DSA1.8 FINAL ANALYSIS ON INFRASTRUCTURE ACTIVITY RESULTS

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Abstract: BalticGrid has been in operations now for 30 months. During that time a well-defined infrastructure has formed with available resources and policies in place. Local scientific community has shown active interest in this infrastructure by a growing amount of computations done from local VO-s. In addition to a working infrastructure of resources the project has also established a full support structure to maintain this infrastructure and provide best possible support for end users. In general the project and more particularly SA1 work has been a success.

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GLOSSARY

APEL	Accounting Processor for Event Logs
ARC	Advanced Resource Connector
BDII	Berkeley Database Information Index
BIIT	Bio-Informatics and IT
CA	Certificate Authority
CAMAGER	CA MAnaGER
CIC	Core Infrastructure Center
DGAS	Distributed Grid Accounting System
EGEE	Enabling Grids for E-sciencE
GAMESS	General Atomic and Molecular Electronic Structure System
GGUS	Global Grid User Support
GOCDB	Grid Operations Centre DataBase
GNU	Gnu's Not Unix
GPG	GNU Privacy Guard
GSTAT	Grid STATus
IM	Instant Messaging
IT	Information Technology
LCG	LHC Computing Grid
LFC	Logical File Catalog
LHC	Large Hadron Collider
NGI	National Grid Initiative
PKI	Public Key Infrastructure
RA	Registrar Authority
RB	Resource Broker
SAM	Site Availability Monitor
SFT	Site Functional Test
SLA	Service Level Agreement
SPI	Software Process & Infrastructure
UIPnP	User Interface Plug-and-Play
VO	Virtual Organization
VOMS	Virtual Organization Management Service
WMS	Workload Management System

1. INTRODUCTION

During the 30 months of the BalticGrid project SA1 activity has focused on creating a viable working infrastructure to support both local and international scientific research collaborations interested in wide scale distributed computing. That kind of an infrastructure requires availability of resources as well as quality of such resources for the end user. To maintain a production quality Grid the infrastructure has to provide a viable means of monitoring to detect potential problems well in advance and notify the respective authorities so that the problems can be fixed without much notice to the user community.

The details on the actual built infrastructure with all the relevant services as well as total available resources and its utilization during the whole project can be found in section 3 with particular details on the Certification Authority management covered in section 2.

To provide the working production quality Grid an operational support structure was formed, providing support for site administrators as well as for monitoring and responding to problems. That includes both the trouble ticketing system; the site functional tests as well as many other features and tools specific to the Baltic region. More details on this can be found in sections 4 and 5.

With a production quality Grid a user expects also production quality support. To make sure no user problem is left unnoticed a support and helpdesk system has been created in the region to provide active as well as passive support for the local and international community. The details of these systems are outlined in section 6.

To make transition from local usage to Grid smoother for the user and to iron out the still under development parts of the Grid infrastructure a separate conceptual testbed was created, which consists of sites with smaller resources, but fast turnover times. The particular details of the necessity and benefits of such a testbed are outlined in section 7.

As Grid is based on resource and knowledge sharing as well as boosting international collaborations, then one important measure is the actual resource usage. This provides a clear overview for the site administrators so they know when and what needs further expansion or which might be problematic areas causing lower quality of return for their users. To provide that kind of information to both the site administrators as well as the users a good accounting system is necessary. During the lifetime of the project the research activity worked on finding a good system to do exactly this and preliminary details on the implementation of such a systems is given in section 8.

2. BALTIC GRID CERTIFICATION AUTHORITY AND NETWORK OF REGISTRATION AUTHORITIES

One of the requirements for any functional Grid is the ability for its users to safely access the resources from any location in the world. However doing that requires a way to remotely authenticate the user and most Grids have adapted the technological concept of PKI to do this. A structure of PKI provides a hierarchical structure of trust.

The structure consists of three participants: Certificate Authority (CA), Registration Authority (RA) and the user. The CA is the authority that provides trust between the communicating parties on the Grid (both users and systems). The RA is providing the trust mediation during the initial contact between the CA and the user. To do that the RA has established trust with the CA in both legal and technological means. In BalticGrid project the legal means is the signing of an RA agreement between the CA representative and the RA and the technological means has been chosen to be the exchange of GPG keys. The GPG key mechanism allows for unique person identification using encryption and signatures.

The BalticGrid CA was set up during the first months of the project and has been operational ever since. The CA is also recognized by the EUGridPMA international body, which oversees the different policies and authorities operating in the Grid community. The usage of the BalticGrid CA has been extremely valuable to the project, as it has provided a simple mechanism, which has been centralized for the whole region, hence taking some of the original startup load away from the rest of the participating countries. The creation of the RA network, which involves numerous participants in all Baltic States, has also served as a good means of international collaboration to reach a common goal without waste of resources.

No national CA-s were established as the current policy of EUGridPMA is to provide consolidation where possible and as the management of a CA is quite a lot of procedural work there didn't seem to be reason enough to separate that service. As the CA policy is a clear document that the CA has to follow, then there is also no real need for national level CA-s as everyone can request a certificate from the same CA through the RA network easily enough. The only reason to create a national CA would be in case the policy of the BalticGrid CA is too restrictive for the tasks planned in that country, however such a need did not rise during the lifetime of the project.

