GRID Deployment Session

Introduction, F.Carminati CERN

LCG Launching Workshop

February 13, 2002

Agenda

14:00 Agenda and Scope F.Carminati (CERN)
14:20 GRID deployment M.Mazzucato (INFN)
14:50 Presentation from funding agencies / countries

- Holland, M.Mazzucato (on behalf of K.Bos, NIKHEF)
- Germany, M.Kunze (Karlsruhe)
- IN2P3, D.Linglin (Lyon) to confirmed
- INFN-Italy, F.Ruggieri (CNAF-INFN)
- Japan, I.Ueda (Tokyo)
- Northern EU Countries, J.Renner Hansen (NBI DK)
- Russia, V.A.Ilyin (SINP MSU Moscow)
- Spain, J.Marco (Santander)
- UK, J.Gordon (RAL)
- US-ATLAS, R.Baker (BNL)
- US-CMS, L.Bauerdick (FNAL)
- US-ALICE, B.Nilsen (OSU)
- Other countries, M.Mazzucato

16:20 Proposal for Coordination Mechanisms L.Robertson
16:50 Discussion

LHC computing at a glance

- The investment in LHC computing will be massive
  - LHC Review estimated 240MCHF (before LHC delay)
  - 80MCHF/y afterwards
- These facilities will be distributed
  - Political as well as sociological and practical reasons

Europe:
267 institutes,
4603 users

Elsewhere:
208 institutes,
1632 users

Beyond distributed computing

- Every physicist should have equal access to data and resources
- The system will be extremely complex
  - Number of sites and components in each site
  - Different tasks performed in parallel: simulation, reconstruction, scheduled and unscheduled analysis
- We need transparent access to dynamic resources
- Bad news is that the basic tools are missing
  - Distributed resource management, file and object namespace and authentication
  - Local resource management of large clusters
  - Data replication and caching
  - Understanding of high speed networking
- Good news is that we are not alone
  - All the above issues are central to the new developments going on in the US and Europe under the collective name of GRID

Resource estimate

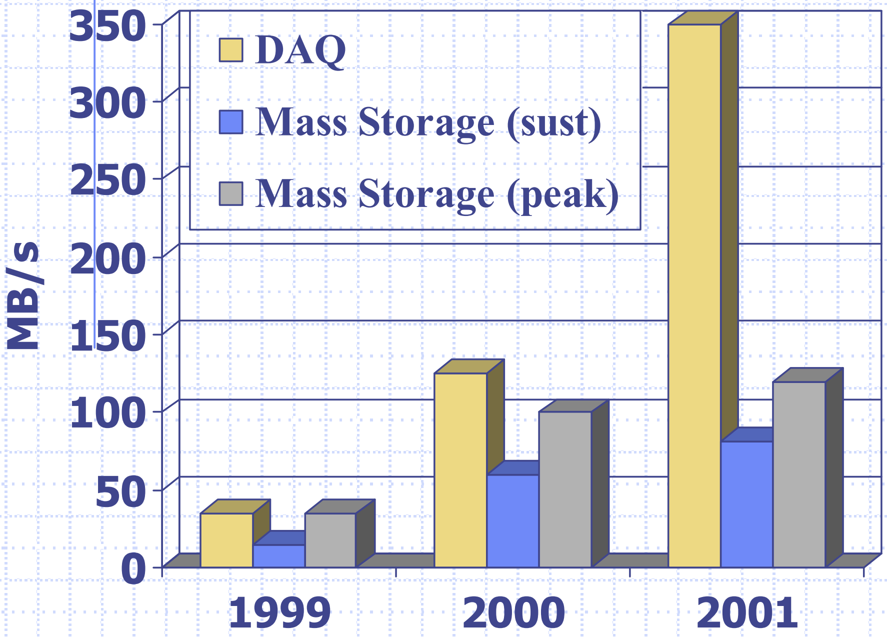
- Source: LHC computing review + recent corrections
  - Event size 0.1-25MB
  - Data rate 20-1250MB/s
  - Disk@CERN ~0.5PB/exp
  - Disk@Tier1 0.15-0.6PB/exp
  - Tape@CERN 0.7-9PB/exp
  - Tape@Tier1 0.2-1.8PB/exp
  - CPU@CERN 200-800kSI95/exp
  - CPU@Tier1 120-250kSI95/exp
- Average of 0.8GB/s per experiment in Tier0
- Estimated uncertainty in the numbers = factor 2
- ± 10% in Moore's law over 4 years = factor 2.7

