

JINR Participation in the WLCG Project

During the 2010-2011 Years

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Since the year 2003 the Joint Institute for Nuclear Research has taken an active part in a large-scale worldwide grid project, Worldwide LHC Computing project (WLCG), in a close cooperation with the CERN Information Technology department [1].

The WLCG project is organized to build and maintain a data storage and analysis infrastructure for the high energy physics community that will use the LHC (<http://lcg.web.cern.ch/LCG/>). The modern grid technologies are the basis of the infrastructure building. The JINR staff members participate in three LHC experiments (ALICE, ATLAS and CMS) and it is strongly important to provide the proper conditions for the JINR physicists for their full-scale participation in the experiments at the LHC running phase.

The JINR currently supports and develops the JINR WLCG-segment in frames of the WLCG infrastructure in accordance with the requirements of the experiments for the LHC running phase. By November, 2011 the JINR computing farm was upgraded up to 2064 cores, a total Storage Element capacity was extended to 1200 TB, two VOboxes (for ALICE and CMS accordingly) are supported, a global file system CVMFS for the access to Virtual Organization's software has been installed, software required for LHC experiments is currently installed (XROOTD, AliROOT, ROOT, GEANT packages for ALICE; CMSSW packages for CMS; LHCb and ATLAS are supported from CVMFS global installation).

The current computing activities for ALICE, CMS and ATLAS are carried out in coordination with LHC experiments:

- **ATLAS:** Functional Test of the ATLAS DDM (Atlas Sonar AOD/ESD/RAW tests); implementation of PD2P (PanDA Dynamic Data Placement); Xrootd and PROOF for Atlas Tier3 data analysis; development and support of ATLAS DQ2 Deletion Service became a major contribution to the cooperation with ATLAS experiment [2];
- **CMS:** participation in CMS Phedex test data transfers; support of Phedex server

installed at the CMS VObox at JINR; CMS data replication to the JINR SE; participation in CMS Dashboard data repository maintenance and CMS Dashboard development, in particular, in improvement of CMS job monitoring and CMS job failures reporting [3-7];

- **ALICE:** regular update and testing of ALICE software (AliEn) required for ALICE production and distributed activities not only at the JINR-WLCG site but also at 8 ALICE sites in Russia;
- tests of readiness of the JINR site to store and process data for all the experiments the JINR participates in (ALICE, ATLAS, CMS).

Besides, the ATLAS Computing technical interchange meeting (the official ATLAS Collaboration computing meeting) was held at JINR on 31.05.2011 - 02.06.2011.

The JINR has gained great and long-term experience in Grid monitoring activities. Currently the main areas of the activity are:

- RDIG monitoring and accounting system for the LCG infrastructure of Russian Tier2 sites (<http://rocmon.jinr.ru:8080>) and a continuous support is provided for the grid site administrators;
- cooperation with Romania in the development of the monitoring system for Romanian Tier 2 federation;
- participation in the development of the global WLCG data transfer monitoring system (<https://twiki.cern.ch/twiki/bin/view/LCG/WLCGTransferMonitoring>);
- Tier3 monitoring project [8] is the overall coordination and development at CERN (<https://svnweb.cern.ch/trac/t3mon>): software environment and development infrastructure (code repository, build system, software repository, external packages built for dependencies) and, in particular, at JINR:

a VM-based infrastructure for simulating different tier3 cluster and storage solutions was deployed. For the moment it consists of the following parts: ganglia and nagios servers, a torque, condor, proof, OGE-based clusters, two xrootd and one lustre-based storage systems;

- participation in the development of web services monitoring for Dashboard project (<http://dashboard41.cern.ch/awstats/awstats.pl?config=master&configdir=/opt/dashboard/var/lib/mawstats/conf>).

The dCache monitoring system for the JINR WLCG-segment has been developed using Nagios, MRTG and custom plug-ins. The system provides information on input/output traffic and requested and utilized space for both ATLAS and CMS experiments (<http://litmon.jinr.ru/dcache.html>).

We continue to take part in the WLCG middleware testing/evaluation. During the last two years the directions and results have been the following:

- development of gLite MPI certification tests (MPI patch #3714 certification and evaluation of the current status of MPI enabled CREAM CE);
- development and modernization of FTS certification tests;
- deployment of few gLite 3.2, EMI and UMD components were tested. Found issues were submitted to GGUS: https://ggus.eu/ws/ticket_info.php?ticket=67857, 69551, 69553, 69676, 69945 and 74431;
- in framework of developing tests for LFC perl API functions a separate LFC server (gLite 3.2) was installed on gLite testbed at JINR and corresponding GGUS tickets were submitted.

