.115.121.1.44
    SINGLE-VALUE )

attributetype ( 1.3.6.1.4.1.11604.2.1.1.10
    NAME 'nordugrid-cluster-homogeneity'
    DESC 'A logical flag indicating the homogeneity of the cluster nodes'
    EQUALITY caseIgnoreMatch
    SYNTAX 1.3.6.1.4.1.1466.115.121.1.7
    SINGLE-VALUE )

attributetype ( 1.3.6.1.4.1.11604.2.1.1.11
    NAME 'nordugrid-cluster-nodecpu'
    DESC 'The cpu type of the nodes (model name + MHz)'
```

```
    EQUALITY integerMatch
    ORDERING caseIgnoreOrderingMatch
    SUBSTR caseIgnoreSubstringsMatch
    SYNTAX 1.3.6.1.4.1.1466.115.121.1.27
    SINGLE-VALUE )


attributetype ( 1.3.6.1.4.1.11604.2.1.1.12
    NAME 'nordugrid-cluster-nodememory'
    DESC 'The installed memory of a node in MB'
    EQUALITY integerMatch
    ORDERING caseIgnoreOrderingMatch
    SUBSTR caseIgnoreSubstringsMatch
    SYNTAX 1.3.6.1.4.1.1466.115.121.1.27
    SINGLE-VALUE )

attributetype ( 1.3.6.1.4.1.11604.2.1.1.13
    NAME 'nordugrid-cluster-totalcpu'
    DESC 'The total number of cpus in the cluster'
    EQUALITY integerMatch
    ORDERING caseIgnoreOrderingMatch
    SUBSTR caseIgnoreSubstringsMatch
    SYNTAX 1.3.6.1.4.1.1466.115.121.1.27
    SINGLE-VALUE )

attributetype ( 1.3.6.1.4.1.11604.2.1.1.14
    NAME 'nordugrid-cluster-cpudistribution'
    DESC 'The cpu distribution of the nodes given in the form of 1cpu:3,2cpu:4,4cpu:1'
    EQUALITY caseIgnoreMatch
    ORDERING caseIgnoreOrderingMatch
    SUBSTR caseIgnoreSubstringsMatch
    SYNTAX 1.3.6.1.4.1.1466.115.121.1.44
    SINGLE-VALUE )

attributetype ( 1.3.6.1.4.1.11604.2.1.1.15
    NAME 'nordugrid-cluster-gridarea'
    DESC 'The absolute path of the (crossmounted) grid working directory'
    EQUALITY caseIgnoreMatch
    ORDERING caseIgnoreOrderingMatch
    SUBSTR caseIgnoreSubstringsMatch
    SYNTAX 1.3.6.1.4.1.1466.115.121.1.44
    SINGLE-VALUE )

attributetype ( 1.3.6.1.4.1.11604.2.1.1.16
    NAME 'nordugrid-cluster-gridspace'
    DESC 'The unallocated diskspace on the grid working area in MB'
```

```
    EQUALITY integerMatch
    ORDERING caseIgnoreOrderingMatch
    SUBSTR caseIgnoreSubstringsMatch
    SYNTAX 1.3.6.1.4.1.1466.115.121.1.27
    SINGLE-VALUE )

attributetype ( 1.3.6.1.4.1.11604.2.1.1.17
    NAME 'nordugrid-cluster-runtimeenvironment'
    DESC 'preinstalled software packages of the cluster'
    EQUALITY caseIgnoreMatch
    ORDERING caseIgnoreOrderingMatch
    SUBSTR caseIgnoreSubstringsMatch
    SYNTAX 1.3.6.1.4.1.1466.115.121.1.44 )

attributetype ( 1.3.6.1.4.1.11604.2.1.1.18
    NAME 'nordugrid-cluster-localse'
     DESC 'The distinguished name of a storage element considered to be local to the
cluster'
    EQUALITY caseIgnoreMatch
    ORDERING caseIgnoreOrderingMatch
    SUBSTR caseIgnoreSubstringsMatch
    SYNTAX 1.3.6.1.4.1.1466.115.121.1.44 )