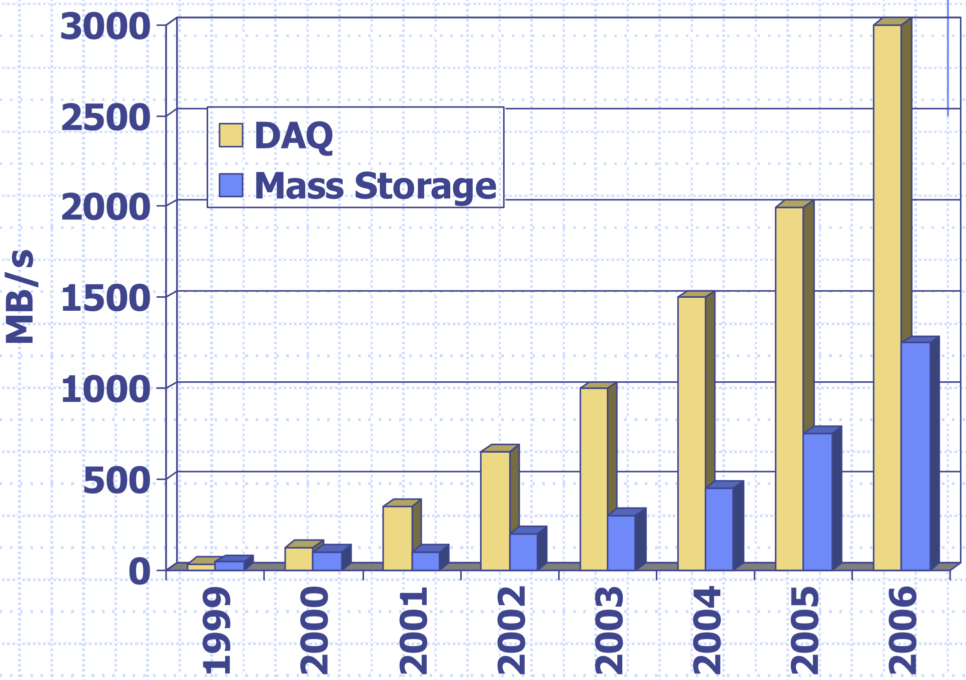
Planning

- With a total factor approaching one order of magnitude plans are very quickly outdated
- For the same very reasons, continual planning is necessary to reduce uncertainties
- However we need experimental points to support our extrapolations
- Therefore:
  - TestBeds at all levels are necessary to establish these points and continuously assess the evolution of technology and computing model

Scalability?

- The ALICE Data Challenge example





- When using COTS the question
  - Is your architecture scalable?
- Is replaced by
  - Have you been there or not?

Physics challenges

- Experiments need simulation, reconstruction and analysis for
  - Detector design
  - Algorithm development
  - HLT studies
  - Refinement of the computing model
- Objectives of Physics Challenges is the physics output
  - *Technology* output is *parasitical*, but very important
- An excellent occasion to deploy and test a global computing model
- *Realistic* test of the results of the LCG project
  - This is the proof of reality of the whole mechanism going from requirements (SC2) to code (PEB/WP)
- Experiments are already doing this routinely, but on separated testbeds with different tools
  - A lot of ground here for scale economy of tools and configurations