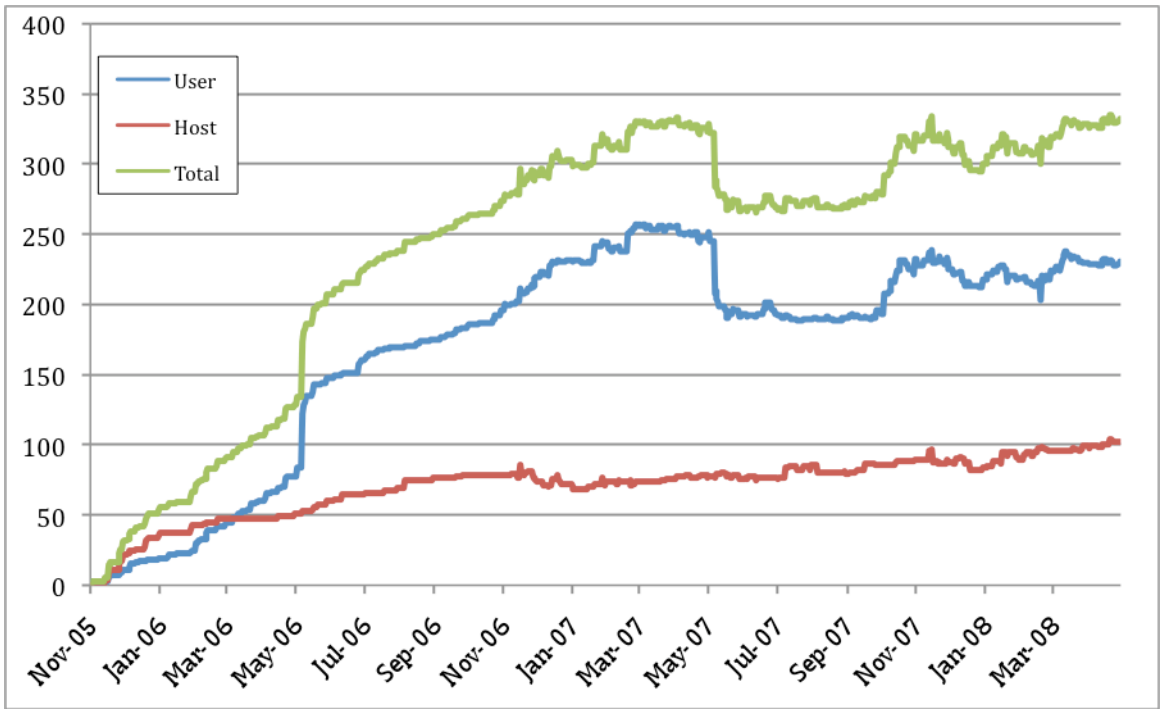

Figure 1 - Distribution of valid certificates over project lifetime

The BalticGrid CA with all the policies, network of RA-s and functioning procedures/technologies is self sustained and can continue well beyond the current project to provide authority and identification service for the Baltic region in any subsequent future projects or national initiatives.

2.1. CAMAGER – CA MANAGEMENT SOFTWARE

During the lifetime of the project a specific software package for managing a CA (in our particular case the BalticGrid CA) was developed. Through numerous iterations the software has reached its maturity and is now available as a stand-alone software package usable by other Grid communities for their CA management.

The following features are available through the CAMAGER software:

- CA operations:
  - keeping track of pending and solved requests
  - database of issued certificates
  - list of CRL-s
  - distribution of the newly signed certificates for requesters
  - request export/import for signing on off-line machine
  - notification of expiring certificates and CRL-s
  - statistics
- RA operations:
  - keeping track of requests
  - issued certificates
  - request validation

- Certificate holder
  - submit new certificate request
  - revoke the certificate.

CAMANAGER is available for use and download from the following address: http://grid.eenet.ee/camager/.

3. CORE GRID SERVICES

The goal of the current project has been to create a sustainable Grid infrastructure in the Baltic States, which crosses boundaries and sparks international collaborations and research. To do that the infrastructure must be of production quality, it has to provide means of centralized management of users, Virtual Organizations (VO-s), Grid jobs etc. In addition it must have a reasonable amount of available resources, which also should span the region to encourage the actual usage and sharing of resources.

To accommodate for all of the above, the whole infrastructure needs a certain amount of central services, which provide specific functions and tasks to the whole Grid and are the central connection points in the mesh of a Grid. Such services include the information system (Central BDII), the VO management software (VOMS), the Logical File Catalog (LFC) and resource brokering (WMS and RB). Also a centralized accounting system was adapted in cooperation with EGEE project and during the course of the project a new accounting system was experimented with, which had separate central servers available in the Baltic region for the BalticGrid project.

To meet the target of a production quality Grid and considering that all of the central services are of vital importance to a healthy and functional Grid all the central services were at least duplicated. During the final phase of the project to anticipate the potential requirements of national interests the central services were mostly tripled to provide at least one instance of the service per country to also allow the local communities access to a functional Grid in case of major networking failures or other unforeseen events, which would hamper communication between countries.

3.1. CENTRAL BDII

The task of a central BDII is to provide a collection point of information throughout the whole infrastructure. It contains the pointers with relevant information to site level information systems, which contain the further details and provides as a means of a single point of contact which any resource or user can query to obtain the preliminary listing of services and resources currently provided.

BalticGrid has two central BDII-s at the end of the project. One in Estonia at EENet and one in Lithuania at the premises of Vilnius University. Both services are complementary to each other and provide full information listing for the whole region as well as data from upstream EGEE central BDII-s.

3.2. VOMS

The VOMS server manages all the different Virtual Organizations that we have in BalticGrid. It is used for user registration as well as validation that a user belongs to a certain VO. Every time a user creates a Grid proxy, the VOMS server extends the proxy with information about the users roles in the VO, which allows the different Grid services to prioritize the tasks based on users, VO-s and the users roles in that VO.

For example a user may belong to the data production role, which would grant him write access to storage while the rest of the users have only read-only data access to the produced data. Or the administrative role, which allows for software installations in the designated software areas of clusters.

EENet hosts the VOMS server in BalticGrid and the server hosts a variety of VO-s. For example BalticGrid catch all VO and BIIT VO.

3.3. LFC

A Logical File Catalog (LFC) is used to unify the file naming convention across the whole grid. Using logical file names the users don't have to worry where their data is actually placed physically on the Grid. Every time they require a file they just use the logical filename and the Grid layer takes care of transporting the file from the appropriate storage element.

There are two LFC servers in BalticGrid. One, which is the main LFC server for BalticGrid VO is hosted at EENet with the VOMS server and other, which is a secondary LFC server is hosted at Vilnius University.

3.4. WMS, RB

The task of a Resource Broker (RB) is to offload the resource finding and job scheduling work from the user. The only task a user has to do is to specify his/her job requirements and submit the job to an RB, which takes care of the job by finding the appropriate cluster where to run the job based on the requirements of the user.

After the migration from LCG software to gLite software, which took place during the second half of the first reporting period, the RB was also modified in its tasks and became a new service called Workload Management Service (WMS). The task of a WMS is essentially the same as an RB, however in addition it provides a certain amount of additional tasks the user can offload now. While the RB was able to take a single job and search the best place for it to run, the WMS can take collections of jobs or even descriptions of parametric executions and do the job description creation and splitting as well as submissions of multiple jobs to the appropriate resources without any additional workload for the user. The introduction of WMS allows scaling the daily submissions for a user in orders of magnitude as submitting thousands of jobs takes the same amount of time and effort as submission of a single job.

During the lifetime of the project the number of resource brokers (both RB and WMS) has increased steadily with a continuous tendency to migrate from the old RB system to the new WMS based system. There are currently three WMS-s in BalticGrid, one in each country.

3.5. RESOURCES MADE AVAILABLE FOR GRID COMMUNITY

The total amount of resources, which the users have access to has steadily increased over time averaging around 2000 job slots with storage growing over time from 100 TB to 180 TB[1]. The resources provided by country can be seen in Table 1. One should take notice that the resources

[1] The polish resources were there mostly from day 1 with the increase coming mostly from new hardware in Baltic States. The final number is taken in the middle of April 2008

provided by Polish partners are on a shared usage where BalticGrid users have access to a percentage of the resources.