attributetype ( 1.3.6.1.4.1.11604.2.1.1.19
    NAME 'nordugrid-cluster-middleware'
    DESC 'The middleware packages on the cluster'
    EQUALITY caseIgnoreMatch
    ORDERING caseIgnoreOrderingMatch
    SUBSTR caseIgnoreSubstringsMatch
    SYNTAX 1.3.6.1.4.1.1466.115.121.1.44 )

attributetype ( 1.3.6.1.4.1.11604.2.1.1.20
    NAME 'nordugrid-cluster-totaljobs'
    DESC 'The total number of active grid jobs in the cluster'
    EQUALITY integerMatch
    ORDERING caseIgnoreOrderingMatch
    SUBSTR caseIgnoreSubstringsMatch
    SYNTAX 1.3.6.1.4.1.1466.115.121.1.27
    SINGLE-VALUE )

objectclass ( 1.3.6.1.4.1.11604.2.1.1
    NAME 'nordugrid-cluster'
    DESC 'Description of a Nordugrid cluster'
    SUP 'Mds'
    STRUCTURAL
    MUST ( nordugrid-cluster-name $ nordugrid-cluster-contactstring $
           nordugrid-cluster-gridarea )
```

```
    MAY  ( nordugrid-cluster-aliasname $ nordugrid-cluster-support $
           nordugrid-cluster-lrms-type $ nordugrid-cluster-lrms-version $
           nordugrid-cluster-lrms-config $ nordugrid-cluster-architecture $
           nordugrid-cluster-opsys $ nordugrid-cluster-homogeneity $
           nordugrid-cluster-nodecpu $ nordugrid-cluster-nodememory $
           nordugrid-cluster-cpudistribution $ nordugrid-cluster-gridspace $
           nordugrid-cluster-totalcpu $ nordugrid-cluster-runtimeenvironment $
           nordugrid-cluster-localse $ nordugrid-cluster-middleware $
           nordugrid-cluster-totaljobs ))
#-------------------------------------------------------------------
# attributes for the nordugrid-info-group objectclass
#
attributetype ( 1.3.6.1.4.1.11604.2.1.2.1
    NAME 'nordugrid-info-group-name'
    DESC 'Locally unique info group name'
    EQUALITY caseIgnoreMatch
    ORDERING caseIgnoreOrderingMatch
    SUBSTR caseIgnoreSubstringsMatch
    SYNTAX 1.3.6.1.4.1.1466.115.121.1.44
    SINGLE-VALUE)

objectclass ( 1.3.6.1.4.1.11604.2.1.2
    NAME 'nordugrid-info-group'
    DESC 'A general entry for grouping together MDS entries'
    SUP 'Mds'
    STRUCTURAL
    MUST ( nordugrid-info-group-name ))

#-------------------------------------------------------------------
# attributes for the nordugrid-pbsqueue objectclass
#
attributetype ( 1.3.6.1.4.1.11604.2.1.3.1
    NAME 'nordugrid-pbsqueue-name'
    DESC 'The queue name'
    EQUALITY caseIgnoreMatch
    ORDERING caseIgnoreOrderingMatch
    SUBSTR caseIgnoreSubstringsMatch
    SYNTAX 1.3.6.1.4.1.1466.115.121.1.44
    SINGLE-VALUE )

attributetype ( 1.3.6.1.4.1.11604.2.1.3.2
    NAME 'nordugrid-pbsqueue-status'
    DESC 'The queue status'
    EQUALITY caseIgnoreMatch
    ORDERING caseIgnoreOrderingMatch
    SUBSTR caseIgnoreSubstringsMatch
```

```
    SYNTAX 1.3.6.1.4.1.1466.115.121.1.44
    SINGLE-VALUE )

attributetype ( 1.3.6.1.4.1.11604.2.1.3.4
    NAME 'nordugrid-pbsqueue-running'
    DESC 'Number of running jobs in the cluster belonging to this queue'
    EQUALITY integerMatch
    ORDERING caseIgnoreOrderingMatch
    SUBSTR caseIgnoreSubstringsMatch
    SYNTAX 1.3.6.1.4.1.1466.115.121.1.27
    SINGLE-VALUE )

