EGI-InSPIRE

UMD COMPUTE CAPABILITIES QUALITY CRITERIA v2

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Abstract

This document describes the Quality Criteria for the Compute Capabilities identified in the UMD Roadmap.

Document Log

Issue	Date	Comment	Author/Partner
1.0	19/01/2011	Reorganisation of criteria according to UMD Roadmap v2	Enol Fernández
1.1	02/02/2011	Review and added Job Scheduling	Enol Fernández, Álvaro Fernández
1.2	09/02/2011	More review of criteria	Enol Fernández
2 DRAFT 1	20/06/2011	Update to new template, update of criteria, Interactive Job Management	Enol Fernández, Álvaro Fernández
2	02/08/2011	Preparation of release 2	Enol Fernández

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1   JOB EXECUTION

1.1   Job Execution Interface

Currently, there are different interfaces considered for the Job Execution Capability, although not interoperable several of them co-exist in the EGI Infrastructure. The implementations must support, at least, one of the interfaces listed.

Job Execution Interface	
ID	**JOBEXEC_IFACE_1**
Description	Job Execution Appliances must support (at least one of) the interfaces currently in production in the EGI Infrastructure or identified by the UMD Roadmap
Mandatory	YES
Applicability	Job Execution Appliances

Input from Technology Provider	Implementation of one of the Job Execution Interface as defined in the UMD Roadmap. Ideally, a complete test suite of the Job Execution interfaces supported by the appliance. The test suite must include tests for all the documented functions, and for all functions, check both correct and invalid input and with valid and invalid credentials.	
Test Description	**Pre-condition**	Valid user credentials.
	Test	Test all interface functionality, with correct/incorrect input and with valid and invalid credentials.
	Expected Outcome	Log of all the operations performed. All the documented functions work as documented. Errors/exceptions should be generated as documented.
Pass/Fail Criteria	The Job Execution Appliance that claims to support an interface must pass complete tests for that interface (provided by the TP or by the verification team). If the API is not completely supported, this **must** be documented. The test suite must be executed without errors. **At least one** of the following interfaces must be supported: - ARC-CE gridFTP [R 5] - CREAM [R 6] - EMI-ES [R 7] - Globus GRAM5 [R 8] - OGF DRMAA [R 9] - OGSA BES [R 10] - UNICORE UAS [R 11]	
Related Information	UMD Roadmap Job Execution Capability [R 1]	
Revision Log	V2: unification of several criteria regarding interfaces into this one.	

1.2 Job Submission tests

The following tests propose example job descriptions using the gLite JDL format for the specification of jobs. These examples are just used for illustrative purposes. Each appliance should execute the tests using their native format.

Simple Job	
ID	**JOBEXEC_JOB_1**
Description	Execute a simple job in the appliance.
Mandatory	YES
Applicability	Job Execution Appliances

Input from Technology Provider	Support for the submission of a job with no input or output files.	
Test Description	**Pre-condition**	Valid user credentials (and delegation if needed in the system)

	Test	Job submission of simple job:
		`Executable = /bin/sleep;`
		`Arguments = "120";`

	Expected Outcome	Job finishes correctly. Unique Identifier for the submitted jobs, status log of the job.
Pass/Fail Criteria	Pass if the test passes correctly.	
Related Information		
Revision Log	V2: merged JOBEXEC_*_JOB_1 into this criterion.	

Simple Job with input/output files	
ID	**JOBEXEC_JOB_2**
Description	Execute a simple job in the appliance that uses both input and output files.
Mandatory	YES
Applicability	Job Execution Appliances

Input from Technology Provider	Support for the submission of a job with input or output files.	
Test Description	**Pre-condition**	Valid user credentials (and delegation if needed in the system) Non-empty files "myfile"

	Test	Job submission for job with input and output files:
		`Executable = "/bin/ls";`
		`Arguments = "-l";`
		`StdOutput = "std.out";`
		`StdError = "std.err";`
		`InputSandbox = {"myfile"};`
		`OutputSandbox = {"std.out", "std.err"};`

	Expected Outcome	Job finishes correctly; output contains the listing of the directory including the input file with correct size. Unique Identifier for the submitted jobs, status log of the job.
Pass/Fail Criteria	Pass if the test passes correctly.	
Related Information		
Revision Log	V2: merged JOBEXEC_*_JOB_2 into this criterion.	

Cancel Job	
ID	**JOBEXEC_JOB_3**
Description	Cancel a previously submitted job.
Mandatory	YES
Applicability	Job Execution Appliances

Input from Technology Provider	Support for the cancellation of a job. Job cancelling must be possible for all different states that the job may be, e.g. cancel the job when it's running or cancel the job when it's already done.	
Test Description	**Pre-condition**	Valid user credentials (and delegation if needed in the system)

	Test	Job Submission and then cancellation.
		
		Possible description for job:
		`Executable = "/bin/sleep";`
		`Arguments = "20m";`

	Expected Outcome	Job is submitted and then cancelled correctly. Unique Identifier for the submitted jobs, status log of the job. The job must be removed from the execution manager.
Pass/Fail Criteria	Pass if the appliance is able to cancel jobs for any previous state of the job. If the job is in the execution manager system, it should be completely removed, especially if it's running.	
Related Information		
Revision Log	V2: merged JOBEXEC_*_JOB_3 into this criterion. Added clarification	

1.3 Execution Manager Support

These QC refer to the interaction of the Job Execution Capability with the underlying execution manager (usually a LRMS) for the work items submitted.

