

PARTICIPATION OF RUSSIAN SITES IN THE DATA CHALLENGE OF THE ALICE EXPERIMENT IN 2004

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Abstract

The report presents an analysis of the Russian sites participation in the Data Challenge of the Alice experiment in CERN in 2004. Job execution and system efficiencies of the Russian sites are compared. The statistics of total events done at these sites are also presented.

GOALS OF ALICE PDC

The year 2004 has been dominated to large distributed data challenges for four LHC experiments. This has been one of the first attempts of using a computational Grid for the real data production. The ALICE physics data challenge (further PDC~2004) pursues several goals. First, it aims to determine the readiness of the off-line framework for data processing of real data which are expected to be taken with the first beam run of ALICE in 2007. This data challenge also has to validate the distributed computing model, for which 10% of the final capacity of the computing resources is to be consumed. In the PDC~2004 the complete chain of simulation, reconstruction and analysis is used for trigger studies. Besides purely software testing, the physics of hard probes (jet and heavy flavour production in heavy ion collisions), as well as proton-proton physics, is to be studied. The PDC~2004 has been splitting into three phases. **The first phase** has lasted 4 months from March to July 2004, during which simulations and production of summable digits have been performed for 10^5 events of Pb-Pb collisions, considered as background, with different centralities, and 10^7 events of pp collisions. The production of simulated data was distributed to regional centers, after that all the data have been shipped to CERN. **At the second phase** of PDC~2004 (started in July and still going on) background Pb-Pb events simulated in the Phase I are transferred to a working nodes of the regional centers (about 2GB/event), signal events are generated locally and merged with the background events, then digitized, reconstructed and event summary data (ESD) are generated. The output files from the reconstruction (including the ESD) are stored on the local storage element (SE). A tar file of all output files is sent to CERN as a backup. **The third phase** which will take place in the forth quarter of 2004, the physics analysis of $5 \cdot 10^6$ Pb-Pb and 10^7 p-p reconstructed events will be performed.

TOOLS

This Data Challenge has been performed on the basis of two different distributed computing environments. The first one is the *Alice Environment* for the distributed computing (**AliEn**) used standalone. **AliEn** [1] is a Grid framework built on top of the latest Internet standards for information exchange and authentication (SOAP, PKI) and common Open Source components. **AliEn** provides a virtual file catalogue that allows transparent access to distributed datasets and a number of collaborating Web services which implement the authentication, job execution, file transport, performance monitor and event logging. The ALICE experiment considers **AliEn** as an implementation of distributed computing infrastructure needed to simulate, reconstruct and analyze data from the experiment. Thanks to **AliEn**, the sites that belong to the ALICE Virtual Organisation can be seen and used as a single entity—any available node executes jobs and access to logical files and datasets is transparent to the user. During data taking the Alice experiment will collect data at a rate of 2 PB per year, producing more than 10^9 files per year which will require massive processing effort for reconstruction [2]. In the preparation and running phase, a large-scale simulation must be carried out involving all available resources worldwide. **AliEn** provides a solution of these tasks in the context of AliRoot, the ALICE simulation and reconstruction framework [3]. AliRoot uses the ROOT [4] framework for performance and simplicity reasons. ROOT provides data persistency on a file level and a wide range of utility libraries [2].

The second tool is the **LCG-2** middleware accessed via **AliEn** with the help of an interface, developed at INFN [5]. ALICE uses a dedicated RB and BDII installed for ALICE by the LCG staff. **AliEn** is installed as experiment software on remote sites (like AliRoot) and the shell script sent to the WN only executes it. **AliEn** services run on a dedicated interface site, which is at the same time an **AliEn** computing element (CE) (it actually runs the CE, SE and Cluster Monitor services) and an **LCG-2** user interface (UI). As already described, the CE gets jobs from the **AliEn** master queue and forwards them to the **LCG RB** via a generated JDL file and job wrapper shell script. For Phase I, all generated data were transferred to CERN CASTOR via AIOD, the **AliEn** I/O Daemon. In the Phase II, the generated files are stored in the local LCG SE (via CopyAndRegister, on the default/close SE,

executed by **AliEn**) and registered in the **AliEn** Data Catalogue using the **LCG SE** and GUID as physical file name. A backup zip file of the files is again sent to CERN CASTOR via AIOD. The **LCG SE** stored along with GUID will be used in the distributed analysis phase.