attributetype ( 1.3.6.1.4.1.11604.2.1.3.5
    NAME 'nordugrid-pbsqueue-queued'
    DESC 'The number of jobs waiting in the queue'
    EQUALITY integerMatch
    ORDERING caseIgnoreOrderingMatch
    SUBSTR caseIgnoreSubstringsMatch
    SYNTAX 1.3.6.1.4.1.1466.115.121.1.27
    SINGLE-VALUE )

attributetype ( 1.3.6.1.4.1.11604.2.1.3.6
    NAME 'nordugrid-pbsqueue-maxrunning'
    DESC 'The maximum number of jobs allowed to run from this queue'
    EQUALITY integerMatch
    ORDERING caseIgnoreOrderingMatch
    SUBSTR caseIgnoreSubstringsMatch
    SYNTAX 1.3.6.1.4.1.1466.115.121.1.27
    SINGLE-VALUE )

attributetype ( 1.3.6.1.4.1.11604.2.1.3.7
    NAME 'nordugrid-pbsqueue-maxqueuable'
    DESC 'The maximum number of jobs allowed to reside in the queue'
    EQUALITY integerMatch
    ORDERING caseIgnoreOrderingMatch
    SUBSTR caseIgnoreSubstringsMatch
    SYNTAX 1.3.6.1.4.1.1466.115.121.1.27
    SINGLE-VALUE )

attributetype ( 1.3.6.1.4.1.11604.2.1.3.8
    NAME 'nordugrid-pbsqueue-maxuserrun'
    DESC 'Maximum number of jobs a user can run at the same time'
    EQUALITY integerMatch
    ORDERING caseIgnoreOrderingMatch
    SUBSTR caseIgnoreSubstringsMatch
    SYNTAX 1.3.6.1.4.1.1466.115.121.1.27
```

```
    SINGLE-VALUE )


attributetype ( 1.3.6.1.4.1.11604.2.1.3.9
    NAME 'nordugrid-pbsqueue-maxcputime'
    DESC 'The maximum cputime allowed in this queue (in minutes)'
    EQUALITY integerMatch
    ORDERING caseIgnoreOrderingMatch
    SUBSTR caseIgnoreSubstringsMatch
    SYNTAX 1.3.6.1.4.1.1466.115.121.1.27
    SINGLE-VALUE )

attributetype ( 1.3.6.1.4.1.11604.2.1.3.10
    NAME 'nordugrid-pbsqueue-mincputime'
    DESC 'The minimum possible cputime of this queue (in minutes)'
    EQUALITY integerMatch
    ORDERING caseIgnoreOrderingMatch
    SUBSTR caseIgnoreSubstringsMatch
    SYNTAX 1.3.6.1.4.1.1466.115.121.1.27
    SINGLE-VALUE )

attributetype ( 1.3.6.1.4.1.11604.2.1.3.11
    NAME 'nordugrid-pbsqueue-defaultcputime'
    DESC 'The default cputime assigned to this queue (in minutes)'
    EQUALITY integerMatch
    ORDERING caseIgnoreOrderingMatch
    SUBSTR caseIgnoreSubstringsMatch
    SYNTAX 1.3.6.1.4.1.1466.115.121.1.27
    SINGLE-VALUE )

attributetype ( 1.3.6.1.4.1.11604.2.1.3.12
    NAME 'nordugrid-pbsqueue-schedulingpolicy'
    DESC 'The scheduling policy of the queue (i.e. FIFO)'
    EQUALITY caseIgnoreMatch
    ORDERING caseIgnoreOrderingMatch
    SUBSTR caseIgnoreSubstringsMatch
    SYNTAX 1.3.6.1.4.1.1466.115.121.1.44
    SINGLE-VALUE )


attributetype ( 1.3.6.1.4.1.11604.2.1.3.13
    NAME 'nordugrid-pbsqueue-assignedcputype'
    DESC 'The type of the cpus asigned to the queue'
    EQUALITY caseIgnoreMatch
    ORDERING caseIgnoreOrderingMatch
    SUBSTR caseIgnoreSubstringsMatch
```

