



CERTIFICATION TESTBED

HARDWARE INSTALLATION DEDICATED FOR TEST AND TRAINING

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Abstract: Complexities in grid middleware and applications makes it necessary to test software before installing it to production grid systems. At the same time, the tutorials held at various grid events need infrastructure to run test jobs on, because the tutorial infrastructure offered by EGEE has often been overloaded and therefore the tutorial participants first experience with grids have been sometimes discouraging. The solution for both problems is Certification testbed – hardware installation dedicated for test and training.





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GLOSSARY

BDII	Berkeley Database Information Index
CA	Certification Authority
CE	Computing Element
CPU	Central Processing Unit
CYFRONET	Academic Computer Centre of the University of Science and Technology in Cracow
EENet	Estonian Educational and Research Network
EGEE	Enabling Grids for E-science
FCR	Freedom of Choice for Resources
IFJ PAN	Institute of Nuclear Physics of Polish Academy of Sciences
LCG	LHC Computing Grid
LFC	LCG File Catalog
LHC	Large Hadron Collider
NICPB	National Institute of Chemical Physics and Biophysics
RB	Resource Broker
RTU	Riga Technical University
SAM	Service Availability Monitoring
VO	Virtual Organization
VOMS	VO Management Service
VU	Vilnius University
WN	Worker Node



1. INTRODUCTION

The grid middleware provides a set of fundamental functionality for grid resources. It needs to be stable enough to ensure building a production level of grid services. The software is however being developed and thus process of the stabilization can still be affected by a possibility to introduce new defects. Another aspect having impact on the overall stability is high heterogeneity of resources that the grid middleware need to cover. As a counterweight for factors destroying middleware stability a task of middleware certification was created.

Due to infrastructure stability concerns the middleware certification need to be performed on a separate infrastructure. Along with testing new version of the middleware the applications can take advantage of having access to new middleware features. Application developers may get familiar with new middleware functionality, use it and analyze how it may fit their needs.

Resources in certification testbed are not so intensively used as in production infrastructure and due to that there is a space to use them also for training activities, when coordinated using some synchronization mechanisms to avoid coincidences that may affect quality of each one.

Grid technology seems to be matured enough to be presented to the users in hands-on exercises where the attendees can make use of the technology by themselves. However, there are different requirements that need to be met in order to provide the tutorial participants with access to such a world-wide infrastructure in a manner that will result in a *worth-using* experience.

At last, for both, namely training and certification activities there are procedures and policies needed. In next sections we show how we have been building the infrastructure and integrate the two activities to live with each other peacefully.

In the following sections we describe Certification Testbed activities in more details, namely Section 3 introduces tutorial preparation process. Next, in Section 3.3 we describe the resources ramp-up procedures. Section 4 covers software certification process. Last two sections presents the resources involved in BalticGrid Certification Testbed and also exploitation of the infrastructure.



2. CERTIFICATION TESTBED

As described in the previous section BalticGrid certification testbed activities are twofold, namely:

1. Trainings
2. Software Certification

For both of them we can distinguish *resources* and *particular activities* that are utilizing the resources.

2.1. TRAININGS

Our need to build own training infrastructure was driven by the necessity to carry out successful training events. Bad experience gained by the users during the tutorial may very often result in they become disaffected and will never come back to idea of computing in grids. The existing training infrastructures seems to have their own shortcomings [2] making it difficult to use for successful events. An infrastructure managed from within the BalticGrid community appears to be convenient than external one and some specific needs can be achieved more easily.

Following other projects approach [2] we embrace the whole training activity into a Virtual Organization equipped with some specific abilities. To satisfy the requirements of users participating in training without a personal certificate we created a Certification Authority with signing policy flexible enough to issue certificates for tutorial participants who does not have their personal grid credentials yet. These are short time, tutorial only certificates.

The new VO we established for trainings is called *bgtut*. To make the new VO fully functional in grid we provided also grid core services supporting that VO.

