WP8 HEP Applications

Final Project evaluation of EDG middleware, and summary of workpackage achievements

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Outline

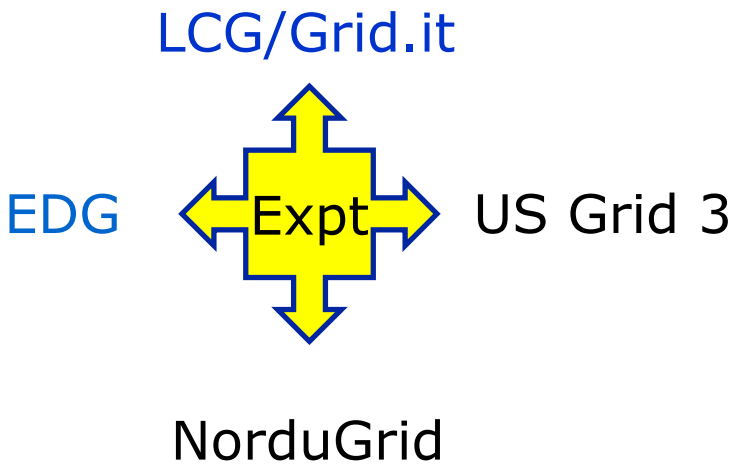
- Overview of objectives and achievements
- Key points in the achievements of the 6 WP8 experiments
- Lessons learned from the three years
- Summary of the exploitation of WP8 work, and of future HEP applications activity in LCG/EGEE
- Concluding comments
- Questions and discussion

Overview of objectives and achievements

OBJECTIVES	***ACHIEVEMENTS***
Continued work in Architectural Task Force (ATF)	◆ Walkthroughs of HEP use cases helped to clarify interfacing problems.
Reactivation of the Application Working Group (AWG)	◆ Extension of HEPCAL use cases covering key areas in Biomedicine and Earth Sciences. ◆ Basis of first proposal for common application work in EGEE
Work with LCG/GAG (Grid Applications group) in further refinement of HEP requirements	◆ HEPCAL-2 requirements document for the use of grid by thousands of individual users. ◆ In addition further refined the original HEPCAL document
Developments of tutorials and documentation for the user community	◆ WP8 has played a substantial role in course design, implementation and delivery

OBJECTIVES	***ACHIEVEMENTS***
Evaluate EDG Application Testbed, and integrate into experiment tests as appropriate.	◆ Further successful evaluation of 1.4.n throughout the summer. ◆ Evaluation of EDG 2.0 on the EDG Application Testbed since October, and of EDG 2.1 since December
Liase with LCG regarding EDG/LCG integration and the development of the LCG service.	◆ EIPs (Loose Cannons) helped testing of EDG components on the LCG Cert TB prior to LCG-1 start in September. ◆ Performed stress tests on LCG-1.
Continue work with experiments on data challenges throughout the year.	◆All 6 experiments have conducted data challenges of different scales throughout 2003 on EDG App TB or LCG/Grid.it.

Comments on experiment work



Experiments are living in an international multi-grid world using other Grids

DataTag project is very important for inter-operability (GLUE schema used for inter-operability with US grids)