```
    SYNTAX 1.3.6.1.4.1.1466.115.121.1.44
    SINGLE-VALUE )


attributetype ( 1.3.6.1.4.1.11604.2.1.3.14
    NAME 'nordugrid-pbsqueue-assignedcpunumber'
    DESC 'The number of cpus assigned to the queue'
    EQUALITY integerMatch
    ORDERING caseIgnoreOrderingMatch
    SUBSTR caseIgnoreSubstringsMatch
    SYNTAX 1.3.6.1.4.1.1466.115.121.1.27
    SINGLE-VALUE )

objectclass ( 1.3.6.1.4.1.11604.2.1.3
    NAME 'nordugrid-pbsqueue'
    DESC 'A PBS queue'
    SUP 'Mds'
    STRUCTURAL
    MUST ( nordugrid-pbsqueue-name $ nordugrid-pbsqueue-status)
    MAY  ( nordugrid-pbsqueue-running $ nordugrid-pbsqueue-queued $
           nordugrid-pbsqueue-maxrunning  $ nordugrid-pbsqueue-maxqueuable$
           nordugrid-pbsqueue-maxuserrun $ nordugrid-pbsqueue-maxcputime $
           nordugrid-pbsqueue-mincputime $ nordugrid-pbsqueue-defaultcputime $
           nordugrid-pbsqueue-schedulingpolicy $
           nordugrid-pbsqueue-assignedcputype $ nordugrid-pbsqueue-assignedcpunumber))

#-----------------------------------------------------------------
#attributes for the nordugrid-pbsjob objectclass
#
attributetype ( 1.3.6.1.4.1.11604.2.1.4.1
    NAME 'nordugrid-pbsjob-globalid'
    DESC 'The global job identifier string'
    EQUALITY caseIgnoreIA5Match
    SUBSTR caseIgnoreIA5SubstringsMatch
    SYNTAX 1.3.6.1.4.1.1466.115.121.1.26
    SINGLE-VALUE )

attributetype ( 1.3.6.1.4.1.11604.2.1.4.2
    NAME 'nordugrid-pbsjob-globalowner'
    DESC 'The SubjectName of the job owner'
    EQUALITY caseIgnoreMatch
    ORDERING caseIgnoreOrderingMatch
    SUBSTR caseIgnoreSubstringsMatch
    SYNTAX 1.3.6.1.4.1.1466.115.121.1.44
    SINGLE-VALUE )
```

```
attributetype ( 1.3.6.1.4.1.11604.2.1.4.3
    NAME 'nordugrid-pbsjob-execcluster'
    DESC 'The name of the executation cluster'
    EQUALITY caseIgnoreMatch
    ORDERING caseIgnoreOrderingMatch
    SUBSTR caseIgnoreSubstringsMatch
    SYNTAX 1.3.6.1.4.1.1466.115.121.1.44
    SINGLE-VALUE)

attributetype ( 1.3.6.1.4.1.11604.2.1.4.4
    NAME 'nordugrid-pbsjob-execqueue'
    DESC 'The name of the executation queue'
    EQUALITY caseIgnoreMatch
    ORDERING caseIgnoreOrderingMatch
    SUBSTR caseIgnoreSubstringsMatch
    SYNTAX 1.3.6.1.4.1.1466.115.121.1.44
    SINGLE-VALUE )

attributetype ( 1.3.6.1.4.1.11604.2.1.4.5
    NAME 'nordugrid-pbsjob-stdout'
    DESC 'The name of the file which contains the stdout'
    EQUALITY caseIgnoreMatch
    ORDERING caseIgnoreOrderingMatch
    SUBSTR caseIgnoreSubstringsMatch
    SYNTAX 1.3.6.1.4.1.1466.115.121.1.44
    SINGLE-VALUE )

attributetype ( 1.3.6.1.4.1.11604.2.1.4.6
    NAME 'nordugrid-pbsjob-stderr'
    DESC 'The name of the file which contains the stderr'
    EQUALITY caseIgnoreMatch
    ORDERING caseIgnoreOrderingMatch
    SUBSTR caseIgnoreSubstringsMatch
    SYNTAX 1.3.6.1.4.1.1466.115.121.1.44
    SINGLE-VALUE )