Table 1 - Resources provided by country

Country	*Average jobslots*[2]	*Average storage (TB)*
Estonia	100	80
Latvia	45	3.5
Lithuania	275	5
Poland	1500	90
Sweden	85	1.5

The usage of the above-mentioned resources has grown over time. However it has largely depended for the first part of the project on the mature VO-s from LHC experiments. The distribution of CPU usage by VO can be seen on Figure 2. The growth of the local virtual organizations has been steady, as can be seen on Figure 3, and during the first five months of the third year they have already computed at least the same amount as in the whole second year as seen on Figure 4.

The total amount of resources, which has been available for the whole duration of the project, is approximately 7 million normalized hours in the Baltic States and an additional 15 million hours of computing time on shared resources in clusters in Poland and Sweden[3].

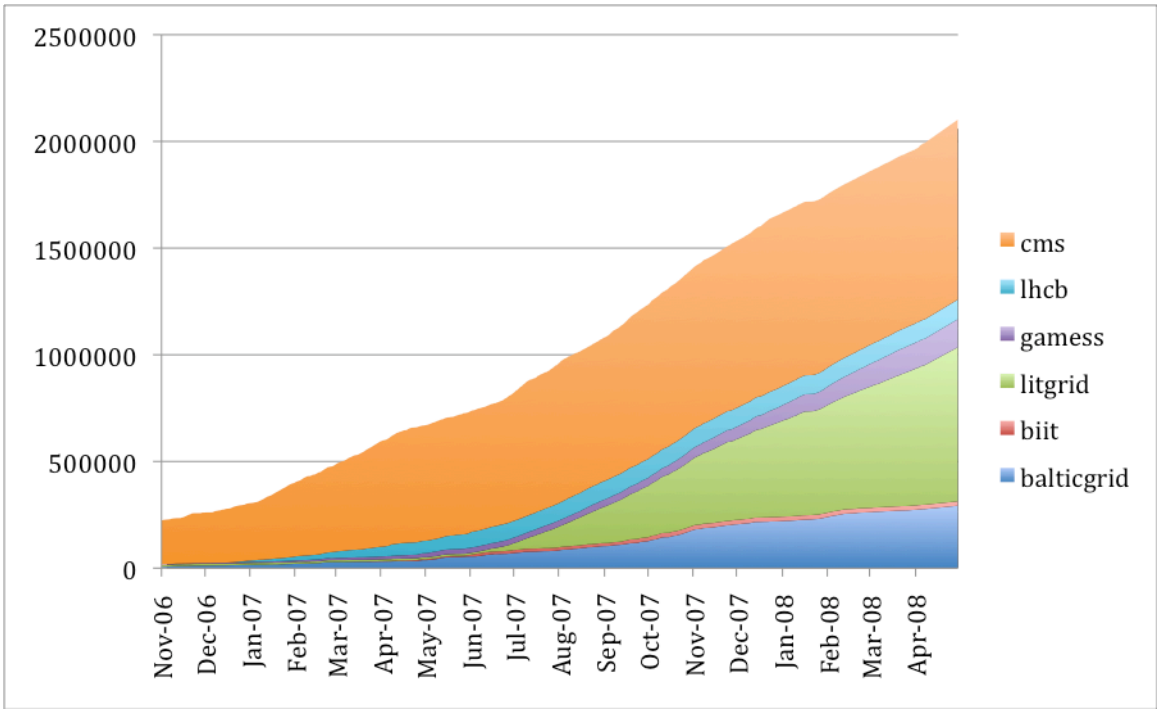

Figure 2 – Total cumulative usage of BalticGrid resources by the different Virtual Organizations

[2] A jobslot is either a CPU in case of single core CPU-s or an execution core on multi-core CPU-s.

[3] Average number of cpu-s online per year number has been used, based on statistics available at GStat portal (http://goc.grid.sinica.edu.tw/gstat/baltic/)