Have used EDG software in a number of grids

EDG Application Testbed

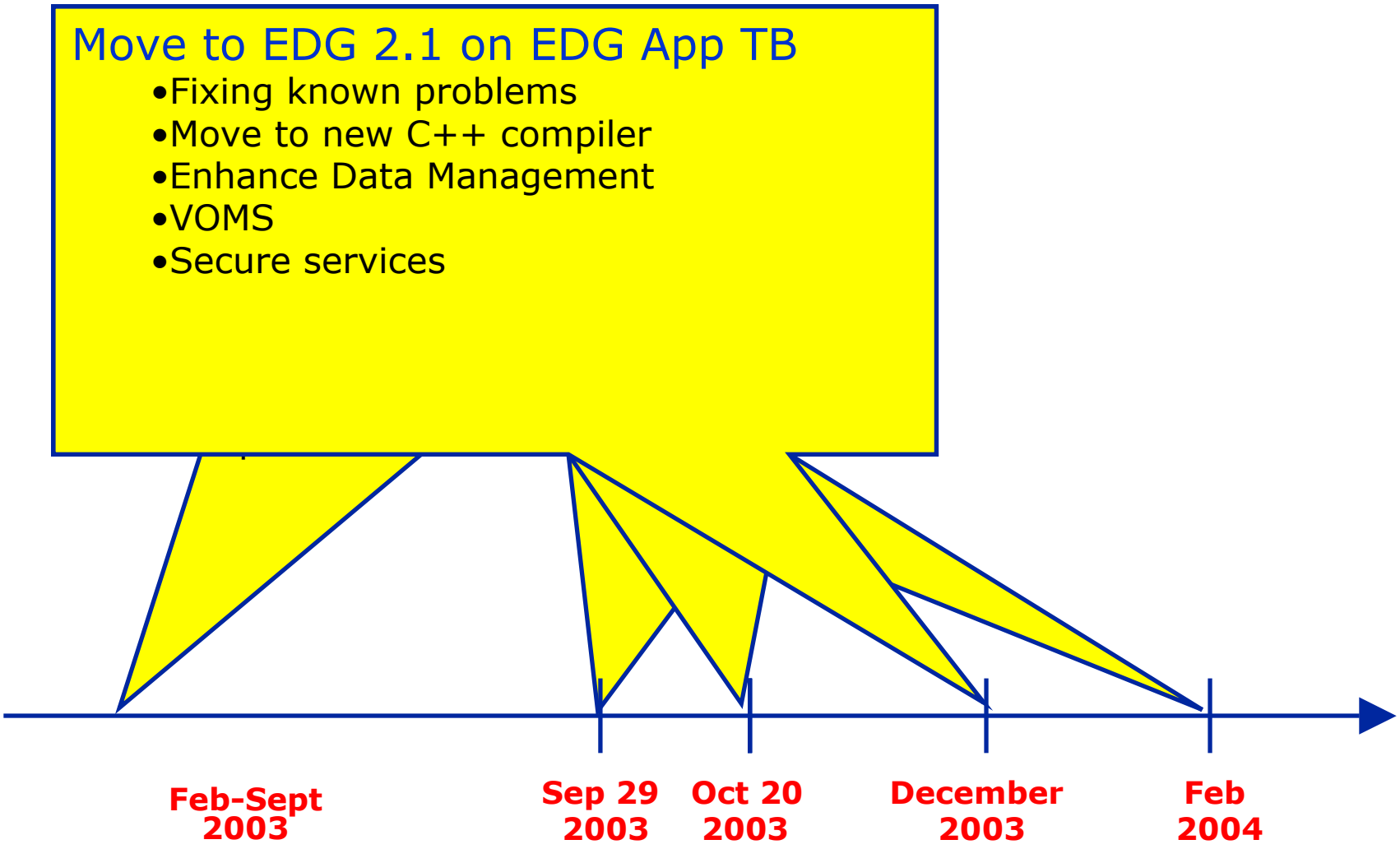
LCG Service (LCG-1 evolving to LCG-2)

Italian Grid.it (identical with LCG-1 release)

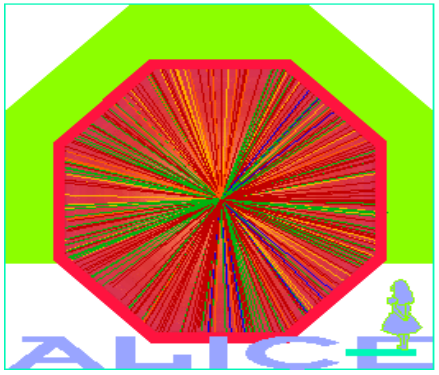
Having 2 running experiments (in addition to the 4 LHC experiments) involved in the evaluations has proved very useful