Not Invasive Deployment	
ID	**JOBEXEC_EXECMNGR_1**
Description	Job Execution Appliances should not introduce any modifications to the underlying execution manager or to the operations of the resources.
Mandatory	YES
Applicability	Job Execution Appliances

Input from Technology Provider	Description of all needed, if any, modifications on the local resources in order to deploy the Job Execution Appliance.
Pass/Fail Criteria	Any modifications must be documented, especially invasive ones. Modifications to consider are: • Installation of additional software at the WN is permitted as long as no extra services are run permanently at the WN. • Require the deployment of extra (shared) filesystems • Modification of the local submission mechanism of jobs (e.g. require the modification of prologue/epilogue scripts of the batch system) • Require the creation of extra user accounts or add special privileges to a specific account. • Require inbound or outbound connectivity
Related Information	
Revision Log	V2: added inbound, outbound connectivity. Relax Pass/Fail criteria

Job Management	
ID	**JOBEXEC_EXECMNGR_2**
Description	Job Execution Appliances must support the creation and management of work items to an execution manager.
Mandatory	YES
Applicability	Job Execution Appliances

Input from Technology Provider	Appliances must be able to: • create new jobs • retrieve the status of the jobs submitted by the appliance • cancel jobs • optionally, hold and resume jobs The Appliance may perform these operations for individual jobs or for set of jobs in order to improve its performance (e.g. for retrieving the status instead of querying each of the individual jobs, do a single query for all jobs submitted for the appliance)
Test Description	**Pre-condition** Configured system
	Test Create new job(s) in execution manager
	Expected Outcome New job(s) is created in the execution manager; id of job(s) returned
	Pre-condition Previously submitted job(s)
	Test Cancel job(s) in execution manager
	Expected Outcome Job(s) is cancelled successfully.
	Pre-condition Previously submitted job(s)
	Test Query status of previously submitted job(s)
	Expected Outcome Job (s) status is correctly fetched
Pass/Fail Criteria	Pass if the Appliance correctly manages jobs in the underlying execution manager. Tests must be executed (and pass) for each of the execution managers the appliance supports. All appliances should provide support for, **at least one**, of the following systems: • Torque/PBS • LSF • SGE/OGE • Slurm Optionally, the appliance may support a *fork* execution manager (spawning processes in the appliance host)
Related Information	
Revision Log	V2: Major rewrite of criterion specification.

Information Retrieval	
ID	**JOBEXEC_EXECMNGR_3**
Description	Job Execution Appliances must be able to collect information from the underlying execution manager.
Mandatory	YES
Applicability	Job Execution Appliances

Input from Technology Provider	Support for the information retrieval from execution manager. Information should be returned as a valid GlueSchema representation.
Test Description	**Pre-condition** Configured system **Test** Get information from execution manager **Expected Outcome** Representation of the current information from the execution manager is generated.
Pass/Fail Criteria	Pass if the Appliance produces information for each of the supported execution managers. The information must include all mandatory attributes of the Computing Element related entities in GlueSchema. All appliances should provide support for, **at least one**, of the following systems: • Torque/PBS • LSF • SGE/OGE • Slurm Optionally, the appliance may support a *fork* execution manager (spawning processes in the appliance host)
Related Information	Information Capabilities QC
Revision Log	

1.4 Availability/Scalability

Service Redundancy	
ID	**JOBEXEC_AVAIL_1**
Description	More than one Job Execution Capability implementation should be able to access a single execution manager concurrently.
Mandatory	YES
Applicability	Job Execution Appliances

Input from Technology Provider	Documentation on how to use more than one appliance instance accessing the same execution manager (if any special consideration must be taken into account) Test of concurrent access to same execution manager from at least two instances.	
Test Description	**Pre-condition**	More than one appliance instance configured to use the same execution manager
	Test	Submission of jobs to all configured appliances
	Expected Outcome	Jobs are executed without problems; they are not mixed up in any situation.
Pass/Fail Criteria	Pass if the documentation specifies the configuration steps for using more than one instance in the same execution manager. Tests passes correctly	
Related Information		
Revision Log	V2: Required documentation, changed ID	

Self Disabling Mechanism	
ID	**JOBEXEC_AVAIL_2**
Description	The Job Execution Capability should detect high load conditions and self-disable the job submission in order to maintain the quality of the service.
Mandatory	NO
Applicability	Job Execution Appliances

Input from Technology Provider	Self-disable mechanism under high-load scenarios. Ideally, stress test for the service that triggers a self-disabling mechanism.
Test Description	**Pre-condition** Correctly configured service. **Test** Introduce high load into machine, submit job. **Expected Outcome** High load situation is detected, job submission request is not allowed and message is sent to client.
Pass/Fail Criteria	Pass if the test executes as expected. The high load level should be configurable (e.g. CPU load > x, swap usage > y…)
Related Information	
Revision Log	Changed ID

Job Submission Peaks	
ID	**JOBEXEC_AVAIL_3**
Description	Job Execution Appliances should be able to handle high job submission rates of several hundreds jobs in short intervals.
Mandatory	NO
Applicability	Job Execution Appliances