attributetype ( 1.3.6.1.4.1.11604.2.1.4.7
    NAME 'nordugrid-pbsjob-stdin'
    DESC 'The name of the file which contains the stdin'
    EQUALITY caseIgnoreMatch
    ORDERING caseIgnoreOrderingMatch
    SUBSTR caseIgnoreSubstringsMatch
    SYNTAX 1.3.6.1.4.1.1466.115.121.1.44
    SINGLE-VALUE )

attributetype ( 1.3.6.1.4.1.11604.2.1.4.8
```

```
    NAME 'nordugrid-pbsjob-reqcput'
    DESC 'The cputime request of the job in minutes'
    EQUALITY integerMatch
    ORDERING caseIgnoreOrderingMatch
    SUBSTR caseIgnoreSubstringsMatch
    SYNTAX 1.3.6.1.4.1.1466.115.121.1.27
    SINGLE-VALUE )

attributetype ( 1.3.6.1.4.1.11604.2.1.4.9
    NAME 'nordugrid-pbsjob-status'
    DESC 'The status of the grid job'
    EQUALITY caseIgnoreMatch
    ORDERING caseIgnoreOrderingMatch
    SUBSTR caseIgnoreSubstringsMatch
    SYNTAX 1.3.6.1.4.1.1466.115.121.1.44
    SINGLE-VALUE )

attributetype ( 1.3.6.1.4.1.11604.2.1.4.10
    NAME 'nordugrid-pbsjob-queuerank'
    DESC 'The queue position of the job'
    EQUALITY integerMatch
    ORDERING caseIgnoreOrderingMatch
    SUBSTR caseIgnoreSubstringsMatch
    SYNTAX 1.3.6.1.4.1.1466.115.121.1.27
    SINGLE-VALUE )

attributetype ( 1.3.6.1.4.1.11604.2.1.4.11
    NAME 'nordugrid-pbsjob-comment'
    DESC 'The jobcomment of the LRMS'
    EQUALITY caseIgnoreMatch
    ORDERING caseIgnoreOrderingMatch
    SUBSTR caseIgnoreSubstringsMatch
    SYNTAX 1.3.6.1.4.1.1466.115.121.1.44
    SINGLE-VALUE )

attributetype ( 1.3.6.1.4.1.11604.2.1.4.12
    NAME 'nordugrid-pbsjob-submissionui'
    DESC 'The name of the UI from where the job was submitted'
    EQUALITY caseIgnoreMatch
    ORDERING caseIgnoreOrderingMatch
    SUBSTR caseIgnoreSubstringsMatch
    SYNTAX 1.3.6.1.4.1.1466.115.121.1.44
    SINGLE-VALUE )

attributetype ( 1.3.6.1.4.1.11604.2.1.4.13
    NAME 'nordugrid-pbsjob-submissiontime'
```

```
    DESC 'The submission time of the job'
    EQUALITY generalizedTimeMatch
    ORDERING generalizedTimeOrderingMatch
    SUBSTR caseIgnoreSubstringsMatch
    SYNTAX 1.3.6.1.4.1.1466.115.121.1.24
    SINGLE-VALUE )

attributetype ( 1.3.6.1.4.1.11604.2.1.4.14
    NAME 'nordugrid-pbsjob-usedcputime'
    DESC 'The consumed cputime of the job (in hh:mm:ss format)'
    EQUALITY integerMatch
    ORDERING caseIgnoreOrderingMatch
    SUBSTR caseIgnoreSubstringsMatch
    SYNTAX 1.3.6.1.4.1.1466.115.121.1.27
    SINGLE-VALUE )

attributetype ( 1.3.6.1.4.1.11604.2.1.4.15
    NAME 'nordugrid-pbsjob-usedwalltime'
    DESC 'The consumed walltime of the job (in hh:mm:ss format)'
    EQUALITY integerMatch
    ORDERING caseIgnoreOrderingMatch
    SUBSTR caseIgnoreSubstringsMatch
    SYNTAX 1.3.6.1.4.1.1466.115.121.1.27
    SINGLE-VALUE )