BaBar and work on Grid.it
D0 and work on EDG App TB

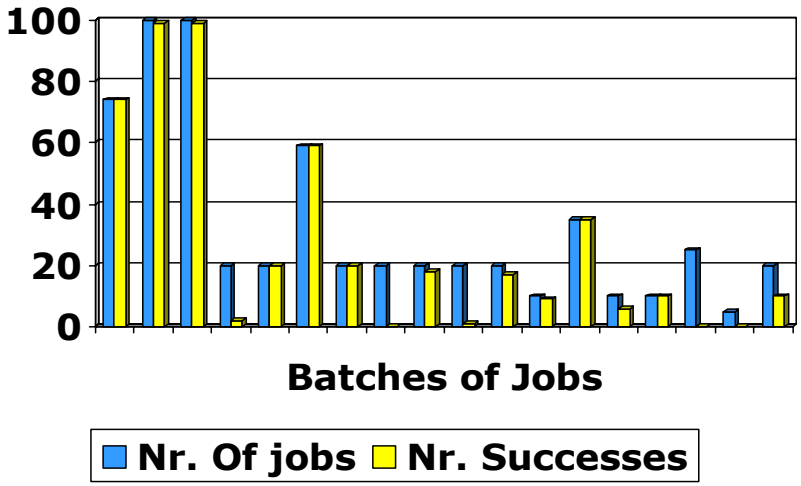
Evolution in the use of EDG App TB and the LCG service (and Grid.it)



Key points in achievements of the 6 WP8 experiments



- evaluation on LCG-1 and Grid.it Sep-Nov 2003
  - Significant improvement in terms of stability with respect to tests in Spring 2003
  - Jobs were sensitive to space on worker nodes
- **Projected load on LCG2 during ALICE DC(start Feb 2004)**
  - 10^5 events (1 event/job)
  - Generate ~30 TB output
  - Test LCG Mass Storage
  - Parallel data analysis (AliEN/PROOF) including LCG



A NOTE on PERFORMANCE

Performance was generally a step function for batches (either close to 0 or close to 100). With long jobs and multi files very sensitive to long-term system stability

ATLAS

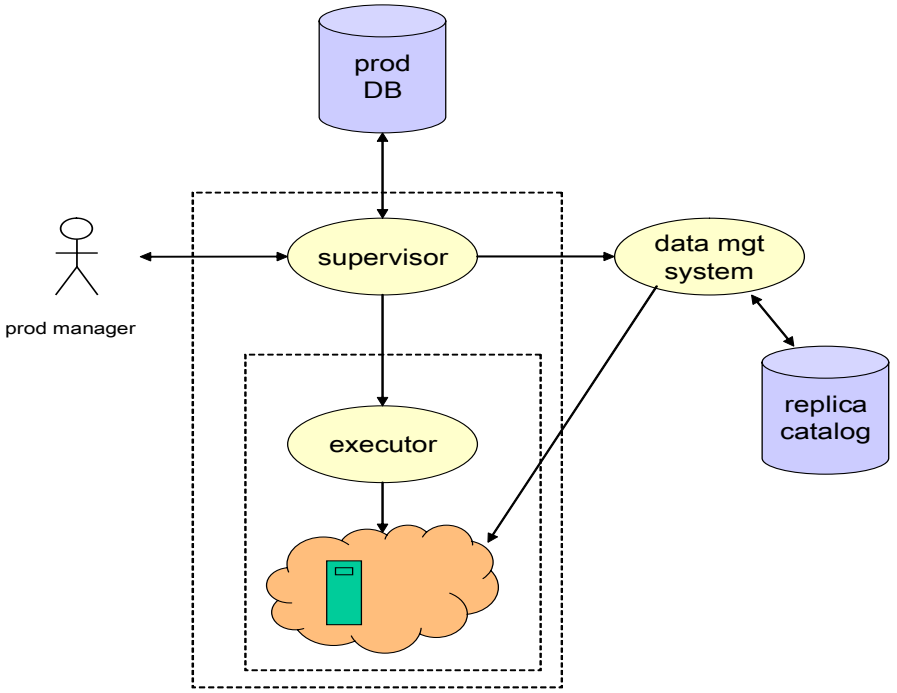
- ***Use of EDG 1.4.11 (mod for RH7.3) in May 2003***
  - *Reconstructed 500 K events in 250 jobs with 85% 1st pass efficiency*
  - *With privately managed configuration of 7 sites in Italy, Lyon and Cambridge*
- **LCG-1(+ Grid.it) production in Jan-Feb 2004**
  - Have simulated 30000 events in 150 20hr. jobs of 200 events each with efficiency ~80%
- **LCG-2 plans**