Participation in the WLCG Monte Carlo database (<http://mcdb.cern.ch>) results in [9, 10]:

- support for CMS production and users;
- libraries for working with automatic documentation for Monte Carlo simulated events (HepML language) were improved;
- automatic data uploading with unified HepML descriptions was improved.

We support users (conducting courses, lectures, trainings) to stimulate their active usage of the WLCG resources [11]. In addition, a special grid-training infrastructure for JINR and the JINR

Member States (Russia, Uzbekistan, Armenia, Bulgaria, Ukraine) has been created. During 2010-2011, a number of schools and training events has been held:

- user trainings on gLite middleware for graduate students of physics at the JINR University Center: the semestrial course in grid technologies was conducted during 02.2010 - 06.2010;
- a grid course for Egyptian students was given in May-June, 2010;
- JINR-CERN School on JINR/CERN Grid and Management Information systems was held on October 25-29, 2010 (<http://ais-grid-2010.jinr.ru/>) (about 50 attended students from JINR, Russian universities and Poland);
- JINR-CERN School on JINR/CERN Grid and Advanced Information systems was held on October 24-28, 2011 (<http://ais-grid-2011.jinr.ru/>) (about 100 attended students from JINR, Russian universities, Poland, Ukraine, Georgia and Bulgaria);
- a training course for system administrators from the Bogoliubov Institute for Theoretical Physics - BITP (Kiev, Ukraine) and National Technical University of Ukraine "Kyiv Polytechnic Institute" - KPI (Kiev, Ukraine) was given. The course was focused mostly on gLite 3.2 and AliEn services deployment;
- basic training courses on gLite 3.2 services deployment for system administrators from Mongolia, Kazakhstan and Azerbaijan were held;
- international practice on grid technologies, JINR University Center, 06.09.11-09.09.11.

Besides, the trainings for system administrators from Ukraine, Romania and Uzbekistan have been conducted. Two grid sites based on gLite middleware (one at the Bogolyubov Institute for Theoretical Physics and another at the National Technical University of Ukraine "Kyiv Polytechnic Institute") were set up during one of these trainings. The trainings for Romanian and Uzbekistan administrators were intended for giving practical skills in setting up MPI enabled CREAM Computing elements.

The traditional international conferences "Distributed computing and Grid technologies in science and education" are organized and hosted by JINR. These conferences gather scientists from Russia and CIS countries and it is the only

conference in the Russian Federation devoted especially to modern grid technologies. The fourth conference was successfully held at the JINR in June, 2010 (<http://grid2010.jinr.ru>).

Information on JINR activities in the WLCG is currently presented at the JINR GRID Portal (<http://grid-eng.jinr.ru>).

We provide a continuous support for the JINR Member States and associated JINR Member States in the WLCG activities working in a close cooperation with partners in Ukraine, Belarus, Azerbaijan, Germany, Czechia, Slovakia, Poland, Romania, Moldova, Mongolia, South Africa, Kazakhstan and Bulgaria.

The results of the work were presented at the GRID'2010 conference in Dubna (<http://grid2010.jinr.ru/>), RDMS CMS Conference in Varna, Bulgaria (<http://rdms2010.jinr.ru/>), ATLAS Software & Computing Workshop (04.04.2011-08.04.2011, CERN), the RDMS conference in Alushta, Ukraine (May 2011) (<http://rdms2011.kipt.kharkov.ua/>), ATLAS Computing technical interchange meeting (Dubna, JINR, 31.05.2011-02.06.2011), Programme Advisory Committee for Particle Physics, 35th meeting Dubna, JINR, 21-22.06.2011 conference "Mathematical Modeling and Computational Physics-(MMCP 2011) (Slovakia, July 4 - 8, 2011), ATLAS Software & Computing Workshop (18 July 2011 - 22 July 2011, CERN), International Summer School, ENU (Astana, Kazakhstan, 07.08.2011-13.08.2011), Meeting on cooperation JINR-Mongolia (21.08.2011-25.08.2011, Mongolia) and NEC'2011 symposium in Varna, Bulgaria (September, 2011) (<http://nec2011.jinr.ru>).

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