Data Challenges

- The *average* bandwidth needed in the Tier0 has been calculated around ~0.8GB/s per experiment in pp mode
  - This includes writing, reading back, exporting, analysing etc
- Unfortunately we are <u>very</u> far from knowing how to do it
- Here we need *technology-driven* challenges that verify the evolution of the Tier0 model
- For the moment ALICE is *leading the way* in this area
  - Due to the famous 1.25GB/s requirement in HI
  - Other experiments follow, collaborate, share the results and this is all working very well
- These *performance driven* challenges can include remote centres
  - Prompt data replication, remote monitoring or distributed prompt reconstruction

Bringing all this together

- The concept of Data Challenge and testbed is central to the development of the LHC Computing GRID Project
- This is where LCG shows its intrinsically distributed nature
- And where probably planning becomes more complicated
  - And instructive / useful
- How to do this is the subject of this area

Data Challenge issues

- Data Challenges are very intensive in personnel and equipment
  - And a large effort from the experiments, almost like a testbeam
- Experiments have made Data Challenges an integral part of their planning
  - These plannings are under constant evolution
- Planning and commitment to resources and timescales are essential from all sides
- Close collaboration is needed between LCG, IT at CERN, remote centres and the experiment to create the conditions for success
- This activity has to be seen as a clear priority for the whole project

GRID opportunities

- GRID (mostly GLOBUS / Condor) already facilitate the day-to-day work of physicists in large distributed productions
- To go forward, we need to deploy a pervasive, ubiquitous, seamless GRID testbed between all the sites providing cycles to LHC
  - Or at least something as close as possible to this
  - And possibly include other HEP and non HEP activities
- Some of the components of the basic technology are or will be there in the near future
  - II, Resource Broker, Replica Manager, automatic installation, authentication/authorisation, monitoring…
- Question is how do we deploy/make use of them

GRID issues – Support

- Testbed need close collaboration between all parties
  - Tier0, Tier1's, experiments, GRID (MW) projects
- Support for the testbed is very labour intensive
  - VO support
  - Application integration
  - Local System Support
  - MW support
  - Escalation of user problems
  - Experience of EDG testbed (MW+applications) very important
- Again a planning and resource commitment is necessary to obtain successful testbeds
- Need development and Production testbeds running in parallel
  - And stability, stability, stability
- Experiments are *buying into* the common testbed concept, they should not be deceived

GRID issues – Technology

- MW from different GRID projects is at risk of diverging
  - iVDGL, PPDG, DataGRID, GriPhyN, CrossGRID
- From bottom-up SC2 has launched a common use case RTAG for LHC experiments
  - Some of the work already started in DataGRID
  - Possibly to be extended to other sciences within DataGRID
- From top-down there are coordination bodies
  - HICB, HIJTB, GLUE, GGF
- LCG has to find an effective way to contribute and follow these processes
  - Increase communication and do not develop parallel structures

GRID issues – Interoperability

- At the end there will be one GRID or zero
  - You may or may not subscribe to this
  - We may not afford more
- … or at least less GRIDs than computing centres!
- Interoperability is a key issue
  - Select common components?
  - Make different components interoperate?
- … on national / regional testbeds
  - … too many to mention them all
- … or transatlantic testbeds
  - DataTAG, iVDGL

GRID issues – Coordination

- Key to all that is coordination between different centres
- This kind of world-wide close coordination has never been done in the past
- We need mechanisms here to make sure that all centres are part of a global planning
  - In spite of their different conditions of funding, internal planning, timescales etc
- And these mechanisms should be <u>complementary</u> and not parallel or conflicting to existing ones
  - See Les' talk

Conclusions

- A challenge in the challenge
  - It is here that technology comes in contact with politics
- GRID deployment and Data Challenges will be the proof of the existence of the system
  - Where it all comes together
- Complicated scenario, manifold role for LCG
  - Follow technology
  - Complement existing GRID coordination
  - Harmonize planning of different experiments and Project
  - Provide support and collaborate with experiments
  - Deploy and support testbeds and Data Challenges