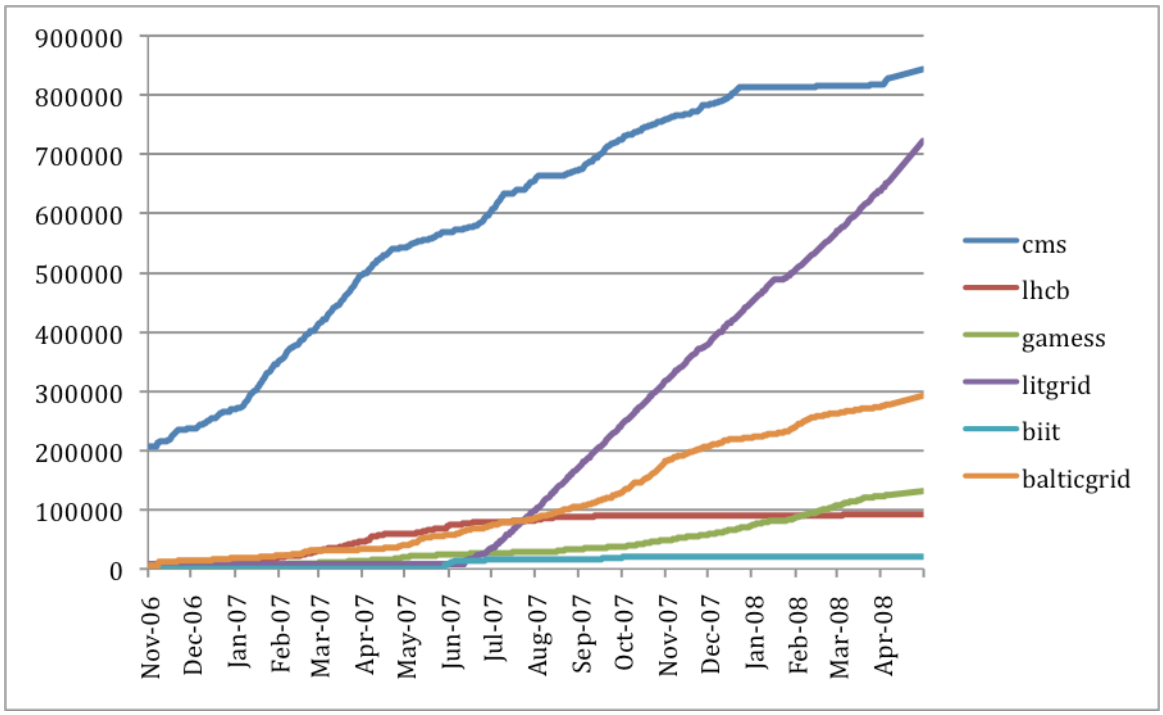

Figure 3 - Growth of CPU time usage by the different VO-s

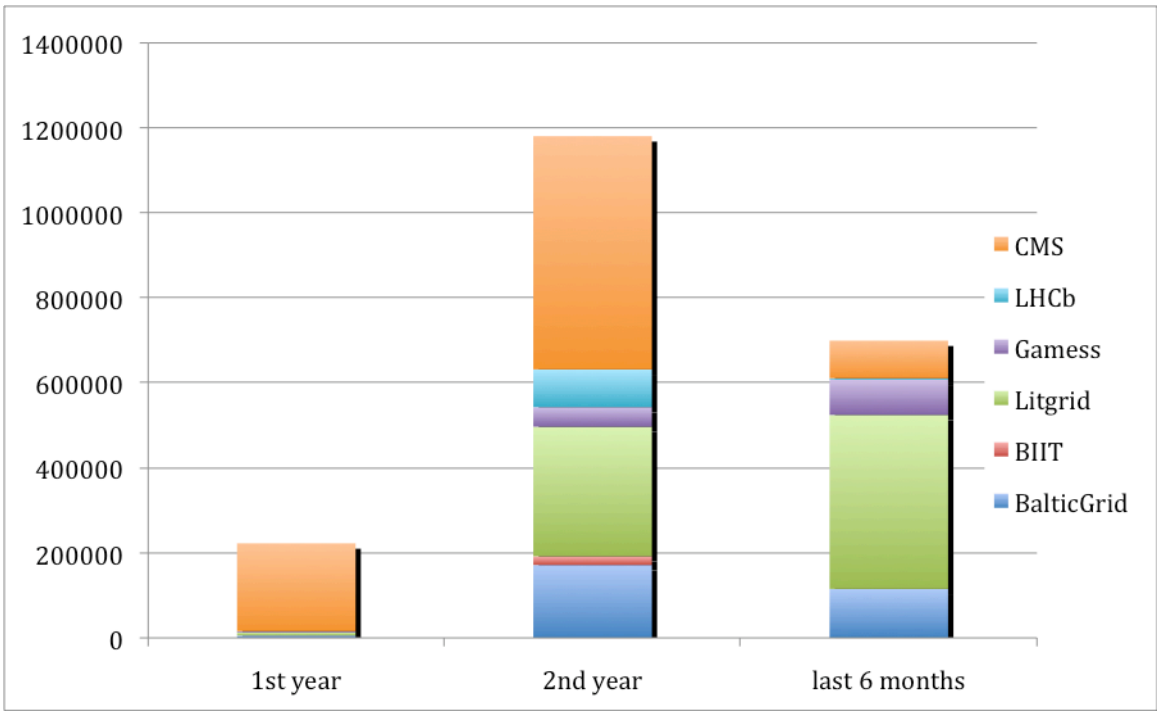

Figure 4 - Usage by year

4. SUPPORT PROVIDED TO INSTALLATION OF MIDDLEWARE

At the start of the project of the three Baltic countries only Estonia had had any experience with any kind of Grid middleware. However that experience was with ARC middleware, which was used in NorduGrid. The purpose of this project was to expand and extend the European Grid infrastructures, which meant migration from ARC based middleware to the versions, created and supported by the majority of Grid sites in Europe, which at that time was LCG middleware provided by the EGEE project.

The more experienced partners in Poland, Sweden and in addition CERN provided the initial help in setting up a small group of sites at the partner institutions. It took months to have the local centers enough experience to start providing similar level of support to other resource centers in the region. However through the constant sharing of information and very active mailing list of the SA1 activity we have now by the end of project in every country a number of sites which host Grid experts capable of teaching and helping out other resource centers in the region. This has been largely helped and accelerated by the experienced partners who have provided continuous know-how sharing and support in operational matters throughout the lifetime of the project. The usage of the mailing list and the level of expertise can easily be correlated when looked at the mailing list number of e-mails sent as seen on Figure 5.

In the later phases of the project (starting from second year) the mailing list was largely replaced by a ticketing system, which was used for keeping track of both site and user issues. This organization provides support both middleware installations for new sites as well as to users with their application gridification. The solution also helps in keeping the manpower down as both groups get their expertise from the same support personnel who are in any case the best expertise available in the region.

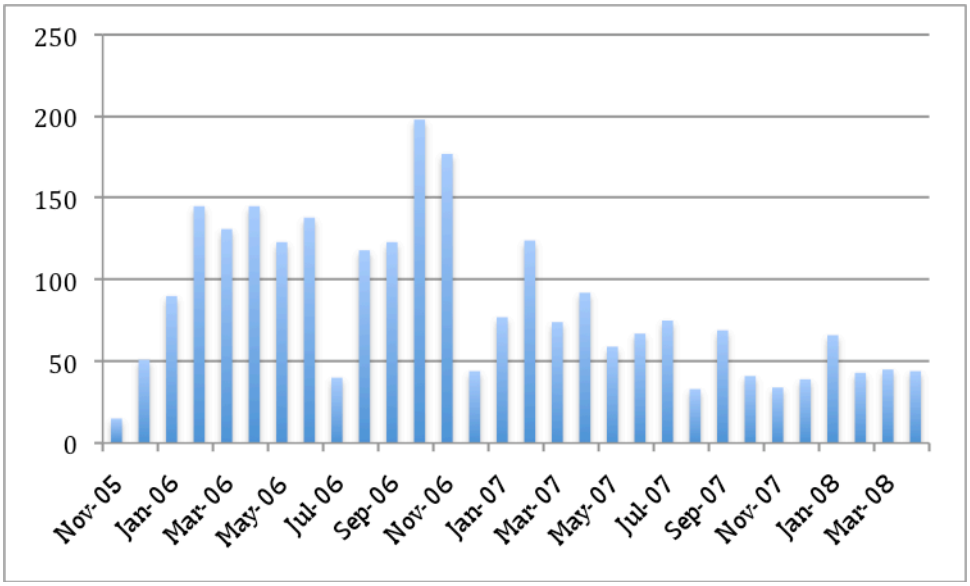

Figure 5 - SA1 mailing list messages during the project duration

5. IMPLEMENTION OF A MONITORING AND OPERATIONAL SUPPORT SYSTEM

For the monitoring of BalticGrid infrastructure and services we use the well-defined and proven tools of EGEE project. In addition to the already developed tools we have added a few smaller tools to validate some scenarios not currently covered or to bring out potential errors, which are not shown in the usual tests. Monitoring and operational support system was covered thoroughly in deliverable DSA1.4 "Report on Implementation of Monitoring and Operational Support System".

The current structure for monitoring provides sites with up-to-date information on their status history as well as the latest results through GStat (Grid Status), SFT (Site Functional Tests) and SAM (Site Availability Monitor). That way a site admininistrator can easily monitor health of the site and take action if needed. However, if the site does not have an active helpdesk, then the monitoring tools also provide a means for opening trouble tickets to be assigned to the particular site.