Input from Technology Provider	Appliance should be able to handle a high number of jobs submitted in a short time interval (e.g. 500 jobs / minute). Ideally, test the service to assert that this is provided
Pass/Fail Criteria	Appliances should be able to handle job bursts of several hundreds of jobs in short intervals.
Related Information	CREAM performance reports: http://gridctb.uoa.gr/cream-performance-notes/report.html
Revision Log	

	Timely Job Status Updates
ID	**JOBEXEC_AVAIL_4**
Description	Job Execution Appliances should be able to report the job status within a reasonable time frame since the events that originate those statuses even in situations of high load
Mandatory	NO
Applicability	Job Execution Appliances

Input from Technology Provider	Appliance must be able to report the status of the submitted jobs without big delays from the event that originates the status change (e.g. mark the job as running/done once the job enters the running/done status in the local batch system). Ideally TP provides a test for the service that asserts that the appliance is able to report immediately the job statuses under high load conditions (big number of concurrent jobs changing status)
Pass/Fail Criteria	Appliances *should* be able to report the status immediately after the event that generated the status change.
Related Information	
Revision Log	

2 PARALLEL JOB

2.1 Submission of parallel jobs

The following tests propose example job descriptions using the gLite JDL format for the specification of jobs. These examples are just used for illustrative purposes. Each appliance should provide the tests using their native format.

Simple parallel job submission	
ID	**PARALLEL_JOB_1**
Description	Job Execution Appliances that also provide the Parallel Job Capability must allow users to submit a job requesting more than one execution slot.
Mandatory	YES
Applicability	Job Execution Appliances with Parallel Job Capability.

Input from Technology Provider	Support for the submission of parallel job, requesting more than 1 slot.	
Test Description	**Pre-condition**	Valid user credentials (and delegation if needed in the system)

	Test	Job submission:
		 `Executable = "/bin/sleep";`
		 `CPUNumber = 4;`
		 `Arguments = "20";`

	Expected Outcome	Job finishes correctly. Unique Identifier for the submitted jobs, status log of the job. Correct number of slots are allocated
Pass/Fail Criteria	Test is executed correctly. Mapping of slots to machines/cores not relevant for the test.	
Related Information	#1391: Support for parallel jobs in JDL.	
Revision Log	V2: Unified PARALLEL_JOB_1, 3 & 4 into this criterion.	

Single machine parallel job submission	
ID	**PARALLEL_JOB_2**
Description	Job Execution Appliances that also provide the Parallel Job Capability should allow users to submit a job requesting more than one execution slot in a single machine.
Mandatory	NO
Applicability	Job Execution Appliances with Parallel Job Capability.

Input from Technology Provider	Support for the submission of parallel job, requesting more than 1 slot in a single machine and for a complete machine.	
Test Description	**Pre-condition**	Valid user credentials (and delegation if needed in the system)

	Test	Job submission:
		`        Executable = "/bin/sleep";`
		`        NodeNumber = 1;`
		`        SMPGranularity = 4;`
		`        Arguments = "20";`

	Expected Outcome	Job finishes correctly. Unique Identifier for the submitted jobs, status log of the job. Correct number of slots are allocated in a single machine
	Pre-condition	Valid user credentials (and delegation if needed in the system)

	Test	Job submission:
		`        Executable = "/bin/sleep";`
		`        NodeNumber = 1;`
		`        SMPGranularity = 4;`
		`        WholeNode = True;`
		`        Arguments = "20";`

	Expected Outcome	Job finishes correctly. Unique Identifier for the submitted jobs, status log of the job. Complete machine with the requested slots is allocated.
Pass/Fail Criteria	Test is executed correctly.	
Related Information		
Revision Log	V2: Unified PARALLEL_JOB_2 & 5.	

Fine grained mapping parallel job submission	
ID	**PARALLEL_JOB_3**
Description	Job Execution Appliances that also provide the Parallel Job Capability should allow users to submit a job requesting a combination of slots per physical machine.
Mandatory	NO
Applicability	Job Execution Appliances with Parallel Job Capability.

Input from Technology Provider	Support for the submission of parallel job requesting specific configurations of slots in several machines.	
Test Description	**Pre-condition**	Valid user credentials (and delegation if needed in the system)

	Test	Job submission:
		        `Executable = "/bin/sleep";`
		        `NodeNumber = 5;`
		        `SMPGranularity = 2;`
		        `Arguments = "20";`

	Expected Outcome	Job finishes correctly. Unique Identifier for the submitted jobs, status log of the job. Correct number of slots is allocated.
Pass/Fail Criteria	Test is executed correctly for different combinations (e.g.: N processes in N different hosts, N processes in a single host, N processes per host in K hosts, K number of complete hosts with at least N slots)	
Related Information		
Revision Log	V2: Unified PARALLEL_JOB_2 & 5.	

2.2 *MPI support*

Precompiled MPI job Execution	
ID	**PARALLEL_MPI_1**
Description	Parallel Job Appliances must support the execution of MPI jobs.
Mandatory	YES
Applicability	Parallel Job Appliances.