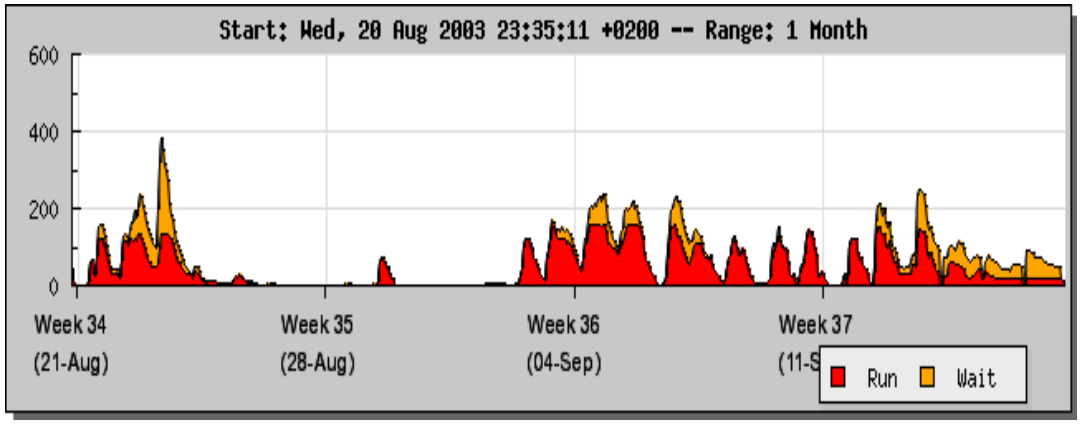
  Start around April

Main features of new DC2 system for multi-grid environment

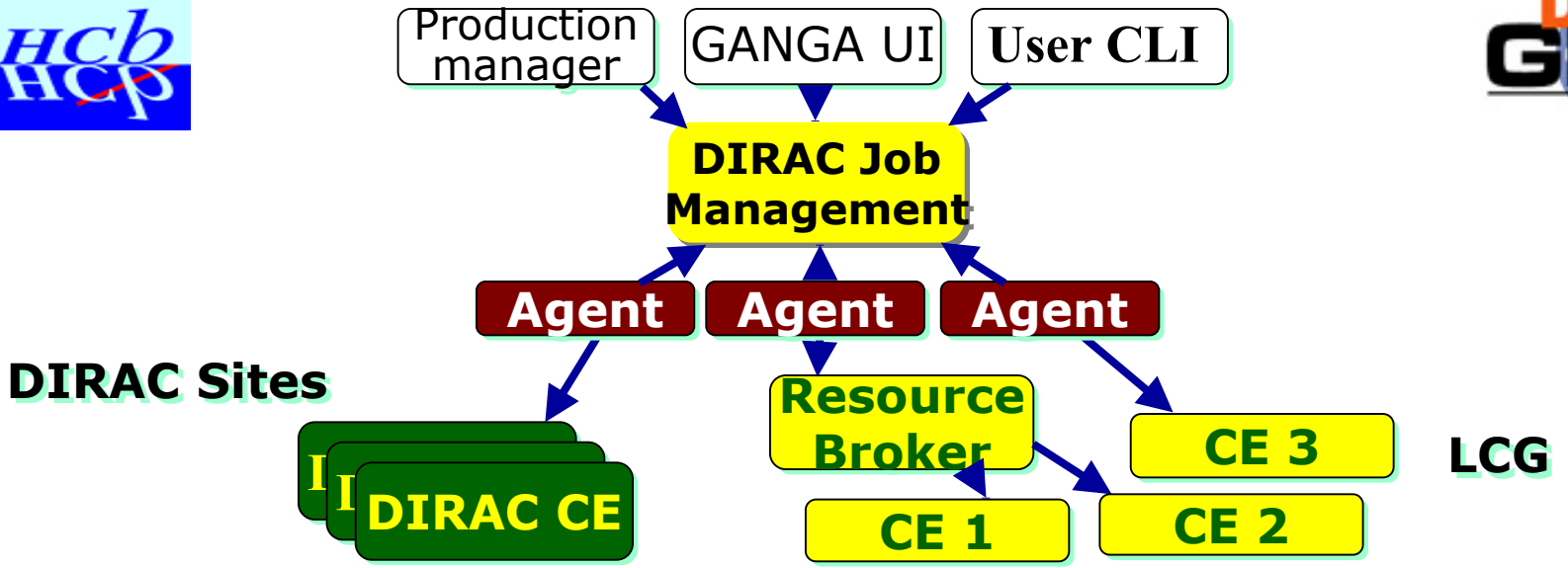
Common production database, supervisor and data management system for all of ATLAS