SITES

At the present time there is a possibility to use non-LCG as well as LCG-oriented computing clusters at Russian sites for need of the Alice Physics Data Challenge. **AliEn** standalone can be running at both types of clusters due to data management tools which ensure successful operation of Data Challenge. The list of available resources at the both kind of clusters are presented in table 1.

Table 1: Russian sites

Sites	AliEn resources for Alice only		LCG resources for all LHC experiments			
	WN	Disk (TB)	WN	Disk (TB)	LCG	SW packages
IHEP			93	2.14	2_2_0	
ITEP	36	1.4	40	1.97	2_2_0	Installed
JINR	30	1.5	20	1.7	2_1_1	Installed
KIAE	14	0.5	Just included into test zone			
PNPI	5	0.1				
MSU			14	0.73	2_1_1	Installed
StPSU	7	0.25				

RESULTS OF ALICE PDC

DC processing by AliEn standalone.

Five Russian sites have been configured as **AliEn** clients of the ALICE virtual organization for the Physics Data Challenge at the non-LCG clusters. These clusters at the **IHEP** site in Protvino, at the **ITEP** site in Moscow, at the **JINR** site in Dubna, **Kurchatov Institute** in Moscow and **St. Petersburg State University** in St.Peterburg) could run a maximum of **111** jobs with total storage disk space equal **~4TB**. The map of sites running PDC under AliEn standalone is presented in figure 1. Sites are operating in time of monitoring are marked by blue-green circles. At the Phase I of DC the JINR site was the most productive among the Russian sites. Presently daily operation of Russian site consist of **~9%** of jobs running



Figure 1. The map of **AliEn** sites participating in the Alice Physic Data Challenge.

by all **AliEn** sites. Tables with statistics of successfully done, killed and failed jobs at these five sites from beginning of DC till today are presented in fig. 2.

Done jobs				
Farm	Last value	Min	Avg	Max
IHEP-PBS	21.67	1	10.82	21.67
ITEP-RRC	4.602 K	2	1.349 K	4.612 K
JINR-PBS	2.235 K	292.7	1.459 K	2.235 K
KI-PBS	4	1	2.424	4
SPBS-PBS	27.93	1	7.844	27.93
Total	6.889 K	297.7	2.829 K	6.9 K

Failed jobs				
Farm	Last value	Min	Avg	Max
IHEP-PBS	180.7	20	140.6	180.7
ITEP-RRC	301.7	29	140.1	301.7
JINR-PBS	404.2	32.34	188	404.9
SPBS-PBS	20.69	1	9.836	20.69
Total	907.2	82.34	478.6	908

Killed jobs				
Farm	Last value	Min	Avg	Max
IHEP-PBS	167.5	20	133.1	167.5
ITEP-RRC	2.155 K	1.184 K	1.799 K	2.155 K
JINR-PBS	571.9	119	364.7	571.9
SPBS-PBS	19.83	1	13.47	19.83
Total	2.896 K	1.32 K	2.298 K	2.896 K

Figure2. Tables of done, killed and failed jobs in DC of ALICE at Russian sites from March till present days.

Total number of successfully done jobs by the Russian sites in the whole time of DC consists of more than 4% of jobs done by all the **AliEn** sites. 3.1% has been done at the Phase I, i.e. at the very beginning of DC, in the time of first lessons with a site configuration and understanding of many other problems in the environment of resources lack. The Phase II is being operating with higher percentage of successfully done jobs in the Russian site. Now about 6.5% of successfully finished jobs have been done in the Russian sites in spite of more strict requirements to the network stability and site operation. 12 files with total capacity of 2 GB have to be downloaded as input files for every job of the DC Phase II. Figure 3 presents a diagram of successfully done jobs in time of the DC Phase II.