Input from Technology Provider	Support for the submission of a MPI job with pre-existing binary.	
Test Description	**Pre-condition**	Valid User proxy and valid delegation in the service. MPI Binary
	Test	Submission of a MPI job requesting more than one execution slot with MPI Binary included in input sandbox of job or already installed in the system (description of job depending on Job Execution interface)
	Expected Outcome	Job is submitted and executed without errors; the requested slots are allocated. Unique Identifier for the submitted jobs, status log of the job.
Pass/Fail Criteria	Pass if the test is provided and passes for all the MPI implementations supported. Support for Open MPI and MPICH2 should be included	
Related Information	User requirements: #672: MPI support	
Revision Log		

MPI job Execution from source.	
ID	**PARALLEL_MPI_2**
Description	Parallel Job Appliances must support the execution of MPI jobs that are compiled at submission time.
Mandatory	YES
Applicability	Parallel Job Appliances.

Input from Technology Provider	Support for the submission of a MPI job compiled from source during its execution.
Test Description	**Pre-condition** Valid User proxy and valid delegation in the service. Source code for MPI application.
	Test Submission of a MPI job requesting more than one execution slot with MPI source code included in input sandbox of job (description of job depending on Job Execution interface). Prior to the execution of the application, the source must be compiled with the available compiler at the site.
	Expected Outcome Job is submitted, compiled and executed without errors; the requested slots are allocated. Unique Identifier for the submitted jobs, status log of the job.
Pass/Fail Criteria	Pass if the test is provided and passes for all the MPI implementations supported. Support for Open MPI and MPICH2 should be included
Related Information	User requirements: #672: MPI support
Revision Log	

2.3 OpenMP support

Precompiled OpenMP job Execution	
ID	**PARALLEL_OMP_1**
Description	Parallel Job Appliances must support the execution of OpenMP jobs.
Mandatory	YES
Applicability	Parallel Job Appliances.

Input from Technology Provider		Support for the submission of an OpenMP job with pre-existing binary.
Test Description	**Pre-condition**	Valid User proxy and valid delegation in the service. OpenMP Binary
	Test	Submission of an OpenMP job requesting more than one execution slot with OpenMP Binary included in input sandbox of job (description of job depending on Job Execution interface)
	Expected Outcome	Job is submitted and executed without errors; the requested slots are allocated. Unique Identifier for the submitted jobs, status log of the job.
Pass/Fail Criteria		Pass if the test is provided and passes for all the OpenMP implementations supported.
Related Information		
Revision Log		

OpenMP job Execution from source	
ID	**PARALLEL_OMP_2**
Description	Parallel Job Appliances must support the execution of OpenMP jobs that are compiled at submission time.
Mandatory	YES
Applicability	Parallel Job Appliances.

Input from Technology Provider	Support for the submission of an OpenMP job that gets compiled at the remote site.	
Test Description	**Pre-condition**	Valid User proxy and valid delegation in the service. Source code for OpenMP application.
	Test	Submission of an OpenMP job requesting more than one execution slot with OpenMP source code included in input sandbox of job (description of job depending on Job Execution interface). Prior to the execution of the application, the source must be compiled with the available compiler at the site.
	Expected Outcome	Job is submitted, compiled and executed without errors; the requested slots are allocated. Unique Identifier for the submitted jobs, status log of the job.
Pass/Fail Criteria	Pass if the test is provided and passes for all the OpenMP implementations supported.	
Related Information		
Revision Log		

3 INTERACTIVE JOB MANAGEMENT

Interactive login	
ID	**INTERACTIVE_JOB_1**
Description	Login interactively to a remote site using grid credentials
Mandatory	NO
Applicability	Interactive Job Management (Interactive Login)

Input from Technology Provider	Tool for providing interactive login to remote machine using any of the supported authn/authz in the UMD Roadmap.
Test Description	**Pre-condition** Valid user credentials (and delegation if needed in the system) **Test** Interactive login to remote site **Expected Outcome** Login is performed and a shell is provided.
Pass/Fail Criteria	Pass if the tool is able to perform the remote logins correctly using the grid credentials
Related Information	gsissh, glogin UMD Roadmap Interactive Job Management [R 1]
Revision Log	

Interactive Job Perusal	
ID	**INTERACTIVE_JOB_2**
Description	Provide a mechanism for getting files produced by a job running in a remote site.
Mandatory	NO
Applicability	Interactive Job Management (Interactive Job Steering)

Input from Technology Provider	Mechanism that is able to retrieve the files produced by a job during its runtime. The provided service should be configurable to retrieve the files at periodic intervals of time. Files to retrieve *should* be configurable.
Pass/Fail Criteria	Pass if the provided service is able to retrieve at periodic intervals job output files during the job execution.
Related Information	WMS Job Perusal UMD Roadmap Interactive Job Management [R 1]
Revision Log	

Interactive Job Monitoring	
ID	**INTERACTIVE_JOB_3**
Description	Provide a mechanism for streaming files produced by a job running in a remote site.
Mandatory	NO
Applicability	Interactive Job Management (Interactive Job Steering)

Input from Technology Provider	Mechanism that is able to stream the files produced by a job during its runtime. Ideally, the files to stream should be configurable. By default the standard output and error of the job should be used.
Pass/Fail Criteria	Pass if the provided service is able to stream the job output files during the job execution.
Related Information	globus-job-get-output, i2glogin UMD Roadmap Interactive Job Management [R 1] #1385: Interactive jobs monitoring
Revision Log	