The trouble ticketing system for sites is used in the same way as in EGEE project. BalticGrid project uses the same infrastructure and software (GGUS, GStat, SFT) and in addition we have created local monitoring and support structures (Stress Tests, RT). This enables small and local problems to be dealt with within the region using local monitoring and support structures while bigger problems or problems extending beyond Baltic region can be maintained using EGEE support structures.

User support is established using a ticketing system (RT) and migration from the previous discussion based support using mail lists took place during the first part of the second project year. As the usage of the Grid grows, the need for user support will grow proportionally. To handle this efficiently all the different categories of supporters such as systems experts, and applications experts use the common BalticGrid ticketing system.

5.1. GSTAT

GStat portal is developed and maintained by EGEE. BalticGrid uses it for monitoring of available resources and for central access to GOCdb and SFTs based on the summary information available. A separate view for the Baltic region has been created in GStat to allow for quick overview of BalticGrid resources only. The link to this specific regions monitoring page is as follows:

http://goc.grid.sinica.edu.tw/gstat/baltic/

A sample view of the GStat status page can be seen on Figure 6. The view comprises of two main sections. A quick color coded view of all sites listing their current status as well as the latest availability test result and the more detailed view with listing of available and used resources as well as averages over a longer period of time.

| | | |

5.2. SFT – SITE FUNCTIONALITY TESTS AND SAM – SERVICE AVAILABILITY MONITOR

The regularly running tests to monitor the health of the resources in the standard usage patterns (CA collection's validity, replica management, jobs submission, grid middleware health etc) is done using central SFT (Site Functional Tests) run by two different locations. We use both the central SFT run by CERN for resources, which are registered already in GOCdb and of production quality.

In addition we run a separate instance of SFT in BalticGrid under the balticgrid VO to cover two different aspects:

- Running SFT for sites which are not in GOCdb yet
- To validate that everything works under balticgrid VO.

During the duration of the project the actual software underlying the testing infrastructure was migrated from SFT testing to generalized SAM testing method. The latter provides more flexibility in site testing as well as providing customized tests for different VO-s.

The current implementation can be seen at the following address: https://sam.mif.vu.lt/sam/sam.py

A sample overview of the latest SAM test results can be seen on Figure 7.

No	RegionName	SiteName	NodeName	Status	balticgrid					
					rm	swdir	csh	js	ca	ver
1	Baltic	eenet	kriit.eenet.ee	OK	ok	ok	ok	ok	ok	3.0.2
2	Baltic	egee.man.poznan.pl	ce.egee.man.poznan.pl	OK	ok	ok	ok	ok	ok	2.7.0
3	Baltic	ifj-pan-bg	fwe01.ifj.edu.pl	OK	ok	ok	ok	ok	ok	3.1.0
4	Baltic	imcsul	puduris.latnet.lv	OK	ok	ok	ok	ok	ok	3.1.0
5	Baltic	imcsul-inf	birzs.latnet.lv	OK	ok	ok	ok	ok	ok	3.1.0
6	Baltic	itpa-lcg2	atomas.itpa.lt	OK	ok	ok	ok	ok	ok	2.7.0
7	Baltic	itpa-lcg2	dangus.itpa.lt	OK	ok	ok	ok	ok	ok	3.1.0
8	Baltic	itpa-lcg2	spektras.itpa.lt	ERROR	error	ok	ok	ok	error	3.0.2
9	Baltic	kmu-pri-lcg2	grid.pri.kmu.lt	ERROR	ok	ok	ok	error	ok	3.0.2
10	Baltic	ktu-bg-glite	ce.bg.ktu.lt	OK	ok	ok	ok	ok	ok	3.0.2
11	Baltic	psnc	ce.reef.man.poznan.pl	OK	ok	ok	ok	ok	ok	3.1.0
12	Baltic	rtuetf	ce01.grid.etf.rtu.lv	OK	ok	ok	ok	ok	ok	3.0.2
13	Baltic	su-grid	grid.su.lt	OK	ok	ok	ok	ok	ok	3.1.0
14	Baltic	t2_estonia	oberon.hep.kbfi.ee	OK	ok	ok	ok	ok	ok	3.1.0
15	Baltic	vdu-if-lcg2	vdupdc.vdu.lt	OK	ok	ok	ok	ok	ok	3.0.2
16	Baltic	vgtu-glite	ce.grid.vgtu.lt	OK	ok	ok	ok	ok	ok	3.1.0
17	Baltic	vu-mif-lcg2	grid6.mif.vu.lt	OK	ok	ok	ok	ok	ok	3.0.2
18	Baltic	vu-mif-lcg2	grid9.mif.vu.lt	OK	ok	ok	ok	ok	ok	3.1.0
19	Baltic	vu-mif-test	grid2.mif.vu.lt	OK	ok	ok	ok	ok	ok	3.0.2

Figure 7 - Excerpt from SAM computing element test results

5.3. STRESS TESTS

In addition to SFT and later SAM, the Baltic Grid Stress Tests were developed for monitoring the status of computing elements. SFT tests primary job is to test the functions of the front-end. It showed that sites are working properly, but in some cases users were still complaining about aborted jobs. As the SFT has quite short and simple tests a proposition was made to use longer jobs (taking up to an hour) to try to reveal some additional issues that the computing elements might have.

The basic intent is to validate that the clusters service is adequate for production use. The Stress Tests have shown that both constant and intermittent problems arise even in clusters, which seem to pass SFT on a regular basis. If the need arises the Stress Tests can be extended further and additional test scenarios can be added.

EENet developed the Stress Tests, which are real CPU-intensive jobs similar to those run by users every day and the reports are available on web. The jobs are about one hour long and those jobs are CPU-intensive. The Stress Tests results can be seen at the following address:

http://infosite.balticgrid.org/infosite/?mod=test

Balticgrid stress-tests

	Site	CE	Last test	Last result	Last 50 tests	Effectiveness	
1.	AMD64.PSNC.PL	fangorn.man.poznan.pl	04.05.2008	N/A		14% Done	All tests
2.	BY-UIIP	itk-110.bas-net.by	04.05.2008	N/A		16% Done	All tests
3.	CYFRONET-IA64	ares02.cyf-kr.edu.pl	04.05.2008	N/A		28% Done	All tests
4.	CYFRONET-LCG2	zeus02.cyf-kr.edu.pl	04.05.2008	N/A		0% Done	All tests
5.	EENet	kriit.eenet.ee	04.05.2008	Done		78% Done	All tests
6.	egee.man.poznan.pl	ce.egee.man.poznan.pl	04.05.2008	Done		52% Done	All tests
7.	FI-LCG2	grid.fi.lt	04.05.2008	N/A		0% Done	All tests
8.	IBT-LCG2	scientific.ibt.lt	04.05.2008	N/A		0% Done	All tests
9.	IFJ-PAN-BG	fwe01.ifj.edu.pl	04.05.2008	Done		44% Done	All tests
10.	IMCSUL	puduris.latnet.lv	04.05.2008	Done		32% Done	All tests
11.	IMCSUL-INF	birzs.latnet.lv	04.05.2008	Done		72% Done	All tests
12.	ITPA-LCG2	atomas.itpa.lt	04.05.2008	Done		62% Done	All tests
13.	ITPA-LCG2	spektras.itpa.lt	04.05.2008	Done		14% Done	All tests
14.	ITPA-LCG2	dangus.itpa.lt	04.05.2008	Done		66% Done	All tests
15.	KMU-PRI-LCG2	grid.pri.kmu.lt	04.05.2008	Aborted		26% Done	All tests
16.	KTU-BG-GLITE	ce.bg.ktu.lt	04.05.2008	Done		70% Done	All tests

Figure 8 - sample view of latest Stress Tests

5.4. OPERATIONAL SUPPORT SYSTEM

Operational support infrastructure has been built with three layers in mind to provide an all-round service to the Grid in both its ramp-up phase as well as later on the production use of the resources.