attributetype ( 1.3.6.1.4.1.11604.2.1.4.16
    NAME 'nordugrid-pbsjob-sessiondirerasetime'
    DESC 'The date when the session dir will be deleted'
    EQUALITY generalizedTimeMatch
    ORDERING generalizedTimeOrderingMatch
    SUBSTR caseIgnoreSubstringsMatch
    SYNTAX 1.3.6.1.4.1.1466.115.121.1.24
    SINGLE-VALUE )


attributetype ( 1.3.6.1.4.1.11604.2.1.4.17
    NAME 'nordugrid-pbsjob-usedmem'
    DESC 'The memory usage of the job (in KB)'
    EQUALITY integerMatch
    ORDERING caseIgnoreOrderingMatch
    SUBSTR caseIgnoreSubstringsMatch
    SYNTAX 1.3.6.1.4.1.1466.115.121.1.27
    SINGLE-VALUE )

attributetype ( 1.3.6.1.4.1.11604.2.1.4.18
    NAME 'nordugrid-pbsjob-errors'
```

```
    DESC 'Error mesages from the cluster'
    EQUALITY generalizedTimeMatch
    ORDERING generalizedTimeOrderingMatch
    SUBSTR caseIgnoreSubstringsMatch
    SYNTAX 1.3.6.1.4.1.1466.115.121.1.24
    SINGLE-VALUE )

attributetype ( 1.3.6.1.4.1.11604.2.1.4.19
    NAME 'nordugrid-pbsjob-jobname'
    DESC 'The jobname specified by the user with the jobname RSL attribute'
    EQUALITY generalizedTimeMatch
    ORDERING generalizedTimeOrderingMatch
    SUBSTR caseIgnoreSubstringsMatch
    SYNTAX 1.3.6.1.4.1.1466.115.121.1.24
    SINGLE-VALUE )

objectclass ( 1.3.6.1.4.1.11604.2.1.4
    NAME 'NorduGrid-pbsjob'
    DESC 'A PBS Grid job'
    SUP 'Mds'
    STRUCTURAL
    MUST ( nordugrid-pbsjob-globalid $ nordugrid-pbsjob-globalowner $
           nordugrid-pbsjob-status )
    MAY  ( nordugrid-pbsjob-queuerank $ nordugrid-pbsjob-submissionui $
           nordugrid-pbsjob-submissiontime  $
           nordugrid-pbsjob-usedcputime $ nordugrid-pbsjob-usedwalltime $
           nordugrid-pbsjob-usedmem $ nordugrid-pbsjob-comment $
           nordugrid-pbsjob-execcluster $ nordugrid-pbsjob-execqueue $
           nordugrid-pbsjob-stdout $ nordugrid-pbsjob-stderr $
           nordugrid-pbsjob-stdin $
           nordugrid-pbsjob-sessiondirerasetime $ nordugrid-pbsjob-reqcput $
           nordugrid-pbsjob-errors $ nordugrid-pbsjob-jobname ))

#-------------------------------------------------------------
# attributes for the nordugrid-authuser objectclass
#

# attributetype ( 1.3.6.1.4.1.11604.2.1.5.1
#     NAME 'nordugrid-authuser-sn'
#     DESC 'The SubjectName of the authorized user'
#     EQUALITY distinguishedNameMatch
#     ORDERING caseIgnoreOrderingMatch
#     SYNTAX 1.3.6.1.4.1.1466.115.121.1.12
#     SINGLE-VALUE )

attributetype ( 1.3.6.1.4.1.11604.2.1.5.1
```

```
    NAME 'nordugrid-authuser-name'
    DESC 'The Common Name of the authorized user plus a local unique number'
    EQUALITY caseIgnoreMatch
    ORDERING caseIgnoreOrderingMatch
    SUBSTR caseIgnoreSubstringsMatch
    SYNTAX 1.3.6.1.4.1.1466.115.121.1.44
    SINGLE-VALUE )

attributetype ( 1.3.6.1.4.1.11604.2.1.5.2
    NAME 'nordugrid-authuser-sn'
    DESC 'The SubjectName of the authorized user'
    EQUALITY caseIgnoreMatch
    ORDERING caseIgnoreOrderingMatch
    SUBSTR caseIgnoreSubstringsMatch
    SYNTAX 1.3.6.1.4.1.1466.115.121.1.44
    SINGLE-VALUE )