Interactive Job Steering	
ID	**INTERACTIVE_JOB_4**
Description	Provide a mechanism for steering a job running in a remote site.
Mandatory	NO
Applicability	Interactive Job Management (Interactive Job Steering)

Input from Technology Provider	Mechanism that is able to stream the files produced by a job during its runtime and to control the job execution (i.e. stream the job's standard input from the user location to the remote site).
Pass/Fail Criteria	Pass if the provided service is able to control the job execution by creating a communication channel that forwards output/error and input streams.between the user and the remote job
Related Information	i2glogin UMD Roadmap Interactive Job Management [R 1]
Revision Log	

4 JOB SCHEDULING

4.1 Job Scheduling Interface

The Job Scheduling Capabilities does not have a standard interface. Any implementation of this capability can support on of the Job Execution interfaces proposed by the OGF (DRMAA, BES) or proprietary interfaces (gLite WMS)

Job Scheduling Interface	
ID	**JOBSCH_IFACE_1**
Description	Job Scheduling Appliances must support one of the interfaces currently in use or identified by the UMD Roadmap
Mandatory	YES
Applicability	Job Scheduling Appliances

Input from Technology Provider	Implementation of one of the Job Scheduling Interfaces as defined in the UMD Roadmap. Ideally, a complete test suite of the Job Execution interfaces supported by the appliance. The test suite must include tests for all the documented functions, and for all functions, check both correct and invalid input and with valid and invalid credentials.
Test Description	**Pre-condition** Valid user credentials.
	Test Test all interface functionality, with correct/incorrect input and with valid and invalid credentials.
	Expected Outcome Log of all the operations performed. All the documented functions work as documented.
Pass/Fail Criteria	The Job Scheduling Appliance that claims to support an interface must pass complete tests for that interface (provided by the TP or by the verification team). If the API is not completely supported, this **must** be documented. The test suite must be executed without errors.
	At least one of the following interfaces must be provided:
	• gLite WMS [R 12]
	• OGF DRMAA [R 9]
	• OGSA BES [R 10]
Related Information	UMD Roadmap Job Scheduling Capability
Revision Log	V2: Merged all the interface related criteria into this.

4.2 Job Execution Capability Support

Remote Job Management	
ID	**JOBSCH_EXEC_1**
Description	Job Scheduling Appliances must support the creation and management of work items to an Job Execution Appliance
Mandatory	YES
Applicability	Job Scheduling Appliances

Input from Technology Provider	Appliance must be able to: • create new jobs • retrieve the status of the jobs submitted by the appliance • cancel jobs • optionally, hold and resume jobs The Appliance may perform these operations for individually for each submitted job or for set of jobs in order to improve its performance (e.g. for retrieving the status instead of querying each of the individual jobs, do a single query for all jobs submitted at a given appliance)
Test Description	**Pre-condition** Configured system
	Test Create new job(s) in job execution appliance
	Expected Outcome New job(s) is created in the job execution appliance; id of job(s) returned
	Pre-condition Previously submitted job(s)
	Test Cancel job(s) in job execution appliance.
	Expected Outcome Job(s) is cancelled successfully.
	Pre-condition Previously submitted job(s)
	Test Query status of previously submitted job(s)
	Expected Outcome Job (s) status is correctly fetched
Pass/Fail Criteria	Pass if the Appliance correctly manages jobs in the job execution appliances. Tests must be executed (and pass) for each of the job execution appliances supported. **At least one**, of the following systems/interfaces must be supported: • ARC-CE [R 5] • CREAM [R 6] • EMI-ES [R 7] • Globus GRAM5 [R 8] • OGF DRMAA [R 9] • OGSA BES [R 10] • UNICORE UAS [R 11]
Related Information	UMD Roadmap Job Execution QC

| **Revision Log** | V2: Major rewrite of criterion specification. |

Remote Resource Information	
ID	**JOBSCH_EXEC_2**
Description	Job Scheduling Appliances must be able to use the resource descriptions using the current Information Model and Information Discovery interfaces.
Mandatory	YES
Applicability	Job Scheduling Appliances

Input from Technology Provider	Appliances must handle resources described with the current Information Model (GlueSchema1.3 and optionally GlueSchema2) and Information Discovery (LDAPv3) interfaces.
Test Description	**Pre-condition** Configured system **Test** Fetch information from Information Discovery Appliance. **Expected Outcome** Information is fetched correctly; resources described are added to the list of possible resources to use.
Pass/Fail Criteria	Pass if the Appliance correctly fetches information from Information Discovery appliances and is able to use the resources described by GlueSchema v1.3 and/or GlueSchema v2.
Related Information	Information Capabilities in the UMD Roadmap [R 1]
Revision Log	

4.3 End-to-end job submission tests

The following tests propose example job descriptions using the gLite JDL format for the specification of jobs. These examples are just used for illustrative purposes. Each appliance should execute the tests using their native format.