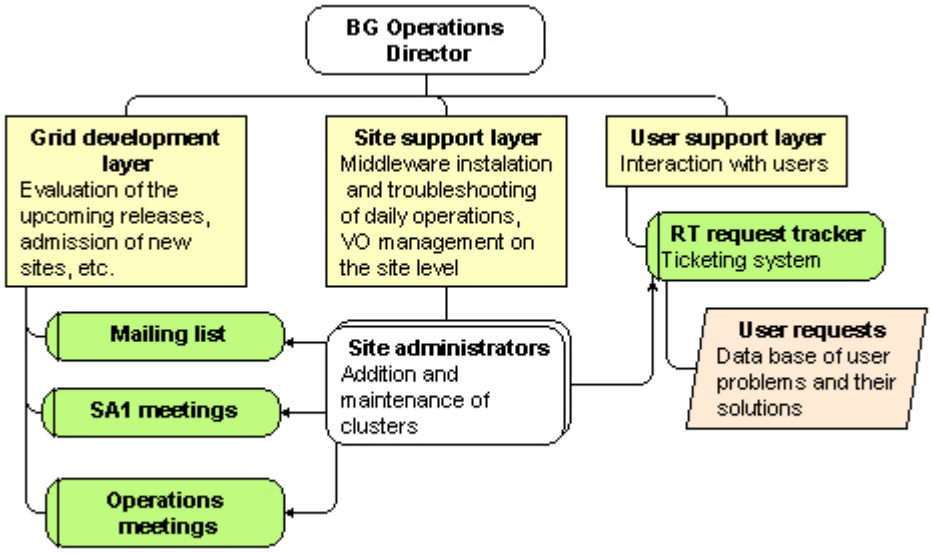

Figure 9 - Layers of support system

The first layer is the project development in which case discussions are necessary to evaluate the upcoming releases, new sites to be joining etc. These discussions take place in either the project SA1 activity mailing list or the weekly SA1/operations meetings.

The second layer is support for sites in their middleware installation and troubleshooting of daily operations as well as software installations and VO management on the site level. Historically this support has also been part of SA1 activity mailing list however this has now been migrated to a Request Tracker (RT) system installed at http://support.balticgrid.org/ or through e-mail interface of support@balticgrid.org. In addition the sites in production receive tickets from GGUS system as part of the central EGEE operational infrastructure and have to file operational reports through the CIC portal as any other site in EGEE. In cases where the problem seems to be bigger than just the resources in BalticGrid or if it cannot be resolved with local help, the tickets in local support system are escalated to GGUS for help from experts.

The third layer is the user support layer. Historically this was done through NA3 and SA1 e-mailing lists as the first nine months of the project were mostly used to build up the Grid infrastructure and start introducing the users to Grid concepts. In this environment the application activity (NA3) and Grid operations and development activity (SA1) had the knowledge and contacts to the users and could help them in this regard. The user support system has been set up using the same infrastructure of RT at support.balticgrid.org. There is an e-mail gateway as well as web ticket opening options. The migration of user support from mailing lists to the new system was completed in the first part of the second project year.

5.5. WEBPAGE

Web page is used for gathering different documents (instructions, tutorials, manuals etc) to one location. This has been in great part the SA1 activity internal pages of the BalticGrid project website (http://www.balticgrid.org/). Some of the more public documents like “How to request a certificate” etc have also been linked on the public parts of the website.

Figure 10 - excerpt from SA1 technical guides web page

In addition the webpage of http://voms.balticgrid.org/ contains also some technical documentation as well as custom packaged Plug-and-Play gLite/LCG User Interface (UIPnP) etc. These documents are to be moved to a central location under the project homepage to provide uniform access to all of the documentation. A wiki is also set up under the SA1 activity internal part of the project website to gather together possible common problems with solutions. At this moment all of the sites in BalticGrid are also participants in the project and hence no access restrictions come from the current location of the wiki. However, once the infrastructure expands beyond partners, then most of the documentation will be made public. This is also the full intention of the project members that much as possible of the documents from the BalticGrid project should be made public.

5.6. MAILINGLIST

BalticGrid project uses EENet's list server lists.eenet.ee. It uses Mailman (http://www.gnu.org/software/mailman/index.html) as its mailing list management software. In the list server, each activity has its own mailing list as well as separate lists for Project Management Board and External Advisory Committee.

The SA1 activity, "BalticGrid Operations" uses mailing list balticgrid-sa1@balticgrid.org

There were more than 2500 messages sent from the beginning till the end of the project. The list is mostly used for discussions on the BalticGrid infrastructure development and maintenance as well as questions on troubleshooting and setting up the operational infrastructure. It is a general-purpose

technical discussions list of anything related to building or operating the BalticGrid. For the distribution of messages in the SA1 mailing list activity please refer to Figure 5.

5.7. TICKETING SYSTEMS: REQUEST TRACKER (RT) AND GGUS

To have a better overview of all issues currently under investigation a Request Tracker (RT) support system was established during the end of first project year and the migration was completed in the beginning of the second project year. As already detailed above, the ticketing system is used for both site related issue tracking as well as a centralized user support system.

In addition to RT, which is for local regional use, we make full use of GGUS, which is the EGEE central trouble ticket system used throughout Europe for problems ranging from single users having trouble with their applications to site level problems reported from central monitoring frameworks like SFT-s. It is a tool outside of the BalticGrid project, but as there is a close collaboration between EGEE and BalticGrid in almost all aspects, then BalticGrid also uses the same trouble ticket system for escalations and problems beyond the control of Baltic partners. It is also used for reporting problems from the monitoring system to site administrators who have to respond to all of the tickets opened against them in the ticketing system.