attributetype ( 1.3.6.1.4.1.11604.2.1.5.3
    NAME 'nordugrid-authuser-freecpus'
    DESC 'The number of cpus/jobs are freely available for the user in the queue'
    EQUALITY integerMatch
    ORDERING caseIgnoreOrderingMatch
    SUBSTR caseIgnoreSubstringsMatch
    SYNTAX 1.3.6.1.4.1.1466.115.121.1.27
    SINGLE-VALUE )

attributetype ( 1.3.6.1.4.1.11604.2.1.5.4
    NAME 'nordugrid-authuser-diskspace'
    DESC 'The free diskspace available for the job (in MB)'
    EQUALITY integerMatch
    ORDERING caseIgnoreOrderingMatch
    SUBSTR caseIgnoreSubstringsMatch
    SYNTAX 1.3.6.1.4.1.1466.115.121.1.27
    SINGLE-VALUE )

attributetype ( 1.3.6.1.4.1.11604.2.1.5.5
    NAME 'nordugrid-authuser-queuelength'
    DESC 'The queuelength experienced by the user due to its local unix mapping'
    EQUALITY integerMatch
    ORDERING caseIgnoreOrderingMatch
    SUBSTR caseIgnoreSubstringsMatch
    SYNTAX 1.3.6.1.4.1.1466.115.121.1.27
    SINGLE-VALUE )

objectclass ( 1.3.6.1.4.1.11604.2.1.5
    NAME 'nordugrid-authuser'
```

```
    DESC 'An authorised user of a NorduGrid cluster'
    SUP 'Mds'
    STRUCTURAL
    MUST ( nordugrid-authuser-name $ nordugrid-authuser-sn )
    MAY  ( nordugrid-authuser-queuelength $ nordugrid-authuser-diskspace $
           nordugrid-authuser-freecpus ))


#------------------------------------------------------------
#
# nordugrid-se


attributetype ( 1.3.6.1.4.1.11604.2.1.6.1
    NAME 'nordugrid-se-name'
    DESC 'The domain name of the machine hosting the Storage Element'
    EQUALITY caseIgnoreMatch
    ORDERING caseIgnoreOrderingMatch
    SUBSTR caseIgnoreSubstringsMatch
    SYNTAX 1.3.6.1.4.1.1466.115.121.1.44
    SINGLE-VALUE )

attributetype ( 1.3.6.1.4.1.11604.2.1.6.2
    NAME 'nordugrid-se-aliasname'
    DESC 'The alias name of the SE'
    EQUALITY caseIgnoreMatch
    ORDERING caseIgnoreOrderingMatch
    SUBSTR caseIgnoreSubstringsMatch
    SYNTAX 1.3.6.1.4.1.1466.115.121.1.44
    SINGLE-VALUE )

attributetype ( 1.3.6.1.4.1.11604.2.1.6.3
    NAME 'nordugrid-se-type'
    DESC 'The type of the SE'
    EQUALITY caseIgnoreMatch
    ORDERING caseIgnoreOrderingMatch
    SUBSTR caseIgnoreSubstringsMatch
    SYNTAX 1.3.6.1.4.1.1466.115.121.1.44
    SINGLE-VALUE )

attributetype ( 1.3.6.1.4.1.11604.2.1.6.4
    NAME 'nordugrid-se-freespace'
    DESC 'The free space available in the SE (in MB)'
    EQUALITY integerMatch
    ORDERING caseIgnoreOrderingMatch
    SUBSTR caseIgnoreSubstringsMatch
```

```
    SYNTAX 1.3.6.1.4.1.1466.115.121.1.27
    SINGLE-VALUE )

attributetype ( 1.3.6.1.4.1.11604.2.1.6.5
    NAME 'nordugrid-se-baseurl'
    DESC 'The URL to contact the Storage Element'
    EQUALITY caseIgnoreMatch
    ORDERING caseIgnoreOrderingMatch
    SUBSTR caseIgnoreSubstringsMatch
    SYNTAX 1.3.6.1.4.1.1466.115.121.1.44
    SINGLE-VALUE )