Executors developed by middleware experts (LCG, NorduGrid, US).





- LCG-0 (summer 2003)
  - Components from VDT 1.1.6 and EDG 1.4.11
  - DataTAG (GLUE)
  - VOMS + RLS + R-GMA
  - *14 sites configured and managed by CMS*
  - *Substantial improvements in efficiency compared to first EDG stress test (~80%)*
  - **76000 CPU hours on LCG-0**
    - *500K Pythia 2000 jobs 8h*
    - *1.5M CMSIM 6000 jobs 10h*
- LCG-1
  - Ran for 9 days on LCG-1 over Xmas
  - In total 600,000 events (30-40h jobs) were produced
  - Sites used mainly in Italy, Spain
  - *Efficiency around 75% over XMAS*
  - Used GENIUS portal
- LCG-2 -data challenge Mar 1



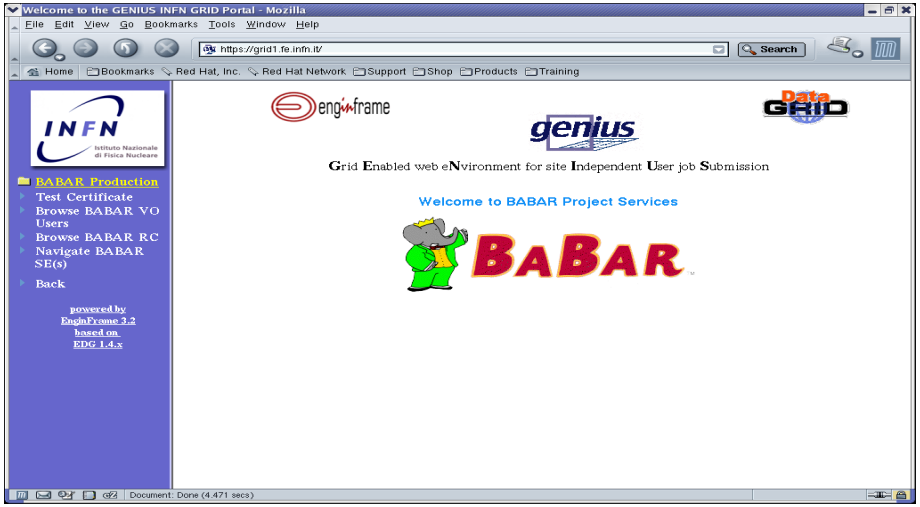
- Tests on the EDG1.4 application testbed (Feb-Mar 2003):
  - Standard LHCb production tasks, 300K events produced;
  - ~35% success rate. (TB support running down)
  - Software installation by the running job;

- EDG2.0 tests (November 2003):

Submission of the jobs:

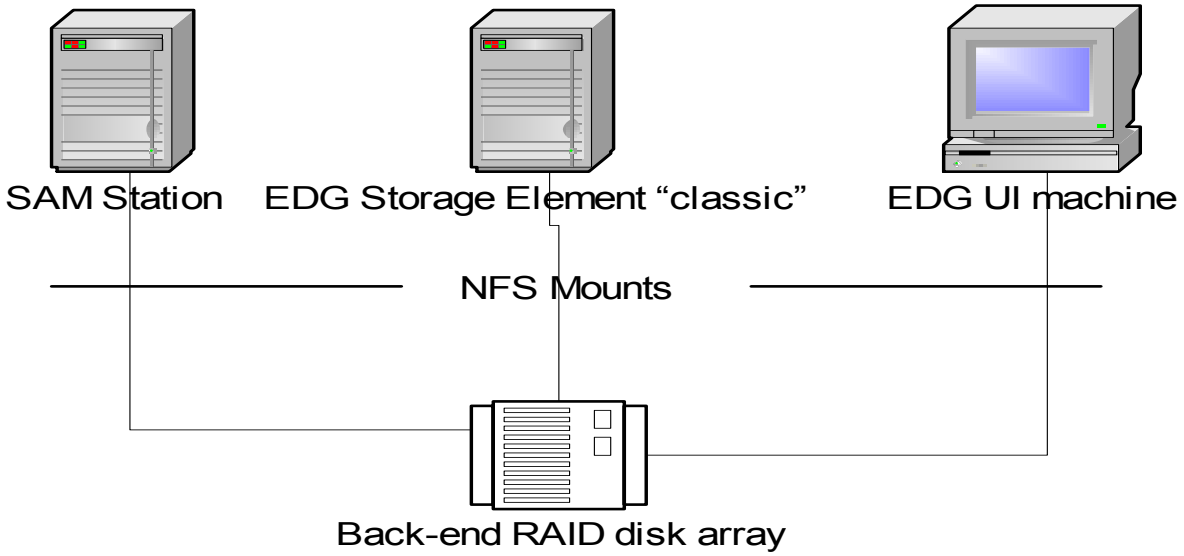
- To EDG RB;
- *Directly to a CE with the CE status information obtained from the CE GRIS server: 90% efficiency*

- GETTING READY NOW FOR LCG-2 and DC in April (tests are positive)



- **Strategy for first integration**
  - Created 'simulation' RPM to be installed at sites
  - Data output stored on closest SE
  - Data copied to Tier-1 or SLAC using edg-copy
- **Scheme first tested with EDG 1.4.11 on 5 Italian sites**

- **Operation on Grid.it with LCG-1 release**
  - RB at CNAF - farms at 8 sites
  - 1 week test with ~ 500 jobs
  - *95% success at Ferrara(site with central DB)*
  - *60% success elsewhere*
  - *33% failures due to network saturation due to simultaneous requests to remote applications database*
  - **Positive experience with use of GENIUS portal**
    - https://genius.ct.infn.it
- **Analysis applications also have been successfully tested on EDG App TB**



- Interfaced EDG software and resources to D0 re-processing
  - Frequent software updates so don't use RPMs
    - Registered compressed tar archives in RLS as grid files for installation by jobs
  - Use RGMA for monitoring
    - Allows users and programs to publish information for inspection by other users, and for archiving in production database
- Found EDG s/w generally satisfactory for task (with caveats)
  - Used 'Classic' SE s/w while waiting for developments to interface to SARA mass-store
  - *Very sensitive to RGMA instability. Since December good progress with RGMA, and can run at ~90% efficiency when RGMA is up*

Summary of middleware evaluations

- Workload management
  - Tests have shown that software is more robust and scalable
    - Stress tests were successful with up to 1600 jobs in multiple streams – efficiencies over 90%
    - Problems with new sites during tests– VOs not set up properly (though site accepted job)
- Data Management
  - Has worked well with respect to functionality and scalability (have registered ~100K files in ongoing tests)
    - Tests so far with only 1 LRC per VO implemented
  - Performance needs enhancement
    - Registrations and simple queries can take up to 10 seconds
  - We have lost (with GDMP) bulk transfer functions
  - Some functions needed inbound IP connectivity (Globus). D0 had to program round this (problem since fixed)

