

WLCG Input to Pisa workshop on Resilience-Explicit Computing in Grids

Introduction

This document summarizes the input from the Worldwide LHC Computing Grid (WLCG) to the [workshop](#) held on Resilience-Explicit Computing in Grids in Pisa, July 14th 2008. The techniques on which WLCG services have been built have been described in numerous papers, including [1][2][3]. They are based on many years of experience in delivering reliable services, using knowledge gained from the LEP era and from other High Energy Physics experiments around the world.

With retrospect, one can distinguish a number of distinct phases in the delivery of WLCG services:

1. The European DataGrid (EDG) days – when components such as the EDG Replica Location Service were first deployed in production;
2. Re-implementation of the CERN database services for the physics community, based on commodity hardware (PCs running Linux) and industry standard techniques (e.g. Oracle's Maximum Availability Architecture)[4];
3. The WLCG "Service Challenge" programme, when the full range of WLCG services were redeployed with the targets for service availability and problem resolution in mind (defined in the LCG Memorandum of Understanding (MoU)[5];
4. The 2008 "Common Computing Readiness Challenge" (CCRC'08 [6]) – designed to show full readiness for 2008 data taking and processing.

Despite such a large amount of work over many years, the WLCG service is still exposed to a number of risks. These include well known weaknesses in the development, deployment and operations models, which are generic to all virtual organizations (VOs) that use this infrastructure, as well as additional risks that come from the computing models of specific VOs. However, the greatest challenges are almost certainly of a sociological nature, which nevertheless need to be addressed if sufficient reliability is to be provided at an affordable cost.

Successes, Challenges and Opportunities

One of the clear successes of the WLCG project is that it delivers a production service that has been demonstrated to work at a well defined level for the LHC experiments. Whilst it is clear that real data taking will reveal new problems and opportunities, to deliver a service that in many cases handles load well in excess of that required for 2008 data taking is no mean achievement. To do so across multiple heterogeneous grids and a large number of sites around the world is also an important result. Whilst being far from perfect, the large amount of effort that has been devoted to communication has been key to this success. An often over-looked element of this success story has been the benefit that providing such distributed services has brought to participating sites. By allowing researchers to perform their tasks largely independently of their and / or the computing resources' location, this has avoided the "brain-drain" effect common on earlier HEP experiments and has revitalized the remote sites, to the clear benefit of local communities and funding agencies.

At least in today's grids, close collaboration and cooperation is required between all services providers, as well as with the user communities. Given that the services are still evolving, as are the computing models of the experiments and as these changes are partly driven by weaknesses or short-comings of the deployed services, a classical customer / service-provider relationship cannot work. This has been well understood in the various phases of the EGEE (I, II, III) project and will need to be continued for the foreseeable future – at least until the stage when grid services are sufficiently mature and understood that new VOs can count on a robust and flexible baseline, as opposed to today's constantly evolving environment.

A corresponding threat is the tendency for individual service providers to focus on their part of the overall service, to the detriment of the whole. That this cannot work – neither for the 'team', nor individuals within the team – is well understood in analogous environments.

The two main technical areas where improvement is required were identified to be:

1. Storage-ware and associated services. So-called "bug fix" releases often contain new and / or changed features, which compound the problem of deploying fixes – often not sufficiently tested in a production-like environment. Information on the motivation for deploying these releases is often poor or hard to find. On the other hand, the equivalent processes for the remaining grid middleware have been proven to be robust and mature;
2. Fragility arising from specific computing models – despite using a largely common infrastructure, the computing models of certain VOs means that service interruptions that are handled transparently in some cases are highly intrusive in others. The extra cost and complexity of making the overall service resilient to these – typically more complex – computing models is arguably too high. In other words, not all computing models can be supported at an affordable cost.

Summary

A short set of well-proven techniques for design, implementation, deployment and operation have been identified and used for production WLCG services. It is foreseen to extend the use of these techniques to all of the services identified by the LHC experiments as critical to their production – target end 2008. This includes a number of grid services whose current design / implementation is not compatible with today's high availability mode solutions. A number of areas where the services are exposed to risk have been identified and it is proposed that these are addressed on the timescale of 2009 / 2010 with the goal of achieving a measurable improvement on the quality of service delivered.

References

- [1] Lessons Learnt from WLCG Service Deployment – in the proceedings of [CHEP 2007](#).
- [2] A Worldwide Production Grid Service Built on EGEE and OSG Infrastructures – Lessons Learnt and Long-term Requirements, [3rd EELA conference](#).
- [3] Robust & Resilient Services – how to design, build and operate them, [3rd EELA conference](#).
- [4] Oracle Maximum Availability Architecture – [MAA](#).
- [5] LCG [Memorandum of Understanding](#).
- [6] WLCG Common Computing Readiness Challenge (CCRC'08) – [post-mortem workshop](#).