Simple Job	
ID	**JOBSCH_JOB_1**
Description	Execute a simple job.
Mandatory	YES
Applicability	Job Scheduling Appliances

Input from Technology Provider	Support for the submission of a job with no input or output files.	
Test Description	**Pre-condition**	Valid user credentials (and delegation if needed in the system)

	Test	Job submission of simple job:
		`Executable = /bin/sleep;`
		`Arguments = "120";`

	Expected Outcome	Job finishes correctly. Unique Identifier for the submitted jobs, status log of the job.
Pass/Fail Criteria	Pass if the test passes correctly.	
Related Information		
Revision Log	V2: moved specific WMS criteria to generic to all Job Scheduling	

Simple Job with input/output files	
ID	**JOBSCH_JOB_2**
Description	Execute a simple job that uses both input and output files.
Mandatory	YES
Applicability	Job Scheduling Appliances

Input from Technology Provider	Support for the submission of a job with input or output files.	
Test Description	**Pre-condition**	Valid user credentials (and delegation if needed in the system) Non-empty file "myfile"

	Test	Job submission for job with input and output files:
		 `Executable = "/bin/ls";`
		 `Arguments = "-l";`
		 `StdOutput = "std.out";`
		 `StdError = "std.err";`
		 `InputSandbox = {"myfile"};`
		 `OutputSandbox = {"std.out", "std.err"};`

	Expected Outcome	Job finishes correctly; output contains the listing of the directory including the input file with correct size. Unique Identifier for the submitted jobs, status log of the job.
Pass/Fail Criteria	Pass if the test passes correctly.	
Related Information		
Revision Log	V2: moved specific WMS criteria to generic.	

Cancel Job	
ID	**JOBSCH_JOB_3**
Description	Cancel a previously submitted job.
Mandatory	YES
Applicability	Job Scheduling Appliances

Input from Technology Provider	Support for the cancellation of a job. Job cancelling must be supported for the different states that the job may be, e.g. cancel the job when it's running or cancel the job when it's already done.	
Test Description	**Pre-condition**	Valid user credentials (and delegation if needed in the system)

	Test	Job Submission and then cancellation.
		Possible description for job:
		`Executable = "/bin/sleep";`
		`Arguments = "20m";`

	Expected Outcome	Job is submitted and then cancelled correctly. Unique Identifier for the submitted jobs, status log of the job. Job is removed from remote Job Execution Appliance.
Pass/Fail Criteria	Pass if the appliance is able to cancel jobs for any previous state of the job. If the job is already submitted to a Job Execution Appliance, it should be completely removed from it, especially if it's running.	
Related Information		
Revision Log	V2: moved specific WMS criteria to generic to all Job Scheduling	

Parallel Job	
ID	**JOBSCH_JOB_4**
Description	Execute a parallel job.
Mandatory	NO
Applicability	Job Scheduling Appliances with Parallel Job Support.

Input from Technology Provider	Support for the submission of a job with input or output files.	
Test Description	**Pre-condition**	Valid user credentials (and delegation if needed in the system)

	Test	Job Submission or parallel job. Possible description for job:
		
		`Executable = "/bin/sleep";`
		`CPUNumber = 2;`
		`Arguments = "20";`

	Expected Outcome	Job finishes correctly. Unique Identifier for the submitted jobs, status log of the job. Correct number of slots is allocated at the remote site.
Pass/Fail Criteria	Pass if the test passes correctly.	
Related Information		
Revision Log	V2: moved specific WMS criteria to generic to all Job Scheduling	

Job List Match	
ID	**JOBSCH_JOB_5**
Description	List the available resources for a given job.
Mandatory	YES
Applicability	Job Scheduling Appliances

Input from Technology Provider	Support for the list match of a job.	
Test Description	**Pre-condition**	Valid user credentials and delegation in the service.

	Test	Job list match for job with requirements and rank expressions, for example:
		`Executable = "/bin/sleep";`
		`Requirements = other.GlueCEStateStatus = "Production";`
		`Rank = -other.GlueCEStateEstimatedResponseTime;`

	Expected Outcome	List of available resources for execution (with correct rank) is returned.
Pass/Fail Criteria	The Job Scheduling Appliance must return a list of available resources for the execution of any given job. Optionally, a *rank* defined by the user is returned by each of the resources.	
Related Information		
Revision Log	V2: moved specific WMS criteria to generic to all Job Scheduling	

Parametric Job Submission	
ID	**JOBSCH_JOB_6**
Description	Execute a parametric job.
Mandatory	NO
Applicability	Job Scheduling Appliances with support for parametric jobs.

Input from Technology Provider	Support for the submission of parametric jobs.	
Test Description	**Pre-condition**	Valid user credentials (and delegation if needed in the system)
	Test	Job submission of job with numeric parameters (e.g. `Parameters = 10000;ParameterStart = 1000; ParameterStep = 10;`).
	Expected Outcome	Job is executed correctly. List of JobIds for the parametric jobs and each of the subjobs is obtained; all states of the jobs must be logged correctly.
	Pre-condition	Valid user credentials (and delegation if needed in the system)
	Test	Job submission of job with a list of parameters (e.g. `Parameters={A, B, C,…}`).
	Expected Outcome	Job is executed correctly. List of JobIds for the parametric jobs and each of the subjobs is obtained; all states of the jobs must be logged correctly.
Pass/Fail Criteria	Pass if the test passes correctly.	
Related Information		
Revision Log	V2: moved specific WMS criteria to generic to all Job Scheduling	

Job Collection Submission	
ID	**JOBSCH_JOB_7**
Description	Execute a job collection
Mandatory	NO
Applicability	Job Scheduling Appliances with support for job collections.