Summary of middleware evaluations(2)

- Information System
  - Partitioned MDS has worked well for LCG following on from work accomplished within EDG (BD II work), but limited to ~100 sites probably.
  - R-GMA work is very promising for 'life after MDS', but needs 'hardening'.
- Mass Storage support (mission critical for data challenges)
  - We await 'accepted' uniform interface to disk and tape systems
    - Solution coming with SRM/GFAL software
    - WP5 have made important contribution to the development of SRM interface
      - EDG 2.0 had mass storage access to CERN (Castor) and RAL(ADS)
    - The 'Classic-SE' has been a useful fallback (gridftp server) while waiting for commissioning of developments

Site Related Issues (major factors in overall efficiency)

- Site Certification
  - Official, standard procedure as part of release
  - Consistency checks of published information
- Site Configuration
  - Large parameter space with insufficient defaults so please can we have…
    - Automated configuration
    - Automated tests
    - Run-time checks of parameters
- Space management and publishing
  - Running out of space on SEs and WNs is still a problem. Jobs need to check availability before running

The Deliverables + 'extra' outputs from WP8

- The formal EU deliverables
  - D8.1 The original HEP requirements document
  - D8.2 'Evaluation by experiments after 1st year'
  - D8.3 'Evaluation by experiments after 2nd year'
  - D8.4 'Evaluation after 3rd year'
- Extra key documents (being used as input to EGEE)
  - HEPCAL Use cases May 2002 (revised Oct 2003)
  - AWG Recommendations for middleware (June 2003)
  - AWG Enhanced use cases (for Biomed,ESA) Sep 2003
  - HEPCAL2 Use cases for analysis (several WP8 people)
- Generic HEP test suite used by EDG/LCG
- Ongoing consultancy from 'loose cannons' to all applications
- *Interfacing of 6 experiment systems to middleware*

Main lessons learned

Architecture & Software Life-cycle

- Information system is nerve centre of grid. We look to R-GMA developments for long term solution to scaling problems
- Globally HEP applications feel it would have been 'better' to start with simpler prototype, and to have more frequent incremental releases
- Applications should have played larger role in architecture in defining interfaces (so we could all learn together!) .

Deployment & Operations of the Middleware

- Formation of Task Forces (applications+middleware) was a very important step midway in project
- Loose Cannons (team of 5) were crucial to all developments. Worked across experiments. This team comprised all the funded effort of WP8.

Main lessons learned (cont'd)

Site Related Lessons

- Site configuration must be automated.
- Site certification needs to be improved. Incompliant sites screw up the brokering.
- Space management on SEs and WNs is a still outstanding problem
- We look to SRM/GFAL as solution to uniform mass storage interfacing
- Must have flexible application s/w installation. Application needs and site policies vary.

Exploitation of the work of WP8, and future HEP applications work in LCG/EGEE

- All experiments have exploited the EDG middleware using WP8 effort, and this exploitation is being carried into the data challenges in 2004
- The HEPCAL and AWG documents are essential inputs to the future LCG/EGEE work
- Future developments will be in the context of LCG/EGEE infrastructure carrying over the important experience from WP8
- The NA4 activity in EGEE will include dedicated people for interfacing middleware to experiments software (8 people at CERN + others distributed in the community)
- Within the EGEE project middleware will be 'hardened' (including EDG components) and evaluated by the HEP applications, in parallel with the use of current EDG software on LCG for the physics data challenges

Concluding comments

- Over the past 3 years the HEP community has moved to the use of grid services in physics production systems using world-wide configurations

- Experiments are using several managed grids (LCG/EGEE,US Grids, Nordugrid) so inter-operability is crucial

- We have learned very important lessons in Datagrid which we carry forward into the LCG/EGEE projects, and we will learn more lessons from the use of EDG/EGEE software in the forthcoming experiment data challenges in 2004

Questions and discussion