In order to build an infrastructure which satisfies the users' needs we took an approach of "users' view".

To carry out a training event the participants need to be provided with:

1. user interface to access the grid
2. grid certificates registered to some Virtual Organization
3. resources the users can use, both computational and storage

There are some specifics behind all that points we are going to touch in more details in section 5

2.2. SOFTWARE CERTIFICATION

As the middleware developers release new software versions, sites need a way to test them before engaging them in full production use. To do that a smaller test Grid has to be created. The same central resources can be used to distribute the test jobs as well as site information. However, the users of these resources should be aware of unstable nature of the testbed infrastructure. There are many reasons for this:

- these are test resources and may not be stable enough hence may cause a job to be lost or killed
- only small clusters are used for testing and hence larger scale running by the common users would quickly fill them and reduce the possibility to test
- testing should only last a short time after a middleware is released requiring quick and organized access for people who know what and how to test (both site administrators and application administrators/VO representatives)



3. ACTIVITIES IN TRAINING INFRASTRUCTURE

The aim of the Training Infrastructure is to provide resources that can be used by attendees of BalticGrid project training events. This aim we achieve by decomposition on of the main task into smaller subtasks we describe in details in the following subsections.

3.1. ARRANGING TUTORIALS

There are three parties involved in preparation and executing tutorials on the BalticGrid Training Infrastructure:

1. Tutorial Organizer - the person or institute willing to give a tutorial
2. Tutorial Technical Team - the Project's technical team responsible for providing the access to infrastructure
3. The Participants - the attendees of the tutorial

During the preparation of the event there are two parties involved: the Organizer and Technical Team which cooperate to provide the best service to tutorial Participants. We define *requirements* and *responsibilities* of each group to understand their expectations and obligations in the process of arranging and executing tutorial.

Tutorial Organizer

Requirements:

- be provided with the credentials for Tutorial Participants
- be provided with the User Interface that the Participants can use to access the grid
- implement other specific tutorial requirements on the infrastructure

Responsibilities:

- handling the credentials acquired from Technical Team in a safe way
- instruct Participants on proper handling of their grid credentials
- instruct Participants on proper using of *bgtut VO*
- register mapping between real participant name and tutorial certificate DN
- provide the mapping to the Technical Team after the event

Tutorial Technical Team

Requirements

- be provided with the following data:
- date of the event,
- expected number of participants
- estimate demand on computational resources
- other specific requirements



All this data need to be provided in advance in order to make a proper set up on time from which the negotiation of resources is the most time-sensitive.

Responsibilities

The Tutorial Technical team is responsible for:

- providing the credentials for the upcoming event Participants as requested by the Organizer
- on demand, it can provide a testing certificate for the Organizer to test the exercises in advance
- make sure an appropriate amount of resources is available for the Participants during the event
- keep the *bgtut VO* core services infrastructure in a stable shape (monitoring)
- store the mapping between real participants and certificate DN at least one year after the training
- provide support for the Organizer in case of any failures on the Training Infrastructure

Tutorial Participants

Requirements

The Participants need to be provided with all facilities to carry out the exercises presented during the training event smoothly. This mainly involves seamless access to the grid infrastructure and uninterrupted control of their activity which itself must present a stable level of infrastructure operation.

Responsibilities

The Participants are requested to obey rules of using grid infrastructure that are explained to them by the Tutorial Organizer at the beginning of the training event. In particular they need to protect their certificates against being stolen by someone else and obey rules of using those credentials to carry out only training activity tasks.

3.2. PROCEDURE FOR ARRANGING TUTORIALS

All above requirements and responsibilities are put into action during the procedure of preparing a training event. The procedure consists of 6 steps.

Some weeks before a training event the Organizer sends the request to the Technical Team with details on upcoming training event (1). The Technical Team generates proper amount of user certificates, registers them in VOMS server (2) and exposes to the Organizer by some secure channel (3). Next, the organizer provides the credentials to some local organizer (4) to install it onto user interface machine. Then, just before the event the mapping between certificates and participants is done (5). After the even the Organizer provides the Technical Team with the mapping (6).

