An LCG Grid Installation at LRZ

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1. Introduction

The international research center CERN is currently finalizing the construction of the Large Hadron Collider (LHC). From 2007 onwards the LHC experiments will produce approximately 8 PetaByte of data per year with an additional 4 PetaByte of simulated data expected each year.

Even when considering optimistic forecasts concerning the evolution of processor speeds and online storage, one single computing center will not be able to provide enough capacity for thousands of scientists worldwide to analyze this huge amount of data. According to the LHC computing model [1] it is thus planned to distribute the work-load to many regional computing centers in the participating countries and to connect them with high speed networks. Grid software will automatically manage the data and work-load distribution and provide a transparent and unique view of the connected resources.

2. ATLAS Computing Model

The LHC computing model in general and ATLAS in particular follows a multi-tier hierarchical structure: one Tier-0 at CERN, a few large Regional Centers (= Tier-1), followed by Computing centers acting as Tier-2 and eventually institute clusters as Tier-3.
The Tiers are differentiated by size and functionality:

- Tier-0: Raw data storage; first calibration and reconstruction; distribution of derived data sets; very large storage capacity; located at CERN.
- Tier-1: Further calibration and reconstruction passes; storage of raw and reconstructed data; organized reconstruction and analysis; large storage capacity; German Tier-1 is the GridKa facility at FZ Karlsruhe.
- Tier-2: Central simulation and user analysis; storage of a fraction of summary data; typically 3 Tier-2 associated to one Tier-1 center; about 30 centers planned for ATLAS, with about 25 active users on average.
- Tier-3: Ntuple analysis; development, visualization.

3. A Munich Tier 2

For the Munich Tier-2 we envisage a joint effort combining the installations at LRZ and RZG. As a baseline assumption an equal sharing of resources is foreseen between MPI/RZG on one hand, and the LMU/LRZ on the other hand. Together the Munich Tier-2 should provide the average ATLAS Tier-2 capacity or about 1/3 of the Tier-2 resources for Germany.

4. LCG at LRZ

The model for using the LRZ center as an LCG resource is non standard and requires some modifications of the LCG setup. At LRZ we are testing a method of bridging into an existing batch cluster. An LCG center usually has a high degree of control over the operating system flavor and user account structure on it's batch system. In contrast at LRZ we are using an existing linux cluster with pre-defined user accounts and a non LCG supported batch management system (SGE)[1]. We have deployed standard nodes which provide the LCG services, the Computing Element(CE) and the Storage Elements(SE). These services are bridged into the existing LRZ batch cluster, see fig 1, to allow user jobs to be run on the batch system with the resulting datasets being returned via the LCG services. This bridging model provides a way in which existing clusters may be exploited by ATLAS to become part of the LCG grid.

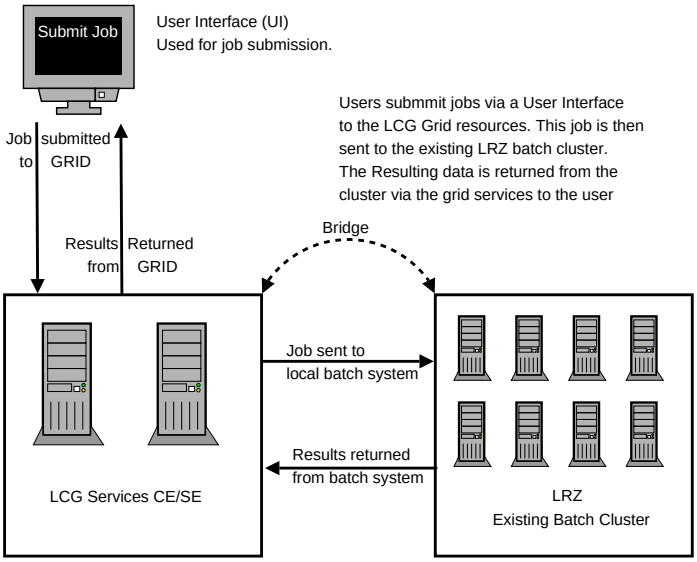

Fig. 1: Schema of Job submission to the LRZ-LCG system

5. Outlook

The LCG installation at LRZ is currently being tested with simple users jobs and we aim to begin with ATLAS simulation jobs in the near future. The example of bridging into an existing batch cluster could provide a good model for the advantageous use of non dedicated resources at computing centers and it is hoped that a more adaptable LCG model can be derived from it. The integration of the LRZ and RZG into one central Tier-2 system is expected to be covered in the coming year before LHC turn on and in time to support user analysis activities.

References

[1] Report of the Steering Group of the LHC Computing Review, CERN/LHCC/2001-004, http://lhc-computing-review-public.web.cern.ch/lhc-computing-review-public/Public/Report_final.PDF
[2] The London e-Science Centre, http://www.lesc.ic.ac.uk/projects/SGE-LCG.html

[1] Some support for SGE is provided by the London e-science center [2]