PROGRESS REPORT ON CURRENT SERVICE LEVEL AGREEMENTS AND THEIR IMPLEMENTATION IN THE BALTIC REGION

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Abstract: Service Level Agreements have been signed between BalticGrid and National Research and Education networks in Estonia, Latvia and Lithuania. According to these Agreements demarcation points have been identified. In order to supervise the implementation of Service Level Agreements, monitoring system has been designed and will be implemented for all clusters involved in BalticGrid project.

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1. INTRODUCTION

1.1. PURPOSE

The purpose of this document is to give an overview on the implementation of the Service Level Agreements concluded between the Baltic Grid project and national research and education networks of Estonia, Latvia and Lithuania. Demarcation points identified by these agreements will be monitored along with network interfaces in order to ensure stability and reliability of network resources.

1.2. APPLICATION AREA

This document is intended for partner's representatives in SA1, SA2 and JRA1, and the developers of monitoring system in particular. The concluded SLAs set the requirements for the upcoming Baltic Grid network monitoring system, for which the main design principles are also described in this document.

1.3. REFERENCES

Cacti: The Complete RRDTool-based Graphing Solution	http://cacti.net/
Ganglia Monitoring System	http://ganglia.sourceforge.net/
EGEE Network Performance Monitoring	http://www.egee-npm.org/

1.4. TERMINOLOGY

ACRONYMS	EXPLANATION
ART-management	Quality of Service management
EGEE	Enabling Grids for E-sciencE
GE	Gigabit Ethernet
GEANT	European Academic Network
JRA	Joint Research Activity
MTU	Maximum Transmission Unit
NOC	Network Operating Centre
NREN	National Research and Education Network
PoP	Point of Presence
QoS	Quality Of Services
SA	Specific Service Activity
SLA	Service Level Agreement

SLR	Service Level Request
SLS	Service Level Specification
SNMP	Simple Network Management Protocol
TCP	Transmission Control Protocol
VO	Virtual Organization

2. OVERVIEW ON THE CONCLUSION OF SLA

2.1. OVERVIEW

Service Level Agreements (SLA) have been concluded between Baltic Grid project and national research and education networks in Estonia (EENet), Latvia (LATNET) and Lithuania (LITNET). Structure of SLA is as following:

1) General provisions
   - Purpose and goals of SLA
   - Definitions
   - Term of Agreement
   - Duties and responsibilities of Parties, including Demarcation points
   - Monitoring SLA adherence
   - Termination and modification of SLA
   - Dispute resolution
2) Specific provisions
   - Over-provisioning
   - ART-management.

Detailed description of SLA is given in DSA2.2.

EENet and LITNET agreed to provide enough resources for both grid users and other GEANT users, i.e., they signed agreement with over-provisioning option in Specific provisions part.

The first SLA No SA2-2006/10-01 was signed with LITNET 16 October, 2006. The terms of agreement were discussed during the meeting between LITNET and Baltic Grid representatives in Riga, Latvia. Both parties agreed that collaboration is mutually beneficial for the further development of networking in Lithuania.

LATNET, as one of the laboratories of IMCS UL – the partner within Baltic Grid project, saw an obvious need for collaboration with the project. But was not possible to offer bandwidth of more than 155Mbps for international capacity due to the lack of funding. Therefore the only option was to provide QoS management to ensure that all GEANT users experience trouble-free bandwidth utilisation. Final version of the agreement No SA2-2006/10-01 was signed 27 October 2006. This collaboration has proved to be fruitful for LATNET, as the Ministry of Education and Science agreed to support grid community in Latvia by upgrading GEANT international connectivity (for more details see Section 2.3).

Although EENet was the first to upgrade GEANT connection from 622Mbps to 1Gbps, discussions between EENet and Baltic Grid project were the most extensive. One of the project partners, NICPB, from Estonia, wished to upgrade the connection between NICPB to GEANT PoP from 1Gbps to 2Gbps. The investigation of the situation and possible solutions took more time then anticipated. Unfortunately for the time being it proved to be impossible to upgrade the said connection. Finally the agreement No SA2-2006/10-03 was signed on 16 February 2007.

As the result, SLAs in all three Baltic states were established and the work on monitoring the adherence of agreement provisions was initiated.

2.2. DEMARCATION POINTS

2.2.1. Estonia

There are four demarcation points identified for Estonia. Two of them are located in Tallinn and two – in Tartu:

Estonian Educational and Research Network (EENet)

Raekoja plats 14, Tartu, Estonia; 3rd floor

Type of interface: GE

Planned capacity of the connection: 1Gbps

National Institute of Chemical Physics and Biophysics (NICPB)

Sõle 14, Tallinn

Type of interface: GE

Planned capacity of the connection: 1Gbps.

University of Tartu (UT)

Raekoja plats 14, Tartu, Estonia, 3rd floor

Type of interface: GE

Planned capacity of the connection: 1Gbps

Tallinn University of Technology (TTU)

Address, Floor, Room, Rack number: Sõle 14, Tallinn

Type of interface: GE

Planned capacity of the connection: 1Gbps

The load data of these clusters and their connections are collected by Ganglia tool.