For tutorial organizers we have a procedure on how to obtain a tutor certificate in advance and get access to the infrastructure before the training event in order to test the exercises. So, we issue one certificate with longer lifetime for organizer to test if the infrastructure fits his needs. Also, we need to be notified in advance about tutorial event since we have to negotiate resources with sites which are in production infrastructure.

Details on interaction between parties are described on the web page:

http://www.balticgrid.org/Grid_Operations/technicalguides/tutorial/organizers



3.3. ADDING AND SHARING COMPUTATIONAL RESOURCES

In order to extend certification testbed resources of new sites we prepared a procedure that helps site administrators to add resources to BalticGrid training activity. It was used to set up initial installation at partners involved in that task, but also we asked some production sites to support us. The reason behind asking production sites to participate in training infrastructure was that in the beginning the amount of resources provided by sites dedicated to trainings was small and may not be sufficient for running a successful tutorial. Until we gain enough resources tutorials will be held on using production and training sites.

The sites dedicated to trainings can however be partially shared with Software Certification. See: Figure 1. Sites that are not production can freely install new version of software and carry out testing there without violating production requirements.

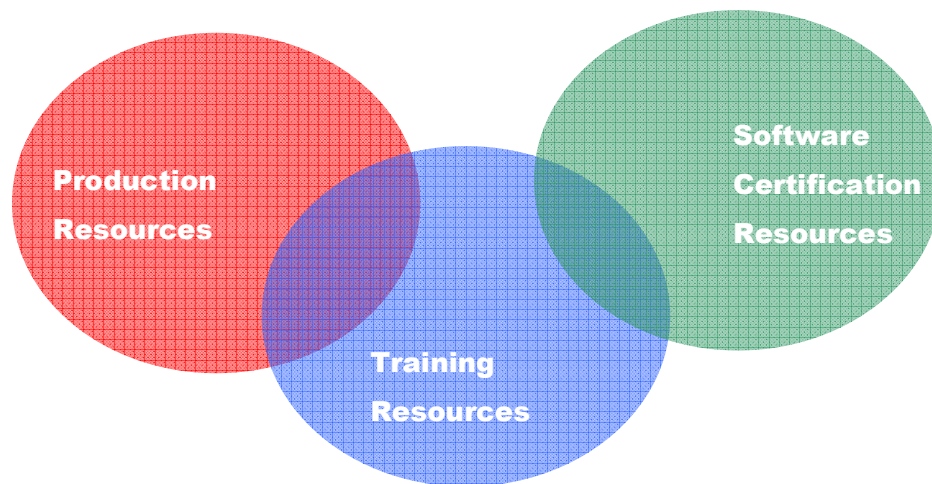


Figure 1. Overlapping of resources usage in Certification Testbed

Detailed procedure on supporting BalticGrid tutorials is described at the following web page:

http://www.balticgrid.org/Grid_Operations/technicalguides/tutorial/tutorial-sites

3.4. PROCEDURE FOR SHARING RESOURCES BETWEEN TRAININGS AND CERTIFICATION

Trainings need to be carried out on an infrastructure that is stable enough to provide good level of service to trainees. On the other hand software certification activity can destabilize the middleware. Due to that we plan to use automatic monitoring tools to have current view on the functionality of sites supporting *bgtut VO*. On that base we can exclude bad sites from the training infrastructure automatically by removing them from *bgtut VO* Information Index, so that they will not be used for a specific training activity. Moreover the training events are usually planned long in advance so the certification activity can take that information into account to postpone certification in this specific period.



CERTIFICATION TESTBED
Hardware installation dedicated for test and training

To implement above requirements we plan to exploit existing EGEE tools for that i.e. the SAM testing suite [4] for checking the sites' functionality and FCR [5] tool to exclude the bad sites from the *bgtut* VO BDII machine.

Core Services like BDII, RB and LFC can be shared by both activities but on them we will not perform software certification.



