Computing Resources Integration with the Grid Technology at IHEP

Sun Gongxing, Yu Chuansong
Institute of High Energy Physics, Beijing, 100039,China

There are a few of PC-Farm computing systems built for various experiments at IHEP, since VAX machines retired in 1996. These PC-Farms are running separately with different job management systems such as NQS or PBS, this leads to making inefficient use of these clusters. In order to share these PC-Farm computing systems across IHEP, we will describe the implementation and deployment of Globus and Condor system, and the sharing policy among different groups, the developing Web-based user's job submission interface as well in this talk. For storage, we use CASTOR as HSM for backup/restoring software, Therefore, there are CEs and only one SE in the moment at IHEP.

1. Introduction

There are several on-going experiments conducted or participated at IHEP. The BES experiment is home experiment for Tau-Charm Physics at IHEP, during BESIII period data volume will reach about 3 petabytes. YBJ-ARGO experiment locates on YangBaJing located more than 3000 meters above sea level in Tibet, and cooperates with Italy, In addition, IHEP also participates in CMS and ATLAS experiments of LHC at CERN.

Since the VAX/VMS computing systems retired at IHEP in 1996, there were a few of PC farms running RedHat Linux OSes built for several experiments, including LHC for Monte Carlo simulation, YBJ-ARGO experiment for physics analysis and MC simulation, and BES experiment for data production and physics analysis and MC simulation. In the moment these PC farms are running separately for respective various experiments. This results in inefficient utilization of these PC farms, for example, for LHC PC farm, sometimes it is very busy during doing MC simulation, while other period it become idle, so sharing of computing resource is very good idea for improvement of CPU utilization.

Grid is an emerging technology, and attracts more and more attention, in particular, in the HEP communities, it can integrate the separate resources into a uniform virtual environment, these resources include computing resources, storage resources and network resources and even smart instruments such as telescopes.

In the paper we will describe the existing PC Farm systems and how to integrate them into a uniform computing environment with the Grid technology at IHEP, and the future plan we are going to do.

2. The Running PC farms at IHEP

At this moment there are the following PC farms for BES, ARGO-YBJ and CMS and ATLAS collaborations respectively at IHEP. These PC farms configurations are:

PC Farm	**OS**	**No. CPUs**	**Batch System**
hepfarm	Linux RH7.2	23 × Intel PIII	OpenPBS 2.4
YBJfarm	Linux RH7.2	32 × AMD MP	OpenPBS 2.4
LHCfarm	Linux RH7.2	32 × AMD MP	OpenPBS 2.4

The LHC and ARGO PC-Farms were built respectively last year, the former is serving as the MC simulation system of CMS and ATLAS experiments, whereas the later for MC simulation and physics data analysis of YBJ-ARGO experiment. These two PC-Farms both achieved 2U rack-mount high dense computing system using Tyan 2466N motherboard and adopted IDE-SCSI storage subsystem at first at IHEP, each was equipped 16 dual athlon MP 1800+ CPUs boxes with 1TB and 2TB storage capacities respectively.

The BESII computing system is for the data production and physics analysis and MC simulation of the BES experiment, it consists of Intel-based commodity PCs, after experiencing two times extensions of computing capability and storage capacity, currently the BESII computing system is consisted of two dual CPU Dell 4400 servers and one quad CPU Dell 6400 server, and 17 Dell PCs in this computing environment with 3 built-in RAIDs and 2 external RAIDs to be attached to these three servers respectively. The configuration of the BESII computing environment is described in the following: The storage capacity reaches 4TB.

The CASTOR software has been fetched from CERN, and setup for the management of DELL PowerVault 136T tape library with 72 LTO Ultrium tape cartridges at IHEP, which can be used Backup/restoring facility for all experiments mentioned above. The connectivity topology of these farms is as Fig. 1.:

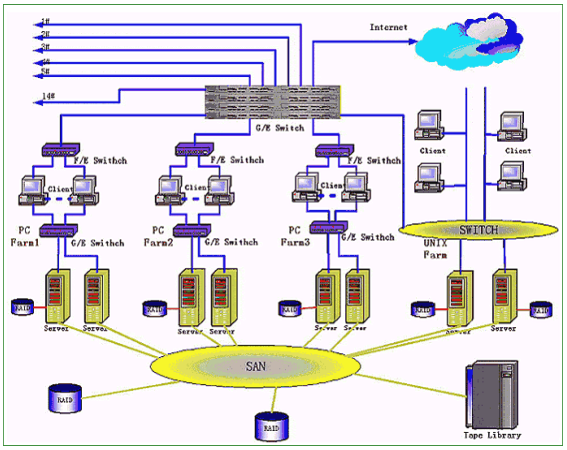

Fig.1: The topology of computing systems at IHEP

3. Computing Resource Integration with Grid Technology

At present, all computing systems are running separately, this leads to a low utilization. In order to make them to arrive at a higher utilization, we are integrating all these computing resources into a uniform computing environment with the help of Grid technology.

Grid technology is attracting more and more attention from HEP communities. It can make various resources shared among many organizations. Grid is of a layered architecture with Fabric, Communication, Collective, Portal, and Application layers. The current IHEP Grid computing environment consists of various interacting components: the User Interface, the Resource Broker, the Job Submission Service (JSS) and the Logging and Bookkeeping (LB) service, the Computing Elements (CE) and Storage Elements (SE).

The interactions and dependencies between the various components are represented in Fig.2.

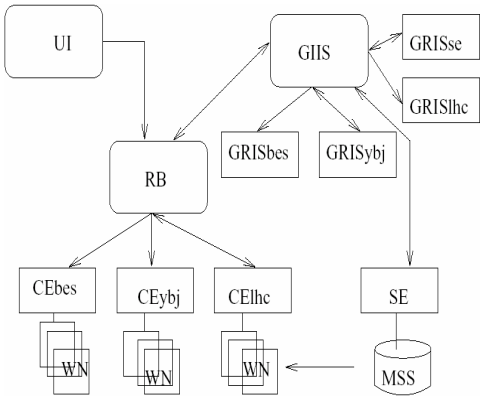

Fig.2: The Grid Computing Environment at IHEP

The UI provides the access to grid resources, GIIS server is the top Grid information service which interact with GRISse, GRISbes, GRISlhc, GRISybj, makes real-time resources information available. There are CEybj, CEbes and CElhc for YBJ farm and BES farm and LHC farm to provide computing resource information, respectively. The SE is equipped with CASTOR software, and used as backup/restoring for all of these 3 experiments. The RB finds the matching resource to process jobs, and send the files through input sandbox to a CE. The facility NFS was used for data sharing among these Worker Nodes.

4. Future Plan

Now we are focusing on IHEPPortal development for user authentication, job submission, scientific visualization, system and networking resource monitoring, and BES software grid-enabled.

If network bandwidth is enough for Grid computing, we will implement the resource sharing with Grid technology among domestic universities and institutes for BES experiment, and CMS and ATLAS experiments of LHC, and also hopefully for international collaboration in these three experiments.

5. References

1, Home page for the Datagrid project http://www.eu-datagrid.org/

2, Integrating GRID Tools to Build a Computing Resource Broker: Activities of DataGrid WP1, Proceedings of CHEP2001.