2.2.2. Latvia

There are two demarcation points identified for Latvia. Both points are located in Riga:

Institute of Mathematics and Computer Science

Raina bulv. 29, Riga, 1st floor, room no 107

Type of interface: GE

Planned capacity of the connection: 1 Gbps

Riga Technical University

Āzenes 12, Riga

Type of interface: GE

Planned capacity of the connection: 1 Gbps

Monitoring of these clusters will be performed using data collected by Cacti tool.

2.2.3. Lithuania

There are two demarcation points identified for Lithuania. Both points are located in Vilnius:

Vilnius University, Faculty of Mathematics and Informatics

Vilnius, Naugarduko 24, second floor, computer room

Type of interface: GE

Planned capacity of the connection: 500 Mbps

Institute of Theoretical Physics and Astronomy

Vilnius, Gostauto 12, second floor, Data center room 105

Type of interface: GE

Planned capacity of the connection: 200 Mbps

2.3. SLA UPDATES

According to the provisions of concluded Service Level Agreements modification of the agreement might be initiated in two cases:

3) if NREN considers changing Specific provisions of the Agreement from ART-management to Over-provisioning;
4) if NREN does not meet network requirements defined in Specific provisions of the Agreement for Over-provisioning. In this case Specific provisions must be changed to ART-management;

Signing SLAs two NRENs, namely EENet and LITNET, preferred over-provisioning to more complicated and resource consuming QoS management. For LATNET with GEANT connectivity of 155 Mbps there was no other option than ART-management.

However, the BalticGrid project in Latvia was the major driving force for a historic upgrade of the GEANT connection from 155Mbps to 1Gbps and the Ministry of Education and Science of Latvia covering the GEANT cost. Thus, LATNET got an opportunity to improve its services and switch to over-provisioning. The procedure was initiated and modifications signed by both parties.

No other NREN has expressed an interest to modify the concluded SLA at the time of this writing.

3. SLA ADHERENCE MONITORING

3.1. REQUIRED MONITORING DATA

In order to monitor the adherence of the concluded SLAs between the BalticGrid project and NRENs in the Baltic countries, multiple parameters of the network performance and traffic flows should be collected on the regular basis and reviewed when necessary or as agreed.

The primary goal is to monitor the network status, whether the Grid clusters are accessible, international links are up and the Grid resource centres at the user institutions are on-line. This information is collected from the network devices via SNMP protocol. The SNMP data should be collected from routers and/or switches that are providing connections to the Grid clusters, international links and Grid user institutions, if possible. The data should be collected regularly, at least every 5 minutes. into enable a timely reaction to the major network breakdowns or incidents, an early warning system should be implemented to inform network administrators about failures of links or devices. The warning system can be implemented by sending e-mail or SMS messages.

The adherence monitoring has to focus on the relevant network performance data depending on which type of the Specific provisioning in the SLA is concluded.

If the NREN has agreed to provide over-provisioning, then the following network performance parameters should be collected and analysed on the monthly basis: packet loss, one-way delay, MTU, jitter, traffic load and available bandwidth.

Several of these parameters can be collected with SNMP data, including traffic load, available bandwidth, error counters.

To get results for other types of data, an active monitoring process has to be used. A special monitoring traffic has to be injected into the network in order to measure one-way delay between the BalticGrid clusters, to determine the packet loss, MTU and jitter. Active measurements can provide information also about other network performance parameters which are not specified in the SLA, but can be useful to determine the cause of problems with data transmission speed and quality.

If the NREN has agreed to perform the ART-management, i.e. to provide Quality of Service according to the agreed service classes, then the same network performance parameters should be collected, but the adherence should be monitored according to the QoS level which has been agreed in the signed SLA.

If the Amber level is requested for a particular traffic, then the most important parameters to monitor are one-way delay, jitter and packet loss. Also the traffic load should be monitored for the particular flow, because within the GEANT network only 10% of the link capacity can get Premium IP service. The Amber level corresponds to the GEANT Premium IP and if the user traffic exceeds 10% of the GEANT capacity, then the NREN cannot guarantee the network performance.

If the Rock level is used (which is the default level), then one-way delay and packet loss are the important parameters as well as the traffic load and available bandwidth.

For the Timber level the performance measurements are less critical, but the NREN should be ready to perform rate-limiting to guarantee minimum quality parameters also in this traffic class. It is necessary to measure the actual traffic load in this service class.

3.2. AVAILABLE MONITORING DATA

To collect all required network monitoring data, several different types of network monitoring systems should be used.

Data about traffic load, available bandwidth and error counters should be collected with SNMP protocol from the involved network devices including routers, switches and Layer3 switches. This data already is being collected by all three NRENs, therefore Baltic Grid network monitoring requires only proper access to the collected data. Usually this collected data is not publicly available, but the access has been granted for the BalticGrid project SA2 activity.