Input from Technology Provider	Support for the submission of job collections.	
Test Description	**Pre-condition**	Valid user credentials (and delegation if needed in the system)
	Test	Job submission for job collection.
	Expected Outcome	Job is executed correctly. List of JobIds for the job collections and each of the subjobs is obtained; all states of the jobs must be logged correctly.
Pass/Fail Criteria	Pass if the test passes correctly.	
Related Information		
Revision Log	V2: moved specific WMS criteria to generic to all Job Scheduling	

DAG Submission	
ID	**JOBSCH_JOB_8**
Description	Execute a DAG job.
Mandatory	NO
Applicability	Job Scheduling Appliances with support for DAGs.

Input from Technology Provider	Support for the submission of DAGs.	
Test Description	**Pre-condition**	Valid user credentials and delegation in the service.
	Test	Job submission for DAG.
	Expected Outcome	Job is executed correctly. List of JobIds for DAG and each of the subjobs is obtained; all states of the jobs must be logged correctly.
Pass/Fail Criteria	Pass if the test passes correctly. DAGs must be able to use any of the Job Execution Interfaces supported by the Job Scheduling Appliance. Explicit test this possibility.	
Related Information		
Revision Log	V2: moved specific WMS criteria to generic to all Job Scheduling	

4.4 gLite WMS

This section includes criteria applicable to the gLite WMS system.

Proxy Renewal	
ID	**JOBSCH_WMS_1**
Description	The WMS must manage the user credentials and renew them if necessary.
Mandatory	YES
Applicability	gLite WMS Job Scheduling Appliances.

Input from Technology Provider	Support for the proxy renewal mechanism for long running jobs.	
Test Description	**Pre-condition**	Valid user credentials with short duration (e.g. 30 min) and delegation in the service. Credentials Renewal service available.
	Test	Submit job that takes longer to complete that the credential lifetime (e.g. 1 hour)
	Expected Outcome	Job executes successfully. The scheduling services should perform a proxy renewal and state it in the log messages (if there is an error, log it also). Output of the job, and status messages stating the renewal of the user credentials.
	Pre-condition	Valid user credentials with short duration, e.g. 30 min, no renewal service.
	Test	Submit job that takes longer to complete that the credential lifetime (e.g. 1 hour)
	Expected Outcome	Job does not complete successfully. Log of operations and status of the job updated with information about the error (no renewal possible)
Pass/Fail Criteria	Will Pass if the proxy renewal is done, or if there is an error logged stating the problem. Will fail if there is no clear information about the process.	
Related Information		
Revision Log		

Job Resubmission	
ID	**JOBSCH_WMS_2**
Description	Any job failures (due to resource malfunctioning or the job itself) must be resubmitted with a configurable amount of retrials.
Mandatory	NO
Applicability	gLite WMS Job Scheduling Appliances.

Input from Technology Provider	Support for the resubmission mechanism of the WMS.	
Test Description	**Pre-condition**	Valid user credentials and delegation in the service.
	Test	Job submission that fails due to simulated remote resource malfunctioning.
	Expected Outcome	Job is resubmitted to other resource. Log of all failures and a complete trace of the job.
	Pre-condition	Valid user credentials and delegation in the service.
	Test	Job submission for job that always fails (e.g. exit code 1)
	Expected Outcome	Job is resubmitted until resubmission attempts reach the configured limit. Log of all failures and a complete trace of the job.
Pass/Fail Criteria	Job failures due to resource malfunctioning and not to the job itself must be resubmitted to other resources, with a configurable amount of repetitions. In the case of job failures due to the job itself must be resubmitted with a configurable amount of repetitions. In both situations, status must reflect clearly what is the cause of resubmission, new resource selected and attempt number	
Related Information	Requirements gathered in MS305 related to resubmission of jobs, and information provided in error messages.	
Revision Log	V2: originally JOBEXEC_WMS_JOB_9	

JDL Acceptance Limits	
ID	**JOBSCH_WMS_3**
Description	The service should accept JDLs without size restrictions
Mandatory	NO
Applicability	gLite WMS Job Scheduling Appliances.

Input from Technology Provider	A test to submit a job and check if it is accepted or rejected, specially for big JDLs.	
Test Description	**Pre-condition**	Valid user credentials and delegation in the service.
	Test	Submission of job descriptions (specially large)
	Expected Outcome	Normal job submission if everything is correct; an error message if any problem arises.
Pass/Fail Criteria	Will Pass if JDL is correct, and submits the job or if there is a report on a known syntax error in the jdl. Will Fail if a wrong Jdl is accepted or if it crashes	
Related Information	Requirements gathered in MS305 related to resubmission of jobs, and information provided in error messages.	
Revision Log	V2: originally JOBEXEC_WMS_JOB_10	

4.4.1 Security Advisories

Security Advisory 1502	
ID	**JOBSCH_WMS_SEC_1**
Description	Steal of proxies is possible without leaving trace.
Mandatory	YES
Applicability	gLite WMS Job Scheduling Appliances.