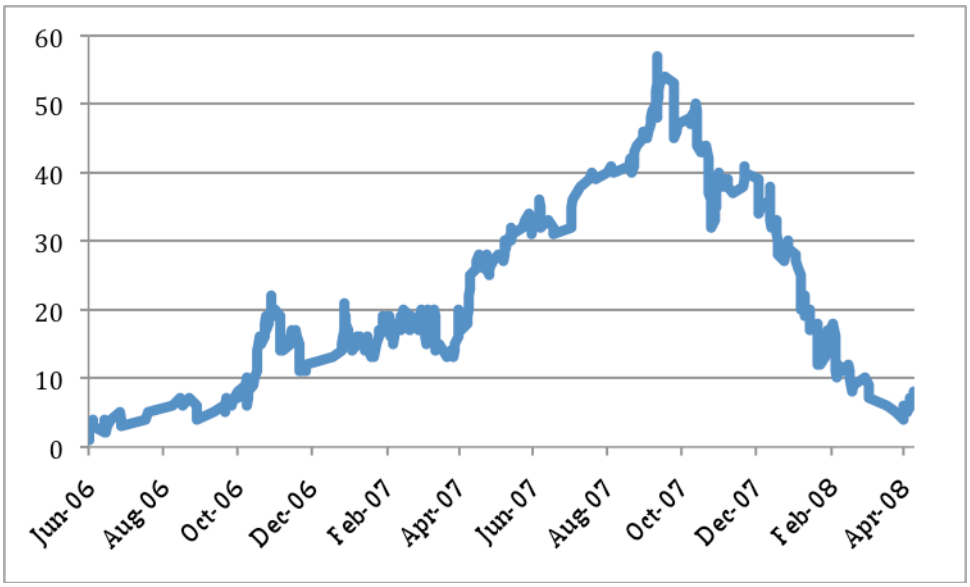

Figure 11 Number of open tickets in RT

6. SET UP A HELP DESK

Support systems for the Baltic Grid users include the following: ticketing system, mailing lists and web pages. We are in cooperation with EGEE on user support and use also their central ticketing system and mailing lists. User support system was covered thoroughly in deliverable DSA1.5 "User Support System: Help-Desk System in Production and Used via Web Interface".

6.1. TROUBLE TICKET SYSTEMS FOR HELP-DESK

When dealing with users' problems it is important that problems are tracked, the response is developed in timely manner and that actions are logged for future reference.

User support is established using the same ticketing system as is used for operational issues. To handle efficiently the need for user support, all the different categories of supporters such as systems and applications experts will use the common BalticGrid ticketing system. Ticketing system is based on Request Tracker software.

The tickets can be opened via sending e-mail to support@balticgrid.org, which is linked to special queue in RT system. Queue watchers will receive notice about new trouble ticket. The ticket will be assigned to a suitable person behind the scenes, and there are checks to ensure that answers are provided in a timely way.

The system is available for all users of BalticGrid project.

6.1.1. GGUS system, http://www.ggus.org/

GGUS system is developed and used by EGEE project for tracking problems and issues in EGEE infrastructure.

GGUS is the EGEE central trouble ticket system used throughout Europe for a wide range of problems from single users having trouble with their applications to site level problems reported from central monitoring frameworks like SFT-s. It is a tool outside of the BalticGrid project, but as there is close collaboration between EGEE and BalticGrid in almost all aspects, then BalticGrid also uses the same trouble ticket system for escalations and problems beyond the control of Baltic partners.

It is used for reporting problems from the monitoring system to BalticGrid site administrators who have to respond to all tickets opened for their sites. Also users outside the Baltic Grid can use GGUS to notify the BalticGrid administrators about problems in their sites.

6.1.2. LCG Savannah, https://savannah.cern.ch

LCG Savannah is a web site provided by the LCG Software Process & Infrastructure (SPI) project. It offers facilities for development, distribution and maintenance of LCG software projects and related projects. The software used to run that site has been developed by the GNU/Savane project and customized for LCG use by SPI.

Savannah is only meant to be used by advanced users and site administrators. The BalticGrid users can submit there their problems related directly to LCG/gLite software.

6.2. USER SUPPORT THROUGH MAILING LISTS

EENet maintains mailing lists for the BalticGrid Project on server lists.eenet.ee. Mailman list management software is used. For users and list owners a web interface is available for administering their subscriptions. Also, archives of messages are available. The language used in those lists is English.

6.3. USER SUPPORT THROUGH WEBPAGES

6.3.1. BalticGrid Central homepage http://www.balticgrid.org

The main BalticGrid webpage has information about the project, contacts and technical guides. There are research papers, overview talks, reference manuals, user guides, installation instructions, conference presentations and even tutorial materials.

For beginners there is a separate section - "**Using Grid**"[4]. This contains step-by-step explanation about how to use BalticGrid.

6.3.2. VOMS server http://voms.balticgrid.org

This server contains technical information for installing and configuring the grid services as well as the stand-alone user interface package UIPnP (User Interface Plug and Play). It contains the central list of BalticGrid resources and VOMS user interface.

6.3.3. BalticGrid Certification Authority http://ca.balticgrid.org

This page contains guides for getting and renewing the end entity certificates signed by BalticGrid CA.

6.4. LOCAL USER SUPPORT IN BALTIC STATES

6.4.1. Estonia

Estonian Grid has a web page http://grid.eenet.ee that contains various guides like grid tutorials and documents about how to get started with grid in Estonia.

There are two lists for grid-related discussions: more general questions at grid-tech@lists.eenet.ee and specific problems about using grid at grid-users@lists.eenet.ee. Those Estonian mailing lists are quite actively in use within Estonian grid-community.

6.4.2. Latvia

Latvian Grid activities are described on http://grid.latnet.lv, it contains detailed information on how to start using grid, including instruction on receiving and installing a personal certificate.

General information about grid activities can be asked by e-mail info@grid.latnet.lv. For grid-related discussions there is mailing list liste@grid.latnet.lv, the subscribers are mostly site administrators, but also advanced users.

6.4.3. Lithuania

Lithuanian Grid initiative has the following webpage: http://www.litgrid.lt. This website contains information for users on how to start using grid and in addition to that it also contains some useful documents for cluster administrators. The site also features a monitor of LitGRID resources.

Users can send their problems to litgrid-admin@grid.mif.vu.lt, where Lithuanian site administrators are available to respond. Also a mailing list (algis-litgridpart@uosis.mif.vu.lt) is available to grid users for discussions on various topics related to Grid.

[4] http://www.balticgrid.org/Using_grid/Try_grid

7. ESTABLISH A CERTIFICATION TESTBED

While the Grid has existed already for a substantial number of years, the code of the middleware has been ever evolving. The reasons for that are numerous. It takes time and scaling to understand the requirements of the system on the resources and the resources requirements on the system. As the available features increase the community reshapes and new requirements emerge. This is the same with all developing systems. They go through a lot of changes from the initial phase until they reach maturity.