Various software can be used for collecting and interpreting SNMP data. The most popular ones currently used by the Baltic NRENs are Cacti (http://cacti.net/) and Ganglia (http://ganglia.sourceforge.net/).

Data collected by these systems allows the BalticGrid SA2 activity personnel to see the load of the GEANT links of the respective countries as well as the load of Grid clusters and institution connections and error counters. This data is crucial for assessing the fulfilment of the SLA and the BalticGrid SA2 activity has been using this data on regular basis already.

The early warning system about network breakdowns have been implemented in the network management systems of the NRENs and there is no immediate need to duplicate it for the BalticGrid SA2 activity.

To monitor packet loss, one-way delay, MTU and jitter of the traffic, active monitoring systems should be used. At the time of writing the deliverable, these measurements have not been collected yet. However, the tool for collecting these measurements has been identified already. The BalticGrid SA2 activity for active measurements will use e2emonit tools developed by the EGEE Network Performance Activity (NPM) (http://www.egee-npm.org/). The e2emonit tools have been already installed on the test nodes and evaluated for implementation for all BalticGrid clusters. E2emonit tools are particularly suited for usage in Grid clusters, because this software is included in the Scientific Linux distributions.

It has been agreed with administrators of the BalticGrid clusters that they will co-operate with SA2 activity and install the needed e2emonit components on the computing elements of their Grid clusters. That will enable the BalticGrid monitoring infrastructure to collect needed active measurements that describe the traffic between the Grid clusters.

Another method to collect data about the network traffic is to use a passive monitoring system which captures traffic from a network by generating a copy of that traffic, often from a span port or mirror port or via a network tap. This traffic then can be analysed with flow analyzer, sniffer, network application analyzer like Ethereal or other tools. For the needs of the BalticGrid SA2 monitoring infrastructure, the flow analysis can used to detect and determine more complicated network problems. Particular passive network monitoring applications have not been investigated yet.

3.3. RESULTS OF THE SLA ADHERANCE MONITORING

According to the data that has been made available by the NRENs to the BalticGrid SA2 activity, the concluded SLA conditions have been met so far. This is primarily due to 1Gbps GEANT network connectivity upgrades implemented in all involved NRENs. The SNMP data provided have been analysed on a monthly basis in accordance with the concluded SLAs since January 2007.

As described in the previous chapter, only SNMP based monitoring data are available from the production network so far, therefore the SA2 activity has been so far using limited information to ensure the fulfilment of the SLAs. The SNMP data provided showed satisfactory results for the bandwidth available for the Grid traffic in the EENet and LITNET links. LATNET link also had tolerable amount of available bandwidth most of the time to allow positive experience of the network usage for the Grid and other GEANT users.

To have profound overview of the delivered network services, the BalticGrid SA2 activity needs data from the active measurement tools. This data will become available from the production network monitoring tools within next months, as planned in the project schedule.

4. CONCLUSIONS

All three NRENs from Estonia, Latvia and Lithuania agreed on collaboration with Baltic Grid project and expressed their readiness to provide high quality service by signing Service Level Agreements. Moreover, all three Baltic NRENs have taken also practical steps by upgrading their international GEANT connectivity to 1Gbps, and making large proportion of this capacity available to Baltic Grid.

The next step is to implement an adequate Baltic Grid network monitoring system to monitor adherence to the signed Service Level Agreements and most importantly – to have means to efficiently identify potential Grid network failures or bottlenecks. Real-time availability of the relevant monitoring data well beyond the agreed demarcation points is a prerequisite for tight and informed cooperation between the Baltic Grid and NREN infrastructures and their respective NOCs. The role of the Baltic Grid network monitoring system is not to duplicate similar systems already implemented in the respective NRENs, GEANT and Grid resource centres – therefore Baltic Grid network monitoring system instead will collect the monitoring data from all these rather heterogeneous, but relevant data sources and present it in the unified format suitable for Baltic Grid network performance monitoring and troubleshooting by the Baltic Grid NOC.

This report documents the means, which will be used towards reaching these goals. Their implementation is in active progress, with the first results outlined in this report, and is expected to be completed in time according to the project schedule.

Already at this early point some interesting conclusions are emerging from the information being collected about the Baltic Grid network performance. With the upgrade of the last-mile links and international GEANT infrastructure to 1Gbps, it is becoming evident, that network itself is not the only bottleneck for occasionally poor performance of the data transfers between the Grid resource centres located in different countries. The limited effect of GridFTP and multilink TCP on performance improvement for international data transfers, compared to local data transfers, suggests that major TCP performance degradation due to increased latency might be a key bottleneck.

This early observation is suggesting to look into other directions, not initially envisioned in the project, such as possibility to replace the standard TCP ‘Reno’ implementation with TCP ‘high-speed’ or TCP ‘scaleable’ for Baltic Grid data transfers. This in turn is likely to require additional coordination with NRENs in order to avoid overload of their networks by these rather aggressive protocols.