Input from Technology Provider	Test that assures the problem described in the SVG Advisory 1502 (proxy stealing) is fixed.
Pass/Fail Criteria	Fix for Advisory-SVG-2011-1502 is provided. A test that proves that the fix is provided should be also present.
Related Information	Advisory-SVG-2011-1502 (https://wiki.egi.eu/wiki/SVG:Advisory-SVG-2011-1502)
Revision Log	

4.5 Service availability, monitoring and error handling.

Error Messages	
ID	**JOBSCH_SERVICE_1**
Description	Error messages provided by the service should be clear and facilitate the solution of those errors by users or service administrators
Mandatory	NO
Applicability	Job Scheduling Appliances.

Input from Technology Provider	Include in documentation, a list of possible errors and possible solution/cause for it. For errors that may reach the user, this list has to be exhaustive.
Pass/Fail Criteria	Will pass if the list of errors is documented and includes information about: • Error code • Error message (if applicable) • Error source (internal module or remote resource (specify it explicitly)) • Cause of error (syntax error, module malfunctioning, configuration problem, network error, other (specify it explicit)) • Type (critical, informative) • Possible solution
Related Information	Requirements gathered in MS305 related to resubmission of jobs, and information provided in error messages.
Revision Log	

Service Information	
ID	**JOBSCH_SERVICE_2**
Description	Job Scheduling Appliances must be able to generate information about the provided service that can be used in a Information Discovery Appliance.
Mandatory	NO
Applicability	Job Scheduling Appliances.

Input from Technology Provider	Support for information generation about the service status.	
Test Description	**Pre-condition**	Configured system, Information Discovery appliance available.
	Test	Generate service information and publish to Information Discovery Appliance. Access Info Discovery Appliance.
	Expected Outcome	Information is produced and can be accessed through the Information Discovery Appliance.
Pass/Fail Criteria	Test is provided and executed as expected.	
Related Information	Requirements gathered in MS305 related to resubmission of jobs, and information provided in error messages.	
Revision Log		

Self Disabling Mechanism	
ID	**JOBSCH_SERVICE_3**
Description	The Job Scheduling Capability should detect high load conditions and self-disable the job submission in order to maintain the quality of the service.
Mandatory	NO
Applicability	Job Scheduling Appliances

Input from Technology Provider	Support for self-disabling mechanism under high load conditions. Ideally, stress test for the service that triggers a self-disabling mechanism.	
Test Description	**Pre-condition**	Correctly configured service.
	Test	Introduce high load into machine, submit job.
	Expected Outcome	High load situation is detected, job submission request is not allowed and message is sent to client.
Pass/Fail Criteria	Pass if the test executes as expected. The high load level should be configurable (e.g. CPU load > x, swap usage > y…)	
Related Information	User requirements: #698: WMS stability and performance #702: Stability of UMD services and improvements	
Revision Log	V2: Changed ID (from JOBSCH_SERVICE_4 to JOBSCH_SERVICE_3)	

Job Submission Peaks	
ID	**JOBSCH_SERVICE_4**
Description	Job Scheduling Appliances should be able to handle high job submission rates of several hundreds jobs in short intervals.
Mandatory	NO
Applicability	Job Scheduling Appliances

Input from Technology Provider	Appliance should be able to handle a high number of jobs submitted in a short time interval (e.g. 500 jobs / minute). Ideally, test the service to assert that this is provided
Pass/Fail Criteria	Appliances should be able to handle job bursts of several hundreds of jobs in short intervals.
Related Information	User requirements: #698: WMS stability and performance
Revision Log	

Timely Job Status Updates	
ID	**JOBSCH_SERVICE_5**
Description	Job Scheduling Appliances should be able to report the job status within a reasonable time frame since the events that originate those statuses even in situations of high load
Mandatory	NO
Applicability	Job Execution Appliances

Input from Technology Provider	Appliance must be able to report the status of the submitted jobs without big delays from the event that originates the status change (e.g. mark the job as running/done once the job enters the running/done status in the local batch system). Ideally TP provides a test for the service that asserts that the appliance is able to report immediately the job statuses under high load conditions (big number of concurrent jobs changing status)
Pass/Fail Criteria	Appliances *should* be able to report the status immediately after the event that generated the status change.
Related Information	User requirements: #698: WMS stability and performance
Revision Log	

5 REFERENCES

R 1	UMD roadmap: https://documents.egi.eu/public/ShowDocument?docid=100
R 2	Generic UMD Quality Criteria
R 3	Security Capabilities Quality Criteria
R 4	Operational Capabilities Quality Criteria
R 5	A. Konstantinov, ARC Computational Job Management Component – A-REX, NORDUGRID-TECH-14
R 6	CREAM: http://grid.pd.infn.it/cream/
R 7	EMI-ES: https://twiki.cern.ch/twiki/bin/view/EMI/EmiExecutionService
R 8	GRAM5: http://www.globus.org/toolkit/docs/latest-stable/execution/gram5/
R 9	OGF DRMAA: http://www.drmaa.org/
R 10	OGSA Basic Execution Service v1.0: http://www.ogf.org/documents/GFD.108.pdf
R 11	UNICORE UAS: http://www.unicore.eu/unicore/architecture/service-layer.php#anchor_uas
R 12	gLite WMS: http://web.infn.it/gLiteWMS/