attributetype ( 1.3.6.1.4.1.11604.2.1.6.6
    NAME 'nordugrid-se-authuser'
    DESC 'The DN of an authorized user'
    EQUALITY caseIgnoreMatch
    ORDERING caseIgnoreOrderingMatch
    SUBSTR caseIgnoreSubstringsMatch
    SYNTAX 1.3.6.1.4.1.1466.115.121.1.44 )

objectclass ( 1.3.6.1.4.1.11604.2.1.6
    NAME 'nordugrid-se'
    DESC 'A storage element in the Nordugrid'
    SUP 'Mds'
    STRUCTURAL
    MUST ( nordugrid-se-name $ nordugrid-se-baseurl)
    MAY  ( nordugrid-se-aliasname $ nordugrid-se-type $
           nordugrid-se-freespace $ nordugrid-se-authuser ))

#-------------------------------------------------------------------
# nordugrid-rc
#
attributetype ( 1.3.6.1.4.1.11604.2.1.7.1
    NAME 'nordugrid-rc-name'
    DESC 'The domain name of the machine hosting the Replica Catalog'
    EQUALITY caseIgnoreMatch
    ORDERING caseIgnoreOrderingMatch
    SUBSTR caseIgnoreSubstringsMatch
    SYNTAX 1.3.6.1.4.1.1466.115.121.1.44
    SINGLE-VALUE )

attributetype ( 1.3.6.1.4.1.11604.2.1.7.2
    NAME 'nordugrid-rc-aliasname'
    DESC 'The alias name of the rc'
    EQUALITY caseIgnoreMatch
    ORDERING caseIgnoreOrderingMatch
```

```
    SUBSTR caseIgnoreSubstringsMatch
    SYNTAX 1.3.6.1.4.1.1466.115.121.1.44
    SINGLE-VALUE )

attributetype ( 1.3.6.1.4.1.11604.2.1.7.3
    NAME 'nordugrid-rc-baseurl'
    DESC 'The URL of the Replica Catalog'
    EQUALITY caseIgnoreMatch
    ORDERING caseIgnoreOrderingMatch
    SUBSTR caseIgnoreSubstringsMatch
    SYNTAX 1.3.6.1.4.1.1466.115.121.1.44
    SINGLE-VALUE )

attributetype ( 1.3.6.1.4.1.11604.2.1.7.4
    NAME 'nordugrid-rc-authuser'
    DESC 'An authorized user of the replica catalog'
    EQUALITY caseIgnoreMatch
    ORDERING caseIgnoreOrderingMatch
    SUBSTR caseIgnoreSubstringsMatch
    SYNTAX 1.3.6.1.4.1.1466.115.121.1.44 )

objectclass ( 1.3.6.1.4.1.11604.2.1.7
    NAME 'nordugrid-rc'
    DESC 'A replica catalogue in the Nordugrid'
    SUP 'Mds'
    STRUCTURAL
    MUST ( nordugrid-rc-name $ nordugrid-rc-baseurl )
    MAY  ( nordugrid-rc-aliasname $ nordugrid-rc-authuser ))
```

References

1. **Globus project, http://www.globus.org**

2. **NorduGrid project, http://www.nordugrid.org**

3. **An Overview of a Grid Architecture for Scientific Computing, to appear in LNCS;**

   http://arxiv.org/abs/cs.DC/0205021

4. **The European DataGrid Project, http://www.eu-datagrid.org**

5. **Comments on the Computing Element Information Provider of the EU DataGrid Testbed 1, http://www.nordugrid.org/documents/comments_on_ceinfo.pdf**

6. **The browsable NorduGrid Information System, http://www.nordugrid.org/NorduGridMDS/IS.php**

7. **The Portable Batch System (PBS), http://www.openpbs.org**

8. **Creating a Hierarchical GIIS, http://www.globus.org/gt2/mds2.1/hierarchical_GIIS.pdf**

9. **The description of the supported runtime environments will be available on the Applications section of NorduGrid website: http://www.nordugrid.org/applications**

10. **The description of the NorduGrid Grid Manager, http://www.nordugrid.org/documents/GM.pdf**

11. **PBS Configuration Instructions for the NorduGrid Testbed, comes together with the NorduGrid software, http://www.nordugrid.org/software.html**