4. ACTIVITIES IN SOFTWARE CERTIFICATION

The aim of Software Certification infrastructure is to provide site administrators, application maintainers and VO representatives a platform where to test and maintain their resources or applications before introducing them to the general production level Grid thus reducing unplanned downtimes. To achieve this task of software certification is divided into smaller subtasks as described below.

4.1. RESOURCE GATHERING

A number of test resources are needed to test a middleware release and scientific applications ported to grid. To acquire such resources the current plan is to utilize smaller sites which do not contribute big in stable production running or are part of some specific research objective. Such resources can then respond quicker to upgrades and announcements in both middleware as well as software releases. It is hoped for that at some point down the line all sites have in addition to their production resources also a smaller version to test the same functionality. At this moment only a small number of sites have such configurations.

4.2. RELEASE ANNOUNCEMENTS

New Grid middleware releases are announced to site administrators through e-mail. The operations director will coordinate the deployment with test resource owners to see how the announced upgrade or new release functions. A number of test scenarios are played through (SAM tests, BalticGrid stress tests etc) as well as application owners should run a number of test jobs to validate that the new upgrade or middleware release does not disturb their running.

Once first round testing of new release has been performed by a number of test sites, then Operations Director announces the upgrade on test sites to software maintainers. The software maintainers then install and test their applications on the test systems to make sure the upgrade does not disrupt their application and its use. Once the application testers have verified that the upgrade does not break their applications, the Operations Director can announce the option to upgrade also to the production sites who then at their discretion will plan the upgrade process with options on further testing depending on their infrastructure peculiarities.

New scientific applications should be installed and tested on certification teststbed resources before installing them on production sites.

4.3. SOFTWARE VALIDATION

In addition to middleware certification and validation, which is done in a coordinated way and managed by the Operations Director, there is also the task of software validation for different applications and interest groups.

The coordinator for software validation is in case of each software application the application maintainer in BalticGrid. In majority of cases this should be the VO software maintainer (or one of them) who coordinates the testing with the test sites after the middleware has been validated to be usable. It is up to the application maintainer to make sure if the application is working correctly with the new middleware available on test sites.

In addition to validation of already existing software versions on newly announced middleware the application testers should test their new application codes and use of features also at first on the test environment before introducing these new codes to production sites. However this testing is not centrally coordinated and is up to the VO to decide its own policies.



5. RESOURCES

5.1. RESOURCES FOR TRAININGS

Resources for trainings include:

- Core Services - crucial for operation of the tutorial VO
- Computational Resources – CPUs that are available for executing tutorial's jobs
- Storage Resources – storage resources to be used for handling tutorial's job files

The procedure of establishing BalticGrid Training Infrastructure was the following:

1. Create a tutorial Certification Authority
2. Erect a new VO dedicated for tutorials called *bgtut*
3. Set up core services for the VO
4. Ask sites to provide some resources for the *bgtut* VO



Currently, training infrastructure consists of the services hosted by EENET, VU, RTU and IFJ PAN (with cooperation of CYFRONET) partners. The following table describe resources in details:

Service	Details
Core Services	
Certification Authority	http://grid.cyfronet.pl/tutorial-ca/
Logical File Catalogue (LFC) for bgtut VO	lfc.cyf-kr.edu.pl
Resource Brokers (RB)	rb-uncert.cyf-kr.edu.pl
	broker.eenet.ee
	rb1.cyf-kr.edu.pl
	grid3.mif.vu.lt
Virtual Organization Membership Service (VOMS) for bgtut VO	https://voms.cyf-kr.edu.pl:8443/voms/bgtut/
Computational Resources	
Computing Element	zeus13.cyf-kr.edu.pl:2119/jobmanager-lcgpbs-bgtut
	zeus02.cyf-kr.edu.pl:2119/jobmanager-lcgpbs-bgtut
	kriit.eenet.ee:2119/jobmanager-pbs-bgtut
	fwe01.ifj.edu.pl:2119/jobmanager-lcgpbs-bgtut
	ce01.grid.etf.rtu.lv:2119/jobmanager-lcgpbs-bgtut
	ce.egee.man.poznan.pl:2119/jobmanager-lcgpbs-bgtut
Storage Resources	
Storage Element	zeus13.cyf-kr.edu.pl
	zeus03.cyf-kr.edu.pl
	kriit.eenet.ee
	fwe01.ifj.edu.pl
	dpm01.grid.etf.rtu.lv
	se1.egee.man.poznan.pl

Table 1. Resources for Certification Testbed Training Infrastructure.