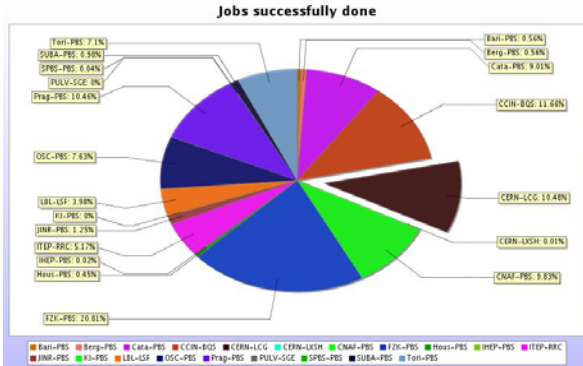


Figure 3. The diagram of successfully done jobs in the Phase 2 of the Alice Physics Data Challenge.

The usage of the MonaLisa services [6] has given a possibility of monitoring the whole DC efficiency as well as its different components. The efficiency and inefficiency of different DC components are presented in fig4.

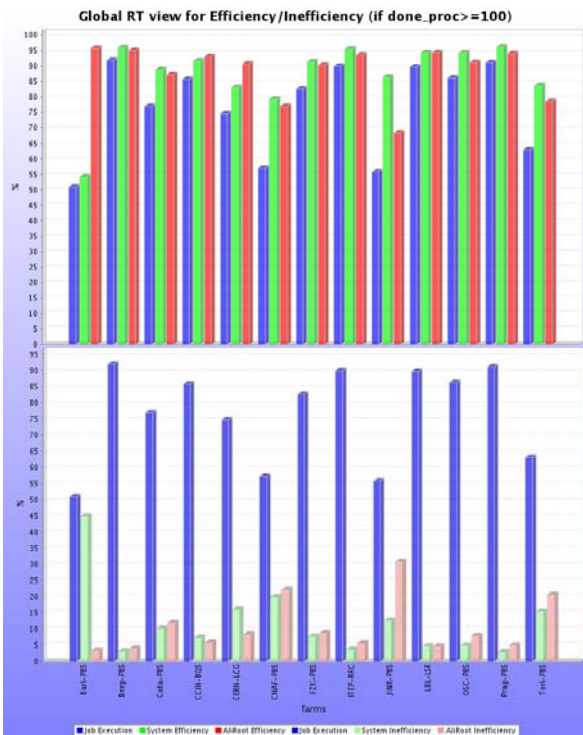


Figure 4. Efficiency of DG run at sites with number of successfully done jobs more than 100.

Efficiencies of a Russian sites operation in the Phases I and II are presented in table 2. It is seen that these efficiencies satisfy the requirements for the proper DC processing.

DC via AliEN-LCG2 interface.

An attempt to run DC via AliEn with the LCG-2 interface has been done. The installation of the Alice software needed for this run has been successfully done at three

LCG-2 clusters of Russian sites. Table 3 presents the result of this installation.

Table 2: System and job execution efficiencies at Russian sites in time DC of ALICE .

Site	System Efficiency (%)			Job Execution Efficiency (%)		
	Phase I	Phase II	Avg	Phase I	Phase II	Avg
IHEP-PBS	11.1	-	11.1	11.1	-	11.1
ITEP-RRC	59.1	93.1	85.8	58.3	82.0	77.0
IJNR-LCG2	91.4	94.3	93.5	89.2	68.8	74.2

Table 3: Alice Software installed at LCG-2 sites.

Site	Software of Alice installed at the LCG-2 Russian sites
ITEP	VO-alice-AliEn-1.33.15; VO-alice-ALICE-v4-01-Rev-04
IJNR-LCG2	VO-alice-AliEn-1.33.15; VO-alice-ALICE-v4-01-Rev-04 VO-alice-ALICE-v4-01-Rev-05
ru-Moscow-SINP-LCG2	VO-alice-AliEn-1.33.15; VO-alice-ALICE-v4-01-Rev-04

After number of test the IJNR-LCG2 site has been included in the Alice BDII. But during the DC run the CERN RB services have a communication problem with this site related to the network connection. After fixing a problem with the local network the DC run at IJNR-LCG2 will continue as well as in the other Russian LCG sites.

CONCLUSION

- About 7000 jobs have been successfully done at AliEn Russian sites from March till present days, which is about 4% of the total Alice statistics. Job efficiency is about 75% and the system efficiency is 90%
- The ALICE software was installed at three LCG sites, but run was not realized yet due to a communication problem with RB services related to the network connection

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