With the Grid, the driving force has been the four LHC experiments at CERN as there is no other computing model available for CERN to analyze all the data of the four experiments. Until the actual startup of the LHC machine (expected to start summer of 2008) the code base will evolve and reshape to take into account everything that the experiments find in large scale tests in preparation of stable operational running. Once the experiment starts however the major driving force for Grids stops, as it is not possible to have constant evolution of code at the same time with very stable production operations. Taking this into account it is estimated that by beginning of 2009 it is likely that the code of gLite middleware will be mostly stable and working in a production environment with no rapid development cycle, but instead stable maintenance and support.

However until such a situation is reached the production Grids in the region have to be able to still provide production quality Grid for the pioneering application communities who do want to exploit the capacities and capabilities provided by a nation spanning computing infrastructure. To do this one needs to buffer the production environment from the development cycle and one way to do this is to have a testing environment that is capable of playing through majority of the important situations before deployment. In BalticGrid project this role was played by the certification testbed.

No separate parallel Grid was created, but instead the smaller sites were not bound by an SLA to provide high availability and production level service throughout time, but instead they were flexible sites, which were also early adaptors of all the updates. This allowed a smaller number of sites to go through the upgrade procedures before the rest of the installation base followed, which in a lot of cases ironed out a number of compatibility issues, which hadn't been documented or encountered before. Although EGEE project also has a pre-production testbed, it cannot possibly test all the scenarios of the software installed in all the regions, which means that the more there are testing environments, the likelier it is that the final result in the production level Grid is going to be smooth and stable operations.

As there is no constant usage for testbeds, the same resources were also utilized for any kind of training events that took place during the project lifetime. A separate VO was created (called bgtut), that was used with temporary certificates at the training events. The events were always registered in advance allowing the respective resource owners to converge on a stable configuration for the duration of the training event. In the first year, when we did not have a certification testbed, a number of training events coincided with other training events in the rest of the world and the commonly used EGEE training resources were overwhelmed. The use of local dedicated resources for the later training events did provide the participants with a good experience of the Grid as there is no time in a training event, which only lasts for hours, to wait for utilized resources to execute the users jobs.

8. ESTABLISH A PROTOTYPE LOGGING SERVICE

The default accounting system of the gLite middleware is based on a producer and consumer scheme, which gathers the data at sites and collects it through different stages finally into a central repository. The implementation of that scheme has had a number of problems over the duration of the project although it has proven to be valuable asset in understanding how well sites are performing.

However the solution currently used (APEL accounting) by default is quite a simple one and only gathers information of Grid usage in a limited manner. To remedy the situation the research activity of BalticGrid worked on finding an alternative accounting system, which could provide more detailed information as well as one which could be more distributed and flexible. Such a system was found to be DGAS accounting system, which early adapters have been using in the BalticGrid now for more than half a year.

The system itself has proven to be a stable and robust system although a number of issues have emerged in trying to unify the two different accounting systems to provide accounting and logging information to both systems simultaneously. By the end of the project a number of sites (for example NICPB) were primarily using DGAS as their main logging and accounting system with the accounting data forwarded from DGAS to APEL through an intermediary process. It is planned that in near future majority of sites will implement DGAS based accounting, which would give us access to a number of additional measurable parameters in addition to the ones available now.

One of the most sought after features is user level accounting as the current systems finest granularity is the VO. With a number of catch-all VO-s like balticgrid VO and the national ones (litgrid, estonian-grid etc) it is difficult to understand at times which research groups are doing which amounts of computation. If such information were available, then the effort, which goes towards user support and application gridification, could be better-managed and more appropriate decisions made.

For more information on the accounting system implementation please refer to the deliverables of the Joint Research Activity of the project.

9. CONCLUSIONS

The purpose of BalticGrid project was to create an initial operating Grid infrastructure in the Baltic States that would extend the European e-Infrastructure to the region and hence spark more international collaborations and to alleviate the needs of compute intensive research areas. The concrete objective for the SA1 activity in BalticGrid was to provide the actual infrastructure with the relevant services in both technical and operational means.

At the end of the project we can conclude that a technically working infrastructure is present with plenty of resources available at all times for the scientists in the region. We can also state that a fully functional operational model is in place with well-defined methods of conduct in both extension and support of the infrastructure as well as a viable system for user support.

The community itself is not yet self sustained and a continuation of a project based coordinated Grid effort is beneficial to the region to allow it to continue to grow and spark local communities towards a sustained Grid throughout Europe. At the time of the writing of this document the BalticGrid-II project contract was in the process of signing, which will extend the same operational model for another two years to prepare the now Grid enabled region for a sustainable NGI (National Grid Initiative) based operational model with emphasis on providing simplified entry to the Grid for users.

ANNEX I – ticketing system policy

Opening tickets:

1. Tickets are opened by users, site admins and central admins in case problems are noticed or feature or info requests are made.
2. There are two options for opening new tickets:
    a. sending an e-mail to support@balticgrid.org
    b. logging into the https://support.balticgrid.org/ RT system and creating the ticket there

Answering to tickets:

1. Ticket watching is a rotating obligation for all the participating sites
2. Ticket watch is usually one week per partner site
3. The person(s) assigned to the ticket watch monitors the support e-mails and if a ticket is opened takes the appropriate action:
    a. If a ticket is related to a concrete site, then the ticket is assigned to that site queue
    b. If a ticket is opened against a central service, then the ticket will be assigned to the site maintaining the central service
    c. If a ticket is related generally to middleware it is set to being open and either the ticket watcher tries to answer himself/herself or he/she assigns the ticket to a person who is the likeliest to be able to answer the question
4. Anyone who manages a ticket must be polite and provide reasonable answers based on the know how of the person opening the ticket (e.g. if the person is an ordinary user one must not assume knowledge of internals of gLite and should explain the procedures more thoroughly)

Closing tickets:

1. Tickets shall be closed only when the person opening the ticket has agreed that a solution has been provided or that nothing further can be done at that point in time (also if a possible solution is supposed to be possible in N months one should not keep the ticket open for that time)
2. If a ticket has not received any updates from either party for more than 1 week the ticket watcher writes a notification in the ticket asking the current status.
3. If the support person provides no answer within 2 working days, then the support person should be contacted by other means (phone, IM, etc)
4. If the previous attempt to contact the support person does not yield results in 2 attempts the ticket should be escalated to SA1 management
5. If there is no answer from the user, then a second notification shall be written 1 week after the first that if no answer will be received in 1 week's time, then the ticket shall be closed.
6. If indeed 1 more week passes without an update or feedback from the opening person, the ticket can be closed.

In any situation that arises during the support tasks that is not covered here, the support personnel shall act in the best interests of the user or if in doubt contact the SA1 management.

The general policy is that every user problem must get answered, whether with a solution or with the information why a solution is not possible. If the user is not satisfied he/she shall be informed to contact the SA1 management.