5.1.1. Technical Deployment of the Requirements

The need for a separate CA was dictated by the fact that we need to provide some tutorial participants with the certificates. We decided to make a CA policy that allows to issue anonymous (but numbered) certificates which while given to the particular user the user personality is being recorded. That part is written in CA policy and also in rules of for tutorial organizers.

We asked some large production sites in Poland to support the *bgtut* VO to make sure we can provide sufficient number of resources even for a larger event. We are working on procedures of resource



negotiation with these sites that will allow us to inform them in advance of upcoming event so they can reserve required amount of resources.

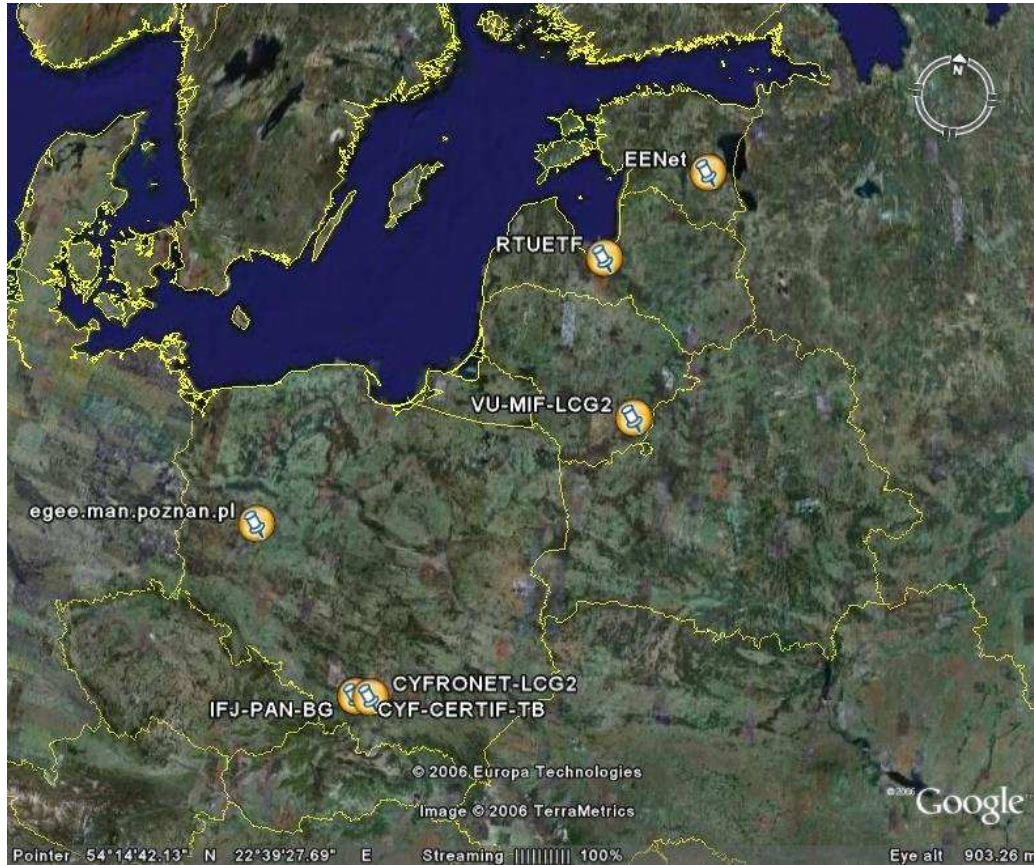


Figure 2. Sites providing resources for BalticGrid Certification Testbed

5.1.2. Resource Monitoring

In order to make sure the Training Infrastructure is stable we plan to integrate *bgtut* VO with a common framework for testing site functionality for balticgrid VO called SAM [1]. The possibility of having such a web page is being investigated with our partners from Lithuania.

5.2. RESOURCES FOR CERTIFICATION

The resources for certification are mostly overlapping with those used in training. However as some production resources allow access to the tutorial VO, then not all of the same computing elements and storage elements can be used for testing the middleware and new scientific applications. The resources for certification include:

- Core services – mostly overlapping with training resources (except for VO-s)
- Computational resources – computing elements available for testing and validation
- Storage resources – storage elements available for testing and validation



There is no separate procedure to become a test resource as any site can set up in addition to their production resources also the test resources both for their own preproduction testing as well as centrally coordinated testing. Once a resource is available to be used for testing the administrator of that resource opens a ticket in the support system to be included in the certification testbed. The central services maintainers as well as Operations Director take notice and make the necessary additions. There is no validation for test resources as they are per-se for testing purposes.

The current list of resources for software certification:

Service	Details
Core Services	
Certification Authority	http://grid.cyfronet.pl/tutorial-ca/
Logical File Catalogue (LFC) for bgtut VO	lfc.cyf-kr.edu.pl
Resource Brokers (RB)	broker.eenet.ee
	rb1.cyf-kr.edu.pl
	grid3.mif.vu.lt
Virtual Organization Membership Service (VOMS)	BalticGrid VO server as well as external VO servers (CMS, LHCb etc)
Computational Resources	
Computing Element	cerncms.hep.kbfi.ee
	turing.ttu.ee
	arvutaja.physic.ut.ee
	penguin.mt.ut.ee
	pupa.elen.ktu.lt
	ce.bg.ktu.lt
	vdupdc.vdu.lt
	grid.pri.kmu.lt
	grid.su.lt
	zeus13.cyf-kr.edu.pl
Storage Resources	
Storage Element	cerncms.hep.kbfi.ee
	vdupdc.vdu.lt
	pupa.elen.ktu.lt
	grid.pri.kmu.lt
	zeus13.cyf-kr.edu.pl



6. EXPLOITATION

The creation process of BalticGrid Training infrastructure started in September 2006 as a result of common need for having own dedicated infrastructure for trainings. The deployment phase just ended before 2nd BalticGrid All Hands Meeting in Riga during which we supported one training event that was held on 4 October 2006 in Riga. Programme of Tutorial was “EGEE gLite – basic functionality” and “Migrating Desktop – support for developers of Grid application”.

We issued 50 certificates for that event and registered number of participants is 32. Full list of them can be seen at: <http://2ahm.lumii.lv/section/show/13>. The accounting tools registered a dozen jobs running during this tutorial.



7. CONCLUSION

The Certification Testbed for BalticGrid is being deployed by BalticGrid partners. It has been already used for BalticGrid training events and it performed well in our grid tutorials.

At the moment the certification testbed has minimal setup for functioning. The policy for using the testbed for software certification requires further development. The need for such infrastructure has been pointed out by the BalticGridi Applicaton Support activity and by site administrators.



8. REFERENCES

[1] SAM testing framework for balticgrid VO

<https://lxb6112.cern.ch/sam/sam.py>

[2] Gilda, an EGEE training infrastructure

<http://public.eu-egee.org/test/aboutgilda.html>

[3] BalticGrid Training Arrangement Procedures Web Page

http://www.balticgrid.org/Grid_Operations/technicalguides/tutorial/

[4] SAM functional tests

<http://goc.grid.sinica.edu.tw/gocwiki/SAM>

[5] Freedom of Choice of Resources

http://goc.grid.sinica.edu.tw/gocwiki/FCR_--_Freedom_of_Choice_for_Resources